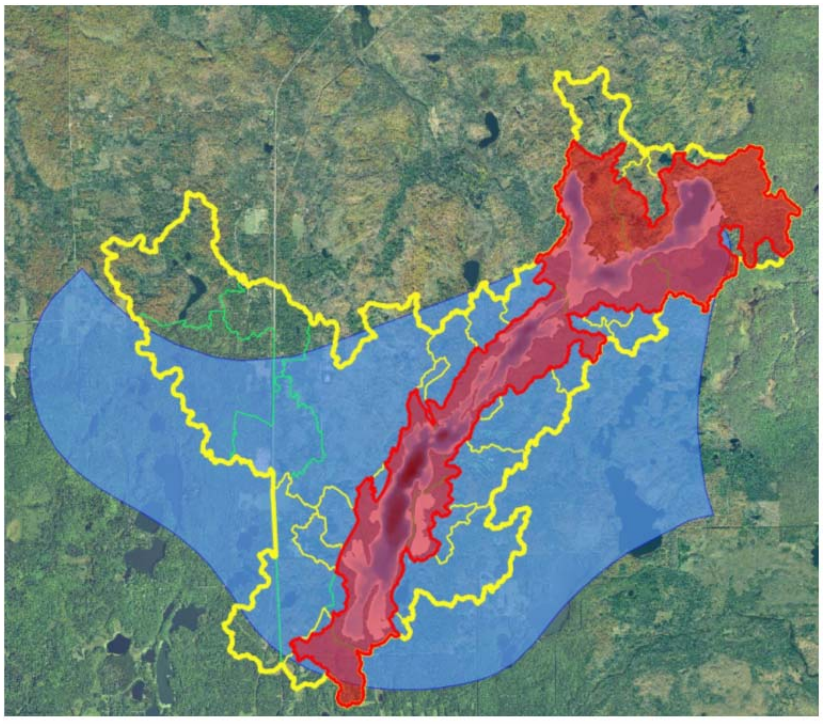
Evaluation of Lake Owen Water Clarity

Lake Owen Watershed and Water and Nutrient Budget

Lake Owen Association consulting scientists gathered and analyzed information to answer questions about Lake Owen water clarity in 2019 and 2020. Their work was supported by donations of LOA board members and lake residents and a grant from the Wisconsin Department of Natural Resources. This summary of the 2020 study provides information about the watershed and potential effects of development. The study examined inputs and outputs of both water and nutrients to make these predictions.[1] A previous summary of a 2019 report[2] provides an overview of lake science and an explanation of why Lake Owen's water is so clear. These full study reports and summaries are available at Water Quality | Lake Owen Association. The study reports describe data collection and analysis methods and more detailed results.

The Lake Owen Watershed



A **watershed** is the area of land that drains to a waterbody. Lake Owen's **direct drainage area**, shown in red, flows directly to the lake.

Runoff from the larger watershed, shown in yellow, is captured in ponds and wetlands (is internally drained), thereby not influencing Lake Owen directly.

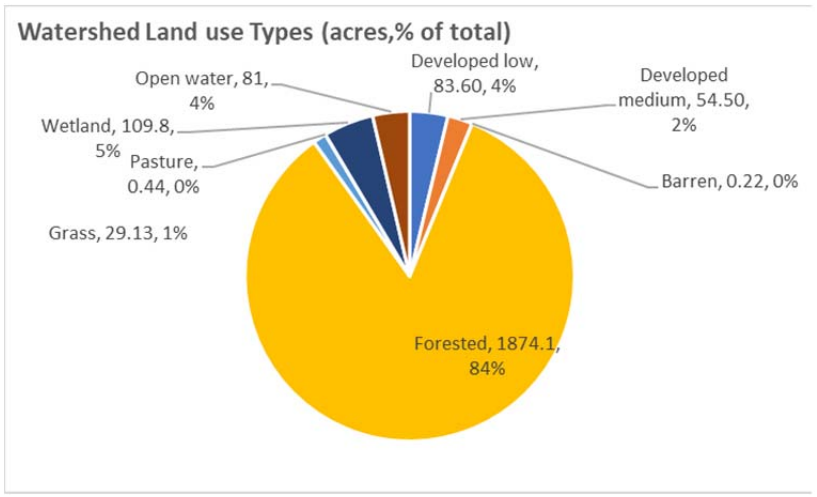
The blue area is the watershed from which **groundwater** flows to Lake Owen.

