

2009 Water Quality Monitoring Report

Kitsap County Health District Water Quality Program

INTRODUCTION

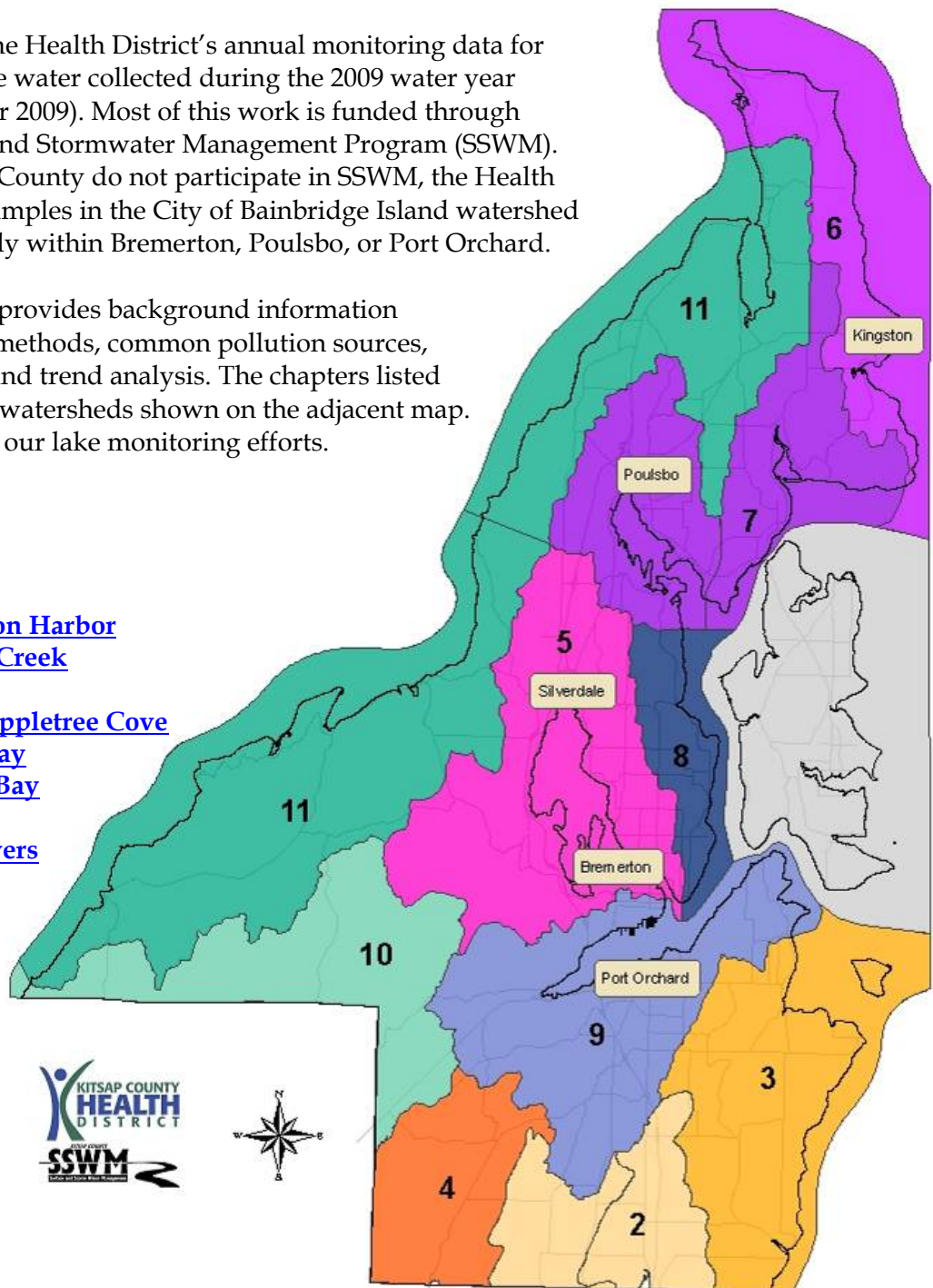
The Kitsap County Health District has been monitoring the water quality of our streams, lakes and marine water since 1996. These efforts allow us to identify areas affected by bacterial pollution, usually from animal or human waste. Sources are corrected when possible, resulting in improved water quality. Our primary goal is to protect people from waterborne illness and other water quality related health hazards.

