SGW-59756
Revision 0

100-H Area RUM Aquifer Pump Test Plan

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

P.O. Box 1600
Richland, Washington 99352

Approved for Public Release;
Further Dissemination Unlimited

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APPROVED
By Julia Raymer at 1:05 pm, May 02, 2016

Release Approval | Date

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Executive Summary

Investigations and monitoring activities have identified hexavalent chromium (Cr(VI)) groundwater contamination within the first water-bearing unit of the Ringold Formation Upper Mud (RUM) unit of the 100-H Reactor area. It is theorized that the Cr(VI) contamination in the first water-bearing unit of the RUM is the direct result of contaminants migrating downward from the unconfined aquifer. The RUM material is thin and possibly discontinuous in the 100-H Area which, combined with a high hydraulic head in the shallow unconfined aquifer imposed in the area during reactor operations (HW-77170, *Status of the Ground Water Beneath Hanford Reactor Areas January, 1962 to January, 1963*), could have allowed for a connection between the two zones.

The current conceptual site model (CSM) for the first water-bearing unit within the RUM (referred to as the RUM aquifer for the rest of this report) is that the unit is discontinuous, with the 100-H Area RUM wells only minimally connected to each other. The aquifer pumping test described in this plan is designed to evaluate hydraulic properties of the RUM aquifer in the 100-H Reactor area, including assessment of connectivity with overlying aquifer unit(s) and continuity of the water-bearing transmissive sediments within the RUM between existing monitoring locations.

Aquifer pumping tests provide an extensive amount of information about hydraulic properties of the aquifer being tested and potential connections between adjacent aquifers. Pumping tests are also useful for obtaining relatively accurate radius of influence, cone of depression, and well efficiency information. The resultant data allow for prediction of long-term pumping capacity of a well and can help determine the spacing of wells needed to ensure capture of contaminant plumes. Utilization of water level data from observation wells and data on the specific capacity is beneficial to ensure a more complete data set, which increases the reliability of the evaluation. In this case, aquifer testing with the appropriate monitoring and testing will allow for improved design of the pump and treat (P&T) system in the RUM and determination regarding whether contamination in the RUM aquifer is a risk to human health and the environment.

This test plan includes field characterization and testing that will be performed to accomplish several objectives. Pumping test data should be adequate to evaluate groundwater connectivity between these RUM wells and connections between the RUM

unit, overlying unconfined aquifer, and Columbia River and identify potential flow pathways. This information will, in turn, support better decisions for remediation of affected groundwater in the 100-H Area.

The aquifer pumping test includes the following objectives:

- Determine the radius of influence of pumping at each test well.
- Determine the connectivity of the RUM aquifer across 100-H.
- Determine if the RUM aquifer is leaky, confined, or semiconfined.
- Determine if the RUM aquifer is connected to the Columbia River.
- Determine the hydraulic parameters of the aquifer (transmissive sediments that make up the first water-bearing unit within the RUM).
- Determine the performance characteristics (e.g., specific capacity) of the test wells.
- Confirm the CSM.

Five wells have been identified for aquifer pumping tests, with one well (199-H4-12C) being optional for testing pending evaluation of the initial data collected as background information. Three of the RUM wells are already connected to the HX P&T system, including 199-H4-12C. Aquifer testing on these wells will be controlled through HX operations. Aquifer tests on the two monitoring wells will be conducted using a submersible pump, operated by an onsite generator, with discharge of water generated during testing to the ground surface.

The step test at each pumping well is designed with six pumping steps of approximately 2 hours duration each. Each step represents a specific increased extraction rate at the well. Additional time may be added to each step, if needed, to ensure that the drawdown has reached an asymptote. Upon completion of the test, the aquifer will be allowed to recover, and water levels will be monitored throughout the test and recovery periods. Following recovery, a constant rate pumping test will be conducted at a rate selected from the results of the step test(s). The constant rate test will be 24 hours in duration, with no change in flow rate. As for the step test, the pumping period will be followed by recovery of the aquifer water levels. Data will be collected during the entire pumping and

recovery periods (for both the step test and constant rate test), primarily through the use of downhole instruments with data loggers capable of recording water levels, temperature, and specific conductance. Instruments will be placed in both the pumping wells and selected observation wells. Data collected during the test will be evaluated upon test completion, and a report will be prepared. The report will include conclusions and recommendations for future remediation of the RUM aquifer.

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Terms

AWLN	automated water level network
bgs	below ground surface
Cr(VI)	hexavalent chromium
CSM	conceptual site model
DOE	U.S. Department of Energy
DTW	depth to water
ECO	Environmental Compliance Officer
Ecology	Washington State Department of Ecology
FWS	Field Work Supervisor
gpm	gallons per minute
OU	operable unit
P&T	pump and treat
QA	quality assurance
Q_{max}	maximum pumping rate
RUM	Ringold Formation Upper Mud
SC	specific conductance
S&GRP	Soil and Groundwater Remediation Project

1 Introduction

The 100-HR-3 Groundwater Operable Unit (OU) is located in the north-central part of the Hanford Site, including the 100-D and 100-H Reactor areas and the area between the reactors known as the Horn (Figure 1). During reactor operations, sodium dichromate dihydrate was added to the cooling water to control corrosion within the reactors. After passing through the reactors, contaminated cooling water was discharged to retention basins and then released to the Columbia River. Leakage rates from the retention basins were reported at 10,000 L/min (2,641 gallons per minute [gpm]) and resulted in large plumes of hexavalent chromium (Cr(VI)) within the unconfined aquifer at 100-HR-3 (DOE/RL-2010-95, *Remedial Investigation/Feasibility Study for the 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 Operable Units*). In addition to leakage, contaminated cooling water was released to the ground during reactor upset conditions such as fuel cladding failures. During 6 months in 1967, prior to final shutdown of the D Reactor, a test was conducted that involved discharge of the entire cooling water stream from the 105-D Reactor to the ground. All of these conditions resulted in the evolution of a substantial Cr(VI) contaminated groundwater mound between the D and H Reactor areas.

Groundwater contamination has also been found in the lower aquifer, specifically within the first water-bearing unit of the Ringold Formation upper mud (RUM) unit, in some areas of the 100-HR-3 OU. For the purposes of this document, the first water-bearing unit in the RUM will be referred to as the RUM aquifer, even though additional deeper water-bearing units may be present within the RUM unit. Investigations and monitoring activities have identified Cr(VI) contamination within the RUM aquifer in both the Horn and at the 100-H Reactor area. Cr(VI) contamination has not been identified in the RUM aquifer at the 100-D Reactor area.

It is theorized that Cr(VI) contamination in the RUM aquifer is the result of a thin and possibly discontinuous RUM surface layer at 100-H and in the Horn, combined with a high hydraulic head imposed in the area during reactor operations (HW-77170, *Status of the Ground Water Beneath Hanford Reactor Areas January, 1962 to January, 1963*). The current conceptual site model (CSM) for the RUM aquifer is that the unit is discontinuous across the 100-HR-3 OU, with the 100-H Area RUM wells only minimally connected to each other, and the wells in the Horn area being connected to each other.

This aquifer pumping test plan is designed to evaluate the RUM aquifer in the 100-H Reactor area. The RUM aquifer in the Horn area may be evaluated at a later date when more wells are available for observation. Testing and evaluation of the RUM aquifer at 100-D are not included herein since contamination has not been identified in that area.

Aquifer pumping tests provide an extensive amount of information about the aquifer being tested and potential connections between adjacent aquifers. Pumping tests are also useful for obtaining relatively accurate radius of influence, cone of depression, and well efficiency information. The resultant data allow for prediction of long-term pumping capacity of a well and can help determine the spacing of wells needed to ensure capture of contaminant plumes. Utilization of water level data from observation wells and data on the specific capacity is beneficial to ensure a more complete data set, which increases the reliability of the evaluation. In this case, aquifer pumping tests with the appropriate observations and measurements will support improved design of the pump and treat (P&T) system in the RUM and allow for a determination as to whether contamination in the RUM aquifer is a risk to human health and the environment.

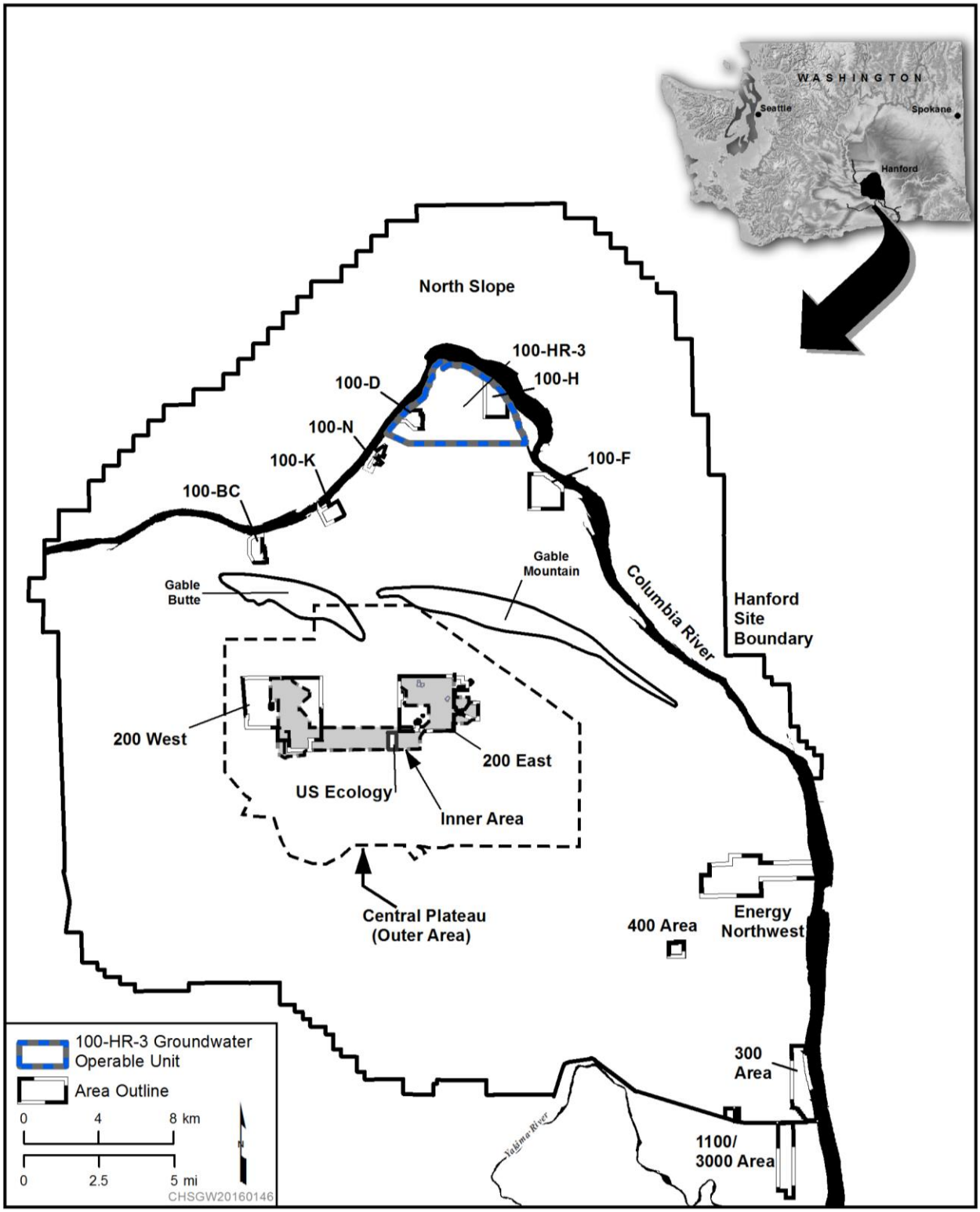

Figure 1. Location of 100-HR-3

2 Study Area Description

The aquifer being investigated is the first water-bearing unit within the RUM unit. The geology and hydrogeology of 100-H play a key role in evaluating the transport of contaminants through the RUM aquifer, as described in the following sections.

2.1 Geology and Hydrogeology

The three major stratigraphic units at 100-H are the Hanford formation, Ringold Formation unit, and RUM. Cataclysmic flood deposits that form a major portion of the sediment present in the Pasco Basin are not formally named in the stratigraphic nomenclature and are, therefore, informally referred to as the Hanford formation. Material of the Hanford formation consists predominantly of unconsolidated sediments that cover a wide range of grain sizes, from boulder-sized gravel to sand, silty sand, and silt. The unconfined aquifer at 100-H is found primarily in Hanford formation material, which is more transmissive than the Ringold Formation unit E (DOE/RL-2010-95). Ringold Formation unit E consists of fluvial matrix supported gravels and sands with intercalated fine- to coarse-grained sand and silt layers. Grain size distributions tend to be bimodal, with granule and coarse sand fractions generally absent. The Ringold Formation unit E is found as small, discontinuous pockets at 100-H and in the Horn (DOE/RL-2010-95).

Forming the base of the unconfined aquifer is the RUM, which is considered an aquitard at most locations. The upper part of the RUM sometimes contains gravel in a silt/clay matrix that represents a transition zone (reworked interval) above the more massive silt or clay. In 100-H, data from borehole logs indicate that the RUM material contains more sand than elsewhere at 100-HR-3. This may result in a less competent barrier between the unconfined aquifer and the RUM aquifer below, possibly contributing to a hydraulic connection between the two units. The RUM surface is encountered between 11 and 40 m (37 and 66 ft) below ground surface (bgs) at 100-H. The silt- and clay-rich RUM generally has low hydraulic conductivity values relative to the Hanford formation and Ringold Formation unit E. Within the RUM, thin sand-to-gravel layers form zones with variable hydraulic conductivities that range from low to high (K_H of 0.00012 to 0.0019 cm/sec [0.34 to 5.39 ft/day]; K_V of 1.4×10^{-8} to 5.0×10^{-3} cm/sec [4×10^{-5} to 14.17 ft/day]) and form confined or semiconfined aquifers (DOE/RL-2010-95).

The surface topography of the RUM is shown in Figure 2. Two low areas can be seen at 100-H, both trending from the northwest to the southeast. One shallow channel in the RUM extends northwest, just west of the H Reactor, and can be seen near 100-H. The second depression, which may be related to the Cr(VI) distribution in the first water-bearing unit of the RUM, parallels the river along the shoreline. These channels appear to be scour channels resulting from erosional activity associated with the Missoula floods (DOE/RL-2010-95).

2.2 Groundwater Flow

Groundwater in the unconfined aquifer flows towards the Columbia River, which forms a discharge boundary during low river stages, and to the south, with some variability throughout the year. Flow direction and velocity change seasonally due to river stage changes and are also influenced by active pumping in the area.

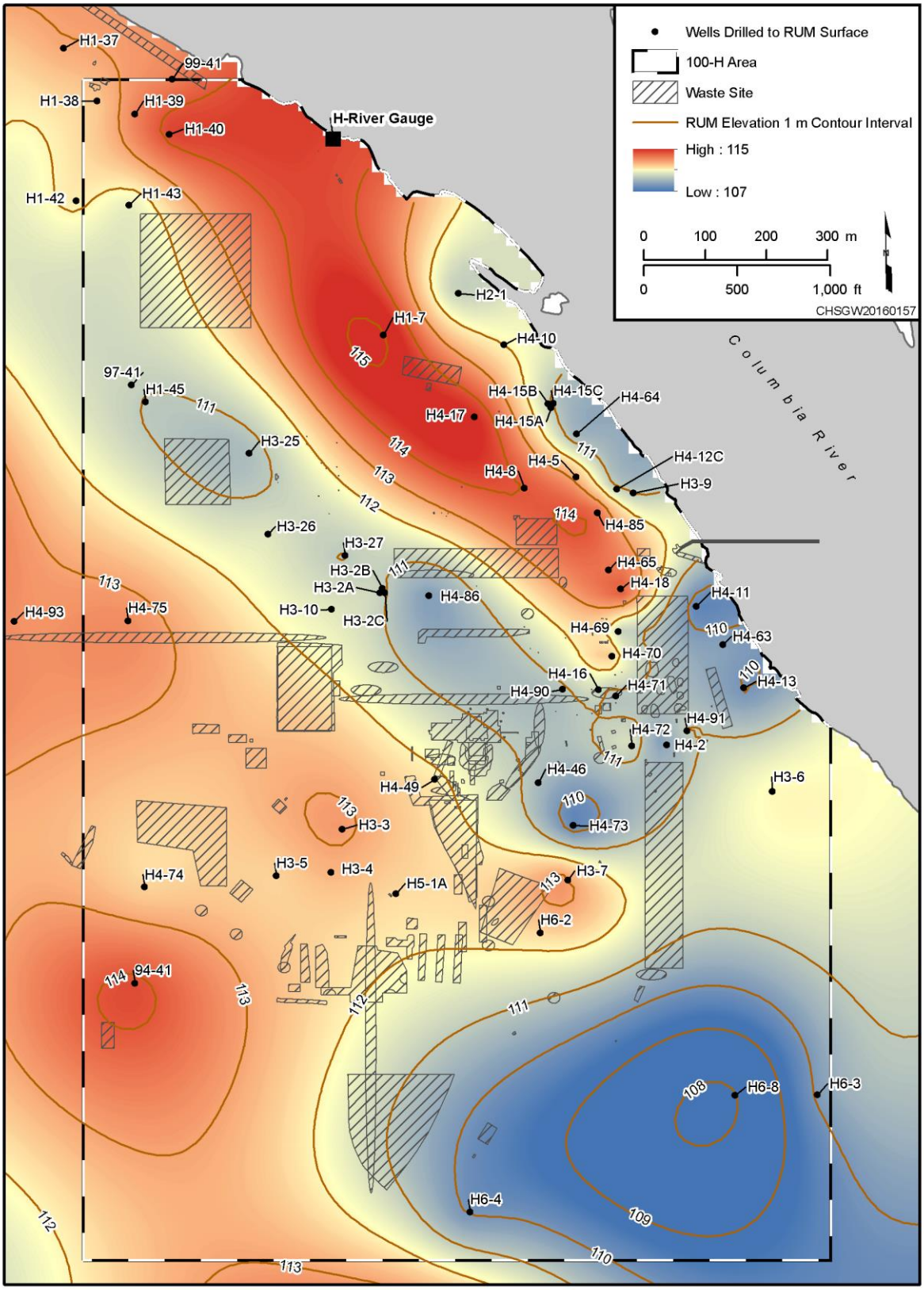

Figure 2. RUM Surface Contours at 100-HR-3

Within the RUM aquifer, the groundwater flow direction cannot be readily established due to inconsistencies in interpretations of water level measurements across the area. For example, the groundwater head information from February results in four different potential flow directions, depending on which wells are used. If the aquifer was connected across all wells, the gradient should be more consistent and not as dependent on which wells were used for the analysis. As a result, the 2015 data do not support the assumption that the aquifer is continuous in the 100-H Area. However, a group or subset of the wells may show a hydraulic connection. Data collected for a period of time prior to pumping tests, during the various pumping tests, and after the tests will be used to establish aquifer connectivity and a gradient for the area if it is determined that the RUM aquifer, or a portion of that aquifer, is connected.

2.3 Groundwater Contamination

Cr(VI) contamination in the RUM aquifer has been identified at both 100-H and the Horn. At 100-H, Cr(VI) concentrations in 2015 ranged from 2.2 µg/L to 137 µg/L in wells 199-H3-10 and 199-H4-12C, respectively. Concentrations in this aquifer have been increasing in several locations. The maximum 2015 Cr(VI) analytical data, including filtered total chromium results, for the first water-bearing unit in the RUM within the 100-HR-3 OU are presented in Figure 3.

