Quality Assurance Project Plan

City of Prosser ASR Feasibility Study

Wine Country Road Bridge, City of Prosser

March 2025

WA Department of Ecology Office of Columbia River Agreement Number: WRYBIP-2325-CiPros-00046

Publication No. 25-12-001

Publication Information

Each study conducted or funded by the Washington State Department of Ecology (Ecology) must have an approved Quality Assurance Project Plan (QAPP). The QAPP describes the objectives of the study and the procedures to be followed to achieve those objectives.

This QAPP was prepared by a licensed hydrogeologist. A signed and stamped copy of the report is available upon request. This QAPP is available via Ecology's publication database and upon request. The Ecology publication number for this QAPP is 25-12-001. This QAPP is valid through March 31, 2030.

Field data collected for this project will be uploaded to Ecology's Environmental Information Management (EIM) database under Study ID: WRYBIP-2325-00046

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Contact Information

The authors for this QAPP can be contacted as follows:

Tyson Carlson, Aspect Consulting, (509) 895-5923, Tyson.Carlson@aspectconsulting.com
Derek Holom, Aspect Consulting, (206) 941-4973, Derek.Holom@aspectconsulting.com
Ian Lauer, Aspect Consulting, (509) 237-5142, Ian.Lauer@aspectconsulting.com

For more information contact:

Jeff Dermond
Project Manager – Office of Columbia River
1250 W Alder St, Union Gap, WA 98903
Phone: (509) 268-1784

Washington State Department of Ecology – https://Ecology.wa.gov

- Headquarters, Olympia 360-407-6000
- Northwest Regional Office, Bellevue 425-649-7000
- Southwest Regional Office, Olympia 360-407-6300
- Central Regional Office, Union Gap 509-575-2490
- Eastern Regional Office, Spokane 509-329-3400

COVER PHOTO: Wine Country Road Bridge over the Yakima River, Aspect Consulting

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Approved by:

Signature:	Date: 3/5/2025
Ian Lauer, LHG, Project Hydrogeologist, Aspect Consulting, Co-Author, Project Manager	
Signature:	Date: 3/5/2025
Derek Holom, LHG, Senior Hydrogeologist, Aspect Consulting, Co-Author	
Signature:	Date: 3/5/2025
Tyson Carlson, LHG, Sr. Principal Hydrogeologist, Aspect Consulting, Principal Investigator	
Signature:	Date: 3/5/2025
Marty Groom, Public Works Director, City of Prosser, Project Manager	
Signature:	Date: 03/05/25
Randee Arrington, Business Unit Manager, Eurofins	
Signature:	Date: 3/6/2025
Jeff Dermond, Department of Ecology, Office of Columbia River, Project Manager	
Signature:	Date: 3/6/2025
McKenna Murray, Department of Ecology, Office of Columbia River, Quality Assurance Coordinator	

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2.0 Abstract

This Quality Assurance Project Plan (QAPP) was prepared by Aspect Consulting (Aspect) for the City of Prosser (City) to outline the procedures for data collection for a feasibility study of an Aquifer Storage and Recovery (ASR) program. The proposed ASR program would treat available source water from the Yakima River and inject it via the City's Well No. 4, which is completed in the Saddle Mountains Basalt aquifer. This program is being evaluated as a component of the City's long-term water supply strategy to protect and maintain groundwater levels in the Saddle Mountains Basalt, one of the City's two primary municipal water supplies. The City's proposed ASR program has the potential to address multiple goals of the Yakima Basin Integrated Plan (YBIP), including expansion of both instream and out-of-stream uses, with a Total Water Supply Available (TWSA)-positive outcome.

This QAPP covers our programmatic approach to assess the technical, operational, regulatory, and cost requirements to implement a future ASR program in the City's municipal water system. The study will develop a conceptual hydrogeologic model detailing the target aquifer conditions in accordance with Chapter 173-157-120 WAC. Well No. 4, the current proposed injection well will be tested to refine local aquifer parameters and provide data for engineering evaluation. An engineering evaluation will be performed to establish targets for injection, storage, and recovery for municipal use and evaluate existing infrastructure, including evaluation of whether Well No. 4 is appropriate for ASR conversion and the option of adding a new dedicated ASR well to the system. The source water quality and aquifer water quality will be evaluated to identify potential constituents of concern listed in Chapter 173-200 WAC and the Washington State Department of Ecology (Ecology) groundwater antidegradation policy per WAC 173-200-030. Geochemical modelling will be performed to determine source and target water compatibility. If needed, treatment requirements and alternatives will be outlined to support future permitting considerations (e.g., All Known Available and Reasonable Treatment [AKART] analysis).

We expect the feasibility study will rely largely on existing information. Our study will build on past efforts funded by the City of Prosser, YBIP, and Ecology, such as local aquifer testing, numerical groundwater modelling, and water quality and quantity assessments.

Key sections of this QAPP that describe the tasks and data collection procedures are as follows:

- Section 3.2.3 provides a description of the water quality constituents to be evaluated.
- Section 4.4 presents the details of the tasks to be completed, in sequential order.
- Section 5 outlines the project schedule and team.
- Section 6.2 presents the Measurement Quality Objectives.
- Section 7.2 describes water quality sampling locations.
- Section 8.2 details the measurement and sampling procedures.

3.0 Background

The City of Prosser provides municipal water supply to a population of over 6,000 people along with many industrial users. The City is experiencing declining yields in their wellfield and has projected long-term issues in water supply (Aspect, 2023). The City's wellfield is currently able to meet existing demands but does not meet Washington State Department of Health (DOH) source reliability recommendations and is projected to approach maximum capacity within 20 years (HLA, 2022). Following drilling and testing of a new water supply well in 2023, Well No. 7, it was found that significant interference was occurring between Well No. 7 and other City wells completed in the Lower Saddle Mountains Basalt aquifer. This interference, compounded with seasonal and historic declines, restricted the total production value of the wellfield. These issues prompted the City to evaluate new strategies to mitigate current and future groundwater supply issues.

3.1 Introduction and Problem Statement

As a component of its long-term water supply strategy, the City is evaluating development of an ASR program to stabilize groundwater levels in the Lower Saddle Mountains Basalt aquifer. Groundwater from the Saddle Mountains and Wanapum Basalt Formations is the City's sole source of water supply, and there are no other immediately viable water supplies for the City. As an initial step, the City identified Well No. 4, which is operational but not actively used as a municipal supply, as an ideal candidate well for the ASR program. Well No. 4 is completed in the Lower Saddle Mountains Basalt at similar depths as City's other groundwater supply wells.

This Feasibility Study (FS) will evaluate if an ASR program is viable for the City, based on hydrogeologic, legal, environmental, and operational considerations. The information required for an ASR reservoir permit application per WC 173-157 will be documented in the FS.

This QAPP specifically addresses the following elements:

- Data and measurement quality objectives;
- Field and laboratory procedures;
- Quality control methods;
- Data verification and validation protocols;
- Data management procedures; and
- Reporting

This QAPP follows Ecology's *Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies* (Ecology, 2004; updated 2016). It has been developed to conduct water level and water quality data collection effectively and accurately as part of the study.

The development of this QAPP is funded under Ecology Office of Columbia River (OCR) Grant (Agreement No. WRYBIP-2325-CiPros-00046) between the City and Ecology. Aspect is under contract to the City to prepare this QAPP and complete the study.

3.2 Study Area and Surroundings

The City of Prosser is located in the western portion of Benton County, Washington, between the Horse Heaven Hills and Yakima River (Figure 1). The City lies on the southern end of the Yakima Fold and Thrust Belt, which forms the east-west trending mountain ranges and structural basins east of the Cascade Mountains. The City is located in the Benton sub-basin of the greater Yakima River Basin, which is bounded on the north by the Rattlesnake Hills Anticline and on the south by the Horse Heaven Hills Structure (Figure 1).

Regional geology is composed of shallow, unconsolidated sedimentary deposits that are underlain by multiple formations of the Columbia River Basalt Group (CRBG), a series of stacked basalt flows and sedimentary interbeds. Locally, surficial deposits are mapped as quaternary alluvial and outburst flood deposits composed of interbedded silts, sands, and gravels and range from absent to 100 feet thick (Figure 2). Underlying the young surficial deposits and occasionally exposed at the surface, bedrock geology is composed of Miocene-aged Saddle Mountains Basalt Formation, which is composed of multiple basalt flows that are frequently interbedded with clay, silt, and sand beds of the Ellensburg Formation. Underlying the Saddle Mountains is the Wanapum Basalt, which is separated from the Saddle Mountains by the Mabton Interbed of Ellensburg Formation (Jones and Vaccaro, 2008).

Hydrogeology in the Prosser area is generally representative of the Yakima River Basin and the greater CRBG aquifer system. Productive aquifers occur within both shallow, coarse-grained unconsolidated deposits and basalt interflow zones of the CRBG. The shallow alluvial aquifer is generally thin, less than 50 feet, and is typically utilized only for domestic water supply. The Saddle Mountains Basalt Formations are the most regionally utilized aquifers, which are often split into an Upper and Lower Formation at the interior of the Pomona Member flow. The Upper Saddle Mountains aquifer is generally several hundred feet thick, exhibits semi-confined to unconfined conditions, and is the primary source for domestic and irrigation supply wells. The Lower Saddle Mountains aquifer is likewise several hundred feet thick, reaching to depths of 700 to 800 feet, exhibits semi-confined to confined conditions, and is the source for a relatively few municipal and irrigation supply wells. The Wanapum aquifer extends below the Saddle Mountains Basalt, exhibits similar hydrogeologic conditions to the Upper Saddle Mountains Basalt, and is the source of a relatively few large water supply wells.

Figure 1. Study Location Map

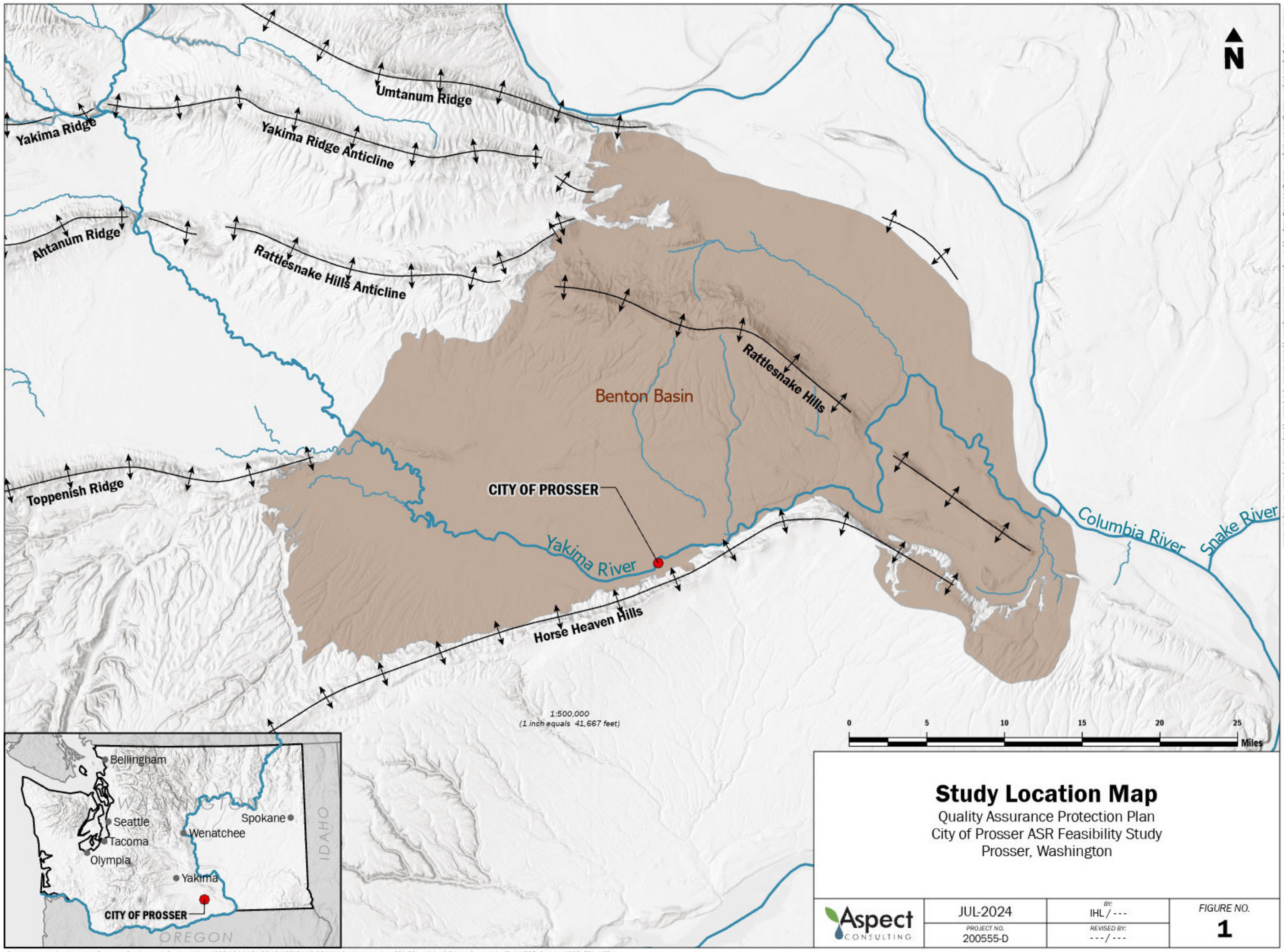
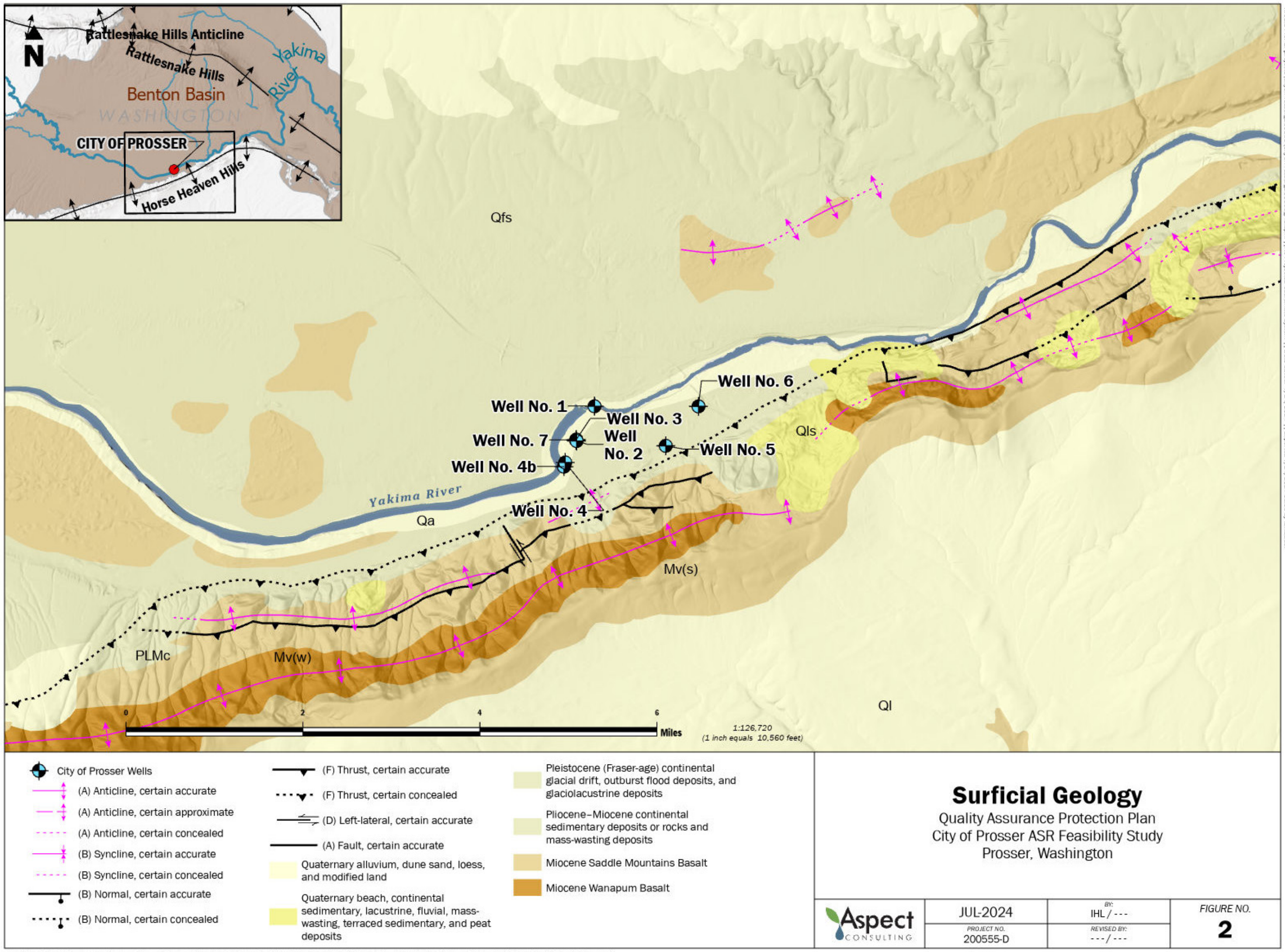


Figure 2. Surficial Geology



3.2.1 History of the Study Area

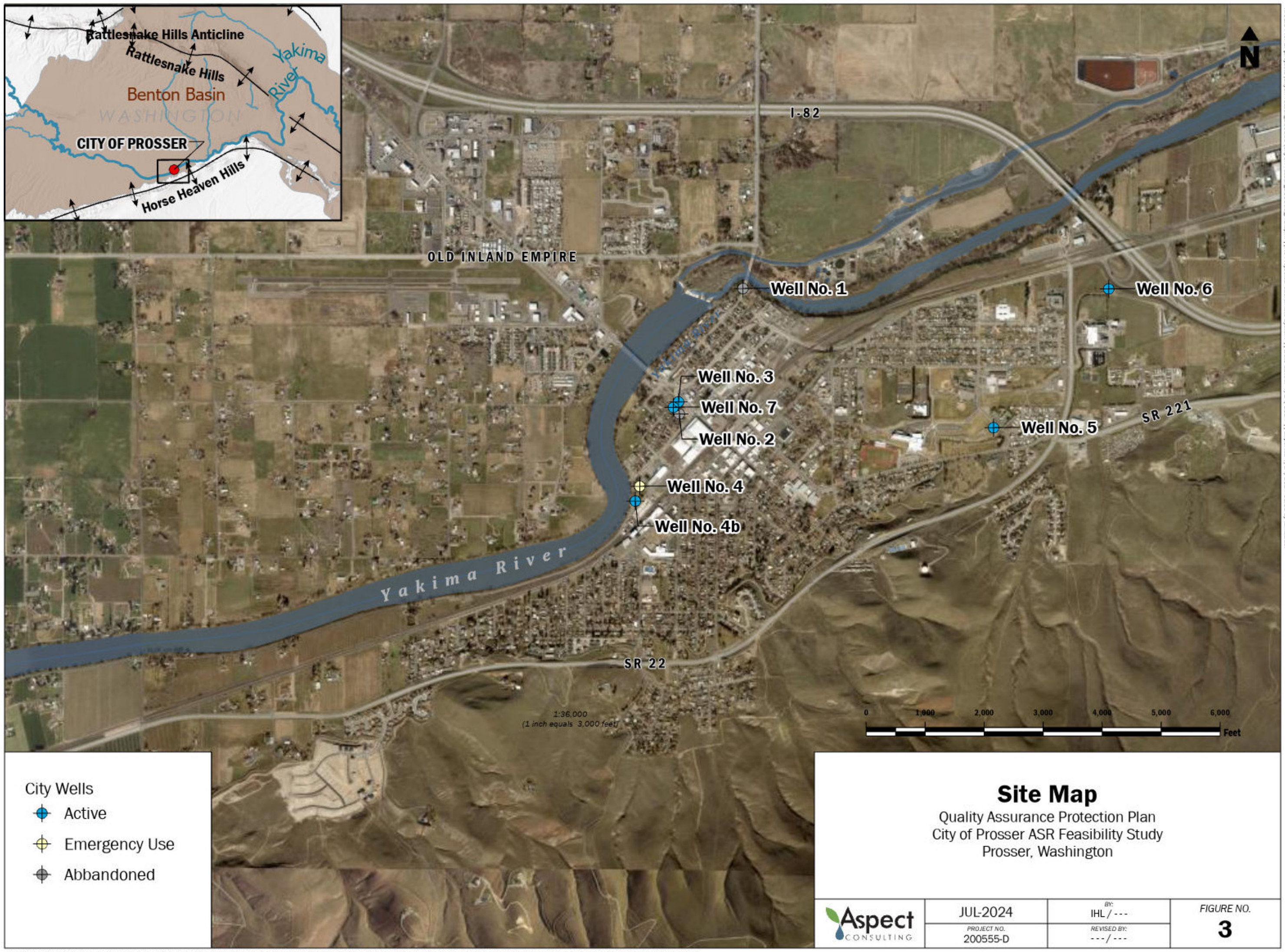
The City operates six primary water supply wells and one emergency well, which are completed in the Lower Saddle Mountains Basalt and Wanapum Basalt aquifers (Figure 3, Appendix A). The majority of the City's wells are completed in the Lower Saddle Mountains aquifer, including Well Nos. 2, 3, 4, 4b, and 7. Well No. 3 also has a short upper screened interval in the Upper Saddle Mountains aquifer. City Well Nos. 5 and 6 are completed in the Wanapum aquifer.

Well Nos. 3, 4b, 5, 6, and 7 are actively operated by the City. Well No. 4 is currently disconnected from the water system but is still equipped for emergency use. Well No. 1 was decommissioned in 1985 and Well No. 2 was decommissioned in 2023 during construction of Well No. 7. The combined maximum pumping capacity among the City's active wells is 5.4 million gallons per day (MGD). However, the City has current water rights totaling about 8.3 MGD, so the City's total pumping capacity is physically limited to less than 70 percent of the City's available water rights (HLA, 2022).

Well No. 7 was constructed and brought online in 2023 to add capacity and improve reliability of the City's water supply system due to decreasing production from ageing wells (i.e., Wells No. 2 and 3). However, based on hydraulic testing in Well No. 7, significant well interference drawdown was observed in nearby Well No. 4b, which ultimately limits the potential production of these two wells to about 60% of their capacity (Aspect 2023).

Although the City can meet their current water level demands with the new Well No. 7, long-term water level declines of 5 to 7 feet per year have been observed in the Prosser area in the Lower Saddle Mountains Basalt and Wanapum aquifers (Aspect, 2023). These declines are attributed to increased summer demand and pumping in other regional aquifer systems and may also be attributed to limited lateral aquifer recharge associated with the Horse Heaven Hills anticline and fault structures that bound the foothills to the south. This illustrates the vulnerability of the City's water supply to climate change and anticipated reduction in future supply.

Figure 3. Site Map



3.2.2 Summary of Previous Studies and Existing Data

Water Levels

The City maintains a database of monitored water levels of their wells. The historical record of manual water level readings is discontinuous and sparse but spans from 1944 to present (date range varies based on well). SCADA water levels are generally recorded on 1-minute intervals with an accuracy of 0.1-foot and have been collected from 2021 to present in Well Nos. 4b, 5, and 7.

Pumping Rates

Pumping rate quantities are available for the City's wells at approximately the same rate and period as water level data. The records generally include daily quantities pumped in gallons. More detailed pumping records are available for Wells 4b, 5, 6, and 7, which record instantaneous discharge in gpm at 1-minute intervals in the SCADA system. Recent data is available from previous well performance and aquifer tests conducted in Wells No. 3, 4b, and 7 (Aspect, 2023).

Water Quality

Groundwater

Groundwater quality data are available for all the City's past and current wells with the exception to Well No. 1, which was decommissioned prior to current records. These data include primary and secondary drinking water parameters per WAC 246-290-310 and various other parameters (e.g., nitrates, lead and copper, arsenic, etc.). Overall, the quality of the groundwater meets the criteria listed in WAC 173-200-040 and WAC 246-290-310, with exception to fluoride, manganese, and sodium. Fluoride has been detected at concentrations up to 2.3 mg/L in Well No. 6 which exceeds the drinking water secondary maximum contaminant level (MCL) of 2.0 mg/L. Manganese has been detected at concentrations up to 0.07 mg/L in Well Nos. 2, 3, 4, 4b which exceeds the secondary MCL of 0.05 mg/L. All City wells have been observed to have elevated concentrations of sodium between 50 to 110 mg/L which is above the State's advisory level of 20 mg/L for people with sodium-restricted diets, although there is no current MCL established.

Surface Water

Ecology conducted a study of the Yakima River water quality at the Selah-Moxee diversion, which included continuous monitoring for dissolved oxygen, pH, specific conductance, and total suspended solids (Urmos-Berry et al., 2021). Ecology also measured alkalinity, total organic carbon (TOC), ammonia, orthophosphate, total phosphorous, nitrate and nitrite as nitrogen, and total persulfate nitrogen. Ecology also collects regular sampling of the Yakima River at Kiona, ECY Site ID 37A090, downstream of the City of Prosser.

The USGS and Ecology also monitored Yakima River water quality as part of the National Water Quality Assessment project (Fuhrer et al. 2004; Johnson et al. 2010; USEPA, 2013). These studies evaluated the effects of agricultural activity on surface water quality from nitrate, phosphorous, fecal coliform, pesticides, and polychlorinated biphenyls (PCBs).

A recent study by Central Washington University (CWU) and Geosyntec Consultants evaluated the feasibility of ASR for the Konnowac Pass area, specifically using the Yakima River as source water and the Roza Irrigation Canal infrastructure for conveyance to hypothetical injection wells (Geosyntec and CWU, 2024). Water quality sampling from the Yakima River and Roza Irrigation Canal as part of that study, as well as routine water quality sampling and analysis conducted by the Roza Sunnyside Joint Board of Control (RSJBOC), indicate that water quality treatment may be necessary for bacteriological agents, pH, and total suspended solids if the Yakima River is used as the source for aquifer recharge. Otherwise, the water quality of the Yakima River meets the criteria of WAC 173-200-040 and WAC 246-290-310.

3.2.3 Parameters of Interest and Potential Sources

This study includes up to seven water quality samples collected from the City's wells to evaluate background water quality of the target aquifer, the Saddle Mountains Basalt, in accordance with Chapter 173-200 WAC and as described in detail in Section 7. One existing sample collected during source water approval will be submitted as the eighth sample required under Chapter 173-200 WAC. At a minimum, two water quality samples will be collected from the Yakima River adjacent to Well No. 4b to evaluate source water quality with the Washington State Groundwater Quality Standards (Chapter 173-200-040 WAC) and Drinking Water Standards (Chapter 246-290 WAC) to support future DOH Source Approval. The proposed sampling locations are Well No. 4, 4b, and 7, as shown on Figure 3.

The schedule for monitoring these constituents during the study is presented in Section 7.2.1. Data collected will be used to begin evaluating the background water quality conditions needed for a future AKART analysis, if needed.

