BC Lake Stewardship and Monitoring Program

Langford Lake 2008-2018

A partnership between the BC Lake Stewardship Society and the BC Ministry of Environment and Climate Change Strategy

BCLSS

BRITISH COLUMBIA
Ministry of Environment and Climate Change Strategy

The Importance of Langford Lake & its Watershed

British Columbians want lakes to provide good water quality, aesthetics, and recreational opportunities. When these features are not apparent in our local lakes, people begin to wonder why. Concerns often include whether the water quality is getting worse, if the lake has been impacted by land development or other human activities, and what conditions will result from more development within the watershed.

The BC Lake Stewardship Society (BCLSS), in collaboration with the Ministry of Environment and Climate Change Strategy (ENV), has designed a program, entitled *The BC Lake Stewardship and Monitoring Program*, to address these concerns. Through regular water sample collections, we can come to understand a lake's current water quality, identify the preferred uses for a given lake, and monitor water quality changes resulting from land development within the lake's watershed. There are different levels of lake monitoring and assessment. The level appropriate for a particular lake depends on the funding and human resources available. In some cases, data collected as part of a Level I or II program can point to the need for a more in-depth Level III program. This report gives the 2008-2018 results of a Level I volunteer program for Langford Lake and briefly discusses the results of historical reports.

The BCLSS can provide communities with both lake-specific monitoring results and educational materials on general lake protection issues. This useful information can help communities play a more active role in the protection of the lake resource. Finally, this program allows government to use its limited resources efficiently with the help of local volunteers and the BCLSS.

A **watershed** is defined as the entire area of land that moves the water it receives into a common waterbody. The term watershed is misused when describing only the land immediately around a waterbody or the waterbody itself. The true definition represents a much larger area than most people normally consider. The watershed area of Langford Lake is 3.3 km^2.

Watersheds are where much of the hydrologic cycle occurs and play a crucial role in the purification of water. Although no "new" water is ever made, it is continuously recycled as it moves through watersheds and other hydrologic compartments. The quality of the water resource is largely determined by a watershed's capacity to buffer impacts and absorb pollution.

Every component of a watershed (vegetation, soil, wildlife, etc.) has an important function in maintaining good water quality and a healthy aquatic environment. It is a common misconception that detrimental land use practices will not impact water quality if they are kept away from the area immediately surrounding a waterbody. Poor land use practices in a watershed can eventually impact the water quality of the downstream environment.

Human activities that impact water bodies range from small but widespread and numerous *non-point* sources throughout the watershed to large *point* sources of concentrated pollution (e.g. waste discharge outfalls, spills, etc). Undisturbed watersheds have the ability to purify water and repair small amounts of damage from pollution and alterations. However, modifications to the landscape and increased levels of pollution impair this ability.

Langford Lake is located approximately 15 km west of Victoria on southern Vancouver Island. It is a kettle lake, formed by the melting of an isolated block of glacial ice more than 10,000 years ago following the Vashon glaciation. Langford Lake has a surface area of 61 hectares, a perimeter of 4,510 meters and lies at an elevation of 62 meters. Its mean depth is 6.4 meters and the maximum depth is 16.7 meters.

Langford Lake flows from south to north through a single inflow and a single outflow to the Goldstream River. Langford Lake originally flowed south to Esquimalt Lagoon through Glen Lake before the outlet was cut off from its natural wetlands when the E&N railway built an embankment along the western shore for its rail line. In 1932, a drainage ditch to the Goldstream River was built at the north end of the lake to prevent flooding of lakeshore homes and a culvert was installed under the railway to allow drainage from an agricultural area known as Hull's Field to south of Langford Lake. When Hull's Field became flooded, the water was pumped into the lake.

Langford Lake provides a number of significant recreational values including swimming, boating, hiking, and fishing. There are trails around most of the west side of the lake and three swimming areas, including two public beaches. The lake also provides important wildlife habitat and aesthetics for lakeshore residents.

Species of fish present in the lake include rainbow and cutthroat trout, brown catfish, pumpkinseed, smallmouth bass, and yellow perch (FIDQ, 2019).

