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Bathymetric Surveys of Selected Lakes in Missouri—2000–2008

Open-File Report 2013–1101

U.S. Department of the Interior
U.S. Geological Survey

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U.S. Geological Survey
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Conversion Factors

Inch/Pound to SI

Multiply	By	To obtain
	Length	
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
mile, nautical (nmi)	1.852	kilometer (km)
yard (yd)	0.9144	meter (m)
	Area	
acre	4,047	square meter (m^2)
acre	0.4047	hectare (ha)
acre	0.4047	square hectometer (hm^2)
acre	0.004047	square kilometer (km^2)
square foot (ft^2)	929.0	square centimeter (cm^2)
square foot (ft^2)	0.09290	square meter (m^2)
	Volume	
acre-foot (acre-ft)	1,233	cubic meter (m^3)
acre-foot (acre-ft)	0.001233	cubic hectometer (hm^3)

Unless otherwise noted, vertical coordinate information is referenced to the National Geodetic Vertical Datum of 1929 (NGVD29). The term elevation, as used in this report, refers to distance above the vertical datum.

Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD83).

Bathymetric Surveys of Selected Lakes in Missouri—2000–2008

By Joseph M. Richards

Abstract

Years of sediment accumulation and abnormally dry conditions in the Midwest in 1999 and 2000 led to the water level decline of many water-supply lakes in Missouri, and caused renewed interest in modernizing outdated area/volume tables for these lakes. The U.S. Geological Survey, in cooperation with the Missouri Department of Natural Resources and the U.S. Army Corps of Engineers, surveyed the bathymetry of 51 lakes in Missouri from July 2000 to May 2008. The data were used to provide water managers with area/volume tables and bathymetric maps of the lakes at the time of the surveys.

In 50 of the lakes, bathymetric surveys were made using a boat-mounted single-beam survey-grade fathometer. In Clearwater Lake, bathymetric data were collected primarily using a boat-mounted survey-grade multibeam fathometer, and some bathymetric data were collected using a single-beam fathometer in areas of the lake that were inaccessible to the multibeam fathometer. Data processing, area/volume table computation, and bathymetric map production were completed for each lake.

Introduction

Abnormally dry conditions in the Midwest in 1999 and 2000 (National Drought Mitigation Center, 1999) led to water level declines for many of the water-supply lakes in Missouri. Because many of the water-supply lakes had outdated area/volume tables or had none at all, managers of the water supplies were concerned that their lake's supply would not be adequate to meet their needs. To provide the water-supply managers with the needed information on the capacity of their lakes, the U.S. Geological Survey, in cooperation with the Missouri Department of Natural Resources, began a project to survey the bathymetry of the 46 most drought-affected lakes (fig. 1) and provide updated area/volume tables for these lakes.

In addition, after years of potential sedimentation, managers were becoming concerned about the accuracy of the area/volume tables at several of the lakes under the administration of the U.S. Army Corps of Engineers. The U.S. Geological Survey, in cooperation with the U.S. Army Corps of Engineers, began a project to survey the bathymetry of the five lakes of most concern (fig. 1) and provide updated area/volume tables for these lakes.

Study Area

Most of the drinking-water lakes surveyed were located in northern or west-central Missouri (sites 1–46; fig. 1), where access to a reliable groundwater supply does not exist. Drinking-water lakes surveyed ranged in size from about 8 to 1,010 acres at the time of the survey, but most were less than 200 acres in size. The U.S. Army Corps of Engineers lakes surveyed generally were larger than the drinking-water lakes, and ranged in size from about 708 to 9,630 acres in size at the time of the survey (sites 47–50; fig. 1).

Purpose and Scope

The purpose of this report is to document the methodology used to survey the bathymetry, compute the area/volume tables, and to present the bathymetric data collected for 51 lakes in Missouri. The report describes the accuracy of the bathymetric surface and the bathymetric contours for lakes.

