INTAKE CHANNEL SURVEY ON JIM CHAPMAN LAKE

April 2023

Texas Water Development Board

September 2023

Texas Water Development Board

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Prepared for:

North Texas Municipal Water District

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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 July 2022, the Texas Water Development Board (TWDB) entered into an agreement with the North Texas Municipal Water District (NTMWD) to perform a detailed bathymetric survey of the area in proximity of the raw intake structure and intake channel on Jim Chapman Lake. Surveying was performed using a Teledyne Odom Hydrographic MB1 Multibeam Echosounder System. All maps generated from this survey are related to this purpose, and TWDB makes no representation and assumes no liability if this information is used for any other purpose, such as boating maps.

Cooper Dam, impounding Jim Chapman Lake, also known as Cooper Lake, is located on the South Sulphur River, in Delta and Hopkins counties, approximately four miles southeast of Cooper, Texas (Figure 1). Jim Chapman Lake is owned and operated by the U.S. Army Corps of Engineers, Fort Worth District. Construction of Cooper Dam and Jim Chapman Lake began in August 1987. The dam was completed, and deliberate impoundment of water began on September 28, 1991 (U.S. Army Corps of Engineers, 2023a). The reservoir was built primarily for water supply purposes and is also used for flood control purposes (U.S. Army Corps of Engineers, 2023b).

Water rights for Jim Chapman Lake have been appropriated as follows: to the NTMWD through Certificate of Adjudication No. 03-4798; to the Sulphur River Municipal Water District through Certificate of Adjudication No. 03-4797 and Amendment to Certificate of Adjudication Nos. 03-4797A and 03-4797B; and to the City of Irving through Certificate of Adjudication No. 03-4799 and Amendment to Certificate of Adjudication Nos. 03-4799A, 03-4799B, 03-4799C, and 03-4799D (Texas Commission on Environmental Quality, 2023). The complete certificates are on file at the Texas Commission on Environmental Quality (TCEQ).