In addition to water quality, performance testing of Well No. 4 will be completed to determine local aquifer parameters for the Lower Saddle Mountains Basalt aquifer including hydraulic conductivity, transmissivity, and storativity. These parameters will help refine our estimate of aquifer storage volumes, injection rates, and other engineering aspects of the project.

The following sections describe the water quality analytes selected for this investigation.

Field Parameters

Field parameters will be measured during each of the sample events to provide independent corroboration of laboratory results and to analyze constituents that have short hold times and can be readily measured in the field. Field parameters are detailed in Section 7.2.2 and include:

- Specific conductance
- Dissolved oxygen
- Oxidation-reduction potential (ORP)
- pH
- Temperature
- Turbidity

Primary and Secondary Inorganic Compounds and Metals (General Chemistry)

This general chemistry suite includes inorganic constituents and conventional water quality parameters. Water quality samples will be analyzed for this suite of constituents in both the dissolved (field-filtered to 45 microns) and total recoverable fractions. This analytical suite will also be used to confirm source treatment requirements in the context of Chapter 173-200 WAC (Groundwater Quality Standards) and WAC 246-290-310 (Drinking Water Standards) using standard analytical methods. Constituents will include:

Alkalinity	Silica	Lead
Bicarbonate	Arsenic	Magnesium
Chloride	Ammonia	Manganese
Total Dissolved Solids (TDS)	Antimony	Molybdenum
Total Suspended Solids (TSS)	Aluminum	Mercury
Total Organic Carbon (TOC)	Barium	Nickel
Dissolved Organic Carbon (DOC)	Beryllium	Potassium
Phosphorus	Cadmium	Selenium
Bromide	Calcium	Silver
Fluoride	Chromium	Sodium
Nitrate-N	Copper	Thallium
Nitrite-N	Iron	Titanium
Sulfate	Zinc	Uranium

Volatile and Semivolatile Organic Compounds (VOCs and SOCs)

Under this study, volatile organic compounds (VOCs), semivolatile organic compounds (SOCs), herbicides, and pesticides will be analyzed for both source and target water supplies. This will include the analytes specified in US EPA Methods for:

- Chlorinated pesticides
- Chlorinated acid herbicides
- Pesticides as carbamates
- Herbicides – diquat, paraquat, endothall, and glyphosate

Disinfectants/Disinfection By-products (DBPs)

DBPs are a subset of volatile compounds. The following DBPs will be analyzed:

- Trihalomethane Compounds (THMs): chloroform (trichloromethane), bromodichloromethane, dibromochloromethane, and bromoform. The combined concentration of these four constituents will be considered total THMs (TTHM)
- Haloacetic Acids (HAAs): monochloroacetic acid, dichloroacetic acid, trichloroacetic acid, monobromoacetic acid, and dibromoacetic acid. The combined concentration of these constituents is referenced to as HAA5.

Microorganisms

Bacteriological constituents will be analyzed to determine baseline conditions. The following constituents will be analyzed:

- E. coli (presence/absence)
- Total coliforms (heterotrophic plate count)
- Fecal coliform
- Iron reducing bacteria

Radionuclides

The follow radionuclides will be analyzed for:

- Radium 226 + Radium 228
- Gross Alpha radiation
- Gross Beta radiation
- Uranium

3.2.4 Regulatory Criteria and Standards

The purpose of this study is to evaluate regulatory compliance considerations for future ASR program operations, where the introduction of recharge water to the storage aquifer is subject to the Antidegradation Rule and numerical groundwater quality standards defined in Chapter 173-200 WAC using standard analytical methods. During future operations, water recovered to the drinking water system through ASR must also meet Drinking Water Criteria in WAC 246-290-310. Section 3.2.3 describes water quality analytes selected for this investigation. Table 1 below presents the regulatory criteria by analyte method that will be evaluated as part of this project for compliance considerations for a future ASR program.

Table 1. Water Quality Analytes and Applicable Standards

Analytical Method	Analyte	Units	WAC 173-200-040 Groundwater Quality Standard	WAC 246-290 Primary Drinking Water Standard	WAC 246-290 Secondary Drinking Water Standard
General Chemistry, Inorganics					
SM 2120B	Color	CU	15		15
EPA 300.0	Chloride	mg/L	250		250
EPA 300.0	Fluoride	mg/L	4	4	2
EPA 245.1	Mercury	mg/L	0.002	0.002	
EPA 300.0	Nitrate (as N)	mg/L	10	10	
EPA 300.0	Nitrite (as N)	mg/L		1	
EPA 300.0	Sulfate	mg/L	250		250
SM 2540C	Total Dissolved Solids	mg/L	500		500
SM 4500_H+	pH	SU	6.5-8.5		
SM 2150B	Odor	TON	3		
EPA 100.2	Asbestos	mfl		7	
EPA 335.4	Cyanide			0.2	
SM 2510B	Specific conductivity	umhos/cm			700
Metals by ICP or ICP/MS					
EPA 200.8	Antimony	mg/L		0.006	
EPA 200.8	Arsenic	ug/L	0.05	0.01	
EPA 200.8	Barium	mg/L	1	2	
EPA 200.8	Beryllium	mg/L		0.004	
EPA 200.8	Cadmium	mg/L	0.01	0.005	
EPA 200.8	Chromium	mg/L	0.05	0.1	
EPA 200.8	Copper	mg/L	1	1.3	
EPA 200.7	Iron	mg/L	0.3		0.3
EPA 200.8	Lead	mg/L	0.05	0.015	
EPA 200.8	Manganese	mg/L	0.05		0.05

Analytical Method	Analyte	Units	WAC 173-200-040 Groundwater Quality Standard	WAC 246-290 Primary Drinking Water Standard	WAC 246-290 Secondary Drinking Water Standard
EPA 200.8	Selenium	mg/L	0.01	0.05	
EPA 200.8	Silver	mg/L	0.05		0.1
EPA 200.7	Sodium	mg/L		20	
EPA 200.8	Thallium	mg/L		0.002	
EPA 200.8	Uranium	ug/L		30	
EPA 200.8	Zinc	mg/L	5		5
Bacteriological					
SM 2510B	Total Coliform Bacteria	mL	1/100	1/100	
Volatile Organic Compounds					
EPA 524.2	1,1,1-Trichloroethane	mg/L	0.2	200	
EPA 524.2	1,1,2-Trichloroethane	ug/L		5	
EPA 524.2	1,1-Dichloroethane	ug/L	1		
EPA 524.2	1,1-Dichloroethylene	ug/L		7	
EPA 524.2	1,2,4-Trichlorobenzene	mg/L		0.07	
EPA 524.2	1,2-Dichloroethane	ug/L	0.5	5	
EPA 524.2	1,2-Dichloropropane	ug/L	0.6	5	
EPA 524.2	1,3-Dichloropropene	ug/L	0.2		
EPA 524.2	1,4-Dichlorobenzene	ug/L	4	75	
EPA 524.2	Acrylonitrile	ug/L	0.07		
EPA 524.2	Benzene	ug/L	1	5	
EPA 524.2	Bromodichloromethane	ug/L	0.3		
EPA 524.2	Bromoform	ug/L	5		
EPA 524.2	Carbon tetrachloride	ug/L	0.3	5	
EPA 524.2	Chlorobenzene	ug/L		100	
EPA 524.2	Chlorodibromomethane	ug/L	0.5		
EPA 524.2	Chloroform	ug/L	7		
EPA 524.2	cis-1,2-Dichloroethylene	ug/L		70	
EPA 524.2	Dibromochloropropane	mg/L		0.0002	
EPA 524.2	Epichlorohydrin	ug/L	8		
EPA 524.2	Ethyl acrylate	ug/L	2		
EPA 524.2	Ethylbenzene	ug/L		700	
EPA 524.2	Ethylene dibromide (EDB)	ug/L	0.001	0.00005	
EPA 524.2	Methylene chloride	ug/L	5	5	
EPA 524.2	o-Dichlorobenzene	ug/L		600	
EPA 524.2	Styrene	ug/L		100	
EPA 524.2	Tetrachloroethylene	ug/L	0.8	0.005	

Analytical Method	Analyte	Units	WAC 173-200-040 Groundwater Quality Standard	WAC 246-290 Primary Drinking Water Standard	WAC 246-290 Secondary Drinking Water Standard
EPA 524.2	Toluene	ug/L		1000	
EPA 524.2	trans-1,2-Dichloroethylene	ug/L		100	
EPA 524.2	Trichloroethylene	ug/L	3	5	
EPA 524.2	Vinyl chloride	ug/L	0.02	2	
EPA 524.2	Xylenes (Total)	ug/L		10000	
EPA 8260D	Benzyl chloride	ug/L	0.5		
EPA 8270D	Bis(chloromethyl) ether	ug/L	0.0004		
EPA 8270D	N-Nitrosodiphenylamine	ug/L	17		
EPA 8270E	2-Methylaniline hydrochloride	ug/L	0.5		
EPA 8270E	3,3'-Dimethoxybenzidine	ug/L	6		
EPA 8321	Ethylene thiourea	ug/L	2		
Synthetic / Semivolatile Organic Compounds					
EPA 1613B	2,3,7,8-TCDD (Dioxin)	ug/L	0.0000006	0.00000003	
EPA 505	Chlordane	ug/L	0.06	0.002	
EPA 505	PCBs	ug/L	0.01	0.0005	
EPA 505	Toxaphene	ug/L	0.08	0.003	
EPA 515.3	2,4,6-Trichlorophenol	ug/L	4		
EPA 515.3	Pentachlorophenol	mg/L		0.001	
EPA 515.3	2,4,5-TP (Silvex)	mg/L	0.01	0.05	
EPA 515.3	2,4-D	mg/L	0.1	0.07	
EPA 515.3	Dalapon	mg/L		0.2	
EPA 515.3	Dinoseb	mg/L		0.007	
EPA 515.3	Picloram	mg/L		0.5	
EPA 525.2	Alachlor	mg/L		0.002	
EPA 525.2	Aldrin	ug/L	0.005		
EPA 525.2	Atrazine	mg/L		0.003	
EPA 525.2	Benzo(a)pyrene	ug/L	0.008	0.0002	
EPA 525.2	Bis(2-ethylhexyl) phthalate	ug/L	6		
EPA 525.2	Chlorthalonil	ug/L	30		
EPA 525.2	DDT (includes DDE and DDD)	ug/L	0.3		
EPA 525.2	Di(2-ethylhexyl) adipate	mg/L		0.4	
EPA 525.2	Di(2-ethylhexyl) phthalate	mg/L		0.006	
EPA 525.2	Dieldrin	ug/L	0.005		
EPA 525.2	Endrin	mg/L	0.0002	0.002	
EPA 525.2	Heptachlor	ug/L	0.02	0.0004	

Analytical Method	Analyte	Units	WAC 173-200-040 Groundwater Quality Standard	WAC 246-290 Primary Drinking Water Standard	WAC 246-290 Secondary Drinking Water Standard
EPA 525.2	Heptachlor epoxide	ug/L	0.009	0.0002	
EPA 525.2	Hexachlorobenzene	ug/L	0.05	0.001	
EPA 525.2	Hexachlorocyclopentadiene	mg/L		0.05	
EPA 525.2	Lindane	ug/L	0.06	0.0002	
EPA 525.2	Methoxychlor	mg/L	0.1	0.04	
EPA 525.2	Simazine	mg/L		0.004	
EPA 531.2	Aldicarb	mg/L		0.003	
EPA 531.2	Aldicarb sulfone	mg/L		0.002	
EPA 531.2	Aldicarb sulfoxide	mg/L		0.004	
EPA 531.2	Carbofuran	mg/L		0.04	
EPA 531.2	Oxamyl (Vydate)	mg/L		0.2	
EPA 547	Glyphosate	mg/L		0.7	
EPA 548.1	Endothall	mg/L		0.1	
EPA 549.2	Diquat	mg/L		0.02	
EPA 8081B	Hexachlorocyclohexane (technical)	ug/L	0.05		
EPA 8141B	Dichlorvos	ug/L	0.3		
EPA 8270E	1,2-Diphenylhydrazine	ug/L	0.09		
EPA 8270E	2,4-Dinitrotoluene	ug/L	0.1		
EPA 8270E	2,6-Dinitrotoluene	ug/L	0.1		
EPA 8270E	3,3'-Dichlorobenzidine	ug/L	0.2		
EPA 8270E	Acrylamide	ug/L	0.02		
EPA 8270E	Aniline	ug/L	14		
EPA 8270E	Azobenzene	ug/L	0.7		
EPA 8270E	Benzidine	ug/L	0.0004		
EPA 8270E	Carbazole	ug/L	5		
EPA 8270E	Diallate	ug/L	1		
EPA 8270E	N-Nitrosodiethylamine	ug/L	0.0005		
EPA 8270E	N-Nitrosodimethylamine	ug/L	0.002		
EPA 8270E	N-Nitroso-di-n-butylamine	ug/L	0.02		
EPA 8270E	N-Nitroso-di-n-propylamine	ug/L	0.01		
EPA 8270E	N-Nitroso-N-methylethylamine	ug/L	0.004		
EPA 8270E	N-Nitrosopyrrolidine	ug/L	0.04		
EPA 8270E	o-Toluidine	ug/L	0.2		
EPA 8270E_SIM	1,4-Dioxane	ug/L	7		
EPA 8290A	Hexachlorodibenzo-p-dioxin, mix	ug/L	0.00001		

Analytical Method	Analyte	Units	WAC 173-200-040 Groundwater Quality Standard	WAC 246-290 Primary Drinking Water Standard	WAC 246-290 Secondary Drinking Water Standard
SM 5540 C	Foaming Agents	mg/L	0.5		
SM 5540 C	PAH	ug/L	0.01		
Disinfection Byproducts					
EPA 300.1	Bromate	mg/L		0.01	
EPA 300.1	Chlorite	mg/L		1	
EPA 524.2	Total Trihalomethanes (TTHMs)	mg/L		0.08	
SM 6251B	Total Haloacetic Acids 5 (HAA5)	mg/L		0.06	
Disinfection Residuals					
SM 4500-Cl G	Chlorine (as Cl2)	mg/L			
SM 4500-Cl G	Chloramines (as Cl2)	mg/L			
SM 4500-ClO2 D	Chlorine dioxide (as ClO2)	mg/L			
Radiological					
EPA 906.0	Tritium	pCi/L	20,000		
EPA 905.0	Strontium-90	pCi/L	8		
EPA 903.0	Radium-226	pCi/L	3		
SM 5540 C	Radium 226 & 228	pCi/L	5	5	
PFAS					
EPA 537.1	HFPO-DA	mg/L		0.00001	
EPA 537.1	PFBS	mg/L			
EPA 537.1	PFHxS	mg/L		0.00001	
EPA 537.1	PFNA	mg/L		0.00001	
EPA 537.1	PFOA	mg/L		0.000004	
EPA 537.1	PFOS	mg/L		0.000004	

Notes: mg/L = milligrams per liter. ug/L = micrograms per liter. µS/cm = micosiemens per centimeter. SU = standard units. NTU = Nephelometric Turbidity Units, mfl = million fibers per liter

* drinking water limit for turbidity is based on a treatment technique in lieu of a Maximum Contaminant Level, where unfiltered surface water cannot exceed 5 NTU (WAC 246-290-632).

3.3 Water Quality Impairment Studies

Not applicable.

3.4 Effectiveness Monitoring Studies

Not applicable.

4.0 Project Description

The proposed ASR program is being considered as a component of the City's long-term water supply strategy to stabilize groundwater levels and increase resiliency of their municipal water supply. This ASR feasibility study will evaluate re-timing seasonally available surface water flow from the Yakima River to augment the City's groundwater supply in the Lower Saddle Mountains Basalt aquifer (target aquifer) via the City's existing Well No. 4. This study is being conducted to collect additional hydrogeologic and water quality data to assess compliance with the ASR reservoir permit application requirements. Additionally, pumping tests will be conducted in Well No. 4 to estimate aquifer parameters to refine our estimates of ASR storage volumes and injection rates.

4.1 Project Goals

The goal of this scope of work is to collect water quality samples from both the source and target water bodies and analyze them for the full suite of parameters required for geochemical compatibility and regulatory compliance. These data will allow an evaluation of whether source water stored in the target aquifer is likely to cause an adverse geochemical reaction or otherwise result in degradation of the target aquifer. These evaluations will help provide a determination on overall feasibility of implementing the ASR project and guide the scope of future feasibility or pilot testing efforts.

In addition to the water quality evaluation, local aquifer parameters are required to determine the potential success of implementing ASR injection in Well No. 4. Inspection and performance testing of the well will provide locally relevant aquifer parameters to refine aquifer storage volumes and injection rates which would be used for planning future pilot testing.

4.2 Project Objectives

The objectives of this study are listed below.

Objective 1 – Determine if water quality of the Yakima River water meets state drinking water (WAC 246-290-310) and antidegradation water quality criteria (WAC 173-200-040) for the implementation of ASR

Objective 2 – Evaluate the baseline native groundwater conditions with respect to the antidegradation criteria (WAC 173-200-040) of the state.

Objective 2 – Assess geochemical compatibility of the source water and target aquifer water supplies.

Objective 3 – Evaluate Well No. 4 performance and local aquifer conditions. Determine if Well No. 4 should be considered for further pilot testing consideration.

Objective 5 –Refine the hydrogeologic conceptual model and characterize the target aquifer for ASR. Estimate groundwater storage and recovery capacities, rate of movement, storage loss and leakage, and/or return flow to the Yakima River. Characterize the overall feasibility of ASR implementation under the proposed conceptual model with regards to water quality, geochemical compatibility, aquifer changes, and potential environmental impacts.

4.3 Information Needed and Sources

Additional water quality data is needed for the Yakima River to evaluate future source water and from the City's wells to evaluate comprehensive water quality and evaluate variability in major chemistry (see Section 3.2.3). Groundwater quality samples will be collected from the City's wells based on the analytical suites shown in the sampling schedule, Table 6, and as determined by regulatory needs in table Table 1. These data will be compared for geochemical compatibility to determine potential changes in groundwater chemistry.

Groundwater level measurements, flow rates, and barometric data will be collected from Well No. 4. Additionally, groundwater levels and flow rates in Well No. 4b and Well No. 7 will be collected as observation data. Manual groundwater level measurement will be taken to evaluate depth to water and groundwater elevation for all City wells completed in the target aquifer.

4.4 Tasks Required

The following tasks are required to meet objectives of this study. Although not detailed in this QAPP, the project will also involve development of the hydrogeologic conceptual model, an engineering evaluation, reporting, and coordination with the City, Ecology, and DOH to ensure regulatory requirements are met per WAC 173-157.

Task 1: Pumping Tests

Work under this task will be completed to evaluate the target aquifer conditions (transmissivity, storativity, boundary conditions, etc.) and to assess the performance of Well No. 4. Results collected during this task will provide information required in WAC 173-157-120 and -130.

Task 1.1: Well Inspection and Test Preparation

An assessment of the wellhead, well appurtenances, conveyance infrastructure, and design constraints will be completed. Temporary pressure transducers or dataloggers will be installed in Well No. 4 for water level monitoring. The City's Well No. 4b will be equipped with a paired datalogger and barometer for observational data. Dataloggers will be installed and maintained at least one day prior to the pumping tests in the test and observational well. Dataloggers will be maintained for at least 10 days after test completion to monitor background groundwater levels. Manual water level measurements, measuring point data, and SCADA data for City Well Nos. 4, 4b, and 7 will be collected for the test period.

Task 1.2: Conduct step-rate pumping test

A step-rate pumping test will be conducted at Well No. 4 to evaluate well capacity and performance. The results of the step-rate test will be analyzed to determine the sustainable yield of the constant-rate pumping test.

Task 1.3: Conduct constant-rate pumping test

A constant-rate pumping test will be conducted for a minimum of 24 hours at Well No. 4. The pumping rate will be the maximum rate that is anticipated to be practically maintained within the constraints of the well and existing conveyance infrastructure. Infrastructural constraints include the discharge location for test water, which is expected to include discharging to the Yakima River.

Task 1.3: Pumping Test Analysis

The pumping test data will be analyzed using appropriate methods depending on results. From our previous experience testing in the Prosser area, we anticipate the analyses will include a combination of Hantush-Bierschenk (for well performance from the step-rate test); and the Theis solution, including Theis superposition (for well interference effects), and Stallman's[1] method for a bounded aquifer. The anticipated aquifer parameters required for reporting include specific capacity, transmissivity, hydraulic conductivity, and storativity (if drawdown is observed at an observation well).

Task 2: Conceptual Hydrogeologic Model

This task includes developing a conceptual hydrogeologic model and characterizing the target aquifer to evaluate the feasibility of implementing an ASR program for the City. The development of the conceptual model will include information requirements listed in WAC 173-157-120 and rely on existing data assembled and data collection under Task 1.

The purpose of developing the conceptual model is to describe the hydrogeology of the project area and identify the target aquifer zone for injection, storage, and recovery. The conceptual model will detail hydraulic parameters, aquifer conditions, potential boundary effects (such as from geologic structure or recharge sources), and groundwater gradients to evaluate the behavior and changes in the groundwater system expected from a proposed ASR project. The hydrogeologic conceptual model includes characterizing the groundwater water quality in the

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[1] Ferris, J.G., Knowles, D.B., Brown, R.H., and Stallman, R.W. (1962). *Theory of Aquifer Tests*. Ground-Water Hydraulics. United States Geological Survey. Water-Supply Paper 1536-E.

target aquifer, geochemical compatibility, and downgradient changes. The conceptual model will be used to:

- Estimate rates and volumes for injection, storage, recovery, and impact to the Yakima River;
- Evaluate the potential for environmental impacts; and
- Serve as a basis to evaluate existing available groundwater models by defining their strengths and limitations, and/or by developing a new groundwater model, if groundwater modeling methods are chosen to evaluate proposed ASR operations in the target aquifer and potential benefits to the YBIP.

Task 3: Water Quality Evaluation

In this task, we will evaluate the source water quality and background water quality in the target aquifer, in accordance with Ecology guidelines. Groundwater samples will be collected from three City wells during multiple sampling events to assess spatial and temporal variability of water quality within the target aquifer. One sample will be taken at the end of the pumping test of the proposed test well, Well No. 4. During both groundwater and surface water sampling, field water quality parameters (i.e., pH, specific conductance, temperature, ORP, dissolved oxygen, and turbidity) will be collected. This data will also be used to model the potential for physiochemical changes (mineral dissolution and/or precipitation) to occur because of recharge operations will be evaluated from the data collected during the test by developing a PHREEQC thermodynamic geochemical equilibrium model (Parkurst et al., 1980) for the target aquifer.

The water quality evaluation will be used to identify potential constituents of concern listed in WAC 173-200-040 and overall compliance with Ecology's groundwater antidegradation policy (WAC 173-200-030). If constituents of concern are identified, we will identify treatment needs and potential alternatives. This includes presenting an anticipated compliance approach, such as the need for a future AKART analysis, pursuing a recommendation of Overriding Consideration of Public Interest (OCPI), or implementing water treatment.

The water quality and geochemical compatibility will be further evaluated to identify additional treatment needs related to operation of the municipal water system, such as changes in disinfection practices and disinfection byproducts, which may result from implementing ASR. If additional water treatment or changes are anticipated, we will include a recommended approach in the draft and final ASR feasibility study report.

Task 4: ASR Feasibility Analysis and Reporting

This task also includes preparing a draft and final ASR feasibility study report. Ecology will review and comment on the draft report and changes will be incorporated into the final ASR feasibility report. The final ASR feasibility report will be available for review by the YBIP Groundwater Storage Subcommittee. At the completion of the study, the findings will be presented to the YBIP Groundwater Storage Subcommittee. Data collected under this QAPP will be uploaded into the Ecology EIM system.

If the results of this feasibility study are favorable, then we anticipate receiving a temporary Reservoir Permit from Ecology to conduct an ASR pilot test as part of the next phase of the ASR program.

4.5 Systematic Planning Process

This QAPP has been prepared to satisfy the systematic planning needs for this project.

5.0 Organization and Schedule

5.1 Key Individuals and Their Responsibilities

Table 2. Organization of Project Staff and Responsibilities

Staff	Title	Responsibilities
Jeff Dermond Department of Ecology, Office of the Columbia River Phone: 509-268-1784	Project Manager, OCR	Provides oversight of the Study and Ecology Grant. Clarifies scope of the project. Provides internal review of the QAPP and approves the final QAPP.
McKenna Murray Department of Ecology, Office of the Columbia River Phone: 509-329-3539	Quality Assurance Coordinator	Provides review of all copies of the QAPP and approves the final QAPP.
Marty Groom City of Prosser Phone: 509-366-8987	Project Manager	Reviews the draft and final QAPP and project deliverables, manages the project budget, and submits deliverables for the Ecology grant.
Tyson Carlson Aspect Consulting Phone: 509-895-5923	Principal Investigator	Co-author of QAPP and Aspect Project Manager. Oversees approach development, data analysis, and QA/QC. Reviews final ASR feasibility report.
Derek Holom Aspect Consulting Phone: 206-941-4973	Senior Hydrogeologist	Co-author of QAPP. Conducts oversight of field program development and execution. Performs review of data, analyses, and hydrogeologic interpretations. Co-authors the draft and final ASR feasibility reports.
Ian Lauer Aspect Consulting Phone: 208-540-1964	Project Hydrogeologist	Co-author of QAPP. Develops and oversees field program. Schedules field work and logistics. Collects field data. Performs review, analyses, and interpretation of data. Co-authors the draft and final ASR feasibility reports.
Stephen Bartlett Aspect Consulting Phone: 509-834-7040	Field Scientist	Performs field work and water quality sampling. Performs data entry and field logging.
Lea Beard Aspect Consulting Phone: 206-780-7749	Data Scientist	Reviews and uploads EIM data.
Randee Arrington Eurofins (509) 924-9200	Business Unit Manager	Prepares laboratory reports
Nicole Irons Eurofins (509) 924-9200	Quality Assurance Manager	Conducts laboratory QA/QC.

QAPP = Quality Assurance Project Plan

5.2 Special Training and Certifications

A hydrogeologist licensed in the State of Washington will perform all analysis and interpretation of field data and provide oversight of hydrogeologic data collection. All field staff involved in this project have either the relevant experience in the required standard operating procedures (SOPs) or will be trained by more senior field staff or the project manager who has the required experience. The experienced staff will then lead the field data collection and oversee/mentor less-experienced staff.

5.3 Organization Chart

See Table 2.

5.4 Proposed Project Schedule

Table 3 below provides the anticipated schedule proposed under this project.

Table 3. Tentative Project Schedule

Task	Target Completion Date	Notes
Technical memorandum of existing data and data gaps	August 1, 2024	--
Project QAPP (this document)	January 2025	--
Well Testing (February-March 2025)	April 2025	
Water quality sampling (Yakima River and City wells) (February-April 2025)	May 2025	Requires approval of QAPP and coordination with laboratory and City water department
Complete Analyses	May 2024	--
Draft Project Report	June 2025	For Ecology review
Final Project Report	July 2025	--
Water Quality and Water Levels Database upload	July 2025	Uploaded to EIM

5.5 Budget and Funding

The City has received a grant from Ecology OCR (Agreement No. WRYBIP-2325-CiPros-00046) to complete all tasks described in Section 4.4.