In response to Cr(VI) contamination in the RUM aquifer, several wells were connected to the P&T system as extraction wells. Extraction wells in the RUM aquifer are generally operated for Cr(VI) mass removal, which is currently being conducted at three well locations: 199-H4-12C, 199-H3-9, and 199-H3-2C. However, even with long-term ongoing extraction from wells 199-H4-12C and 199-H3-2C, the levels of contamination in the RUM have not declined as expected. Well 199-H3-9 was added to the extraction system in 2015.

2.4 Previous Investigations

A pumping test at the 100-H Area (SGW-47776, *Aquifer Testing and Rebound Study in Support of the 100-H Deep Chromium Investigation*) was conducted in 2009. Three wells completed in the RUM aquifer were tested: 199-H4-12C, 199-H3-2C, and 199-H4-15CS. Both step tests and constant rate tests were conducted. The design of the test, however, was focused on refining the CSM for each well and did not allow for conclusions about the connectivity of the RUM aquifer across the 100-H Reactor area. Monitoring during testing was limited to the nearby nested well pairs and allowed for limited evaluation of vertical connectivity only within each individual well group.

The test results were evaluated in more detail in 2012, as part of DOE/RL-2010-95 (Section 3.7.6, “Groundwater Geochemistry”). The evaluation suggested that the RUM aquifer is connected to the unconfined aquifer at well 199-H3-2C, near the 105-H Reactor. Test results, along with a geochemical analysis of the groundwater, also suggested that well 199-H4-12C, located adjacent to the Columbia River, is hydraulically connected to the river.

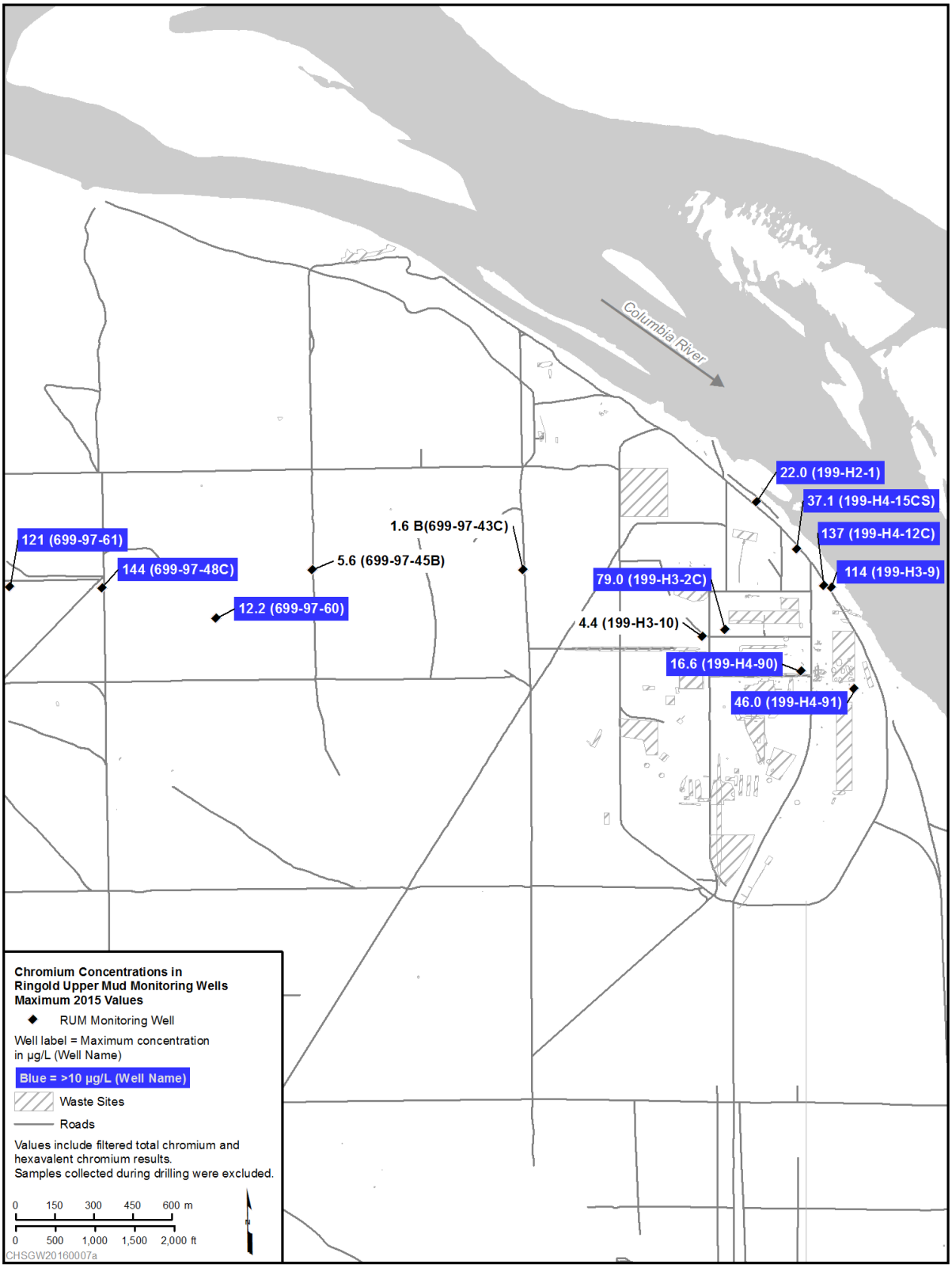

Figure 3. Chromium Distribution in RUM Wells at 100-HR-3 (2015 Maximum Values)

3 Objectives and Description of Work

The purpose of this test plan is to outline the critical items needed for successful testing, type of pumping tests to be conducted, and pumping durations needed to obtain adequate RUM aquifer data at the 100-H Reactor area. Data collected during the various pumping tests, along with background data, will be used to determine hydraulic properties needed to optimize remedial strategies for the HX P&T system within the RUM aquifer at 100-H.

3.1 Objectives

The aquifer pumping test includes the following objectives:

- Determine the radius of influence of pumping at each test well.
- Determine the connectivity of the RUM aquifer across 100-H.
- Determine if the RUM aquifer is leaky, confined, or semiconfined.
- Determine if the RUM aquifer is connected to the Columbia River.
- Determine the hydraulic parameters of the aquifer (transmissive sediments that make up the first water-bearing unit within the RUM).
- Determine the performance characteristics (e.g., specific capacity) of the test wells.
- Confirm the CSM.

This test plan includes field characterization and testing to accomplish these objectives. Pumping test data should be adequate to conduct an evaluation of groundwater flow between these RUM wells, connections between the two aquifers and the Columbia River, and potential flow pathways and support decisions for remediation of that lower unit.

3.2 Description of Work

The two pumping test scenarios that will be performed under this document are step drawdown pumping test with recovery and constant rate pumping test with recovery. Details for each pumping test and the test parameters are described in the following subsections.

To achieve test objectives, activities for this testing will be divided into the following phases:

- Phase 1 – Perform preliminary data evaluation.
  - Evaluate previous drawdown tests and pumping data for each test well to determine the expected sustainable discharge rate that will be used for the long-term pumping test.
  - Evaluate water level and analytical data.
- Phase 2 – Determine test design and configuration.
- Phase 3 – Install appropriate water level and specific conductivity instruments and data loggers in selected wells. Collect data for approximately 1 month prior before the start of pumping tests. These data will be reviewed and evaluated before Phase 4 is started to confirm the test design.
- Phase 4 – Conduct a series of pumping/recovery tests. During pumping tests, a portion of the HX P&T system will be turned off, and other wells will be set to have steady flow at a reduced rate.

No extraction from the RUM aquifer will be conducted during testing. Tests are to be conducted in the following order at each location:

  - Step Test: Conduct a relatively short term pumping test with defined pumping rates, designed to stress the aquifer. This data will provide the expected sustainable discharge rate for the long-term pumping test
  - Recovery: Allow for water level recovery and record recovery test data.
  - Constant Rate Test: Conduct a long-term, constant-rate pumping test.
  - Recovery: Allow for water level recovery and record recovery test data

- Phase 5 – Evaluate data from each test and observation wells.
- Phase 6 – Prepare a report with recommendations and conclusions.

3.2.1 Preliminary Evaluation

The preliminary evaluation of data consists of collecting and examining historical hydrologic and geochemical data. This evaluation is done to support development of a technical approach for the characterization of the RUM aquifer. A discussion of this evaluation is presented in Chapter 5.

3.2.2 Step Drawdown Tests

This type of test consists of a series of sequential, relatively short-duration constant rate pumping tests (steps), with each step being of equal duration and at a progressively higher pumping rate. The specific design, presented in Chapter 8, is based on aquifer test design described in Driscoll, 1986, *Groundwater and Wells*, and Dawson and Istok, 1991, *Aquifer Testing Design and Analysis of Pumping and Slug Tests*. Each step should be at least 2 hours in duration. The water level within the well should stabilize until the next higher pumping rate is initiated. If the water level has not stabilized within 2 hours, the pumping time should be extended until that occurs. Each step is to be of the same approximate duration. Ideally, drawdown at the pumping well should not exceed 50 percent of the available water column, but it may occur during the final pumping step. During these tests, a drawdown of up to 75 percent of the available water will be permitted.

Step drawdown tests are normally conducted to assess well/aquifer performance and for guidance in selecting an optimum pumping rate for the longer duration constant rate test, described below. Monitoring of specific conductance (SC) and water levels will be conducted for approximately 30 days before pumping begins to establish baseline conditions, such as natural barometric fluctuations reflected in elevation changes of the groundwater. Data obtained during the step drawdown test can be used to derive the following characteristics:

- Specific drawdown
- Specific capacity
- Qualitative assessment of well performance (yield-drawdown)
- Pumping rate for the constant rate test

Pumping and monitoring details are presented in Chapters 7 and 8.

3.2.3 Constant Rate Tests

During constant rate pumping tests, groundwater is extracted from the test interval and regulated to maintain a constant uniform rate. The head (water level) response within the pumped well is monitored

during the drawdown phase and during the subsequent recovery period following termination of pumping. The specific design, presented in Chapter 8, is based on aquifer test design described in Driscoll (1986), and Dawson and Istok (1991). The analysis of the drawdown and recovery response within the pumped well and surrounding monitoring wells provides a means for estimating hydraulic and storage properties of the aquifer and discerning formational and nonformational flow conditions (e.g., wellbore storage, skin effects, and presence of boundaries). As is the case for the step drawdown rate test, drawdown at the pumping well should not exceed 50 percent of the available water column.

Use of water level measurements from nearby observation wells should be included, if possible, for a more complete data set and accurate analysis. Data obtained during the constant rate test results can be used to derive the following characteristics:

- Aquifer transmissivity
- Storage coefficient, assuming an observation well is available
- Qualitative assessment of ability to maintain the planned yield
- Radius of influence
- Boundary condition effects, such as river influence and recharge areas
- Whether the aquifer is confined, semiconfined, or connected to another aquifer (leaky)

Pumping and monitoring details are presented in Chapters 7 and 8. Analytical data will be collected at the end of the constant rate test before the pump is turned off.

3.2.4 Recovery Tests

The recovery test is done by monitoring the recovery of water levels after pumping is stopped. It provides a useful check on the aquifer characteristics derived from other tests but is valid only if a foot valve is fitted to the riser main to prevent backflow; otherwise, water surges back into the well when the pump is turned off. All water level measuring equipment and the pump are to remain in the well during the entire recovery period. The water level in the well should not be disturbed during this time frame. Data obtained during the recovery test results can be used to derive the following characteristics:

- Confirmation of aquifer transmissivity
- Qualitative assessment of well losses (related to well efficiency)

Monitoring specifics are presented in Chapters 7 and 8.

4 Project Organization

This chapter presents the project organization, roles, and responsibilities for this test plan.

4.1 Regulatory and DOE Lead

The Washington State Department of Ecology (Ecology) is the regulatory lead for the 100-HR-3 Groundwater OU. Authorization for temporary shutoff of selected extraction and injection wells will be requested from Ecology prior to conducting the pumping tests described herein. The U.S. Department of Energy (DOE) OU lead is responsible for authorizing the pumping tests as described.

4.2 100-HR-3 Operable Unit Project Manager

The Project Manager is responsible for managing field activities and requirements, subcontracted tasks, and ensuring that the project file is properly maintained. The Project Manager ensures that aquifer pumping test design requirements are converted into field instructions (e.g., work packages) providing specific direction for field activities. The Project Manager works closely with Quality Assurance (QA), Health and Safety, and the Field Team Lead to integrate these and other lead disciplines in planning and implementation of the work scope. The Project Manager maintains a list of individuals or organizations filling each of the functional elements of the project organization. The Project Manager is also responsible for version control of the test plan to ensure that personnel are working to the most current job requirements.

4.3 Quality Assurance Manager

The QA manager (or designee) is responsible for QA issues on the project. Responsibilities include overseeing implementation of project QA requirements and reviewing project documents.

4.4 Environmental Compliance Officer

The Environmental Compliance Officer (ECO) provides technical oversight, direction, and acceptance of project and subcontracted environmental work and develops appropriate mitigation measures with a goal of minimizing adverse environmental impacts. The ECO also reviews plans, procedures, and technical documents to ensure that environmental requirements have been addressed; identifies environmental issues that affect operations and develops cost effective solutions; and responds to environmental/ regulatory issues or concerns raised by DOE and regulatory agencies. The ECO also oversees project implementation for compliance with applicable internal and external environmental requirements.

4.5 Operable Unit Technical Lead

The Technical Lead is responsible for defining the pumping test design, purpose, and scope. Other duties include data analysis, final test reporting, and clarification of technical issues pertaining to the test requirements. The Technical Lead will be contacted if any issues arise during testing.

4.6 Field Team Lead

The Field Team Lead is responsible for ensuring that prerequisite conditions are met and coordinating activities among the various organizations. The Field Team Lead, in conjunction with the OU Technical Lead, will provide clarification of requirements for all field activities. The Field Team Lead will be the point of contact for various organizations during the planning and setup stages. During field work, the Field Work Supervisor (FWS) will be the contact person.

4.7 Field Work Supervisor

The FWS is responsible for the following activities:

- Act as the central point of contact during field activities covered in this test plan.
- Ensure well access in accordance with GRP-PRO-041, *Well Access*, requirements.
- Perform field oversight during testing.
- Ensure and document that all testing equipment needed for the task, along with the appropriate personnel, are on site.

- Ensure that measurements and monitoring equipment use meet the requirements of GRP-EE-01-7.4, *Requirements for Use of Hydrogeologic Field Measurement & Monitoring Equipment*.
- Ensure that water level data are collected, as required by this plan.
- Document equipment configurations in the appropriate notes section in Appendix A.
- Ensure monitoring of testing is performed in accordance with the guidelines of this plan and the requirements of the appropriate test-specific governing documents and/or contractual agreements.
- Record each test activity, such as change in flow rate, to the nearest minute and note measurement reference point for all depth measurements.
- Along with the Field Team Lead, ensure that equipment and personnel needed are available and in place prior to test startup.

4.8 Field Data Collection and Reporting

During the pumping and recovery tests, data will be collected with in-well level loggers capable of measuring water level, temperature, and SC. Specific instrumentation is specified in Chapter 7. Water levels will be checked during pumping by use of the digital readout of the logger to ensure that the pump intake is submerged during the testing.

4.9 S&GRP Well Maintenance

Soil and Groundwater Remediation Project (S&GRP) well maintenance will be available to install and remove sampling and test pumps, as needed, for both the step drawdown and constant rate pumping tests. Equipment configuration and setup for the pumping tests, including installation and removal of sampling and test pumps, are needed for both the step drawdown and constant rate pumping tests.

4.10 S&GRP Pump and Treat Operations

S&GRP P&T Operations will provide the necessary support to conduct testing and operation of the P&T system, as required by this plan. HX P&T operations is responsible for providing the necessary support to conduct testing and operational support of the P&T facility, as required by this test plan. S&GRP will provide water level data from operational wells collected by the HX P&T system monitoring.

4.11 S&GRP Engineering

S&GRP engineering is responsible for providing all design and construction support to perform the pumping tests.

5 RUM Aquifer Geometry and Well Configuration

The geology encountered during drilling and construction of wells planned for testing is useful for the design of a pumping test, including determining which wells are appropriate for pumping and which observation wells should be utilized.

5.1 RUM Well Geology

Within the RUM aquifer, eight wells located in the 100-H Area are completed and screened. Wells 199-H2-1, 199-H3-10, 199-H4-15CS, 199-H4-90, and 199-H4-91 are groundwater monitoring wells. Wells 199-H4-12C, 199-H3-2C, and 199-H3-9 are connected to the HX P&T system and currently

operate as extraction wells. The area geology, well construction, and distance from pumping wells to potential observation wells are considered during pumping test design.

In the 100-H Area, the RUM surface is undulating, with a trough trending parallel to the river (Figure 2). This is likely a result of scouring during historical catastrophic flooding. The eight wells completed in the RUM at 100-H are located in two general areas. One group is generally along the shoreline of the Columbia River; from north to south, these are wells 199-H2-1, 199-H4-15CS, 199-H4-12C, and 199-H3-9. Wells 199-H3-10 and 199-H3-2C are located more inland and on the western side of the RUM ridge. Wells 199-H4-90 and 199-H4-91 are farther to the south. These two wells are located near the point of the ridge.

As presented in Table 1, the first sand-dominated unit within the RUM is typically about 6 m (20 ft) thick. The unit appears to be as much as 11.6 m (38 ft) thick at well 199-H2-1 but located on the north end of 100-H. A cross section through the ridge (Figure 4) in the RUM surface shows an upward angle in the water-bearing sand unit, from west to east, getting closer to the surface near the river. The low spot in the RUM surface is not as apparent in the cross section but is shown in Figure 2. In wells 199-H4-90 and 199-H4-91, the water-bearing sand unit is nearly 10 m higher in elevation than at wells 199-H3-10 and 199-H3-2C.

5.2 RUM Well Construction

Details on the RUM aquifer, including well screen information, for the eight RUM wells at 100-H are provided in Table 1. Well identification and location information is provided in Table 2, including the distance from each well to the Columbia River. The wells completed in the RUM aquifer are typically constructed with a 0.010 slot screen size due to the fine grain size of the RUM aquifer material. These wells are not expected to produce high groundwater flow rates due to the tight nature of the RUM material, which limits flow movement. A connection to the overlying unconfined aquifer or the nearby Columbia River, however, would allow for higher pumping rates. This may be the case in well 199-H4-12C and 199-H3-2C, both of which have maintained flow rates ranging from 25 to 50 gpm since 2009. Connectivity to the river is most likely in wells that are located in close proximity to the river (Table 2), such as wells 199-H2-1, 199-H3-9, 199-H4-12C, and 199-H4-15CS.

6 Pre-Design Data Evaluation

Three geographical areas within 100-H were selected for evaluation and testing. Locations were selected based on the following criteria:

- Availability of RUM well for pumping (with preference given to those wells connected to the extraction system)
- One or more nearby RUM wells available for observation
- Proximity to the Columbia River
- One or more observation wells available within the overlying unconfined aquifer

Selected test areas are (1) well group 199-H3-2C/199-H3-10, (2) well group 199-H4-90/199-H4-91, and (3) well group 199-H4-12C/199-H3-9, as shown in Figure 5. Water level responses, geochemical data, pumping performance, and past pumping tests were evaluated; results are presented in the following sections.