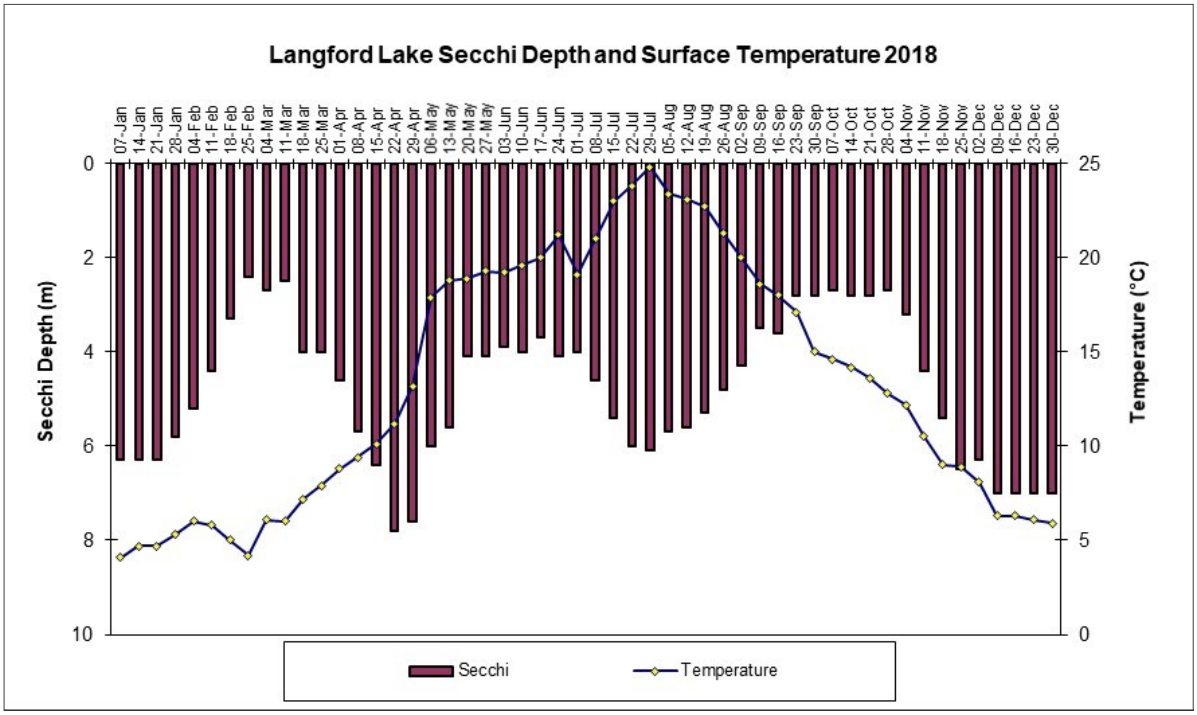
What's Going on Inside Langford Lake?

Temperature

Lakes show a variety of annual temperature patterns based on their location and depth. Most interior lakes form layers (stratify), with the coldest water at the bottom. Because colder water is denser, it resists mixing into the warmer upper layer for much of the summer. In spring and fall, these lakes usually mix from top to bottom (overturn) as wind energy overcomes the reduced temperature and density differences between surface and bottom waters. In the winter, lakes re-stratify under ice with the densest water (4 °C) near the bottom. These lakes are called dimictic lakes because they turn over twice per year. They are the most common type of lake in British Columbia.

Coastal lakes in BC are more often termed warm monomictic lakes because they turn over once per year. These lakes have temperatures that do not fall below 4°C. Warm monomictic lakes generally do not freeze and circulate freely in the winter at or above 4°C, and stratify only in the summer. Langford Lake is classified as a monomictic lake.

Ice-on and ice-off dates for BC lakes are important data for climate change research. By comparing these dates to climate change trends, we can examine how global warming is affecting our lakes. Langford Lake does not freeze over.