6.0 Quality Objectives

6.1 Data Quality Objectives [2]

The primary data quality objective (DQO) for this study is to collect sufficient water quality data to determine geochemical compatibility of source and target waters. Water samples will be submitted to an accredited laboratory and analyzed at sufficient accuracy and precision. The analysis will use common methodologies to evaluate geochemistry and water quality criteria that meet the measurement quality objectives (MQOs) described below.

Additionally, a data quality objective (DQO) for this study is to collect sufficient pumping test data to analyze aquifer parameters and evaluate if the well is a good candidate for pilot ASR testing. Groundwater level measurements and barometric pressure data will be collected from the test well and observation wells, covering at minimum pre-test static conditions, pumping test drawdown and recovery, and return to static groundwater condition. Pumping test analysis will use appropriate methodologies to evaluate well performance and aquifer parameters based on the observed groundwater level response to pumping. Groundwater elevation hydrographs of the City's wells will be prepared using the City's SCADA data.

6.2 Measurement Quality Objectives

MQOs are statements of the precision, bias, and lower measurement limits necessary to meet the Study objectives. Precision and bias together express data accuracy, whereas other considerations include the representativeness, completeness, and comparability of the data.

The investigation will be conducted to collect representative water samples for analyses, and to measure water quality field parameters. The MQOs for the field investigation are based on the requirements for the chosen analytical methods, the accuracy and precision of the field equipment used to collect measurements, and the SOPs employed to make decisions in the field. The data collection instrumentation will meet the measurement quality objectives listed in Table 4, and the water quality samples will be analyzed using standard methods that meet the MQOs listed in Table 5.

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[2] DQO can also refer to ***Decision*** Quality Objectives. The need to identify Decision Quality Objectives during the planning phase of a project is less common. For projects that do lead to important decisions, DQOs are often expressed as tolerable limits on the probability or chance (risk) of the collected data leading to an erroneous decision For projects that intend to estimate present or future conditions, DQOs are often expressed in terms of acceptable uncertainty (e.g., width of an uncertainty band or interval) associated with a point estimate at a desired level of statistical confidence.

The MQOs for the groundwater level monitoring of any City wells are as follows:

- Obtain horizontal well locations within 2-meter (6.5 feet) accuracy in the North American Datum of 1983 (NAD83).
- Obtain the elevation (if not already determined) of the wellhead or water level reference point relative to ground surface within 1-foot accuracy in the North American Vertical Datum of 1988 (NAVD88).
- Obtain ground surface elevations within a 1-foot accuracy (using GPS measurements, with elevations cross-referenced with a 10-meter digital elevation model available from the Washington State Department of Natural Resources).
- Obtain groundwater level measurements relative to the established measuring point or ground surface within a 0.1-foot accuracy.
- Obtain historical water level records from the City's SCADA system within 1-foot accuracy.

A description of the water level monitoring techniques that will be used to obtain the MQOs for the water level measurements and well locations is provided in the Field Procedures section (Section 8.0). Water level monitoring during well and aquifer testing (discharge and recovery testing) will be conducted per Ecology's Aquifer Test Procedures and Depth to Water Measurement SOP (Ecology, 2023a; Ecology, 2023b).

Table 4. Field Method MQOs and Field Equipment Information

Parameter	Equipment/ Method	Bias (median)	Precision Field Duplicates (median)	Equipment Information			Expected Range
				Accuracy	Resolution	Range	
Field Water Quality Parameters							
pH	In-Situ AquaTroll 600 (with flow-through cell)	--	--	±0.1 SU	0.01 SU	0 to 14 SU	6.5 to 8.5 SU
Specific Conductivity		--	--	±0.5% + 1 µS/cm	0.1 µS/cm	0 to 350,000 µS/cm	150 to 500 µS/cm
Dissolved Oxygen		--	--	± 0.1 mg/L	0.01 mg/L	0 to 20 mg/L	0 to 10 mg/L
Oxidation-Reduction Potential		--	--	±5 mV	0.1 mV	-1400 to +1400 mV	-300 to +300 mV
Temperature		--	--	±0.1°C	0.01°C	-5 to 50°C	1 to 25°C
Turbidity		--	--	±2% or 0.5 NTU	0.01 NTU	0 – 4,000 NTU	0 – 100 NTU
Air Monitoring							
Temperature	Van Essen Baro-Diver	--	--	0.1°C	0.01°C	-10 to 50°C	-7 to 31°C

Parameter	Equipment/ Method	Bias (median)	Precision Field Duplicates (median)	Equipment Information			Expected Range
				Accuracy	Resolution	Range	
Barometric Pressure	Van Essen Baro-Diver	--	--	0.016 ft-H_2O	0.001 ft-H_2O	--	50 to 300 ft- H_2O
Groundwater Level Measurements							
Temperature	Seametrics PT2X – 300 PSI Vented	--	--	0.5°C	0.1°C	-15 to 55°C	0 to 25°C
Pressure	Seametrics PT2X – 300 PSI Vented	--	--	±0.05% FSO	±0.0034% FSO	Max 692 ft-H_2O	10 to 300 ft-H_2O
Temperature	Van Essen TD-Diver D1801	--	--	0.1°C	0.01°C	0 to 50°C	1 to 25°C
Pressure	Van Essen TD-Diver D1801	--	--	0.016 ft-H_2O	0.007 ft-H_2O	Max 330 ft-H_2O	10 to 300 ft-H_2O
Depth to Water	Waterline Envirotech 800-ft Water Level Meter Tape	--	--	0.05 ft	0.01 ft	0.5 to 800 ft	50 to 300 ft
Wellhead Position (GPS)	EOS Arrow 100+ GNSS Receiver (RTK)	--	--	0.1 ft	0.01 ft	--	--
Aquifer Testing Measurements							
Discharge Rate	Soundwater Orcas T31-C7 Ultrasonic Flowmeter	--	--	± 2.0%	0.01 gpm	0 to 60 ft/s (0 to >5000 gpm in 6-inch diameter pipe)	50 to 500 gpm

Notes: mV – millivolts. ft H_2O = feet of water. mg/L = milligrams per liter. µS/cm = micosiemens per centimeter. SU = standard units.

Table 5. Laboratory MQOs of Water Samples

Analytical Method	Analyte	Method Detection Limit	Method Reporting Limit	Units	Matrix Spike (% Rec.)	Matrix Spike (RPD)	Blank Spike (LCS % Rec.)	Blank Spike (RPD)	Regulatory Authority[1]
General Chemistry, Inorganics									
SM 2320B	Alkalinity	5	20	mg/L	80-120	20	90-110	20	
SM 4500	Ammonia (as N)	0.134	0.3	mg/L	90-100	20	90-110	20	
EPA 100.2	Asbestos		0.2	mfl	-		-		DW
SM 2320B	Bicarbonate	5	20	mg/L	80-120	20	90-110	20	
EPA 300.0	Chloride	0.42	0.8	mg/L	80-120	10	90-110	20	GW, DW
SM 2120B	Color		5	CU	-		80-120	20	GW, DW
EPA 335.4	Cyanide	0.002	0.005	mg/L	-		-		DW
SM 5310C	Dissolved Organic Carbon	0.088	0.3	mg/L	80-120	20	90-110	20	
EPA 300.0	Fluoride	0.1	0.2	mg/L	80-120	20	90-110	20	GW, DW
EPA 245.1	Mercury	0.09	0.2	ug/L	70-130	20	85-115	20	GW, DW
EPA 245.1	Mercury (Dissolved)	0.09	0.2	ug/L	70-130	20	85-115	20	
EPA 300.0	Nitrate (as N)	0.057	0.2	mg/L	80-120	12.1	90-110	20	GW, DW
EPA 300.0	Nitrite (as N)	0.0689	0.2	mg/L	80-120	10	90-110	20	DW
SM 2150B	Odor		1	TON	-		-		GW
SM 4500_H+	pH	-	0.1	SU	-		98.6-101.4	20	GW
SM 2510B	Specific conductivity				-		-		DW
EPA 300.0	Sulfate	0.128	0.5	mg/L	80-120	10	90-110	20	GW, DW
SM 2540C	Total Dissolved Solids	13	25	mg/L	-		80-120	20	GW, DW
SM 2510B	Total Organic Carbon	0.088	0.3	mg/L	120-80	20	90-110	20	
EPA 365.1	Total Phosphorous	0.031	0.15	mg/L	80-120	20	90-110	20	
SM 2540D	Total Suspended Solids	4	10	mg/L	-		80-120	20	

Analytical Method	Analyte	Method Detection Limit	Method Reporting Limit	Units	Matrix Spike (% Rec.)	Matrix Spike (RPD)	Blank Spike (LCS % Rec.)	Blank Spike (RPD)	Regulatory Authority[1]
Metals by ICP or ICP/MS									
EPA 200.8	Aluminum	3.94	20	ug/L	70-130	20	85-115	20	
EPA 200.8	Antimony	0.479	1	ug/L	70-130	20	85-115	20	DW
EPA 200.8	Arsenic	0.245	1	ug/L	70-130	20	85-115	20	GW, DW
EPA 200.8	Barium	0.215	2	ug/L	70-130	20	85-115	20	GW, DW
EPA 200.8	Beryllium	0.115	0.3	ug/L	70-130	20	85-115	20	DW
EPA 200.8	Cadmium	0.0811	0.5	ug/L	70-130	20	85-115	20	GW, DW
EPA 200.7	Calcium	0.0705	1	mg/L	70-130	20	85-115	20	
EPA 200.8	Chromium	0.326	0.9	ug/L	70-130	20	85-115	20	GW, DW
EPA 200.8	Copper	0.275	1	ug/L	70-130	20	85-115	20	GW, DW
EPA 200.7	Iron	0.00217	0.01	mg/L	70-130	20	85-115	20	GW, DW
EPA 200.8	Lead	0.0835	0.5	ug/L	70-130	20	85-115	20	GW, DW
EPA 200.7	Magnesium	0.00994	0.1	mg/L	70-130	20	85-115	20	
EPA 200.8	Manganese	0.41	2	ug/L	70-130	20	85-115	20	GW, DW
EPA 200.8	Molybdenum	0.219	2	ug/L	70-130	20	85-115	20	
EPA 200.8	Nickel	0.378	1	ug/L	70-130	20	85-115	20	
EPA 200.7	Potassium	0.12	1	mg/L	70-130	20	85-115	20	
EPA 200.8	Selenium	0.248	2	ug/L	70-130	20	85-115	20	GW, DW
EPA 200.7	Silica (as SiO2)	0.0334	0.428	mg/L	-		-		
EPA 200.7	Silicon	0.0156	0.2	mg/L	70-130	20	85-115	20	
EPA 200.8	Silver	0.3	0.5	ug/L	70-130	20	85-115	20	GW, DW
EPA 200.7	Sodium	0.41	1	mg/L	70-130	20	85-115	20	DW
EPA 200.8	Thallium	0.1	0.3	ug/L	70-130	20	85-115	20	DW
EPA 200.8	Titanium	0.137	1	ug/L	70-130	20	85-115	20	
EPA 200.8	Uranium	0.116	1	ug/L	70-130	20	85-115	20	DW

Analytical Method	Analyte	Method Detection Limit	Method Reporting Limit	Units	Matrix Spike (% Rec.)	Matrix Spike (RPD)	Blank Spike (LCS % Rec.)	Blank Spike (RPD)	Regulatory Authority[1]
EPA 200.8	Zinc	4.28	20	ug/L	70-130	20	85-115	20	GW, DW
EPA 245.7	Mercury	0.41	2	ug/L	130-70	20	85-115	20	
EPA 200.8	Aluminum (Dissolved)	3.94	20	ug/L	70-130	20	85-115	20	
EPA 200.8	Antimony (Dissolved)	0.479	1	ug/L	70-130	20	85-115	20	
EPA 200.8	Arsenic (Dissolved)	0.245	1	ug/L	70-130	20	85-115	20	
EPA 200.8	Barium (Dissolved)	0.215	2	ug/L	70-130	20	85-115	20	
EPA 200.8	Beryllium (Dissolved)	0.115	0.3	ug/L	70-130	20	85-115	20	
EPA 200.8	Cadmium (Dissolved)	0.0811	0.5	ug/L	70-130	20	85-115	20	
EPA 200.7	Calcium (Dissolved)	0.0705	1	mg/L	70-130	20	85-115	20	
EPA 200.8	Chromium (Dissolved)	0.326	0.9	ug/L	70-130	20	85-115	20	
EPA 200.8	Copper (Dissolved)	0.275	1	ug/L	70-130	20	85-115	20	
EPA 200.7	Iron (Dissolved)	0.00217	0.01	mg/L	70-130	20	85-115	20	
EPA 200.8	Lead (Dissolved)	0.0835	0.5	ug/L	70-130	20	85-115	20	
EPA 200.7	Magnesium (Dissolved)	0.00994	0.1	mg/L	70-130	20	85-115	20	
EPA 200.8	Manganese (Dissolved)	0.41	2	ug/L	70-130	20	85-115	20	
EPA 200.8	Molybdenum (Dissolved)	0.219	2	ug/L	70-130	20	85-115	20	
EPA 200.8	Nickel (Dissolved)	0.378	1	ug/L	70-130	20	85-115	20	
EPA 200.7	Potassium (Dissolved)	0.12	1	mg/L	70-130	20	85-115	20	
EPA 200.8	Selenium (Dissolved)	0.248	2	ug/L	70-130	20	85-115	20	
EPA 200.7	Silica (as SiO2) (Dissolved)	0.0334	0.428	mg/L	-		-		
EPA 200.7	Silicon (Dissolved)	0.0156	0.2	mg/L	70-130	20	85-115	20	
EPA 200.8	Silver (Dissolved)	0.3	0.5	ug/L	70-130	20	85-115	20	
EPA 200.7	Sodium (Dissolved)	0.41	1	mg/L	70-130	20	85-115	20	
EPA 200.8	Thallium (Dissolved)	0.1	0.3	ug/L	70-130	20	85-115	20	
EPA 200.8	Titanium (Dissolved)	0.137	1	ug/L	70-130	20	85-115	20	
EPA 200.8	Uranium (Dissolved)	0.116	1	ug/L	70-130	20	85-115	20	

Analytical Method	Analyte	Method Detection Limit	Method Reporting Limit	Units	Matrix Spike (% Rec.)	Matrix Spike (RPD)	Blank Spike (LCS % Rec.)	Blank Spike (RPD)	Regulatory Authority[1]
EPA 200.8	Zinc (Dissolved)	4.28	20	ug/L	70-130	20	85-115	20	
Bacteriological									
SM 2510B	Total Coliform Bacteria				-		-		GW
Volatile Organic Compounds									
EPA 524.2	1,1,1-Trichloroethane	0.2	0.5	ug/L	70-130	20	80-120		GW, DW
EPA 524.2	1,1,2-Trichloroethane	0.2	0.5	ug/L	70-130	20	80-120		DW
EPA 524.2	1,1-Dichloroethane	0.2	0.5	ug/L	70-130	20	80-120		GW
EPA 524.2	1,1-Dichloroethylene	0.2	0.5	ug/L	70-130	20	80-120		DW
EPA 524.2	1,2,4-Trichlorobenzene	0.3	0.5	ug/L	70-130	20	80-120		DW
EPA 524.2	1,2-Dichloroethane	0.2	0.5	ug/L	70-130	20	80-120		GW, DW
EPA 524.2	1,2-Dichloropropane	0.1	0.25	ug/L	70-130	20	80-120		GW, DW
EPA 524.2	1,3-Dichloropropene	0.1	0.5	ug/L	70-130	20	80-120		GW
EPA 524.2	1,4-Dichlorobenzene	0.2	0.5	ug/L	70-130	20	80-120		GW, DW
EPA 524.2	Acrylonitrile	0.4	1	ug/L	70-130	20	80-120		GW
EPA 524.2	Benzene	0.1	0.5	ug/L	70-130	20	80-120		GW, DW
EPA 524.2	Bromodichloromethane	0.1	0.5	ug/L	70-130	20	80-120		GW
EPA 524.2	Bromoform	0.2	0.5	ug/L	70-130	20	80-120		GW
EPA 524.2	Carbon tetrachloride	0.2	0.5	ug/L	70-130	20	80-120		GW, DW
EPA 524.2	Chlorobenzene	0.1	0.5	ug/L	70-130	20	80-120		DW
EPA 524.2	Chlorodibromomethane	0.1	0.5	ug/L	70-130	20	80-120		GW
EPA 524.2	Chloroform	0.2	0.5	ug/L	70-130	20	80-120		GW
EPA 524.2	cis-1,2-Dichloroethylene	0.2	0.5	ug/L	70-130	20	80-120		DW
EPA 524.2	Dibromochloropropane			ug/L	-		-		DW
EPA 524.2	Epichlorohydrin	0.8	1	ug/L	35-170	20	80-120		GW
EPA 524.2	Ethyl acrylate	0.4	1	ug/L	70-130	20	80-120		GW

Analytical Method	Analyte	Method Detection Limit	Method Reporting Limit	Units	Matrix Spike (% Rec.)	Matrix Spike (RPD)	Blank Spike (LCS % Rec.)	Blank Spike (RPD)	Regulatory Authority[1]
EPA 524.2	Ethylbenzene	0.1	0.5	ug/L	70-130	20	80-120		DW
EPA 524.2	Ethylene dibromide (EDB)	0.1	0.2	ug/L	70-130	20	80-120		GW, DW
EPA 524.2	Methylene chloride	0.42	0.5	ug/L	70-130	20	80-120		GW, DW
EPA 524.2	o-Dichlorobenzene	0.1	0.5	ug/L	70-130	20	80-120		DW
EPA 524.2	Styrene	0.2	0.5	ug/L	70-130	20	80-120		DW
EPA 524.2	Tetrachloroethylene	0.2	0.5	ug/L	70-130	20	80-120		GW, DW
EPA 524.2	Toluene	0.1	0.5	ug/L	70-130	20	80-120		DW
EPA 524.2	trans-1,2-Dichloroethylene	0.2	0.5	ug/L	70-130	20	80-120		DW
EPA 524.2	Trichloroethylene	0.1	0.5	ug/L	70-130	20	80-120		GW, DW
EPA 524.2	Vinyl chloride	0.2	0.2	ug/L	70-130	20	80-120		GW, DW
EPA 524.2	Xylenes (Total)	0.5	0.5	ug/L	-		-		DW
EPA 8260D	Benzyl chloride	0.5	1	ug/L	56-129	15	56-129	15	GW
EPA 8270D	Bis(chloromethyl) ether				-		-		GW
EPA 8270D	N-Nitrosodiphenylamine				-		-		GW
EPA 8270E	2-Methylaniline hydrochloride	4	10	ug/L	31-120	42	31-120	42	GW
EPA 8270E	3,3'-Dimethoxybenzidine				-		-		GW
EPA 8321	Ethylene thiourea	2	5	ug/L	70-130	30	70-130	30	GW
Synthetic / Semivolatile Organic Compounds									
EPA 8270E	1,2-Diphenylhydrazine	4	10	ug/L	54-120	32	54-120	32	GW
EPA 8270E	1,4-Dioxane	0.036	0.2	ug/L	78-130	13	78-130	13	GW
EPA 8270E	1-Methylnaphthalene	0.0230	0.0900	ug/L	49-120	32	49-120	32	GW
EPA 1613B	2,3,7,8-TCDD (Dioxin)	3.71	10	ug/L	67-158	50	67-158	50	GW, DW
EPA 515.3	2,4,5-TP (Silvex)	0.03	0.1	ug/L	70-130	22	80-120		GW, DW
EPA 515.3	2,4,6-Trichlorophenol	0.02	0.1	ug/L	70-130	40	80-120		GW
EPA 515.3	2,4-D	0.08	0.1	ug/L	70-130	41	80-120		GW, DW

Analytical Method	Analyte	Method Detection Limit	Method Reporting Limit	Units	Matrix Spike (% Rec.)	Matrix Spike (RPD)	Blank Spike (LCS % Rec.)	Blank Spike (RPD)	Regulatory Authority[1]
EPA 8270E	2,4-Dinitrotoluene	4	10	ug/L	67-122	30	67-122	30	GW
EPA 8270E	2,6-Dinitrotoluene	4	10	ug/L	65-120	30	65-120	30	GW
EPA 8270E	2-Methylnaphthalene	0.0440	0.0900	ug/L	46-120	34	46-120	34	GW
EPA 8270E	3,3'-Dichlorobenzidine	10	30	ug/L	48-132	30	48-132	30	GW
EPA 8270E	Acenaphthene	0.0220	0.0900	ug/L	53-120	26	53-120	26	GW
EPA 8270E	Acenaphthylene	0.0160	0.0900	ug/L	56-120	24	56-120	24	GW
EPA 8270E	Acrylamide	200	500	ug/L	10-120	100	10-120	100	GW
EPA 525.2	Alachlor	0.024	0.05	ug/L	70-130	20	70-130	20	DW
EPA 531.2	Aldicarb	0.16	0.5	ug/L	70-130	30	70-130	30	DW
EPA 531.2	Aldicarb sulfone	0.172	0.5	ug/L	70-130	30	70-130	30	DW
EPA 531.2	Aldicarb sulfoxide	0.142	0.5	ug/L	70-130	30	70-130	30	DW
EPA 525.2	Aldrin	0.01	0.01	ug/L	70-130	20	70-130	20	GW
EPA 8270E	Aniline	4	10	ug/L	10-120	84	10-120	84	GW
EPA 8270E	Anthracene	0.0250	0.0900	ug/L	56-128	25	56-128	25	GW
EPA 525.2	Atrazine	0.013	0.05	ug/L	70-130	20	70-130	20	DW
EPA 8270E	Azobenzene	1	4	ug/L	54-120	32	54-120	32	GW
EPA 8270E	Benzidine	50	100	ug/L	5-120	100	5-120	100	GW
EPA 8270E	Benzo(a)anthracene	0.0280	0.0900	ug/L	62-130	21	62-130	21	GW
EPA 525.2	Benzo(a)pyrene	0.004	0.02	ug/L	70-130	20	70-130	20	GW, DW
EPA 525.2	Benzo(a)pyrene	0.00400	0.0200	ug/L	70-130	20	70-130	20	GW
EPA 8270E	Benzo(b)fluoranthene	0.0250	0.0900	ug/L	47-136	27	47-136	27	GW
EPA 8270E	Benzo(g,h,i)perylene	0.0210	0.0900	ug/L	59-129	20	59-129	20	GW
EPA 8270E	Benzo(k)fluoranthene	0.0260	0.0900	ug/L	55-131	28	55-131	28	GW
EPA 525.2	Bis(2-ethylhexyl) phthalate	0.19	0.6	ug/L	70-130	20	70-130	20	GW
EPA 8270E	Carbazole	1	4	ug/L	66-123	30	66-123	30	GW
EPA 531.2	Carbofuran	0.104	0.5	ug/L	70-130	30	70-130	30	DW

Analytical Method	Analyte	Method Detection Limit	Method Reporting Limit	Units	Matrix Spike (% Rec.)	Matrix Spike (RPD)	Blank Spike (LCS % Rec.)	Blank Spike (RPD)	Regulatory Authority[1]
EPA 505	Chlordane	0.032	0.1	ug/L	65-135	20	70-130	20	GW, DW
EPA 525.2	Chlorthalonil	0.051	0.1	ug/L	70-130	20	70-130	20	GW
EPA 8270E	Chrysene	0.0180	0.0900	ug/L	57-135	20	57-135	20	GW
EPA 515.3	Dalapon	0.5	1	ug/L	70-130	40	80-120		DW
EPA 525.2	DDT (includes DDE and DDD)	0.041	0.1	ug/L	70-130	20	70-130	20	GW
EPA 525.2	Di(2-ethylhexyl) adipate	0.063	0.6	ug/L	70-130	20	70-130	20	DW
EPA 525.2	Di(2-ethylhexyl) phthalate	0.19	0.6	ug/L	70-130	20	70-130	20	DW
EPA 8270E	Diallate	5	20	ug/L	49-126	30	49-126	30	GW
EPA 8270E	Dibenz(a,h)anthracene	0.0260	0.0900	ug/L	59-127	20	59-127	20	GW
EPA 8141B	Dichlorvos	0.5	2	ug/L	52-120	24	52-120	24	GW
EPA 525.2	Dieldrin	0.007	0.01	ug/L	70-130	20	70-130	20	GW
EPA 515.3	Dinoseb	0.09	0.2	ug/L	70-130	24	80-120		DW
EPA 549.2	Diquat	0.296	2	ug/L	-		-		DW
EPA 548.1	Endothall	2.65	5	ug/L	80.0-120	30	80-120	30	DW
EPA 525.2	Endrin	0.005	0.01	ug/L	70-130	20	70-130	20	GW, DW
EPA 8270E	Fluoranthene	0.0430	0.0900	ug/L	58-129	24	58-129	24	GW
EPA 525.2	Fluorene	0.00800	0.0500	ug/L	70-130	20	70-130	20	GW
SM 5540C	Foaming Agents			ug/L	-		-		GW
EPA 547	Glyphosate	1.6	6	ug/L	80-120	20	80-120	20	DW
EPA 525.2	Heptachlor	0.005	0.01	ug/L	70-130	20	70-130	20	GW, DW
EPA 525.2	Heptachlor epoxide	0.004	0.01	ug/L	70-130	20	70-130	20	GW, DW
EPA 525.2	Hexachlorobenzene	0.015	0.05	ug/L	70-130	20	70-130	20	GW, DW
EPA 8081B	Hexachlorocyclohexane (technical)				-		-		GW
EPA 525.2	Hexachlorocyclopentadiene	0.01	0.05	ug/L	70-130	20	70-130	20	DW

Analytical Method	Analyte	Method Detection Limit	Method Reporting Limit	Units	Matrix Spike (% Rec.)	Matrix Spike (RPD)	Blank Spike (LCS % Rec.)	Blank Spike (RPD)	Regulatory Authority[1]
EPA 8290A	Hexachlorodibenzo-p-dioxin, mix			ug/L	-		-		GW
EPA 8270E	Indeno(1,2,3-cd)pyrene	0.0220	0.0900	ug/L	61-121	20	61-121	20	GW
EPA 525.2	Lindane	0.003	0.01	ug/L	70-130	20	70-130	20	GW, DW
EPA 525.2	Methoxychlor	0.044	0.05	ug/L	70-130	20	70-130	20	GW, DW
EPA 525.2	Naphthalene	0.400	0.500	ug/L	70-130	20	80-120		GW
EPA 8270E	N-Nitrosodiethylamine	4	10	ug/L	40-120	31	40-120	31	GW
EPA 8270E	N-Nitrosodimethylamine	4	10	ug/L	25-120	37	25-120	37	GW
EPA 8270E	N-Nitroso-di-n-butylamine	4	10	ug/L	52-139	32	52-139	32	GW
EPA 8270E	N-Nitroso-di-n-propylamine	4	10	ug/L	48-120	32	48-120	32	GW
EPA 8270E	N-Nitroso-N-methylethylamine	4	10	ug/L	34-120	37	34-120	37	GW
EPA 8270E	N-Nitrosopyrrolidine	4	10	ug/L	37-120	31	37-120	31	GW
EPA 8270E	o-Toluidine	4	10	ug/L	31-120	42	31-120	42	GW
EPA 531.2	Oxamyl (Vydate)	0.173	0.5	ug/L	70-130	30	70-130	30	DW
EPA 505	PCBs	0.085	0.1	ug/L	65-135	20	70-130	20	GW, DW
EPA 515.3	Pentachlorophenol	0.02	0.04	ug/L	70-130	29	80-120		DW
EPA 8270E	Phenanthrene	0.0430	0.0900	ug/L	59-128	21	59-128	21	GW
EPA 515.3	Picloram	0.04	0.1	ug/L	70-130	43	80-120		DW
EPA 8270E	Pyrene	0.0450	0.0900	ug/L	61-135	24	61-135	24	GW
EPA 525.2	Simazine	0.016	0.05	ug/L	70-130	20	70-130	20	DW
EPA 505	Toxaphene	0.083	0.5	ug/L	65-135	20	70-130	20	GW, DW
Disinfection Byproducts									
EPA 300.1	Bromate	0.873	5.00	ug/L	75-125	10	90-110	10	DW
EPA 300.1	Chlorite	1.02	10.0	ug/L	80-120	20	90-110	10	DW

Analytical Method	Analyte	Method Detection Limit	Method Reporting Limit	Units	Matrix Spike (% Rec.)	Matrix Spike (RPD)	Blank Spike (LCS % Rec.)	Blank Spike (RPD)	Regulatory Authority[1]
EPA 524.2	Total Trihalomethanes (TTHMs)	0.2	0.5	ug/L	70-130	20	80-120		DW
SM 6251B	Total Haloacetic Acids 5 (HAA5)	0.054	2	ug/L	-		-		DW
Disinfection Residuals									
SM 4500-Cl G	Chlorine (as Cl2)	0.0399	0.0500	ug/L	-		85-115	20	DW
SM 4500-Cl G	Chloramines (as Cl2)	0.0500	0.0500	ug/L	-		-		DW
SM 4500-ClO2 D	Chlorine dioxide (as ClO2)	0.140	0.240	ug/L	-		85-115	20	DW
Radiological									
EPA 906.0	Tritium		500	pCi/L	60-140	25	75-125	25	GW
EPA 905.0	Strontium-90		3.00	pCi/L	60-140	25	75-125	25	GW
EPA 903.0	Radium-226		1.00	pCi/L	60-140	25	75-125	25	GW
EPA 904.0	Radium-228		1.00	pCi/L	60-140	25	75-125	25	GW, DW
PFAS									
EPA 537.1	HFPO-DA	1.00	2.00	ng/L	70-130	30	70-130	30	DW
EPA 537.1	PFBS	0.370	2.00	ng/L	70-130	30	70-130	30	DW
EPA 537.1	PFHxS	0.320	2.00	ng/L	70-130	30	70-130	30	DW
EPA 537.1	PFNA	0.400	2.00	ng/L	70-130	30	70-130	30	DW
EPA 537.1	PFOA	0.380	2.00	ng/L	70-130	30	70-130	30	DW
EPA 537.1	PFOS	0.430	2.00	ng/L	70-130	30	70-130	30	DW

Notes: Dup. = Duplicate Sample, RPD = relative percent difference, LCS = laboratory control sample, %Rec = percent recovered, Surr. = Surrogate.

mg/L – milligrams per liter; mfl = millions of fibers per liter; CU = color units; ug/L = micrograms per liter; TON = threshold odor number; SU = standard units (pH); pCi/L = pico Curies per liter; ng/L = nanograms per liter.

