Thurston County
Water Resources Monitoring Report
2005-2006 Water Year
2006-2007 Water Year

Report Includes:

Water Quality of Streams and Lakes

December 2008

Prepared by:
Thurston County Public Health and Social Services Department, Environmental Health Division and Thurston County Water and Waste Management Department, Storm and Surface Water Program

In Cooperation With:
City of Olympia Public Works, Water Resources Program
City of Lacey Public Works, Water Resources Program
City of Tumwater Public Works Department
Washington State Department of Ecology
# Table of Contents

## Introduction

- Report Organization ............................................................................................................. 1
- Monitoring Methods ............................................................................................................. 2
- Water Quality Standards ...................................................................................................... 8

## Black River Watershed

- Beaver Creek .................................................................................................................. ....11
- Black River ....................................................................................................................... 17
- Deep Lake .......................................................................................................................... 23
- Scott Lake .......................................................................................................................... 33

## Budd Inlet / Deschutes River Watershed

- Barnes Lake ....................................................................................................................... 39
- Black Lake .......................................................................................................................... 49
- Black Lake Ditch ................................................................................................................ 59
- Capitol Lake ....................................................................................................................... 65
- Chambers Creek ................................................................................................................ 87
- Deschutes River ................................................................................................................ 93
- Ellis Creek .......................................................................................................................... 99
- Indian Creek ....................................................................................................................... 105
- Mission Creek ................................................................................................................... 111
- Moxlie Creek ................................................................................................................... 117
- Percival Creek ................................................................................................................ 121
- Schneider Creek ............................................................................................................... 127
- Spurgeon Creek ............................................................................................................... 133
- Ward Lake ......................................................................................................................... 139

## Chehalis River Watershed

- Chehalis River ............................................................................................................... 149
- Prairie Creek ..................................................................................................................... 155
- Scatter Creek .................................................................................................................... 161
- Skookumchuck River ...................................................................................................... 167

## Eld Inlet Watershed

- Green Cove Creek .......................................................................................................... 173
- McLane Creek .................................................................................................................. 179
- Perry Creek ....................................................................................................................... 185

## Henderson Inlet Watershed

- Hicks Lake ......................................................................................................................... 191
- Long lake ............................................................................................................................ 201
- Pattison Lake ..................................................................................................................... 221
- Tanglewilde Stormwater Outfall ...................................................................................... 237
- Woodard Creek ............................................................................................................... 243
- Woodland Creek ............................................................................................................. 249
Nisqually River Watershed
Lake St. Clair ...................................................................................................................255
McAllister Creek.............................................................................................................. 269

Totten / Little Skookum Inlet Watershed
Kennedy Creek.................................................................................................................275
Schneider Creek (Totten).................................................................................................281
Summit Lake....................................................................................................................289

Volunteer Monitoring Activities .........................................................................................299

Benthic Macroinvertebrates Monitoring ..............................................................................323

References ..........................................................................................................................337
Introduction

This report contains water quality data collected by Thurston County Environmental Health Division during the 2005/06 and 2006/07 water years (Note: A water year is October 1 through September 30). The surface water monitoring is part of an ambient monitoring program funded by the local stormwater utilities and Thurston County Storm and Surface Water Utility funds. The report also contains a chapter of student volunteer-collected water quality data. This is the twelfth annual water resources report.

The objectives of the surface water monitoring program are to:

- Collect baseline information about the water quantity and water quality condition of streams and lakes in Thurston County;
- Identify problem areas and;
- Track trends in stream flow and water quality over time.

The county map on page three shows currently monitored and historically monitored sites.

Report Organization

Surface Water Report Organization

The surface water report is divided into sections by watershed or drainage basin. The eight major drainage basins within Thurston County are shown on the map on page three and are as follows:

Puget Sound:
- Nisqually River
- Budd Inlet/Deschutes River
- Henderson Inlet
- Eld Inlet
- Totten Inlet

Chehalis Drainage to Pacific:
- Skookumchuck River
- Chehalis River
- Black River

The first item at the beginning of each watershed section is a map highlighting the watershed area. Following the watershed maps are descriptive summaries and data for each stream and lake monitored within the watershed. These summaries appear alphabetically by the most common name for that stream, river, or lake. In some cases there is no official name for a stream, so it has been assigned a name by County staff for reference.

