

STORM 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 2010. For additional background on the information provided here or to find out more about Storm Lake visit www.lakes.surfacewater.info or call Snohomish County Surface Water Management (SWM) at 425-388-3464.

LAKE DESCRIPTION

Storm Lake is a 76-acre lake located six miles north of Monroe. It sits at the headwaters of a three-lake chain. Storm Lake is fed by groundwater and drains into Flowing Lake, which in turn discharges into Panther Lake. Storm Lake has a maximum depth of 14 meters (46 feet) and an average depth of 6.7 meters (22 feet). The watershed for this lake is very small—less than three times the size of the lake. This means that there is less potential for pollution from activities in the watershed affecting the lake water quality compared to other lakes. Also, there is only scattered development in the watershed, except around the shoreline. Most of the lake shore is developed with single family homes.

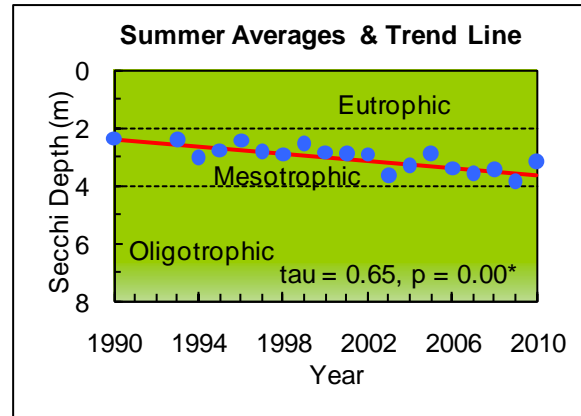
LAKE CONDITIONS

The following graphs illustrate the summer averages and trend lines (in red) for water clarity, total phosphorus, and chlorophyll *a* for Storm 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

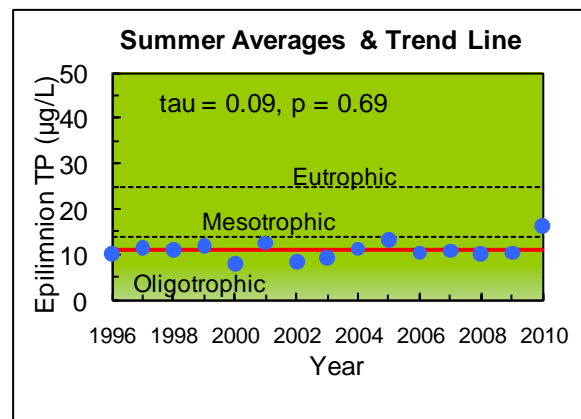
Water clarity in Storm Lake is moderate, with a 1990 – 2010 long-term summer average of 3.0 meters. Natural humic substances color the water light brown and reduce the water clarity. However, this color does not affect water quality. Between 1990 and 2010 there has been a statistically significant trend toward improving water clarity. This is at odds with potential increases in phosphorus and algal growth described below. Reasons for the improving

water clarity are not clear, but better water clarity is a good sign for the lake.



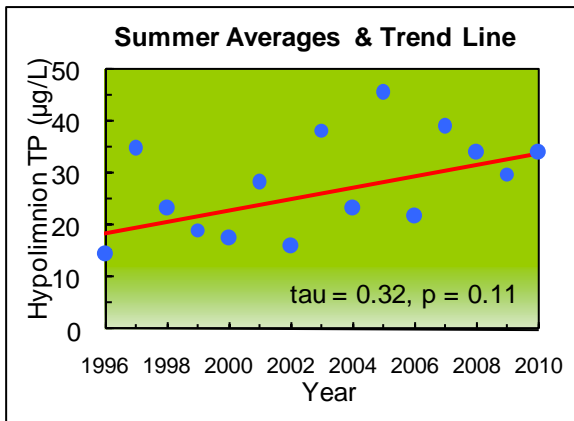
Total Phosphorus (key nutrient for algae)

Total phosphorus concentrations in the epilimnion (upper waters) are low, with a 1996 - 2010 long-term summer average of 11 µg/l. Summer phosphorus averages have varied only slightly from year to year. There is no evidence of a long-term trend in phosphorus concentrations in the epilimnion, but the summer average for 2010 (16 µg/l) was the highest on record. Higher phosphorus levels can lead to more algae in the lake.



