Volumetric Survey of LAKE ANAHUAC

April 2006 Survey

Prepared by:

The Texas Water Development Board

December 2006

Texas Water Development Board

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Prepared for:

Chambers-Liberty Counties Navigation District

With Support Provided by:

U.S. Army Corps of Engineers, Fort Worth District

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Executive Summary

In February of 2006, the Texas Water Development Board (TWDB) entered into agreement with the US Army Corps of Engineers, Fort Worth District, for the purpose of performing a volumetric survey of Lake Anahuac while the reservoir was near the top of the conservation pool elevation. The information gathered was converted into updated Elevation-Volume and Elevation-Area Tables. In addition, sediment range lines were established by the TWDB to examine the reservoir in cross-section and to facilitate future tracking of any sedimentation in Lake Anahuac.

The results of the TWDB 2006 Survey indicate Lake Anahuac has a total storage capacity of 33,348 acre-feet and encompasses 5,035 acres at elevation 4.0 ft above mean sea level. According to the Chambers-Liberty Counties Navigation District (CLCND), the pool elevation changed from 5.0 ft to 4.0 ft when the district added a second, short spillway about 15 years ago. Based on information provided by CLCND and as permitted in Certificate of Adjudication No. 08-4279, the storage capacity of Lake Anahuac was 35,300 acre-feet at elevation 5.0 ft above mean sea level after the project was enlarged in the 1950's. From the Area Capacity Curves provided by CLCND, found in TWDB Report 126- Engineering Data on Dams and Reservoirs in Texas Part II, the TWDB estimates the total storage capacity at elevation 4.0 ft above mean sea level to have been 29,500 acre-feet in 1954. This indicates a 3,848 acre-feet, or 13.0%, gain in volume between volume reported in 1954 and the 2006 survey. Report 126, with information provided by CLCND, lists the area of Lake Anahuac at 5,300 acres at elevation 5.0 ft above mean sea level. The scale of the Area Capacity Table in Report 126 prevents TWDB staff from accurately estimating the 1954 reservoir area at 4.0 ft above mean sea level.

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Lake Anahuac General Information

Illustrated below in Figure 1, Lake Anahuac, previously known as Turtle Bay, is located 45 miles east of Houston in western Chambers County near Anahuac, TX.[1]

Figure 1. Location Map: Lake Anahuac

In 1900 the Farmers Canal Company began using water in Turtle Bay to irrigate rice fields. Depletion of fresh water led the newly formed Trinity River Irrigation District to construct a barrier across the mouth of the bay to protect against the encroachment of salt water. In 1915 a hurricane destroyed the bulkhead allowing salt water to threaten the bay's ecology and area farmers. In 1931 the Lone Star Canal Company began reconstructing the saltwater barrier. In 1936 the United States War Department decided to close the entrance to Turtle Bay, already being called Lake Anahuac, and construction of a

new dam, levee, and spillway began on March 17, 1953. The project was completed on July 1, 1954, and increased Lake Anahuac's storage capacity from 17,000 to 35,300 acre-feet.[1,2]

The Chambers-Liberty Counties Navigation District (CLCND) was approved by election on July 8, 1944. The district's two main functions are navigation and raw water supply. In 1947 the district purchased the Lone Star Canal Company. In 1953 the district purchased Lake Anahuac from the State of Texas to ensure a reliable source of fresh water. In 1968, the district began supplying raw water for municipal supplies and now supplies the City of Anahuac Treatment Plant among others.[3]

Since 1984, Lake Anahuac has supplied the needs of irrigation, local industry, and mineral extraction.[1] The lake receives water from both the Turtle Bayou watershed and direct diversion from the Trinity River, through Big Hog Bayou, by pumping if necessary.[4]

Certificate of Adjudication No. 08-4279 authorizes the Chambers-Liberty Counties Navigation District to maintain an existing reservoir, Lake Anahuac, on Turtle Bay, and impound therein not to exceed 35,300 acre-feet of water. CLCND is authorized to divert and use not to exceed 2,147 ac-ft of water per annum for municipal purposes, 30,000 ac-ft of water per annum for industrial purposes, and 800 ac-ft of water per annum for mining purposes from the Trinity River, Lake Anahuac, and from Trinity Bay. In addition, CLCND is authorized to divert and use not to exceed 110,000 ac-ft of water per annum from the Trinity River, Lake Anahuac, and Trinity Bay to irrigate 30,000 acres of land within their service area. The effective date of the owner's right to impound 17,000 ac-ft of water in Lake Anahuac is June 23, 1914, and October 7, 1952 for the impoundment of the remaining 18,300 ac-ft. The effective date of the owner's right to divert and use water from the Trinity River, Lake Anahuac, and Trinity Bay is April 14, 1906 for the diversion and use of the first 36,667 ac-ft of water, February 12, 1914 for the diversion and use of the next 36,667 ac-ft of water, and June 26, 1914 for the diversion and use of the remaining 36,666 ac-ft of water for irrigation purposes; November 7, 1936 for the diversion and use of water for mining purposes and November 11, 1971 for the diversion and use of water for municipal and industrial purposes.

An Amendment to Certificate of Adjudication No. 08-4279B granted October 25, 2004, recognizes CLCND's right to impound 35,300 ac-ft of water in Lake Anahuac and divert and use not to exceed 2,147 ac-ft of water per year for municipal purposes, 30,000

ac-ft of water per year for industrial purposes, 800 ac-ft of water per year for mining purposes, and 80,000 ac-ft of water per year for agricultural purposes to irrigate 30,000 acres of land within the service area of CLCND from the Trinity River, Lake Anahuac, and Trinity Bay. Amendment to Certificate of Adjudication No. 08-4279B authorizes CLCND to use the 80,000 ac-ft of water per year for agricultural purposes for additional purposes. CLCND is now authorized to use the 80,000 ac-ft of water per year for municipal and industrial purposes in addition to irrigating 30,000 acres of land with in its service area in the Trinity River Basin and Trinity-San Jacinto Coastal Basin. The CLCND is also authorized an exempt interbasin transfer for the 80,000 ac-ft of water from the Trinity River Basin to the Trinity-San Jacinto Coastal Basin for agricultural (irrigation), municipal, and industrial uses. Any water not consumed of the 80,000 ac-ft of water must be returned to streams in the Trinity River Basin or the Trinity-San Jacinto Coastal Basin. The complete certificates are on file in the Records Department of the Texas Commission on Environmental Quality.

The following table is a list of pertinent data about Anahuac Dam and Lake Anahuac.

Table 1: Pertinent Data for Anahuac Dam and Lake Anahuac[2]

Owner:	
Chambers-Liberty Counties Navigation District	
Engineer (Design)	
Freese, Nichols, and Turner for enlarged project	
Location	
On Turtle Bay in Chambers County near Anahuac	
Drainage Area	
199 square miles, main source of water in pumpage from the Trinity River	
Dam (actually a levee)	
Type	Earthfill (hydraulic)
Length (including spillways)	59,000 ft
Maximum Height	10 ft
Top Width	8 ft
Elevation top of levee	9.0 ft above msl
Spillway (Emergency)	
Type	Part of embankment (uncontrolled)
Crest length	1,200 ft
Elevation	8.0 ft above msl
Spillway (Service)	
Type	Concrete slab (uncontrolled)
Crest length	700 ft
Elevation	4.0 ft above msl[5]
Outlet Works	
Type	Gated sluiceway
Size	6 ft by 6 ft
Discharge	To forebay and pumping plant

Volumetric Survey of Lake Anahuac

Introduction

The TWDB Hydrographic Survey Program was authorized by the state legislature in 1991. The Texas Water Code authorizes the TWDB, at the request of a political subdivision, to perform a survey to determine reservoir storage capacity, sedimentation levels, rates of sedimentation, projected water supply availability, or potential mitigative measures, and to conduct other bathymetric studies.

In February of 2006, the Texas Water Development Board entered into agreement with the US Army Corps of Engineers, Fort Worth District, for the purpose of performing a volumetric survey of Lake Anahuac while the reservoir was near the top of the conservation pool elevation. This information was converted into updated Elevation-Volume and Elevation-Area Tables. In addition, sediment range lines were established by the TWDB to examine the reservoir in cross-section and to facilitate future tracking of any sedimentation in Lake Anahuac.

Datum

Volume and area calculations in this report are referenced to the water levels provided by the Chambers-Liberty Counties Navigation District. These water levels were measured in feet above the National Geodetic Vertical Datum of 1929 (NGVD29) or mean sea level (msl)[5,6], therefore, all elevation mentioned within are referenced to the CLCND water levels or mean sea level. The horizontal datum used for this report is NAD83 State Plane Texas South Central Zone.

Bathymetric Survey

Bathymetric data collection for Lake Anahuac occurred on April 19th – 20th, April 25th, and April 27th of 2006. Currently Lake Anahuac does not have a reservoir elevation gauge installed for measuring the water surface elevation. Water surface elevations for Lake Anahuac were furnished by the Chambers-Liberty Counties Navigation District. Water surface elevations were measured on April 18, 2006 and determined to be 2.55 ft above mean sea level and on April 26, 2006 and determined to be 2.80 ft above mean sea

level. It was assumed that the water surface elevations did not change significantly between April 18-20, 2006 and April 25-27, 2006, and the data collected in those time frames were referenced to the water surface elevations provided by CLCND for April 18th and April 26th respectively. Additionally, the TWDB returned to Lake Anahuac on September 25-26, 2006 to correct inconsistencies found in the original survey data. The water surface elevation was recorded at 3.53 ft above mean sea level on September 26, 2006 by the CLCND and data collected on both days were referenced to this elevation.

