



Southwest Regional Office Addendum to Quality Assurance Project Plan Appendix A3

Nonpoint Pollution Investigations in Western WA Lower Cowlitz River Verification Study

By

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For the

Water Quality Program

Washington State Department of Ecology
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This is an addition to an original Quality Assurance Project Plan (QAPP). It is not a correction (erratum) to the original plan.

Data for this project is available in Ecology's [EIM Database](#), Study ID: LCRT_WQP

Original Quality Assurance Project Plan:

Ultican, S., J. Riedmayer, and M. Gleason. 2021. Quality Assurance Project Plan: Nonpoint Pollution Investigations in Western Washington. Publication 21-10-027. Washington State Department of Ecology, Olympia.

<https://fortress.wa.gov/ecy/publications/SummaryPages/2110027.html>

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Central Region
509-575-2490

Eastern Region
509-329-3400

Region	Counties served	Mailing Address	Phone
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Northwest	Island, King, Kitsap, San Juan, Skagit, Snohomish, Whatcom	P.O. Box 330316 Shoreline, WA 98133	206-594-0000
Central	Benton, Chelan, Douglas, Kittitas, Klickitat, Okanogan, Yakima	1250 West Alder Street Union Gap, WA 98903	509-575-2490
Eastern	Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Spokane, Stevens, Walla Walla, Whitman	4601 North Monroe Spokane, WA 99205	509-329-3400
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DEPARTMENT OF
ECOLOGY
State of Washington

Approved by:

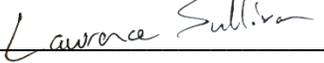
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Introduction and Problem Statement

The Cowlitz River is a major tributary to the lower Columbia River. At the confluence of these two rivers, the Columbia has an [existing Total Maximum Daily Load¹](#) (TMDL) for temperature and is listed for bacteria in Category 5 (water bodies not meeting water quality standards) of assessed waters in Washington State. Land use practices in the lower portion of the Cowlitz watershed are primarily agricultural, rural residential, and forestry. There is limited water quality data from this river and its tributaries, aside from a long-term monitoring station located near the mouth of the Cowlitz River. In the handful of locations where there is sufficient data for assessment, water quality standards for temperature and bacteria are frequently not met. Many of the tributaries to the Cowlitz River provide important salmon habitat and support recreation and tribal resources in this watershed. The [WA Lower Columbia Salmon Recovery² and Fish & Wildlife Subbasin Plans³](#) for the Lower Cowlitz and Coweeman River identifies several [priority reaches⁴](#) where salmon populations are most impacted by water quality impairments (LCFRB, 2010). This ambient monitoring will focus on several of these priority areas draining into the Cowlitz River in order to characterize water quality conditions. Parameters will include bacteria (*E. coli*), temperature, dissolved oxygen, pH, turbidity, and conductivity. The data from this study will be used to identify impaired waters currently lacking data, help Ecology nonpoint staff prioritize efforts in the area, and provide a basis for future water quality restoration work.

Study Area and Surroundings

The Cowlitz River is located in Southwest Washington, draining 2,586 square miles of the western slopes of the Cascades, including portions of Mount Rainier, Mount Adams, and Mount St Helens. The Cowlitz River discharges to the Columbia River in Longview, WA. The average daily discharge of the river is 9,122 cubic feet per second (USGS, 2005). There are three major dams on the river, with the Cowlitz Falls Project being the furthest upstream, then the Mossyrock Dam, and the Mayfield Dam being the furthest downstream of the three.

¹ <https://www.epa.gov/columbiariver/tmdl-temperature-columbia-and-lower-snake-rivers>

