LAKE RILEY

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

LAKE DESCRIPTION

Lake Riley is a 33-acre bog lake located near the Cascade foothills 10 miles northeast of Arlington. The lake is fed mainly by groundwater; there are no visible surface water flows into the lake. The lake drains to Jim Creek and eventually to the south fork of the Stillaguamish River.

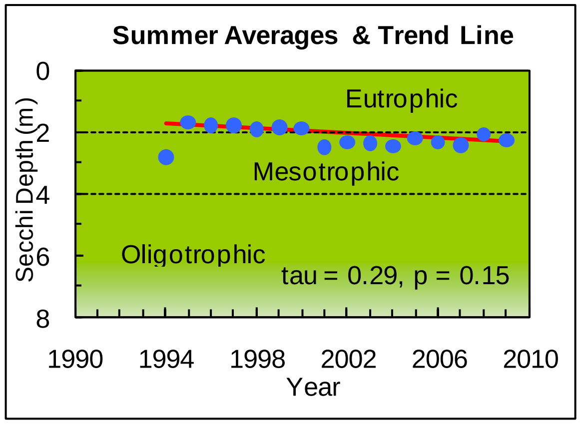
Lake Riley has a maximum depth of 13.7 meters (45 feet) and an average depth of 6.7 meters (22 feet). The watershed is relatively small—over 9 times the size of the lake. Much of the watershed is forested, but the Normanna Park recreational community is located next to the lake.

LAKE CONDITIONS

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

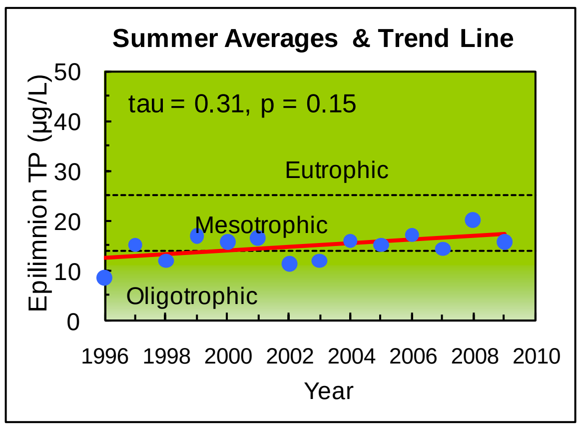
Water Clarity

Water clarity in Lake Riley is low to moderate, partly because of the naturally dark color of the water. The color is caused by humic compounds coming from the surrounding wetlands. Dark color does not harm water quality. The 1994-2009 long-term summer average for water clarity is 2.2 meters. Since 2001, water clarity has been slightly better than it was in prior years. In spite of this apparent improvement, there is not yet a statistically significant trend toward improving water clarity in Lake Riley.

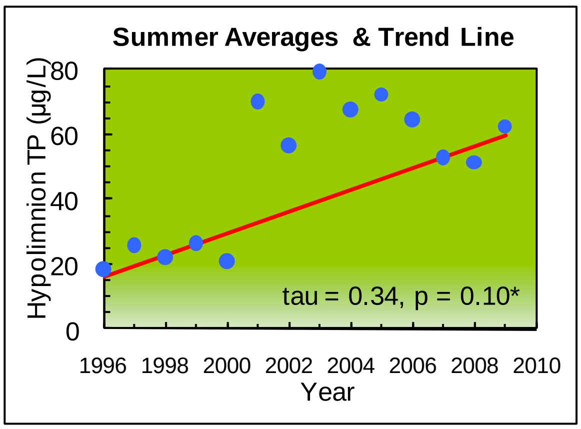


Total Phosphorus (key nutrient for algae)

Total phosphorus concentrations in the epilimnion (upper waters) are low to moderate. The long-term summer average between 1996 and 2009 is 15 µg/l. In general, it appears that values may be a little higher in recent years, but the changes are not enough to constitute a statistically significant trend toward increasing phosphorus levels.