This report summarizes the Health District's annual monitoring data for streams, lakes, and marine water collected during the 2009 water year (October 2008 - September 2009). Most of this work is funded through Kitsap County's Surface and Stormwater Management Program (SSWM). Since cities within Kitsap County do not participate in SSWM, the Health District does not collect samples in the City of Bainbridge Island watershed or from streams exclusively within Bremerton, Poulsbo, or Port Orchard.

This introductory section provides background information including data collection methods, common pollution sources, water quality standards, and trend analysis. The chapters listed below discuss each of the watersheds shown on the adjacent map. The last chapter describes our lake monitoring efforts.

Chapters

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- 2 - [Burley / Minter](#)
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The Purpose of Health District Water Quality Monitoring

The quality of water in our lakes, streams, and rivers often reflects whether human activities are being managed to effectively protect public health and the environment. Since most of our streams are relatively small, impacts from pollution are more apparent, and damage occurs more quickly. Polluted streams also have the potential to impact marine water and shellfish growing areas, because all our streams eventually flow into Puget Sound or Hood Canal.

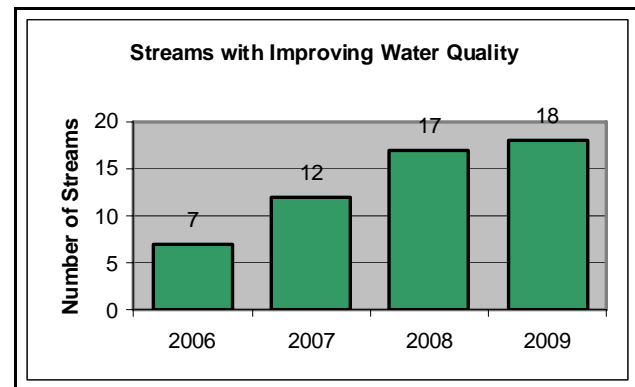
To protect public health and prevent further degradation of Kitsap County surface waters, the Health District conducts water quality monitoring, pollution source identification and correction projects, public education, and regulatory enforcement. These activities must continue if we are to protect and improve the water quality where we live.

Overall Kitsap County Water Quality Issues

There are water quality problems in many areas of Kitsap County. These are generally more common in developed areas, where stream and marine water quality is being significantly impacted by human activity. The good news is that bacteria levels are improving in more areas than ever before, often due to projects focused on finding and correcting pollution sources.

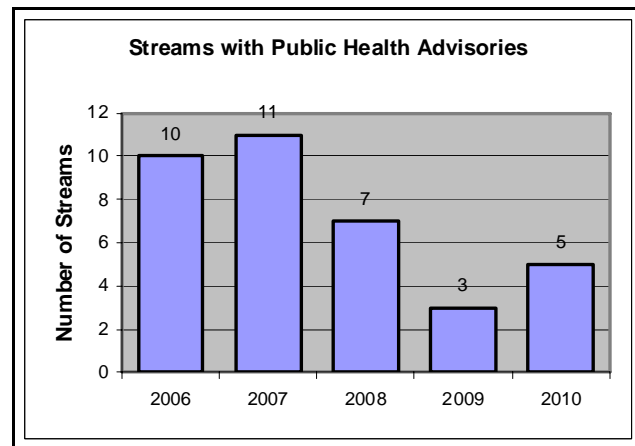
Stream Water Quality and Trends

Streams are sampled monthly to determine which ones are affected by bacterial pollution, and whether conditions are getting better or worse. This data is also used to prioritize areas for our Pollution Investigation and Correction (PIC) projects. Trend analysis shows that the number of streams with statistically significant improvements has increased over the last few years, as shown in the graph at right.



