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PUBLIC WORKS COMMISSION OF THE CITY OF FAYETTEVILLE

WATER-RESOURCES INVESTIGATIONS REPORT 99-4029
BATHYMETRY OF BONNIE DOONE LAKE, KORNBOW LAKE, MINTZ POND, AND GLENVILLE LAKE,
CUMBERLAND COUNTY, NORTH CAROLINA, 1996–98
PLATE 1 of 1

ABSTRACT

Bathymetric surveys were conducted at four water-supply impoundments of Little Cross Creek in Cumberland County, North Carolina. The surveys were conducted in April 1996 at Mintz Pond and Glenville Lake, and in January 1998 at Bonnie Doone Lake and Kornbow Lake. The resulting bathymetric maps are the first to cover the entire range in depth for these reservoirs and provide a framework for future evaluations of bathymetry and storage capacity.

Bathymetric maps were constructed from depth and position data collected at each reservoir. A boat-mounted, research-grade fathometer was used to record water depths with a vertical accuracy of 0.1 foot. At Mintz Pond and Glenville Lake, position was measured by using a wide-band laser tracking system interfaced with a total station survey instrument. This positioning method required multiple land-based control points to be established and was hampered by line-of-sight restrictions between the control points and the boat. At Bonnie Doone Lake and Kornbow Lake, a global positioning system was used to collect differentially corrected location data. This positioning method enabled more rapid data collection, eliminated the need for land-based control points, and provided improved data coverage.

Spillway elevations range from 172.8 feet above mean sea level at Bonnie Doone Lake to 113.1 feet at Glenville Lake. Surface area and storage volume were computed for each reservoir and were related to water-surface elevations at 1-foot intervals. The combined surface acreage of the four Little Cross Creek reservoirs at their full-pool elevations is 120.97 acres, consisting of 21.20 acres at Bonnie Doone Lake, 47.09 acres at Kornbow Lake, 15.56 acres at Mintz Pond, and 37.12 acres at Glenville Lake. The four reservoirs have a combined usable storage capacity of 674.91 acre-feet, which is the sum of 127.93 acre-feet in Bonnie Doone Lake, 320.62 acre-feet in Kornbow Lake, 53.25 acre-feet in Mintz Pond, and 173.11 acre-feet in Glenville Lake.

INTRODUCTION

The City of Fayetteville, the primary municipality and the county seat of Cumberland County, relies on Little Cross Creek for approximately 40 percent of its public drinking water supply. In 1990, the Public Works Commission of the City of Fayetteville (PWC) instituted a watershed program for the purpose of monitoring and protecting the quality of the raw water supply in Little Cross Creek and for evaluating the water quality of several other streams in the Fayetteville area. In order to accomplish the goals of the watershed program, the PWC needed information related to bathymetry and water-storage capacity for each of the four reservoirs of Little Cross Creek.

The U.S. Geological Survey (USGS) collects scientific data that local, State, and other Federal agencies rely on to assess and manage the Nation's drinking-water resources. During 1996 and 1998, at the request of the PWC, the USGS conducted surveys of Mintz Pond, Glenville Lake, Bonnie Doone Lake, and Kornbow Lake in northwestern Cumberland County, North Carolina (fig. 1), to determine the bathymetries and storage capacities of these water-supply reservoirs. These surveys were part of a larger investigation conducted in cooperation with the PWC to evaluate hydrology and water quality in the Little Cross Creek watershed. In addition, these surveys provided an opportunity for the USGS to refine bathymetric surveying and mapping methods using state-of-the-art equipment and techniques.

LOCATION OF STUDY AREA AND CUMBERLAND COUNTY IN THE COASTAL PLAIN PROVINCE OF NORTH CAROLINA

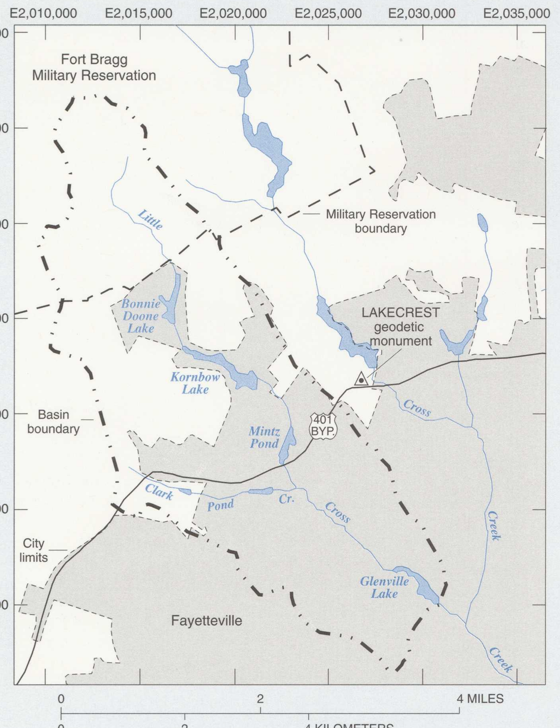


Figure 1. Little Cross Creek Basin in Cumberland County, North Carolina.

Purpose and Scope

This report presents the results of bathymetric surveys conducted at Mintz Pond and Glenville Lake in 1996 and at Bonnie Doone and Kornbow Lakes in 1998. The bathymetry of each reservoir, including volume computations, is discussed, and maps are presented depicting elevation contours of each reservoir. The investigation included (1) collection of bathymetric data, (2) development of elevation contours, and (3) computation of volumes and surface areas. Reservoir volumes and surface areas were related to water-surface elevations at 1-foot (ft) intervals. Volumes of usable storage also were computed for each reservoir and, for Bonnie Doone Lake, Kornbow Lake, and Mintz Pond, were compared to estimates produced during a previous investigation.

