



DEPARTMENT OF
ECOLOGY
State of Washington

**Addendum to
Quality Assurance Project Plan**

**French Creek and Pilchuck River
Temperature, Dissolved Oxygen, and pH
Total Maximum Daily Load**

July 2014

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Addendum

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This addendum is an addition to an original Quality Assurance Project Plan. It is not a correction (errata) to the original plan.

Data for this project will be available on Ecology's Environmental Information Management (EIM) website at www.ecy.wa.gov/eim/index.htm. Search Study ID TSWA0004.

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Temperature, Dissolved Oxygen, and pH Total Maximum Daily Load Water Quality Study
Design (QAPP)

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Addendum to Quality Assurance Project Plan

French Creek and Pilchuck River Temperature, Dissolved Oxygen, and pH Total Maximum Daily Load

July 2014

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3.0 Background

Tetra Tech, a consulting and engineering firm, designed the initial Quality Assurance Project Plan (QAPP) and was contracted by EPA to perform the analysis and modeling for the French Creek and Pilchuck River Temperature, Dissolved Oxygen, and pH TMDL Study. Ecology was tasked with collecting the data outlined in a QAPP prepared jointly by Tetra Tech and Ecology (Swanson et al., 2012). Ecology collected the field data in the summer of 2012. Tetra Tech was unable to perform the analysis due to a lack of continued funding and the modeling/analysis work was transferred to Ecology’s Environmental Assessment Program in 2013.

Upon review of the collected data, Ecology determined that additional data was needed to adequately define the channel geometry and identify areas of potential groundwater input on the Pilchuck River.

The primary objective of this additional work is to characterize depth along the length of the river at a range of flows. The resulting depth-flow relationship will be used to more accurately define the river’s channel geometry within the QUAL2Kw model, an important step for an accurate representation of the physical processes that affect temperature in the system.

All required sections not mentioned in this addendum are discussed in the original QAPP (Swanson et al., 2012).

5.0 Organization and Schedule

Field and laboratory work	Due date	Lead staff
Field work completed	September 2014	Nuri Mathieu
Environmental Information System (EIM) database		
EIM Study ID	TSWA0004	
Product	Due date	Lead staff
EIM data loaded	October 2015	Nuri Mathieu
EIM QA	November 2015	TBD
EIM complete	December 2015	Nuri Mathieu
Final report		
Author lead / support staff	Nuri Mathieu	
Schedule		
Draft due to supervisor	August 2015	
Draft due to client/peer reviewer	September 2015	
Draft due to external reviewer(s)	October 2015	
Final (all reviews done) due to EAP publications coordinator	November 2015	
Final report due to water quality program publications coordinator	December 2015	

6.0 Measurement Quality Objectives

See Section 10.

7.0 Sampling Process Design

See Section 8.

8.0 Sampling Procedures

Ecology staff will conduct three longitudinal river surveys along the Pilchuck River between July and September of 2014. The surveys will include the following:

- **Thalweg depth measurements.** These measurements will provide high resolution geometry data which will be used to construct the QUAL2Kw model.
- **Stream bottom temperature measurements.** These measurements will identify areas of potential groundwater or hyporheic inputs of cooler water to the stream or areas that provide good thermal refuge (habitat) for fish populations. The 2012 study did not collect any groundwater information.
- **Pool habitat vertical temperature profiles.** Vertical temperature profile measurements will document thermal stratification within pool habitats along the Pilchuck River. These measurements will provide information about the quality of habitat and supplemental information for temperature calibration of the water quality model.

- **Seepage survey with flow measurements.** Field staff will collect flow measurements at key locations spaced approximately every 2 miles along the river. The measurements will provide channel geometry across the width of the channel and information about potential gaining and losing groundwater reaches.

Staff will conduct the surveys by floating the river, following the general longitudinal depth and temperature profile methods used by the USGS Tacoma Field Office (Vaccaro and Maloy, 2006; Gendaszek, 2011). Use of temperature, flow, depth, and sonde equipment will follow Ecology protocols:

- EAP023 - Collection and Analysis of Dissolved Oxygen (Winkler Method) (Ward and Mathieu, 2013)
- EAP024 - Estimating Streamflow (Kardouni, 2013)
- EAP033 - Hydrolab[®], DataSonde[®], and MiniSonde[®] Multiprobes (Swanson, 2010)
- EAP044 - Continuous Temperature Monitoring of Fresh Water Rivers and Streams Conducted in a Total Maximum Daily Load (TMDL) Study (Bilhimer and Stohr, 2009)
- EAP074 - Use of Submersible Pressure Transducers during Groundwater Studies (Sinclair and Pitz, 2010)

Limited staff resources and other logistical constraints may make it unfeasible to survey the entire 25-mile stretch of the Pilchuck River. Field staff will prioritize longitudinal surveys in between sites 16 and 22 (Figure 1) of the Pilchuck River.

Within this reach, a 2012 salmonid habitat evaluation identified over 400 pools (Snohomish County, 2012). Since many of these pools are too deep to measure by conventional channel survey techniques, cross sections are typically surveyed at shallower locations, as in the 2012 study. This can result in the model channel geometry not being representative of the river as a whole (biased too shallow). The 2014 longitudinal depth surveys will avoid this problem by collecting continuous depth data at a high resolution for the entire length of the river, including through these deeper pools. Adequately representing pools within the model is very important as they can have a large effect on the river's travel time and heating and cooling processes.

