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State of Washington

Addendum to Quality Assurance Project Plan

2010 Yakima Area Creeks Fecal Coliform Total Maximum Daily Load Study

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DEPARTMENT OF ECOLOGY
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FROM: James Ross, Environmental Assessment Program

SUBJECT: Addendum to Quality Assurance Project Plan for Yakima Area Creeks Fecal Coliform Total Maximum Daily Load Study

Publication No: 05-03-101

This Addendum to Quality Assurance Project Plan: Yakima Area Creeks Fecal Coliform Total Maximum Daily Load Study describes supplemental work to the 2006 technical study that was designed to develop Fecal Coliform bacteria (FC) TMDLs in Moxee Drain, Cowiche and Wide Hollow Creeks, and their tributaries. These TMDLs will set water quality targets to meet FC standards, identify key reaches for source reduction, and allocate pollutant loads to point and nonpoint sources.

cc: Jenna Durkee, Environmental Assessment Program
Bill Kammin, Ecology Quality Assurance Officer
Joel Bird, Manchester Environmental Laboratory
Scott Tarbutton, Environmental Assessment Program

Table of Contents

Introduction

Wide Hollow and Cowiche Creeks and Moxee Drain are on the Washington State 303(d) list for impaired water quality due to Fecal Coliform bacteria (FC). Total Maximum Daily Load (TMDL) evaluations of these three streams are required by the federal Clean Water Act. The TMDL will identify how much pollution loading needs to be reduced in order to meet state water quality criteria that protect the streams' designated uses. The streams are located in or around the city of Yakima, a rapidly urbanizing area.

This Quality Assurance Project Plan (QAPP) addendum describes supplemental work to the 2006 technical study that was designed to develop FC TMDLs in Moxee Drain, Cowiche and Wide Hollow Creeks, and their tributaries. These TMDLs will set water quality targets to meet FC standards, identify key reaches for source reduction, and allocate pollutant loads to point and nonpoint sources.

The Yakima urban area is located at the intersection of three Water Resource Inventory Areas (WRIAs) in Yakima County. The city of Yakima forms the urban center, with smaller nearby urban communities at Selah, Union Gap, Naches, Tieton, and Moxee City. The area has been growing rapidly in the last ten years and has a checkerboard of industrial, urban, transportation, residential, orchard, irrigated agriculture, non-commercial farm, forest, and range land uses. Several streams, canals, and drains transect the urban area, carrying water to or from the Naches and Yakima Rivers and from creeks emanating from the surrounding foothills. Many were formerly used for irrigation and farmland drainage when the land use was dominated by agriculture. Now they provide water for agriculture but also for a broader range of sometimes conflicting uses like stormwater conveyance, fish habitat, and recreation.

Each of the three watersheds drains less than 150 square miles to the Yakima River but delivers more water than the watersheds generate naturally. During the irrigation season, the creeks carry interbasin returns transferred through the irrigation network, mainly from the Yakima, Naches, and Tieton Rivers.

The Moxee Drain is a 136-square-mile watershed east of the city of Yakima.

Wide Hollow Creek drains 65 square miles south and west of Yakima. The Wide Hollow Creek Watershed has the largest percentage of urban land use (28%) of the three creeks in the study.

Cowiche Creek drains approximately 120 square miles north and west of Yakima in the Naches Basin.