Methods

Technology used to conduct bathymetric surveys in lakes has changed substantially since bathymetric data were first collected, but the general procedure largely remains the same whether collecting data using a weighted sounding line or boat-mounted survey-grade multibeam fathometer (hereafter referred to as multibeam fathometer). Under ideal conditions, the lake surface would be at the full pool elevation when conducting a bathymetric survey so the survey instrument can collect the maximum amount of data with little or no data collection necessary above the water surface elevation. Water-depth measurements are made at numerous points within a lake, and then the depths are converted to elevation by subtracting the water depth from the water surface elevation. Elevation

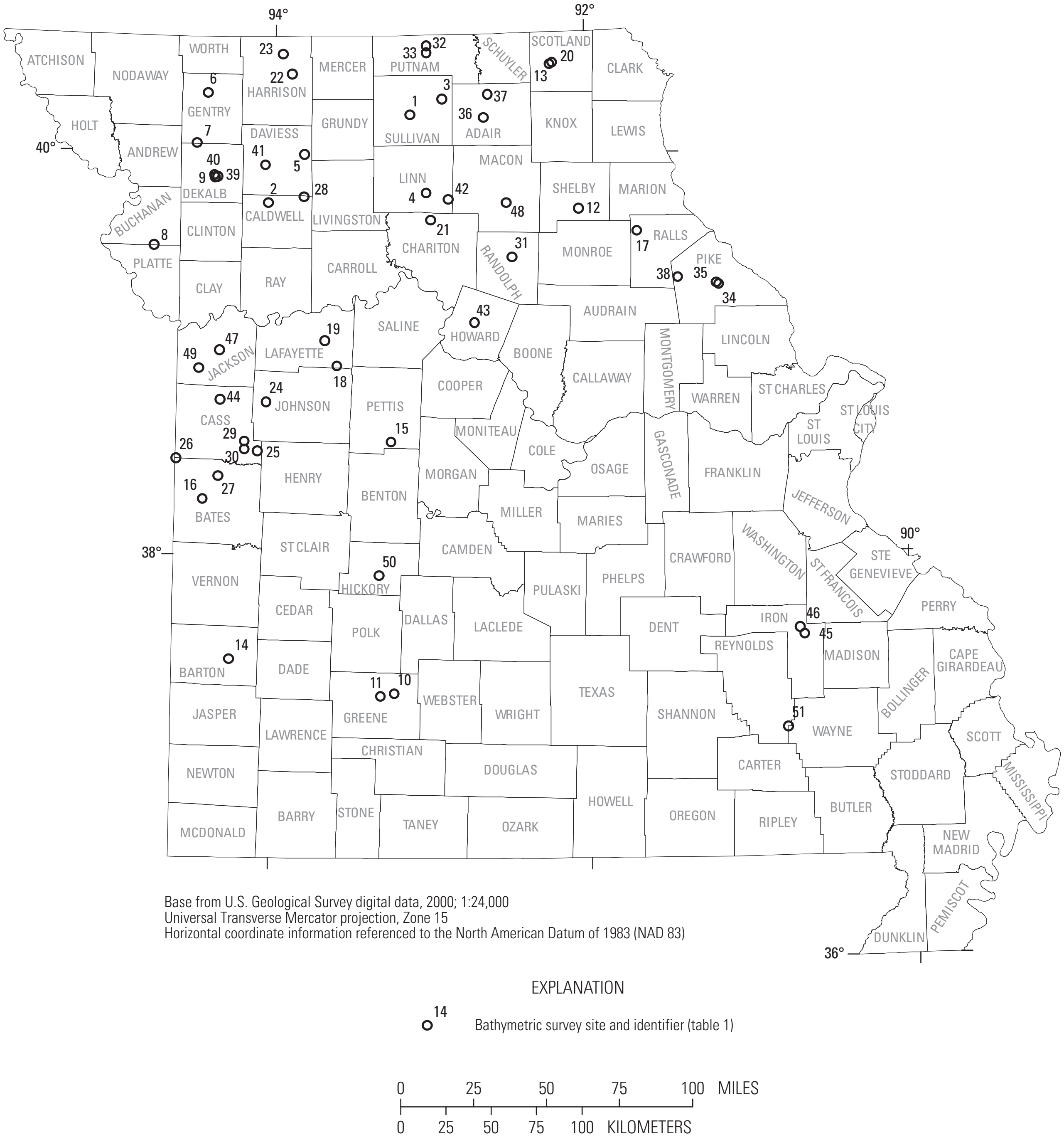

Figure 1. Location of sites for bathymetric surveys made in selected Missouri lakes from July 2000 to May 2008.