Table 1. RUM Well Completion Details

Well Name	Surface Elevation in meters (ft)	RUM Surface Elevation in meters (ft)	Depth to RUM in meters (ft)	Depth to Water in meters (ft)	Total Well Depth in meters (ft)	Thickness of RUM Aquifer in meters (ft)	Depth to Screen in meters (ft)		Screen Elevation in meters (ft)	
							Top	Bottom	Top	Bottom
199-H2-1	123.35 (404.69)	111.16 (364.70)	12.19 (40)	7.22 (23.7)	23.46 (77.0)	11.6 (38)	19.5 (64)	22.5 (74)	103.85 (340.73)	100.81 (330.73)
199-H3-2C[a]	128.02 (420.01)	111.22 (364.89)	16.80 (55)	12.50 (41.0)	35.20 (115.5)	6.1 (20)	30.5 (100)	33.5 (110)	97.54 (320.01)	94.49 (310.01)
199-H3-9[a]	126.36 (414.57)	111.16 (364.69)	15.20 (50)	10.81 (35.5)	27.78 (91.1)	6.4 (21)	23.8 (78.1)	26.9 (88.1)	102.54 (336.43)	99.49 (326.43)
199-H3-10	128.25 (420.77)	111.48 (365.75)	16.76 (55)	12.65 (41.5)	35.31 (115.9)	4.9 (16)	31.4 (102.9)	34.4 (112.9)	96.90 (317.91)	93.85 (307.91)
199-H4-12C[a]	126.34 (414.50)	111.13 (364.51)	15.2 (50)	11.64 (38.2)	24.99 (82.0)	4.6 (15)	21.9 (72)	25.0 (82)	104.39 (342.5)	101.35 (332.50)
199-H4-90	130.02 (426.57)	110.82 (363.57)	19.20 (63)	13.89 (45.6)	29.69 (97.4)	5.8 (19)	22.9 (75.3)	27.5 (90.3)	107.07 (351.29)	102.50 (336.27)
199-H4-91	128.22 (420.67)	111.00 (364.17)	17.22 (57)	12.40 (40.9)	28.80 (94.5)	7.6 (25)	21.4 (70.2)	26.0 (85.2)	106.82 (350.47)	102.25 (335.47)
199-H4-15CS[b]	No Available Data									

Notes: Wells are 6 in. diameter with 10 slot screen and 20-40 filter sand pack size.

Aquifer thickness is based on the sand unit identified in the borehole log and may not represent that saturated thickness depths are relative to ground surface at time of drilling.

a. Extraction well is connected to the HX pump and treat system.

b. Well is a 2 in. diameter piezometer. Geologic details are not available.

Location of the water-bearing unit is estimated based on the well logs. Well logs for 199-H3-2C and 199-H4-12C have limited geologic data included.

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Table 2. RUM Well Location Summary

Well Name	Well Use/Type	Easting (m)	Northing (m)	Distance to Columbia River in meters (ft)
199-H2-1	Monitoring	577752.31	153239.89	47 (153)
199-H3-2C	Extraction	577632.07	152750.30	470 (1,543)
199-H3-9	Extraction	578039.13	152913.59	48 (158)
199-H3-10	Monitoring	577545.13	152723.52	557 (1,827)
199-H4-12C	Extraction	578011.75	152919.81	71 (233)
199-H4-15CS	Monitoring	577907.69	153059.98	56 (183)
199-H4-90	Monitoring	577911.13	152560.23	308 (1,012)
199-H4-91	Monitoring	578126.38	152524.59	171 (562)

Note: Distance to the Columbia River is based on a perpendicular line to the shore during low river stage and may vary during the year.

6.1 Test Area 1: 199-H3-2C and 199-H3-10

Water levels in the unconfined aquifer respond to changes in river stage in this area, as does the head in RUM well 199-H3-10. Pressure responses associated with pumping rate changes at H3-2C are also observed at H3-10. This historical data indicate a potential connection between the two RUM wells in the area and between the RUM and unconfined aquifer.

Analytical data from well 199-H3-2C show a rapid increase in Cr(VI) concentrations immediately following the 2009 pumping test. Concentrations increased from 30 µg/L on August 9, 2010 (the first measurement following the pumping test) to 57 µg/L in January 2011, and remained stable at that level afterwards. Well 199-H3-10, located approximately 91 m (300 ft) from 199-H3-2C, has fairly consistent Cr(VI) concentrations below 10 µg/L. These data are inconsistent with the connectivity suggested by the water level data.

SC results over time show a marked difference between the RUM and unconfined aquifers. Those wells completed in the RUM have a typical SC result between 250 and 350 µS/cm, while the nearby wells in the unconfined aquifer have a SC of around 500 µS/cm (Figure 6).

Based on multiple lines of evidence, including a previous pumping test at 199-H3-2C, a small amount of intercommunication between the RUM aquifer and the overlying unconfined aquifer is indicated. Measurements of water levels and SC during testing will be used to determine the extent of any leakage between the two aquifers. Monitoring of Cr(VI) during and after testing will also be useful in evaluation of the aquifer connectivity. Pumping tests are to be conducted on both extraction well 199-H3-2C and monitoring well 199-H3-10.

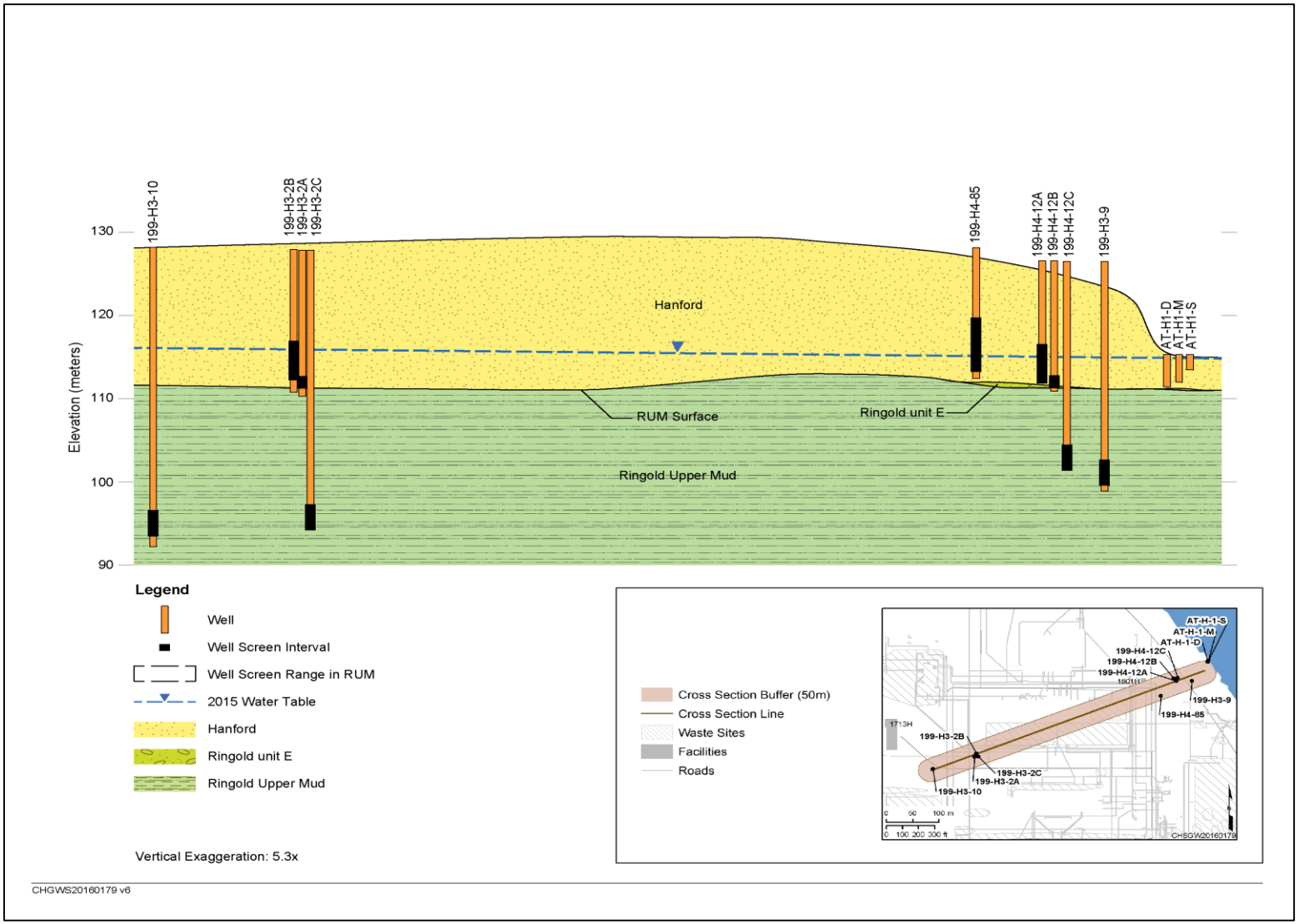


Figure 4. Cross Section of Select RUM Wells at 100-H

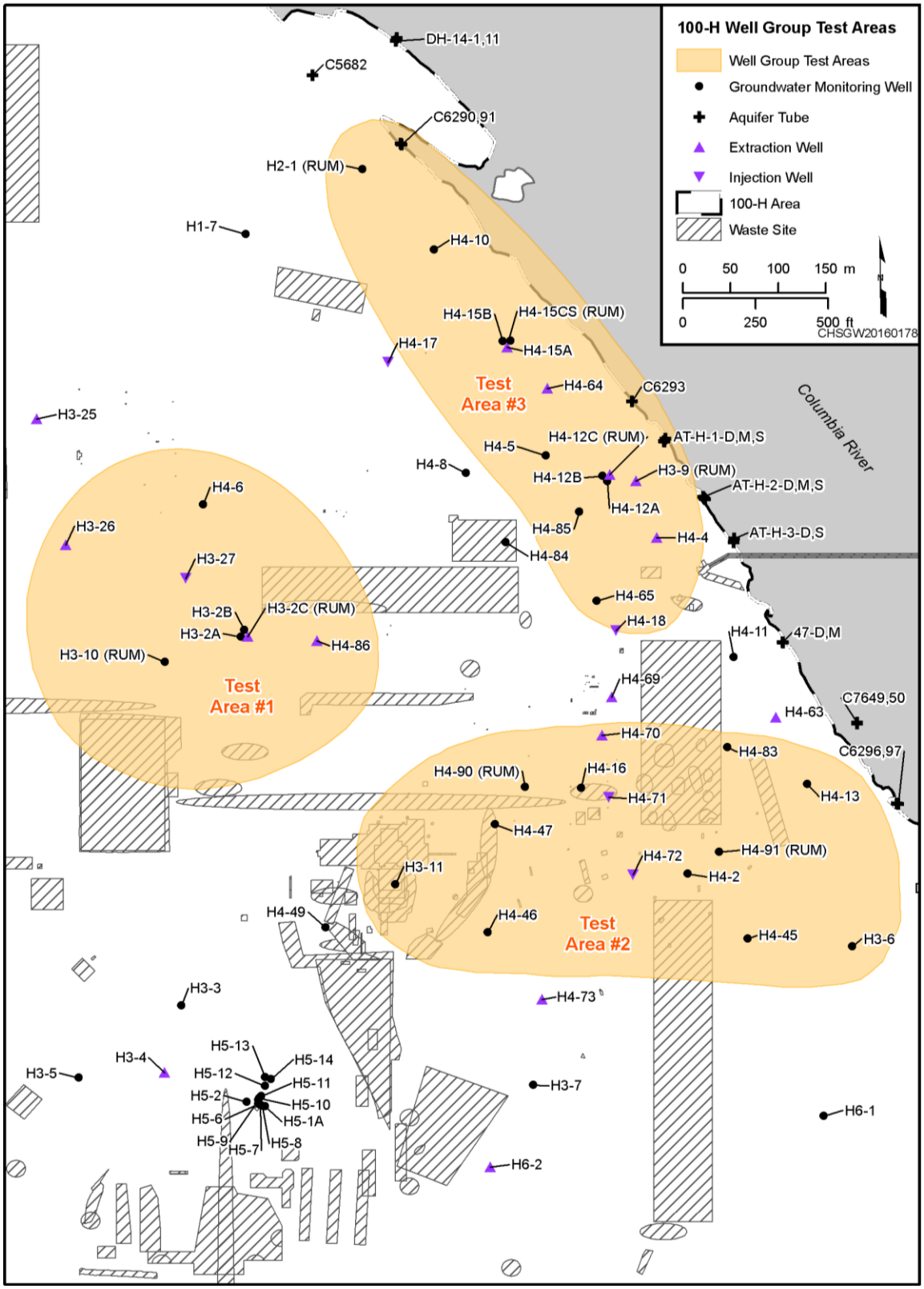


Figure 5. General Well Group Test Areas

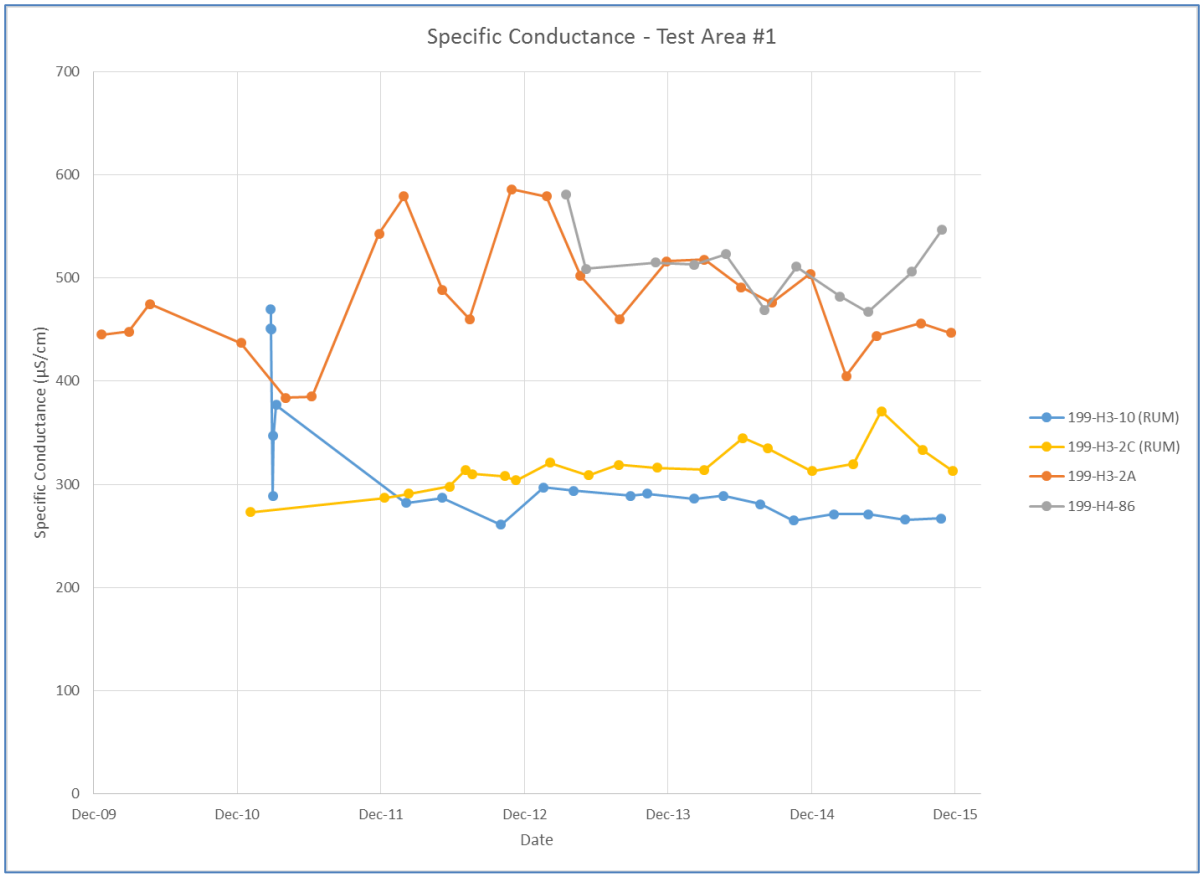


Figure 6. Specific Conductance Trends in Test Area 1

6.2 Test Area 2: 199-H4-90 and 199-H4-91

Water level data indicate that a response to changes in river stage is exhibited in both the unconfined and RUM aquifers. Analytical results from both wells show Cr(VI) concentrations at around 10 to 20 µg/L in well 199-H4-90 and at concentrations of about 20 to 40 µg/L in well 199-H4-91. SC data in the RUM aquifer are slightly higher than in Test Area 1, which typically ranges from 300 to 350 µS/cm, but are still well below the SC levels found in the overlying unconfined aquifer. Other data on the two RUM wells are limited since they were both installed in September 2013.

Measurements of water levels and SC during testing will be used to determine the extent of any leakage between the two aquifers. Monitoring of Cr(VI) during and after testing will also be useful in evaluation of the aquifer connectivity. Pumping tests are to be conducted on monitoring well 199-H4-90, since this well is located farther inland than well 199-H4-91, to minimize impacts from river stage.

6.3 Test Area 3: 199-H4-12C and 199-H3-9

A strong river stage effect is exhibited in both the unconfined aquifer and the RUM aquifer wells. This is expected due to the proximity of the river to the wells. Data from the 2009 pumping test in well 199-H4-12C indicated a skin effect at the well from the quick recovery response, and no apparent drawdown response in the overlying unconfined aquifer, as measured in adjacent well 199-H4-2B.

SC values are highly variable at this near-river location, as expected. RUM wells 199-H4-12C and 199-H3-9 both have SC values, ranging from about 250 µS/cm during most of the year to as high as

450 µS/cm during short time periods. This variability will make timing and the use of pre-test data important during evaluation of potential aquifer leakage.

Cr(VI) concentrations in well 199-H4-12C had been declining from 260 µg/L in 1996, following well installation, until the well was pumped as part of a test in 2009. At that time, concentrations rose from 82.4 µg/L just prior to pumping, to 110 µg/L at the end of the testing. By the end of 2011, concentration was at 147 µg/L, at which time it started to decline. Since that time, Cr(VI) data in well 199-H4-12C have been relatively stable, with concentrations near 120 µg/L. More recently, however, Cr(VI) concentrations have started to rise and are exhibiting substantial fluctuation between measurements. The cause of this fluctuation is unclear and may be related to continuous pumping at the well since 2009 resulting in a preferential pathway due to the stress on the aquifer. Subsequently, extraction flow rates have been reduced from 114 L/min (30 gpm) to 38 L/min (10 gpm) at this well to reduce stress on the aquifer and the potential to create a connection between the RUM aquifer and the overlying unconfined aquifer. Other possible explanations include a hydraulic connection to the river, or a flow path to another area of the RUM aquifer that is not contaminated. A pumping test at well 199-H4-12C will be considered following evaluation of additional data and review of existing Cr(VI) data for potential transcription errors.

Measurements of water levels and SC during testing will be used to determine the extent of any leakage between the two aquifers and connections to the Columbia River. Monitoring of Cr(VI) during and after testing will also be useful in evaluation of the aquifer connectivity. Once these monitoring data have been collected and analyzed, it will be determined whether additional hydrologic testing at this location is warranted at well 199-H4-12C. A pumping test is planned at extraction well 199-H3-9.