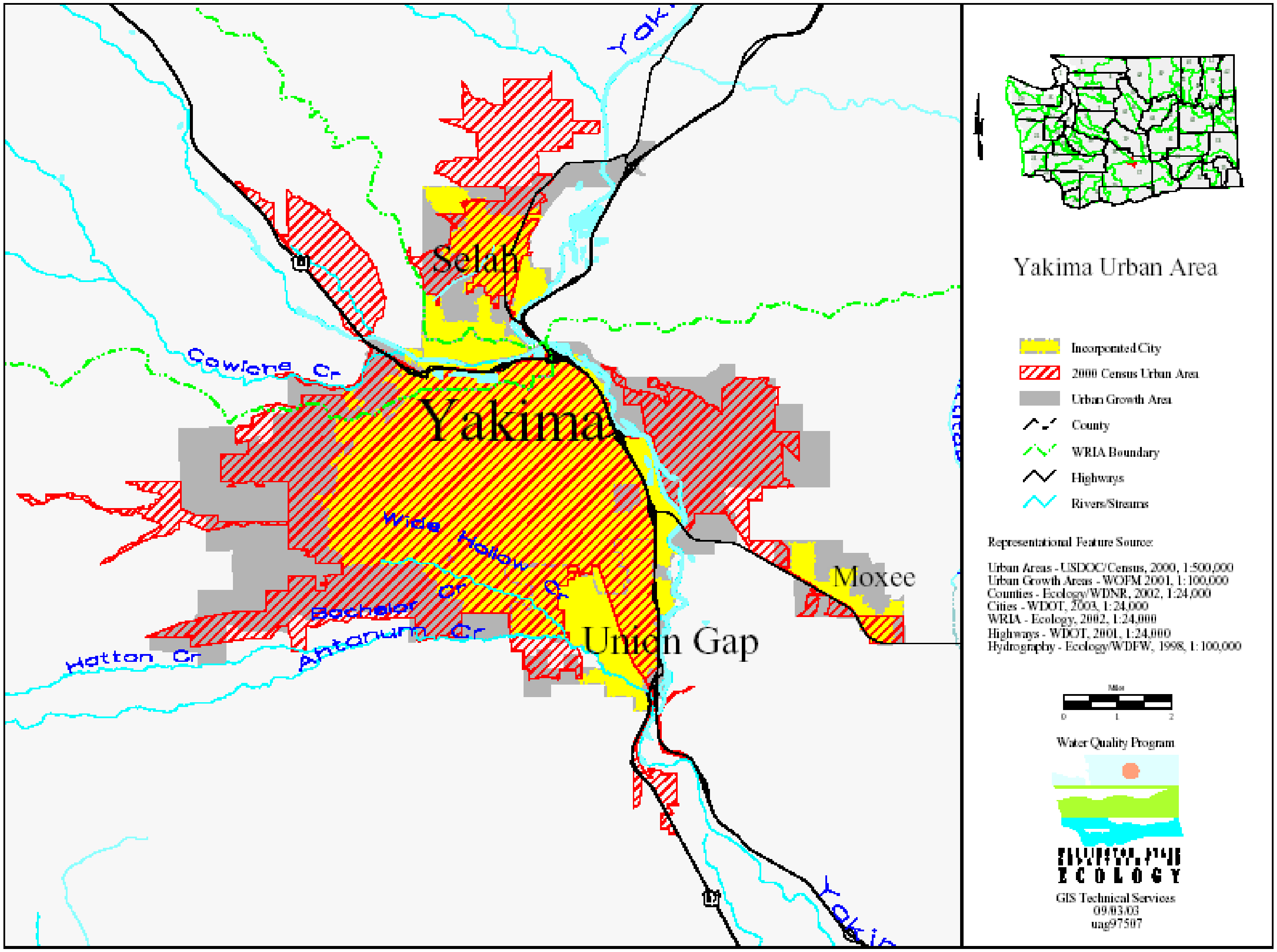

Figure 1. A Map of the Yakima Urban Area and Urban Growth Areas for Municipalities in the Cowiche and Wide Hollow Creeks and Moxee Drain Watersheds (Ecology, 2003).

Project Goal and Objectives

The goal of the project is to collect additional data to be used to establish FC bacteria TMDLs for Cowiche Creek, Wide Hollow Creek, and Moxee Drain. The TMDL evaluation will be used to develop a water cleanup plan that directs specific activities to reduce or remove pollutant sources. The five objectives in the original study listed below are still:

1. Identify FC loads by reach and from specific sources along Cowiche and Wide Hollow Creeks and Moxee Drain under various seasonal or hydrological conditions.
2. Determine the cumulative FC loads and calculate loading capacities along key points in Cowiche and Wide Hollow Creeks and Moxee Drain.
3. Estimate the FC count and load reductions necessary to meet the loading capacities.
4. Determine the percent *E. coli* bacteria in some FC samples for better source identification and treatment.
5. Assign FC wasteload allocations to National Pollutant Discharge Elimination System (NPDES)-permitted wastewater and stormwater sources, and estimate background and nonpoint FC load allocations.

An additional objective will be to determine if efforts to improve stormwater conveyances in the Yakima urban areas have resulted in reducing bacteria loads to Wide Hollow Creek.

Sampling Design

The sampling design will use a fixed network of sites sampled twice monthly and a pair of surveys conducted to characterize drainage improvement ditch sources. FC samples will be collected at each site during both types of surveys. FC counts for each site will be compared to state criteria or permit limits. Instantaneous FC loads will be estimated at each site using the best available discharge data. FC correlations with TSS concentrations, turbidity data, and discharge volumes will be tested. If possible, seasonal and annual FC loads will be estimated from regression analyses of the results. *E. coli* will be collected from one random site at each drainage during each sampling event to potentially help characterize wastes from various sources.

