

Lake Level Data for Natural Lakes in Northern Indiana

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Have you ever wondered if your lake is higher or lower than it has ever been? Or, if the lake is gradually getting higher or lower over time? The only way to know the answers to these questions is through the collection of a long-term lake level record. For many natural lakes in northern Indiana, an historic lake level record does exist. The IDNR, Division of Water can help you find out more about what data are available for your lake and how you can use the data or continue the record.

This brief article is a follow-up to a presentation delivered at the Indiana Lake Management Conference in March. I wish to thank the Indiana Lake Management Society (ILMS) for allowing me to speak about lake level data at the conference. This article will focus on the take-home points of the ILMS presentation regarding lake level data. In doing so, it is my hope that citizens located on Indiana's public freshwater lakes will be able to identify resources to begin the task of understanding the need, application, and methodologies associated with lake level data for their specific lake.

Interpreting Lake Level Elevation Data

The ILMS presentation provided graphical displays of 40+ years of daily lake level elevation data for several northern Indiana lakes. The lake level graphs were shown with the county court-established average normal level as an elevation, the Flood Protection Grade (FPG), and the 100-year flood elevation, also known as the 1% chance per year or a flood elevation that occurs on average once every 100 years. The graphs showed that common weather conditions, while regionally observable in the data, often result in very different lake level responses for lakes that are geographically close. The relationship between the 100-year flood level and the higher-frequency water levels could also be seen in the graphs. In many cases, a difference of less than one foot in elevation can greatly alter the flood frequency. Low lake level periods and common low level trends were also apparent on the graphs. For many lakes, the low water level is much more problematic than high water. In all cases, the lake level data for a specific lake can add to the story and history of the lake over the period of observation, providing increased insight related to the unique circumstances that determine lake level.

Lake data for the Barbee Chain, Kosciusko County, can be seen in Figure 1 as an example of data specific to a lake system. The court-established lake level of 837.5 feet MSL (feet above mean sea level), the 10%, and 1% chance per year flood frequency elevations are included along with the Flood Protection Grade, defined by county ordinance as two feet above the 1% chance per year (100-year) flood elevation.

Several features can be seen on this graph. The lake level outlet control structure was constructed in the late 1950s following a period of monitoring where several extremely dry periods caused very low lake levels. During this same period, the lake chain also experienced two events that

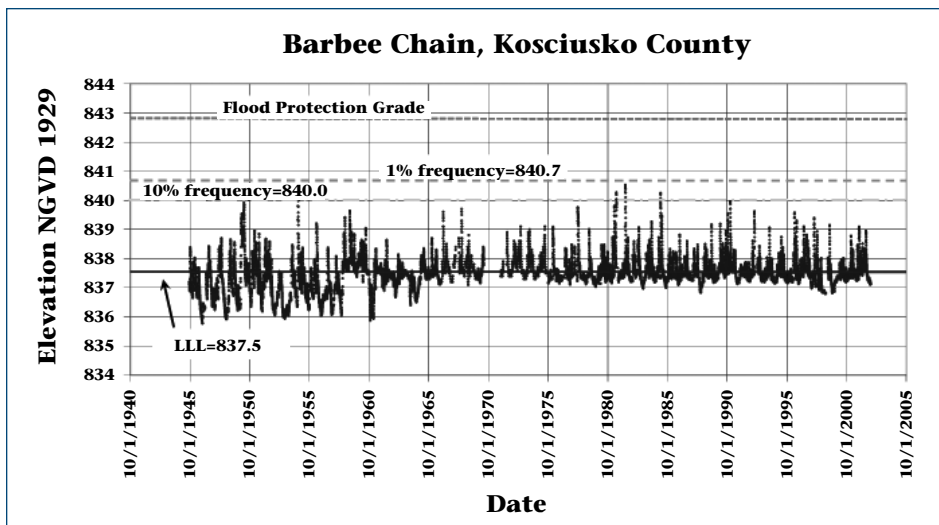


Figure 1. Fifty-five years of lake level elevation changes on the Barbee Chain.

were near or above the 10% chance per year. The lake level outlet control structure likely helped to minimize the impacts of the droughts that occurred in the early 1960s. Following the early 1960s, seasonal low lake levels can be seen as typically less than one-half foot below the established level.