7 Well Testing Configuration

This chapter presents the configuration of pumping wells, observation wells, monitoring instrumentation, and equipment for conducting the pumping tests.

7.1 Pumping and Observation Wells

The eight groundwater wells completed in the RUM aquifer in the 100-H Reactor area are listed in Table 1. As discussed in Chapter 4, the wells are located across an area with an undulating RUM surface. Wells 199-H3-2C and 199-H4-12C also appear to be connected to either the unconfined aquifer or the Columbia River. A connection across the RUM aquifer is being evaluated with this testing. The three Test Area groups are discussed in Chapter 5 and shown in Figure 5.

Testing will include both step tests and a constant rate pumping test, with recovery testing after each pumping test. Observation wells will be used to improve data quality and ensure that adequate information is collected to meet testing objectives.

7.1.1 Pumping Wells

Pumping wells for this test plan have been identified as 199-H3-2C, 199-H3-10, 199-H3-9, 199-H4-90, and potentially 199-H4-12C. Pumping on well 199-H4-12C is dependent on the evaluation of initial SC and water level data due to the recent irregularities in contaminant concentrations.

7.1.2 Observation Wells

An observation well can be any well that may be influenced by the pump well, or not, during testing. Observation wells for a pumping test conducted on an unconfined aquifer are generally within close proximity to the pumping well. In this case, the pumping test is being conducted on a confined or semiconfined aquifer (the RUM aquifer). As a result, head changes can be noted at much greater distances

from the pumping well because less water is available from storage in confined aquifers compared to unconfined aquifers (Driscoll, 1986).

In anticipation of an aquifer response at larger distances, instrumentation and monitoring will be conducted over the entire study area. Numerous observation wells have been identified in both the RUM aquifer and the overlying unconfined aquifer within 100-H. Distances between pumping wells and observation wells are provided in Table 3, with those wells located within a closer proximity and, therefore, considered more critical to the test, highlighted in orange. Should the instrumentation in the pumping well or critical observation wells malfunction during the test period(s), reinitiating the affected test will be evaluated. The automated water level network (AWLN) wells within 100-H are also observation points, but are not necessarily having additional instrumentation, and are not included in Table 3. In addition to groundwater head data collected from observation and pumping wells, data will be collected from the 100-H Area river gauge and the U.S. Geological Survey gauge station below Priest Rapids Dam.

Key observation wells were selected based on the proximity to the pumping well, although available wells within 300 m (approximately 1,000 ft) were somewhat limited. Observation wells in each test area group are presented in Table 4.

Table 3. Distance from Pumping to Observation Wells

Observation Well	Pumping Well									
	199-H3-10		199-H3-2C		199-H3-9		199-H4-12C		199-H4-90	
	Distance		Distance		Distance		Distance		Distance	
	m	ft	m	ft	m	Ft	m	ft	m	ft
199-H2-1	556	1,825	504	1,654	434	1,425	412	1,352	669	2,196
199-H3-10	--	--	91	298	529	1,737	506	1,661	400	1,312
199-H3-26	161	529	214	702	602	1,975	576	1,889	545	1,788
199-H3-2B	90	294	8	26	440	1,442	417	1,367	338	1,107
199-H3-2C	91	298	--	--	439	1,439	416	1,364	331	1,086
199-H3-6	781	2,561	713	2,339	539	1,767	556	1,825	382	1254
199-H3-9	529	1,737	439	1,439	--	--	28	92	341	1,120
199-H3-11	336	1,101	302	992	493	1,617	485	1,403	170	559
199-H4-12B	499	1,637	409	1,340	35	115	8	25	336	1,102
199-H4-12C	506	1,661	416	1,364	28	92	--	--	339	1,112
199-H4-13	686	2,251	607	1,993	366	1,200	385	1,264	296	972
199-H4-15A	488	1,600	407	1,337	194	637	171	563	461	1,513
199-H4-15CS	495	1,623	415	1,360	197	645	175	573	468	1,534
199-H4-16	456	1,497	384	1,260	327	1,073	330	1,081	59	193
199-H4-4	532	1,745	441	1,447	63	208	82	269	296	970
199-H4-5	455	1,491	366	1,200	98	321	70	229	348	1,141
199-H4-6	170	557	146	478	455	1,491	428	1,403	449	1,473
199-H4-45	677	2,220	613	2,010	494	1,622	507	1,665	283	927

Table 3. Distance from Pumping to Observation Wells

Observation Well	Pumping Well									
	199-H3-10		199-H3-2C		199-H3-9		199-H4-12C		199-H4-90	
	Distance		Distance		Distance		Distance		Distance	
	m	ft	m	ft	m	Ft	m	ft	m	ft
199-H4-46	442	1,449	400	1,311	499	1,636	497	1,630	158	517
199-H4-47	386	1,265	326	1,068	389	1,278	386	1,266	51	166
199-H4-64	493	1,618	408	1,338	134	441	112	368	419	1,373
199-H4-65	458	1,501	368	1,208	133	436	133	437	209	685
199-H4-85	462	1,517	372	1,219	68	222	50	165	294	964
199-H4-86	161	528	73	238	374	1,228	353	1,159	267	875
199-H4-90	400	1,312	331	1,086	341	1,120	339	1,112	--	--
199-H4-91	615	2,017	544	1,784	399	1,310	412	1,352	215	705

Note: Orange highlighted cells indicate that observation wells are located closer to the pumping well (approximately 300 m [1,000 ft]), which makes them more critical to that particular pumping test.

Only wells with added instrumentation are listed.

Table 4. Critical Observation Wells by Test Area

Test Area 1	Test Area 2		Test Area 3	
Pumping Wells: Extraction Well 199-H3-2C; Monitoring Well 199-H3-10	Pumping Well: Monitoring Well 199-H4-90		Pumping Wells: Extraction Well 199-H3-9; Extraction Well 199-H4-12C*	
Critical Observation Wells (within 300 m [1,000 ft] of Pumping Well)				
199-H3-2B 199-H3-11 199-H3-26 199-H4-6 199-H4-86	199-H3-11 199-H4-4 199-H4-13 199-H4-16 199-H4-45	199-H4-46 199-H4-47 199-H4-65 199-H4-85 199-H4-86	199-H4-12B 199-H4-15A 199-H4-15CS 199-H4-4	199-H4-5 199-H4-64 199-H4-65 199-H4-85

Note: Pumping wells are to be used for observation when not being pumped.

* Well 199-H4-12C may not be used for pumping, depending on initial data collection.

7.2 Equipment Requirements

The following general list of required test equipment was used in pumping tests. The specific description (size, type, model, range, equipment dimensions, and other specifications) of this equipment may vary, depending on well and site conditions.

For extraction wells:

- The current submersible pump in use for the HX P&T system will be used. Pump size and other details are available in the HX construction drawings.
- Pumping rates will be controlled from the P&T facility.

For monitoring wells:

- A submersible pump has sufficient capacity to produce the target pump rate. The FWS should record the pump type (i.e., submersible, positive displacement, or bladder), make, identification number, and horsepower rating on the field data form in Table A-9 Monitoring Well Notes (Appendix A).
- A generator is used to power the submersible pump. The FWS should record the details regarding the type and size of generator used in Table A-9 Monitoring Well Notes (Appendix A).
- For the riser pipe, diameter, type (i.e., galvanized, stainless steel, polyvinyl chloride, or acrylonitrile-butadiene-styrene), number, and lengths of pipe joints used are recorded in the pumping test notes (Appendix A).
- A flow meter has sufficient range to cover the target flow rate. A 5 gal bucket and stopwatch should also be available checking flow rates, as confirmation of the flow meter data in the flow rate notes section (Appendix A).
- Self-powered data logger and transducer(s) are appropriate for the expected head changes. The serial number, calibration date, size, and type of equipment used are recorded. Instrumentation details are presented in Tables 5 and 6 and information should be recorded in the Pumping Test Notes (Appendix A).

Based on the pre-design data evaluation (Chapter 5), it was determined that SC and water level would be beneficial data for collection before testing and during and after a pumping test. Temperature data will also be collected and are generally included in most downwell loggers. Monitoring will extend into the summer months so that changes in unconfined aquifer SC and temperature, associated with incursion of river water from seasonal changes in Columbia River stage, can be used as a direct measure and/or positive confirmation of the occurrence of intercommunication between the unconfined aquifer and underlying RUM aquifer. River stage data will be collected from the 100-H Area river gauge. All field work, including data collection, will be conducted per standard operating procedures. Some of the wells identified for monitoring already have some level of instrumentation. Wells that are part of the existing P&T system have a downhole pressure transducer for recording water levels. The existing transducer will be supplemented with additional equipment to obtain SC and temperature readings. Wells that are part of the AWLN currently record water level measurements on an hourly basis. A subset of these wells will be augmented with additional equipment to obtain SC and temperature readings.

Data loggers with transducers will be installed, and data will be collected for approximately 30 days before the aquifer step drawdown pumping test is started. Data collected from this time frame may be used to modify this test plan and will be noted in the pumping test report. Instrumentation will be installed as in Table 5, and shown in Figure 7, which includes the AWLN not having additional instrumentation. Required equipment during testing is outlined in Table 6.

Table 5. Instrumentation

Well	Aquifer Monitored[a]	Well Use	Instrumentation Installed for Aquifer Test[c]	Data Collected	Depth of Instrumentation in meters (feet) bgs
199-H2-1	RUM	Monitoring Well with AWLN Station	Campbell Scientific 547A-L50	Water level, SC	10.9 (35.84)
199-H3-10	RUM	Monitoring Well with AWLN Station	Campbell Scientific 547A-L50	Water level, SC	16.6 (54.51)
199-H3-2B	Unconfined	Monitoring Well with AWLN Station	Campbell Scientific 547A-L50	Water level, SC	14.5 (47.45)
199-H4-5	Unconfined	Monitoring Well with AWLN Station	Campbell Scientific 547A-L50	Water level, SC	13.6 (44.66)
199-H4-12B	Unconfined	Monitoring Well with AWLN Station	Campbell Scientific 547A-L50	Water level, SC	13.3 (43.72)
199-H4-13	Unconfined	Monitoring Well with AWLN Station	Campbell Scientific 547A-L50	Water level, SC	16.1 (52.93)
199-H4-6	Unconfined	Monitoring Well	In-Situ Inc. Aqua TROLL® 200	Water level, SC	15.1 (49.50)
199-H4-45	Unconfined	Monitoring Well	In-Situ Inc. Aqua TROLL 200	Water level, SC	14.3 (47.00)
199-H4-46	Unconfined	Monitoring Well	In-Situ Inc. Aqua TROLL 200	Water level, SC	16.9 (55.50)
199-H4-85	Unconfined	Monitoring Well	In-Situ Inc. Aqua TROLL 200	Water level, SC	15.8 (52.00)
199-H4-16	Unconfined	Monitoring Well	Solinst Levelogger® Junior 3001	Water level, SC	17.2 (56.50)
199-H4-47	Unconfined	Monitoring Well	Solinst Levelogger Junior 3001	Water level, SC	18.0 (59.00)
199-H4-90	RUM	Monitoring Well	Solinst Levelogger Junior 3001	Water level, SC	18.0 (59.00)
199-H4-91[b]	RUM	Monitoring Well	Solinst Levelogger Junior 3001	Water level, SC	15.8 (52.00)
			Solinst Barologger®	Atmospheric Pressure	13.8 (45.25)
199-H3-6	Unconfined	Monitoring Well	Solinst Levelogger Junior Edge	Water level	15.8 (52.00)
199-H3-11	Unconfined	Monitoring Well	Solinst Levelogger Junior Edge	Water level	15.9 (52.25)
199-H4-15CS	RUM	Monitoring Well	Solinst Levelogger Junior Edge	Water level	11.6 (38.00)
199-H4-65	Unconfined	Monitoring Well	Solinst Levelogger Junior Edge	Water level	16.2 (53.00)
199-H3-2C	RUM	HX System Extraction Well	In Situ Inc. Aqua TROLL 200	Water level, SC	32.1 (105.23)
199-H3-9	RUM	HX System Extraction Well	In Situ Inc. Aqua TROLL 200	Water level, SC	25.6 (84.00)
199-H3-26	Unconfined	HX System Extraction Well	In Situ Inc. Aqua TROLL 200	Water level, SC	12.7 (41.55)
199-H4-4	Unconfined	HX System Extraction Well	In Situ Inc. Aqua TROLL 200	Water level, SC	12.1 (39.58)
199-H4-12C	RUM	HX System Extraction Well	In Situ Inc. Aqua TROLL 200	Water level, SC	23.5 (77.00)

Table 5. Instrumentation

Well	Aquifer Monitored[a]	Well Use	Instrumentation Installed for Aquifer Test[c]	Data Collected	Depth of Instrumentation in meters (feet) bgs
199-H4-15A	Unconfined	HX System Extraction Well	In Situ Inc. Aqua TROLL 200	Water level, SC	11.5 (37.76)
199-H4-64	Unconfined	HX System Extraction Well	In Situ Inc. Aqua TROLL 200	Water level, SC	11.2 (36.68)
199-H4-86	Unconfined	HX System Extraction Well	In Situ Inc. Aqua TROLL 200	Water level, SC	17.1 (56.00)
199-H1-7	Unconfined	Monitoring Well with AWLN Station	--	Water level	11.6 (37.99)
199-H4-8	Unconfined	Monitoring Well with AWLN Station	--	Water level	14.8 (48.64)
199-H4-10	Unconfined	Monitoring Well with AWLN Station	--	Water level	12.4 (40.57)
199-H4-11	Unconfined	Monitoring Well with AWLN Station	--	Water level	14.2 (46.43)
199-H4-15B	Unconfined	Monitoring Well with AWLN Station	--	Water level	13.2 (43.22)
199-H4-83	Unconfined	Monitoring Well with AWLN Station	--	Water level	12.7 (41.72)
199-H4-84	Unconfined	Monitoring Well with AWLN Station	--	Water level	14.7 (48.21)
199-H5-1A	Unconfined	Monitoring Well with AWLN Station	--	Water level	16.2 (53.13)
H River Gauge	Columbia River[a]	AWLN Station	--	Columbia River Level	12.8 (41.91)

Notes: Solinst, Levelogger, and Barologger are registered trademarks of Solinst Canada Ltd., Georgetown, Ontario, Canada.

TROLL is a registered trademark of In-Situ Inc., Fort Collins, Colorado.

a. The Columbia River is included herein, but is not an aquifer.

b. The Solinst Levelogger Junior 3001 and Solinst Barologger instruments are both to be installed at well 199-H4-91.

c. The Aqua TROLL 200 and Solinst Levelogger Junior 3001 units are interchangeable. Actual model installed will be noted for each well in the final report.

AWLN = automated water level network

bgs = below ground surface

RUM = Ringold Formation Upper Mud

SC = specific conductance

Table 6. Required Equipment

Activity	Pumping Well Type	Testing Equipment	Monitoring Equipment
Step Test and Constant Rate Test	Monitoring Wells	Test pump with controller and check valve to prevent backflow into the well, generator, piping for water disposal	Data loggers installed in wells, flow meter
	Extraction Wells	Extraction pump	Data loggers installed in wells
Recovery Test	Monitoring Wells	None	Data loggers installed in wells
	Extraction Wells	None – Pumping well to be off	Data loggers installed in wells

8 Pumping Tests

Testing will be conducted in each of the three test areas, as outlined in Chapter 6. Pumping will be conducted on the following wells within the RUM aquifer: 199-H3-2C, 199-H3-10, 199-H4-90, and 199-H3-9. Pumping at well 199-H4-12C will be dependent on the evaluation of initial SC and water level data. The pumping test will include step tests with recovery and constant rate tests with recovery. The 100-H Area wells will be monitored while testing is conducted, with instrumentation as described in Tables 5 and 6.

8.1 Planning and Initial Conditions

Aquifer testing must be planned prior to commencement to ensure that test requirements are identified and met, personnel and equipment are available, and appropriate coordination with other onsite personnel (e.g., P&T operating personnel) has been made.

8.1.1 HX Pump and Treat System

Pumping from the RUM aquifer and/or the unconfined aquifer must be controlled during the pumping and recovery testing periods. Extraction/injection wells that will be used for observation and may be affected by the pumping test will be set to flow rates as described below for a minimum of 24 hours prior to the start of any test and maintained until the recovery period is completed. This time frame is designed to allow for the RUM aquifer to rebound to a static water level condition and the conditions in the unconfined aquifer to stabilize. The required system changes are presented in the following subsections. Actual flow rates are to be recorded on the Extraction Well – Pumping Test Initiation Form, Extraction Wells – Flow Rate Notes, and Injection Wells – Flow Rate Notes (Appendix A).

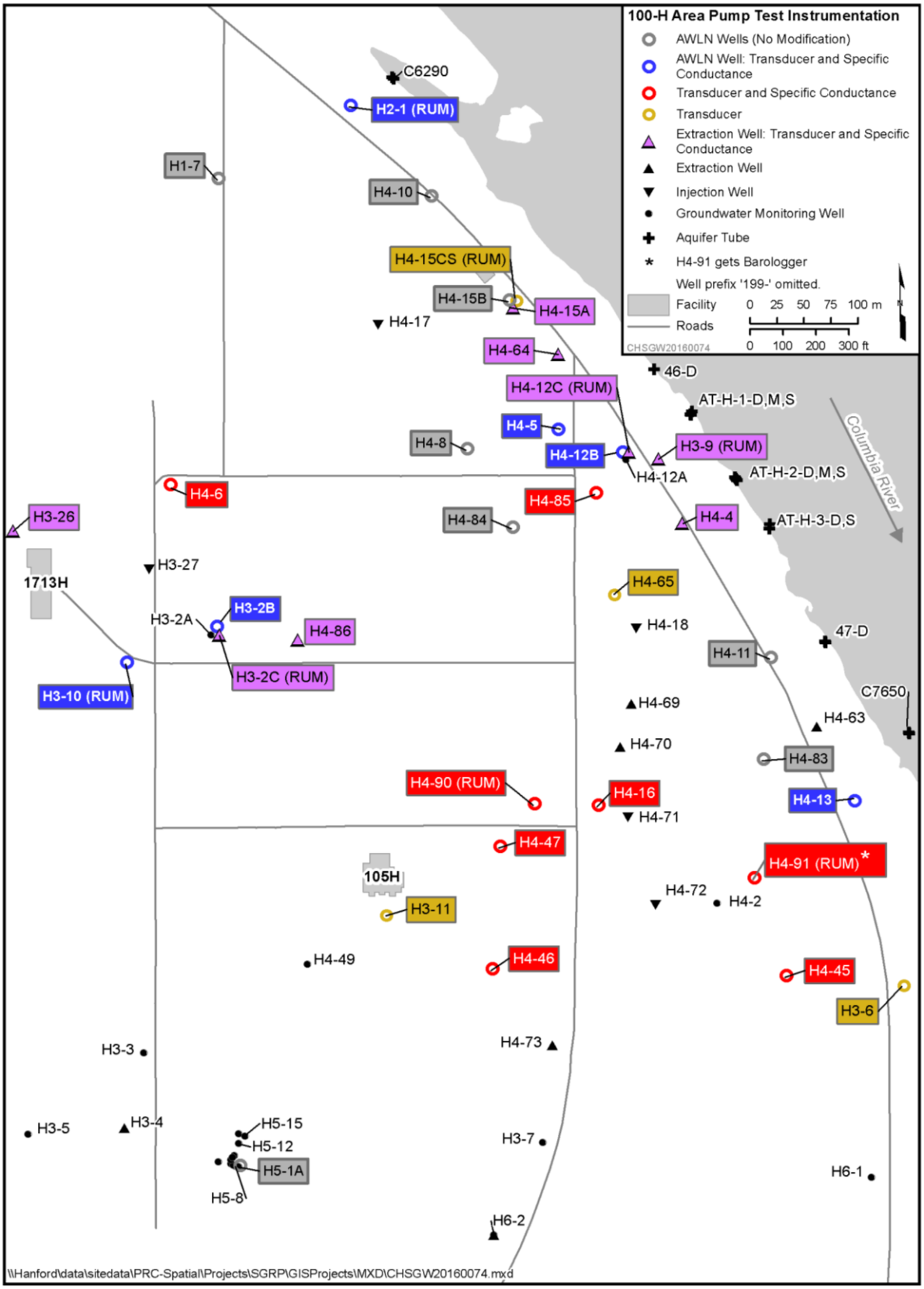


Figure 7. Test Area Instrumentation Plan

8.1.1.1 Extraction Wells

Extraction from the RUM aquifer will be suspended for the duration of the test. The wells to be left off, unless being used as the pumping well, are presented in Table 7.