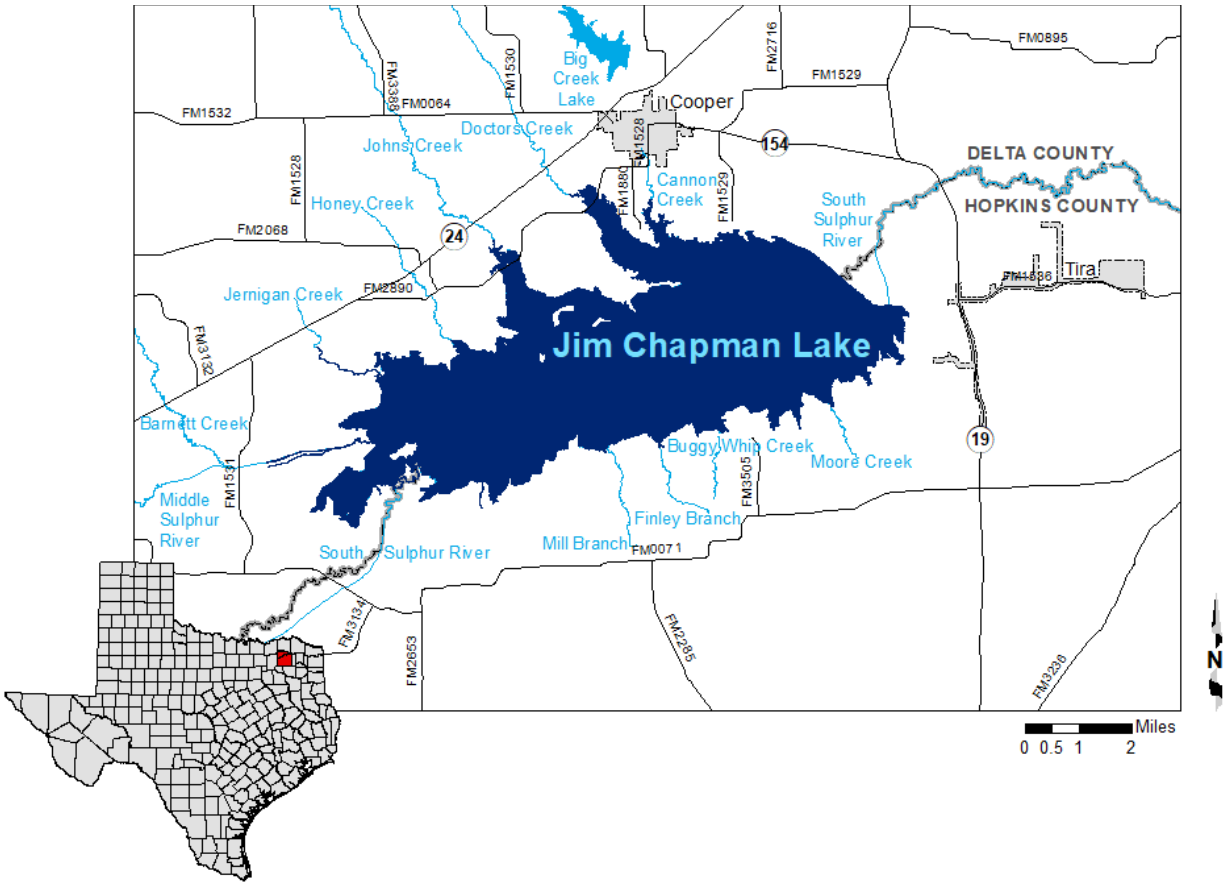


Figure 1. Location map.

Methodology[1]

The TWDB collected high-resolution multibeam bathymetry data adjacent to the raw water intake structure owned by NTMWD at Jim Chapman Lake on April 11, 2023, while the daily water surface elevation averaged 440.33 feet NGVD29. The raw water intake structure is located on the south shoreline in Finley Branch of Jim Chapman Lake (Figure 2). Data were collected in a manner to provide full coverage bathymetry plots of the raw water intake structure channels and the reservoir bottom near these structures. For data collection, the TWDB used a Teledyne Odom Hydrographic MB1 Multibeam Echosounder System with a maximum ping frequency of 60 hertz (Hz), an adjustable operating frequency ranging from 170 to 220 kilohertz (kHz), adjustable swath coverage up to 120 degrees, an integrated real-time sound velocity probe, and differential global positioning system (DGPS) equipment. Additional fixed point sound velocity profile measurements were taken throughout the collection area before, during, and after data collection.

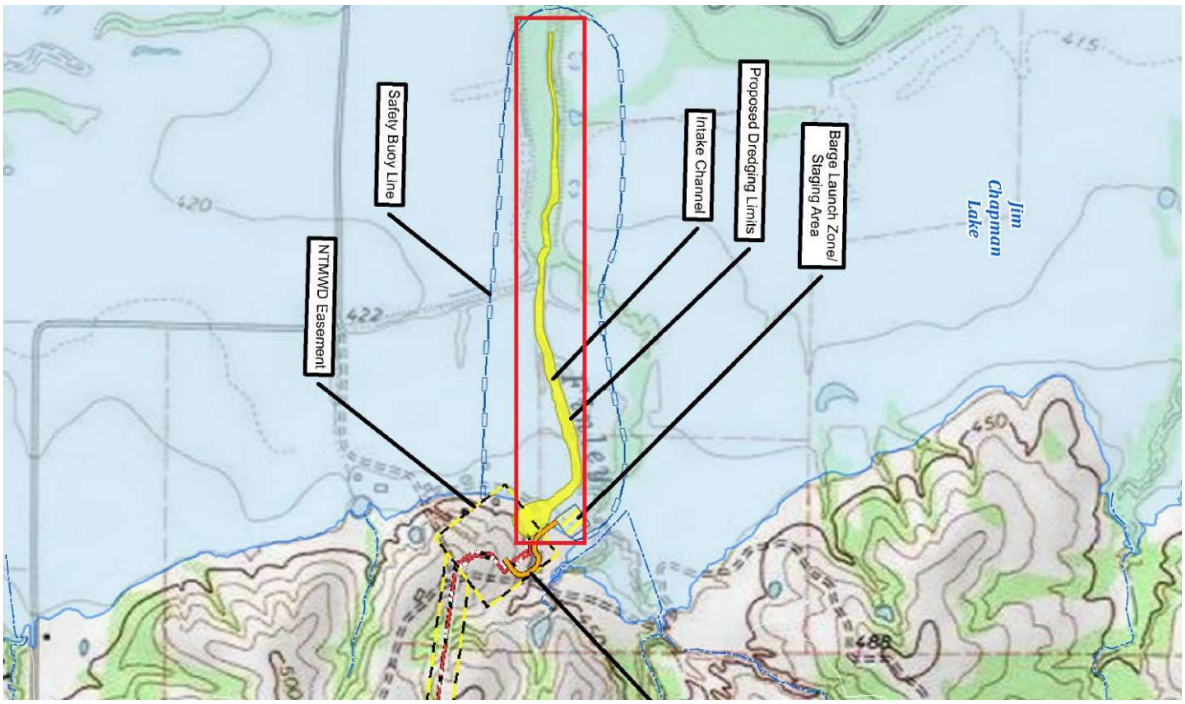


Figure 2. Intake channel survey area of interest. The survey area, identified by the red box, originates from the south shore of the reservoir, and extends approximately 4000 feet north.

