Volumetric Survey of LADY BIRD LAKE

December 2008 Survey

Prepared by:

The Texas Water Development Board

December 2009

Texas Water Development Board

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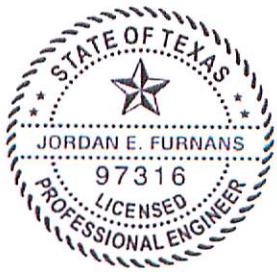

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Executive summary

In September of 2008, the Texas Water Development Board (TWDB) entered into agreement with the City of Austin, to perform a volumetric survey of Lady Bird Lake. Longhorn Dam and Lady Bird Lake are located on the Colorado River in Travis County, inside the city limits of Austin, Texas.

This survey was performed using a single-frequency (200 kHz) depth sounder and Differential Global Positioning System navigation equipment. Data points were collected along pre-planned survey lines spaced at approximately 500 foot intervals perpendicular to the submerged river channel. In areas of interest to the City of Austin, data points were also collected at 100 foot intervals for detailed analysis. Bathymetric data collection occurred on December 4th and December 8th of 2008, while the daily average water surface elevation of the lake ranged between 428.07 and 428.53 feet above mean sea level (NGVD 29). Additional bathymetric data was collected on June 29, 2009 while the daily average water surface elevation of the lake ranged between 427.91 and 427.96 feet above mean sea level (NGVD 29), and on July 6-7, 2009 while the daily average water surface elevation of the lake ranged between 427.77 and 428.66 feet above mean sea level (NGVD 29). The conservation pool elevation for the lake is 429.0 feet above mean sea level (NGVD 29).

Results of the 2008 TWDB volumetric survey indicate Lady Bird Lake has a total reservoir capacity of 7,338 acre-feet and encompasses 471 acres at conservation pool elevation (429 feet above mean sea level, NGVD 29). Lady Bird Lake has been surveyed multiple times since it was impounded. The most recent survey was conducted by TWDB in 1999. Based on the 1999 and current surveys, since 1999 the capacity of Lady Bird Lake has increased approximately 348 acre-feet. To improve estimation of lake capacity and the sediment accumulation rate, TWDB recommends a combined volumetric and sedimentation survey of Lady Bird Lake in approximately 10 years or after a major flood event. In sedimentation surveys, TWDB employs a multi-frequency depth sounder to measure both the water depth and the sediment thickness throughout the lake. In addition to the volumetric survey results similar to those presented within, sedimentation surveys include computed sediment volumes, computed sediment accumulation rates, sediment core samples, and maps identifying the spatial distribution of accumulated sediment throughout the lake.

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Note: *References to brand names throughout this report do not imply endorsement by the Texas Water Development Board*

Introduction

The Texas Water Development Board's (TWDB) Hydrographic Survey Program was authorized by the state legislature in 1991. The Texas Water Code authorizes TWDB to perform surveys to determine reservoir storage capacity, sedimentation levels, rates of sedimentation, and projected water supply availability.

In September of 2008, TWDB entered into agreement (TWDB, 2008) with the City of Austin for the purpose of performing a volumetric survey of Lady Bird Lake. This report describes the methods used in conducting the volumetric survey, including data collection and data processing. This report serves as the final contract deliverable from TWDB to the City of Austin, and contains as deliverables: (1) an elevation-area-capacity table of the lake acceptable to the Texas Commission on Environmental Quality [Appendix A,B], (2) a bottom contour map [Figure 5], and (3) a shaded relief plot of the lake bottom [Figure 3].

Lady Bird Lake general information

Longhorn Dam and Lady Bird Lake are located on the Colorado River (Colorado River Basin) in Travis County, inside the city limits of Austin, Texas. (Figure 1). The City of Austin owns the water rights to Lady Bird Lake and owns, operates, and maintains Longhorn Dam. Construction on Longhorn Dam began in April 1959, with completion and deliberate impoundment beginning in September 1960. The reservoir was originally named Town Lake, but was renamed Lady Bird Lake in 2007 to honor Lady Bird Johnson (COA, 2009a).

Lady Bird Lake serves primarily as water supply storage, but is also valued for recreation and wildlife habitat (COA, 2009a, 2009b). Lady Bird Lake is operated as a pass through reservoir, and is the last reservoir in the Highland Lakes chain on the Colorado River. The Lower Colorado River Authority regulates flow through the reservoir based on seasonal needs and weather conditions. Water released from mid-March to mid-October is mainly used for irrigation downstream. During the rest of the year, water is released primarily to meet the requirements of instream flow needs of the Colorado River and freshwater inflow to Matagorda Bay (COA, 2009a). Additional pertinent data about Longhorn Dam can be found in Table 1.

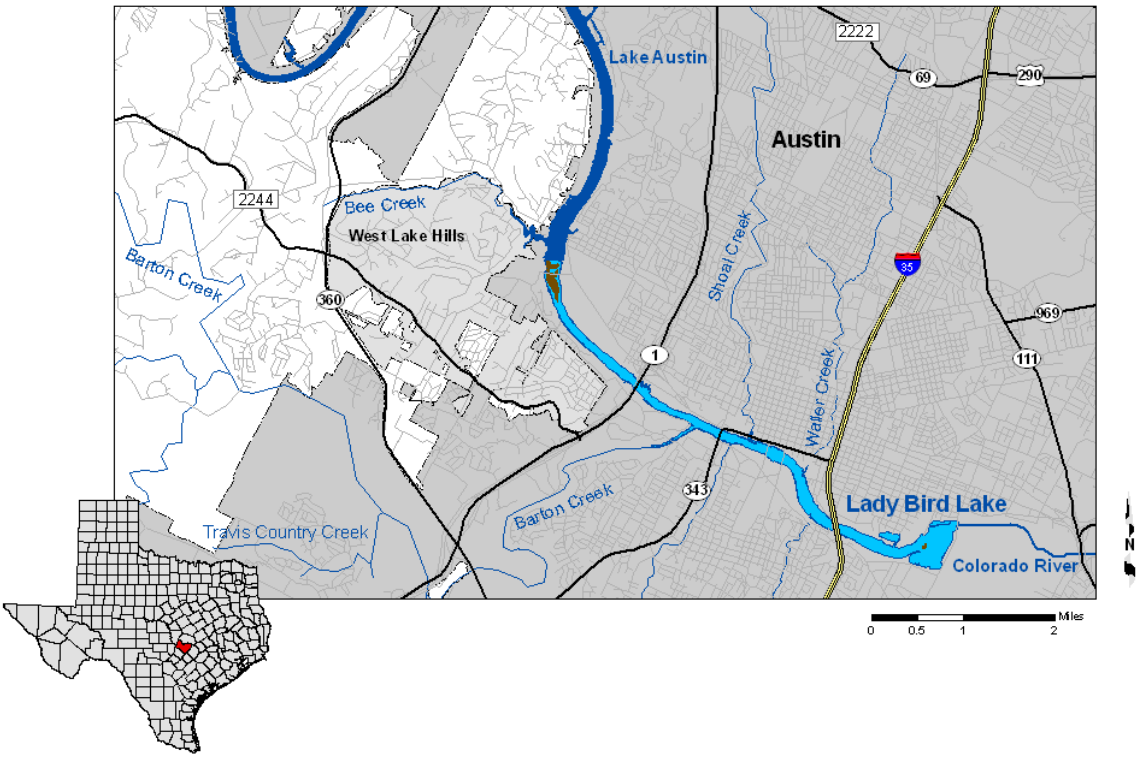


Figure 1: *Location map - Lady Bird Lake*

Table 1. Pertinent data for Longhorn Dam and Lady Bird Lake

Owner

The City of Austin,.

