Volumetric and Sedimentation Survey of LAKE CONROE

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Executive summary

In February 2020, the Texas Water Development Board (TWDB) entered into an agreement with the San Jacinto River Authority to perform a volumetric and sedimentation survey of Lake Conroe (Montgomery and Walker counties, Texas). Surveying was performed using a multi-frequency (208 kHz, 50 kHz, and 12 kHz), sub-bottom profiling depth sounder. Sediment core samples were collected and correlated with sub-bottom acoustic profiles to estimate sediment accumulation thicknesses and sedimentation rates.

Conroe Dam, impounding Lake Conroe, is located on the West Fork San Jacinto River in Montgomery County, 7 miles northwest of Conroe, Texas. The conservation pool elevation of Lake Conroe is 201.0 feet above mean sea level. The TWDB collected bathymetric data for Lake Conroe between March 2 and October 30, 2020, while daily average water surface elevations ranged between 199.18 and 200.31 feet above mean sea level. The TWDB collected bathymetric data for the remainder of the lake in the Caney Creek area on April 12, 2021, while daily water surface elevations measured 200.47 feet above mean sea level.

The 2020 TWDB volumetric survey indicates Lake Conroe has a total reservoir capacity of 417,605 acre-feet and encompasses 19,894 acres at conservation pool elevation (201.0 feet above mean sea level). Previous capacity estimates at elevation 201.0 feet include an original design estimate of 430,260 acre-feet, a 1996 TWDB estimate of 420,659 acre-feet, and a 2010 TWDB estimate of 411,022 acre-feet. Because of differences in past and present survey methodologies, direct comparison of volumetric surveys to others to estimate loss of area and capacity can be unreliable. Information from past surveys is presented here for informational purposes only.

The 2020 TWDB sedimentation survey measured 25,827 acre-feet of sediment. The sedimentation survey indicates sediment accumulation is greatest in the river channels with heavy accumulation in the submerged floodplains of the main channel and tributaries. The TWDB recommends that a similar methodology be used to resurvey Lake Conroe in 10 years or after a major high flow event.

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

Introduction

The Hydrographic Survey Program of the Texas Water Development Board (TWDB) was authorized by the 72nd Texas State Legislature in 1991. Texas Water Code Section 15.804 authorizes the TWDB to perform surveys to determine reservoir storage capacity, sedimentation levels, rates of sedimentation, and projected water supply availability.

In February 2020, the TWDB entered into an agreement with the San Jacinto River Authority (SJRA), to perform a volumetric and sedimentation survey of Lake Conroe (Texas Water Development Board, 2020). This report provides an overview of the survey methods, analysis techniques, and associated results. Also included are the following contract deliverables: (1) an elevation-area-capacity table of the reservoir acceptable to the Texas Commission on Environmental Quality (Appendices I and J), (2) a bottom contour map (Figure 6), (3) a shaded relief plot of the reservoir bottom (Figure 4), and (4) an estimate of sediment accumulation and location (Figure 10).

Lake Conroe general information

Conroe Dam, impounding Lake Conroe, is located on the West Fork San Jacinto River in Montgomery and Walker counties, seven miles northwest of Conroe, Texas (Figure 1). Lake Conroe is owned and operated by the SJRA. Construction of the dam began on February 9, 1970, and the dam was completed in January 1973. Deliberate impoundment of water began in January 1973 (Texas Water Development Board, 1973). The reservoir was built primarily for water supply and is an important source of water for the Montgomery County area (San Jacinto River Authority, 2021). Additional pertinent data about Conroe Dam and Lake Conroe can be found in Table 1.

Water rights for Lake Conroe have been appropriated to the SJRA through Certificate of Adjudication No. 10-4963 and Amendment to Certificate of Adjudication No. 10-4963A (Texas Commission on Environmental Quality, 2021). The complete certificates are on file at the Texas Commission on Environmental Quality (TCEQ).

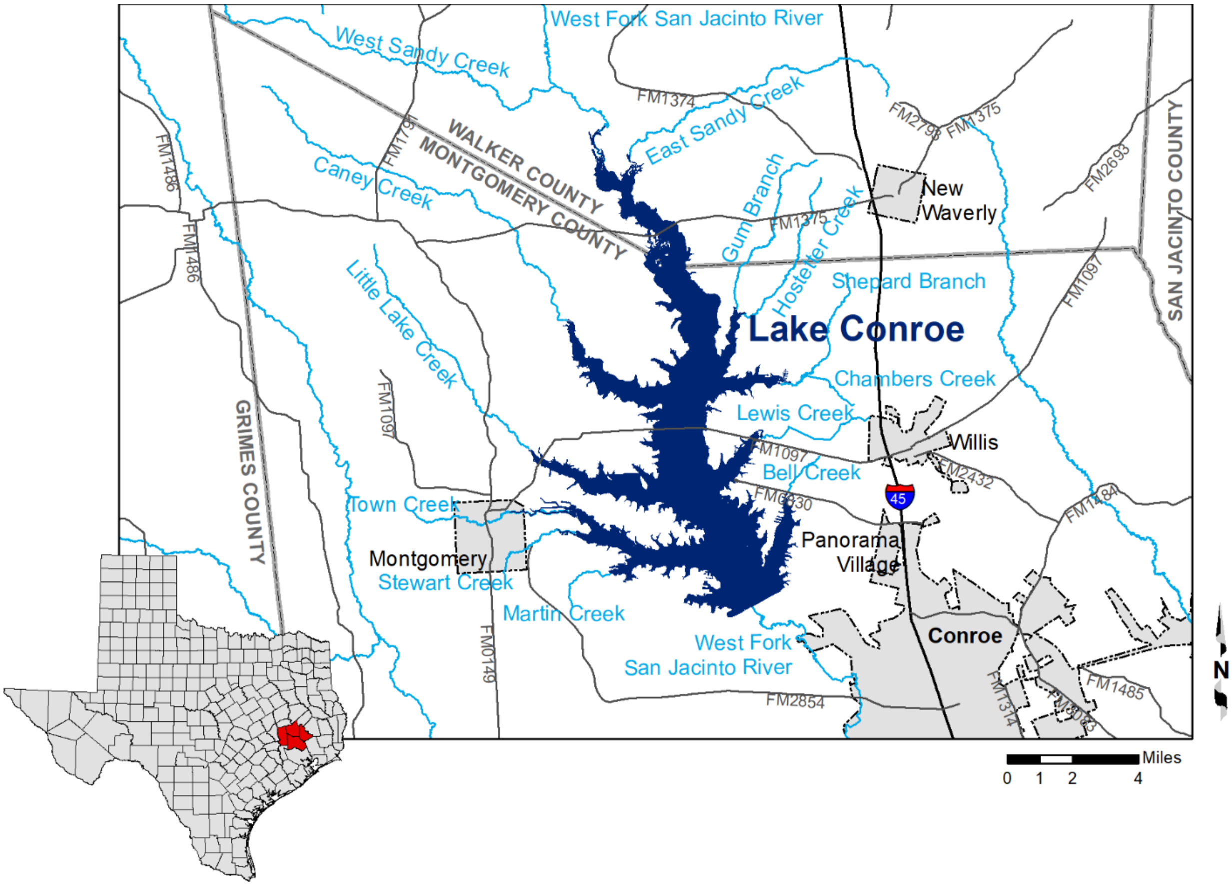


Figure 1. Location map.

Table 1. Pertinent Data for Conroe Dam and Lake Conroe			
Owner(s)			
San Jacinto River Authority (SJRA)			
Engineer (Design)			
Freese, Nichols, and Endress			
Drainage Area			
Total Drainage Area	450 square miles		
Dam			
Type	Earth filled		
Length	11,280 feet		
Maximum Height	82 feet		
Top Width	20 feet		
Spillway			
Type	Concrete Ogee		
Total Length	200 feet		
Control	5 tainter gates, each gate is 40 by 30 feet		
Crest Elevation	173.0 feet above mean sea level		
Top of gate elevation	202.5 feet above mean sea level		
Outlet Works			
Type	Concrete tower and stilling basin		
Number and Type of Inlets	3 with sluice gates		
Gate Size	Two 4 by 6 feet and one 5 by 5 feet		
Discharge Control	10-foot concrete conduit		
Reservoir Data (Based on 2020 TWDB survey)			
Feature	**Elevation (feet above MSL[a])**	**Capacity (acre-feet)**	**Area (acres)**
Top of dam	212.0	688,936	29,193
Maximum design elevation	207.0	553,502	25,059
Top of spillway gates	202.5	449,469	21,371
Top of conservation pool	201.0	417,605	19,894
Invert of high outlet	191.0	246,314	14,200
Emergency spillway crest elevation	173.0	62,115	6,148
Invert of low outlet/dead pool elevation	145.0	27	14
Conservation storage capacity[b]	—	417,578	—

Sources: San Jacinto River Authority, 2021; Texas Water Development Board, 1973

a. Mean Sea Level (MSL) indicates a reference to USGS National Geodetic Vertical Datum 1929 (NGVD29) incorporating the -0.20-foot adjustment from April 2018.

b. Usable conservation storage equals total capacity at conservation pool elevation minus dead pool capacity. Dead pool refers to water that cannot be drained by gravity through a dam's outlet works.

Volumetric and sedimentation survey of Lake Conroe

Datum

The vertical datum used during this survey is the National Geodetic Vertical Datum 1929 (NGVD29). This datum is utilized by the United States Geological Survey (USGS) for the reservoir elevation gage *USGS 08067600 Lk Conroe nr Conroe, TX* (U.S. Geological Survey, 2021). Elevations herein are reported in feet relative to the NGVD29 datum. Volume and area calculations in this report are referenced to water levels reported by the USGS gage. The horizontal datum used for this report is North American Datum 1983 (NAD83), and the horizontal coordinate system is State Plane Texas Central Zone (feet).

TWDB bathymetric and sedimentation data collection

The TWDB collected bathymetric data for Lake Conroe between March 2 and October 30, 2020, while daily water surface elevations ranged from 199.18 and 200.31 feet above mean sea level. The TWDB collected bathymetric data for the remainder of the lake in the Caney Creek area on April 12, 2021, while daily water surface elevations measured 200.47 feet above mean sea level. For data collection, the TWDB used a Specialty Devices, Inc. (SDI), single-beam, multi-frequency (208 kHz, 50 kHz, and 12 kHz) sub-bottom profiling depth sounder integrated with differential global positioning system (DGPS) equipment. Data were collected along pre-planned survey lines oriented perpendicular to the assumed location of the original river channels and spaced approximately 500 feet apart. Many of the same survey lines also were used by the TWDB for the *Volumetric Survey of Lake Conroe, April 1996 Survey* (Texas Water Development Board, 2003) and the *Volumetric and Sedimentation Survey of Lake Conroe, June-August 2010 Survey* (Texas Water Development Board, 2012). The depth sounder was calibrated daily using a velocity profiler to measure the speed of sound in the water column and a weighted tape or stadia rod for depth reading verification. Each speed of sound profile, or velocity cast, is saved for further data processing. Figure 2 shows the data collection locations for the 2020 TWDB survey.

All sounding data were collected and reviewed before sediment core sampling sites were selected. Sediment core samples are collected throughout the reservoir to assist with interpretation of the sub-bottom acoustic profiles. After analyzing the sounding data, the TWDB selected 20 locations to collect sediment core samples (Figure 2). Sediment cores were collected on March 2-4, 2021, with a custom-coring boat and an SDI VibeCore system.

Sediment cores are collected in 3-inch diameter aluminum tubes. A sediment core extends from the current reservoir-bottom surface, through the accumulated sediment, and into the pre-impoundment surface. After the sample is retrieved, the core tube is cut to the level of the sediment core. The tube is capped, labeled, and transported to TWDB headquarters for further analysis.

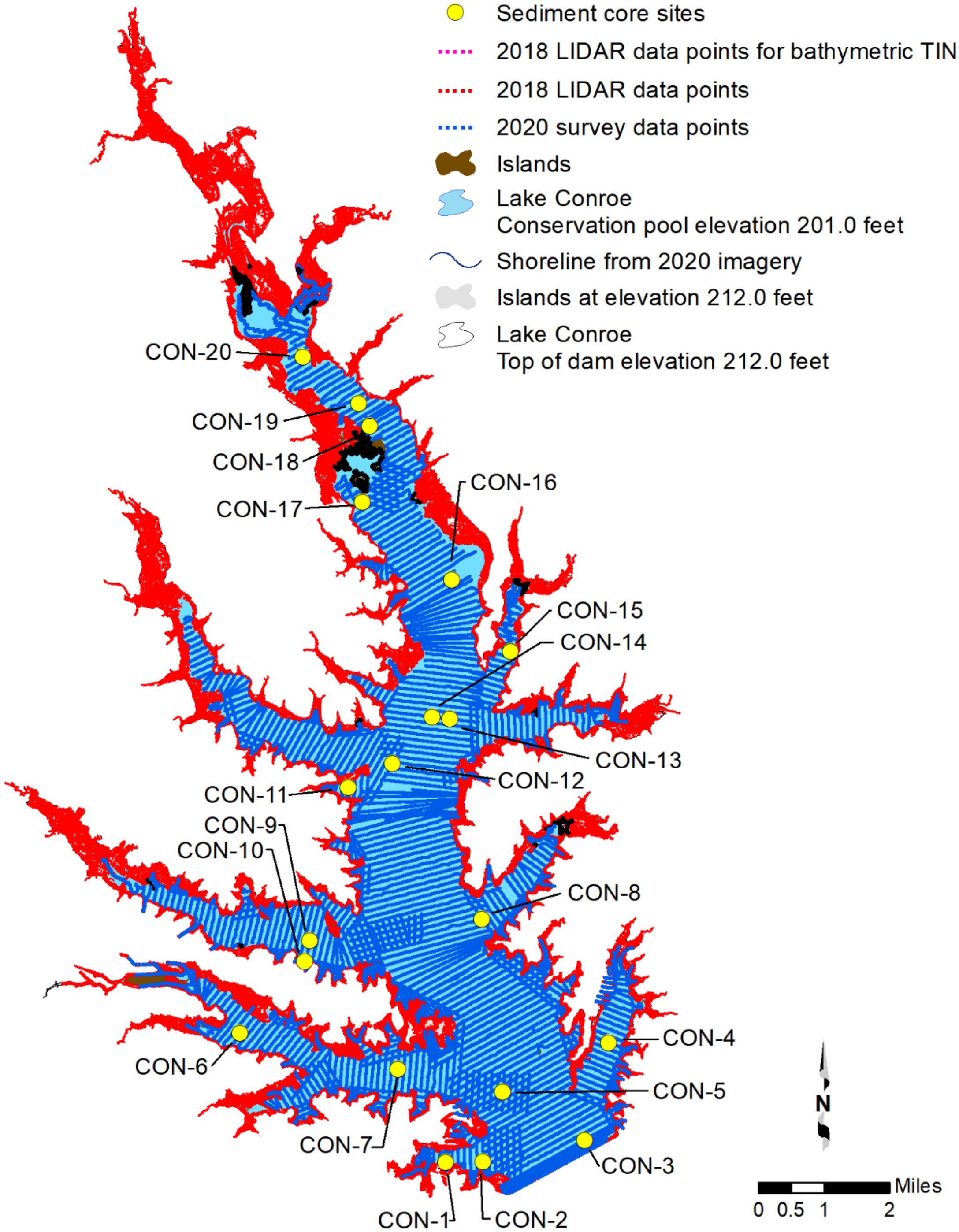


Figure 2. 2020 TWDB sounding data (*blue dots*), sediment coring locations (*yellow circles*), and 2018 LIDAR data (*red dots*).

Data processing

Model boundary

The reservoir's bathymetric model boundary was digitized from aerial photographs, also known as digital orthophoto quarter-quadrangle images (DOQQs), obtained through the Texas Imagery Service. The Texas Natural Resources Information System manages the Texas Imagery Service, allowing public organizations in the State of Texas to access high resolution imagery as a service using Environmental Systems Research Institute's ArcGIS software (Texas Natural Resources Information System, 2020a, Texas Natural Resources Information System, 2020b). DOQQs photographed on March 27, 2015, while the daily average water surface elevation measured 201.18 feet were used to digitize a model boundary at the land-water interface. For modeling purposes, the boundary was assigned an elevation of 201.0 feet. In the upper reaches, this boundary was adjusted using images photographed on September 8, 2017, while the daily average water surface elevation measured 201.53 feet, because much less vegetation was present in the 2017 photos making shoreline detection clearer. The model was also augmented with additional boundary information in areas where data collection was limited by water depths. Islands and partial contours were digitized from aerial imagery photographed on January 18, 2020, while the daily average water surface elevation measured 199.13 feet.

The reservoir's topographic model boundary was generated with Light Detection and Ranging (LIDAR) Data available from the Texas Natural Resource Information System (TNRIS). LIDAR data acquired between January 12, 2018, and March 22, 2018, while the daily average water surface elevation of the reservoir measured between 202.05 feet and 201.00 feet, respectively (Figure 2). The 2018 LIDAR data were imported into an Environmental Systems Research Institute's ArcGIS file geodatabase. The LIDAR data .las files were imported into an LAS Dataset and the dataset was converted to a raster using a cell size of 1.0 meters by 1.0 meters. The horizontal datum of the LIDAR data is North American Datum 1983 (NAD83; meters) and the projection is Universal Transverse Mercator (UTM) Zone 15. The vertical datum is North American Vertical Datum 1988 (NAVD88; meters). Therefore, a contour representing top of dam elevation of 64.613 meters NAVD88, equivalent to 211.984 feet NAVD88 or 212.0 feet NGVD29, was extracted from the raster. The vertical datum transformation offset of 0.016 feet, was used to convert from feet NAVD88 to feet NGVD29. The vertical datum transformation offset for the conversion from NAVD88 to NGVD29 was determined by applying the National

Oceanic and Atmospheric Administration National Geodetic Survey's NADCON software (National Geodetic Survey, 2017a) and VERTCON software (National Geodetic Survey, 2017b) to a single reference point in the vicinity of the survey, the reservoir elevation gage *USGS 08067600 Lk Conroe nr Conroe, TX Latitude 30º21'30"N, Longitude 95º33'39"W NAD27.* The topographic model contour was edited to close the contour across the dam and remove other artifacts. Horizontal coordinate transformations to NAD83 State Plane Texas Central Zone (feet) coordinates were applied using the ArcGIS Project tool.

LIDAR data points

To utilize the LIDAR data in the reservoir topographic model, the LIDAR data .las files were converted to a multipoint feature class in an Environmental Systems Research Institute's ArcGIS file geodatabase filtered to include only data classified as ground points. A topographical model of the data was generated. The ArcGIS tool Terrain to Points was used to extract points from the Terrain, or topographical model of the reservoir. The Terrain was created using the z-tolerance Pyramid Type. Points were extracted from the terrain at the z-tolerance level of 0.25 meters. New attribute fields were added to convert the elevations from meters to feet NAVD88 and then to feet NGVD29 for compatibility with the bathymetric survey data. LIDAR data outside of the 212.00-foot contour and inside the 201.00-foot contour were deleted and the feature class projected to NAD83 State Plane Texas Central Zone (feet). A small subset of LIDAR data points were used in the bathymetric model representing a shallow area in the upper reaches of East Sandy Creek.

Triangulated Irregular Network model

Following completion of data collection, the raw data files collected by the TWDB were edited to remove data anomalies. The current bottom surface of the reservoir is automatically determined by the data acquisition software. Hydropick software, developed by TWDB staff, was used to display, interpret, and edit the multi-frequency data by manually removing data anomalies in the current bottom surface and to manually edit the pre-impoundment surfaces. The speed of sound profiles, also known as velocity casts, were used to further refine the measured depths. For each location velocity casts are collected, the harmonic mean sound speed of all the casts are calculated. From this, depths collected using one average speed of sound are corrected with an overall optimum speed of sound for each specific depth (Specialty Devices, Inc., 2018).