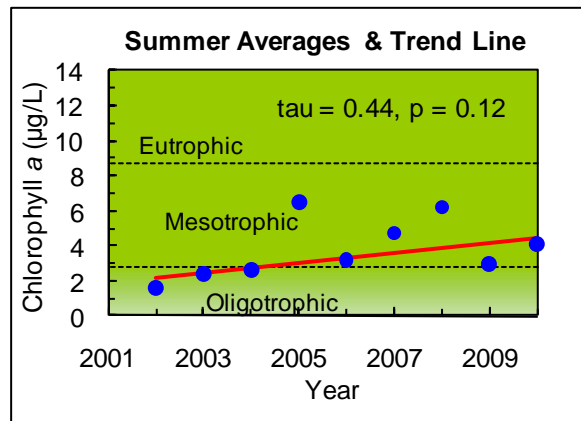
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Phosphorus values in the hypolimnion (bottom waters) are higher and much more variable than in the epilimnion. The 1996 – 2010 long-term summer average is 28 µg/l. In recent years, phosphorus averages have been higher than in the 1990s, which indicates more release of phosphorus from bottom sediments during periods of low dissolved oxygen. High phosphorus levels in the bottom waters may also be a sign of accelerating eutrophication and may lead to increases in algal growth in future years. Although there is not yet a statistically significant trend toward increasing phosphorus in the hypolimnion, the general pattern appears to be moving toward higher phosphorus levels. The possibility of continuing increases in nutrients in the bottom waters is a concern.



Chlorophyll a (Algae)

Chlorophyll a values indicate moderate levels of algae in the lake. The long-term 2002 - 2010 summer chlorophyll a average is 3.8 µg/l. Although there is no statistically significant trend toward increasing chlorophyll a concentrations, chlorophyll a levels have been higher in some recent years, which indicates more algae is growing in the lake. More algae may be a response to more phosphorus in the bottom waters that becomes available when the lake turns over and mixes in the fall.



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SHORELINE CONDITION

The Storm Lake shoreline was surveyed in 2008 (see map on page 4). The condition of the lake shoreline is important to understanding overall lake health. As development on a lake increases, the shorelines typically are modified either through removal of natural vegetation, the installation of bulkheads or other hardening structures, and/or the removal of large 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.

The Storm Lake shoreline is moderately developed. There were 26 homes or cabins around the lake in 1973. By the mid-90s, there were 38 homes bordering the lake. Although homes were not surveyed in 2008, 41 docks were counted. Fortunately, there have been limited modifications to the shoreline through the years. Only 7% of the shoreline has been armored with bulkheads, rock or log revetments, or fill. A sizeable portion (69%) of the shore immediately adjacent to the lake still contains a zone of intact native vegetation. On the other hand, this does mean that 31% of the vegetation has been altered. There is also a moderate amount of large wood (about 71 pieces) still remaining in the lake. These old logs and branches are valuable for fish and wildlife habitat.

These various forms of shoreline modification leave the lake susceptible to pollution from the watershed, eliminate the buffer of native vegetation that can filter out pollution, and limit the amount of habitat available for fish and wildlife. The loss of native vegetation along the shoreline could also lead to shoreline erosion.

SUMMARY

Trophic State

Storm Lake may be classified as mesotrophic based on moderate water clarity and low to moderate levels of phosphorus and algae. There are low

amounts of aquatic plants in the lake, partly because the colored water and steep shoreline limit the amount of light and the area available for plant growth.