DW = Drinking Water standards per WAC 246-290-310; GW = Groundwater standards per WAC 173-200-040

The MQOs for the water quality analyses are summarized above in Table 5. Water quality sampling will be performed using industry-standard procedures (Section 8.2) to minimize bias and maximize precision. All sampling equipment will be decontaminated before and after completion of sampling activities.

Eurofins is accredited by Ecology for all analytical procedures performed for this project and by the National Environmental Laboratory Accreditation Program (NELAP) for a comprehensive analytical laboratory accreditation. The laboratory is responsible for ensuring that all procedures performed comply with all requirements specified in the accreditation programs, laboratory quality assurance (QA) manuals, individual analytical methods, and this QAPP. Copies of the lab accreditation for Eurofins are included as Appendix B.

6.2.1 Targets for Precision, Bias, and Sensitivity

Table 5 outlines expected precision of sample duplicates and method reporting limits. The reporting limits of the methods listed in Table 5 are appropriate for the expected range of results and the required level of sensitivity to meet project objectives.

The quality and usability of data collected will be determined, based on the outcomes of data verification and validation, and expressed as the following MQOs: precision, accuracy (bias), representativeness, comparability, completeness, and sensitivity. The MQOs routinely obtained by the laboratory for the analytical procedures performed for this project are considered adequate. The definitions of the MQOs are presented in the following sections.

6.2.1.1 Precision

Precision is defined as the degree of agreement between or among independent, similar, or repeated measurements. Precision is a measure of variability in the results of replicate measurements due to random error. Precision is usually assessed by analyzing duplicate field measurements and random error is imparted by the variation in field procedures. Therefore, field sampling precision is addressed by collection of replicate measurements.

Precision is also expressed in terms of analytical variability. For this investigation, analytical variability will be measured as the relative percent difference (RPD) or coefficient of variation between analytical laboratory duplicates and between the matrix spike (MS) and matrix spike duplicate (MSD) analyses. Precision will be calculated as the RPD as follows:

$$RPD\ (\%) = 100 \times \frac{|S - D|}{(S + D)/2}$$

where:

S = analyte concentration in a sample

D = analyte concentration in a duplicate sample

The resultant RPD will be compared with criteria established by this QAPP in Table 5, and deviations from these criteria will be reported. If the QAPP criteria are not met, the laboratory will supply a justification of why the limits were exceeded and implement the appropriate corrective actions. The RPD will be evaluated during data review and validation. The data reviewer will note deviations from the specified limits and comment on the effect of the deviations on the reported data.

6.2.1.2 Bias

Bias is the difference between the sample mean and the true value. It will be measured as the percent recoveries of MS and MSD, organic surrogate compounds, and the blank spike. Additional potential bias will be assessed using calibration standards and blank samples (e.g., method blanks). In cases where accuracy is determined from spiked samples, accuracy will be expressed as the percent recovery. The closer these values are to 100 percent, the more accurate the data. Surrogate recovery will be calculated as follows:

$$\text{Recovery}\ (\%) = \frac{MC}{SC} \times 100$$

where:

SC = spiked concentration

MC = measured concentration

MS percent recovery will be calculated as follows:

$$\text{Recovery}\ (\%) = \frac{MC - USC}{SC} \times 100$$

where:

SC = spiked concentration

MC = measured concentration

USC = unspiked sample concentration

MSD percent recovery will be calculated as follows:

$$\text{Recovery}\ (\%) = \frac{MDC - USC}{SC} \times 100$$

where:

SC = spiked concentration

MDC = measured duplicate spike concentration

USC = unspiked sample concentration

and

$$\text{RPD (\%)} = \frac{MC - MDC}{(MC+MDC)/2} \times 100,$$

where:

RPD = relative percent difference

The resultant percentage recoveries will be compared with criteria established by this QAPP in Table 5, and deviations from these criteria will be reported in the final report (and in laboratory limits for RPD reported by the lab in individual reports). If the objective criteria are not met, the laboratory will supply a justification of why the limits were exceeded and implement the appropriate corrective actions. Percent recoveries will be evaluated during data review and validation, and the data reviewer will comment on the effect of the deviation on the reported data.

Additionally, a likely source of bias in the proposed project tasks are sensor drift (accuracy loss) over time in automated monitoring equipment, including both pressure transducer and SCADA data, and lack of sufficient sampling rate to accurately resolve changes in measurement. All measurements will be performed at or greater than the frequency outlined in the SOP. Automated equipment will be calibrated and checked for accuracy by performing contemporaneous manual field measurements and comparing time-plots of both data sets based on the SOP. Groundwater level measurements for the pressure transducer are barometrically corrected through the use of a vented tube and collection of atmospheric data in an independent barometric pressure transducer. Transducer submergence depths are plotted with manual measurements to assess if a bias is present. If sensor drift is observed, it will be corrected using appropriate method as outlined in EAP074 (Ecology, 2019a).

6.2.1.3 Sensitivity

Sensitivity will be determined by reviewing Method Reporting Limits (MRLs). MRLs will be set low enough to allow meaningful comparisons with screening criteria to the extent possible, considering matrix effects. The laboratory will be directed to report compounds detected above the Method Detection Limit (MDL) and positively identified below the MRL as estimated (J flag).

6.2.2 Targets for Comparability, Representativeness, and Completeness

6.2.2.1 Comparability

Comparability is the degree to which the data can be compared to historical data, reference values (such as background), and reference materials. This will be achieved through the use of standard techniques to collect samples, EPA-approved methods to analyze samples, and consistent units to report analytical results. Ecology SOPs will be followed for the data collection supporting the aquifer test. The SOPs that will be followed for this project are listed in Section 8.2. Data comparability also depends on data quality; data of unknown quality cannot be compared.

6.2.2.2 Representativeness

Representativeness is the degree to which sample results represent the system under study. This component is generally considered during the design phase of a project. This project will use the results of all analyses to evaluate the data in terms of its intended use.

Representativeness of the sample will be ensured during the collection process by: (1) employing proper decontamination procedures and (2) thorough purging of the well and ensuring stability of field parameters prior to collecting groundwater samples (Section 8.2). The representativeness of analytical results will be determined by evaluating hold times, sample preservation, and blank contamination. Samples with expired hold times, improper preservation, or contamination may not be representative.

6.2.2.3 Completeness

Completeness will be calculated as follows:

$$Completeness\ (\%) = \frac{V}{P} \times 100$$

where:

V = number of valid measurements

P = number of planned measurements

Valid and invalid data (i.e., data qualified with the R flag [rejected]) will be identified during data validation. The completeness target for the study is 100 percent of water quality samples.

6.3 Acceptance Criteria for Quality of Existing Data

Existing data has been collected at the City's wells as part of the DOH source approval (for Group A water systems) and as part of routine monitoring. All water quality samples previously collected for analysis followed approved standards and procedures. Water quality analyses were conducted at accredited laboratory facilities. Acceptance of the results by DOH is acceptable criteria under this study.

Water level data retrieved from the City's SCADA systems will be manually checked for errors and inconsistencies in historical data and erroneous data will be flagged, as described in Section 14. Measuring points, depth to water, and groundwater elevations will be manually collected from the wells as described in Section 8.2 and compared to the SCADA data. Any differences in measuring points and or resulting depth to water measurements will be documented. The overall accuracy of the historical water level readings will be 1 foot, as described in Section 6.2.

Peer reviewed published datasets produced by USGS, Ecology, and others will be used to compare data collected under this QAPP and hydrogeologic testing results and to support geochemical modeling.

No other outside unpublished is anticipated to be used as part of the analysis completed within the scope of this QAPP. However, if additional data is identified relevant to this study, it will be considered acceptable if collected according to another Ecology approved QAPP, data was produced using the same analytical procedures and quality assurance criteria as defined in this QAPP, or peer reviewed documents.

6.4 Model Quality Objectives

The potential for physiochemical changes (mineral dissolution and/or precipitation) to occur because of recharge operations will be evaluated from the data collected during the test by developing a PHREEQC thermodynamic geochemical equilibrium model (Parkhurst et al., 1980) for the target aquifer. The model will consider changes in Saturation Indices (SIs) for the primary minerals found in the storage aquifer. A range of combinations for potential mineral assemblages will be evaluated by the model as part of a sensitivity analysis and quality evaluation (Section 13.4).

The qualitative quality objective for the modeling is that the SIs calculated for water quality at various stages of future testing shall agree with the trends predicted from water quality data collected prior to any pilot testing. The results of the model will be used to identify potential constituents and/or well performance trends to monitor during pilot testing. Model results will be compared to water quality measurements using graphical representation. Such visual comparisons are useful in evaluating model quality and uncertainty.

The model will evaluate potential changes in water quality that may occur due to mineral dissolution and precipitation. Predicted water quality constituent concentrations will be compared to measured water quality during pilot testing. The rates of the predicted reactions will not be explicitly modeled (i.e., a kinetic geochemical model will not be developed for this project). Therefore, no quantitative quality objectives are set for a comparison of the geochemical modeling to observed water chemistry.

7.0 Study Design

A narrative of the overall study design is provided in Section 4. This section provides the details of the data collection and analysis.

7.1 Study Boundaries

The approximate study area is shown on Figure 1. The proposed sampling locations are at Well Nos. 4, 4b, and 7, and adjacent to Well No. 4b on the Yakima River (Figure 3).

7.2 Field Data Collection

The following sections describe field data collection tasks and schedules.

7.2.1 Water Quality Sampling Location and Frequency

This study includes the collection of up to nine water quality samples plus required duplicates. Two water quality samples will be collected from the Yakima River and analyzed for the comprehensive suite of parameters needed to support a future Source Approval request to DOH (see full list of analyte suites in Table 5); and seven samples will be collected from the City's wells (Figure 3) for analysis of the antidegradation criteria parameters (WAC 173-200-040). These results will be used in conjunction with past drinking water parameters analyzed as part of the DOH Source Approval to characterize background groundwater quality, evaluate geochemical compatibility, and identify future considerations for compliance with AKART implementation, if necessary.

Water Quality Sampling Schedule

To characterize ambient water quality conditions in the target aquifer, water quality samples will be collected during multiple sampling events detailed in Table 6 to assess spatial and temporal variability of water quality within the target aquifer. All samples for a sampling event will be collected within a 1-2 day period.

Table 6. Water Quality Sampling Schedule

Date	Sample Location	Sample Type	Analytical Suite		
			WAC 173-200-040	Dissolved Metals	WAC 246-290-310 + PFAS
February 2025	Well No. 4	Groundwater	✓		
	Well No. 4b	Groundwater	✓	✓	✓
	Well No. 7	Groundwater	✓	✓	
	Yakima River	Surface Water	✓	✓	✓
March 2025	Well No. 4b	Groundwater	✓		
	Well No. 7	Groundwater	✓		
April 2025	Well No. 4	Groundwater	✓		
	Well No. 4b	Groundwater	✓		
	Yakima River	Surface Water	✓	✓	✓

Notes:
Field parameters will be measured during every sampling event.

One field duplicate and data validation (DV) sample will be collected for every ten samples. The DV sample for a trip blank will include the VOC and general chemistry, as applicable based on analytical suite in table above.

See Figure 3 for well locations.

7.2.2 Field Parameters and Laboratory Analytes to be Measured

The analyte suite for water quality is described in Sections 3.2.3 and 6.2 and will be sampled according to the quality objectives described in Section 6. Following sampling, laboratory results will be evaluated to determine effectiveness of the chosen analyte lists. Select contaminants which have been shown to be non-detect in two or more samples will be submitted to Ecology for approval to be removed from subsequent sampling events.

Field parameters will be measured using an AquaTroll 600 multimeter (as described in Section 8.2) to provide independent corroboration of laboratory results and to analyze constituents that have short hold times and can be reliably measured in the field. These include:

- Specific conductance
- Dissolved oxygen
- ORP
- pH
- Temperature

- Turbidity

In addition to manual measurements of the above constituents during sampling events, measurements will be collected until values are stable, as described in Section 8.2.

7.2.3 Groundwater Level Monitoring Locations and Frequency

Manual depth-to-water measurements will be collected during the aquifer testing program at the test well according to Ecology's Aquifer Test Procedures (Ecology, 2023a) using an electronic water level indicator as discussed in Section 8 and in accordance with EAP052 standard operating procedures. (Ecology, 2023b). Manual water levels will be measured both during deployment and retrieval of dataloggers to provide depth-to-water, groundwater elevation, and sensor drift corrections to the pressure transducer data.

Dataloggers will be installed at least one week prior to testing to collect background water levels and will remain in the well for at least 10 days following test completion. A dedicated pressure transducer will be installed at the test well, Well No. 4, to collect continuous groundwater level measurements prior to and after testing and will record at minimum rate of one observation per minute. During testing, a vented PT2X pressure transducer will be used to collect drawdown and recovery data in the test well and will record at a minimum interval of every 30 seconds. A barometric pressure transducer will be installed at the test well to collect continuous atmospheric pressure measurements prior to and after testing at a rate of one observation every ten minutes.

Dataloggers will be installed in the observation well, Well No. 4b, one week prior to testing and will remain in the well for at least 10 days following test completion. Dataloggers will consist of a dedicated pressure transducer and barometer to measure observation water level data and atmospheric pressure. Water levels will be measured at a rate of one observation per minute, and atmospheric pressure

Manual depth-to-water measurements will be collected at each of the City's wells using an electronic water level indicator. Measurements will be performed twice at each well to verify depth to water and will be scheduled to avoid active pumping conditions.

Additional details on groundwater monitoring are provided in Section 8.2.1.

7.3 Modeling and Analysis Design

Aquifer properties and well performance will be estimated using appropriate analytical methods for the observed hydrogeologic conditions, available data, and governing analytical model assumptions. The published underlying assumptions for the analytical methods used will be verified as being met prior to selecting a specific analytical method.

Water quality modeling will be conducted using the PHREEQC geochemical software developed by the U.S. Geological Survey (USGS).

The following sections detail the hydraulic and geochemical modeling procedures and analysis.

7.3.1 Analytical Framework

Analytical methods for hydraulic analysis will be chosen that best fit the project specific hydrogeologic conceptual model. We anticipate this includes a confined, homogenous, isotropic, fault-bounded aquifer with potential leakage.

The PHREEQC model will evaluate the potential for common primary and secondary minerals to dissolve or precipitate based on the predicted chemistry of mixed waters and calculated mineral saturation indices. The model simulations will incorporate water quality results for native groundwater in the target storage aquifer of the Lower Saddle Mountains Basalt) and from the source water (Yakima River). The results of the model will be used to identify potential constituents and/or well performance trends to monitor for during future pilot testing.

7.3.2 Model Setup and Data Needs

Model setup to determine aquifer properties will be based on time-drawdown and distance-drawdown data collected during the constant-rate pumping test (e.g., Theis curve fitting or Cooper-Jacob methods). Well efficiency testing will be conducted using published analytical methods for step-rate pumping (e.g., the Hantush-Bierschenk method).

Data needs for the model include time-series drawdown and discharge data, background water level measurements, well locations, and published geologic information. Data will be tabulated, compared with type pumping curves, and analyzed in Excel spreadsheet or third-party analytical software.

Mixed water chemistry will be predicted by the model based on water quality data collected for City Wells 4, 4b, and 7 and the Yakima River as described in Section 7.2.1. Geochemical modeling will begin by adding water from the potential sources to groundwater at assumed mixing ratios of 50/50 and 80/20 (source water / groundwater). The stored water will also be modeled in equilibrium with common alluvial/outwash aquifer minerals (based on LLNL equilibrium and speciation data for aqueous and mineral compounds) to simulate potential water quality impacts from interaction with the target aquifer. Following mixing, saturation indices (SIs) for common basalt minerals deemed to have potentially applicable reaction kinetics (i.e., with potential to react within the timeframe considered for storage) will be calculated to assess the potential for mineral precipitation or dissolution.

7.4 Assumptions of Study Design

This Study assumes that existing water quality and groundwater level data are of sufficient quality to meet acceptance criteria of this QAPP and there is sufficient budget to complete tasks.

There are also several assumptions around designing a pumping test and analyzing the results. These assumptions include:

- The equipment used in the pumping test (flow meters, pressure transducers, water level data loggers, water level indicators, etc.,) give accurate readings when they are installed, used, and calibrated properly.
- Discharge from the pumping test will not recharge the aquifer.
- A constant discharge is maintained during the entirety of the pumping test.
- An appropriate method will be used to analyze aquifer test data. Analytical methods have several built-in assumptions that are incorporated into this study, including:
    - The aquifer has infinite areal extent;
    - The aquifer is homogeneous, isotropic and of uniform thickness;
    - Flow to the pumping well is horizontal;
    - The aquifer is nonleaky, confined or semi-confined;
    - Water is released instantaneously from storage with decline in hydraulic head;
    - Diameter of the pumping well is very small so that storage in the well can be neglected.
- Measured drawdown at the observation well data is representative of influence from the test well

7.5 Possible Challenges and Contingencies

7.5.1 Logistical Problems

Logistical problems that interfere with measurement collection may occur during fieldwork. These problems include:

- Inability to access groundwater measurement locations;
- Water quality samples meeting hold times and temperature criteria when shipping samples to laboratory for analysis.

Access to measurement locations is mitigated due to all locations being owned by the City of Prosser. If a location is inaccessible due to unforeseen circumstances, staff will communicate the issue immediately, corrective action will be developed, and a new sampling event will be scheduled.

Water quality samples which do not meet criteria for laboratory acceptance will be identified immediately and a new sampling event will be scheduled for confirmation resampling.

7.5.2 Practical Constraints

Practical constraints that can interfere with a project include scheduling problems with personnel, equipment failure, or availability of adequate resources. Funding opportunities are typically the greatest limitation to collection of baseline data.

7.5.3 Schedule Limitations

No schedule limitations have been currently identified but could potentially arise from unforeseen circumstances or other sources.

8.0 Field Procedures

8.1 Invasive Species Evaluation

Aspect field staff will follow Ecology's SOP EAP070 (publicly available in digital format on Ecology's website; Ecology, 2023a). for minimizing the spread of invasive species for areas of both moderate and extreme concern.

At the end of each field visit, field staff will minimize the spread of invasive species by:

- Inspecting and cleaning all equipment by removing any visible soil, vegetation, vertebrates, invertebrates, plants, algae, or sediment. If necessary, a scrub brush will be used and then rinsed with clear water either from the site or brought for that purpose. The process will be continued until all equipment is clean.
- Draining all water in samplers or other equipment that may harbor water from the site. This step will take place before leaving the sampling site or at an interim site. If cleaning after leaving the sampling site, field staff will take steps to prevent debris from leaving the equipment and potentially spreading invasive species during transit or cleaning.

Established Ecology procedures will be followed if an unexpected contamination incident occurs.

8.2 Measurement and Sampling Procedures

The procedures used in this study are typical for any hydrogeologic investigations. SOPs to be followed are publicly available in digital format online and include the following:

- Ecology's Aquifer Test Procedures (Ecology, 2023a),
- SOP EAP052, Version 1.4 – Manual Well-Depth and Depth-to-Water Measurements (Ecology, 2023b),
- SOP EAP074, Version 1.2 – Use of Submersible Pressure Transducers During Groundwater Studies (Ecology, 2019a), and
- Standard Operating Procedure EAP070, Version 2.3 – Minimize the Spread of Invasive Species (Ecology, 2023c)
- Standard Operating Procedure EAP099, Version 1.2 – Collecting Groundwater Samples: Purging and Sampling Monitoring Wells for General Chemistry Parameters (Ecology, 2023b)
- Standard Operating Procedure EAP098, Version 1.1 – Collecting Groundwater Samples for Metals Analysis from Water Supply Wells (Ecology, 2019a)

- Standard Operating Procedure EAP015, Version 1.4 – Manually Obtaining Surface Water Samples (Ecology, 2019b)
- Washington State Department of Health General Sampling Procedure (DOH, 2003).

8.2.1 Groundwater Sampling

Groundwater quality samples from City wells will be collected in general accordance with Ecology (2019a; 2023b) and DOH (2023) standard procedures when using existing turbine pumps. Groundwater samples will be collected from the existing sample port during operation of the existing pumps. The well will be purged for a minimum of 10 minutes (or three well volumes) prior to the collection of any groundwater samples or until the water quality parameters stabilize, whichever is longer (note that SOP EAP098 does not include this provision for a minimum purge volume).

Field water quality parameters (temperature, pH, specific conductivity, dissolved oxygen, ORP, and turbidity) will be monitored using a closed flow-through cell during sample collection. Water quality parameters will be considered stable when three successive measurements indicate that the parameters fall within the stabilization criteria established in Standard Operating Procedure EAP098 Collecting Groundwater Samples for Metals Analysis from Water Supply Wells. (Ecology, 2019a) and shown in Table 7 below. Once the water quality parameters have stabilized, the groundwater quality samples shall be collected from the respective sampling port.

Table 7. Field Parameter Stabilization Criteria

Parameter	Value	Units
pH	±0.1	SU
Specific Conductance	±10.0	uS/cm
Dissolved Oxygen	± 0.05 for values < 1 mg/L ± 0.2 for values > 1 mg/L	mg/L
Temperature	±0.1	Celsius
ORP	±10	millivolts

8.2.2 Surface Water Sampling

Surface water quality samples from the Yakima River will be collected in general accordance with Ecology Standard Operating Procedure EAP015 (2019b).

8.2.3 Groundwater Level Monitoring

Groundwater levels will be measured at the test well and observation wells with both manual electronic water level indicator and with automated pressure transducers installed in each well. Long term monitoring data will be collected with a pressure transduces installed below the anticipated minimum water level of the well. Barometric pressure loggers will collect paired atmospheric observations, which will be used to correct pressure transducer data into gaged submergence pressure (feet of water above the sensor). During the pumping test and recovery, a vented PT2X pressure transducer will be deployed in the test well to take direct submergence pressure readings. During testing, manual measurements will be performed in the test well at a frequency equal to or more frequent than outlined in Ecology's Aquifer Test Procedures (Ecology, 2023a). Manual measurements in the test and observation well will be made during deployment and recovery of pressure transducers to provide manual verification and calibration of automated transducer data.

Water levels will be collected using an electrical water level meter with a precision of 0.01-ft and estimated accuracy of 0.05-ft. Water levels will be measured from the existing measurement point (MP) at each well to ensure data comparability. If an MP does not exist, then we will establish one based on the following procedure:

1. MPs are normally established on the north side of the top rim of the actual well casing; this position is commonly referred to as "top of casing" (TOC). Locate the MP at a convenient place from which to measure the water level. If the TOC is level, collect the measurement from the north edge.
2. Clearly mark the MP. The MP must be as permanent as possible and be clearly visible and easily located. The MP may be marked using a permanent black marker, bright colored paint stick, or with a notch filed into the TOC.
3. Describe the position of the MP clearly in the field-data sheets.
4. The MP height is established in reference to a land surface datum (LSD). The LSD is generally chosen to be approximately equivalent to the average altitude of ground surface around the well.
5. Measure the height of the MP in feet relative to the LSD. Generally, MPs are established to the nearest 0.1-ft using a pocket tape to measure the distance from the MP to the LSD. Note that values for measuring points that lie below land surface should be preceded by a minus sign (-). Record the height of the MP and the date it was established.
6. MPs and the LSD may change over time, the distance between the two should be checked whenever there have been activities, such as land development that could have affected either the MP or LSD at the site. Such changes must be measured as accurately as possible, documented and dated in field-data sheets, and in any database(s) into which the water-level data are entered.