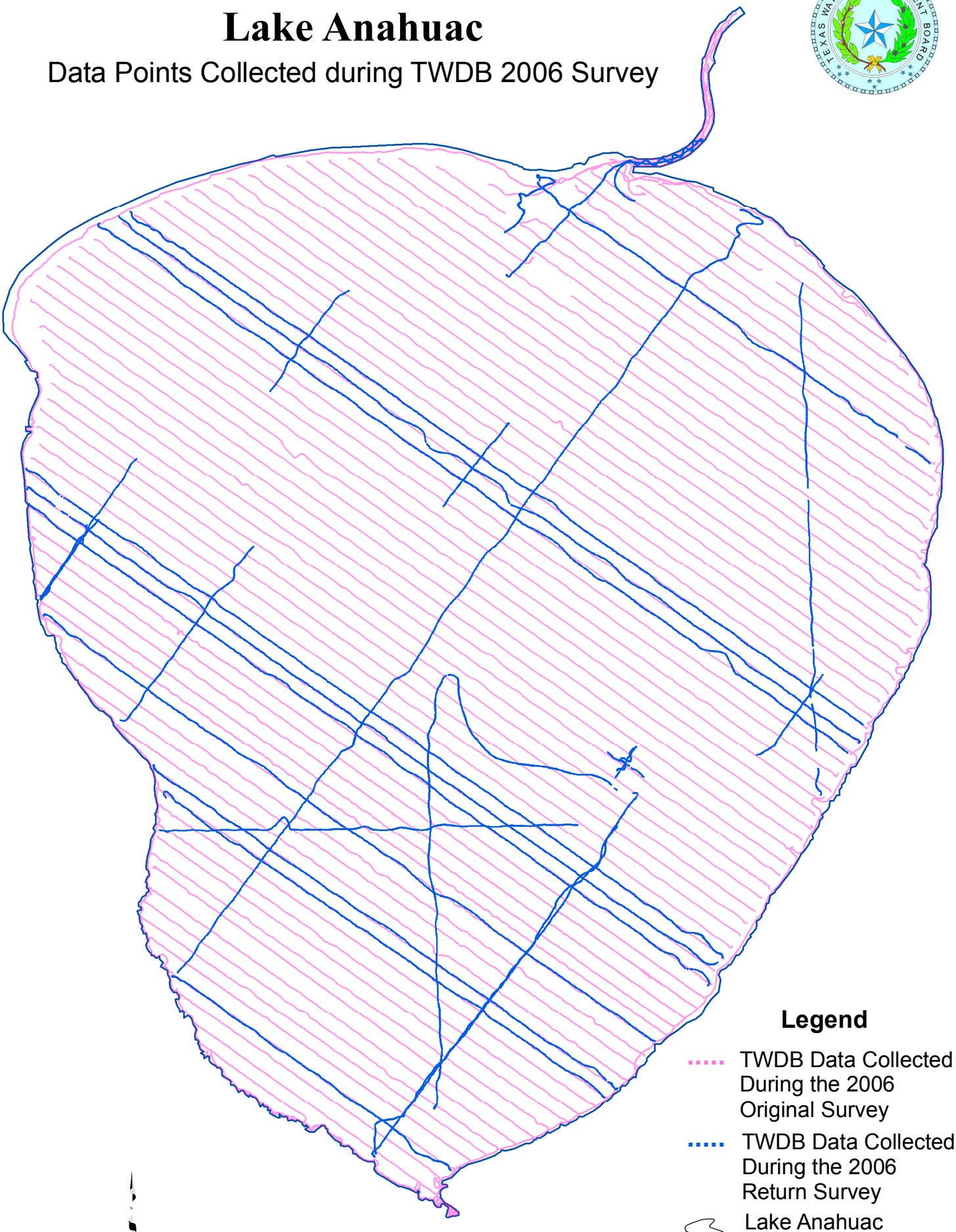
The survey team used two boats equipped with depth sounders integrated with Differential Global Positioning System (DGPS) equipment to navigate along pre-planned range lines spaced approximately 250 feet apart in a perpendicular fashion to the original stream channel. During the 2006 TWDB survey the team navigated approximately 222 miles of range lines and collected approximately 114,600 data points. Figure 2, on the following page shows the data points collected during the complete TWDB 2006 survey.

During the 2006 survey the depth sounder was calibrated each day using the velocity profiler to measure the speed of sound in the water column. The average speed of sound through the water column varied between 4,891 and 4,950 feet per second. Team members performed a modified bar check using a weighted tape or stadia rod to verify the depth sounder was reading correctly. Using the survey software HYPACK MAX, survey crew members recorded target points and stored the GPS location of each modified bar check. Figure 3 shows the locations of target points where the TWDB survey crew verified depth sounder readings with a stadia rod. Several other depth checks were made and not recorded.

Figure 2

Lake Anahuac

Data Points Collected during TWDB 2006 Survey



Legend

- TWDB Data Collected During the 2006 Original Survey
- TWDB Data Collected During the 2006 Return Survey
- Lake Anahuac Water Surface Elev. 4 ft above msl

0 0.25 0.5 1 Miles

TWDB 2006 Survey

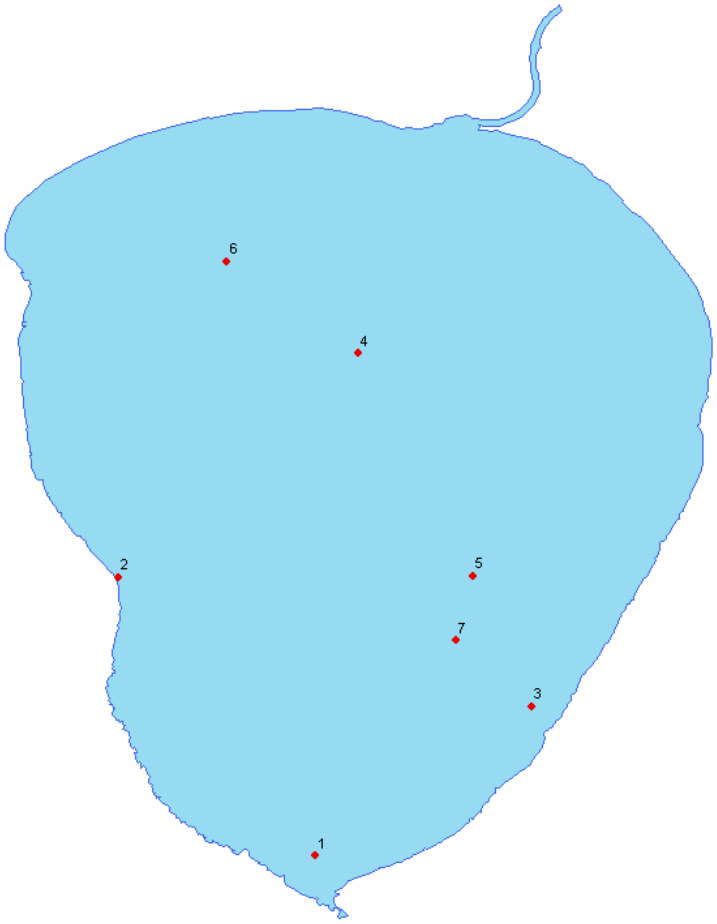


Table 2. Recorded targets during TWDB return survey

ID	date	time	x	y	depth sounder reading	stadia rod reading
1	9/26/2006	8:32:22	-94.68810715	29.77722909	5.3	5.3
2	9/26/2006	9:47:31	-94.70187539	29.79551509	3.9	3.9-4.0
3	9/26/2006	11:15:29	-94.67186535	29.78624685	6.3	6.3
4	9/26/2006	12:32:30	-94.68364606	29.80925294	6.9	6.9-7.0
5	9/26/2006	15:40:01	-94.67582608	29.79473786	7	7
6	9/26/2006	16:12:43	-94.69302586	29.81543414	6.6-6.7	6.6-6.7
7	9/26/2006	17:05:38	-94.67726253	29.79066928	6.8	6.8-7.0

Figure 3. Recorded locations where TWDB staff verified depth sounder readings with a stadia rod.

Survey Results

The results of the TWDB 2006 Survey indicate Lake Anahuac has a total storage capacity of 33,348 acre-feet and encompasses 5,035 acres at elevation 4.0 ft, the top of pool elevation.[5] Based on information provided by the Chambers-Liberty Counties Navigation District (CLCND) and as permitted in Certificate of Adjudication No. 08-

4279, the storage capacity of Lake Anahuac was 35,300 acre-feet at elevation 5.0 ft after the project was enlarged in the 1950's. From the Area and Capacity Curves provided by CLCND found in TWDB Report 126- Engineering Data on Dams and Reservoirs in Texas Part II, the TWDB estimates the total storage capacity at elevation 4.0 ft to have been 29,500 acre-feet in 1954. This indicates a 3,848 acre-feet, or 13.0%, gain in volume between 1954 and 2006. Report 126, with information provided by CLCND, lists the area of Lake Anahuac at 5,300 acres at elevation 5.0 ft. The scale of the Area Capacity Table in Report 126 prevents TWDB staff from estimating the 1954 reservoir area at 4.0 ft. Due to the likely differences in the methodologies used to calculate the reservoir's capacity between original impoundment and 2006, comparison of these values is not recommended and numbers are presented here for informational purposes only.[7]

Data Processing

Model Boundary

The reservoir boundary was digitized from aerial photographs using Environmental Systems Research Institute's (ESRI) ArcGIS 9.1 software. The aerial photographs, or digital orthophoto quarter-quadrangle images (DOQQs), used for Lake Anahuac were the Anahuac quarter quads. These images were photographed on August 16, 2004, during which time the water surface elevation[8] at Lake Anahuac measured 2.0 ft. TWDB staff determined that there was not a significant difference in lake area between 2.0 ft and 4.0 ft, as discernable from the photographs and given that steep sided levees surround most of the lake. Therefore, the boundary was digitized from the land water interface in the photos and labeled 4.0 ft to allow area and volume to be calculated to the top of pool elevation.

