Volumetric Survey
of
PAT MAYSE LAKE

July 2008 Survey

Prepared by:

The Texas Water Development Board

December 2008

Texas Water Development Board

J. Kevin Ward, Executive Administrator

Prepared for:

City of Irving

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Executive Summary

In June of 2008, the Texas Water Development Board (TWDB) entered into agreement with the City of Irving, Texas, for the purpose of performing a volumetric survey of Pat Mayse Lake. Pat Mayse Dam and Pat Mayse Lake are located on Sanders Creek in Lamar County, 12 miles north of Paris, Texas. TWDB conducted the Pat Mayse Lake survey on July 15th-16th, 2008 and July 22nd-24th, 2008 while the water surface elevation of the lake varied between 450.46 feet and 450.73 feet above mean sea level (NGVD 29). The conservation pool elevation for the lake is 451.0 feet above mean sea level (NGDV 29).

The results of the TWDB 2008 Volumetric Survey indicate Pat Mayse Lake has a total reservoir capacity of 117,844 acre-feet and encompasses 5,638 acres at conservation pool elevation (451.0 feet above mean sea level, NGVD 29). In 1965, the capacity at conservation pool elevation was estimated at 124,500 acre-feet[1]. Due to differences in the methodologies used in calculating areas and capacities from this and previous Pat Mayse Lake surveys, comparison of these values is not recommended. The TWDB considers the 2008 survey to be a significant improvement over previous methods and recommends that a similar methodology be used to resurvey Pat Mayse Lake in approximately 10 years or after a major flood event.

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

Pat Mayse Lake General Information

Pat Mayse Dam and Pat Mayse Lake are located on Sanders Creek, a tributary of the Red River, 12 miles north of Paris, Texas, in Lamar County[1] (Figure 1). The U.S. Army Corps of Engineers, Tulsa District, maintains and operates Pat Mayse Lake. Construction of Pat Mayse Dam began on March 9, 1965, with deliberate impoundment beginning on September 28, 1967.[1] Pat Mayse Lake serves as a municipal and industrial water supply for the City of Paris, as well as provides flood control and recreational opportunities for the local community.[2] Additional pertinent data about Pat Mayse Dam can be found in Table 1.

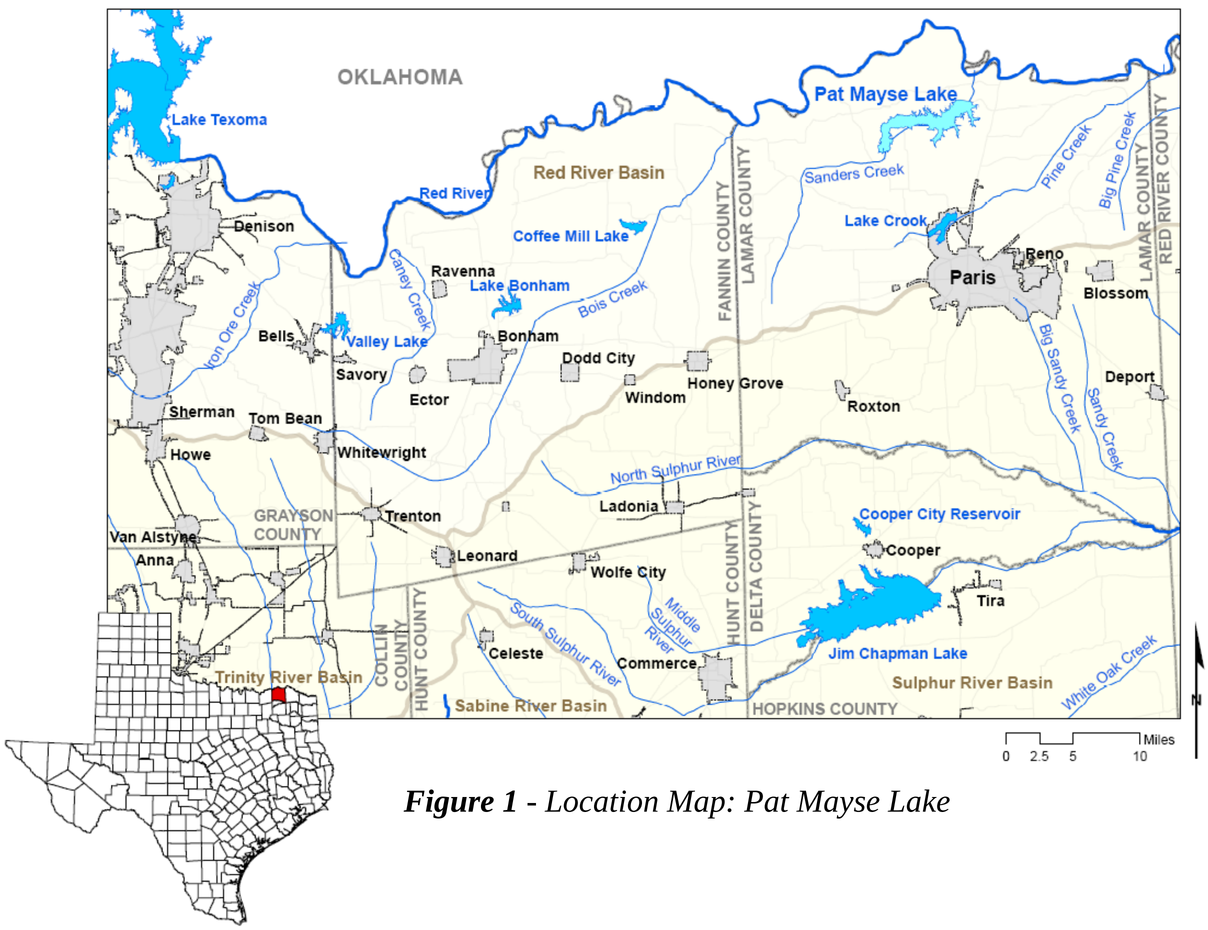


Figure 1 *- Location Map: Pat Mayse Lake*

Table 1. Pertinent Data for Pat Mayse Dam and Pat Mayse Lake[1,2]

Owner

The U.S. Government, Operated by the U.S. Army Corps of Engineers, Tulsa District

Engineer

U.S. Army Corps of Engineers, Tulsa District

Location of Dam

At river mile 4.6 on Sanders Creek, a tributary of the Red River in the Red River Basin in Lamar County, 2 miles southwest of Arthur City, approximately 1 mile south of Chicota, 4 miles northwest of Powderly, and 12 miles north of Paris, Texas.

