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BATHYMETRIC ANALYSIS OF

LAKE APOPKA

PROJECT 10-150-01

PREPARED FOR:

ST. JOHNS RIVER WATER MANAGEMENT DISTRICT
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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

A bathymetric survey consisting of a 347-point, 2,000-ft spaced sampling grid was conducted on Lake Apopka in June 1989. The survey was conducted using a Raytheon Model DE-719 fathometer and LORAN-C for navigation. The depth readings were calibrated, adjusted for lake surface slope, hand contoured, and entered onto a GIS computer system for subsequent analysis and plotting. The measured lake surface area is 1.342 x 10^9 ft^2 and the volume is 6.453 x 10^9 ft^3 with lake level at 66 ft (MSL) (excluding interstitial water in the sediments and flucculent layer). The mean lake depth is 4.81 ft. The lake is generally flat with two major erosional trough features: one running approximately east-to-west across the center of the lake and the other along the south and west shoreline. The maximum depth measured (other than the depth at Apopka Springs) was 16.0 ft in the trough along the south shore.

Error analysis of the results indicated the field survey depth data were adjusted to fit the calibration data points with an accuracy of $\pm$ 0.25 ft at the 95 percent confidence level. This corresponds to an error of $\pm$ 0.335 x 10^9 ft^3 for the lake volume estimate or about 5 percent. The surface area and the lake volume calculations made from the metric bathymetry chart and the English-unit chart agreed within 2.0 percent.

1.0 INTRODUCTION

The St. Johns River Water Management District (SJRWMD) requested that a bathymetric survey of Lake Apopka be conducted. The request was initiated because declining water quality in the lake prompted the Florida Legislature, in 1985, to instruct SJRWMD to begin pilot studies for restoring the lake's quality.

Lake Apopka is a unique lake because of the flocculent layer near the bottom and the extremely soft sediments. This makes it difficult to measure accurately the depth of the sediment-water interface with standard sounding methods. Approximately 100 sediment cores were recently collected on the lake to document the thickness of the "muck layer". To complete the description of the lake bottom, however, an accurate bathymetric survey and hypsographic curves were needed. Consequently, the following study was conducted to provide an accurate bathymethic survey of the lake to be used to estimate the lake volume and provide relationships between lake stage, volume, and surface area.

2.0 METHODS

The general scope of work for this project was to conduct a bathymetric survey of Lake Apopka using a 2,000-foot (ft) sampling grid to define the water depth. The results were used to produce bathymetric contour maps of the lake and hypsographic curves relating water elevation to lake area and volume. The following sections describe the methods and materials used to complete these tasks.

2.1 FIELD METHODS

The bathymetric survey was conducted along a 2,000-ft sampling grid. The 2,000-ft grid provided 347 data points or nearly 8 points per square mile. The 2,000-ft grid was needed to provide sufficient resolution to produce accurate contours and reliable hypsographic curves for the large lake.

The selected sampling grid was plotted on a base map prepared with the Geographic Information System (GIS), ARC/INFO. This base map was created by digitizing U.S. Geological Survey (USGS) quadrangle maps. The latitude and longitude coordinates of each point were determined prior to the field survey. These coordinates were used to direct the boat operator to the beginning of each transect and to help the operator to navigate along a given transect. Because the transects were run either east-to-west or west-to-east, any deviation in latitude (i.e., deviation from the predetermined transect) was apparent on the navigation readings and was easily corrected. The approximate grid pattern and additional sampling points in the Gourd Neck are shown in Figure 1.

The general survey technique was to transverse each transect at a constant latitude using the helmsman's control on the LORAN-C system to help remain on line. Depth was continuously recorded with an acoustic fathometer. As each predetermined grid point was reached (as indicated by the LORAN readings), a "fix" was marked on the graph and numbered to coordinate the depth reading with the appropriate grid point.

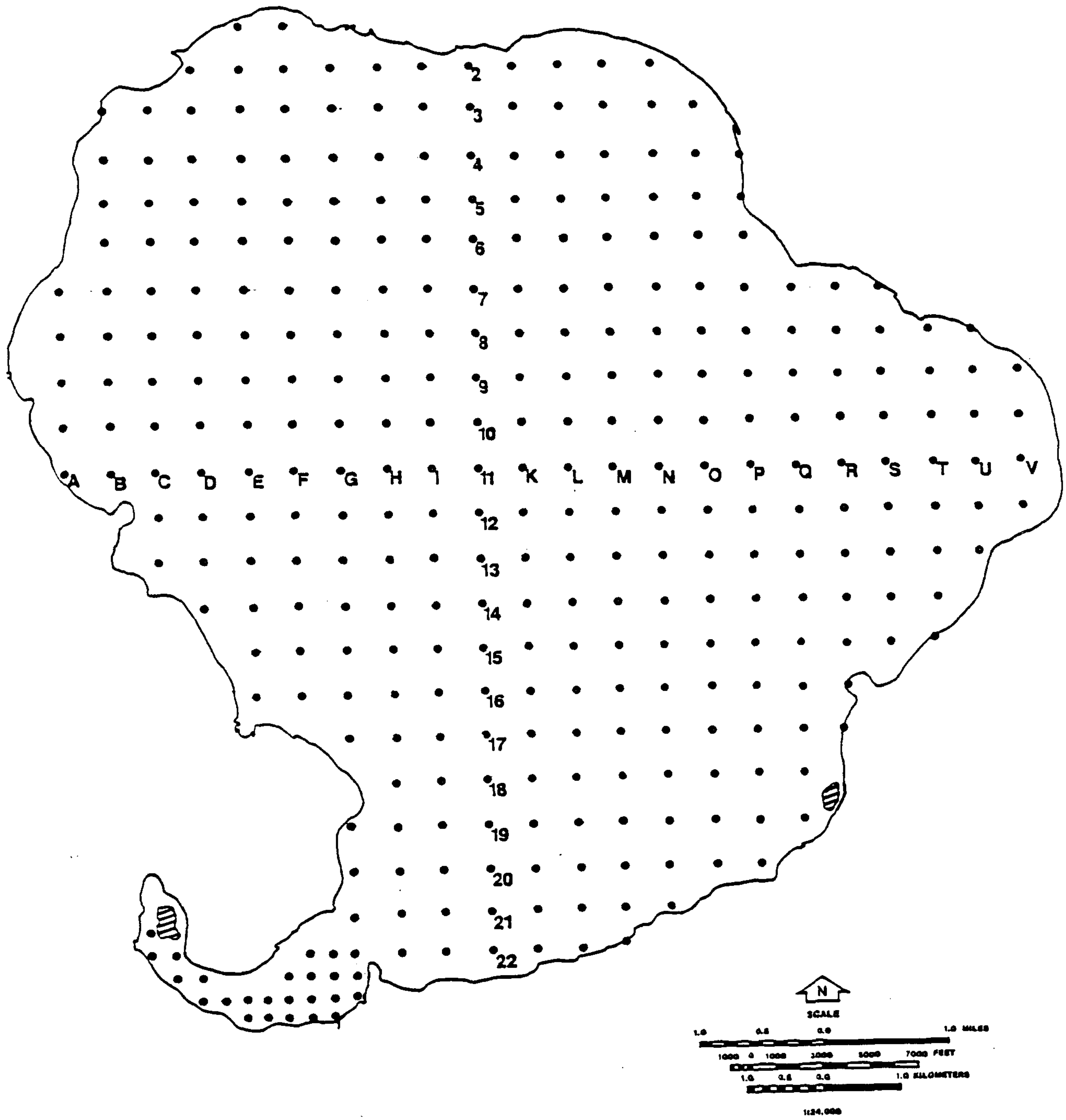

Figure 1. Bathymetry Sampling Grid for Lake Apopka

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Final calibrated depth data, corrected for lake level variations, were combined with the grid data to produce the data set used for subsequent plotting and analysis. Each component of the field effort is discussed in detail in the following subsections.

2.1.1 Depth Readings

Because of a suspended flocculent layer overlying soft sediments, there was some concern regarding the ability to determine the sediment-water interface with acoustic techniques. Originally it was thought that the sediment in the lake, with its slow gradation with depth from suspended material to consolidated sediments, might produce a broad band return on the fathometer. Furthermore, it is difficult to "feel" the bottom with a lead line or sounding rod because of the soft nature of the sediments.

Consequently, it was necessary first to "define" the bottom before the bathymetric survey commenced. This evaluation was completed on June 19 by sampling at 20 randomly selected stations and comparing the readings from an acoustic fathometer, a sounding rod with a 6-inch square base, and a photoelectric device provided by the SJRWMD. The results from these three techniques were compared to assure that acoustic returns on the fathometer could accurately identify the sediment-water interface.

The three techniques compared favorably and in most cases the three measurements were within 0.2 ft. The survey rod was the least sensitive technique because it was very difficult to feel the bottom and this method was not used for the final calibrations. However, the photoelectric device and the fathometer could readily detect the sediment-water interface. A comparison of the depth readings from both of these methods is presented in the appendix. Because both methods appeared to be comparable in accuracy, the fathometer was selected to complete the survey because (1) it was as accurate as the photoelectric device, (2) it provided a continuous trace of the bottom between survey points, and (3) the readings could be made while the survey vessel was moving.

A Raytheon Model DE-719 acoustic fathometer was used to measure depth during the field survey. This instrument operates at 200 kilohertz (KHz) and is capable of recording 534 soundings per minute on chart paper. The fathometer is accurate to 0.5 percent ± 1 inch of the measured depth and can be resolved reliably to the nearest 0.2 ft. The fathometer was calibrated at least four times per day with a target on a graduated line lowered beneath the transducer. In addition, periodically, as the vessel passed a grid point, a marker buoy was deployed and the deployment marked on the fathometer chart. The vessel then returned to the buoy and the depth was measured with a sounding rod, sounding line, or the SJRWMD's photoelectric device, or a combination of these three devices for comparison with the fathometer reading.

The fathometer operated continuously as the boat traveled at a constant speed along each transect. Fix marks were added to the fathometer chart as each grid point was crossed. In areas of steep depth gradients, depth recordings between grid points were used to aid in producing the depth contours. This approach greatly enhanced the detail and accuracy of the bathymetry maps.

2.1.2 Navigation

Navigation was accomplished with a SI-TEX Model 790 LORAN-C receiver. Two receivers were on board at all times with one as a back up. The LORAN was calibrated to known coordinates at the Apopka-Beauclair Bridge. These coordinates were provided by SJRWMD. The LORAN was operated in the latitude-longitude mode. These readings were adjusted to match the coordinates of the Apopka-Beauclair Bridge while the vessel was tied to the bridge. The bridge is located 1.5 miles north of the lake on the canal. This check point was used for calibration twice a day. The latitude-longitude mode was used instead of the time-delay (TD) mode. It was easier for the operator to direct the boat to a given point using latitude and longitude and it was also easier for the operator to maintain a constant heading.

Transects were run east-to-west or west-to-east along constant latitude transects. This approach was helpful in keeping the survey vessel on line. In addition, the navigation units were equipped with helmsman's control that shows the boat operator when he is off the transect by more than 0.01 nautical miles (about 20 yards). Consequently, the navigational accuracy was well within ± 40 yards, which is about the practical accuracy of a LORAN system.

Since the grid pattern was pre-set, an automatic recorder was not needed. Each time a corresponding longitude reading was reached for a grid point, a fix mark was recorded on the fathometer and the appropriate grid number and time was written on the fathometer graph paper.

