Addendum 2: Soos Creek Supplemental Monitoring

Addendum to:

Modeling Quality Assurance Project Plan for Soos Creek Watershed Temperature and Dissolved Oxygen TMDL Technical Analysis

September 2020

Publication No. 20-03-111

Publication Information

This Quality Assurance Project Plan Addendum is on the Department of Ecology's website at https://fortress.wa.gov/ecy/publications/SummaryPages/2003111.html. This is an addition to an original Quality Assurance Project Plan. It is not a correction (errata) to the original plan.

Suggested citation for this addendum:
Neculae, C. and N. Mathieu. 2020. Addendum 2 Soos Creek Supplemental Modeling: Addendum to: Modeling Quality Assurance Project Plan for Soos Creek Watershed Temperature and Dissolved Oxygen TMDL Technical Analysis. Publication 20-03-111. Washington State Department of Ecology, Olympia.
https://fortress.wa.gov/ecy/publications/SummaryPages/2003111.html.

EIM: Data for this project will be available on Ecology's Environmental Information Management (EIM) website at EIM Database. Search Study ID NMAT0008.

Activity Tracker code:
Ecology's Activity Tracker code for this addendum is 16-068.

Original Quality Assurance Project Plan:
Modeling Quality Assurance Project Plan for Soos Creek Watershed Temperature and Dissolved Oxygen TMDL Technical Analysis. February 2012. Publication 12-03-111. Washington State Department of Ecology, Olympia.
https://fortress.wa.gov/ecy/publications/SummaryPages/1203111.html.

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Modeling Quality Assurance Project Plan for Soos Creek Watershed Temperature and Dissolved Oxygen TMDL Technical Analysis

by Cleo Neculae and Nuri Mathieu

September 2020

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Signatures are not available on the Internet version.
WQP: Water Quality Program
EAP: Environmental Assessment Program

1.0 Table of Contents

Note: The numbered headings in this document correspond to the headings used in the original QAPP. Only relevant sections are included, therefore, some numbered headings are missing, and the text begins at 3.0

2.0 Abstract

This document is the second amendment to the original *Modeling Quality Assurance Project Plan for Soos Creek Watershed Temperature and Dissolved Oxygen TMDL Technical Analysis*.

The purpose of this addendum is to collect (1) data on parameters related to temperature and dissolved oxygen to assess the impact that the Soos Creek Fish Hatchery has on downstream water quality, and (2) field data from the previously unmonitored headwaters of Big Soos Creek.

3.0 Background

3.1 Introduction and problem statement

Sampling and Analysis Plan and Quality Assurance Project Plan Soos Creek (Timm 2009) and the parent Quality Assurance Project Plan (QAPP) *Modeling Quality Assurance Project Plan for Soos Creek Watershed Temperature and Dissolved Oxygen TMDL Technical Analysis* (Mohamedali 2018) describe the methods used to collect data in Big Soos Creek, as well as its tributaries, including Jenkins, Covington, and Little Soos creeks. This data collection occurred in the summer of 2007 and supplied data for a temperature and dissolved oxygen water quality model, called QUAL2Kw, of Big Soos Creek and its tributaries. However, the 2007 field effort did not include monitoring of the most upstream reaches of Big Soos Creek nor did it monitor the effluent of the Soos Creek hatchery to assess its influence on downstream water quality. This QAPP addendum outlines the study design to collect these data and fill gaps in our understanding of the factors that contribute to temperature and dissolved oxygen (DO) impairments in the watershed.

3.1.1 Soos Creek Hatchery

The Soos Creek Hatchery is located 0.9 miles (1.5 km) upstream from the creek's confluence with Green River. The hatchery is owned by the Washington Department of Fish and Wildlife (WDFW) and raises Fall Chinook, coho, and winter- and summer-run steelhead. In 2019, WDFW moved the hatchery operations from the floodplains into a new facility built across Big Soos Creek and just upstream from the old complex. The new facility became operational in the fall of 2019. The engineering report submitted to Ecology indicates that the new facility is built in-kind with no changes to the fish production, so the move is not expected to cause any changes in the water use patterns in the near term (Carr and Gerth, 2017). Facility operations described below are primarily based on information from the previous facility but, unless otherwise noted, are also applicable to the new facility.

To operate the adult and rearing ponds, the hatchery withdraws surface water from Soos Creek. Incubation and steelhead rearing uses flow from the nearby Wilson Spring Pond (Carr and Gerth, 2017). The pumped water runs through the facility's ponds and returns to the creek via the effluent discharge pipe and a fish ladder. Data submitted by the WDFW to Ecology for NPDES requirements show that between June 2014 and March 2019, the hatchery outflows ranged from 1.8 million gallons per day (MGD) in June 2018 to 29.2 MGD in December 2015.

This range underscores the variation in the hatchery's annual operations: during the winter and early spring months, the hatchery runs at full capacity until most juveniles are released. Summer operations are scaled back and require significantly less water until adult salmon return to spawn. Depending on the amount of water diverted from Big Soos Creek relative to instream flows, summer hatchery operations have the potential to increase downstream temperatures by routing the flows through unshaded ponds that are exposed to solar radiation before returning to the creek.

Starting in 2017, WDFW downscaled its summer operations at the hatchery significantly and started moving juvenile salmon it holds during the summer months to a separate facility on the Green River. WDFW adopted this practice to avoid the juveniles' exposure to pathogens and high temperatures that can cause high salmonid mortality. This practice limits the potential for the hatchery to affect instream temperatures during the shoulder months (i.e., May-June and August-September). We will monitor water temperatures upstream, downstream, and inside the hatchery to evaluate the potential for the hatchery to increase downstream temperatures in Soos Creek. Section 7 describes the study design for the temperature data collection.

In parallel with the temperature monitoring effort, we will also collect data to assess the impact of the hatchery on DO levels in Big Soos Creek. An Ecology study from 1989 that surveyed 20 state facilities found that hatchery discharges can exacerbate downstream DO problems, especially during cleaning and pond drawdown and under poor-dilution conditions (Kendra 1989). At the Soos Creek hatchery, the effluent may be discharged via two pathways: (1) a fish ladder that discharges flows from the adult ponds, and (2) a discharge pipe that carries flows from the rearing raceways. During cleaning, flows from all ponds within the facility run through a pollution abatement pond before being released into the stream via the discharge pipe (Carr and Gerth, 2017). The abatement pond is expected to remove most of the waste generated by the holding ponds, but no actual monitoring data associated with this operation exist to characterize the hatchery's effluent water quality. Section 7 describes our approach to monitoring the DO and associated parameters at the hatchery.