All data were exported into a single file, including the current reservoir bottom surface, pre-impoundment surface, and sediment thickness at each sounding location. The water surface elevation at the time of each sounding was used to convert each sounding depth to a corresponding reservoir-bottom elevation. This survey point dataset was then preconditioned by inserting a uniform grid of artificial survey points between the actual survey lines. Bathymetric elevations at these artificial points were determined using an anisotropic spatial interpolation algorithm described in the next section. This technique creates a high resolution, uniform grid of interpolated bathymetric elevation points throughout a majority of the reservoir (McEwen *et al.* 2011a). The resulting point file was used in conjunction with sounding and boundary data to create volumetric and sediment Triangulated Irregular Network (TIN) models utilizing the 3D Analyst Extension of ArcGIS. The 3D Analyst algorithm uses Delaunay's criteria for triangulation to create a grid composed of triangles from non-uniformly spaced points, including the boundary vertices (Environmental Systems Research Institute, 1995).

Spatial interpolation of reservoir bathymetry

Isotropic spatial interpolation techniques such as the Delaunay triangulation used by the 3D Analyst extension of ArcGIS are, in many instances, unable to suitably interpolate bathymetry between survey lines common to reservoir surveys. Reservoirs and stream channels are anisotropic morphological features where bathymetry at any particular location is more similar to upstream and downstream locations than to transverse locations. Interpolation schemes that do not consider this anisotropy lead to the creation of several types of artifacts in the final representation of the reservoir bottom surface and hence to errors in volume. These artifacts may include artificially curved contour lines extending into the reservoir where the reservoir walls are steep or the reservoir is relatively narrow, intermittent representation of submerged stream channel connectivity, and oscillations of contour lines in between survey lines. These artifacts reduce the accuracy of the resulting volumetric and sediment TIN models in areas between actual survey data.

To improve the accuracy of bathymetric representation between survey lines, the TWDB developed various anisotropic spatial interpolation techniques. Generally, the directionality of interpolation at different locations of a reservoir can be determined from external data sources. A basic assumption is that the reservoir profile in the vicinity of a particular location has upstream and downstream similarity. In addition, the sinuosity and directionality of submerged stream channels can be determined by directly examining the survey data, or more robustly by examining scanned USGS 7.5-minute quadrangle maps (DRGs), hypsography files (the vector format of USGS 7.5-minute quadrangle map contours), and historical aerial photographs, when available. Using the survey data, polygons are created to partition the reservoir into segments with centerlines defining the directionality of interpolation within each segment. Using the interpolation definition files and survey data, the current reservoir-bottom elevation, pre-impoundment elevation, and sediment thickness are calculated for each point in the high-resolution uniform grid of artificial survey points. The reservoir boundary, artificial survey points grid, and survey data points are used to create volumetric and sediment TIN models representing reservoir bathymetry and sediment accumulation throughout the reservoir. Specific details of this interpolation technique can be found in the HydroTools manual (McEwen and others, 2011a) and in McEwen and others (2011b).

In areas inaccessible to survey data collection, such as small coves and shallow upstream areas of the reservoir, linear interpolation is used for volumetric and sediment accumulation estimations (McEwen and others, 2011a). Although LIDAR was utilized, linear interpolation was necessary to accurately model features in the areas between survey data and LIDAR data. Linear interpolation results in improved elevation-capacity and elevation-area calculations.

Figure 3 illustrates typical results from application of the anisotropic interpolation as applied to Lake Conroe. In Figure 3A, deeper channels and steep slopes indicated by surveyed cross-sections are not continuously represented in areas between survey cross-sections. This is an artifact of the TIN generation routine rather than an accurate representation of the physical bathymetric surface. Inclusion of interpolation points in creation of the volumetric TIN model, represented in Figure 3B, directs Delaunay triangulation to better represent the reservoir bathymetry between survey cross-sections. The bathymetry shown in Figure 3C was used in computing reservoir elevation-capacity (Appendix I) and elevation-area (Appendix J) tables.

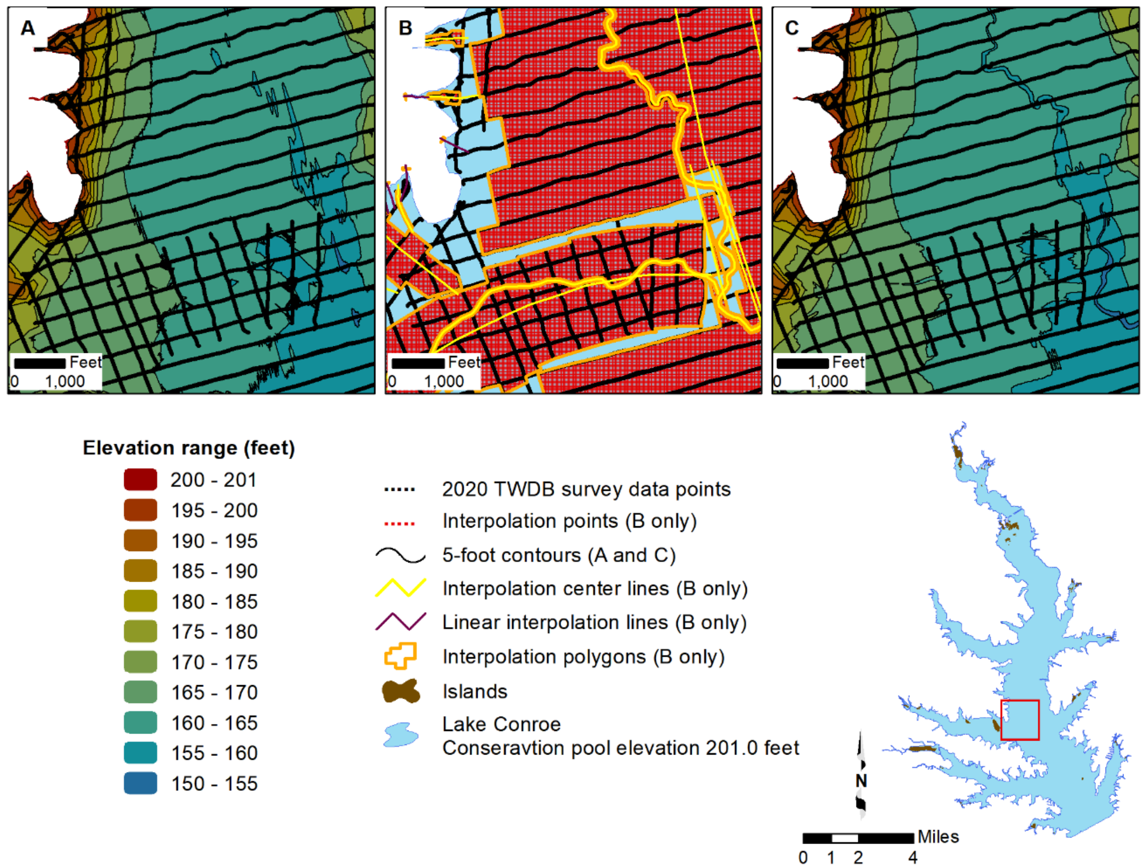


Figure 3. Anisotropic spatial interpolation as applied to Lake Conroe sounding data; A) bathymetric contours without interpolated points, B) sounding points (*black*) and interpolated points (*red*), C) bathymetric contours with interpolated points.

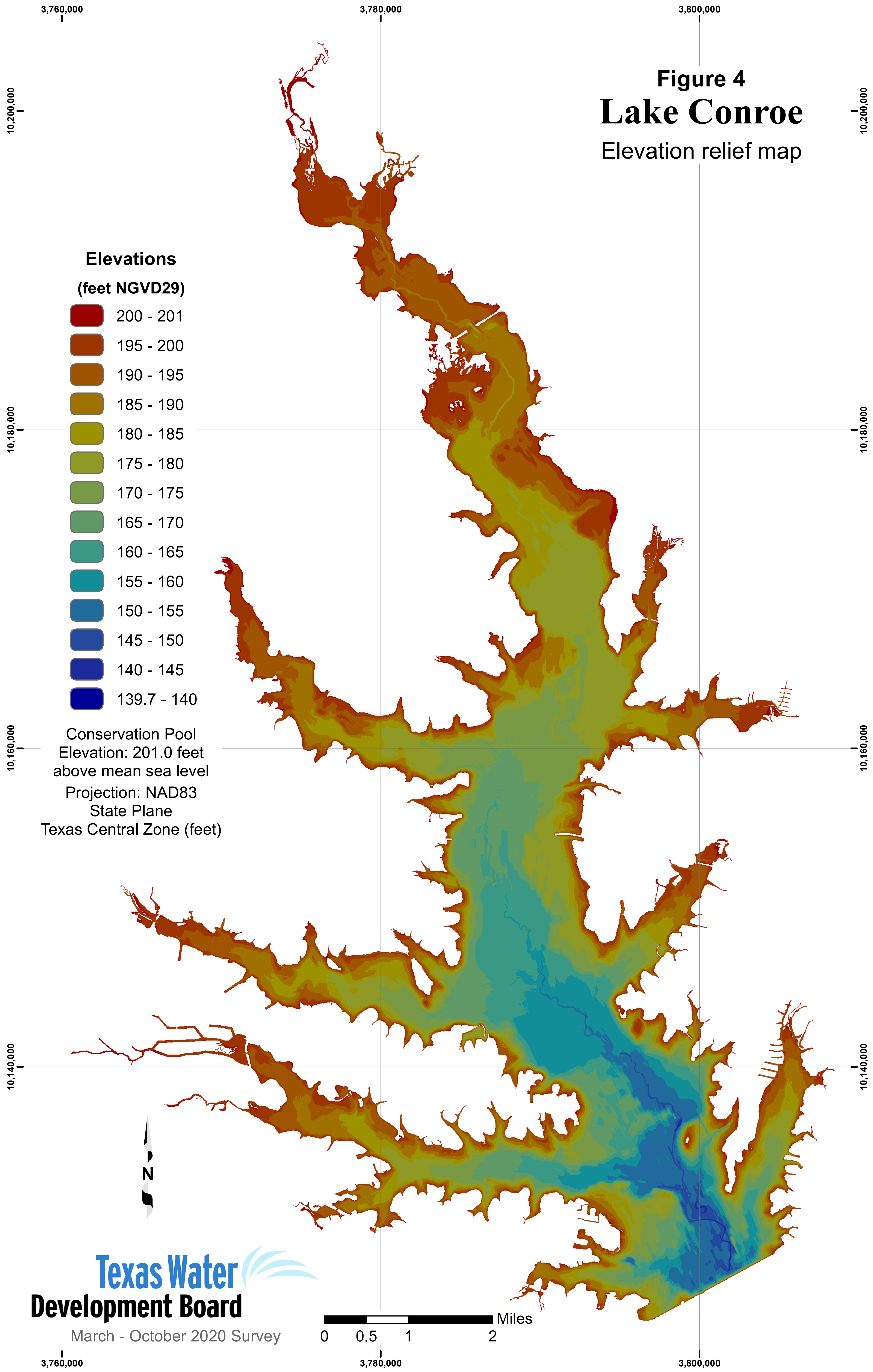
To properly compare results from the 1996 TWDB survey of Lake Conroe, the TWDB applied anisotropic spatial interpolation to the survey data collected in 1996. The 1996 survey boundary was digitized from 7.5-minute USGS quadrangle maps, with a stated accuracy of ± 1/2 the contour interval (U.S. Geological Survey, 1999). While linear interpolation was used to estimate the topography in areas without data, flat triangles led to anomalous area and volume calculations at the boundary elevation of 201.00 feet. Therefore, areas between 198.00 feet and 201.00 feet were linearly interpolated between the computed values, and volumes above 198.00 feet were calculated based on the corrected areas (Texas Water Development Board, 2016). The 1996 re-calculated elevation-capacity table and elevation-area table are presented in Appendices A and B, respectively. The re-calculated capacity curve is presented in Appendix C, and the re-calculated area curve is presented in Appendix D.

Although anisotropic spatial interpolation and linear interpolation were originally applied to the 2010 TWDB survey, in 2016, the 2010 TWDB survey of Lake Conroe was updated to account for flat triangles. Computed areas between 196.00 feet and 201.10 feet were linearly interpolated between the computed values, and volumes above 196.00 feet were calculated based on the corrected areas (Texas Water Development Board, 2016). The 2010 re-calculated elevation-capacity table and elevation-area table are presented in Appendices E and F, respectively. The re-calculated capacity curve is presented in Appendix G, and the re-calculated area curve is presented in Appendix H.

Area, volume, and contour calculation

Volumes and areas were computed for the entire reservoir at 0.1-foot intervals, from 139.6 to 201.0 feet for the bathymetric TIN model, and from 139.6 to 212.0 feet for the bathymetric and topographic TIN model. While linear interpolation was used to estimate the topography in areas without data, flat triangles led to anomalous area and volume calculations at the boundary elevations of 199.13 and 201.00 feet. Therefore, areas between 199.00 feet and 201.00 feet were linearly interpolated between the computed values, and volumes above 199.00 feet were calculated based on the corrected areas. The bathymetric elevation-capacity table and bathymetric elevation-area table, based on the 2020 survey and analysis, are presented in Appendices I and J, respectively. The bathymetric capacity curve is presented in Appendix K, and the bathymetric area curve is presented in Appendix L. The topographic elevation-capacity table and topographic elevation-area table developed from the 2020 survey and analysis are presented in Appendices M and N, respectively. The topographic capacity curve is presented in Appendix O, and the topographic area curve is presented in Appendix P.

The bathymetric volumetric TIN model was converted to a raster representation using a cell size of 2 feet by 2 feet. The raster data then were used to produce three figures: (1) an elevation relief map representing the topography of the reservoir bottom (Figure 4); (2) a depth range map showing depth ranges for Lake Conroe (Figure 5); and (3) a 5-foot contour map (Figure 6).



3,760,000
3,780,000
3,800,000
10,200,000
10,180,000
10,160,000
10,140,000
Figure 4
Lake Conroe
Elevation relief map
Elevations
(feet NGVD29)
200 - 201
195 - 200
190 - 195
185 - 190
180 - 185
175 - 180
170 - 175
165 - 170
160 - 165
155 - 160
150 - 155
145 - 150
140 - 145
139.7 - 140
Conservation Pool
Elevation: 201.0 feet
above mean sea level
Projection: NAD83
State Plane
Texas Central Zone (feet)
N
Texas Water
Development Board
March - October 2020 Survey
Miles
0
0.5
1
2

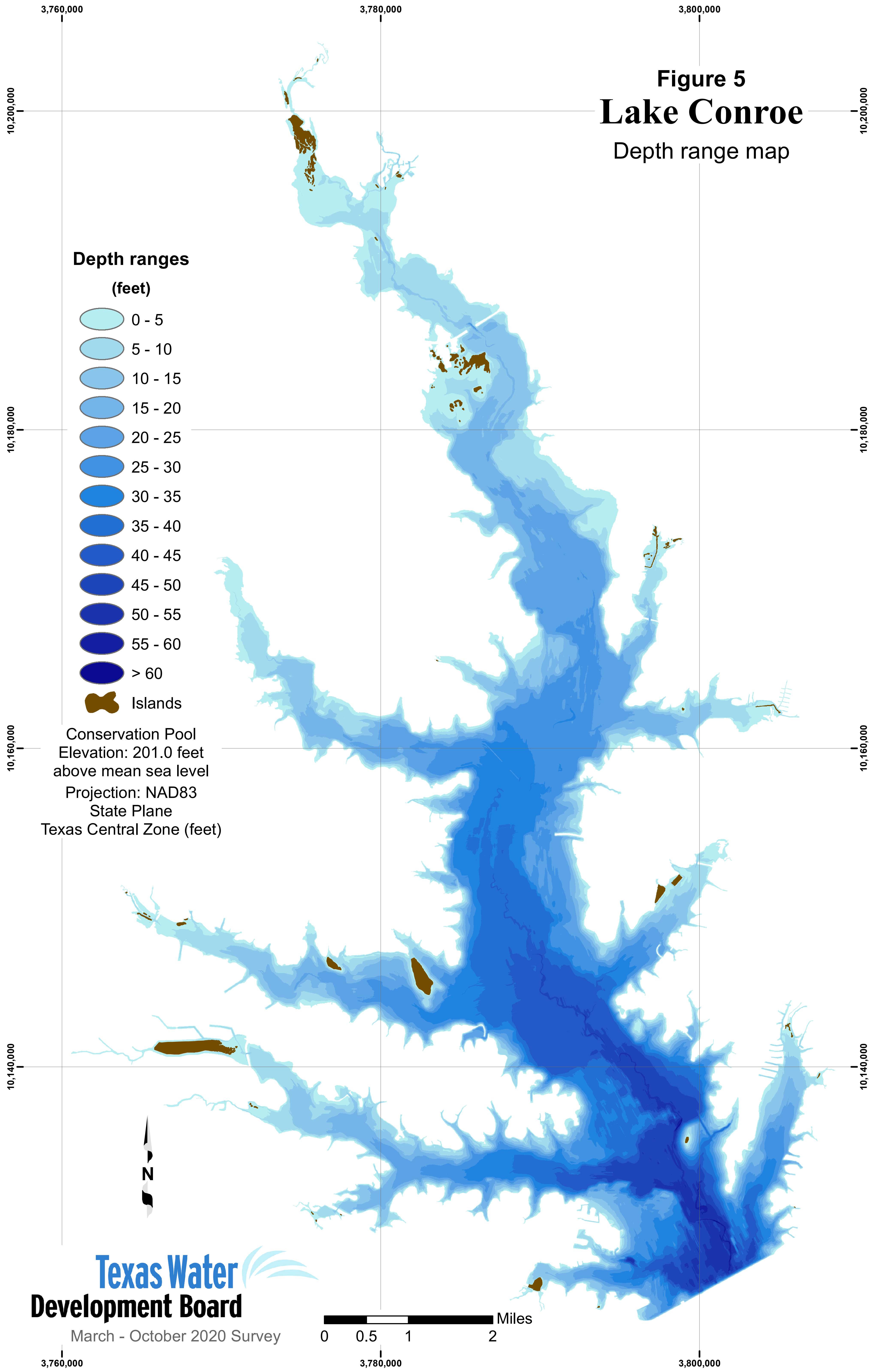


Figure 5
Lake Conroe
Depth range map
Depth ranges
(feet)
0 - 5
5 - 10
10 - 15
15 - 20
20 - 25
25 - 30
30 - 35
35 - 40
40 - 45
45 - 50
50 - 55
55 - 60
> 60
Islands
Conservation Pool
Elevation: 201.0 feet
above mean sea level
Projection: NAD83
State Plane
Texas Central Zone (feet)
3,760,000
3,780,000
3,800,000
10,200,000
10,180,000
10,160,000
10,140,000
N
Texas Water
Development Board
March - October 2020 Survey
Miles
0
0.5
1
2

Analysis of sediment data from Lake Conroe

Sedimentation in Lake Conroe was determined by analyzing the acoustic signal returns of all three depth sounder frequencies using customized software called Hydropick. While the 208 kHz signal is used to determine the current bathymetric surface, the 208 kHz, 50 kHz, and 12 kHz are analyzed to determine the reservoir bathymetric surface at the time of initial impoundment, *i.e.*, pre-impoundment surface. Sediment core samples collected in the reservoir are correlated with the acoustic signals in each frequency to assist in identifying the pre-impoundment surface. The difference between the current surface bathymetry and the pre-impoundment surface bathymetry yields a sediment thickness value at each sounding location.

Sediment cores were analyzed at TWDB headquarters in Austin. Each core was split longitudinally and analyzed to identify the location of the pre-impoundment surface. The pre-impoundment surface was identified within the sediment core using the following methods: (1) a visual examination of the sediment core for terrestrial materials, such as leaf litter, tree bark, twigs, intact roots, *etc.*, concentrations of which tend to occur on or just below the pre-impoundment surface; (2) recording changes in texture from well sorted, relatively fine-grained sediment to poorly sorted mixtures of coarse and fine-grained materials; and, (3) identifying variations in the physical properties of the sediment, particularly sediment water content and penetration resistance with depth (Van Metre and others, 2004). Total sediment core length, post impoundment sediment thickness, and pre-impoundment thickness were recorded. Physical characteristics of the sediment core, such as Munsell soil color, texture, relative water content, and presence of organic materials are presented in Table 2.

Table 2. Sediment core sample analysis data.

