



# Upper Kennedy Creek Fecal Coliform Bacteria Investigation, 2008 - 2009

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## Purpose of This Technical Memo

The purpose of this technical memo is to provide the Washington State Department of Ecology's (Ecology) Water Cleanup Plan Coordinator for the Eastern Olympics with current information about fecal coliform bacteria (FC) concentrations in upper Kennedy Creek. The study focused on conditions above and below the Ranch House BBQ restaurant and its septic system; the restaurant is located on Kennedy Creek Road SW, off Highway 8 west of Olympia. The project was conducted from October 15, 2008, through October 6, 2009.

## Publication Information

This report is available on the Department of Ecology's website at <http://www.ecy.wa.gov/biblio/0910098.html>

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# Background

Kennedy Creek discharges into the head of Totten Inlet in southern Puget Sound (Figure 1). This area is in the Washington State Department of Ecology's (Ecology's) Water Resource Inventory Area 14, Kennedy-Goldsborough Watershed. Most of the watershed is in Thurston County, with the mouth and lower reach in Mason County.

Kennedy Creek must meet the FC bacteria freshwater standard for Extraordinary Primary Contact Recreation (WAC 173-201A). The freshwater FC standard for this classification requires:

“Fecal coliform organism levels must not exceed a geometric mean value of 50 colonies/100 milliliters (mL), with not more than 10 percent of all samples (or any single sample when less than ten sample points exist) obtained for calculating the geometric mean value exceeding 100/colonies mL”

Ecology monitored one site near the mouth of the creek upstream of the Old Olympic Highway bridge (above marine influence) from 1992 through 2002 as part of the comprehensive National Monitoring Program (NMP) in Totten and Eld Inlets (Batts and Seiders, 2003a and 2003b). Kennedy Creek violated water quality standards for fecal coliform (FC) bacteria, temperature, and dissolved oxygen. Ecology placed Kennedy Creek on Ecology's 2004 list of impaired water bodies (303(d) list).

Ecology developed a Total Maximum Daily Load (TMDL) study for tributaries to Totten Inlet (Ahmed and Hempleman, 2006) using historic data. A Water Quality Implementation Plan (Hempleman, 2007) was prepared in response to the TMDL study. Ecology was identified as the lead for conducting a water quality study to identify FC bacteria sources in Kennedy Creek. As a result, water quality monitoring was conducted in 2007 (Dickes, 2008). Elevated FC bacteria concentrations were found in the watershed particularly in the upper watershed immediately downstream of the Ranch House BBQ restaurant and its septic system. This report describes FC bacteria concentrations above and below the Ranch House BBQ restaurant and its septic system from October 15, 2008, through October 6, 2009.

## Objective

The objective of this study was to conduct water quality monitoring above and below the Ranch House BBQ restaurant and its septic system to determine if water quality met state water quality standards and ensure that it is protecting human health. Samples were collected during critical low flow conditions and during the wet season to verify that the septic system is adequate to protect water quality.

## Study Design

Quality assurance objectives and field and laboratory protocols followed the Quality Assurance Project Plan developed for earlier Kennedy Creek sampling (Dickes, 2007).

There were two sampling locations in Kennedy Creek (Figure 2):

1. The upstream site (site UBBQ) was located above the restaurant, septic system and all outbuildings on the property.
2. The downstream site (site BBQ) was located below the area described above. Sampling was conducted in the creek between the Kennedy Creek Road bridge crossing and State Highway 8.

The downstream site is the same site used when sampling in 2007 (Dickes 2007). Replicate samples were taken at both sites for all sample events. Originally, Ecology was planning to collect samples once a week. However, due to low bacteria concentrations and economic considerations, Ecology reduced the sampling frequency to once a month.

## Quality Assurance

### Laboratory

All laboratory blank sample results were below detection for FC bacteria. This indicates a lack of contamination from the laboratory procedures.

The measurement quality objective (MQO) for laboratory duplicates at Manchester Laboratory is to have duplicate pairs with a relative percent difference (RPD) ranging from 0 percent to 40 percent. Twenty out of 27 duplicate pairs fell within the expected range. Five duplicate pairs were outside of the range but were accepted by the laboratory. These five duplicate pairs were accepted because the result values were less than five times the reporting limit resulting in an artificially high RPD.