All subsequent water level measurements should be referenced to the established MP. The MP value will be used to convert measurements into values that are relative to land surface.

After a permanent MP is established for each well, continue sampling using the following process:

1. Open the top of the well and note any “popping” sounds that would indicate pressure buildup, any odors, and the condition of the well head.
2. If there is a pressure transducer attached to the well cap carefully note the initial position of the cap (mark cap position on casing with permanent marker). If the well was airtight, wait a few minutes for the water level to return to equilibrium with atmospheric pressure.
3. Turn the water level meter on and slowly lower the probe into the well until it makes a tone indicated contact with the water level. To confirm contact, slowly raise and lower the electric-tape probe in and out of the water column. If necessary, adjust the sensitivity setting of the meter to provide a “crisp” indication of the water surface. Measure the depth of water against the MP and mark the date and time the reading was made.
4. At the precise location the indicator shows contact with the water surface, pinch the tape between your fingernails at the MP. Read the depth-to-water.
5. Repeat the measurement to ensure that the water level is stable (not rising or falling over time).
6. When the probe is pulled back up, make a note of any mud, staining, or anything else on the tip. Before moving on to the next well, decontaminate the probe with a brush or paper towel, then rinse with distilled water and 10 percent bleach.

On occasion, condensation on the interior casing of the well can prematurely trigger the electric-tape indicator giving a false positive reading. In this situation, it can help to center the tape in the well casing above the water level and lightly shake the tape to remove the excess water on the probe.

8.2.5 Atmospheric Pressure Monitoring

A barometric pressure transducer and datalogger will be deployed within the project limits. Data from this transducer will be used to correct measured well water levels for barometric effects at the Test well and the observation wells. Barometric efficiency can affect the representativeness of water level measurements from vented and unvented transducers (Spane, 2002). Corrections for barometric efficiency of wells will be made, as appropriate.

8.2.6 Aquifer and Well Testing

Well and aquifer testing will be performed in accordance with Ecology’s *Aquifer Test Procedures* (Ecology, 2023a). A licensed hydrogeologist will oversee all testing activities by staff listed in Table 2 and ensure data collection is conducted in accordance with professional standards.

Step-Rate Pumping Tests

A step-rate pumping test will be conducted at Well No. 4 using best practices to evaluate well capacity and performance. The results of the step-rate test will be analyzed to determine the sustainable yield of the constant rate pumping test as described in Section 4.4.

The anticipated duration and rates for the step-rate pumping test are summarized in Table 8.

Table 8. Anticipated Step-rate Pumping Test Rates, 1-hour per step

Step No.	Pumping Rate (% sustainable production)	Anticipated Pumping Rate (gpm)
1	50	250
2	75	375
3	100	500
4	125	625

Based on the original well log and existing pump configuration, the sustainable production capacity of the well is anticipated to be approximately 500 gpm. Pumping steps will be chosen to best match the anticipated total production of the well as shown in Table 8 and defined by Ecology's Aquifer Test Procedures (Ecology, 2023a). Actual pumping rates will be determined while conducting the test to ensure that four evenly spaced steps can be accommodated with the existing capabilities of the well and equipment, which may be affected by the minimum available pumping rate and maximum available drawdown at the time of testing.

The duration of each step will be a minimum of 1-hour, which is typically the minimum time required to reach a stable rate of drawdown and for conventional analysis of the test data to determine turbulent and laminar flow losses. The relative stability of the rate of drawdown will be confirmed on the first step and prior to advancing to the 2nd step. If stable drawdown has not been reached within the 1st hour, the step will be extended until stable drawdown is observed. Each subsequent step will be equivalent in duration to the first step.

Discharge rates will be observed throughout testing to ensure constant discharge throughout each step. Discharge rates will be recorded at the same interval as manual depth to water readings and during any manual correction to discharge rate. Totalizer readings will be recorded prior to initializing the test and at the conclusion of each step.

Constant Rate Pumping Tests

A constant-rate pumping test will be conducted for a minimum of 24 hours at the test well. The pumping rate will be the maximum rate that is anticipated to be practically maintained within the constraints of the well and existing conveyance infrastructure (i.e., the sustainable yield), as determined by the step-rate test.

Discharge rates will be observed throughout testing to ensure constant discharge throughout each step. Discharge rates will be recorded at the same interval as manual depth to water readings and during any manual correction to discharge rate. Totalizer readings will be recorded prior to initializing the test and at the conclusion of each step.

8.3 Containers, Preservation Methods, Holding Times

The sample bottles and respective preservatives for each sample will be provided by the laboratory and filled accordingly. Latex or nitrile gloves will be worn at all times during collection of the water quality parameters and samples. Samples for dissolved metal analyses shall be filtered with a 0.45-micron pore-size filter. All bottles shall be clearly labeled with a unique sample name, date, time, and preservative. Samples shall be stored in a cooler at 4 degrees Celsius (°C) and delivered to the laboratory under standard chain-of-custody protocols, within the hold times provided by the laboratory.

8.4 Equipment Decontamination

Water samples are collected from dedicated sampling equipment or directly into laboratory provided containers to prevent cross-contamination. All sampling equipment will be decontaminated before and after completion of all sampling activities. Sampling equipment will be decontaminated with an industry standard, phosphorous-free detergent and brush or paper towel, then rinsed with distilled water.

8.5 Sample ID

All bottles shall be clearly labeled with a unique sample name, date, time, and preservative. Samples shall be stored in a cooler at 4°C and delivered to the laboratory under standard chain-of-custody protocols, within the hold times provided by the lab.

8.6 Chain of Custody

After collection, samples will be maintained in Aspect's custody until formally transferred to the analytical laboratory. For purposes of this work, custody of the samples will be defined as follows:

- In plain view of the field representatives
- Inside a cooler that is in plain view of the field representative
- Inside any locked space, such as a cooler, locker, car, or truck to which the field representative has the only immediately available key(s)

A chain-of-custody record provided by the laboratory will be initiated at the time of sampling for all samples collected. The record will be signed by the field representative and others who subsequently take custody of the samples. Couriers or other professional shipping representatives are not required to sign the chain-of-custody form; however, shipping receipts will be collected and maintained as a part of custody documentation in the project files. A copy of the chain-of-custody form with appropriate signatures will be maintained in Aspect's files and included as an appendix to the project report.

8.7 Field Log Requirements

During the collection of any field samples, accompanying field documentation must be made that clearly states:

- Name and location of project
- Field personnel
- Sequence of events
- Any changes or deviations from the QAPP or SOPs
- Environmental conditions
- Date, time, location, ID, and description of each sample
- Field instrument calibration procedures
- Field measurement results
- Identity of QC samples collected
- Unusual circumstances that might affect interpretation of results

For this Study, data collected in the field will be contained in a field log (a binder backed by electronic scans of documents) that will consist of field notes (freehand notes) and Aspect field data sheets (Appendix C).

Field notes will be bound, waterproof notebooks with prenumbered pages (Rite in the Rain®). Permanent, waterproof ink should be used for all entries. Corrections will be made with single-line strikethroughs, initials, and date of correction. Use of white-out or correction fluid is not permitted.

While conducting field work, the field hydrogeologist or technician (Table 2) will document general, pertinent observations and events in a waterproof field notebook and, when warranted, provide photographic documentation of specific sampling efforts. Data collected during the sample collection procedures will be recorded on standard Aspect field data sheets (Appendix C). Field notes will include a description of each field activity, sample descriptions, and associated details, such as the date, time, and field conditions. The laboratory chain-of-custody forms will be filled out before leaving the site. Upon completion of a field task, the field personnel will then scan field notes and Aspect field data sheets into digital files and provide the original versions to the Aspect Project Manager. Copies of Aspect field data sheet and laboratory chain of custody are provided in Appendix C.

8.8 Other activities

Not applicable.

9.0 Laboratory Procedures

9.1 Laboratory Procedures Table

Table 9 presents the laboratory procedures for each analyte, including the sample matrix, number of samples, expected range of results, reporting limit, and analytical method.

Table 9. Laboratory Procedures

Analytical Method	Analyte	Sample Matrix	Number of Samples	Expected Range of Results	Method Reporting Limit	Units
General Chemistry, Inorganics						
SM 2330B	Corrosivity	Water	9	Unknown	0	
SM 2120B	Color	Water	9	Unknown	5	CU
SM 2320B	Alkalinity	Water	9	120-350	20	mg/L
SM 2320B	Bicarbonate	Water	9	120-350	20	mg/L
EPA 300.0	Chloride	Water	9	3-120	0.8	mg/L
EPA 300.0	Fluoride	Water	9	0.2-2	0.2	mg/L
EPA 245.1	Mercury	Water	9	<RL	0.2	ug/L
EPA 300.0	Nitrate (as N)	Water	9	0.2-15	0.2	mg/L
EPA 300.0	Nitrite (as N)	Water	9	<RL	0.2	mg/L
EPA 300.0	Sulfate	Water	9	0.6-200	0.5	mg/L
SM 4500	Ammonia (as N)	Water	9	<RL	0.3	mg/L
SM 2540C	Total Dissolved Solids	Water	9	150-650	25	mg/L
EPA 365.1	Total Phosphorous	Water	9	Unknown	0.15	mg/L
SM 2540D	Total Suspended Solids	Water	9	<RL	10	mg/L
SM 4500_H+	pH	Water	9	7-8.6	0.1	SU
SM 2150B	Odor	Water	9	Unknown	1	TON
EPA 100.2	Asbestos	Water	9	<RL	0.2	mfl
EPA 335.4	Cyanide	Water	9	<RL	0.005	mg/L
SM 2510B	Total Organic Carbon	Water	9	Unknown	0.3	mg/L
SM 2510B	Specific conductivity	Water	9	225-1,100		umhos/cm
SM 5310C	Dissolved Organic Carbon	Water	9	Unknown	0.3	mg/L
Metals by ICP or ICP/MS						
EPA 200.8	Aluminum	Water	9	Unknown	20	ug/L
EPA 200.8	Antimony	Water	9	Unknown	1	ug/L
EPA 200.8	Arsenic	Water	9	Unknown	1	ug/L
EPA 200.8	Barium	Water	9	Unknown	2	ug/L
EPA 200.8	Beryllium	Water	9	Unknown	0.3	ug/L

Analytical Method	Analyte	Sample Matrix	Number of Samples	Expected Range of Results	Method Reporting Limit	Units
EPA 200.8	Cadmium	Water	9	Unknown	0.5	ug/L
EPA 200.7	Calcium	Water	9	2-100	1	mg/L
EPA 200.8	Chromium	Water	9	Unknown	0.9	ug/L
EPA 200.8	Copper	Water	9	Unknown	1	ug/L
EPA 200.7	Iron	Water	9	0.003-0.07	0.01	mg/L
EPA 200.8	Lead	Water	9	Unknown	0.5	ug/L
EPA 200.7	Magnesium	Water	9	0.3-62	0.1	mg/L
EPA 200.8	Manganese	Water	9	1-72	2	ug/L
EPA 200.8	Molybdenum	Water	9	Unknown	2	ug/L
EPA 200.8	Nickel	Water	9	Unknown	1	ug/L
EPA 200.7	Potassium	Water	9	1.5-13	1	mg/L
EPA 200.8	Selenium	Water	9	Unknown	2	ug/L
EPA 200.7	Silica (as SiO2)	Water	9	36-71	0.428	mg/L
EPA 200.7	Silicon	Water	9		0.2	mg/L
EPA 200.8	Silver	Water	9	Unknown	0.5	ug/L
EPA 200.7	Sodium	Water	9	12-100	1	mg/L
EPA 200.8	Thallium	Water	9	Unknown	0.3	ug/L
EPA 200.8	Titanium	Water	9	Unknown	1	ug/L
EPA 200.8	Uranium	Water	9	Unknown	1	ug/L
EPA 200.8	Zinc	Water	9	Unknown	20	ug/L
EPA 245.7	Mercury	Water	9	Unknown	2	ug/L
Bacteriological						
SM 2510B	Total Coliform Bacteria	Water				
Volatile Organic Compounds						
EPA 524.2	1,1,1-Trichloroethane	Water	9	<RL	0.5	ug/L
EPA 524.2	1,1,2-Trichloroethane	Water	2	<RL	0.5	ug/L
EPA 524.2	1,1-Dichloroethane	Water	9	<RL	0.5	ug/L
EPA 524.2	1,1-Dichloroethylene	Water	2	<RL	0.5	ug/L
EPA 524.2	1,2,4-Trichlorobenzene	Water	2	<RL	0.5	ug/L
EPA 524.2	1,2-Dichloroethane	Water	9	<RL	0.5	ug/L
EPA 524.2	1,2-Dichloropropane	Water	9	<RL	0.25	ug/L
EPA 524.2	1,3-Dichloropropene	Water	9	<RL	0.5	ug/L
EPA 524.2	1,4-Dichlorobenzene	Water	9	<RL	0.5	ug/L
EPA 524.2	Acrylonitrile	Water	9	<RL	1	ug/L
EPA 524.2	Benzene	Water	9	<RL	0.5	ug/L
EPA 524.2	Bromodichloromethane	Water	9	<RL	0.5	ug/L
EPA 524.2	Bromoform	Water	9	<RL	0.5	ug/L

Analytical Method	Analyte	Sample Matrix	Number of Samples	Expected Range of Results	Method Reporting Limit	Units
EPA 524.2	Carbon tetrachloride	Water	9	<RL	0.5	ug/L
EPA 524.2	Chlorobenzene	Water	2	<RL	0.5	ug/L
EPA 524.2	Chlorodibromomethane	Water	9	<RL	0.5	ug/L
EPA 524.2	Chloroform	Water	9	<RL	0.5	ug/L
EPA 524.2	cis-1,2-Dichloroethylene	Water	2	<RL	0.5	ug/L
EPA 524.2	Dibromochloropropane	Water	2	<RL		ug/L
EPA 524.2	Epichlorohydrin	Water	9	<RL	1	ug/L
EPA 524.2	Ethyl acrylate	Water	9	<RL	1	ug/L
EPA 524.2	Ethylbenzene	Water	2	<RL	0.5	ug/L
EPA 524.2	Ethylene dibromide (EDB)	Water	9	<RL	0.2	ug/L
EPA 524.2	Methylene chloride	Water	9	<RL	0.5	ug/L
EPA 524.2	o-Dichlorobenzene	Water	2	<RL	0.5	ug/L
EPA 524.2	Styrene	Water	2	<RL	0.5	ug/L
EPA 524.2	Tetrachloroethylene	Water	9	<RL	0.5	ug/L
EPA 524.2	Toluene	Water	2	<RL	0.5	ug/L
EPA 524.2	trans-1,2-Dichloroethylene	Water	2	<RL	0.5	ug/L
EPA 524.2	Trichloroethylene	Water	9	<RL	0.5	ug/L
EPA 524.2	Vinyl chloride	Water	9	<RL	0.2	ug/L
EPA 524.2	Xylenes (Total)	Water	2	<RL	0.5	ug/L
EPA 8260D	Benzyl chloride	Water	9	<RL	1	ug/L
EPA 8270D	Bis(chloromethyl) ether	Water	9	<RL		
EPA 8270D	N-Nitrosodiphenylamine	Water	9	<RL		
EPA 8270E	2-Methylaniline hydrochloride	Water	9	<RL	10	ug/L
EPA 8270E	3,3'-Dimethoxybenzidine	Water	9	<RL		
EPA 8321	Ethylene thiourea	Water	9	<RL	5	ug/L
Synthetic / Semivolatile Organic Compounds						
EPA 8270E	1,2-Diphenylhydrazine	Water	9	<RL	10	ug/L
EPA 8270E_SIM	1,4-Dioxane	Water	9	<RL	0.2	ug/L
EPA 1613B	2,3,7,8-TCDD (Dioxin)	Water	9	<RL	10	ug/L
EPA 515.3	2,4,5-TP (Silvex)	Water	9	<RL	0.1	ug/L
EPA 515.3	2,4,6-Trichlorophenol	Water	9	<RL	0.1	ug/L
EPA 515.3	2,4-D	Water	9	<RL	0.1	ug/L
EPA 8270E	2,4-Dinitrotoluene	Water	9	<RL	10	ug/L
EPA 8270E	2,6-Dinitrotoluene	Water	9	<RL	10	ug/L
EPA 8270E	3,3'-Dichlorobenzidine	Water	9	<RL	30	ug/L
EPA 8270E	Acrylamide	Water	9	<RL	500	ug/L
EPA 525.2	Alachlor	Water	2	<RL	0.05	ug/L

Analytical Method	Analyte	Sample Matrix	Number of Samples	Expected Range of Results	Method Reporting Limit	Units
EPA 531.2	Aldicarb	Water	2	<RL	0.5	ug/L
EPA 531.2	Aldicarb sulfone	Water	2	<RL	0.5	ug/L
EPA 531.2	Aldicarb sulfoxide	Water	2	<RL	0.5	ug/L
EPA 525.2	Aldrin	Water	9	<RL	0.01	ug/L
EPA 8270E	Aniline	Water	9	<RL	10	ug/L
EPA 525.2	Atrazine	Water	2	<RL	0.05	ug/L
EPA 8270E	Azobenzene	Water	9	<RL	4	ug/L
EPA 8270E	Benzidine	Water	9	<RL	100	ug/L
EPA 525.2	Benzo(a)pyrene	Water	9	<RL	0.02	ug/L
EPA 525.2	Bis(2-ethylhexyl) phthalate	Water	9	<RL	0.6	ug/L
EPA 8270E	Carbazole	Water	9	<RL	4	ug/L
EPA 531.2	Carbofuran	Water	2	<RL	0.5	ug/L
EPA 505	Chlordane	Water	9	<RL	0.1	ug/L
EPA 525.2	Chlorthalonil	Water	9	<RL	0.1	ug/L
EPA 515.3	Dalapon	Water	2	<RL	1	ug/L
EPA 525.2	DDT (includes DDE and DDD)	Water	9	<RL	0.1	ug/L
EPA 525.2	Di(2-ethylhexyl) adipate	Water	2	<RL	0.6	ug/L
EPA 525.2	Di(2-ethylhexyl) phthalate	Water	2	<RL	0.6	ug/L
EPA 8270E	Diallate	Water	9	<RL	20	ug/L
EPA 8141B	Dichlorvos	Water	9	<RL	2	ug/L
EPA 525.2	Dieldrin	Water	9	<RL	0.01	ug/L
EPA 515.3	Dinoseb	Water	2	<RL	0.2	ug/L
EPA 549.2	Diquat	Water	2	<RL	2	ug/L
EPA 548.1	Endothall	Water	2	<RL	5	ug/L
EPA 525.2	Endrin	Water	9	<RL	0.01	ug/L
SM 5540 C	Foaming Agents	Water	9	<RL		
EPA 547	Glyphosate	Water	2	<RL	6	ug/L
EPA 525.2	Heptachlor	Water	9	<RL	0.01	ug/L
EPA 525.2	Heptachlor epoxide	Water	9	<RL	0.01	ug/L
EPA 525.2	Hexachlorobenzene	Water	9	<RL	0.05	ug/L
EPA 8081B	Hexachlorocyclohexane (technical)	Water	9	<RL		
EPA 525.2	Hexachlorocyclopentadiene	Water	2	<RL	0.05	ug/L
EPA 8290A	Hexachlorodibenzo-p-dioxin, mix	Water	9	<RL		
EPA 525.2	Lindane	Water	9	<RL	0.01	ug/L
EPA 525.2	Methoxychlor	Water	9	<RL	0.05	ug/L
EPA 8270E	N-Nitrosodiethylamine	Water	9	<RL	10	ug/L

Analytical Method	Analyte	Sample Matrix	Number of Samples	Expected Range of Results	Method Reporting Limit	Units
EPA 8270E	N-Nitrosodimethylamine	Water	9	<RL	10	ug/L
EPA 8270E	N-Nitroso-di-n-butylamine	Water	9	<RL	10	ug/L
EPA 8270E	N-Nitroso-di-n-propylamine	Water	9	<RL	10	ug/L
EPA 8270E	N-Nitroso-N-methylethylamine	Water	9	<RL	10	ug/L
EPA 8270E	N-Nitrosopyrrolidine	Water	9	<RL	10	ug/L
EPA 8270E	o-Toluidine	Water	9	<RL	10	ug/L
EPA 531.2	Oxamyl (Vydate)	Water	2	<RL	0.5	ug/L
EPA 8270E	PAH	Water	9	<RL	Varies	ug/L
EPA 505	PCBs	Water	9	<RL	0.1	ug/L
EPA 515.3	Pentachlorophenol	Water	2	<RL	0.04	ug/L
EPA 515.3	Picloram	Water	2	<RL	0.1	ug/L
EPA 525.2	Simazine	Water	2	<RL	0.05	ug/L
EPA 505	Toxaphene	Water	9	<RL	0.5	ug/L
Disinfection Byproducts						
EPA 300.1	Bromate	Water	2	<RL	5	ug/L
EPA 300.1	Chlorite	Water	2	<RL	10	ug/L
EPA 524.2	Total Trihalomethanes (TTHMs)	Water	2	<RL	0.5	ug/L
SM 6251B	Total Haloacetic Acids 5 (HAA5)	Water	2	<RL	2	ug/L
Disinfection Residuals						
SM 4500-Cl G	Chlorine (as Cl2)	Water	2	<RL	0.05	ug/L
SM 4500-Cl G	Chloramines (as Cl2)	Water	2	<RL	0.05	ug/L
SM 4500-ClO2 D	Chlorine dioxide (as ClO2)	Water	2	<RL	0.24	ug/L
Radiological						
EPA 906.0	Tritium	Water	9	Unknown	500	pCi/L
EPA 905.0	Strontium-90	Water	9	Unknown	3	pCi/L
EPA 903.0	Radium-226	Water	9	Unknown	1	pCi/L
SM 5540 C	Radium 226 & 228	Water	9	Unknown		pCi/L
PFAS						
EPA 537.1	HFPO-DA	Water	2	<RL	2	ng/L
EPA 537.1	PFBS	Water	2	<RL	2	ng/L
EPA 537.1	PFHxS	Water	2	<RL	2	ng/L
EPA 537.1	PFNA	Water	2	<RL	2	ng/L
EPA 537.1	PFOA	Water	2	<RL	2	ng/L
EPA 537.1	PFOS	Water	2	<RL	2	ng/L

9.2 Sample Preparation Method(s)

Samples will be prepared and extracted by an accredited lab in accordance with industry standards and analytical methods. The selected laboratory is discussed in Section 9.4.

9.3 Special Method Requirements

Not applicable.

9.4 Laboratories Accredited for Methods

Analysis of water quality samples will be performed by Eurofins at their Spokane, Washington office. Eurofins is accredited by Ecology for analysis of all parameters included in this project (see Appendix A).

Contact information for the laboratory is:

Eurofins Spokane
11922 East 1st Ave
Spokane, WA 99206

Project Manager: Randee Arrington
Phone: (509) 924-9200
Email: Randee.Arrington@et.eurofinsus.com

Bacteriological, nitrate, and nitrite analysis will be performed by LabTest of Yakima, Washington, to minimize holding times for analysis. LabTest is accredited by Ecology for these analyses (see Appendix A).

Contact information for the laboratory is:
LabTest
201 East D Street
Yakima, WA

Lab Supervisor: Giles Hamilton
Phone: 509-575-3999
Email: vws155@gmail.com

10.0 Quality Control Procedures

QC procedures provide the information needed to assess the quality of the data that is collected. These procedures also help identify problems or issues associated with data collection or data analysis while the project is underway.

10.1 Table of Field and Laboratory Quality Control

Standard EPA Level II procedures will be followed by the laboratory for one standard check, method blank, analytical duplicate, and matrix spike per laboratory batch (typically 10 to 20, as accommodated by laboratory auto sampling equipment and sample backlog). Field procedures will follow standard guidelines and SOPs for the relevant field activity. As detailed below data validation samples will be collected at a minimum of every 10 samples collected.

Data Validation Samples

Field quality control (QC) is accomplished through the analysis of controlled data validation (DV) samples that are introduced to the laboratory from the field. Field duplicates and trip blanks will be collected and submitted to the investigation laboratory to provide a means of assessing the quality of data resulting from the field sampling program.

Trip Blank

Trip blank samples will be used to monitor any possible cross-contamination that occurs during the transport of VOCs and samples. Trip blank samples are prepared by the laboratory using organic-free reagent-grade water into a volatile organic analysis (VOA) vial prior to the collection of field samples. Two vials per trip blank sample are placed with and accompany the VOCs samples through the entire transport process. Trip blank samples will be prepared and analyzed only for VOCs.

Field Duplicates

Field duplicate samples are used to check for sampling and analysis reproducibility. Field duplicate samples will be collected at a frequency of 10 percent of the field samples for every matrix and analytical method.

A single DV sample will be collected. The DV sample will include the following (see Section 6 for calculation of DV parameters and acceptance criteria and Section 9 for description of lab procedures):

- A MS/MSD
- A “blind” field duplicate (i.e., not indicated to the lab as a field duplicate)
- Trip blanks (for VOCs, bacteria, and inorganic constituent suites)

Except for the trip blank, the chemical analysis of DV samples will include the entire list of chemical analytes (Section 3.2.3). The trip blank will include only analysis of VOCs but will only be applicable to the surface water sample. VOCs were previously tested in the City's wells and are therefore omitted from this round of groundwater sampling. The blind field duplicate will be labeled in a manner that does not indicate its true sample location, and the MS/MSD will be labeled, as such, for laboratory processing.

10.2 Corrective Action Processes

Corrective action processes will be used if:

- Activities are inconsistent with the QAPP;
- Field instruments yield unusual results;
- Results do not meet MQOs or performance expectations; or
- If some other unforeseen problem arises.

Following identification of any of the above, the field personnel or Aspect Project Manager, as appropriate, will identify the likely cause of the error, document the error and corrective action, and collect a replacement measurement at the earliest convenience. If field methods are determined to be the cause of the deficiency, the method will be updated and documented. If field instruments are resulting in the deficiency, the field equipment will be recalibrated or replaced with an identical unit or another device which meets the QAPP specifications and MQOs. Following corrective action, the Aspect Project Manager will confirm that the corrective action had the intended resolution or will continue to address the problem as needed.

The laboratory will follow the analytical method for corrective action procedures when the sample results do not meet the QC acceptance criteria. The laboratory will notify the Aspect Hydrogeologist who submitted the samples and include a narrative in the laboratory report when following the analytical method corrective action procedures results in a sample result not meeting the QC acceptance criteria. Findings will be reviewed by the Aspect Project Manager. QC results may indicate problems with data during the course of the project. If QA/QC results in a sample not being acceptable for the study, the affected analytes will be resampled at the soonest convenience.

11.0 Data Management Procedures

11.1 Data Recording and Reporting Requirements

Field technicians will record all field data in a water-resistant field notebook, electronic data forms, or Aspect's standard field data sheet. Before leaving each site, staff will check field notebooks, data sheets, or electronic data forms for missing or improbable measurements. Field technicians will enter field-generated data into spreadsheets or a project database as soon as practical after they return from the field. For data collected electronically, data will be backed up on servers when staff return from the field. Raw data files will be stored separate from processed data files.

