



## BC Lake Stewardship and Monitoring Program

# Lake Errock 2009 - 2011

*A partnership between the BC Lake Stewardship Society  
and the Ministry of Environment*



## The Importance of Lake Errock & 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 (MoE), 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 2009 - 2011 results of a Level I program for Lake Errock.



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.

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 compart-

ments. 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.

Lake Errock, located along Hwy 7, between Mission and Agassiz, and is approximately 4.2 km west of the confluence of the Harrison and Fraser rivers. The lake has a perimeter of 3364 m and lies at an elevation of 14 m. The surface area is 0.26 km<sup>2</sup> and the maximum depth is 7.9 m (FISS, 2013). The north, west and south shores of the lake are bordered by residential development and the west shore is bordered by a railway and Hwy 7. A gravel pit is also located at the southwest end of the lake.

Lake Errock has one main inflow, Holachten Creek, which enters at the south end of the lake, and one outflow, Squawkum Creek, located at the north end (Berge 2013, Pers. Comm.). The lake contains brown catfish (formerly brown bullhead), prickly sculpin, largescale sucker, cutthroat trout, lake whitefish, peamouth chub, rainbow trout, northern pike-minnow, redbelly dace, steelhead, coho and chum salmon and threespine stickleback. Until 1940, the lake was stocked with lake whitefish, cutthroat trout, rainbow trout and steelhead (FISS, 2013), however volunteers note that the lake has been stocked in recent years as well (Berge 2013, Pers. Comm.).

# What's Going on Inside Lake Errock?

## Temperature

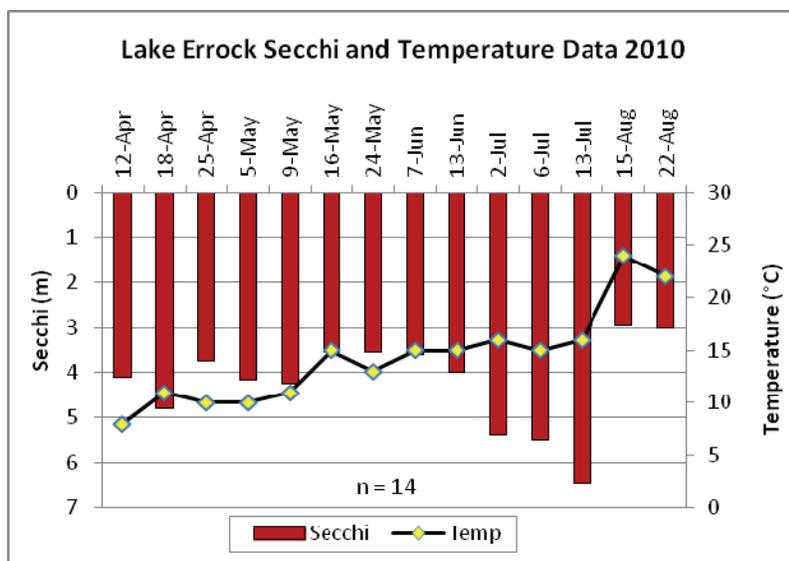
Lakes show a variety of annual temperature patterns based on their location and depth. Most interior lakes form layers (stratify), with the coldest water at the bottom. Because colder water is more dense, it resists mixing into the warmer upper layer for much of the summer. In spring and fall, these 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. Lake Errock is classified as a warm 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. Lake Errock has completely frozen in the past, however volunteers report that in most years the lake only partially freezes (i.e. a “slushy freeze”) along the shoreline (Berge 2011, Pers. Comm.).

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.

Temperature and Secchi depth (water clarity) were measured at the deep site on Lake Errock from 2009-2012. The minimum requirement of twelve Secchi and temperature readings was met in 2009-2011, but not in 2012. Note that sampling did not begin until mid to late June in 2010-12 and readings in 2010 were not evenly spaced in July and August. The adjacent graph illustrates the 2010 Secchi and temperature data for Lake Errock, as well as the number of readings (n). The maximum surface temperature was 24°C (Aug 15) and the minimum surface temperature was 8°C (Apr 12). The maximum surface temperatures measured in 2009, 2011 and 2012 were 24°C (Aug 3 & Jul 27), 20.5°C (Aug 21) and 23°C (Aug 6), respectively. Minimum surface temperatures were 16°C (Jun 29), 14°C (Jun 16 & 14 in 2009 and 2011) and 12°C (Jun 10), respectively.



## 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.

Lakes of low productivity are referred to as *oligotrophic*, meaning they are typically clear water lakes with low nutrient levels, sparse plant life and low fish production. Lakes of high productivity are *eutrophic*. They have abundant plant life because of higher nutrient levels. Lakes with an intermediate productivity are called *mesotrophic* and generally combine the qualities of oligotrophic and eutrophic lakes.