The United States Department of Agriculture, Farm Service Agency's, Aerial Photography Field Office (APFO), National Agriculture Imagery Program (NAIP) acquires the photographic imagery during the agricultural growing seasons in the continental U.S.[9] The imagery resides in the public domain and can be downloaded from the Texas Natural Resources Information System (TNRIS) website at http://www.tnris.state.tx.us/. For more information visit the APFO website at http://www.apfo.usda.gov/NAIP.html or contact TNRIS.

Triangular Irregular Network (TIN) Model

Upon completion of data collection, the raw data files are edited in HYPACK MAX to remove any data anomalies. The water surface elevations for each respective day are applied and the depths are converted to corresponding elevations and exported as a MASS points file. The MASS points and boundary files are used to create a Triangulated Irregular Network (TIN) model, a function of the 3D Analyst Extension of ArcGIS. The model uses Delaunay's criteria for triangulation to place a triangle between three non-uniformly spaced points, including the boundary.[10]

It was during this process that the TWDB discovered inconsistencies in the data between different collection days, which prompted the TWDB to return to Anahuac to verify the original data. Upon processing the return survey data, TWDB staff determined the depth sounder must have been incorrectly set during the original survey causing the depth sounder to record a bias to the data from day to day. To correct this bias, the TWDB collected data on a subset of the original pre-planned range lines. Additionally, tie lines or lines perpendicular to the pre-planned range lines, were run to evaluate the return survey data for consistency. Once the range line data was collected, the original data and the return survey data were plotted and the difference in elevation was calculated for several prominent features along each range line. These differences were summed and averaged for each range line, then added to the original data and plotted with the return survey data for final evaluation. Figure 4, on the following page, compares a sample cross-section from the original survey, the return survey, and the adjusted original survey data, illustrating the original bias in sounding measurements. Figure 5 shows the location of this cross-section in Lake Anahuac.

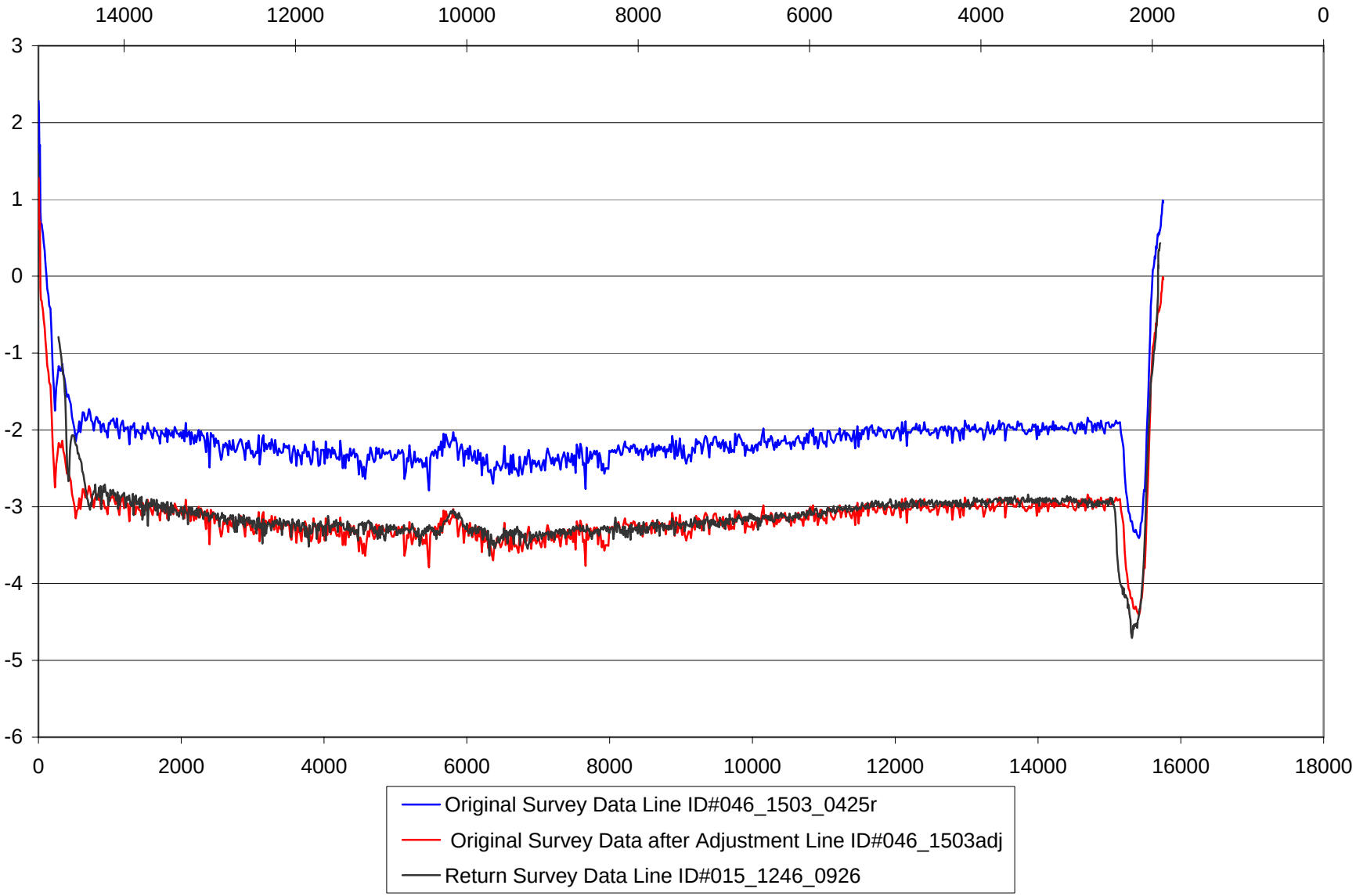


Figure 4. Comparison of cross-sections illustrating bias in the original TWDB survey data

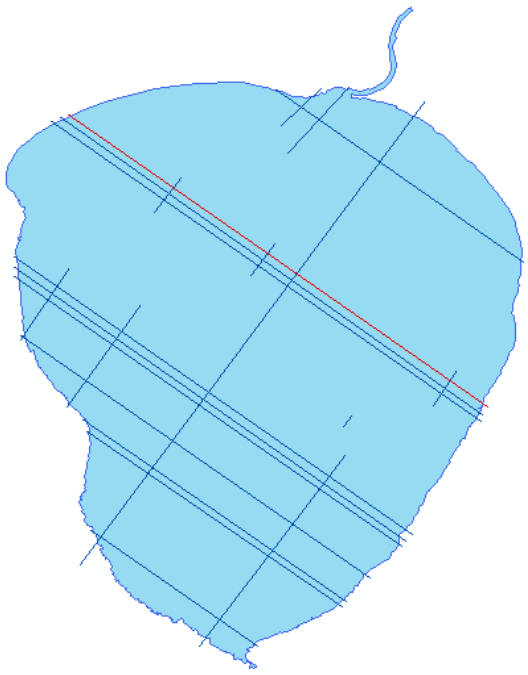


Figure 5. Map of Lake Anahuac illustrating the planned lines for the TWDB Return Survey. The resulting data were used to adjust the original survey data. The line in red represents the location of the cross-sections shown in Figure 4.

Using Arc/Info software, volumes and areas were calculated from the TIN Model for the entire reservoir at one-tenth of a foot intervals, from elevation -16.8 ft to elevation 4.0 ft. The Elevation-Volume and Elevation-Area Tables, updated for 2006, are presented in Appendices A and B, respectively. An Elevation-Volume graph and an Elevation-Area graph are presented in Appendices C and D, respectively. It is worth noting that the total volume of water calculated below elevation -7.0 ft is essentially confined to Turtle Bayou, the stream emptying into Lake Anahuac at the north end, and equals 28 acre-feet, or 0.08% of the total volume calculated.

The TIN Model was interpolated and averaged using a cell size of 10 ft and converted to a raster. The raster was used to produce Figure 6, an Elevation Relief Map representing the topography of the reservoir bottom, Figure 7, a map showing shaded depth ranges for Lake Anahuac, and Figure 8, a 1-ft contour map

Lake Anahuac in Cross-Section

The TWDB selected several planned lines from the 2006 return survey to examine the reservoir in cross-section and to facilitate future tracking of any sedimentation in Lake Anahuac. The cross-sections were extracted from the TIN Model and are presented in Appendix E, along with a map showing their locations and a table listing their endpoint coordinates.