[1] References to brand names throughout this report do not imply endorsement by the Texas Water Development Board

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 07342495 Jim L. Chapman Lk nr Cooper, TX* (U.S. Geological Survey, 2023). Elevations herein are referenced to water levels reported by the USGS gage reported in feet relative to the NGVD29 datum. The horizontal datum used for this report is North American Datum 1983 (NAD83), and the horizontal coordinate system is State Plane Texas North Central Zone (feet).

The echo sounder was mounted to the TWDB's HYDRO boat, a 23-foot survey vessel, via a two-point mounting system. Vessel and equipment offsets were measured prior to the survey during a dimensional control survey and checked prior to deployment at the survey site. Heave, pitch, and role were accounted for using an integrated motion reference unit.

A patch test was performed to quantify any residual biases in the initial alignment measurements of the multibeam echosounder, the motion reference unit (MRU), and the heading sensor. The patch test ensures timing errors, transducer pitch offset, transducer roll offset, and transducer azimuth offset were within specifications for the survey. A patch test is a series of reciprocal transects where data are collected at varying speeds, depths, and bottom terrain in a test area. These data are used to determine angular offsets and time delays to calibrate the sensor orientation system between each component and the vessel. The patch test determines the vessel orientation alignment corrections for latency, pitch, roll, and yaw (U.S. Army Corps of Engineers, 2013). Data were post-processed using the HYPACK software suite to remove data anomalies as well as compute the offsets for latency, pitch, roll, and yaw.

Deliverables

The processed multibeam data was exported from Hypack to an XYZ file using the median value of the cell resulting in a high-resolution grid of points with a spacing of one foot by one foot. The program required three points in the cell to populate the output grid. The XYZ file was converted to a shapefile in ArcGIS Pro. A Triangulated Irregular Network (TIN) model was generated using volumetric survey data from the TWDB 2022 survey and the multibeam data for a complete picture of the area. Where multibeam and single beam survey data overlapped, single

beam data and other TIN inputs were removed. An approximate polygon representing the multibeam data coverage area was used to erase single beam data and interpolated data points from the Volumetric and Sedimentation Survey (Texas Water Development Board, 2023) dataset. Additionally, shorelines digitized from aerial imagery dated July 12, 2014, and November 1, 2020, were edited to not overlap with the multibeam data. The TIN model was converted to a raster representation using a cell size of two feet by two feet. Contours were generated from the raster at one-foot intervals. These data were used to produce three figures: (1) an elevation relief map representing the topography of the reservoir bottom (Figure 3); (2) a depth range map showing depth ranges for Jim Chapman Lake in the vicinity of the raw water intake channel and structure (Figure 4); and (3) a 2-foot contour map of the area of interest (Figure 5).

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

Texas Commission on Environmental Quality, 2023, Texas Water Rights Viewer, accessed March 13, 2023, at https://tceq.maps.arcgis.com/apps/webappviewer/index.html?id=44adc80d90b749cb85cf39e04027dbdc.

Texas Water Development Board, 2023, Volumetric Survey of Jim Chapman Lake, accessed September 28, 2023, at http://www.twdb.texas.gov/hydro_survey/JimChapman/2022-07/JimChapman2022_FinalReport.pdf.

Texas Water Development Board, 2022, Contract No. 2248012642 with the North Texas Municipal Water District.

U.S. Army Corps of Engineers, 2013, Engineering and Design, Hydrographic Surveying - Engineer Manual, EM 1100-2-1003 (30 Nov 13): U.S. Army Corps of Engineers, Appendix P.

U.S. Army Corps of Engineers, 2023a, Pertinent Data – Cooper Dam and Jim Chapman Lake, accessed March 13, 2023, at https://www.swf-wc.usace.army.mil/pertdata/sclt2.pdf.

U.S. Army Corps of Engineers, 2023b, History of Jim Chapman Lake/ Cooper Dam, accessed March 13, 2023, at https://www.swf-wc.usace.army.mil/cooper/Information/History.shtml.

U.S. Geological Survey, 2023, U.S. Geological Survey National Water Information System: Web Interface, USGS 07342495 Jim L. Chapman Lk nr Cooper, TX, accessed July 5, 2023, at https://waterdata.usgs.gov/nwis/dv?referred_module=sw&site_no=07342495.