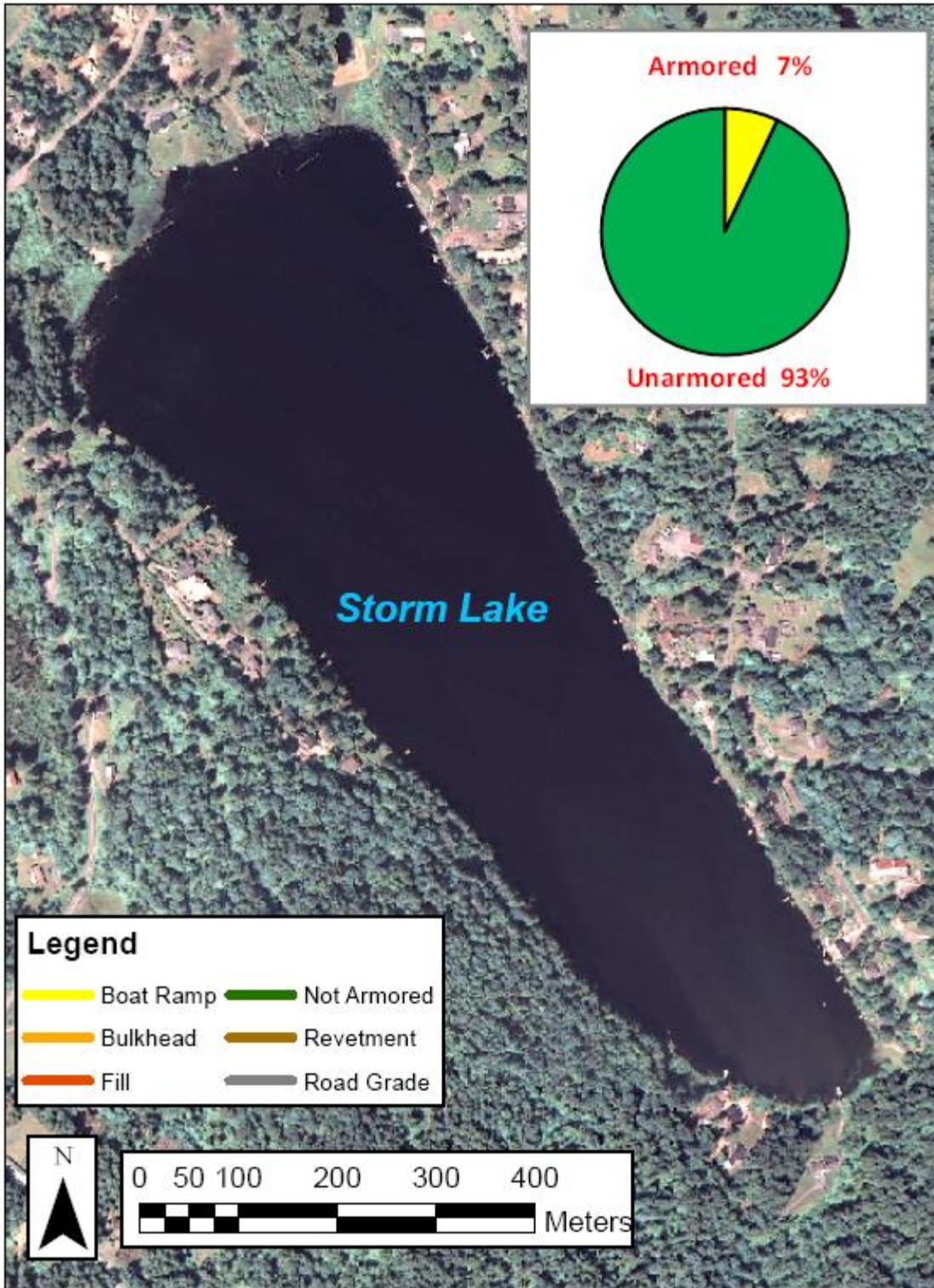
Condition and Trends

The water quality targets for Storm Lake set forth in the 2003 State of the Lakes Report were to maintain stable water clarity and phosphorus levels. The lake is exceeding the water clarity target. There has been a statistically significant trend toward improving water clarity between 1990 and 2010. The lake is also meeting the phosphorus target for the upper waters. Levels of phosphorus in the epilimnion appear to be stable.

However, phosphorus levels in the bottom waters have been higher in recent years, which may point to more nutrients entering the lake. There also appears to be a corresponding increase in algal growth since 2002, but this is not yet a statistical trend.

Overall, Storm Lake is in healthy condition. However, there is some concern about potentially increasing phosphorus levels in the bottom waters. The primary threat to lake water quality is the possibility of rapid development or other human activities that would increase the inflow of nutrients from the watershed. Nutrients enter the lake through stormwater runoff or small streams flowing into the lake. Sources of nutrients include fertilizers, pet wastes, runoff from roofs and driveways, 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. To find out more about the causes and problems of elevated lake nutrient levels and learn about steps to improve lake water quality visit www.lakes.surfacewater.info.