Stream Public Health Advisories

The Health District issues public health advisories when streams have chronic water quality problems that increase the risk of people getting sick, especially children who might play in the streams during the summer months. This list is evaluated each year, once more recent water quality data from our trend monitoring is available. Clean up work has been done on many of these streams, with water quality improvements in some areas. *Based on the water quality sampling results from 2009, 5 streams will have health advisories in 2010.*



Sources of Water Pollution in Kitsap County

Although there are many types of pollutants, the Health District focuses on Fecal coliform bacteria as our primary indicator of surface water quality. High levels of this bacteria have been correlated with the presence of viruses or other pathogens that can affect human health.

The primary cause of degraded water quality in Kitsap County's streams, lakes, and marine water is "nonpoint source" pollution. Nonpoint source pollution can generally be defined as pollutants that come from many smaller sources, rather than a few large sources. This accumulation of pollutants often results from common activities in both urban and rural areas. Major categories of nonpoint source pollution are:

- Human Sewage and Animal Waste from failing on-site sewage systems, inadequate livestock keeping practices, pet and wildlife waste, combined sewer overflows, sewage spills, and sewage discharges from boats.

Human and animal waste may contain harmful and pathogenic organisms that can cause a variety of diseases and illnesses including giardia, cholera, hepatitis A, shigella, salmonella, and viral gastroenteritis to name a few. Humans are exposed to these pathogens through direct water contact or the consumption of shellfish from contaminated waters.



Livestock and manure impacting surface water

- Soil erosion and sedimentation from improper land clearing activities, poor construction practices, inadequate livestock keeping practices, insufficient stream buffers, stormwater, wetlands elimination, and the re-channeling of natural streams.

Sedimentation buries salmon and shellfish habitat. Insufficient stream buffers can increase stream temperatures (due to a lack of shade) and decrease dissolved oxygen levels (due to elevated stream temperatures). Fine sediments may also increase survival of fecal coliform bacteria and associated pathogens within stream beds and beaches.



Sediment loaded stormwater runoff

- Chemicals from vehicles, excess fertilizer, pesticides, industrial and military wastewater discharges, urban runoff, and the illegal dumping or mismanagement of solid and hazardous wastes can all pollute storm water, streams and Puget Sound.

Chemicals can be toxic to aquatic life, can alter water pH (acidity) or lower the oxygen levels that support aquatic life. Excess nutrients can trigger harmful algae blooms.



Oil spilled on beach

Health District Monitoring Goals

The Health District conducts water quality monitoring to accomplish multiple goals, which are summarized in the outline below. These efforts also support the goals and objectives of Kitsap County's Surface and Stormwater Management (SSWM) Program. For more detailed information about our monitoring plans, please contact the Health District. Copies of these plans are available upon request.

Water Quality Trend Monitoring, Streams and Marine Waters:

- Assess surface water quality trends through long-term monitoring.
- Compare results against applicable standards.
- Prioritize problem areas for corrective actions.
- Identify public health concerns.
- Issue public health advisories.
- Provide input to other agencies for evaluation of Kitsap County waterbodies.
- Provide input to other agencies about shellfish resources.
- Provide water quality data to the public and other interested parties.



KCHD staff collecting a stream sample

Swimming Beach Monitoring (lakes):

- Monitor public swimming beaches for *E.coli* bacteria.
- Track and respond to reports of Swimmer's Itch and toxic algae blooms.
- Track and respond to reports of waterborne illness.
- Coordinate with swimming beach owners/operators regarding public health issues.
- Inform and educate swimming beach owners/operators and the public about public health and safety issues at public swimming beaches.

Lake Trophic Assessment Monitoring:

- Monitor lakes annually.
- Assess nutrient enrichment from human sources.
- Compare nutrient levels with other local lakes and state water quality standards.
- Prioritize lakes with high nutrient levels for clean up projects.