Water volume and nutrient concentrations in runoff are influenced by the land cover in the watershed.

[1] *Watershed Evaluation: Water and Nutrient Budget Lake Owen, Bayfield County Wisconsin 2019-2020.* Ecological Integrity Service-LLC, Black Brook Environmental-LLC, and Harmony Environmental, Inc.

[2] *Evaluation of the water clarity: Interaction of epilimnion and metalimnion in regard to bioavailable phosphorus, chlorophyll, and zooplankton. Lake Owen, Bayfield County, WI.* Ecological Integrity Service and Harmony Environmental. 2019.

Watershed Land Cover

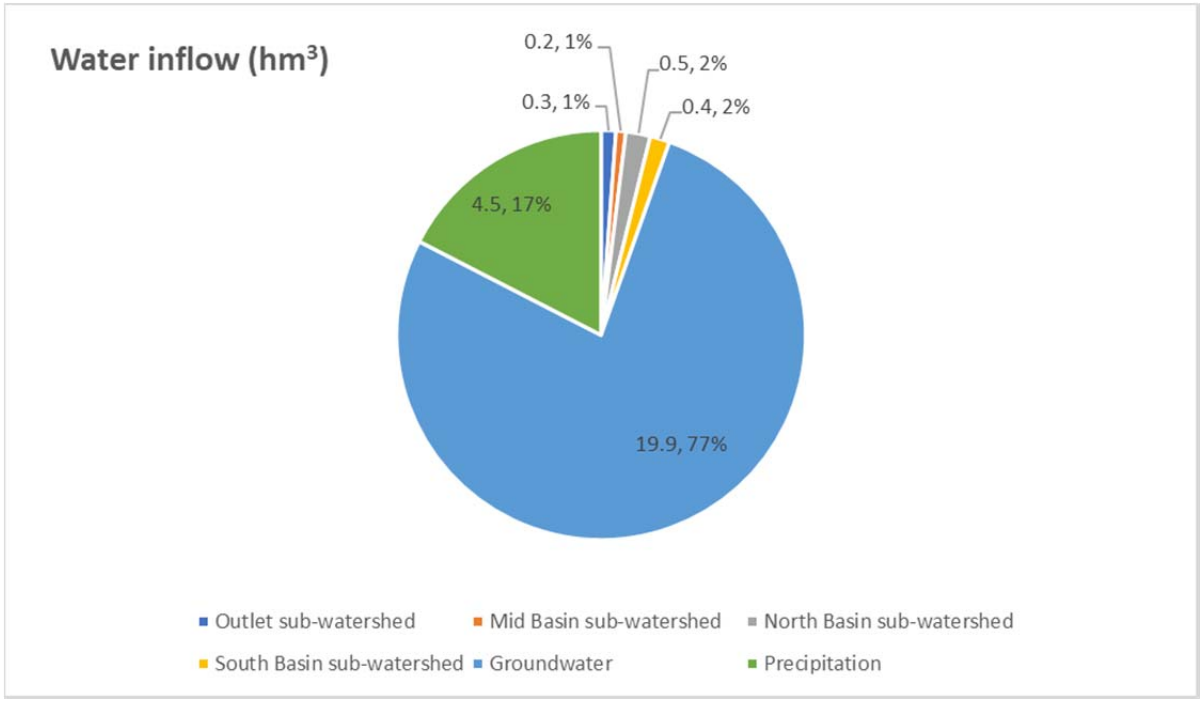


The high percentage of forested land in the watershed protects Lake Owen because runoff from this land cover tends to be in lower volume with low nutrient concentrations. In contrast, developed areas with impervious surfaces such as roofs, driveways and parking areas result in more runoff with higher nutrient concentrations.

Well-vegetated areas slow runoff flow and encourage infiltration. A protective buffer of natural vegetation between residential development and the lake can make a difference.

