

INTRODUCTION

Indian Creek Reservoir, formed from an earthen dam built in 1972 on Indian Creek in central Louisiana, is used for water-based activities such as water skiing, fishing, boating, and swimming. An understanding of current hydrologic conditions of this reservoir and other reservoirs and lakes in Louisiana is essential to the management and protection of these valuable natural resources. Water quality and quantity are important concerns to those who use these bodies of water for municipal, recreational, agricultural, or industrial purposes. Current and accurate information regarding the physical and chemical-related properties and conditions of freshwater reservoirs and lakes in Louisiana is fundamental to planners and managers for evaluating these resources. In October 1996, the U.S. Geological Survey, in cooperation with the Louisiana Department of Transportation and Development, began a study to conduct a bathymetric survey and determine the physical and chemical-related properties of Indian Creek Reservoir.

The purpose of this report is to present the results of the bathymetric survey and the results of vertical profiles of physical and chemical-related properties, including depth, water temperature, dissolved oxygen (DO), specific conductance, and pH, which were measured at three sites in the reservoir. Hydrographic surveying software was used for combining differential global positioning system (DGPS) information with digital survey fathometer data to accurately map the bathymetry of the reservoir. The bathymetric map was produced using geographic information systems (GIS), and lines of equal depth of water were reviewed and edited for accuracy and consistency. On-site physical and chemical-related properties were measured at the three selected locations using a water-quality monitor. This report is one in a series of planned map reports describing current bathymetry and physical and chemical-related properties of reservoirs and lakes in Louisiana.

Description of Study Area

Indian Creek Reservoir (fig. 1) is located in Rapides Parish, about 12 miles south of Alexandria, Louisiana, and about 5 miles west of Lecompte, Louisiana. A 1997 census estimated a population of 127,855 for Rapides Parish, 50,726 for Alexandria, and 7,604 for Lecompte (Northeast Louisiana University, Uniform Resource Locator accessed December 1, 1998). This area has a subtropical transitional climate with a mean annual rainfall of 58.5 inches and a mean annual temperature of 66.2°F (degrees Fahrenheit) (Jay Grymes, Louisiana Office of State Climatology, written commun., 1998).

Indian Creek Reservoir has a drainage area of 23.5 square miles and receives inflow from Indian Creek, Carrs Creek, Burgess Creek, and unnamed tributaries entering throughout the reservoir. The earthen dam has a top elevation of 95.6 feet above sea level and is 7,400 feet in length. The reservoir level is controlled by an 80-foot-long concrete spillway, at a crest elevation of 86.5 feet above sea level. The maximum design discharge for the spillway is 3,680 cubic feet per second. (Ray Elifami, Louisiana Department of Transportation and Development, written and oral commun., 1998). Approximately 40 percent of the reservoir-surface area has stumpy remnants of the once densely forested basin of Indian Creek. Boat access is limited with well-demarcated channels. Boat ramps are available at three locations on the reservoir (fig. 1).

Acknowledgments

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BATHYMETRY

Bathymetric data for Indian Creek Reservoir were collected during June 11-18, 1997. Accurate position and depth data were obtained to comprehensively describe the bathymetry of the reservoir; 125,009 data points of latitude, longitude, and depth were recorded. The bathymetry of the reservoir is shown in figure 1; water depths are referenced to the water-surface elevation of 86.6 feet above sea level, which existed throughout the bathymetric survey. The normal pool elevation of the reservoir is 86.5 feet above sea level.

Equipment used for the bathymetric survey included a Starlink DNAV-212 DGPS, an Odom digital survey fathometer, and HYPACK software. The DGPS measured spatial position in latitude and longitude with routine accuracy of 5 feet; horizontal control points were established at the beginning and rechecked at the end of each survey day to maintain that accuracy. The survey fathometer measured the depth with routine accuracy of 0.1 foot; the fathometer was calibrated at the start and verified at the end of each survey day to maintain that accuracy. The HYPACK software was used for survey planning, survey execution, and storage and editing of data. Data were exported to ARC/INFO for drawing lines of equal depth of water and subsequent reviewing and editing of results.

Surface area and volume spatial analyses also were performed within ARC/INFO. The water-surface area of Indian Creek Reservoir was 1,800 acres, and the water volume was 20,500 acre-feet. The depth-surface area and depth-volume relations are shown in figure 2. The average depth of the reservoir was 11.4 feet, with a depth of 8.2 feet or greater over more than 50 percent of the reservoir-surface area. The greatest depths are located in the central part of the reservoir, with deep pockets exceeding 25 feet.