Engineer (design)

Brown and Root, Inc.

Location of dam

On the Colorado River in Travis County, inside the eastern city limits of Austin, Texas.

Drainage area

157.5 square miles.

Dam

Type	Earthen embankment
Length	760 feet (total)
Height	65 feet
Width of Crest	64 feet
Crest Elevation (North Embankment)	464 feet
Crest Elevation (South Embankment)[a]	434 feet

Spillway (service)

Type	Concrete
Length (net)	506 feet
Crest elevation	416 feet above mean sea level at the base of lift gates 420 feet above mean sea level at the base of bascule gates[b]
Control	7 lift gates, each 50 feet by 13 feet
Control (inner bays)	2 bascule gates, each 50 feet by 8 feet

Reservoir data

Feature	Elevation (feet above mean sea level)	Capacity (Acre-feet)	Area (Acres)
Top of Dam (North Embankment)	464.0	N/A	N/A
Top of Dam (South Embankment)	434.0	N/A	N/A
Maximum design water surface	429.0	7,338	471
Spillway Crest	420.0	3,528	385
	416.0	2,178	299
Top of flood control pool	429.0	7,338	471
Top of conservation pool	429.0	7,338[c]	471
Dead pool storage[d]	416.0	2,178	299
Usable storage		5,160[e]	
Streambed	393.9	0	0

Source: (TWDB, 1999)

*capacity and area information derived from current volumetric survey

[a] Serves as the emergency spillway.

[b] These gates are automatically controlled to maintain the desired lake level and for low-flow releases.

[c] Total reservoir capacity.

[d] The dead pool storage or sediment pool is that capacity of water below the invert of the lowest outlet.

[e] Conservation storage capacity (total reservoir capacity minus sediment pool storage).

Water rights

The water rights for Lady Bird Lake have been appropriated to the City of Austin through Certificate of Adjudication No. 14-5472 and its amendments. A brief summary of the certificate and each amendment follows. The complete certificates are on file in the Records Division of the Texas Commission on Environmental Quality.

Certificate of Adjudication No. 14-5472

Priority Dates: June 27, 1914 and March 5, 1959

This certificate authorizes the City of Austin to maintain an existing dam and reservoir on the Colorado River (Longhorn Dam and Town Lake), and to impound therein a maximum of 3,520 acre-feet of water. The City of Austin is authorized to divert and use a maximum of 22,403 acre-feet of water per year from Town Lake for municipal purposes. The City of Austin is authorized to divert, circulate, and recirculate water from Town Lake for industrial (cooling) purposes, without limit as to amount, provided that not more than 24,000 acre-feet of water per year is consumptively used. The City of Austin is also authorized to use the water impounded for recreation purposes.

Amendment to Certificate of Adjudication No. 14-5471A

Granted: March 20, 1991

This amendment combines the City of Austin's water rights authorized under Certificate Numbers 14-5471, 14-5472, and 14-5490, authorizing the City to maintain the existing dams and reservoirs as follows: Tom Miller and Lake Austin, Longhorn Dam and Town Lake, and Barton Springs Pool. Under this combined certificate, the City of Austin is authorized to divert and use a maximum of 271,403 acre-feet of water per year from Lake Austin and Town Lake for municipal purposes; to temporarily change the purpose of use of 1000 acre-feet of the above municipal authorization to irrigation purposes and to divert said water from Lake Austin, Town Lake, and Barton Springs Pool for a period of time ending December 31, 2011, at which time the 1000 acre-feet of water will revert to municipal use; and to divert and use a maximum of 150 acre-feet of water per year from Lake Austin, Town Lake, and Barton Springs Pool for irrigation purposes. The City of Austin also retains its rights to release water for hydroelectric power generation and interbasin transfers, subject to several conditions.

Amendment to Certificate of Adjudication No. 14-5471B

Granted: July 30, 1999

This amendment re-establishes the priority date of the City of Austin's right to divert, circulate, and recirculate water from Town Lake for industrial (cooling) purposes to June 27, 1914. In addition to the authorization to divert this water from the perimeter of Town Lake, the City of Austin is now authorized to divert water from a point on the east bank of the Colorado River in Fayette County that is the same point in the Lower Colorado River Authority's Certificate of Adjudication No. 14-5474, and from the perimeter of Cedar Creek Reservoir on Cedar Creek for industrial (cooling) purposes at the Fayette Power Project. The total amount of water diverted at the Fayette Power Project and the amount of water consumed from Town Lake shall not exceed 24,000 acre-feet per year.

Amendment to Certificate of Adjudication No. 14-5471C-

Granted: January 31, 2005

In addition to the current diversion points in certificate 14-5471B, the City of Austin is authorized to divert, circulate and recirculate the maximum combined amount of 24,000 acre-feet of water per year from an additional diversion point, at a maximum diversion rate of 13.93 cfs (6,250 gpm), located near the confluence of the Colorado River and Onion Creek for industrial (cooling) purposes at the Sand Hill Energy Center.

Volumetric survey of Lady Bird Lake

Datum

The vertical datum used during this survey is that used by the Lower Colorado River Authority (LCRA) for the reservoir elevation gage known as Lady Bird Lake near Longhorn Dam (LCRA, 2009). The datum for this gage is reported as National Geodetic Vertical Datum 1929 (NGVD 29), thus elevations reported here are in feet above mean sea level. Volume and area calculations in this report are referenced to water levels provided by the LCRA gage. The horizontal datum used for this report is North American Datum of 1983 (NAD83), and the horizontal coordinate system is State Plane Texas Central Zone (feet).

TWDB bathymetric data collection

Bathymetric data collection occurred on December 4th and December 8th of 2008, while the daily average water surface elevation of the lake ranged between 428.07 and 428.53 feet above mean sea level (NGVD 29). Additional bathymetric data was collected on June 29, 2009, while the daily average water surface elevation of the lake ranged between 427.91 and 427.96 feet above mean sea level (NGVD 29), and on July 6-7, 2009, while the daily average water surface elevation of the lake ranged between 427.77 and 428.66 feet above mean sea level (NGVD 29). The conservation pool elevation for the lake is 429.0 feet above mean sea level (NGVD 29). For data collection, TWDB used a Knudsen Engineering Ltd. single-frequency (200 kHz) depth sounder integrated with Differential Global Positioning System (DGPS) equipment. The DGPS unit, used at the request of the City of Austin, has a better than 10 centimeter horizontal accuracy. Data was collected along pre-planned survey lines spaced at approximately 500 foot intervals perpendicular to the submerged river channel. In areas of interest specified by the City of Austin, data was also collected along pre-planned survey lines oriented perpendicular to the location of the original river channels and spaced approximately 100 feet apart. Many of the survey lines were those originally surveyed by TWDB during the 1999 Lady Bird Lake volumetric survey.