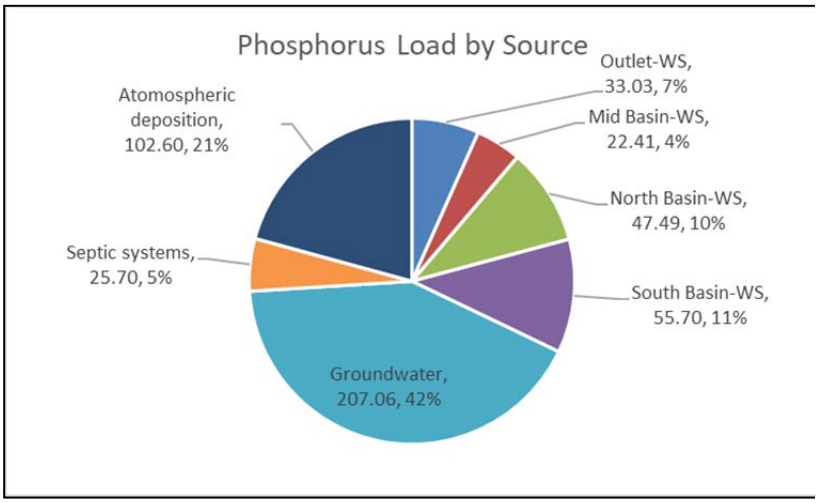
Water Budget

Water enters the lake from runoff from the watershed, precipitation on the lake surface, and the groundwater. It leaves the lake in the outlet stream, evaporates from the lake surface, and flows out in groundwater. The largest source of water to Lake Owen is groundwater. While we continue to analyze how much water enters and leaves the lake in groundwater along with the groundwater nutrient concentration, we know that groundwater is a large source of water which is relatively low in nutrients.

