The Research and Scholarship Symposium

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Progressive Assessment of Lake Depths in Cedar Lake

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Background
Cedar Lake on the campus of Cedarville University (CU) has a history that probably does not match what the original developers had envisioned. At present, the lake is the visual focal point of the campus and people often ask about its physical characteristics. The questioned characteristics include, but are not limited to, water depth, bottom configuration, water volume, drainage area that feeds it, rate of infilling, perimeter length, and lake surface area.

Considerations
This study considers the issues of potential changes in water depth, bottom configuration, and lake volume over an extended period of time, and further considers what to use as baseline data to start a long-term assessment. Changes to water depth, bottom configuration, and water volume in any lake are most often attributed to sediment infilling unless observed purposeful alteration by man is known to have occurred. A comparison of changes in total water volume of Cedar Lake will probably be the most valuable means by which the rate of infilling can be assessed.

Previous Methods and Results
In the fall of 2012 the CU Environmental Geology class did an assignment which produced a bathymetry (bottom-contour) map of Cedar Lake. Although the depth measurements using stadia rods and the position measurements using handheld GPS units were somewhat crude, the end result was a map that seemed to be a very reasonable depiction on the lake bottom configuration.

Discussion
The 2014 measurements for this study duplicated the techniques used in 2012, including equipment used. The primary difference between the two measurement periods involved the number of depth readings taken, 364 readings were taken in 2014 and 138 were taken in 2012. Measurement locations and depths were determined by using Garmin GPS units and surveyors’ stadia rods. The data had to be processed using a variety of file types for the different software applications that were used. A Golden Software package called Surfer 8 was used to produce the bathymetry (bottom contour) maps of the lake and to calculate the water volume. The contour maps were then transferred into ArcGIS imagery for final presentation.

The data collected in 2012 produced a volume of ~1,320,000 cubic feet and the data collected in 2014 produced a volume of ~1,450,000 cubic feet. This 130,000 cubic feet difference is an increase of almost a million gallons. This increase of water implies that there was not sediment infill but a sediment loss. Nearly 5 to 6 inches of additional water across the 6 acres of the lake surface would be required to produce this volume. During the past two years the lake has not been altered (dredged, for example) in any way to create a volume increase. This significant increase of water shows that the data collection method may have been too inaccurate to predict the sediment infill rate of the lake. Or, more likely, the increase in number of readings in 2014 has produced a more detailed bathymetry map than was produced in 2012. This, in turn, creates a volume discrepancy.

Future of this Project
In the future this project can be refined by using improved field techniques and data processing. New maps could be created every other year in the fall from new field data. The project should continue for a minimum of ten years. Ultimately, if techniques and assessments are deemed adequate, then conclusions can be made regarding the infilling rate of the lake. Rate-of-infilling is a condition that needs to be understood in order to address both the short- and long-term health of the lake. The economic consequences may be minor or significant depending on the findings.