Each day prior to beginning the survey, TWDB used a weighted tape and stadia rod to physically verify the depth readings recorded by the Knudsen Engineering Ltd. depth sounder. During the 2008 survey, team members collected over 24,600 data points over cross-sections totaling approximately 30 miles in length. Figure 2 shows where data points were collected during the 2008 TWDB survey.

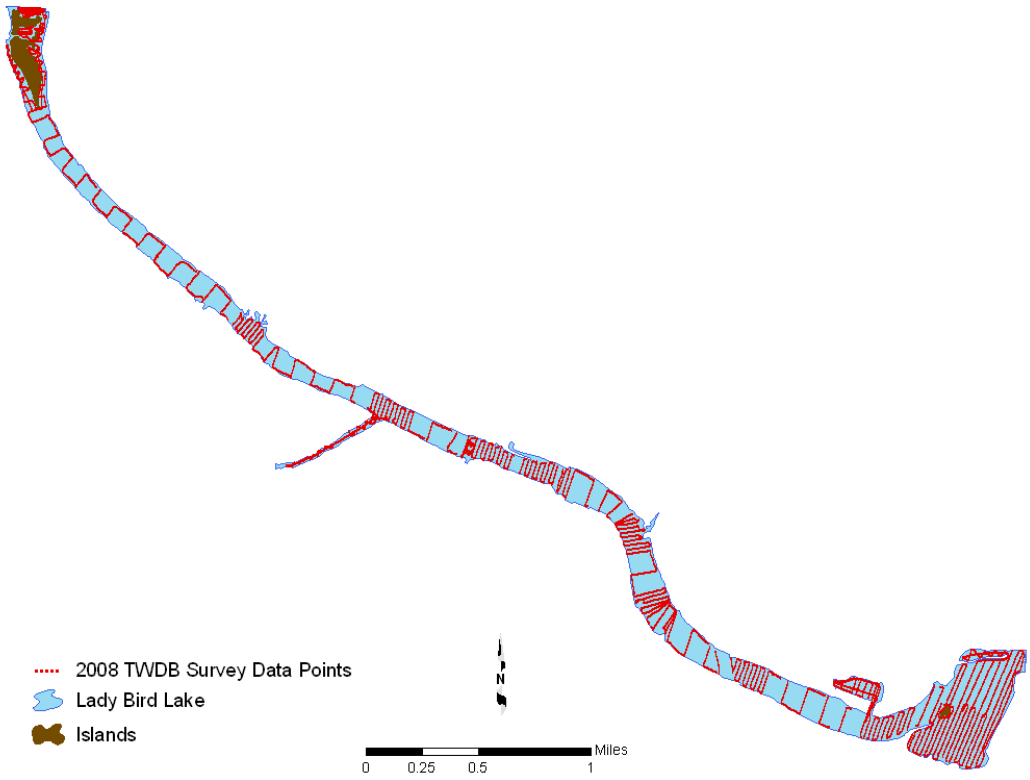


***Figure 2**: Map of data collected during 2008 TWDB survey*

Data processing

Model boundary

The reservoir boundary for Lady Bird Lake was digitized from aerial photos known as digital ortho quarter-quadrangle images (DOQQs) from the Texas Natural Resources Information System (TNRIS) using Environmental Systems Research Institute's (ESRI) ArcGIS 9.2 software (USDA, 2009; TNRIS, 2009). The DOQQs that cover Lady Bird Lake are Austin West SE, Austin East SW, and Montopolis NW. The Lady Bird Lake boundary was digitized from DOQQs that were photographed on July 27, 2008, while the water surface elevation was 428.2 feet above mean sea level, within 0.8 vertical feet of the conservation pool elevation. The 2008 DOQQs are of 1-meter resolution; therefore, the physical lake boundary is assumed to be within ± 1 horizontal meter of the location derived from the manual delineation. The delineated boundary was given an elevation of 429.0 feet to facilitate calculating the area-capacity tables up to the conservation pool elevation.

Triangular irregular network (TIN) model

Upon completion of the data collection effort, the raw data files collected by TWDB were edited using customized MATLAB processing scripts and the HydroEdit software package to remove any data anomalies. Specifically, HydroEdit applies a median filter to the raw survey data and removes individual data anomalies or points with incorrect GPS coordinates. HydroEdit also uses the water surface elevations at the times of each sounding to convert sounding depths to corresponding bathymetric elevations. The MATLAB processing scripts are used to visually inspect each of the filtered cross-sections to indentify and rectify any series of data anomalies that were not edited using the HydroEdit filters. For added control in removing bad data, the data collected in the Barton Springs tributary, as well as some additional data, were manually edited within the survey software HYPACK Max. For processing outside of MATLAB, HydroEdit, and HYPACK Max, the sounding coordinates (X,Y,Z) are exported as a MASS points file. Using the self-similar interpolation technique (described below), TWDB interpolated bathymetric elevation data located between surveyed cross sections. To better represent reservoir bathymetry in shallow regions, TWDB used the line extrapolation technique (described below) (Furnans, 2006).

To create a surface representation of the Lady Bird Lake bathymetry, the 3D Analyst Extension of ArcGIS (ESRI, Inc.) is used. This extension allows for the creation of a triangulated irregular network (TIN) model of the bathymetry, where each MASS point and boundary node becomes the vertex of a triangular portion of the reservoir bottom surface (ESRI, 1995). Using the 3D Analyst Extension and the TIN model, reservoir capacity and surface area are calculated at one-tenth of a foot (0.1 foot) intervals, from the deepest elevation recorded within the lake, 393.9 feet, to the conservation pool elevation, 429.0 feet.

The Elevation-Capacity and Elevation-Area Tables, updated for 2008, are presented in Appendices A and B, respectively. Tables are provided with elevations referenced to the NGVD 29 datum. The Area-Capacity Curves are presented in Appendix C.

The Lady Bird Lake TIN model was converted to a raster representation using a cell size of 1 foot by 1 foot. The raster data was then used to produce an Elevation Relief Map (Figure 3) representing the topography of the reservoir bottom, a Depth Range Map

(Figure 4) showing shaded depth ranges for Lady Bird Lake, and a 5-foot Contour Map (Figure 5 - attached). The reservoir extent, depicted in these figures, is the lake digitized from the 2008 DOQQs, approximately 429.0 feet above mean sea level.

Self-similar interpolation

The 3D Analyst extension utilizes the Delaunay method for triangulation. A limitation of the Delaunay method for triangulation when creating TIN models results in artificially-curved contour lines extending into the reservoir where the reservoir walls are steep and the reservoir is relatively narrow. These contours are likely a poor representation of the true reservoir bathymetry in these areas. Also, if the surveyed cross sections are not perpendicular to the centerline of the submerged river channel (the location of which is often unknown until after the survey), then the TIN model is not likely to represent the true channel bathymetry.