is interpolated in areas between collected data points. The elevation values are interpreted and a bathymetric surface is derived. The area/volume table is computed, and a bathymetric contour map is generated from the bathymetric surface. Wilson and Richards (2006) provide a detailed description of the methods used to conduct bathymetric surveys of small lakes using a single-beam survey-grade fathometer (hereafter referred to as single-beam fathometer). Huizinga (2010, 2011), and Huizinga and others (2010) provide descriptions of the methods used to conduct bathymetric surveys using a multibeam fathometer in large rivers; however, the methods are applied the same way in lakes.

Single-Beam Fathometer Surveys

In general, for sites 1 to 50 (fig. 1 and table 1), position data were collected using boat-mounted differential global positioning system (DGPS) equipment. Water depths were collected using a single-beam fathometer, operating at 200 kilohertz. The single-beam fathometer emitted sound pulses that were reflected off the lake bottom and received by a transducer. In some areas, the water depth was below the minimum operating depth [approximately 2.5 feet (ft)] of the single-beam fathometer, and water depths were measured manually using a graduated rod. Shoreline points were collected using only the DGPS coordinate data with zero depth. These various data types are described in more detail, and illustrations of their spatial relation to one another are presented, in Wilson and Richards (2006).

Bathymetric maps and tables of the drinking-water lakes (sites 1–46, fig. 1 and table 1) were most often computed to the spillway elevation of the lake (normally considered the full pool elevation). In some cases, for sites 1–46, bathymetric maps and tables were computed to the elevation of the top of the dam. Because of drought conditions during and before the time of some of the surveys, the water surface for some of the drinking-water lakes (sites 1–46, fig. 1 and table 1) was several feet below the full pool elevation. The lakes that were surveyed in 2000 and 2001 generally had the greatest difference between the lake surface elevation and the full pool elevation. The maximum difference was 9.3 feet at Stanberry Lake (site 6, fig. 1 and table 1). The median difference between the lake surface elevation and the full pool elevation was 0.3 feet for sites 1–46. In some cases when the lake surface was not at the full pool elevation, land surface elevation points, collected with DGPS equipment, were obtained at various locations and densities between the lake shoreline and the full pool elevation of the lake to augment the fathometer data. These two datasets were combined, and a bathymetric surface was produced for these lakes up to the full pool elevation.

Bathymetric maps and tables of U.S. Army Corps of Engineers lakes (sites 47–50, fig. 1 and table 1) were computed to the elevation of top of the dam. Land surface elevation data above the water surface for sites 47–50 were collected using DGPS equipment and were obtained at various locations and densities where possible. DGPS data were augmented above the water surface with 1:24,000 scale topographic data to complete the maps and tables for sites 47–50 where DGPS data could not be collected or were distributed sparsely.

Single-beam fathometer surveys were designed to collect data along transects oriented generally perpendicular to the down valley flow direction of the original stream course (fig. 2). The distance between transects was approximately 1 to 2 percent of the length of the long axis of the lake. For example, a lake with a long axis length of 5,000 ft would have an approximate transect spacing of 50 to 100 ft. Wilson and Richards (2006) indicate that this transect density is sufficient to develop a bathymetric surface from which an area/capacity table, referred to as an area/volume table in this report, can be computed. The resulting bathymetric surface would provide a reliable representation of the lake bottom and the resulting table would give a volume difference at full pool of less than 5.1 percent when compared to surveys with higher density transect spacing (Wilson and Richards, 2006). Wilson and Richards (2006) also indicate a minimum boat navigation limit for single-beam fathometer surveys would be approximately 30 ft between transects.