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 Barney Austin, Director of Surface Water Resources, at 512-463-8856, or by email at: Barney.Austin@twdb.state.tx.us.

References

1. Handbook of Texas Online, 6 June 2001, Lake Anahuac, viewed 9 October 2006, http://www.tsha.utexas.edu/handbook/online/articles/LL/rolaf.html.

2. Texas Water Development Board, Report 126, Engineering Data on Dams and Reservoirs in Texas, Part I, October 1974.

3. Chambers-Liberty Counties Navigation District, History, viewed 9 October 2006, http://www.clcnd.com/.

4 .Lakes of Southeast Texas, Chambers County, Lake Anahuac, viewed 9 October 2006, http://www.fun365days.com/LakeRivers.asp.

5. Willcox, G, (pudge@clcnd), 11 October 2006, RE: Information on elevation datum. Email to R. Burns (Randall.Burns@twdb.state.tx.us)

6. National Geodetic Survey, United States Department of Commerce, viewed November 2, 2006, http://www.ngs.noaa.gov/faq.shtml.

7. United States Department of Agriculture, Natural Resource Conservation Service, National Engineering Handbook, Section 3, Sedimentation, Chapter 7, Field Investigations and Surveys, December 1983.

8. Willcox, G. (pudge@clcnd.com), 21 December 2005, RE: Lake Anahuac. Email to H. Weyant (Holly.Weyant@twdb.state.tx.us).

9. U.S Department of Agriculture, Farm Service Agency, Aerial Photography Field Office, National Agriculture Imagery Program, http://www.apfo.usda.gov/NAIP.html, 2/10/06.

10. ESRI, Environmental Systems Research Institute. 1995. ARC/INFO Surface Modeling and Display, TIN Users Guide.

Figure 6

Lake Anahuac

Elevation Relief Map

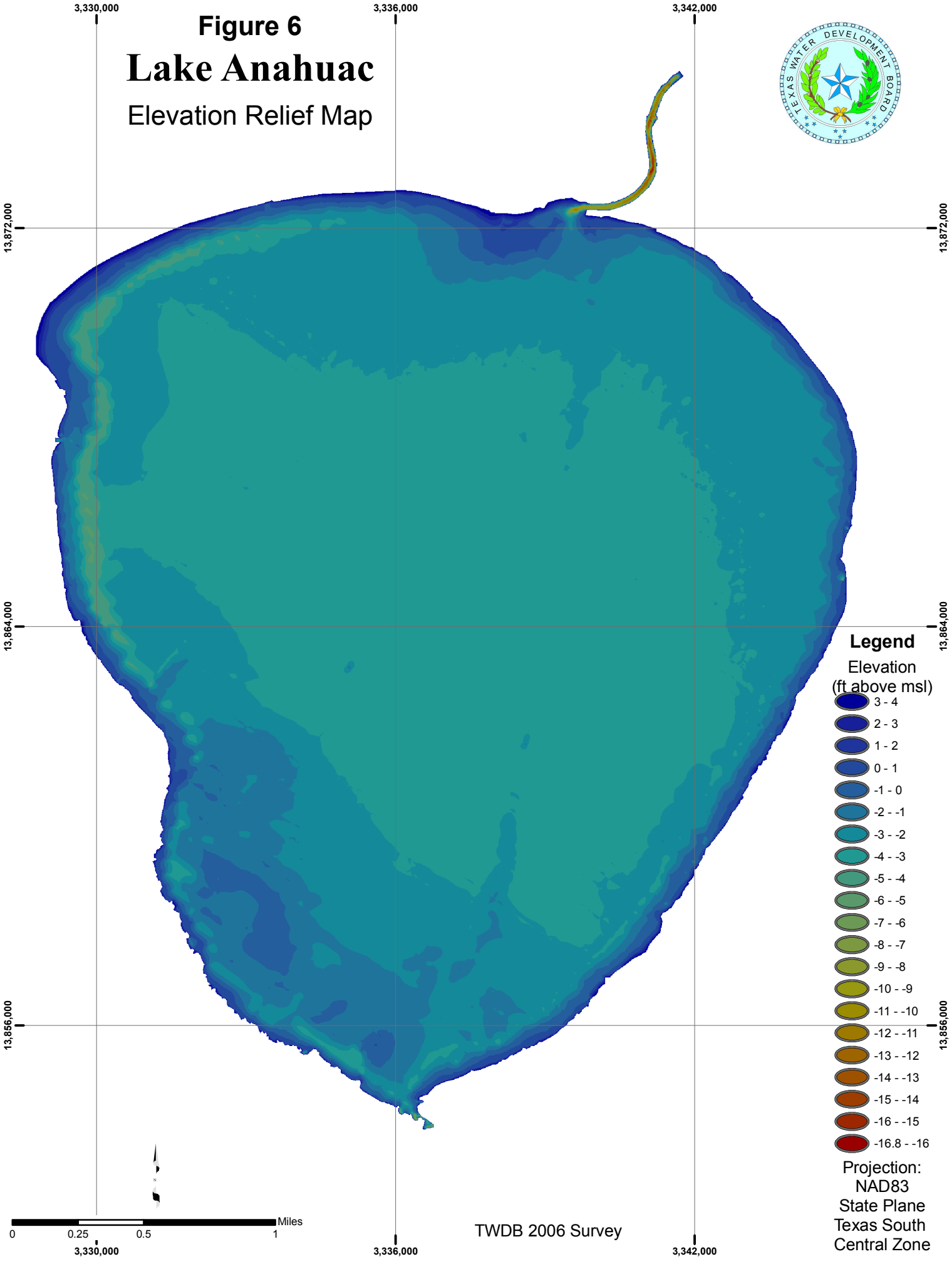
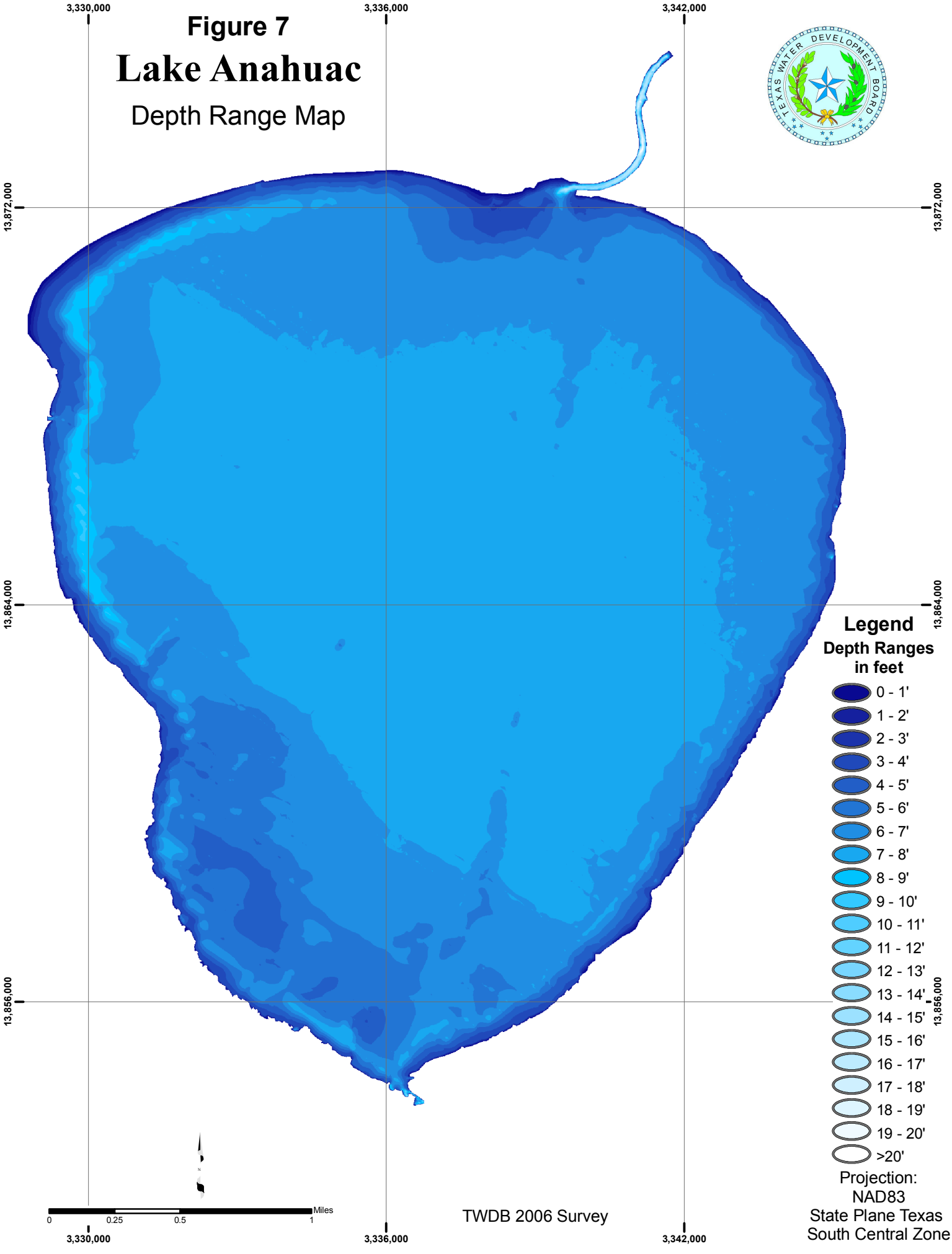