Table 7. RUM Aquifer Extraction Well Flow Rates

Well Name	Plant Identification	Typical Flow Rate during High River (gpm)	Flow Rate during All Pumping Tests (gpm); Assumes Well Is Not Pumping Well
199-H3-2C	HE09	25 to 30	0
199-H4-12C	HE10	25 to 30	0
199-H3-9	HE13	10 to 20	0

Note: High river rates are based on 2014 averages.

Extraction wells in the unconfined aquifer are to be held to the flow rates (gpm) in Table 8.

Table 8. Unconfined Aquifer Extraction Well Flow Rates

Well Name	Plant Identification	Typical High River Flow (gpm)	Flow Rate during Pumping Tests (gpm) and Recovery Periods by Area				
			Test Area 1		Test Area 2	Test Area 3	
			HE09 199-H3-2C	199-H3-10	199-H4-90	HE13 199-H3-9	HE10 199-H4-12C
199-H4-15A	HE02	30	20	20	20	**0**	**0**
199-H4-69	HE03	20	20	20	**0**	20	20
199-H4-70	HE04	20	20	20	**0**	20	20
199-H4-4	HE06	10	10	10	10	**0**	**0**
199-H4-63	HE07	25	20	20	**0**	20	20
199-H4-64	HE08	20	20	20	20	**0**	**0**
199-H3-26	HE37	50	**0**	**0**	50	50	50
199-H4-86	HE44	40	**0**	**0**	30	30	30
Total Flow Rate (gpm)		**215**	**110**	**110**	**110**	**140**	**140**

Notes: High river rates are based on 2014 averages.

Blue shading indicates wells with zero flow during the test period.

Rates may be adjusted based on plant flow through needs and discussions with the Technical Lead.

8.1.1.2 Injection Wells

Injection wells at 100-H are to be off or held at a specified flow rate, as shown in Table 9.

Table 9. Unconfined Aquifer Injection Well Flow Rates

Well Name	Plant Identification	Typical High River Flow (gpm)	Flow Rate during Pumping Tests (gpm) and Recovery Periods by Area				
			Test Area 1		Test Area 2	Test Area 3	
			HE09 199-H3-2C	199-H3-10	199-H4-90	HE13 199-H3-9	HE10 199-H4-12C
199-H4-73	HJ02	35	0	0	0	0	0
199-H4-72	HJ03	50	0	0	0	0	0
199-H4-71	HJ04	45	0	0	0	0	0
199-H4-18	HJ05	15	0	0	0	0	0
199-H3-27	HJ06	60	0	0	0	0	0
199-H4-17	HJ14	10	0	0	0	0	0

Note: High river rates are based on 2014 averages.

8.1.1.3 Monitoring Wells

Two wells are being tested that are not connected to the HX P&T system: 199-H3-10 and 199-H4-90. Water generated during pumping will be discharged to the ground surface (see Chapter 11, “Waste Management”). Expected water volumes generated during aquifer pumping at well 199-H3-10 range from 52,996 L (14,000 gal) during the step test (minimum duration) to 136,274 L (36,000) gal during the constant rate test. This volume assumes a maximum pumping rate (Q_{max}) for this well of 95 L/min (25 gpm). At well 199-H4-90, water volumes generated during pumping are estimated to range from 10,599 L (2,800 gal) during the step test (minimum duration) to 7,200 gal during the constant rate test. This volume assumes a Q_{max} for this well of 19 L/min (5 gpm). It should be noted that the actual volumes may exceed this estimate, depending on the final pumping rate (Q_{max}) determined by evaluation of the step test. Estimated purgewater volumes and rates for each step, by well, are included in Appendix A.

8.2 Step Drawdown Pumping Test

Step tests will be conducted at the designated pumping wells prior to constant rate tests. Estimated flow rates (gpm) are shown in Table 10, which includes estimated design flow rates for each well for the step tests. Several of these wells are presently being used as extraction wells for the P&T system; therefore, the most recent pumping rate is identified. Any change in flow rates during the test will be determined by the Technical Lead, based on the drawdown rate during pumping.

Table 10. Estimated Step Test Flow Rates

Test Area Number	Well Name	Estimated Step Test Rates (gpm)					
		Step 1: $0.25xQ_{max}$	Step 2: $0.50xQ_{max}$	Step 3: $0.75xQ_{max}$	Step 4: $0.90xQ_{max}$	Step 5: Q_{max}	Step 6: $1.25xQ_{max}$
Test Area 1	199-H3-2C	12.5	25.0	37.5	45.0	50.0	62.5
	199-H3-10[a]	6.3	12.5	18.8	22.5	25.0	31.3
Test Area 2	199-H4-90[a]	1.3	2.5	3.8	4.5	5.0	6.3
Test Area 3	199-H3-9	3.8	7.5	11.25	13.5	15	18.75
	199-H4-12C[b]	7.5	15.0	22.5	27.0	30.0	37.5

Notes: For monitoring wells, flow rates are targets; actual flow rates are to be determined based on well performance and documented.

Qmax = the maximum sustainable discharge rate.

gpm = gallons per minute

a. Monitoring well is not connected to the HX system.

b. Well 199-H4-12C may not be used for pumping, depending on initial data collection.

The step drawdown test will include pumping rate steps equally spread out from the Q_{max} shown in Table 10 (Step 5). Pump rates and/or durations may be modified during testing by the Technical Lead, based on the well response. A typical step test design includes pumping at the following rates:

- Step 1 = 0.25 * Q_{max}
- Step 2 = 0.50 * Q_{max}
- Step 3 = 0.75 * Q_{max}
- Step 4 = 0.90 * Q_{max}
- Step 5 = Q_{max}
- Step 6 = 1.25 * Q_{max}

A minimum of four steps is required; however, a total of six steps is preferred. The final step should approach or exceed the estimated maximum sustainable yield of the well. Drawdown at the pumping well should be monitored and should not exceed 75 percent of the available water column, if possible. If the water level is drawn down to a point near the transducer, the flow rate may be adjusted by a minimal amount so the transducer does not become dry. This is to be avoided if at all possible, but any changes in flow rate are to be noted on the Pumping Test Notes (Appendix A).

Step drawdown tests will be conducted over an estimated period of at least 12 hours. Each step should be for the same amount of time, estimated to be at least 2 hours per step. The pumping rate should not be adjusted during a step, if possible. The water level should (ideally) reach equilibrium near the end of each step. Pumping should continue until the drawdown is reduced to less than 0.01 ft over a period of 10 minutes. Therefore, additional pumping time for each step may be needed, depending on whether the drawdown stabilizes during the 2-hour period. If the water level is still dropping quickly at the end of the first step, the time for the test should be extended (along with all of the subsequent steps). Each step will be performed for the same time interval (typically 2 hours), which will be determined by the Technical Lead. Adjustments in test duration should be expected since each pumping test is dependent on the response of each individual well, and will be communicated by the Technical Lead. The specific steps and pumping rates are shown in Table 10. Overtime work may be required to ensure that the test is conducted as necessary.

8.2.1 Step Tests at Extraction Wells

Prior to pump startup for step testing at an extraction well, the well name, plant identification, and date should be noted on the Extraction Well – Pumping Test Initiation Form (A-5 Appendix A), in the notes section as needed. The flow rate, start time, and stop time should also be recorded. Extraction Wells – Flow Rate Notes and Injection Wells – Flow Rate Notes forms should be used to record any deviation from the anticipated flows.

8.2.2 Step Tests at Monitoring Wells

Prior to pump startup for a pumping test at monitoring wells, arrangements for water management should be in place. Information for the well should be recorded on the Monitoring Well – Pumping Test Initiation Form (Appendix A). The Monitoring Well – Pumping Test Flow Rate Notes form should be used to record any deviation from the anticipated flows and water level checks to that ensure the pump remains submerged. The well information to be recorded includes well name, date, start and stop time for each step, flow rates for each step, and intials of field personnel in the appropriate section of Table A-8, Monitoring Well – Pumping Test Initiation From, and Table A-9, Monitoring Well – Pumping Test Flow Rate Notes (Appendix A), using the notes sections as needed. Active drawdown will be measured by the in-well transducer, and the readout is to be checked periodically to ensure that pump intake is below the water level. Data recorders will be programmed to maximize information retrieval. Data to be collected before, during, and after testing are specified in Chapter 9.

Upon completing the step test(s), the aquifer will be allowed to recover and no further testing will be performed until the static water level is fully recharged to its pre-test level. Recovery in this area is expected within 24 hours. The pump and all other equipment should remain in the well until the recovery period is completed. Details on recovery tests are in Section 8.4.

8.3 Constant Rate Pumping Test

After the recovery shutdown period for the step drawdown test is complete, constant rate tests will be performed. The discharge rate for each pumping well will be determined by the Technical Lead based on results of the step drawdown test. Initial estimates for flow rate values during the constant rate pumping test are listed in Table 11.

The pumping rate will be set with the intent that pumping does not draw the well water level down below 50 percent of the available water column. This rate should not be adjusted during the test, if possible. The anticipated pumping test period will be 24 hours, which is typical for a confined aquifer test.

8.3.1 Constant Rate Tests at Extraction Wells

Prior to pump startup for constant rate testing at an extraction well, the well name, plant identification, and date should be noted on the Extraction Well – Pumping Test Initiation Form (Appendix A), using the notes section as needed. The flow rate, start time, and stop time should also be recorded. Extraction Wells – Flow Rate Notes and Injection Wells – Flow Rate Notes forms should be used to record any deviation from the anticipated flows.

8.3.2 Constant Rate Tests at Monitoring Wells

Prior to pump startup for constant rate testing at monitoring wells, arrangements for water management should be in place. Information for the well should be recorded on the Monitoring Well – Pumping Test Initiation Form (Appendix A). The Monitoring Well – Pumping Test Flow Rate Notes form should be used to record any deviation from the anticipated flows and water level checks to ensure that the pump remains submerged. The well information to be recorded includes well name, date, start and stop time for the test, flow rate, and initials of field personnel on the Monitoring Well – Pumping Test Initiation From

(Appendix A). Active drawdown will be measured by the in-well transducer, and the readout is to be checked periodically to ensure that pump intake is below the water level. The data recorder will be programmed to maximize information retrieval. Data to be collected before, during, and after testing are specified in Chapter 9.

Recovery in this area is expected within 24 hours. The pump and all other equipment should remain in the well until the recovery period is completed. Recovery tests are detailed in Section 8.4.

Table 11. Estimated Constant Rate Flow Rates

Test Area Number	Pumping Well	Initial Estimate of Constant Flow Rate (gpm)[b]	Flow Rates During Recovery (gpm)
Test Area 1	199-H3-2C	50	0
	199-H3-10[c]	25	0
Test Area 2	199-H4-90[c]	5	0
Test Area 3	199-H3-9	15	0
	199-H4-12C[a]	30	0

Qmax = the maximum sustainable discharge rate.

gpm = gallons per minute

a. Well 199-H4-12C may not be used for pumping, depending on initial data collection.

b. Actual flow rate for the constant rate pumping test will be determined, based on results of the step drawdown test.

c. Monitoring well is not connected to the HX system.

8.4 Recovery Tests

Aquifer recovery tests will be conducted following each step test and after each constant rate test. No pumping will be conducted at the pumping well during this time period. Extraction and injection well flow rates will be maintained at the flows specified in Tables 8 and 9 during recovery, for identified wells. Additional details include the following:

- Data loggers will remain in place and recording during the aquifer recovery time frame.
- Data will be collected from each data logger station after completion of each recovery test.
- When the FWS confirms that the aquifer has recovered to at or near static water level conditions, the next pumping test will be conducted.
- No changes will be made to the configuration of the wells during recovery.
- Backflow prevention valves must remain closed.

8.5 Test Termination

The FWS or Technical Lead must monitor the test for the following pumping termination conditions:

- The ability of the P&T system (or purgewater storage facility) to contain or process water produced during pumping has been compromised. If this is the case, the FWS must inform the Technical Lead,

and the decision and any other relevant information must be recorded on the appropriate field activity report form.

- A stop work or unsafe condition is encountered. If this is the case, the FWS will ensure that the work is stopped and secured in a safe standby condition and the appropriate health, safety, and quality procedures are followed. The FWS will record the reasons and conditions for the stop work on the appropriate field activity report form and notify the Technical Lead.
- Flooding or ground disturbance is noted during discharge of pumped water during the testing.
- Test equipment failure would produce one of the above conditions if pumping continued.
- The test duration has been met.

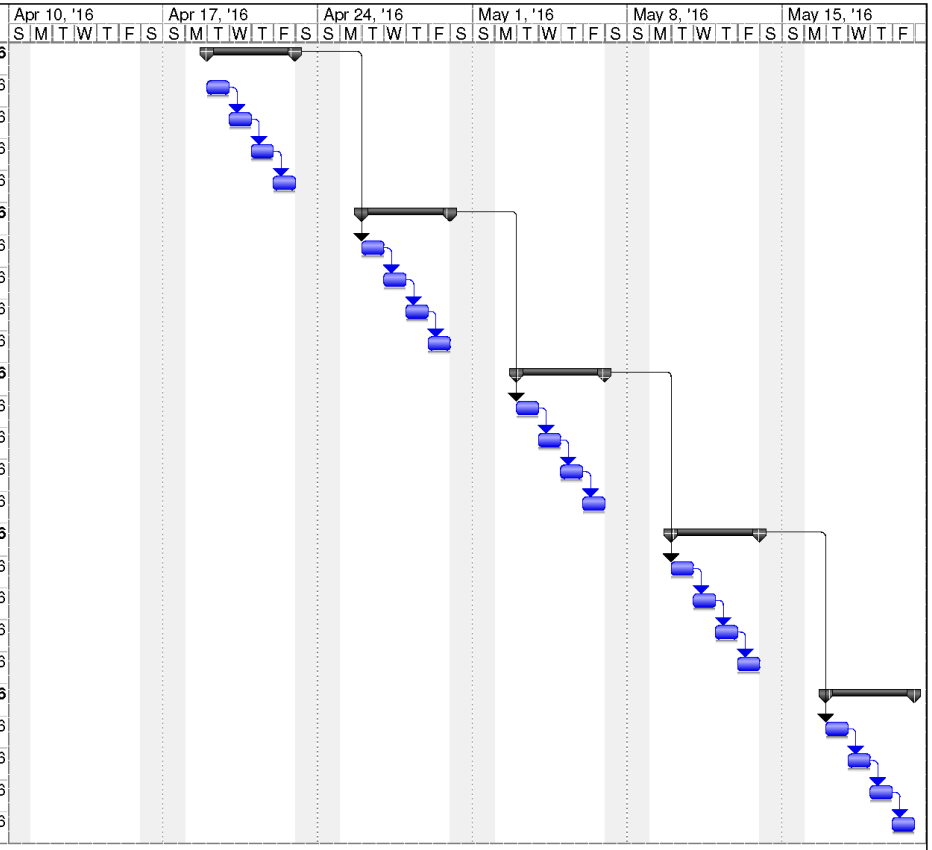
The FWS or Technical Lead must be contacted any time one of the above conditions is encountered. If a pumping test is prematurely terminated, testing at that well will be suspended until the aquifer has recovered to static conditions and the issue that caused termination is corrected. At that time, the test may be attempted a second time. Pumping tests at other locations will be evaluated to ensure that they are not affected.

At the completion of work, outlined in this test plan, extraction and injection wells will be returned to normal operations.

8.6 Pumping Test Schedule

Pumping tests are to be conducted according to the approximate schedule outlined in Figure 8. The order of the wells tested can be adjusted; however, the step test with recovery will be completed prior to the constant rate test for any specific well.

ID	Task Name	Duration	Start
1	**Monitoring Well 199-H4-90**	**4 days**	**Tue 4/19/16**
2	Step Test	1 day	Tue 4/19/16
3	Step Test Recovery	1 day	Wed 4/20/16
4	Constant Rate Test	1 day	Thu 4/21/16
5	Constant Rate Recovery	1 day	Fri 4/22/16
6	**Extraction Well 199-H3-2C**	**4 days?**	**Tue 4/26/16**
7	Step Test	1 day?	Tue 4/26/16
8	Step Test Recovery	1 day?	Wed 4/27/16
9	Constant Rate Test	1 day?	Thu 4/28/16
10	Constant Rate Recovery	1 day?	Fri 4/29/16
11	**Monitoring Well 199-H3-10**	**4 days?**	**Tue 5/3/16**
12	Step Test	1 day?	Tue 5/3/16
13	Step Test Recovery	1 day?	Wed 5/4/16
14	Constant Rate Test	1 day?	Thu 5/5/16
15	Constant Rate Recovery	1 day?	Fri 5/6/16
16	**Extraction Well 199-H3-9**	**4 days?**	**Tue 5/10/16**
17	Step Test	1 day?	Tue 5/10/16
18	Step Test Recovery	1 day?	Wed 5/11/16
19	Constant Rate Test	1 day?	Thu 5/12/16
20	Constant Rate Recovery	1 day?	Fri 5/13/16
21	**Extraction Well 199-H4-12C (T**	**4 days?**	**Tue 5/17/16**
22	Step Test	1 day?	Tue 5/17/16
23	Step Test Recovery	1 day?	Wed 5/18/16
24	Constant Rate Test	1 day?	Thu 5/19/16
25	Constant Rate Recovery	1 day?	Fri 5/20/16



Project: TestSchedule
Date: Thu 3/3/16

Task | Split | Progress | Milestone | Summary | Project Summary | External Tasks | External Milestone | Deadline

Page 1

Figure 8. Pumping Test Schedule

9 Data Recording

Testing and data recording will be performed in accordance with this test plan and GRP-EE-01-6.3, *Well Development and Testing*.

The DX P&T facility will continue to operate as normal during this testing. The HX P&T facility operations will be modified during testing, as noted in Chapter 8. Regularly scheduled contaminant monitoring samples, for system operations and for contaminant tracking, will not be collected during the pumping tests from any well that is not operating at the time.

9.1 Data Collection

Data collected during the pumping tests include water levels, SC, barometric pressure, flow rates, and test durations.

