Part 2

Bathymetric Maps and What They Tell Us About Lakes

Amy Richard

When planning a trip to unfamiliar territory, the first thing many of us will do is reach for a map of the area. If traveling by car, one might use a road map. However, if traveling "off road," a topographic map would be especially helpful as it would provide details about the actual terrain such as distances and elevations of mountain ranges, as well as the location of rivers and streams.

Bathymetric maps are similar to topographic maps, in that they provide details about the terrain of a landscape. In the case of a bathymetric map, the terrain that is described is underwater.

As you can see in Figure 2-1 on page 7, a bathymetric map is generally depicted as a grouping of concentric contour lines, with the outermost contour line representing the shoreline of the lake at a given point in time. Lines within the map are obtained by recording water depths throughout the lake and connecting the recorded points of equal water depth. Contour lines drawn close together indicate rapid changes in water depth and lines that are far apart indicate water depths that change gradually.

The contour lines are only estimates of water depth between two points of a known depth. There may be discrepancies in any given map depending on the number of depth measurements taken. To put it simply, the more depth measurements one is able to record, the more accurate the map will be.

It's also important to note that the outermost contour line, as well as the rest of a lake's bathymetry, is subject to change depending on rainfall patterns and resulting lake levels.

Bathymetric maps are the primary method used to describe a lake's physical characteristics.

Once we have a bathymetric map, we can calculate several measurements that are crucial to understanding how a lake system functions, including surface area, maximum length, mean width, maximum width, mean depth, maximum depth, shoreline length, shoreline development, and volume. These measurements are discussed in greater detail in Part 3.

*See **Part 3 Commonly Measured Morphometric Features and What They Tell Us About Lakes** on page 10 for detailed information about these features.*

The following are a few examples of how bathymetric maps may be useful to scientists or anyone interested in learning more about a lake:

Anatomy of a Bathymetric Map

Figure 2-1 below is an example of a bathymetric map made by LAKEWATCH staff.

Notice how the outermost line delineates the lake's shoreline. Lines within that outline are called contour lines. They are obtained by recording water depths throughout the lake and connecting the recorded points of equal water depth.

Contour lines drawn close together indicate rapid changes in water depth and lines that are far apart indicate water depths that change gradually. All of these contour lines are estimates of water depth and so there may be discrepancies in any given map depending on the number of depth measurements taken to make the map. A general rule of thumb: the more depth measurements one is able to record, the more accurate the map will be.

It's also important to note that the map shown here documents the bathymetry of Lake Jackson for one particular date in time. Based on weather conditions, etc., the bathymetry of the lake is susceptible to change. For example, during a period of drought, it's likely that the lake's surface area could "shrink" in which case the outermost contour line and each of the depth contour lines would change right along with the water levels.

A well-made bathymetric map will usually include:

A The name, county and geographic location of the waterbody;

B An outline of the lake shoreline, drawn to a known scale;

C Depth contour lines drawn at known intervals;

D Symbol indicating geographic orientation (i.e., north);

E Name of the mapmakers and date.

While the map shown here is not designed for navigation purposes, it can be used to calculate important morphometric features of a lake such as:

surface area, maximum length, mean length, maximum width, mean width, maximum depth, mean depth, shoreline length, shoreline development, and volume.