Figure 7

Lake Anahuac

Depth Range Map



Appendix A

Lake Anahuac

RESERVOIR VOLUME TABLE

TEXAS WATER DEVELOPMENT BOARD — APRIL 2006 SURVEY

Conservation Pool Elevation 4.0'

VOLUME IN ACRE-FEET — ELEVATION INCREMENT IS ONE TENTH FOOT

ELEVATION in Feet	-0.9	-0.8	-0.7	-0.6	-0.5	-0.4	-0.3	-0.2	-0.1	0.0
-16		0	0	0	0	0	0	0	0	0
-15	0	0	0	0	0	0	0	0	0	0
-14	0	0	0	0	0	0	0	0	0	0
-13	0	0	0	0	0	1	1	1	1	1
-12	1	1	1	1	1	1	1	2	2	2
-11	2	2	2	3	3	3	3	4	4	4
-10	4	5	5	5	6	6	7	7	7	8
-9	8	9	9	10	10	11	11	12	12	13
-8	14	14	15	16	16	17	18	18	19	20
-7	20	21	22	23	24	24	25	26	27	28
-6	28	29	30	31	32	33	34	35	36	37
-5	37	38	39	40	41	42	43	44	45	47
-4	48	50	52	54	57	60	64	68	73	79
-3	86	93	101	113	145	214	327	481	675	905
-2	1,166	1,453	1,760	2,086	2,432	2,795	3,171	3,558	3,955	4,359
-1	4,771	5,189	5,614	6,043	6,477	6,915	7,356	7,801	8,252	8,707
0	9,167	9,631	10,098	10,568	11,040	11,514	11,990	12,468	12,948	13,430

ELEVATION in Feet	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	13,430	13,914	14,399	14,887	15,377	15,868	16,361	16,855	17,350	17,846
1	18,343	18,839	19,337	19,834	20,332	20,829	21,328	21,826	22,324	22,823
2	23,322	23,821	24,321	24,820	25,320	25,820	26,321	26,821	27,322	27,823
3	28,324	28,825	29,327	29,829	30,331	30,833	31,336	31,838	32,341	32,844
4	33,348									

Appendix B

Lake Anahuac

RESERVOIR AREA TABLE

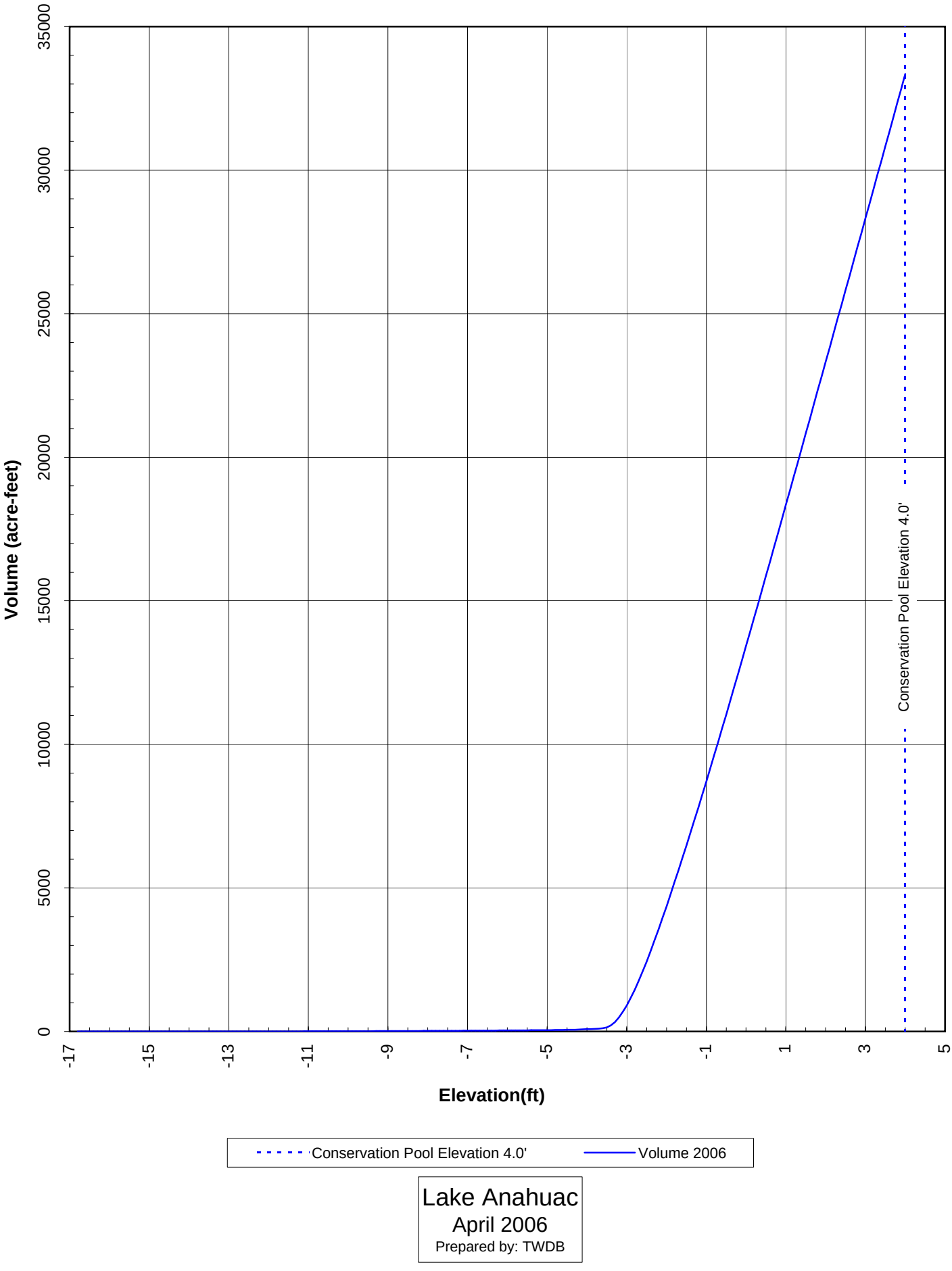
TEXAS WATER DEVELOPMENT BOARD — APRIL 2006 SURVEY

Conservation Pool Elevation 4.0'