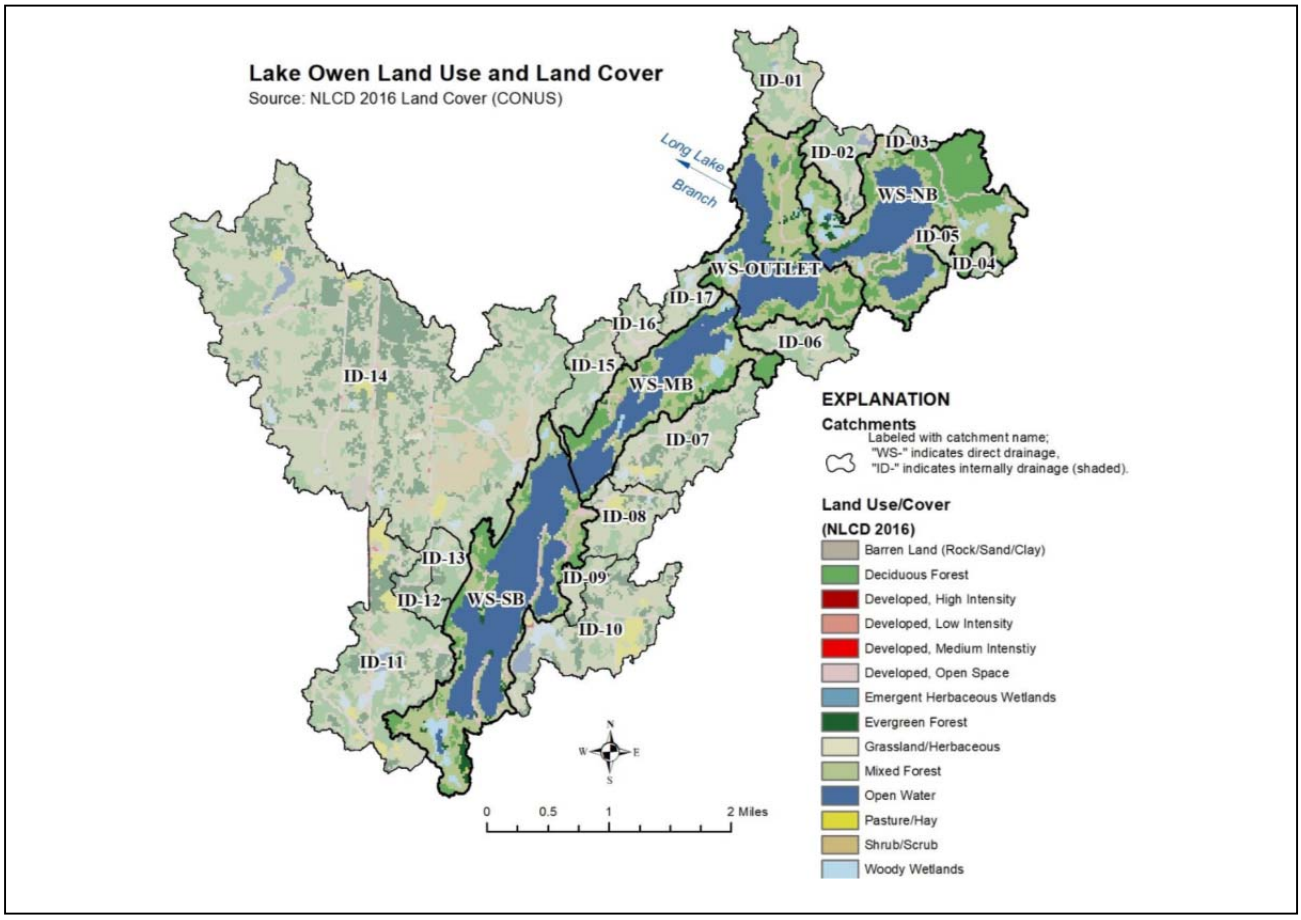


Nutrient Budget

Phosphorus is the nutrient of concern for Lake Owen because it is the limiting factor for algae growth in the lake. Because of the large volume of water, groundwater carries the most phosphorus to the lake (42%). When all portions of the watershed are combined, they make up the next largest source (31%). Atmospheric deposition, likely from tree pollen, is 21% of the phosphorus budget, followed by septic systems (5%).

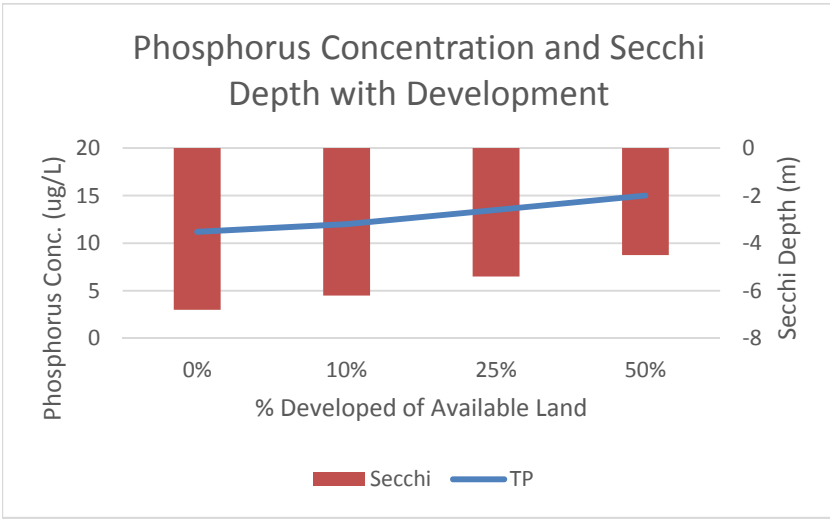


Limiting phosphorus inputs will limit algae growth in Lake Owen. Controllable sources of phosphorus include runoff from the watershed and septic systems. The South Basin (WS-SB below) has the largest estimated inputs of phosphorus, largely because of medium density residential resort and condominium development on the south end of the lake.



Impacts of Land Use Changes

We developed a mathematical lake model based on the water and nutrient data collected. This lake model was used to predict changes in the lake water quality that would result from changes in the watershed. Of the 2298 acre direct drainage watershed, we estimated that about 717 acres is available for future development. (We hope to investigate this in more detail in the coming year.) To predict impacts, we assumed that a certain percentage of this available forested land would be converted to residential development.



The lake model predicts that if 25% of the forest land available for development is converted to residential land, the Secchi depth (water clarity) will decrease from 6.8m (22.3ft) to 5.4m (17.7ft).

If 50% is developed, Secchi depth will decrease from 6.8m (22.3ft) to 4.5m (14.8ft).

Protecting Lake Owen Water Quality

While Lake Owen is a resilient deep-water lake fed by groundwater and protected by a largely forested watershed, human development and use have the potential to negatively impact the lake. In addition to potential overall lake impacts, runoff and erosion from developed areas can have localized impacts. Increased runoff can increase the temperature of the water. Erosion resulting from runoff can increase sedimentation and change bottom habitat for fish and other organisms by filling in space between rocks with fine sediments. Sediment build-up can also provide more conducive habitat for invasive species such as Eurasian watermilfoil.

The Lake Owen Association (LOA) is following study recommendations by focusing grant resources on developed areas in the South Basin and around Otter Bay. Technical and financial support will be provided for projects such as diversions, rain gardens, and rock infiltration areas. These mitigation measures can protect Lake Owen and provide a measure of safety to guard against impacts of future development. Because of the benefits provided by natural vegetation between development and the lake, the LOA is also offering assistance to owners around the lake who are interested in enhancing this protective buffer.