Sediment core sample	Easting[a] (feet)	Northing[a] (feet)	Total core sample / post-impoundment sediment length (inches)	Sediment core description[b]		Munsell soil color
CON-1	3791692.27	10126527.72	27.0 / 16.0	post-impoundment	0.0–2.0" very high water content, silt, soupy, smooth	2.5Y 3/3 dark olive brown
					2.0–16.0" high water content, silt, puddinglike, smooth, uniform texture throughout	5Y 4/2 olive gray
				pre-impoundment	16.0–27.0" low water content, silty clay, dense, malleable, sticky, organic material present throughout (fibrous roots, vegetation)	2.5Y 2.5/1 black
CON-2	3794679.12	10126593.55	28.0 / 23.0	post-impoundment	0.0–3.0" very high water content, silt, soupy, smooth	5Y 4/3 olive
					3.0–23.0" high water content, water content decreases with depth, silt, puddinglike, smooth, uniform texture, mottled coloration	5Y 4/2 olive gray 5Y 2.5/1 black
				pre-impoundment	23.0–28.0" low water content, silty clay, dense, malleable, organic material present throughout (fibrous roots, small woody debris)	2.5Y 2.5/1 black
CON-3	3802845.12	10128299.27	13.0 / 5.0	post-impoundment	0.0–5.0" very high water content, silt, soupy, smooth	5Y 4/3 olive
				pre-impoundment	5.0–13.0" low water content, sandy clay, bits of clay throughout, 2-inch rock present in middle of layer, organic material present throughout (fibrous roots)	5Y 6/4 pale olive
CON-4	3804762.08	10136167.05	34.0 / 30.0	post-impoundment	0.0–10.0" high water content, silt, soupy, smooth, uniform throughout	5Y 4/3 olive
					10.0–30.0" high water content, water content decreases with depth, silt, puddinglike, smooth, uniform throughout	5Y 3/2 dark olive gray
				pre-impoundment	30.0–34.0" low water content, sandy clay, dense, loosely packed, organic material present throughout (fibrous roots, leaf litter)	5Y 2.5/2 black

[a.] Coordinates are based on NAD83 State Plane Texas Central System (feet).
[b.] Sediment core samples are measured in inches with zero representing the current bottom surface.

Table 2 (continued). Sediment core sample analysis data.

Sediment core sample	Easting[a] (feet)	Northing[a] (feet)	Total core sample / post-impoundment sediment length (inches)	Sediment core description[b]		Munsell soil color
CON-5	3796275.69	10132186.46	41.0 / 37.0	post-impoundment	0.0–3.0" very high water content, silt, soupy, smooth, uniform throughout	5Y 4/3 olive
					3.0–37.0" high water content, silt, puddinglike, smooth, uniform throughout, mottled coloration	5Y 4/3 olive 5Y 2.5/1 black
				pre-impoundment	37.0–41.0" low water content, silty clay, dense, malleable, loosely packed, organic material present throughout (fibrous roots, leaf litter)	5Y 2.5/1 black
CON-6	3775122.45	10136949.75	16.0 / 12.0	post-impoundment	0.0–12.0" high water content, water content decreases with depth, silt, soupy, smooth, uniform throughout	5Y 4/3 olive
				pre-impoundment	12.0–16.0" low water content, silty clay, dense, malleable, organic material present throughout (fibrous roots)	5Y 2.5/1 black
CON-7	3787815.79	10134055.69	32.0 / 27.0	post-impoundment	0.0–27.0" high water content, water content decreases with depth, silt, puddinglike, smooth, uniform texture throughout, mottled coloration	5Y 4/3 olive 5Y 2.5/1 black
				pre-impoundment	27.0–32.0" moderate to low water content, water content decreases with depth, silty clay, dense, malleable, organic material present throughout (fibrous roots)	5Y 2.5/1 black
CON-8	3794565.35	10146084.84	18.0 / 13.0	post-impoundment	0.0–2.0" very high water content, silt, soupy, smooth	5Y 4/3 olive
					2.0–13.0" moderate water content, silt, puddinglike, smooth, bits of clay throughout	5Y 3/2 dark olive gray
				pre-impoundment	13.0–18.0" low water content, silty clay, dense, malleable, organic material present throughout (fibrous roots)	5Y 2.5/1 black
CON-9	3780771.44	10144384.71	21.0 / 15.0	post-impoundment	0.0–6.0" very high water content, silt, soupy, smooth	5Y 4/3 olive
					6.0–15.0" high water content, silt, puddinglike, smooth, organic material present (a piece of small woody debris)	5Y 3/2 dark olive gray
				pre-impoundment	15.0–21.0" low water content, silty clay, dense, malleable, organic material present throughout (fibrous roots, woody debris)	5Y 5/1 gray

[a.] Coordinates are based on NAD83 State Plane Texas Central System (feet).
[b.] Sediment core samples are measured in inches with zero representing the current bottom surface.

Table 2 (continued). Sediment core sample analysis data.

Sediment core sample	Easting[a] (feet)	Northing[a] (feet)	Total core sample / post-impoundment sediment length (inches)	Sediment core description[b]		Munsell soil color
CON-10	3780362.65	10142689.01	8.0 / 1.0	post-impoundment	0.0–1.0” very high water content, very thin film of silt on top of layer, soupy, smooth	5Y 4/2 olive gray
				pre-impoundment	1.0–8.0” low water content, sandy clay, dense, compacted, organic material present throughout (woody debris, vegetation, macroinvertebrates)	5Y 4/2 olive gray
CON-11	3783846.12	10156688.81	44.0 / 43.0	post-impoundment	0.0–43.0” low water content, sandy clay, dense, malleable, organic material scattered throughout (woody debris, stems)	5Y 4/2 olive gray
				pre-impoundment	43.0–44.0” low water content, sandy clay, dense, organic material present throughout (fibrous/dendritic roots)	5Y 4/2 olive gray
CON-12	3787386.56	10158610.72	16.0 / 12.0	post-impoundment	0.0–12.0” high water content, silt, soupy, smooth, organic material present (vegetation and one piece of small woody debris)	5Y 4/3 olive
				pre-impoundment	12.0–16.0” low water content, silty clay, dense, organic material present throughout (fibrous roots, leaf litter)	5Y 3/1 very dark gray
CON-13	3792045.46	10162167.72	16.0 / 1.0	post-impoundment	0.0–1.0” moderate water content, sandy silt, does not hold shape	5Y 4/3 olive
				pre-impoundment	1.0–16.0” low water content, silty clay, dense, loosely packed, malleable, organic material present throughout (fibrous/dendritic roots, leaf litter)	5Y 4/2 olive gray
CON-14	3790604.68	10162336.02	25.0 / 3.0	post-impoundment	0.0–3.0” high water content, sandy silt, soupy, smooth	5Y 4/3 olive
				pre-impoundment	3.0–25.0” low water content, sandy clay, peanut butter consistency, uniform texture throughout, dense, malleable, organic material present throughout (fibrous/dendritic roots)	5Y 4/2 olive gray
CON-15	3796919.94	10167624.32	38.0 / 33.0	post-impoundment	0.0 – 3.0” very high water content, silt, soupy, smooth	5Y 4/2 olive gray
					3.0 – 27.0 high water content, silt, puddinglike, smooth	5Y 3/2 dark olive gray

[a.] Coordinates are based on NAD83 State Plane Texas Central System (feet).
[b.] Sediment core samples are measured in inches with zero representing the current bottom surface.

Table 2 (continued). Sediment core sample analysis data.

Sediment core sample	Easting[a] (feet)	Northing[a] (feet)	Total core sample / post-impoundment sediment length (inches)	Sediment core description[b]		Munsell soil color
CON-15 (continued)	3796919.94	10167624.32	38.0 / 33.0	post-impoundment	27.0–33.0" very high water content, silty clay, soupy, smooth, bits of clay throughout	5Y 4/2 olive gray
				pre-impoundment	33.0–38.0" low water content, silty clay, dense, malleable, organic material present throughout (fibrous/dendritic roots)	5Y 3/2 dark olive gray
CON-16	3792156.01	10173359.02	39.0 / 34.0	post-impoundment	0.0–2.0" very high water content, silt, soupy, smooth	5Y 4/3 olive
					2.0–34.0" high to moderate water content, water content decreases with depth, silty clay, puddinglike, puddinglike, organic material scattered throughout (woody debris)	5Y 4/2 olive gray
				pre-impoundment	34.0–39.0" low water content, silty clay, dense, malleable, organic material present throughout (fibrous/dendritic roots, woody debris)	5Y 2.5/1 black
CON-17	3784970.25	10179607.04	26.0 / 3.0	post-impoundment	0.0–3.0" very high water content, silt, soupy, smooth	5Y 3/1 very dark gray
				pre-impoundment	3.0 – 26.0" low water content, silty clay, smooth, dense, organic material present throughout (fibrous/dendritic roots, woody debris)	5Y 4/2 olive gray
CON-18	3785560.05	10185734.34	60.0 / 57.0	post-impoundment	0.0–3.0" very high water content, silt, smooth, soupy	5Y 3/1 very dark gray
					3.0–57.0" moderate water content, silty clay, puddinglike, smooth, uniform texture throughout	5Y 3/2 dark olive gray
				pre-impoundment	57.0–60.0" moderate to low water content, silty clay, bits of clay throughout, dense	5Y 3/2 dark olive gray
CON-19	3784689.09	10187547.41	28.0 / 26.0	post-impoundment	0.0–3.0" very high water content, silt, soupy, smooth	5Y 4/2 olive gray
					3.0 – 26.0" moderate water content, water content decreases with depth, silt, smooth, uniform texture throughout, organic material present throughout (woody debris)	5Y 4/2 olive gray

[a.] Coordinates are based on NAD83 State Plane Texas Central System (feet).

[b.] Sediment core samples are measured in inches with zero representing the current bottom surface.

Table 2 (continued). Sediment core sample analysis data.

Sediment core sample	Easting[a] (feet)	Northing[a] (feet)	Total core sample / post-impoundment sediment length (inches)	Sediment core description[b]		Munsell soil color
CON-19 (continued)	3784689.09	10187547.41	28.0 / 26.0	pre-impoundment	26.0–28.0" moderate to low water content, silty clay, bits of clay throughout, dense, loosely packed, organic material present throughout (fibrous roots)	5Y 3/2 dark olive gray
CON-20	3780230.25	10191284.58	36.0 / 32.0	post-impoundment	0.0–2.0" very high water content, silt, soupy, smooth	5Y 4/2 olive gray
					2.0–32.0" high to moderate water content, water content decreases with depth, silty clay, bits of clay throughout, puddinglike, smooth	5Y 4/2 olive gray
				pre-impoundment	32.0 – 36.0" low water content, silty clay, dense, organic material present throughout (fibrous roots, woody debris)	5Y 2.5/1 black

a. Coordinates are based on NAD83 State Plane Texas Central System (feet).

b. Sediment core samples are measured in inches with zero representing the current bottom surface.

A photograph of sediment core CON-5 (for location, refer to Figure 2) is shown in Figure 7. The base, or deepest part of the sample is denoted by the blue line. The pre-impoundment boundary (yellow line closest to the base) was evident within this sediment core sample at 37 inches and identified by the change in color, texture, moisture, porosity, and structure. Identification of the pre-impoundment surface for each sediment core followed a similar procedure.

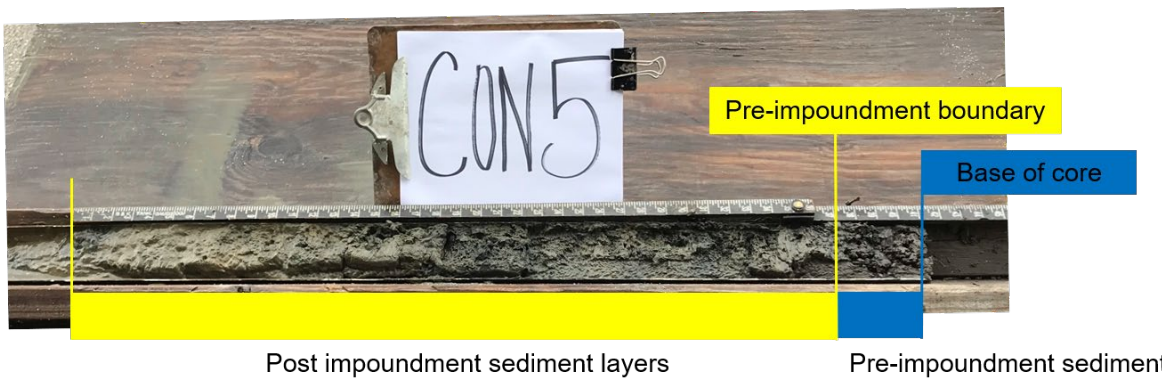


Figure 7. Sediment core CON-5. Post-impoundment sediment layers occur in the top 37 inches of this sediment core (identified by the yellow box). Pre-impoundment sediment layers were identified and are defined by the blue box.

Figure 8 illustrates the relationships between acoustic signal returns and the depositional layering seen in sediment cores. In this example, sediment core CON-5 is shown correlated with each frequency: 208 kHz, 50 kHz, and 12 kHz. The current bathymetric surface is determined based on signal returns from the 208 kHz transducer as represented by the top red line in Figure 8. The pre-impoundment surface is identified by comparing boundaries observed in the 208 kHz, 50 kHz, and 12 kHz signals to the location of the pre-impoundment surface of the sediment core sample. Many layers of sediment may be identified during analysis based on changes in observed characteristics such as water content, organic matter content, and sediment particle size, and each layer is classified as either post-impoundment or pre-impoundment. Yellow boxes represent post-impoundment sediments identified in the sediment core. Blue boxes indicate pre-impoundment sediments.

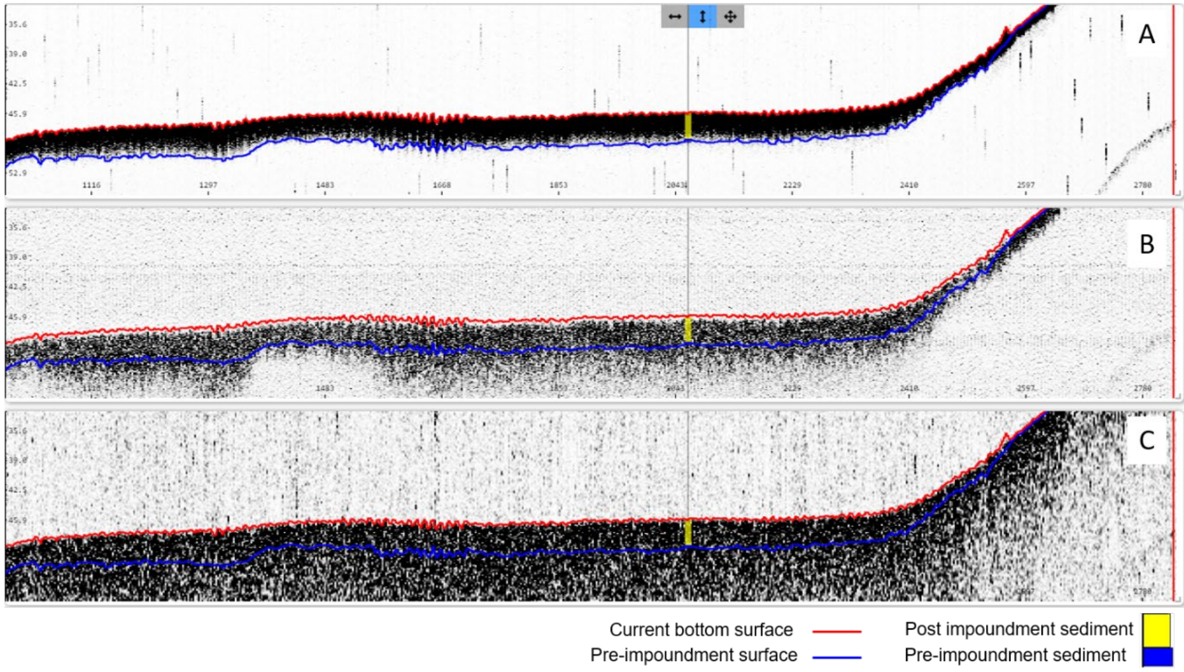


Figure 8. Sediment core sample CON-5 compared with acoustic signal returns. A) 208 kHz frequency, B) 50 kHz frequency, and C) 12 kHz frequency.

The pre-impoundment boundary in sediment core CON-5 most closely aligned with the different layers picked up by the 208 kHz acoustic returns (Figure 8). The pre-impoundment surface is first identified along cross-sections for which sediment core samples were collected. This information then is used as a guide for identifying the pre-impoundment surface along cross-sections where sediment core samples were not collected.

After the pre-impoundment surface for all cross-sections is identified, a pre-impoundment TIN model and a sediment thickness TIN model are created. Pre-impoundment elevations and sediment thicknesses are interpolated between surveyed cross-sections using HydroTools with the same interpolation definition file used for bathymetric interpolation. For the purposes of TIN model creation, the TWDB assumed the sediment thickness at each LIDAR data point and the reservoir boundary was 0 feet (defined as the 201-foot elevation contour). The sediment thickness TIN model was converted to a raster representation using a cell size of 5 feet by 5 feet and was used to produce a sediment thickness map (Figure 9). Elevation-capacity and elevation-area tables were computed from the pre-impoundment TIN model for the purpose of calculating the total volume of accumulated sediment.

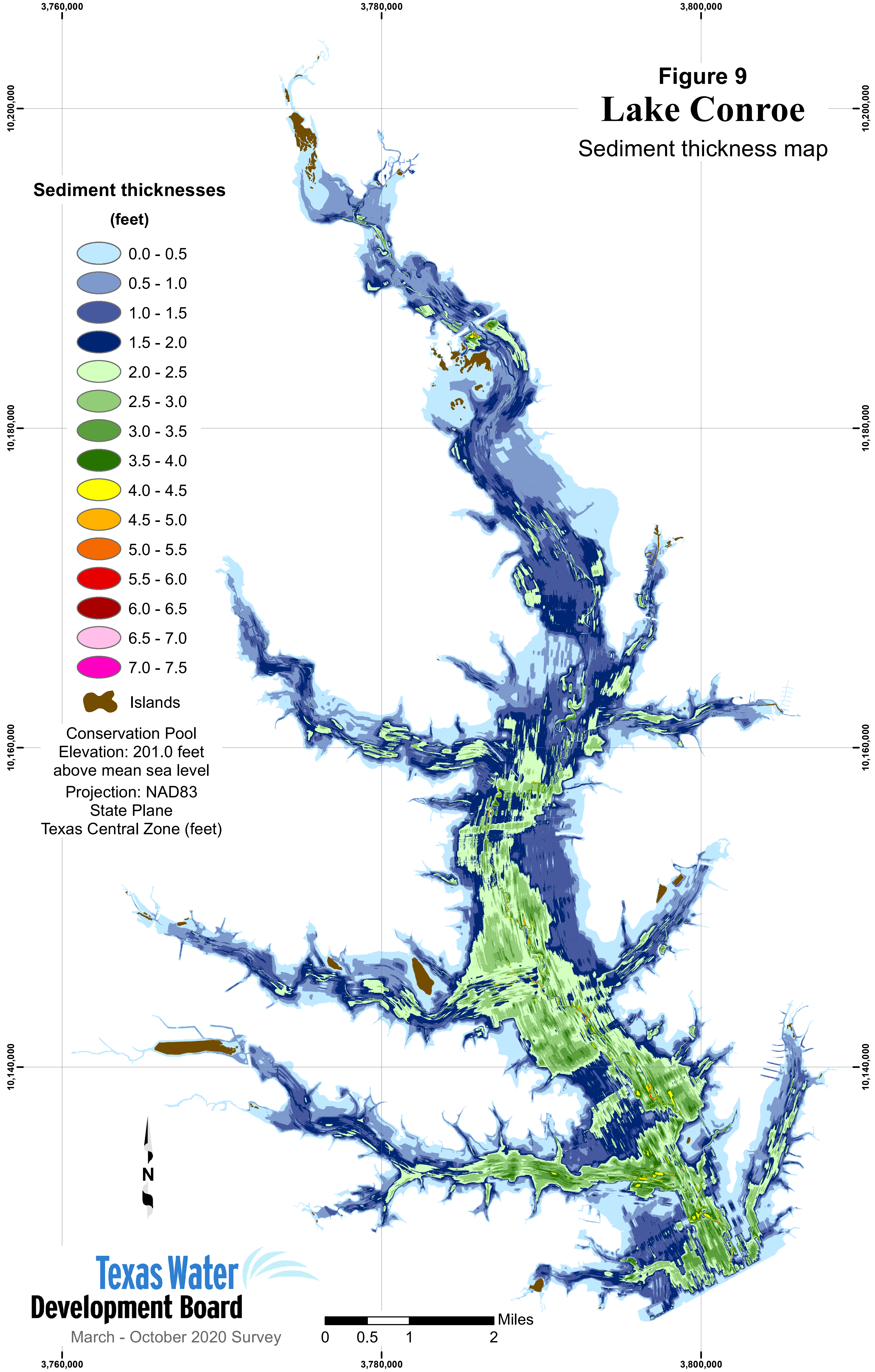


Figure 9
Lake Conroe
Sediment thickness map
Sediment thicknesses
(feet)
0.0 - 0.5
0.5 - 1.0
1.0 - 1.5
1.5 - 2.0
2.0 - 2.5
2.5 - 3.0
3.0 - 3.5
3.5 - 4.0
4.0 - 4.5
4.5 - 5.0
5.0 - 5.5
5.5 - 6.0
6.0 - 6.5
6.5 - 7.0
7.0 - 7.5
Islands
Conservation Pool
Elevation: 201.0 feet
above mean sea level
Projection: NAD83
State Plane
Texas Central Zone (feet)
3,760,000
3,780,000
3,800,000
10,200,000
10,180,000
10,160,000
10,140,000
N
Texas Water
Development Board
March - October 2020 Survey
Miles
0
0.5
1
2

Survey results

Volumetric survey

The 2020 TWDB volumetric survey indicates that Lake Conroe has a total reservoir capacity of 417,605 acre-feet and encompasses 19,894 acres at conservation pool elevation (201.0 feet above mean sea level). Current area and capacity estimates are compared to previous area and capacity estimates at different elevations in Table 3. Because of differences in past and present survey methodologies, direct comparison of volumetric surveys to others to estimate loss of area and capacity can be unreliable.