Data from the fixed-network will:

- Provide an estimate of the annual and seasonal geometric mean and 90th percentile statistics
- Provide reach-specific FC load and concentration comparisons
- Help delineate any jurisdictional responsibilities for FC sources
- Identify if certain land uses affect instream changes in FC loads

The surveys will focus on the FC inputs from drainage improvement district (DID) outfalls in September and November and stormwater sources during storm events.

Table 1 lists a subset of sites from the original TMDL study. These sites will be sampled twice a month from June through November 2010. Data will be compared to the original data set to determine if recent stormwater conveyance improvements, especially in Wide Hollow Creek, have been effective in reducing bacteria loads. Table 2 lists sites selected for two DID surveys. Table 3 lists sites selected for stormwater surveys. These are also a subset of sites used during the original TMDL.

Table 1. Water Quality Monitoring Sites

User Location ID	Location Description
37 FW 8	Wide Hollow Creek @ 80th
37 SS 12	Wide Hollow Creek @ 64th
37 FW 6	Wide Hollow Creek @ 44th
37 SS 9	Duck Pond outlet to Wide Hollow Creek
37 FW 4	Wide Hollow Creek @ 16th Ave.
37 FW 3	Wide Hollow Creek @ 3rd Ave.
37 FW 0	Wide Hollow Creek @ Union Gap shop
37 FM 2	Moxee Drain @ Birchfield Road gage
37 FM 3	Moxee Drain @ Birchfield Road drain (Thorp Road)
37 FM 10	Moxee Drain @ Beane Road
38 FC 1	Cowiche Creek @ Powerhouse Road
38 FC 5	Cowiche Creek @ Cowiche Creek Trailhead

Table 2. Potential Drainage Improvement District Sites

User Location ID	Location Description
37 SS 38	DID 38 outfall into Wide Hollow Creek
37 SS 48	DID 48 outfall into Wide Hollow Creek
37 IS 18	DID 48 outfall into ditch
37 IS 17	DID 40 outfall into Wide Hollow Creek
37 IS 16	Congdon Canal
37 IS 15	DID 4 by outfall into Wide Hollow Creek
37 IS 13	Shaw Creek
37 IS 13	DID 24 outfall L2 into Wide Hollow Creek
37 IS 12	DID 24 outfall L1 into Wide Hollow Creek
37 IS 9	Tieton Canal Wide Hollow and 96th Ave.
37 IS 10	Canal/Drain West Pine between 4th and 5th

Table 3. Potential Stormwater Survey Sites

User Location ID	Location Description
37 SS 13	Shaw Creek W. of 80th Ave & N. Nob Hill
37 SS 12	Wide Hollow Creek at 64th
37 SS 7	Wide Hollow Creek at 16th Avenue
37 SS 6	Wide Hollow Creek at 3rd
37 SS 3	Eakin Fruit-Union Gap
37 SS 5	Downtown Union Gap-Main Street Road Run Off
37 SS 20	I-82 Outfall
37 SS 10	WSDOT Maintenance –East Spring Creek
37 SS 19	Wide Hollow Creek below Hwy 82

Organization, Schedule, and Laboratory Budget

Tables 4, 5, 6, and 7 outline the project's staff organization, time schedule, and laboratory budget.

Organization

Table 4. Project Staff Roles and Responsibilities

Staff	Role	Responsibilities
Gregory Bohn CRO WQ	Overall Project Lead	Point of contact between EAP and other interested parties. Reviews and approves QAPP. Reviews technical report. Prepares TMDL report for submittal to EPA.
Scott Tarbutton ERO EAP	Project Manager	Writes TMDL technical report
Jenna Durkee CRO EAP	Field Lead	Oversees field operations. Collects field samples and record field data.
James Ross ERO EAP	EOS Lead	Writes QAPP addendum.
Jenifer Parsons EOS EAP	EAP EOS Manager	Approves QAPP and Data Summary report. Schedules and assigns personnel to complete the data summary and TMDL technical report.
Joel Bird EAP	MEL Director	Provides laboratory staff and resources. Provides review and approves the QAPP.
William Kammin EAP	Ecology QA Officer	Provides technical assistance on QA/QC issues. Reviews draft QAPP and approves final QAPP.