2.1.3 Lake Elevation Recordings

In order to produce accurate bathymetric maps, the depth readings had to be adjusted to known referenced water levels. Two water level recorders are maintained on the lake, one on the north end and one on the south end of the lake. SJRWMD provided ECT with these water level data. The hourly water level data were used to adjust the depth readings to a known reference datum [66 ft above mean sea level (MSL)]. Additional water level recorders would have been useful for more accurate definition of the plane of the lake to allow for better adjustment for any wind set-up; however, the two water level recorders that were available were considered sufficient to make adjustments within the overall accuracy of the study. In addition there was very little wind during the survey and consequently only minor corrections for wind set-up were required.

2.2 DATA ANALYSIS

2.2.1 Data Entry and Calibration

The bathymetric data collected in the field were originally in analog form on strip charts. These data were digitized manually by reading the depth values from the chart and entering them into a Lotus 1-2-3 file database. The depths were read independently by two individuals and the results were compared to eliminate erroneous readings.

The Lake Apopka water level data were used to adjust the initial depth readings to the reference lake level of 66 ft (above MSL). The lake slope determined from the two water level recorders was used to adjust for water level variations. A linear interpolation between the water level stations was used to estimate the water level at each transect during the time it was surveyed. Fortunately, surveying was completed each day before the late afternoon thunderstorms disturbed the lake (Figure 2). The winds associated with the thunderstorms resulted in a water surface slope greater than 0.5 ft across the lake. However, during the times of the survey the lake was relatively level with a slope less than 0.1 ft. The time of survey for each bathymetry transect was marked on the lake water level record. The lake level at each transect during the time it was surveyed was then estimated by interpolating between the water level measured at Winter Garden and the value measured at the Apopka-Beauclair Canal. Each depth reading was then adjusted with the appropriate lake level value to provide depth readings relative to a lake level of 66 ft above MSL. The east-west water surface slope was assumed to be negligible.

Following adjustment of all data points to the same lake reference level the fathometer depth readings collected on June 19th during the method evaluation survey were compared to values collected at the same points during the actual survey (only 19 of the 20 points were valid because of a navigational error). The results of the comparison are shown in Figure 3(A). Most of the survey values are within 0.5 ft of the

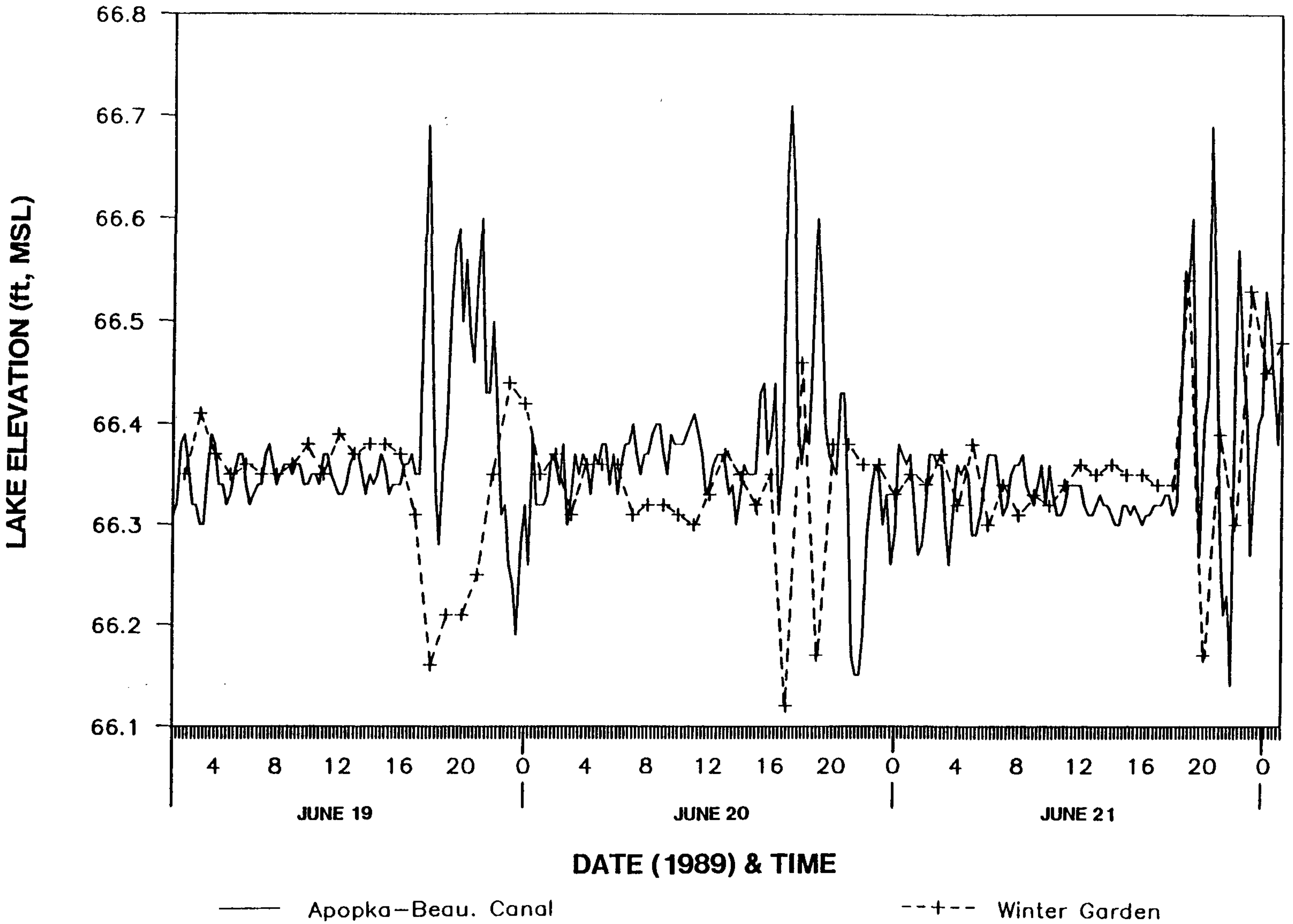

Figure 2. Lake Apopka Water Level Data

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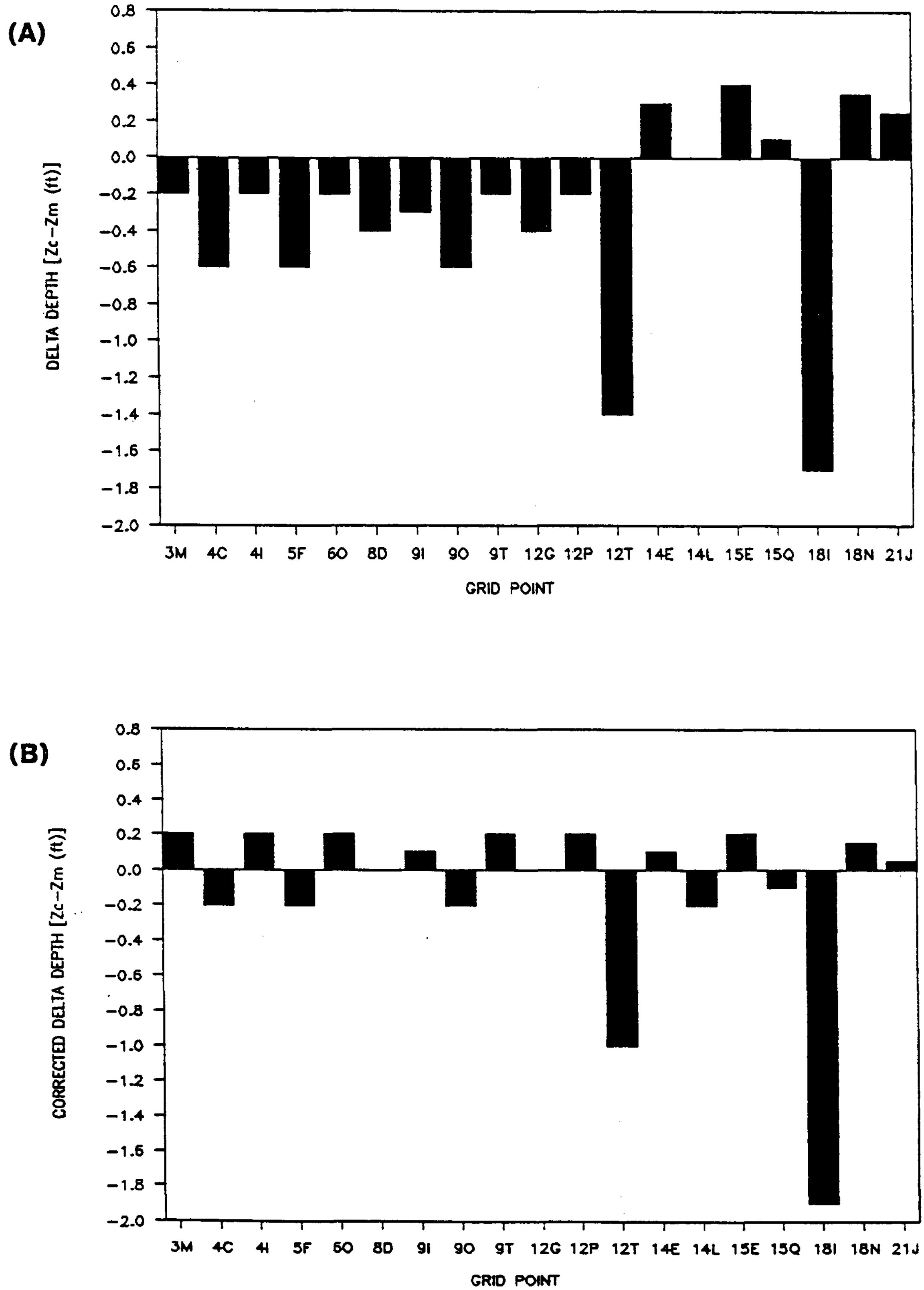

Figure 3. Difference between Survey Data (Z_m) and Calibration Point Data (Z_c): (A) Prior to Final Calibration and (B) After Final Calibration

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calibration values except for two points (grid points 12T and 18I). These two points were measured in areas where there was a steep bottom gradient such that small errors in navigation would result in considerable error in the measured depth.

Since the depth data from June 19th were collected using three depth measurement techniques from a standing vessel, these data are considered to be the most reliable data and indicative of the actual depth at the corresponding grid points. Consequently, these data were used to make a final calibration adjustment on the survey data to provide the best fit between the two data sets. The survey data from June 20 (transects 1 through 12) all indicated depths slightly deeper than the calibration data from June 19th and the results from June 21 all indicated depths shallower than the calibration data (except grid point 18I). Consequently, separate calibration adjustments were applied to the results from each day's survey. In order to produce a zero mean difference in the comparison data sets (excluding the two large variations, grid points 12T and 18I) a value of 0.4 ft was subtracted from the June 20 data and 0.2 ft was added to the June 21 data. The results of this final calibration are shown in Figure 3(B). This calibration adjustment was applied to the entire data set to produce the final calibrated data base. The data base then consisted of:

1. Grid point number,
2. Date sampled,
3. Time sampled,
4. Latitude,
5. Longitude,
6. Calibrated depth,
7. Lake level,
8. Corrected depth (ft), and
9. Corrected depth (m).

The final data base is presented in the appendix.

2.2.2 Plotting and Contouring

The data file was entered into a GIS, Version 3.2.1 of ARC/INFO, which is loaded on an IBM 386 microcomputer. The data file was combined with a separate file provided by SJRWMD that contained the digitized perimeter of the lake. The depth readings in both feet and meters and the lake perimeter were plotted at a 1:24,000 scale so the results could be applied directly to a USGS 7.5-minute topographic quadrangle. The data were plotted on a Calcomp Model 1043 GT plotter at KBN Engineering and Applied Science, Inc.