Description of Study Area

Little Cross Creek is a small, slow-moving stream in the Coastal Plain Province of North Carolina (fig. 1). The headwaters of the creek originate within Fort Bragg Military Reservation. Within the 7-mile (mi) reach of Little Cross Creek upstream from its confluence with Cross Creek, are four impoundments that form, in downstream order, Bonnie Doone Lake, Kornbow Lake, Mintz Pond, and Glenville Lake (fig. 1). These reservoirs were constructed between 1909 and 1925 (table 1) and, at present, are used primarily for public water supply and water-supply storage. Consequently, Little Cross Creek and these four impoundments are classified WS-IV, the classification assigned to surface-water supplies in North Carolina that are located in moderately to highly developed watersheds (North Carolina Department of Environment, Health, and Natural Resources, 1997).

Table 1. Summary of general and bathymetric characteristics of four reservoirs on Little Cross Creek in Cumberland County, North Carolina [msl, mean sea level]

			Bathymetry of reservoir at full pool			
Reservoir name	Year dam was completed	Drainage area[1] (square miles)	Water-surface elevation (feet above msl)	Surface area (acres)	Mean depth (feet)	Usable storage (acre-feet)
Bonnie Doone	1920	1.97	172.8	21.20	7.1	127.93
Kornbow Lake	1925	4.44	159.2	47.09	7.2	320.62
Mintz Pond	1925	5.88	133.8	15.56	3.4	53.25
Glenville Lake	1909	9.63	113.1	37.12	6.2	173.11

[1]Drainage area was determined from U.S. Geological Survey topographic maps (scale 1:24,000).

In a recent water-quality assessment, the North Carolina Department of Environment, Health, and Natural Resources (1994) determined that the ability to support aquatic life was threatened by sedimentation and turbidity, high nutrient concentrations, and extensive growths of aquatic plants at three of the four reservoirs. Although there are no permitted point-source discharges of effluent to Little Cross Creek, extensive land clearing and urban development have occurred in the watershed and may have contributed to sedimentation and trophic enrichment of the impoundments.

Previous Investigations

No design data or construction plans or records exist for the four reservoirs; thus, no records of their original bathymetries are available (North Carolina Department of Natural Resources and Community Development, 1978; Soil and Material Engineering, Inc., 1979a, b, c). Partial bathymetric maps of Bonnie Doone Lake, Kornbow Lake, and Mintz Pond were produced in 1986 during a drawdown of these reservoirs (Public Works Commission of the City of Fayetteville, 1986a, b, c). These maps show the topography of the reservoir bottoms from their full-pool elevations down to the elevations of their respective outlet structures and present estimates of usable storage volume for Bonnie Doone Lake, Kornbow Lake, and Mintz Pond. No previous investigations of the bathymetry of Glenville Lake have been conducted.

Acknowledgments

The assistance throughout this investigation of Mr. Sidney Post of the Public Works Commission of the City of Fayetteville is appreciated. The authors also wish to thank Mr. Johnny Raynor of the Civil Engineering Division of the City of Fayetteville for supplying digital topographic data that were used to construct base maps for the four reservoirs. Mr. Harry Hitchcock, Hydrologic Technician from the Kentucky District of the USGS, is acknowledged for providing outstanding technical expertise and logistical support with bathymetric data collection.

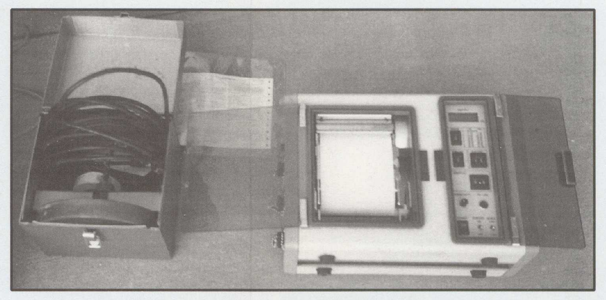
METHODS

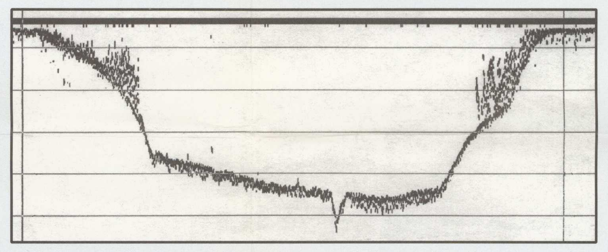
Bathymetric maps for Bonnie Doone Lake, Kornbow Lake, Mintz Pond, and Glenville Lake, the first to cover the entire ranges in depth of these reservoirs, were constructed from depth and position data collected at each reservoir and superimposed on reservoir boundary base maps. Reservoir boundaries, derived from 1990 aerial photographs, were provided to the USGS by the City of Fayetteville. A geographic information system (GIS) was used to map bathymetric contours and calculate volumes at 1-ft intervals above mean sea level (msl).

Data Collection

Bathymetric data were collected at Mintz Pond and Glenville Lake in April 1996 and at Bonnie Doone and Kornbow Lakes in January 1998. At each reservoir, the water surface was used as the datum for all depth soundings. Water-surface elevations were obtained from staff plates located near the spillway of each reservoir. The staff plates were tied to existing benchmarks located on the spillway headwall at each reservoir. The msl elevation of each benchmark was checked by using the North Carolina Geodetic Survey control monument LAKECREST (National Geodetic Survey, 1966). The elevation of this monument is 183.718 ft msl (National Geodetic Vertical Datum of 1929), and it is located near U.S. Highway 401 Bypass approximately 1 mi northeast of Mintz Pond (fig. 1).