3.1.2 Headwaters of Big Soos Creek

Data collected under this QAPP addendum will be used to characterize the temperature and DO conditions in the headwaters of Big Soos Creek. In 2007, King County's L320 monitoring station was the most upstream monitoring station on Big Soos Creek. Monitoring data from this station were used to define the upstream boundary condition for Soos Creek in the QUAL2Kw model. The model boundary, however, was located 3 miles (5 km) upstream of where this station is actually located and it was assumed that conditions between the upstream boundary and the station were somewhat homogenous. This resulted in a gap that limits our understanding of temperature and DO regime in the upper three-mile section of the creek.

The Big Soos Creek headwaters originate in a low-gradient glacial outwash plain, with an extensive system of interconnected lakes, wetlands, and infiltrating soils (King County, 2000). Groundwater and wetlands are the main sources of inputs to the upper reaches and supply the system with low-DO flows.

Based on preliminary investigation of this reach in February 2020, the headwaters of Big Soos Creek likely experience either intermittent or subsurface flow in the dry season. This factor, combined with the non-channelized wetland flow routing, suggests it may not be possible for the model to accurately simulate these conditions; in which case, this reach will be excluded from the final calibrated model domain. The 2020 field data collection and observations will be used to guide this decision.

If the stream is flowing and measurable, we will collect flow, temperature, DO, pH, and specific conductance data (as described in Section 7) in this headwater area of the Big Soos Creek, to fill gaps in our understanding of what factors influence temperature and DO.

4.0 Project Description

4.1 Project goals

This QAPP addendum supports the purpose of the overall project goal as described in Section 1.3 of Mohamedali (2018). Data to be collected under this QAPP addendum will be used to assess the impact of the Soos Creek hatchery on temperature and DO in Soos Creek and better characterize water quality in the headwater reaches of Big Soos Creek. These data, combined with the ongoing modeling effort, will be used to assign a wasteload allocation to the hatchery for both temperature and DO.

4.2 Project objectives

Data collection in the field is planned for May 2020 through September 2020.

The following objectives will aid in the accomplishment of the goals listed above:

- Collect temperature and water quality data upstream of the hatchery intake point and downstream of the point of discharge for the hatchery effluent, to assess the potential influence of hatchery effluent on instream temperature and DO.
- Collect temperature and water quality data of the hatchery effluent itself before it exits the facility.
- Collect in-process temperature data within the hatchery facility to help identify potential significant sources of heat and make recommendations for mitigation.
- Collect temperature and water quality data at the Big Soos Creek confluence with Green River to evaluate impacts on downstream uses.
- Collect temperature and water quality data at three stations in the upper three miles of Big Soos Creek (if the stream is measurable there) to characterize the temperature and DO regime in this section.

4.3 Information needed and sources

Streamflow data for Big Soos Creek will be needed. Data reported at 15-minute intervals are available from the USGS online database National Water Information System.[1]

We will also need to acquire data from WDFW on the hatchery's use of water from different sources, including surface flows from Big Soos Creek, spring flows from Wilson Spring Pond, and groundwater. We will evaluate flow and fish feed data from Discharge Monitoring Reports (DMRs) that WDFW has submitted in PARIS and request any additional relevant records not

[1] https://waterdata.usgs.gov/nwis/uv?site_no=12112600

included in the DMRs. Additionally, we will review records WDFW may have on water temperature or any other parameters subject to this QAPP addendum.

4.4 Tasks required

The tasks required to meet project goals are discussed in Section 4.2. More details on field and lab tasks are described in Section 7.

5.0 Organization and Schedule

5.1 Key individuals and their responsibilities

Key responsibilities of individuals are listed in Table 1.

Table 1. Organization of project staff and responsibilities

Staff	Title	Responsibilities
Cleo Neculae Water Quality Program Northwest Regional Office Phone: 425-649-4425	EAP Client/TMDL Lead	Authors the QAPP addendum. Clarifies scope of the project. Co-leads field data collection. Writes final TMDL Implementation Plan and serves as a liaison with stakeholders.
Ralph Svrjcek Watershed Unit Northwest Regional Office Phone: 425-649-7165	Unit Supervisor for the TMDL Lead	Reviews and approves the draft and final QAPP addendum, and TMDL report. Provides an advisory role as the project progresses.
Nuri Mathieu Modeling and TMDL Unit Western Operations Section Phone: 360-407-7359	Principal Investigator/Project Manager	Designs study and co-leads field data collection. Conducts technical analysis and modeling. Synthesizes results, writes the draft and final technical sections of the TMDL report.
Cristiana Figueroa-Kaminsky Modeling and TMDL Unit Western Operations Section Phone: 360-407-7392	Unit Supervisor for the Project Manager	Reviews and approves the draft and final QAPP addendum, technical memo and TMDL report, and approves the budget. Provides technical advice and oversight.
Stacy Polkowske Western Operations Section Phone: 360-407-6730	Section Manager for the Project Manager & Study Area	Reviews the project scope and budget, tracks progress, reviews and approves final QAPP addendum.
Alan Rue Manchester Environmental Laboratory Phone: 360-871-8820	Laboratory Director	Reviews the project scope and budget, tracks budget and progress, reviews the draft QAPP, and approves the final QAPP.
Arati Kaza Phone: 360-407-6964	Ecology Quality Assurance Officer	Reviews and approves the draft and final QAPP addendum.

EAP: Environmental Assessment Program
EIM: Environmental Information Management database
QAPP: Quality Assurance Project Plan

5.4 Project schedule

Table 2. Proposed schedule for completing field and laboratory work and data entry into EIM

Work type	Due date	Lead staff
Field and laboratory work		
Field work completed	September 2020	Cleo Neculae/ Nuri Mathieu
Laboratory analyses completed	December 2020	MEL
Environmental Information System (EIM) database		
EIM data loaded	February 2021	Nuri Mathieu
EIM data entry review	March 2021	TBD
EIM complete	December 2021	Nuri Mathieu
Final report – N/A These data will be incorporated into the ongoing Soos Creek Temperature and Dissolved Oxygen TMDL and will not be used for a separate report.		