To ameliorate these problems, a self-similar interpolation routine developed by TWDB was used to interpolate the bathymetry between the 500 and 100 foot-spaced survey lines. The self-similar interpolation technique increases the density of points input into the TIN model, and directs the TIN interpolation to better represent the reservoir topography between cross sections (Furnans, 2006). In the case of Lady Bird Lake, the application of self-similar interpolation improved the representation of the lake morphology near the banks and the submerged river channel (Figure 6). In areas where obvious geomorphic features indicate a high-probability of cross-section shape changes (e.g. incoming tributaries, significant widening/narrowing of channel, etc.), the assumptions used in applying self-similar interpolation are not likely to be valid. Therefore, interpolation was not used in areas of Lady Bird Lake where a high probability of change between cross-sections exists (Furnans, 2006). Figure 6 illustrates typical results from the self-similar interpolation routine in Lady Bird Lake, and the bathymetry shown in Figure 6C was used in computing reservoir capacity and area tables (Appendix A, B).

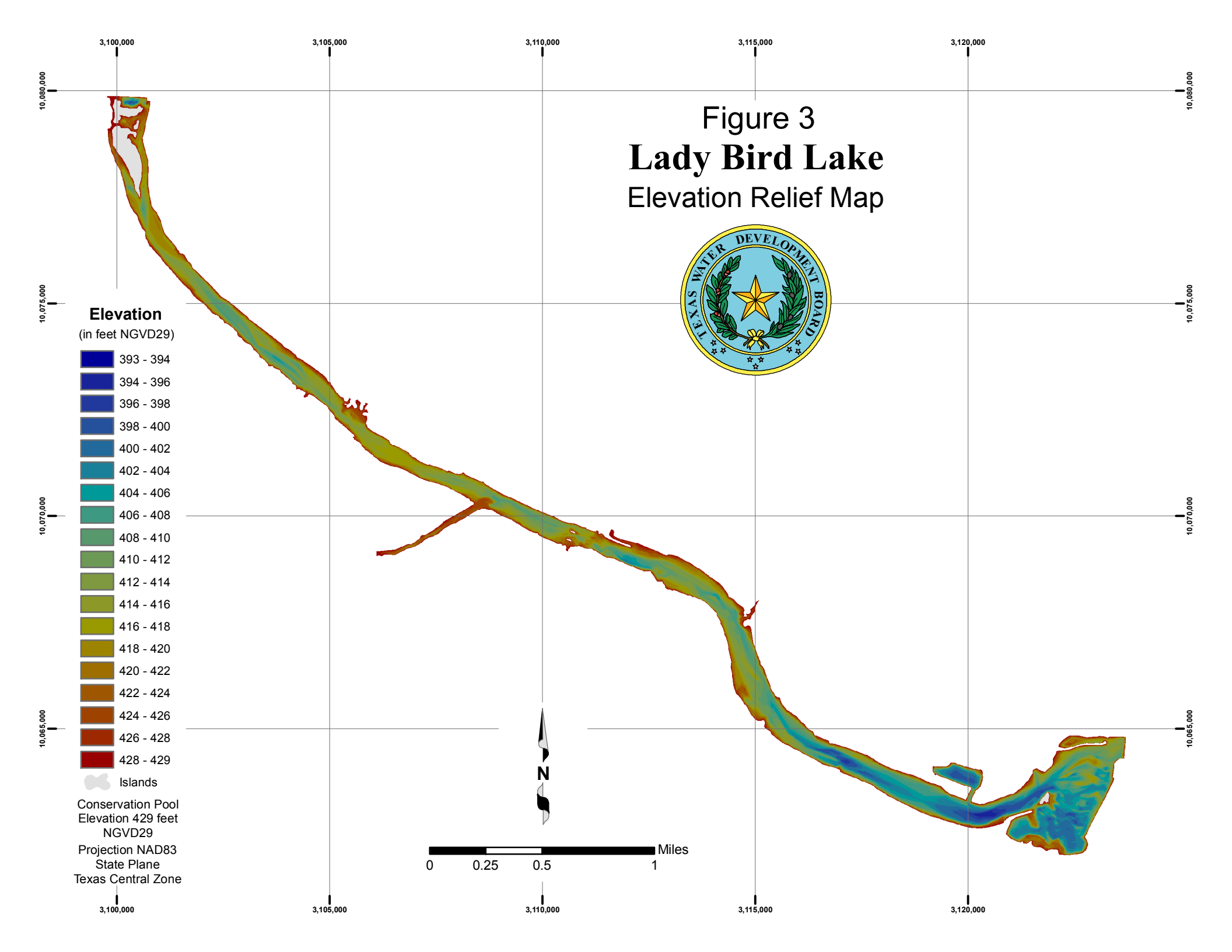
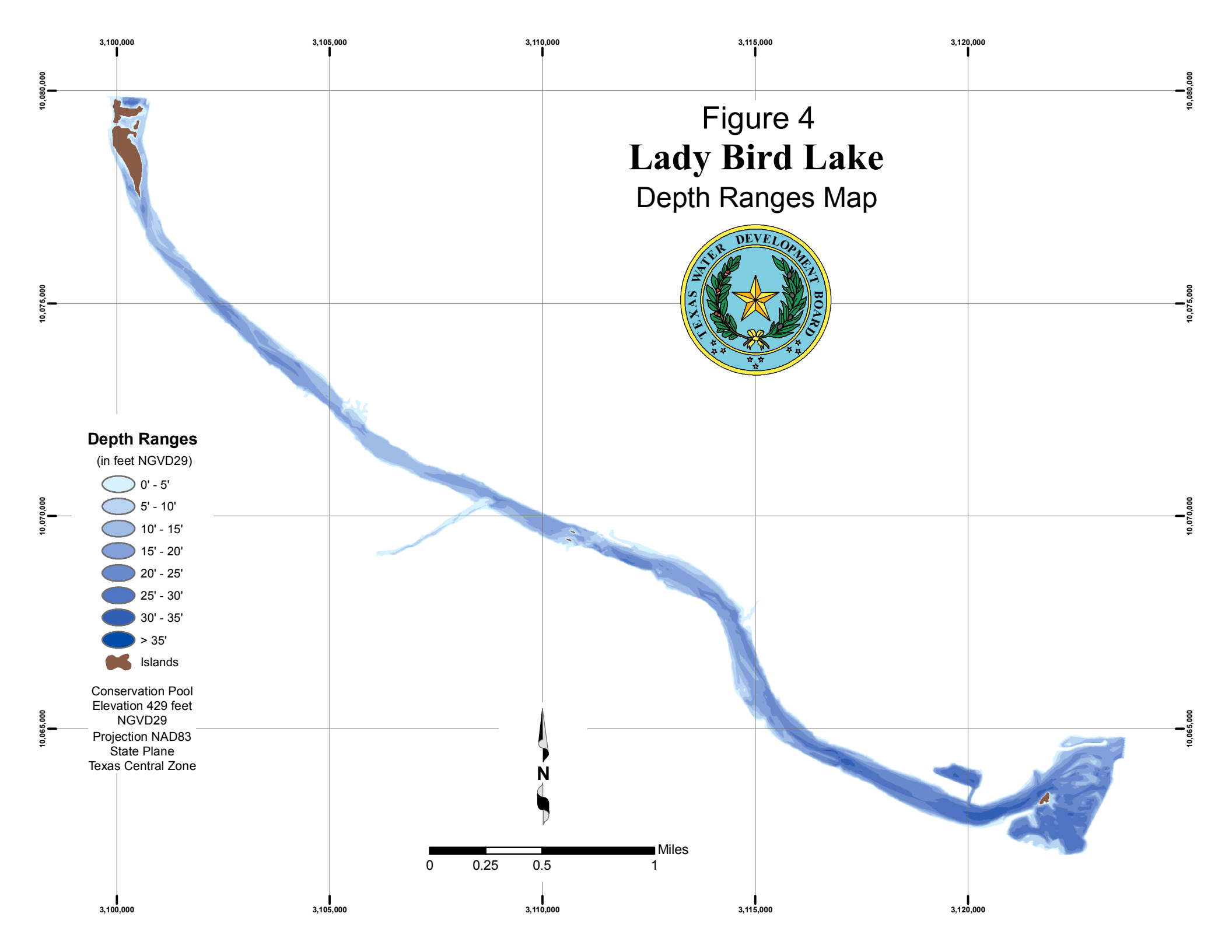