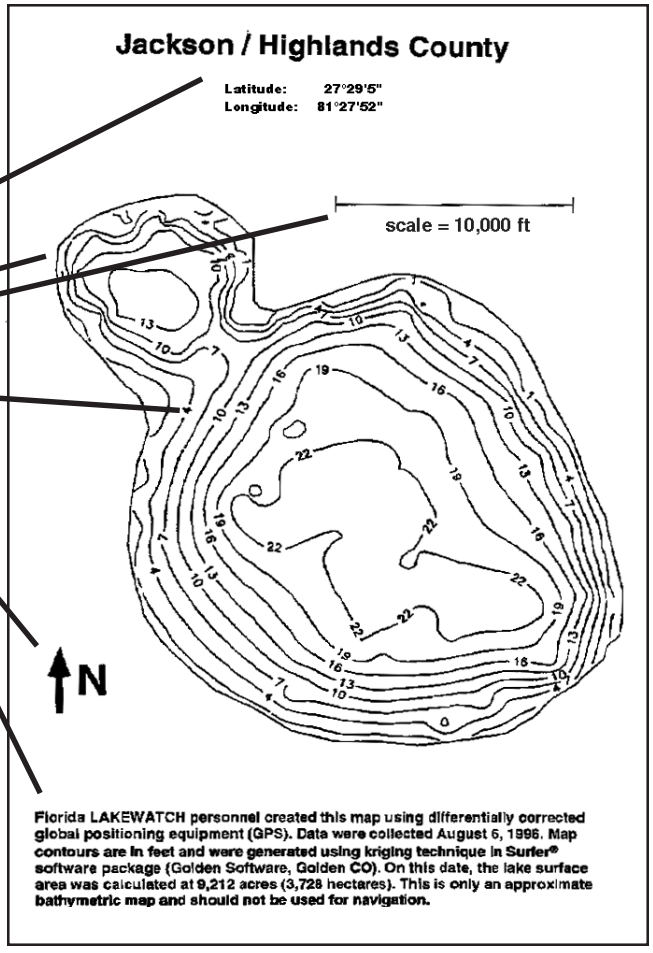

Figure 2-1

Joe Richard

Local residents of Lake Alice in Gainesville, Florida.

♦ Lake surface area can be calculated from a bathymetric map. This measurement determines the size of the lake and is usually expressed in acres or hectares.

*For more on this, see **Part 3 Commonly Measured Morphometric Features** on page 10.*

♦ Bathymetric maps can be used to help calculate lake volume, which is usually expressed in acre-feet or cubic meters.

*See **Hypsographic curves** on page 12, **Volume** on page 15, and **Appendix B** on pages 31- 32.*

♦ Bathymetric maps can also be used to calculate average depth, which can help predict biological productivity (i.e., shallow lakes tend to be more productive than deep lakes).

♦ Using the scale provided in a bathymetric map, one can calculate fetch distances from all directions.

*See **Fetch** on page 19.*

♦ The irregularity of a lake's shoreline, as depicted by bathymetric maps, can tell us much about a lake's potential for biological habitat (i.e., its ability to support animals such as fish, birds, alligators, etc.).

*See **Shoreline Development** on pages 18 .*

♦ Mention bathymetric maps to an angler and he or she is likely to get starry-eyed at the prospect of finding a fishing "hotspot." Anglers use these maps to spot areas where lake depth changes rapidly; they know that larger predatory fish can often be found there.

Making a bathymetric map

Making a bathymetric map can be a simple process or a complex one. LAKEWATCH uses a technique that is somewhere in between. Regardless of their complexity, a well made bathymetric map generally consists of a line drawing of the shoreline, to scale, along with depth measurements taken at different areas of the lake.

*See **Anatomy of a Bathymetric Map** on page 7.*

Beyond that, the amount of detail in a bathymetric map depends on the amount of time and effort expended in making it, as well as consideration of its intended use. For example, some bathymetric maps are designed for navigation, requiring many, many data points or depth measurements.

Complex bathymetric maps are constructed by completing a survey of the shoreline using standard surveying methods and then combining the survey with electronically measured water depths at known locations throughout the lake. Lake water levels, in relation to mean sea levels, are often represented.

Water depth readings are collected with an electronic depth recorder (a.k.a. fathometer) and simultaneously linked with global positioning system (GPS) coordinates.[10] The procedure is repeated numerous times on the lake, generally following a grid pattern. This type of mapping procedure allows for more data points to be recorded and is considered to be very accurate.

It's important to point out however that not all bathymetric maps provide lake level data in relation to mean sea level (MSL). LAKEWATCH bathymetric maps, for example, provide data only for one point in time and not in relation to MSL.

Simple bathymetric maps can be made by sketching a general outline of a lake basin and then measuring and recording water depths at a number of locations within the lake.

The more depth measurements one is able to record, the more accurate the map will be. Water depths can be measured with an electronic depth recorder or something as basic as a weighted line, marked in increments of feet or meters.

This approach can be used by anyone with a boat and can be a valuable exercise, especially for those who live on or frequently use a lake.

While these maps may not be appropriate for navigation purposes, they are perfectly adequate for developing aquatic plant management strategies or planning a fishing trip.

10 *This type of system utilizes satellite technology to determine one's geographic location.*

LAKEWATCH Bathymetric Maps

Every summer since 1996, LAKEWATCH staff work with students and volunteers to create bathymetric maps for a limited number of LAKEWATCH lakes. The maps are designed to compliment LAKEWATCH data on individual lakes, providing a snapshot of the lake's bathymetry at a given time, and at a minimum of cost and effort.

LAKEWATCH uses a technique that involves the use of Global Positioning (GPS) equipment in coordination with a depth recorder (i.e., echosounding equipment). The depthfinder is used for recording actual lake depth measurements, while the GPS equipment simultaneously determines and records the location of each depth measurement. Bathymetric maps are completed with a computer software program that merges the information together and "draws" the lake's contours.

A good number of these bathymetric maps (200+) are available on the Florida LAKEWATCH web site:

http://lakewatch.ifas.ufl.edu

Amy Richard

*See **Figure 2-1** on page 7 for an example of a **LAKEWATCH Bathymetric map**.*