Drainage Area

175 square miles

Dam

Type	Earthfill
Length	7,080 feet
Maximum height	96 feet
Top width	32 feet

Spillway

Type	Excavated channel
Control	None
Invert elevation	477.0 feet above mean sea level
Crest length	100 feet

Outlet Works

Type	Morning glory drop inlet with 7.25-foot diameter conduit
Control	None
Crest elevation	451.0 feet above mean sea level
Low flow inlet elevation	407.0 feet above mean sea level

Reservoir Data (Based on TWDB 2008 Volumetric Survey)

Feature	Elevation (feet above mean sea level)	Capacity (acre-feet)	Area (acres)
Top of dam	488.5	N/A	N/A
Top of flood control pool	460.5	N/A	N/A
Top of conservation pool	451.0	117,844	5,638
Bottom of conservation pool	415.0	4,160	852
Usable conservation storage	------	113,684	

Water Rights

The water rights for Pat Mayse Lake are appropriated to the City of Paris through Certificate of Adjudication No. 02-4940 and its amendment. A brief summary of each water right appropriation follows. The complete certificates are on file in the Records Department of the Texas Commission on Environmental Quality.

Certificate of Adjudication No. 02-4940 Priority Date: November 5, 1964

This certificate authorizes the City of Paris to maintain an existing dam and reservoir (Pat Mayse Lake) on Sanders Creek and to impound therein a maximum of 124,500 acre-feet of water. The City of Paris is authorized to divert and use a maximum of 25,000 acre-feet of water per year for municipal purposes and a maximum of 36,610 acre-feet of water per year for industrial purposes. The certificate also authorizes the City of Paris to use 1,115 acre-feet of water per year, from the 25,000 acre-foot municipal authorization, for use outside the Red River Basin for the purpose of supplying municipal water to various small communities and rural customers in the Sulphur River Basin.

Amendment to Certificate of Adjudication No. 02-4940A Granted: April 18, 2000

This amendment authorizes the City of Paris to use up to 20,000 acre-feet of their 36,610 acre-foot annual industrial authorization, for use outside the Red River Basin for industrial purposes in the Sulphur River Basin in Lamar County. This new authorization retains the priority date of November 5, 1964.

Volumetric Survey of Pat Mayse Lake

Introduction

The Hydrographic Survey Program of the Texas Water Development Board (TWDB) 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 June of 2008, the TWDB entered into agreement[3] with the City of Irving, Texas, for the purpose of performing a volumetric survey of Pat Mayse Lake. This report describes the methods used in conducting the volumetric survey, including data collection methods and data processing techniques. This report serves as the final contract deliverable from TWDB to the City of Irving, 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].

Datum

The vertical datum used during this survey is that used by the United States Army Corps of Engineers (Corps), Tulsa District, for the reservoir elevation gauge MYST2: Pat Mayse Lake.[4] The datum for this gauge is reported as National Geodetic Vertical Datum 1929 (NGVD 29) or mean sea level, 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 Corps gauge. The horizontal datum used for this report is North American Datum of 1983 (NAD83) State Plane Texas North Central Zone (feet).

TWDB Bathymetric Data Collection

TWDB conducted the Pat Mayse Lake survey on July 15th-16th, 2008 and July 22nd-24th while the water surface elevation of the lake varied between 450.46 feet and 450.73 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. Data collection occurred while navigating along pre-planned range lines oriented perpendicular to the approximate location of the original river channels and spaced approximately 500 feet apart. For all data collection efforts, the depth sounder was calibrated daily by comparing depth readings recorded by the Knudsen echosounder to physical depth measurements made with a weighted tape and stadia rod. During the 2008 survey, team members collected 70,661 data points over cross-sections totaling nearly 127 miles in length. Figure 2 shows where data points were collected during the TWDB 2008 survey.

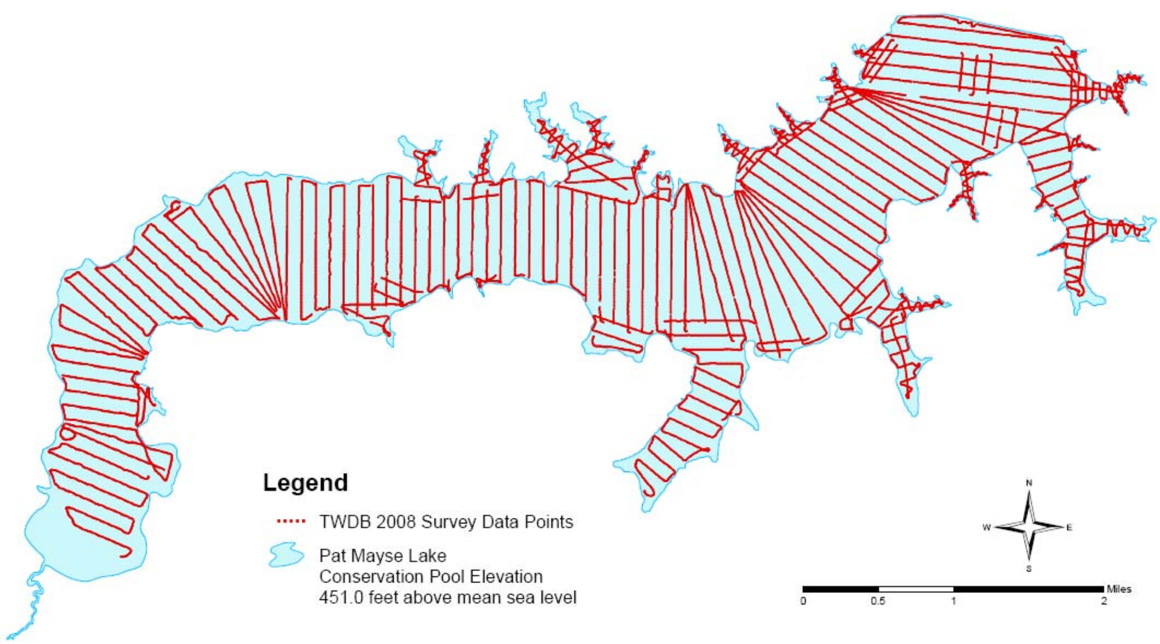


Figure 2 *– TWDB 2008 Survey Data Points*

Data Processing

Lake Boundaries

The boundary of Pat Mayse Lake was manually digitized from digital ortho quarter quadrangle (DOQQ) aerial photographs[5] available from the Texas Natural Resources Information System (TNRIS)[6]. The lake boundary was digitized from the Pat Mayse Lake West NE, Pat Mayse Lake West SE, Pat Mayse Lake East NW, and Pat Mayse Lake East NE DOQQs photographed on February 2, 1995 when the water surface elevation in Pat Mayse Lake averaged 452.89 feet, as measured by the Corps gauge MYST2: Pat Mayse Lake[4]. Additional lake boundary data were derived through digitization of DOQQs obtained from aerial photographs taken on September 30, 2004. On this date, the water surface elevation in Pat Mayse Lake averaged 449.41 feet according to the Corps gauge MYST2: Pat Mayse Lake[4]. As the DOQQs used in digitizing the boundaries are of 1-meter resolution, the physical lake boundaries may be within ± 1 meter of the location derived from the manual delineation. The 2004 boundary was used to supplement the TWDB survey data in locations where the survey data alone was insufficient to properly represent the reservoir bathymetry.