The plotted positions of the data points relative to the lake perimeter data obtained from an independent source were examined closely to assure the two data sets were compatible. The agreement in the northern half of the lake was excellent; points that were sampled near identifiable shore features fell near these features when plotted. However, the agreement in the southern part of the lake was not as good. Some of the survey points in the Gourd Neck area appeared to fall on shore when plotted. Comparison of the survey field notes with the plotted data indicated that the plotted values were displaced approximately 100 meters (m) to the south.

The northern half of the lake was surveyed on June 20 and the LORAN signals were very stable and consistent. The southern half of the lake was surveyed on June 21 and one of the LORAN signals used on the previous day was not operational. Consequently, it was necessary to use a different signal. The LORAN was calibrated at the canal bridge before the survey; after the survey the readings still agreed with the values at the bridge. However, the signal was not as stable during the survey as the previous day. The longitude readings were very consistent but the latitude readings were unstable. Consequently, after further comparison of the plotted data with field notes it appeared that the offset observed on the southern half of the lake only affected the latitude readings made on June 21. Since the readings were accurate at the calibration point and offset approximately 100 m at the south end of the lake, the affected transects were adjusted northward an amount linearly proportional to the transects position between the calibration point and the south end of the lake. After this adjustment the data were plotted again and the positions agreed very well relative to the lake perimeter.

The final calibrated data set was plotted in both feet and meters for subsequent bathymetric contouring. To eliminate spurious contours that are frequently produced by computer contouring packages, the depth data were contoured by hand. Two contour maps at a scale of 1:24,000 were produced: one in feet (1-ft contour interval) and one in meters (0.50 m contour interval). The original fathometer strip charts were used to help interpolate between grid points in areas of steep bottom gradients thereby enhancing the quality of the final product.

The final depth contours including the Lake Apopka shoreline (obtained from SJRWMD) from the USGS quadrangles were digitized and entered into the ARC/INFO system. The contours were digitized with a Calcomp Model 9100 digitizer accurate to $\pm$ .01 inches. The bathymetric maps were then plotted with the Calcomp 1043 GT plotter. The computer plots were compared with the hand contours to assure accuracy.

2.2.3 Area and Volume Calculations

After the bathymetric contour data were entered into the ARC/INFO system, surface area and volume calculations were produced. The surface area within each contour was calculated to a depth of 15 ft by summing appropriate polygons calculated by the GIS. This provided 16 data points to produce a hypsographic curve of lake level versus surface area. An identical procedure was used to calculate surface areas as a function of depth for the metric bathymetric chart at 0.5 m intervals. Since the metric-unit chart and the English-unit chart were hand contoured and digitized/entered into the GIS independently, the results were used to estimate the error involved in contouring and digitizing the bathymetry as discussed in Section 3.3.

Lake volumes were calculated using the surface areas within each contour and computing the volumes in 1-ft layers (or 0.5-m layers for the metric chart). For example, the water volume contained between the shoreline and the 1-ft interval was calculated using the truncated cone method (Wetzel, 1983) according to:

$$V = h\ (A_1 + A_2 + (A_1A_2)^{1/2})/3$$

where:

V = volume of the layer

h = thickness of the layer

A_1 = area of the upper surface

A_2 = area of the lower surface

This calculation was completed for all layers to a lake depth of 15 feet thereby producing 15 data points that were used to develop a hypsographic curve for lake level versus volume. As with the surface area calculations, this procedure was completed for the English-unit chart and the metric-unit chart to provide two estimates of the lake volume as a function of water depth.

3.0 RESULTS

3.1 BATHYMETRY

The depth contours in meters from the bathymetric survey are presented in Figure 4. The results indicate the lake is generally flat and shallow with 79 percent of the lake falling between the 1.0- and 2.0-m contours. Much of the northern half of the lake is between 1.5 and 2 m deep and is separated from the southern half by a shallow trough that reaches a depth of 3.2 m. The southern half of the lake is mostly 1.0 to 1.5 m deep with several deeper features. The southwest and south shorelines are paralleled by a continuous trough that reaches a maximum measured depth of 4.9 m. The trough extends for more than 7 miles from the south shore of the lake near Winter Garden to the west shore of the lake near Smith's Island. The trough appears to be an erosional feature resulting from wind-driven currents that are intensified along the shoreline. Other notable features in the bathymetry include a deep area to the east that reaches a depth of 3.1 m and Apopka Springs in the Gourd Neck region that exceeds 11 m deep. The Gourd Neck area is generally between 1 and 2 m deep.

A previous bathymetric survey was conducted on Lake Apopka in 1968 (Schneider and Little, 1969). The results of this survey (plotted relative to a lake level of 66.5 ft MSL) are presented in Figure 5. The results of the present survey with the depth contours in feet are presented in Figure 6 for comparison. The general features of the lake measured in 1968 are about the same with the following few exceptions:

1. The trough along the south and west shore did not extend across the mouth of the Gourd Neck,
2. The mid-lake trough did not extend across the entire lake,
3. A 12-ft deep hole at the extreme eastern edge was not observed in 1989, and
4. An 8-ft deep depression in the northern portion of the lake was not observed in 1989.

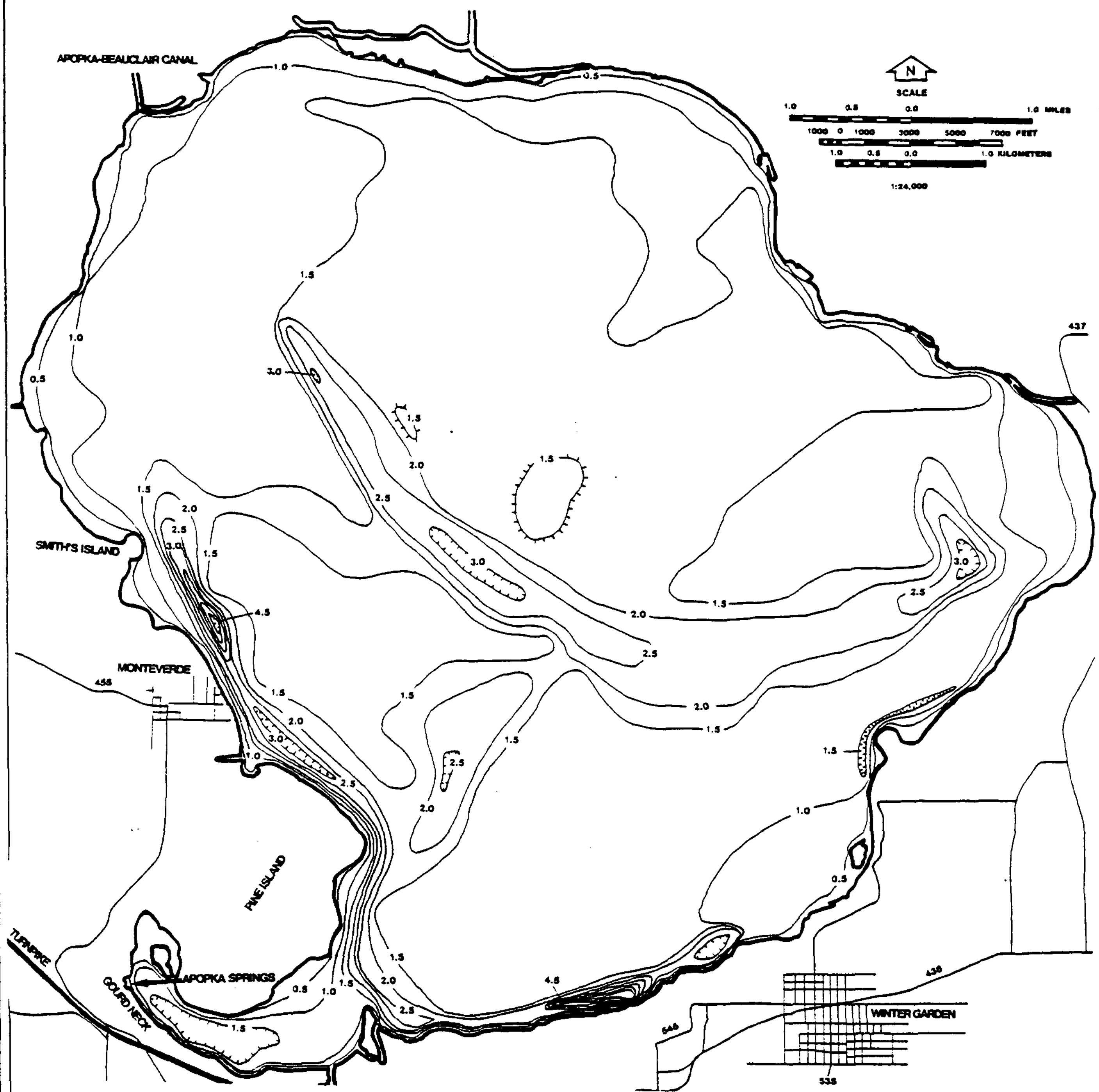

Figure 4. Lake Apopka Bathymetry Chart (contours are in meters)

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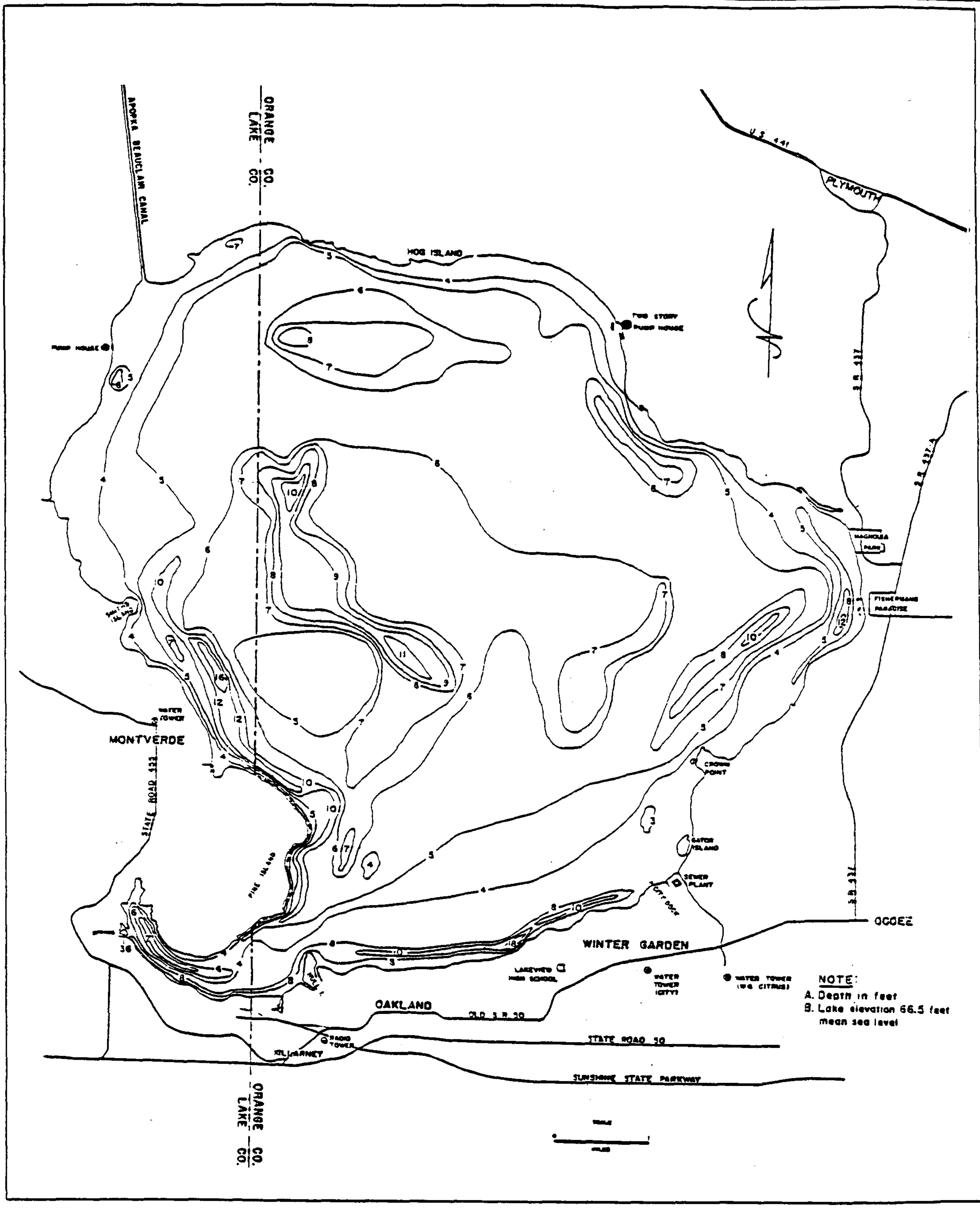

