Bathymetric Survey of Select Dissolved Oxygen Impaired Reservoirs FY 2020

PROJECT 03 FY19/20 §106 I-006400-19

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OKLAHOMA WATER RESOURCES BOARD

PREPARED FOR:
OKLAHOMA DEPARTMENT OF ENVIRONMENTAL QUALITY

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TABLE OF CONTENTS

TABLE OF FIGURES

TABLE OF TABLES

TABLE OF EQUATIONS

Bathymetric Survey of Select Dissolved Oxygen Impaired Reservoirs FY 2020

INTRODUCTION

Project

The Oklahoma Water Resources Board (OWRB) was contracted by the Oklahoma Department of Environmental Quality (ODEQ) to conduct hydrographic surveys on three Oklahoma reservoirs listed on the state's 303(d) list as impaired for dissolved oxygen. These reservoirs include Holdenville Lake, Stilwell City Lake, and Lake Wayne Wallace. The purpose of this project is to produce current elevation-area-capacity tables, to allow for volumetric determination of dissolved oxygen for beneficial use assessment.

Reservoirs

Holdenville Lake

Holdenville Lake is located on Beemore Creek, a tributary of the Canadian River. It is located in Hughes County, approximately 2 miles southeast of the City of Holdenville, as shown in **Figure 1**. The dam (NID ID: OK10479) was completed in 1931, and the reservoir (Waterbody ID: 520800010040) is owned by the City of Holdenville. The dam is located at 35° 01' 38.4" N 096° 22' 08.7" W in Sec. 4-T6N-R9E. Holdenville's designated beneficial uses include Agriculture, Aesthetics, Fish and Wildlife Propagation, Recreation, and Public and Private Water Supply. Holdenville Lake is also designated as a Sensitive Water Supply (OAC, 785:45, Appendix A).

Stilwell City Lake

Stilwell City Lake is located on a minor tributary of Sallisaw Creek. It is located in Adair County, approximately 5.5 miles southwest of the City of Stilwell, as shown in **Figure 2**. The dam (NID ID: OK00081) was originally completed in 1931 with rehabilitation completed in 2010. The reservoir (Waterbody ID: 220200030120) is owned by the City of Stilwell. The dam is located at 35° 45' 41.9" N 094° 42' 28.0" W in Sec. 24-T15N-R24E. Stilwell's designated beneficial uses include Agriculture, Aesthetics, Fish and Wildlife Propagation, Recreation, and Public and Private Water Supply.

Lake Wayne Wallace

Lake Wayne Wallace is located on Fourche Maline Creek a tributary of the Poteau River. It is located in Latimer County, approximately 6 miles northwest of the City of Wilburton, as shown in **Figure 3**. The dam (NID ID: OK02174) was completed in 1969, and the reservoir (Waterbody ID: 220100040150) is owned by the State of Oklahoma. The dam is located at 34° 59' 31.7" N 095° 21' 23.6" W in Sec. 13-T6N-R18E. Wayne Wallace's designated beneficial uses include Agriculture, Aesthetics, Fish and Wildlife Propagation, Recreation, and Public and Private Water Supply.

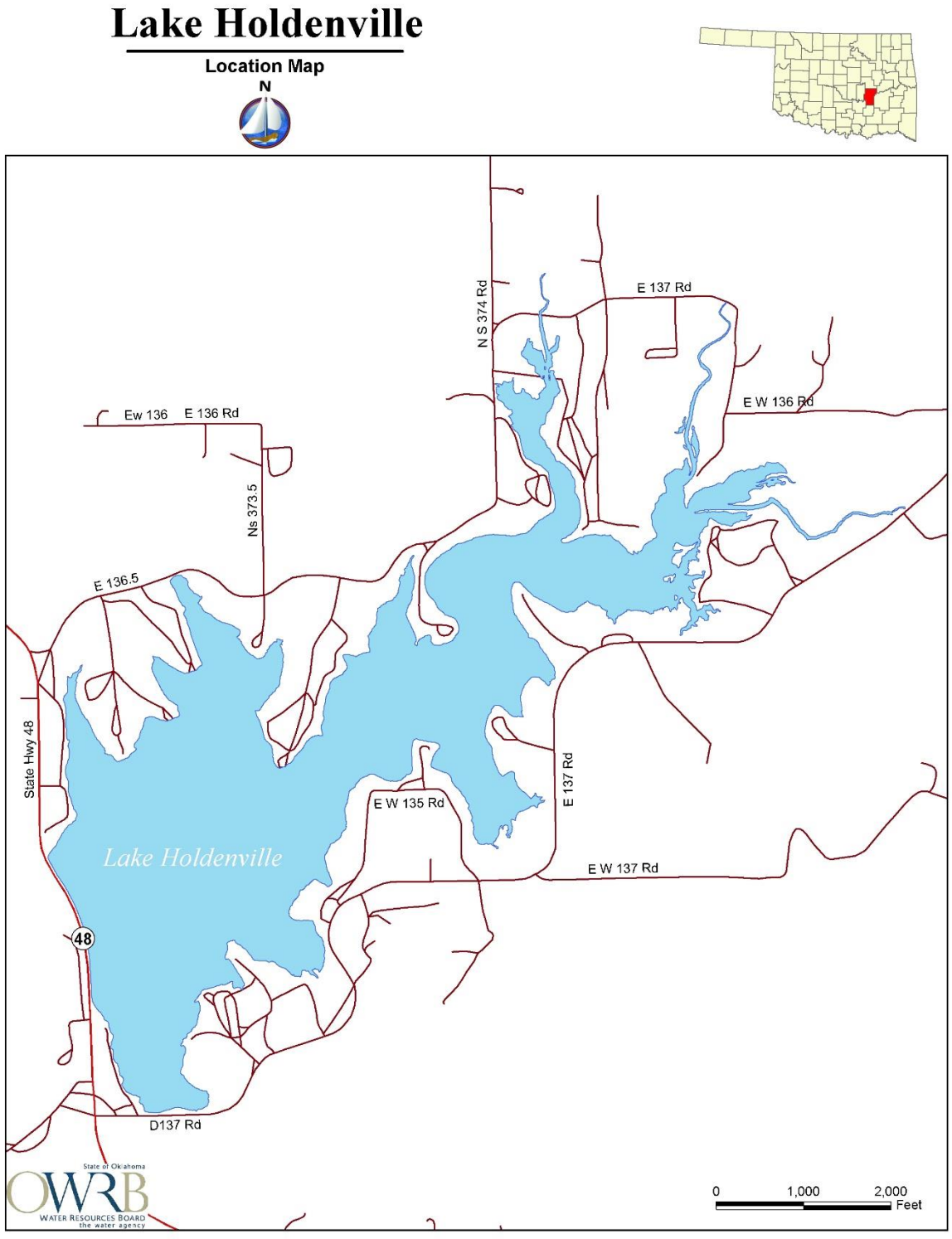


Figure 1: Location map for Holdenville Lake

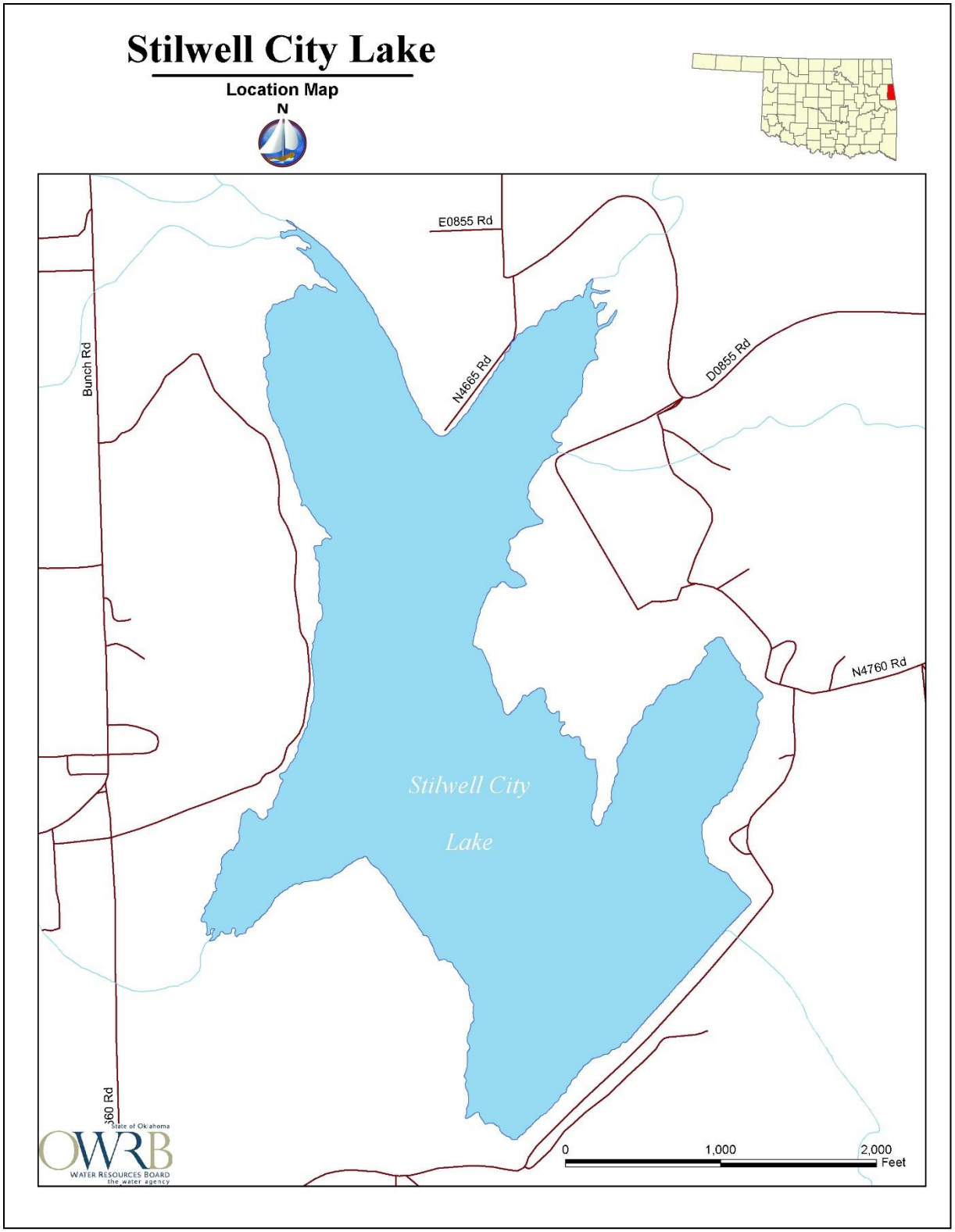


Figure 2: Location map of Stilwell City Lake

Figure 3: Location map of Lake Wayne Wallace

HYDROGRAPHIC SURVEYING PROCEDURES

The process of surveying a reservoir uses a combination of Geographic Positioning Systems (GPS) and acoustic depth sounding technologies incorporated into a hydrographic survey vessel. As the survey vessel travels across the lake's surface, the echosounder gathers multiple depth readings every second. Depth readings are stored on the survey vessel's on-board computer along with positional data generated from the vessel's GPS receiver. The collected data files are downloaded daily from the computer and edited upon returning to the office. During editing, data "noise" is removed or corrected and depth readings are converted to elevation readings based on the water level elevation recorded on the day the survey was performed. The edited data sets are then thinned to manageable sizes using Hypack's "Sounding Selection-Sort Program" using a 1 sort radius. Using ArcGIS, accurate estimates of area-capacity can then be determined for the lake by building a three-dimensional model of the reservoir from the sorted data set. The process of completing a hydrographic survey includes four steps: pre-survey planning, field survey, data processing, and model construction.