Triangular Irregular Network (TIN) Model

Upon completion of the data collection effort, the raw bathymetry files were edited using customized MATLAB processing scripts and the HydroEdit software package. 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. MATLAB processing scripts are then 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 processing outside of MATLAB and HydroEdit, the sounding coordinates (X,Y,Z) are exported as a MASS points file. TWDB also created MASS points files of interpolated data located between surveyed cross sections and extrapolated data in areas where the lake was too shallow to allow for boat passage. These points files are described in the sections entitled "Self-Similar Interpolation" and "Line Extrapolation."

To create a surface representation of the Pat Mayse Lake bathymetry, the 3D Analyst Extension of ArcGIS (ESRI, Inc.) is used. This extension creates 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.[7] From the TIN model, reservoir capacities and areas are calculated at 0.1 foot intervals, from elevation 398.6 feet to elevation 451.0 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. An Elevation-Area-Capacity graph is presented in Appendix C.

The Pat Mayse Lake TIN model was interpolated and averaged using a cell size of 1 foot by 1 foot and converted to a raster. The raster was used to produce an Elevation Relief Map representing the topography of the reservoir bottom (Figure 3), a map showing shaded depth ranges for Pat Mayse Lake (Figure 4), and a 5-foot contour map (Figure 5 - attached). The reservoir extent depicted in these figures is that corresponding to the conservation pool elevation (451.0 feet).

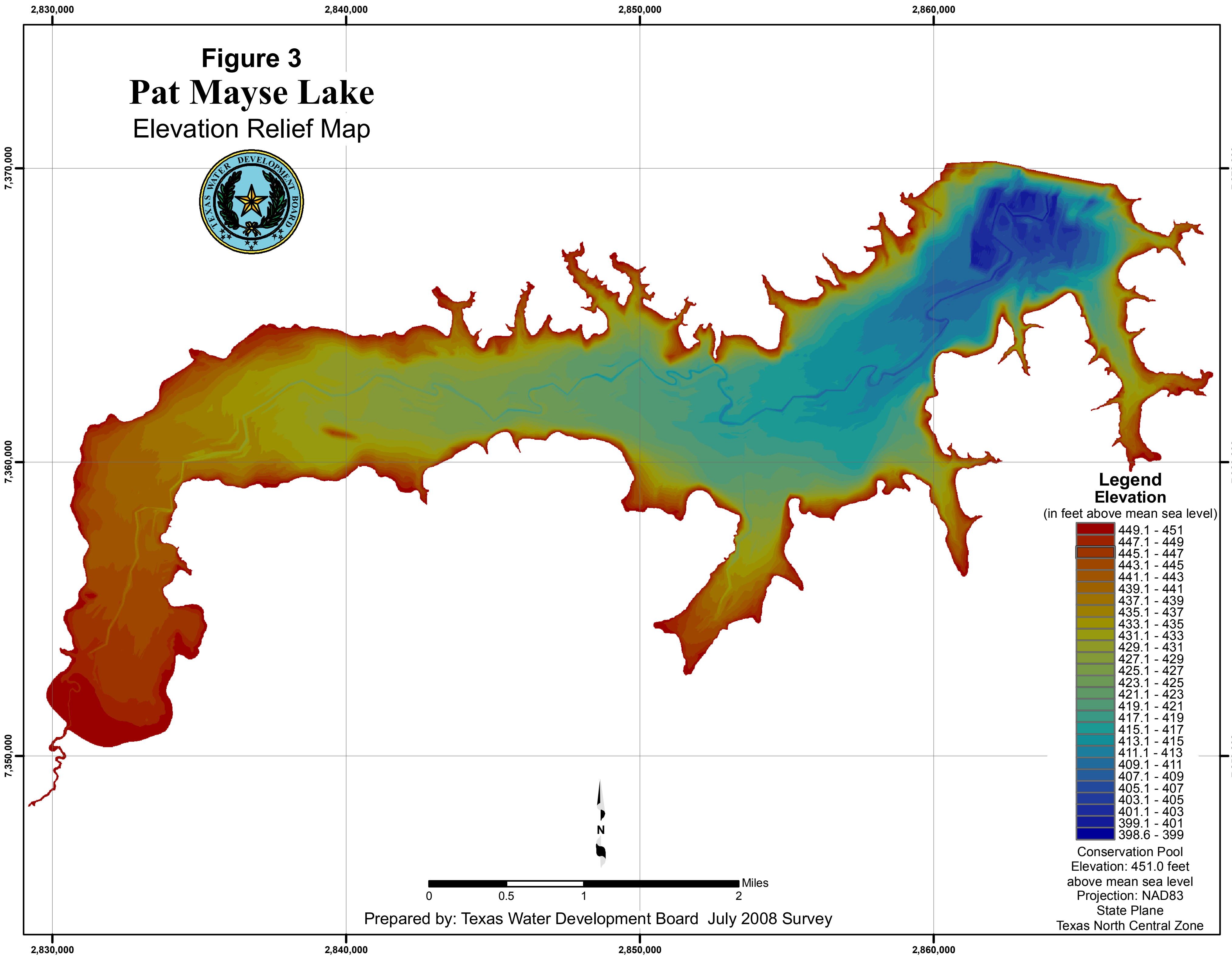
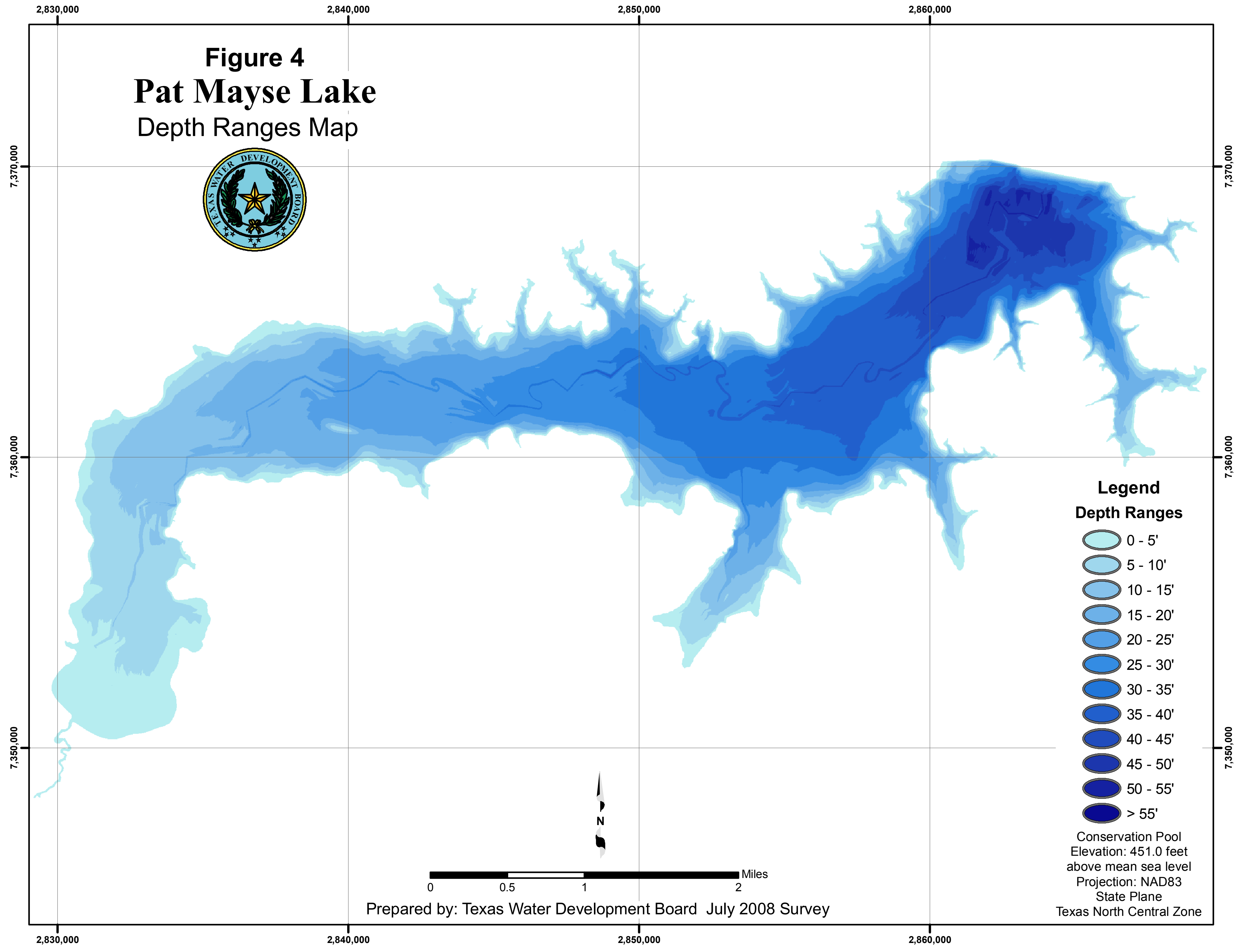