Figure 3
Lady Bird Lake
Elevation Relief Map
TEXAS WATER DEVELOPMENT BOARD
3,100,000
3,105,000
3,110,000
3,115,000
3,120,000
10,080,000
10,075,000
10,070,000
10,065,000
Elevation
(in feet NGVD29)
393 - 394
394 - 396
396 - 398
398 - 400
400 - 402
402 - 404
404 - 406
406 - 408
408 - 410
410 - 412
412 - 414
414 - 416
416 - 418
418 - 420
420 - 422
422 - 424
424 - 426
426 - 428
428 - 429
Islands
Conservation Pool
Elevation 429 feet
NGVD29
Projection NAD83
State Plane
Texas Central Zone
N
0
0.25
0.5
1
Miles


3,100,000
3,105,000
3,110,000
3,115,000
3,120,000
10,080,000
10,075,000
10,070,000
10,065,000
Figure 4
Lady Bird Lake
Depth Ranges Map
TEXAS WATER DEVELOPMENT BOARD
Depth Ranges
(in feet NGVD29)
0' - 5'
5' - 10'
10' - 15'
15' - 20'
20' - 25'
25' - 30'
30' - 35'
> 35'
Islands
Conservation Pool
Elevation 429 feet
NGVD29
Projection NAD83
State Plane
Texas Central Zone
N
0
0.25
0.5
1
Miles

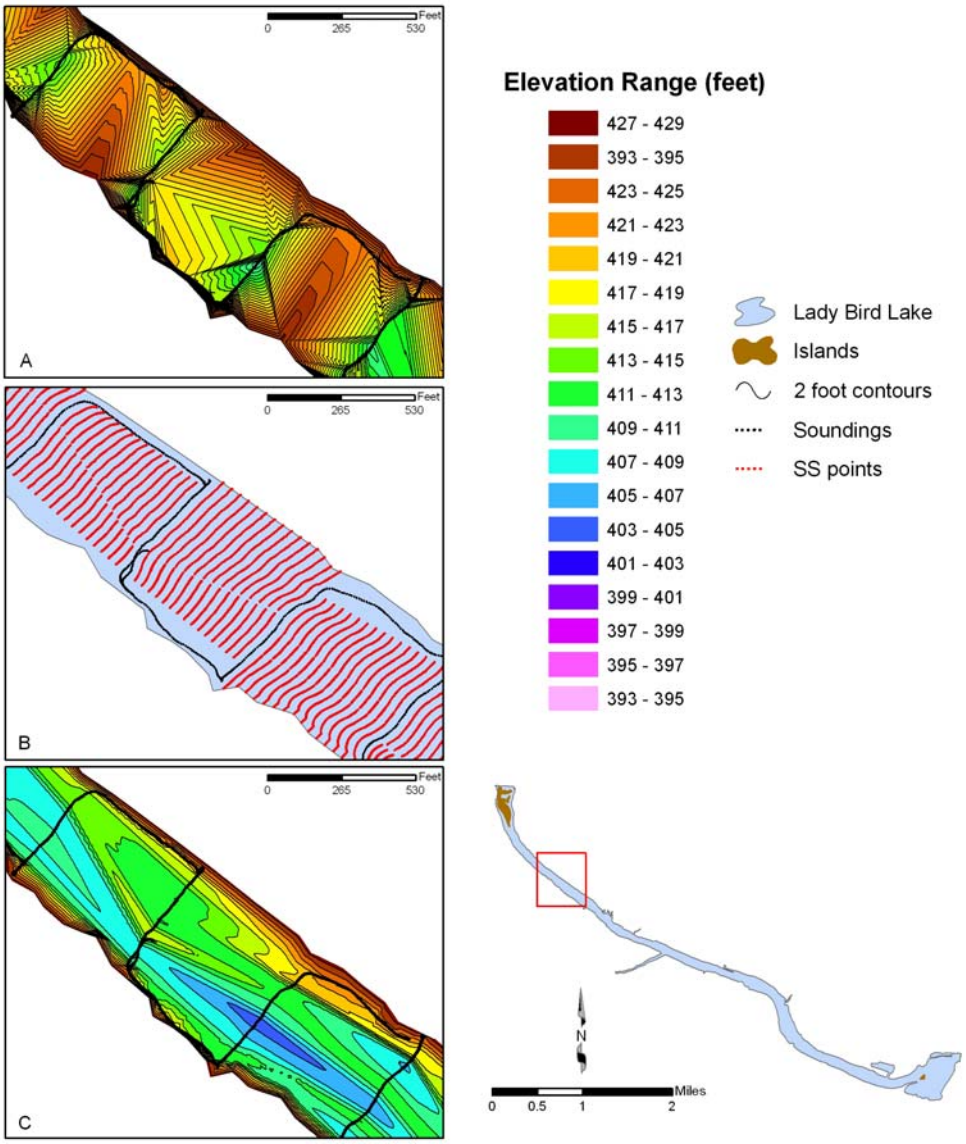


Figure 6*: Application of the self-similar interpolation technique to Lady Bird Lake sounding data – A) bathymetric contours without interpolated points, B) sounding points (black) and interpolated points (red) with reservoir boundary shown at elevation 429.0 feet (grey), C) bathymetric contours with the interpolated points. Note: In 6A the deeper channels indicated by the surveyed cross sections are not continuously represented in the areas in-between the cross sections. This is an artifact of the TIN generation routine, rather than an accurate representation of the physical bathymetric surface. Inclusion of the interpolated points (6C) corrects this and smoothes the bathymetric contours.*

Line extrapolation

In order to estimate the bathymetry within the small coves and other un-surveyed portions of Lady Bird Lake, TWDB applied line extrapolation, which is similar to self-similar interpolation discussed above. TWDB uses line extrapolation to extrapolate bathymetries in small coves where water depths are too shallow to allow boat passage. Line extrapolation requires the user to define (1) a longitudinal axis approximately bisecting the small cove, (2) the elevation at the beginning of the longitudinal axis, (3) the number of cross sections along the longitudinal axis, and (4) the number of points between the longitudinal axis and the cove boundary. The starting elevation of the longitudinal axis is typically assumed equivalent to the elevation of the TIN model near the beginning of the longitudinal line or estimated based on the nearest surveyed depth.