9.1.1 Level Logger Data

Level loggers deployed into monitoring wells, AWLN wells, and P&T system wells will be set to record data at either 1-minute or 2-minute intervals throughout the duration of testing. Data will be downloaded on a weekly or more frequent basis to ensure continuity of the data set. One level logger will be used to collect barometric data to enable corrections for changes in atmospheric pressure during the test period. Barometric pressure will be recorded to a sensitivity of plus or minus 0.01 in. of mercury. Instrumentation used during this test plan is outlined in Table 5 and 6.

Monitoring will continue for approximately 30 days prior to pumping, throughout the planned aquifer pumping tests and for at least 1 week after completion of the recovery measurement period. These data, when combined with the water level trends measured during the study, will be used to correct for the effects of barometric pressure changes that may occur.

9.1.2 P&T System Data

Flow rates of extraction wells, water levels, and notes on start and stop times will be collected during testing. The schedule of flow rates is provided in Chapter 8. Forms for noting testing dates, times, flow rates, and changes in flows during pumping tests are provided in Appendix A.

9.1.3 Manual Data Records

Flow rates for monitoring wells and notes during pumping tests will be recorded in the field during testing. This includes the date of each test, start and stop times of each test, and changes in flow rates during testing. The pumping well water level will be checked during testing to ensure that the pump remains submerged.

Field activities are to be recorded, as outlined in Chapter 8, using forms provided in Appendix A. All field activities should be recorded (to the nearest minute) in an appropriate notes section in Appendix A. All depth to water (DTW) measurements will include the reference point of each measurement (i.e., top of the casing or the ground surface). All elevation measurements will be recorded in feet (to the nearest hundredth of a foot), with a reference point noted for all depth measurements.

The following information will be collected for step testing:

- Record all pre-test information on field activity reports including, but not limited to, as-found well data (depth to bottom, stick-up, and well diameter) and pump information (size, model, and type).
- Record the pumping and downhole equipment configuration and well dimensions from field measurements and relevant as-built information.

- Measure and record DTW in the pumping well.
- Measure and record the depth of the bottom of the pumping well.
- Install test pump in the well at a depth to maximize the amount of available drawdown. Record the amount of riser pipe used and pump intake depth to the nearest tenth of a foot.
- Make certain that water levels have stabilized from the above activities (i.e., change no greater than 0.05 ft for a 15-minute interval).
- Start the pump, and adjust the flow regulator to the initial lowest flow rate (per Chapter 8) for the step drawdown test.
- Record the discharge rate every 15 minutes, and maintain this flow for at least 2 hours or until asymptotic conditions are reached (see Chapter 8).
- At the end of this period, step up to the next highest rate of discharge.
- Record the discharge rate, and maintain this flow for a period of time equal to the previous step. Repeat this step for the remaining steps or as directed by the Technical Lead.
- To conclude the step drawdown test, shut down the pump and close the discharge ball valve (if used) on the discharge line to prevent backflow to the well. (Note: an automatic check valve is preferred).
- After 24 hours, record final static water level, date, and time.
- Remove test pump from well, if appropriate. Do not remove the pump until recovery is completed, and the static water level has recovered to pre-test levels.
- Measure and record post-test depth to bottom.

The following information will be collected for constant rate testing:

- Record all pre-test information including, but not limited to, as-found well data (depth to bottom, stick-up, and well diameter) and pump information (size, model, and type) in the the appropriate notes section of Appendix A, Tables.
- Record the pumping and downhole equipment configuration and well dimensions from field measurements and relevant as-built information.
- Measure and record DTW in the pumping well.
- Measure and record the depth of the bottom of the pumping well.
- Install test pump in the well at a depth to maximize the amount of available drawdown. Record the amount of riser pipe used and pump intake depth to the nearest tenth of a foot.
- Make certain that water levels have stabilized from the above activities (i.e., change no greater than 0.05 ft for a 15-minute interval).
- Start the pump, and adjust the flow regulator to the test flow rate (per Chapter 8) for the constant rate pumping test.
- Record the discharge rate every 15 minutes to an hour, and maintain this flow for 24 hours minimum.

- To conclude the constant rate test, shut down the pump and close the discharge ball valve (if used) on the discharge line to prevent backflow to the well. (Note: an automatic check valve is preferred).
- After a 24 hour period, record final static water level, date, and time.
- Remove test pump from well. Do not remove the pump until recovery is completed, and the static water level has recovered to pre-test levels.
- Measure and record post-test depth to bottom.

9.2 Reporting Elements

The following elements are to be included in the aquifer pumping test report upon completion of testing:

- Date and duration of test
- Level logger data for all monitoring wells, AWLN wells, and P&T wells (as an appendix)
- Transducer depths with reference points
- Transducer recording intervals
- Well configuration and test setup including the following information:
  - Depth to the top of the pump and pump intake
  - Type of pump, horsepower, make, and model
  - Depth of transducer below top of casing/Measurement Point
- Water level measurements taken before pumping (after all equipment has been placed in the well), after pumping is completed, and after recovery is completed (before removal of equipment)
- Pumping test initiation forms, or any other notes collected on the appropriate forms provided in Appendix A

Data collected from the tests should be reviewed, checked, processed, and reported to the Technical Lead. The Technical Lead will analyze the data and then report the results via a test report. The report will include the results of the aquifer testing and rebound study, the analysis and interpretation of the testing results, and any recommendations for further actions.

10 Data Management

Data collection should be conducted using automated digital recording equipment whenever possible. Level logger data will be collected on a weekly basis from all wells where additional instrumentation was installed.

Data files will be identified using the following information:

- Well name from which data were obtained
- Location of collection of the data in the file
- Date

An electronic tape measurement of water levels will be used for data correlation and confirmation during the testing at monitoring wells. Hand measurement data will be recorded in a tabulated field log and then transcribed to a spreadsheet. The handwritten record will be retained and used for an independent check of the transcribed data entry.

Data analyses will be conducted by the Technical Lead or designee. Each data set will be delivered to the Technical Lead for incorporation into the project report/final report. Data reduction techniques and aquifer testing interpretation will be documented in an environmental calculation in accordance with PRC-PRO-EP-40205, *CHPRC Environmental Calculation Preparation and Issue*, which will include a record of all data collected, reduced data, identification of selected data used, and references for specific aquifer analysis techniques applied.

11 Waste Management

Water generated during aquifer pumping at the extraction wells will be treated at the HX P&T system. All extracted water for these wells will be treated at HX through normal system operations.

Water generated during aquifer pumping tests at monitoring wells 199-H3-10 and 199-H4-90 will be discharged to the ground surface, pursuant to DOE/RL-2011-41, *Hanford Site Strategy for Management of Investigation Derived Waste*. An Environmental Activity Screening Form has been completed for this effort (Appendix B), which includes a CHPRC Planned Water Discharge Review and Concurrence. The following waste sites are located near the two monitoring wells:

- 100-H-35 clean water pipeline
- 100-H-58 mud dauber nest area
- 100-H-37 mud dauber nest area
- 100-H-28 former H Reactor process sewers

There are eight subsites, all of which have been interim closed out or require no action. Based on the location of the wells and nearby waste sites, discharge areas were identified. During pumping from well 199-H3-10, water will be discharged to the gravel area located to the west. During pumping from well 199-H4-90, water will be discharged to the vegetated areas to the east of the well. Details for each area are provided in the Environmental Activity Screening Form in Appendix B.

12 References

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Appendix A

Pumping Test Initiation Form

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Table A-1. Step Drawdown Flow Rate Form 199-H3-10

Well 199-H3-10	Estimated Flow (gpm)	Estimated Pumping Time (minutes)	Estimated Volume Discharged (gal)	Column A	Column B	Column A* Column B
				Actual Flow Rate (gpm)	Actual Pumping Time (minutes)	Actual Volume Discharged (gal)
Step 1	6.3	120	750			
Step 2	12.5	120	1,500			
Step 3	18.8	120	2,250			
Step 4	22.5	120	2,700			
Step 5	25.0	120	3,000			
Step 6	31.3	120	3,750			

Table A-2. Constant Rate Discharge Form 199-H3-10

Well 199-H3-10	Estimated Flow (Qmax) in gpm	Column A	Estimated Volume (gal)	Column B	Column A * Column B
		Duration (minutes)		Actual Flow Rate (gpm)	Actual Volume Discharged (gal)
Constant Flow Rate Test	25	1,440	36,000		

Table A-3. Step Drawdown Flow Rate Form 199-H4-90

Well 199-H4-90	Estimated Flow (gpm)	Estimated Pumping Time (minutes)	Estimated Volume Discharged (gal)	Column A	Column B	Column A* Column B
				Actual Flow Rate (gpm)	Actual Pumping Time (min)	Actual Volume Discharged (gal)
Step 1	1.3	120	150			
Step 2	2.5	120	300			
Step 3	3.8	120	450			
Step 4	4.5	120	540			
Step 5	5.0	120	600			
Step 6	6.3	120	750			

Table A-4. Constant Rate Discharge Form 199-H4-90

Well 199-H4-90	Estimated Flow (Qmax) in gpm	Column A	Estimated Volume (gal)	Column B	Column A* Column B
		Duration (minutes)		Actual Flow Rate (gpm)	Actual Volume Discharged (gal)
Constant Flow Rate Test	5	1,440	7,200		

Table A-5. Extraction Well – Pumping Test Initiation Form

Pumping Well: ☐ **HE09** (199-H3-2C) ☐ **HE13** (199-H3-9) ☐ **HE10** (199-H4-12C)	Start Date:_____ Start Time:_____ Initials: _____	Recovery Time Start: _____ Recovery Time Stop: _____
Selected Test Type: ☐ Step Drawdown Test ☐ Constant Rate Test	Stop Date:_____ Stop Time:_____ Initials: _____	Notes:
STEP TEST – Flow Step 1 Flow Rate (gpm): _____ Step 2 Flow Rate (gpm): _____ Step 3 Flow Rate (gpm): _____ Step 4 Flow Rate (gpm): _____ Step 5 Flow Rate (gpm): _____ Step 6 Flow Rate (gpm): _____	**STEP TEST – Time** Step 1 Start Time: _____ Step 2 Start Time: _____ Step 3 Start Time: _____ Step 4 Start Time: _____ Step 5 Start Time: _____ Step 6 Start time: _____ Stop Date/Time: _____	**CONSTANT RATE TEST** Flow Rate (gpm): _____ Start Date/Time: _____ Stop Date/Time: _____ Notes:

Table A-6. Extraction Wells – Flow Rate Notes Form

Well Name	Plant ID	Requested Flow Rate (gpm) during Pumping Test at Locations					Note Deviations to Flow Rates
		Test Area 1		Test Area 2	Test Area 3		
		HE09 (199-H3-2C)	Monitoring Well 199-H3-10	Monitoring Well 199-H4-90	HE13 (199-H3-9)	HE10 (199-H4-12C)	
199-H3-2C	HE09	PUMPING WELL	**0**	**0**	**0**	**0**	
199-H3-9	HE13	**0**	**0**	**0**	PUMPING WELL	**0**	
199-H4-12C	HE10	**0**	**0**	**0**	**0**	PUMPING WELL	
199-H4-15A	HE02	20	20	20	**0**	**0**	
199-H4-69	HE03	20	20	**0**	20	20	
199-H4-70	HE04	20	20	**0**	20	20	
199-H4-4	HE06	10	10	10	**0**	**0**	
199-H4-63	HE07	20	20	**0**	20	20	
199-H4-64	HE08	20	20	20	**0**	**0**	
199-H3-26	HE37	**0**	**0**	50	50	50	
199-H4-86	HE44	**0**	**0**	30	30	30	

Table A-7. Injection Wells – Flow Rate Notes

Well Name	Plant Identification	Requested Flow Rate (gpm) during Pumping Test at Locations					Note Deviations to Flow Rates
		Test Area 1		Test Area 2	Test Area 3		
		HE09 (199-H3-2C)	Monitoring Well 199-H3-10	Monitoring Well 199-H4-90	HE13 (199-H3-9)	HE10 (199-H4-12C)	
199-H4-73	HJ02	0	0	0	0	0	
199-H4-72	HJ03	0	0	0	0	0	
199-H4-71	HJ04	0	0	0	0	0	
199-H4-18	HJ05	0	0	0	0	0	
199-H3-27	HJ06	0	0	0	0	0	
199-H4-17	HJ14	0	0	0	0	0	

Table A-8. Monitoring Well – Pumping Test Initiation Form

Pumping Well: ☐ 199-H3-10 ☐ 199-H4-90	Start Date:_____ Start Time:_____	Recovery Time Start: _____ Recovery Time Stop: _____	Initials: _____
Selected Test Type: ☐ Step Drawdown Test ☐ Constant Rate Test		**Static Water Level (ft bgs):** Start of Test: _____ End of Pumping: _____ End of Recovery: _____	Notes:
STEP TEST – Flow Step 1 Flow Rate (gpm): _____ Step 2 Flow Rate (gpm): _____ Step 3 Flow Rate (gpm): _____ Step 4 Flow Rate (gpm): _____ Step 5 Flow Rate (gpm): _____ Step 6 Flow Rate (gpm): _____		**STEP TEST – Time** Step 1 Start Time: _____ Step 2 Start Time: _____ Step 3 Start Time: _____ Step 4 Start Time: _____ Step 5 Start Time: _____ Step 6 Start Time: _____ Stop Date/Time: _____	**CONSTANT RATE TEST** Flow Rate (gpm): _____ Start Date/Time: _____ Stop Date/Time: _____ Notes:

Table A-9. Monitoring Well – Pumping Test Flow Rate Notes

Date:_____ **Time:**_____ **Water Level Reference Point:** _____

Pumping Well: 199-H3-10 ***Step Test***

Time	Water Level	Flow Rate (gpm)	Notes

Monitoring Well – Pumping Test Flow Rate Notes

Date:_____ **Time:**_____ **Water Level Reference Point:** _____

Pumping Well: 199-H3-10 **Constant Rate Test**

Time	Water Level	Time	Water Level	Time	Water Level	Time	Water Level

Monitoring Well – Pumping Test Flow Rate Notes

Date:_____ Time:_____ Water Level Reference Point: _____

Pumping Well: 199-H4-90 Step Test

Time	Water Level	Flow Rate (gpm)	Notes

Monitoring Well – Pumping Test Flow Rate Notes

Date:_____ **Time:**_____ **Water Level Reference Point:** _____

Pumping Well: 199-H4-90 ***Constant Rate Test***

Time	Water Level	Time	Water Level	Time	Water Level	Time	Water Level

Appendix B

Environmental Activity Screening Form

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CHPRC ENVIRONMENTAL-ACTIVITY SCREENING FORM

SECTION A. Work Description

Title and Summary (include a detailed summary):

Conduct aquifer pumping test according to 100-H Area RUM Aquifer Test Plan (SGW-59756). Wells to be pumped are 199-H2-1, 199-H3-2C, 199-H3-9, 199-H3-10, 199-H4-12C, 199-H4-15CS, 199-H4-90 and 199-H4-91. The pumped groundwater will be treated at the 100-HX Pump and Treat Facility except for groundwater from wells 199-H3-10 and 199-H4-90, which will be discharged to the ground near each wellhead.
Pumped groundwater from aquifer testing meets the definition of "purgewater" and may be discharged to the ground without submittal and approval of a discharge request pursuant to DOE/RL-2011-41 (Hanford Site Strategy for Management of Investigation Derived Waste), section 2. section 6.2 and section 10. The purgewater must be below maximum contaminant levels (MCL), and the discharge location may not occur in a WIDS site, in a solid waste management unit, in burial grounds, in effluent disposal sites (ponds, cribs, ditches or trenches) nor in surface or subsurface contamination areas. Discharges must be 20 feet or greater from the wellhead to prevent channeling of water along the well annulus.

There is no MCL for hexavalent chromium, therefore the MTCA Method B Cleanup Level for hexavalent chromium (48 ug/L) is used. Analytical results for groundwater in wells 199-H3-10 and 199-H4-90 are well below 48 ug/L (see attached trend plots). The discharge locations were evaluated (see attached GVZ forms) and determined to meet the location criteria.

Identification No. (e.g., Project No., Work Plan No., Work Order No.):	Date:	Revision No.:

SEE FOLLOWING PAGES FOR SECTIONS B, E, AND F

SECTION C. Work Management Applicability (based on information from Sections B, E, and F)

- ☐ The work is covered under existing NEPA Documentation (see Sections B-3 and B-4).
- ☒ The work is covered under existing CERCLA Documentation (see Section B-2).
- ☐ Screening showed no new environmental documents, approvals, or other actions are needed.
- ☐ Screening showed the following new environmental documents, approvals, or other actions are needed (list in Section G):
- ☐ Screening identified new environmental aspects that require evaluation (list and notify EMS Coordinator; see Section F).
- ☐ The work has potential to effect accomplishment of CHPRC/Project EMS objectives and targets. List controls that will mitigate negative effects, and notify EMS Coordinator (see Section F).

SECTION G. New Environmental Documents, Approvals, Other Actions Required Before Work Proceeds (based on information from Sections B, E, and F)

No ground disturbance is authorized in this evaluation. Work is to take place on existing well pads or roads.

See Note 1 on Page 2 for prohibition on "proceeding at regulatory risk."

SECTION D. Approvals	Name (Printed)	Signature	Date	Form Disposition
Initiator				MAINTAIN A COPY IN THE APPLICABLE PROJECT FILE OR WORK PACKAGE
Concurrence (Cognizant Environmental Compliance Officer [ECO])	Rick Oldham	RW Oldham	3.9.16	

SECTION B. NATIONAL ENVIRONMENTAL POLICY ACT (NEPA)/CULTURAL AND/OR ECOLOGICAL RESOURCES/COMPREHENSIVE ENVIRONMENTAL RESPOSE, COMPENSATION AND LIABILITY ACT (CERCLA)

B-1, CULTURAL AND/OR ECOLOGICAL RESOURCE EVALUATION	Yes	No
Will work affect **cultural and/or ecological resources**, as described in PRC-PRO-EP-15332, *Environmental Protection Requirements*, Section 2.2 (e.g., cultural artifacts, wetlands, historical facility, aquifers, Hanford Reach National Monument, areas within ¼ mile of Columbia River)? If **NO**, go to B-2. If any answer is **YES**, list the cultural and/or ecological review and/or excavation permit number that applies. Cultural Review _____ Ecological Review ECR- _____ Excavation Permit No. _____ Go to **B-2**.	☐	☒

B-2. CERCLA RESPONSE ACTION (To be completed by ECO)	Yes	No
*Is the work being conducted as part of a CERCLA response action? See Note 2 below. List CERCLA Document(s) Title/ No.: 100-HR-3/KR-4 Interim Record of Decision, as amended. If the answer is **YES**, go to Section E. If the answer is **NO**, go to Section B-3. ***Note: Although work performed under CERCLA does not require separate NEPA documentation, such work is limited to activities that directly support the response action identified in the associated CERCLA documentation. Actions planned at, or adjacent to, CERCLA facilities that are not within the scope of the CERCLA documentation must be reviewed separately under the NEPA process.*** ***If assistance is needed to coordinate a NEPA analysis, or to incorporate NEPA values into CERCLA documentation, contact the NEPA / SEPA or CERCLA SME.***	☒	☐

B-3. EXISTING NEPA DOCUMENTATION APPLIES	Yes	No
Is the work (proposed action) evaluated in a previous EA or EIS? If **YES**, fill in Section I – IV and VII of the NEPA Review Screening Form (RL-721), send to the DOE Hanford NEPA Compliance Officer for information, and attach a copy to this form. Go to Section E If **NO**, go to B-4.	☐	☐

B-4. SITEWIDE CATEGORICAL EXCLUSION (SWCX) APPLIES	Yes	No
Does the work (proposed action) fit within the scope of actions identified in a DOE Hanford NEPA Compliance Officer approved SWCX? If **NO**, go to B-5. If **YES**, fill in Sections I – V of the NEPA Review Screening Form (RL-721). If the answers to all of the SWCX criteria in Section V are **NO**, the SWCX applies. Complete Section VII of the NEPA Review Screening Form, send it to the DOE Hanford NEPA Compliance Officer for information, and attach a copy to this form. Go to Section E. If the answer to any of the SWCX criteria in Section V is **YES**, go to B-5.	☐	☐

B-5. SITEWIDE CATEGORICAL EXCLUSION (SWCX) DOES NOT APPLY

Contact the NEPA/SEPA Subject Matter Expert to identify NEPA review requirements, then go to Section E.