Figure 3
Pat Mayse Lake
Elevation Relief Map
TEXAS WATER DEVELOPMENT BOARD
2,830,000
2,840,000
2,850,000
2,860,000
7,370,000
7,360,000
7,350,000
Legend
Elevation
(in feet above mean sea level)
449.1 - 451
447.1 - 449
445.1 - 447
443.1 - 445
441.1 - 443
439.1 - 441
437.1 - 439
435.1 - 437
433.1 - 435
431.1 - 433
429.1 - 431
427.1 - 429
425.1 - 427
423.1 - 425
421.1 - 423
419.1 - 421
417.1 - 419
415.1 - 417
413.1 - 415
411.1 - 413
409.1 - 411
407.1 - 409
405.1 - 407
403.1 - 405
401.1 - 403
399.1 - 401
398.6 - 399
Conservation Pool
Elevation: 451.0 feet
above mean sea level
Projection: NAD83
State Plane
Texas North Central Zone
N
0
0.5
1
2
Miles
Prepared by: Texas Water Development Board July 2008 Survey



2,830,000
2,840,000
2,850,000
2,860,000
Figure 4
Pat Mayse Lake
Depth Ranges Map
7,370,000
7,360,000
7,350,000
Legend
Depth Ranges
0 - 5'
5 - 10'
10 - 15'
15 - 20'
20 - 25'
25 - 30'
30 - 35'
35 - 40'
40 - 45'
45 - 50'
50 - 55'
> 55'
Conservation Pool
Elevation: 451.0 feet
above mean sea level
Projection: NAD83
State Plane
Texas North Central Zone
N
Miles
0
0.5
1
2
Prepared by: Texas Water Development Board July 2008 Survey

Self-Similar Interpolation

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 curved 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 very well.

To ameliorate these problems, a "Self-Similar" interpolation routine (developed by TWDB) was used to interpolate the bathymetry between many of the survey lines. The Self-Similar interpolation technique effectively increases the density of points input into the TIN model, and directs the TIN interpolation to better represent the reservoir topography.[8] In the case of Pat Mayse Lake, the application of Self-Similar interpolation helped represent the lake morphology near the banks and improved the representation of 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 the Self-Similar interpolation technique are not likely to be valid; therefore, Self-Similar interpolation was not used in areas of Pat Mayse Lake where a high probability of change between cross-sections exists.[8] Figure 6 illustrates typical results of the application of the Self-Similar interpolation routine in Pat Mayse Lake, and the bathymetry shown in Figure 6C was used in computing reservoir capacity and area tables (Appendix A, B).