Figure 5. Lake Apopka Bathymetry Chart from 1968 (Schneider and Little, 1969)

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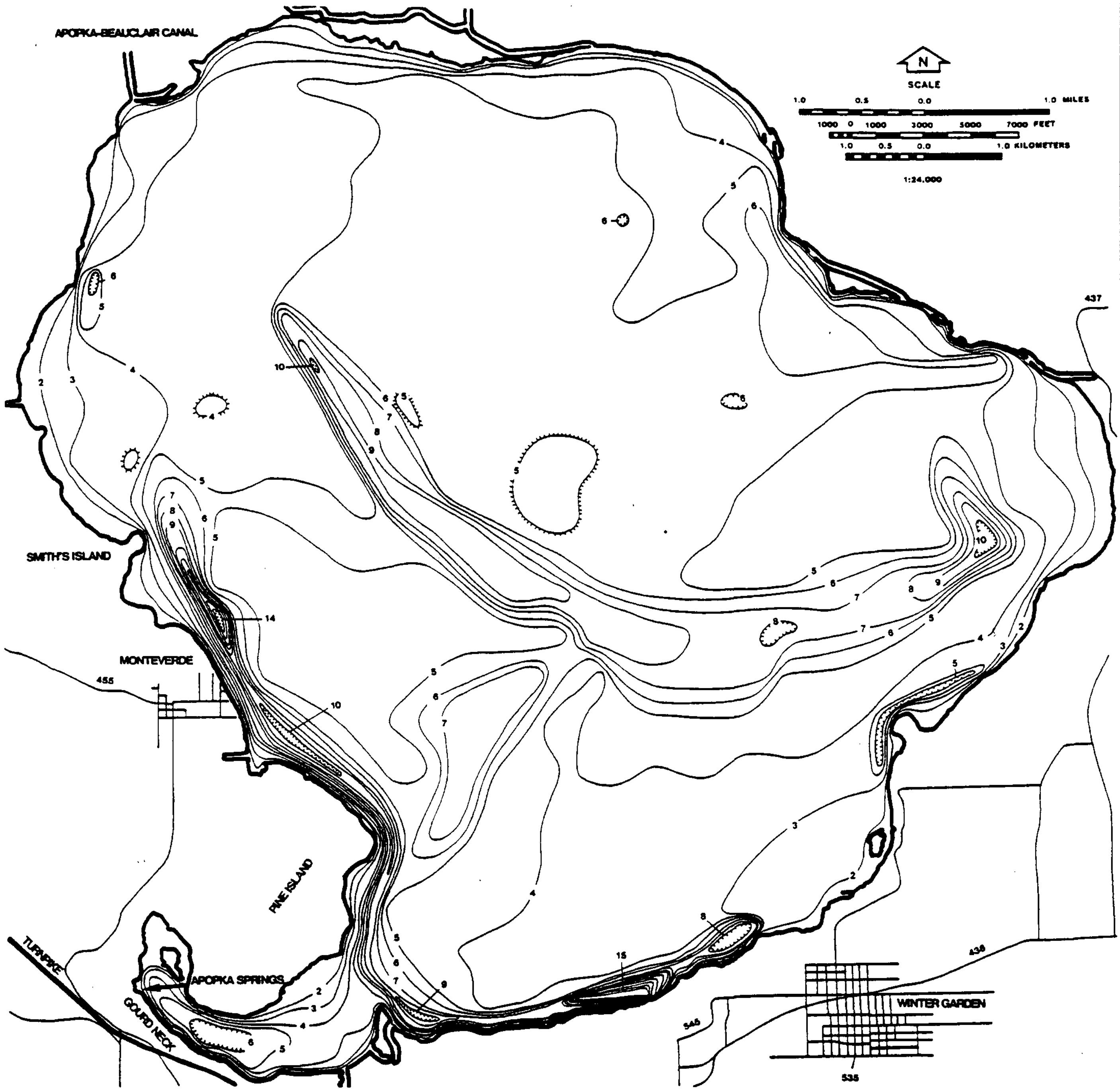

Figure 6. Lake Apopka Bathymetry Chart (contours are in feet)

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Other than the few features mentioned above, the bathymetry charts are quite similar.

3.2 SURFACE AREA AND LAKE VOLUME

Hypsographic data providing the lake surface area and the lake volume as a function of water level calculated from the English-units bathymetric chart are provided in Table 1. Comparable information calculated from the metric-units chart is provided in Table 2. These data are plotted as hypsographic curves in Figure 7(A) and 7(B). The results from both calculations estimate the lake surface area at full stage (66 ft above MSL) to be 1.342 x 10^9 ft^2 (approximately 30,812 acres). Lowering the lake 2 ft would only reduce the surface area by about 4 percent. The greatest exposure of lake bottom would occur by lowering the lake from 62 ft to 60 ft. This two-foot reduction in water level would expose an additional 62 percent of the lake bottom resulting in a total exposed area of about 85 percent with the lake at a level of 60 ft (MSL).

The surface area estimates from the metric-unit chart and the English-unit chart are both presented on Figure 7(A) for comparison. Even though the surface area measurements were made from independently hand-contoured charts, the agreement is good. There is little difference in the surface area estimates at all lake stages which suggests that the GIS digitizing and processing technique used is reliable.

The lake volume estimates made from both bathymetry charts are provided in Figure 7(B). The average lake volume at 66 ft (MSL) computed from the two bathymetry charts is 6.453 x 10^9 ft^3. The two estimates varied by only about 2 percent as the estimate from the metric chart was 6.387 x 10^9 ft^3 compared to 6.518 x 10^9 ft^3 from the English-unit chart. As illustrated in Figure 7(B) the estimates from both charts agreed well at all lake stages.

Table 1. Hypsographic Data for Lake Apopka (Computed from the English-Units Chart)

Depth Contour (ft)	Lake Level (ft)	Cumulative Area (sf X 10**9)	Cumulative Area (acres)	Layer Volume (cf X 10**9)	Lake Volume (cf X 10**9)	Lake Volume (%)
0	66	1.342	30812	1.329	6.518	100.00%
-1	65	1.316	30215	1.304	5.189	79.61%
-2	64	1.291	29641	1.259	3.885	59.60%
-3	63	1.227	28172	1.131	2.626	40.29%
-4	62	1.038	23832	0.801	1.495	22.94%
-5	61	0.586	13455	0.377	0.694	10.65%
-6	60	0.202	4638	0.163	0.317	4.86%
-7	59	0.126	2893	0.090	0.154	2.36%
-8	58	0.059	1355	0.041	0.064	0.98%
-9	57	0.025	574	0.014	0.023	0.35%
-10	56	0.005	115	0.004	0.009	0.14%
-11	55	0.003	69	0.002	0.005	0.08%
-12	54	0.001	23	0.001	0.003	0.05%
-13	53	0.001	23	0.001	0.002	0.03%
-14	52	<0.001	--	<0.001	<0.001	0.02%
-15	51	<0.001	--	--	--	--

sf = square feet
cf = cubic feet

Source: ECT, 1989

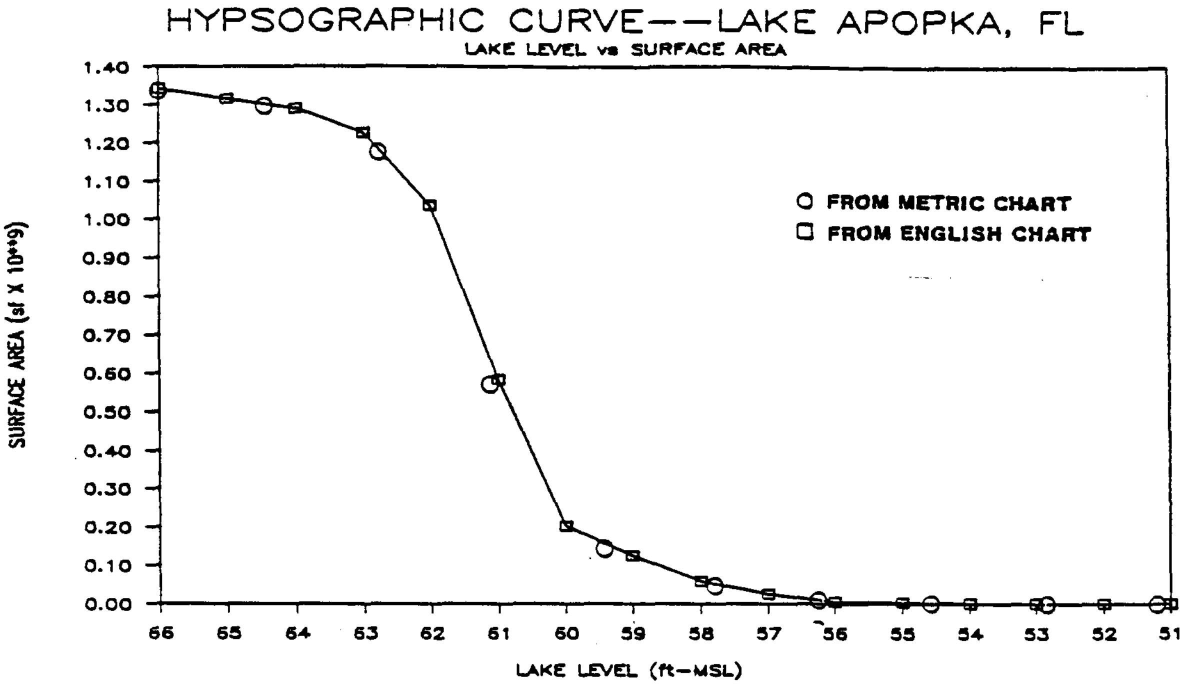
Table 2. Hypsographic Data for Lake Apopka (Computed from the Metric Chart)

Depth Contour (m)	Lake Level (ft)	Cumulative Area (sf X 10**9)	Cumulative Area (acres)	Layer Volume (cf X 10**9)	Lake Volume (cf X 10**9)	Lake Volume (%)
0.0	66.000	1.342	30812	2.176	6.387	100.00%
-0.5	64.360	1.311	30101	2.047	4.211	65.93%
-1.0	62.719	1.186	27231	1.420	2.164	33.88%
-1.5	61.079	0.581	13340	0.538	0.744	11.65%
-2.0	59.438	0.129	2962	0.143	0.206	3.23%
-2.5	57.798	0.051	1171	0.047	0.063	0.99%
-3.0	56.157	0.011	253	0.011	0.016	0.25%
-3.5	54.517	0.003	69	0.003	0.005	0.08%
-4.0	52.876	0.001	23	0.002	0.002	0.03%
-4.5	51.236	<0.001	--	--	--	--

sf = square feet
cf = cubic feet

Source: ECT, 1989

(A)