² <https://www.lcfrb.gen.wa.us/librarysalmonrecovery>

³ <https://www.lcfrb.gen.wa.us/librarysalmonrecovery>

⁴ <https://www.lowercolumbiasalmonrecovery.org/mappage#b>

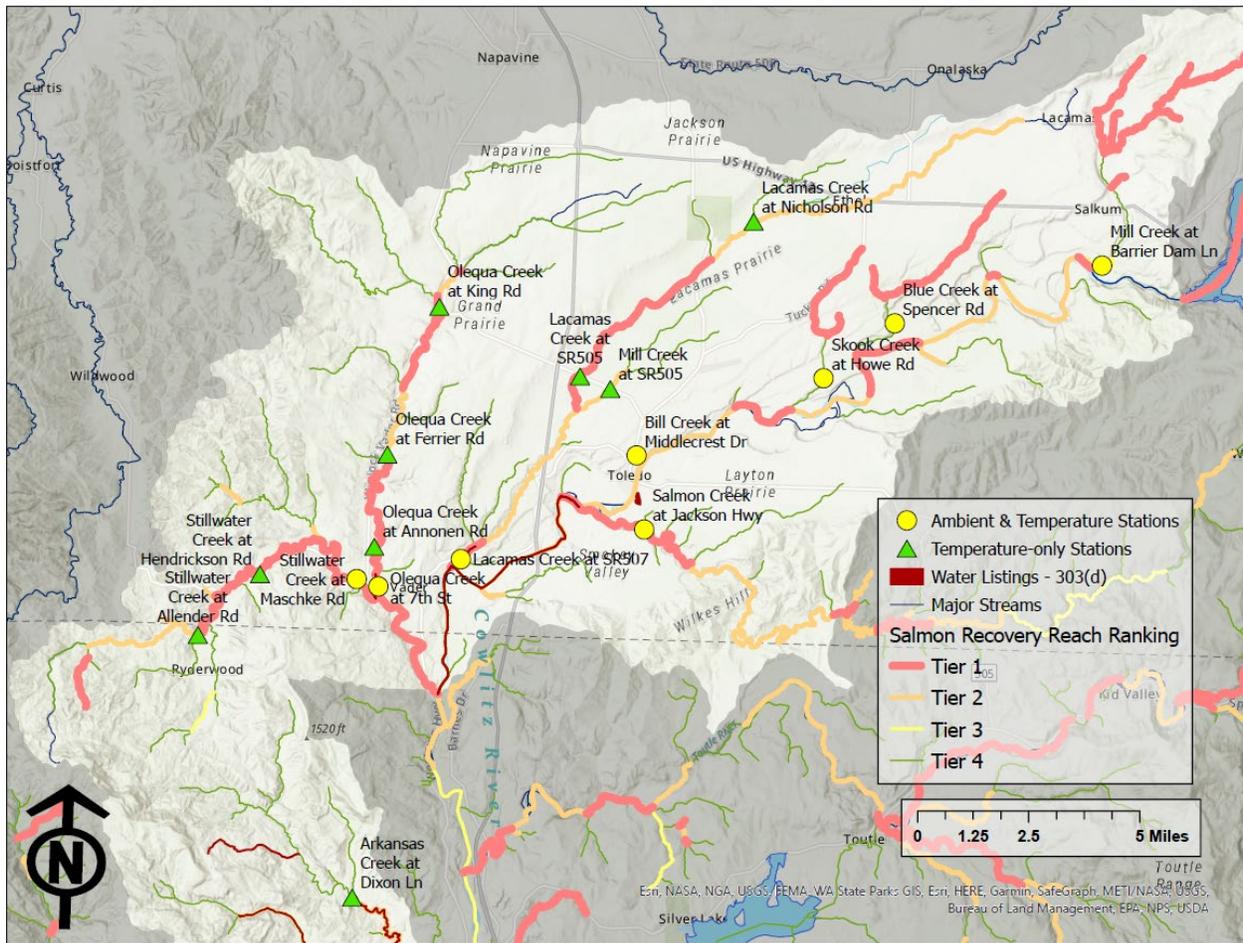


Figure 1. Monitoring locations in the northern portion of the study area.