Pre-Survey Planning

Boundary File

Holdenville Lake

The shoreline boundary for Holdenville Lake was derived from 2-meter Digital Elevation Model (DEM)Light Detection and Ranging (LiDAR) data downloaded from OKMaps[1]. The LiDAR raster file TIFF was clipped and contours were generated. The Natural Resource Conservation Service (NRCS) Contour Tool v10x, which utilizes the ArcGIS Spatial Analyst extension, was used to generate 0.5 ft contours from the LiDAR file. A lake boundary line shapefile was created from the 789.0 ft contour line; this elevation was most representative of Holdenville Lake at or near normal pool elevation (789.0 ft). This boundary file was verified using both orthophotos and measured elevation readings.

For development of the area/capacity table values for the flood and surcharge pools 0.5 ft contours were selected from the LiDAR derived data as described in the previous paragraph, which best represented those elevations. Holdenville Lake's flood and surcharge boundaries are the same. Their boundary line shapefile was created from the 798.0 ft contour line; this elevation being most representative of the Holdenville Lake flood/surcharge pool elevation (798.0 ft).

Stilwell City Lake

The shoreline boundary for Stilwell City Lake was derived from 2-meter DEM LiDAR data downloaded from OKMaps[1]. The LiDAR raster file TIFF was clipped and contours were generated. The NRCS Contour Tool v10x, which utilizes the ArcGIS Spatial Analyst extension, was used to generate 0.5 ft contours from the LiDAR file. A lake boundary line shapefile was

[1] https://okmaps.org/OGI/search.aspx

created from the 949.0 ft contour line; this elevation was most representative of Stilwell City Lake at or near normal pool elevation (948.7 ft). A small amount of editing of this line was needed for a creek located in the northeast portion of the lake due to errors in the contour. This boundary file was verified using both orthophotos and measured elevation readings.

For development of the area/capacity table values for the flood and surcharge pools 0.5 ft contours were selected from the LiDAR derived data as described in the previous paragraph, which best represented those elevations. A flood pool boundary line shapefile was created from the 958.5 ft contour line; this elevation being most representative of the Stilwell City Lake flood pool elevation (958.6 ft). A surcharge boundary line shapefile was created from the 969.0 ft contour line; this elevation being most representative of the surcharge elevation (969.2ft).

Lake Wayne Wallace

The shoreline boundary for Lake Wayne Wallace was derived from 2-meter DEM LiDAR data downloaded from OKMaps[2]. The LiDAR raster file TIFF was clipped and contours were generated. The NRCS Contour Tool v10x, which utilizes the ArcGIS Spatial Analyst extension, was used to generate 0.5 ft contours from the LiDAR file. A lake boundary line shapefile was created from the 793.0 ft contour line; this elevation was most representative of Lake Wayne Wallace at or near normal pool elevation (792.1 ft). A small amount of editing of this line was needed for the creek located in the southeast portion of the lake where steep banks created errors in the contour. This boundary file was verified using both orthophotos and measured elevation readings.

For development of the area/capacity table values for the flood and surcharge pools 0.5 ft contours were selected from the LiDAR derived data as described in the previous paragraph, which best represented those elevations. A flood pool boundary line shapefile was created from the 818.0 ft contour line; this elevation being most representative of the Lake Wayne Wallace flood pool elevation (818.0 ft). A surcharge boundary line shapefile was created from the 826.5 ft contour line; this elevation being most representative of the surcharge elevation (826.5ft).

Hypack Set-up

Hypack software from Xylem, Inc. was used to assign geodetic parameters, import background files, and create virtual track lines (transect and crosscheck) (Hypack, 2019). The geodetic parameters assigned were ellipsoid World Geodetic System of 1984 (WGS-84) in State Plane North American Datum of 1983 (NAD-83) Zone OK-3501 Oklahoma North or OK-3502 Oklahoma South, depending on location of the reservoir in regards to Highway Interstate 40 (I40). The distance and depth units used were US Survey Feet. The vertical datum was set to the North American Vertical Datum of 1988 (NAVD88), and any measurements in the National Geodetic Vertical Datum of 1929 (NGVD29) were converted using the National Geodetic Survey (NGS) VERTCON tool[3].

[2] https://okmaps.org/OGI/search.aspx

[3] http://www.ngs.noaa.gov/TOOLS/Vertcon/vertcon.html

Survey transects were spaced according to the size and shape of each individual lake in order to maintain a high level of accuracy and coverage (**Table 1**). The survey transects within the digitized reservoir boundary ran perpendicular to the original stream channels and tributaries. Stream lines were placed along the center of channels in areas deemed too small for transect coverage, as well as perpendicular to transect lines down the center of any major lake arms. These stream lines were used for data collection in difficult to navigate areas as well as quality control (QC) purposes. Additional track lines set perpendicular to the transect lines were added to be used for QC cross check statistics if needed.

Table 1: Summary of track line coverage for all lakes surveyed.

Track Line Coverage				
Lake	Line Spacing	Transect Lines	Stream Lines	Additional QC Lines
Holdenville Lake	150 ft	95	15	6
Stilwell City Lake	100 ft	94	3	7
Lake Wayne Wallace	100 ft	46	4	8

Field Survey

Lake Elevation Acquisition

The lake elevations for all surveys were obtained by collecting positional data over a period of time. Data collection was done using a Trimble Zephyr Geodetic Antenna connected to Trimble 5700 receiver controlled using Trimble TSC1 survey controller (Trimble, 2008). Data was then uploaded to the On-line Positioning Users Service[4] (OPUS) website. The National Geodetic Survey (NGS) operates the OPUS as a means to provide GPS users with easier access to the National Spatial Reference System (NSRS). OPUS allows users to submit their GPS data files to NGS, where the data is processed to determine a position using NGS computers and software. Each data file that is submitted is processed with respect to at least three Continuously Operating Reference Stations (CORS). All collection and processing of elevation data followed methods covered in full detail in the OWRB Standard Operating Procedures (SOP) for lake elevation measurement found in the approved project Quality Assurance Project Plan (QAPP) (OWRB, 2018).

Method

The procedures followed by the OWRB during the hydrographic survey adhere to U.S. Army Corps of Engineers (USACE) standards EM 1110-2-1003 (USACE, 2013) as stated in the approved project QAPP (OWRB, 2018). The quality assurance and quality control (QA/QC) procedures for equipment calibration and operation, field survey, data processing, and accuracy standards are presented in the following sections and covered in more detail in the approved project QAPP (OWRB, 2018).

[4] https://www.ngs.noaa.gov/OPUS

Technology

The Hydro-survey vessel is a 16-ft aluminum hull boat, powered by a single 40-horsepower outboard motor. Equipment used to conduct the survey included: a rugged notebook computer running Hypack's 2019 survey data collection software (Hypack, 2019), Knudsen 1614 Echo Sounder (Knudsen, 2010), with a depth resolution of 0.1 ft, Hemisphere R131 receiver with differential global positioning system (DGPS) correction (Hemisphere, 2013), a Valeport SWiFT SVP (Sound Velocity Profiler) (Valeport, 2020). All field equipment was used in accordance with their corresponding manuals.

Survey

A two-man survey crew was used throughout the duration of the project. Data collection began at the dam and moved upstream. The survey crew followed the parallel transects created during the pre-survey planning while collecting depth soundings and positional data. In areas of the lake that were too narrow for pre-planned transect lines; stream lines were followed, using both straight and with a zigzag pattern to collect data. These areas included small tributaries as well as the upstream section of the reservoir. Similar to the shoreline data collection procedure, upstream data was collected until depths were too shallow for the boat to navigate and/or an obstruction prevented travel past a certain point. All lake surveys followed the aforementioned procedure for survey data collection. Survey dates and water level elevations can be found in **Table 2**.

Table 2: Summary of water elevations measured or recorded for all survey dates.

Survey Dates and Water Elevations		
Lake	Date	Water Elevations (NAVD88)
Holdenville Lake	03/06/2020	789.89 ft
Stilwell City Lake	12/18/2019	948.73 ft
Lake Wayne Wallace	12/11/2019	792.89 ft

Quality Assurance/Quality Control

Sound Velocity

The hydrographic surveys followed the quality control procedures presented in the approved QAPP (OWRB, 2018) and summarized in **Table 3**. While on board the Hydro-survey vessel, the Knudsen 1614 Echo Sounder was calibrated using both a SWiFT SVP and a bar-check setup. The sound velocimeter measures the speed of sound (SOS) at incremental depths throughout the water column. The factors that influence the SOS—depth, temperature, and salinity—are all taken into account. Deploying the unit involved lowering the probe into the water to the calibration depth mark to allow for acclimation and calibration of the depth sensor. The unit was then gradually lowered at a controlled speed to a depth just above the lake bottom, and then was raised to the surface. The unit collected sound velocity measurements in feet/seconds at regular increments on both the deployment and retrieval phases. The data was then reviewed for any discrepancies, which were subsequently edited out of the sample. Sound velocity profiles are used to calibrate collected raw depth readings during the editing process.

Table 3: Summary of Relevant Minimum Performance Standards (MPS) and Quality Assurance (QA) Practices for the Hydrographic Survey (USACE, 2002&2013).

Minimum Performance Standards and Quality Assurance Practices for the Hydrographic Survey		
Repeatability (Bias)	0.3 ft	0.5 ft
Standard Deviation (± ft at 95%)	± 0.8 ft	
Resultant Elevation/Depth Accuracy (95%)(15>d<40 ft)	± 2.0 ft	
Horizontal Positioning System Accuracy (95%)	5 m (16 ft)	
Minimum Survey Coverage Density	Not to Exceed 500 ft (150 m)	
Quality Control and Assurance Criteria	--	
➢ Bar-check	1/project	
➢ Sound Velocity QC calibration	2/day	
➢ Squat Test	1/year	
➢ Position calibration QC check	1/project	
From the **2002** version of EM 1110-2-1003	From the **2013** version of EM 1110-2-1003	

Bar-Check

The bar-check procedure adheres to USACE methods (USACE, 2013). The setup consists of a steel plate lowered using chains measured and marked in five ft increments. The setup is lowered initially to a depth of 5 ft from the surface of the water. Taking the 5 ft depth and subtracting the unmodified depth from the echosounder provides the static draft or depth of the transducer in reference to the water's surface. This offset was measured and recorded by the Knudsen echosounder using its Bar-Check Mode where the SOS at five 5 ft depth is also entered. The bar-check setup is then lowered to 25 ft to check for variations. Data is collected at both 5 ft and 25 ft depths and processed with the correlating sound velocity profile to validate calibration. Bar-check echograms can be found in **Figure 4**. **Table E- 1** containing Static draft, average SOS, as well as SOS set in the echosounder for all survey dates can be found in **APPENDIX E:** Additional Survey Data Tables.