On the first page of each stream summary is the name of the stream and its stream catalog number assigned to it by the Washington Department of Fisheries, November 1975, in A Catalog of Washington Streams and Salmon Utilization. On the top half of the page is a map of the stream or lake. If water quality sampling was conducted, the sampling site is identified.
Introduction

Below the map is a general description of the stream or lake: the watershed it is located in, length of the stream or lake shoreline, and basin size in acres or square miles. Stream order, which is a number from 1 to 6 ranked from headwaters to river mouth that designates the relative position of a stream in the drainage basin system, is listed. U.S. Geological Survey 7.5 minute quadrant maps were used to determine the stream order for this report. Fisheries resources are listed using A Catalog of Washington Streams and Salmon Utilization, November 1975, unless otherwise noted.

A brief description of the area topography is included followed by a general water quality description of "excellent," "good," "fair," or "poor" for the stream. The description is based on the water quality data collected in the water year reported, the number and degree of excursions outside the water quality standards, as well as other water quality indicators. A definition of these categories can be found on page 10. Following the “General Water Quality” category is a listing of sources for additional information.

The remainder of the summary includes summary tables and comparisons of water quality data to water quality standards, with a narrative discussion of water quality and quantity conditions and issues, as well as volunteer data, if any is available. Each summary ends with water quality data and stream flow or lake level records.

Monitoring Methods

Surface Water Quality Monitoring Methods

Streams

In water year 2005/06, water quality information was collected on twenty one streams. In water year 2006/07, water quality information was collected on twenty-six streams. Sampling sites for streams are generally located close to the mouths of the streams before they discharge into the larger river or marine water body. The stream monitoring was done monthly.

The following parameters were measured at all stream sites:
- total phosphorus
- nitrate-nitrite nitrogen
- turbidity
- fecal coliform
- temperature
- pH
- specific conductivity
- dissolved oxygen

Ammonia was measured at three sites: Deschutes River throughout water year 2005/06 and on October 2006 and May and June 2007; Tanglewilde and Moxlie Creek.

Field parameters were measured using a YSI multi-parameter field instrument. Stream discharges, measured during water quality monitoring events, were measured using a Swoffer flow meter and by wading the stream.
Introduction

THURSTON COUNTY
Water Quality Monitoring Sites

Thurston County makes every effort to ensure that this map is a true and accurate representation of the work of County government. However, the County and all related completeness or convenience of any information disclosed on this map. Nor does the County accept liability for any damage or injury caused by the use of this map.

To the fullest extent permissible pursuant to applicable law, Thurston County disclaims merchantability, data fitness for a particular purpose, and non-infringements of proprietary rights.

Under no circumstances, including, but not limited to, negligence, shall Thurston County be liable for any direct, indirect, incidental, special or consequential damages that result from the use of, or the inability to use, Thurston County materials.
Lakes

In 2006, water quality information was collected at fifteen sites on ten lakes. In 2007, sixteen sites on nine lakes were sampled and monitored. For lake monitoring, field parameters were measured at one or two meter increments from the surface to the bottom of the lake using the YSI multiparameter field instrument. The nutrients (total phosphorus and total nitrogen) were sampled near the surface and near the bottom. The bottom samples were collected using a Kemmerer sampler. Chlorophyll $a$ and algae identification samples were taken as composite samples from the epilimnion (warm surface layer) or the photic zone (the surface area where sunlight can penetrate). Secchi disk visibility (or water clarity) was measured using a standard black and white quadrant disk. Sampling sites in the lakes were located in the deepest area of each lake as determined by available bathymetric maps. Three lakes had two sampling sites on them and Capitol Lake had three sites, because these lakes have separate basins.

The average summer total phosphorus and chlorophyll $a$ concentrations and secchi disk measurements are used to calculate the Carlson trophic state indices. The Carlson trophic state indices (TSI) are used to express the degree of productivity, or plant and algae growth, in a lake. Average summer total phosphorus concentrations, chlorophyll $a$ concentrations, and secchi disk transparency are each used to calculate a TSI for the lake. A TSI of 0 to 40 indicates an oligotrophic, or low productivity, lake. A TSI of 41 to 50 indicates a mesotrophic, or moderately productive lake. A TSI of greater than 50 indicates an eutrophic, or highly productive lake.

The three graphs on the following page show the 2007 lake sample sites in order of their trophic state by parameter. Lakes toward the bottom of the graph have the clearest water, lowest algae production and low total phosphorus levels. Low productivities lakes are ones that people like to swim and recreate in and associate with “good” water quality. Those lakes toward the top of the graphs have poor water clarity and tend to have frequent and/or prolonged algae blooms. The plant and algae growth on these lakes can interfere with recreational uses at times.
Surface Water Quantity Monitoring

Thurston County’s Department of Water and Waste Management, Storm and Surface Water Utility performs stream flow and stream temperature, lake level, ground water level and precipitation monitoring. There are currently eleven active stream gaging stations, fifteen rainfall gaging stations, ground water level recorders in four areas, and sixteen lake level gages. The data are used for a variety of purposes including to calibrate and validate hydrologic and hydraulic models used to predict and track changes in stream flow resulting from changes in land use and changes in stormwater management activities. The data also serves as an early warning of possible flooding, especially the ground water level data.