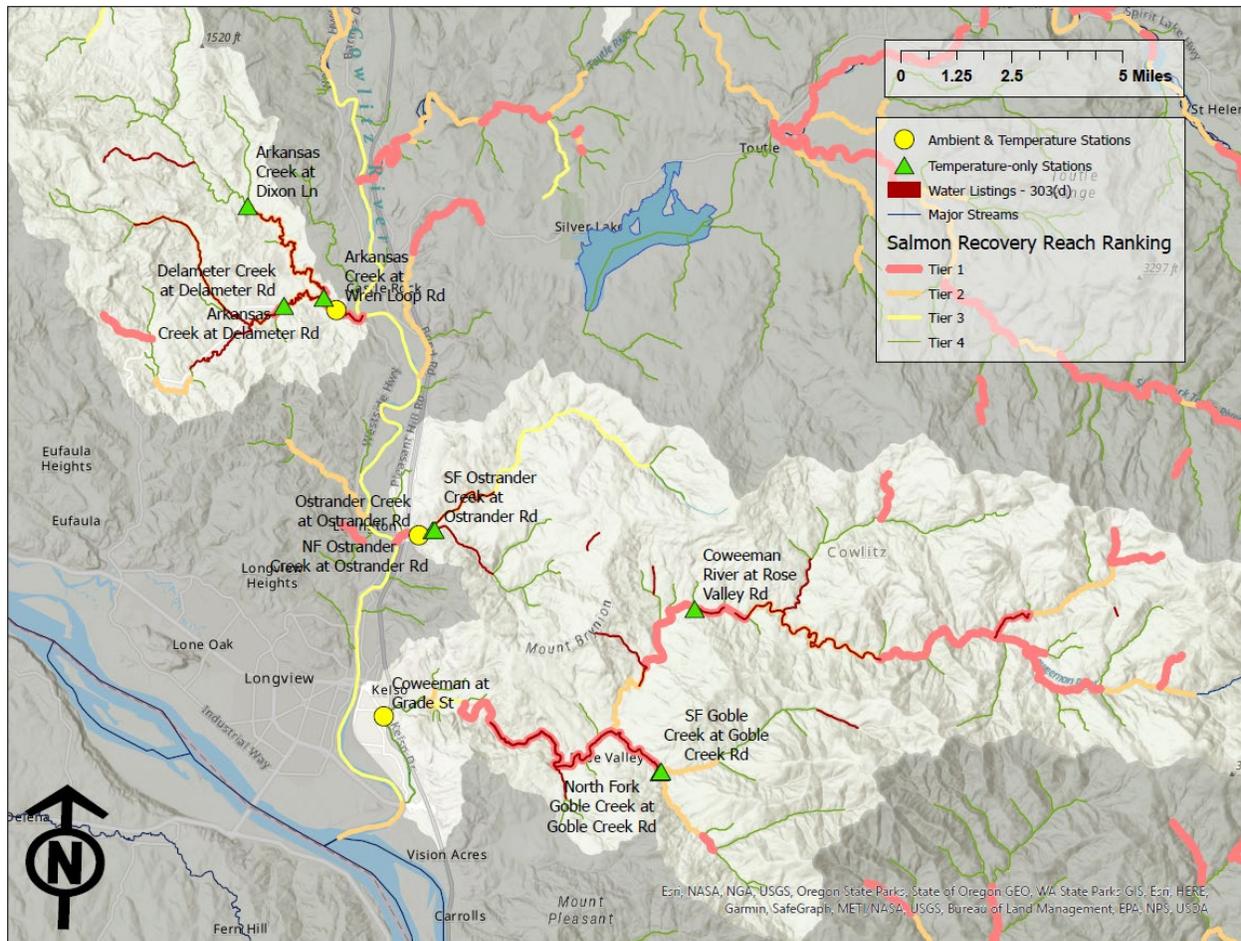


Figure 2. Monitoring locations in the southern portion of the study area.

The area targeted for this study is the lower portion of the Cowlitz watershed, starting just downstream of the Mayfield Dam, and extending down near the confluence with the Columbia River. This study will focus on priority tributaries selected based on likelihood of water quality impairments due to land use practices, as well as importance for salmon habitat and recovery, in accordance with the [WA Lower Columbia Salmon Recovery and Fish & Wildlife Subbasin Plan⁵](https://www.lcfrb.gen.wa.us/librarysalmonrecovery) for the Lower Cowlitz and Coweeman River. This plan outlines priority reaches in the study area, ranking them in tiers 1-4, with tier 1 having the greatest priority for restoration and/or protection (Figures 1 & 2). This includes:

- Coweeman River
- NF & SF Goble Creek
- Ostrander Creek
- Arkansas Creek
- Delameter Creek
- Olequa Creek
- Stillwater Creek
- Lacamas Creek
- Bill Creek
- Skook Creek
- Blue Creek
- Mill Creek

⁵ <https://www.lcfrb.gen.wa.us/librarysalmonrecovery>

Summary of Previous Studies and Existing Data

There is an existing long-term monitoring station located on the Cowlitz River mainstem in Kelso, WA. Bacteria and temperature are monitored at this location, along with a suite of other parameters monitored in the Statewide River and Stream Ambient Monitoring project. The 2018 Washington State Water Quality Assessment found this site [met standards for bacteria](#)⁶ and identified a [Category 5 listing for temperature](#)⁷.

There is limited data on tributaries to the lower Cowlitz River. Previous studies for these streams are listed below. Table 1 outlines existing listings on tributaries to the Cowlitz River in the project area from the 2018 water quality assessment.

Statewide river and stream ambient monitoring

The purpose of [this ongoing study](#)⁸ conducted by the Washington State Department of Ecology (ECY) is to “collect long-term water quality data from a state-wide network of stations. Thirteen conventional constituents are measured monthly at 82 stations...”. This work was responsible for all the existing data used for assessment on Lacamas and Olequa Creeks, as well as some on the Coweeman River.

Extensive riparian status and trends

From 2007-2010, [this study](#)⁹ conducted by ECY collected continuous temperature data on streams throughout Washington state that were located on lands managed under the current Forest Practices Rules. The purpose of the study was to aid in the evaluation of forest management prescriptions. Within the study area, this project was limited to the Coweeman River.

Local involvement in resources issues

From 2002-2006, [this study](#)¹⁰ conducted by the Cowlitz Conservation District involved monitoring for summer water temperatures and dissolved oxygen in numerous streams within WRIA’s 25 & 26. Within the study area, this project was limited to Arkansas, Delameter, and Ostrander creeks.

⁶ <https://apps.ecology.wa.gov/approvedwqa/approvedpages/viewapprovedlisting.aspx?ListingId=16769>

⁷ <https://apps.ecology.wa.gov/approvedwqa/approvedpages/viewapprovedlisting.aspx?ListingId=6586>

⁸ <http://ecyeim/search/Detail/Detail.aspx?DetailType=Study&SystemProjectId=17990621>

⁹ <https://apps.ecology.wa.gov/eim/search/Detail/Detail.aspx?DetailType=Study&SystemProjectId=4515396>

¹⁰ <https://apps.ecology.wa.gov/eim/search/Detail/Detail.aspx?DetailType=Study&SystemProjectId=194952>

Table 1. Current listings in the project area.

Waterbody	EIM Location ID(s)	EIM Study ID(s)	Category 5 Listing(s)	Category 2 Listing(s)	Category 1 Listing(s)	Sample Year(s)
Lacamas Creek	26G050	AMS001	Bacteria: 88237	Temperature: 93901		2013
Olequa Creek	26F050	AMS001 ; AMS004	Bacteria: 45910 Temperature: 72850	Dissolved Oxygen: 47763		2007
Delameter/Arkansas Creek	Ar-01 ; Ar-02 ; Ar-03 ; DI-01 ; DI-02 ; DI-03	G010003 8	Temperature: 34977 ; 34976 ; 35173 ; 34981 ; 72834 ; 48250 ; 35252 ; 34953 ; 72825	Temperature: 34952		2002-2006
Ostrander Creek	OS-01 ; OS-02	G010003 8	Temperature: 34980 ; 34975 ; 72823 ; 72843	-	Temperature: 72829	2002-2005
Coweeman River	26C073 ; CW-01 ; CW-02 ; CW-03 CW-07 ; CW-08 ; CW-09 ; ERST_WF0001 ODW ; ERST_WF0001 01UW	G010003 8; AMS001 ; WEHI000 2	Bacteria: 88447 ; Temperature: 34973 ; 48697 ; 7795 ; 34974 ; 34978 ; 48705 ; 48690 ; 7797 ; 72833 ; 34979 ; 48706 ; 48707 ; 7802 ; 7790 ; 72844	Temperature: 72839	Bacteria: 16768 ; 16767	1961-2014

Within the study area, there are four sites with bacteria data (fecal coliform): Lacamas Creek at Highway 506; Olequa Creek at 7th Street in Vader, WA; Coweeman River at 3802 Allen Street; and Cowlitz River at Toledo, WA. The latter of these only has this data as recent as 1992. The other three sites have bacteria data from 2012-2013, 2006-2007, and 2009-2010, respectively.