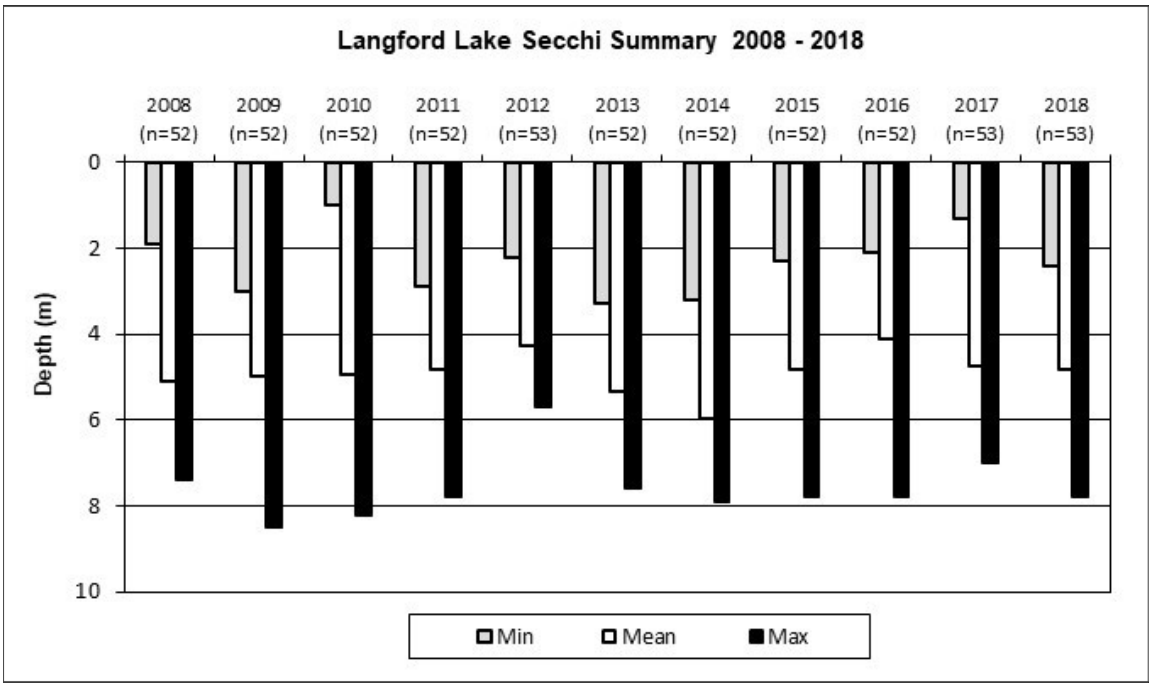


Surface temperature readings serve as an important ecological indicator. By measuring surface temperature, we can record and compare readings from season to season and year to year. Surface temperature helps to determine much of the seasonal oxygen, phosphorus, and algal conditions.

Surface temperature (T) and Secchi depth (water clarity) were measured on a weekly basis at Langford Lake from 2008-2018 by a dedicated volunteer. The adjacent graph illustrates the 2018 Secchi and surface temperature data from the sampling site. In 2018 the maximum temperature measured was 24.8°C (Jul 29) and the minimum was 4.1°C (Jan 7). The maximum Secchi depth in 2018 was 7.8 m (Apr 22) and 2.4 m (Feb 25).

Trophic Status and Water Clarity

The term *trophic status* is used to describe a lake's level of productivity and depends on the amount of nutrients available for plant growth, including tiny floating algae called phytoplankton. Algae are important to the overall ecology of the lake because they are food for zooplankton, which in turn are food for other organisms, including fish. In most lakes, phosphorus is the nutrient in shortest supply and thus acts to limit the production of aquatic life. When in excess, phosphorus accelerates growth and may artificially age a lake. Total phosphorus (TP) in a lake can be greatly influenced by human activities.



One measure of productivity is water clarity. The more productive a lake, the higher the algal growth and, therefore, the less clear the water becomes. The clarity of the water can be evaluated by using a Secchi disc, a 20 cm diameter black and white disc that measures the depth of light penetration.

Natural variation and trends in Secchi depth and temperature not

only occur between years, but also throughout one season. In general, as temperatures increase during the summer months, Secchi depth decreases. As the temperature of the lake increases, so do some species of algae. Due to the increase in algae, the water clarity can decrease.