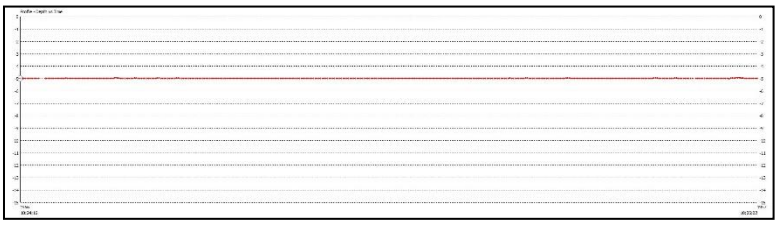
Cross-Line Check

Depth observations contain both random errors (σ Random Error) and systematic biases (σ Bias). Biases are often referred to as systematic or external errors and may contain observational oversight. A constant error in tide or stage would be an example of a bias. Biases are reduced as much a possible by using the quality control measures discussed previously. Random errors are those errors present in the measurement system that cannot be easily minimized by additional calibration. Examples include echo sounder resolution, water sound velocity variations, tide/staff gage reading resolution, etc. The precision of the observations is a measure of the closeness of a set of measurements--or their internal agreement. Accuracy relates to the closeness of measurements to their true or actual value.

Accuracy and precision were assessed utilizing a cross-line check method referenced in the approved QAPP (OWRB, 2018). The cross-line check was performed by collecting depth

readings along survey track lines perpendicular to, and intersecting the survey transect lines. Hypack's Cross Check Statistics program was used to assess vertical accuracy and confidence measures of the recorded depths at the points where the lines intersected. This program tabulates and statistically analyzed the depth differences between overlapping points of single beam data. The program provides a report calculating the standard deviation and mean difference. **Table E- 2** contains the results of the cross-line checks; include the number of Quality Control (QC) intersections, arithmetic mean (Bias), and the standard deviation (Random Error) for all reservoirs and can be found in **APPENDIX E:** Additional Survey Data Tables.

a)



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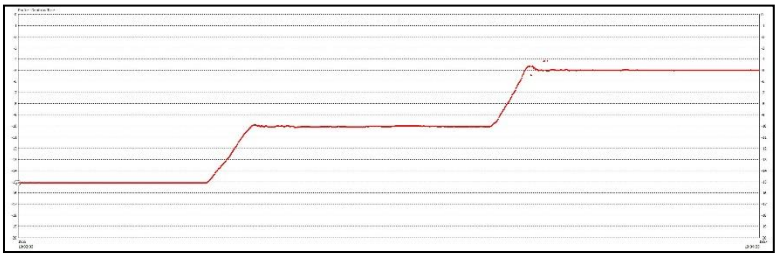

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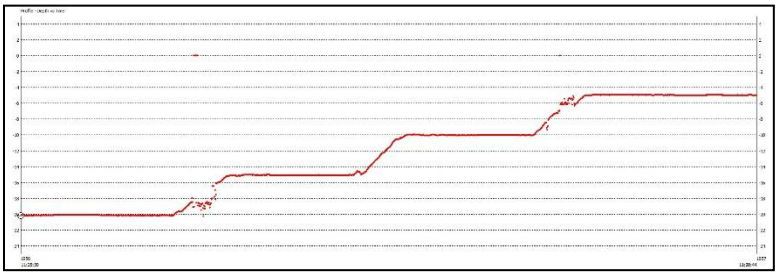

Figure 4: Digital Echogram of Bar-checks for All Lakes Surveyed a) Holdenville Lake 03/06/2020 b) Stilwell City Lake 12/18/2019 c) Lake Wayne Wallace 12/11/2019

Depth Accuracy Calculation

Mean difference and the standard deviation can be used to calculate the Root Mean Square (RMS) error using **Equation 1**. The RMS error estimate is used to compare relative accuracies of estimates that differ substantially in bias and precision (USACE, 2002). According to the recommended standards in the approved QAPP, RMS at the 95% confidence level should not exceed a tolerance of $\pm$ 2.0 ft for reservoir surveys (OWRB, 2018). This simply means that on average, 19 of every 20 observed depths will fall within the specified accuracy tolerance.

Equation 1: Depth/Elevation Accuracy Calculation

$$RMS = \sqrt{\sigma^{2}_{Random\ \ error} + \sigma^{2}_{Bias}}$$

where:

Random error = standard deviation
Bias = mean difference
RMS = Root Mean Square error (68% confidence level)

and:

$$RMS\ (95\ \%)\ depth\ \ accuracy = 1.96 \times RMS\ (68\ \%)$$

All reservoirs resulted in an RMS of less than ± 2.0 ft with a 95% confidence level meeting the QAPP's MPS for reservoir surveys. The calculated 95% RMS for all reservoirs can be found in **Table 4**.

Table 4: Calculated Depth Accuracies for All Lakes Surveyed.

Calculated Depth Accuracy	
Reservoir	RMS at 95% Confidence
Holdenville Lake	±0.41 ft
Stilwell City Lake	±0.57 ft
Lake Wayne Wallace	±0.62 ft

GPS

The GPS system is an advanced high-performance geographic data-acquisition tool that uses differential GPS (DGPS) to provide sub-meter positional accuracy on a second-by-second basis. Potential errors are reduced with DGPS because additional data from a reference GPS receiver at a known position are used to correct positions obtained during the survey. Prior to the survey, the settings on the Hemisphere R131 were checked to ensure correct configuration of the GPS receiver. These settings are discussed in more detail in the OWRB SOP for hydrographic surveying found in the approved project QAPP (OWRB, 2018).

Latency Test

A latency test was performed to determine the fixed delay time between the GPS and single beam echo sounder. The timing delay was determined by running reciprocal survey lines over a channel bank. The raw data files were downloaded into Hypack - LATENCY TEST program. The program varies the time delay to determine the "best fit" setting. Position latency in seconds was produced and adjustments were applied to the raw data using Hypack's Single Beam Editor Program, during data processing. **Table E- 1** contains all latency offsets for all survey dates and can be found in **APPENDIX E:** Additional Survey Data Tables.

Data Processing

After uploading the collected data to an OWRB desktop, each raw data file was reviewed using the Single Beam Editor program within Hypack. The Single Beam Editor program allows the user to assign equipment offsets, latency corrections, tide corrections, display the raw data profile,

and review/edit all raw depth information. Raw data files are checked for gross inaccuracies that occur during data collection. Data editing is covered in more detail in the approved project QAPP (OWRB, 2018).

The DGPS latency offset was applied. The Echosounder was corrected for the static vertical draft. These offsets were applied to all raw data sets. The SOS corrections were applied during editing of raw data using the sound velocity correction files created with the sound velocity tool.

An elevation correction file was produced using Hypack's Manual Tides program to account for variance in lake elevation at the time of data collection. The corrected depths were subtracted from the elevation reading to convert their depth in feet to an elevation within the Single Beam Editor program.

During the editing process any areas with unconsolidated bottom returns were manually digitized. This was done using the digital echogram of the data and Hypack's Digitize tool as seen in **Figure 5**. The bottom was digitized on the first return, which was verified as bottom surface using multiple manual measurements over various unconsolidated bottom areas. The measurements were performed using a lead weight on a measure chain while simultaneously collecting echograms, then comparing them to identify the depth to solid bottom.

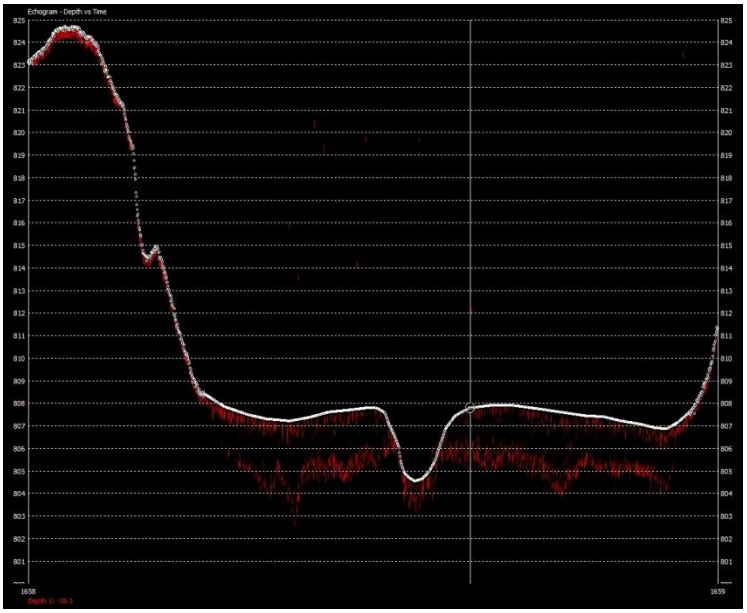

Figure 5: Example echogram showing results after manual bottom digitization

After editing the data for errors and correcting the spatial attributes (offsets and tide corrections), a data reduction scheme was utilized due to the large quantity of collected data. To accomplish this, the corrected data was sorted spatially at a 1 ft interval using the Sounding Selection program in Hypack. Resultant data was saved and exported as a xyz.txt file containing

X and Y horizontal coordinates as well as Z elevations for all data points. The Hypack raw and corrected data files for all reservoirs are stored and available upon request.

GIS Application and Model Construction

Geographic Information Systems (GIS) software was used to process the edited XYZ data collected from the survey. The GIS software used was ArcGIS Desktop, version 10.2, from Environmental Systems Research Institute (ESRI). All GIS datasets created are in Oklahoma State Plane Coordinate System (North or South) referenced to the North American Datum 1983. Horizontal and vertical units are in feet. The edited data points in XYZ text file format were converted into a point feature class in an ArcGIS file geodatabase. The point feature class contains horizontal coordinates and elevation and depth values associated with each collected point.

Volumetric and area calculations were derived from a Triangulated Irregular Network (TIN) surface model. A TIN consists of connected data points that form a network of triangles representing the bottom surface of the lake. The TIN model was created with ArcGIS using the following datasets: 2, 5, or 10 ft contours derived from a raster file interpolated from the collected survey data points, lake boundary at normal pool elevation, and lidar data covering flood and surcharge pools. Lake area and cumulative volume were calculated by slicing the TIN horizontally into planes 0.1 ft thick. Area and cumulative volume of each slice are shown in **APPENDIX A: Area-Capacity Data.**

Contours, depth ranges, and the shaded relief maps were derived from a constructed DEM grid. This grid was created using the ArcGIS Topo to Raster Tool and had a spatial resolution of 1 ft. Contours lines were created at a 2, 5, or 10 ft interval using the ArcGIS contour tool. Contour lines were edited to allow for polygon topology improving accuracy and general smoothness of the lines. Lines were visually edited, paying close attention to the channel area, while also ensuring the lines matched the original data set. The contours were then converted to a polygon feature class and attributed to show 2, 5, or 10 ft depth ranges across the lake. All geographic datasets derived from the survey contain Federal Geographic Data Committee (FGDC) compliant metadata documentation. The metadata describes the procedures and commands used to create the datasets. The GIS metadata for all reservoirs are stored and available upon request, along with all GIS Data.

