

FLOWING 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 Flowing Lake visit www.lakes.surfacewater.info or call Snohomish County Surface Water Management (SWM) at 425-388-3464.

LAKE DESCRIPTION

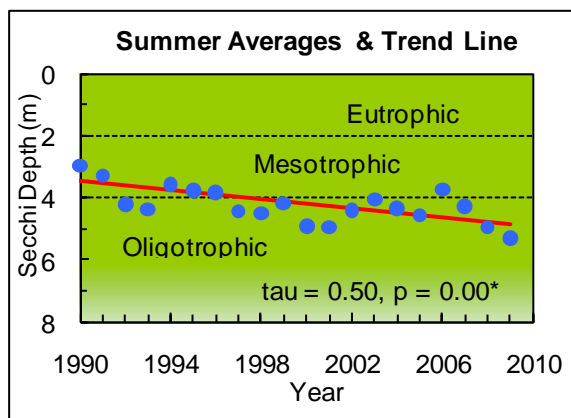
Flowing Lake is located five miles northeast of Snohomish. Fed by Storm Lake, it drains to Panther Lake and eventually to the Pilchuck River. Flowing Lake is one of the largest and deepest lakes in the County at 133 acres in area and a maximum depth of 21 meters (almost 70 feet). The lake watershed is quite small—only 5.7 times the size of the lake (including the Storm Lake watershed). A small watershed means that there should be less potential for pollution from the watershed than at a lake with a large watershed. However, the lake shore is densely developed with single family homes.

LAKE CONDITIONS

The following graphs illustrate the summer averages and trend lines (in red) for water clarity, total phosphorus, and chlorophyll for Flowing Lake. Please refer to the table at the end of the report for long-term averages and for averages and ranges for individual years.

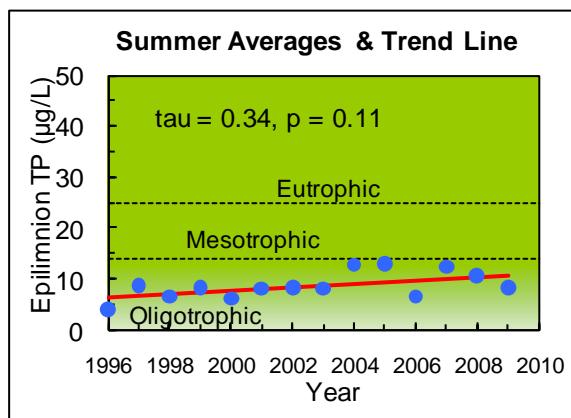
Water Clarity

The water clarity in Flowing Lake is moderate to high, with a long-term summer average of 4.2 meters. Between 1990 and 2009, there has been a statistically significant trend toward improving water clarity. This trend toward improving water clarity was first identified in the 2003 State of the Lakes Report and, in spite of poorer water clarity in 2006 (summer average of 3.7 meters), it appears that this trend is continuing. This trend is at odds with the trends toward more nutrients in the upper and lower lake waters described below.



Total Phosphorus (key nutrient for algae)

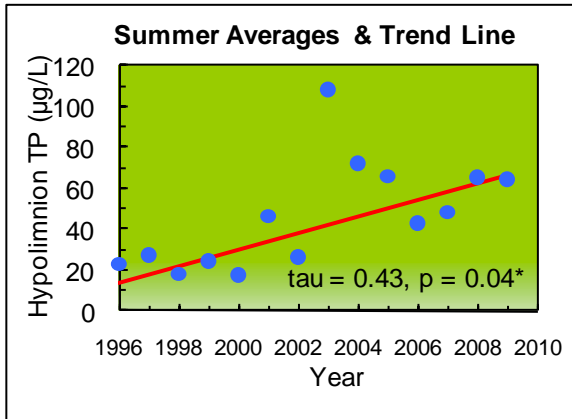
Total phosphorus concentrations in the epilimnion (upper waters) are generally low, with a long-term average of 9 µg/l. However, there is evidence that phosphorus concentrations in the upper waters may be increasing. This is not a statistically significant trend, but the overall direction of change bears watching. The averages in recent years are still in the low range but are approaching the mid or mesotrophic range.