5.5 Budget and funding

This project requires a total of $18,217 for laboratory analysis of water quality samples, with $7,419 needed in fiscal year (FY) 2020 and $10,798 needed in FY 2021. Ecology's Manchester Environmental Laboratory will analyze all samples. The budget for field staff time and travel is managed through the respective budgets of the units for the co-lead staff. Existing program and unit equipment will be used to collect measurements, so no new equipment will be necessary.

Table 3 contains the proposed lab budget for the 2020 sampling effort.

Table 3. Proposed lab budget for 2020 sampling

Parameter/ analysis	Sites	Surveys per site	Sub-total	Replicates	Field blanks	Total samples	$/ sample	Sub-total
Alkalinity	8	2	16	2	1	19	$20	$380
BOD 5 Inhibited (Carbonaceous)	8	2	16	2	1	19	$65	$1,235
Total Persulfate Nitrogen	8	5	40	6	1	47	$24*	$1,128
Ammonia	8	10	80	8	1	89	$18*	$1,602
Nitrite/Nitrate	8	10	80	8	1	89	$18*	$1,602
Orthophosphate	8	10	80	8	1	89	$24*	$2,136
Total Phosphorus	8	5	40	6	1	47	$48*	$2,256
Total Organic Carbon	8	5	40	5	1	46	$42*	$1,932
Dissolved Organic Carbon	8	10	80	8	1	89	$54*	$4,806
Total Suspended Solids	8	2	16	2	1	19	$15	$285
Turbidity	8	2	16	2	1	19	$15	$285
Total Non-Volatile Suspended Solids	8	2	16	2	1	19	$30	$570
							Total Budget	**$18,217**

*Includes 20% potential surcharge for MEL to review results below the MRL.

6.0 Quality Objectives

Quality objectives are statements of the precision, bias, and lower reporting limits necessary to meet project objectives. Precision and bias together express data accuracy. Other considerations of quality objectives include representativeness and completeness.

6.1 Data quality objectives

The main data quality objective (DQO) for this project is to collect a minimum of 487 water quality samples (95% of each type of samples listed in Table 3, excluding replicates and field blanks) and at least 122 days (80% of five months) of continuous temperature data representative of Soos Creek hatchery effluent. The analysis of these data will use standard methods of data collection that meet measurement quality objectives (MQOs) described below.

6.2 Measurement quality objectives

Field sampling procedures and laboratory analysis inherently have associated error. Measurement quality objectives state the allowable error for a project. Precision and bias provide measures of data quality and are used to assess agreement with measurement quality objectives.

6.2.1 Targets for precision, bias, and sensitivity

6.2.1.1 Precision

Precision is a measure of the variability in the results of replicate measurements due to random error. Precision is usually assessed by analyzing duplicate field measurements or lab samples. Random error stems from the variation in concentrations of samples from the environment as well as other introduced sources of variation (e.g., field and laboratory procedures). Table 5 of the Programmatic QAPP (McCarthy and Mathieu, 2017) presents field measurement MQOs for precision and bias, as well as the manufacturer's stated accuracy, resolution, and range for the field equipment that will be used in this study.

6.2.1.2 Bias

Bias is the difference between the population mean and the true value of the parameter measured. Bias is usually addressed by calibrating field and laboratory instruments, and by analyzing lab control samples, matrix spikes, and standard reference materials. Laboratory QC procedures such as blanks, check standards, and spiked samples will provide a measure of any bias affecting sampling and analytical procedures for this project.

The MQOs for water samples taken in the field and associated laboratory analyses are shown in Table 5 of the Programmatic QAPP (McCarthy and Mathieu, 2017). Table 6 in the Programmatic QAPP outlines analytical methods, expected precision of sample duplicates, and method reporting limits. The target expectations for precision of field duplicates are based on historical performance by MEL for environmental samples taken around the state by EAP (Mathieu, 2006). The reporting limits of the methods listed in the table are appropriate for the expected range of results and the required level of sensitivity to meet project objectives.

6.2.1.3 Sensitivity

Sensitivity is a measure of the capability of a method to detect a substance. It is commonly described as detection limit. In a regulatory sense, the method detection limit (MDL) is usually used to describe sensitivity. The method reporting limit and the reporting limits are the same for the parameters of interest for this project. See Table 6 in the Programmatic QAPP (McCarthy and Mathieu, 2017) for MDLs for this project.

6.2.2 Targets for comparability, representativeness, and completeness

6.2.2.1 Comparability

See Section 6.2.2.1 in the Programmatic QAPP (McCarthy and Mathieu, 2017).

6.2.2.2 Representativeness

See Section 6.2.2.2 in the Programmatic QAPP (McCarthy and Mathieu, 2017).

6.2.2.3 Completeness

See Section 6.2.2.3 in the Programmatic QAPP (McCarthy and Mathieu, 2017).

7.0 Study Design

7.2 Field data collection

Water quality data used for the calibration of the QUAL2Kw model were originally collected in 2007 by King County, Ecology, and others and was documented in Timm (2009). The field data collection effort described in this section will supplement the original monitoring study.

7.2.1 Sampling location and frequency

Tables 4 through 6 list the type and frequency of monitoring planned for each of the monitoring locations. Data collection will occur from May through September 2020 and include three main groups of stations:

- Instream temperature and water quality monitoring in Big Soos Creek upstream and downstream of the hatchery to evaluate its influence on receiving water quality (see Figure 1 and Table 4).
- Monitoring of temperature and water quality of the actual hatchery effluent close to the point of discharge, plus additional temperature monitoring within the hatchery to help identify where water might be gaining heat through the facility (see Figure 2 and Table 5).
- Limited water quality monitoring and observations in the upper three miles of Big Soos Creek (see Figure 3 and Table 6).