PHYSICAL AND CHEMICAL-RELATED PROPERTIES

Data on physical and chemical-related properties were collected on September 22, 1997, at selected sites in Indian Creek Reservoir. At these sites (1, 2, and 3 in fig. 1), multiple points along a vertical profile were sampled to establish the occurrence and depth of stratification. The HYDROLAB, a water-quality monitor, was calibrated at the beginning of the day prior to physical and chemical-related property data collection.

Data were collected along a vertical profile from above the reservoir bed to 1.6 feet below the water surface, with additional sampling points within the stratification zone. The deepest measurements at the three sampling sites were 15.1 feet at site 1, 17.1 feet at site 2, and 19.0 feet at site 3. Water temperature was approximately 85°F from the surface to approximately 11 feet in depth, then decreased with depth to approximately 79°F at 19 feet (fig. 3).

The DO concentration profiles indicated a distinct stratification existed on September 22, 1997. Concentrations of DO decreased markedly within the narrow range from 10 to 13 feet below water surface. Shallow-water DO concentrations varied between 5.8 and 6.3 mg/L (milligrams per liter), and bottom-water DO concentrations were approximately 0.15 mg/L. Concentrations of DO vary considerably with depth, location, and season (Demas, 1985). The criterion for DO is 5 mg/L for freshwater aquatic life (Louisiana Department of Environmental

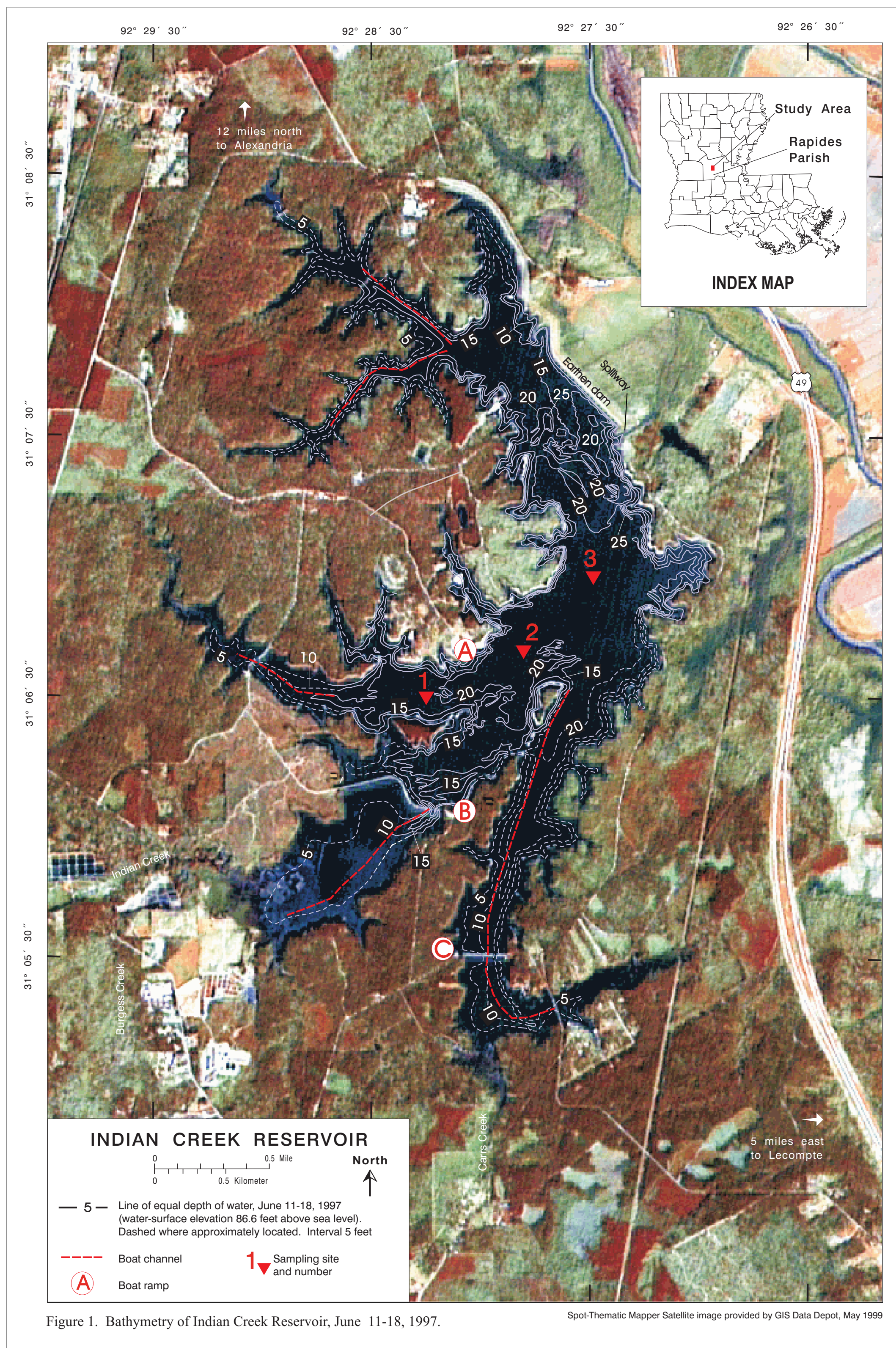


Figure 1. Bathymetry of Indian Creek Reservoir, June 11-18, 1997.