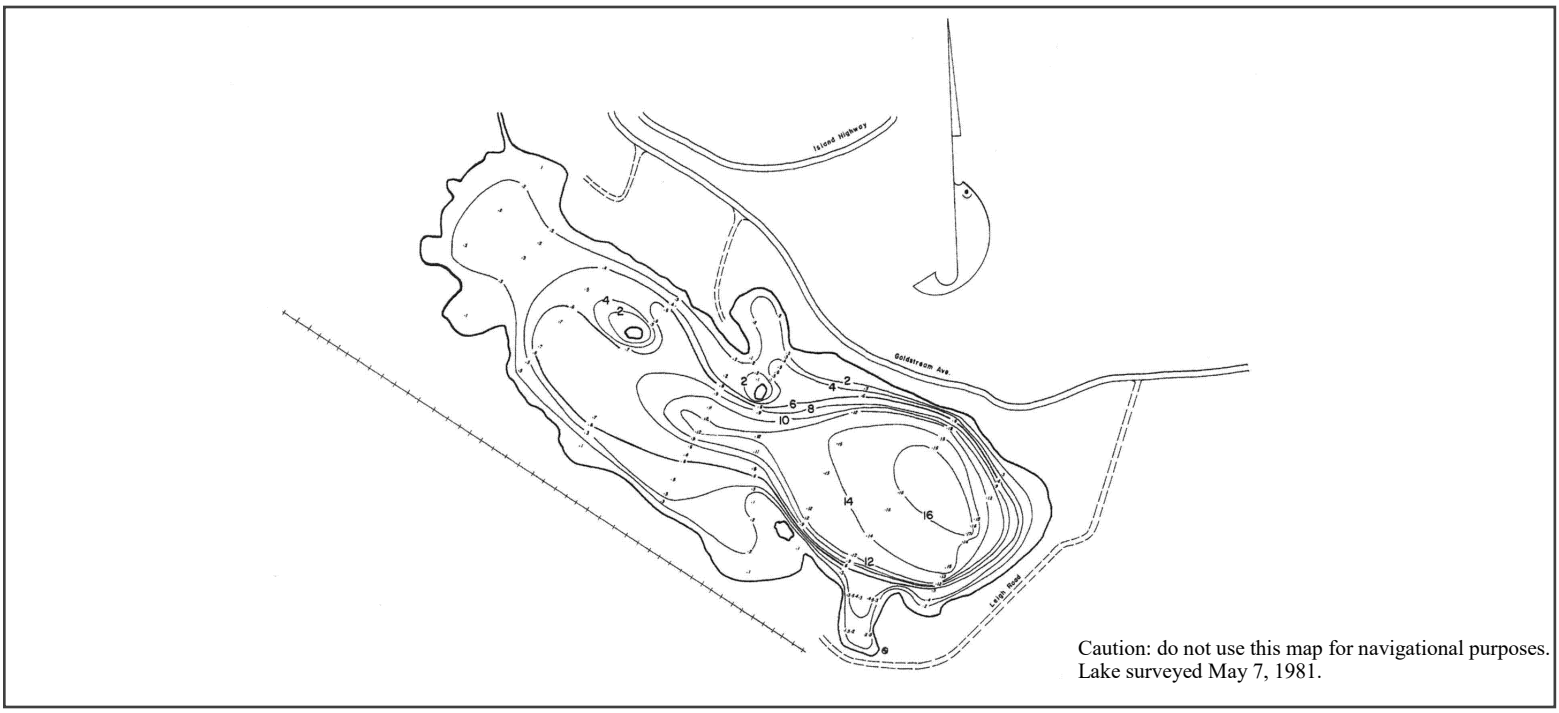
The previous graph shows the minimum, average, and maximum Secchi readings from 2008-2018 and the number of readings for each year (n). The maximum reading during these years was 8.5 m (Dec 20, 2009) and the minimum was 1.0 m (Mar 7, 2010). The average Secchi readings ranged from 4.1 m (2016) to 6.0 m (2014). Overall, the water clarity remained fairly consistent during the sampling period. Based on these summer average Secchi values, Langford Lake was exhibiting mesotrophic (3-6 m Secchi depth) conditions (Nordin, 1985).

