2009 STATE OF THE LAKES UPDATE

CHAIN LAKE

REPORT DESCRIPTION

This report is an annual update to the 2003 State of the Lakes Report and includes water quality data collected from 2003 through 2009. For additional background on the information provided here or to find out more about Chain Lake visit www.lakes.surfacewater.info or call Snohomish County Surface Water Management (SWM) at 425-388-3464.

LAKE DESCRIPTION

Chain Lake is a 39-acre lake located a few miles north of Monroe. The lake is fed by seasonal streams and drains west to French Creek. Chain Lake is relatively shallow, with a maximum depth of 6.5 meters (21 feet) based on a new bathymetric map developed by SWM in 2003.

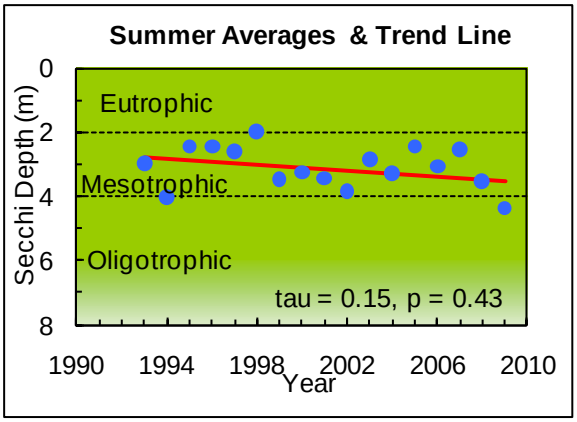
Chain Lake has a large watershed, which means that there is a high potential for negative impacts to the lake from watershed pollution. Although there are only a few homes around the lake shore, there has been accelerating development of new residential subdivisions within the watershed in recent years.

LAKE CONDITIONS

The following graphs illustrate the summer averages and trend lines (in red) for water clarity, total phosphorus, and chlorophyll for Chain Lake. Please refer to the table on the last page for long-term averages and for averages and ranges for individual years.

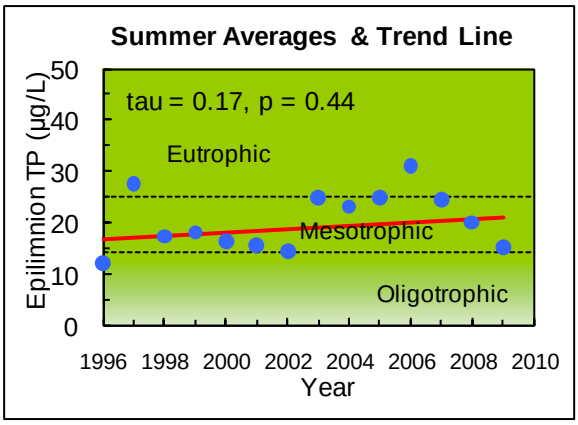
Water Clarity

Water clarity in Chain Lake is moderate, with a long-term 1993 to 2009 summer average of 3.1 meters. Water clarity averages are highly variable ranging between 2 and 4.4 meters. The water clarity appears to be slightly improving over the 17-year monitoring period time, but it is not a statistically significant trend at this time.



Total Phosphorus (key nutrient for algae)

Total phosphorus concentrations in the epilimnion (upper waters) are moderate to high. The long-term summer average is 20 µg/l. Higher concentrations occurring from 2003 to 2007 made it appear that phosphorus concentrations were increasing. However, recent years are closer to the long-term average, and there is no statistically significant trend apparent between 1996 and 2009. The relatively high phosphorus levels are the reason that Chain Lake is listed as "impaired" in Washington State's official 2008 water quality assessment.