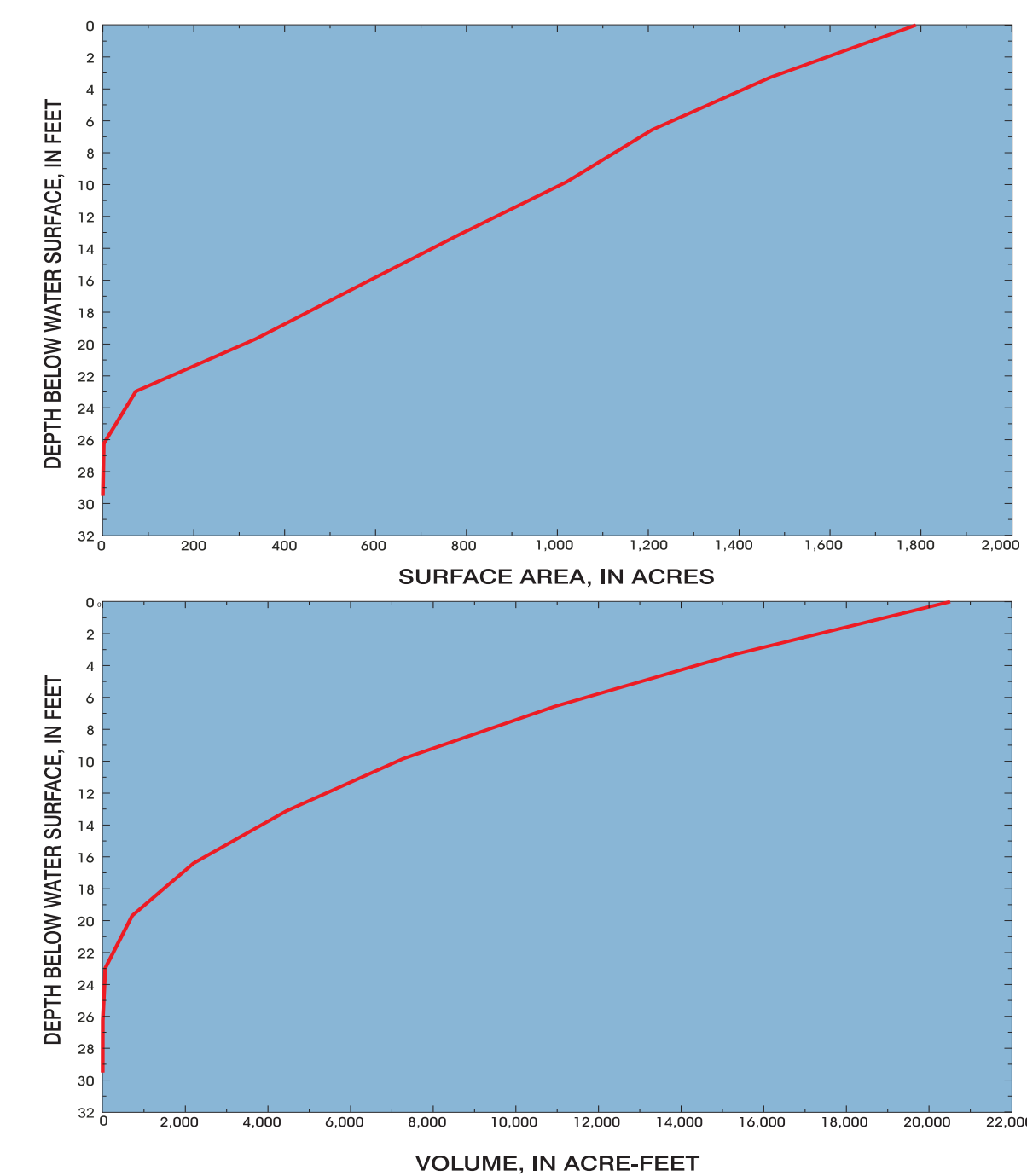


Figure 2. Depth-surface area and depth-volume relations for Indian Creek Reservoir. Water-surface elevation was 86.6 feet above sea level during the bathymetric survey, June 11-18, 1997.