The flushing rate, another factor that affects water quality, is the rate of water replacement in a lake and depends on the amount of in-flow and outflow. The higher the flushing rate, the more quickly excess nutrients can be removed from the system. The flushing rate for Langford Lake is 3.3 years.

Land Use and Pollution Sources

Non-point sources of waste (urban runoff, land development, on-site sewage systems) are the major input of pollutants to Langford Lake (Rieberger, 2007). The majority of development is currently on the north, east, and northwest shorelines of Langford Lake, however a large residential development on the western shore is in progress. Rapid growth and development within the watershed, in addition to an increased level of recreational use, could present challenges to maintaining or improving the water quality of Langford Lake. All recreational users and land developers within the watershed are advised to practice good land management so that nutrient migration to the lake and its tributaries are minimized.

Langford Lake Bathymetric Map



Caution: do not use this map for navigational purposes.
Lake surveyed May 7, 1981.

Should Further Monitoring be Done on Langford Lake?

Trophic status of a lake is based on a combination of parameters such as Secchi depth, nutrients, and chlorophyll *a*. Prior to 1984, Langford Lake had high nutrient levels and consequently low oxygen levels. In an attempt to increase oxygen levels in the lake and reduce the change in temperature from surface to lake-bottom (destratify), an aerator was installed in 1984. This first aerator did not meet the oxygen consumption rate of the sediments so was replaced with a more efficient aerator in 1985 (Nordin and McKean, 1988). A new aerator was installed on August 19, 2012 (Hare, 2018).

Based on the weekly Secchi data collected by a volunteer on Langford Lake from 2018-2018, the water clarity has remained stable throughout the sampling years. Average annual Secchi readings were in the mesotrophic category. However, comprehensive historical studies of Langford Lake indicate that the lake is eutrophic. Data from 2005 indicated that the overall eutrophic condition of the lake was not degrading at the time, likely due to the ongoing operation of the aerator (Rieberger, 2005). Spring overturn sampling also indicated fewer nutrients than previous years (Rieberger, 2005).

Volunteer monitors are encouraged to continue collecting Secchi depth and surface temperature readings, which will provide valuable long term records and help identify early warning signs should there be a deterioration in water quality from its current state. This information can complement additional data collected by the Ministry of Environment and Climate Change Strategy. Increased monitoring of nutrients is suggested due to the amount and high rate of development in the watershed.

Tips to Keep Langford Lake Healthy

Recreation and Boating

- The use of outboard motors and personal watercraft is prohibited on Langford Lake.
- Do not throw trash overboard or use lakes or other water bodies as toilets.
- Clean off all aquatic plants, animals, and mud from boats and equipment before entering or leaving a lake.
- Do not use metal drums in dock construction. They rust, sink and become unwanted debris. Do not use non-encapsulated Styrofoam as this material often breaks up, litters beaches, and may be consumed by fish and other wildlife. All floats should be labelled with the owner's name, phone number, and confirmation that barrels have been properly maintained.
- Pick up after your pets as their waste can lead to bacterial contamination of lake water.
- Leading by example is often the best method of improving practices - help educate fellow lake users.

Yard Maintenance, Landscaping, and Gardening

- Minimize the disturbance of shoreline areas by maintaining natural vegetation cover.
- Minimize high-maintenance grassed areas.
- Replant lakeside grassed areas with native vegetation. Do not import fine fill.
- Use paving stones instead of pavement.
- Stop or limit the use of fertilizers and pesticides.
- Do not use fertilizers in areas where the potential for water contamination is high, such as sandy soils, steep slopes, or compacted soils.
- Do not apply fertilizers or pesticides before or during rain due to the likelihood of runoff.
- Hand pull weeds rather than using herbicides.
- Use natural insecticides such as diatomaceous earth.
- Prune infested vegetation and use natural predators to keep pests in check. Pesticides can kill beneficial and desirable insects, such as ladybugs, as well as pests.
- Compost yard and kitchen waste and use it to boost your garden's health as an alternative to chemical fertilizers.

Who to Contact for More Information

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General Enquiries Phone: 250-387-6121 (Victoria) or 1-800-663-7867

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Acknowledgements

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Photo Credit:
Rob Hare

Bathymetric Map:
FIDQ (Fisheries Inventory Data Query)

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