1. NOTE: PROCEEDING AT 'REGULATORY RISK' PROHIBITED. Project and activity planning must, at the outset, identify all environmental protection requirements governing the work, and include the timely completion of those requirements into project schedules. In particular, schedules should fully allow for the time required by regulatory agencies to complete their review of applications for permits, and similar submittals. Work cannot begin or continue unless all regulatory prerequisites applicable to project commencement and/or completion have been satisfied. In cases where it is unclear if preliminary work (e.g., procurement, site preparation) can proceed prior to a regulatory approval, consult with the Director, Environmental Protection. If we intend to satisfy a particular regulatory requirement through a waiver or variance granted by the enforcing agency, such waiver or variance must be clearly documented in writing from the enforcing agency (including, but not limited to, DOE, the Environmental Protection Agency, Washington Department of Ecology, Washington Department of Health) and the waiver or variance must be reviewed and determined adequate by the Director, Environmental Protection. Failure to do this could place CHPRC at serious risk of enforcement action, fines and penalties, contract penalties, and damage to CH2M HILL's business reputation and integrity.

2. NOTE: It is CHPRC policy to conduct activities under CERCLA authority whenever possible. In order to expedite CERCLA actions and allow them to proceed at less cost, Congress removed the "permitting," administrative, reporting and enforcement provisions requirements of other promulgated environmental regulations from these actions, providing that only "substantive" provisions from these regulations would apply. By contract, CHPRC is tasked with performing Hanford Site cleanup with maximum efficiency. Therefore CHPRC is to take every opportunity to ensure that whenever possible, activities and projects are identified as components of CERCLA response actions. This includes explicit identification of the activities in CERCLA project documents such as Remedial Investigation/Feasibility Study reports, Proposed Plans, Records of Decision, Engineering Evaluation/Cost Analyses, Action Memoranda, and Remedial Action/Removal Action Work Plans. Further, activities which are conducted for the purpose of information gathering for the CERCLA process (including sampling and analysis, construction/operation of treatability studies, and management of wastes generated by these activities (investigation derived waste)) should be documented in project descriptions and correspondence with DOE and the regulatory agencies as being CERCLA removal actions.

CHPRC ENVIRONMENTAL-ACTIVITY SCREENING FORM (continued)

SECTION E. Activity Screening – Select the activities that apply to the workscope. Refer to PRC-RD-EP-15332, *Environmental Protection Requirements*, Section 2.0, for Category Applicability Statements. NOTE: When reviewing this section for activities that are conducted as part of a CERCLA response action, review the requirements against the approved removal action/remedial action work plan. Where requirements are not addressed by the work plan, consult the CERCLA SME. List necessary follow-up actions in Section G.

Performing Project Scoping Activities and Siting Studies

- ☐ 2.2 Performing Project Scoping Activities and Siting Studies

Constructing or Modifying Facilities, Equipment, or Processes

- ☐ **2.3 General**
- ☐ 2.4 Constructing or Modifying Stationary Criteria / Toxic Air Emission Sources
- ☐ 2.5 Constructing or Modifying Air Emission Units That Potentially Emit Radionuclides to the Ambient Air
- ☐ 2.6 Constructing or Modifying RCRA TSD Units
- ☐ 2.7 Constructing or Modifying Public Water, Raw Water, or Export Water Systems
- ☐ 2.8 Constructing or Modifying Sanitary Sewer Systems, or Constructing or Modifying Onsite Sewage Systems, or Adding or Modifying Discharges to the Columbia River, or Discharges to the Land
- ☐ 2.9 Constructing or Modifying Storage Tanks or Container Storage Areas That Store Oil
- ☐ 2.10 Installing Regulated USTs
- ☐ 2.11 Relocating Portable Criteria Pollutant Air Emission Sources, or Bringing Portable or Stationary Criteria Air Pollutant Emission Source Onto the Site

Operating Facilities, Equipment, or Processes

- ☐ **2.12 General**
- ☐ 2.13 Operating Facilities, Equipment, or Processes That Emit Criteria / Toxic Air Pollutants
- ☐ 2.14 Operating Stationary Facilities and Equipment That Potentially Emit Radionuclides to the Ambient Air
- ☐ 2.15 Operating Regulated USTs
- ☐ 2.16 Operating Onsite Sewage Systems
- ☐ 2.17 Operating Storage Tanks or Container Storage Areas That Store Oil
- ☐ 2.18 Operating Public Water Systems
- ☐ 2.19 Operating Interim Status RCRA TSD Units
- ☐ 2.20 Operating Final Status RCRA TSD Units
- ☐ 2.21 Using Portable or Temporary Air Emission Sources That Emit Radionuclides
- ☐ 2.22 Using PCB Oil-Filled Electrical Equipment, Electromagnets, Switches, and Voltage Regulators
- ☐ 2.23 Using and Storing Chemicals, Chemical Products, and Hazardous Materials
- ☐ 2.24 Performing Operations Consistent With NEPA Routine Administrative Activities
- ☐ 2.25 Finding Special Status Animals or Plants (Live or Dead) on the Hanford Site
- ☐ 2.26 Responding to Regulatory Agency Inspections

Maintaining and Repairing Facilities, Equipment, or Processes

- ☐ **2.27 General**
- ☐ 2.28 Maintaining Stationary Facilities and Equipment That Potentially Emit Radionuclides to the Ambient Air
- ☐ 2.29 Maintaining or Repairing Major Continuous Emissions Monitoring or Emissions Measurement Systems

Maintaining and Repairing Facilities, Equipment, or Processes – Continued

- ☐ 2.30 Maintaining and Testing HEPA Filters
- ☐ 2.31 Starting Up, Shutting Down, or Performing Scheduled Maintenance on Stationary Air Emissions Sources
- ☐ 2.32 Repairing an Onsite Sewage System / Maintaining UIC Stormwater Well
- ☐ 2.33 Reporting New WIDS Sites and Reclassifying or Reassigning WIDS Sites
- ☐ 2.34 Maintaining Assigned WIDS Sites, Including Assessing Potential Impacts
- ☐ 2.35 Servicing "Motor Vehicle Air-Like" Conditioners
- ☐ 2.36 Maintaining, Servicing, or Repairing Stationary Heating, Ventilation, Air Conditioning, and Refrigeration Equipment
- ☐ 2.37 Performing Activities That May Break Up, Disturb, or Preclude Access to Regulated Asbestos-Containing Material
- ☐ 2.38 Removing and/or Disturbing Asbestos-Containing Material (i.e., Renovation)
- ☐ 2.39 Repairing Regulated USTs
- ☐ 2.40 Applying and Storing Pesticides
- ☐ 2.41 Conducting Open Burning
- ☐ 2.42 Decontaminating Materials and Equipment Contaminated with PCBs

Discontinuing Use of, DD&D, or Closing Facilities (Including Trailers), Equipment, or Processes

- ☐ **2.43 General**
- ☐ 2.44 Temporarily Closing Regulated USTs
- ☐ 2.45 Permanently Closing Regulated USTs or Making a Change in Service
- ☐ 2.46 Closing RCRA TSD Units
- ☐ 2.47 Discontinuing Use of or Relocating a Satellite Accumulation Area
- ☐ 2.48 Discontinuing Use of or Closing a 90-Day Accumulation Area
- ☐ 2.49 Closing or Removing a Septic Tank Farm Service
- ☒ 2.50 Performing CERCLA Response Actions (PRC-PRO-EP-25415)
- ☐ 2.51 Discontinuing Use of or Closing Injection Wells

Purchasing Goods or Services

- ☐ 2.52 Purchasing Refrigerants, Appliances Containing Refrigerants, System Components That Operate Using Refrigerants, or Refrigerant Recovery or Recycling Equipment
- ☐ 2.53 Procuring Pesticides or Pesticide Applicators
- ☐ 2.54 Procuring HEPA Filters

- ☐ **2.55 Excavating or Otherwise Disturbing Soils**
- ☐ **2.56 Environmental Event Notification (Including Spills and Releases and Agency Notifications)**

CHPRC ENVIRONMENTAL-ACTIVITY SCREENING FORM (continued)

SECTION E (continued). Activity Screening – Select the activities that apply to the workscope. Refer to PRC-RD-EP-15332, *Environmental Protection Requirements*, Section 2.0, for Category Applicability Statements.

Generating, Identifying, and Designating Waste

- ☐ 2.57 Generating Waste
- ☐ 2.58 Identifying and Designating Waste
- ☐ 2.59 Generating Investigation Derived Waste Within a Waste Site or Suspected Waste Site
- ☒ 2.60 Generating Investigation Derived Waste Outside a Waste Site
- ☐ 2.61 Identifying and Designating Investigation Derived Waste

Managing, Accumulating, or Storing Waste or Materials

- ☐ 2.62 Managing Soil, Groundwater, and Debris Contaminated With Listed Dangerous Waste
- ☐ 2.63 Managing Waste Characterization and Treatability Study Samples and Their Residues
- ☐ 2.64 Managing Unknown Waste
- ☐ 2.65 Managing Materials With Potential Future Use
- ☐ 2.66 Accumulating Waste in a Satellite Accumulation Area
- ☐ 2.67 Accumulating Waste in a 90-Day Accumulation Area
- ☐ 2.68 Storing PCB Items For Reuse
- ☐ 2.69 Storing PCB Waste and PCB Items For Disposal
- ☐ 2.70 Storing Asbestos Waste
- ☐ 2.71 Storing Investigation Derived Waste

Treating Dangerous and/or Mixed Waste

- ☐ 2.72 Performing Treatability Studies
- ☐ 2.73 Performing Generator Treatment of Dangerous and/or Mixed Wastes
- ☐ 2.74 Treating Dangerous and/or Mixed Waste

Pollution Prevention/Waste Minimization (P2/WMin) Process

- ☐ **2.75 General**
- ☐ 2.76 Recycling Process
- ☐ 2.77 Managing Recyclable or Reclaimable Materials Through the Centralized Consolidation/Recycling Center
- ☐ 2.78 Managing Lead-Acid Batteries That Will *Not* Be Sent to the Centralized Consolidation/Recycling Center
- ☐ 2.79 Accumulating Used Oil For Recycling and Managing Used Automotive Oil Filters
- ☐ 2.80 Accumulating Spent Antifreeze For Recycling
- ☐ 2.81 Accumulating Used Shop Towels For Recycling

Disposing of Waste Materials

- ☐ 2.82 Disposing of Containerized Waste
- ☐ 2.83 Disposing of Asbestos Waste
- ☐ 2.84 Disposing of Sanitary Waste
- ☐ 2.85 Disposing of Empty Containers
- ☐ 2.86 Disposing of Inert and Demolition Waste (Nonradioactive, Nondangerous)
- ☐ 2.87 Disposing of Nondangerous, Nonradioactive, Containerized Waste
- ☐ 2.88 Disposing of PCB Waste and PCB Items
- ☒ 2.89 Disposing of Investigation Derived Waste
- ☐ 2.90 Distributing, Excessing, or Disposing of Appliances Containing Refrigerants

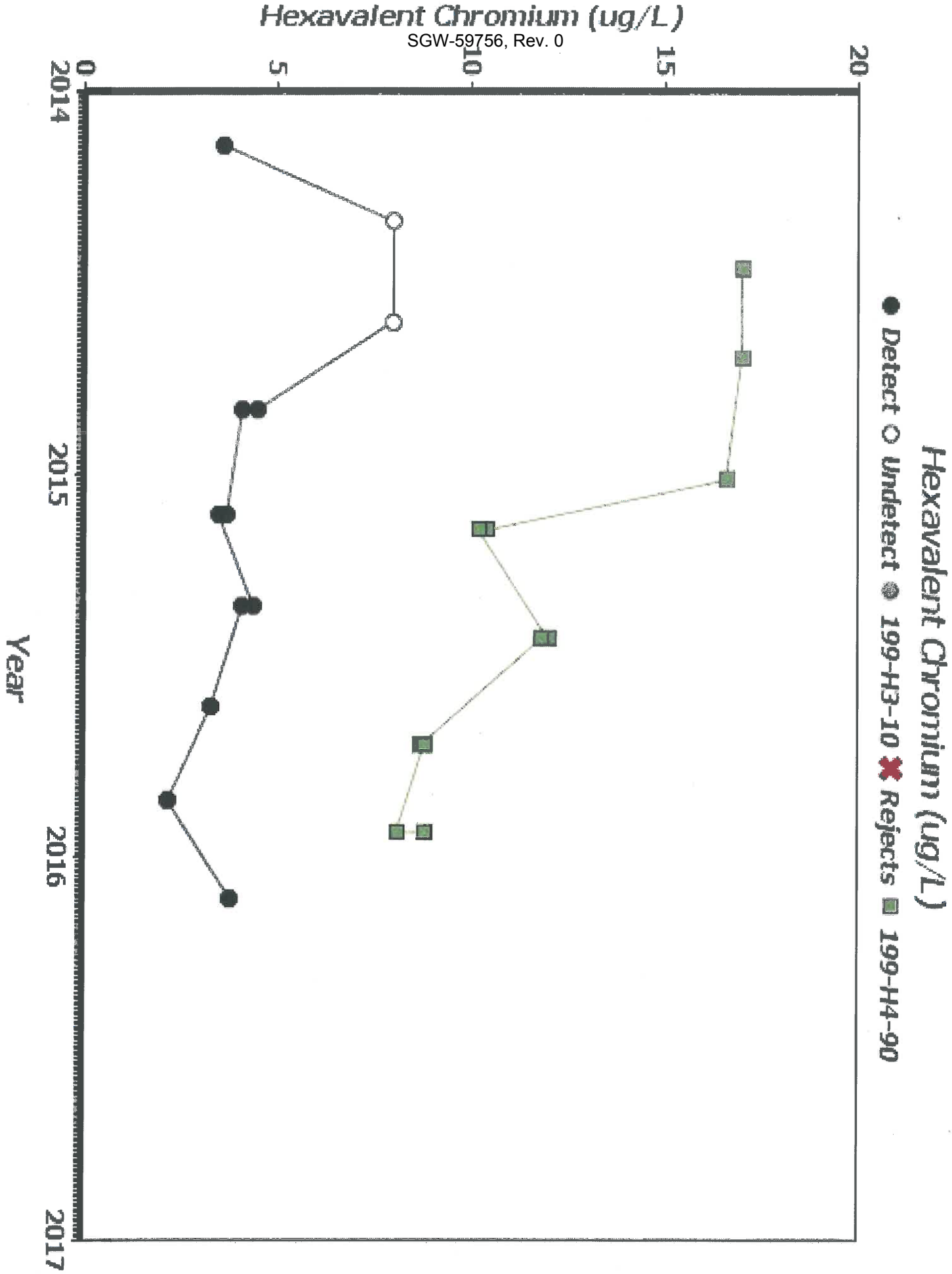
Discharging Existing Approved Wastewaters

- ☐ 2.91 Discharging Wastewaters to the Columbia River
- ☐ 2.92 Discharging Wastewaters to the Land Surface, Including Injection Wells
- ☐ 2.93 Discharging Wastewaters to a Sanitary Sewer System
- ☐ 2.94 Conducting a UIC Well Assessment
- ☐ 2.95 Annual UIC Well Update Submitted to Washington Department of Ecology
- ☐ 2.96 Portable Radioactive Air Emissions Monitoring and Tracking Documentation

SECTION F. Environmental Management System (EMS) Impacts (To be completed by ECO)

	Yes	No
Does this activity need to be added to the CHPRC Aspect Ranking work sheet (i.e., is it a new activity that triggers an environmental aspect evaluation)?	☐	☒
Does this activity have the potential to effect accomplishment of CHPRC EMS Objectives and Targets?	☐	☒

NOTE: ***Current EMS Objectives and Targets can be viewed on the CHPRC ISMS / EMS website.***


199-H3-10, 199-H4-90
Hexavalent Chromium (ug/L)
Detect
Undetect
199-H3-10
Rejects
199-H4-90
Hexavalent Chromium (ug/L)
20
15
10
5
0
2014
2015
2016
2017
Year

GROUNDWATER VADOSE ZONE (GVZ)

To be completed ONLY if planned discharge will exceed a volume of 2,000 gallons or application rate of 10 gal/ft$_2$ /day.
(HNF-PRO-15333, Sections 5.8 and 5.9)

CHPRC PLANNED WATER DISCHARGE REVIEW AND CONCURRENCE

1. Requestor:	2. Organization:	3. Request Date:
Kris Ivarson	S&GRP	03/09/16

DISCHARGE INFORMATION

4. Reason for Discharge:
Aquifer test for H Area wells 199-H3-10 and 199-H4-90. Step tests will be completed with a total discharge of 36,000 gallons from well 199-H3-10 and 14,400 gallons from well 199-H4-90. Aquifer test water is purgewater and may be discharged to ground pursuant to DOE/RL-2011-41, Hanford Site Strategy for Management of Investigation Derived Waste.

5. Date(s) of Planned Discharge(s) (dd/mm/yy):	6. Duration (weeks/days/hours):
~March - April	~4 days

7. Total Volume (gal):	8. Discharge Rate (gal/min):	9. Point Source (check one):
~50,400	Variable	☒ Yes ☐ No (if No, proceed to No. 11)

10. Location (attach topographic base map with discharge location marked): See attached plats and photos.

11. Area of Discharge Distribution (area in ft$_2$; attach topographic base map with area indicated): See attached plats and photos.

POTENTIALLY AFFECTED AREAS OF CONTAMINATION (INCLUDE ANY WITHIN 1,000 FT)

12. Waste Areas/Vadose Zone Contamination (check one): ☒ Yes (if Yes, list by WIDS name, below) ☐ No
The following WIDS sites are located near wells 199-H4-90 and 199-H3-10: WIDS pipeline 100-H-35 were a clean water pipelines. WIDS site 100-H-58 and WIDS site 100-H-37 are a collection of former mud dauber nest areas. WIDS site 100-H-28 is the former H Reactor process sewers. There are 8 subsites, all of which have been interim closed out or require no action.