Table 3. Surface area, total capacity, and conservation pool elevation.

Survey	Surface Area (acres)	Total Capacity (acre-feet)	Conservation Pool Elevation[a]	Source
SJRA original design	20,985	430,260	201.00	Texas Department of Water Resources, 1984
TWDB 1996	20,118	416,228	201.00	Texas Water Development Board, 1996
TWDB 1996 re-calculated	20,118	422,148	201.00	Texas Water Development Board, 2016
TWDB 2010	19,640	411,022	201.00	Texas Water Development Board, 2012
TWDB 2010 re-calculated	19,640	412,200	201.00	Texas Water Development Board, 2016
TWDB 2020	19,894	417,605	201.00	

[a.] Feet above mean sea level, National Geodetic Vertical Datum 1929 (NGVD29).

Sedimentation survey

The 2020 TWDB sedimentation survey measured 25,827 acre-feet of sediment. The sedimentation survey indicates sediment accumulation is greatest in the river channels and floodplains. Comparison of capacity estimates of Lake Conroe derived using differing methodologies are provided in Table 4 for sedimentation rate calculation. The 2020 TWDB sedimentation survey indicates Lake Conroe has lost capacity at an average of 550 acre-feet per year since impoundment due to sedimentation below conservation pool elevation (201.0 feet above mean sea level). Long-term trends indicate Lake Conroe loses capacity at an average of 496 acre-feet per year since impoundment due to sedimentation below conservation pool elevation (201.0 feet above mean sea level) (Figure 10).

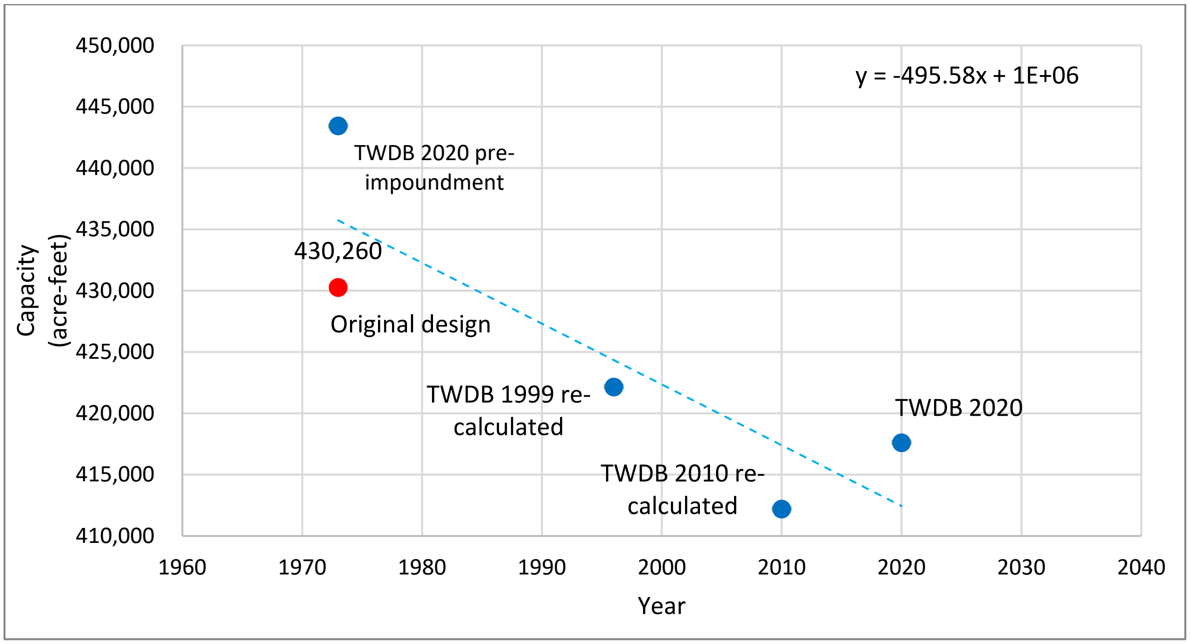


Figure 10. Plot of current and previous capacity estimates (acre-feet) at elevation 201.0 feet. Capacity estimates for each TWDB survey plotted as blue dots and other surveys as red dots. The blue trend line illustrates the total average loss of capacity through 2020.

Table 4. Average annual capacity loss comparisons.

Survey	Top of conservation pool elevation 201.0 feet above mean sea level (acre-feet)			
Original design[a]	430,260	<>	<>	<>
TWDB 1996 re-calculated	<>	422,148	<>	<>
TWDB 2010 re-calculated	<>	<>	412,200	<>
TWDB pre-impoundment estimate based on 2020 survey	<>	<>	<>	443,432
2020 volumetric survey	417,605	417,605	417,605	417,605
Volume difference (acre-feet) Percent change	12,655 2.9	4,543 1.1	-5,405 -1.3	25,827 5.8
Number of years	47	24	10	47
Capacity loss rate (acre-feet/year)	269	189	-541	550
Capacity loss rate (acre-feet/square mile of drainage area of 445 square miles /year)	0.61	0.42	-1.2	1.2

[a.] Source: Texas Water Development Board, 1973; Conroe Dam was completed, and deliberate impoundment began in January 1973.

Recommendations

The TWDB recommends a detailed analysis of sediment deposits in the areas where exposure of the lake bottom may have led to identification of a false pre-impoundment using augured-coring techniques, as well as a volumetric and sedimentation survey in 10 years or after a major high flow event to further improve estimates of sediment accumulation rates.

TWDB contact information

For more information about the TWDB Hydrographic Survey Program, visit www.twdb.texas.gov/surfacewater/surveys. Any questions regarding the TWDB Hydrographic Survey Program or this report may be addressed to: Hydrosurvey@twdb.texas.gov.

References

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

McEwen, T., Brock, N., Kemp, J., Pothina, D. and Weyant, H., 2011a, HydroTools User's Manual: Texas Water Development Board.

McEwen, T., Pothina, D. and Negusse, S., 2011b, Improving efficiency and repeatability of lake volume estimates using Python: Proceedings of the 10th Python for Scientific Computing Conference.

National Geodetic Survey, 2017a, NADCON computations, accessed June 8, 2021, http://www.ngs.noaa.gov/cgi-bin/nadcon.prl.

National Geodetic Survey, 2017b, Orthometric Height Conversion, accessed June 8, 2021, http://www.ngs.noaa.gov/cgi-bin/VERTCON/vert_con.prl.

San Jacinto River Authority, 2021, History of Lake Conroe, accessed March 16, 2021, at https://www.sjra.net/lakeconroe/history/.

Texas Commission on Environmental Quality, 2021, Texas Water Rights Viewer, accessed March 16, 2021, at https://tceq.maps.arcgis.com/home/webmap/viewer.html?webmap=796b001513b9407a9818897b4dc1ec4d

Texas Department of Water Resources, 1984, Water for Texas—Technical appendix: Austin, Tex., Texas Department of Water Resources, v. 2, p. III–14–1—III–14–11, accessed July 8, 2020, at https://www.twdb.texas.gov/publications/State_Water_Plan/1984/Water%20for%20Texas%20Volume%202%20Technical%20Appendix.pdf?d=14835

Texas Natural Resources Information System, 2020a, Texas Imagery Service | TNRIS – Texas Natural Resources Information System, accessed July 31, 2020, at https://www.tnris.org/texas-imagery-service/.

Texas Natural Resources Information System, 2020b, Texas Imagery Service | TNRIS – Texas Natural Resources Information System, Helpful Downloads, Google Imagery Accuracy Assessment, accessed July 31, 2020, at https://tnris-org-static.s3.amazonaws.com/documents/google-imagery-formal-accuracy-assessment.pdf.

Texas Water Development Board, 1973, *Conroe Dam and Lake Conroe*, Report 126, Engineering Data on Dams and Reservoirs in Texas, Part II.

Texas Water Development Board, 2003, Volumetric Survey of Lake Conroe, accessed August 30, 2021, at http://www.twdb.texas.gov/hydro_survey/Conroe/1996-04/Conroe1996_FinalReport.pdf

Texas Water Development Board, 2012, Volumetric and Sedimentation Survey of Lake Conroe, accessed March 17, 2021, at http://www.twdb.texas.gov/surfacewater/surveys/completed/files/conroe/2010-08/Conroe2010_FinalReport.pdf

Texas Water Development Board, 2016, Application of New Procedures to Re-Assess Reservoir Capacity, accessed June 16, 2021, at http://www.twdb.texas.gov/hydro_survey/Re-assessment/ReassessOldSurveys_Draft4Comment.pdf.

Texas Water Development Board, 2020, Contract No. 2048012404 with the San Jacinto River Authority.

U.S. Geological Survey, 1999, Map Accuracy Standards, accessed August 30, 2021, at https://pubs.usgs.gov/fs/1999/0171/report.pdf.

U.S. Geological Survey, 2021, U.S. Geological Survey National Water Information System: Web Interface, *USGS 08067600 Lk Conroe nr Conroe, TX*, accessed March 16, 2021, at https://waterdata.usgs.gov/tx/nwis/uv/?site_no=08067600&PARAmeter_cd=00054,62614,62615,62619.

Van Metre, P.C., Wilson, J.T., Fuller, C.C., Callender, E., and Mahler, B.J., 2004, Collection, analysis, and age-dating of sediment cores from 56 U.S. lakes and reservoirs sampled by the U.S. Geological Survey, 1992-2001: U.S. Geological Survey Scientific Investigations Report 2004-5184, 180 p.

Appendix A

Lake Conroe

RESERVOIR CAPACITY TABLE

TEXAS WATER DEVELOPMENT BOARD — April 1996 Survey re-calculated November 2016

CAPACITY IN ACRE-FEET — Conservation pool elevation 201.0 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
134	0	0	0	0	0	0	0	0	0	0
135	0	0	0	0	0	0	0	0	0	0
136	0	0	0	0	0	0	0	0	0	0
137	0	0	0	0	0	0	0	0	0	0
138	0	0	0	0	0	0	0	0	0	0
139	0	0	0	0	0	0	0	0	0	0
140	0	0	0	0	0	1	1	1	1	1
141	1	1	2	2	2	2	3	3	3	4
142	4	4	5	5	6	6	7	7	8	8
143	9	9	10	11	11	12	13	14	15	15
144	16	17	18	19	20	21	22	24	25	26
145	27	29	30	31	33	34	36	37	39	41
146	43	45	47	49	51	54	56	59	62	65
147	69	72	76	81	86	91	97	103	110	117
148	126	135	145	155	166	178	191	205	219	234
149	249	266	283	301	320	340	360	382	404	428
150	452	478	504	532	561	591	622	654	687	721
151	757	794	832	872	913	956	1,000	1,046	1,093	1,142
152	1,193	1,246	1,301	1,357	1,415	1,474	1,535	1,598	1,662	1,727
153	1,794	1,863	1,933	2,005	2,078	2,153	2,231	2,309	2,390	2,472
154	2,556	2,641	2,728	2,817	2,906	2,998	3,090	3,184	3,279	3,375
155	3,472	3,570	3,670	3,771	3,872	3,976	4,080	4,186	4,294	4,405
156	4,518	4,633	4,752	4,872	4,996	5,122	5,250	5,381	5,514	5,650
157	5,788	5,928	6,071	6,216	6,363	6,513	6,665	6,820	6,977	7,137
158	7,300	7,466	7,634	7,805	7,979	8,155	8,334	8,515	8,699	8,885
159	9,074	9,266	9,460	9,657	9,857	10,059	10,264	10,471	10,681	10,894
160	11,109	11,326	11,545	11,767	11,991	12,217	12,445	12,675	12,908	13,143
161	13,379	13,618	13,859	14,103	14,348	14,596	14,846	15,098	15,353	15,610
162	15,870	16,133	16,398	16,666	16,938	17,213	17,492	17,773	18,058	18,347
163	18,638	18,933	19,230	19,531	19,834	20,141	20,451	20,765	21,083	21,404
164	21,728	22,056	22,387	22,722	23,060	23,402	23,748	24,096	24,447	24,801
165	25,159	25,519	25,882	26,248	26,617	26,990	27,366	27,746	28,129	28,517
166	28,908	29,303	29,701	30,104	30,511	30,921	31,335	31,752	32,172	32,595
167	33,022	33,451	33,883	34,318	34,755	35,196	35,639	36,085	36,534	36,986
168	37,441	37,899	38,360	38,824	39,292	39,763	40,237	40,715	41,198	41,684
169	42,174	42,668	43,166	43,667	44,173	44,682	45,195	45,712	46,233	46,757
170	47,285	47,817	48,353	48,892	49,434	49,980	50,529	51,082	51,638	52,197
171	52,760	53,326	53,895	54,467	55,043	55,621	56,202	56,786	57,374	57,965
172	58,559	59,157	59,758	60,361	60,968	61,579	62,192	62,809	63,430	64,054
173	64,682	65,313	65,948	66,586	67,228	67,873	68,522	69,175	69,832	70,492
174	71,157	71,826	72,500	73,178	73,860	74,546	75,238	75,934	76,636	77,342
175	78,054	78,770	79,492	80,219	80,952	81,690	82,435	83,185	83,943	84,707
176	85,476	86,252	87,033	87,819	88,610	89,407	90,209	91,015	91,826	92,642
177	93,462	94,287	95,116	95,951	96,789	97,632	98,479	99,331	100,187	101,048
178	101,914	102,785	103,661	104,541	105,425	106,315	107,209	108,108	109,013	109,922
179	110,835	111,752	112,674	113,599	114,529	115,463	116,401	117,343	118,290	119,241
180	120,196	121,155	122,119	123,087	124,059	125,036	126,016	127,002	127,991	128,986
181	129,985	130,989	131,997	133,011	134,028	135,050	136,076	137,106	138,140	139,178
182	140,220	141,265	142,314	143,366	144,422	145,481	146,544	147,610	148,681	149,754
183	150,832	151,913	152,998	154,087	155,178	156,274	157,373	158,476	159,583	160,694
184	161,809	162,928	164,051	165,179	166,310	167,445	168,583	169,726	170,873	172,023
185	173,178	174,337	175,499	176,667	177,838	179,015	180,195	181,380	182,570	183,764
186	184,962	186,165	187,372	188,584	189,800	191,020	192,245	193,475	194,710	195,949
187	197,192	198,441	199,695	200,954	202,218	203,487	204,761	206,040	207,323	208,610
188	209,902	211,198	212,499	213,803	215,112	216,426	217,744	219,066	220,392	221,723
189	223,058	224,397	225,740	227,088	228,439	229,795	231,155	232,520	233,889	235,262

Appendix A (continued)

Lake Conroe

RESERVOIR CAPACITY TABLE (Continued)

TEXAS WATER DEVELOPMENT BOARD | April 1996 Survey re-calculated November 2016

CAPACITY IN ACRE-FEET | Conservation pool elevation 201.0 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
190	236,640	238,023	239,409	240,800	242,196	243,596	245,002	246,411	247,825	249,244
191	250,668	252,097	253,530	254,969	256,412	257,861	259,315	260,773	262,238	263,707
192	265,183	266,665	268,151	269,643	271,141	272,643	274,151	275,664	277,183	278,708
193	280,238	281,774	283,316	284,864	286,417	287,978	289,544	291,116	292,694	294,278
194	295,868	297,463	299,065	300,672	302,286	303,905	305,531	307,162	308,800	310,442
195	312,091	313,745	315,405	317,070	318,742	320,420	322,104	323,794	325,490	327,192
196	328,901	330,615	332,335	334,061	335,793	337,531	339,275	341,024	342,779	344,541
197	346,308	348,083	349,865	351,655	353,453	355,257	357,069	358,889	360,715	362,546
198	364,383	366,225	368,073	369,926	371,786	373,651	375,521	377,398	379,280	381,168
199	383,062	384,962	386,867	388,778	390,695	392,618	394,546	396,480	398,420	400,366
200	402,317	404,274	406,237	408,206	410,180	412,161	414,146	416,138	418,136	420,139
201	422,148									

Note: Capacities above elevation 198.0 feet caclulated from interpolated areas

Appendix B

Lake Conroe

RESERVOIR AREA TABLE

TEXAS WATER DEVELOPMENT BOARD

AREA IN ACRES

ELEVATION INCREMENT IS ONE TENTH FOOT

April 1996 Survey re-calculated November 2016

Conservation pool elevation 201.0 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
134	0	0	0	0	0	0	0	0	0	0
135	0	0	0	0	0	0	0	0	0	0
136	0	0	0	0	0	0	0	0	0	0
137	0	0	0	0	0	0	0	0	0	0
138	0	0	0	0	0	0	0	0	0	0
139	0	0	0	0	0	0	0	0	0	0
140	0	0	1	1	1	1	1	1	1	1
141	2	2	2	2	2	3	3	3	3	4
142	4	4	4	4	5	5	5	5	6	6
143	6	6	7	7	7	8	8	8	9	9
144	9	10	10	10	10	11	11	12	12	12
145	13	13	14	14	15	15	16	16	17	18
146	19	20	21	22	24	26	27	29	31	33
147	36	38	42	46	50	55	60	66	73	80
148	87	95	102	109	116	124	131	138	145	153
149	161	169	176	184	193	201	211	220	230	239
150	250	261	272	283	293	304	315	327	338	350
151	362	375	388	403	419	435	451	467	483	500
152	518	537	555	571	586	602	617	632	647	662
153	677	694	711	727	743	761	779	796	813	830
154	847	863	877	891	904	918	930	943	955	967
155	978	990	1,002	1,013	1,025	1,037	1,052	1,071	1,095	1,118
156	1,142	1,168	1,195	1,221	1,246	1,271	1,295	1,321	1,345	1,369
157	1,392	1,415	1,438	1,462	1,485	1,509	1,534	1,560	1,587	1,616
158	1,643	1,671	1,698	1,725	1,750	1,774	1,798	1,823	1,850	1,877
159	1,903	1,930	1,955	1,983	2,010	2,036	2,062	2,088	2,113	2,137
160	2,160	2,183	2,205	2,227	2,249	2,271	2,294	2,315	2,336	2,357
161	2,379	2,400	2,421	2,444	2,467	2,489	2,511	2,534	2,559	2,585
162	2,612	2,640	2,669	2,699	2,734	2,768	2,802	2,834	2,867	2,900
163	2,930	2,959	2,989	3,019	3,051	3,086	3,123	3,158	3,192	3,226
164	3,260	3,296	3,332	3,367	3,402	3,437	3,468	3,497	3,527	3,557
165	3,587	3,616	3,646	3,676	3,710	3,744	3,780	3,817	3,854	3,891
166	3,929	3,969	4,008	4,047	4,085	4,120	4,154	4,187	4,219	4,250
167	4,278	4,306	4,333	4,362	4,390	4,419	4,447	4,476	4,504	4,533
168	4,564	4,595	4,626	4,659	4,692	4,727	4,763	4,803	4,843	4,883
169	4,921	4,958	4,996	5,035	5,074	5,112	5,150	5,188	5,225	5,263
170	5,300	5,336	5,373	5,408	5,442	5,476	5,510	5,543	5,577	5,610
171	5,644	5,676	5,706	5,737	5,767	5,797	5,828	5,860	5,893	5,926
172	5,959	5,991	6,023	6,054	6,086	6,119	6,154	6,189	6,224	6,259
173	6,295	6,329	6,364	6,400	6,435	6,472	6,509	6,548	6,587	6,627
174	6,669	6,712	6,756	6,800	6,844	6,891	6,939	6,988	7,040	7,091
175	7,142	7,193	7,245	7,299	7,353	7,412	7,475	7,540	7,608	7,669
176	7,726	7,781	7,835	7,889	7,942	7,991	8,038	8,087	8,134	8,180
177	8,226	8,273	8,320	8,364	8,407	8,449	8,493	8,539	8,586	8,638
178	8,686	8,731	8,776	8,824	8,871	8,917	8,967	9,019	9,067	9,110
179	9,153	9,195	9,235	9,276	9,316	9,359	9,402	9,444	9,488	9,532
180	9,574	9,615	9,657	9,699	9,744	9,787	9,830	9,875	9,920	9,967
181	10,016	10,064	10,109	10,153	10,196	10,239	10,281	10,322	10,361	10,398
182	10,434	10,469	10,505	10,540	10,576	10,611	10,648	10,683	10,720	10,758
183	10,794	10,830	10,866	10,901	10,936	10,973	11,009	11,049	11,089	11,131
184	11,172	11,212	11,253	11,292	11,330	11,368	11,407	11,446	11,486	11,526
185	11,566	11,608	11,652	11,696	11,740	11,783	11,828	11,874	11,918	11,962
186	12,006	12,050	12,094	12,137	12,181	12,227	12,274	12,321	12,368	12,414
187	12,462	12,512	12,563	12,617	12,667	12,715	12,763	12,808	12,853	12,897
188	12,940	12,983	13,025	13,068	13,112	13,157	13,200	13,243	13,286	13,328
189	13,371	13,412	13,453	13,495	13,537	13,579	13,623	13,668	13,711	13,758