Early in the project (before December 2003), methods of collecting bathymetric data using a single-beam fathometer and data processing techniques were being developed. The data collection and data processing methods for these earlier surveys may be slightly different compared to surveys completed later in the project. The most significant difference between the earlier surveys and the later surveys is the collection of a quality-assurance dataset that was added to the procedure in December 2003. The quality-assurance data were collected with the single-beam fathometer at an oblique angle to the survey transects and at a spacing of approximately five times the survey transect spacing. This dataset allowed the accuracy of the survey to be evaluated. Because surveys completed before December 2003 do not have a quality-assurance dataset, accuracy of these surveys cannot be quantified; however, the methods of data collection and processing of the earlier surveys were similar to the later surveys and the expected accuracy is likely to be similar to the accuracies computed in later surveys.

Multibeam Fathometer Survey

For Clearwater Lake (site 51; fig. 1 and table 1), the single-beam fathometer and the multibeam fathometer were used. The multibeam fathometer operates in a similar way to the single-beam fathometer with the main difference being that it uses multiple sonar transceivers instead of one, and that depth and position data are corrected for boat movement (heave, pitch, and roll). For each sounding, or "ping," the multibeam fathometer collects a swath consisting of 512 points of data perpendicular to the direction of travel. When compared to the single-beam fathometer, the multibeam fathometer collects far greater numbers of data points and provides nearly complete data coverage of the survey area.

For Clearwater Lake (site 51; fig. 1 and table 1), the bathymetric survey was completed while the lake stage was above the normal pool elevation, and parts of the lake designated as the flood pool were inundated. The part of the lake that is in the flood pool is inundated infrequently, and because of this, the area has substantial vegetative cover such as trees, vines, and brush. The generally shallow depths in this area combined with the vegetative cover caused problems for boat navigation and increased impact hazards to the multibeam fathometer. As a result, the parts of the lake that were shallow and heavily vegetated were impractical to survey with the multibeam fathometer. The bathymetry in these areas were estimated from 1:24,000 scale digital elevation model data that were vertically adjusted with data collected using the single-beam fathometer at intervals across and along the flood plains (fig. 3). Methods similar to those used in Wilson and Richards (2006) for processing single-beam fathometer data were used to process the multibeam fathometer data, the main differences being that the volume of data was much greater and there

Table 1. Lakes in Missouri where bathymetric surveys were made by the U.S. Geological Survey from July 2000 to May 2008.

[NGVD29, National Geodetic Vertical Datum of 1929; --, no data; N/A, not applicable; No., number]