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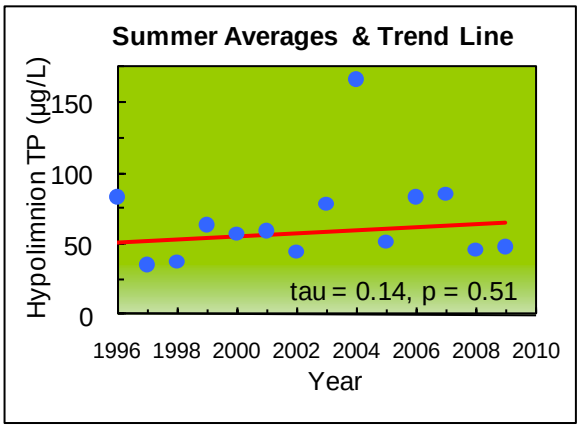
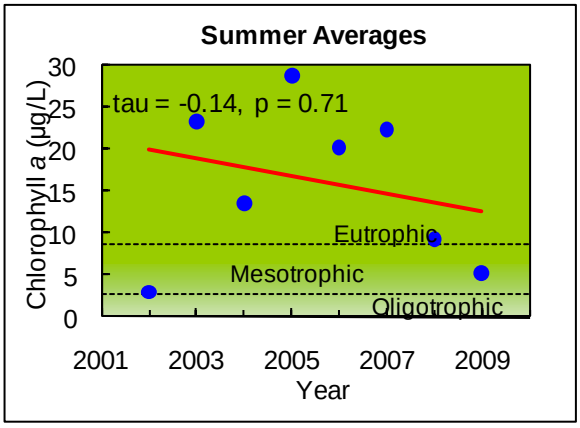
Summertime phosphorus levels in the hypolimnion (bottom waters) are moderate to high, with a long-term average of 67 µg/l. Higher phosphorus levels can lead to excess algal growth in the lake. In 2004, the summer average jumped to more than twice previous averages. In other years the data are closer to the long-term average, but there appears to be a high degree of natural variability in total phosphorus from year to year. Overall, there is no statistically significant trend in phosphorus in the hypolimnion.



Chlorophyll a (Algae)

Chlorophyll *a* summer averages from 2002 through 2008 have been high, averaging 16 µg/l. This indicates abundant algal growth in Chain Lake. The averages have also been variable ranging from 3.0 µg/l in 2002 to 29 µg/l in 2005. A larger data set is needed to identify long-term trends in chlorophyll *a*.



Toxic Blue-Green Algae (Cyanobacteria)

Blue-green algae, also called cyanobacteria, are a group of algae capable of producing toxins during periods of high growth, known as blooms. The toxins can cause serious illness in people and pets that come into contact with affected water. Blooms often look like blue or green paint floating on the surface. Lake users should avoid contact with the water and keep pets away from the lake when it is experiencing a blue-green algal bloom. If a bloom has been identified as toxic, the lake will information posted at the public access site.

Since 2005, SWM staff has screened algae at Chain Lake for potential toxic blooms. Beginning in 2009, routine toxin testing also began as part of a larger project coordinated by the Washington State Department of Health. The project is funded by a grant from the U.S. Centers for Disease Control (CDC) and includes monitoring of thirty lakes in Snohomish, King, and Pierce Counties. The CDC project is being conducted to identify algal blooms that could pose a potential health threat and to alert the public about toxic algae. Water samples are tested for two types of toxins: microcystin (a liver toxin) and anatoxin-a (a neurotoxin).

Chain Lake has a history of blue-green algal blooms. However, in 2009, Chain Lake did not have noticeable surface accumulations or scums of blue-green algae during the summer. Additionally, neither microcystin nor anatoxin-a toxins were detected in any of the samples collected. The project will continue in 2010 and 2011.

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SHORELINE CONDITION

SWM staff surveyed the shoreline of Chain Lake in 2008. The condition of the lake shoreline is important to understanding the overall lake health. Frequently, lake shorelines are modified through removal of natural vegetation, the installation of bulkheads or other hardening structures, and/or removal of partially submerged logs and branches. These types of alterations can be harmful to the lake ecosystem because natural shorelines protect the lake from harmful pollution, prevent bank erosion, and provide important habitat for fish and wildlife.

Chain Lake has one of the least developed shorelines in the county (see map on page 4). The development around the lake appears to have changed little over the past few decades, with only 4 homes bordering the lake. The shoreline has been modified only at the boat launch, which comprises less than one percent of the 1.1 mile shoreline. In addition, there are no docks on the entire lake. There is only a small amount (about 15 pieces) of large wood, old logs and branches, still remaining in the lake to provide fish and wildlife habitat. However, Chain Lake is unique in that the vegetation immediately adjacent to the shoreline is 95% intact, and there are large wetlands with stands of floating aquatic plants bordering the majority of the lake. The natural state of the shoreline provides rich habitat for fish and wildlife and plays an important role in filtering out nutrients to protect the lake.

SUMMARY

Trophic State

Chain Lake may be classified as meso-eutrophic, based on moderate water clarity, moderate to high phosphorus levels, and high algae levels. The lake also supports dense growths of aquatic plants.

Condition and Trends

Chain Lake is not meeting the targets set forth in the 2003 State of the Lakes Report of maintaining stable water clarity and phosphorus levels. Although there are no statistically significant trends in water clarity or total phosphorus through 2009, the long-term averages have deteriorated. The long-term epilimnion phosphorus average has increased from 17 µg/l to 20 µg/l and the hypolimnion average has increased from 54 µg/l to 67 µg/l. The State of Washington has listed Chain Lake as “impaired” because of high phosphorus concentrations.