Two replicate pairs exceeded the MQO and the values were qualified by the laboratory as estimates (a 'J' is used to designate an estimate). On June 29, 2009, the field sample concentration was 11 cfu/ 100 mL and the duplicate was 19 cfu/ 100 mL, and on September 8, 2009, the field sample concentration was 11 cfu/ 100 mL and the duplicate was 21 cfu/ 100 mL. The RPDs were 53 percent and 62 percent respectively. Both RPDs exceed the MQO, however the result values are within expected variability for FC bacteria so the project manager accepted these data and used them in data analysis.

### Field

There was 100 percent field sample replication for this monitoring project resulting in 57 replicate pairs. The MQO for precision follow the guidelines established by Mathieu (2006) which recommends that for all replicate pairs greater than 20 cfu/ 100 mL, 50 percent of the replicate pairs be at or below 20 percent relative standard deviation (RSD) and 90 percent of the pairs be at or below 50 percent RSD. There was only one field replicate pair, from site UBBQ on June 29, 2009, with a mean value of over 20 cfu/ 100 mL (Table 1). This replicate pair had an RSD of six percent. The project manager is comfortable with the quality of the data and accepted all data results.

## Results and Conclusions

All results can be reviewed in Table 1.

- Water quality in the project area in upper Kennedy Creek met the freshwater FC bacteria standard for Extraordinary Primary Contact Recreation. The geometric mean at both the upstream and downstream site was 2 cfu/ 100 mL. There were no sample results above 100 cfu/100 mL.
- No obvious sources of FC bacteria were detected during this monitoring project.

# Recommendations

Perform routine operation and maintenance on the restaurant septic system.

## References

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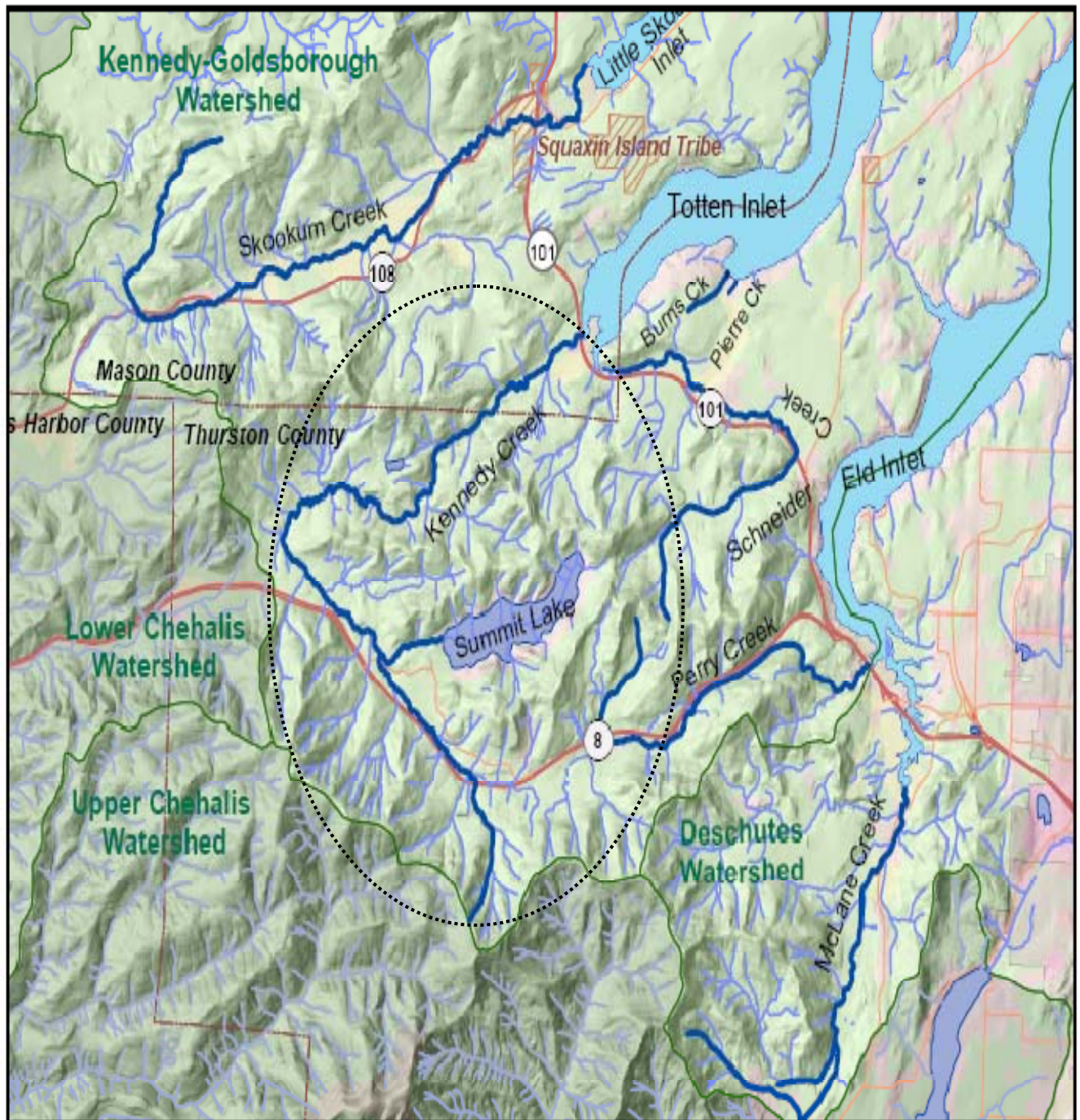