Name	Site number (fig. 1; appendix)	Transect spacing (feet/meters)	Number of points collected during survey	Survey date(s) (month/day/year)	Spillway elevation (feet, NGVD29)	Lake surface elevation at time of survey (feet, NGVD29)	Bathymetric surface accuracy (feet, at the 95-percent confidence level)	Bathymetric contour accuracy (feet, at the 95-percent confidence level)
Shadow Lake	1	32.8/10	35,177	7/20/2000	895.6	890.3	--	--
Hamilton Lake	2	65.6/20	38,038	7/11/2000	923.9	921.6	--	--
Green City Lake	3	82.0/25	17,593	7/6/2000	1,004.0	995.0	--	--
Brookfield City Lake	4	98.4/30	28,260	7/13/2000	803.0	795.8	--	--
Jamesport City Lake	5	32.8/10	12,957	7/16/2000	889.3	889.0	--	--
Stanberry Lake	6	65.6/20	33,487	7/26/2000	893.4	884.1	--	--
King City South Lake	7	39.4/12	14,724	7/19/2000	[1]1,034	1,025.4	--	--
Dearborn Reservoir	8	32.8/10	11,369	7/27/2000	917.5	917.0	--	--
Willow Brook Lake	9	98.4/30	46,388	7/25/2000	[1]918	909.6	--	--
Fellows Lake	10	164.0/50	49,562	4/23/2001	[1]1,264	1,256.5	--	--
McDaniel Lake	11	98.4/30	103,616	5/30/2001	1,124.5	1,124.0	--	--
Shelbina Lake	12	49.2/15	29,724	6/20/2001	715.0	714.3	--	--
Memphis Reservoir	13	98.4/30	151,957	6/19/2001	718.0	718.0	--	--
Lamar Lake	14	65.6/20	87,979	5/22/2002	955.7	955.7	--	--
Spring Fork Lake	15	49.2/15	22,746	4/17/2002	892.6	891.6	--	--
Butler City Lake	16	49.2/15	84,694	4/18/2001	795.1	794.3	--	--
Monroe City Lake	17	65.6/20	64,733	6/5/2002	669.6	669.3	--	--
Edwin A. Pape Lake	18	82.0/25	130,358	6/26/2002	709.6	709.3	--	--
Higginsville City Lake (Upper)	19	82.0/25	--	6/24/2002–6/25/2002	763.0	762.8	--	--
Higginsville City Lake (Lower)	19	82.0/25	[2]103,086	6/24/2002–6/25/2002	755.0	754.7	--	--
Lake Showme	20	32.8/10	38,878	6/3/2002	[1]774	769.8	--	--
New Marceline City Lake	21	65.6/20	101,381	5/19/2003	[3]756.9	[3]754.5	--	--
Rock House Lake	22	39.4/12	80,031	5/28/2003–5/29/2003	[3]906.3	[3]906.3	--	--
Eagleville Lake	23	32.8/10	20,411	5/28/2003	[3]991.3	[3]988.8	--	--
Holden City Lake	24	65.6/20	151,458	6/2/2003	[3]841.8	[3]841.3	--	--
Creighton City Lake	25	--/--	5,559	6/28/2003	[3]823.2	[3]820.0	--	--
Drexel City Lake No. 2	26	32.8/10	42,785	6/5/2003	[3]972.5	[3]968.1	--	--
Adrian Reservoir (Upper)	27	32.8/10	--	6/5/2003–6/6/2003	[3]852.3	[3]850.7	--	--
Adrian Reservoir (Lower)	27	32.8/10	[2]69,871	6/5/2003–6/6/2003	[3]846.2	[3]846.1	--	--
Breckenridge Lake	28	32.8/10	13,589	4/5/2004	[3]806.5	[3]806.0	1.55	1.91
Garden City Lake	29	32.8/10	43,873	4/6/2004	[3]892.1	[3]892.0	0.74	0.52
Garden City (New) Lake	30	32.8/10	67,626	4/5/2004	[3]862.4	[3]862.4	0.94	1.41
Sugar Creek Lake	31	49.2/15	258,865	12/15/2003–12/18/2003, 12/30/2003–12/31/2003	[3]746.8	[3]746.9	0.91	1.51
Lake Thunderhead	32	131.2/40	179,184	3/29/2004–4/3/2004	[3]967.3	[3]967.8	1.62	2.78
Lake Mahoney	33	65.6/20	30,727	4/6/2004	[3]977.0	[3]977.3	1.50	2.47

Table 1. Lakes in Missouri where bathymetric surveys were made by the U.S. Geological Survey from July 2000 to May 2008.—Continued

[NGVD29, National Geodetic Vertical Datum of 1929; --, no data; N/A, not applicable; No., number]