(B)

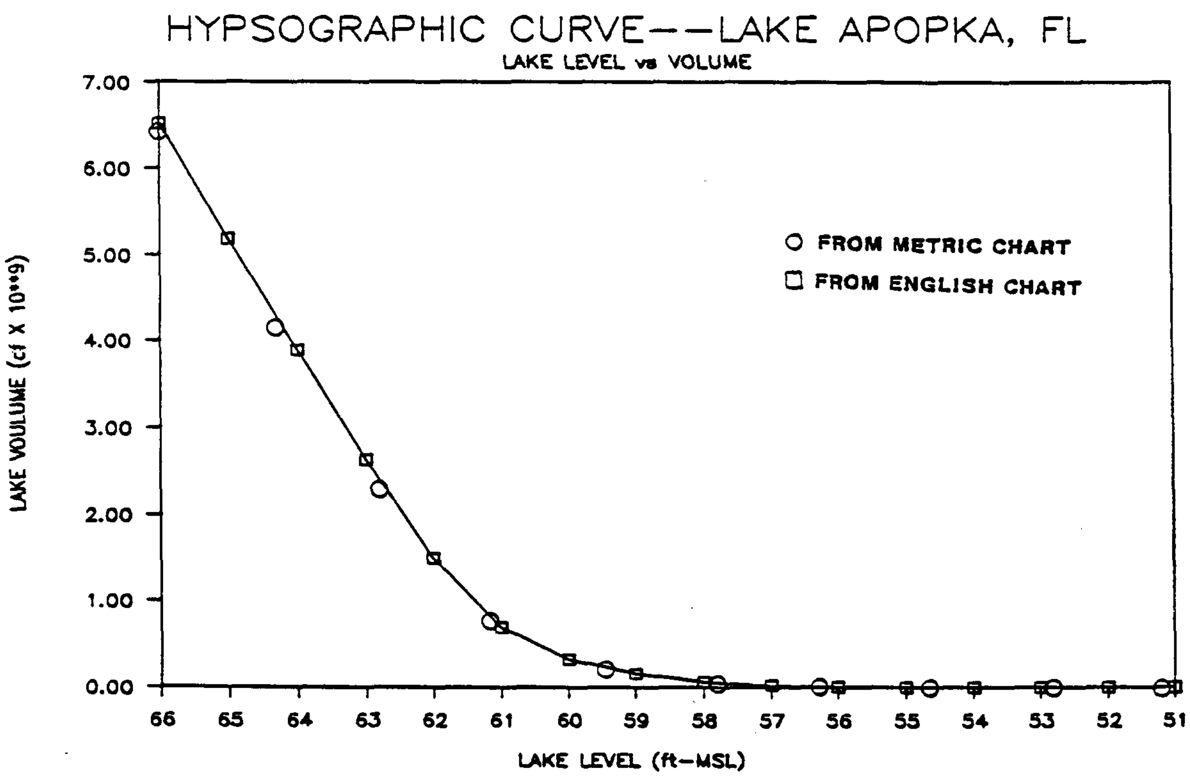


Figure 7. Hypsographic Curves for Lake Apopka Providing (A) Surface Area vs Lake Level, and (B) Lake Volume vs Lake Level

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The average lake depth at 66 ft (MSL) is 4.81 ft. To lower the lake 2 ft would require removing 2.633 x 10^9 ft^3 of water (40.8 percent of the lake) and would only expose about 4 percent of the lake bottom (0.051 x 10^9 ft^2). Removing 50 percent of the lake volume would expose approximately 6 percent of the lake bottom. To expose 50 percent of the lake bottom would require draining 87 percent of the lake. It should be noted that these values only account for lake water above the sediment-water interface. Interstitial water in the soft sediment and flocculent layers has not been included in the calculations.

3.3 ERROR ANALYSIS

Errors in completing bathymetric surveys and calculating hypsographic statistics can be introduced through several means that include: fathometer calibration, lake level slope, navigation, contouring, and digitizing. It is difficult not only to estimate the amount of error involved with each component, but also to determine the effect that error has on the final bathymetric results. For example, the navigational accuracy of the survey was about ± 20 m, but determining the effect this inaccuracy has on the final bathymetry is difficult. To complete a detailed error analysis in the strictest sense would require completing the entire survey independently several times and statistically analyzing the results to produce confidence levels. Since this was not practical, the individual components of the survey were analyzed.

An estimate of the accuracy of measuring the water depth, correcting for navigation errors, calibrating the measured depth and correcting for lake level fluctuations was done by comparing the results of the survey with the "calibration points" collected on the day before the survey. Since considerable care was taken in accurately establishing the depth of the calibration points (including measuring the depth at each point with three methods) the depth measured at each calibration point was considered to be the true lake depth. As described in Section 2.2.1, these calibration points were used to make a final calibration adjustment to the survey data to produce the final data set (see Figure 3(B) for comparison of calibration data with survey data). A quantitative error estimate for depth measurements was derived from the standard deviation of the differences between the true lake depth and the final corrected survey depth for the calibration sites [Figure 3(B)]. This standard deviation was used with the corresponding student's t value with 18 degrees of freedom to estimate the 95 percent confidence interval of $\pm$ 0.25 ft. This indicates that the field techniques and calibration procedure used were capable of adjusting the field survey data to within $\pm$ 0.25 ft of the calibration data with 95 percent confidence. This corresponds to an error estimate of the lake volume [at 66 ft (MSL)] of $\pm 0.335 \times 10^9$ ft^3 or approximately $\pm$ 5.2 percent.

A qualitative estimate of the error involved in hand contouring, digitizing, and computing the surface areas and volume was made by comparing the values obtained from the metric bathymetry chart with those that were independently obtained from the English-unit chart. The total lake surface areas from both charts were identical for the first four significant digits (1.342×10^9 ft^2). The values at other lake levels were comparable as was illustrated on Figure 7(A). The lake volume estimates were within 2.0 percent of each other (i.e., $\pm$ 1.0 percent from the mean value of 6.453×10^9 ft^3). Values calculated at other lake levels also agreed well as was illustrated on Figure 7(B).

The results indicate that the greatest error occurs in measuring, calibrating, and adjusting the water depth for lake level fluctuations. The survey data were calibrated to within $\pm$ 0.25 ft of the calibration data which corresponds to an error of about 5 percent. This is much better than the typically reported bathymetry accuracy of $\pm$ 1 ft. The error involved in hand contouring, digitizing, and computing area and volume statistics was about 1 percent based on comparison of the two bathymetry charts. Consequently, about 5 times more error is involved in developing the data set than in the final digitizing and data processing.

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APPENDIX

METHOD CALIBRATION DATA
BATHYMETRY DATA BASE

Table 1 Comparison of Acoustic and Photoelectric Depth Sounding Measurements

Grid Point	Photo–electric Depth (m)	Photo–electric Depth (ft)	Acoustic Depth (ft)	Delta Depth (ft)
3M	1.63	5.35	5.4	0.05
4C	MD	MD	4.4	MD
4I	1.75	5.74	5.8	0.06
5F	1.40	4.59	4.4	–0.19
6O	1.59	5.22	5.4	0.18
8D	1.40	4.59	4.6	0.01
9I	1.78	5.84	5.8	–0.04
9O	1.96	6.43	6.3	–0.13
9T	1.54	5.05	4.8	–0.25
12G	1.70	5.58	5.6	0.02
12P	1.50	4.92	5.1	0.18
12T	2.52	8.27	8.2	–0.07
14E	1.49	4.89	5.0	0.11
14L	2.68	8.79	8.7	–0.09
15E	1.52	4.99	5.0	0.01
15Q	1.38	4.53	4.9	0.37
18I	1.94	6.36	6.3	–0.06
18N	1.28	4.20	4.35	0.15
21J	1.27	4.17	4.25	0.08
22.5D'	MD	MD	4.20	MD
			Mean	0.02
			SD	0.15

MD = Missing Data

Source: ECT, 1989.

Table 2 Lake Apopka Bathymetry Data Collected June 20-21, 1989.

No.	Grid Point	Date	Time	N Lat 28 Deg (Min)	W Lon 81 Deg (Min)	Calib. Depth (ft)	Lake Level (ft)	Corr. Depth (ft)	Corr. Depth (m)
1	1 E	20-Jun-89	18:55	40.79	39.75	3.4	66.36	3.0	0.93
2	1 F	20-Jun-89	18:51	40.79	39.38	3.0	66.36	2.6	0.80
3	2 D	20-Jun-89	18:11	40.46	40.13	5.2	66.53	4.7	1.42
4	2 E	20-Jun-89	18:14	40.46	39.75	5.0	66.53	4.5	1.36
5	2 F	20-Jun-89	18:16	40.46	39.38	5.6	66.53	5.1	1.55
6	2 G	20-Jun-89	18:18	40.46	39.00	5.5	66.53	5.0	1.51
7	2 H	20-Jun-89	18:20	40.46	38.63	5.7	66.53	5.2	1.58
8	2 I	20-Jun-89	18:22	40.46	38.25	6.0	66.53	5.5	1.67
9	2 J	20-Jun-89	18:26	40.46	37.88	5.2	66.53	4.7	1.42
10	2 K	20-Jun-89	18:29	40.46	37.50	5.1	66.53	4.6	1.39
11	2 L	20-Jun-89	18:35	40.46	37.13	4.7	66.53	4.2	1.27
12	2 M	20-Jun-89	18:37	40.46	36.75	5.0	66.53	4.5	1.36
13	2 N	20-Jun-89	18:40	40.46	36.38	4.3	66.53	3.8	1.15
14	3 B	20-Jun-89	14:09	40.13	40.88	3.6	66.40	3.2	0.98
15	3 C	20-Jun-89	14:08	40.13	40.50	3.3	66.40	2.9	0.88
16	3 D	20-Jun-89	14:07	40.13	40.13	4.6	66.40	4.2	1.28
17	3 E	20-Jun-89	14:06	40.13	39.75	4.6	66.40	4.2	1.28
18	3 F	20-Jun-89	14:05	40.13	39.38	4.9	66.40	4.5	1.37
19	3 G	20-Jun-89	14:04	40.13	39.00	5.3	66.40	4.9	1.49
20	3 H	20-Jun-89	14:03	40.13	38.63	5.5	66.40	5.1	1.55
21	3 I	20-Jun-89	14:02	40.13	38.25	5.6	66.40	5.2	1.58
22	3 J	20-Jun-89	14:01	40.13	37.88	5.7	66.40	5.3	1.62
23	3 K	20-Jun-89	14:00	40.13	37.50	5.5	66.40	5.1	1.55
24	3 L	20-Jun-89	13:59	40.13	37.13	5.6	66.40	5.2	1.58
25	3 M	20-Jun-89	13:58	40.13	36.75	5.2	66.40	4.8	1.46
26	3 N	20-Jun-89	13:57	40.13	36.38	4.4	66.40	4.0	1.22
27	3 O	20-Jun-89	13:56	40.13	36.00	4.2	66.40	3.8	1.16
28	4 B	20-Jun-89	13:29	39.80	40.88	2.4	66.35	2.1	0.62
29	4 C	20-Jun-89	13:37	39.80	40.50	4.6	66.35	4.3	1.30
30	4 D	20-Jun-89	13:38	39.80	40.13	4.3	66.35	4.0	1.20
31	4 E	20-Jun-89	13:39	39.80	39.75	4.7	66.35	4.4	1.33
32	4 F	20-Jun-89	13:40	39.80	39.38	5.0	66.35	4.7	1.42
33	4 G	20-Jun-89	13:41	39.80	39.00	5.3	66.35	5.0	1.51
34	4 H	20-Jun-89	13:42	39.80	38.63	5.5	66.35	5.2	1.57
35	4 I	20-Jun-89	13:44	39.80	38.25	5.6	66.35	5.3	1.60
36	4 J	20-Jun-89	13:45	39.80	37.88	6.1	66.35	5.8	1.75
37	4 K	20-Jun-89	13:46	39.80	37.50	5.7	66.35	5.4	1.63
38	4 L	20-Jun-89	13:47	39.80	37.13	5.6	66.35	5.3	1.60
39	4 M	20-Jun-89	13:47	39.80	36.75	5.1	66.35	4.8	1.45
40	4 N	20-Jun-89	13:48	39.80	36.38	4.7	66.35	4.4	1.33
41	4 O	20-Jun-89	13:49	39.80	36.00	4.6	66.35	4.3	1.30
42	4 P	20-Jun-89	13:51	39.80	35.63	3.9	66.35	3.6	1.08
43	5 B	20-Jun-89	09:00	39.48	40.88	3.6	66.35	3.3	0.99
44	5 C	20-Jun-89	09:12	39.48	40.50	4.7	66.35	4.4	1.33
45	5 D	20-Jun-89	09:13	39.48	40.13	4.6	66.35	4.3	1.30
46	5 E	20-Jun-89	09:15	39.48	39.75	4.7	66.35	4.4	1.33
47	5 F	20-Jun-89	09:16	39.48	39.38	4.6	66.35	4.3	1.30
48	5 G	20-Jun-89	09:17	39.48	39.00	5.4	66.35	5.1	1.54
49	5 H	20-Jun-89	09:18	39.48	38.63	5.6	66.35	5.3	1.60