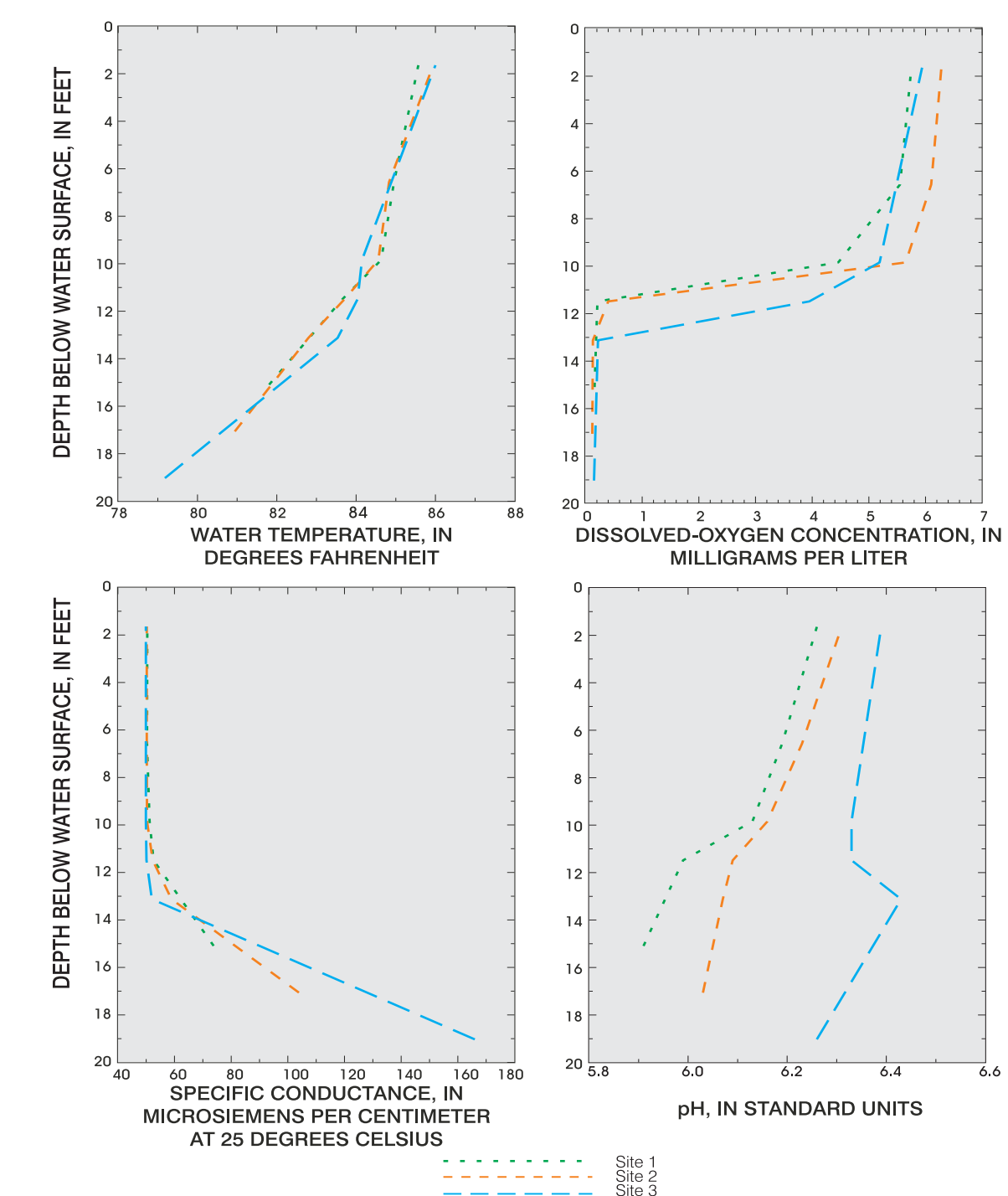


Figure 3. Variation of water temperature, dissolved-oxygen concentration, specific conductance, and pH at Indian Creek Reservoir, September 22, 1997.

Quality, 1998, p. 128; U.S. Environmental Protection Agency, 1976; 1986). Water visibility, measured with a Secchi disk, was 3.8 feet.

The specific conductance remained constant at 50 $\mu\text{S}/\text{cm}$ (microsiemens per centimeter at 25 degrees Celsius) from the surface to about 11 feet, then increased with depth; the bottom-water measurements ranged from 74 to 166 $\mu\text{S}/\text{cm}$. The pH was about 6.3 (standard units) near the surface, then decreased with depth, with the deepest measurement of 6.26 at 19 feet (fig. 3).

REFERENCES

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-----1986, Quality criteria for water: Washington, D.C., U.S. Environmental Protection Agency [variously paged].

In this report, "sea level" refers to the National Geodetic Vertical Datum of 1929--a geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called Sea Level Datum of 1929.

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