Lake Conroe

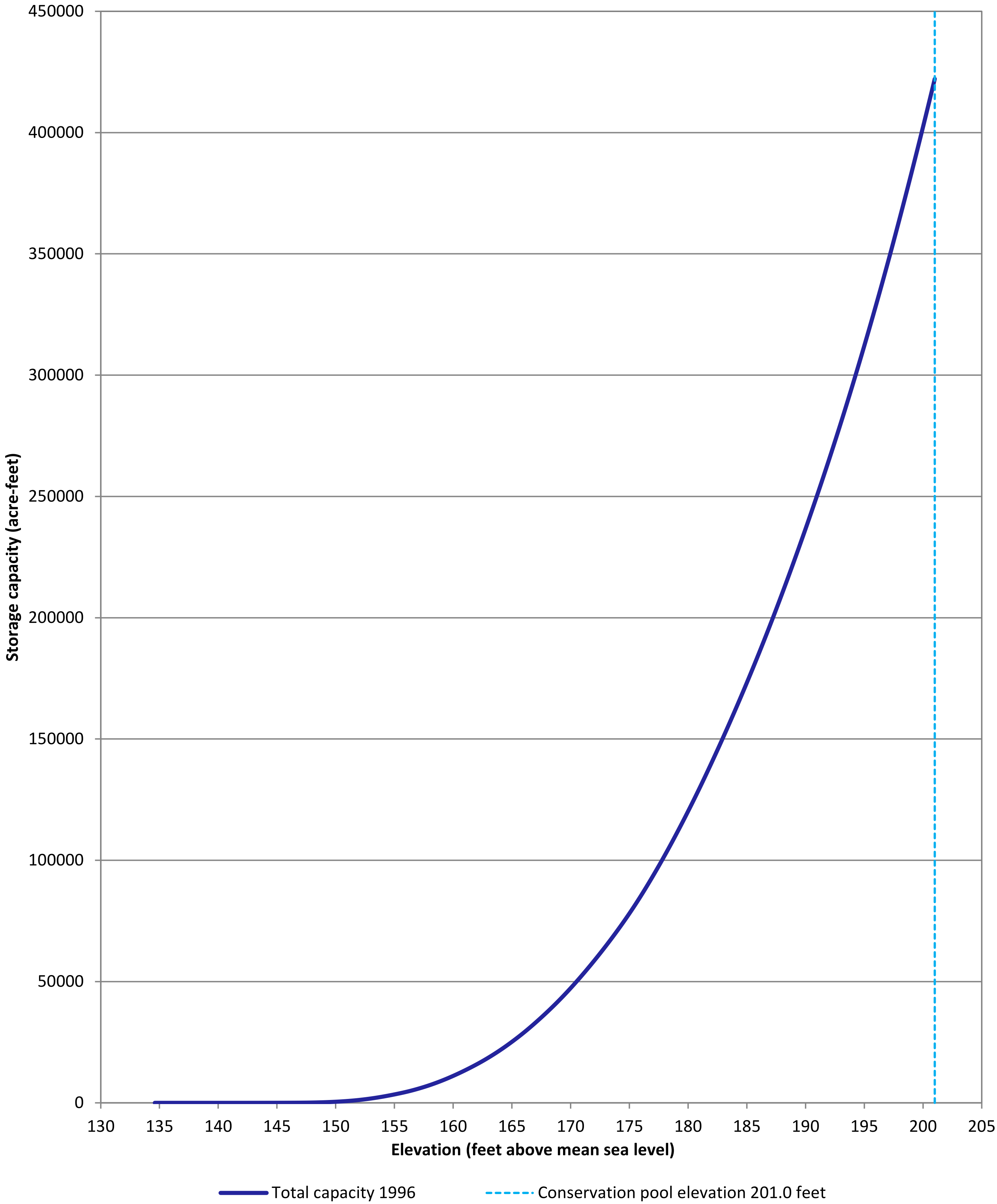
RESERVOIR AREA TABLE (Continued)

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

April 1996 Survey re-calculated November 2016
Conservation pool elevation 201.0 feet NGVD29

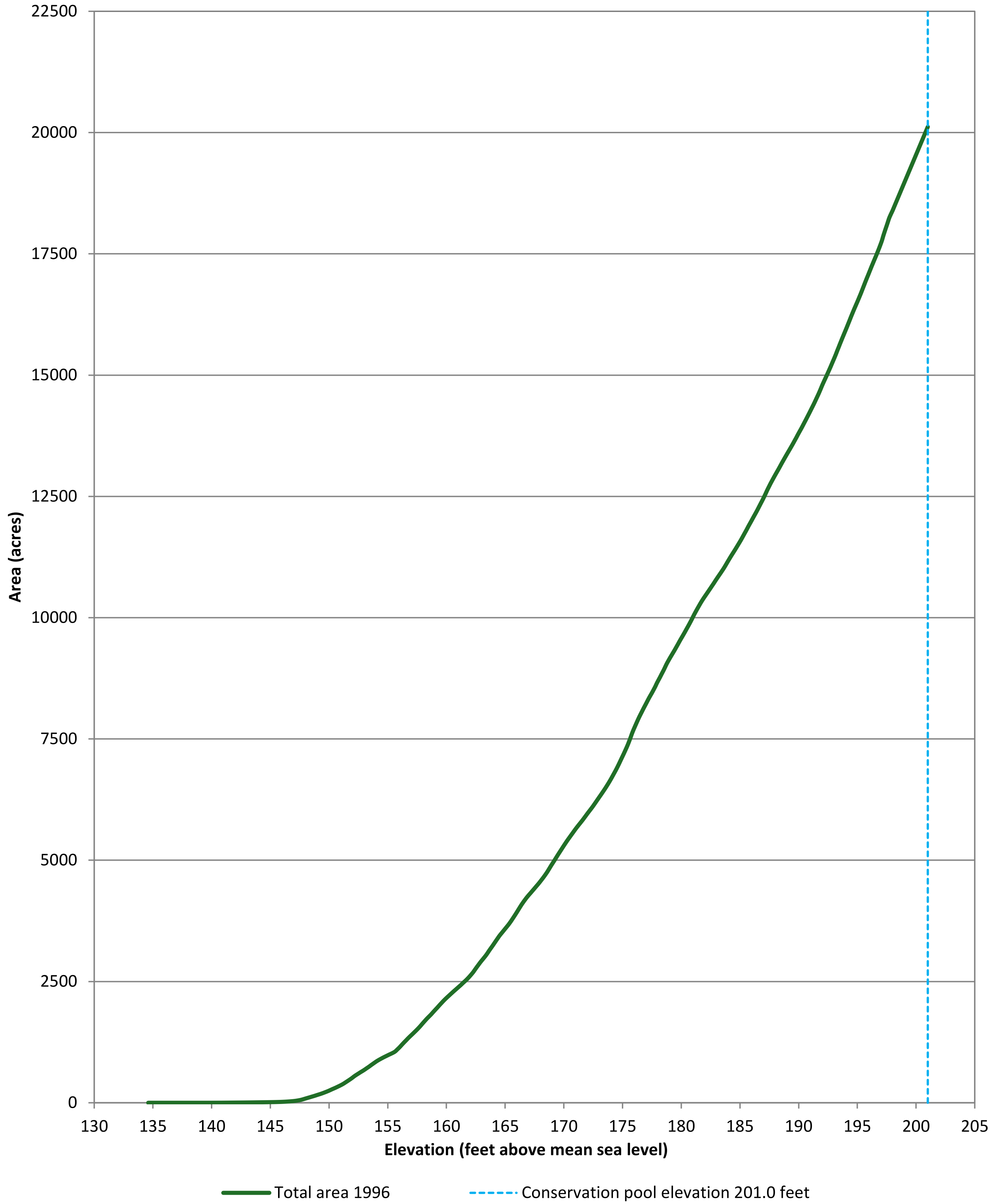
ELEVATION in Feet	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
190	13,802	13,846	13,889	13,934	13,981	14,027	14,073	14,120	14,167	14,214
191	14,263	14,311	14,359	14,408	14,459	14,511	14,563	14,615	14,670	14,728
192	14,787	14,841	14,894	14,946	14,999	15,052	15,106	15,160	15,217	15,274
193	15,330	15,388	15,447	15,511	15,570	15,632	15,692	15,751	15,810	15,868
194	15,926	15,985	16,045	16,105	16,166	16,227	16,286	16,344	16,400	16,456
195	16,511	16,569	16,626	16,685	16,747	16,809	16,871	16,933	16,993	17,052
196	17,112	17,172	17,233	17,291	17,349	17,406	17,464	17,523	17,584	17,646
197	17,710	17,779	17,863	17,939	18,012	18,083	18,156	18,230	18,288	18,340
198	18,392	18,449	18,507	18,564	18,622	18,679	18,737	18,795	18,852	18,910
199	18,967	19,025	19,082	19,140	19,197	19,255	19,312	19,370	19,428	19,485
200	19,543	19,600	19,658	19,715	19,773	19,830	19,888	19,946	20,003	20,061
201	20,118									

Note: Areas between elevations 198.0 and 201.0 feet linearly interpolated



Lake Conroe
April 1996 Survey
re-calculated November 2016
Prepared by: TWDB

Appendix C: 1996 re-calculated capacity curve



Lake Conroe
April 1996 Survey
re-calculated November 2016
Prepared by: TWDB

Appendix D: 1996 re-calcuated area curve

Appendix E

Lake Conroe

RESERVOIR CAPACITY TABLE

TEXAS WATER DEVELOPMENT BOARD — June - August 2010 Survey recalculated September 2015

CAPACITY IN ACRE-FEET — Conservation pool elevation 201.0 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
137	0	0	0	0	0	0	0	0	0	0
138	0	0	0	0	0	0	0	0	0	0
139	0	0	0	0	0	0	0	0	0	0
140	0	0	1	1	1	1	1	1	2	2
141	2	2	3	3	3	4	4	4	5	5
142	6	6	7	7	8	8	9	10	10	11
143	12	13	14	15	15	16	17	18	19	20
144	21	23	24	25	26	27	29	30	31	33
145	34	36	37	39	41	42	44	46	48	50
146	52	54	56	59	61	64	66	69	72	75
147	78	81	85	89	93	97	102	106	111	117
148	122	128	135	141	148	155	163	171	179	188
149	197	207	217	228	239	251	264	277	292	307
150	324	342	360	380	401	422	445	468	493	519
151	547	575	605	636	669	703	738	775	814	854
152	896	939	984	1,031	1,079	1,130	1,182	1,235	1,291	1,348
153	1,407	1,467	1,529	1,592	1,657	1,723	1,790	1,859	1,930	2,002
154	2,076	2,153	2,231	2,311	2,393	2,477	2,563	2,650	2,739	2,830
155	2,922	3,015	3,109	3,204	3,301	3,399	3,498	3,598	3,700	3,803
156	3,907	4,013	4,120	4,228	4,337	4,448	4,561	4,675	4,791	4,909
157	5,029	5,150	5,275	5,401	5,531	5,663	5,798	5,935	6,076	6,220
158	6,366	6,515	6,666	6,819	6,975	7,133	7,293	7,456	7,621	7,788
159	7,958	8,131	8,306	8,484	8,664	8,847	9,033	9,221	9,413	9,607
160	9,804	10,003	10,205	10,410	10,617	10,828	11,041	11,258	11,477	11,699
161	11,924	12,151	12,380	12,612	12,847	13,084	13,323	13,564	13,808	14,053
162	14,301	14,551	14,803	15,058	15,315	15,575	15,837	16,102	16,370	16,641
163	16,914	17,190	17,469	17,751	18,036	18,325	18,615	18,909	19,206	19,506
164	19,810	20,117	20,429	20,744	21,063	21,385	21,711	22,041	22,373	22,709
165	23,047	23,389	23,734	24,081	24,432	24,786	25,144	25,505	25,870	26,237
166	26,608	26,984	27,363	27,746	28,134	28,525	28,920	29,318	29,720	30,124
167	30,532	30,943	31,357	31,774	32,194	32,616	33,042	33,470	33,901	34,335
168	34,772	35,211	35,654	36,099	36,547	36,998	37,452	37,910	38,371	38,835
169	39,303	39,774	40,248	40,726	41,207	41,693	42,182	42,674	43,170	43,669
170	44,172	44,678	45,188	45,702	46,221	46,743	47,269	47,798	48,331	48,868
171	49,408	49,952	50,499	51,049	51,603	52,161	52,721	53,285	53,852	54,422
172	54,995	55,572	56,152	56,735	57,322	57,913	58,507	59,104	59,706	60,311
173	60,920	61,533	62,150	62,771	63,396	64,024	64,656	65,292	65,931	66,574
174	67,220	67,870	68,524	69,181	69,841	70,505	71,173	71,845	72,521	73,201
175	73,886	74,576	75,271	75,971	76,677	77,388	78,105	78,827	79,555	80,287
176	81,026	81,772	82,524	83,283	84,048	84,819	85,597	86,381	87,171	87,965
177	88,766	89,571	90,381	91,195	92,015	92,839	93,668	94,502	95,341	96,185
178	97,033	97,886	98,743	99,604	100,470	101,341	102,217	103,097	103,982	104,872
179	105,766	106,666	107,570	108,479	109,392	110,310	111,233	112,159	113,090	114,025
180	114,964	115,907	116,854	117,806	118,762	119,722	120,687	121,656	122,629	123,606
181	124,587	125,573	126,562	127,557	128,555	129,559	130,567	131,579	132,596	133,616
182	134,641	135,670	136,703	137,739	138,779	139,823	140,870	141,921	142,975	144,033
183	145,094	146,160	147,228	148,300	149,375	150,454	151,537	152,622	153,712	154,805
184	155,902	157,003	158,109	159,219	160,333	161,452	162,576	163,704	164,837	165,973
185	167,113	168,258	169,406	170,559	171,716	172,878	174,044	175,214	176,390	177,570
186	178,755	179,945	181,139	182,338	183,542	184,751	185,964	187,183	188,406	189,634
187	190,866	192,104	193,345	194,592	195,844	197,100	198,362	199,628	200,899	202,175
188	203,456	204,741	206,031	207,326	208,625	209,929	211,237	212,550	213,867	215,188
189	216,514	217,844	219,177	220,515	221,857	223,203	224,552	225,906	227,264	228,625

Appendix E (continued)

Lake Conroe

RESERVOIR CAPACITY TABLE (Continued)

TEXAS WATER DEVELOPMENT BOARD — June - August 2010 Survey recalculated September 2015

CAPACITY IN ACRE-FEET — Conservation pool elevation 201.0 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
190	229,991	231,361	232,735	234,113	235,496	236,883	238,275	239,670	241,071	242,476
191	243,886	245,301	246,721	248,145	249,574	251,008	252,447	253,891	255,340	256,794
192	258,253	259,717	261,186	262,661	264,141	265,626	267,117	268,613	270,114	271,620
193	273,131	274,647	276,167	277,694	279,225	280,762	282,305	283,853	285,407	286,966
194	288,531	290,101	291,677	293,258	294,845	296,439	298,039	299,645	301,256	302,873
195	304,496	306,124	307,758	309,398	311,043	312,694	314,352	316,014	317,683	319,357
196	321,037	322,722	324,413	326,110	327,812	329,520	331,234	332,953	334,678	336,408
197	338,144	339,886	341,633	343,386	345,145	346,909	348,678	350,454	352,235	354,022
198	355,814	357,612	359,415	361,225	363,039	364,860	366,686	368,518	370,355	372,198
199	374,047	375,901	377,761	379,626	381,497	383,374	385,256	387,144	389,038	390,937
200	392,842	394,753	396,669	398,590	400,518	402,451	404,389	406,334	408,284	410,239
201	412,200									

Note: Capacities above elevation 196.0 feet calculated from interpolated areas

Appendix F

Lake Conroe

RESERVOIR AREA TABLE

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

June - August 2010 Survey recalculated September 2015
Conservation pool elevation 201.0 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
137	0	0	0	0	0	0	0	0	0	0
138	0	0	0	0	0	0	0	0	0	0
139	0	0	0	0	0	0	0	0	1	1
140	1	1	1	1	1	2	2	2	2	2
141	3	3	3	3	3	3	4	4	4	4
142	5	5	5	6	6	7	7	7	8	8
143	8	8	9	9	9	9	10	10	10	11
144	11	11	12	12	12	13	13	13	14	14
145	15	15	16	17	17	18	18	19	20	21
146	21	22	23	23	24	25	26	28	29	31
147	32	35	37	39	42	44	47	49	52	55
148	58	61	64	67	71	75	78	82	85	89
149	94	99	104	110	117	124	132	140	150	161
150	172	181	191	201	211	221	231	243	254	266
151	279	292	305	320	334	347	361	377	393	409
152	426	443	459	476	494	511	529	547	563	579
153	595	611	625	639	653	667	682	698	715	734
154	753	771	791	811	831	849	866	882	897	912
155	925	937	949	961	973	985	997	1,010	1,023	1,036
156	1,049	1,062	1,075	1,088	1,102	1,118	1,134	1,152	1,169	1,187
157	1,206	1,228	1,255	1,283	1,308	1,334	1,361	1,390	1,421	1,451
158	1,475	1,498	1,522	1,548	1,571	1,592	1,614	1,637	1,662	1,686
159	1,711	1,738	1,764	1,790	1,817	1,844	1,871	1,900	1,928	1,956
160	1,982	2,008	2,034	2,059	2,087	2,118	2,150	2,180	2,208	2,234
161	2,258	2,283	2,309	2,333	2,357	2,379	2,402	2,424	2,445	2,467
162	2,489	2,512	2,536	2,558	2,583	2,610	2,636	2,665	2,692	2,719
163	2,746	2,776	2,807	2,838	2,866	2,895	2,924	2,953	2,984	3,016
164	3,055	3,095	3,135	3,172	3,208	3,243	3,276	3,308	3,340	3,371
165	3,401	3,431	3,462	3,492	3,524	3,561	3,596	3,628	3,660	3,693
166	3,729	3,771	3,813	3,855	3,894	3,931	3,968	4,000	4,030	4,062
167	4,095	4,126	4,154	4,183	4,212	4,240	4,269	4,297	4,326	4,353
168	4,381	4,408	4,436	4,466	4,497	4,528	4,559	4,593	4,626	4,659
169	4,692	4,725	4,762	4,798	4,833	4,871	4,908	4,941	4,974	5,009
170	5,045	5,082	5,122	5,163	5,203	5,239	5,275	5,313	5,350	5,384
171	5,419	5,454	5,490	5,523	5,557	5,589	5,621	5,652	5,685	5,718
172	5,750	5,782	5,816	5,852	5,887	5,922	5,957	5,997	6,036	6,072
173	6,110	6,150	6,189	6,228	6,266	6,302	6,339	6,375	6,410	6,445
174	6,482	6,517	6,552	6,586	6,622	6,660	6,699	6,738	6,779	6,825
175	6,873	6,925	6,977	7,030	7,083	7,142	7,196	7,249	7,297	7,354
176	7,424	7,490	7,556	7,619	7,682	7,749	7,810	7,867	7,922	7,976
177	8,026	8,075	8,123	8,170	8,218	8,269	8,316	8,365	8,414	8,460
178	8,504	8,547	8,592	8,639	8,685	8,733	8,780	8,826	8,872	8,921
179	8,969	9,017	9,065	9,113	9,159	9,202	9,246	9,289	9,328	9,368
180	9,409	9,451	9,495	9,539	9,583	9,625	9,667	9,710	9,750	9,791
181	9,834	9,876	9,920	9,965	10,010	10,057	10,102	10,145	10,187	10,230
182	10,269	10,309	10,345	10,382	10,418	10,453	10,488	10,525	10,562	10,598
183	10,633	10,668	10,703	10,736	10,770	10,805	10,841	10,877	10,913	10,951
184	10,992	11,033	11,077	11,121	11,168	11,214	11,260	11,303	11,343	11,382
185	11,424	11,466	11,509	11,551	11,592	11,636	11,680	11,730	11,779	11,826
186	11,874	11,922	11,969	12,015	12,062	12,111	12,159	12,207	12,256	12,303
187	12,349	12,395	12,442	12,491	12,541	12,591	12,639	12,687	12,735	12,782
188	12,830	12,877	12,924	12,970	13,016	13,060	13,105	13,149	13,192	13,234
189	13,276	13,317	13,358	13,398	13,438	13,477	13,517	13,556	13,596	13,637