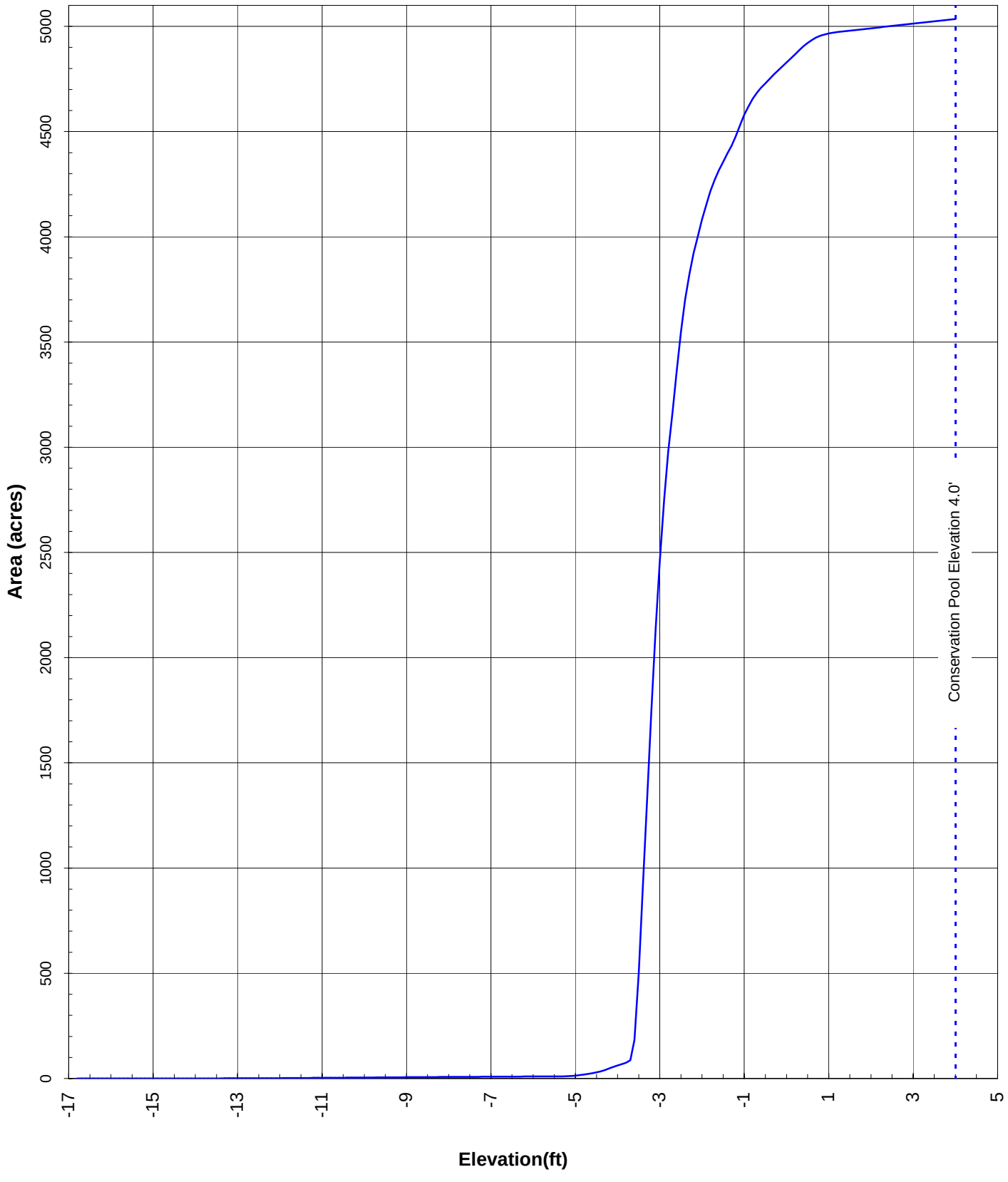
AREA IN ACRES — ELEVATION INCREMENT IS ONE TENTH FOOT

ELEVATION in Feet	-0.9	-0.8	-0.7	-0.6	-0.5	-0.4	-0.3	-0.2	-0.1	0.0
-16		0	0	0	0	0	0	0	0	0
-15	0	0	0	0	0	0	0	0	0	0
-14	0	0	0	0	0	0	0	0	0	0
-13	0	0	0	0	0	1	1	1	1	1
-12	1	1	1	1	1	1	1	1	1	2
-11	2	2	2	2	2	2	3	3	3	3
-10	3	3	3	4	4	4	4	4	4	4
-9	5	5	5	5	5	5	6	6	6	6
-8	6	6	6	7	7	7	7	7	7	7
-7	7	8	8	8	8	8	8	8	8	8
-6	9	9	9	9	9	9	9	9	9	9
-5	10	10	10	10	10	10	10	10	11	13
-4	16	19	22	25	29	34	40	48	55	62
-3	68	75	87	183	504	916	1,337	1,745	2,138	2,456
-2	2,749	2,979	3,167	3,360	3,550	3,701	3,822	3,922	4,002	4,082
-1	4,153	4,218	4,272	4,316	4,356	4,395	4,433	4,477	4,530	4,580
0	4,620	4,656	4,685	4,708	4,729	4,750	4,771	4,791	4,810	4,828

ELEVATION in Feet	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	4,828	4,848	4,867	4,886	4,905	4,922	4,936	4,947	4,956	4,962
1	4,967	4,970	4,973	4,975	4,977	4,980	4,982	4,984	4,986	4,989
2	4,991	4,993	4,995	4,998	5,000	5,002	5,004	5,006	5,009	5,011
3	5,013	5,015	5,017	5,019	5,022	5,024	5,026	5,028	5,030	5,032
4	5,035									