CRO: Central Regional Office
WQ: Water Quality
ERO: Eastern Regional Office
EAP: Environmental Assessment Program
EOS: Eastern Operations Section
MEL: Manchester Environmental Laboratory

Table 5. Proposed Sampling Dates

Fixed Network			
June 14 & 15	June 29 & 30	July 13&14	July 27 & 28
August 10 & 11	August 24 & 25	September 14 & 15	September 20 & 21
October 4 & 5	October 19 & 20	November 2 & 3	November 16 & 17
Storm & DID Survey			
September	November		

Schedule

Table 6. Project Schedule

Field and laboratory work	**Due date**	**Lead staff**
Field work completed	11/2010	Jenna Durkee
Laboratory analyses completed	12/2010	
Environmental Information System (EIM) database		
EIM user study ID	ID number	
Product	Due date	Lead staff
EIM data loaded	2/2011	Kristin Carmack
EIM QA	2/2011	Jenna Durkee
EIM complete	3/2011	Kristin Carmack
Final report		
Author lead / support staff	Scott Tarbutton	
Schedule		
Draft due to supervisor	8/2011	
Draft due to client/peer reviewer	9/2011	
Draft due to external reviewer(s)	10/2011	
Final (all reviews done) due to pub. coordinator	11/2011	
Final report due on web	12/2011	

Laboratory Budget

Table 7. Laboratory Budget

Parameter	**Cost per Sample**	**Number of Field Samples**	**Cost**
Fecal Coliform	23.88	226	5,396.88
Turbidity	11.42	226	2,580.92
Total Suspended Solids	11.42	226	2,580.92
E. coli	40.49	48	1,943.52
		Total Cost	**12,502.24**

Sampling Procedures

The following Ecology Environmental Assessment Program Standard Operating Procedures (SOPs) will be used as appropriate. See procedures at www.ecy.wa.gov/programs/eap/quality.html.

EAP012 - Sampling Bacteria in Water

EAP013 - Determining Coordinates via hand-held Global Positioning System (GPS) Receivers

EAP015 - Manually Obtaining Surface Water Samples

EAP023 - Collection and Analysis of Dissolved Oxygen (Winkler Method)

EAP024 - Estimating Streamflow

EAP030 - Fecal Coliform Sampling

EAP033 - Hydrolab®, DataSonde®, and MiniSonde® Multiprobes

EAP034 - Collection, Processing, and Analysis of Stream Samples

EAP035 - Measuring Dissolved Oxygen in Surface Water

EAP044 - Continuous Temperature Monitoring of Fresh Water Rivers and Streams Conducted in a Total Maximum Daily Load (TMDL) Study

EAP056 - Measuring and Calculating Stream Discharge

EAP071 - Minimizing the Spread of Aquatic Invasive Species from areas of Moderate Concern

Field measurements at all sampling stations will include conductivity, DO, pH, and temperature. All meters will be pre- and post-calibrated in accordance with the manufacturer's instructions. Pre-, mid-survey, and post-checks with pH and conductivity standards will evaluate field measurement precision and bias. A minimum of 10% of all DO measurements will be checked by a Winkler titration. Duplicate Winkler samples will be collected periodically to verify the precision of the Winkler measurements.

Duplicate FC and *E. coli* samples will be collected in the field in a side-by-side manner for 10% of the samples collected during an individual survey. Samples will be collected in the thalweg and just under the water's surface.

Turbidity and TSS samples will have 10% duplication for each survey.

Grab samples will be collected directly into pre-cleaned containers supplied by Manchester Environmental Laboratory (MEL) and described in the MEL User's Manual (2008). Sample containers, volumes, preservation requirements, and holding times are listed in Table 8.

Samples for laboratory analysis will be stored on ice and delivered to MEL within 24 hours of collection via Horizon Air and MEL courier.

Table 8. Containers, Preservation Requirements, and Holding Times for Samples Collected.

Parameter	Sample Matrix	Container	Preservative	Holding Time
Bacteria	Surface water	250 or 500 mL poly autoclaved	Cool to 4 °C	24 hours
Total Suspended Solids	Surface water	1000 mL poly	Cool to 4 °C	7 days
Turbidity	Surface water	500 mL poly	Cool to 4 °C	48 hours

Data Quality Objectives

The measurement methods and quality objectives will be consistent with the previous QAPP. A summary of the measurement quality objectives for field and laboratory parameters is listed in Table 9, including microbiological and analytical methods, expected range of sample results, and method reporting limits. The expected range of sample results are based on historical data from the study area. The reporting limits meet the expected range of results and the required level of sensitivity to meet project objectives.