The Soos Creek Fish Hatchery is located at RM 0.9 of Big Soos Creek, above the confluence with the Green River. We will perform instream monitoring at four locations within Big Soos Creek (stations SC1 through SC4 – see Figure 1), two stations upstream and two downstream of the hatchery effluent discharge. Some of the measurements will be planned to coincide in time with discharges from the pollution abatement pond in the hatchery in order to measure the potential influence of its effluent discharge on receiving water quality. Field staff will document if the pollution abatement pond is discharging or not during each visit.

Additionally, we will monitor the effluent from the Soos Creek hatchery. Measurements will be taken at three core hatchery locations (Figure 2):

- Station H1: water flowing through the official outflow pipe
- Station H2: water flowing through the hatchery's fish ladder, when flow is directed through adult ponds in the late summer and fall
- Station H3: water from the drain box, which receives flows from the raceways, when juvenile salmon are present in the late spring and early summer (the drain box eventually flows into the outflow pipe)

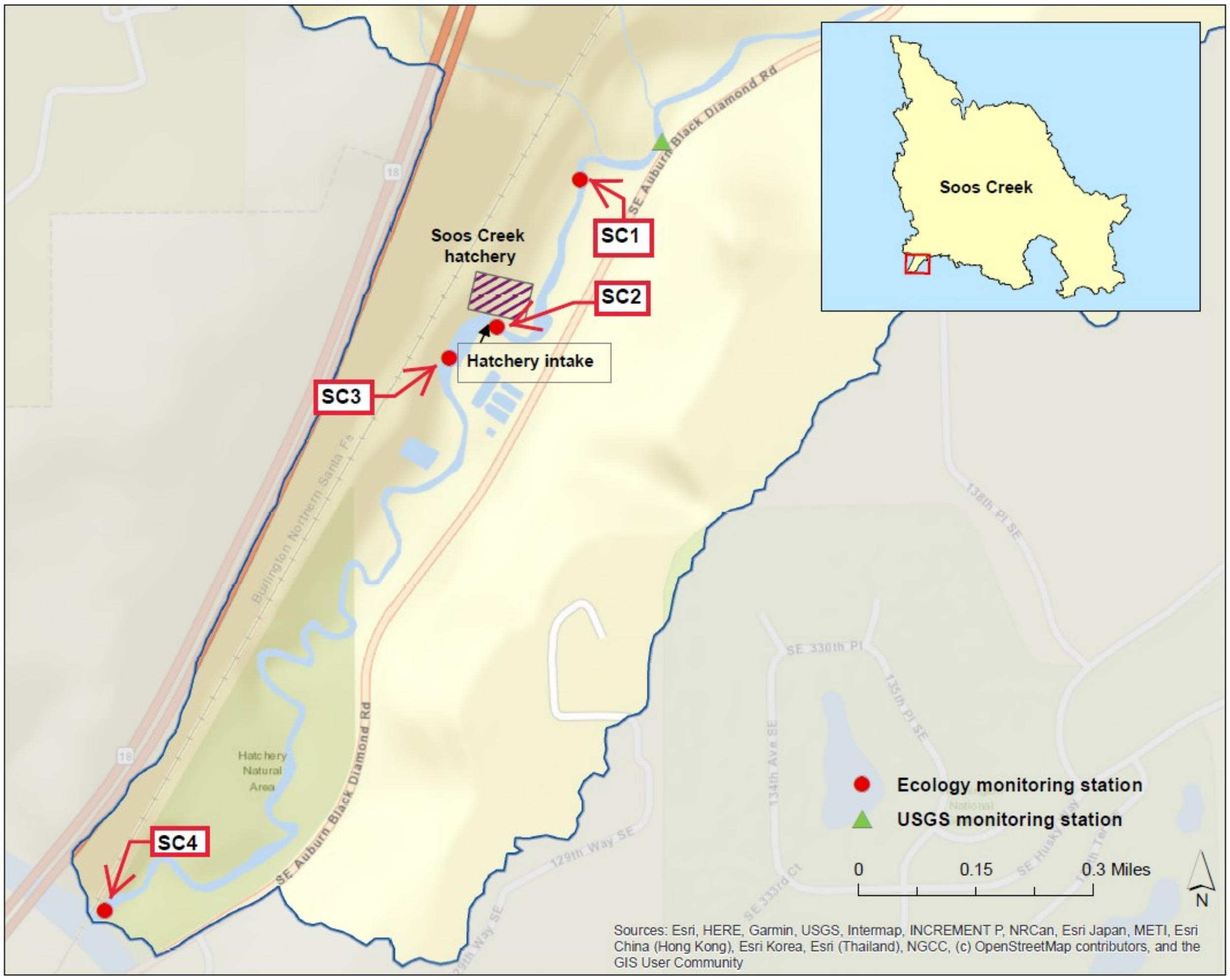

Figure 1. Location of monitoring stations outside the Soos Creek hatchery

If time and resources allow, optional monitoring of flow, water level, and temperature may occur at more locations within the hatchery, as shown in blue shaded areas in Figure 2.

Finally, three locations in the upper watershed will be visited monthly and only monitored if flowing water is observed in the channel (Figure 3). The most downstream of these three headwater stations is coincident with station L320, which was originally used to characterize the upstream model boundary of Big Soos Creek in the QUAL2Kw model. Our ability to understand the processes in the upper reaches of the stream is limited, however, because this station is located downstream on Big Soos Creek about three miles from the model boundary.