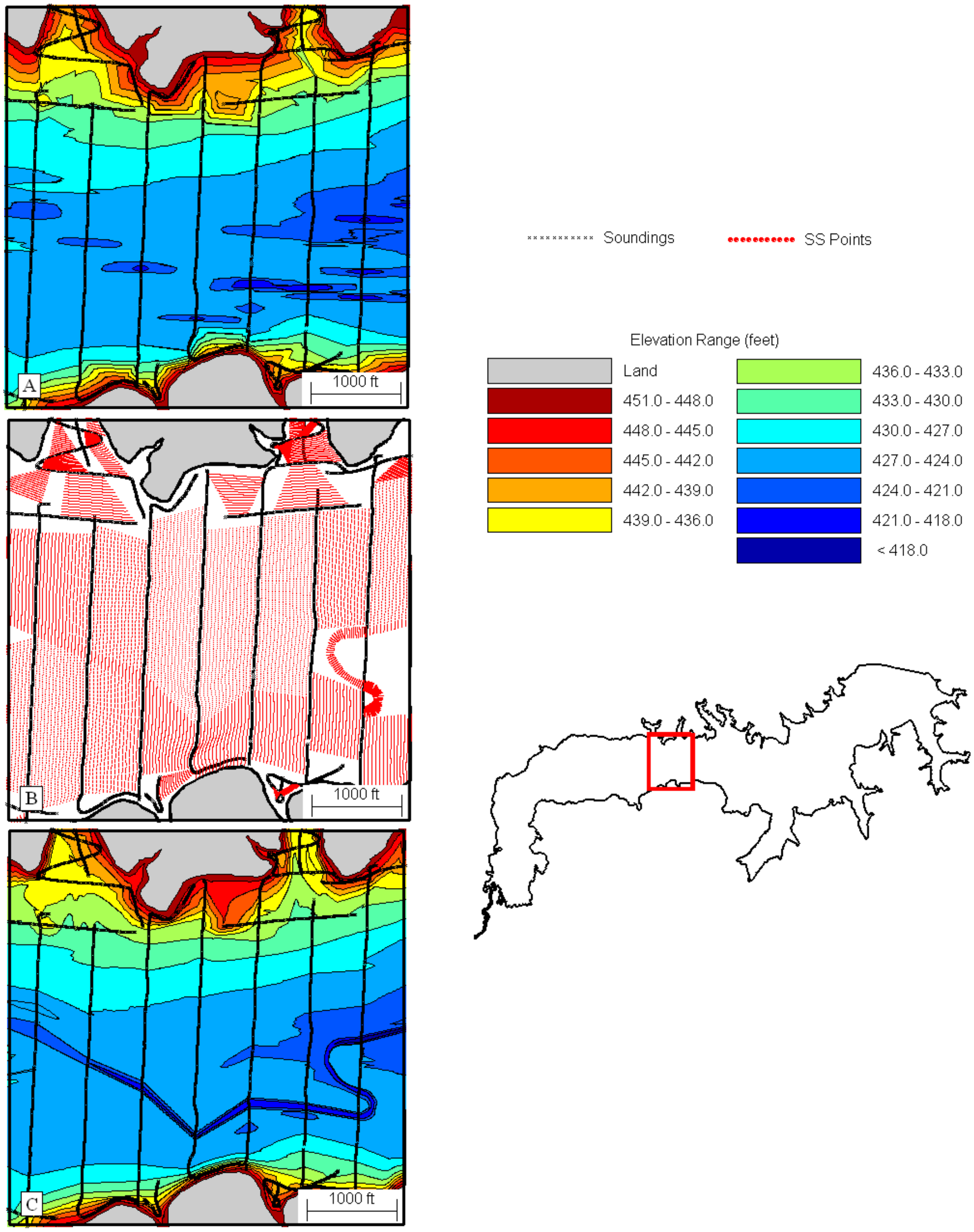


Figure 6 *- Application of the Self-Similar interpolation technique to Pat Mayse Lake sounding data – A) bathymetric contours without interpolated points, B) Sounding points (black) and interpolated points (red) with reservoir boundary shown at elevation 451.0 feet (black), C) bathymetric contours with the interpolated points. Note: In 6A the submerged river channel is evident from the surveyed cross sections but is discontinuous. This is an artifact of the TIN generation routine when data points are too far apart. Inclusion of the interpolated points (6C) corrects this, smoothes the bathymetric contours, and creates a connected submerged river channel.*

Line Extrapolation

In order to estimate the bathymetry within the unsurveyed portions of Pat Mayse Lake, TWDB applied a “Line Extrapolation” technique[8] similar to the Self-Similar interpolation technique discussed above. The Line Extrapolation method is used by TWDB in extrapolating bathymetries in shallow coves near the upstream ends of reservoirs, where the water is too shallow to allow boat passage. The method assumes that cross-sections within the “extrapolation area” have a V-shaped profile, with the deepest section located along a line drawn along the longitudinal axis of the area. Elevations along this “longitudinal line” are interpolated linearly based on the distance along the line from the line’s start (nearest the reservoir interior) to the line’s end (where the line crosses the reservoir boundary). The elevations at points along each extrapolated cross-section are linearly interpolated from an elevation on the longitudinal line (at the intersection with the cross-section) and the elevation at the extrapolation area boundary. The Line Extrapolation method requires that the user specify the position of the longitudinal line and the elevation at the beginning of the longitudinal line. This elevation is usually assumed equivalent to the elevation of the TIN model near the beginning of the longitudinal line. Figure 7 illustrates the Line Extrapolation technique as applied to Pat Mayse Lake.

As shown in Figure 7, the Line Extrapolation technique for Pat Mayse Lake was implemented using the 449.41-foot contour (derived from the 2004 DOQQs) as the bounding extent of the extrapolation areas. The assumption inherent in the Line Extrapolation method 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 the Line Extrapolation method are “more accurate” than those derived without the extrapolation. For the purpose of estimating the volume of water within Pat Mayse Lake, the Line Extrapolation method is justified in that it produces a reasonable representation of reservoir bathymetry in the unsurveyed areas. The use of a V-shaped extrapolated cross-section likely provides a conservative estimate of the water volume in unsurveyed areas, as most surveyed cross-sections within Pat Mayse 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 the line extrapolation method is provided in the HydroEdit User's Manual.[8]

