A Department of Ecology Report

Medicine Creek
Fecal Coliform Bacteria Review
Summer 2009

Purpose of This Document

The purpose of this memorandum is to provide the Washington State Department of Ecology (Ecology) South Puget Sound TMDL Coordinator with current information regarding bacterial water quality at the mouth of Medicine Creek in Thurston County. Fecal coliform (FC) bacteria samples were collected during eight sample events, from June 22, 2009, through October 14, 2009. Data are compared to the state Extraordinary Primary Contact water quality standard for FC bacteria in fresh water.

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For more information contact:

Betsy Dickes, Author
Water Quality Program
PO Box 47775
Olympia, WA 98504-7775
Phone: 360-407-6296

Water Quality Program
Southwest Regional Office
P.O. Box 47775
Olympia, WA 98504-7775
Phone: 360-407-6300

Washington State Department of Ecology - www.ecy.wa.gov/

o Headquarters, Olympia	360-407-6000
o Northwest Regional Office, Bellevue	425-649-7000
o Southwest Regional Office, Olympia	360-407-6300
o Central Regional Office, Yakima	509-575-2490
o Eastern Regional Office, Spokane	509-329-3400

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Background

In 1998, Ecology placed McAllister Creek and Nisqually River on its list of impaired water bodies (303(d) list) because bacteria concentrations exceeded the state's water quality standard for fecal coliform (FC) bacteria. A Total Maximum Daily Load (TMDL) water cleanup study was conducted to further characterize conditions and to develop a strategy to improve water quality. The Nisqually TMDL technical report (Sargeant et al., 2005) identified elevated FC bacteria concentrations in McAllister Creek and Medicine Creek, a smaller tributary to McAllister Creek (Figure 1). Previous sampling conducted in Medicine Creek during the 2007/ 2008 wet season (Dickes, 2009a) found that water quality met the standard for FC bacteria. The 2009 water quality investigation described in this report resulted from a recommendation to characterize FC bacteria in Medicine Creek during summertime low flow conditions.

Water quality criteria

Medicine Creek must meet the FC bacteria freshwater standard for Extraordinary Primary Contact Recreation (Appendix B). The freshwater bacteria 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." (WAC 173-201A).

Goals and objectives

The project goal for water quality monitoring in Medicine Creek was:

- Characterize FC bacteria concentrations to document dry season conditions at the mouth of Medicine Creek watershed during out-going low tides from July through September 2009.

The project objectives for Medicine Creek water quality monitoring were:

- Collect water quality samples to be analyzed for FC bacteria.
- Assess compliance with freshwater State Extraordinary Primary Contact Recreational water quality standards for FC bacteria.
- Determine the current FC bacteria concentrations at the mouth of Medicine Creek to see if Medicine Creek may contribute to FC bacteria concentrations in McAllister Creek.

Study design

Water samples were collected at river mile (RM) 0.05 during an out-going tide. A replicate sample was collected for each sample event. Conductivity was used to verify collection of fresh water samples. Tidal elevation was determined using information from the DuPont Wharf/Nisqually tide station (Station ID 1093). Due to tidal lag, samples could be collected at least an hour after the predicted low tide. Refer to the Quality Assurance Project plans (Dickes, 2009b and Dickes, 2007) for additional study information.

Results

- Manchester Laboratory met all of its quality assurance objectives such as chain of custody, sample holding time, and laboratory duplicates and analytical blanks.

- Field sampling method and chain of custody expectations were met.

- When less than ten replicate samples are collected in a project, the project manager determines the usability of the data (Mathieu, 2006). In this project there were eight sample events with eight replicates. Three out of eight replicate pairs were below 20 % RSD with 100 percent below 50% RSD (Table 1). Reviewing the results, and considering the high variability of bacteria in the environment, the author decided to accept the quality of the data. It was determined that several of the RSDs between 20 % and 50 % were due to low sample result values and not reflective of unreliable data.

- Precipitation during the first seven sampling events never exceeded 0.02 inches in the 24 hours before sampling. However, on October 14, 2009, 0.2 inches of rain fell within the previous 12 hours of sample collection with a total of 0.28 inches falling within the previous 24 hours. Increased precipitation did not make a noticeable difference in FC bacteria concentrations.

- Samples collected at RM 0.05 met the Extraordinary Primary Contact water quality standard for FC bacteria in fresh water. The geometric mean was 32 cfu/100 mL and no samples exceeded 100 cfu/100 mL (Table 1 and Figure 2).