Phosphorus values in the hypolimnion (bottom waters) are higher and more variable than in the epilimnion. The 1996 – 2009 long-term summer average is 46 µg/l. Even with the high variability, there is a statistically significant trend toward increasing phosphorus concentrations in the hypolimnion over these years. Higher phosphorus levels indicate a build-up of nutrients which are released from the bottom

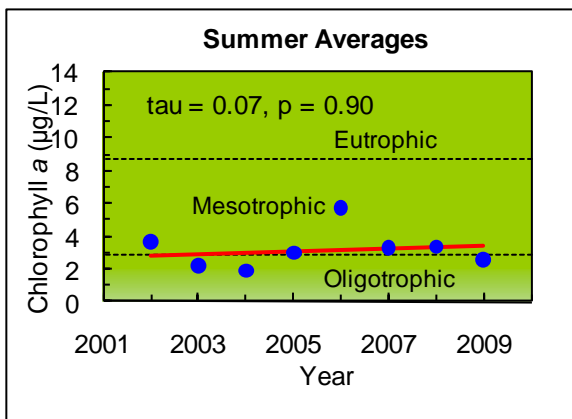
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sediments during times of low dissolved oxygen. This build-up is likely a sign of accelerating eutrophication.



Chlorophyll a (Algae)

Chlorophyll a values have been consistently low to moderate in the summers of 2002 through 2009. The long-term average is 3.2 µg/l. However, in June of 2006, there was a notable algal bloom, and chlorophyll a was measured at 13 µg/l. Fortunately, blooms of blue-green algae, known as cyanobacteria, are not a regular occurrence at Flowing Lake. Additional years of data collection are needed to better characterize any long-term trends in algal growth.



SHORELINE CONDITION

The Flowing Lake shoreline was surveyed in 2009 (see map on page 4). 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. This type of alteration can be harmful to the lake ecosystem because natural shorelines protect the lake from pollution, prevent bank erosion, and provide important habitat for fish and wildlife.

Flowing Lake has a high level of shoreline development compared to other lakes in the County. Surveys conducted in the mid-90s identified 104 homes bordering the lake with an average of 9.0 homes per 1000 feet of shoreline. Although homes were not counted in 2009, 116 docks are now present, covering over 1 acre of the lake. Over half (51%) of the 2.6 miles of shoreline has been armored. The armoring is mainly in the form of bulkheads (44%) and wood or rock revetments (42%). The native vegetation immediately adjacent to the shoreline has also been significantly altered, with only 36% being classified as remaining intact. The shoreline alterations make the lake susceptible to pollution inputs from the watershed and limit the amount of aquatic habitat available to fish and wildlife. The loss of native vegetation along the shoreline eliminates a buffer to filter pollution and could also lead to shoreline erosion. There is still a moderate amount of large wood (about 82 pieces) remaining in the lake. These old logs and branches are valuable for fish and wildlife habitat.