Appendix F (continued)

Lake Conroe

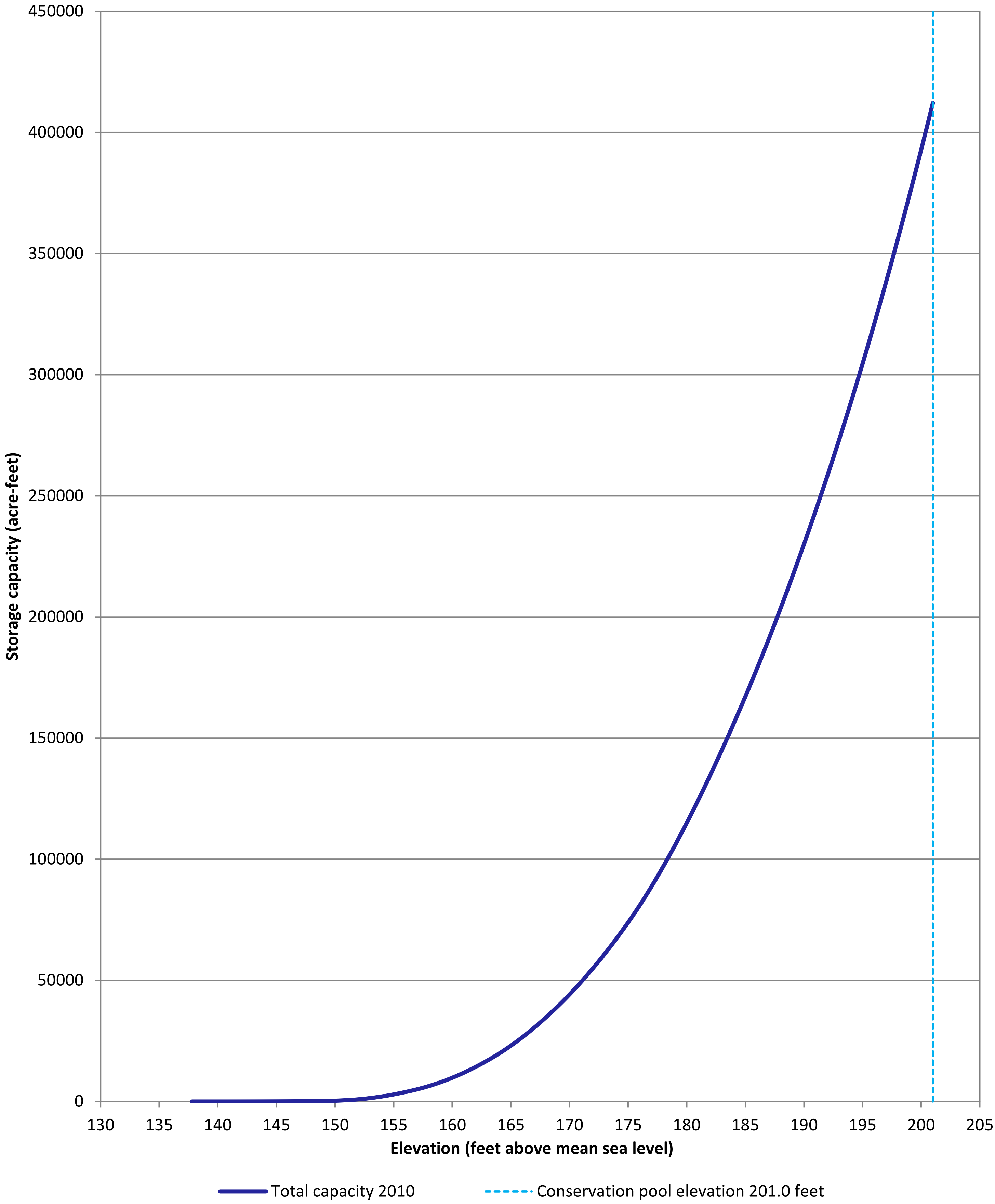
RESERVOIR AREA TABLE (Continued)

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

June - August 2010 Survey recalculated September 2015
Conservation pool elevation 201.0 feet NGVD29

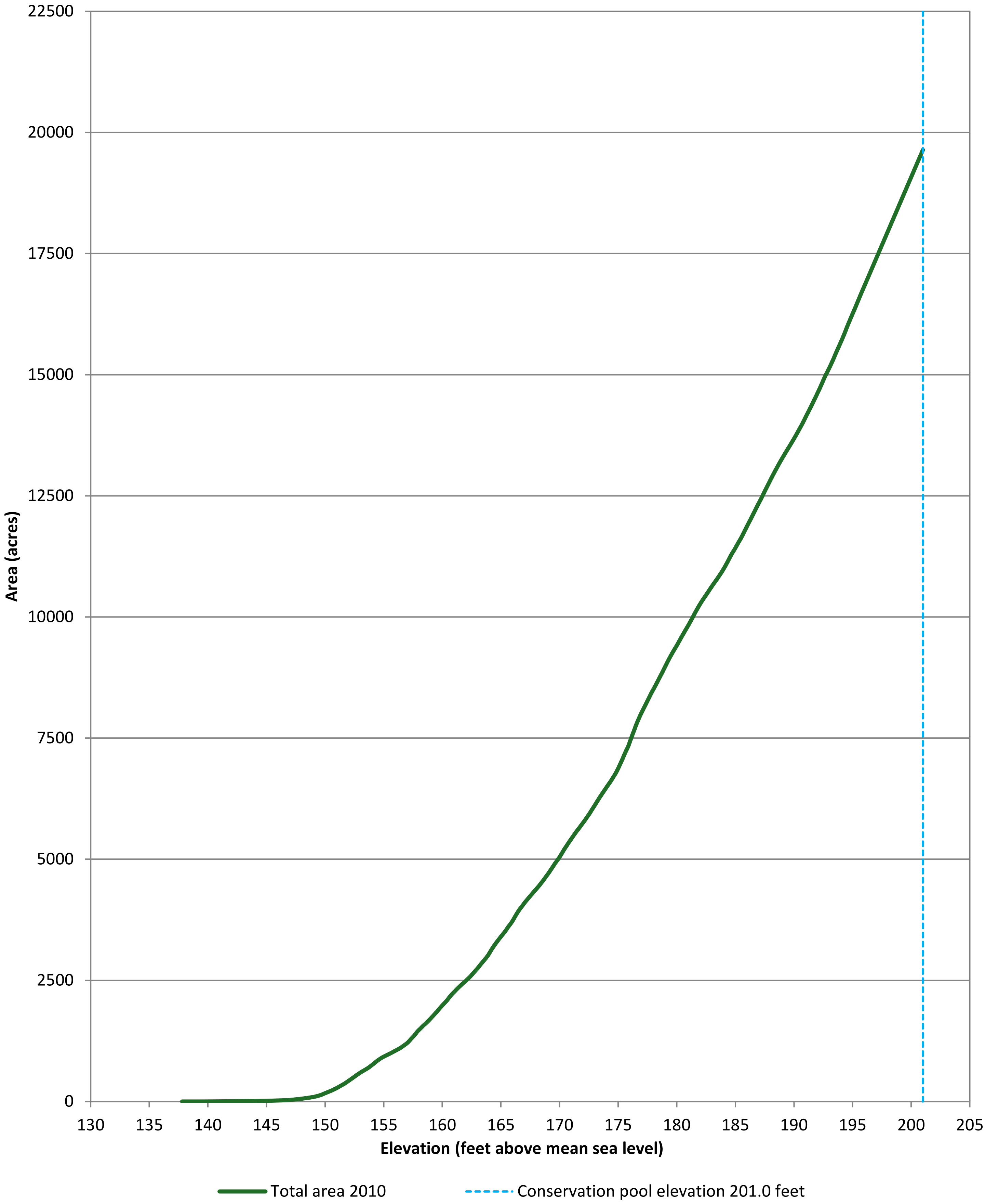
ELEVATION in Feet	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
190	13,678	13,720	13,762	13,805	13,849	13,893	13,937	13,981	14,028	14,077
191	14,126	14,173	14,220	14,268	14,316	14,364	14,415	14,466	14,514	14,564
192	14,615	14,666	14,718	14,772	14,825	14,883	14,936	14,986	15,034	15,083
193	15,133	15,182	15,234	15,288	15,343	15,400	15,457	15,511	15,565	15,619
194	15,674	15,728	15,785	15,843	15,904	15,968	16,027	16,084	16,142	16,199
195	16,256	16,311	16,367	16,425	16,484	16,542	16,599	16,658	16,715	16,770
196	16,826	16,882	16,938	16,994	17,051	17,107	17,163	17,220	17,276	17,332
197	17,388	17,445	17,501	17,557	17,614	17,670	17,726	17,782	17,839	17,895
198	17,951	18,008	18,064	18,120	18,176	18,233	18,289	18,345	18,401	18,458
199	18,514	18,570	18,627	18,683	18,739	18,795	18,852	18,908	18,964	19,021
200	19,077	19,133	19,189	19,246	19,302	19,358	19,415	19,471	19,527	19,583
201	19,640									

Note: Areas between elevations 196.0 and 201.0 feet linearly interpolated



Lake Conroe
June - August 2010 Survey
re-calculated September 2015
Prepared by: TWDB

Appendix G: 2010 re-calculated capacity curve



Lake Conroe
June - August 2010 Survey
re-calculated September 2015
Prepared by: TWDB

Appendix H: 2010 re-calculated area curve

Appendix I

Lake Conroe

RESERVOIR BATHYMERTIC CAPACITY TABLE

TEXAS WATER DEVELOPMENT BOARD
CAPACITY IN ACRE-FEET
ELEVATION INCREMENT IS ONE TENTH FOOT

March – October 2020 Survey
Conservation pool elevation 201.0 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
139	0	0	0	0	0	0	0	0	0	0
140	0	0	0	0	0	0	0	0	0	0
141	0	1	1	1	1	1	2	2	2	2
142	3	3	3	4	4	5	5	6	7	7
143	8	8	9	10	11	11	12	13	14	15
144	16	17	18	19	20	21	22	24	25	26
145	27	29	30	32	33	35	37	38	40	42
146	44	45	47	49	51	54	56	58	61	63
147	66	69	72	76	79	83	87	91	95	100
148	105	110	115	121	127	134	140	147	154	162
149	170	179	188	197	208	218	230	242	255	269
150	283	299	315	332	351	370	391	413	436	461
151	487	513	542	571	602	634	668	703	739	778
152	818	861	905	951	999	1,048	1,100	1,154	1,209	1,266
153	1,326	1,386	1,449	1,513	1,579	1,646	1,715	1,786	1,858	1,932
154	2,008	2,085	2,165	2,246	2,329	2,414	2,500	2,588	2,677	2,768
155	2,861	2,955	3,051	3,148	3,246	3,345	3,446	3,549	3,652	3,757
156	3,864	3,971	4,081	4,191	4,303	4,417	4,532	4,649	4,767	4,888
157	5,011	5,137	5,265	5,396	5,530	5,668	5,810	5,955	6,103	6,255
158	6,410	6,568	6,728	6,892	7,058	7,226	7,396	7,569	7,743	7,921
159	8,101	8,285	8,471	8,659	8,849	9,042	9,236	9,432	9,630	9,831
160	10,033	10,238	10,446	10,656	10,869	11,085	11,303	11,523	11,747	11,973
161	12,201	12,432	12,665	12,900	13,138	13,378	13,620	13,864	14,110	14,359
162	14,610	14,863	15,118	15,376	15,637	15,900	16,165	16,434	16,705	16,979
163	17,256	17,536	17,819	18,105	18,393	18,685	18,980	19,278	19,579	19,883
164	20,192	20,504	20,820	21,140	21,463	21,790	22,121	22,455	22,793	23,134
165	23,480	23,829	24,182	24,539	24,900	25,264	25,632	26,003	26,378	26,757
166	27,140	27,526	27,916	28,309	28,707	29,108	29,512	29,920	30,331	30,746
167	31,164	31,585	32,009	32,436	32,867	33,300	33,737	34,177	34,619	35,065
168	35,513	35,965	36,421	36,879	37,341	37,806	38,274	38,746	39,221	39,700
169	40,182	40,667	41,155	41,647	42,143	42,641	43,143	43,647	44,155	44,666
170	45,180	45,698	46,219	46,743	47,271	47,801	48,334	48,871	49,410	49,953
171	50,499	51,049	51,602	52,158	52,718	53,281	53,847	54,417	54,989	55,565
172	56,144	56,726	57,311	57,900	58,491	59,086	59,685	60,287	60,893	61,502
173	62,115	62,732	63,352	63,977	64,606	65,239	65,875	66,516	67,160	67,808
174	68,459	69,115	69,775	70,438	71,106	71,778	72,455	73,135	73,820	74,510
175	75,205	75,904	76,609	77,318	78,033	78,753	79,478	80,211	80,949	81,695
176	82,447	83,207	83,972	84,744	85,522	86,305	87,094	87,888	88,687	89,491
177	90,299	91,112	91,930	92,752	93,579	94,410	95,246	96,087	96,932	97,782
178	98,637	99,497	100,362	101,232	102,107	102,987	103,872	104,761	105,655	106,553
179	107,457	108,365	109,277	110,194	111,115	112,039	112,968	113,901	114,837	115,778
180	116,723	117,673	118,626	119,583	120,546	121,512	122,483	123,458	124,438	125,423
181	126,411	127,404	128,402	129,405	130,412	131,423	132,437	133,456	134,479	135,505
182	136,535	137,569	138,607	139,648	140,693	141,741	142,793	143,849	144,909	145,973
183	147,040	148,110	149,185	150,262	151,343	152,428	153,516	154,607	155,703	156,803
184	157,907	159,015	160,127	161,244	162,366	163,492	164,622	165,757	166,895	168,038
185	169,184	170,335	171,491	172,651	173,815	174,984	176,158	177,336	178,520	179,708
186	180,900	182,098	183,300	184,507	185,718	186,933	188,153	189,378	190,607	191,840
187	193,078	194,321	195,567	196,819	198,076	199,337	200,603	201,874	203,150	204,431
188	205,717	207,008	208,303	209,603	210,907	212,215	213,528	214,844	216,165	217,491
189	218,820	220,154	221,492	222,834	224,181	225,531	226,886	228,244	229,608	230,975
190	232,347	233,723	235,104	236,489	237,879	239,274	240,672	242,076	243,484	244,897

Appendix I (continued)

Lake Conroe

RESERVOIR BATHYMERTIC CAPACITY TABLE (Continued)

TEXAS WATER DEVELOPMENT BOARD — March 2020 – April 2021 Survey

CAPACITY IN ACRE-FEET — Conservation pool elevation 201.0 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
191	246,314	247,737	249,164	250,597	252,034	253,476	254,924	256,378	257,837	259,302
192	260,772	262,248	263,730	265,217	266,711	268,210	269,715	271,225	272,740	274,261
193	275,787	277,319	278,858	280,402	281,952	283,509	285,072	286,642	288,219	289,803
194	291,393	292,989	294,593	296,203	297,820	299,444	301,075	302,713	304,357	306,009
195	307,667	309,332	311,004	312,683	314,369	316,061	317,759	319,464	321,175	322,893
196	324,616	326,345	328,080	329,821	331,568	333,321	335,080	336,846	338,618	340,396
197	342,181	343,971	345,766	347,567	349,373	351,184	353,000	354,821	356,646	358,476
198	360,311	362,149	363,993	365,840	367,692	369,548	371,409	373,275	375,144	377,019
199	378,897	380,781	382,671	384,566	386,466	388,371	390,283	392,199	394,121	396,048
200	397,981	399,919	401,862	403,811	405,765	407,725	409,690	411,661	413,637	415,618
201	417,605									