On the high lake level perspective, in a period of record that approaches 60 years, four events have clearly exceeded the 10% chance per year elevation and two were less than one-tenth of a foot below the 10% elevation. Three of the events that exceeded the 10% chance per year elevation occurred between 1980 and 1985. These same three events are seen on lake level records from many other northern Indiana lakes. In the late 1990s, a seepage problem associated with the Barbee Chain lake level outlet control structure caused the lake level to fall below normal seasonal lows. This problem was addressed with a temporary repair in 1999. The outlet structure was rebuilt in 2006. A long gap in the period of record occurs in the late 1960s through the early 1970s. Additional short gaps also exist. The graph clearly shows that even with some missing data, the overall trend of lake level can be provided through this record.

Long-term lake level elevation trends like that for the Barbee

Chain can help DNR and others understand how the lake level responds relative to the lake level outlet control structure. Documentation of lake level is a good way to understand the variation in lake level and outlet conditions. It can help determine if a problem exists with the outlet works or if the current conditions are within a “normal” range of expected levels for a specific lake. This can greatly assist us in understanding and addressing the concerns of citizens on a specific lake.

Collecting Lake Level Elevation Data

The state, through cooperative agreements with the United States Geological Survey (USGS), has collected data for many lakes or lake systems over relatively long periods. Therefore, the justification of need for these data, from a state perspective, was somewhat lessened by the long-term nature of the record as budget constraints required difficult decisions to be made to reduce data collection costs. Presently, only a few lakes are monitored under this cooperative agreement and these may be subject to reduction in the future. The cooperative effort to collect lake level data resulted in a publication in 1988. The publication, *Annual Maximum and*

Minimum Lake Levels for Indiana, by Kathleen K. Fowler, can be found at: <http://pubs.er.usgs.gov/usgspubs/ofr/ofr88331>. The need for this publication was likely influenced by the period of high lake levels that occurred between 1980 and 1985.

Lake level data for a specific lake can provide useful planning tools for local zoning and development. Effective planning and zoning can only occur through wise local application of good data. Local knowledge of lake level data and the ranges over time can help local officials determine the lake level at which specific sections of roads begin to flood, or the low lake level that may impede boat access to specific locations. By knowing the range of lake levels and the present level, a person can plan for the common or extreme highs or lows relative to the present elevation by simple addition or subtraction. They can use the information to understand the relative risk long before the lake level reaches the important level for their activity or structure.

Lake level records could be helpful in understanding possible variations in water quality that may be influenced by inflow or lack of inflow. Lake level records can indicate if lake level trends, and therefore flow, are higher or lower than normal at the time of water quality tests.

Opportunities for Volunteer Monitors

IDNR will, as staff time and resources permit, assist local lake associations in understanding historic lake level fluctuations for their specific public freshwater lake that has a court established average normal level. Citizens can help this effort by volunteering to record lake levels on their lakes. IDNR staff are working with IDEM’s Volunteer Lake Monitoring Program to help train interested citizens to collect, convert, and record lake level data. This additional training will include the needed conversions (datum) to add to a gage reading

that will convert the numeric value to a sea level value as stipulated in the court lake level establishment and used for historic data. In that way, the new data will directly relate to the historic data. The local citizens will then be able to assist their neighbors in relating recent lake levels to historic readings.

There are basically two methods for recording lake level data: Either the data are collected using a fixed visual reference and recorded by hand or an instrument can be used both take a reading and record the results.

Using a visual reference most often involves a measuring device called a “staff gage.” Most northern Indiana lakes with a court-established average normal lake level have a staff gage located on the lake. In many cases the judge has actually set conditions for a staff gage. Gages are marked in feet with tenths and hundredths of feet shown on the scale (see Figure 2). An observer simply records the point at which the water level meets the gage. Scum or debris coating the gage should be wiped off prior to recording the lake level.

The staff gage may become ineffective at extreme high or low lake levels, for example, if the lake level exceeds the height of the gage. For extreme levels a visual reference may include distance below a bridge, below the top of a seawall, above the bottom edge

of the boat ramp, or any water level measurement that could be measured relative to a normal lake level and then checked against a staff gage reading when the lake returns to a more normal level. Knowledge of your lake will be very helpful in understanding where objects exist that may provide a relative lake level measurement that can then be easily converted to approximate elevation.

Using instrumentation to automatically record lake level at pre-set intervals has some definite advantages, but is not a replacement for understanding lake levels using a staff gage. Instruments, usually some type of pressure transducer and data logger, are available from several manufacturers with a range of price, features, and complexity. The discussion of instrumentation would exceed the scope of this article. The USGS does use instrumentation for lake level recording and can reactivate gages for lakes, providing the technical assistance to a lake association as needed to understand the data. The USGS service does require a local cost share to activate and an annual fee to maintain. Other resources for instrumentation packages may become available as data recording increases.