Temperature data has greater coverage than bacteria data, though it is still limited in most of these tributaries. Lacamas Creek has two assessed segments for temperature: one in Category 5 and one in Category 2. Olequa Creek has one assessed unit listed in Category 5. Ostrander Creek has four in Category 5 and one in Category 1. The Delameter/Arkansas Creek watershed was part of a more thorough temperature investigation from 2002-2006; there are ten assessed units here, nine of which are category 5 with one in category 2.

The Olequa Creek site is also on the 303(d) list for temperature. The Lacamas Creek site is listed in Category 2 and lacks continuous temperature data for calculating 7-day average daily maximum (7DADmax).

There are no additional assessed stream segments in tributaries to the Cowlitz River between Olequa Creek and Mayfield Lake.

Parameters of Interest and Potential Sources

The parameters of interest for this study include bacteria (*E. coli*), temperature, and dissolved oxygen. Additional conventional measurements (turbidity, conductivity, and pH) will be collected during ambient sampling. The study area contains extensive agriculture (in Figure 3 below, note the prevalence of land cover categorized “Pasture/Hay”). This land use can be associated with bacteriological nonpoint pollution due to livestock combined with degraded or nonexistent riparian buffers. A lack of riparian buffers which provide shade can also increase temperatures, and increased temperatures can reduce dissolved oxygen. Some continuous temperature stations will be located downstream of forest land, which is managed under the current Forest Practice Rules. Some of these areas downstream of forest land have existing Category 5 listings for temperature.