Conclusions and Recommendations

- Water quality at Medicine Creek RM 0.05 met the Extraordinary Primary Contact water quality standard for FC bacteria in fresh water from June 22, 2009, through October 14, 2009.

- Protect water quality in Medicine Creek through continued use of best management practices and education.

Figure 1. Map of Sampling Location

Table 1. Medicine Creek FC Bacteria Data, June to October, 2009

Site	Date	Time	Sample Result (cfu /100 mL)	Result Mean* (cfu /100 mL)	Relative Standard Deviation (RSD)**
RM 0.05	6/22/09	13:45	10	9	25
replicate	6/22/09	13:45	7		
RM 0.05	7/6/09	13:20	22	29	34
replicate	7/6/09	13:20	36		
RM 0.05	7/20/09	12:05	24	23	6
replicate	7/20/09	12:05	22		
RM 0.05	8/3/09	12:30	69	70	1
replicate	8/3/09	12:30	70		
RM 0.05	8/17/09	10:40	21	26	27
replicate	8/17/09	10:40	31		
RM 0.05	8/31/09	11:45	37	39	6
replicate	8/31/09	11:45	40		
RM 0.05	9/14/09	10:40	42	51	25
replicate	9/14/09	10:40	60		
RM 0.05	10/14/09	10:25	64	53	31
replicate	10/14/09	10:25	41		

* The mean of the replicate pairs was used in data analysis

** RSD of the replicate pairs

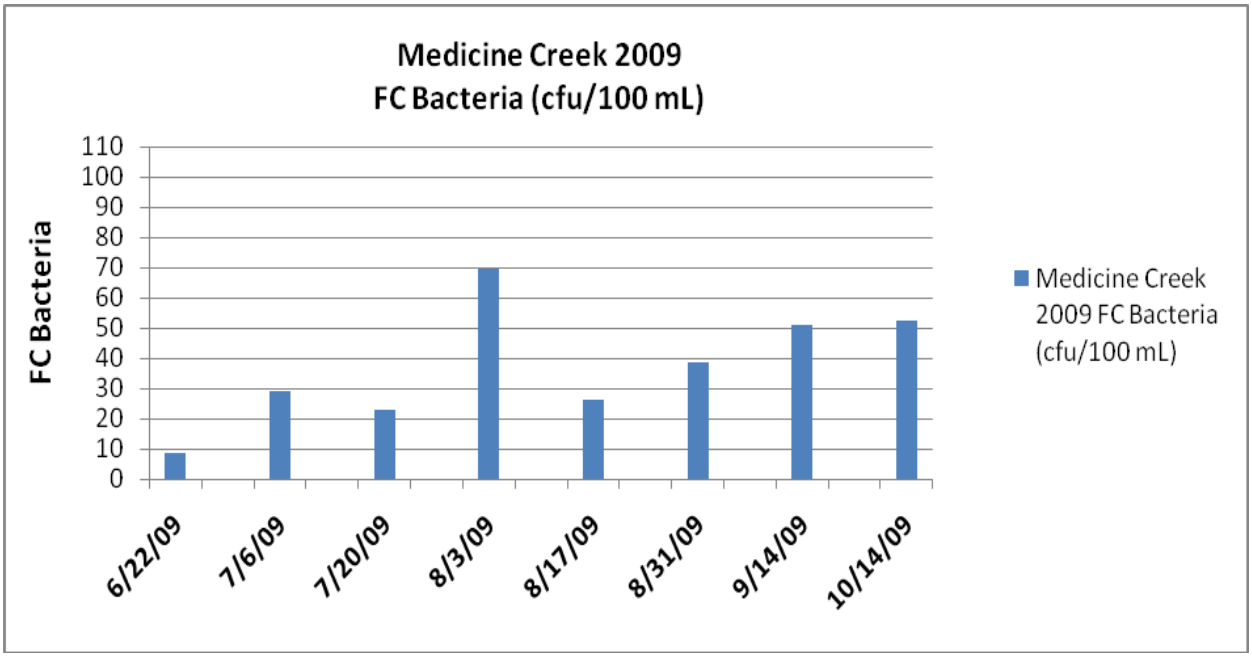

Figure 2. Medicine Creek FC Bacteria Data

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BD: kh

cc: Cindy James
Kim McKee
Ecology's Webpage http://www.ecy.wa.gov/biblio/0910091.html