Overall, Chain Lake appears to be at risk of future water quality declines because of increasing nutrients in the lake. The primary threat to lake water quality is an increase of nutrients entering the lake through new development and human activities in the watershed. Nutrients enter the lake through stormwater runoff after rain storms. Sources of nutrients include fertilizers, pet wastes, and erosion from construction and land clearing. Nutrients may also directly enter the lake through poorly maintained septic systems. Measures to control nutrients in the watershed should be taken now to prevent any future negative impacts to the lake. In addition, the shoreline should remain largely unaltered to protect the lake. To find out more about ways to preserve lake water quality and information on the causes and problems of elevated lake nutrient levels visit www.lakes.surfacewater.info.

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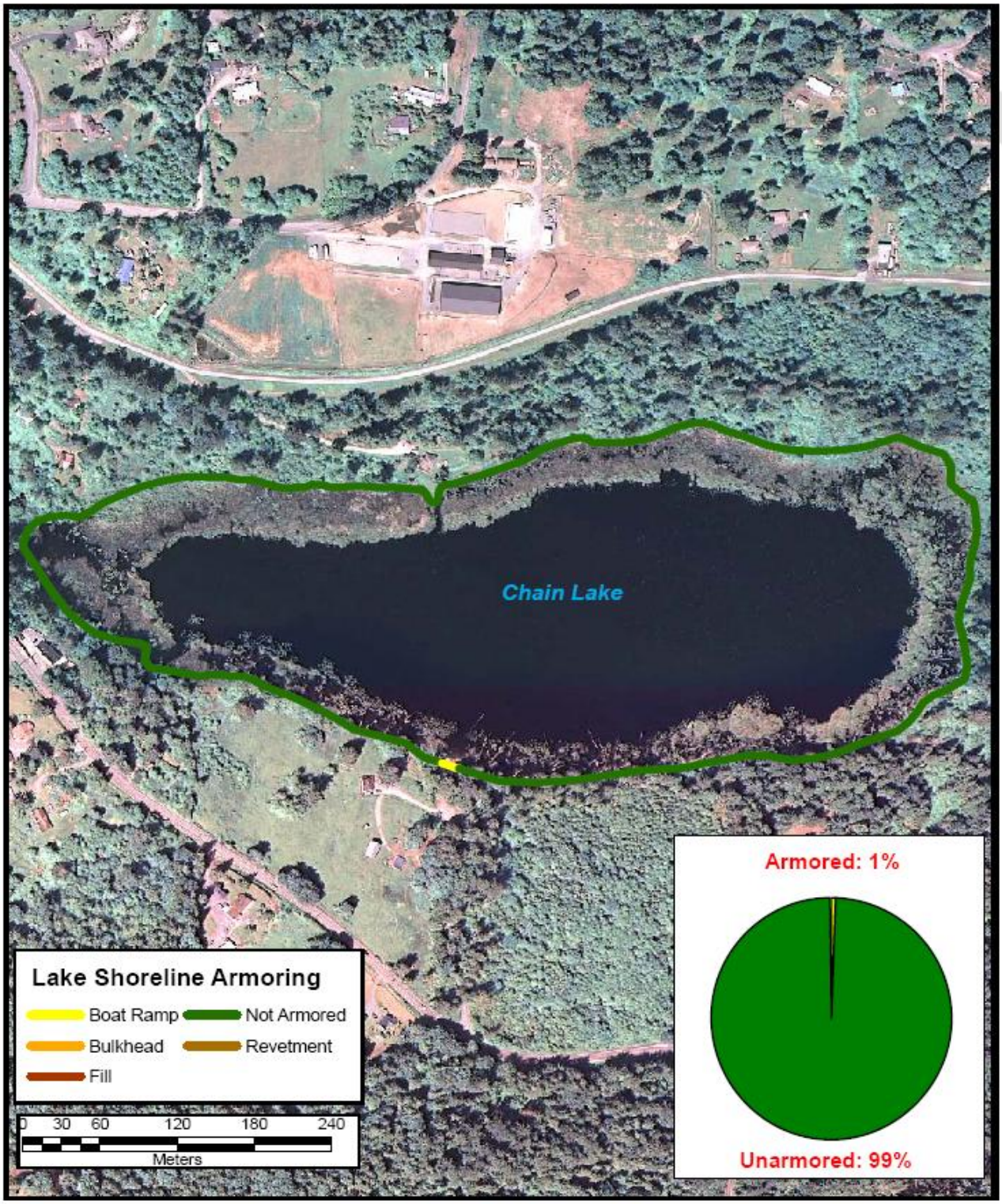
Chain Lake
Lake Shoreline Armoring
Boat Ramp
Not Armored
Bulkhead
Revetment
Fill
0 30 60 120 180 240
Meters
Armored: 1%
Unarmored: 99%