Appendix C Elevation vs. Volume

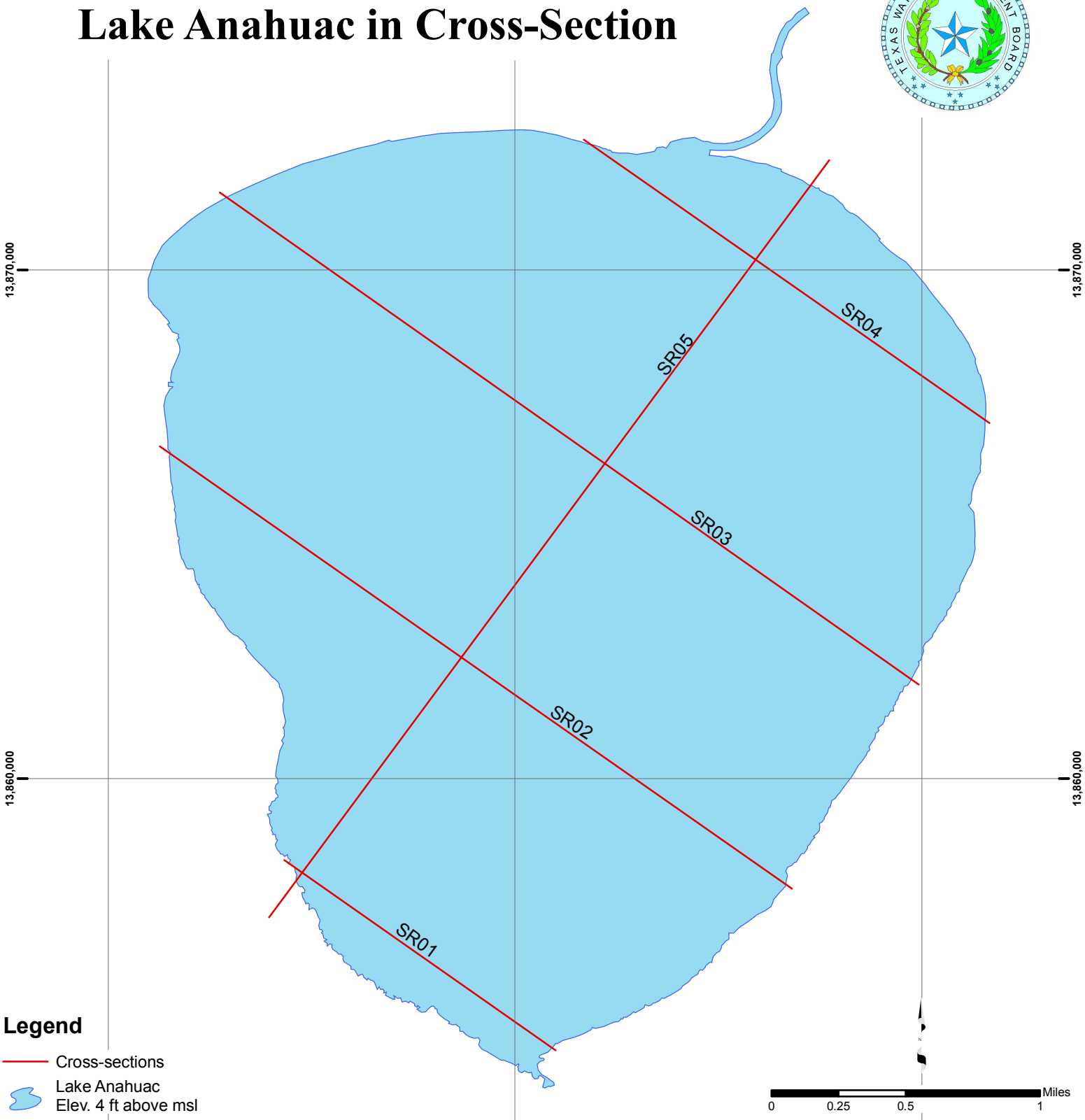


Conservation Pool Elevation 4.0' — Area 2006

Lake Anahuac
April 2006
Prepared by: TWDB

Appendix E

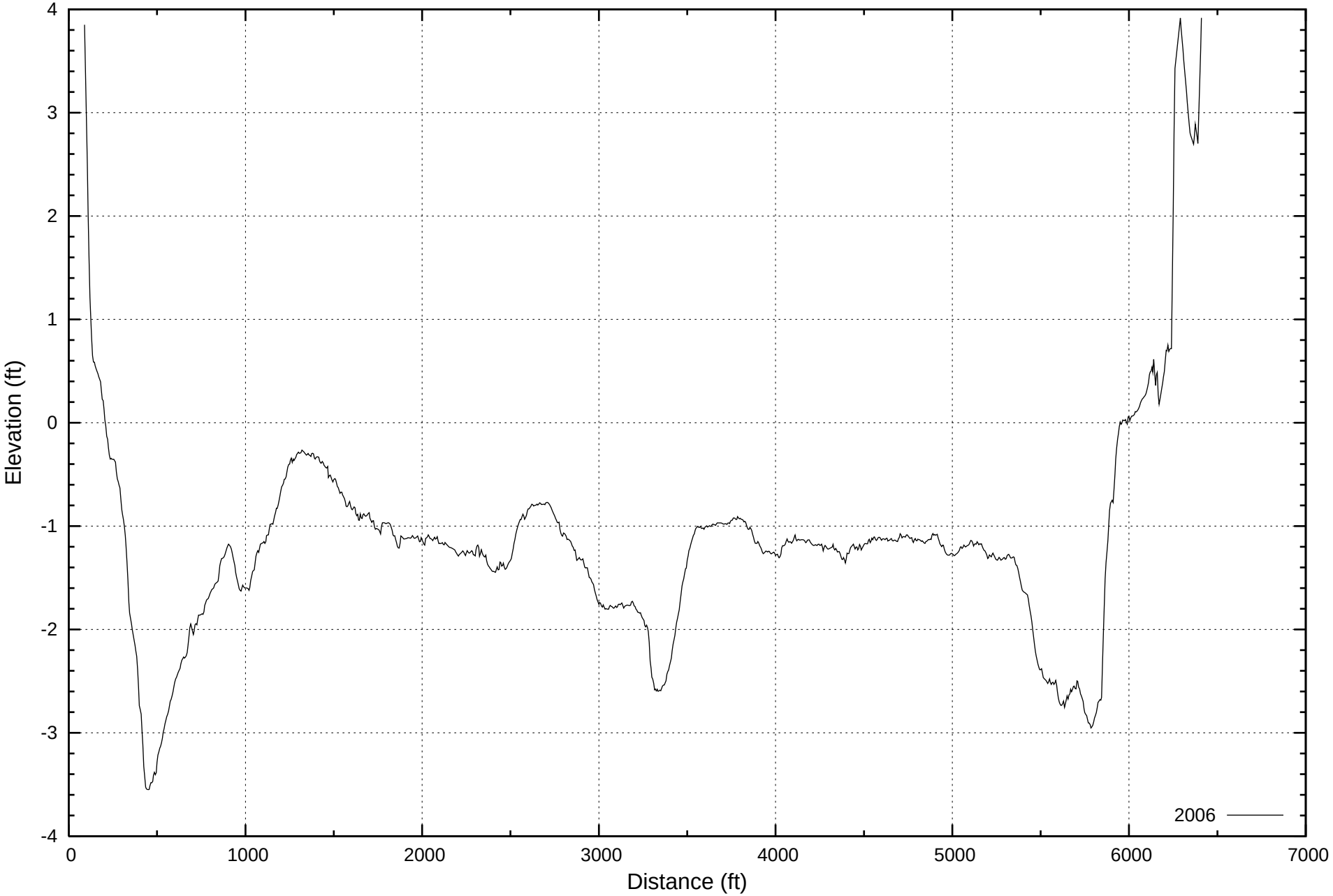
Lake Anahuac in Cross-Section



Endpoint Coordinates for Lake Anahuac Cross-Sections				
ID	X_L	Y_L	X_R	Y_R
SR01	3,336,799.4689326700	13,854,646.8252726000	3,331,466.2962816000	13,858,390.8810111000
SR02	3,341,446.2878318000	13,857,830.1773657000	3,329,017.8855328500	13,866,534.4924025000
SR03	3,343,942.9318829700	13,861,849.2067812000	3,330,198.2459049900	13,871,521.9893002000
SR04	3,345,329.9831544000	13,866,986.9856270000	3,337,356.2257403300	13,872,566.9586740000
SR05	3,331,166.4115475000	13,857,263.7983069000	3,342,183.7748476300	13,872,154.7014378000
Coordinates in NAD83 State Plane Texas South Central Zone				$_L$= Left $_R$= Right