The Aspect field hydrogeologist and field technician will check data entry against the field notebook data for errors and omissions. The hydrogeologist will notify the Aspect Project Manager of missing or unusual data.

Data will be uploaded to Ecology's EIM database as described in Section 11.4.

11.2 Laboratory Data Package Requirements

All continuous and laboratory data will be stored in a project database that includes station location information and data QA information. This database will facilitate summarization and graphical analysis of the data.

11.3 Electronic Transfer Requirements

The lab will provide an EPA Level II data package as a PDF and an electronic data deliverable (EDD), in the format of a csv or xls file (comma-separated value and Excel workbook). The data package will include the following sections: Case narrative; Chain-of-custody (COC) documentation; Summary of results for environmental samples; Summary of QA/QC results; and Raw data.

11.4 Data Upload Procedures

Following completion of the QC procedures described in Section 10 and the DV procedures described in Section 8.2.2, all quality assured data will be formatted and uploaded to Ecology's EIM database by an Aspect data scientist using Study ID: WRYBIP-2325-CiPros-00046.

11.5 Model Information Management

Modeling will be completed using the PHREEQC code and existing peer-reviewed geochemical databases (Section 6.4). Aspect will maintain the final version of the model files, including input, output, and executables, for archiving at the completion of the task. Electronic copies of the data and supporting documentation will be made available upon request. Aspect will maintain copies in a task subdirectory, subject to regular system backups, for a minimum period of 3 years after task termination, unless otherwise directed. Maintenance of computer resources will be conducted by Aspect's in-house computer specialists.

12.0 Audits and Reports

12.1 Audits

Field technicians will be required to review this QAPP prior to each monitoring event and to maintain a copy of the QAPP and its appendices in the field. Field technicians may be audited at any time by the appropriate project manager or the Aspect data manager (Table 2) to check that field work is being completed according to this QAPP, work plan, and published SOPs.

12.2 Responsible Personnel

Personnel responsible for the audits are as follows:

- Field audit: Aspect Project Manager
- Field consistency review: experienced (at least 3 years) staff (senior hydrogeologist or project manager)
- Data analysis: Aspect hydrogeologists (project, senior, and principal, as required for specific analysis)

Personnel assigned to these roles are listed in Table 2.

12.3 Frequency and Distribution of Reports

Results of the field data collection, data quality assessment, and any data analysis will be documented in a published report. The final report will be distributed to all other stakeholders involved or interested in the study as determined by the City and Ecology.

Field and Laboratory Data will be entered into EIM when data collection is complete and Quality Control assessment has been finished.

12.4 Responsibility for Reports

The Aspect Project Manager is responsible for verifying data completeness and usability before the data are used in the technical report and entered into the EIM database. The Aspect Project Manager is also responsible for writing the final technical report or memo, unless an alternate author is agreed upon and documented prior to the start of the report.

The Aspect Project Manager is responsible for assigning a peer reviewer with the appropriate expertise to review technical report. A draft report will be prepared and submitted to Ecology, then a final report will be prepared that addresses Ecology's comments. The peer reviewer is responsible for working with the author to resolve or clarify any issues with the report.

13.0 Data Verification

Data verification is the process of evaluating the completeness, correctness, and conformance of a specific data set against the method, procedural, or contractual requirements.

13.1 Field Data Verification, Requirements, and Responsibilities

Field notebooks, data sheets, and electronic information storage will be checked for missing or improbable measurements, and initial data will be verified before leaving each site. This process involves checking the data sheet (written or electronic) for omissions or outliers. If measurement data are missing or a measurement is determined to be an outlier, the measurement will be flagged on the data sheet and repeated if possible. The field hydrogeologist or field technician is responsible for in-field data verification.

Upon returning from the field, data are either manually entered (data recorded on paper) or downloaded from instruments and then uploaded into the appropriate database or project folder (see Section 11). Manually entered data will be verified/checked by a staff member who did not enter the data. Downloaded electronic data files will also be checked for completeness and appropriate metadata (such as file name and time code).

Following data entry verification, raw field measurement data will undergo a quality analysis verification process to evaluate the performance of the sensors. Field measurement data may be adjusted for bias or drift (increasing bias over time) based on the results of fouling, field, or standards checks following general USGS guidelines (Wagner, 2007) and the process described below.

Review Discrete Field QC Checks

The field check of instrumentation will consist of a manual measurement for water levels, and measurement of water quality standards in the field (checks with water quality standards will be completed separate from equipment calibration events). The post-check data from the field QC instrument check (water quality and water level) will be reviewed, and the result will be qualified, rejected, or accepted as appropriate.

Review/Adjust Time Series (Continuous) Data

1. Plot raw time series with field checks.
2. Reject data based on deployment/retrieval times, site visit disruption, blatant fouling events, and sensor/equipment failure.
3. Review sensor offsets for both recalibration and post-deployment buffer/standard checks. Flag any potential chronic drift or bias issues specific to the instrument.
4. If applicable, review fouling check and make drift adjustment, if necessary. In some situations, an event fouling adjustment may be warranted.

5. Review residuals from both field checks and post-checks, together referred to as QC checks. Adjust data, as appropriate, using a weight-of-evidence approach. Give the most weight to post-checks with National Institute of Standards and Technology standards (for pH, specific conductance, and ORP), then accept, reject, or qualify the field checks. Potential data adjustments include:
    a. **Bias** – Data are adjusted by the average difference between the QC checks and deployed instrument. The majority of QC checks must show bias to use this method.
    b. **Regression** – Data are adjusted using regression, typically linear, between QC checks and deployed instrument. This accounts for both a slope and bias adjustment. The regression must have at least five data points and an R^2 value of >0.95 to use for adjustment. Do not extrapolate regressions beyond the range of the QC checks.
    c. **Calibration/Sensor Drift** – Data are adjusted using linear regression with time from calibration or deployment to post-check or retrieval. The majority of QC checks, particularly post-checks, must confirm pattern of drift.
6. Typically, choose the adjustment that results in the smallest residuals and bias between the adjusted values and QC checks. Best professional judgement and visual review are necessary to confirm adjustment.
7. If the evidence is weak, or inconclusive, do not adjust the data.

It will be noted in the final report if any data is adjusted. Data adjustment must be performed or reviewed by the Aspect Project Manager or personnel with the appropriate training and experience in processing raw sensor data.

13.2 Laboratory Data Verification

The lab will provide an EPA Level II data package. Additional laboratory data validation (check batch QC) will be conducted by Aspect's project data scientist (Table 2). Laboratory validation results will be summarized in the laboratory reports, and Aspect's validation results will be summarized in the final report. An Aspect hydrogeologist will verify the validated laboratory results.

13.3 Validation Requirements, if necessary

Not applicable.

13.4 Model Quality Assessment

The geochemical model to be used in this project is a thermodynamic equilibrium model developed by the USGS. The model uses an existing database of mineral phase equilibria (Section 6.4) to evaluate the potential for reactions to occur without consideration for reaction kinetics. The model is intended to be used to "bookend" potential water quality changes that may occur through ASR and will be used primarily to identify potential changes to monitor for during pilot testing.

Quality assessment is defined as the process by which QC is implemented in the model development task. All modelers will conform to the following guidelines:

- All modeling activities including data interpretation are subject to audit or peer review. Thus, the modelers are instructed to maintain careful written and electronic records for all aspects of model development.
- If historical data are used in accordance with acceptance criteria (, a written record on where the data were obtained and any information on their quality will be documented in the final report. A written record on where this information is on a computer or backup media will be maintained in the task files.
- If new theory is incorporated into the model framework, references for the theory and how it is implemented in any computer code will be documented and peer-reviewed.

Model results will be compared to water quality measured during the ASR pilot test, and from data obtained from other ASR projects operating under very similar conditions (e.g., the City of Yakima ASR program). The model quality assessment will be entirely qualitative and will be discussed in the Feasibility Study Report and future reports on pilot testing.

A sensitivity analysis of input parameters and assumed mineral assemblages will be completed to assess the dependence of the geochemical model results on key input parameters. The resulting changes in mineral SI's and predicted water quality parameter concentrations will be assessed and discussed in the Feasibility Study Report.

14.0 Data Quality (Usability) Assessment

14.1 Process for Determining Project Objectives were met

The Aspect Project Manager will assess all data (qualified and unqualified), results or verification, compliance with MQOs, and the overall quality of the data set to provide a final determination regarding usability in the context of the project-specific goals and objectives. The final report will document whether the final, acceptable-quality data set meets the needs of the project (allows desired conclusion/decisions to be made with the desired level of certainty).

14.2 Treatment of non-detects

Non-detects will be reported as the MRL for that analyte with the appropriate flag ("<") indicating it as a non-detect.

14.3 Data Analysis and Presentation Methods

Data found to be of acceptable quality for project objectives will be analyzed before being summarized. Any relevant and interesting data analysis will be presented in the final report using a combination of tables and plots of various kinds, such as time-series plots, histograms, and box plots.

The report will contain a summary table of chemistry, figures of continuous data (water level hydrographs, potentiometric maps, etc.), discussion of results pertaining to each sample location (well), and a map of the study area.

14.4 Sampling Design Evaluation

The Aspect Project Manager will decide whether (1) the data package meets the MQOs, and criteria for completeness, representativeness, and comparability; and (2) meaningful conclusions (with enough statistical power) can be drawn from summary statistics. If so, the sampling design will be considered effective. If the sampling design is found ineffective, the approach will be modified in accordance with Ecology, and/or the study will be halted for redesign.

14.5 Documentation of Assessment

In the final report, the Aspect Project Manager will include a summary and detailed description of the data quality assessment and model quality evaluation findings. This summary is usually included in the Data Quality section. The final report will also provide results of the data analysis, uncertainty analysis, and margin of safety.

15.0 References

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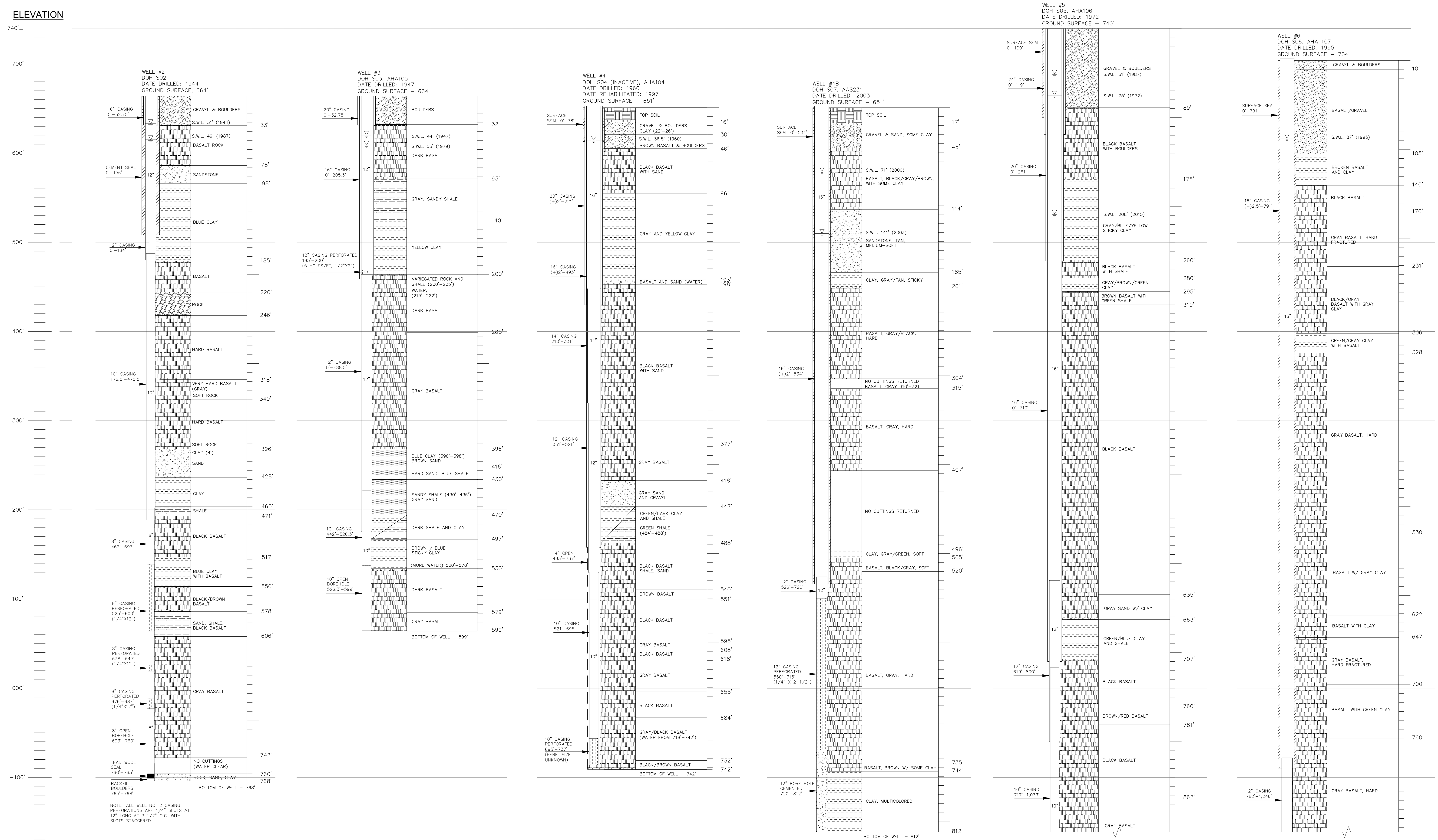
Washington State Department of Health (DOH), 2003, General Sampling Procedures. DOH Pub. No. 331-219, https://doh.wa.gov/sites/default/files/legacy/Documents/Pubs//331-219.pdf

16.0 Appendices

Appendix A. Well Logs



HLA
Engineering and Land Surveying, Inc.
2803 River Road
Yakima, WA 98902
509.966.7000
Fax 509.965.3800
www.hlacivil.com

PRELIMINARY
SUBJECT TO REVISION

REVISION	DATE

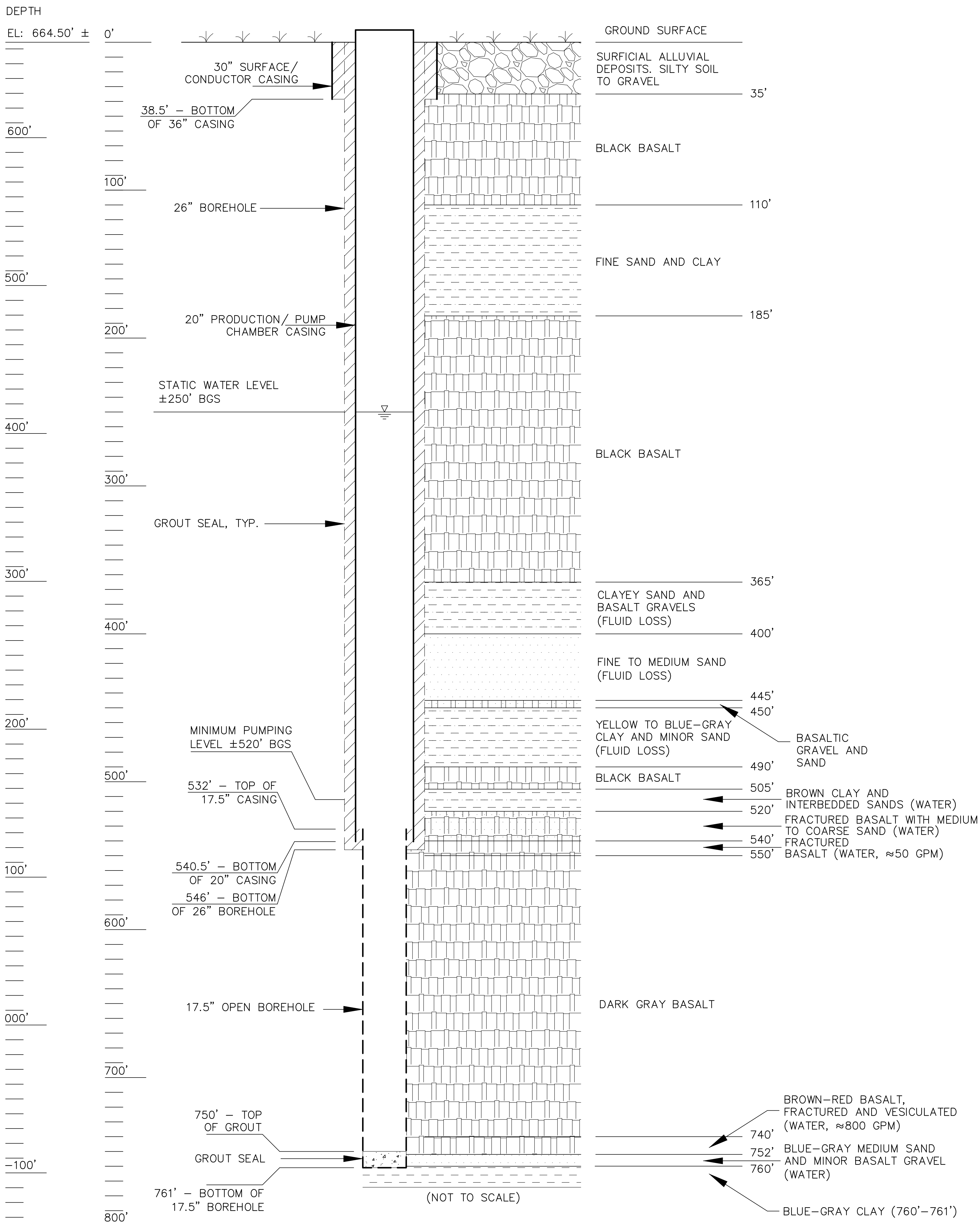
JOB NUMBER: 20132 | DATE: 11-10-2020

FILE NAMES:
DRAWING: Prosser Well Logs.dwg
PLAN: 20132.dwg

DESIGNED BY: JLB
ENTERED BY: JWM

CITY OF PROSSER
WELLS NO. 2 & 3 REPLACEMENT

SHEET
OF -



NOTE: REFER TO DRILLER'S FORMATION LOG AND WATER WELL REPORT FOR ADDITIONAL WELL CONSTRUCTION AND FORMATION DETAIL.

HLA Engineering and Land Surveying, Inc.
2803 River Road
Yakima, WA 98902
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Fax 509.965.3800
www.hlacivil.com

JOB NUMBER:	DATE:
20132	9/16/2022

FILE NAMES:
DRAWING: 20132.dwg

DESIGNED BY: JLB
ENTERED BY: JWM

CITY OF PROSSER

WELL NO. 7
CONSTRUCTION SCHEMATIC

Appendix B. Laboratory Accreditations

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
PO Box 488 • Manchester, WA 98353-0488 • (360) 871-8840

March 26, 2024

Robert Dean
Eurofins Eaton Analytical, LLC - Pomona
941 Corporate Center Drive
Pomona, CA 91768

Dear Robert Dean:

Thank you for your application for renewal in the Environmental Laboratory Accreditation Program. Attached is a new Certificate of Accreditation covering the one-year period beginning March 14, 2024 and a current Scope of Accreditation.

Accreditation is based in part on third party recognition of the Labs Utah NELAP accreditation.

Several parameters were Withdrawn at laboratory request. See **240326N_Eurofins Eaton Pomona** document, footnote a.

The following parameters have been added to the laboratory's scope of accreditation in recognition of your Utah accreditation and acceptable PT results:

- 4-Methyl-2-pentanone (MIBK) by EPA 524.2_4.1_1995 in Drinking Water
- Di-isopropylether (DIPE) by EPA 524.2_4.1_1995 in Drinking Water

The analysis method for 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) has been updated from EPA 1613_1994 to EPA 1613B_1994 in Drinking in recognition of your Utah accreditation and acceptable PT results.

The following parameters will need two acceptable PT prior to your next renewal due to an unacceptable result in the previous accreditation year. Please ensure that your PT reports are reporting the version of the accredited method that matches your current scope of accreditation.

- Total Cyanide by SM 4500-CN¯ F-2011 in Drinking Water
- Cyanides, Amenable to Chlorination by SM 4500-CN¯ G-2011 in Drinking Water
- Silica by SM 4500-SiO2 C-2011 in Drinking Water
- UV Absorbing Organics by SM 5910 B-00 in Drinking Water

Based on your laboratory's two most recent sets of PT Study results, full accreditation is warranted for all applicable parameters. As a reminder, continued participation in the Ecology Lab Accreditation Program requires the lab to:

- Submit a renewal application and fees annually
- Report significant changes in facility, personnel, analytical methods, equipment, the lab's quality assurance (QA) manual or QA procedures as they occur
- **Participate in proficiency testing studies semi-annually, with the following exception: For each parameter where all PT results were satisfactory, you are required to submit only one PT result over this next year, and in subsequent years, as long as the results are satisfactory.**
- Submit copies of current third-party Scopes of Accreditation when they are available.

If you have any questions concerning the accreditation of your lab, please contact Ryan Zboralski at (360) 764-9364, fax (360) 871-8849, or by e-mail at ryan.zboralski@ecy.wa.gov.

Sincerely,

Rebecca Wood

Rebecca Wood
Lab Accreditation Unit Supervisor

RW:ERZ:erz
Enclosures

The State of Washington
Department of Ecology

Eurofins Eaton Analytical, LLC - Pomona
Pomona, CA

has complied with provisions set forth in Chapter 173-50 WAC and is hereby recognized by the Department of Ecology as an ACCREDITED LABORATORY for the analytical parameters listed on the accompanying Scope of Accreditation.

This certificate is effective March 14, 2024 and shall expire March 13, 2025.

Witnessed under my hand on March 26, 2024.

Rebecca Wood
Lab Accreditation Unit Supervisor

Laboratory ID
C838

WASHINGTON STATE DEPARTMENT OF ECOLOGY

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM

SCOPE OF ACCREDITATION

Eurofins Eaton Analytical, LLC - Pomona

Pomona, CA

is accredited for the analytes listed below using the methods indicated. Full accreditation is granted unless stated otherwise in a note. EPA is the U.S. Environmental Protection Agency. SM is "Standard Methods for the Examination of Water and Wastewater." SM refers to EPA approved method versions. ASTM is the American Society for Testing and Materials. USGS is the U.S. Geological Survey. AOAC is the Association of Official Analytical Chemists. Other references are described in notes.

Matrix/Analyte	Method	Notes
Drinking Water		
Turbidity	EPA 180.1_2_1993	1
Chromium, Hexavalent	EPA 218.6_3.3_1994	1
Chromium, Hexavalent	EPA 218.7_1_2011	1
Bromide	EPA 300.0_2.1_1993	1
Chlorate	EPA 300.0_2.1_1993	1
Chloride	EPA 300.0_2.1_1993	1
Chlorite	EPA 300.0_2.1_1993	1
Nitrate	EPA 300.0_2.1_1993	1
Nitrate + Nitrite	EPA 300.0_2.1_1993	1
Nitrite	EPA 300.0_2.1_1993	1
Sulfate	EPA 300.0_2.1_1993	1
Bromate	EPA 300.1_1_1997	1
Bromide	EPA 300.1_1_1997	1
Chlorate	EPA 300.1_1_1997	1
Perchlorate	EPA 314.0-99	1
Bromate	EPA 317.0_2_2001	1
Perchlorate	EPA 331.0_1.0_2005	1
Cyanide, Total	EPA 335.4_1_1993	1
Color	SM 2120 B-2011	1
Odor	SM 2150 B-2011	1
Alkalinity as CaCO3	SM 2320 B-2011	1
Corrosivity	SM 2330 B-2011	1
Hardness, Calcium (as CaCO3)	SM 2340 B-2011	1
Hardness, Total (as CaCO3)	SM 2340 B-2011	1
Specific Conductance	SM 2510 B-2011	1
Solids, Total Dissolved	SM 2540 C-2011	1

Matrix/Analyte	Method	Notes
Drinking Water		
Chlorine (Residual), Free	SM 4500-Cl G-2011	1,2
Chlorine (Residual), Total	SM 4500-Cl G-2011	1,2
Chlorine Dioxide	SM 4500-ClO2 D-93	1
Cyanide, Total	SM 4500-CN¯ F-2011	1
Cyanides, Amenable to Chlorination	SM 4500-CN¯ G-2011	1
Fluoride	SM 4500-F¯ C-2011	1
pH	SM 4500-H+ B-2011	1,2
Orthophosphate as P	SM 4500-P E-2011	1
Silica	SM 4500-SiO2 C-2011	1
Dissolved Organic Carbon	SM 5310 C-2011	1
Total Organic Carbon	SM 5310 C-2011	1
Anionic Surfactants (MBAS)	SM 5540 C-2011	1
UV Absorbing Organics	SM 5910 B-00	1
Aluminum	EPA 200.7_4.4_1994	1
Barium	EPA 200.7_4.4_1994	1
Beryllium	EPA 200.7_4.4_1994	1
Boron	EPA 200.7_4.4_1994	1
Cadmium	EPA 200.7_4.4_1994	1
Calcium	EPA 200.7_4.4_1994	1
Chromium	EPA 200.7_4.4_1994	1
Copper	EPA 200.7_4.4_1994	1
Hardness, Calcium (as CaCO3)	EPA 200.7_4.4_1994	1
Hardness, Total (as CaCO3)	EPA 200.7_4.4_1994	1
Iron	EPA 200.7_4.4_1994	1
Lithium	EPA 200.7_4.4_1994	1
Magnesium	EPA 200.7_4.4_1994	1
Manganese	EPA 200.7_4.4_1994	1
Molybdenum	EPA 200.7_4.4_1994	1
Nickel	EPA 200.7_4.4_1994	1
Potassium	EPA 200.7_4.4_1994	1
Silica	EPA 200.7_4.4_1994	1
Sodium	EPA 200.7_4.4_1994	1
Zinc	EPA 200.7_4.4_1994	1
Aluminum	EPA 200.8_5.4_1994	1
Antimony	EPA 200.8_5.4_1994	1
Arsenic	EPA 200.8_5.4_1994	1
Barium	EPA 200.8_5.4_1994	1