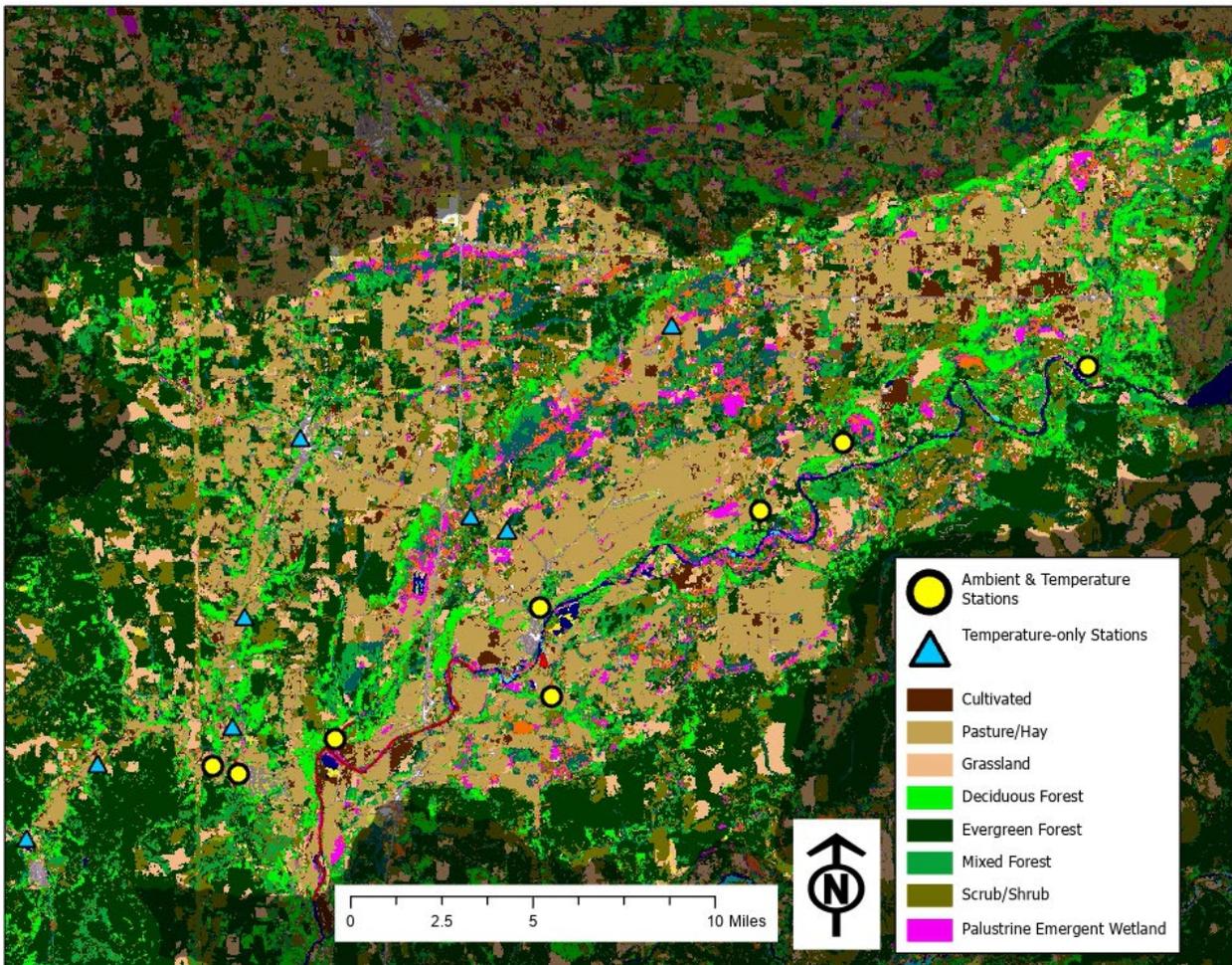


Figure 3. Land cover in the northern portion of the study area.

Tasks Required

Objective 1: Characterize water quality in priority tributaries

Task 1.1: Collect twelve monthly grab samples for *E. coli* at the ambient monitoring locations outlined in Table 3.

Task 1.2: Collect twelve monthly discrete measurements of turbidity, DO, pH, conductivity, and temperature at the ambient monitoring locations outlined in Table 3.

Task 1.3: Collect source identification samples for *E. coli* at additional locations on priority tributaries, as needed.

Task 1.4: Optionally deploy YSI EXO multiparameter sonde to document diurnal patterns of DO, pH and temperature.

Objective 2: Characterize stream temperatures during summer months

Task 1.1: From no later than September 15, 2023, through September 15, 2024, deploy temperature loggers at the sites outlined in Table 4.

Proposed Project Schedule

Ambient station monitoring for Objective 1 will begin April 2023 and continue once monthly for 12 months, ending in March 2024.

Continuous temperature monitoring will begin no later than September 15, 2023, and continue through the critical warm period ending after September 15, 2024.

All data will be reviewed in accordance with the QAPP (Ecology, 2021) and submitted to EIM within six months of the last data collection.

Budget and Funding

Table 2. Project budget.

Description	Quantity	Price	Total Cost
Ambient station samples (<i>E. coli</i>)	132	\$42	\$5,544
Replicates	14	\$42	\$588
Source identification samples	24	\$42	\$1,008
Temperature Loggers	54	\$149	\$8,046
Logger deployment supplies (rebar, anchors, tools, PVC, etc.)	1	\$1,776	\$1,776
Total			\$16,962

Sampling Locations and Frequency

The ambient monitoring locations outlined in Table 3 will be sampled once per month for one year. Continuous temperature loggers will be deployed at the sites outlined in Table 4 from no later than September 15, 2023, through September 15, 2024.

Table 3. Locations for monthly ambient monitoring.