Bathymetric data for Mintz Pond and Glenville Lake were collected from a boat by using a research-grade echo fathometer with a 3-degree beam width to measure water depth and a wide-band laser tracking system interfaced with a total station survey instrument to measure position. On the boat, the fathometer was connected to a laptop computer, a paper strip chart, and a laser reflector array. The fathometer was calibrated at each reservoir by using a standard check-bar method (U.S. Army Corps of Engineers, 1994). Although the fathometer recorded depths with a precision of 0.01 ft in the zero to 30-ft range used for the reservoir surveys, depth measurements were considered accurate to the nearest 0.1 ft as a result of conditions encountered during field deployment.


Research-grade fathometer used to collect depth measurements


Fathometer trace from a transect in Kornbow Lake, January 1998

The laser tracking system was set up at appropriate land-based control points and transmitted data to the laptop computer by a UHF radio transmitter. As boat transects were run across each section of a reservoir, a technician manually tracked the position of the fathometer by bouncing the laser off the reflector array. In this manner, angle and distance data were transmitted to the laptop simultaneously with fathometer-depth soundings at approximately 0.5-second intervals. The laptop software converted angles and distances to Cartesian coordinates relative to the control points. In general, transects were located about 100 ft apart.

This method of data collection was dependent on line of sight from the land-based control points to the boat-mounted reflector array. Four control points were needed to collect the bathymetric data at Glenville Lake, and two control points were needed at Mintz Pond. Control points were geographically located in the North Carolina State plane coordinate system by using standard surveying traverse methods.

Bald cypress stands blocked lines of sight in the headwaters of Glenville Lake and Mintz Pond. In addition, dense growths of aquatic plants interfered with fathometer readings in the headwaters of Mintz Pond. Therefore, traditional range-line methods were used to collect additional depth soundings in these areas. Transects were established and located by using standard surveying traverse methods. A tag line was placed between the end points, and depths were measured manually with a survey level rod at 2-ft increments across the transect. Three additional transects were made at Glenville Lake, and two additional transects were made at Mintz Pond by using this method.

At Mintz Pond, depths were measured at a total of 2,220 points located along 26 transects. Data coverage was good overall, but was limited in coves and near shore where trees obstructed the laser tracking device. At Glenville Lake, 3,909 depth measurements were collected along 28 transects. Data coverage was good except in a few near-shore areas and in the first 1,000 ft downstream from the upstream boundary of the reservoir where data were limited to the three manually measured transects described previously.

The upper half of Bonnie Doone Lake was dredged during January through March 1997, significantly altering the reservoir's bathymetry. Moreover, dredging activities at Bonnie Doone Lake likely influenced the transport of sediment downstream to Kornbow Lake. For these reasons, bathymetric data for Bonnie Doone Lake and Kornbow Lake were collected in January 1998, several months after dredging was completed. Leaf canopy was minimal during the winter, which aided in the collection of near-shore data. Aquatic plant biomass also was low during this period. These conditions simplified boat navigation, especially in shallow areas of Kornbow Lake, which supported extensive milfoil beds during the growing season.

Improved data-collection methods were used in 1998 as a result of experience gained during the 1996 surveys and technological advances that occurred in the interim. Depths were measured with the same fathometer that was used in 1996; however, position data were collected at Bonnie Doone Lake and Kornbow Lake with a global positioning system (GPS). A radio link was used in conjunction with the GPS to receive differentially corrected location data once per second. This high-accuracy GPS technology became available after the surveys of Glenville Lake and Mintz Pond were completed in 1996, and enabled more rapid data collection that was not hampered by line-of-sight restrictions or the need for land-based control points.

At Bonnie Doone Lake, 39 cross-channel transects were measured, and 56 transects were measured at Kornbow Lake. In addition, depth and position data were collected around the entire perimeter of each reservoir as close to the shoreline as possible. One or more longitudinal transects also were measured along the main channel of each reservoir and in the major coves. Finally, the laptop computer software was used to filter the data, thus reducing redundant depth measurements. The resulting bathymetric data sets provided excellent coverage for each reservoir with minimal data redundancy. A total of 1,592 data points were used to construct the map of Bonnie Doone Lake, and 2,940 point measurements were used to construct the map of Kornbow Lake.

Map Development and Volume Calculation

Bathymetric maps were developed from measured point depths obtained during the surveys. At the 1:2,400 scale chosen for the final maps, gentle reservoir-bottom slopes allowed the use of a 1-ft contour interval.

For each reservoir, depth measurements were entered into ARC/INFO[1] GIS and were converted to elevations above msl by subtracting the depth from the reservoir water-surface elevation at the time of data collection. Reservoir boundaries were entered into the GIS. The ARC/INFO TOPOGRID procedure was used to generate a continuous surface of elevation values from the input depths and boundary information (Environmental Systems Research Institute, Inc., 1994). TOPOGRID is a spline interpolator specially optimized for interpolation of hypsographic surfaces (elevations) (Hutchinson, 1989). For these computations, a 2-ft cell size was defined for Mintz Pond and Glenville Lake, and a 1-ft cell size was defined for Bonnie Doone Lake and Kornbow Lake.

Elevation contours were created from the output surface. Contours were visually checked against the point data and the fathometer charts and were edited to correct interpolation artifacts. Artifacts were most pronounced in data-poor areas, such as near shorelines and between parallel transects in Mintz Pond and Glenville Lake. Because the excellent data coverage for Bonnie Doone Lake and Kornbow Lake resulted in better initial interpolations, much less editing was required for these maps.

The bathymetric contours were used to build a triangulated irregular network (TIN) for each reservoir. The TIN approximated the reservoir-bottom terrain and was the basis for area and volume computations. Surface areas and storage volumes associated with each elevation contour were computed by using the ARC/INFO VOLUME procedure (Environmental Systems Research Institute, Inc., 1994).