Name	Site number (fig. 1; appendix)	Transect spacing (feet/meters)	Number of points collected during survey	Survey date(s) (month/day/year)	Spillway elevation (feet, NGVD29)	Lake surface elevation at time of survey (feet, NGVD29)	Bathymetric surface accuracy (feet, at the 95-percent confidence level)	Bathymetric contour accuracy (feet, at the 95-percent confidence level)
Jack Floyd Memorial Lake	34	32.8/10	58,596	2/23/2005	[3]794.6	[3]794.6	2.28	2.67
Bowling Green West Lake	35	32.8/10	42,766	2/24/2005–2/25/2005	[3]773.6	[3]773.6	1.72	2.44
Forest Lake	36	98.4/30	226,167	3/1/2005–3/2/2005	[3]800.2	[3]800.2	1.47	2.92
Hazel Creek Lake	37	98.4/30	182,620	3/2/2005–3/4/2005	[3]847.8	[3]847.2	1.95	3.01
Vandalia Reservoir	38	32.8/10	62,403	2/23/2005–2/24/2005	[3]666.3	[3]666.3	1.67	1.73
Maysville South Lake	39	16.4/5	31,294	3/21/2006	[3]898.6	[3]898.6	1.08	1.61
Maysville West Lake	40	32.8/10	8,561	3/21/2006	[3]899.3	[3]899.5	1.01	1.34
Lake Viking	41	131.2/40	98,253	3/22/2006–3/23/2006	[3]865.0	[3]865.1	3.57	3.69
Bucklin Lake	42	26.2/8	35,290	3/19/2007	[3]844.2	[3]844.2	1.28	1.48
D.C. Rogers Lake	43	82.0/25	112,535	3/19/2007–3/20/2007	[3]695.2	[3]695.2	1.29	1.98
Harrisonville City Lake	44	98.4/30	164,452	3/21/2007–3/22/2007	[3]896.0	[3]892.1	1.58	3.28
Shepherd Mountain Lake	45	32.8/10	58,396	7/9/2007–7/10/2007	[3]976.9	[3]977.2	0.92	1.20
Snow Hollow Lake	46	32.8/10	60,268	7/10/2007	[3]1,285.0	[3]1,285.3	1.17	1.48
Blue Springs Lake	47	164.0/50	162,494	7/15/2003–7/16/2003	--	802.3	--	--
Long Branch Lake	48	196.8/60	443,009	8/12/2003–8/14/2003	--	786.5	--	--
Longview Lake	49	164.0/50	176,626	7/17/2003–7/18/2003	--	890.8	--	--
Pomme de Terre Lake	50	492.1/150	167,087	7/22/2002–7/24/2002	--	840.0	--	--
Clearwater Lake	51	N/A	796,817	4/25/2008–5/7/2008	--	[3]559.77	1.64	--

[1]Approximate elevation.

[2]Total number of points of both lakes.

[3]Elevation referenced to North American Vertical Datum of 1988 (NAVD88).

was less interpolation necessary because the lake bottom had nearly full survey coverage. The volume of data was reduced by averaging the collected data to a 16.4-ft grid so that an area/volume table and bathymetric contour map could be produced.

Bathymetric Survey Products and Accuracy

Bathymetric surveys of 51 lakes (fig. 1 and table 1) were made between July 2000 and May 2008. Bathymetric contour maps for each lake are presented in the *appendix* (link to appendix) at the back of this report. Area and volume at selected lake stage elevations were computed for each lake and are presented as a table on the corresponding lake map in the *appendix* (link to appendix). The volume of water contained in the lake shown in the tables is an estimate of the storage capacity at various lake stages based on the surveyed bathymetric surface. It should be noted that in most cases, the stated volume of water may not all be available for use because of various limiting factors. Limiting factors can include the elevation of the water intake (below which water cannot be used), and, in the case of paired lakes such as the Higginsville upper and lower lakes (site 19), the volume contributed to the lower lake from the upper lake is limited by the elevation of the connection between the two.

The fundamental vertical accuracy for the single-beam fathometer surveys is evaluated by comparing the quality-assurance dataset collected at the time of the survey to the computed bathymetric contours and bathymetric surface, and computing the root mean square error at the 95-percent confidence level (Wilson and Richards, 2006). For lakes that were surveyed using the single-beam fathometer after December 2003, accuracy of the contour maps had a median of