RESULTS

Holdenville Lake

Results from the March 2020 OWRB survey indicate that Holdenville Lake encompasses 433.43 surface acres and contains a cumulative capacity of 7096.88 acre-ft at normal pool elevation of 789.0 ft (NAVD88). The mean depth for Holdenville Lake is 16.37 ft, while the deepest point measured was 44.55 ft. Lake Maps can be found in **APPENDIX B: Holdenville Lake Maps**.

Stilwell City Lake

Results from the December 2019 OWRB survey indicate that Stilwell City Lake encompasses 207.27 surface acres and contains a cumulative capacity of 3598.57 acre-ft at normal pool elevation of 948.7 ft (NAVD88). The average depth for Stilwell City Lake is 17.36 ft, while the deepest point measured was 46.2 ft. Lake Maps can be found in **APPENDIX C: Stilwell City Lake Maps**.

Lake Wayne Wallace

Results from the December 2019 OWRB survey indicate that Lake Wayne Wallace encompasses 89.58 surface acres and contains a cumulative capacity of 1573.45 acre-ft at normal pool elevation of 792.1 ft (NAVD88). The average depth for Lake Wayne Wallace is 17.56 ft, while the deepest point measured was 47.76 ft. Lake Maps can be found in **APPENDIX D: Lake Wayne Wallace Maps**.

SUMMARY and COMPARISON

Table 5 displays areas and volumes calculated at normal pool elevations for both design specifications and the current surveys. Percent change was then calculated for area, capacity, and average depth. Caution should be used when directly comparing between the design specifications and the current surveys conducted by the OWRB as different methods were used to collect the data and extrapolate capacity and area.

Table 5: Areas and Volumes calculated at normal pool elevations during design specifications and current survey periods for all lakes (OWRB, 1990).
***Values after dam/spillway rehabilitation project for Stillwell City in 2010.**

Feature	Survey Year		Change (%)
	Design Specifications	Current Survey	
Holdenville Lake – March 2020			
Area (acres)	410	433.43	5.72
Capacity (acre-ft)	11000	7096.88	-35.48
Mean depth (ft)	26.83	16.37	-38.97
Stilwell City Lake – December 2019			
Area (acres)	207*	207.27	0.13
Capacity (acre-ft)	3548*	3598.57	1.43
Mean depth (ft)	17.14*	17.36	1.29
Lake Wayne Wallace – December 2019			
Area (acres)	94	89.58	-4.70
Capacity (acre-ft)	1987	1573.45	-20.81
Mean depth (ft)	21.14	17.56	-16.91

All current calculated changes are only estimations and can be verified by performing additional surveys. To make the most accurate comparison across surveys, it is the recommendation of

the OWRB that additional/future surveys utilizing the current survey methods be conducted in 10 years. By using the current survey figures as a baseline, similarly performed future surveys would allow for accurate mean sedimentation rates to be determined.

Holdenville Lake

The surface area of Holdenville Lake shows an apparent increase of 23.43 acres or 5.72%. The March 2020 survey shows that Holdenville Lake had an apparent decrease in capacity of 3903.12 acre-ft or 35.48%. Average depth for the reservoir decreased 10.46 ft or 38.97%. Calculations were based on design specifications from the Oklahoma Water Atlas (OWRB, 1990) and as-built drawings on record at the OWRB. The estimated average annual loss in capacity is 43.86 acre-ft or 0.40% over the 89-year life of the reservoir.

Stilwell City Lake

The surface area of Stilwell City Lake shows an apparent increase of 0.27 acres or 0.13%. The December 2019 survey shows that Stilwell City Lake had an apparent increase in capacity of 50.57 acre-ft or 1.43%. Average depth for the reservoir increased 0.22 ft or 1.29%. Calculations were done using as-built design specifications from a 2010 dam/spillway rehabilitation project, of which are on record at the OWRB. Estimation of the average annual capacity loss was not calculated due to the increase in capacity, this increase in capacity may be attributed to updated survey methods.

Lake Wayne Wallace

The surface area of Lake Wayne Wallace shows an apparent decrease of 4.42 acres or 4.70%. The December 2020 survey shows that Lake Wayne Wallace had a decrease in capacity of 413.55 acre-ft or 20.81%. Average depth for the reservoir has decreased 3.57 ft or 16.91%. Calculations were done using as-built design specifications listed in a conformance analysis document (OCC, 2014). The estimated average annual loss in capacity is 8.27 acre-ft or 0.42% over the 50-year life of the reservoir.

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APPENDIX A: Area-Capacity Data

Table A- 1: Holdenville Lake Area by 0.1 ft Increments.

Holdenville Area Table Area in Acres by 0.1 ft Elevation Increments 2020 Survey Oklahoma Water Resources Board										
Elevation in Feet	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
744			0.0000	0.0000	0.0008	0.0091	0.0277	0.0663	0.1089	0.1489
745	0.1822	0.2121	0.2398	0.2669	0.2955	0.3275	0.3751	0.4415	0.5023	0.5595
746	0.6192	0.6795	0.7410	0.8050	0.8754	0.9793	1.0851	1.1963	1.3257	1.4468
747	1.5680	1.6920	1.8216	1.9576	2.1006	2.2441	2.3954	2.5520	2.7171	2.8848
748	3.0616	3.2319	3.4026	3.5886	3.7901	3.9810	4.1730	4.3819	4.6588	4.8973
749	5.1192	5.3339	5.5739	5.8048	6.0323	6.2449	6.4417	6.6365	6.8346	7.0414
750	7.2825	7.5421	7.8524	8.2229	8.7009	9.1894	9.6312	10.0610	10.5088	10.9750
751	11.4641	11.9653	12.4591	12.9360	13.4053	13.8778	14.3499	14.8211	15.2894	15.7505
752	16.2438	16.7598	17.2885	17.8245	18.3644	18.9212	19.4793	20.1293	20.8155	21.5268
753	22.1641	22.8075	23.5135	24.2244	24.9219	25.5922	26.1964	26.7832	27.3503	27.9143
754	28.5069	29.0916	29.6644	30.2512	30.8902	31.5570	32.2513	33.0009	33.7659	34.5103
755	35.2342	36.0126	36.7826	37.5420	38.2678	38.9567	39.5949	40.2251	40.8401	41.4346
756	41.9904	42.5387	43.0905	43.6362	44.1853	44.7408	45.3123	45.9046	46.5404	47.1351
757	47.7452	48.3525	48.9308	49.5007	50.0677	50.6287	51.2062	51.8087	52.4235	52.9821
758	53.5481	54.0911	54.6362	55.1898	55.7558	56.3377	56.9298	57.5202	58.0838	58.6471
759	59.2187	59.8129	60.3869	60.9659	61.5701	62.1628	62.7477	63.3370	63.9242	64.5069
760	65.0879	65.6725	66.2696	66.8800	67.5282	68.2288	69.0011	69.8614	70.8980	71.9942
761	73.0831	74.2680	75.5192	76.7428	77.8921	79.0524	80.1749	81.3085	82.4846	83.6966
762	84.9634	86.2447	87.4857	88.7176	89.9820	91.2245	92.5157	93.8259	95.0509	96.3689
763	97.7532	99.1364	100.4238	101.6919	102.9414	104.1681	105.3602	106.6129	107.8368	108.9975
764	110.1750	111.3537	112.5520	113.7672	115.0534	116.2711	117.4743	118.6867	119.8934	121.1229
765	122.2916	123.4675	124.6987	125.9193	127.2132	128.4276	129.6608	130.8246	131.9596	133.0311
766	134.1472	135.2587	136.3628	137.4732	138.5536	139.5727	140.6144	141.6444	142.6867	143.7190
767	144.8221	145.8963	146.9177	147.9175	148.9604	150.0809	151.1671	152.2543	153.3123	154.3391
768	155.3462	156.3484	157.3460	158.3269	159.3449	160.3271	161.3433	162.3452	163.3540	164.3437
769	165.3458	166.3479	167.3520	168.3235	169.2858	170.2421	171.2158	172.1932	173.1639	174.1380
770	175.1193	176.1774	177.2913	178.3783	179.4320	180.4630	181.4791	182.4978	183.5513	184.6374
771	185.7268	186.8485	188.0194	189.2401	190.4473	191.6621	192.8534	194.0383	195.2278	196.4047
772	197.6200	198.8308	200.0383	201.2448	202.4389	203.6327	204.8348	205.9760	207.1012	208.2262
773	209.3611	210.5659	211.8522	213.1873	214.4544	215.6183	216.7769	217.9335	219.0857	220.2531
774	221.4708	222.7056	223.9691	225.2765	226.5785	227.8405	229.0950	230.3683	231.6837	232.9820
775	234.1888	235.3592	236.5212	237.6823	238.8414	240.0045	241.1821	242.4323	243.6687	244.9161
776	246.2811	247.5267	248.6100	249.7023	250.8041	251.8971	252.9855	254.0693	255.1504	256.2248
777	257.3157	258.4109	259.5119	260.6271	261.7477	262.8842	264.0464	265.2137	266.3922	267.6235
778	268.8734	270.0957	271.3092	272.5568	273.8039	275.0445	276.2927	277.5555	278.8283	280.1137
779	281.4075	282.7038	284.0332	285.3892	286.7523	288.1391	289.5089	290.9077	292.2721	293.6085
780	295.0014	296.4409	297.8892	299.3321	300.9149	303.9587	305.3394	306.7060	308.0792	309.5098
781	311.1513	312.3611	313.5717	314.8027	316.0980	317.5167	318.6227	319.7291	320.8532	322.0155
782	323.2950	324.3536	325.4088	326.4723	327.5884	328.8544	329.9219	330.9946	332.0798	333.2105
783	334.7056	335.8938	337.0877	338.2936	339.5421	341.0042	342.2341	343.4639	344.7032	345.9824
784	347.5342	348.8134	350.0964	351.3965	352.7480	354.7215	356.0591	357.4009	358.7573	360.1513
785	362.0310	363.3938	364.7595	366.1450	367.5884	369.6253	371.0698	372.5234	373.9953	375.5153
786	377.5897	379.1137	380.6522	382.2141	383.8298	386.2168	387.8864	389.5822	391.3061	393.0658
787	395.8279	397.5509	399.2796	401.0152	402.7593	405.5461	407.2292	408.9198	410.6189	412.3265
788	414.8336	416.4317	418.0373	419.6504	421.2709	423.8528	425.4806	427.1202	428.7715	430.4346
789	433.4322	435.1554	436.8895	438.6345	440.3906	443.4518	445.1885	446.9327	448.6844	450.4436
790	453.5099	455.2338	456.9603	458.6895	460.4214	463.2237	464.9471	466.6778	468.4158	470.1610
791	473.1275	474.8651	476.6072	478.3536	480.1045	482.8502	484.6560	486.4718	488.2974	490.1329
792	493.2032	495.0860	496.9788	498.8815	500.7943	503.9925	505.9823	507.9832	509.9952	512.0184
793	515.4058	517.4344	519.4629	521.4913	523.5198	526.6843	528.7580	530.8316	532.9052	534.9787
794	538.1936	540.2838	542.3811	544.4855	546.5969	549.8414	551.9554	554.0797	556.2142	558.3589
795	561.5043	563.6931	565.8963	568.1141	570.3463	573.6990	575.9377	578.1908	580.4583	582.7402
796	586.0193	588.3311	590.6597	593.0050	595.3671	598.8217	601.2836	603.7525	606.2282	608.7108
797	612.4196	614.9311	617.4517	619.9813	622.5200	626.4312	628.9963	631.5702	634.1531	636.7449
798	637.4330									

Table A- 2: Holdenville Lake Capacity by 0.1 ft Increments.