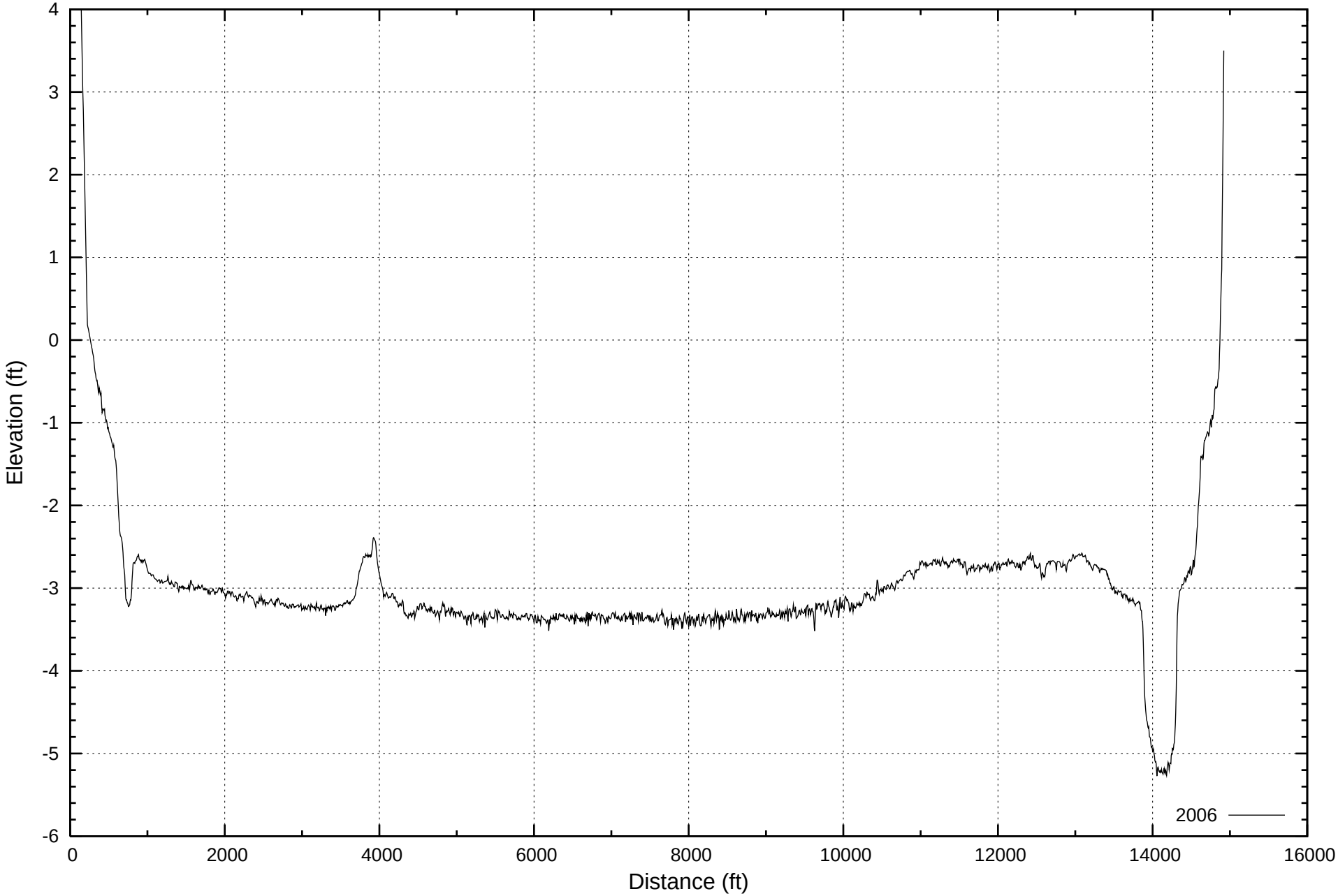
Lake Anahuac

Range Line SR01



Lake Anahuac

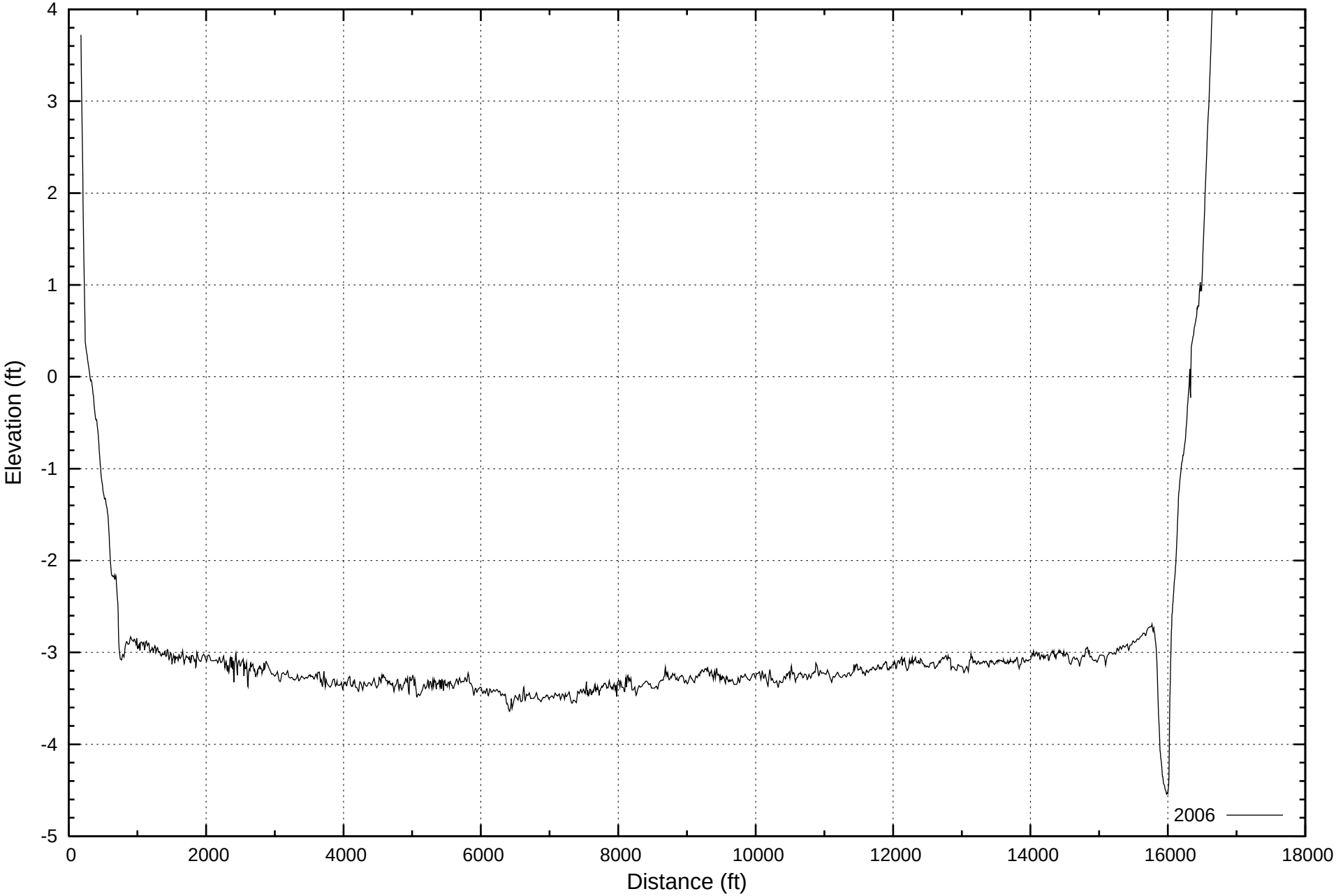
Range Line SR02



Appendix E

Lake Anahuac

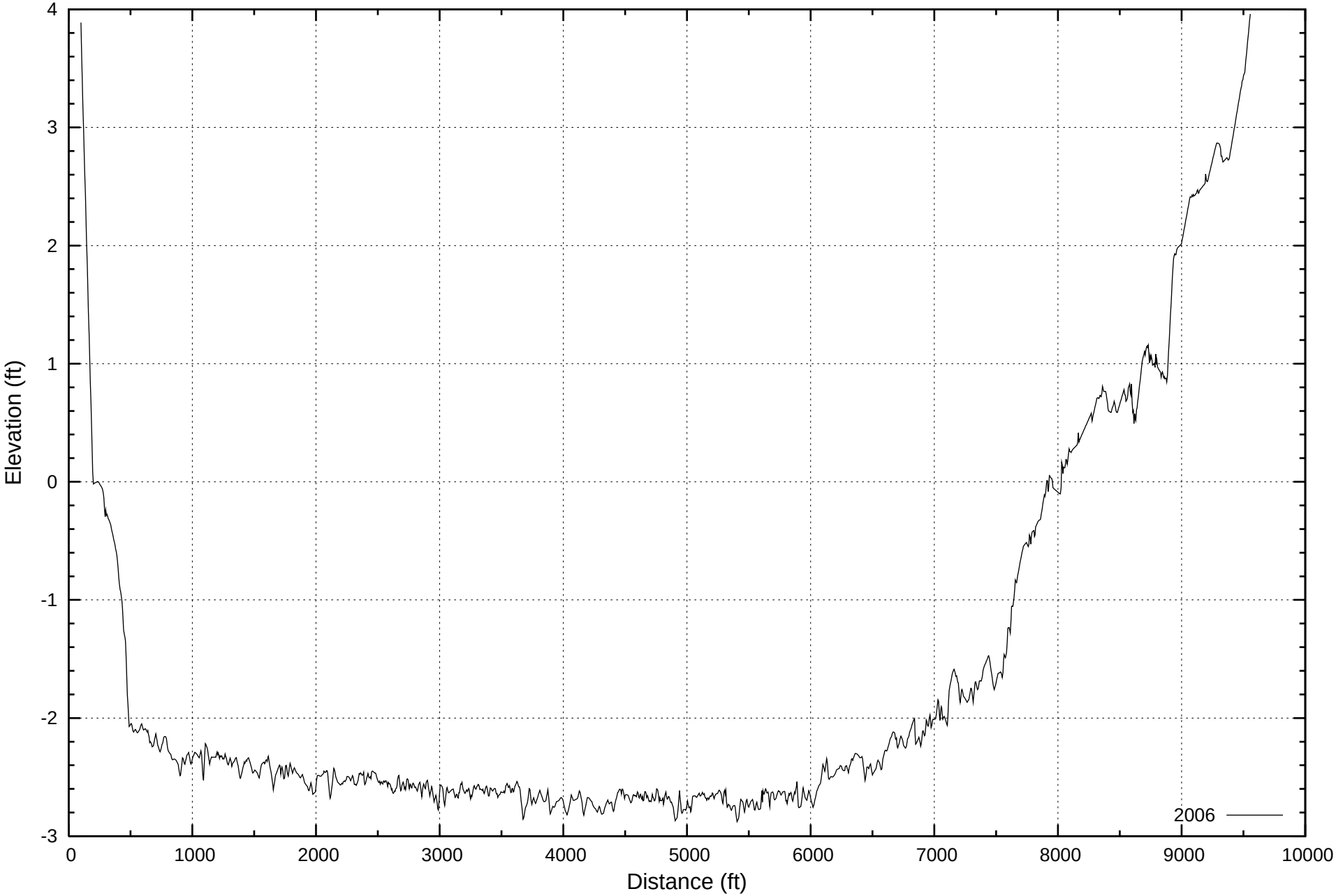
Range Line SR03



Appendix E

Lake Anahuac

Range Line SR04



Appendix E

Lake Anahuac

Range Line SR05

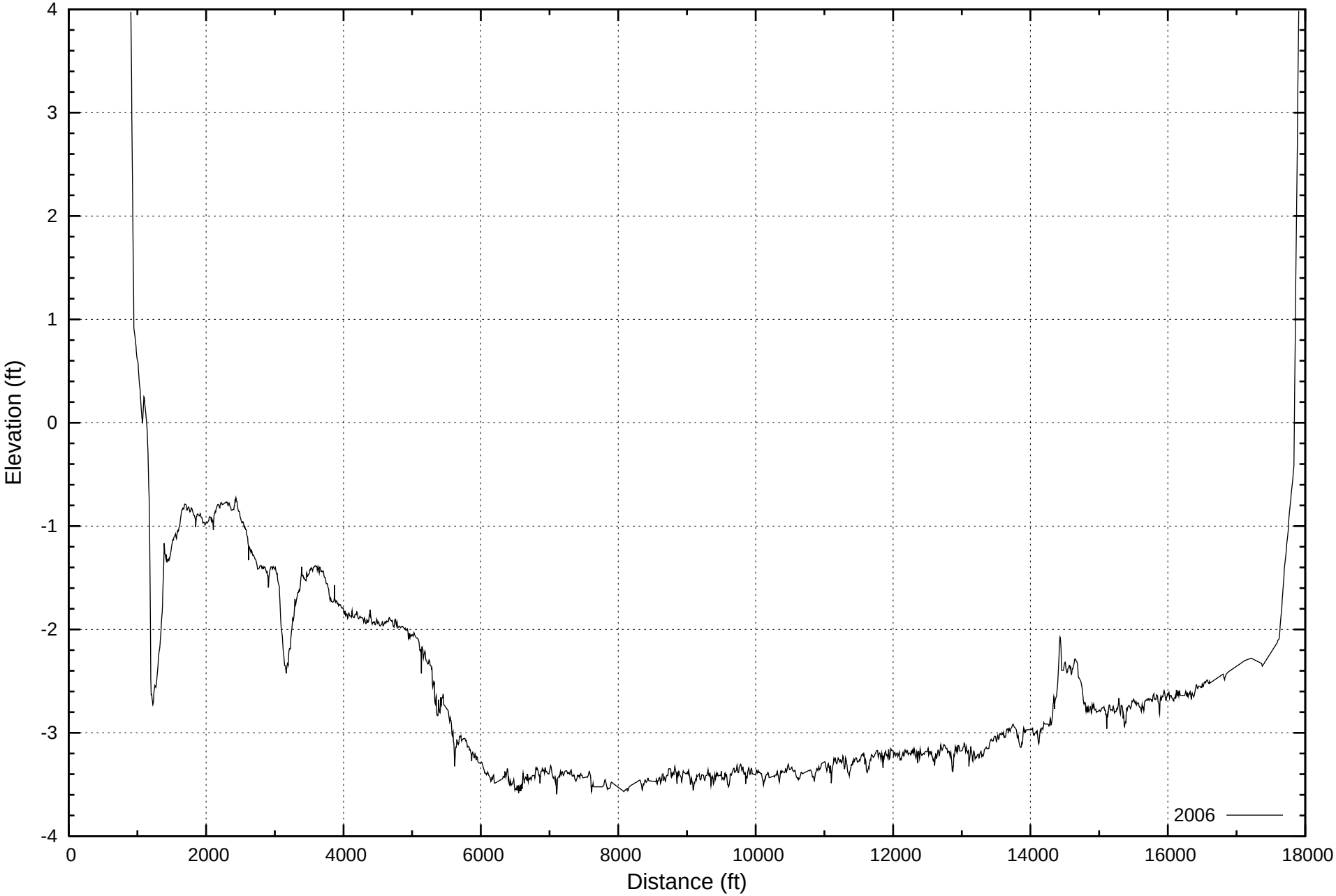


Figure 8

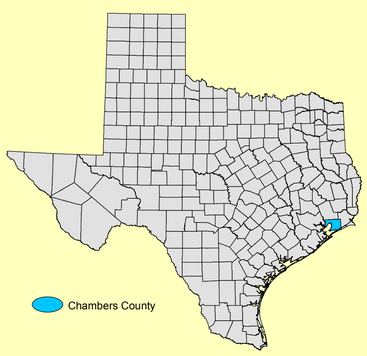
Lake Anahuac

1' - Contour Map

CONTOURS

- 4'
- 3'
- 2'
- 1'
- 0'
- -1'
- -2'
- -3'
- -4'
- -5'
- -6'
- -7'
- -8'
- -9'
- -10'
- -11'
- -12'
- -13'
- -14'
- -15'
- -16'

Lake Anahuac
Elevation:
4 ft above msl



This map is the product of a survey conducted by the Texas Water Development Board's Hydrographic Survey Program to determine the capacity of Lake Anahuac. The Texas Water Development Board makes no representation or assumes any liability.

3,344,000

13,872,000

13,864,000

13,856,000

3,336,000

3,344,000

N

0.5 0.25 0 0.5 1 Miles

Prepared by: TEXAS WATER DEVELOPMENT BOARD April 2006 Survey