Matrix/Analyte	Method	Notes
Drinking Water		
Beryllium	EPA 200.8_5.4_1994	1
Cadmium	EPA 200.8_5.4_1994	1
Chromium	EPA 200.8_5.4_1994	1
Copper	EPA 200.8_5.4_1994	1
Lead	EPA 200.8_5.4_1994	1
Manganese	EPA 200.8_5.4_1994	1
Mercury	EPA 200.8_5.4_1994	1
Molybdenum	EPA 200.8_5.4_1994	1
Nickel	EPA 200.8_5.4_1994	1
Selenium	EPA 200.8_5.4_1994	1
Silver	EPA 200.8_5.4_1994	1
Thallium	EPA 200.8_5.4_1994	1
Uranium	EPA 200.8_5.4_1994	1
Vanadium	EPA 200.8_5.4_1994	1
Zinc	EPA 200.8_5.4_1994	1
1,2,3-Trichloropropane	EPA 504.1_1.1_1995	1
1,2-Dibromo-3-chloropropane (DBCP)	EPA 504.1_1.1_1995	1
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 504.1_1.1_1995	1
Alachlor	EPA 505_2.1_1995	1
Aldrin	EPA 505_2.1_1995	1
Aroclor-1016 (PCB-1016)	EPA 505_2.1_1995	1
Aroclor-1221 (PCB-1221)	EPA 505_2.1_1995	1
Aroclor-1232 (PCB-1232)	EPA 505_2.1_1995	1
Aroclor-1242 (PCB-1242)	EPA 505_2.1_1995	1
Aroclor-1248 (PCB-1248)	EPA 505_2.1_1995	1
Aroclor-1254 (PCB-1254)	EPA 505_2.1_1995	1
Aroclor-1260 (PCB-1260)	EPA 505_2.1_1995	1
Chlordane (tech.)	EPA 505_2.1_1995	1
Dieldrin	EPA 505_2.1_1995	1
Endrin	EPA 505_2.1_1995	1
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 505_2.1_1995	1
Heptachlor	EPA 505_2.1_1995	1
Heptachlor epoxide	EPA 505_2.1_1995	1
Methoxychlor	EPA 505_2.1_1995	1
Toxaphene (Chlorinated camphene)	EPA 505_2.1_1995	1
2,4,5-T	EPA 515.4_1_2000	1
2,4-D	EPA 515.4_1_2000	1

Matrix/Analyte	Method	Notes
Drinking Water		
2,4-DB	EPA 515.4_1_2000	1
3,5-Dichlorobenzoic acid	EPA 515.4_1_2000	1
Acifluorfen	EPA 515.4_1_2000	1
Bentazon	EPA 515.4_1_2000	1
Dacthal (DCPA)	EPA 515.4_1_2000	1
Dacthal Acid Metabolites	EPA 515.4_1_2000	1
Dalapon	EPA 515.4_1_2000	1
DCPA di acid degradate	EPA 515.4_1_2000	1
DCPA mono acid degradate	EPA 515.4_1_2000	1
Dicamba	EPA 515.4_1_2000	1
Dichloroprop (Dichlorprop)	EPA 515.4_1_2000	1
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 515.4_1_2000	1
Pentachlorophenol	EPA 515.4_1_2000	1
Picloram	EPA 515.4_1_2000	1
Silvex (2,4,5-TP)	EPA 515.4_1_2000	1
3-Hydroxycarbofuran	EPA 531.2_1_2001	1
Aldicarb (Temik)	EPA 531.2_1_2001	1
Aldicarb sulfone	EPA 531.2_1_2001	1
Aldicarb sulfoxide	EPA 531.2_1_2001	1
Carbaryl (Sevin)	EPA 531.2_1_2001	1
Carbofuran (Furaden)	EPA 531.2_1_2001	1
Methiocarb (Mesurol)	EPA 531.2_1_2001	1
Methomyl (Lannate)	EPA 531.2_1_2001	1
Oxamyl	EPA 531.2_1_2001	1
Propoxur (Baygon)	EPA 531.2_1_2001	1
Glyphosate	EPA 547_1990	1
Diquat	EPA 549.2_1_1997	1
Paraquat	EPA 549.2_1_1997	1
Bromoacetic acid (MBAA, BAA)	SM 6251 B-05	1
Bromochloroacetic acid (BCAA)	SM 6251 B-05	1
Chloroacetic acid (MCAA, CAA)	SM 6251 B-05	1
Dibromoacetic acid (DBAA)	SM 6251 B-05	1
Dichloroacetic acid (DCAA)	SM 6251 B-05	1
Total haloacetic acids (HAA5)	SM 6251 B-05	1
Trichloroacetic acid (TCAA)	SM 6251 B-05	1
2,3,7,8-TCDD	EPA 1613B_1994	1
1,4-Dioxane (1,4- Diethyleneoxide)	EPA 522_1_2008	1

Matrix/Analyte	Method	Notes
Drinking Water		
1,1,1,2-Tetrachloroethane	EPA 524.2_4.1_1995	1
1,1,1-Trichloroethane	EPA 524.2_4.1_1995	1
1,1,2,2-Tetrachloroethane	EPA 524.2_4.1_1995	1
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	EPA 524.2_4.1_1995	1
1,1,2-Trichloroethane	EPA 524.2_4.1_1995	1
1,1-Dichloroethane	EPA 524.2_4.1_1995	1
1,1-Dichloroethylene	EPA 524.2_4.1_1995	1
1,1-Dichloropropene	EPA 524.2_4.1_1995	1
1,2,3-Trichlorobenzene	EPA 524.2_4.1_1995	1
1,2,3-Trichloropropane	EPA 524.2_4.1_1995	1
1,2,4-Trichlorobenzene	EPA 524.2_4.1_1995	1
1,2,4-Trimethylbenzene	EPA 524.2_4.1_1995	1
1,2-Dichlorobenzene	EPA 524.2_4.1_1995	1
1,2-Dichloroethane (Ethylene dichloride)	EPA 524.2_4.1_1995	1
1,2-Dichloropropane	EPA 524.2_4.1_1995	1
1,3,5-Trimethylbenzene	EPA 524.2_4.1_1995	1
1,3-Dichlorobenzene	EPA 524.2_4.1_1995	1
1,3-Dichloropropane	EPA 524.2_4.1_1995	1
1,4-Dichlorobenzene	EPA 524.2_4.1_1995	1
2,2-Dichloropropane	EPA 524.2_4.1_1995	1
2-Chlorotoluene	EPA 524.2_4.1_1995	1
4-Chlorotoluene	EPA 524.2_4.1_1995	1
4-Isopropyltoluene (p-Cymene)	EPA 524.2_4.1_1995	1
4-Methyl-2-pentanone (MIBK)	EPA 524.2_4.1_1995	1
Benzene	EPA 524.2_4.1_1995	1
Bromobenzene	EPA 524.2_4.1_1995	1
Bromochloromethane	EPA 524.2_4.1_1995	1
Bromodichloromethane	EPA 524.2_4.1_1995	1
Bromoform	EPA 524.2_4.1_1995	1
Carbon disulfide	EPA 524.2_4.1_1995	1
Carbon tetrachloride	EPA 524.2_4.1_1995	1
Chlorobenzene	EPA 524.2_4.1_1995	1
Chlorodibromomethane	EPA 524.2_4.1_1995	1
Chloroethane (Ethyl chloride)	EPA 524.2_4.1_1995	1
Chloroform	EPA 524.2_4.1_1995	1
cis-1,2-Dichloroethylene	EPA 524.2_4.1_1995	1
cis-1,3-Dichloropropene	EPA 524.2_4.1_1995	1

Matrix/Analyte	Method	Notes
Drinking Water		
Dibromomethane	EPA 524.2_4.1_1995	1
Dichlorodifluoromethane (Freon-12)	EPA 524.2_4.1_1995	1
Dichloromethane (DCM, Methylene chloride)	EPA 524.2_4.1_1995	1
Di-isopropylether (DIPE)	EPA 524.2_4.1_1995	1
Ethylbenzene	EPA 524.2_4.1_1995	1
Ethyl-t-butylether (ETBE) (2-Ethoxy-2-methylpropane)	EPA 524.2_4.1_1995	1
Hexachlorobutadiene	EPA 524.2_4.1_1995	1
Isopropylbenzene	EPA 524.2_4.1_1995	1
Methyl bromide (Bromomethane)	EPA 524.2_4.1_1995	1
Methyl chloride (Chloromethane)	EPA 524.2_4.1_1995	1
Methyl tert-butyl ether (MTBE)	EPA 524.2_4.1_1995	1
Naphthalene	EPA 524.2_4.1_1995	1
n-Butylbenzene	EPA 524.2_4.1_1995	1
n-Propylbenzene	EPA 524.2_4.1_1995	1
sec-Butylbenzene	EPA 524.2_4.1_1995	1
Styrene	EPA 524.2_4.1_1995	1
tert-amylmethylether (TAME)	EPA 524.2_4.1_1995	1
tert-Butyl alcohol	EPA 524.2_4.1_1995	1
tert-Butylbenzene	EPA 524.2_4.1_1995	1
Tetrachloroethylene (Perchloroethylene)	EPA 524.2_4.1_1995	1
Toluene	EPA 524.2_4.1_1995	1
Total Trihalomethanes	EPA 524.2_4.1_1995	1
trans-1,2-Dichloroethylene	EPA 524.2_4.1_1995	1
trans-1,3-Dichloropropylene	EPA 524.2_4.1_1995	1
Trichloroethene (Trichloroethylene)	EPA 524.2_4.1_1995	1
Trichlorofluoromethane (Freon 11)	EPA 524.2_4.1_1995	1
Vinyl chloride	EPA 524.2_4.1_1995	1
Xylene (total)	EPA 524.2_4.1_1995	1
2,4-Dinitrotoluene (2,4-DNT)	EPA 525.2_2_1995	1
2,6-Dinitrotoluene (2,6-DNT)	EPA 525.2_2_1995	1
4,4'-DDD	EPA 525.2_2_1995	1
4,4'-DDE	EPA 525.2_2_1995	1
4,4'-DDT	EPA 525.2_2_1995	1
Acenaphthylene	EPA 525.2_2_1995	1
Alachlor	EPA 525.2_2_1995	1
Aldrin	EPA 525.2_2_1995	1
Anthracene	EPA 525.2_2_1995	1

Matrix/Analyte	Method	Notes
Drinking Water		
Atrazine	EPA 525.2_2_1995	1
Benzo(a)anthracene	EPA 525.2_2_1995	1
Benzo(a)pyrene	EPA 525.2_2_1995	1
Benzo(g,h,i)perylene	EPA 525.2_2_1995	1
Benzo(k)fluoranthene	EPA 525.2_2_1995	1
Benzo[b]fluoranthene	EPA 525.2_2_1995	1
Bromacil	EPA 525.2_2_1995	1
Butachlor	EPA 525.2_2_1995	1
Butyl benzyl phthalate	EPA 525.2_2_1995	1
Chlordane (tech.)	EPA 525.2_2_1995	1
Chrysene	EPA 525.2_2_1995	1
Di(2-ethylhexyl)adipate	EPA 525.2_2_1995	1
Di(2-ethylhexyl)phthalate	EPA 525.2_2_1995	1
Diazinon	EPA 525.2_2_1995	1
Dibenz(a,h) anthracene	EPA 525.2_2_1995	1
Dieldrin	EPA 525.2_2_1995	1
Diethyl phthalate	EPA 525.2_2_1995	1
Dimethyl phthalate	EPA 525.2_2_1995	1
Di-n-butyl phthalate	EPA 525.2_2_1995	1
Di-n-octyl phthalate	EPA 525.2_2_1995	1
Endrin	EPA 525.2_2_1995	1
EPTC (Eptam, s-ethyl-dipropyl thio carbamate)	EPA 525.2_2_1995	1
Fluoranthene	EPA 525.2_2_1995	1
Fluorene	EPA 525.2_2_1995	1
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 525.2_2_1995	1
Heptachlor	EPA 525.2_2_1995	1
Heptachlor epoxide	EPA 525.2_2_1995	1
Hexachlorobenzene	EPA 525.2_2_1995	1
Hexachlorocyclopentadiene	EPA 525.2_2_1995	1
Indeno(1,2,3-cd) pyrene	EPA 525.2_2_1995	1
Methoxychlor	EPA 525.2_2_1995	1
Metolachlor	EPA 525.2_2_1995	1
Metribuzin	EPA 525.2_2_1995	1
Molinate	EPA 525.2_2_1995	1
Napropamide	EPA 525.2_2_1995	1
Phenanthrene	EPA 525.2_2_1995	1
Propachlor (Ramrod)	EPA 525.2_2_1995	1

Matrix/Analyte	Method	Notes
Drinking Water		
Pyrene	EPA 525.2_2_1995	1
Simazine	EPA 525.2_2_1995	1
Terbacil	EPA 525.2_2_1995	1
Thiobencarb	EPA 525.2_2_1995	1
Trifluralin (Treflan)	EPA 525.2_2_1995	1
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11-Cl-PF3OUdS)	EPA 533	1
1H,1H,2H,2H,-Perfluorodecanesulfonic acid (8:2 FTS)	EPA 533	1
1H,1H,2H,2H,-Perfluorooctanesulfonic acid (6:2 FTS)	EPA 533	1
1H,1H,2H,2H-Perfluorohexanesulfonic acid (4:2 FTS)	EPA 533	1
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	EPA 533	1
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9-Cl-PF3ONS)	EPA 533	1
Hexafluoropropylene oxide dimer acid (HFPO-DA)	EPA 533	1
Nonafluoro-3,6-dioxaheptanoic acid (NFDHA)	EPA 533	1
Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA)	EPA 533	1
Perfluoro-3-methoxypropanoic acid (PFMPA)	EPA 533	1
Perfluoro-4-methoxybutanoic acid (PFMBA)	EPA 533	1
Perfluorobutane sulfonic acid (PFBS)	EPA 533	1
Perfluorobutanoic acid (PFBA)	EPA 533	1
Perfluorodecanoic acid (PFDA)	EPA 533	1
Perfluorododecanoic acid (PFDoA)	EPA 533	1
Perfluoroheptane sulfonic acid (PFHpS)	EPA 533	1
Perfluoroheptanoic acid (PFHpA)	EPA 533	1
Perfluorohexane sulfonic acid (PFHxS)	EPA 533	1
Perfluorohexanoic acid (PFHxA)	EPA 533	1
Perfluorononanoic acid (PFNA)	EPA 533	1
Perfluorooctane sulfonic acid (PFOS)	EPA 533	1
Perfluorooctanoic acid (PFOA)	EPA 533	1
Perfluoropentane sulfonic acid (PFPeS)	EPA 533	1
Perfluoropentanoic acid (PFPeA)	EPA 533	1
Perfluoroundecanoic acid (PFUnA)	EPA 533	1
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11-Cl-PF3OUdS)	EPA 537.1_(11/18)	1
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	EPA 537.1_(11/18)	1
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9-Cl-PF3ONS)	EPA 537.1_(11/18)	1
Hexafluoropropylene oxide dimer acid (HFPO-DA)	EPA 537.1_(11/18)	1
N-Ethylperfluorooctane sulfonamido acetic acid (NEtFOSAA)	EPA 537.1_(11/18)	1
N-Methylperfluorooctane sulfonamido acetic acid (NMeFOSAA)	EPA 537.1_(11/18)	1
Perfluorobutane sulfonic acid (PFBS)	EPA 537.1_(11/18)	1

Matrix/Analyte	Method	Notes
Drinking Water		
Perfluorodecanoic acid (PFDA)	EPA 537.1_(11/18)	1
Perfluorododecanoic acid (PFDoA)	EPA 537.1_(11/18)	1
Perfluoroheptanoic acid (PFHpA)	EPA 537.1_(11/18)	1
Perfluorohexane sulfonic acid (PFHxS)	EPA 537.1_(11/18)	1
Perfluorohexanoic acid (PFHxA)	EPA 537.1_(11/18)	1
Perfluorononanoic acid (PFNA)	EPA 537.1_(11/18)	1
Perfluorooctane sulfonic acid (PFOS)	EPA 537.1_(11/18)	1
Perfluorooctanoic acid (PFOA)	EPA 537.1_(11/18)	1
Perfluorotetradecanoic acid (PFTeDA)	EPA 537.1_(11/18)	1
Perfluorotridecanoic acid (PFTrDA)	EPA 537.1_(11/18)	1
Perfluoroundecanoic acid (PFUnA)	EPA 537.1_(11/18)	1
Anatoxin-a	EPA 545	1
Cylindrospermopsin	EPA 545	1
Endothall	EPA 548.1_1_1992	1
Heterotrophic Bacteria	SM 9215 B (PCA)	1
Total & Fecal Coli - detect	SM 9221 B (LTB) + E1 (EC)	1,3
Fecal coliform-count	SM 9221 B+E1+C (LTB/BGB/EC-MPN)	1
Total coli/E.coli - detect	SM 9221 B+F (LTB/BGB/EC MUG-PA)	1
E.coli-count	SM 9221 B+F+C (LTB/BGB/EC Mug-MPN)	1
Total coliforms-count	SM 9221 B+F+C (LTB/BGB/EC Mug-MPN)	1
Total coli/E.coli - detect	SM 9223 B Colilert 18® (PA)	1
E.coli-count	SM 9223 B Colilert 18® QTray®	1
Total coliforms-count	SM 9223 B Colilert 18® QTray®	1
Total coli/E.coli - detect	SM 9223 B Colilert® 24 (PA)	1
E.coli-count	SM 9223 B Colilert® 24 QTray®	1
Total coliforms-count	SM 9223 B Colilert® 24 QTray®	1
Total coli/E.coli - detect	SM 9223 B Colisure® (PA)	1
Enterococci	SM 9230 D Enterolert®	1
Microcystins	EPA 546	1

Matrix/Analyte	Method	Notes

Accredited Parameter Note Detail

(1) Accreditation based in part on recognition of Utah Department of Health NELAP accreditation. (2) Not to be used for regulatory purposes due to short holding time. (3) Not for regulatory samples.

03/26/2024

Authentication Signature
Rebecca Wood, Lab Accreditation Unit Supervisor

Date

The State of Washington
Department of Ecology

Eurofins Spokane

Spokane Valley, WA

has complied with provisions set forth in Chapter 173-50 WAC and is hereby recognized by the Department of Ecology as an ACCREDITED LABORATORY for the analytical parameters listed on the accompanying Scope of Accreditation. This certificate is effective January 7, 2025 and shall expire January 6, 2026.

Witnessed under my hand on January 8, 2025

Rebecca Wood
Lab Accreditation Unit Supervisor

Laboratory ID
C569

WASHINGTON STATE DEPARTMENT OF ECOLOGY

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM

SCOPE OF ACCREDITATION

Eurofins Spokane

Spokane Valley, WA

is accredited for the analytes listed below using the methods indicated. Full accreditation is granted unless stated otherwise in a note. EPA is the U.S. Environmental Protection Agency. SM is "Standard Methods for the Examination of Water and Wastewater." SM refers to EPA approved method versions. ASTM is the American Society for Testing and Materials. USGS is the U.S. Geological Survey. AOAC is the Association of Official Analytical Chemists. Other references are described in notes.

Matrix/Analyte	Method	Notes
Drinking Water		
Turbidity	EPA 180.1_2_1993	2
Chloride	EPA 300.0_2.1_1993	
Fluoride	EPA 300.0_2.1_1993	2,4
Nitrate as N	EPA 300.0_2.1_1993	
Nitrite as N	EPA 300.0_2.1_1993	
Sulfate	EPA 300.0_2.1_1993	
Color	SM 2120 B-2011	
Specific Conductance	SM 2510 B-2011	
Solids, Total Dissolved	SM 2540 C-2015	2
Total coli/E.coli - detect	SM 9223 B Colilert® 24 (PA)	
Non-Potable Water		
Specific Conductance	EPA 120.1_1982	1
non-Polar Extractable Material (TPH)	EPA 1664B (SGT-HEM)	1
n-Hexane Extractable Material (O&G)	EPA 1664B -10 (HEM)	1
Turbidity	EPA 180.1_2_1993	1
Chloride	EPA 300.0_2.1_1993	1
Fluoride	EPA 300.0_2.1_1993	1
Nitrate as N	EPA 300.0_2.1_1993	1
Nitrite as N	EPA 300.0_2.1_1993	1
Sulfate	EPA 300.0_2.1_1993	1
Color	SM 2120 B-2011	1
Alkalinity	SM 2320 B-2011	1
Hardness (calc.)	SM 2340 B-2011	1
Specific Conductance	SM 2510 B-2011	1
Solids, Total Dissolved	SM 2540 C-2015	1,2
Solids, Total Suspended	SM 2540 D-2015	1

Matrix/Analyte	Method	Notes
Non-Potable Water		
pH	SM 4500-H+ B-2011	1
Dissolved Oxygen	SM 4500-O G-2016	1
Phosphorus, total	SM 4500-P E-2011	1
Biochemical Oxygen Demand (BOD)	SM 5210 B-2016	1
Carbonaceous BOD (CBOD)	SM 5210 B-2016	1
Aluminum	EPA 200.7_4.4_1994	1
Antimony	EPA 200.7_4.4_1994	1
Arsenic	EPA 200.7_4.4_1994	1
Barium	EPA 200.7_4.4_1994	1
Beryllium	EPA 200.7_4.4_1994	1
Boron	EPA 200.7_4.4_1994	1
Cadmium	EPA 200.7_4.4_1994	1
Calcium	EPA 200.7_4.4_1994	1
Chromium	EPA 200.7_4.4_1994	1
Cobalt	EPA 200.7_4.4_1994	1
Copper	EPA 200.7_4.4_1994	1
Iron	EPA 200.7_4.4_1994	1
Lead	EPA 200.7_4.4_1994	1
Magnesium	EPA 200.7_4.4_1994	1
Manganese	EPA 200.7_4.4_1994	1
Molybdenum	EPA 200.7_4.4_1994	1
Nickel	EPA 200.7_4.4_1994	1
Potassium	EPA 200.7_4.4_1994	1
Selenium	EPA 200.7_4.4_1994	1
Silver	EPA 200.7_4.4_1994	1
Sodium	EPA 200.7_4.4_1994	1
Thallium	EPA 200.7_4.4_1994	1
Tin	EPA 200.7_4.4_1994	1
Vanadium	EPA 200.7_4.4_1994	1
Zinc	EPA 200.7_4.4_1994	1
Mercury	EPA 245.1_3_1994	1
Solid and Chemical Materials		
pH	EPA 9045D_2002	1
Aluminum	EPA 6010D_(7/14)	1
Antimony	EPA 6010D_(7/14)	1
Arsenic	EPA 6010D_(7/14)	1
Barium	EPA 6010D_(7/14)	1

Matrix/Analyte	Method	Notes
Solid and Chemical Materials		
Beryllium	EPA 6010D_(7/14)	1
Boron	EPA 6010D_(7/14)	1
Cadmium	EPA 6010D_(7/14)	1
Calcium	EPA 6010D_(7/14)	1
Chromium	EPA 6010D_(7/14)	1
Cobalt	EPA 6010D_(7/14)	1
Copper	EPA 6010D_(7/14)	1
Iron	EPA 6010D_(7/14)	1
Lead	EPA 6010D_(7/14)	1
Magnesium	EPA 6010D_(7/14)	1
Manganese	EPA 6010D_(7/14)	1
Molybdenum	EPA 6010D_(7/14)	1
Nickel	EPA 6010D_(7/14)	1
Potassium	EPA 6010D_(7/14)	1
Selenium	EPA 6010D_(7/14)	1
Silver	EPA 6010D_(7/14)	1
Sodium	EPA 6010D_(7/14)	1
Thallium	EPA 6010D_(7/14)	1
Tin	EPA 6010D_(7/14)	1
Vanadium	EPA 6010D_(7/14)	1
Zinc	EPA 6010D_(7/14)	1
Mercury	EPA 7470A_1_1994	1
Mercury	EPA 7471B_(1/98)	1
1,2-Dibromo-3-chloropropane (DBCP)	EPA 8011-92	1
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 8011-92	1
Aroclor-1016 (PCB-1016)	EPA 8082A_(2/07)	1
Aroclor-1221 (PCB-1221)	EPA 8082A_(2/07)	1
Aroclor-1232 (PCB-1232)	EPA 8082A_(2/07)	1
Aroclor-1242 (PCB-1242)	EPA 8082A_(2/07)	1
Aroclor-1248 (PCB-1248)	EPA 8082A_(2/07)	1
Aroclor-1254 (PCB-1254)	EPA 8082A_(2/07)	1
Aroclor-1260 (PCB-1260)	EPA 8082A_(2/07)	1
Diesel range organics (DRO)	WDOE NWTPH-Dx_(1997)	1
Motor Oil	WDOE NWTPH-Dx_(1997)	1
1,1,1,2-Tetrachloroethane	EPA 8260D_4_(6/18)	1
1,1,1-Trichloroethane	EPA 8260D_4_(6/18)	1
1,1,2,2-Tetrachloroethane	EPA 8260D_4_(6/18)	1

Matrix/Analyte	Method	Notes
Solid and Chemical Materials		
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	EPA 8260D_4_(6/18)	1
1,1,2-Trichloroethane	EPA 8260D_4_(6/18)	1
1,1-Dichloroethane	EPA 8260D_4_(6/18)	1
1,1-Dichloroethylene	EPA 8260D_4_(6/18)	1
1,1-Dichloropropene	EPA 8260D_4_(6/18)	1
1,2,3-Trichlorobenzene	EPA 8260D_4_(6/18)	1
1,2,3-Trichloropropane	EPA 8260D_4_(6/18)	1
1,2,4-Trichlorobenzene	EPA 8260D_4_(6/18)	1
1,2,4-Trimethylbenzene	EPA 8260D_4_(6/18)	1
1,2-Dibromo-3-chloropropane (DBCP)	EPA 8260D_4_(6/18)	1
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 8260D_4_(6/18)	1
1,2-Dichlorobenzene	EPA 8260D_4_(6/18)	1
1,2-Dichloroethane (Ethylene dichloride)	EPA 8260D_4_(6/18)	1
1,2-Dichloropropane	EPA 8260D_4_(6/18)	1
1,3,5-Trimethylbenzene	EPA 8260D_4_(6/18)	1
1,3-Butadiene	EPA 8260D_4_(6/18)	1
1,3-Dichlorobenzene	EPA 8260D_4_(6/18)	1
1,3-Dichloropropane	EPA 8260D_4_(6/18)	1
1,4-Dichlorobenzene	EPA 8260D_4_(6/18)	1
2,2-Dichloropropane	EPA 8260D_4_(6/18)	1
2-Butanone (Methyl ethyl ketone, MEK)	EPA 8260D_4_(6/18)	1
2-Chlorotoluene	EPA 8260D_4_(6/18)	1
2-Hexanone	EPA 8260D_4_(6/18)	1
4-Chlorotoluene	EPA 8260D_4_(6/18)	1
4-Isopropyltoluene (p-Cymene)	EPA 8260D_4_(6/18)	1
4-Methyl-2-pentanone (MIBK)	EPA 8260D_4_(6/18)	1
Acetone	EPA 8260D_4_(6/18)	1
Allyl chloride (3-Chloropropene)	EPA 8260D_4_(6/18)	1
Benzene	EPA 8260D_4_(6/18)	1
Bromobenzene	EPA 8260D_4_(6/18)	1
Bromochloromethane	EPA 8260D_4_(6/18)	1
Bromodichloromethane	EPA 8260D_4_(6/18)	1
Bromoform	EPA 8260D_4_(6/18)	1
Carbon disulfide	EPA 8260D_4_(6/18)	1
Carbon tetrachloride	EPA 8260D_4_(6/18)	1
Chlorobenzene	EPA 8260D_4_(6/18)	1
Chlorodibromomethane	EPA 8260D_4_(6/18)	1