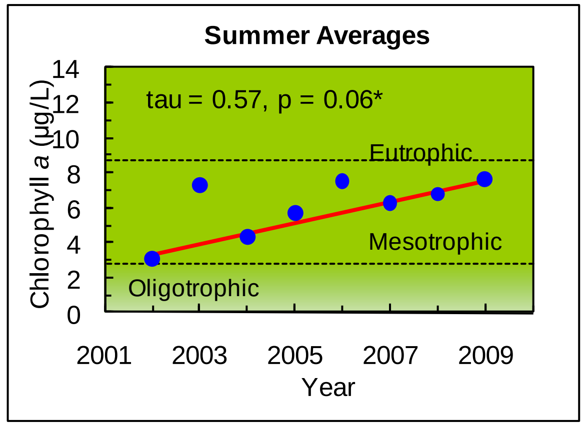


Summertime phosphorus averages in the hypolimnion (bottom waters) are much higher, with a long-term 1996 – 2009 summer average of 49 µg/l. There is also a weak, but statistically significant, trend toward increasing phosphorus levels. This trend is evident because phosphorus concentrations in the bottom waters have been much higher since 2001. Increased phosphorus in the hypolimnion indicates a release of nutrients from bottom sediments during times of low dissolved oxygen. This may also be a sign of accelerated eutrophication. However, the increasing trend should be viewed cautiously because many of the samples collected in 2001-2009 were taken one meter deeper than in previous years. Between 2001 and 2009, there does not appear to be any trend in summer averages. As more data are collected, the validity of the overall trend can be better evaluated.



Chlorophyll a (Algae)

Chlorophyll *a* values showed moderate levels of algae during the summers of 2002 through 2009, with a long-term average of 6.1 µg/l. With the inclusion of the 2009 data, there is now a statistically significant trend towards increasing chlorophyll *a* averages in Lake Riley. In addition, relatively greater amounts of algae have been observed in recent years, although there have been only a few observations of nuisance algal blooms that produce surface scums. The increasing chlorophyll *a* values suggest that more algal growth may be due to the potential increase of phosphorus in the upper waters and the apparent build-up of phosphorus in the bottom waters. Fortunately, the dark color of the water limits the amount of light available for algal growth.



SHORELINE CONDITION

The Lake Riley shoreline was surveyed in 2009 (see map on page 3). The condition of the lake shoreline is important to understanding 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 harmful pollution, prevent bank erosion, and provide important habitat for fish and wildlife.

Lake Riley has low development around the shoreline. There are about 18 homes near the lake shore and 14 docks on the lake. Lake Riley is unique in that it has a large wetland surrounding much of the lake shoreline. The wetland protects the lake because it forces homes around the lake to be set back a significant distance from the lake shore. Therefore, the shoreline is completely unarmored except for the fill material put in place for the two boat launches on the lake. Similarly, 97% of the vegetation along the shoreline remains intact. Furthermore, Lake Riley still has a high level of large wood present. Although the dark water color made surveying difficult, it was estimated that about 207 pieces of old logs and branches remain, which are extremely valuable for fish and wildlife habitat.

The natural state of the shoreline plays an important role in protecting the lake. The natural shoreline reduces the sources of pollution, provides a buffer of native vegetation to filter out nutrients before they can reach the lake, and provides high quality aquatic habitat for fish and wildlife.

SUMMARY

Trophic State

Lake Riley may be classified as mesotrophic, with low to moderate water clarity and moderate levels of phosphorus and chlorophyll *a*. The lake is moderately productive of plants and algae.

Condition and Trends

Water clarity has been slightly better in recent years. This means that the lake is exceeding the water clarity target set forth in the 2003 State of the Lakes Report of maintaining a long-term average of 2.1 meters.

Lake Riley is not quite meeting the 2003 target of maintaining stable phosphorus levels in the epilimnion. The long-term average has increased slightly from 14 to 15 µg/l. Although there is not yet a significant trend toward higher phosphorus in the upper waters, chlorophyll a levels are increasing, which may reflect the results of more nutrients available for algal growth.