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DATA SUMMARY FOR CHAIN LAKE					
		Water Clarity (Secchi depth	Total Phosphorus (*ug*/l)		Chlorophyll *a* (*ug*/l)
Source	**Date**	**in meters)**	**Surface**	**Bottom**	**Epilimnion**
Bortleson, et al, 1976	**7/23/73**	1.8	33	30	-
Volunteer	**1993**	2.0 - 4.1 (3.0) *n = 6*	-	-	-
SWM Staff	**1994**	3.5 - 4.3 (4.0) *n = 3*	-	-	2.8 - 13 (7.9) *n = 2*
SWM Staff	**1995**	2.5	-	-	14
SWM Staff or Volunteer	**1996**	2.3 - 2.5 (2.4) *n = 4*	8 - 16 (12) *n = 2*	48 - 119 (84) *n = 2*	-
SWM Staff	**1997**	2.2 - 3.1 (2.6) *n = 2*	15 - 40 (28) *n =2*	21 - 49 (35) *n = 2*	-
SWM Staff or Volunteer	**1998**	1.4 - 2.6 (2.0) *n = 6*	10 - 24 (17) *n = 4*	33 - 46 (38) *n = 4*	-
SWM Staff or Volunteer	**1999**	2.8 - 4.3 (3.5) *n = 14*	11 - 25 (18) *n = 4*	48 - 76 (64) *n = 4*	-
SWM Staff or Volunteer	**2000**	2.3 - 4.3 (3.3) *n = 11*	11 - 22 (16) *n = 4*	26 - 111 (57) *n = 4*	-
SWM Staff	**2001**	2.9 - 3.8 (3.5) *n = 4*	12 - 19 (16) *n = 4*	26 - 92 (59) *n = 4*	-
SWM Staff	**2002**	3.4 - 4.3 (3.9) *n = 4*	10 - 21 (14) *n = 4*	25 - 85 (45) *n = 4*	1.9 - 5.1 (3.0) *n = 4*
SWM Staff	**2003**	2.1 - 3.9 (2.9) *n = 4*	16 - 41 (25) *n = 4*	60 - 102 (79) *n = 4*	2.4 - 69 (23) *n = 4*
SWM Staff	**2004**	1.5 - 4.0 (3.3) *n = 4*	14 - 31 (23) *n = 4*	30 - 395 (167) *n = 4*	2.1 - 39 (14) *n = 4*
SWM Staff	**2005**	1.5 - 3.5 (2.5) *n = 4*	18 - 36 (25) *n = 4*	42 - 61 (52) *n = 4*	3.5 - 93 (29) *n = 4*
SWM Staff	**2006**	2.3 - 4.3 (3.1) *n = 4*	16 - 37 (31) *n = 4*	27 - 176 (83) *n = 4*	4.8 - 48 (20) *n = 4*
SWM Staff	**2007**	1.3 - 3.7 (2.5) *n = 4*	20 - 28 (25) *n = 4*	29 - 146 (85) *n = 4*	8.5 - 36 (22) *n = 4*

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DATA SUMMARY FOR CHAIN LAKE					
		Water Clarity (Secchi depth	**Total Phosphorus (*ug*/l)**		**Chlorophyll *a* (*ug*/l)**
Source	**Date**	**in meters)**	**Surface**	**Bottom**	**Epilimnion**
SWM Staff	**2008**	2.7 - 4.0 (3.5) *n = 4*	14 - 33 (20) *n = 4*	25 - 64 (46) *n = 3*	4.2 - 21 (9.3) *n = 4*
SWM Staff	**2009**	4.3 - 4.5 (4.4) *n = 4*	12 - 18 (15) *n = 4*	27 - 66 (48) *n = 4*	2.7 - 6.8 (5.2) *n = 4*
Long Term Avg		**3.1 (1993-2009)**	**20 (1996-2009)**	**67 (1996-2009)**	**16 (2002-2009)**
TRENDS		**None**	**None**	**None**	**None**

NOTES

- Table includes summer (May-Oct) data only.
- Each box shows the range on top, followed by summer average in ( ) and number of samples (*n*).
- Total phosphorus data are from samples taken at discrete depths only.
- "Surface" samples are from 1 meter depth and "bottom" samples are from 1-2 meters above the bottom.