

# Stratton Lake Well Water Testing Summary

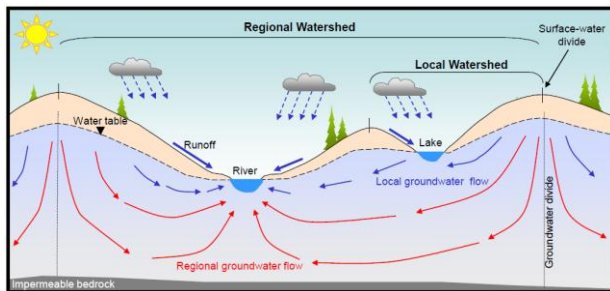
Center for Watershed Science and Education and Waupaca County UW-Extension Office

## Background

Well water testing was performed by 14 well owners in October of 2011. Since groundwater is intimately connected to Stratton Lake, these samples provide a snapshot of water quality in the watershed. Fourteen wells is a small sample of overall groundwater entering the lake; therefore it is difficult to make conclusions from such a small sample set. These samples do however provide a starting point for monitoring changes in water quality over time and hopefully encourages others along the lake to sample their wells on a more regular basis. Here we summarize the results from those tests and pair it with information from a past study of Stratton Lake performed in 2000.

## Groundwater Basics

Groundwater is contained in water bearing geological formations that transmit and store water called aquifers. An aquifer can be thought of as a kind of underground sponge. In the Stratton Lake watershed, sand and gravel deposited by the glaciers is the primary groundwater storage unit and the aquifer most utilized as a source of water for private wells.



**Figure 1.** Generalized watershed groundwater flow diagram showing watershed boundaries.

Groundwater is always moving very slowly through the small pores or cracks found in the soil and bedrock. Typically groundwater may only move a few inches to a few feet per day. In shallow aquifers, groundwater flows only short distances, a few thousand feet to a few miles, from recharge areas (areas where water infiltrates into the ground), to discharge areas (lower points on the landscape where water exits the ground). Examples of discharge areas include streams, rivers, lakes and wetlands. Groundwater traveling in shallow flowpaths has been in the groundwater system only a few years or decades; most private well water is supplied by these shallow flowpaths. Deeper in the aquifer where the groundwater flowpaths are longer, water may be in the groundwater system for decades or longer.

Since groundwater discharges to the landscape at surface water bodies, we use the concept of a watershed to determine the area of recharge for lakes and rivers (Fig. 1). Any water that falls within a watershed has the potential to end up in that watershed's discharge area. Precipitation that is not used by plants or does not evaporate will eventually find its way into Stratton Lake; a small amount via direct runoff over the land surface and most through infiltration and groundwater flow.



**Figure 2.** Groundwater contribution area to Stratton Lake. (courtesy of P. McGinley)

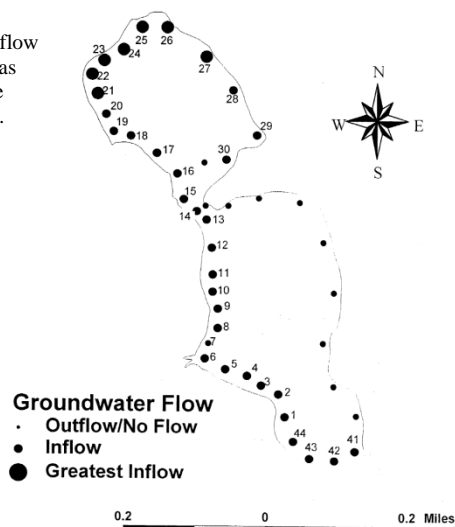
Water is never just H<sub>2</sub>O or pure hydrogen and oxygen atoms. Water is referred to as the universal solvent because of the ability to dissolve many different types of materials. Groundwater naturally contains certain solutes depending on the type of soils and minerals the water contacts. Common minerals and elements found in groundwater include calcium and magnesium. Groundwater can become contaminated when chemicals such as fertilizer and pesticides are dissolved in water and carried by recharge into the aquifer. Testing for compounds like nitrate and triazine provides insight into the severity of impact from local land use.