Holdenville Capacity Table Volume in Acre-Feet by 0.1 ft Elevation Increments 2020 Survey Oklahoma Water Resources Board										
Elevation in Feet	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
744			0.000	0.000	0.000	0.000	0.000	0.002	0.007	0.015
745	0.028	0.045	0.065	0.087	0.113	0.141	0.172	0.207	0.247	0.295
746	0.348	0.407	0.472	0.543	0.620	0.704	0.796	0.900	1.013	1.140
747	1.278	1.429	1.592	1.768	1.956	2.159	2.377	2.608	2.856	3.119
748	3.399	3.696	4.011	4.343	4.692	5.061	5.450	5.857	6.285	6.737
749	7.215	7.716	8.239	8.784	9.353	9.945	10.559	11.193	11.847	12.521
750	13.214	13.931	14.672	15.441	16.244	17.090	17.985	18.926	19.911	20.939
751	22.013	23.135	24.306	25.527	26.797	28.115	29.479	30.890	32.349	33.854
752	35.406	37.006	38.656	40.358	42.114	43.923	45.788	47.707	49.687	51.734
753	53.852	56.037	58.285	60.600	62.988	65.445	67.971	70.561	73.210	75.917
754	78.680	81.501	84.381	87.319	90.315	93.371	96.493	99.683	102.946	106.284
755	109.698	113.185	116.747	120.387	124.103	127.894	131.756	135.684	139.675	143.728
756	147.842	152.014	156.240	160.522	164.858	169.249	173.695	178.198	182.758	187.381
757	192.065	196.808	201.614	206.478	211.399	216.378	221.413	226.504	231.655	236.867
758	242.137	247.464	252.846	258.282	263.773	269.320	274.925	280.588	286.311	292.091
759	297.928	303.821	309.773	315.783	321.850	327.977	334.164	340.409	346.713	353.076
760	359.498	365.978	372.516	379.113	385.770	392.490	399.277	406.138	413.080	420.117
761	427.261	434.515	441.881	449.370	456.984	464.715	472.563	480.524	488.598	496.788
762	505.096	513.529	522.089	530.777	539.586	548.521	557.581	566.768	576.085	585.529
763	595.100	604.803	614.649	624.628	634.733	644.965	655.321	665.798	676.396	687.119
764	697.961	708.919	719.996	731.191	742.506	753.948	765.514	777.202	789.010	800.939
765	812.990	825.161	837.449	849.857	862.388	875.045	887.827	900.731	913.756	926.896
766	940.145	953.504	966.975	980.556	994.249	1008.050	1021.957	1035.967	1050.079	1064.296
767	1078.616	1093.042	1107.579	1122.220	1136.962	1151.805	1166.757	1181.819	1196.991	1212.269
768	1227.652	1243.136	1258.721	1274.406	1290.189	1306.074	1322.058	1338.142	1354.326	1370.611
769	1386.996	1403.480	1420.065	1436.750	1453.534	1470.414	1487.390	1504.463	1521.634	1538.902
770	1556.267	1573.729	1591.293	1608.966	1626.750	1644.641	1662.636	1680.733	1698.932	1717.234
771	1735.643	1754.161	1772.789	1791.532	1810.395	1829.379	1848.485	1867.711	1887.055	1906.518
772	1926.100	1945.801	1965.624	1985.567	2005.632	2025.815	2046.119	2066.543	2087.084	2107.738
773	2128.504	2149.383	2170.379	2191.500	2212.751	2234.135	2255.639	2277.259	2298.994	2320.845
774	2342.812	2364.898	2387.106	2409.440	2431.902	2454.495	2477.216	2500.063	2523.036	2546.138
775	2569.372	2592.731	2616.209	2639.803	2663.513	2687.339	2711.281	2735.341	2759.520	2783.825
776	2808.254	2832.813	2857.506	2882.312	2907.228	2932.253	2957.388	2982.632	3007.985	3033.446
777	3059.015	3084.692	3110.478	3136.374	3162.381	3188.500	3214.731	3241.077	3267.540	3294.121
778	3320.821	3347.646	3374.594	3401.664	3428.858	3456.176	3483.618	3511.185	3538.877	3566.696
779	3594.643	3622.719	3650.925	3679.261	3707.732	3736.339	3765.084	3793.966	3822.987	3852.146
780	3881.440	3910.871	3940.442	3970.159	4000.020	4030.029	4060.354	4090.819	4121.421	4152.160
781	4183.039	4214.092	4245.267	4276.564	4307.982	4339.526	4371.221	4403.028	4434.946	4466.974
782	4499.117	4531.393	4563.776	4596.264	4628.858	4661.559	4694.391	4727.330	4760.376	4793.529
783	4826.793	4860.203	4893.733	4927.382	4961.151	4995.042	5029.081	5063.243	5097.528	5131.936
784	5166.469	5201.158	5235.976	5270.921	5305.995	5341.202	5376.606	5412.145	5447.818	5483.626
785	5519.571	5555.705	5591.977	5628.384	5664.929	5701.615	5738.505	5775.540	5812.719	5850.045
786	5887.520	5925.202	5963.037	6001.026	6039.169	6077.470	6116.008	6154.713	6193.586	6232.631
787	6271.849	6311.345	6351.014	6390.856	6430.870	6471.059	6511.530	6552.168	6592.976	6633.953
788	6675.100	6716.504	6758.067	6799.790	6841.675	6883.721	6926.025	6968.491	7011.121	7053.916
789	7096.876	7140.134	7183.563	7227.165	7270.941	7314.892	7359.151	7403.583	7448.189	7492.970
790	7537.926	7583.191	7628.628	7674.238	7720.020	7765.976	7812.212	7858.621	7905.202	7951.957
791	7998.885	8046.111	8093.511	8141.085	8188.833	8236.756	8284.951	8333.326	8381.882	8430.621
792	8479.542	8528.769	8578.183	8627.786	8677.579	8727.563	8777.863	8828.362	8879.060	8929.959
793	8981.059	9032.498	9084.140	9135.985	9188.033	9240.284	9292.848	9345.620	9398.600	9451.787
794	9505.181	9558.896	9612.820	9666.953	9721.296	9775.850	9830.729	9885.819	9941.121	9996.635
795	10052.364	10108.405	10164.665	10221.145	10277.845	10334.768	10392.026	10449.508	10507.214	10565.147
796	10623.307	10681.794	10740.511	10799.460	10858.643	10918.062	10977.821	11037.826	11098.078	11158.577
797	11219.324	11280.441	11341.808	11403.427	11465.299	11527.424	11589.939	11652.710	11715.739	11779.025
798	11842.570									

Table A- 3: Stilwell City Lake Area by 0.1 ft Increments.