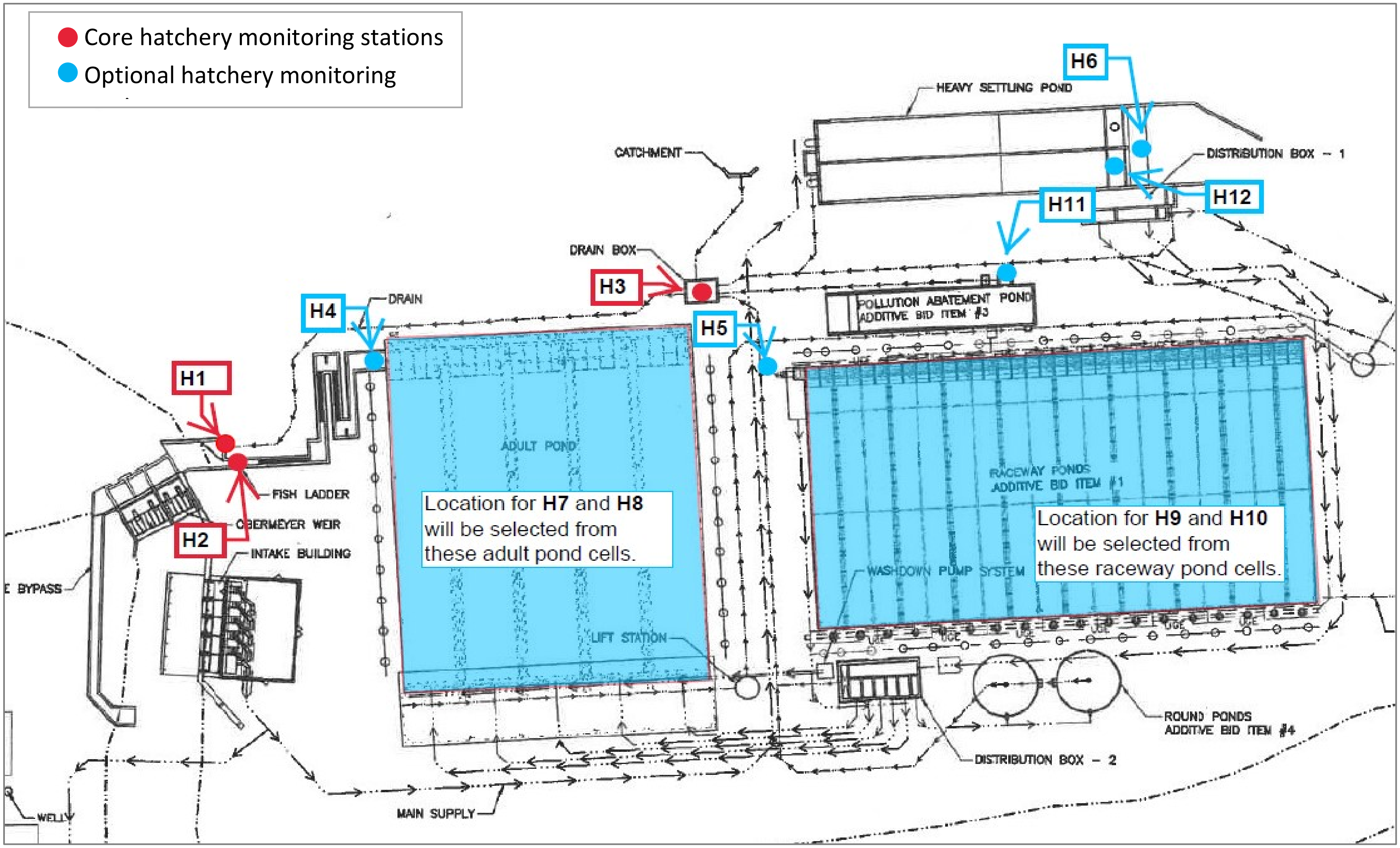

Figure 2. Location of core and optional monitoring stations in the Soos Creek hatchery