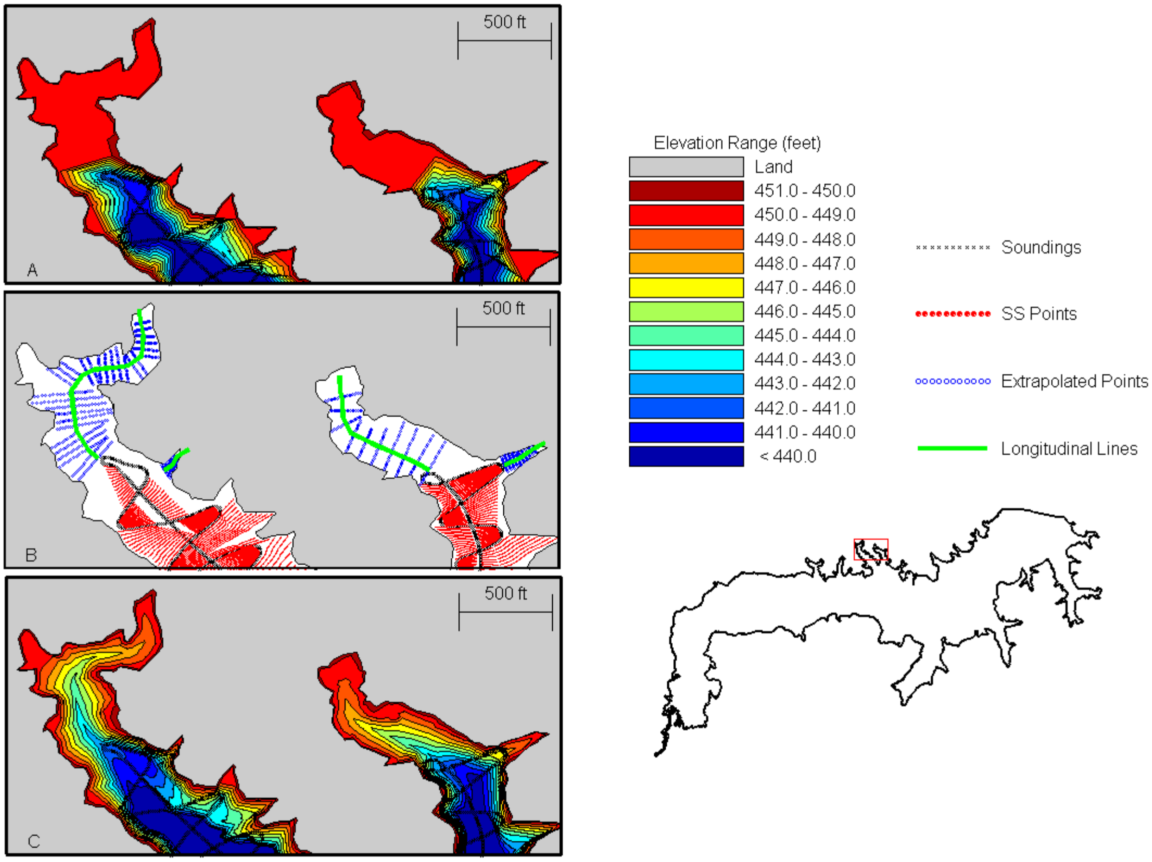


Figure 7 - Application of the Line Extrapolation technique to Pat Mayse Lake sounding data – A) bathymetric contours without extrapolated points, B) Sounding points (black), longitudinal lines (green), and extrapolated points (blue) with reservoir boundary shown at elevation 451.0 feet (black), C) bathymetric contours with the extrapolated points. Note: In 7A the bathymetric contours do not extend into the unsurveyed 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 TWDB 2008 Volumetric Survey indicate Pat Mayse Lake has a total reservoir capacity of 117,844 acre-feet and encompasses 5,638 acres at conservation pool elevation (451.0 feet above mean sea level, NGVD 29). At elevation 415.0 feet, the bottom of conservation pool elevation, Pat Mayse Lake has a capacity of 4,160 acre-feet. Therefore, the conservation storage capacity of Pat Mayse Lake is 113,684 acre-feet. In 1965, the capacity at conservation pool elevation was estimated at 124,500 acre-feet[1]. Due to differences in the methodologies used in calculating areas and capacities from this and previous Pat Mayse Lake surveys, comparison of these values is not recommended. The TWDB considers the 2008 survey to be a significant improvement over previous methods and recommends that a similar methodology be used to resurvey Pat Mayse Lake in approximately 10 years or after a major flood event.

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
Phone: (512) 463-2465
Email: Jason.Kemp@twdb.state.tx.us

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Appendix A

Pat Mayse Lake

RESERVOIR CAPACITY TABLE

TEXAS WATER DEVELOPMENT BOARD — JULY 2008 SURVEY

CAPACITY IN ACRE-FEET — Conservation Pool Elevation 451.0 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
398	0	0	0	0	0	0	0	0	0	0
399	0	0	0	0	0	0	0	1	1	1
400	1	2	2	3	4	4	5	6	7	9
401	10	12	14	16	19	21	24	27	30	34
402	37	41	45	50	54	59	64	70	76	82
403	88	94	101	108	116	124	132	140	149	158
404	167	176	186	196	207	218	229	240	252	264
405	277	290	303	316	330	344	359	374	389	404
406	420	436	453	470	487	504	522	540	558	577
407	596	615	634	654	674	694	715	736	757	778
408	800	822	845	867	890	914	938	962	986	1,011
409	1,036	1,062	1,089	1,116	1,143	1,171	1,199	1,228	1,258	1,288
410	1,319	1,351	1,384	1,419	1,454	1,490	1,528	1,567	1,606	1,647
411	1,688	1,730	1,773	1,816	1,861	1,906	1,952	1,999	2,047	2,095
412	2,145	2,195	2,247	2,300	2,353	2,408	2,465	2,522	2,580	2,640
413	2,700	2,762	2,825	2,889	2,954	3,020	3,088	3,157	3,227	3,298
414	3,371	3,444	3,519	3,594	3,671	3,750	3,829	3,910	3,992	4,076
415	4,160	4,246	4,333	4,421	4,510	4,601	4,693	4,786	4,881	4,978
416	5,076	5,176	5,277	5,379	5,483	5,587	5,693	5,799	5,907	6,016
417	6,126	6,238	6,351	6,466	6,581	6,698	6,816	6,935	7,055	7,176
418	7,299	7,422	7,547	7,673	7,800	7,928	8,057	8,188	8,320	8,454
419	8,589	8,725	8,863	9,003	9,145	9,288	9,432	9,578	9,725	9,874
420	10,024	10,176	10,328	10,482	10,637	10,793	10,951	11,110	11,270	11,431
421	11,594	11,758	11,924	12,091	12,260	12,429	12,600	12,772	12,945	13,120
422	13,296	13,473	13,652	13,832	14,013	14,196	14,379	14,564	14,751	14,938
423	15,127	15,317	15,508	15,700	15,894	16,089	16,285	16,482	16,680	16,879
424	17,080	17,282	17,484	17,688	17,893	18,098	18,305	18,513	18,721	18,931
425	19,142	19,353	19,566	19,780	19,995	20,210	20,427	20,645	20,864	21,084
426	21,306	21,529	21,753	21,978	22,205	22,433	22,662	22,893	23,124	23,357
427	23,591	23,827	24,064	24,302	24,542	24,782	25,024	25,268	25,512	25,758
428	26,005	26,253	26,502	26,753	27,004	27,257	27,511	27,766	28,022	28,280
429	28,539	28,799	29,060	29,323	29,587	29,852	30,118	30,385	30,654	30,924
430	31,195	31,468	31,741	32,016	32,292	32,569	32,847	33,126	33,407	33,688
431	33,971	34,255	34,540	34,826	35,114	35,403	35,694	35,986	36,279	36,573
432	36,869	37,167	37,465	37,766	38,067	38,371	38,675	38,981	39,289	39,598
433	39,908	40,220	40,533	40,848	41,163	41,480	41,798	42,117	42,437	42,759
434	43,082	43,406	43,731	44,057	44,385	44,715	45,045	45,377	45,710	46,044
435	46,380	46,716	47,054	47,393	47,733	48,075	48,418	48,762	49,107	49,453
436	49,801	50,149	50,499	50,849	51,201	51,554	51,908	52,263	52,620	52,978
437	53,337	53,697	54,059	54,422	54,787	55,153	55,520	55,888	56,258	56,629
438	57,001	57,374	57,748	58,124	58,501	58,879	59,258	59,639	60,021	60,404
439	60,789	61,175	61,562	61,951	62,341	62,733	63,126	63,520	63,916	64,313
440	64,712	65,112	65,514	65,917	66,321	66,727	67,135	67,544	67,955	68,368
441	68,782	69,198	69,615	70,034	70,454	70,876	71,300	71,724	72,150	72,578
442	73,006	73,437	73,868	74,301	74,736	75,172	75,610	76,049	76,490	76,932
443	77,375	77,820	78,267	78,715	79,165	79,616	80,069	80,523	80,978	81,435
444	81,894	82,354	82,816	83,279	83,744	84,210	84,679	85,148	85,620	86,092
445	86,566	87,042	87,519	87,998	88,478	88,961	89,445	89,931	90,418	90,908
446	91,399	91,892	92,386	92,882	93,380	93,880	94,381	94,884	95,388	95,894
447	96,402	96,910	97,420	97,932	98,445	98,959	99,474	99,991	100,509	101,028
448	101,548	102,069	102,591	103,115	103,640	104,166	104,693	105,222	105,752	106,283
449	106,815	107,349	107,885	108,422	108,961	109,507	110,056	110,605	111,156	111,707
450	112,260	112,813	113,368	113,924	114,480	115,038	115,597	116,157	116,718	117,280
451	117,844									