Table 2 Lake Apopka Bathymetry Data Collected June 20-21, 1989.

No.	Grid Point	Date	Time	N Lat 28 Deg (Min)	W Lon 81 Deg (Min)	Calib. Depth (ft)	Lake Level (ft)	Corr. Depth (ft)	Corr. Depth (m)
50	5 I	20-Jun-89	09:20	39.48	38.25	5.6	66.35	5.3	1.60
51	5 J	20-Jun-89	09:21	39.48	37.88	5.8	66.35	5.5	1.66
52	5 K	20-Jun-89	09:22	39.48	37.50	6.2	66.35	5.9	1.78
53	5 L	20-Jun-89	09:23	39.48	37.13	6.0	66.35	5.7	1.72
54	5 M	20-Jun-89	09:24	39.48	36.75	5.4	66.35	5.1	1.54
55	5 N	20-Jun-89	09:25	39.48	36.38	5.1	66.35	4.8	1.45
56	5 O	20-Jun-89	09:27	39.48	36.00	5.6	66.35	5.3	1.60
57	5 P	20-Jun-89	09:28	39.48	35.63	4.6	66.35	4.3	1.30
58	6 B	20-Jun-89	09:48	39.15	40.88	4.5	66.35	4.2	1.26
59	6 C	20-Jun-89	09:47	39.15	40.50	4.6	66.35	4.3	1.30
60	6 D	20-Jun-89	09:46	39.15	40.13	4.6	66.35	4.3	1.30
61	6 E	20-Jun-89	09:45	39.15	39.75	4.7	66.35	4.4	1.33
62	6 F	20-Jun-89	09:44	39.15	39.38	5.5	66.35	5.2	1.57
63	6 G	20-Jun-89	09:43	39.15	39.00	5.6	66.35	5.3	1.60
64	6 H	20-Jun-89	09:42	39.15	38.63	5.6	66.35	5.3	1.60
65	6 I	20-Jun-89	09:41	39.15	38.25	5.6	66.35	5.3	1.60
66	6 J	20-Jun-89	09:40	39.15	37.88	5.7	66.35	5.4	1.63
67	6 K	20-Jun-89	09:39	39.15	37.50	5.4	66.35	5.1	1.54
68	6 L	20-Jun-89	09:37	39.15	37.13	5.4	66.35	5.1	1.54
69	6 M	20-Jun-89	09:36	39.15	36.75	5.3	66.35	5.0	1.51
70	6 N	20-Jun-89	09:35	39.15	36.38	5.3	66.35	5.0	1.51
71	6 O	20-Jun-89	09:34	39.15	36.00	5.2	66.35	4.9	1.48
72	6 P	20-Jun-89	09:33	39.15	35.63	6.6	66.35	6.3	1.91
73	7 A	20-Jun-89	09:55	38.82	41.25	3.0	66.35	2.7	0.81
74	7 B	20-Jun-89	09:56	38.82	40.88	4.7	66.35	4.4	1.33
75	7 C	20-Jun-89	09:57	38.82	40.50	4.6	66.35	4.3	1.30
76	7 D	20-Jun-89	09:58	38.82	40.13	4.8	66.35	4.5	1.36
77	7 E	20-Jun-89	09:59	38.82	39.75	4.8	66.35	4.5	1.36
78	7 F	20-Jun-89	10:01	38.82	39.38	5.6	66.35	5.3	1.60
79	7 G	20-Jun-89	10:02	38.82	39.00	5.4	66.35	5.1	1.54
80	7 H	20-Jun-89	10:03	38.82	38.63	5.7	66.35	5.4	1.63
81	7 I	20-Jun-89	10:04	38.82	38.25	5.8	66.35	5.5	1.66
82	7 J	20-Jun-89	10:05	38.82	37.88	5.7	66.35	5.4	1.63
83	7 K	20-Jun-89	10:06	38.82	37.50	5.6	66.35	5.3	1.60
84	7 L	20-Jun-89	10:07	38.82	37.13	5.4	66.35	5.1	1.54
85	7 M	20-Jun-89	10:08	38.82	36.75	5.2	66.35	4.9	1.48
86	7 N	20-Jun-89	10:09	38.82	36.38	5.5	66.35	5.2	1.57
87	7 O	20-Jun-89	10:10	38.82	36.00	5.6	66.35	5.3	1.60
88	7 P	20-Jun-89	10:11	38.82	35.63	6.7	66.35	6.4	1.94
89	7 Q	20-Jun-89	10:12	38.82	35.25	7.1	66.35	6.8	2.06
90	7 R	20-Jun-89	10:13	38.82	34.88	5.5	66.35	5.2	1.57
91	7 S	20-Jun-89	10:14	38.82	34.50	4.6	66.35	4.3	1.30
92	8 A	20-Jun-89	10:45	38.49	41.25	4.0	66.35	3.7	1.11
93	8 B	20-Jun-89	10:44	38.49	40.88	4.3	66.35	4.0	1.20
94	8 C	20-Jun-89	10:43	38.49	40.50	4.6	66.35	4.3	1.30
95	8 D	20-Jun-89	10:42	38.49	40.13	4.6	66.35	4.3	1.30
96	8 E	20-Jun-89	10:41	38.49	39.75	4.6	66.35	4.3	1.30
97	8 F	20-Jun-89	10:40	38.49	39.38	10.0	66.35	9.7	2.94
98	8 G	20-Jun-89	10:38	38.49	39.00	5.8	66.35	5.5	1.66

Table 2 Lake Apopka Bathymetry Data Collected June 20-21, 1989.

No.	Grid Point	Date	Time	N Lat 28 Deg (Min)	W Lon 81 Deg (Min)	Calib. Depth (ft)	Lake Level (ft)	Corr. Depth (ft)	Corr. Depth (m)
99	8 H	20-Jun-89	10:37	38.49	38.63	5.5	66.35	5.2	1.57
100	8 I	20-Jun-89	10:36	38.49	38.25	5.7	66.35	5.4	1.63
101	8 J	20-Jun-89	10:35	38.49	37.88	5.6	66.35	5.3	1.60
102	8 K	20-Jun-89	10:34	38.49	37.50	5.5	66.35	5.2	1.57
103	8 L	20-Jun-89	10:33	38.49	37.13	5.5	66.35	5.2	1.57
104	8 M	20-Jun-89	10:32	38.49	36.75	5.5	66.35	5.2	1.57
105	8 N	20-Jun-89	10:31	38.49	36.38	5.6	66.35	5.3	1.60
106	8 O	20-Jun-89	10:30	38.49	36.00	5.9	66.35	5.6	1.69
107	8 P	20-Jun-89	10:29	38.49	35.63	6.7	66.35	6.4	1.94
108	8 Q	20-Jun-89	10:28	38.49	35.25	6.6	66.35	6.3	1.91
109	8 R	20-Jun-89	10:27	38.49	34.88	6.5	66.35	6.2	1.87
110	8 S	20-Jun-89	10:26	38.49	34.50	5.6	66.35	5.3	1.60
111	8 T	20-Jun-89	10:25	38.49	34.13	5.7	66.35	5.4	1.63
112	8 U	20-Jun-89	10:19	38.49	33.75	3.2	66.35	2.9	0.87
113	9 A	20-Jun-89	11:02	38.16	41.25	2.8	66.35	2.5	0.75
114	9 B	20-Jun-89	11:03	38.16	40.88	4.2	66.35	3.9	1.17
115	9 C	20-Jun-89	11:05	38.16	40.50	4.3	66.35	4.0	1.20
116	9 D	20-Jun-89	11:06	38.16	40.13	4.2	66.35	3.9	1.17
117	9 E	20-Jun-89	11:07	38.16	39.75	4.8	66.35	4.5	1.36
118	9 F	20-Jun-89	11:08	38.16	39.38	5.1	66.35	4.8	1.45
119	9 G	20-Jun-89	11:09	38.16	39.00	9.0	66.35	8.7	2.64
120	9 H	20-Jun-89	11:10	38.16	38.63	5.2	66.35	4.9	1.48
121	9 I	20-Jun-89	11:11	38.16	38.25	5.7	66.35	5.4	1.63
122	9 J	20-Jun-89	11:12	38.16	37.88	5.6	66.35	5.3	1.60
123	9 K	20-Jun-89	11:13	38.16	37.50	5.5	66.35	5.2	1.57
124	9 L	20-Jun-89	11:14	38.16	37.13	5.6	66.35	5.3	1.60
125	9 M	20-Jun-89	11:15	38.16	36.75	5.6	66.35	5.3	1.60
126	9 N	20-Jun-89	11:16	38.16	36.38	5.8	66.35	5.5	1.66
127	9 O	20-Jun-89	11:17	38.16	36.00	6.5	66.35	6.2	1.87
128	9 P	20-Jun-89	11:18	38.16	35.63	5.7	66.35	5.4	1.63
129	9 Q	20-Jun-89	11:19	38.16	35.25	5.6	66.35	5.3	1.60
130	9 R	20-Jun-89	11:19	38.16	34.88	4.9	66.35	4.6	1.39
131	9 S	20-Jun-89	11:20	38.16	34.50	4.8	66.35	4.5	1.36
132	9 T	20-Jun-89	11:21	38.16	34.13	4.6	66.35	4.3	1.30
133	9 U	20-Jun-89	11:22	38.16	33.75	3.6	66.35	3.3	0.99
134	9 V	20-Jun-89	11:23	38.16	33.38	2.4	66.35	2.1	0.62
135	10 A	20-Jun-89	12:08	37.83	41.25	4.3	66.37	3.9	1.20
136	10 B	20-Jun-89	12:07	37.83	40.88	4.0	66.37	3.6	1.11
137	10 C	20-Jun-89	12:06	37.83	40.50	3.8	66.37	3.4	1.05
138	10 D	20-Jun-89	12:05	37.83	40.13	4.7	66.37	4.3	1.32
139	10 E	20-Jun-89	12:04	37.83	39.75	5.1	66.37	4.7	1.44
140	10 F	20-Jun-89	12:03	37.83	39.38	5.2	66.37	4.8	1.47
141	10 G	20-Jun-89	12:02	37.83	39.00	8.9	66.37	8.5	2.60
142	10 H	20-Jun-89	12:01	37.83	38.63	7.7	66.37	7.3	2.23
143	10 I	20-Jun-89	12:00	37.83	38.25	5.6	66.37	5.2	1.59
144	10 J	20-Jun-89	11:59	37.83	37.88	5.6	66.37	5.2	1.59
145	10 K	20-Jun-89	11:58	37.83	37.50	5.3	66.37	4.9	1.50
146	10 L	20-Jun-89	11:57	37.83	37.13	5.4	66.37	5.0	1.53
147	10 M	20-Jun-89	11:55	37.83	36.75	5.5	66.37	5.1	1.56

Table 2 Lake Apopka Bathymetry Data Collected June 20-21, 1989.