BATHYMETRY OF BONNIE DOONE LAKE, KORNBOW LAKE, MINTZ POND, AND GLENVILLE LAKE

Bathymetric results for the four reservoirs of Little Cross Creek are presented in downstream order. Relations between water-surface elevations, reservoir surface areas, and storage volumes were calculated at 1-ft intervals. Mean depth for each reservoir was computed by dividing total volume by surface area. The volume of usable storage was calculated as the volume of water above the invert elevation of the drain at each reservoir. The invert elevation of the drain is defined as the elevation of the bottom of the outlet pipes at Bonnie Doone Lake, Kornbow Lake, and Mintz Pond dams and the bottom of the raw-water intake at Glenville Lake.

Bonnie Doone Lake

In January 1998, the surface area of Bonnie Doone Lake was 21.20 acres at the full-pool elevation of 172.8 ft msl, and the total storage volume was 149.66 acre-ft (fig. 2; table 2). Mean depth was 7.1 ft (table 1). The minimum recorded elevation of the reservoir bed was 157.6 ft msl, or 15.2 ft below full pool. The invert elevation of the outlet pipe in the Bonnie Doone Lake dam is 164.7 ft msl; therefore, the usable storage volume between 164.7 and 172.8 ft msl is 127.93 acre-ft (tables 1, 2).

In 1986, a survey of the reservoir showed that the surface area of Bonnie Doone Lake was only 14.20 acres and that the usable volume was 86.91 acre-ft (Public Works Commission of the City of Fayetteville, 1986a). However, results of the two surveys are not directly comparable. During the 1986 survey, an additional 7.5 acres in Bonnie Doone Lake were referred to as "mud flats" (Public Works Commission of the City of Fayetteville, 1986a). These areas were not surveyed, nor were they included in volume computations. Inclusion of these 7.5 acres increases the 1986 surface area of Bonnie Doone Lake to 21.70 acres, which is similar to the 1998 value.

An estimated 33,447 cubic yards of sediment was removed from the northeastern half of Bonnie Doone Lake by hydraulic dredging during 1997, thus increasing the storage volume of the reservoir by approximately 20.7 acre-ft (Sidney Post, Public Works Commission of the City of Fayetteville, oral commun., December 18, 1998). The downstream extent of the dredging appears on the bathymetric map as an abrupt change in elevation near mid-reservoir (fig. 2). The lowest recorded reservoir-bottom elevations (less than 158.0 ft msl) in Bonnie Doone Lake were observed in this area.

Kornbow Lake

At its full-pool elevation of 159.2 ft msl, the surface area of Kornbow Lake in January 1998 was 47.09 acres, and the total storage volume was 341.39 acre-ft (fig. 3; table 3). Bathymetry derived from the 1998 survey indicate that the usable storage volume is 320.62 acre-ft (table 1), which is within 1 percent of the 322.93 acre-ft computed in 1986 (Public Works Commission of the City of Fayetteville, 1986b). In 1986, the surface area of Kornbow Lake was 48.78 acres; thus, surface area appears to have decreased 3.5 percent between 1986 and 1998. It should be noted that some of the differences between the two surveys may be attributable to the different data-collection and mapping methods that were used rather than to changes in reservoir bathymetry.

Bathymetric data collected at Kornbow Lake indicate that the upstream portion from the headwaters to about 1,100 ft downstream is relatively shallow (fig. 3). This area of low channel slope may be prone to sedimentation. The minimum recorded elevation of 141.9 ft msl, or 17.3 ft below full pool, is located at mid-channel near the dam (fig. 3). The mean depth of Kornbow Lake is 7.2 ft (table 1).

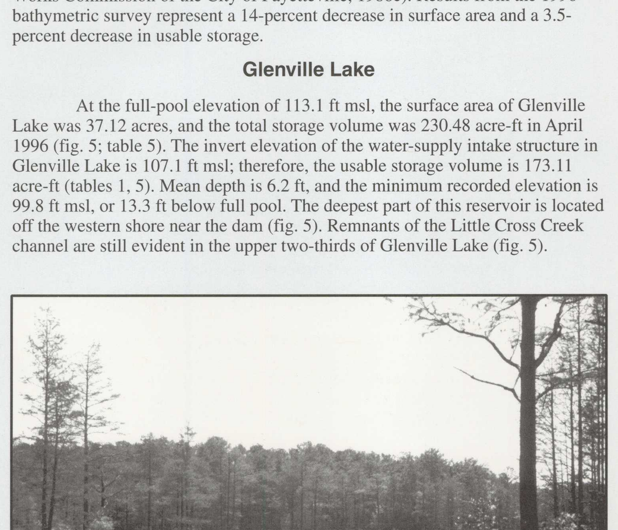
Mintz Pond

In April 1996, at the full-pool elevation of 133.8 ft msl, the surface area of Mintz Pond was 15.56 acres, and the total storage volume was 53.57 acre-ft (fig. 4; table 4). Mean depth is only 3.4 ft, making Mintz Pond the most shallow of the four Little Cross Creek reservoirs. The relatively flat terrain of the reservoir bed, particularly in the upper half of the reservoir, is evident in the bathymetric map (fig. 4). The minimum elevation recorded in Mintz Pond is 123.5 ft msl, or 10.3 ft below full pool, and is located in a small depression close to the dam spillway. The invert elevation of the drain is 127.5 ft msl; therefore, the usable storage volume of Mintz Pond is 53.25 acre-ft (tables 1, 4).

The survey of Mintz Pond completed in 1986 indicated that the surface area was 18.12 acres, and the usable storage volume was 55.19 acre-ft (Public Works Commission of the City of Fayetteville, 1986c). Results from the 1996 bathymetric survey represent a 14-percent decrease in surface area and a 3.5-percent decrease in usable storage.