## Description of Area

Stratton Lake is a 64 acre groundwater drainage lake in Waupaca County, WI. Water inputs to the lake are groundwater inflow and precipitation. Water output from the lake is from a surface water outlet which drains out the southern portion of Stratton Lake and a small amount of groundwater outflow. Water table elevation maps show that groundwater flow is generally from west to east (Fig. 2). This is backed up by a previous study of Stratton Lake that identified the major inflow areas to be situated in the northern lake shore extending south along the western shore (Fig. 3).

Land use within the watershed consists of roughly 40% irrigated and non-irrigated agriculture, approximately 40% forest/grassland, 14% low-density residential, and Stratton Lake and other surface water features accounting for 6% of overall land cover.

**Figure 3.** Groundwater inflow and outflow areas of Stratton Lake (Hudson, 2000).



### Well Testing Summary

Fourteen private well samples were submitted by homeowners in Stratton Lake watershed in October of 2011. Samples were tested for coliform bacteria, nitrate-nitrogen, chloride, pH, alkalinity, total hardness and pH. Eight homeowners also tested for triazine type pesticides and seven decided to test for metals.

### pH, Alkalinity and Total Hardness

Water quality indicates moderately hard water (avg = 178 mg/L CaCO<sub>3</sub>), moderate alkalinity (avg = 133 mg/L CaCO<sub>3</sub>) and an average pH of 8.05. These results are typical for groundwater that passes through an aquifer consisting of significant amounts of calcium and magnesium containing dolomitic sands and gravels. It is the total hardness (calcium and magnesium) and moderate alkalinity that are responsible for marl formation in Stratton Lake. These same properties also buffer the lake from fluctuations in the pH and help to limit the amount of phosphorus available for aquatic vegetation and algae.

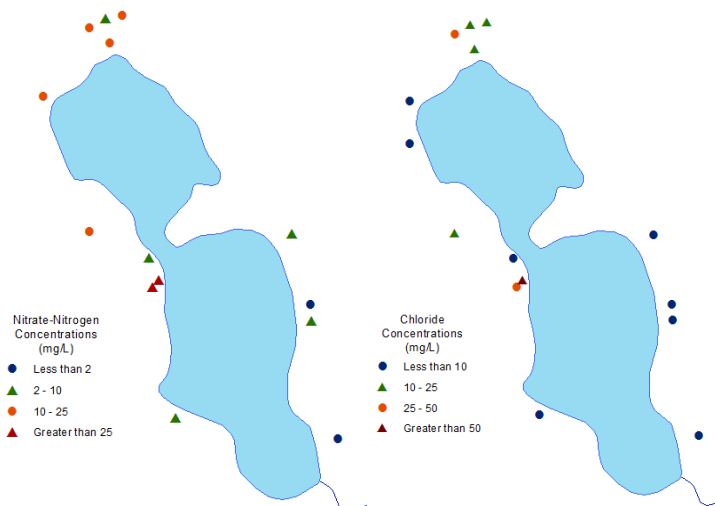
### Nitrate and Chloride

Nitrate and chloride can be used to indicate the impact of local land-use on groundwater quality. Eleven out of 14 samples reported nitrate-nitrogen concentrations above natural levels found in groundwater. *Less than 2 mg/L is generally considered to be natural or background levels of NO<sub>3</sub>-N.* The average concentration of nitrate-nitrogen was 12.0 mg/L (minimum = 0.1 mg/L, maximum 29.7

mg/L). The average was 22.6 mg/L (minimum = 3.1 mg/L, maximum = 101 mg/L). *Less than 10 mg/L is generally considered to be natural or background levels of chloride.*

Water quality of Stratton Lake is dominated by groundwater flow from the north and west of Stratton Lake. Elevated nitrate levels measured in well water samples suggest large amount of nitrate loading into the lake. As a result concentrations of nitrate in the lake are likely to still be high but no lake sampling has been performed since 2000. Resuming lake testing is necessary to see how they have changed since 2000.

Given the prevalence of agriculture in the watershed, fertilizers represent the majority of nitrate and chloride loading to Stratton Lake. Septic system drainfields are also a source of these two compounds but represent a lesser contribution to the overall lake budget. Because wells often represent a very discrete flowpath, further testing would be needed to pinpoint the source of nitrate and chloride for any individual well. A more detailed description of nitrate and chloride concentrations in private wells and the lake can be found in Hudson et. al., 2000.