No.	Grid Point	Date	Time	N Lat 28 Deg (Min)	W Lon 81 Deg (Min)	Calib. Depth (ft)	Lake Level (ft)	Corr. Depth (ft)	Corr. Depth (m)
148	10 N	20-Jun-89	11:54	37.83	36.38	5.6	66.37	5.2	1.59
149	10 O	20-Jun-89	11:53	37.83	36.00	5.5	66.37	5.1	1.56
150	10 P	20-Jun-89	11:52	37.83	35.63	5.5	66.37	5.1	1.56
151	10 Q	20-Jun-89	11:51	37.83	35.25	5.0	66.37	4.6	1.41
152	10 R	20-Jun-89	11:50	37.83	34.88	4.7	66.37	4.3	1.32
153	10 S	20-Jun-89	11:49	37.83	34.50	5.3	66.37	4.9	1.50
154	10 T	20-Jun-89	11:48	37.83	34.13	5.1	66.37	4.7	1.44
155	10 U	20-Jun-89	11:47	37.83	33.75	3.7	66.37	3.3	1.01
156	10 V	20-Jun-89	11:43	37.83	33.38	2.6	66.37	2.2	0.68
157	11 A	20-Jun-89	12:17	37.50	41.25	1.6	66.37	1.2	0.37
158	11 B	20-Jun-89	12:20	37.50	40.88	3.7	66.37	3.3	1.01
159	11 C	20-Jun-89	12:21	37.50	40.50	7.6	66.37	7.2	2.20
160	11 D	20-Jun-89	12:22	37.50	40.13	5.5	66.37	5.1	1.56
161	11 E	20-Jun-89	12:23	37.50	39.75	5.6	66.37	5.2	1.59
162	11 F	20-Jun-89	12:24	37.50	39.38	5.5	66.37	5.1	1.56
163	11 G	20-Jun-89	12:25	37.50	39.00	5.2	66.37	4.8	1.47
164	11 H	20-Jun-89	12:27	37.50	38.63	9.8	66.37	9.4	2.87
165	11 I	20-Jun-89	12:28	37.50	38.25	5.9	66.37	5.5	1.69
166	11 J	20-Jun-89	12:29	37.50	37.88	5.5	66.37	5.1	1.56
167	11 K	20-Jun-89	12:30	37.50	37.50	5.1	66.37	4.7	1.44
168	11 L	20-Jun-89	12:31	37.50	37.13	5.6	66.37	5.2	1.59
169	11 M	20-Jun-89	12:32	37.50	36.75	5.5	66.37	5.1	1.56
170	11 N	20-Jun-89	12:33	37.50	36.38	5.4	66.37	5.0	1.53
171	11 O	20-Jun-89	12:34	37.50	36.00	5.4	66.37	5.0	1.53
172	11 P	20-Jun-89	12:35	37.50	35.63	5.2	66.37	4.8	1.47
173	11 Q	20-Jun-89	12:36	37.50	35.25	4.9	66.37	4.5	1.38
174	11 R	20-Jun-89	12:37	37.50	34.88	4.7	66.37	4.3	1.32
175	11 S	20-Jun-89	12:38	37.50	34.50	5.2	66.37	4.8	1.47
176	11 T	20-Jun-89	12:39	37.50	34.13	7.9	66.37	7.5	2.30
177	11 U	20-Jun-89	12:40	37.50	33.75	3.6	66.37	3.2	0.98
178	11 V	20-Jun-89	12:41	37.50	33.38	3.6	66.37	3.2	0.98
179	12 C	20-Jun-89	13:07	37.17	40.50	10.3	66.33	10.0	3.04
180	12 D	20-Jun-89	13:03	37.17	40.13	4.8	66.33	4.5	1.36
181	12 E	20-Jun-89	13:02	37.17	39.75	5.1	66.33	4.8	1.45
182	12 F	20-Jun-89	13:01	37.17	39.38	5.3	66.33	5.0	1.51
183	12 G	20-Jun-89	13:00	37.17	39.00	5.6	66.33	5.3	1.61
184	12 H	20-Jun-89	12:59	37.17	38.63	5.3	66.33	5.0	1.51
185	12 I	20-Jun-89	12:58	37.17	38.25	10.7	66.33	10.4	3.16
186	12 J	20-Jun-89	12:57	37.17	37.88	8.9	66.33	8.6	2.61
187	12 K	20-Jun-89	12:56	37.17	37.50	5.4	66.33	5.1	1.55
188	12 L	20-Jun-89	12:55	37.17	37.13	5.5	66.33	5.2	1.58
189	12 M	20-Jun-89	12:54	37.17	36.75	5.4	66.33	5.1	1.55
190	12 N	20-Jun-89	12:53	37.17	36.38	5.4	66.33	5.1	1.55
191	12 O	20-Jun-89	12:52	37.17	36.00	5.2	66.33	4.9	1.48
192	12 P	20-Jun-89	12:51	37.17	35.63	4.9	66.33	4.6	1.39
193	12 Q	20-Jun-89	12:50	37.17	35.25	4.9	66.33	4.6	1.39
194	12 R	20-Jun-89	12:49	37.17	34.88	4.6	66.33	4.3	1.30
195	12 S	20-Jun-89	12:48	37.17	34.50	4.4	66.33	4.1	1.24
196	12 T	20-Jun-89	12:47	37.17	34.13	9.2	66.33	8.9	2.70

Table 2 Lake Apopka Bathymetry Data Collected June 20-21, 1989.

No.	Grid Point	Date	Time	N Lat 28 Deg (Min)	W Lon 81 Deg (Min)	Calib. Depth (ft)	Lake Level (ft)	Corr. Depth (ft)	Corr. Depth (m)
197	12 U	20-Jun-89	12:45	37.17	33.75	5.6	66.33	5.3	1.61
198	12 V	20-Jun-89	12:44	37.17	33.38	3.3	66.33	3.0	0.91
199	13 C	21-Jun-89	09:03	36.8739	40.50	4.1	66.33	3.8	1.15
200	13 D	21-Jun-89	09:04	36.87	40.13	5.2	66.33	4.9	1.48
201	13 E	21-Jun-89	09:06	36.87	39.75	5.2	66.33	4.9	1.48
202	13 F	21-Jun-89	09:07	36.87	39.38	5.2	66.33	4.9	1.48
203	13 G	21-Jun-89	09:08	36.87	39.00	5.2	66.33	4.9	1.48
204	13 H	21-Jun-89	09:09	36.87	38.63	5.2	66.33	4.9	1.48
205	13 I	21-Jun-89	09:10	36.87	38.25	5.3	66.33	5.0	1.51
206	13 J	21-Jun-89	09:11	36.87	37.88	9.9	66.33	9.6	2.92
207	13 K	21-Jun-89	09:12	36.87	37.50	9.9	66.33	9.6	2.92
208	13 L	21-Jun-89	09:13	36.87	37.13	6.4	66.33	6.1	1.85
209	13 M	21-Jun-89	09:14	36.87	36.75	5.4	66.33	5.1	1.55
210	13 N	21-Jun-89	09:15	36.87	36.38	5.1	66.33	4.8	1.45
211	13 O	21-Jun-89	09:16	36.87	36.00	4.5	66.33	4.2	1.27
212	13 P	21-Jun-89	09:17	36.87	35.63	5.0	66.33	4.7	1.42
213	13 Q	21-Jun-89	09:18	36.87	35.25	6.3	66.33	6.0	1.82
214	13 R	21-Jun-89	09:19	36.87	34.88	7.5	66.33	7.2	2.19
215	13 S	21-Jun-89	09:20	36.87	34.50	8.7	66.33	8.4	2.55
216	13 T	21-Jun-89	09:21	36.87	34.13	5.2	66.33	4.9	1.48
217	13 U	21-Jun-89	09:22	36.87	33.75	4.6	66.33	4.3	1.30
218	14 D	21-Jun-89	09:46	36.55	40.13	12.2	66.32	11.9	3.62
219	14 E	21-Jun-89	09:45	36.55	39.75	4.9	66.32	4.6	1.40
220	14 F	21-Jun-89	09:44	36.55	39.38	4.3	66.32	4.0	1.21
221	14 G	21-Jun-89	09:43	36.55	39.00	5.0	66.32	4.7	1.43
222	14 H	21-Jun-89	09:42	36.55	38.63	5.0	66.32	4.7	1.43
223	14 I	21-Jun-89	09:40	36.55	38.25	5.1	66.32	4.8	1.46
224	14 J	21-Jun-89	09:39	36.55	37.88	4.5	66.32	4.2	1.27
225	14 K	21-Jun-89	09:38	36.55	37.50	4.9	66.32	4.6	1.40
226	14 L	21-Jun-89	09:37	36.55	37.13	8.9	66.32	8.6	2.62
227	14 M	21-Jun-89	09:36	36.55	36.75	9.2	66.32	8.9	2.71
228	14 N	21-Jun-89	09:35	36.55	36.38	8.2	66.32	7.9	2.40
229	14 O	21-Jun-89	09:34	36.55	36.00	8.2	66.32	7.9	2.40
230	14 P	21-Jun-89	09:32	36.55	35.63	8.4	66.32	8.1	2.46
231	14 Q	21-Jun-89	09:30	36.55	35.25	7.9	66.32	7.6	2.31
232	14 R	21-Jun-89	09:29	36.55	34.88	6.7	66.32	6.4	1.94
233	14 S	21-Jun-89	09:28	36.55	34.50	4.5	66.32	4.2	1.27
234	14 T	21-Jun-89	09:27	36.55	34.13	4.5	66.32	4.2	1.27
235	14 U	21-Jun-89	09:26	36.55	33.75	0.2	66.32	-0.1	-0.04
236	15 E	21-Jun-89	09:50	36.22	39.75	4.8	66.32	4.5	1.37
237	15 F	21-Jun-89	09:51	36.22	39.38	4.3	66.32	4.0	1.21
238	15 G	21-Jun-89	09:52	36.22	39.00	5.0	66.32	4.7	1.43
239	15 H	21-Jun-89	09:54	36.22	38.63	5.2	66.32	4.9	1.49
240	15 I	21-Jun-89	09:55	36.22	38.25	5.5	66.32	5.2	1.58
241	15 J	21-Jun-89	09:56	36.22	37.88	7.6	66.32	7.3	2.22
242	15 K	21-Jun-89	09:57	36.22	37.50	5.9	66.32	5.6	1.70
243	15 L	21-Jun-89	09:58	36.22	37.13	4.2	66.32	3.9	1.18
244	15 M	21-Jun-89	09:59	36.22	36.75	8.0	66.32	7.7	2.34
245	15 N	21-Jun-89	10:00	36.22	36.38	8.0	66.32	7.7	2.34

Table 2 Lake Apopka Bathymetry Data Collected June 20-21, 1989.