Monitoring Frequency

During the 2009 water year, both stream and marine stations were typically sampled once each month. Fewer samples may be collected at a monitoring station due to lack of flow during the dry season, hazardous weather conditions, equipment failures, or other circumstances. Sampling frequency for lake swimming beaches was based on beach usage; more popular lakes were sampled more frequently during the summer. Lake nutrient monitoring was conducted monthly between June and September at Carney, Horseshoe, Mission and Wye Lakes. Kitsap Lake was monitored more frequently, typically twice a month, as part of a phosphorous reduction project.



Storm water flow.

Bacterial Water Pollution Cleanup Programs

The Health District's water quality programs have two primary functions: water quality monitoring and the cleanup of polluted waters. Pollution Identification and Correction (PIC) projects are conducted in an effort to improve the water quality for a polluted waterbody. These projects are generally, short-term (2-3 years), intensive, and comprehensive programs that work with property owners in the areas around polluted waters. The goal of each project is to identify possible pollution sources and correct these problems to reduce the overall amount of bacteria and other pollutants. Each year the Health District evaluates and revises our [Priority Area Work List](#) based on the level of pollution, public exposure, and a variety of other ranking factors in each watershed. Funding for PIC projects generally comes from the Kitsap County SSWM Program and the Washington State Department of Ecology.

Each watershed section of this report contains brief summaries of [Health District PIC projects](#) in that area. Other agency cleanup programs may also be mentioned in the applicable watersheds.

The Washington State Department of Health ([DOH Office of Shellfish and Water Protection](#)) is responsible for classifying commercial shellfish growing areas in Washington State. Areas are classified as *Approved*, *Conditionally Approved*, *Restricted*, or *Prohibited*. These classifications are based on DOH shoreline inspections for potential contamination sources, and marine water monitoring for bacterial pollution. Some areas are left *Unclassified* until enough data is collected to determine another classification. Applicable shellfish classifications are listed in each chapter.

Bacterial Pollution Trend Analysis

Stream Trend Analysis

Long term and short term trend analysis is performed on the FC data collected at all stream mouth stations. For a given station, *long term trend* is determined over the entire historic data set and a *short term trend* is determined over the last three (3) years when significant data gaps do not exist. Trends are identified as "stationary", "worsening", or "improving".

In each watershed section, the water quality summary chart displays both the long and short term trend for each stream. A trend graph is also provided for many streams that have had elevated levels of fecal coliform bacteria. The trend graphs plot "moving 12 sample geometric means" over time. "Moving" means that the first geometric mean plotted in the graph is calculated from samples one to twelve, the second is calculated from samples two to 13, and so on. *It is important to remember that streams may have changes in water quality over time but still exhibit a stationary trend if the changes are not statistically significant.* The majority of Kitsap County streams exhibit a stationary trend. Lines near the bottom of each trend graph show the applicable FC standard, so it is apparent whether sampling data exceeds these standards.

Marine Water Trend Analysis

Trend analysis is performed on the FC data collected at all marine water sampling stations where a minimum of 36 samples has been collected. The trend analysis procedure is the same as for the stream mouth stations. In addition to the individual marine stations trend analysis, the trend for the watershed's overall marine water quality is also analyzed. In each watershed

section, a box plot is provided to show the distribution of all FC results. The box plots display the data using the following format:

For each listed station, the diamond is the most recent 12-sample geometric mean. The bar (within the box) is the median. The median is the middle value of all FC results; 50% of the FC results are below it, and 50% of the FC results are above it. The vertical lines that extend from the box show the minimum and maximum values. The lines that mark the bottom and top of the box represent the 25th percentile and 75th percentile values, respectively. Consequently, the middle 50% of the FC values fall within the box. The 25th and 75th percentile values are similar to the median value, for example the 25th percentile means that 25% of the FC values are below and 75% of the FC values are above the number.

Washington State Water Quality Standards

Surface water quality standards are established by the Washington Department of Ecology, and described in [Chapter 173-201A](#) of the Washington Administrative Code (WAC). Having specific standards also sets pollution limits, and provides goals for water clean-up projects. The water quality standards which apply in Kitsap County are summarized the below. State law also places bodies of water in different classifications, i.e. Primary or Extraordinary, depending on designated beneficial uses such as human recreation or fish habitat. Classifications for more pristine areas, like Extraordinary, are generally more stringent.