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DATA SUMMARY FOR STORM 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	2.1	13	37	-
DOE	1990	1.8 - 3.1 (2.4) n = 6	-	-	-
Volunteer	1993	1.7 - 3.1 (2.4) n = 9	-	-	-
SWM Staff or Volunteer	1994	2.2 - 4.5 (3.0) n = 14	-	-	1.9 - 9.8 (5.9) n = 2
SWM Staff or Volunteer	1995	2.0 - 3.9 (2.8) n = 13	-	-	6.7
Volunteer or DOE	1996	1.8 - 3.3 (2.4) n = 14	5 - 15 (10) n = 2	10 - 19 (15) n = 2	4.4 - 6.3 (5.4) n = 2
SWM Staff or Volunteer	1997	2.5 - 3.5 (2.8) n = 15	9 - 14 (12) n = 2	27 - 43 (35) n = 2	-
Volunteer	1998	2.3 - 3.9 (2.9) n = 13	7 - 20 (11) n = 4	20 - 28 (24) n = 4	-
Volunteer	1999	1.3 - 3.7 (2.6) n = 14	8 - 17 (12) n = 4	14 - 23 (19) n = 4	-
SWM Staff or Volunteer	2000	2.2 - 3.5 (2.9) n = 12	4 - 13 (8) n = 4	3 - 27 (18) n = 4	-
SWM Staff or Volunteer	2001	2.4 - 3.5 (2.9) n = 12	9 - 19 (13) n = 4	26 - 30 (29) n = 4	-
SWM Staff or Volunteer	2002	2.3 - 3.6 (2.9) n = 13	4 - 11 (8) n = 4	15 - 19 (16) n = 4	0.1 - 3.7 (1.6) n = 4
SWM Staff or Volunteer	2003	2.4 - 5.2 (3.7) n = 4	6 - 12 (9) n = 4	29 - 54 (38) n = 4	1.6 - 4.3 (2.4) n = 4
SWM Staff or Volunteer	2004	2.1 - 4.4 (3.3) n = 4	7 - 13 (11) n = 4	8 - 35 (24) n = 4	0.8 - 4.5 (2.7) n = 4
SWM Staff or Volunteer	2005	2.3 - 3.3 (2.9) n = 4	10 - 17 (13) n = 4	26 - 65 (46) n = 4	4.3 - 9.1 (6.5) n = 4
SWM Staff or Volunteer	2006	2.8 - 4.4 (3.4) n = 10	8 - 12 (10) n = 4	20 - 25 (22) n = 4	1.6 - 5.3 (3.2) 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 or Volunteer	2007	3.2 - 4.0 (3.6) <i>n</i> = 9	8 - 13 (11) <i>n</i> = 4	23 - 54 (39) <i>n</i> = 4	3.2 - 7.2 (4.7) <i>n</i> = 4
SWM Staff or Volunteer	2008	2.6 - 4.3 (3.5) <i>n</i> = 11	7 - 13 (10) <i>n</i> = 3	23 - 47 (34) <i>n</i> = 3	2.4 - 16 (6.2) <i>n</i> = 4
SWM Staff or Volunteer	2009	3.0 - 4.5 (3.9) <i>n</i> = 12	8 - 12 (10) <i>n</i> = 4	23 - 34 (30) <i>n</i> = 4	1.6 - 5.1 (3.0) <i>n</i> = 4
SWM Staff or Volunteer	2010	2.2 - 3.8 (3.2) <i>n</i> = 10	9 - 34 (16) <i>n</i> = 4	27 - 47 (34) <i>n</i> = 4	2.7 - 6.4 (4.1) <i>n</i> = 4
Long Term Avg		3.0 (1990-2010)	11 (1996-2010)	28 (1996-2010)	3.8 (2002-2010)
TRENDS		Increasing	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.
- DOE = Washington Department of Ecology
- "Surface" samples are from 1 meter depth and "bottom" samples are from 1-2 meters above the bottom.