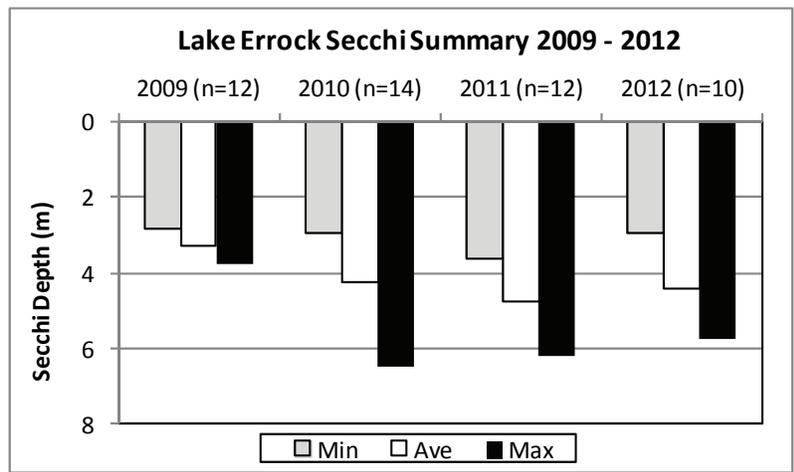
One measure of productivity is water clarity. The more productive a lake, the higher the algal growth and, therefore, the less clear the water becomes. The clarity of the water can be evaluated by using a Secchi disc, an 8 inch diameter black and white disc that measures the depth of light penetration.

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. This general trend is apparent in 2010, 2011 and 2012, however continued monitoring of these parameters would allow for more meaningful interpretation of these data.

The graph on the following page illustrates the minimum, average and maximum Secchi readings from 2009 to 2012. The maximum reading for all sampling years, 6.5 m, occurred on July 13, 2010. The lowest Secchi depth measured was 2.8 m in 2009 (Jul 20 & 27). The average Secchi values ranged between 3.3 m (2009) and 4.8 m (2011) throughout the four years sampled. Based

on the average summer Secchi values, Lake Errock was exhibiting mesotrophic (3 - 6 m) conditions in all sampling years (Nordin, 1985).

The adjacent graph shows the 2009 - 2012 minimum, average and maximum Secchi values, as well as the number of readings per year (n). Lake Errock had relatively similar conditions between 2010 and 2012, however it appears that the data in 2009 are anomalous as volunteers noted higher than usual surface water temperatures and increased algae blooms, which likely contributed to lower Secchi readings throughout the summer.



The flushing rate, another factor that affects water quality, is the rate of water replacement in a lake and depends on the amount of inflow and outflow of a lake. The higher the flushing rate, the more quickly excess nutrients can be removed from the system. The flushing rate for Lake Errock is unknown at this time.

## Land Use and Pollution Sources

Gravel mining, residential development (seasonal and permanent) and some small scale farming are considered to be the main land uses surrounding Lake Errock. Approximately 25% of the 50 residential properties at the south end of the lake are permanent (75% seasonal), whereas the majority of the 200 properties at the north end are year round residences. All residential areas surrounding the lake use septic, many of which are older systems. (Berge 2013, Pers. Comm.).

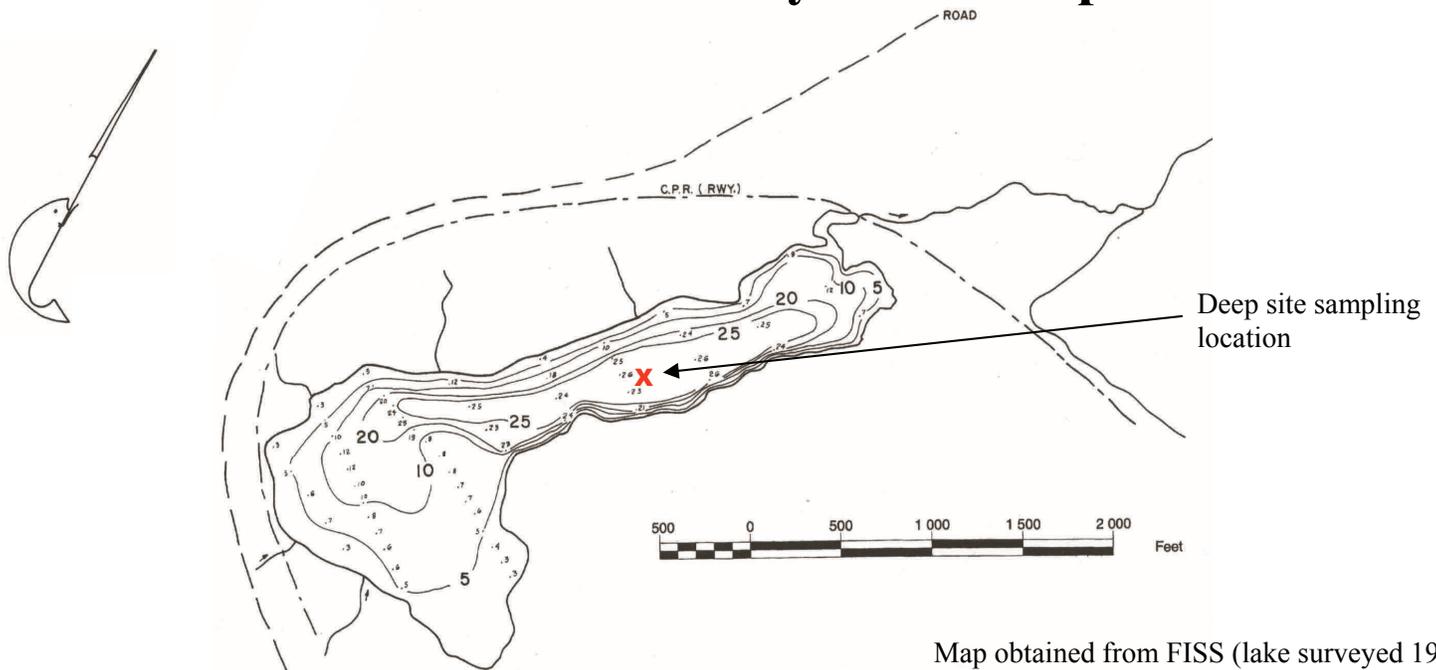
Local residents are encouraged to ensure their septic systems are up to standard. Residents and recreational users who visit Lake Errock are encouraged to ensure they are following good environmental practices and that their boats and equipment are properly maintained. Further information on keeping Lake Errock healthy can be found on the following page.