Stilwell City Area Table Area in Acres by 0.1 ft Elevation Increments 2019 Survey Oklahoma Water Resources Board										
Elevation in Feet	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
902			0.0000	0.0000	0.0001	0.0014	0.0042	0.0113	0.0234	0.0383
903	0.0565	0.0792	0.1023	0.1205	0.1384	0.1573	0.1772	0.1999	0.2319	0.2703
904	0.3134	0.3619	0.4189	0.4938	0.5656	0.6410	0.7291	0.8303	0.9346	1.0550
905	1.2026	1.3680	1.5498	1.7237	1.9008	2.0911	2.2846	2.4960	2.7316	2.9669
906	3.2019	3.4624	3.7115	3.9616	4.2203	4.4803	4.7446	5.0146	5.2805	5.5564
907	5.8668	6.2183	6.5537	6.8481	7.1421	7.4274	7.6962	7.9493	8.1884	8.4170
908	8.6358	8.8559	9.0831	9.3161	9.5172	9.7011	9.8608	10.0159	10.1724	10.3298
909	10.4887	10.6504	10.8216	11.0039	11.1912	11.3762	11.5572	11.7381	11.9223	12.1095
910	12.3001	12.5022	12.7248	12.9640	13.2058	13.4403	13.6692	13.8922	14.1170	14.3415
911	14.5739	14.8093	15.0626	15.2958	15.5220	15.7640	16.0477	16.3086	16.5332	16.7479
912	16.9651	17.1973	17.4667	17.7766	18.0494	18.3057	18.5583	18.8103	19.0704	19.3332
913	19.5919	19.8672	20.1518	20.4378	20.7682	21.1477	21.5432	21.9348	22.3154	22.7194
914	23.1535	23.5828	24.0091	24.4403	24.9009	25.3384	25.7589	26.1798	26.5796	26.9702
915	27.3698	27.7655	28.1638	28.5729	28.9874	29.3862	29.7659	30.1355	30.5071	30.8869
916	31.2894	31.6668	32.0304	32.3848	32.7156	33.0461	33.3911	33.7545	34.1203	34.4888
917	34.8364	35.1793	35.5458	35.9222	36.2947	36.6678	37.0290	37.3821	37.7304	38.1040
918	38.4595	38.7998	39.1515	39.5033	39.8436	40.1842	40.5360	40.8786	41.1998	41.5169
919	41.8357	42.1553	42.4706	42.7830	43.1071	43.4353	43.7795	44.1091	44.4308	44.7430
920	45.0952	45.4728	45.8559	46.2531	46.6365	46.9977	47.3623	47.7220	48.0780	48.4317
921	48.7899	49.1513	49.5026	49.8497	50.2041	50.5768	50.9466	51.3162	51.6844	52.0556
922	52.4347	52.8085	53.1790	53.5415	53.9044	54.2606	54.6142	54.9656	55.3240	55.6793
923	56.0440	56.4232	56.8016	57.1608	57.5196	57.8805	58.2476	58.6146	58.9801	59.3500
924	59.7313	60.1183	60.5214	60.9386	61.3385	61.7239	62.1146	62.5005	62.9065	63.3202
925	63.7426	64.1513	64.5731	64.9948	65.4048	65.8193	66.2449	66.6554	67.0613	67.4639
926	67.8639	68.2511	68.6356	69.0210	69.4121	69.8182	70.2415	70.6756	71.0961	71.5166
927	71.9492	72.3788	72.8093	73.2287	73.6435	74.0552	74.4740	74.8846	75.2989	75.7101
928	76.1152	76.5226	76.9351	77.3393	77.7413	78.1359	78.5286	78.9292	79.3336	79.7586
929	80.2237	80.7193	81.2058	81.7051	82.2137	82.7111	83.1979	83.6682	84.1256	84.5822
930	85.0668	85.5738	86.0835	86.6034	87.1301	87.6485	88.1686	88.6893	89.2250	89.7790
931	90.3135	90.8362	91.3394	91.8345	92.3007	92.7692	93.2439	93.7137	94.1688	94.6207
932	95.0726	95.5253	95.9796	96.4329	96.8900	97.3467	97.8070	98.2765	98.7467	99.2284
933	99.7076	100.1941	100.6891	101.1875	101.6901	102.1994	102.7213	103.2473	103.7768	104.3051
934	104.8385	105.3949	105.9706	106.5628	107.1759	107.8195	108.4812	109.1390	109.7993	110.4590
935	111.1276	111.8116	112.5095	113.2054	113.9033	114.6412	115.3843	116.1281	116.8706	117.6033
936	118.2979	118.9847	119.6517	120.3084	120.9712	121.6310	122.2861	122.9449	123.5997	124.2528
937	124.9070	125.5428	126.1801	126.8632	127.4950	128.1357	128.7892	129.4283	130.0708	130.7178
938	131.3747	132.0369	132.7191	133.3959	134.0415	134.6815	135.3229	135.9596	136.5957	137.2330
939	137.8750	138.5256	139.1880	139.8664	140.5670	141.2765	142.0162	142.7700	143.5073	144.2516
940	145.0003	145.7578	146.5162	147.2751	148.0458	148.7998	149.5441	150.2822	151.0349	151.7881
941	152.5706	153.3872	154.1965	155.0172	155.8103	156.6097	157.4085	158.2184	159.0327	159.8537
942	160.6665	161.4239	162.1666	162.8951	163.6139	164.3219	165.0209	165.7067	166.3750	167.0319
943	167.6873	168.3398	168.9899	169.6444	170.3061	170.9825	171.6725	172.3732	173.0903	173.8084
944	174.4977	175.1959	175.9083	176.6372	177.3585	178.1000	178.8562	179.6019	180.3484	181.0940
945	181.8161	182.5224	183.2162	183.9088	184.5636	185.2146	185.8678	186.5025	187.1408	187.8030
946	188.4517	189.1237	189.7930	190.4558	191.1202	191.7856	192.4501	193.0611	193.6666	194.2747
947	194.8860	195.5014	196.1207	196.7440	197.3712	198.0023	198.6374	199.2765	199.9195	200.5664
948	201.2173	201.8722	202.5310	203.1937	203.8604	204.5310	205.2056	207.2693	207.7479	208.2280
949	208.7094	209.1922	209.6764	210.1620	210.6490	211.9548	212.6625	213.3708	214.0798	214.7893
950	215.8641	216.5673	217.2728	217.9805	218.6905	219.9050	220.6002	221.2959	221.9923	222.6893
951	223.7887	224.4701	225.1536	225.8392	226.5268	227.5236	228.2067	228.8913	229.5774	230.2648
952	231.4260	232.1389	232.8502	233.5601	234.2684	235.5317	236.2407	236.9537	237.6707	238.3916
953	239.3710	240.0940	240.8181	241.5432	242.2695	243.3930	244.1458	244.8996	245.6545	246.4103
954	247.4983	248.2666	249.0345	249.8018	250.5687	251.5606	252.2652	252.9730	253.6839	254.3980
955	255.4184	256.1311	256.8469	257.5657	258.2874	259.3135	260.0258	260.7404	261.4575	262.1769
956	263.0807	263.8251	264.5748	265.3298	266.0901	267.3031	268.1418	269.0006	269.8796	270.7787
957	272.0926	272.9612	273.8346	274.7128	275.5958	276.7986	277.6534	278.5084	279.3637	280.2193
958	281.3577	282.2426	283.1393	284.0480	284.9685	286.1465	287.0096	287.8689	288.7242	289.5757
959	290.6098	291.4301	292.2521	293.0758	293.9013	294.8939	295.6613	296.4279	297.1936	297.9584
960	299.0513	299.8237	300.5975	301.3728	302.1496	303.2363	304.0263	304.8169	305.6079	306.3995
961	307.4142	308.1669	308.9176	309.6663	310.4130	311.4801	312.3145	313.1652	314.0323	314.9158
962	316.0325	316.7775	317.5221	318.2663	319.0101	319.8867	320.6558	321.4261	322.1975	322.9702
963	323.9378	324.7134	325.4869	326.2582	327.0272	327.9448	328.7047	329.4666	330.2303	330.9960
964	332.1245	332.9081	333.6925	334.4779	335.2640	336.2829	337.0672	337.8513	338.6352	339.4189
965	340.4383	341.2190	341.9979	342.7750	343.5502	344.6298	345.4060	346.1800	346.9517	347.7211
966	348.6870	349.4250	350.1614	350.8962	351.6293	352.4698	353.2064	353.9467	354.6907	355.4386
967	356.3605	357.1126	357.8663	358.6215	359.3783	360.3385	361.1543	361.9824	362.8226	363.6749
968	364.8937	365.7352	366.5815	367.4325	368.2883	369.2091	369.8419	370.4740	371.1054	371.7360
969	372.3658	372.9950	373.1130							

Table A- 4: Stilwell City Lake Capacity by 0.1 ft Increments.

Stilwell City Capacity Table Volume in Acre-Feet by 0.1 ft Elevation Increments 2019 Survey Oklahoma Water Resources Board										
Elevation in Feet	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
902			0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.003
903	0.006	0.011	0.017	0.026	0.038	0.050	0.065	0.082	0.101	0.122
904	0.147	0.177	0.210	0.249	0.295	0.348	0.408	0.476	0.554	0.643
905	0.742	0.855	0.983	1.129	1.293	1.474	1.674	1.892	2.131	2.392
906	2.677	2.985	3.319	3.678	4.062	4.471	4.906	5.367	5.855	6.370
907	6.911	7.482	8.086	8.726	9.396	10.095	10.824	11.580	12.363	13.170
908	14.000	14.853	15.727	16.624	17.544	18.486	19.447	20.425	21.419	22.429
909	23.454	24.495	25.551	26.625	27.716	28.826	29.954	31.101	32.266	33.449
910	34.650	35.871	37.111	38.372	39.656	40.965	42.297	43.653	45.031	46.431
911	47.854	49.300	50.769	52.263	53.781	55.321	56.885	58.476	60.094	61.736
912	63.400	65.086	66.794	68.527	70.289	72.080	73.898	75.741	77.610	79.504
913	81.424	83.370	85.343	87.344	89.373	91.433	93.528	95.663	97.837	100.049
914	102.301	104.595	106.932	109.311	111.734	114.201	116.713	119.268	121.865	124.503
915	127.180	129.897	132.654	135.450	138.287	141.165	144.084	147.042	150.037	153.069
916	156.139	159.247	162.395	165.580	168.801	172.057	175.345	178.666	182.024	185.417
917	188.848	192.314	195.815	199.351	202.924	206.535	210.183	213.868	217.589	221.344
918	225.136	228.964	232.827	236.724	240.657	244.625	248.626	252.662	256.733	260.837
919	264.973	269.140	273.340	277.571	281.834	286.129	290.456	294.817	299.211	303.638
920	308.097	312.588	317.117	321.683	326.289	330.933	335.615	340.333	345.087	349.877
921	354.703	359.564	364.461	369.394	374.361	379.364	384.403	389.479	394.592	399.742
922	404.929	410.154	415.416	420.716	426.052	431.424	436.832	442.276	447.755	453.269
923	458.819	464.405	470.029	475.690	481.388	487.122	492.892	498.699	504.542	510.422
924	516.338	522.292	528.285	534.316	540.389	546.503	552.657	558.848	565.079	571.349
925	577.661	584.014	590.408	596.844	603.323	609.843	616.404	623.007	629.652	636.338
926	643.065	649.831	656.637	663.481	670.364	677.286	684.247	691.250	698.296	705.384
927	712.515	719.688	726.905	734.164	741.466	748.810	756.195	763.621	771.089	778.598
928	786.149	793.740	801.372	809.045	816.758	824.513	832.306	840.140	848.012	855.925
929	863.880	871.878	879.926	888.022	896.167	904.363	912.609	920.905	929.248	937.638
930	946.073	954.555	963.087	971.670	980.304	988.991	997.730	1006.521	1015.364	1024.259
931	1033.209	1042.214	1051.272	1060.381	1069.540	1078.747	1088.000	1097.301	1106.649	1116.043
932	1125.482	1134.967	1144.497	1154.072	1163.693	1173.359	1183.071	1192.828	1202.632	1212.483
933	1222.382	1232.329	1242.324	1252.368	1262.462	1272.606	1282.800	1293.046	1303.345	1313.696
934	1324.100	1334.557	1345.068	1355.636	1366.263	1376.950	1387.699	1398.514	1409.395	1420.342
935	1431.355	1442.435	1453.581	1464.797	1476.083	1487.438	1498.865	1510.366	1521.942	1533.592
936	1545.316	1557.111	1568.975	1580.908	1592.905	1604.969	1617.100	1629.295	1641.557	1653.884
937	1666.277	1678.735	1691.258	1703.844	1716.497	1729.214	1741.996	1754.842	1767.753	1780.728
938	1793.767	1806.872	1820.042	1833.280	1846.586	1859.958	1873.394	1886.894	1900.458	1914.086
939	1927.777	1941.533	1955.353	1969.238	1983.191	1997.212	2011.304	2025.468	2039.708	2054.022
940	2068.410	2082.872	2097.410	2112.024	2126.714	2141.479	2156.322	2171.239	2186.230	2201.296
941	2216.437	2231.655	2246.953	2262.331	2277.793	2293.334	2308.955	2324.656	2340.437	2356.300
942	2372.244	2388.270	2404.375	2420.555	2436.808	2453.134	2469.530	2485.998	2502.534	2519.138
943	2535.809	2552.545	2569.346	2586.213	2603.144	2620.142	2637.206	2654.339	2671.541	2688.814
944	2706.159	2723.574	2741.059	2758.613	2776.241	2793.941	2811.713	2829.561	2847.484	2865.481
945	2883.554	2901.699	2919.916	2938.203	2956.560	2974.983	2993.472	3012.027	3030.645	3049.327
946	3068.074	3086.887	3105.766	3124.712	3143.724	3162.803	3181.948	3201.160	3220.436	3239.772
947	3259.169	3278.627	3298.146	3317.728	3337.371	3357.076	3376.845	3396.677	3416.573	3436.533
948	3456.557	3476.646	3496.800	3517.020	3537.307	3557.659	3578.079	3598.566	3619.269	3640.020
949	3660.818	3681.665	3702.560	3723.504	3744.496	3765.536	3786.696	3807.927	3829.229	3850.601
950	3872.045	3893.596	3915.218	3936.910	3958.672	3980.506	4002.462	4024.487	4046.582	4068.746
951	4090.980	4113.325	4135.738	4158.219	4180.769	4203.387	4226.105	4248.892	4271.747	4294.670
952	4317.662	4340.769	4363.947	4387.197	4410.517	4433.909	4457.427	4481.015	4504.675	4528.406
953	4552.209	4576.110	4600.083	4624.129	4648.247	4672.438	4696.739	4721.116	4745.569	4770.096
954	4794.700	4819.411	4844.199	4869.064	4894.006	4919.025	4944.146	4969.337	4994.599	5019.931
955	5045.336	5070.842	5096.419	5122.068	5147.789	5173.581	5199.477	5225.444	5251.483	5277.592
956	5303.774	5330.045	5356.390	5382.810	5409.306	5435.876	5462.566	5489.338	5516.195	5543.139
957	5570.171	5597.337	5624.590	5651.930	5679.357	5706.872	5734.510	5762.232	5790.040	5817.934
958	5845.913	5874.005	5902.185	5930.454	5958.813	5987.264	6015.835	6044.493	6073.237	6102.067
959	6130.982	6160.002	6189.104	6218.288	6247.554	6276.903	6306.354	6335.882	6365.486	6395.167
960	6424.925	6454.792	6484.735	6514.756	6544.855	6575.031	6605.315	6635.678	6666.120	6696.642
961	6727.242	6757.946	6788.725	6819.579	6850.508	6881.512	6912.619	6943.809	6975.083	7006.442
962	7037.890	7069.456	7101.096	7132.811	7164.601	7196.464	7228.415	7260.442	7292.546	7324.727
963	7356.985	7389.340	7421.773	7454.283	7486.870	7519.534	7552.291	7585.123	7618.032	7651.017
964	7684.078	7717.251	7750.503	7783.833	7817.242	7850.729	7884.318	7917.985	7951.731	7985.556
965	8019.458	8053.463	8087.546	8121.707	8155.945	8190.262	8224.686	8259.187	8293.767	8328.423
966	8363.157	8397.989	8432.894	8467.874	8502.927	8538.053	8573.263	8608.547	8643.905	8679.337
967	8714.843	8750.441	8786.115	8821.864	8857.688	8893.588	8929.582	8965.656	9001.813	9038.053
968	9074.378	9110.826	9147.357	9183.973	9220.673	9257.459	9294.349	9331.301	9368.317	9405.396
969	9442.538	9479.743	9517.011							