No.	Grid Point	Date	Time	N Lat 28 Deg (Min)	W Lon 81 Deg (Min)	Calib. Depth (ft)	Lake Level (ft)	Corr. Depth (ft)	Corr. Depth (m)
246	15 O	21-Jun-89	10:01	36.22	36.00	8.1	66.32	7.8	2.37
247	15 P	21-Jun-89	10:02	36.22	35.63	5.2	66.32	4.9	1.49
248	15 Q	21-Jun-89	10:03	36.22	35.25	5.0	66.32	4.7	1.43
249	15 R	21-Jun-89	10:04	36.22	34.88	5.2	66.32	4.9	1.49
250	15 S	21-Jun-89	10:05	36.22	34.50	3.8	66.32	3.5	1.06
251	15 T	21-Jun-89	10:06	36.22	34.13	5.3	66.32	5.0	1.52
252	16 E	21-Jun-89	10:24	35.89	39.75	9.4	66.34	9.1	2.76
253	16 F	21-Jun-89	10:23	35.89	39.38	5.6	66.34	5.3	1.60
254	16 G	21-Jun-89	10:22	35.89	39.00	4.9	66.34	4.6	1.39
255	16 H	21-Jun-89	10:21	35.89	38.63	5.9	66.34	5.6	1.69
256	16 I	21-Jun-89	10:20	35.89	38.25	7.9	66.34	7.6	2.30
257	16 J	21-Jun-89	10:19	35.89	37.88	7.9	66.34	7.6	2.30
258	16 K	21-Jun-89	10:18	35.89	37.50	3.8	66.34	3.5	1.05
259	16 L	21-Jun-89	10:17	35.89	37.13	5.0	66.34	4.7	1.42
260	16 M	21-Jun-89	10:16	35.89	36.75	4.9	66.34	4.6	1.39
261	16 N	21-Jun-89	10:15	35.89	36.38	5.2	66.34	4.9	1.48
262	16 O	21-Jun-89	10:14	35.89	36.00	5.1	66.34	4.8	1.45
263	16 P	21-Jun-89	10:13	35.89	35.63	4.8	66.34	4.5	1.36
264	16 Q	21-Jun-89	10:12	35.89	35.25	4.5	66.34	4.2	1.27
265	16 R	21-Jun-89	10:11	35.89	34.88	5.9	66.34	5.6	1.69
266	17 G	21-Jun-89	10:30	35.57	39.00	6.0	66.34	5.7	1.73
267	17 H	21-Jun-89	10:31	35.57	38.63	5.0	66.34	4.7	1.42
268	17 I	21-Jun-89	10:32	35.57	38.25	8.8	66.34	8.5	2.58
269	17 J	21-Jun-89	10:33	35.57	37.88	4.2	66.34	3.9	1.18
270	17 K	21-Jun-89	10:34	35.57	37.50	4.2	66.34	3.9	1.18
271	17 L	21-Jun-89	10:35	35.57	37.13	4.5	66.34	4.2	1.27
272	17 M	21-Jun-89	10:36	35.57	36.75	4.3	66.34	4.0	1.21
273	17 N	21-Jun-89	10:37	35.57	36.38	4.4	66.34	4.1	1.24
274	17 O	21-Jun-89	10:38	35.57	36.00	4.2	66.34	3.9	1.18
275	17 P	21-Jun-89	10:39	35.57	35.63	4.2	66.34	3.9	1.18
276	17 Q	21-Jun-89	10:40	35.57	35.25	4.1	66.34	3.8	1.15
277	17 R	21-Jun-89	10:41	35.57	34.88	5.3	66.34	5.0	1.51
278	18 H	21-Jun-89	10:57	35.24	38.63	5.9	66.36	5.5	1.69
279	18 I	21-Jun-89	10:56	35.24	38.25	8.2	66.36	7.8	2.39
280	18 J	21-Jun-89	10:55	35.24	37.88	4.6	66.36	4.2	1.29
281	18 K	21-Jun-89	10:54	35.24	37.50	4.3	66.36	3.9	1.20
282	18 L	21-Jun-89	10:53	35.24	37.13	4.1	66.36	3.7	1.14
283	18 M	21-Jun-89	10:52	35.24	36.75	4.1	66.36	3.7	1.14
284	18 N	21-Jun-89	10:50	35.24	36.38	4.2	66.36	3.8	1.17
285	18 O	21-Jun-89	10:49	35.24	36.00	4.1	66.36	3.7	1.14
286	18 P	21-Jun-89	10:48	35.24	35.63	3.6	66.36	3.2	0.99
287	18 Q	21-Jun-89	10:47	35.24	35.25	3.2	66.36	2.8	0.87
288	19 H	21-Jun-89	11:16	34.91	38.63	6.2	66.36	5.8	1.78
289	19 I	21-Jun-89	11:17	34.91	38.25	4.8	66.36	4.4	1.35
290	19 J	21-Jun-89	11:18	34.91	37.88	4.9	66.36	4.5	1.38
291	19 K	21-Jun-89	11:19	34.91	37.50	4.2	66.36	3.8	1.17
292	19 L	21-Jun-89	11:20	34.91	37.13	4.0	66.36	3.6	1.11
293	19 M	21-Jun-89	11:21	34.91	36.75	3.9	66.36	3.5	1.08
294	19 N	21-Jun-89	11:22	34.91	36.38	4.0	66.36	3.6	1.11

Table 2 Lake Apopka Bathymetry Data Collected June 20-21, 1989.

No.	Grid Point	Date	Time	N Lat 28 Deg (Min)	W Lon 81 Deg (Min)	Calib. Depth (ft)	Lake Level (ft)	Corr. Depth (ft)	Corr. Depth (m)
295	19 O	21-Jun-89	11:23	34.91	36.00	3.5	66.36	3.1	0.96
296	19 P	21-Jun-89	11:24	34.91	35.63	3.2	66.36	2.8	0.87
297	19 Q	21-Jun-89	11:25	34.91	35.25	2.8	66.36	2.4	0.74
298	20 G	21-Jun-89	12:05	34.58	39.00	6.2	66.35	5.9	1.78
299	20 H	21-Jun-89	12:04	34.58	38.63	4.7	66.35	4.4	1.33
300	20 I	21-Jun-89	12:03	34.58	38.25	5.3	66.35	5.0	1.51
301	20 J	21-Jun-89	12:02	34.58	37.88	4.5	66.35	4.2	1.26
302	20 K	21-Jun-89	12:02	34.58	37.50	3.9	66.35	3.6	1.08
303	20 L	21-Jun-89	12:01	34.58	37.13	3.7	66.35	3.4	1.02
304	20 M	21-Jun-89	12:00	34.58	36.75	3.7	66.35	3.4	1.02
305	20 N	21-Jun-89	11:59	34.58	36.38	4.0	66.35	3.7	1.11
306	20 O	21-Jun-89	11:58	34.58	36.00	3.1	66.35	2.8	0.84
307	20 P	21-Jun-89	11:57	34.58	35.63	2.9	66.35	2.6	0.78
308	21 G	21-Jun-89	12:13	34.26	39.00	8.5	66.36	8.1	2.48
309	21 H	21-Jun-89	12:14	34.26	38.63	4.5	66.36	4.1	1.26
310	21 I	21-Jun-89	12:15	34.26	38.25	4.4	66.36	4.0	1.23
311	21 J	21-Jun-89	12:16	34.26	37.88	4.2	66.36	3.8	1.17
312	21 K	21-Jun-89	12:17	34.26	37.50	3.9	66.36	3.5	1.08
313	21 L	21-Jun-89	12:18	34.26	37.13	3.4	66.36	3.0	0.93
314	21 M	21-Jun-89	12:19	34.26	36.75	4.0	66.36	3.6	1.11
315	21 N	21-Jun-89	12:20	34.26	36.38	5.8	66.36	5.4	1.66
316	21 O	21-Jun-89	12:21	34.26	36.00	9.2	66.36	8.8	2.69
317	21.5 B'	21-Jun-89	13:46	34.09	40.69	4.2	66.36	3.8	1.17
318	22 B'	21-Jun-89	13:42	33.93	40.69	5.0	66.36	4.6	1.41
319	22 C	21-Jun-89	13:43	33.93	40.50	4.2	66.36	3.8	1.17
320	22 F	21-Jun-89	12:39	33.93	39.38	2.5	66.36	2.1	0.65
321	22 F'	21-Jun-89	12:38	33.93	39.19	4.3	66.36	3.9	1.20
322	22 G	21-Jun-89	12:38	33.93	39.00	5.2	66.36	4.8	1.48
323	22 H	21-Jun-89	12:37	33.93	38.63	6.9	66.36	6.5	1.99
324	22 I	21-Jun-89	12:36	33.93	38.25	4.5	66.36	4.1	1.26
325	22 J	21-Jun-89	12:35	33.93	37.88	3.9	66.36	3.5	1.08
326	22 K	21-Jun-89	12:34	33.93	37.50	5.0	66.36	4.6	1.41
327	22 L	21-Jun-89	12:33	33.93	37.13	12.9	66.36	12.5	3.82
328	22 M	21-Jun-89	12:31	33.93	36.75	16.1	66.36	15.7	4.80
329	22.5 C	21-Jun-89	13:34	33.77	40.50	6.3	66.36	5.9	1.81
330	22.5 C'	21-Jun-89	13:31	33.77	40.31	6.4	66.36	6.0	1.84
331	22.5 E'	21-Jun-89	12:47	33.77	39.56	4.0	66.36	3.6	1.11
332	22.5 F	21-Jun-89	12:46	33.77	39.38	4.1	66.36	3.7	1.14
333	22.5 F'	21-Jun-89	12:46	33.77	39.19	4.8	66.36	4.4	1.35
334	22.5 G	21-Jun-89	12:45	33.77	39.00	5.0	66.36	4.6	1.41
335	23 C'	21-Jun-89	13:03	33.60	40.31	6.4	66.36	6.0	1.84
336	23 D	21-Jun-89	13:03	33.60	40.13	6.9	66.36	6.5	1.99
337	23 D'	21-Jun-89	13:04	33.60	39.94	6.4	66.36	6.0	1.84
338	23 E	21-Jun-89	12:58	33.60	39.75	5.8	66.36	5.4	1.66
339	23 E'	21-Jun-89	12:57	33.60	39.56	5.1	66.36	4.7	1.44
340	23 F	21-Jun-89	12:57	33.60	39.38	4.7	66.36	4.3	1.32
341	23 F'	21-Jun-89	12:56	33.60	39.19	4.3	66.36	3.9	1.20
342	23 G	21-Jun-89	12:56	33.60	39.00	3.3	66.36	2.9	0.90
343	23.5 D'	21-Jun-89	13:18	33.44	39.94	5.8	66.36	5.4	1.66

Table 2 Lake Apopka Bathymetry Data Collected June 20-21, 1989.

No.	Grid Point	Date	Time	N Lat 28 Deg (Min)	W Lon 81 Deg (Min)	Calib. Depth (ft)	Lake Level (ft)	Corr. Depth (ft)	Corr. Depth (m)
344	23.5 E	21-Jun-89	13:17	33.44	39.75	4.6	66.36	4.2	1.29
345	23.5 E'	21-Jun-89	13:16	33.44	39.56	4.7	66.36	4.3	1.32
346	23.5 F	21-Jun-89	13:16	33.44	39.38	4.2	66.36	3.8	1.17
347	23.5 F'	21-Jun-89	13:15	33.44	39.19	3.2	66.36	2.8	0.87

Source: ECT, 1989.