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SUMMARY

Trophic State

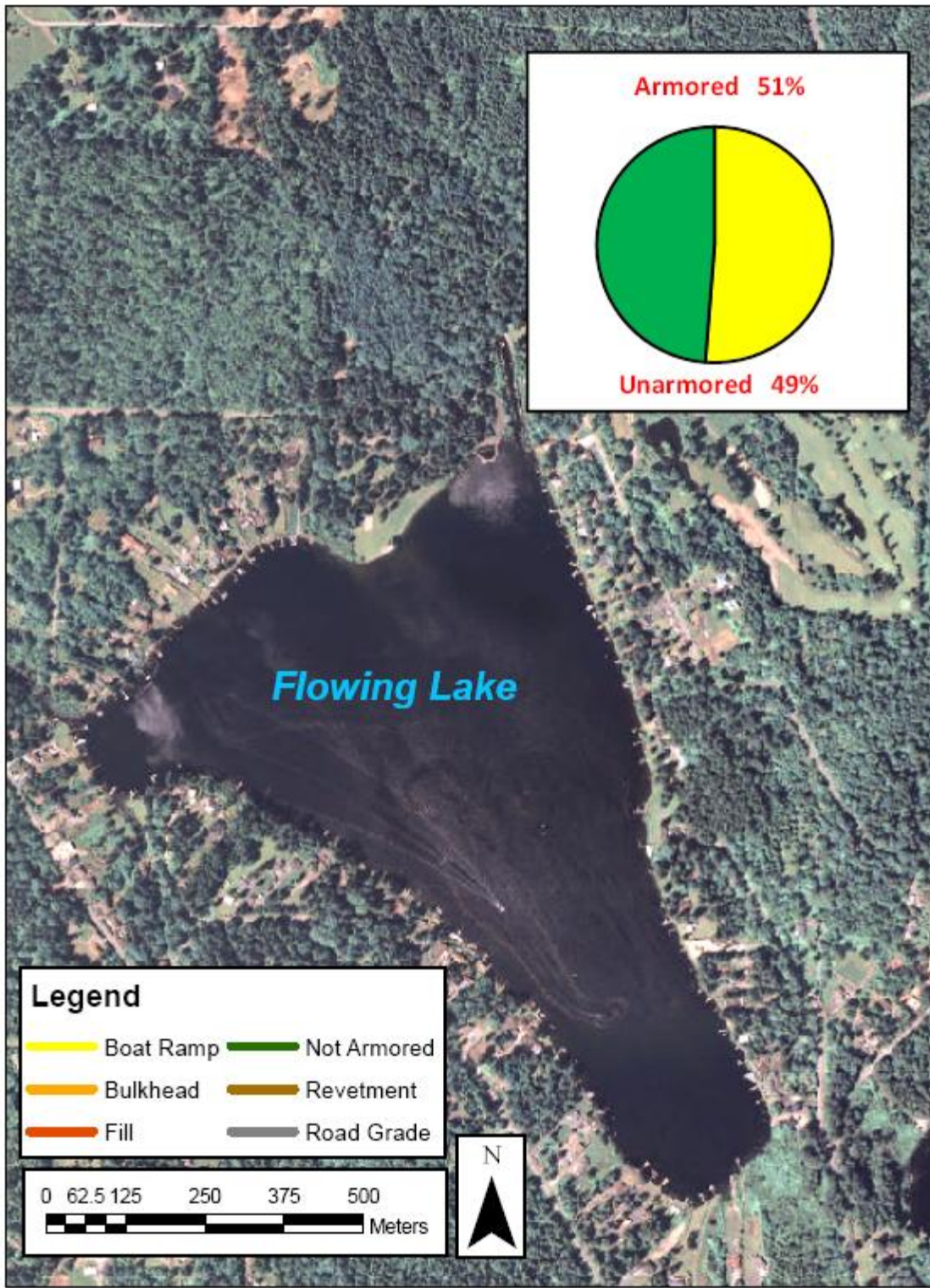
Based on moderate to high water clarity, low phosphorus levels, and low to moderate chlorophyll *a* concentrations, Flowing Lake may be classified as oligo-mesotrophic. This means that the lake has low production of algae and aquatic plants.

Condition and Trends

The monitoring data reveal mixed results for Flowing Lake. The lake is meeting the target set forth in the 2003 State of the Lakes Report to maintain good water clarity. There is even a significant trend toward improving water clarity. However, the lake is not meeting its phosphorus targets of maintaining long-term averages of 7 µg/l in the epilimnion and 26 µg/l in the hypolimnion. The long-term epilimnion phosphorus average is now 9 µg/l, and the average in the hypolimnion is now 46 µg/l. There is also a statistically significant trend toward increasing phosphorus in the hypolimnion and the potential beginnings of an increasing trend in the epilimnion. The higher nutrient levels are likely a sign of accelerating eutrophication in the lake.

Overall, Flowing Lake is still in healthy condition compared to most lakes in the county. However, the lake is showing early signs of accelerated eutrophication which leads to more algal growth and reduced water clarity. The primary threat to lake water quality is a high inflow of nutrients entering the lake because of new development and from human activities in the watershed. Nutrients enter the lake through stormwater runoff from the watershed. Sources of nutrients include fertilizers, pet wastes, and erosion from land clearing and construction. 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 future negative impacts to the lake. To find out more about ways to protect lake water quality and information on the causes and problems of elevated lake nutrient levels visit www.lakes.surfacewater.info.