Continuous Stream Flow and Stream Temperature Data

Stream flow data is collected using a combination of Geokon LC-1 measurement and control module utilizing a vibrating wire pressure transducer and Waterlogger DH-21 pressure transducers. Stream temperatures and ambient air temperatures are also recorded concurrently. Stage measurements are recorded either 60 minute or 15 minute intervals. The stage is then converted to a flow value (cubic feet per second) by the use of a rating curve. Historical 15-minute data is available for most of the stream flow collection sites listed below. Stream flow and temperature data are available on the Thurston County website at http://www.co.thurston.wa.us/monitoring/StreamFlow_temp/Streamflow_Home.htm

Continuous stream flow data for the following creeks and rivers are available:

- Black Lk Ditch @ Jones Quarry Bridge Start date: 2003 – present (Discontinued 2006)
- Black Lake Ditch at Black Lake outlet Start date: Aug 2006 - present
- Chambers Creek at Rich Road Start date: 8/28/89 - present
- Green Cove Creek at 36th Avenue NW Start date: 6/20/89 - present
- McLane Creek at Delphi Road Start date: 9/21/94 - present
- Percival Ck @ Black Lk Ditch Confluence Start date: 2003 - present
- Percival Creek at Mottman Road Start date: 2/26/88 - 3/7/96 (Discontinued 2008)
- Percival Creek at South Puget Sound Comm. Col. Start date: Nov 2008 - present
- Woodland Creek at Pleasant Glade Road Start date: 2/26/88 - 2/5/96, 2003 - present
- Woodard Creek at 36th Avenue NE Start date: 3/1/88 – present
- Scatter Creek at James Rd Start Date: April 2008
- Black River at Littlerock (128th Ave SW) Start Date: June 2008

The streamflow monitoring program is currently under significant reorganization and upgrades in 2008. Most of the sites have been upgraded with new equipment and the data quality has been reviewed for quality and will be posted in early 2009. In addition, cooperation with the United States Geological Survey – Hydrologic Data Division will bring additional river and streamflow data to the program in the upcoming year. Data from newer stations may not be available because rating curves have not been reliably developed yet.
Introduction

Precipitation

Thurston County’s Storm and Surface Water Utility measures precipitation at fifteen locations throughout Thurston County. Data is collected using a Campbell Scientific precipitation, temperature, and barometric pressure recording equipment. Rainfall is recorded with a tipping bucket that registers every 1/100 of an inch of rainfall. Precipitation data is collected from field recordings every month or by radio telemetry and is downloaded to a database and processed for posting on the County’s Monitoring Website. The data can be downloaded at http://www.co.thurston.wa.us/monitoring/Precipitation/Precipitation_Home.htm. The water year begins October 1 and ends September 30. Rainfall statistics for the water year and period of record are available.

In addition to County-maintained precipitation stations, the National Oceanic and Atmospheric Administration (NOAA) measures precipitation at the Olympia Airport. That information is also available at the above website.

Rainfall data is available for the following areas.

- Upper Deschutes River  Start Date: October 1990 to present
- Eaton Creek/Lake St. Clair  Start Date: March 1992 to 2000, 2002 to present
- Green Cove Creek Basin  Start Date: October 1990 to 2000, 2002 to present
- Nisqually/McAllister Basin  Start Date: 2002 to present
- Olympia Airport  Start Date: 1955 to present
- Percival Creek Basin  Start Date: October 1989 to 2000, 2001 to present
- Summit Lake  Start Date: November 1993 to 2000, 2003 to present
- Tenino  Start Date: October 1994 to 2001, 2003 to present
- Woodard Creek Basin  Start Date: October 1988 to present
- Woodland Creek Basin  Start Date: October 1988 to present
- Grand Mound  Start Date: June 2007 to present
- Skookumchuck  Start Date: December 2008
- Boston Harbor  Start Date: April 2006 to present
- Sunrise Beach  Start Date: October 2002 to present
- Yelm  Start Date: November 2007 to present

Lake Levels

Thurston County Department of Water and Waste Management, Surface and Storm Water Utility has volunteer lake level gage readers for sixteen lake sites. Graphs of each lake’s water surface elevation over time can be seen by going to http://www.co.thurston.wa.us/monitoring/index.htm. The following is a listing of the lakes monitored:

- Black Lake
- East and West Chambers Lake
- Deep Lake
- Offutt Lake
- Pattison Lake
- Scott Lake
Ground Water Level Monitoring

Continuous ground water elevations are monitored in the following areas of the County:

- Salmon Creek Basin (Thirteen Sites)
- Hidden Forest Subdivision (Three sites)
- Yelm (Nine sites)
- Tanglewilde Subdivision (Ten Sites)
- Evergreen Terrace (Six sites)

The groundwater data can be downloaded from the Thurston County Monitoring website at: [http://www.co.thurston.wa.us/monitoring/Groundwater/Groundwater_home.htm](http://www.co.thurston.wa.us/monitoring/Groundwater/Groundwater_home.htm). Data from some of these locations may not be posted on the website. To check for availability and to request data, contact the Department of Water and Waste Management.
Water Quality Standards

The Washington State water quality standards for all surface water bodies are established in Chapter 173-201A of the Washington Administrative Code (WAC) which was amended July 1, 2003. Water quality standards for surface waters were established consistent with public health and public enjoyment of the waters and the propagation and protection of fish, shellfish, and wildlife. The standards for the parameters that are monitored by Thurston County are shown in Table 1. Refer to WAC 173-201A for a complete description of the water quality standards.

Table 1. Water Quality Standards for Surface Waters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Extraordinary Primary Contact Recreation (includes lakes)</th>
<th>Primary Contact Recreation</th>
<th>Secondary Contact Recreation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freshwater Fecal Coliform (colonies/100 L)</td>
<td>50</td>
<td>100</td>
<td>200</td>
</tr>
<tr>
<td>Part I – geometric mean ≤ X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freshwater Fecal Coliform (colonies/100 L)</td>
<td>100</td>
<td>200</td>
<td>400</td>
</tr>
<tr>
<td>Part II - not more than 10% of the samples &gt;XX</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Freshwater Aquatic Life Uses Criteria

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Char</th>
<th>Salmon &amp; Trout Spawning, Core Rearing, and Migration</th>
<th>Salmon &amp; Trout Spawning, Non-core Rearing, and Migration</th>
<th>Salmon &amp; Trout Rearing and Migration Only</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dissolved Oxygen (mg/l) Lowest 1-Day Minimum</td>
<td>9.5</td>
<td>9.5</td>
<td>8.0</td>
<td>6.5</td>
</tr>
<tr>
<td>Temperature (degrees C) Highest 7-DAD* Maximum</td>
<td>12°C (53.6°F)</td>
<td>16°C (60.8°F)</td>
<td>17.5°C (63.5°F)</td>
<td>17.5°C (63.5°F)</td>
</tr>
<tr>
<td>pH Within range shown with human-caused variation within the range of less than XX units.</td>
<td>6.5 – 8.5; 0.2</td>
<td>6.5 – 8.5; 0.2</td>
<td>6.5 – 8.5; 0.5</td>
<td>6.5 – 8.5; 0.5</td>
</tr>
<tr>
<td>Turbidity (NTUs) Not exceed X over background when background is 50 NTU or less; or a XX% increase in turbidity when background is &gt; 50 NTU.</td>
<td>5; 10%</td>
<td>5; 10%</td>
<td>5; 10%</td>
<td>10; 20%</td>
</tr>
</tbody>
</table>

*7 day average of the daily maximum temperatures
The “General Water Quality” condition stated in the descriptive summary for each stream and lake in this report is made on the basis of the guidelines below.

**Stream Water Quality Categories**

“Excellent” - No water quality standard violations, and very low fecal coliform and nutrient concentrations.

“Good” - Usually meets water quality standards; OR violates only one part of the two part fecal coliform standard; OR the violation is most likely the result of natural conditions rather than pollution.

“Fair” - Frequently fails one or more water quality standards and other parameters such as nutrients indicate water quality is being impacted by pollution.

“Poor” - Routinely fails water quality standards by a large margin; other parameters such as nutrients are at elevated concentrations.

**Lake Water Quality Categories**

“Excellent” - Very low nutrient and chlorophyll \( a \) concentrations, and very high water clarity; Classified as Oligotrophic; Uses not impaired.

“Good” - Low to moderate nutrient and chlorophyll \( a \) concentrations, and moderate to high water clarity; Classified as Mesotrophic; Uses not impaired.

“Fair” - Moderate to high nutrient and chlorophyll \( a \) concentrations, and low to moderate water clarity; Classified as Eutrophic; Uses sometimes impaired.

“Poor” - High nutrient and chlorophyll \( a \) concentrations, and low water clarity; Classified as Eutrophic; Uses impaired during most of the summer season by excess algae and/or aquatic macrophyte (plant) growth.