Line extrapolation assumes a V-shaped profile for cross-sections within the extrapolation area, with the deepest section of the profile located along the longitudinal axis. Elevations along the longitudinal axis are interpolated linearly based on the distance along the axis from the start (nearest the reservoir interior) to the end (where the axis crosses the reservoir boundary). The elevations at points along each extrapolated cross-section are linearly interpolated from an elevation on the longitudinal axis (at the intersection with the cross-section) and the elevation at the extrapolation area boundary. Figure 7 illustrates line extrapolation as applied to Lady Bird Lake.

The inherent assumption of line extrapolation is that a V-shaped cross section is a reasonable approximation of the actual unknown cross-section within the extrapolated area. As of yet, TWDB has been unable to test this assumption, and therefore can only assume that the results of the usage of line extrapolation are more accurate than those derived without line extrapolation. The use of a V-shaped extrapolated cross-section likely provides a conservative estimate of the water volume in un-surveyed areas, as most surveyed cross-sections within Lady Bird Lake had shapes more similar to U-profiles than to V-profiles. The V-profiles are thus conservative in that a greater volume of water is implied by a U-profile than a V-profile. Further information on line extrapolation is provided in the HydroEdit User's Manual (Furnans, 2006).

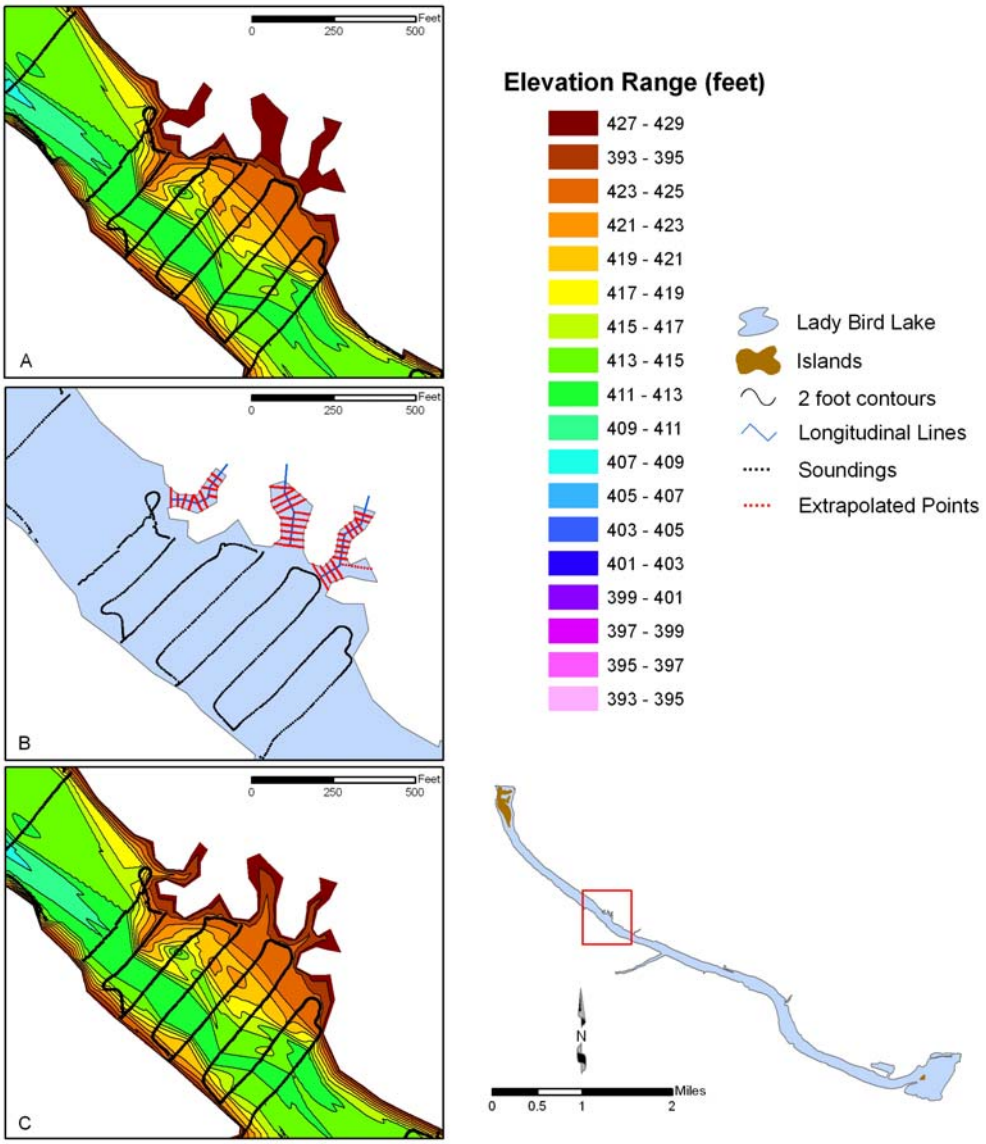


Figure 7: *Application of the line extrapolation technique to Lady Bird Lake sounding data – A) bathymetric contours without extrapolated points, B) Sounding points (black) and extrapolated points (red) with reservoir boundary shown at elevation 429.0 feet (black), and C) bathymetric contours with the extrapolated points. Note: In 7A the bathymetric contours do not extend into the un-surveyed area and "flat" triangles are formed connecting the nodes of the reservoir boundary. This is an artifact of the TIN generation routine when data points are too far apart or are absent from portions of the reservoir. Inclusion of the extrapolated points (7C) corrects this and smoothes the bathymetric contours.*

Volumetric survey results

The results of the 2008 TWDB Volumetric Survey indicate Lady Bird Lake has a total reservoir capacity of 7,338 acre-feet and encompasses 471 acres at conservation pool elevation (429 feet above mean sea level, NGVD 29).

Lady Bird Lake has been surveyed multiple times since it was impounded in 1960 (Table 2). TWDB previously surveyed Lady Bird Lake in March of 1999. Differences in past, present, and future methodologies makes direct comparison of volumetric surveys potentially unreliable. Also, TWDB does not recommend directly comparing results from one TWDB survey to the next unless data from each survey was collected and processed using similar techniques.