Glenville Lake

At the full-pool elevation of 113.1 ft msl, the surface area of Glenville Lake was 37.12 acres, and the total storage volume was 230.48 acre-ft in April 1996 (fig. 5; table 5). The invert elevation of the water-supply intake structure in Glenville Lake is 107.1 ft msl; therefore, the usable storage volume is 173.11 acre-ft (tables 1, 5). Mean depth is 6.2 ft, and the minimum recorded elevation is 99.8 ft msl, or 13.3 ft below full pool. The deepest part of this reservoir is located off the western shore near the dam (fig. 5). Remnants of the Little Cross Creek channel are still evident in the upper two-thirds of Glenville Lake (fig. 5).


Bald cypress trees in Glenville Lake

[1]The use of trade, product, or firm names in this publication is for descriptive purposes only and does not imply endorsement by the U.S. Government.

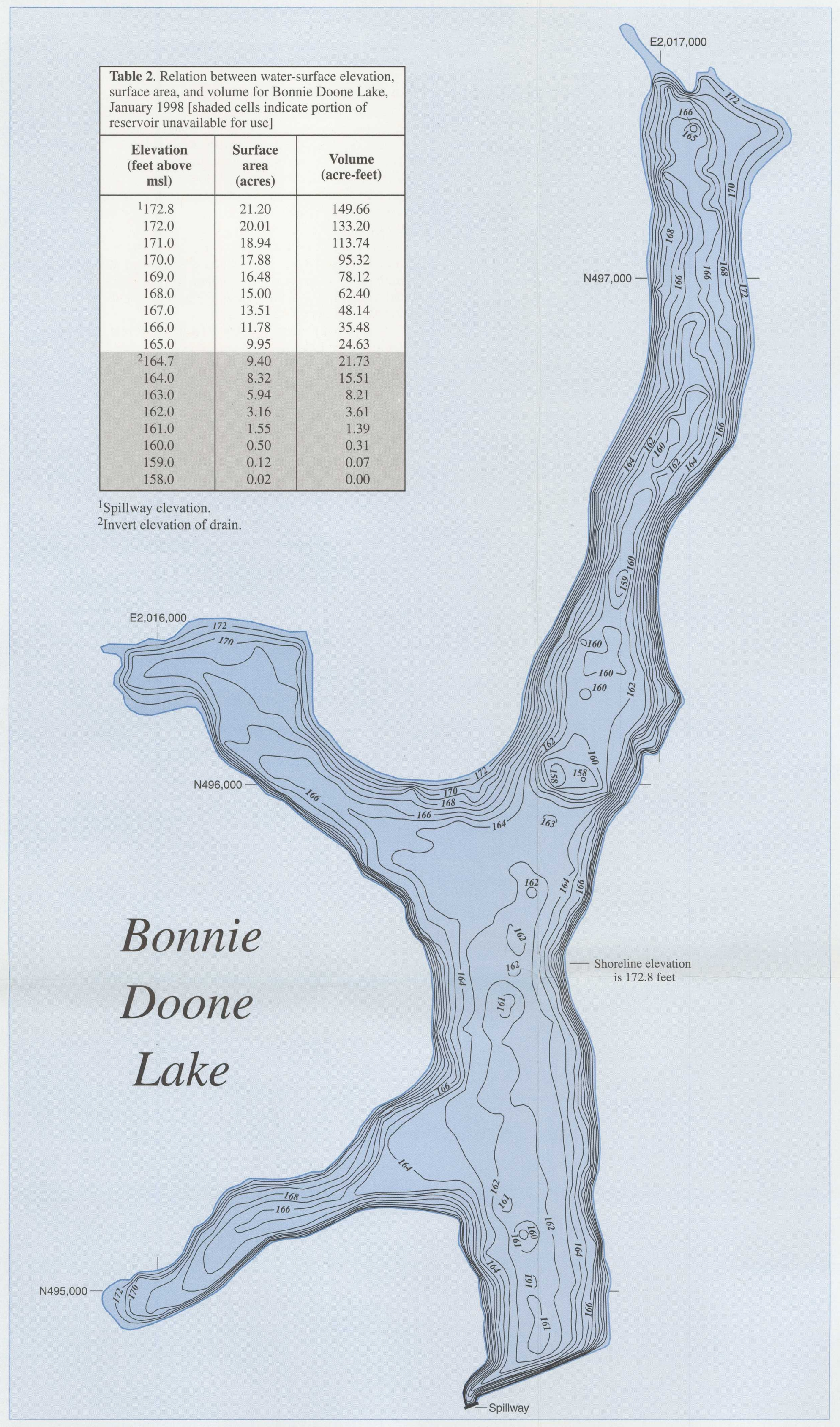


Table 2. Relation between water-surface elevation, surface area, and volume for Bonnie Doone Lake, January 1998 [shaded cells indicate portion of reservoir unavailable for use]

Elevation (feet above msl)	Surface area (acres)	Volume (acre-feet)
[1]172.8	21.20	149.66
172.0	20.01	133.20
171.0	18.94	113.74
170.0	17.88	95.32
169.0	16.48	78.12
168.0	15.00	62.40
167.0	13.51	48.14
166.0	11.78	35.48
165.0	9.95	24.63
[2]164.7	9.40	21.73
164.0	8.32	15.51
163.0	5.94	8.21
162.0	3.16	3.61
161.0	1.55	1.39
160.0	0.50	0.31
159.0	0.12	0.07
158.0	0.02	0.00

[1]Spillway elevation.
[2]Invert elevation of drain.

Figure 2. Bathymetry of Bonnie Doone Lake.