Table A- 5: Lake Wayne Wallace Area by 0.1 ft Increments.

Wayne Wallace Area Table Area in Acres by 0.1 ft Elevation Increments 2019 Survey Oklahoma Water Resources Board										
Elevation in Feet	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
744		0.0000	0.0000	0.0004	0.0024	0.0055	0.0096	0.0145	0.0204	0.0274
745	0.0358	0.0459	0.0570	0.0693	0.0827	0.0982	0.1140	0.1283	0.1439	0.1604
746	0.1768	0.1929	0.2090	0.2250	0.2409	0.2576	0.2747	0.2924	0.3106	0.3301
747	0.3507	0.3725	0.3966	0.4248	0.4550	0.4849	0.5256	0.5777	0.6347	0.6900
748	0.7435	0.7932	0.8416	0.8921	0.9451	1.0000	1.0441	1.0849	1.1260	1.1657
749	1.2048	1.2439	1.2841	1.3267	1.3731	1.4206	1.4628	1.5033	1.5426	1.5837
750	1.6297	1.6779	1.7210	1.7619	1.8004	1.8387	1.8784	1.9200	1.9641	2.0112
751	2.0624	2.1164	2.1733	2.2339	2.2999	2.3730	2.4610	2.5690	2.6953	2.8221
752	2.9078	2.9829	3.0487	3.1138	3.1801	3.2512	3.3201	3.3890	3.4585	3.5285
753	3.6007	3.6750	3.7480	3.8222	3.8989	3.9790	4.0656	4.1522	4.2337	4.3129
754	4.3906	4.4683	4.5461	4.6234	4.7001	4.7778	4.8568	4.9409	5.0297	5.1334
755	5.2374	5.3455	5.4799	5.6146	5.7475	5.9031	6.0675	6.2230	6.3674	6.4984
756	6.6284	6.7581	6.8922	7.0305	7.1788	7.3310	7.4842	7.6389	7.8030	7.9610
757	8.1173	8.2750	8.4429	8.6148	8.7945	8.9828	9.1683	9.3602	9.5634	9.7775
758	9.9970	10.2047	10.4058	10.6073	10.8148	11.0403	11.2565	11.4884	11.7268	11.9452
759	12.1515	12.3519	12.5468	12.7426	12.9496	13.1500	13.3366	13.5200	13.7045	13.8857
760	14.0667	14.2490	14.4383	14.6170	14.7927	14.9644	15.1370	15.3159	15.4994	15.6836
761	15.8659	16.0425	16.2158	16.3789	16.5375	16.6972	16.8565	17.0158	17.1799	17.3507
762	17.5182	17.6787	17.8362	17.9921	18.1496	18.3090	18.4709	18.6281	18.7809	18.9325
763	19.0838	19.2399	19.4039	19.5754	19.7463	19.9158	20.0875	20.2727	20.4539	20.6433
764	20.8580	21.0618	21.2640	21.4684	21.6599	21.8473	22.0551	22.2638	22.5309	22.8526
765	23.1474	23.4074	23.6731	23.9317	24.1989	24.4940	24.7977	25.0764	25.3311	25.5806
766	25.8161	26.0668	26.3275	26.5890	26.8290	27.0591	27.2990	27.5374	27.7626	27.9745
767	28.1783	28.3645	28.5400	28.7136	28.8933	29.0923	29.2886	29.4837	29.6632	29.8345
768	30.0024	30.1710	30.3450	30.5294	30.7195	30.9042	31.0844	31.2653	31.4492	31.6260
769	31.8055	31.9823	32.1622	32.3511	32.5536	32.7539	32.9511	33.1499	33.3323	33.5110
770	33.6933	33.8773	34.0568	34.2395	34.4270	34.6195	34.8032	34.9874	35.1693	35.3484
771	35.5198	35.6897	35.8584	36.0295	36.2006	36.3698	36.5349	36.6988	36.8631	37.0275
772	37.1920	37.3553	37.5176	37.6735	37.8244	37.9747	38.1240	38.2744	38.4259	38.5790
773	38.7344	38.8970	39.0644	39.2303	39.3937	39.5589	39.7243	39.8901	40.0539	40.2163
774	40.3781	40.5402	40.7025	40.8674	41.0366	41.2122	41.3928	41.5731	41.7500	41.9207
775	42.0931	42.2673	42.4425	42.6196	42.7985	42.9807	43.1663	43.3510	43.5361	43.7205
776	43.9024	44.0855	44.2714	44.4549	44.6382	44.8212	45.0055	45.1918	45.3879	45.5951
777	45.8044	46.0204	46.2335	46.4532	46.6764	46.9014	47.1251	47.3483	47.5718	47.8043
778	48.0411	48.2892	48.5618	48.8931	49.1868	49.4865	49.7783	50.0678	50.3603	50.6442
779	50.9298	51.2114	51.4857	51.7668	52.0479	52.3335	52.6237	52.9087	53.1837	53.4397
780	53.6929	53.9400	54.1844	54.4278	54.6788	54.9359	55.1884	55.4333	55.6743	55.9096
781	56.1441	56.3763	56.6062	56.8325	57.0589	57.2898	57.5476	57.7842	58.0219	58.2581
782	58.4977	58.7479	59.0063	59.2652	59.5208	59.7766	60.0313	60.2858	60.5398	60.7929
783	61.0485	61.3118	61.5777	61.8507	62.1333	62.4440	62.7639	63.0670	63.3687	63.6938
784	63.9918	64.2722	64.5473	64.8233	65.1128	65.3947	65.6856	65.9692	66.2454	66.5194
785	66.7933	67.0610	67.3311	67.5913	67.8461	68.1008	68.3566	68.6159	68.8813	69.1639
786	69.4529	69.7425	70.0304	70.3206	70.6145	70.9120	71.2176	71.5291	71.8416	72.1572
787	72.4739	72.8006	73.1387	73.4801	73.8256	74.1812	74.5434	74.9053	75.2702	75.6394
788	76.0167	76.4067	76.8034	77.2003	77.6108	78.0048	78.3782	78.7433	79.1037	79.4560
789	79.8073	80.1443	80.4900	80.8264	81.1617	81.4988	81.8336	82.1620	82.4833	82.8025
790	83.1212	83.4400	83.7631	84.0866	84.4055	84.7291	85.0519	85.3720	85.6843	85.9926
791	86.2938	86.5869	86.8811	87.1765	87.4730	87.7707	88.0695	88.3696	88.6707	88.9731
792	89.2766	89.5812	89.8870	90.1940	90.5022	90.8115	91.1219	91.4336	91.7464	92.0603
793	92.3754	92.6917	93.0092	93.3278	93.6475	96.0763	96.4363	96.7965	97.1569	97.5175
794	97.9316	98.2604	98.5884	98.9156	99.2420	99.5918	99.9077	100.2246	100.5426	100.8618
795	101.2712	101.6015	101.9320	102.2626	102.5934	103.0303	103.3614	103.6933	104.0261	104.3599
796	104.8207	105.1571	105.4948	105.8337	106.1738	106.6141	106.9521	107.2894	107.6259	107.9617
797	108.4036	108.7503	109.0966	109.4427	109.7884	110.2321	110.5743	110.9163	111.2581	111.5996
798	112.0586	112.4025	112.7425	113.0788	113.4113	113.8662	114.2058	114.5437	114.8801	115.2148
799	115.6812	116.0183	116.3571	116.6974	117.0394	117.5333	117.8659	118.1970	118.5264	118.8542
800	119.3365	119.6715	120.0050	120.3370	120.6676	121.1218	121.4347	121.7463	122.0565	122.3654
801	122.8372	123.1399	123.4425	123.7451	124.0476	124.4683	124.7867	125.1054	125.4242	125.7434
802	126.2089	126.5354	126.8626	127.1906	127.5194	127.9800	128.3151	128.6503	128.9858	129.3214
803	129.7714	130.1244	130.4795	130.8367	131.1961	131.7826	132.1624	132.5435	132.9258	133.3093
804	133.8909	134.2888	134.6849	135.0793	135.4719	136.0846	136.4875	136.8906	137.2937	137.6968
805	138.2934	138.7238	139.1524	139.5791	140.0040	140.6615	141.0579	141.4544	141.8513	142.2485
806	142.7765	143.1984	143.6233	144.0513	144.4823	145.1310	145.5528	145.9740	146.3948	146.8150
807	147.3182	147.7435	148.1708	148.6001	149.0313	149.6958	150.1430	150.5903	151.0378	151.4855
808	152.3826	152.8802	153.3800	153.8820	154.3863	155.0129	155.4781	155.9445	156.4121	156.8811
809	157.5915	158.0747	158.5584	159.0427	159.5276	160.2111	160.6692	161.1268	161.5836	162.0397
810	162.5936	163.0446	163.4941	163.9421	164.3885	164.9678	165.4199	165.8738	166.3294	166.7869
811	167.3465	167.8021	168.2579	168.7139	169.1701	169.8011	170.2668	170.7341	171.2029	171.6735
812	172.2439	172.7056	173.1694	173.6350	174.1027	174.7388	175.1933	175.6461	176.0973	176.5468
813	177.0808	177.5372	177.9954	178.4553	178.9171	179.5232	179.9846	180.4484	180.9149	181.3838
814	181.9697	182.4577	182.9479	183.4403	183.9349	184.5681	185.0770	185.5892	186.1047	186.6235
815	187.2916	187.8412	188.3914	188.9422	189.4936	190.1941	190.7324	191.2743	191.8196	192.3685
816	193.2049	193.7242	194.2448	194.7668	195.2902	195.8761	196.3847	196.8977	197.4152	197.9371
817	198.6213	199.1492	199.6784	200.2090	200.7410	201.3613	201.8969	202.4366	202.9804	203.5282
818	204.1840	204.7137	205.2463	205.7819	206.3204	206.9596	207.5055	208.0565	208.6125	209.1735
819	209.8630	210.4296	210.9985	211.5697	212.1431	212.9856	213.5571	214.1312	214.7079	215.2873
820	216.0434	216.6456	217.2546	217.8704	218.4930	219.3097	219.9364	220.5694	221.2088	221.8545
821	222.7797	223.4194	224.0634	224.7117	225.3644	226.2866	226.9277	227.5760	228.2314	228.8939
822	229.8559	230.5020	231.1534	231.8100	232.4718	233.3752	234.0104	234.6508	235.2963	235.9470
823	236.8395	237.4807	238.1261	238.7759	239.4301	240.3393	241.0022	241.6737	242.3538	243.0425
824	243.9551	244.6384	245.3300	246.0296	246.7375	247.7247	248.4327	249.1424	249.8540	250.5675
825	251.4662	252.1614	252.8605	253.5637	254.2709	255.2908	256.0201	256.7520	257.4864	258.2235
826	261.8869									