To properly compare results from the TWDB surveys of Lady Bird Lake, TWDB applied the 2008 data processing techniques to the survey data collected in 1999. Specifically, TWDB applied self-similar interpolation and line extrapolation techniques to the 1999 survey dataset (Furnans, 2006). A revised TIN model was created using the boundary from the original 1999 survey. The 1999 survey boundary was created from 7.5 minute USGS quadrangle maps, with a stated accuracy of ± ½ the contour interval (COA, 1984). As presented in Table 2, revision of the 1999 survey using current TWDB data processing methods resulted in a 394 acre-feet (6.0 %) increase in reservoir capacity. Such an increase is typical for lakes of similar size and shape as Lady Bird Lake, and is due to the improved representation of the lake bathymetry between adjacent cross sections obtained with interpolation. (see Figure 6, Figure 7, section entitled self-similar interpolation, and line extrapolation).

Table 2: Current and previous survey capacity and surface area data.

Survey (date)	**Capacity (acre-feet)**			**Surface area (acres)**		
Elevation (feet)	**428**	**428.25**	**429**	**428**	**428.25**	**429**
USACE[a] (1960)	3,520					
Armstrong, et al (1991)	5,168					
City of Austin (1992)		6,784			477	
TWDB (1999)	6,135	6,248	6,596	451	454	469
TWDB (1999 self-similar interpolation revised)	6,529	6,665	6,990	454	458	470
TWDB (2008)	6,874	7,013	7,338	459	462	471

[a] United States Army Corps of Engineers

Theoretically, comparing lake volumes from multiple lake surveys allows for calculation of capacity loss rates, and if all lost capacity is due to sediment accumulation, then comparisons of lake volumetric surveys would yield sediment accumulation rates. In practice, however, the differences in methodologies used in each lake survey may yield greater differences in computed lake volumes than physical volume differences due to sediment accumulation over time. In addition, because volumetric surveys are not exact, small losses or gains in sediment may be masked by the imprecision of the computed volumes. For this reason, TWDB prefers to estimate sediment accumulation rates through sedimentation surveys, which directly measure the sediment layer thicknesses throughout the reservoir. The sediment accumulation rates derived from such surveys reflect the average rate of sediment accrual since the time of impoundment. However, the values shown in Table 2 suggest a general trend of increasing lake capacity. The exception is between 1992 and 1999.

The TWDB did not investigate the validity of the results of the 1960, 1991, and 1992 capacity estimates for Lake Lady Bird. Comparisons between the most recent TWDB surveys of Lady Bird Lake suggest that Lady Bird Lake gained 348 acre-feet of capacity, an average of approximately 39 acre-feet per year, between 1999 and 2008. TWDB did not attempt to determine a potential cause for the increase in capacity between surveys. Such differences could indicate sediment removal from the lake, or might be attributed to differences in the extent of data collection efforts within each survey. TWDB notes that the lake areas at conservation pool elevation are different for the compared surveys, and that some of the reported volume differences are directly attributable to the area differences. Spatial comparisons of the bathymetry from the 1999 and 2008 survey may indicate whether the reported volume increase is due to sediment scour or due to simple differences in data collection locations between surveys.

Recommendations

TWDB recommends resurveying Lady Bird Lake in 10 years or after a major flood event to improve estimated capacity changes occurring in the reservoir. In an attempt to improve Lady Bird Lake capacity estimates, TWDB recommends conducting a combined volumetric and sedimentation survey. For sedimentation surveys, TWDB employs a multi-frequency depth sounder to measure both the water depth and the sediment thickness throughout the lake. TWDB also collects sediment core samples as direct spot-

measurements of accumulated sediment. These measurements are used in assessing the multi-frequency sounding data and deriving lake-wide sediment thickness datasets. Results from sedimentation surveys include current reservoir capacities, computed sediment volumes, and maps identifying the spatial distribution of sediment throughout the lake.

TWDB contact information

More information about the Hydrographic Survey Program can be found at:
http://www.twdb.state.tx.us/assistance/lakesurveys/volumetricindex.asp
Any questions regarding the TWDB Hydrographic Survey Program may be addressed to:

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Or

Jason Kemp
Team Leader, TWDB Hydrographic Survey Program
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Appendix A

Lady Bird Lake

RESERVOIR CAPACITY TABLE

TEXAS WATER DEVELOPMENT BOARD — DECEMBER 2008 SURVEY

CAPACITY IN ACRE-FEET — Conservation Pool Elevation 429 Feet NGVD29

ELEVATION INCREMENT IS ONE TENTH FOOT

ELEVATION in Feet	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
393	0	0	0	0	0	0	0	0	0	0
394	0	0	0	0	0	0	0	0	0	0
395	0	0	0	0	0	0	1	1	1	1
396	1	1	1	1	1	2	2	2	2	2
397	2	3	3	3	3	4	4	4	4	5
398	5	5	6	6	7	7	7	8	9	9
399	10	11	12	12	13	14	15	17	18	19
400	20	22	23	25	27	28	30	32	34	37
401	39	41	44	46	49	52	55	58	61	64
402	68	71	75	78	82	86	90	94	98	103
403	107	112	117	122	127	132	137	143	149	155
404	161	167	173	180	186	193	200	207	214	222
405	229	237	245	253	261	269	278	286	295	304
406	313	322	331	340	350	359	369	379	389	399
407	410	420	431	441	452	463	475	486	498	509
408	521	533	546	558	570	583	596	609	623	636
409	650	664	678	692	707	722	737	752	767	783
410	799	815	831	848	865	882	899	916	934	952
411	970	988	1,006	1,025	1,044	1,063	1,083	1,102	1,122	1,142
412	1,162	1,183	1,204	1,225	1,246	1,268	1,290	1,312	1,334	1,357
413	1,380	1,403	1,427	1,451	1,475	1,499	1,524	1,549	1,574	1,599
414	1,624	1,650	1,676	1,702	1,728	1,754	1,781	1,808	1,835	1,862
415	1,890	1,918	1,946	1,974	2,002	2,031	2,060	2,089	2,119	2,148
416	2,178	2,208	2,238	2,269	2,299	2,330	2,361	2,393	2,424	2,456
417	2,488	2,520	2,552	2,585	2,617	2,650	2,683	2,716	2,750	2,783
418	2,817	2,851	2,885	2,919	2,953	2,988	3,023	3,058	3,093	3,128
419	3,164	3,199	3,235	3,271	3,308	3,344	3,381	3,417	3,454	3,491
420	3,528	3,566	3,603	3,641	3,678	3,716	3,754	3,792	3,830	3,869
421	3,907	3,946	3,984	4,023	4,062	4,101	4,140	4,180	4,219	4,259
422	4,298	4,338	4,378	4,418	4,458	4,498	4,538	4,579	4,619	4,660
423	4,701	4,742	4,783	4,824	4,865	4,906	4,948	4,989	5,031	5,073
424	5,114	5,156	5,198	5,241	5,283	5,325	5,368	5,411	5,453	5,496
425	5,539	5,582	5,626	5,669	5,712	5,756	5,800	5,843	5,887	5,931
426	5,975	6,019	6,063	6,108	6,152	6,197	6,241	6,286	6,331	6,375
427	6,420	6,465	6,510	6,556	6,601	6,646	6,692	6,737	6,783	6,829
428	6,874	6,920	6,966	7,013	7,059	7,105	7,151	7,198	7,245	7,291
429	7,338									