## Should Further Monitoring be Done on Lake Errock?

Based on average summer Secchi data, Lake Errock was exhibiting mesotrophic conditions in all sampling years. The Secchi readings collected on Lake Errock in 2009 are lower than in subsequent years, however 2010-2012 Secchi data are relatively similar. This indicates that the water quality has remained stable between 2010 and 2012, however further monitoring would be helpful in determining water quality trends. If volunteers are willing to continue monitoring at a Level 1 (min. 12 evenly spaced readings from April through September), this could also help identify early warning signs should there be a deterioration in water quality.

All residents and land developers within the watershed are advised to continue to practice good land management so that nutrient migration to the lake and its tributaries are minimized.

## Lake Errock Bathymetric Map



# Tips to Keep Lake Errock Healthy

## Onsite Sewage Systems

- Make sure that your system meets local requirements before installing, repairing, or upgrading an onsite sewage system.
- Upgrade your system when you upgrade your home (i.e. when you add a bedroom or suite).
- Inspect your system yearly and have the septic tank pumped out every 2 to 5 years by a septic service company. Regular pumping is cheaper than having to rebuild a drain-field.
- Use phosphate-free soaps and detergents.
- Do not put toxic chemicals or harmful cleaners down the drain, as they can contaminate waterbodies.

## Yard Maintenance, Landscaping and Gardening

- Replant lakeside grassed areas with native vegetation, and do not import sand.
- Minimize the disturbance of shoreline areas by maintaining natural vegetation cover.
- Do not apply fertilizers or pesticides before or during rain due to the likelihood of runoff.
- Hand pull weeds rather than using herbicides.
- Volunteers note that Japanese knotweed is present around the lake; for more information on invasive plants such as Japanese knotweed or to report an invasive plant, please visit the Invasive Species Council of BC at [www.bcinvasives.ca](http://www.bcinvasives.ca)

## Boating

- Check for and remove all aquatic plant fragments from boats and trailers before entering or leaving a lake.
- Use biodegradable, phosphate-free cleaners instead of harmful chemicals.
- Conduct major maintenance chores on land.
- Keep motors well maintained and tuned to prevent fuel and lubricant leaks.
- Use absorbent bilge pads for minor leaks or spills.
- Do not throw trash overboard or use lakes or other water bodies as toilets.
- Leading by example is often the best method of improving practices - help educate fellow boaters.
- Consider using 4 stroke engines, which are less polluting, rather than 2 stroke engines. Use an electric motor where practical.

## Auto Maintenance

- Check your car's fuel, oil, brake, transmission, exhaust, and cooling systems regularly. Fix leaks or problems immediately.
- Use a dropcloth if you fix problems yourself.
- Use phosphate-free biodegradable products to clean your car. Wash your car over gravel or grassy areas, but not over onsite sewage systems.

## Agriculture

- Do not spread manure during wet weather, on frozen ground, in low-lying areas prone to flooding, with 3 m of ditches, 5 m of streams, or 30 of wells, or on land where runoff is likely to occur.
- Limit the use of fertilizers and pesticides.
- Construct adequate manure storage facilities.

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## Who to Contact for More Information

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### Bathymetric Map:

Fisheries Information Summary System (FISS)

## References

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