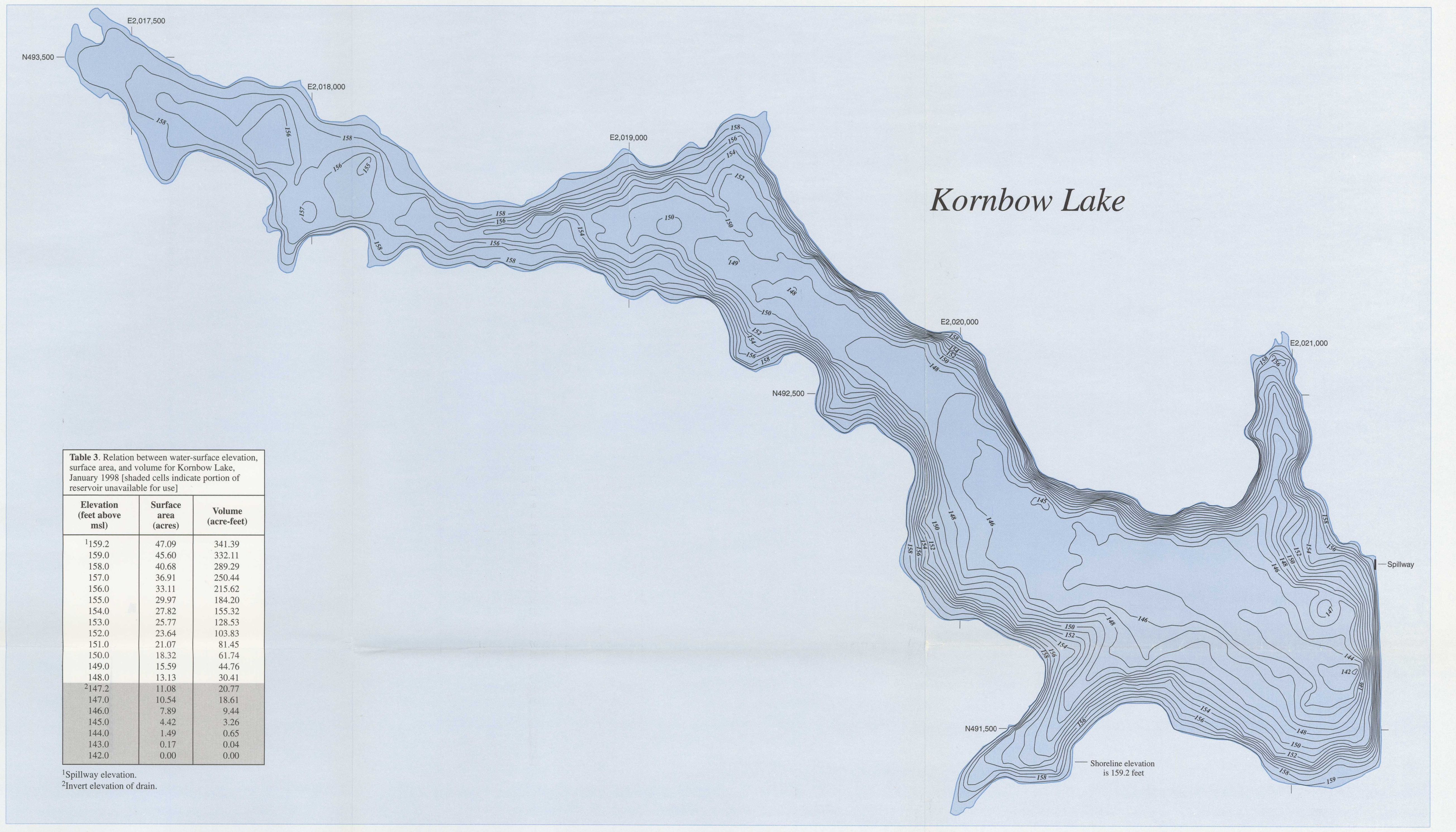


Table 3. Relation between water-surface elevation, surface area, and volume for Kornbow Lake, January 1998 [shaded cells indicate portion of reservoir unavailable for use]

Elevation (feet above msl)	Surface area (acres)	Volume (acre-feet)
[1]159.2	47.09	341.39
159.0	45.60	332.11
158.0	40.68	289.29
157.0	36.91	250.44
156.0	33.11	215.62
155.0	29.97	184.20
154.0	27.82	155.32
153.0	25.77	128.53
152.0	23.64	103.83
151.0	21.07	81.45
150.0	18.32	61.74
149.0	15.59	44.76
148.0	13.13	30.41
[2]147.2	11.08	20.77
147.0	10.54	18.61
146.0	7.89	9.44
145.0	4.42	3.26
144.0	1.49	0.65
143.0	0.17	0.04
142.0	0.00	0.00

[1]Spillway elevation.
[2]Invert elevation of drain.

Figure 3. Bathymetry of Kornbow Lake.