Figure 3

Jim Chapman Lake Intake channel

Elevation relief map

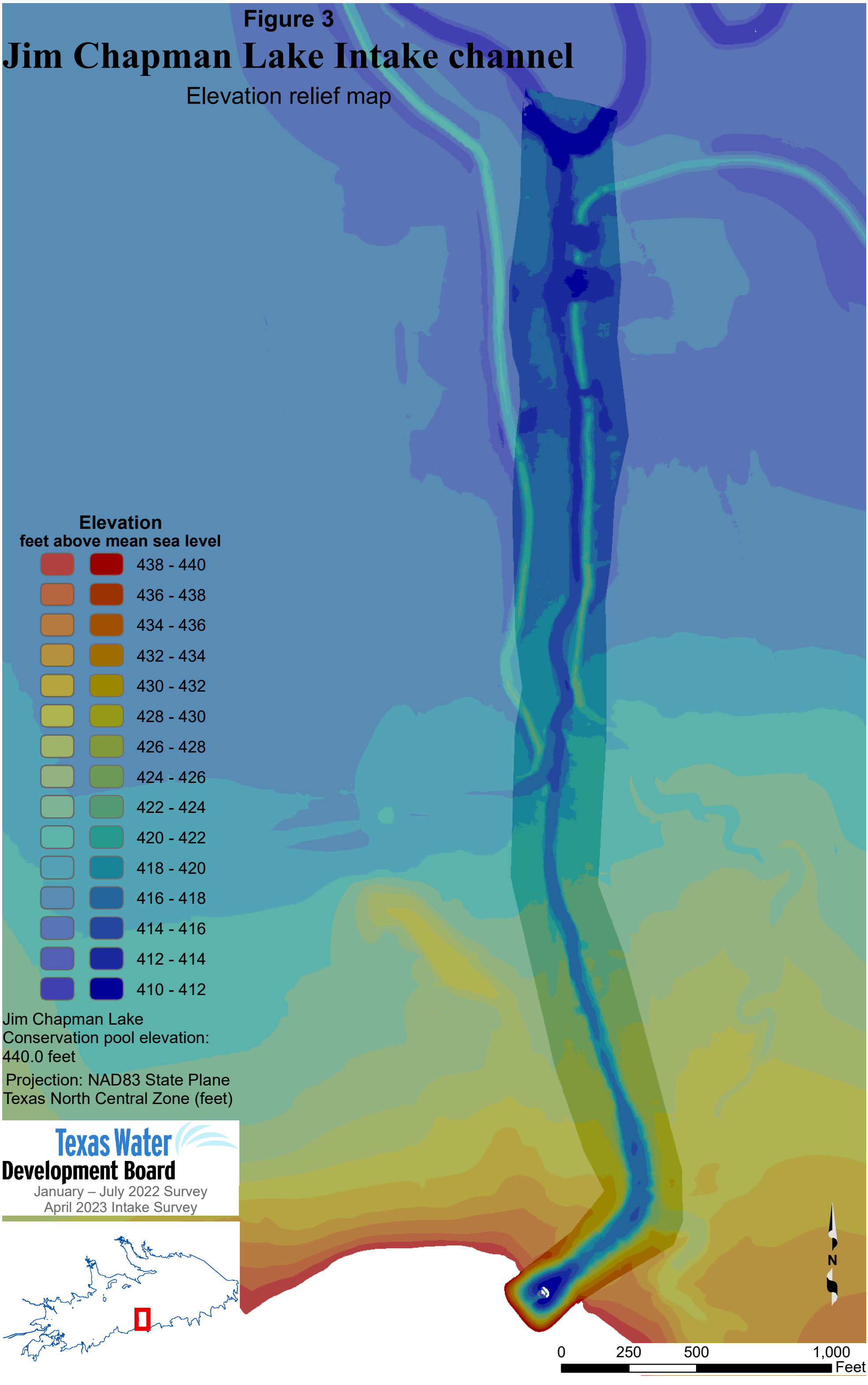


Figure 4

Jim Chapman Lake Intake channel

Depth range map

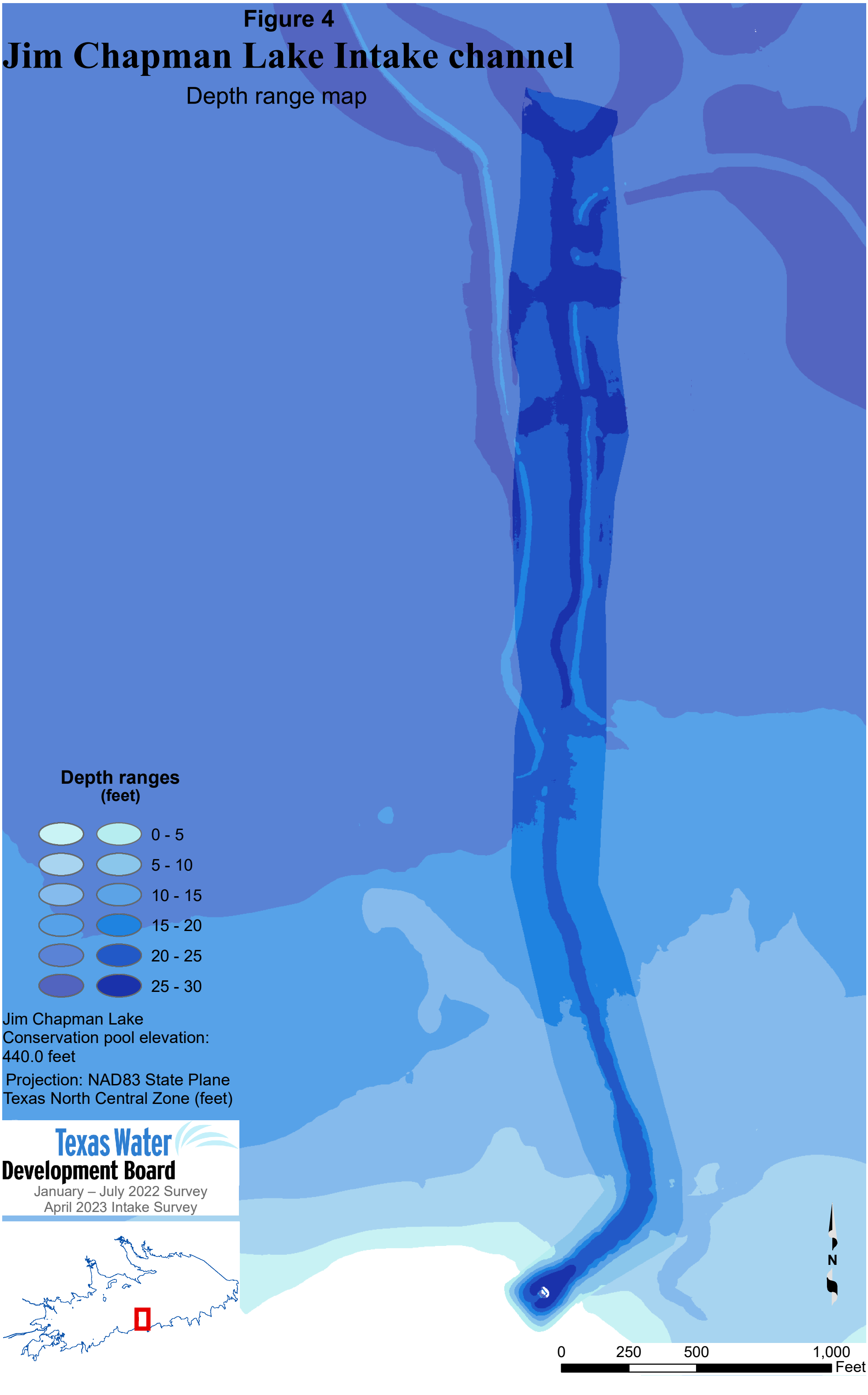


Figure 5

Jim Chapman Lake Intake channel

2-foot contour map

Contours (feet)

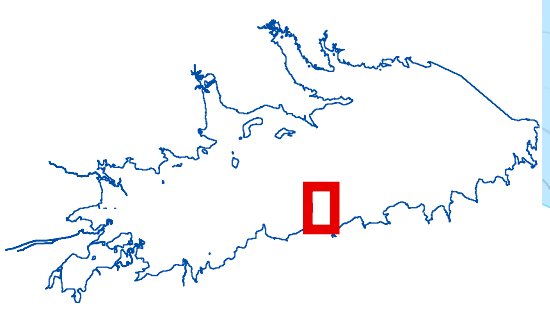
- 440
- 438
- 436
- 434
- 432
- 430
- 428
- 426
- 424
- 422
- 420
- 418
- 416
- 414
- 412
- 410

Jim Chapman Lake
Conservation pool elevation:
440.0 feet

Projection: NAD83 State Plane
Texas North Central Zone (feet)

Texas Water Development Board

January – July 2022 Survey
April 2023 Intake Survey



N

0 250 500 1,000 Feet