Note: Capacities above elevation 199.0 feet calculated from interpolated areas

Appendix J

Lake Conroe

RESERVOIR BATHYMETRIC AREA TABLE

TEXAS WATER DEVELOPMENT BOARD — March - October 2020 Survey

AREA IN ACRES — Conservation pool elevation 201.0 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
139	0	0	0	0	0	0	0	0	0	0
140	0	0	0	0	0	0	1	1	1	1
141	1	1	2	2	2	2	2	3	3	3
142	4	4	4	5	5	5	6	6	6	6
143	7	7	7	7	8	8	8	8	9	9
144	10	10	11	11	11	12	12	13	13	13
145	14	14	15	15	16	16	17	17	17	18
146	18	19	20	20	21	22	23	24	26	27
147	29	30	32	34	36	38	41	43	45	48
148	50	54	56	59	62	65	68	71	75	79
149	83	88	93	99	105	112	119	126	133	140
150	149	158	167	179	190	202	214	226	239	251
151	263	275	288	301	315	329	344	359	375	393
152	414	433	452	469	487	507	527	546	564	582
153	599	616	633	650	665	681	698	715	731	748
154	767	786	804	821	838	854	870	887	903	919
155	934	950	963	976	989	1,002	1,015	1,029	1,043	1,057
156	1,071	1,085	1,100	1,114	1,128	1,143	1,160	1,177	1,196	1,219
157	1,243	1,268	1,294	1,327	1,364	1,397	1,431	1,466	1,499	1,534
158	1,565	1,595	1,622	1,647	1,670	1,692	1,713	1,736	1,762	1,788
159	1,820	1,847	1,872	1,894	1,914	1,933	1,952	1,972	1,992	2,014
160	2,039	2,064	2,089	2,115	2,142	2,168	2,194	2,221	2,248	2,272
161	2,295	2,318	2,341	2,364	2,387	2,410	2,431	2,452	2,474	2,498
162	2,521	2,544	2,567	2,592	2,617	2,643	2,670	2,698	2,727	2,756
163	2,786	2,814	2,842	2,871	2,902	2,932	2,963	2,994	3,028	3,064
164	3,102	3,141	3,179	3,216	3,252	3,288	3,323	3,360	3,399	3,436
165	3,474	3,512	3,550	3,587	3,624	3,661	3,696	3,732	3,770	3,808
166	3,844	3,879	3,918	3,955	3,991	4,026	4,060	4,096	4,130	4,164
167	4,196	4,226	4,257	4,289	4,321	4,352	4,381	4,409	4,440	4,472
168	4,503	4,536	4,569	4,601	4,634	4,667	4,701	4,734	4,768	4,802
169	4,836	4,869	4,902	4,938	4,969	5,000	5,029	5,060	5,093	5,128
170	5,161	5,194	5,226	5,257	5,290	5,320	5,350	5,380	5,411	5,445
171	5,478	5,511	5,546	5,580	5,614	5,647	5,679	5,710	5,741	5,772
172	5,804	5,837	5,870	5,901	5,934	5,968	6,003	6,038	6,074	6,111
173	6,148	6,187	6,228	6,268	6,307	6,347	6,386	6,423	6,459	6,496
174	6,535	6,576	6,618	6,658	6,700	6,741	6,785	6,829	6,875	6,922
175	6,969	7,019	7,069	7,119	7,172	7,229	7,290	7,354	7,421	7,488
176	7,559	7,628	7,688	7,747	7,806	7,861	7,915	7,966	8,014	8,062
177	8,108	8,153	8,199	8,244	8,290	8,337	8,382	8,428	8,475	8,526
178	8,580	8,627	8,675	8,725	8,774	8,821	8,868	8,916	8,962	9,009
179	9,059	9,103	9,145	9,187	9,228	9,267	9,306	9,347	9,387	9,430
180	9,472	9,513	9,554	9,598	9,645	9,687	9,732	9,777	9,822	9,865
181	9,907	9,952	10,001	10,049	10,089	10,129	10,168	10,207	10,245	10,282
182	10,320	10,357	10,394	10,430	10,467	10,504	10,540	10,579	10,617	10,653
183	10,689	10,725	10,759	10,793	10,827	10,862	10,899	10,937	10,976	11,017
184	11,060	11,103	11,148	11,195	11,237	11,282	11,325	11,364	11,404	11,446
185	11,489	11,533	11,576	11,620	11,668	11,715	11,761	11,808	11,856	11,905
186	11,953	12,001	12,044	12,088	12,132	12,177	12,223	12,268	12,312	12,357
187	12,401	12,446	12,492	12,541	12,589	12,639	12,685	12,733	12,783	12,836
188	12,885	12,931	12,975	13,020	13,063	13,104	13,145	13,189	13,231	13,276
189	13,318	13,359	13,401	13,442	13,483	13,524	13,567	13,611	13,654	13,696
190	13,740	13,786	13,831	13,877	13,921	13,965	14,011	14,056	14,105	14,153

Appendix J (continued)

Lake Conroe

RESERVOIR BATHYMETRIC AREA TABLE (Continued)

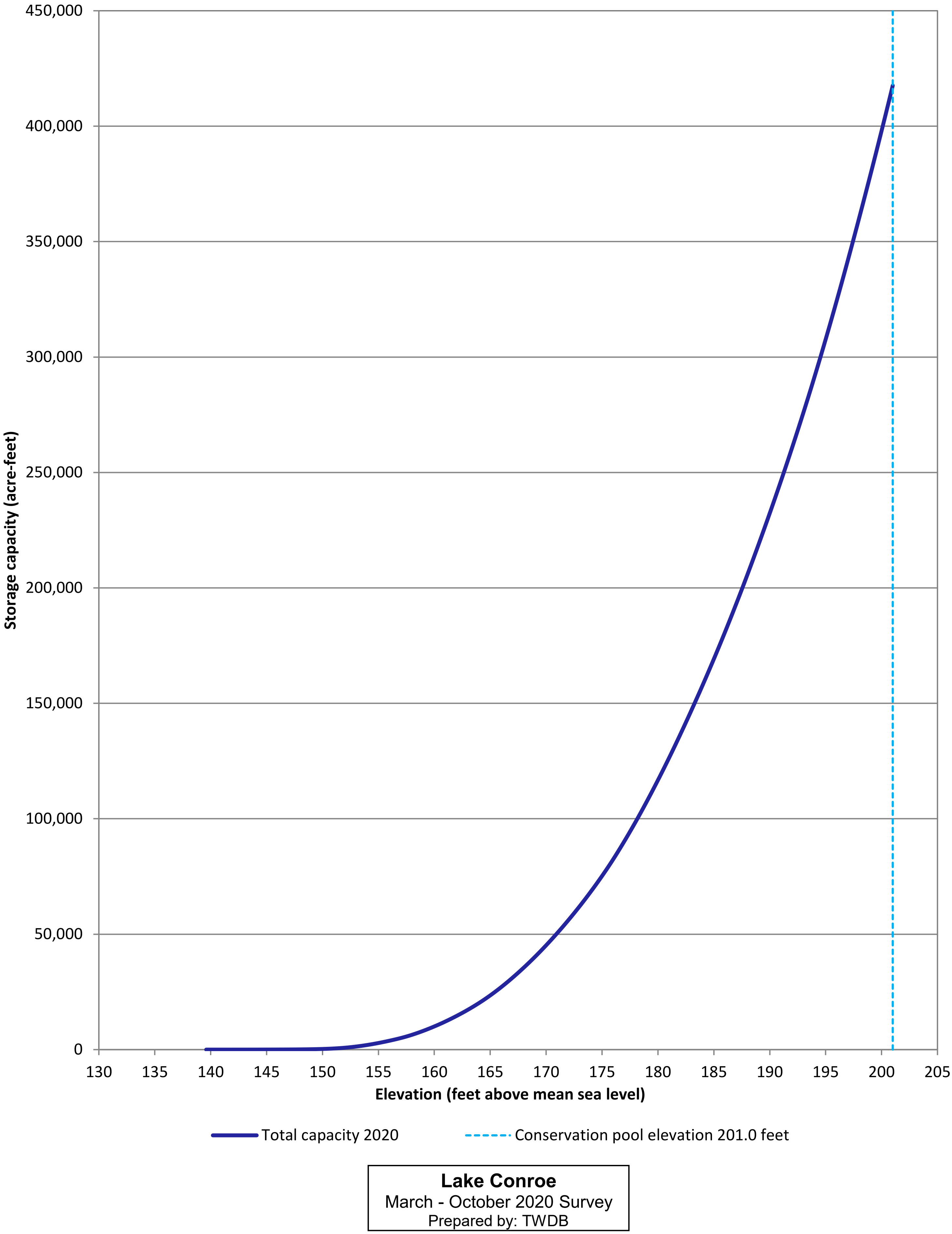
TEXAS WATER DEVELOPMENT BOARD | March - October 2020 Survey

AREA IN ACRES | Conservation pool elevation 201.0 feet NGVD29

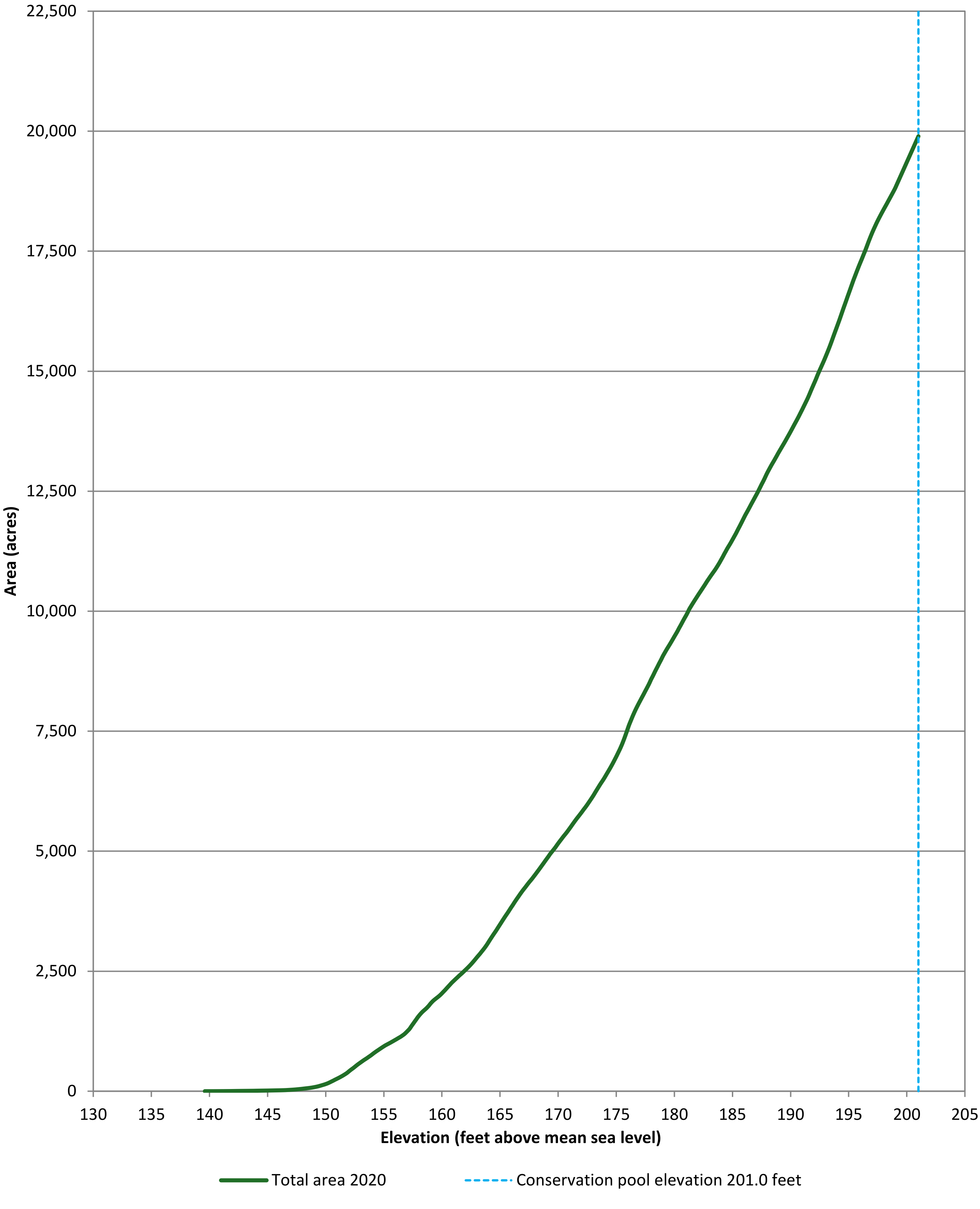
ELEVATION INCREMENT IS ONE TENTH FOOT

ELEVATION in Feet	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
191	14,200	14,250	14,299	14,349	14,398	14,450	14,506	14,563	14,621	14,677
192	14,733	14,788	14,845	14,906	14,964	15,018	15,072	15,126	15,180	15,236
193	15,293	15,352	15,412	15,472	15,535	15,601	15,667	15,735	15,802	15,867
194	15,933	15,999	16,066	16,135	16,206	16,276	16,345	16,411	16,480	16,550
195	16,618	16,685	16,754	16,822	16,890	16,954	17,017	17,080	17,142	17,203
196	17,262	17,320	17,380	17,440	17,498	17,561	17,625	17,691	17,753	17,813
197	17,872	17,928	17,982	18,035	18,087	18,136	18,184	18,230	18,276	18,321
198	18,366	18,410	18,453	18,497	18,542	18,586	18,631	18,675	18,720	18,766
199	18,813	18,867	18,921	18,975	19,029	19,083	19,137	19,191	19,245	19,300
200	19,354	19,408	19,462	19,516	19,570	19,624	19,678	19,732	19,786	19,840
201	19,894									

Note: Areas between elevations 199.0 and 201.0 feet linearly interpolated



Appendix K: 2020 Bathymetric capacity curve



Lake Conroe
March - October 2020 Survey
Prepared by: TWDB

Appendix L: 2020 Bathymetric area curve

Appendix M

Lake Conroe

RESERVOIR BATHYMERTIC AND TOPOGRAPHIC CAPACITY TABLE

TEXAS WATER DEVELOPMENT BOARD
CAPACITY IN ACRE-FEET
ELEVATION INCREMENT IS ONE TENTH FOOT

March – October 2020 Survey
Conservation pool elevation 201.0 feet NGVD29
Top of dam elevation 212.0 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
139	0	0	0	0	0	0	0	0	0	0
140	0	0	0	0	0	0	0	0	0	0
141	0	1	1	1	1	1	2	2	2	2
142	3	3	3	4	4	5	5	6	7	7
143	8	8	9	10	11	11	12	13	14	15
144	16	17	18	19	20	21	22	24	25	26
145	27	29	30	32	33	35	37	38	40	42
146	44	45	47	49	51	54	56	58	61	63
147	66	69	72	76	79	83	87	91	95	100
148	105	110	115	121	127	134	140	147	154	162
149	170	179	188	197	208	218	230	242	255	269
150	283	299	315	332	351	370	391	413	436	461
151	487	513	542	571	602	634	668	703	739	778
152	818	861	905	951	999	1,048	1,100	1,154	1,209	1,266
153	1,326	1,386	1,449	1,513	1,579	1,646	1,715	1,786	1,858	1,932
154	2,008	2,085	2,165	2,246	2,329	2,414	2,500	2,588	2,677	2,768
155	2,861	2,955	3,051	3,148	3,246	3,345	3,446	3,549	3,652	3,757
156	3,864	3,971	4,081	4,191	4,303	4,417	4,532	4,649	4,767	4,888
157	5,011	5,137	5,265	5,396	5,530	5,668	5,810	5,955	6,103	6,255
158	6,410	6,568	6,728	6,892	7,058	7,226	7,396	7,569	7,743	7,921
159	8,101	8,285	8,471	8,659	8,849	9,042	9,236	9,432	9,630	9,831
160	10,033	10,238	10,446	10,656	10,869	11,085	11,303	11,523	11,747	11,973
161	12,201	12,432	12,665	12,900	13,138	13,378	13,620	13,864	14,110	14,359
162	14,610	14,863	15,118	15,376	15,637	15,900	16,165	16,434	16,705	16,979
163	17,256	17,536	17,819	18,105	18,393	18,685	18,980	19,278	19,579	19,883
164	20,192	20,504	20,820	21,140	21,463	21,790	22,121	22,455	22,793	23,134
165	23,480	23,829	24,182	24,539	24,900	25,264	25,632	26,003	26,378	26,757
166	27,140	27,526	27,916	28,309	28,707	29,108	29,512	29,920	30,331	30,746
167	31,164	31,585	32,009	32,436	32,867	33,300	33,737	34,177	34,619	35,065
168	35,513	35,965	36,421	36,879	37,341	37,806	38,274	38,746	39,221	39,700
169	40,182	40,667	41,155	41,647	42,143	42,641	43,143	43,647	44,155	44,666
170	45,180	45,698	46,219	46,743	47,271	47,801	48,334	48,871	49,410	49,953
171	50,499	51,049	51,602	52,158	52,718	53,281	53,847	54,417	54,989	55,565
172	56,144	56,726	57,311	57,900	58,491	59,086	59,685	60,287	60,893	61,502
173	62,115	62,732	63,352	63,977	64,606	65,239	65,875	66,516	67,160	67,808
174	68,459	69,115	69,775	70,438	71,106	71,778	72,455	73,135	73,820	74,510
175	75,205	75,904	76,609	77,318	78,033	78,753	79,478	80,211	80,949	81,695
176	82,447	83,207	83,972	84,744	85,522	86,305	87,094	87,888	88,687	89,491
177	90,299	91,112	91,930	92,752	93,579	94,410	95,246	96,087	96,932	97,782
178	98,637	99,497	100,362	101,232	102,107	102,987	103,872	104,761	105,655	106,553
179	107,457	108,365	109,277	110,194	111,115	112,039	112,968	113,901	114,837	115,778
180	116,723	117,673	118,626	119,583	120,546	121,512	122,483	123,458	124,438	125,423
181	126,411	127,404	128,402	129,405	130,412	131,423	132,437	133,456	134,479	135,505
182	136,535	137,569	138,607	139,648	140,693	141,741	142,793	143,849	144,909	145,973
183	147,040	148,110	149,185	150,262	151,343	152,428	153,516	154,607	155,703	156,803
184	157,907	159,015	160,127	161,244	162,366	163,492	164,622	165,757	166,895	168,038
185	169,184	170,335	171,491	172,651	173,815	174,984	176,158	177,336	178,519	179,708
186	180,900	182,098	183,300	184,507	185,718	186,933	188,153	189,378	190,607	191,840
187	193,078	194,321	195,567	196,819	198,076	199,337	200,603	201,874	203,150	204,431
188	205,717	207,008	208,303	209,603	210,907	212,215	213,528	214,844	216,165	217,491
189	218,820	220,154	221,492	222,834	224,181	225,531	226,886	228,244	229,608	230,975
190	232,347	233,723	235,104	236,490	237,879	239,274	240,673	242,076	243,484	244,897

Appendix M (continued)

Lake Conroe

RESERVOIR BATHYMERTIC AND TOPOGRAPHIC CAPACITY TABLE (Continued)

TEXAS WATER DEVELOPMENT BOARD — March – October 2020 Survey

CAPACITY IN ACRE-FEET — Conservation pool elevation 201.0 feet NGVD29

ELEVATION INCREMENT IS ONE TENTH FOOT — Top of dam elevation 212.0 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
191	246,315	247,737	249,165	250,597	252,034	253,477	254,924	256,378	257,837	259,302
192	260,773	262,249	263,730	265,218	266,711	268,211	269,715	271,225	272,740	274,261
193	275,788	277,320	278,858	280,402	281,953	283,510	285,073	286,643	288,220	289,804
194	291,394	292,990	294,594	296,204	297,821	299,445	301,076	302,714	304,358	306,010
195	307,668	309,334	311,006	312,684	314,370	316,062	317,761	319,466	321,177	322,894
196	324,618	326,347	328,082	329,823	331,570	333,323	335,082	336,848	338,620	340,399
197	342,183	343,973	345,769	347,570	349,376	351,187	353,003	354,824	356,649	358,479
198	360,314	362,153	363,996	365,843	367,695	369,552	371,413	373,278	375,148	377,023
199	378,902	380,787	382,680	384,582	386,491	388,409	390,334	392,267	394,209	396,158
200	398,116	400,081	402,055	404,036	406,026	408,023	410,029	412,042	414,064	416,093
201	418,131	420,176	422,228	424,287	426,351	428,422	430,499	432,582	434,671	436,766
202	438,867	440,974	443,088	445,208	447,335	449,469	451,609	453,757	455,912	458,074
203	460,243	462,419	464,603	466,794	468,992	471,197	473,409	475,629	477,856	480,091
204	482,333	484,583	486,841	489,106	491,379	493,661	495,950	498,248	500,553	502,867
205	505,190	507,520	509,859	512,207	514,564	516,929	519,303	521,687	524,079	526,481
206	528,891	531,311	533,740	536,179	538,626	541,083	543,549	546,024	548,508	551,001
207	553,502	556,012	558,531	561,058	563,593	566,136	568,687	571,246	573,813	576,388
208	578,971	581,562	584,160	586,767	589,382	592,004	594,635	597,274	599,920	602,575
209	605,238	607,909	610,588	613,275	615,971	618,674	621,386	624,106	626,834	629,571
210	632,316	635,068	637,829	640,599	643,377	646,163	648,957	651,760	654,571	657,390
211	660,218	663,054	665,898	668,750	671,610	674,478	677,354	680,237	683,127	686,026
212	688,936									

Note: Capacities above elevation 199.0 feet calculated from interpolated and computed areas