EXPLANATION

112 — LINE OF EQUAL ELEVATION OF THE RESERVOIR BOTTOM, IN FEET ABOVE MEAN SEA LEVEL

CONTOUR INTERVAL IS 1 FOOT
NATIONAL GEODETIC VERTICAL DATUM OF 1929

SCALE 1:2,400
0 200 400 600 800 FEET
0 50 100 150 200 METERS

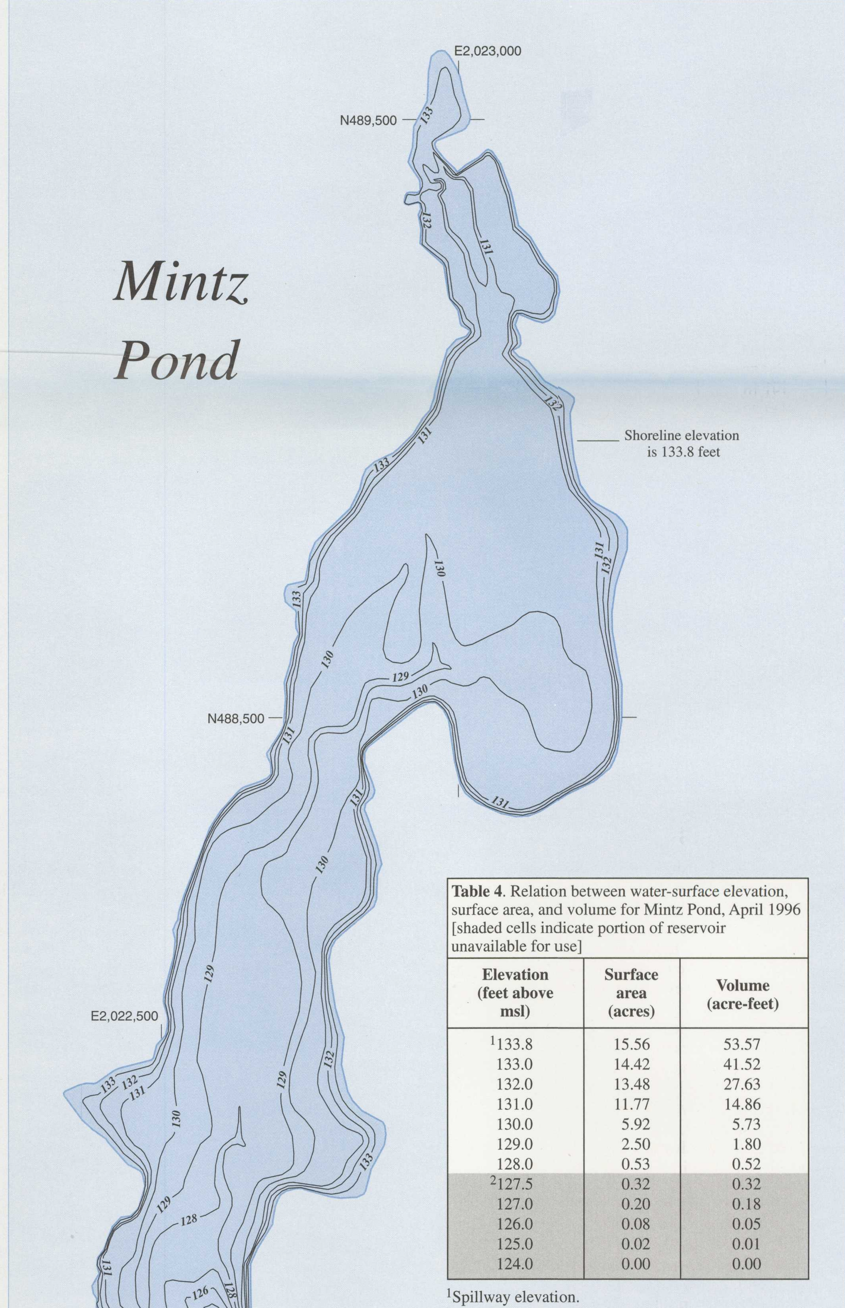


Table 4. Relation between water-surface elevation, surface area, and volume for Mintz Pond, April 1996 [shaded cells indicate portion of reservoir unavailable for use]

Elevation (feet above msl)	Surface area (acres)	Volume (acre-feet)
[1]133.8	15.56	53.57
133.0	14.42	41.52
132.0	13.48	27.63
131.0	11.77	14.86
130.0	5.92	5.73
129.0	2.50	1.80
128.0	0.53	0.52
[2]127.5	0.32	0.32
127.0	0.20	0.18
126.0	0.08	0.05
125.0	0.02	0.01
124.0	0.00	0.00

[1]Spillway elevation.
[2]Invert elevation of drain.

Figure 4. Bathymetry of Mintz Pond.