Compilation of data can be achieved at the local level. However, the School of Public and Environmental Affairs (SPEA), through the Volunteer Lake Monitoring Program, can compile citizen-collected lake level data for long-term records and maximize the utility of the new data as it relates to historic data. As an association develops a plan to collect store and utilize lake level data, they can also report the data to SPEA for record keeping. That will allow confirmation and

use of data by other sources, thus providing validity to the activity over time.

Lake level data are easily obtained measurements with only minimal training. They can provide an important backdrop for planning and understanding several aspects of a specific lake and its associated watershed.

For additional information, please contact David Nance at dnance@dnr.in.gov.

State Ban on Phosphorus in Dishwasher Detergents will Help Protect Lakes

Thirty-five years ago, Indiana became the first state in the nation to protect its lakes and waterways by prohibiting the use of laundry detergents containing phosphorus. Now the state has taken another step to protect surface waters from nutrient pollution. During its spring legislative session, the Indiana legislature extended the phosphorus ban to detergents used in residential automatic dishwashers. Automatic dishwashers were not in common use back in 1974, so phosphorus in dishwashing detergent wasn't included in the original ban.

Phosphorus, along with nitrogen, is a nutrient that, when added to lakes, stimulates excessive growth of algae and vegetation – a process called “eutrophication” that can severely damage water quality and ruin aquatic ecosystems. In most freshwater lakes, phosphorus is the “limiting nutrient:” More phosphorus means more algae growth.

The impetus for the new limitations came from the Indiana Lake Management Work Group, a legislatively authorized group of citizens and professionals, appointed by the governor, to evaluate lake-related policies that assist state agencies.

Work Group member Bill Jones worked with state Rep. Nancy



Figure 2. A typical lake level staff gage.

Dembowski of Knox, Ind., and the Legislative Services Agency to draft House Bill 1120, which prohibits the use of dishwasher detergents with phosphorus. In a "short session" of the legislature, focused chiefly on property tax relief, the phosphorus bill passed by margins of 85-7 in the House and 46-0 in the Senate. Gov. Mitch Daniels signed it into law on March 3.

"Eliminating phosphorous in dishwasher detergents is one more step we need to take to preserve the natural ecosystems of Indiana's lakes and rivers," Dembowski said upon approval of the legislation.

Indiana is one of about a half-dozen states to enact bans on phosphorus in dishwasher detergents. Commercial automatic dishwashers were exempted after industry officials argued that enzyme-based alternatives to phosphorus detergents may not be effective in the extremely high temperatures reached in commercial machines. The ban doesn't take effect until July 2010, giving the industry time to adjust.

How much of an impact will a ban have? According to the Minnesota Pollution Control Agency, residential and commercial dishwashers contribute 3% of the phosphorus going into surface waters in that state. It's likely that the situation in Indiana is similar. So eliminating phosphorus from all dishwasher detergents could reduce nutrient loads in lakes by about 3%, resulting in less algae and plant growth.

Excessive use of phosphorus as a fertilizer for suburban lawns is a bigger factor in damaging Indiana lakes. But getting the phosphorus out of automatic dishwasher detergents is something the state can do now to protect its surface waters.

Boats Need Annual Permit to Use State Waters

As prime boating season approaches, those who plan to boat in Indiana should take note that if they plan to use state park, reservoir, or forestry lakes, they must purchase a DNR Lake Permit.

As of January 2006, the DNR no longer issues daily or annual boat launch fees for lakes at state parks, reservoirs, and forests. These launch fees have been replaced by a DNR Lake Permit, which costs \$20 per year for each motorized watercraft lake permit and \$5 per year for each non-motorized watercraft lake permit. Boaters only need to buy a permit one time per year; not each time they visit one of these lakes. This allows boaters to launch and get on the water with no delays to pay attendants – and no waiting for others to pay attendants.

All private watercraft using state park, reservoir, or forestry lakes must have this permit. This includes personal watercraft, motorboats, canoes, paddleboats, rowboats, and all watercraft moored at marinas, private docks, group docks, or bank ties. State-owned watercraft and state-managed boat rental concessions are exempt.

All boaters must still register their watercraft as the law requires through the Indiana Department of Motor Vehicles. The Lake Permit does not replace that registration process; it replaces the daily and annual launch permits for state park and reservoirs properties that were sold prior to 2006.

For more information, call: 317-232-4200 or visit the following Web site: <http://estore.dnr.state.in.us/tek9.asp?pg=products&grp=106>.