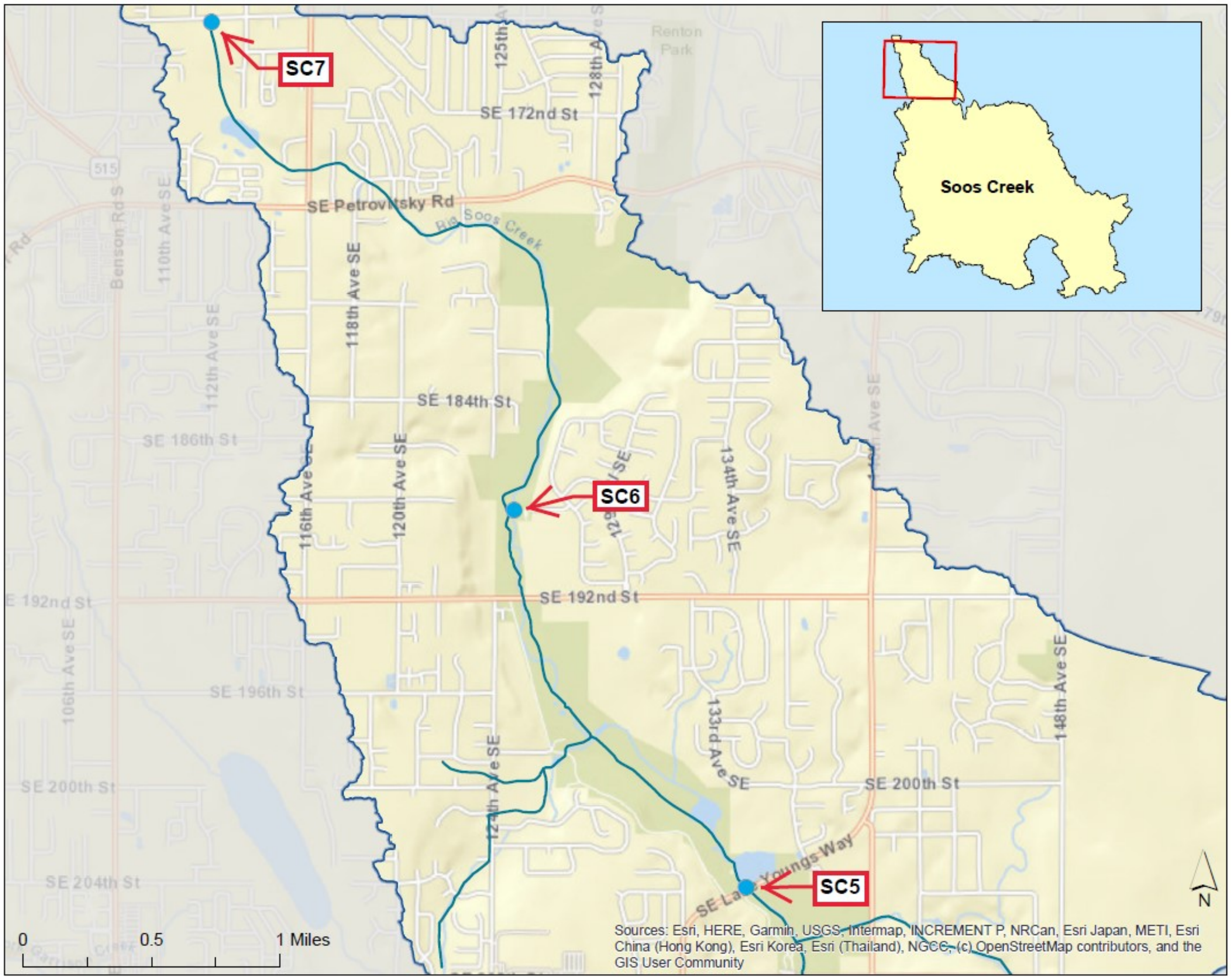

Figure 3. Location of monitoring stations in the upper Big Soos Creek watershed

Different types and frequency of monitoring are planned in-stream around the hatchery, within the hatchery, and in the headwater region. Tables 4 through 6 list the type of monitoring that will occur at each station. Below is a description of each monitoring type:

- Continuous temperature monitoring at 30-minute intervals using tidbits
- Two separate multi-day continuous sonde deployments, each two to four days long. The sonde will continuously measure stream temperature, DO, pH and specific conductance throughout the deployment period. The SOP for continuous sonde deployments includes spot Winkler DO measurements at two to four instances during the deployment (Mathieu and Stuart, 2019a).
- Bi-weekly discrete sonde measurements of temperature, DO, pH, and specific conductance.
- Bi-weekly nutrient grab samples to measure dissolved nutrient fractions including ammonia, nitrite/nitrate, orthophosphate, and dissolved organic carbon. Particulate fractions will be assessed by sampling total persulfate nitrogen, total phosphorus, and total organic carbon every other event (monthly).

- Two surveys with expanded water quality grab samples to measure a more complete suite of water quality parameters in addition to the bi-weekly nutrients. This will include samples for alkalinity, total and dissolved organic carbon, solids (total suspended solids, turbidity, and total non-volatile suspended solids), and BOD5. These surveys will take place while the hatchery is in operation – once in late spring/early summer and once in late summer/early fall.
    - Additional 60 day ultimate BOD tests may be conducted during these surveys pending sufficient lab funding and available lab capacity. These samples provide DO readings on days 0, 2, 3, 5, 10, 15, 30, and 60. UCBOD will be analyzed for 60 days. TOC splits are analyzed on days 0 and 60. This provides more accurate BOD decay rates over time, estimates of labile and recalcitrant organic carbon, and better extrapolation to ultimate BOD (if beyond 60 days).
- **Discrete flow measurements** of hatchery effluent discharge and instream flow measurements at headwater locations.
- **Continuous water levels** (pressure) at key locations within the hatchery using pressure transducers.
- **High resolution discrete temperature surveys** including vertical profiles at ~6-10 locations spatially distributed throughout the ponds using a sonde.
- **Continuous measurements** of air temperature, relative humidity, and barometric pressure at select locations near or within the hatchery to determine if water temperature loggers that are exposed to air characterize localized air temperature influence, and compensate for barometric pressure in water level measurements collected by pressure transducers. These stations are not included in the maps of monitoring locations since they will be finalized during temperature and water level equipment deployment.

The following additional data collection elements may be completed during the course of the project, depending on available time and resources:

- Manual or automated composite sampling of hatchery effluent over the course of daily operations.
- Additional hatchery effluent nutrient samples to better characterize any difference in effluent quality when the pollution abatement pond is discharging to drain box compared to when it is not; depending on what is captured during routine sampling.
- Continuous temperature monitoring at additional locations within or near the hatchery or within the headwaters area.
- Discrete flow measurements and/or water levels at additional locations within the hatchery.
- Additional 60 day ultimate BOD tests may be conducted outside of expanded WQ surveys pending sufficient lab funding and available lab capacity.

See Section 8.2 in the Programmatic QAPP (McCarthy and Mathieu, 2017). Table 9 in the Programmatic QAPP (McCarthy and Mathieu, 2017) lists the field activities and their associated SOPs used to collect the different types of data. Ecology Standard Operating Procedures (SOPs) can be found on [Ecology's website](https://ecology.wa.gov/About-us/How-we-operate/Scientific-services/Quality-assurance).[2]

Table 4. Type and frequency of instream monitoring at stations outside the Soos Creek hatchery

Station ID	Continuous temperature	Multi-day continuous sonde deployments	Bi-weekly discrete sonde measurements	Bi-weekly nutrients grab samples	Expanded WQ grab samples	Description of monitoring location
SC1	5 mo	2X	10X	10X	2X	Big Soos Creek below USGS monitoring station, downstream of tributary influences, but upstream of weir influence, depending on access
SC2	5 mo	-	10X	10X	2X	Big Soos Creek at hatchery intake
SC3	5 mo	2X	10X	10X	2X	Big Soos Creek 300 feet or more below hatchery discharge
SC4	5 mo	2X	10X	10X	2X	Big Soos Creek at confluence with Green River

[2] https://ecology.wa.gov/About-us/How-we-operate/Scientific-services/Quality-assurance

Table 5. Type and frequency of monitoring at Soos Creek hatchery stations

Station ID	Continuous temperature	Bi-weekly discrete sonde measurements	Bi-weekly nutrients grab samples	Expanded WQ grab samples	Discrete flow measurements	Continuous water level	High res. temperature surveys/profiles	Monitoring priority	Description of monitoring location
H1	5 mo	10X	10X	2X	≥5X	5 mo	-	C	Hatchery discharge pipe outflow
H2	5 mo	10X	10X	2X	≥5X	5 mo	-	C	Hatchery fish ladder outflow
H3	5 mo	10X	10X	2X	≥5X	5 mo	-	C	Hatchery drain box
H4	5 mo	≥5X	-	-	-	-	-	O	Adult pond outflow
H5	5 mo	≥5X	-	-	-	-	-	O	Raceway pond outflow
H6	5 mo	≥5X	-	-	-	-	2X	O	Heavy settling pond outflow*
H7	5 mo	≥5X	-	-	-	-	2X	O	Adult pond cell 1 outflow*
H8	5 mo	≥5X	-	-	-	-	2X	O	Adult pond cell 2 outflow*
H9	5 mo	≥5X	-	-	-	-	2X	O	Raceway cell 1 outflow*
H10	5 mo	≥5X	-	-	-	-	2X	O	Raceway cell 2 outflow*
H11	5 mo	≥5X	≥5X	2X	-	-	2X	O	Pollution abatement pond cell outflow*
H12	5 mo	≥5X	-	-	-	-	2X	O	Heavy settling pond cell outflow*

C: core; O: optional.
*Outflow for all data collection types, except the high resolution temperature surveys/profiles which will be spatially distributed throughout the cell.