**Figure 4.** Nitrate-nitrogen and chloride concentrations of well water samples from October 2011.

### Diaminochlorotriazine (DACT) Screen

Triazines are a class of herbicides that include atrazine, simazine and cyanazine. The DACT screen is an approximate test for triazine type herbicides that is performed as an inexpensive alternative to more detailed tests. It is specific to one of the three metabolites of atrazine called diaminochlorotriazine (DACT), as a result this test typically underestimates the amount of total atrazine. It does not account for other classes of herbicides, fungicides or insecticides that may have been applied in the Stratton Lake watershed.

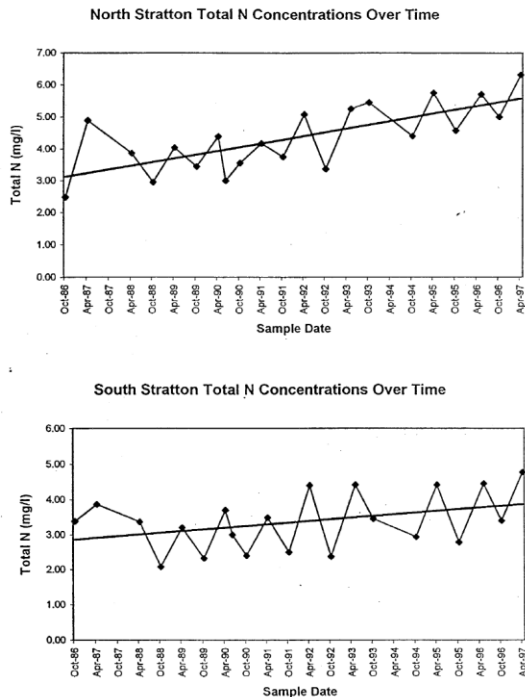
Eight wells were tested for the DACT screen. Six wells did not report any measurable concentration of DACT. The two wells that detected DACT measured at 0.1 ppb (parts per billion). The previous study of Stratton Lake and private wells reported much higher concentrations of triazines in water. This was a very limited sampling therefore, more detailed testing of wells and the lake would be needed in order to compare current atrazine concentrations with those from the study performed in 2000.

## Recommendations

### Water quality monitoring

**Objective:** Obtain long-term water quality data that shows whether water quality has gotten better, worse or stayed the same.

- Activity 1: Resume sampling of multi-level wells upgradient of lake. *At least sample once to see how water quality compares to 2000.*
- Activity 2: Resume spring and fall turnover monitoring of both South and North Stratton Lake to observe and document any changes that are occurring in water quality.



**Figure 5.** Total nitrogen concentration data from spring and fall lake turnover sampling (Hudson, 2000). No data collected since 1997.

- Activity 3: Begin annual or bi-annual sampling of water quality from surface water outlet for nitrate, chloride, and pesticides.
- Activity 4: Continue monitoring of private wells either through the lake association or by individuals to determine long-term trends and document changes over time. Make it a goal to sample all wells within the watershed once every 5 years.

### Water Quality Protection Strategies

**Objective:** Encourage activities that will improve or maintain water quality of Stratton Lake.

- Activity 1: Continue efforts with lake property owners to minimize the use of fertilizers on lake shore property; especially phosphorus fertilizers.
- Activity 2: Encourage lake shore property owners to maintain natural vegetation buffers along the lake shore. Vegetative buffers help to reduce runoff of sediments and nutrients, enhance aesthetics and increase habitat for birds and wildlife.
- Activity 3: Work with producers on nearby agricultural fields to grow less nutrient intensive crops.

### References:

Hudson, M., B. Shaw, and L. Reas. 2000. An Evaluation of Water Quality Characteristics in Stratton Lake, Waupaca Co., WI. College of Natural Resources, UW-Stevens Point. Available online: <http://www.uwsp.edu/cnr-ap/watershed/Documents/StrattonLakeWaterEval.pdf>



### Information provided by:

Kevin Masarik  
Groundwater Education Specialist  
Center for Watershed Science and Edu.  
UW-Extension/UW-Stevens Point  
[kmasarik@uwsp.edu](mailto:kmasarik@uwsp.edu)

and

Mike Koles  
Community, Natural Resource and  
Economic Development Faculty  
UW-Extension, Waupaca County  
[Michael.Koles@ces.uwex.edu](mailto:Michael.Koles@ces.uwex.edu)