Appendix B

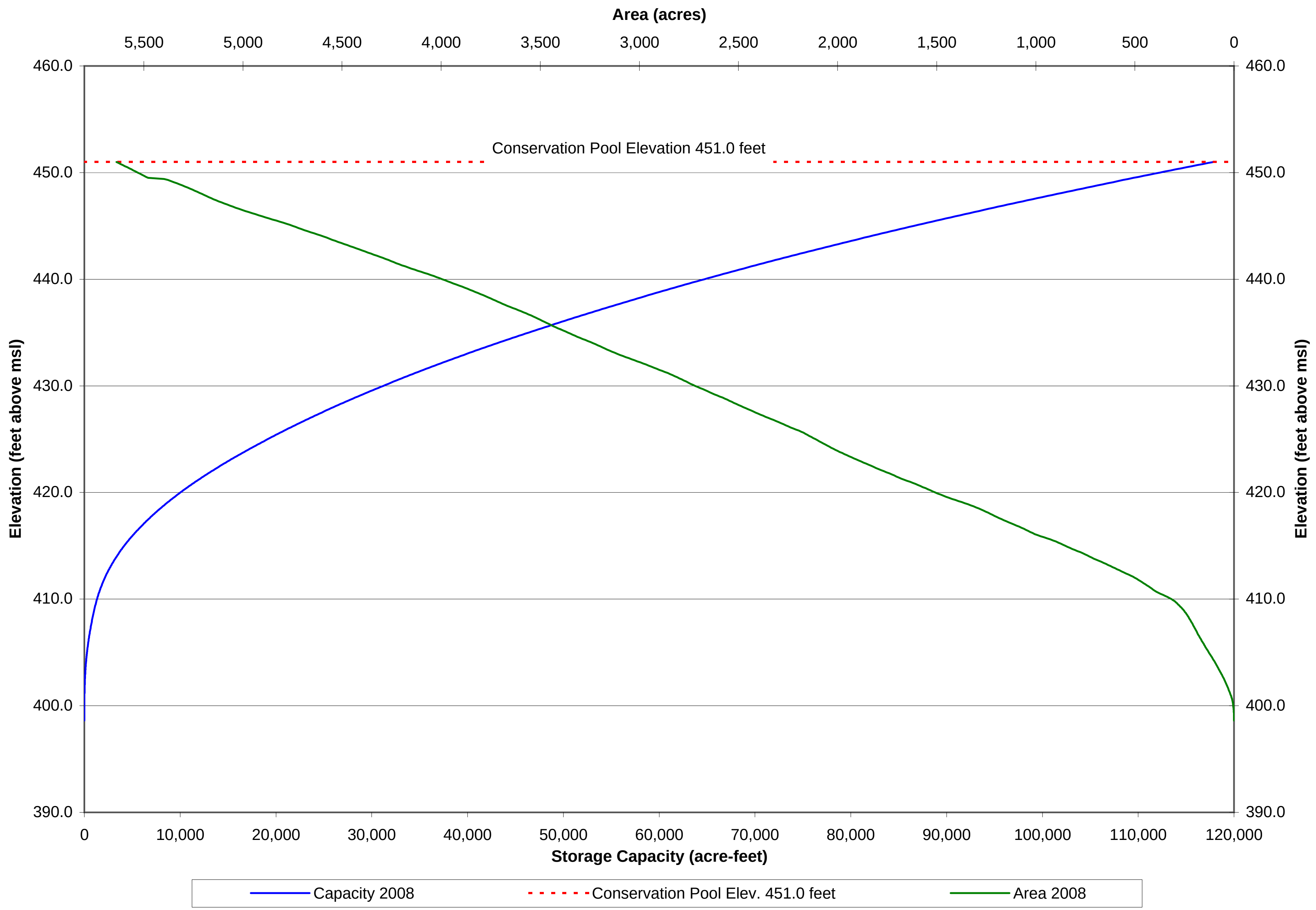
Pat Mayse Lake

RESERVOIR AREA TABLE

TEXAS WATER DEVELOPMENT BOARD
AREA IN ACRES
ELEVATION INCREMENT IS ONE TENTH FOOT

JULY 2008 SURVEY
Conservation Pool Elevation 451.0 Feet NGVD29

ELEVATION in Feet	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
398	0	0	0	0	0	0	0	0	0	0
399	0	0	0	1	1	1	1	2	3	3
400	4	4	5	6	7	8	10	11	13	15
401	17	19	21	23	25	27	29	31	33	36
402	38	40	42	45	47	50	53	56	58	61
403	64	67	70	73	76	79	82	85	88	91
404	94	96	100	103	107	110	113	117	120	124
405	127	130	134	137	140	144	147	150	153	156
406	160	163	166	169	173	176	179	182	185	187
407	190	192	196	199	202	204	207	210	214	217
408	220	223	226	229	232	236	239	243	247	252
409	256	261	266	271	277	282	287	293	299	307
410	315	325	336	347	359	371	382	392	401	409
411	416	423	431	439	448	456	465	474	482	491
412	500	510	521	533	544	556	567	578	589	601
413	612	623	634	646	657	670	682	696	708	719
414	729	740	751	762	776	789	803	816	828	840
415	852	863	874	886	899	912	927	943	959	976
416	992	1,005	1,017	1,027	1,038	1,049	1,061	1,072	1,084	1,097
417	1,110	1,125	1,137	1,149	1,161	1,174	1,185	1,197	1,208	1,218
418	1,229	1,241	1,252	1,263	1,275	1,288	1,301	1,314	1,328	1,343
419	1,358	1,374	1,390	1,406	1,422	1,438	1,452	1,467	1,481	1,494
420	1,508	1,520	1,532	1,544	1,556	1,570	1,581	1,594	1,607	1,620
421	1,634	1,650	1,665	1,679	1,691	1,703	1,714	1,726	1,739	1,753
422	1,767	1,780	1,794	1,806	1,818	1,831	1,843	1,856	1,869	1,881
423	1,893	1,906	1,918	1,930	1,941	1,953	1,965	1,977	1,989	2,000
424	2,011	2,021	2,032	2,042	2,052	2,062	2,072	2,082	2,092	2,102
425	2,112	2,122	2,132	2,142	2,152	2,162	2,172	2,183	2,196	2,209
426	2,224	2,237	2,249	2,260	2,273	2,285	2,298	2,310	2,323	2,336
427	2,351	2,363	2,376	2,388	2,401	2,413	2,425	2,438	2,451	2,463
428	2,476	2,487	2,499	2,511	2,523	2,534	2,545	2,556	2,568	2,581
429	2,594	2,607	2,621	2,634	2,645	2,656	2,668	2,680	2,694	2,706