EIM Location ID	Description	Latitude	Longitude
26-COWE-1.4	Coweeman River at Grade St	46.135555	-122.901044
26-OST-0.7	Ostrander Creek at Ostrander Rd	46.194868	-122.887327
Ar-01	Arkansas Creek at Wren Loop Rd	46.267412	-122.929028
26F050	Olequa Creek at 7 th St	46.40194	-122.96455
26-STI-0.7	Stillwater Creek at Maschke Rd	46.404106	-122.974829
26G050	Lacamas Creek at SR507 [506]	46.411722	-122.926139
26K090	Salmon Creek at Jackson Hwy	46.423371	-122.841042
26-BIL-0.4	Bill Creek at Middlecrest Dr	46.442595	-122.844840
26-SKO-1.2	Skook Creek at Howe Rd	46.474330	-122.757191
26-BLU-1.2	Blue Creek at Spencer Rd	46.492716	-122.725044
26-MIL-0.6	Mill Creek at Barrier Dam Ln	46.513177	-122.627907

Table 4. Locations for continuous temperature monitoring.

EIM Location ID	Description	Latitude	Longitude
26-COWE-1.4	Coweeman River at Grade St	46.135555	-122.901044
26-COWE-15.3	Coweeman River at Rose Valley Rd	46.173867	-122.756614
26-NFGOB-0.0	NF Goble Creek at S Goble Creek rd	46.120633	-122.770494
26-SFGOB-0.0	SF Goble Creek at S Goble Creek rd	46.120357	-122.770910
26_ OST 0.7	Ostrander Creek at Ostrander Rd	46.194868	-122.887327
OS-01	NF Ostrander Creek above SF confluence	46.19661	-122.880723
OS-02	SF Ostrander Creek above NF confluence	46.196613	-122.880544
Ar-01	Arkansas Creek at Wren Loop Rd	46.267412	-122.929028
Ar-02	Arkansas Creek at Delameter Rd	46.271464	-122.93536
Ar-03	Arkansas Creek above Dixon Ln	46.300595	-122.971259
DI-01	Delameter Creek at Delameter Rd	46.268701	-122.954048
26F050	Olequa Creek at 7 th St	46.40194	-122.96455
26-OLE-5.0	Olequa at Ammonen Rd	46.415198	-122.967108
26-OLE-8.3	Olequa at Ferrier Rd	46.445413	-122.962323
26-OLE-12.4	Olequa at King Rd	46.494028	-122.940033
26-STI-0.7	Stillwater Creek at Maschke Rd	46.404106	-122.974829
26-STI-5.1	Stillwater Creek at Hendrickson Rd	46.405129	-123.020635
26-STI-8.3	Stillwater at Allender Rd	46.384862	-123.049120
26G050	Lacamas Creek at SR507	46.411722	-122.926139
26-LAC-6.3	Lacamas Creek at SR505	46.472701	-122.872607
26-LAC-MIL-1.0	Mill Creek at SR505	46.468770	-122.857792
26-LAC-12.4	Lacamas Creek at Nicholson Rd	46.524395	-122.792893
26K090	Salmon Creek at Jackson Hwy	46.423371	-122.841042
26-BIL-0.4	Bill Creek at Middlecrest Dr	46.442595	-122.844840
26-SKO-1.2	Skook Creek at Howe Rd	46.474330	-122.757191
26-BLU-1.2	Blue Creek at Spencer Rd	46.492716	-122.725044
26-MIL-0.6	Mill Creek at Barrier Dam Ln	46.513177	-122.627907

Field Parameters and Laboratory Analytes to be Measured

Field Parameters

- Temperature
- pH
- Dissolved Oxygen
- Turbidity
- Specific Conductivity

All field parameters for the ambient station monitoring will be measured using a YSI ProDSS handheld multiprobe, used in accordance with the associated QAPP for this project (Ecology, 2021). A YSI EXO multiparameter sonde may also be deployed to collect diel data at select locations. The continuous temperature data will be acquired using Onset Hobo Tidbit V2 and MX loggers in accordance with EAP080 *Continuous Temperature Monitoring of Freshwater Rivers and Streams* (Ecology, 2022). Specifications and MQO's for the EXO sonde and the Tidbit loggers are outlined in Table 5.

Table 5. MQOs for continuous temperature measurements.