Parameters	Freshwater Standard		Marine Water Standard	
	Extraordinary Primary Contact	Primary Contact	Extraordinary Aquatic, Primary Contact	Excellent Aquatic, Primary Contact
Fecal Coliform Bacteria (FC)	Part 1: ≤50 FC/100 ml. (geometric mean) Part 2: Not more than 10% of all samples obtained for calculating a geomean >100 FC/100 ml.	Part 1: ≤100 FC/100 ml. (geometric mean) Part 2: Not more than 10% of all samples obtained for calculating a geomean >200 FC/100 ml.	Part 1: ≤14 FC/100 ml. (geomean) Part 2: Not more than 10% of all samples obtained for calculating a geomean >43 FC/100 ml.	Same as Extraordinary Aquatic - Primary Contact waters
Dissolved Oxygen	> 9.5 mg/L	> 8.0 mg/L	> 7.0 mg/L	> 6.0 mg/L
pH	6.5 - 8.5 units	6.5 - 8.5 units	7.0 - 8.5 units	7.0 - 8.5 units
Temperature	≤16.0 ⁰ C ¹	≤18.0 ⁰ C ¹	≤13.0 ⁰ C ¹	≤16.0 ⁰ C ¹

¹. Temperatures shall not exceed standard due to *human activities*. When natural conditions exceed these standards, no temperature increases are allowed which will raise the receiving water temperature by greater than 0.3⁰ C.

The geometric mean value (GMV), measures the central tendency of a data set. The geometric mean is especially useful for groups of data that contain a broad range of values. Since sample results for bacterial concentrations tend to be highly variable, the geometric mean is a more appropriate tool for analyzing this type of data than using an arithmetic mean or average.

Bacteria Levels in Kitsap County Streams

The following table summarizes stream monitoring results for the 2009 water year, starting with the most contaminated streams. The table is sorted by the levels of fecal bacteria in each stream during 2009, listed as a Geometric Mean Value (GMV) for each water year. The colors used in the "Sampling Station" column indicate whether or not streams met the applicable state water quality standards for fecal coliform bacteria.

Red	- the stream frequently had high levels of bacteria and failed the standard.
Yellow	- the stream had periodic bacteria problems, and failed only part 2 of the standard.
Green	- the stream had consistently low levels of bacteria, and met the standard.

Each stream is also evaluated to determine whether there is a statistically significant change, or trend, in bacteria levels over time. A long-term trend is calculated for the entire data set, and a short-term trend for the last 3 year period. Please note that while stream water quality may change from year to year, it can still have a stationary trend if the changes are not statistically significant compared to the rest of the data set.