Figure 1. Kennedy Creek Watershed and the Surrounding Area

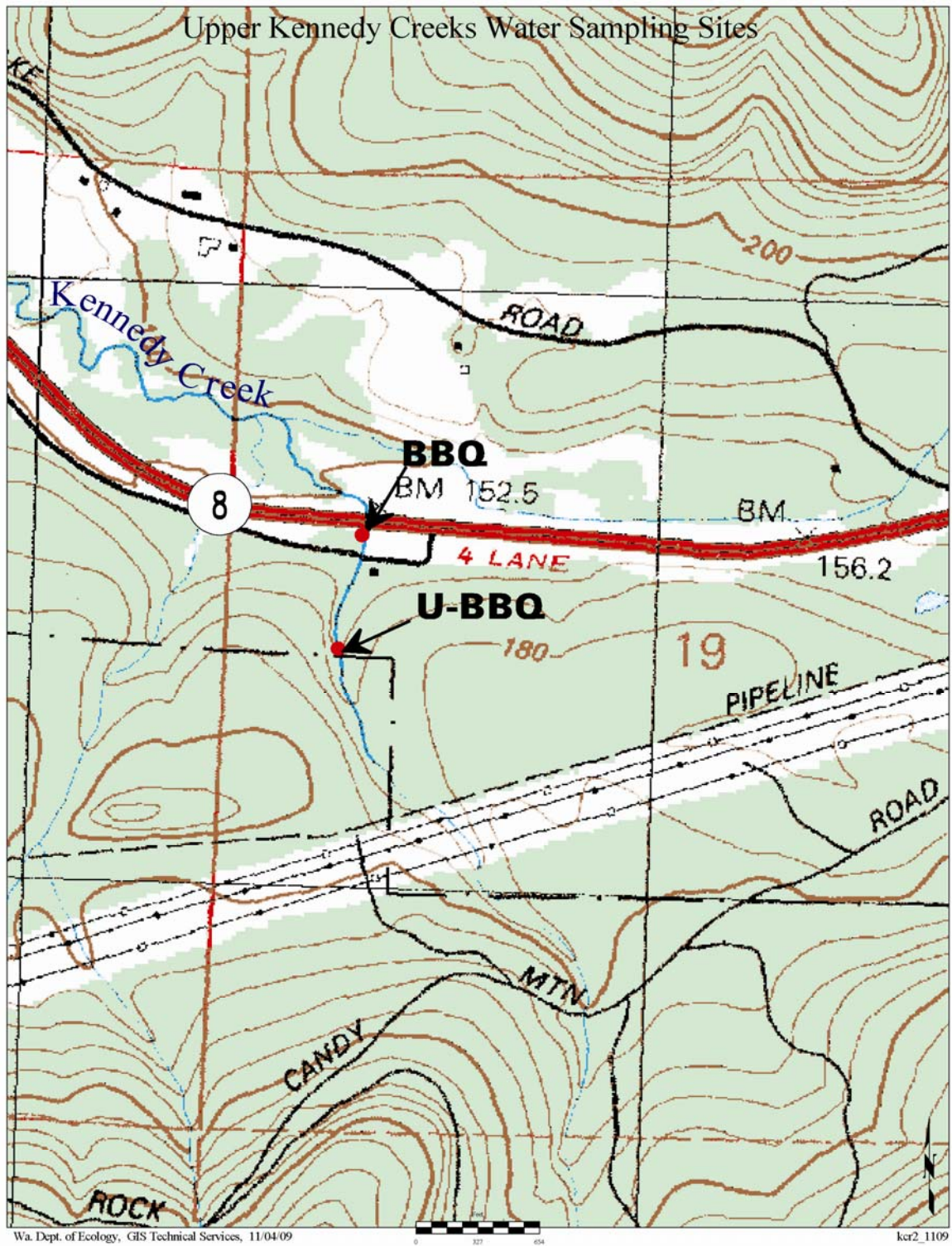


Figure 2. Upper Kennedy Creek Project Area. Sample Sites are Identified.

**Table 1. Fecal Coliform Bacteria concentrations in Kennedy Creek.**

Site Name	Date	Collection Time	Result * (cfu/100 mL)	Field Replicate Result (cfu/100 mL)
BBQ	10/15/08	12:51	8	8
UBBQ	10/15/08	13:05	6	3
BBQ	10/22/08	13:30	1	1
UBBQ	10/22/08	13:35	1	1
BBQ	10/29/08	13:25	1 U	1 U
UBBQ	10/29/08	13:33	2	1
BBQ	11/3/08	14:55	9	3
UBBQ	11/3/08	15:00	4	3
BBQ	11/12/08	11:05	14	14
UBBQ	11/12/08	11:15	11	3
BBQ	11/17/08	12:18	1 U	1 U
UBBQ	11/17/08	12:35	1 U	1 U
BBQ	11/24/08	11:50	1	1 U
UBBQ	11/24/08	12:05	1	1 U
BBQ	12/1/08	10:15	1 U	1 U
UBBQ	12/1/08	10:27	1	1 U
BBQ	12/15/08	10:15	1 U	1 U
UBBQ	12/15/08	10:25	1 U	2
BBQ	1/5/09	10:42	1 U	1 U
UBBQ	1/5/09	10:50	1 U	1 U
BBQ	1/12/09	12:53	1 U	1 U
UBBQ	1/12/09	13:05	1 U	1 U
BBQ	1/21/09	15:10	1 U	1 U
UBBQ	1/21/09	15:15	1 U	1 U
BBQ	1/26/09	13:00	1 U	1
UBBQ	1/26/09	13:05	1 U	1 U
BBQ	2/2/09	10:55	1 U	1 U
UBBQ	2/2/09	11:05	1 U	1 U