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DATA SUMMARY FOR FLOWING LAKE					
Source	Date	Water Clarity (Secchi depth in meters)	Total Phosphorus (ug/l)		Chlorophyll a (ug/l)
			Surface	Bottom	Epilimnion
Bortleson, et al, 1976	7/23/73	2.7 -	7	34	-
DOE	1989	2.9 - 3.8 (3.4) n = 12	-	-	-
DOE	1990	1.8 - 3.8 (3.0) n = 14	-	-	-
DOE	1991	2.7 - 3.8 (3.3) n = 12	-	-	-
Volunteer	1992	4.0 - 4.6 (4.2) n = 4	-	-	-
DOE	1993	3.7 - 5.3 (4.4) n = 8	-	-	-
SWM Staff or Volunteer	1994	2.7 - 4.8 (3.6) n = 7	-	-	2.4 - 2.9 (2.7) n = 2
SWM Staff or Volunteer	1995	3.0 - 4.4 (3.8) n = 11	-	-	-
SWM Staff, Volunteer or DOE	1996	3.0 - 5.0 (3.8) n = 10	<2 - 6 (4) n = 2	16 - 30 (23) n = 2	-
SWM Staff or Volunteer	1997	3.5 - 5.9 (4.4) n = 9	5 - 12 (9) n = 2	23 - 32 (28) n = 2	-
SWM Staff or Volunteer	1998	3.3 - 5.8 (4.5) n = 13	4 - 8 (7) n = 4	6 - 37 (18) n = 4	-
Volunteer	1999	3.8 - 5.0 (4.2) n = 10	6 - 10 (8) n = 4	11 - 37 (24) n = 4	-
SWM Staff or Volunteer	2000	3.6 - 5.9 (4.9) n = 10	3 - 8 (6) n = 3	2 - 33 (18) n = 4	-
SWM Staff	2001	4.6 - 5.3 (5.0) n = 4	6 - 9 (8) n = 4	22 - 71 (47) n = 4	-
SWM Staff	2002	3.2 - 5.4 (4.4) n = 4	6 - 10 (8) n = 4	11 - 43 (26) n = 4	2.7 - 5.6 (3.7) n = 4
Volunteer	2003	2.7 - 5.3 (4.1) n = 11	5 - 12 (8) n = 4	48 - 156 (108) n = 4	1.3 - 3.2 (2.2) n = 4

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Source	Date	Water Clarity (Secchi depth in meters)	Total Phosphorus (ug/l)		Chlorophyll a (ug/l)
			Surface	Bottom	Epilimnion
SWM Staff	2004	4.0 - 4.6 (4.4) n = 4	9 - 19 (13) n = 4	36 - 118 (72) n = 4	1.3 - 2.7 (1.9) n = 4
SWM Staff	2005	4.1 - 5.1 (4.6) n = 4	11 - 14 (13) n = 4	30 - 98 (66) n = 4	2.7 - 3.2 (3.0) n = 4
SWM Staff or Volunteer	2006	2.7 - 5.0 (3.7) n = 10	5 - 8 (7) n = 4	22 - 62 (43) n = 4	3.0 - 13 (5.7) n = 4
SWM Staff or Volunteer	2007	3.0 - 5.0 (4.3) n = 5	8 - 16 (12) n = 4	12 - 74 (48) n = 4	1.9 - 4.3 (3.3) n = 3
SWM Staff or Volunteer	2008	4.8 - 5.1 (5.0) n = 3	8 - 16 (11) n = 3	27 - 90 (65) n = 3	1.9 - 5.1 (3.4) n = 3
SWM Staff or Volunteer	2009	4.7 - 5.9 (5.3) n = 9	6 - 11 (8) n = 4	31 - 99 (65) n = 4	1.9 - 4.0 (2.5) n = 4
Long Term Avg		4.2 (1989-2009)	9 (1996-2009)	46 (1996-2009)	3.2 (2002-2009)
TRENDS		Increasing	None	Increasing	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.
- DOE = Washington Department of Ecology
- "Surface" samples are from 1 meter depth and "bottom" samples are from 1-2 meters above the bottom.