Appendix B

Lady Bird Lake

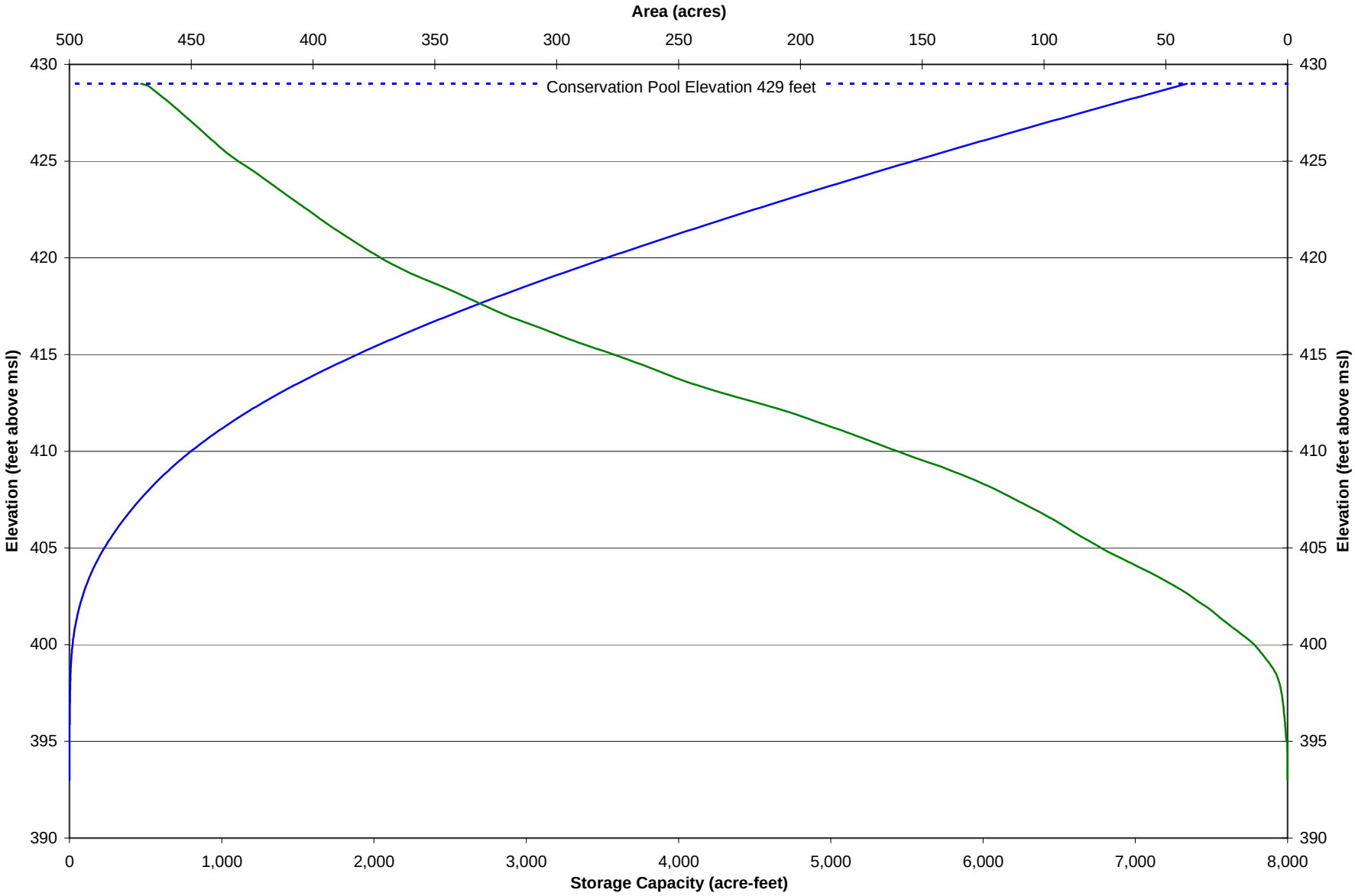
RESERVOIR AREA TABLE

TEXAS WATER DEVELOPMENT BOARD — DECEMBER 2008 SURVEY

AREA IN ACRES — Conservation Pool Elevation 429 Feet NGVD29

ELEVATION INCREMENT IS ONE TENTH FOOT

ELEVATION in Feet	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
393	0	0	0	0	0	0	0	0	0	0
394	0	0	0	0	0	0	0	0	0	0
395	0	0	1	1	1	1	1	1	1	1
396	1	1	1	1	1	1	2	2	2	2
397	2	2	2	2	2	2	3	3	3	3
398	3	4	4	4	4	5	5	6	6	7
399	7	8	8	9	10	10	11	12	12	13
400	14	15	15	16	17	19	20	21	22	23
401	24	25	26	27	28	29	30	31	32	33
402	34	35	36	37	39	40	41	42	43	45
403	46	47	49	50	52	53	55	56	58	59
404	61	62	64	66	67	69	70	72	74	75
405	77	78	79	81	82	83	85	86	88	89
406	90	91	93	94	95	97	98	99	101	102
407	104	106	107	109	110	112	113	115	116	118
408	119	121	123	125	126	128	130	132	134	136
409	138	140	142	144	147	149	152	154	156	158
410	160	162	164	167	169	171	173	175	177	179
411	181	184	186	188	190	193	195	197	199	202
412	204	207	209	212	215	217	220	223	226	229
413	232	235	237	240	242	245	247	249	251	253
414	255	257	259	261	264	266	268	270	272	274
415	277	279	281	284	286	288	291	293	295	297
416	299	301	303	305	307	309	312	314	316	318
417	320	322	324	326	327	329	331	333	334	336
418	338	340	341	343	345	347	349	351	353	355
419	356	358	360	362	363	365	366	368	369	371
420	372	374	375	376	378	379	380	381	383	384
421	385	386	388	389	390	391	392	394	395	396
422	397	398	399	400	401	402	404	405	406	407
423	408	409	410	411	413	414	415	416	417	418
424	419	420	421	422	424	425	426	427	428	430
425	431	432	433	434	435	436	437	438	439	440
426	441	442	442	443	444	445	446	447	448	449
427	450	450	451	452	453	454	455	456	457	458
428	459	460	461	462	463	464	465	466	467	468
429	471									



Lady Bird Lake
December 2008 Survey
Prepared by: TWDB

Appendix C: Area and Capacity Curves

Figure 5

Lady Bird Lake

5' - Contour Map

CONTOURS
(in feet NGVD29)

- 395
- 400
- 405
- 410
- 415
- 420
- 425
- Islands
- Lady Bird Lake

Conservation Pool Elevation:
429.0 feet NGVD29

Projection: NAD83
State Plane Texas Central Zone

This map is a product of a survey conducted by the Texas Water Development Board's HydrographicSurvey Program to determine the capacity of Lady Bird Lake.
The Texas Water Development Board makes no representations nor assumes any liability.

3,105,000
3,110,000
3,115,000
3,120,000
10,080,000
10,075,000
10,070,000
10,065,000

N

0 0.25 0.5 1 Miles

Prepared by: TEXAS WATER DEVELOPMENT BOARD December 2008 Survey