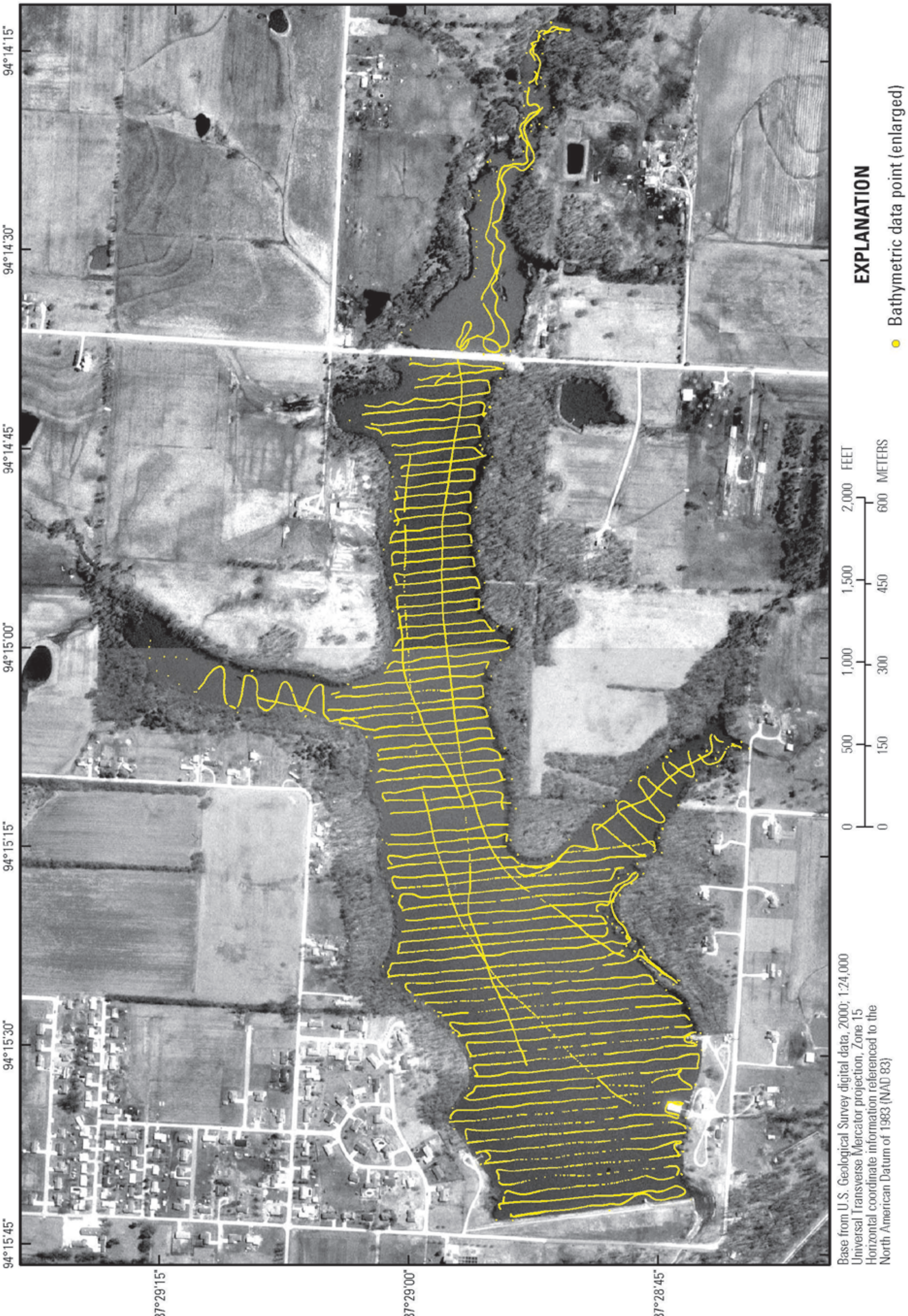

Figure 2. Example of transect orientation and spacing, and resulting data density in a typical bathymetric survey at Lamar Lake near Lamar, Missouri, on May 22, 2002.

Figure 3. Clearwater Lake bathymetric survey from April 25 to May 7, 2008. The bathymetry for the downstream part of the lake was surveyed with the multibeam fathometer. The bathymetry for the remainder of the lake was determined from digital elevation model data adjusted using single-beam fathometer data collected at intervals across and along the flood plains.