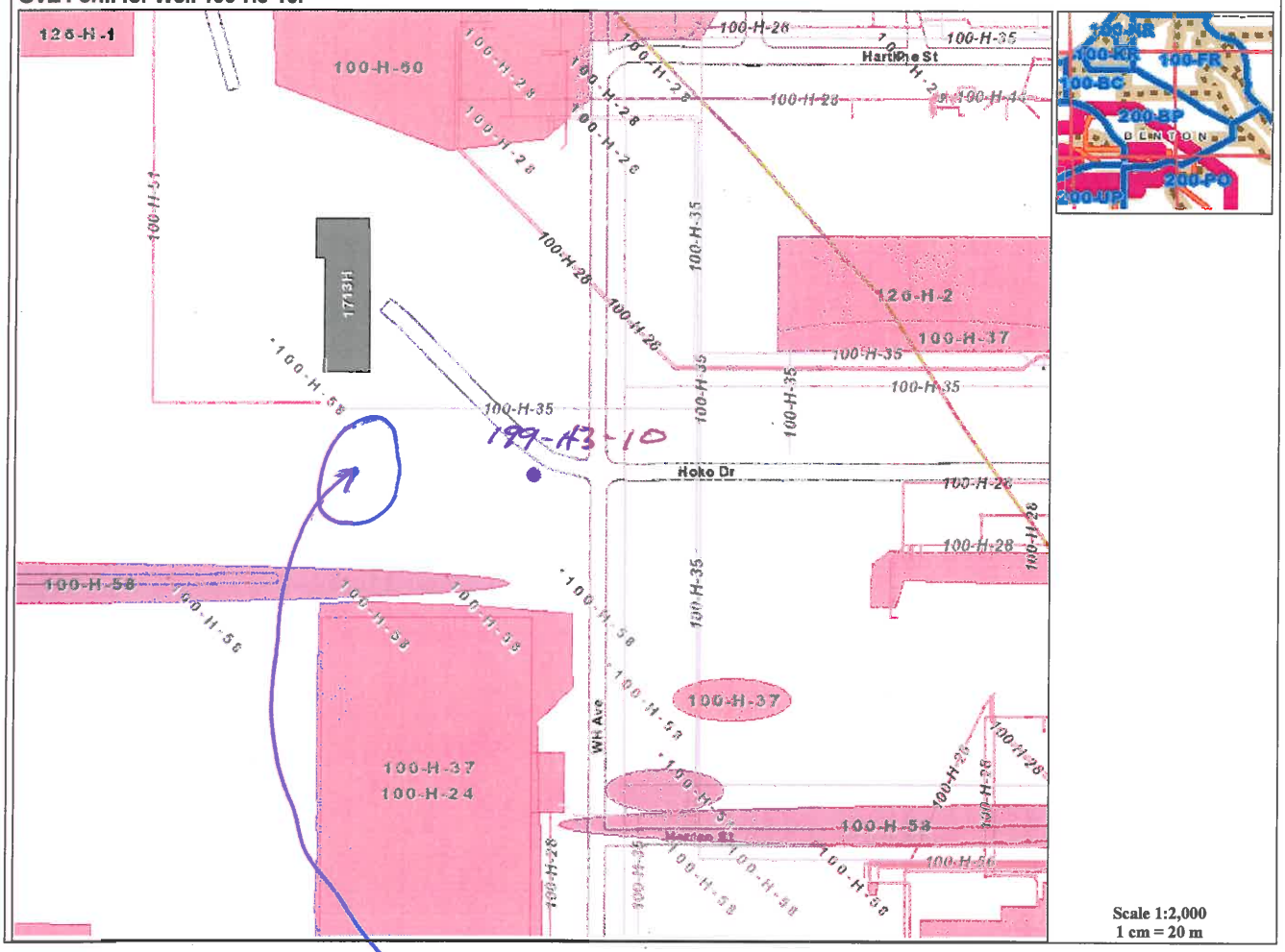
13. Groundwater Contaminant Plumes (from annual groundwater report): ☒ Yes ☐ No
100-HR-3-H hexavalent chromium plume.

14. Groundwater Remedial Actions (from annual operations summary reports): ☒ Yes ☐ No
100-HR-3/KR-4 Interim Record of Decision, as amended.

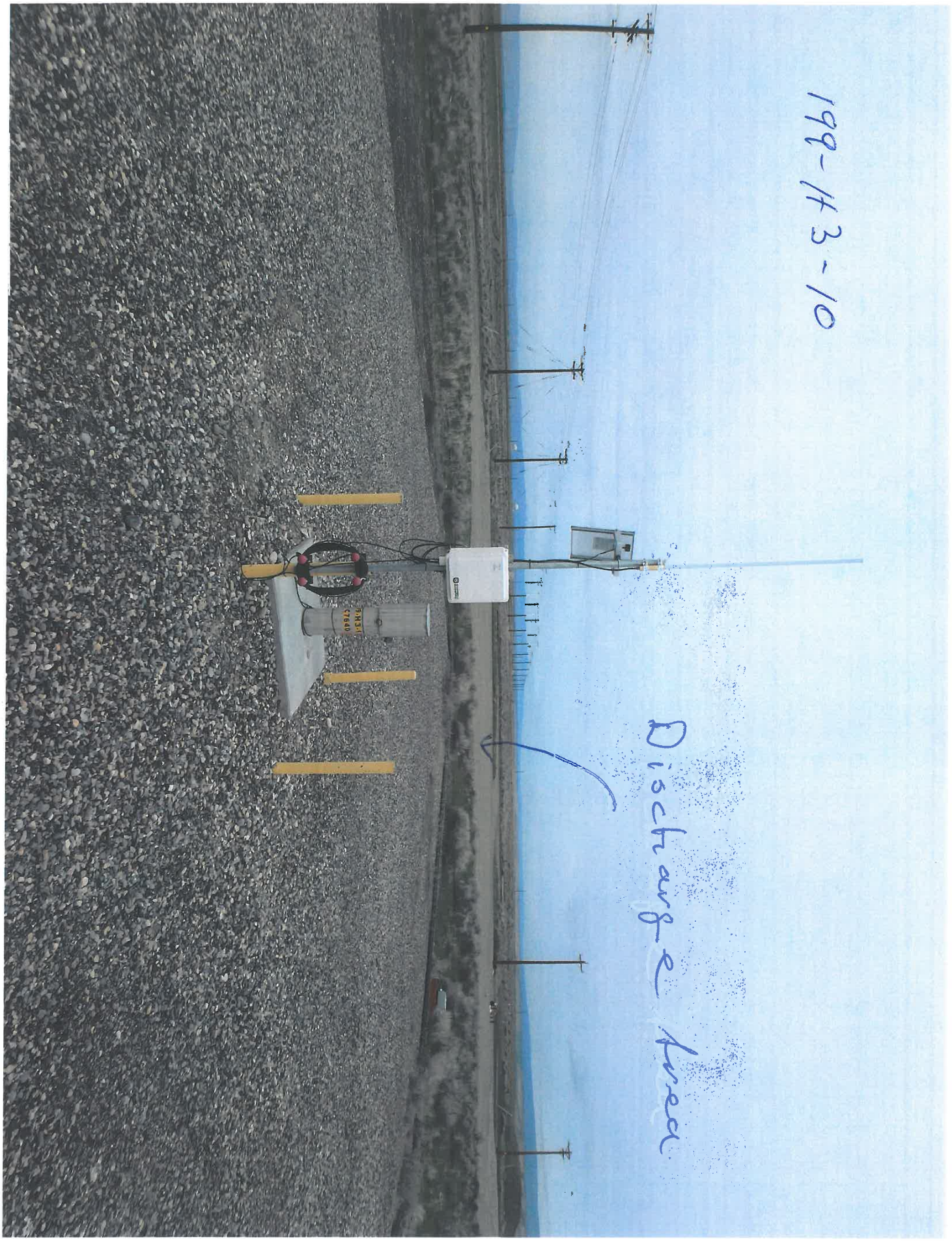
REVIEW/CONCURRENCE

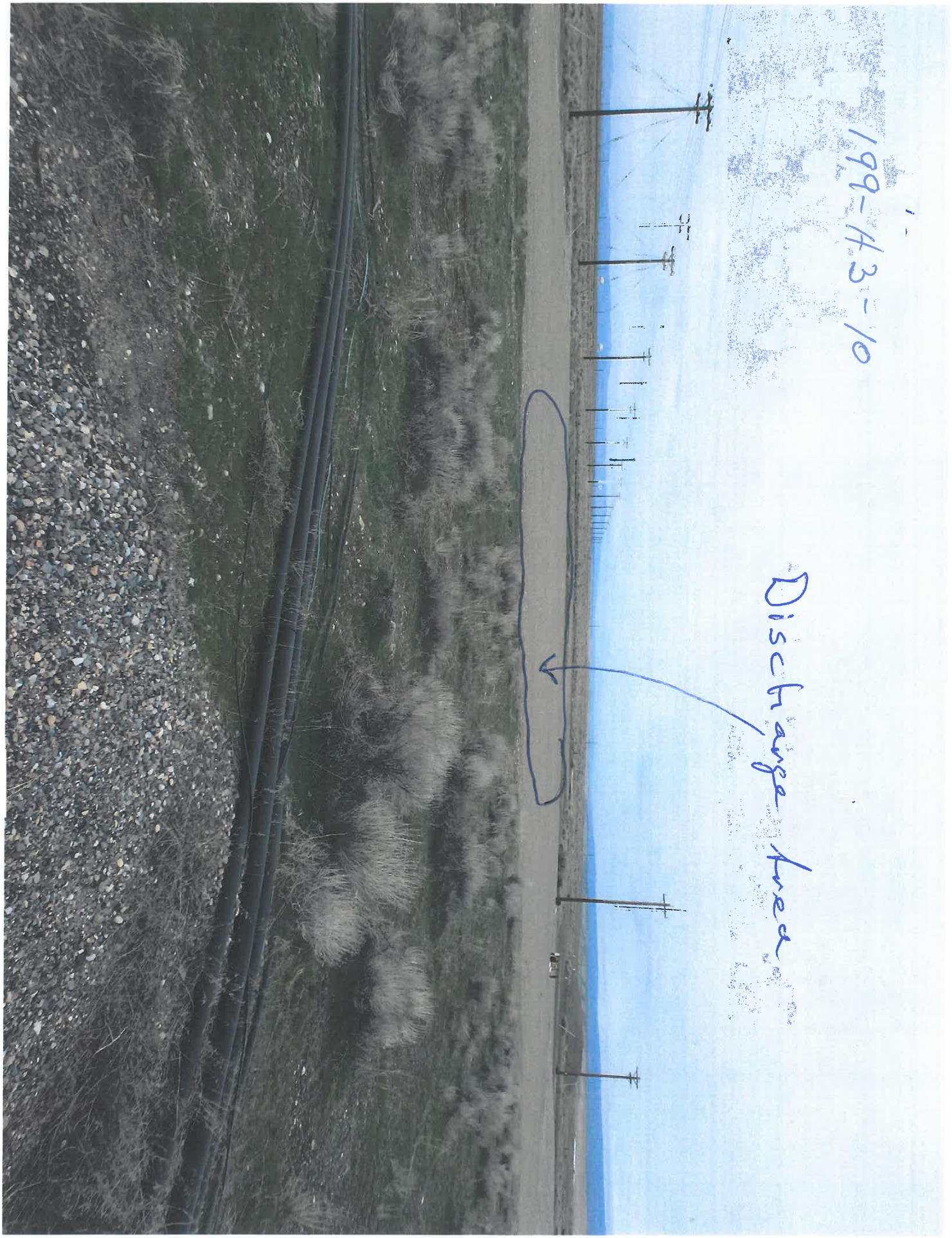
	Print Name	*Signature*	*Date*
15. GVZ Environmental Compliance Officer (ECO)	Rick Oldham	[signature]	3.9.16
16. Requesting Organization ECO			
17. GVA Technical Lead			

GVZ Form for Well 199-H3-10.

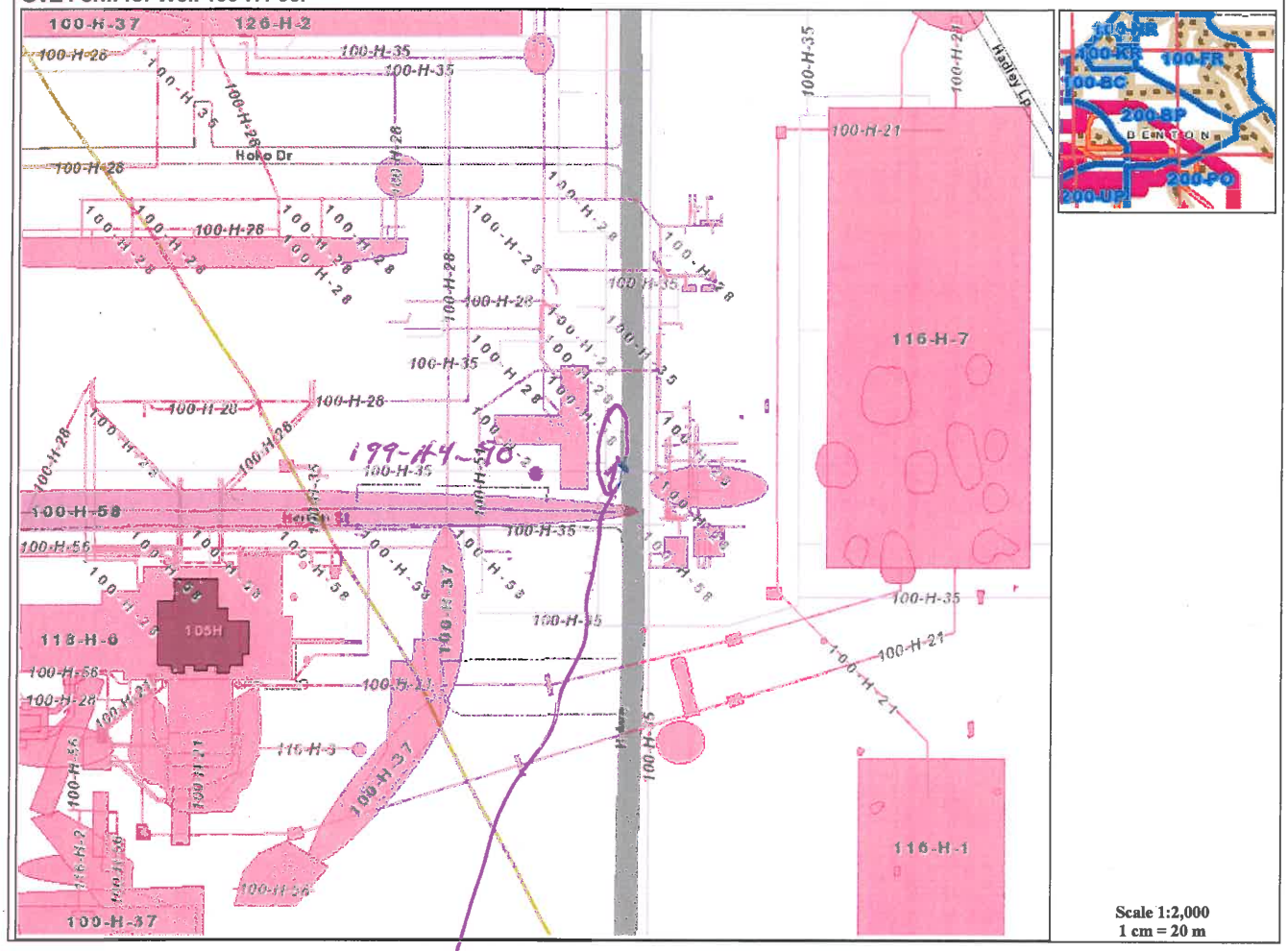


Discharge on gravel area south of the old warehouse location.

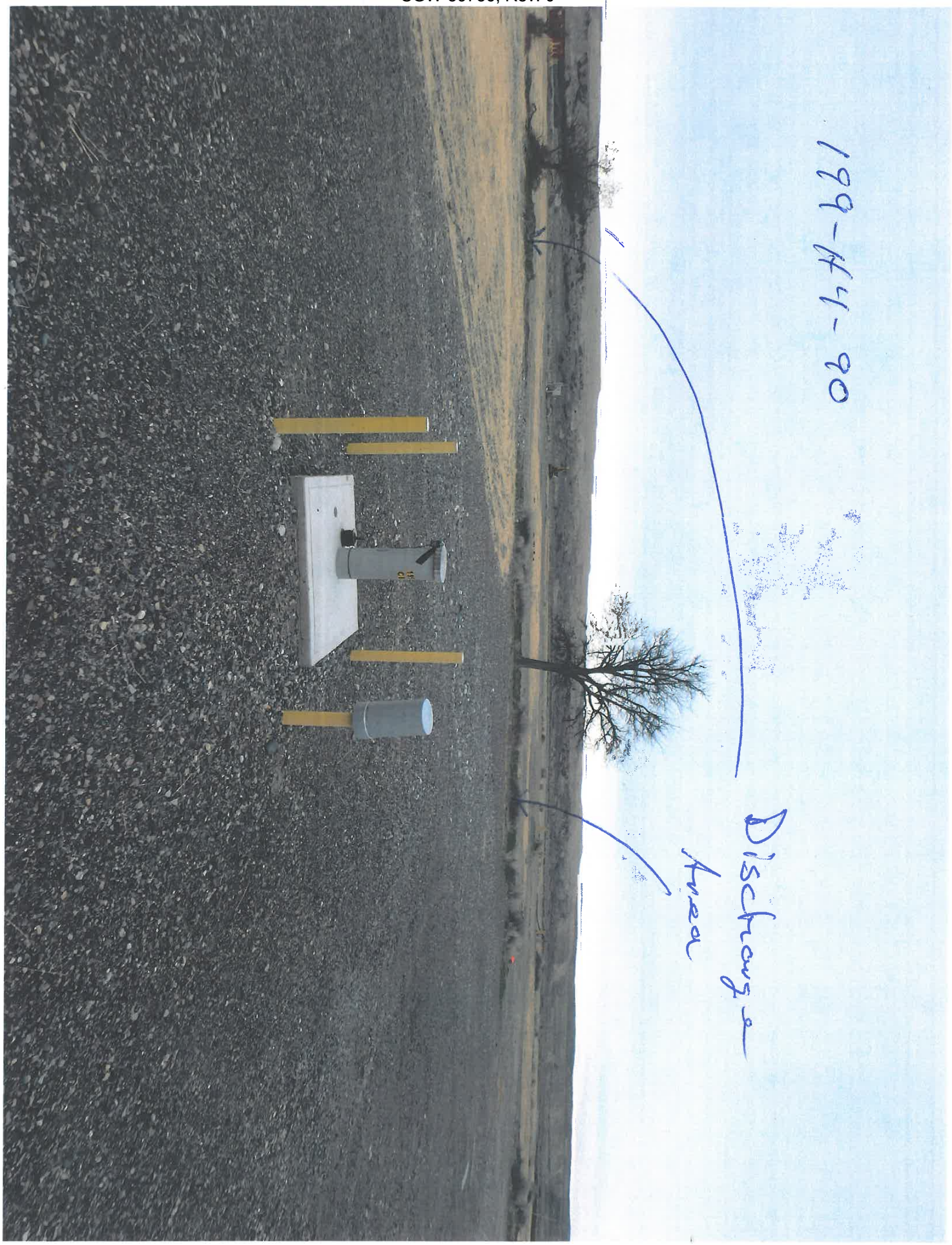

199-H3-10
Discharge Area


199-H3-10
Discharge Area

GVZ Form for Well 199-H4-90.



Discharge on vegetated area east of 199-H4-90


08-14-99
Discharge
Area

199-H4-80
Discharge
Area