Watershed	Stream Name	Sampling Station	2008 FC GMV	2009 FC GMV	Long Term Trend	Short Term Trend (3 yr)
Upper Hood Canal	Lofall Creek	LF01	360	414	Worsening	Stationary
Dyes Inlet	Phinney Creek	PH01	290	364	Stationary	Stationary
Liberty Bay/Miller Bay	Little Scandia Creek	LS01	168	196	NA	Stationary
Burley Minter	Burley Creek	BL01	78	100	Stationary	Stationary
Liberty Bay/Miller Bay	Dogfish Creek - South Fork	SF01	73	95	Improving	Worsening
Dyes Inlet	Ostrich Bay Creek	OB01	164	88	Stationary	Stationary
Sinclair Inlet	Karcher Creek	KA01	164	86	Stationary	Stationary
Liberty Bay/Miller Bay	Bjorgen Creek	BN01	58	76	NA	Stationary
Liberty Bay/Miller Bay	Big Scandia Creek	BS01	75	67	Stationary	Worsening
Liberty Bay/Miller Bay	Daniels Creek	DC01	65	67	Stationary	Stationary
Liberty Bay/Miller Bay	Kitsap Creek	KT01	30	67	Stationary	Stationary
Sinclair Inlet	Beaver Creek	BV01	63	66	Improving	Stationary
Sinclair Inlet	Sacco Creek	SC01	353	62	Stationary	Stationary
Port Orchard/Burke Bay	Enetai (Dee) Creek	DE01	47	56	Improving	Stationary
Sinclair Inlet	Blackjack Creek	BJ01	52	54	Stationary	Stationary
Foulweather Bluff/Appletree Cove	Carpenter Creek	CA02	15	54	Stationary	Stationary
Dyes Inlet	Barker Creek	BK01	56	53	Stationary	Stationary
Liberty Bay/Miller Bay	Grovers Creek	GC01	45	53	Stationary	Stationary
Upper Hood Canal	Kinman Creek	KN01	28	53	Stationary	Stationary
Liberty Bay/Miller Bay	Dogfish Creek	DF01	49	52	Improving	Stationary
Dyes Inlet	Kitsap Mall Creek (West)	KW01	105	50	NA	Stationary
Sinclair Inlet	Gorst Creek	GR01	33	50	Improving	Stationary
Port Orchard/Burke Bay	Steele Creek	ST01	65	49	Stationary	Stationary
Sinclair Inlet	Annapolis Creek	AP01	146	47	Improving	Stationary
Colvos Passage/Yukon Harbor	Curley Creek	CY01	44	41	Stationary	Stationary
Colvos Passage/Yukon Harbor	Willson Creek	WN01	55	40	Stationary	Stationary
Port Orchard/Burke Bay	State Park Creek	SP01	31	35	Improving	Stationary

Watershed	Stream Name	Sampling Station	2008 FC GMV	2009 FC GMV	Long Term Trend	Short Term Trend (3 yr)
Upper Hood Canal	Martha John Creek	MJ01	41	34	Stationary	Stationary
Liberty Bay/Miller Bay	Cowling Creek	CW01	16	33	Stationary	Stationary
Dyes Inlet	Clear Creek	CC01	80	30	Stationary	Improving
Tahuyeh/Union River	Union River	UN01	13	30	Stationary	Stationary
Dyes Inlet	Strawberry Creek	SR01	36	29	Stationary	Stationary
Colvos Passage/Yukon Harbor	Salmonberry Creek	SM01	26	29	Stationary	Stationary
Colvos Passage/Yukon Harbor	Olalla Creek	OC02	15	28	Improving	Stationary
Burley Minter	Huge Creek	HG01	12	28	Stationary	Stationary
Liberty Bay/Miller Bay	Johnson Creek	JC01	17	27	Stationary	Stationary
Upper Hood Canal	Jump Off Joe Creek	JJ01	17	26	Improving	Stationary
Sinclair Inlet	Ross Creek	RS02	29	25	Stationary	Stationary
Liberty Bay/Miller Bay	Indianola Creek	IN01	10	25	Improving	Stationary
Upper Hood Canal	Port Gamble Creek	PG01	19	24	Stationary	Worsening
Burley Minter	Purdy Creek	PR01	12	24	Stationary	Stationary
Dyes Inlet	Chico Creek	CH01	18	18	Improving	Stationary
Liberty Bay/Miller Bay	Kleibel Creek	KL01	17	17	NA	Stationary
Burley Minter	Minter Creek	MN01	23	15	Improving	Stationary
Dyes Inlet	Mosher Creek	MS01	21	14	Improving	Stationary
Sinclair Inlet	Anderson Creek	AN01	11	14	Stationary	Stationary
Dyes Inlet	Parmann Creek	PA01	31	13	Stationary	Stationary
Upper Hood Canal	Boyce Creek	BY01	12	12	Stationary	Stationary
Port Orchard/Burke Bay	Illahee Creek	IC01	11	26	Improving	Stationary
Upper Hood Canal	Stavis Creek	SV01	9	10	Stationary	Stationary
Upper Hood Canal	Seabeck Creek	SB01	6	10	Improving	Stationary
Upper Hood Canal	Big Anderson Creek	BA01	8	9	Improving	Stationary
Upper Hood Canal	Big Beef Creek	BB01	12	7	Stationary	Stationary
Tahuyeh/Union River	Tahuyeh River	TR01	7	7	Stationary	Stationary
Upper Hood Canal	Little Anderson Creek	LA02	10	6	Stationary	Stationary
Colvos Passage/Yukon Harbor	Fragaria Creek	FG01	9	5	Improving	Stationary
Coulter Creek/Rock Creek	Coulter Creek	CU01	3	5	Stationary	Stationary