BBQ	2/18/09	12:50	1 U	1 U
UBBQ	2/18/09	13:00	1 U	1 U
BBQ	2/23/09	11:20	1 U	1
UBBQ	2/23/09	11:25	1	1 U

\* U= Organism not detected at or above the reported result

J= Organism positively identified, but numerical result is an estimate



**Table 1 (continued). Fecal Coliform Bacteria concentrations in Kennedy Creek.**

Site Name	Date	Collection Time	Result * (cfu/100 mL)	Field Replicate Result (cfu/100 mL)
BBQ	3/10/09	12:14	3	1 U
UBBQ	3/10/09	12:20	1 U	1 U
BBQ	3/23/09	13:15	1 U	1 U
UBBQ	3/23/09	13:21	1 U	1 U
BBQ	4/20/09	10:15	1 U	1 U
UBBQ	4/20/09	10:25	1 U	1 U
BBQ	5/18/09	12:40	1 U	1
UBBQ	5/18/09	12:45	1 U	1 U
BBQ	6/15/09	12:40	20	17
UBBQ	6/15/09	12:50	19	19
BBQ	6/29/09	12:10	12	11 J
UBBQ	6/29/09	12:15	36	33
BBQ	7/20/09	13:40	11	7
UBBQ	7/20/09	13:50	5	2
B				
BQ	8/10/09	12:05	8	2
UBBQ	8/10/09	12:20	1	1
BBQ	9/8/09	12:55	10	11 J
UBBQ	9/8/09	13:05	13	6
BBQ	10/6/09	12:30	2	2
UBBQ	10/6/09	12:40	1 U	1 U

\* U= Organism not detected at or above the reported result

J= Organism positively identified, but numerical result is an estimate