Table 6. Type and frequency of monitoring at stations in the upper Big Soos Creek watershed

Station ID	Discrete sonde measurements	Discrete flow measurements	Description of monitoring location
SC5	5X	5X	Big Soos Creek at station L320
SC6	5X	5X	Big Soos Creek at Boulevard Lane Park
SC7	5X	5X	Big Soos Creek at SE 168th Street

7.2.2 Field parameters and laboratory analytes to be measured

Section 7.2.1 and Table 3 list field parameters and laboratory to be collected at each site.

7.3 Maps or diagram

Figures 1, 2, and 3 illustrate proposed monitoring locations.

7.4 Assumptions underlying design

The design of this field study assumes that the collected data will be sufficient to fill in existing information gaps – primarily to help better characterize water quality of the upstream and downstream reaches of Soos Creek, as well as that of the effluent from the Soos Creek hatchery.

We also assume that while these data are collected several years later after the calibration period of the QUAL2Kw model, they will still provide valuable supplemental information about water quality in Soos Creek to better understand the characteristics of the upstream modeled reaches, and will allow Ecology to develop wasteload allocations for the Soos Creek hatchery.

7.5 Possible challenges and contingencies

See Section 7.5 in the Programmatic QAPP (McCarthy and Mathieu, 2017) for a list of potential logistical problems, practical constraints, and schedule limitations. Headwater monitoring in Big Soos Creek may be impeded due to our ability to access the stream in this section or the lack of flows during the summer months.

The proposed schedule and number of collected samples, as well as MEL's ability to process the samples, may be affected by advisories on working in groups related to COVID-19. At the time of the development of this QAPP addendum, the State of Washington is under a shelter-in-place order through May 4, 2020. Depending on when advisories are lifted, Ecology will adjust the schedule of field work without deviating from data quality objectives discussed in Section 6.1. Below are our plans of action in the event that COVID-19-related advisories are lifted and in the event that the advisory continues into the summer:

- If field work is allowed after May 4, 2020, the work described in this addendum will start as planned in May and will follow the schedule outlined in Table 2, Section 5.4.
- For temperature data collection:
  - If field work is not allowed after May 4, we are going to ask for an exception to install the temperature tidbits and start collecting data in May.
  - If we don't get approval, we will wait until field work is allowed or until next year.
- For collecting data on water quality parameters:
  - If field work is allowed and MEL opens after May 4 but before mid-June, we will start grab samples and continue the schedule proposed in this addendum through the end of September. The current schedule has some buffer built in around the targeted periods of time.
  - If we can't do field work or MEL remains closed past mid-June, we will wait until next year.

8.0 Field Sampling Procedures

8.1 Invasive species evaluation

See Section 8.1 in the Programmatic QAPP (McCarthy and Mathieu, 2017).

8.2 Measurement and sampling procedures

Temperature data will be collected continuously using data loggers placed in the stream's thalweg upstream and downstream of the Soos Creek hatchery. In addition, hatchery effluent temperature will be measured continuously using data loggers placed inside the facility's fish ladder, discharge pipe, and drain box. Water temperature at the optional sites within the facility will be monitored using continuous data loggers.

We will estimate flows at the hatchery points of discharge (e.g., fish ladder and discharge points) using continuous water levels monitored with pressure transducers and discrete flow measurements, if we find an adequate correlation between the two. Alternatively, we will use an appropriate interpolation method between the discrete data points.

All field activities conducted for this study will follow methodologies described in SOPs referenced in Table 9, Section 8.2 in the Programmatic QAPP (McCarthy and Mathieu, 2017). In addition to the SOPs identified in the Programmatic QAPP, continuous sonde deployment and data management will follow procedures described in two recently published SOPs (note these will be added to Programmatic QAPP Table 9 during next update):

- SOP EAP129, Version 1.0: Short-term Continuous Data Collection with a Multiparameter Sonde, Part 1: Field Procedures (Mathieu and Stuart, 2019a).
- SOP EAP130, Version 1.0: Short-term Continuous Data Collection with a Multiparameter Sonde, Part 2: Data Processing (Mathieu and Stuart, 2019b).

Ecology Standard Operating Procedures (SOPs) can be found on Ecology's website.[3]

[3] https://ecology.wa.gov/About-us/How-we-operate/Scientific-services/Quality-assurance

8.3 Containers, preservation methods, holding times

See Section 8.3 in the Programmatic QAPP (McCarthy and Mathieu, 2017). Table 7 is included to show that the container size for total organic carbon should be 125 mL.

Table 7. Sampling container, holding time, and preservative for total organic carbon

Parameter	Matrix	Recommended Quantity	Container	Holding Time	Preservative
TOC	Water	125 mL	125 mL n/m poly bottle*	28 days	1:1 HCl to pH <2; Cool to ≤6°C

*Container is sent by lab with preservative in it.

8.4 Equipment decontamination

See Section 8.4 in the Programmatic QAPP (McCarthy and Mathieu, 2017).

8.5 Sample ID

See Section 8.5 in the Programmatic QAPP (McCarthy and Mathieu, 2017).

8.6 Chain of custody, if required

See Section 8.6 in the Programmatic QAPP (McCarthy and Mathieu, 2017).

8.7 Field log requirements

See Section 8.7 in the Programmatic QAPP (McCarthy and Mathieu, 2017).

8.8 Other activities

See Section 8.8 in the Programmatic QAPP (McCarthy and Mathieu, 2017).

9.0 Laboratory Procedures

9.1 Lab procedures table

See Table 8 for lab methods (including sample matrix, expected range of results, and method detection limit). The expected range of results is lower for some of the parameters compared the range listed in the Programmatic QAPP (McCarthy and Mathieu, 2017).