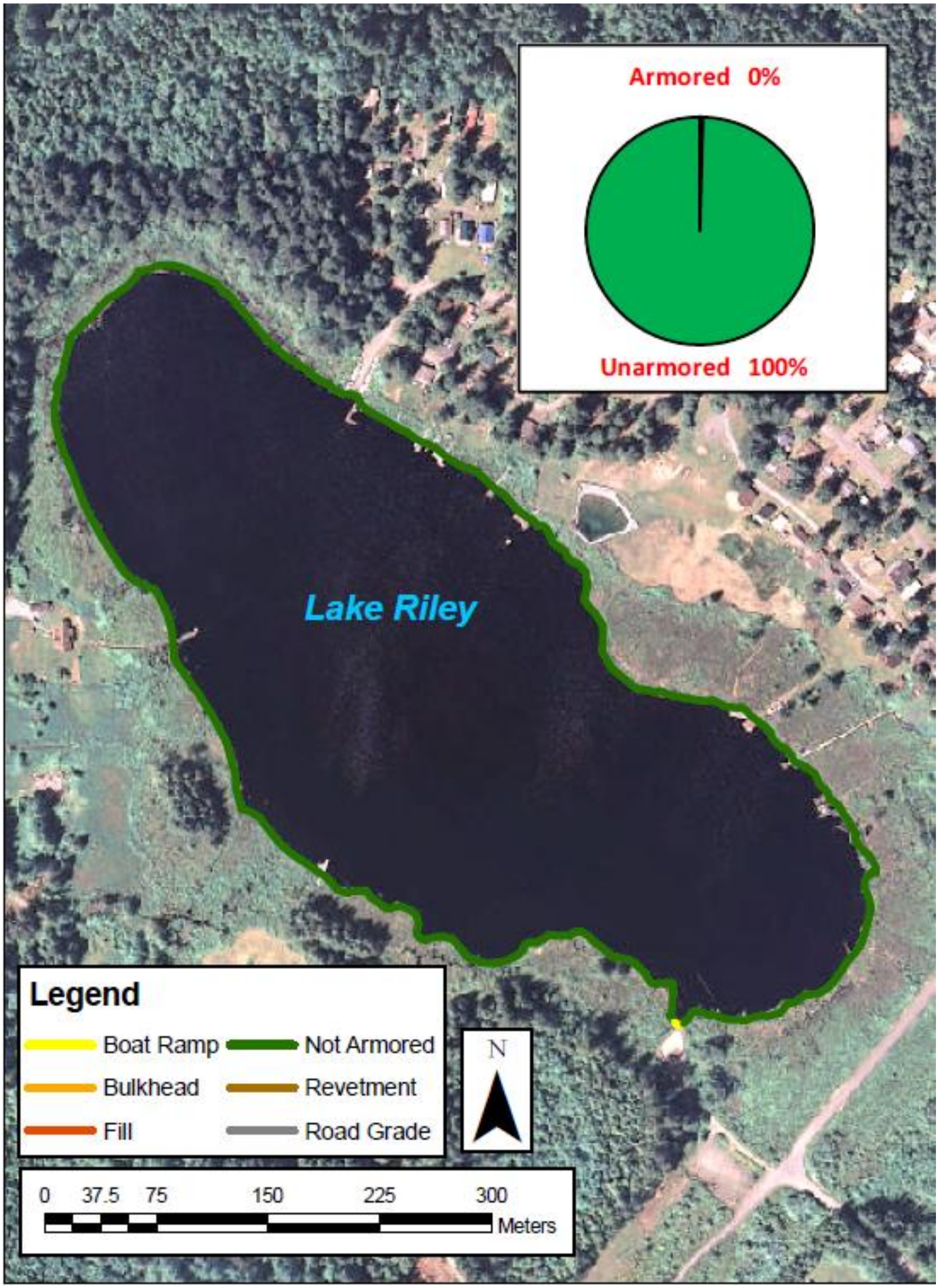
The target of maintaining stable total phosphorus levels in the hypolimnion is not being met. There has been a significant trend toward increasing phosphorus concentrations in the bottom waters. It is possible, however, that this trend is the result of a change in sampling depths. But, if the trend is valid, even more nutrients may become available for nuisance algal growth.

Overall, Lake Riley is in satisfactory condition for a relatively shallow bog lake. The lake provides high value for lake users and good quality habitat for fish and wildlife. However, the lake is at risk of future water quality declines as indicated by the potential increases in phosphorus in the epilimnion and hypolimnion and the increase in chlorophyll *a*.

The primary threat to lake water quality is any increase of nutrients entering the lake through new development and human activities in the watershed. Nutrients enter the lake through stormwater runoff from the watershed. Sources of nutrients include fertilizers, pet wastes, runoff from roofs and driveways, and erosion from land clearing and construction. Poorly maintained septic systems can also be a source of nutrients in Lake Riley. 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 ways to protect lake water quality and information on the causes and problems of elevated lake nutrient levels, please visit www.lakes.surfacewater.info.