Table 9. Summary of Measurement Quality Objectives for Field and Laboratory Parameters.

Parameter	Method	**Accuracy** % deviation from true value	**Precision** Relative Standard Deviation	**Bias** % deviation from true value	**Required Reporting Limits** Concentration units
Field					
Velocity*	Marsh McBirney Flow-Mate® Flowmeter	0.1 ft/s	0.1 ft/s	N/A	0.01 ft/s
pH*	Hydrolab Minisonde®	0.1 s.u	0.1 s.u	0.10 s.u	1 - 14 s.u.
Temperature*	Hydrolab Minisonde®	0.2 °C	0.1 °C	0.1 °C	1 - 40 °C
Dissolved Oxygen	Hydrolab Minisonde®	15	10%	5	0.1 - 15 mg/L
Specific Conductivity	Hydrolab Minisonde®	25	10%	5	1 µmhos/cm
Laboratory					
Fecal Coliform (MF)	SM 9222D	N/A	25%	N/A	1 cfu/100 mL
E. coli	EPA 1603 mTEC	N/A	25%	N/A	1 cfu/100 mL
Total Suspended Solids	SM 2540D	15	15%	15%	1 mg/L
Turbidity	EPA 180.1	15	15%	15%	1 NTU

[1] Two-tiered: 50% of replicates ≤ 20% RSD; 90% of replicates ≤ 50% RSD
* As units of measure, not percentages

Quality Control

The collection of replicates, sample preservation, and sample transport time will be consistent with the original QAPP. Table 10 is a summary of field and laboratory quality control procedures.

Table 10. Summary of Field and Laboratory Quality Control Procedures

Parameter	Field Blanks	Field Replicates	Lab Check Standard	Lab Method Blanks	Lab Replicates	Matrix Spikes
Field						
Velocity*	N/A	1/run	N/A	N/A	N/A	N/A
pH*	N/A	1/10 samples	N/A	N/A	N/A	N/A
Temperature*	N/A	1/10 samples	N/A	N/A	N/A	N/A
Dissolved Oxygen	N/A	1/10 samples	N/A	N/A	N/A	N/A
Specific Conductivity	N/A	1/10 samples	N/A	N/A	N/A	N/A
Laboratory						
Fecal Coliform (MF)	N/A	1/10 samples	N/A	1/run	1/10 samples	N/A
E-Coli	N/A	1/10 samples	N/A	1/run	1/10 samples	N/A
Total Suspended Solids	N/A	1/10 samples	1/run	1/run	1/10 samples	N/A
Turbidity	N/A	1/10 samples	1/run	1/run	1/10 samples	N/A

Audits and Reports

MEL conducts performance and system audits for its procedures. Results of these audits are available upon request.

At the end of the study, the project results will be published in a technical report and will contain at a minimum:

1. Map of sampling locations
2. Summary table of data, as well as pertinent field notes
3. Discussion of data quality and the significance of problems encountered
4. Evaluation of significant findings and recommendations for further action

The final report will be prepared by September 2012.

Data Management and Verification

Laboratory data reduction, review, and reporting will follow procedures outlined in MEL's User Manual (MEL 2008). Data entry, analysis, and review will be consistent with the original QAPP. Laboratory results will be checked for missing and/or improbable data. Variability in lab duplicates will be quantified using the procedures outlined in the MEL Users Manual. If laboratory blanks show levels of analyte above reporting limits, the resulting data will be qualified and their use restricted as appropriate. A standard case narrative of laboratory QA/QC results will be sent to the project manager for each set of samples.

Field notebooks will be checked for missing or improbable measurements before leaving each site. Field-generated data will be entered into EXCEL® spreadsheets (Microsoft, 2001) as soon as practical after returning from the field. Data entry will be checked by the field assistant against the field notebook data for errors and omissions. Missing or unusual data will be brought to the attention of the project manager for consultation.

Data requiring additional qualifiers will be reviewed by the project manager. After data validity and data entry tasks are completed, all field, laboratory, and flow data will be entered into the EIM system. EIM data will be independently reviewed by another EAP field assistant for errors at an initial 10% frequency. If significant entry errors are discovered, a more intensive review will be undertaken. At the end of the field collection phase of the study, the data will be published in a data summary.

References

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