Table 8. Laboratory analytes, matrices, expected range of results, methods, and detection limits

Analyte	Sample Matrix	Expected Range of Results	Method	Method Detection Limit*
Alkalinity	Water	20 – 200 mg/L as CaCO3	SM 2320B	0.57 mg/L
Ammonia	Water	<0.005 – 30 mg/L	SM 4500 NH3H	0.00449 mg/L
Biochemical Oxygen Demand 5-day-Inhibited (BOD5)	Water	0.5 – 210 mg/L	SM 5210B	0.2 mg/L (RL)
Dissolved Organic Carbon	Water	0.1 – 10 mg/L	SM 5310B; EPA 415.1	0.122 mg/L
Dissolved Oxygen (Winkler)	Water	0.1 – 15 mg/L	SM 4500OC	0.1 mg/L
Nitrate/Nitrite	Water	<0.010 – 30 mg/L	SM 4500NO3I	0.00248 mg/L
Orthophosphate	Water	0.003 – 1 mg/L	SM 4500PG	0.00174 mg/L
Total Non-Volatile Suspended Solids	Water	<1 – 2,000 mg/L	EPA 160.4	1.0 mg/L (RL)
Total Organic Carbon	Water	0.2 – 10 mg/L	SM 5310B	0.122 mg/L
Total Persulfate Nitrogen	Water	0.5 – 50 mg/L	SM 4500-NB	0.01377 mg/L
Total Phosphorous	Water	0.005 – 10 mg/L	SM 4500-PH	0.00567 mg/L
Total Suspended Solids	Water	<1 – 2,000 mg/L	SM 2540D	1.0 mg/L (RL)
Turbidity	Water	0 – 1,000 NTU	SM 2130 B	0.105 NTU

*MDL as of May 2020, some parameters are adjusted annually (EPA, 2016).
RL= reporting limit.

9.2 Sample preparation methods

See Section 9.2 in the Programmatic QAPP (McCarthy and Mathieu, 2017).

9.3 Special method requirements

For this project, MEL is requested to report results down to the method detection limit (MDL) for the following parameters (MDLs are shown in parentheses):

- Ammonia (0.00449 mg/L)
- Nitrate-Nitrite (0.00248 mg/L)
- Total Persulfate Nitrogen (0.013 mg/L)
- Orthophosphate (0.00174 mg/L)
- Total Phosphorus (0.00567 mg/L)
- Dissolved Organic Carbon (0.122 mg/L)
- Total Organic Carbon (0.122 mg/L)

EPA (2016) recently revised their method detection limit procedure to require that method blanks collected throughout the year are used to calculate MDLs on an annual basis. Therefore the MDLs listed in this QAPP may change during the course of the sampling effort.

9.4 Lab accredited for methods

All chemical analysis will be performed at Manchester Environmental Laboratory (MEL), which is accredited for all methods.

10.0 Quality Control (QC) Procedures

See Section 10.0 in the Programmatic QAPP (McCarthy and Mathieu, 2017) for a list of field and laboratory quality control procedures.

10.1 Table of field and laboratory quality control

See Section 10.1 (Table 13) in the Programmatic QAPP (McCarthy and Mathieu, 2017) for list of the types and frequency of quality control samples needed for laboratory and field samples.

10.2 Corrective action processes

See Section 10.2 in the Programmatic QAPP (McCarthy and Mathieu, 2017).

11.0 Data Management Procedures

11.1 Data recording/reporting requirements

See Section 11.1 in the Programmatic QAPP (McCarthy and Mathieu, 2017).

11.2 Laboratory data package requirements

See Section 11.2 in the Programmatic QAPP (McCarthy and Mathieu, 2017).

11.3 Electronic transfer requirements

See Section 11.3 in the Programmatic QAPP (McCarthy and Mathieu, 2017).

11.4 EIM data upload procedures

See Section 11.4 in the Programmatic QAPP (McCarthy and Mathieu, 2017).

12.0 Audits and Reports

12.1 Number, frequency, type, and schedule of audits

No audits are planned for this study. However, there could be a field consistency review by another experienced EAP field staff member during this project. The aim of this review is to improve fieldwork consistency, improve adherence to SOPs, provide a forum for sharing innovations, and strengthen our data QA program.

12.2 Responsible personnel

Table 1 in Section 5.1 lists the key individuals and their responsibilities.

12.4 Responsibility for reports

No separate report is planned for this field effort. Results of this monitoring effort will be included in the technical report for the Soos Creek Temperature and Dissolved Oxygen TMDL.

13.0 Data Verification

13.1 Field data verification, requirements, and responsibilities

Section 13.1 in the Programmatic QAPP (McCarthy and Mathieu, 2017).

13.2 Verification of laboratory data

See Section 13.2 in the Programmatic QAPP (McCarthy and Mathieu, 2017).

13.3 Validation requirements, if necessary

See Section 13.3 in the Programmatic QAPP (McCarthy and Mathieu, 2017).

14.0 Data Quality (Usability) Assessment

14.1 Process for determining whether project objectives have been met

See Section 14.1 in the Programmatic QAPP (McCarthy and Mathieu, 2017).

14.2 Treatment of non-detects

See Section 14.2 in the Programmatic QAPP (McCarthy and Mathieu, 2017). As described in Section 9.1, seven of the parameters will be reported below the MRL down to the MDL. All sample and method blank results below the MRL will be reported and qualified as J, estimated values. As requested, MEL will not censor potential false positives from method blank contamination.

The project manager will review all results below the MRL as well as the associated method blank data. Results with blank contamination will be excluded from the analysis if both a) the sample result plus the blank contamination exceeds the MRL and b) the blank contamination is greater than 50% of the sample result.

14.3 Data analysis and presentation methods

See Section 14.3 in the Programmatic QAPP (McCarthy and Mathieu, 2017).

14.4 Sampling design evaluation

See Section 14.4 in the Programmatic QAPP (McCarthy and Mathieu, 2017).

14.5 Documentation of assessment

See Section 14.5 in the Programmatic QAPP (McCarthy and Mathieu, 2017).

15.0 References

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