DNR Awards Funds to Treat Lakes

The Indiana Department of Natural Resources has awarded funding totaling nearly \$1.2 million over the last year (from FY 2007-08 funds) to 45 projects to protect and restore Indiana lakes in 13 counties.

The funds come from the Lake and River Enhancement (LARE) program in the Division of Fish and Wildlife and will be used on 56 different lakes around the state.

The grants mark the 21st year of the continuing partnership between the DNR and local groups. Funding comes from the LARE fee paid by boat owners. In 2003 the legislature initiated a variable fee based on the value of each boat, with one-third of the money slated for use by the DNR for lake projects that remove sediment or control exotic or invasive plants or animals. The remainder is split among traditional LARE projects and the DNR's Division of Law Enforcement.

"This year's awards are especially pertinent to help address the spread of certain aquatic invasive species that may have devastating consequences on the lakes if not controlled," said Jim Ray, chief of the DNR's LARE program.

The DNR awarded \$724,973 in grants to survey and treat exotic invasive plants in 48 lakes in 13 counties. Eighty percent of the lake associations that requested funding received awards.

The other type of grant, for sediment removal, provides positive recreational and economic benefits to both users and residents of the affected lakes. A total of \$473,500 will be distributed in seven counties to seven sediment removal projects involving 11 Indiana lakes.

For more information, see the LARE Web site: <http://www.in.gov/dnr/fishwild/7032.htm>.

**Have you checked out the Indiana Clean Lakes Program Web page lately?
Take a look at <http://www.spea.indiana.edu/clp/>
and see what's new and happening with the program and with Indiana lakes!**

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**ENVIRONMENTAL
COUNCIL**

Workshops Planned

May 17 and August 23
Invasive Aquatic Plants I.D. Workshop

10:00 a.m. - Noon

Culver/Union Township Library, N. Main St., Culver, IN

The LMEC has invited aquatic plant specialist Mark Mongin to Culver to teach us how to identify the hydrilla plant and distinguish it from other aquatic plants common to lakes in our area. These workshops are intended for all lake users and will include marking and reporting procedures to be followed if the plant is found. Attendees will be working with live plant species as well as mounted plants. Both workshops will be identical, so if you miss the May session, just join us in August. Both workshops are open to the public – we all need to work to spread the word, not the weed!

June 18
Lakescaping Workshop

4:00 p.m. - 6:00 p.m.

Culver/Union Library, N. Main St., Culver, IN

Plan on attending this panel presentation for the latest information on shoreline landscaping tips, in-water planting programs, and the LMEC's new glacial stone program. Presenters will include Angela Sturdevant and Gwen White of the Indiana Department of Natural Resources' Lake and River Enhancement division; Chris Kline and Sara Peel of JFNew; and Allen Chesser (LMEC) with Tony Sellers (Sellers Landscaping and Lawn Care). This panel workshop will teach you everything you need to know about the latest dos and don'ts in friendly lake-side landscaping.

No reservations are required, but contact Kathy Clark at LMEC (lmec@culcom.net or 574-842-3686) for more information – please take a couple hours out of your day to learn ways to keep our lakes, rivers, and streams healthy!

Perspectives

A recent article in the F.X. Browne newsletter presented water proverbs from other countries. Here is the final installment.

Don't spit into the well - you may need to drink from it. ~ Russia

Fools grow without watering. ~ Italy

Report Places Even Odds on Hoover Dam Running Dry by 2017

A new study warns that the 2,080-megawatt Hoover Dam could have too little water to produce power within the next decade. The study by researchers at the Scripps Institution of Oceanography concludes that the growing demand for water in the West, combined with reduced runoff due to climate change, are causing a net deficit of nearly 1 million acre-feet of water per year in the Colorado River system, which includes Lake Powell and Lake Mead. Lake Mead feeds the Hoover Dam, and the researchers estimate a 50% chance that Lake Mead could drop too low for power production by 2017. According to the U.S. Bureau of Reclamation, the Hoover Dam is one of the largest hydropower facilities in the nation, producing enough power to serve 1.3 million people in Arizona, California, and Nevada.

With recent droughts in the West, the Colorado River system is currently operating at only half of its capacity, and the researchers estimate that the system is already operating at a deficit. They find a 50% chance that Lake Mead could run completely dry by 2021 if the climate changes as expected and if future water demand is not curtailed. The research paper has been accepted for publication in *Water Resources Research*, a publication of the American Geophysical Union (AGU). See the description of Hoover Dam on the Bureau of Reclamation Web site: <http://www.usbr.gov/lc/hooverdam/faqs/powerfaq.html>.



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