Parameter	Equipment	Duplicate Measurements: Precision	Equipment Information: Accuracy	Equipment Information: Resolution	Equipment Information: Range	Expected Range
Water Temperature	YSI EXO Multiparameter Sonde	± 0.2°C	± 0.05°C	0.01°C	-5-70°C	0-30°C
Dissolved Oxygen	YSI EXO Multiparameter Sonde	5% RSD	± 0.1 mg/L or ± 1% of reading, w.i.g.	0.01 or 0.1 mg/L (auto-scaling)	0 – 50 mg/L	0.1 – 15 mg/L
pH	YSI EXO Multiparameter Sonde	± 0.2 s.u.	± 0.2 s.u.	0.01 s.u.	0 – 14 s.u.	6 – 10 s.u.
Turbidity	YSI EXO Multiparameter Sonde	15% RSD	0 to 999 NTU: 0.3 NTU or ±2% of reading, w.i.g.; 1000 to 4000 NTU: ±5% of reading	0 to 999 = 0.01 NTU; 1000 to 4000 = 0.1 NTU	0 – 4,000 NTU	0 – 500 NTU
Specific Conductivity	YSI EXO Multiparameter Sonde	5% RSD	±0.5% of reading or 1 µS/cm, w.i.g.	0.001, 0.01, 0.1 mS/cm (auto-scaling)	0 – 200,000 µS/cm	20 – 1,000 µS/cm
Water Temperature	HOBO Tidbit MX	± 0.2°C	± 0.2°C	0.01°C	-20-70°C	0-30°C

w.i.g.: whichever is greater.

Laboratory Analytes

- E. coli (MF)

Invasive Species Evaluation and Applicable Procedures

The Cowlitz River is included in the map of areas of extreme concern for invasive species. Field staff will be trained and adhere to Standard Operating Procedure EAP070 *Minimize the Spread of Invasive Species* (Ecology, 2018).

EIM Data Upload Procedures, Including Project EIM Study ID When Applicable

All data collected from this study will be reviewed for quality objectives and data verification requirements outlined in the Nonpoint Pollution Investigations QAPP (Ecology, 2021) and uploaded to EIM under the Study ID LCRT_WQP.

Responsible Personnel and Contact Information

Sampling, data management and analysis will be completed by the SWRO WQP Water Quality Monitoring and Data Analysis Specialist. Laboratory analysis will be completed by Manchester Environmental Laboratory. SWRO WQP Nonpoint staff may assist in field sampling as needed.

References

- Ecology, 2021. Quality Assurance Project Plan – Nonpoint Pollution Investigations in Western Washington. Publication No. 21-10-027. Washington State Department of Ecology, Olympia, WA.
[Quality Assurance Project Plan – Nonpoint Pollution Investigations in Western Washington](#)¹¹
- LCFRB, 2010. Washington Lower Columbia Salmon Recovery and Fish & Wildlife Subbasin Plan. Lower Columbia Fish Recovery Board, Vancouver, WA.
[Salmon Recovery Plan | lcfbr-1 \(gen.wa.us\)](#)¹²
- USGS, 2005. Water Resources Data, Washington, Water Year 2005. US Geological Survey, Tacoma, Washington.
[Water Resources Data-Washington Water Year 2005 \(usgs.gov\)](#)¹³
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[Standard Operating Procedure EAP070, Version 2.2: Minimize the Spread of Invasive Species \(wa.gov\)](#)¹⁴
- Ecology, 2022. Standard Operating Procedure EAP080, Version 2.2- Continuous Temperature Monitoring of Freshwater Rivers and Streams. Publication No. 22-03-216. Washington State Department of Ecology, Olympia, WA.
[Standard Operating Procedure EAP080, Version 2.2: Continuous Temperature Monitoring of Freshwater Rivers and Streams](#)¹⁵

¹¹ <https://apps.ecology.wa.gov/publications/SummaryPages/2110027.html>

¹² <https://www.lcfbr.gen.wa.us/librarysalmonrecovery>

¹³ <https://pubs.usgs.gov/wdr/2005/wdr-wa-05-1/>

¹⁴ <https://apps.ecology.wa.gov/publications/SummaryPages/1803201.html>

¹⁵ <https://apps.ecology.wa.gov/publications/SummaryPages/2203216.html>