Matrix/Analyte	Method	Notes
Solid and Chemical Materials		
Chloroethane (Ethyl chloride)	EPA 8260D_4_(6/18)	1
Chloroform	EPA 8260D_4_(6/18)	1
cis-1,2-Dichloroethylene	EPA 8260D_4_(6/18)	1
cis-1,3-Dichloropropene	EPA 8260D_4_(6/18)	1
Cyclohexane	EPA 8260D_4_(6/18)	1
Dibromomethane	EPA 8260D_4_(6/18)	1
Dichlorodifluoromethane (Freon-12)	EPA 8260D_4_(6/18)	1
Dichlorofluoromethane (Freon 21)	EPA 8260D_4_(6/18)	1
Diethyl ether	EPA 8260D_4_(6/18)	1
Ethyl methacrylate	EPA 8260D_4_(6/18)	1
Ethylbenzene	EPA 8260D_4_(6/18)	1
Hexachlorobutadiene	EPA 8260D_4_(6/18)	1
Iodomethane (Methyl iodide)	EPA 8260D_4_(6/18)	1
Isobutyl alcohol (2-Methyl-1-propanol)	EPA 8260D_4_(6/18)	1
Isopropylbenzene	EPA 8260D_4_(6/18)	1
m+p-xylene	EPA 8260D_4_(6/18)	1
Methyl acetate	EPA 8260D_4_(6/18)	1
Methyl bromide (Bromomethane)	EPA 8260D_4_(6/18)	1
Methyl chloride (Chloromethane)	EPA 8260D_4_(6/18)	1
Methyl tert-butyl ether (MTBE)	EPA 8260D_4_(6/18)	1
Methylcyclohexane	EPA 8260D_4_(6/18)	1
Methylene chloride (Dichloromethane)	EPA 8260D_4_(6/18)	1
Naphthalene	EPA 8260D_4_(6/18)	1
n-Butylbenzene	EPA 8260D_4_(6/18)	1
n-Heptane	EPA 8260D_4_(6/18)	1
n-Hexane	EPA 8260D_4_(6/18)	1
n-Propylbenzene	EPA 8260D_4_(6/18)	1
o-Xylene	EPA 8260D_4_(6/18)	1
sec-Butylbenzene	EPA 8260D_4_(6/18)	1
Styrene	EPA 8260D_4_(6/18)	1
tert-Butyl alcohol	EPA 8260D_4_(6/18)	1
tert-Butylbenzene	EPA 8260D_4_(6/18)	1
Tetrachloroethylene (Perchloroethylene)	EPA 8260D_4_(6/18)	1
Tetrahydrofuran (THF)	EPA 8260D_4_(6/18)	1
Toluene	EPA 8260D_4_(6/18)	1
trans-1,2-Dichloroethylene	EPA 8260D_4_(6/18)	1
trans-1,3-Dichloropropylene	EPA 8260D_4_(6/18)	1

Matrix/Analyte	Method	Notes
Solid and Chemical Materials		
trans-1,4-Dichloro-2-butene	EPA 8260D_4_(6/18)	1
Trichloroethene (Trichloroethylene)	EPA 8260D_4_(6/18)	1
Trichlorofluoromethane (Freon 11)	EPA 8260D_4_(6/18)	1
Vinyl chloride	EPA 8260D_4_(6/18)	1
Xylene (total)	EPA 8260D_4_(6/18)	1
1-Methylnaphthalene	EPA 8270E_6_(6/18)	1
2-Methylnaphthalene	EPA 8270E_6_(6/18)	1
Acenaphthene	EPA 8270E_6_(6/18)	1
Acenaphthylene	EPA 8270E_6_(6/18)	1
Anthracene	EPA 8270E_6_(6/18)	1
Benzo(a)anthracene	EPA 8270E_6_(6/18)	1
Benzo(a)pyrene	EPA 8270E_6_(6/18)	1
Benzo(g,h,i)perylene	EPA 8270E_6_(6/18)	1
Benzo(k)fluoranthene	EPA 8270E_6_(6/18)	1
Benzo[b]fluoranthene	EPA 8270E_6_(6/18)	1
Chrysene	EPA 8270E_6_(6/18)	1
Dibenz(a,h) anthracene	EPA 8270E_6_(6/18)	1
Fluoranthene	EPA 8270E_6_(6/18)	1
Fluorene	EPA 8270E_6_(6/18)	1
Indeno(1,2,3-cd) pyrene	EPA 8270E_6_(6/18)	1
Naphthalene	EPA 8270E_6_(6/18)	1
Phenanthrene	EPA 8270E_6_(6/18)	1
Pyrene	EPA 8270E_6_(6/18)	1
Gasoline range organics (GRO)	WDOE NWTPH-Gx_(1997)	1

Accredited Parameter Note Detail

(1) Accreditation based in part on recognition of the Lab ORELAP accreditation.(2) Provisional accreditation pending submittal of acceptable Proficiency Testing (PT) results (WAC 173-50-110). (4) Provisional accreditation pending submittal of acceptable corrective action report.

Rebecca Wood | 01/08/2025

Authentication Signature | Date

Rebecca Wood, Lab Accreditation Unit Supervisor

The State of Washington
Department of Ecology

LabTest
Yakima, WA

has complied with provisions set forth in Chapter 173-50 WAC and is hereby recognized by the Department of Ecology as an ACCREDITED LABORATORY for the analytical parameters listed on the accompanying Scope of Accreditation. This certificate is effective July 14, 2022 and shall expire July 13, 2023.

Witnessed under my hand on August 2, 2022

Rebecca Wood
Lab Accreditation Unit Supervisor

Laboratory ID
C1008

WASHINGTON STATE DEPARTMENT OF ECOLOGY

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM

SCOPE OF ACCREDITATION

LabTest

Yakima, WA

is accredited for the analytes listed below using the methods indicated. Full accreditation is granted unless stated otherwise in a note. EPA is the U.S. Environmental Protection Agency. SM is "Standard Methods for the Examination of Water and Wastewater." SM refers to EPA approved method versions. ASTM is the American Society for Testing and Materials. USGS is the U.S. Geological Survey. AOAC is the Association of Official Analytical Chemists. Other references are described in notes.

Matrix/Analyte	Method	Notes
Drinking Water		
Sulfate	ASTM D516-90	
pH	EPA 150.1_1982	1
Turbidity	EPA 180.1_2_1993	
Cyanide, Total	EPA 335.4_1_1993	
Nitrate	EPA 353.2_2_1993	
Nitrite	EPA 353.2_2_1993	1
Color	SM 2120 B-2011	
Hardness (calc.)	SM 2340 B-2011	
Specific Conductance	SM 2510 B-2011	
Chloride	SM 4500-Cl¯ E-2011	
Thallium	EPA 200.9 Rev 2.2 (1994)	2,3
Calcium	SM 3111 B-2011	2,3
Iron	SM 3111 B-2011	2,3
Magnesium	SM 3111 B-2011	2,3
Sodium	SM 3111 B-2011	2,3
Zinc	SM 3111 B-2011	2,3
Antimony	SM 3113 B-2010	
Arsenic	SM 3113 B-2010	
Barium	SM 3113 B-2010	
Beryllium	SM 3113 B-2010	
Cadmium	SM 3113 B-2010	
Chromium	SM 3113 B-2010	
Copper	SM 3113 B-2010	
Lead	SM 3113 B-2010	
Manganese	SM 3113 B-2010	
Nickel	SM 3113 B-2010	

Matrix/Analyte	Method	Notes
Drinking Water		
Selenium	SM 3113 B-2010	2,3
Silver	SM 3113 B-2010	
Fecal coliform-count	SM 9222 D (mFC)-06	
Total coli/E.coli - detect	SM 9223 B Colilert® 24 (PA)	
Non-Potable Water		
Sulfate	ASTM D516-90	
Turbidity	EPA 180.1_2_1993	
Cyanide, Total	EPA 335.4_1_1993	
Ammonia	EPA 350.1_2_1993	1
Nitrate	EPA 353.2_2_1993	
Nitrate + Nitrite	EPA 353.2_2_1993	
Nitrite	EPA 353.2_2_1993	1
Specific Conductance	SM 2510 B-2011	1
Chloride	SM 4500-Cl¯ E-2011	
Biochemical Oxygen Demand (BOD)	SM 5210 B-2011	
Thallium	EPA 200.9 Rev 2.2 (1994)	2
Calcium	SM 3111 B-2011	2
Iron	SM 3111 B-2011	2
Magnesium	SM 3111 B-2011	2
Sodium	SM 3111 B-2011	2
Zinc	SM 3111 B-2011	2
Antimony	SM 3113 B-2010	
Arsenic	SM 3113 B-2010	
Barium	SM 3113 B-2010	
Beryllium	SM 3113 B-2010	
Cadmium	SM 3113 B-2010	
Chromium	SM 3113 B-2010	
Copper	SM 3113 B-2010	
Lead	SM 3113 B-2010	
Manganese	SM 3113 B-2010	
Nickel	SM 3113 B-2010	
Selenium	SM 3113 B-2010	2
Silver	SM 3113 B-2010	
Fecal coliform-count	SM 9222 D (mFC)-06	

Matrix/Analyte	Method	Notes

Accredited Parameter Note Detail

(1) Provisional accreditation pending submittal of acceptable Proficiency Testing (PT) results (WAC 173-50-110).(2) Provisional status pending the submission of an acceptable corrective action plan in response to the 2019 audit findings (3) Provisional status for Drinking Water Parameters must be resolved within 90 days of the scope effective date.

08/02/2022

Authentication Signature
Rebecca Wood, Lab Accreditation Unit Supervisor

Date

Appendix C. Aspect Field Data Sheets

Chain of Custody Record

Anatek Labs, Inc.
1282 Alturas Drive, Moscow ID 83843 (208) 883-2839
504 E Sprague Ste D, Spokane WA 99202 (509) 838-3999

Company Name:	Project Manager:
Address:	Project Name & # :
City: State: Zip:	Purchase Order #:
Phone:	Sampler Name & Phone:
Email Address(es):	

Turn Around Time & Reporting

Please refer to our normal turn around times at www.anateklabs.com/pricing-lists

__Normal
__Next Day*
__2nd Day*
__Other*________

__Phone
__Email

*All rush order requests must have prior approval

List Analyses Requested

Lab ID	Sample Identification	Sampling Date/Time	Matrix	# of Containers	Sample Volume										
				Preservative:											

Note Special Instructions/Comments

Inspection Checklist

Received Intact?	Y	N
Labels & Chains Agree?	Y	N
Containers Sealed?	Y	N
No VOC Head Space?	Y	N
Cooler?	Y	N
Ice/Ice Packs Present?	Y	N

Temperature (°C):________________________
Number of Containers:____________________
Shipped Via:____________________________
Preservative:____________________________
____
Date & Time:____________________________
Inspected By:___________________________

	Printed Name	Signature	Company	Date	Time
Relinquished by					
Received by					
Relinquished by					
Received by					
Relinquished by					
Received by					

Samples submitted to Anatek Labs may be subcontacted to other accredited labs if necessary. This message serves as notice of this possibility. Subcontracted analyses will be clearly noted on the analytical report.

DAILY REPORT

350 Madison Avenue North
Bainbridge Island, Washington 98110
(206) 780-9370

710 Second Avenue, Suite 550
Seattle, Washington 98104
(206) 328-7443

DATE:	PROJECT NO.	WEATHER:
PROJECT NAME:	CLIENT:	
EQUIPMENT USED:	PROJECT LOCATION:	

THE FOLLOWING WAS NOTED:

COPIES TO:	Aspect Consulting PROJECT MANAGER:
	Page 1 of 1 FIELD REP.:

Aspect CONSULTING

Sample number ______________________

GROUNDWATER SAMPLING RECORD

WELL NUMBER: _______ **Page:**____ **of** ____

Project Name: ______________________
Project Number: ______________________
Date: ______________________
Starting Water Level (ft TOC): ______________________
Sampled by: ______________________
Casing Stickup (ft): ______________________
Measuring Point of Well: TOC
Total Depth (ft TOC): ______________________
Screened Interval (ft. TOC) ______________________
Casing Diameter (inches): ______________________
Filter Pack Interval (ft. TOC) ______________________

Casing Volume ___________ (ft Water) x ___________ (Lpfv)(gpf) = ___________ (L)(gal)

Casing volumes: 3/4"= 0.02 gpf 2" = 0.16 gpf 4" = 0.65 gpf 6" = 1.47 gpf
3/4"= 0.09 Lpf 2" = 0.62 Lpf 4" = 2.46 Lpf 6" = 5.56 Lpf

Sample Intake Depth (ft TOC): ___________

PURGING MEASUREMENTS

Criteria:		Typical 0.1-0.5 Lpm	Stable	na	± 3%	± 10%	± 0.1	± 10 mV	± 10%	
Time	Cumul. Volume (gal or L)	Purge Rate (gpm or Lpm)	Water Level (ft)	Temp. (°C)	Specific Conductance (µS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mv)	Turbidity (NTU)	Comments

Total Gallons Purged: ______________________
Total Casing Volumes Removed: ______________

Ending Water Level (ft TOC): ______________________
Ending Total Depth (ft TOC): ______________

SAMPLE INVENTORY

Time	Volume	Bottle Type	Quantity	Filtration	Preservation	Appearance		Remarks
						Color	Turbidity & Sediment	

METHODS

Parameters measured with (instrument model & serial number): ______________________

Purging Equipment: ______________________ Decon Equipment: ______________________

Disposal of Discharged Water: ______________________

Observations/Comments: ______________________

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Appendix D. Glossaries, Acronyms, and Abbreviations

Glossary of General Terms

Ambient: Background or away from point sources of contamination. Surrounding environmental condition.

Conductivity: A measure of water's ability to conduct an electrical current. Conductivity is related to the concentration and charge of dissolved ions in water.

Dissolved oxygen (DO): A measure of the amount of oxygen dissolved in water.

Fecal coliform (FC): That portion of the coliform group of bacteria which is present in intestinal tracts and feces of warm-blooded animals as detected by the product of acid or gas from lactose in a suitable culture medium within 24 hours at 44.5 plus or minus 0.2 degrees Celsius. Fecal coliform bacteria are "indicator" organisms that suggest the possible presence of disease-causing organisms. Concentrations are measured in colony forming units per 100 milliliters of water (cfu/100 mL).

Margin of safety: Required component of TMDLs that accounts for uncertainty about the relationship between pollutant loads and quality of the receiving water body.

pH: A measure of the acidity or alkalinity of water. A low pH value (0 to 7) indicates that an acidic condition is present, while a high pH (7 to 14) indicates a basic or alkaline condition. A pH of 7 is considered to be neutral. Since the pH scale is logarithmic, a water sample with a pH of 8 is ten times more basic than one with a pH of 7.

Sediment: Soil and organic matter that is covered with water (for example, river or lake bottom).

Streamflow: Discharge of water in a surface stream (river or creek).

Total suspended solids (TSS): Portion of solids retained by a filter.

Turbidity: A measure of water clarity. High levels of turbidity can have a negative impact on aquatic life.

Watershed: A drainage area or basin in which all land and water areas drain or flow toward a central collector such as a stream, river, or lake at a lower elevation.

Acronyms and Abbreviations

DO	Dissolved oxygen
DOC	Dissolved organic carbon
e.g.	For example
Ecology	Washington State Department of Ecology
EIM	Environmental Information Management database
EPA	U.S. Environmental Protection Agency
et al.	And others
FC	Fecal coliform
FS	Feasibility Study
GPS	Global Positioning System
i.e.	In other words
MQO	Measurement quality objective
NPDES	National Pollutant Discharge Elimination System
PBDE	Polybrominated diphenyl ethers
QA	Quality assurance
QC	Quality control
RPD	Relative percent difference
RSD	Relative standard deviation
SOP	Standard operating procedures
SRM	Standard reference materials
TOC	Total organic carbon
TSS	Total suspended solids
USFS	United States Forest Service
USGS	United States Geological Survey
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WQA	Water Quality Assessment
WRIA	Water Resource Inventory Area

Units of Measurement

°C	degrees centigrade
cfs	cubic feet per second
cfu	colony forming units
cms	cubic meters per second, a unit of flow
dw	dry weight
ft	feet
g	gram, a unit of mass
kcfs	1000 cubic feet per second
kg	kilograms, a unit of mass equal to 1,000 grams
kg/d	kilograms per day
km	kilometer, a unit of length equal to 1,000 meters
L/s	liters per second (0.03531 cubic foot per second)
m	meter
mm	millimeter
mg	milligram
mgd	million gallons per day
mg/d	milligrams per day
mg/kg	milligrams per kilogram (parts per million)
mg/L	milligrams per liter (parts per million)
mg/L/hr	milligrams per liter per hour
mL	milliliter
mmol	millimole or one-thousandth of a mole
mole	an International System of Units (IS) unit of matter
ng/g	nanograms per gram (parts per billion)
ng/kg	nanograms per kilogram (parts per trillion)
ng/L	nanograms per liter (parts per trillion)
NTU	nephelometric turbidity units
pg/g	picograms per gram (parts per trillion)
pg/L	picograms per liter (parts per quadrillion)

psu	practical salinity units
s.u.	standard units
µg/g	micrograms per gram (parts per million)
µg/kg	micrograms per kilogram (parts per billion)
µg/L	micrograms per liter (parts per billion)
µm	micrometer
µM	micromolar (a chemistry unit)
µmhos/cm	micromhos per centimeter
µS/cm	microsiemens per centimeter, a unit of conductivity
ww	wet weight

Quality Assurance Glossary

Accreditation: A certification process for laboratories, designed to evaluate and document a lab's ability to perform analytical methods and produce acceptable data (Kammin, 2010). For Ecology, it is defined according to WAC 173-50-040: "Formal recognition by [Ecology] that an environmental laboratory is capable of producing accurate and defensible analytical data."

Accuracy: The degree to which a measured value agrees with the true value of the measured property. USEPA recommends that this term not be used, and that the terms *precision* and *bias* be used to convey the information associated with the term *accuracy* (USEPA, 2014).

Analyte: An element, ion, compound, or chemical moiety (pH, alkalinity) which is to be determined. The definition can be expanded to include organisms, e.g., fecal coliform, Klebsiella (Kammin, 2010).

Bias: Discrepancy between the expected value of an estimator and the population parameter being estimated (Gilbert, 1987; USEPA, 2014).

Blank: A synthetic sample, free of the analyte(s) of interest. For example, in water analysis, pure water is used for the blank. In chemical analysis, a blank is used to estimate the analytical response to all factors other than the analyte in the sample. In general, blanks are used to assess possible contamination or inadvertent introduction of analyte during various stages of the sampling and analytical process (USGS, 1998).

Calibration: The process of establishing the relationship between the response of a measurement system and the concentration of the parameter being measured (Ecology, 2004).

Check standard: A substance or reference material obtained from a source independent from the source of the calibration standard; used to assess bias for an analytical method. This is an obsolete term, and its use is highly discouraged. See Calibration Verification Standards, Lab

Control Samples (LCS), Certified Reference Materials (CRM), and/or spiked blanks. These are all check standards but should be referred to by their actual designator, e.g., CRM, LCS (Kammin, 2010; Ecology, 2004).

Comparability: The degree to which different methods, data sets and/or decisions agree or can be represented as similar; a data quality indicator (USEPA, 2014; USEPA, 2020).

Completeness: The amount of valid data obtained from a project compared to the planned amount. Usually expressed as a percentage. A data quality indicator (USEPA, 2014; USEPA 2020).

Continuing Calibration Verification Standard (CCV): A quality control (QC) sample analyzed with samples to check for acceptable bias in the measurement system. The CCV is usually a midpoint calibration standard that is re-run at an established frequency during the course of an analytical run (Kammin, 2010).

Control chart: A graphical representation of quality control results demonstrating the performance of an aspect of a measurement system (Kammin, 2010; Ecology 2004).

Control limits: Statistical warning and action limits calculated based on control charts. Warning limits are generally set at +/- 2 standard deviations from the mean, action limits at +/- 3 standard deviations from the mean (Kammin, 2010).

Data integrity: A qualitative DQI that evaluates the extent to which a data set contains data that is misrepresented, falsified, or deliberately misleading (Kammin, 2010).

Data quality indicators (DQI): Commonly used measures of acceptability for environmental data. The principal DQIs are precision, bias, representativeness, comparability, completeness, sensitivity, and integrity (USEPA, 2006).

Data quality objectives (DQO): Qualitative and quantitative statements derived from systematic planning processes that clarify study objectives, define the appropriate type of data, and specify tolerable levels of potential decision errors that will be used as the basis for establishing the quality and quantity of data needed to support decisions (USEPA, 2006).

Data set: A grouping of samples organized by date, time, analyte, etc. (Kammin, 2010).

Data validation: The process of determining that the data satisfy the requirements as defined by the data user (USEPA, 2020). There are various levels of data validation (USEPA, 2009).

Data verification: Examination of a data set for errors or omissions, and assessment of the Data Quality Indicators related to that data set for compliance with acceptance criteria (MQOs). Verification is a detailed quality review of a data set (Ecology, 2004).

Detection limit (limit of detection)**:** The concentration or amount of an analyte which can be determined to a specified level of certainty to be greater than zero (Ecology, 2004).

Duplicate samples: Two samples taken from and representative of the same population, and carried through and steps of the sampling and analytical procedures in an identical manner. Duplicate samples are used to assess variability of all method activities including sampling and analysis (USEPA, 2014).

Field blank: A blank used to obtain information on contamination introduced during sample collection, storage, and transport (Ecology, 2004).

Initial Calibration Verification Standard (ICV): A QC sample prepared independently of calibration standards and analyzed along with the samples to check for acceptable bias in the measurement system. The ICV is analyzed prior to the analysis of any samples (Kammin, 2010).

Laboratory Control Sample (LCS)/LCS duplicate: A sample of known composition prepared using contaminant-free water or an inert solid that is spiked with analytes of interest at the midpoint of the calibration curve or at the level of concern. It is prepared and analyzed in the same batch of regular samples using the same sample preparation method, reagents, and analytical methods employed for regular samples. Monitors a lab's performance for bias and precision (USEPA, 2014).

Matrix spike/Matrix spike duplicate: A QC sample prepared by adding a known amount of the target analyte(s) to an aliquot of a sample to check for bias and precision errors due to interference or matrix effects (Ecology, 2004).

Measurement Quality Objectives (MQOs)**:** Performance or acceptance criteria for individual data quality indicators, usually including precision, bias, sensitivity, completeness, comparability, and representativeness (USEPA, 2006).

Measurement result: A value obtained by performing the procedure described in a method (Ecology, 2004).

Method: A formalized group of procedures and techniques for performing an activity (e.g., sampling, chemical analysis, data analysis), systematically presented in the order in which they are to be executed (USEPA, 2001).

Method blank: A blank prepared to represent the sample matrix, prepared and analyzed with a batch of samples. A method blank will contain all reagents used in the preparation of a sample, and the same preparation process is used for the method blank and samples (Ecology, 2004; Kammin, 2010).

Method Detection Limit (MDL): The minimum measured concentration of a substance that can be reported with 99% confidence that the measured concentration is distinguishable from method blank results (USEPA, 2016). MDL is a measure of the capability of an analytical method of distinguished samples that do not contain a specific analyte from a sample that contains a low concentration of the analyte (USEPA, 2020).

Minimum level: Either the sample concentration equivalent to the lowest calibration point in a method or a multiple of the method detection limit (MDL), whichever is higher. For the purposes of NPDES compliance monitoring, EPA considers the following terms to be synonymous: "quantitation limit," "reporting limit," and "minimum level" (40 CFR 136).

Parameter: A specified characteristic of a population or sample. Also, an analyte or grouping of analytes. Benzene and nitrate + nitrite are all parameters (Kammin, 2010; Ecology, 2004).

Population: The hypothetical set of all possible observations of the type being investigated (Ecology, 2004).

Precision: The extent of random variability among replicate measurements of the same property; a data quality indicator (USGS, 1998).

Quality assurance (QA): A set of activities designed to establish and document the reliability and usability of measurement data (Kammin, 2010).

Quality Assurance Project Plan (QAPP): A document that describes the objectives of a project, and the processes and activities necessary to develop data that will support those objectives (Kammin, 2010; Ecology, 2004).

Quality control (QC): The routine application of measurement and statistical procedures to assess the accuracy of measurement data (Ecology, 2004).

Relative Percent Difference (RPD): RPD is commonly used to evaluate precision. The following formula is used:

$$RPD = [Abs(a-b)/((a + b)/2)] * 100\%$$

where "Abs()" is absolute value and a and b are results for the two replicate samples. RPD can be used only with 2 values. Percent Relative Standard Deviation is (%RSD) is used if there are results for more than 2 replicate samples (Ecology, 2004).

Relative Standard Deviation (RSD): A statistic used to evaluate precision in environmental analysis. It is determined in the following manner:

$$RSD = (100\% * s)/x$$

where s is the sample standard deviation and x is the mean of results from more than two replicate samples (Kammin, 2010).

Replicate samples: Two or more samples taken from the environment at the same time and place, using the same protocols. Replicates are used to estimate the random variability of the material sampled (USGS, 1998).

Reporting level: Unless specified otherwise by a regulatory authority or in a discharge permit, results for analytes that meet the identification criteria (i.e., rules for determining qualitative presence/absence of an analyte) are reported down to the concentration of the minimum level established by the laboratory through calibration of the instrument. EPA considers the terms "reporting limit," "quantitation limit," and "minimum level" to be synonymous (40 CFR 136).

Representativeness: The degree to which a sample reflects the population from which it is taken; a data quality indicator (USGS, 1998).

Sample (field): A portion of a population (environmental entity) that is measured and assumed to represent the entire population (USGS, 1998).

Sample (statistical): A finite part or subset of a statistical population (USEPA, 1992).

Sensitivity: In general, denotes the rate at which the analytical response (e.g., absorbance, volume, meter reading) varies with the concentration of the parameter being determined. In a specialized sense, it has the same meaning as the detection limit (Ecology, 2004).

Spiked blank: A specified amount of reagent blank fortified with a known mass of the target analyte(s); usually used to assess the recovery efficiency of the method (USEPA, 2014).

Spiked sample: A sample prepared by adding a known mass of target analyte(s) to a specified amount of matrix sample for which an independent estimate of target analyte(s) concentration is available. Spiked samples can be used to determine the effect of the matrix on a method's recovery efficiency (USEPA, 2014).

Split sample: A discrete sample subdivided into portions, usually duplicates (Kammin, 2010).

Standard Operating Procedure (SOP): A document which describes in detail a reproducible and repeatable organized activity (Kammin, 2010).

Surrogate: For environmental chemistry, a surrogate is a substance with properties similar to those of the target analyte(s). Surrogates are unlikely to be native to environmental samples. They are added to environmental samples for quality control purposes, to track extraction efficiency and/or measure analyte recovery. Deuterated organic compounds are examples of surrogates commonly used in organic compound analysis (Kammin, 2010).

Systematic planning: A step-wise process which develops a clear description of the goals and objectives of a project, and produces decisions on the type, quantity, and quality of data that will be needed to meet those goals and objectives. The DQO process is a specialized type of systematic planning (USEPA, 2006).

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