The Snohomish County (2012) study also identified 85 high quality habitat pools within this reach suitable as holding areas for adult salmon migrating during spawning and 106 high quality pools for juvenile rearing. The 2014 surveys will provide valuable information about the water temperatures within these pools, which is important in the context of protecting the beneficial use of salmonid rearing and spawning.

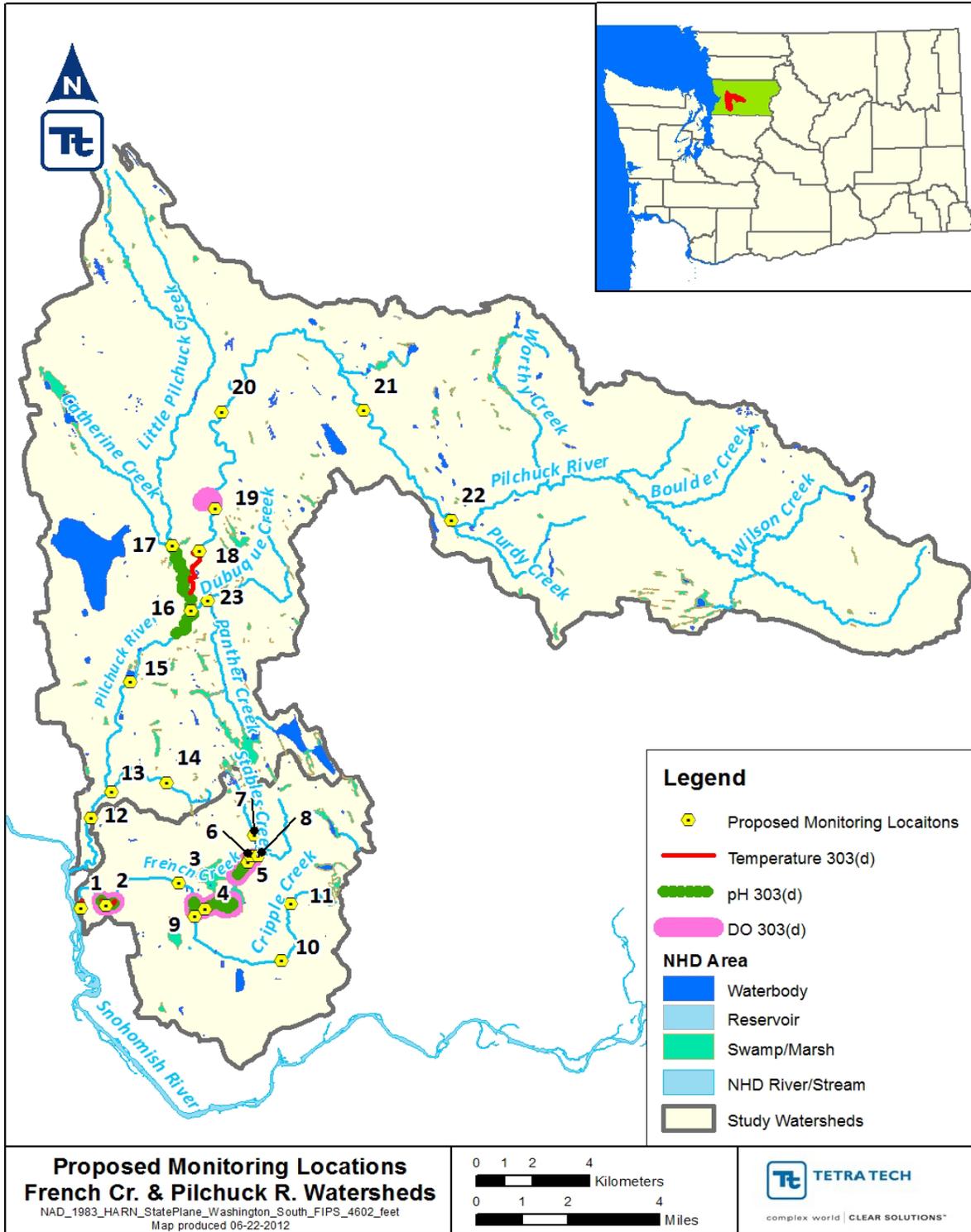


Figure 1. Monitoring locations in the Pilchuck River watershed for the 2012 study (Swanson et. al, 2012). 2014 data collection will focus on sites between 16 and 22 on the Pilchuck River.

10.0 Quality Control Procedures

Ecology will adhere to all quality control procedures outlined in the original QAPP (Swanson et. al., 2012). Likewise, Ecology will use the measurement quality objectives defined in the original QAPP to assess quality/usability of the collected data.

The original QAPP discusses quality procedures for all parameters that will be collected during the 2014 study, with the exception of depth. For depth instruments, Ecology staff will follow these additional quality procedures:

- Calibrate depth instruments, according to manufacturer's instructions, before each survey in a stilling tube at Ecology headquarters.
- Check calibration at the surface and a known depth, before and after each survey.
- Record ambient barometric air pressure using a separate pressure transducer.
- Evaluate data quality based on the following measurement quality objectives:
 - <10% RSD for field replicates
 - ± 0.3 ft for calibration checks

15.0 References

- Bilhimer, D. and A. Stohr, 2009. Standard Operating Procedures for Continuous Temperature Monitoring of Fresh Water Rivers and Streams Conducted in a Total Maximum Daily Load (TMDL) Study, Version 3.0. Washington State Department of Ecology, Olympia, WA. SOP Number EAP044. www.ecy.wa.gov/programs/eap/quality.html
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