Appendix N

Lake Conroe

RESERVOIR BATHYMETRIC AND TOPOGRAPHIC AREA TABLE

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

March – October 2020 Survey
Conservation pool elevation 201.0 feet NGVD29
Top of dam elevation 212.0 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
139	0	0	0	0	0	0	0	0	0	0
140	0	0	0	0	0	0	1	1	1	1
141	1	1	2	2	2	2	2	3	3	3
142	4	4	4	5	5	5	6	6	6	6
143	7	7	7	7	8	8	8	8	9	9
144	10	10	11	11	11	12	12	13	13	13
145	14	14	15	15	16	16	17	17	17	18
146	18	19	20	20	21	22	23	24	26	27
147	29	30	32	34	36	38	41	43	45	48
148	50	54	56	59	62	65	68	71	75	79
149	83	88	93	99	105	112	119	126	133	140
150	149	158	167	179	190	202	214	226	239	251
151	263	275	288	301	315	329	344	359	375	393
152	414	433	452	469	487	507	527	546	564	582
153	599	616	633	650	665	681	698	715	731	748
154	767	786	804	821	838	854	870	887	903	919
155	934	950	963	976	989	1,002	1,015	1,029	1,043	1,057
156	1,071	1,085	1,100	1,114	1,128	1,143	1,160	1,177	1,196	1,219
157	1,243	1,268	1,294	1,327	1,364	1,397	1,431	1,466	1,499	1,534
158	1,565	1,595	1,622	1,647	1,670	1,692	1,713	1,736	1,762	1,788
159	1,820	1,847	1,872	1,894	1,914	1,933	1,952	1,972	1,992	2,014
160	2,039	2,064	2,089	2,115	2,142	2,168	2,194	2,221	2,248	2,272
161	2,295	2,318	2,341	2,364	2,387	2,410	2,431	2,452	2,474	2,498
162	2,521	2,544	2,567	2,592	2,617	2,643	2,670	2,698	2,727	2,756
163	2,786	2,814	2,842	2,871	2,902	2,932	2,963	2,994	3,028	3,064
164	3,102	3,141	3,179	3,216	3,252	3,288	3,323	3,360	3,399	3,436
165	3,474	3,512	3,550	3,587	3,624	3,661	3,696	3,732	3,770	3,808
166	3,844	3,879	3,918	3,955	3,991	4,026	4,060	4,096	4,130	4,164
167	4,196	4,226	4,257	4,289	4,321	4,352	4,381	4,409	4,440	4,472
168	4,503	4,536	4,569	4,601	4,634	4,667	4,701	4,734	4,768	4,802
169	4,836	4,869	4,902	4,938	4,969	5,000	5,029	5,060	5,093	5,128
170	5,161	5,194	5,226	5,257	5,290	5,320	5,350	5,380	5,411	5,445
171	5,478	5,511	5,546	5,580	5,614	5,647	5,679	5,710	5,741	5,772
172	5,804	5,837	5,870	5,901	5,934	5,968	6,003	6,038	6,074	6,111
173	6,148	6,187	6,228	6,268	6,307	6,347	6,386	6,423	6,459	6,496
174	6,535	6,576	6,618	6,658	6,700	6,741	6,785	6,829	6,875	6,922
175	6,969	7,019	7,069	7,119	7,172	7,229	7,290	7,354	7,421	7,488
176	7,559	7,628	7,688	7,747	7,806	7,861	7,915	7,966	8,014	8,062
177	8,108	8,153	8,199	8,244	8,290	8,337	8,382	8,428	8,475	8,526
178	8,580	8,627	8,675	8,725	8,774	8,821	8,868	8,916	8,962	9,009
179	9,059	9,103	9,145	9,187	9,228	9,267	9,306	9,347	9,387	9,430
180	9,472	9,513	9,554	9,598	9,645	9,687	9,732	9,777	9,822	9,865
181	9,907	9,952	10,001	10,049	10,089	10,129	10,168	10,207	10,245	10,282
182	10,320	10,357	10,394	10,430	10,467	10,504	10,540	10,579	10,617	10,653
183	10,689	10,725	10,759	10,793	10,827	10,862	10,899	10,937	10,976	11,017
184	11,060	11,103	11,148	11,195	11,237	11,282	11,325	11,364	11,404	11,446
185	11,489	11,533	11,576	11,620	11,668	11,715	11,761	11,808	11,856	11,905
186	11,953	12,001	12,044	12,088	12,132	12,177	12,223	12,268	12,312	12,357
187	12,401	12,446	12,492	12,541	12,589	12,639	12,685	12,733	12,783	12,836
188	12,885	12,931	12,975	13,020	13,063	13,104	13,145	13,189	13,231	13,276
189	13,318	13,359	13,401	13,442	13,483	13,524	13,567	13,611	13,654	13,697
190	13,741	13,786	13,831	13,877	13,921	13,965	14,011	14,057	14,105	14,153

Appendix N (continued)

Lake Conroe

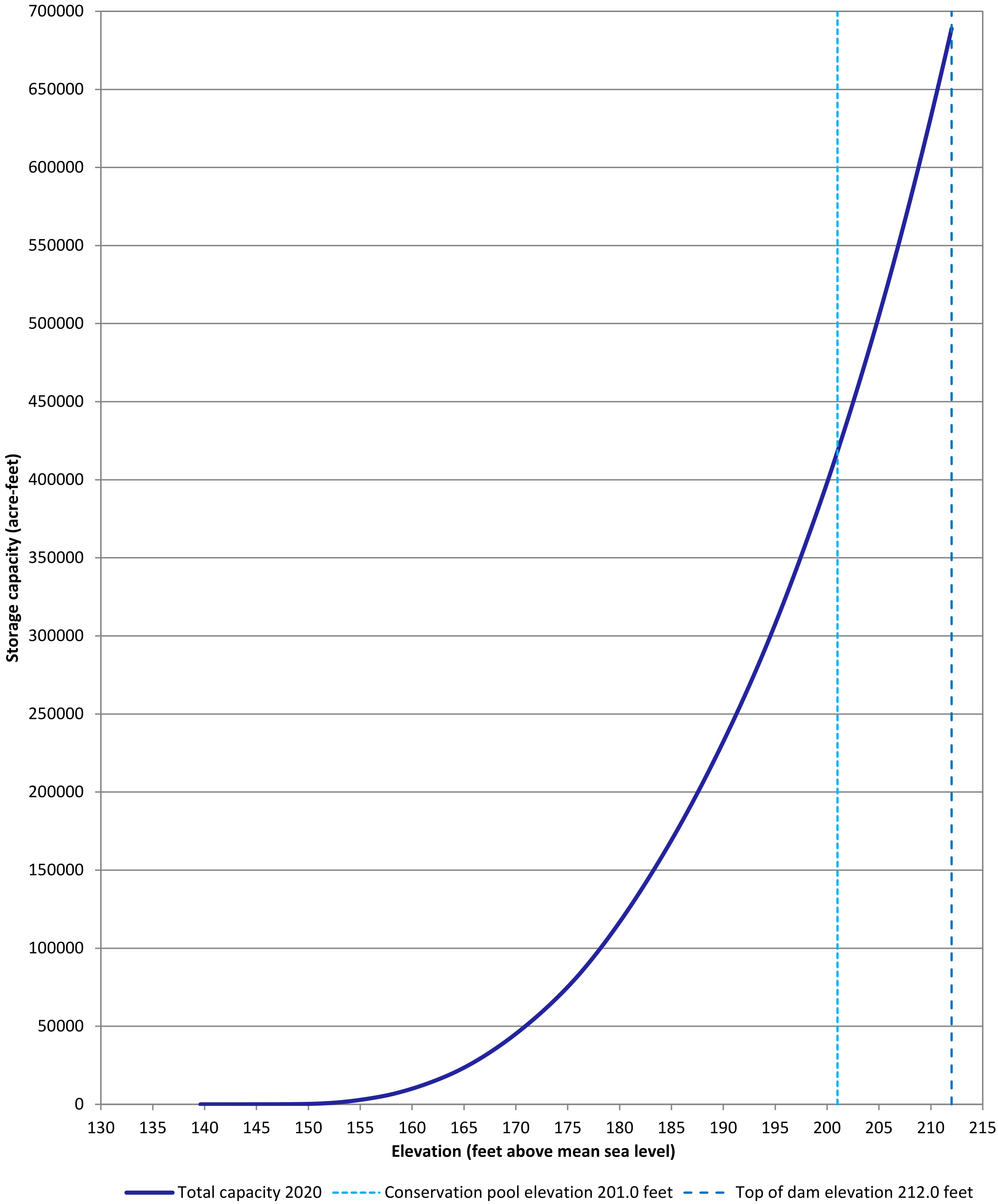
RESERVOIR BATHYMETRIC AND TOPOGRAPHIC AREA TABLE (Continued)

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

March – October 2020 Survey
Conservation pool elevation 201.0 feet NGVD29
Top of dam elevation 212.0 feet NGVD29

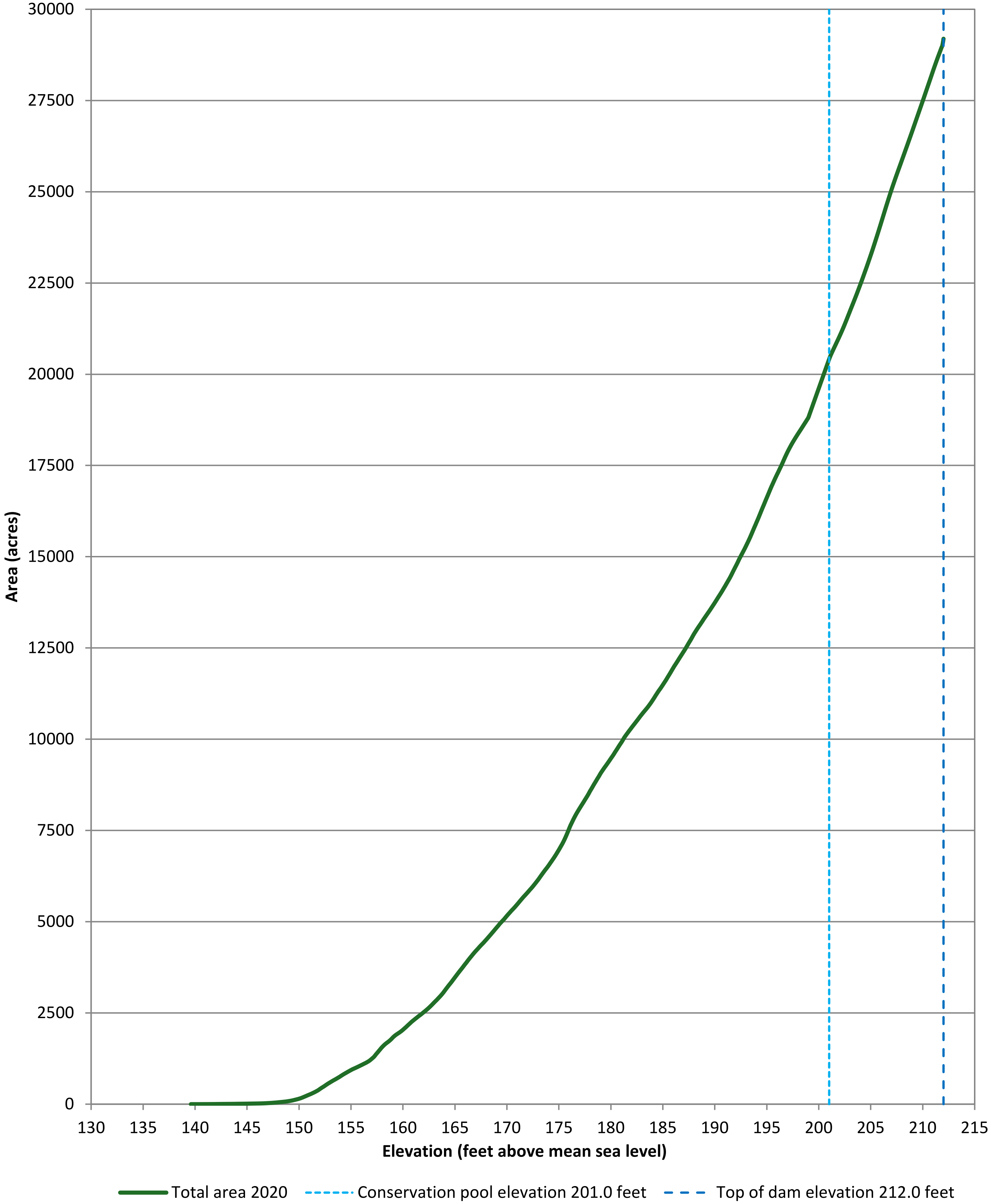
ELEVATION in Feet	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
191	14,200	14,250	14,299	14,349	14,398	14,450	14,506	14,564	14,622	14,677
192	14,733	14,788	14,845	14,907	14,964	15,019	15,072	15,127	15,180	15,236
193	15,294	15,353	15,412	15,473	15,536	15,601	15,668	15,735	15,802	15,867
194	15,934	16,000	16,066	16,136	16,206	16,276	16,345	16,412	16,481	16,551
195	16,618	16,685	16,754	16,822	16,891	16,954	17,017	17,081	17,143	17,203
196	17,263	17,320	17,380	17,441	17,499	17,561	17,626	17,691	17,753	17,814
197	17,873	17,929	17,983	18,035	18,088	18,137	18,185	18,231	18,277	18,322
198	18,367	18,410	18,454	18,498	18,543	18,587	18,632	18,676	18,721	18,767
199	18,814	18,894	18,974	19,054	19,134	19,214	19,294	19,374	19,455	19,535
200	19,615	19,695	19,775	19,855	19,935	20,015	20,095	20,175	20,255	20,335
201	20,415	20,489	20,554	20,616	20,677	20,738	20,799	20,859	20,919	20,980
202	21,042	21,105	21,169	21,235	21,302	21,371	21,441	21,512	21,584	21,657
203	21,729	21,801	21,872	21,943	22,015	22,087	22,160	22,234	22,309	22,385
204	22,461	22,538	22,616	22,694	22,774	22,853	22,934	23,016	23,098	23,181
205	23,264	23,349	23,434	23,522	23,610	23,699	23,788	23,878	23,969	24,060
206	24,153	24,245	24,338	24,430	24,523	24,614	24,705	24,795	24,884	24,972
207	25,059	25,144	25,227	25,310	25,391	25,472	25,551	25,630	25,709	25,788
208	25,868	25,948	26,027	26,106	26,186	26,266	26,346	26,427	26,507	26,587
209	26,668	26,750	26,832	26,914	26,996	27,078	27,160	27,242	27,324	27,405
210	27,487	27,569	27,652	27,736	27,819	27,902	27,985	28,068	28,152	28,236
211	28,319	28,402	28,482	28,562	28,640	28,717	28,793	28,869	28,944	29,021
212	29,193									

Note: Areas between elevations 199.0 and 201.0 feet linearly interpolated



Lake Conroe
March - October 2020 Survey
Prepared by: TWDB

Appendix O: 2020 Bathymetric and topographic capacity curve



Lake Conroe
March - October 2020 Survey
Prepared by: TWDB

Appendix P: 2020 Bathymetric and topographic area curve

Figure 6

CONTOURS
(feet NGVD29)

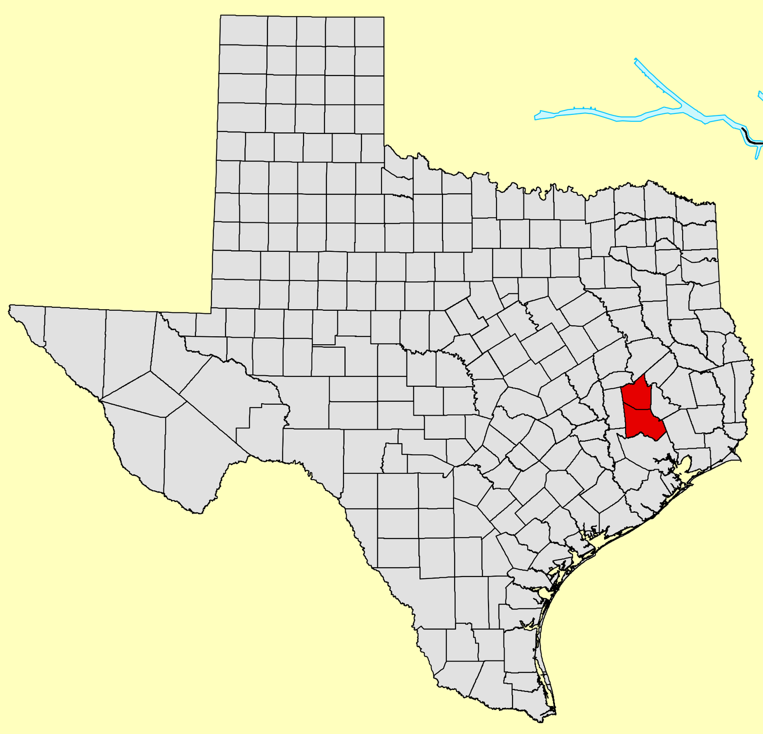
- 200
- 195
- 190
- 185
- 180
- 175
- 170
- 165
- 160
- 155
- 150
- 145
- 140

Islands

Lake Conroe

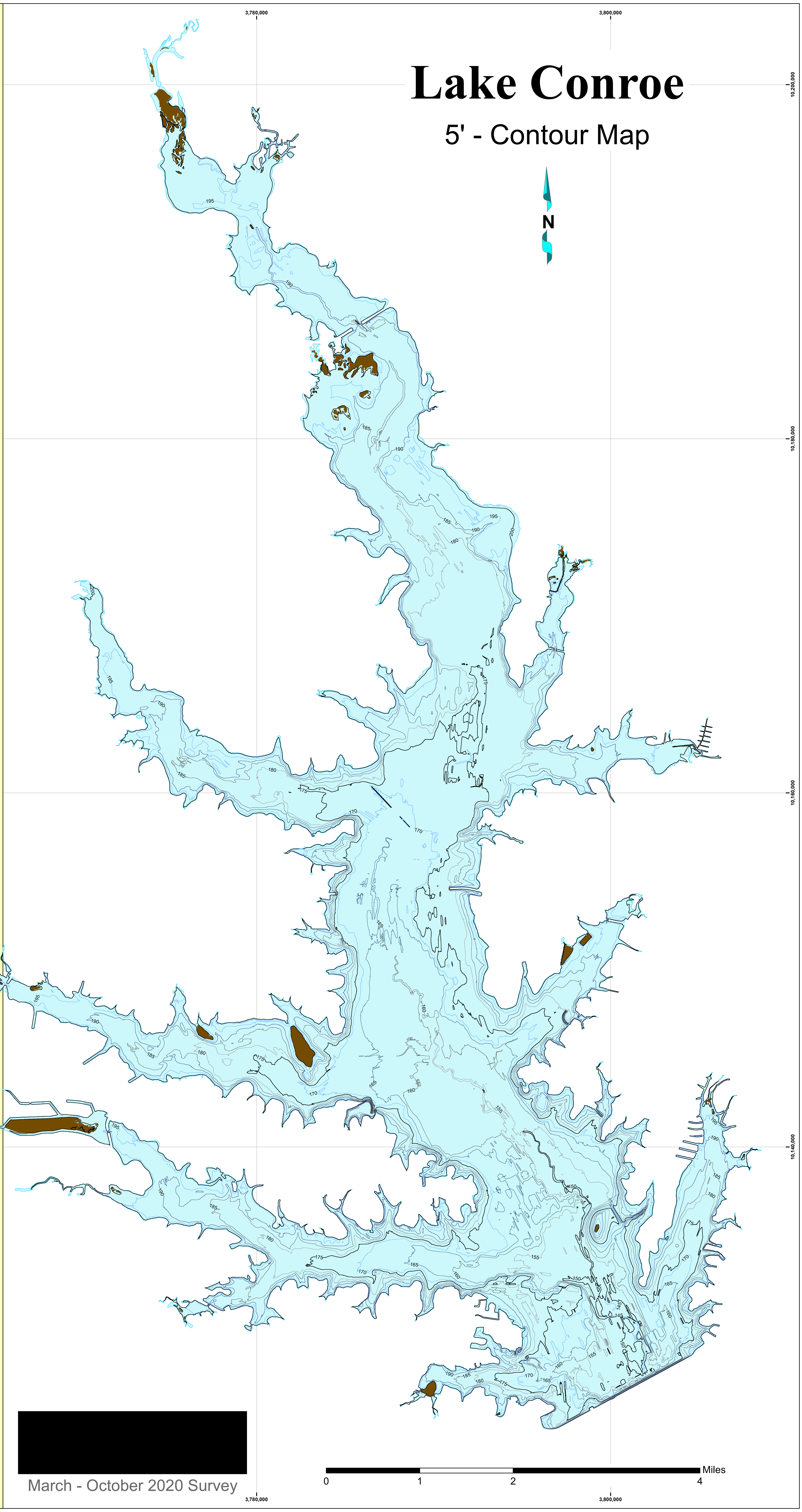
Conservation Pool Elevation
201.0 feet above mean sea level

Projection: NAD83
State Plane
Texas Central Zone (feet)



Montgomery and Walker Counties

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 Conroe. The Texas Water Development Board makes no representations nor assumes any liability.



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March - October 2020 Survey