430	2,719	2,731	2,742	2,753	2,764	2,775	2,787	2,798	2,809	2,821
431	2,833	2,844	2,857	2,871	2,885	2,899	2,912	2,926	2,939	2,953
432	2,966	2,980	2,995	3,010	3,024	3,039	3,053	3,068	3,083	3,097
433	3,111	3,125	3,138	3,150	3,162	3,174	3,186	3,197	3,209	3,221
434	3,233	3,246	3,259	3,272	3,287	3,299	3,312	3,324	3,336	3,348
435	3,360	3,372	3,384	3,397	3,410	3,423	3,434	3,446	3,457	3,468
436	3,479	3,490	3,501	3,512	3,523	3,535	3,546	3,559	3,572	3,585
437	3,598	3,611	3,624	3,638	3,652	3,666	3,679	3,691	3,703	3,714
438	3,726	3,738	3,750	3,762	3,775	3,788	3,801	3,814	3,827	3,840
439	3,853	3,866	3,880	3,894	3,909	3,923	3,938	3,952	3,966	3,979
440	3,994	4,008	4,022	4,037	4,053	4,068	4,084	4,101	4,117	4,134
441	4,150	4,166	4,182	4,198	4,212	4,226	4,240	4,253	4,266	4,280
442	4,294	4,309	4,324	4,340	4,354	4,369	4,384	4,398	4,413	4,428
443	4,443	4,458	4,474	4,489	4,504	4,519	4,534	4,549	4,563	4,578
444	4,593	4,608	4,625	4,641	4,658	4,674	4,690	4,705	4,719	4,734
445	4,748	4,763	4,779	4,797	4,814	4,831	4,851	4,869	4,885	4,903
446	4,920	4,936	4,953	4,971	4,988	5,005	5,021	5,037	5,051	5,065
447	5,079	5,093	5,108	5,122	5,136	5,148	5,160	5,172	5,184	5,195
448	5,207	5,219	5,230	5,242	5,254	5,267	5,279	5,292	5,305	5,319
449	5,333	5,347	5,362	5,379	5,398	5,479	5,489	5,499	5,510	5,520
450	5,531	5,541	5,552	5,562	5,573	5,584	5,595	5,605	5,616	5,627
451	5,638									



Pat Mayse Lake
July 2008 Survey
Prepared by: TWDB

Appendix C: Area and Capacity Curves

Figure 5

CONTOURS
(in feet above mean sea level)

450
445
440
435
430
425
420
415
410
405
400

Pat Mayse Lake

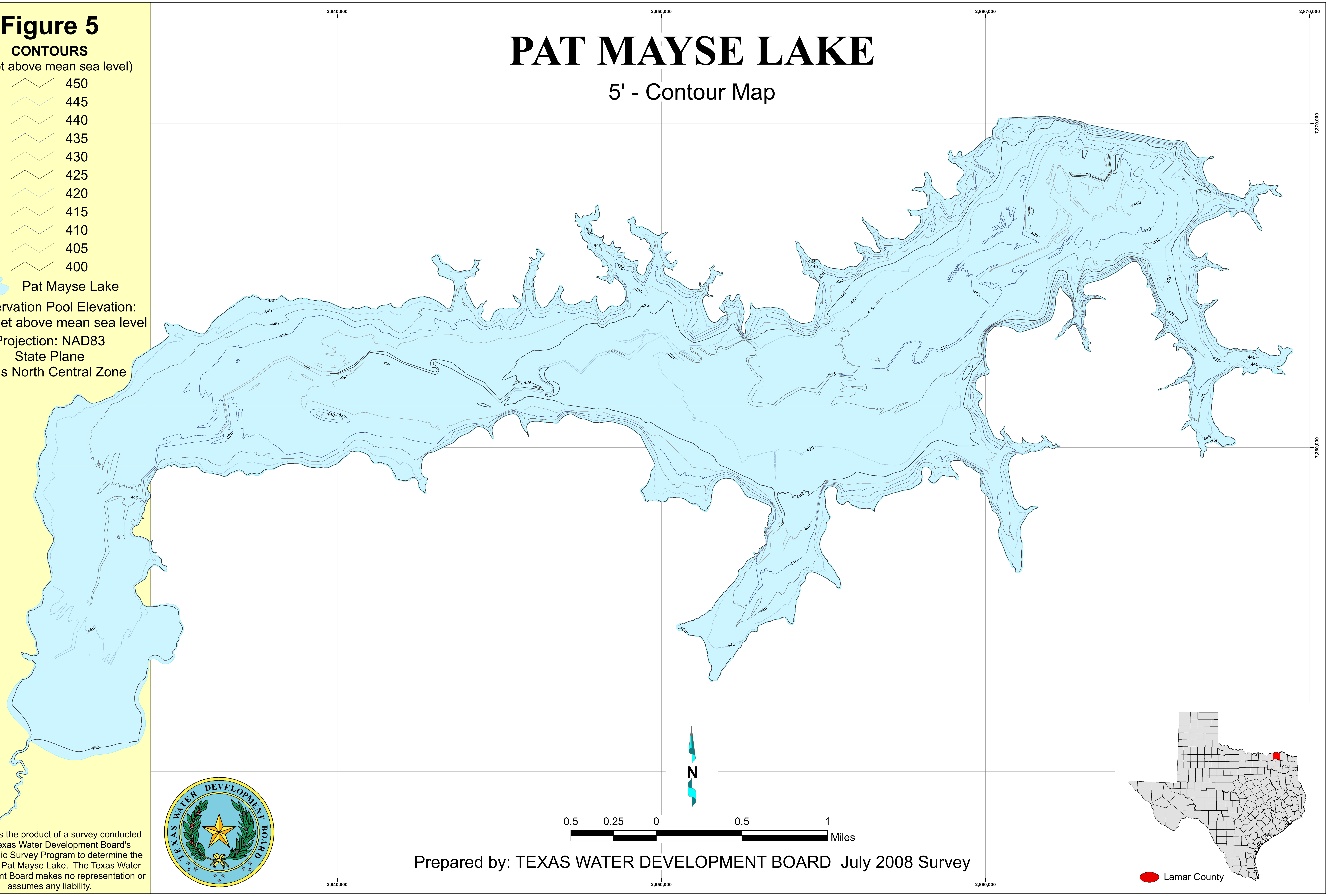
Conservation Pool Elevation:
451.0 feet above mean sea level

Projection: NAD83
State Plane
Texas North Central Zone

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

PAT MAYSE LAKE

5' - Contour Map



Prepared by: TEXAS WATER DEVELOPMENT BOARD July 2008 Survey