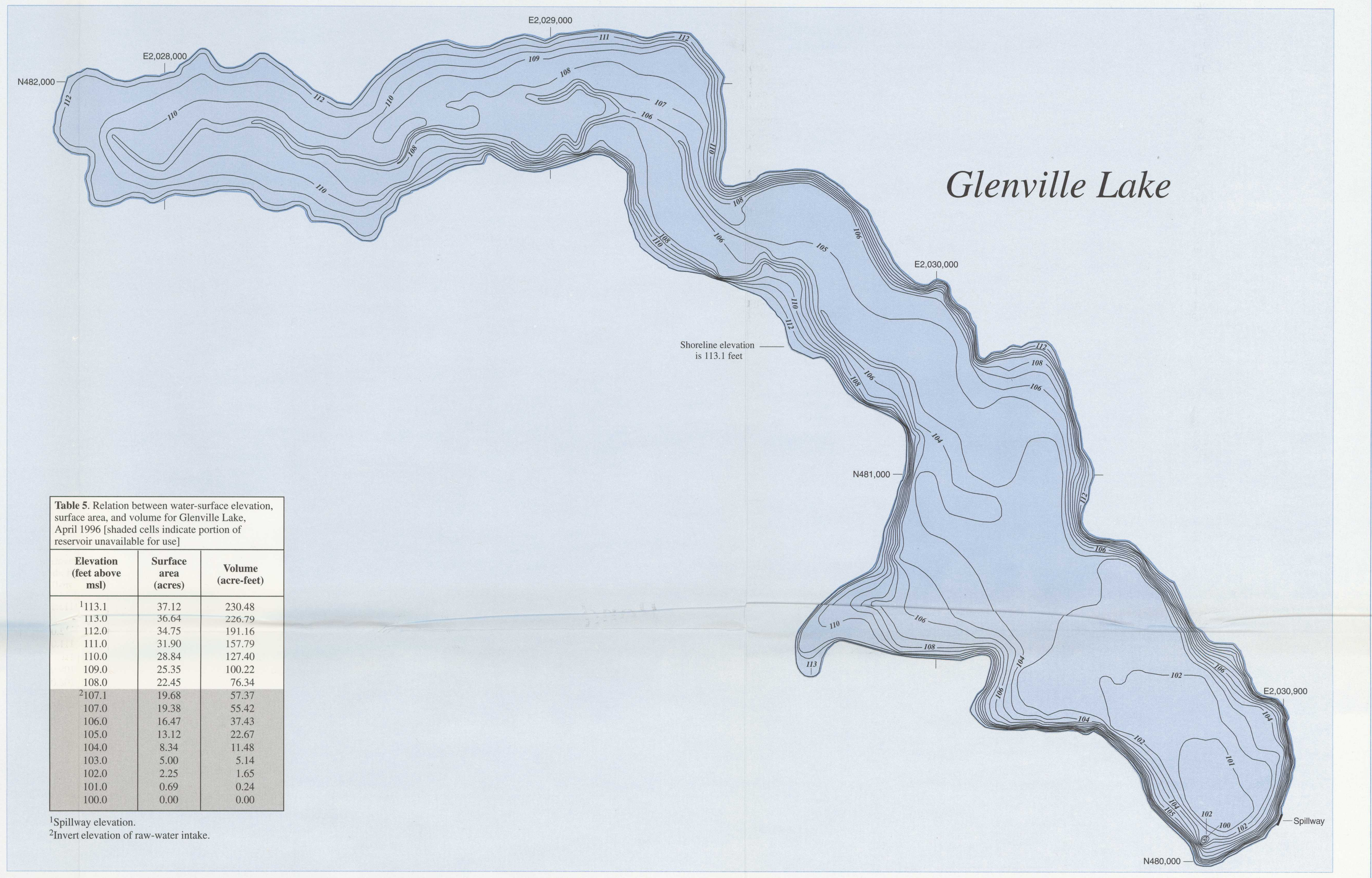


Table 5. Relation between water-surface elevation, surface area, and volume for Glenville Lake, April 1996 [shaded cells indicate portion of reservoir unavailable for use]

Elevation (feet above msl)	Surface area (acres)	Volume (acre-feet)
[1]113.1	37.12	230.48
113.0	36.64	226.79
112.0	34.75	191.16
111.0	31.90	157.79
110.0	28.84	127.40
109.0	25.35	100.22
108.0	22.45	76.34
[2]107.1	19.68	57.37
107.0	19.38	55.42
106.0	16.47	37.43
105.0	13.12	22.67
104.0	8.34	11.48
103.0	5.00	5.14
102.0	2.25	1.65
101.0	0.69	0.24
100.0	0.00	0.00

[1]Spillway elevation.
[2]Invert elevation of raw-water intake.

Figure 5. Bathymetry of Glenville Lake.

SUMMARY AND CONCLUSIONS

In 1996 and 1998, the USGS collected depth and position data at Bonnie Doone Lake, Kornbow Lake, Mintz Pond, and Glenville Lake. The USGS surveys were the first to cover the entire range in depth and the first to provide estimates of total volume for the four reservoirs. Partial bathymetric surveys were conducted previously at Bonnie Doone Lake, Kornbow Lake, and Mintz Pond by using traditional land-surveying techniques when the reservoir levels were lowered in 1986. Results of the recent bathymetric surveys were compared to results obtained in 1986 at these three reservoirs.

During the USGS investigation, water depths were measured by using a boat-mounted fathometer, which did not require the reservoirs to be drawn down. Position data were collected in 1996 with a laser tracking system and a land-based total station instrument, and in 1998 with a differentially corrected GPS. Both positioning methods enabled rapid data collection. However, because the GPS method was not restricted by line-of-sight requirements, it produced better data coverage in coves, near shorelines, and in reservoir headwaters. Moreover, the GPS method reduced ancillary data-collection time by eliminating the need to establish and survey multiple land-based control points.

Bathymetric results indicate both similarities and differences between the four reservoirs of Little Cross Creek. The most notable similarity is a tendency for reservoir-bed elevations to drop several feet within a close distance from the shoreline, as indicated by closely spaced contours on the bathymetric maps. Mid-channel areas in the reservoirs generally are characterized by relatively gentle slopes and wide, flat terrain, except for the upper portion of Bonnie Doone Lake, which was dredged in the year preceding the survey. The upper portions of Kornbow Lake and Mintz Pond are shallow and may be prone to sedimentation. Kornbow Lake is the largest and deepest lake and has the most storage capacity of the four reservoirs; Mintz Pond is the smallest and most shallow.

The combined surface acreage of the Little Cross Creek reservoirs at their full-pool elevations is 120.97 acres, consisting of 21.20 acres at Bonnie Doone Lake, 47.09 acres at Kornbow Lake, 15.56 acres at Mintz Pond, and 37.12 acres at Glenville Lake. Combined usable storage capacity is 674.91 acre-ft, which is the sum of 127.93 acre-ft in Bonnie Doone Lake, 320.62 acre-ft in Kornbow Lake, 53.25 acre-ft in Mintz Pond, and 173.11 acre-ft in Glenville Lake.

Usable storage at Bonnie Doone Lake was significantly greater in 1998 than in a 1986 survey, partly because dredging during 1997 increased the storage capacity of the reservoir. However, it is not possible to compare results of the 1986 and 1998 studies directly, because approximately one-third of the Bonnie Doone Lake bed was not included in the 1986 investigation. In addition, different surveying and mapping methods were used during the two investigations. Despite methodological differences, usable storage capacities computed for Kornbow Lake and Mintz Pond in 1998 were comparable to those computed in 1986. In contrast, the estimated surface area of Mintz Pond decreased by 14 percent between 1986 and 1996.

The following conclusions were arrived at based on experience gained during this investigation. First, in small southeastern reservoirs such as those located on Little Cross Creek, winter is the optimal season for data collection because macrophyte biomass and leaf canopy are minimal and reservoirs are likely to be at full pool. Second, collecting bathymetric data along near-shore and mid-channel longitudinal transects in addition to cross-channel transects provides excellent data coverage, which reduces interpolation artifacts and map-editing time. Third, paper fathometer recordings are valuable for checking point data and final contours.

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