Watershed Chapter Format

At the front of each chapter, there is a water quality summary table that includes information about individual streams and overall marine water quality. An example table is shown on the next page. Each chapter also contains sections describing clean up projects, shellfish classifications, and violations of water quality standards listed under the current Washington State Water Quality Assessment.

This assessment is required by sections 303(d) and 305(b) of the federal Clean Water Act. States must assess impairments to waterbodies and submit this information to the federal Environmental Protection Agency (EPA). The [most current assessment](#) was finalized in 2008. Streams and marine waters are listed in different categories, depending on the frequency of water quality problems; Category 2 (waters of concern), Category 4B (impaired waters with a cleanup plan), or Category 5 (impaired waters *without* a cleanup plan).

EXAMPLE - Water Quality Summary Table

Waterbody	Long term trend	Short term trend	Meets WQ Standard?	2008 Annual FC Bacteria GMV	2009 Annual FC Bacteria GMV	Health Advisory
Stream Name (XX01)				##	##	No
Stream Name (XX01)				##	##	No
Stream Name (XX01)				##	##	No
Stream Name (XX01)				##	##	
Overall marine water		None	3 of 4 Stations			

Waterbody - Lists the stream name and associated monitoring station ID (example: Big Anderson Creek, BA01). If there are marine water quality monitoring stations in the watershed, the overall marine water quality summary will be listed in the last row.

Trends - In fecal coliform data are shown as “Long Term” (overall data) or “Short Term” (last 3 years) in separate columns. Only long term trends are calculated for marine water. The symbols and their meanings are:

- Green, upward arrow **Improving** trend
- Blue, level arrow **Stationary** trend
- Red, downward arrow **Worsening** trend
- “No” symbol..... **Insufficient data** for trend analysis

Meets WQ Standard? - These symbols indicate whether a stream met the State water quality standard for fecal coliform bacteria, with the same color scheme used in the County summary table. See page 1-6 for an explanation of these standards. In the overall marine water summary, the number of marine water monitoring stations that met the FC standard will be listed.

- Red** - the stream frequently had high levels of bacteria and failed the standard.
- Yellow** - the stream had periodic bacteria problems, and failed only part 2 of the standard.
- Green** - the stream had consistently low levels of bacteria, and met the standard.

Health Advisory - For Kitsap County streams that are so polluted with Fecal bacteria that the Health District advises no contact with them, a stop sign symbol is shown in this column.

The last chapter describes our lake monitoring efforts. The lake summaries include discussions of *E.coli* bacteria monitoring results from lake swimming beaches, any health advisories issued in the last year, and nutrient levels for some lakes.

For copies of reports on specific projects, please check our website or call the Health District for further information.

More Information: Kitsap County Health District
Water Quality Program
345 6th Street, Suite 300
Bremerton, WA 98337-1866
(360) 337-5235
www.kitsapcountyhealth.com

Internet Addresses for Other Programs and Documents

When possible, hyperlinks to reports or websites are included within the text of this report. These are indicated by blue underlined words, but they only work in electronic versions of the document. The follow list provides internet addresses for these references.

Kitsap County Surface and Storm Water Management Program (SSWM)
<http://www.kitsapgov.com/sswm/>

Washington State Department of Health:
<http://www.doh.wa.gov>

Washington State Department of Ecology:
<http://www.ecy.wa.gov>

Water Quality Standards for Surface Waters of the State of Washington
<http://www.ecy.wa.gov/pubs/0610091.pdf>

United States Environmental Protection Agency:
<http://www.epa.gov/>