1.91 ft and ranged from 0.52 ft to 3.69 ft at the 95-percent confidence level, and accuracy of the bathymetric surfaces used to compute the area/volume tables had a median of 1.47 ft and ranged from 0.74 ft to 3.57 ft at the 95-percent confidence level (sites 28 to 46, fig. 1 and table 1). Lakes surveyed before December 2003 were surveyed before quality-assurance procedures were established and documented for bathymetric surveys of small lakes, so survey accuracies for sites 1 to 27 (fig. 1 and table 1) could not be computed and are unknown; however, because lakes surveyed before December 2003 are similar in size and geometry to those surveyed after December 2003 and because the survey data density and procedures used to collect and process the bathymetric data were similar, lakes surveyed before December 2003 are expected to have a similar range in accuracy values compared to those surveyed after December 2003.

Uncertainty is evaluated somewhat differently for multibeam fathometer surveys than for single-beam fathometer surveys. The Combined Uncertainty Bathymetric Estimator (CUBE) method (Calder and Mayer, 2003) was used to estimate the total propagated uncertainty (TPU) for the 16.4-ft gridded bathymetric surface of Clearwater Lake (site 51, fig. 1 and table 1), where the multibeam fathometer was used. This method, as it relates to multibeam fathometer surveys, is described more fully in Huizinga (2010, 2011). The CUBE analysis of the multibeam fathometer survey of Clearwater Lake (site 51, fig. 1 and table 1) indicated that 99.4 percent of the tested data had a TPU of less than 1.64 ft, 68.4 percent of the tested data had a TPU of less than 0.82 ft, and 40.9 percent of the tested data had a TPU of less than 0.50 ft. The accuracy of the bathymetric surface of Clearwater Lake was not evaluated in areas that were not surveyed with the multibeam fathometer.

For multibeam fathometer surveys, the greatest uncertainty in vertical elevation generally tends to occur in areas of high relief such as steep-sided submerged ridges and channels, and steep areas along shorelines (Huizinga, 2010, 2011). Areas of generally low relief tend to have lower uncertainty in vertical elevation. Examination of the distribution of the magnitude of the differences in vertical elevation for single-beam fathometer surveys generally indicates these same trends (Gary Wilson, U.S. Geological Survey, written commun., 2008,).

References Cited

Calder, B.R., and Mayer, L.A., 2003, Automatic processing of high-rate, high-density multi-beam echosounder data: Geochemistry, Geophysics, Geosystems, v. 4, p. 1048.

Huizinga, R.J., 2010, Bathymetric surveys at highway bridges crossing the Missouri River in Kansas City, Missouri, using a multibeam echo sounder, 2010: U.S. Geological Survey Scientific Investigations Report 2010–5207, 61 p.

Huizinga, R.J., 2011, Bathymetric surveys at highway bridges crossing the Missouri and Mississippi Rivers near St. Louis, Missouri, 2010: U.S. Geological Survey Scientific Investigations Report 2011–5170, 75 p.

Huizinga, R.J., Elliott, C.M., and Jacobson, R.B., 2010, Bathymetric and velocimetric survey and assessment of habitat for pallid sturgeon on the Mississippi River in the vicinity of the proposed Interstate 70 Bridge at St. Louis, Missouri: U.S. Geological Survey Scientific Investigations Report 2010–5017, 28 p.

National Drought Mitigation Center, 1999, Drought monitor archives, University of Nebraska-Lincoln, accessed July 2012, at *http://droughtmonitor.unl.edu/animations.html*.

Wilson, G.L., and Richards, J.M., 2006, Procedural documentation and accuracy assessment of bathymetric maps and area/capacity tables for small reservoirs: U.S. Geological Survey Scientific Investigations Report 2006–5208, 24 p. plus oversize figs.

Appendix

This *appendix* (link to appendix) contains the bathymetric map produced and the area/volume table computed for the selected lakes surveyed in Missouri from July 2000 to May 2008. Each is found in this appendix as a figure (A1, A2, … A51) with the number corresponding to the site number that can be found on figure 1 and table 1 in the body of this report. Each appendix figure contains the area/volume table (numbered the same as the figure number) for the lake depicted on the figure.

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