LAKE RILEY

2009 Shoreline Survey Results



LAKE RILEY

DATA SUMMARY FOR LAKE RILEY					
		Water Clarity (Secchi depth	**Total Phosphorus (*ug*/l)**		**Chlorophyll *a* (*ug*/l)**
Source	**Date**	**in meters)**	**Surface**	**Bottom**	**Epilimnion**
Bortleson, et al, 1976	**8/18/73**	1.8	6	14	-
SWM Staff	**1994**	2.6 - 3.2 (2.9) *n = 2*	-	-	2.6 - 5.5 (4.1) *n = 2*
SWM Staff or Volunteer	**1995**	1.3 - 2.2 (1.7) *n = 7*	-	-	9.8
SWM Staff or Volunteer	**1996**	1.5 - 2.5 (1.8) *n = 12*	8 - 9 (9) *n = 2*	18 - 19 (19) *n = 2*	-
SWM Staff or Volunteer	**1997**	1.4 - 2.5 (1.8) *n = 7*	12 - 18 (15) *n = 2*	25 - 27 (26) *n = 2*	-
SWM Staff or Volunteer	**1998**	1.5 - 2.9 (1.9) *n = 12*	9 - 14 (12) *n = 4*	19 - 23 (22) *n = 4*	-
SWM Staff	**1999**	1.6 - 2.1 (1.9) *n = 4*	14 - 19 (17) *n = 4*	17 - 35 (27) *n = 4*	-
SWM Staff or Volunteer	**2000**	1.5 - 2.2 (1.9) *n = 13*	5 - 20 (16) *n = 4*	6 - 30 (21) *n = 4*	-
SWM Staff or Volunteer	**2001**	2.2 - 3.0 (2.5) *n = 5*	12 - 25 (17) *n = 4*	47 - 99 (70) *n = 4*	-
SWM Staff or Volunteer	**2002**	2.2 - 2.6 (2.4) *n = 5*	11 - 12 (11) *n = 4*	23 - 139 (57) *n = 4*	2.1 - 4.8 (3.1) *n = 4*
SWM Staff or Volunteer	**2003**	1.9 - 2.7 (2.4) *n = 4*	9 - 14 (12) *n = 4*	24 - 137 (80) *n = 4*	3.2 - 12 (7.3) *n = 4*
SWM Staff or Volunteer	**2004**	2.2 - 3.0 (2.5) *n = 5*	11 - 26 (16) *n = 4*	38 - 110 (68) *n = 4*	2.4 - 5.9 (4.4) *n = 4*
SWM Staff or Volunteer	**2005**	2.1 - 2.5 (2.2) *n = 5*	13 - 19 (15) *n = 4*	38 - 104 (72) *n = 4*	3.2 - 9.6 (5.7) *n = 4*
SWM Staff or Volunteer	**2006**	1.9 - 2.8 (2.4) *n = 4*	12 - 22 (17) *n = 4*	30 - 117 (65) *n = 4*	2.4 - 12 (7.5) *n = 4*

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DATA SUMMARY FOR LAKE RILEY					
		Water Clarity (Secchi depth	Total Phosphorus (*ug*/l)		Chlorophyll *a* (*ug*/l)
Source	**Date**	**in meters)**	**Surface**	**Bottom**	**Epilimnion**
SWM Staff or Volunteer	**2007**	2.2-2.7 (2.4) *n = 5*	11 - 17 (14) *n = 4*	42 - 71 (53) *n = 4*	4.3 - 7.5 (6.2) *n = 4*
SWM Staff or Volunteer	**2008**	1.8 - 2.7 (2.1) *n = 4*	19 - 21 (20) *n = 3*	34 - 74 (51) *n = 3*	4.3 - 9.1 (6.8) *n = 3*
SWM Staff or Volunteer	**2009**	2.0 - 2.6 (2.3) *n = 4*	12 - 20 (16) *n = 4*	34 - 119 (63) *n = 4*	5.9 - 11 (7.6) *n = 4*
Long Term Avg		**2.2 (1994-2009)**	**15 (1996-2009)**	**49 (1996-2009)**	**6.1 (2002-2009)**
TRENDS		**None**	**None**	**Increasing**	**Increasing**

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.