Table A- 6: Lake Wayne Wallace Capacity by 0.1 ft Increments.

Wayne Wallace Capacity Table Volume in Acre-Feet by 0.1 ft Elevation Increments 2019 Survey Oklahoma Water Resources Board										
Elevation in Feet	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
744		0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.002	0.004
745	0.007	0.010	0.014	0.019	0.025	0.033	0.042	0.052	0.065	0.078
746	0.093	0.110	0.129	0.149	0.171	0.194	0.219	0.245	0.274	0.304
747	0.336	0.370	0.406	0.445	0.486	0.530	0.577	0.627	0.682	0.743
748	0.809	0.881	0.957	1.039	1.126	1.218	1.315	1.417	1.524	1.634
749	1.749	1.867	1.990	2.116	2.247	2.382	2.521	2.666	2.814	2.966
750	3.123	3.283	3.449	3.619	3.793	3.971	4.153	4.339	4.529	4.723
751	4.921	5.125	5.334	5.548	5.769	5.995	6.229	6.471	6.722	6.985
752	7.261	7.547	7.842	8.144	8.452	8.767	9.088	9.417	9.752	10.095
753	10.444	10.800	11.164	11.535	11.914	12.300	12.694	13.096	13.507	13.926
754	14.353	14.789	15.232	15.682	16.141	16.607	17.081	17.562	18.052	18.551
755	19.059	19.577	20.106	20.647	21.202	21.770	22.352	22.951	23.565	24.195
756	24.838	25.495	26.164	26.847	27.543	28.253	28.978	29.719	30.475	31.247
757	32.036	32.840	33.659	34.495	35.348	36.218	37.107	38.015	38.941	39.887
758	40.854	41.843	42.853	43.883	44.934	46.005	47.098	48.212	49.349	50.511
759	51.694	52.899	54.124	55.369	56.634	57.918	59.223	60.548	61.890	63.252
760	64.631	66.029	67.444	68.879	70.332	71.802	73.290	74.795	76.318	77.859
761	79.418	80.995	82.591	84.204	85.833	87.479	89.141	90.819	92.512	94.222
762	95.948	97.692	99.452	101.228	103.019	104.826	106.649	108.488	110.343	112.213
763	114.099	116.000	117.916	119.848	121.797	123.763	125.746	127.746	129.764	131.801
764	133.855	135.930	138.026	140.143	142.279	144.436	146.611	148.806	151.022	153.261
765	155.530	157.830	160.158	162.512	164.893	167.299	169.733	172.198	174.692	177.212
766	179.758	182.328	184.922	187.541	190.188	192.859	195.553	198.271	201.013	203.778
767	206.565	209.372	212.200	215.045	217.908	220.788	223.687	226.606	229.545	232.502
768	235.477	238.469	241.477	244.503	247.547	250.609	253.691	256.790	259.907	263.043
769	266.197	269.369	272.558	275.765	278.991	282.236	285.501	288.787	292.092	295.416
770	298.758	302.118	305.497	308.893	312.308	315.742	319.194	322.665	326.155	329.662
771	333.188	336.732	340.292	343.870	347.464	351.076	354.704	358.349	362.011	365.689
772	369.384	373.095	376.822	380.566	384.325	388.100	391.890	395.695	399.515	403.350
773	407.200	411.066	414.947	418.846	422.760	426.692	430.639	434.603	438.584	442.581
774	446.595	450.624	454.670	458.733	462.811	466.906	471.018	475.149	479.297	483.463
775	487.647	491.847	496.066	500.301	504.554	508.825	513.114	517.421	521.747	526.091
776	530.454	534.835	539.235	543.653	548.089	552.544	557.017	561.508	566.018	570.547
777	575.096	579.666	584.257	588.870	593.504	598.160	602.839	607.540	612.264	617.010
778	621.779	626.571	631.388	636.230	641.103	646.007	650.941	655.904	660.896	665.918
779	670.968	676.047	681.154	686.289	691.451	696.642	701.861	707.109	712.385	717.690
780	723.021	728.378	733.760	739.166	744.597	750.052	755.532	761.039	766.570	772.125
781	777.705	783.307	788.933	794.582	800.254	805.949	811.666	817.408	823.175	828.965
782	834.779	840.617	846.479	852.367	858.280	864.219	870.184	876.175	882.191	888.232
783	894.298	900.391	906.508	912.653	918.824	925.023	931.252	937.512	943.804	950.126
784	956.479	962.863	969.277	975.718	982.186	988.683	995.208	1001.762	1008.345	1014.956
785	1021.594	1028.260	1034.952	1041.672	1048.418	1055.190	1061.987	1068.810	1075.659	1082.534
786	1089.436	1096.367	1103.326	1110.315	1117.333	1124.379	1131.456	1138.562	1145.699	1152.868
787	1160.068	1167.299	1174.563	1181.860	1189.191	1196.556	1203.956	1211.392	1218.865	1226.374
788	1233.919	1241.502	1249.123	1256.783	1264.483	1272.224	1280.005	1287.824	1295.680	1303.573
789	1311.501	1319.464	1327.462	1335.493	1343.559	1351.659	1359.791	1367.958	1376.158	1384.390
790	1392.655	1400.951	1409.279	1417.639	1426.031	1434.456	1442.913	1451.402	1459.923	1468.476
791	1477.060	1485.674	1494.318	1502.992	1511.694	1520.427	1529.189	1537.981	1546.803	1555.655
792	1564.537	1573.450	1582.393	1591.366	1600.370	1609.405	1618.470	1627.567	1636.695	1645.854
793	1655.044	1664.266	1673.519	1682.804	1692.121	1701.470	1711.060	1720.685	1730.347	1740.045
794	1749.778	1759.555	1769.365	1779.207	1789.082	1798.990	1808.934	1818.908	1828.915	1838.953
795	1849.024	1859.134	1869.278	1879.455	1889.664	1899.907	1910.194	1920.513	1930.866	1941.252
796	1951.671	1962.136	1972.635	1983.168	1993.734	2004.335	2014.979	2025.658	2036.370	2047.115
797	2057.895	2068.718	2079.575	2090.468	2101.395	2112.356	2123.362	2134.403	2145.477	2156.586
798	2167.729	2178.917	2190.140	2201.398	2212.689	2224.013	2235.383	2246.787	2258.224	2269.695
799	2281.200	2292.751	2304.336	2315.955	2327.608	2339.295	2351.031	2362.801	2374.604	2386.441
800	2398.310	2410.226	2422.177	2434.161	2446.178	2458.228	2470.325	2482.452	2494.611	2506.802
801	2519.023	2531.291	2543.590	2555.919	2568.279	2580.668	2593.099	2605.562	2618.057	2630.583
802	2643.141	2655.746	2668.383	2681.053	2693.756	2706.491	2719.273	2732.087	2744.936	2757.817
803	2770.733	2783.692	2796.687	2809.717	2822.783	2835.885	2849.044	2862.241	2875.476	2888.750
804	2902.062	2915.431	2928.840	2942.288	2955.777	2969.304	2982.893	2996.521	3010.190	3023.899
805	3037.649	3051.457	3065.307	3079.201	3093.138	3107.117	3121.163	3135.249	3149.375	3163.540
806	3177.745	3192.002	3206.301	3220.642	3235.025	3249.452	3263.944	3278.478	3293.055	3307.673
807	3322.334	3337.044	3351.797	3366.593	3381.431	3396.313	3411.260	3426.252	3441.289	3456.370
808	3471.496	3486.710	3501.973	3517.286	3532.649	3548.062	3563.541	3579.065	3594.636	3610.254
809	3625.919	3641.654	3657.437	3673.269	3689.149	3705.077	3721.075	3737.119	3753.209	3769.345
810	3785.526	3801.763	3818.045	3834.372	3850.743	3867.160	3883.634	3900.153	3916.718	3933.328
811	3949.984	3966.696	3983.453	4000.256	4017.105	4033.999	4050.956	4067.959	4085.010	4102.106
812	4119.250	4136.452	4153.699	4170.993	4188.333	4205.720	4223.171	4240.667	4258.209	4275.797
813	4293.429	4311.114	4328.845	4346.622	4364.444	4382.313	4400.242	4418.218	4436.239	4454.307
814	4472.422	4490.595	4508.816	4527.087	4545.406	4563.775	4582.206	4600.688	4619.222	4637.806
815	4656.443	4675.144	4693.901	4712.713	4731.579	4750.501	4769.494	4788.540	4807.640	4826.795
816	4846.004	4865.299	4884.645	4904.044	4923.494	4942.997	4962.560	4982.173	5001.837	5021.552
817	5041.320	5061.156	5081.044	5100.986	5120.980	5141.027	5161.137	5181.300	5201.517	5221.787
818	5242.113	5262.505	5282.950	5303.448	5323.999	5344.604	5365.273	5385.996	5406.774	5427.608
819	5448.497	5469.455	5490.470	5511.541	5532.669	5553.855	5575.125	5596.452	5617.837	5639.278
820	5660.778	5682.353	5703.987	5725.682	5747.438	5769.256	5791.156	5813.119	5835.144	5857.233
821	5879.386	5901.632	5923.942	5946.316	5968.755	5991.258	6013.855	6036.516	6059.241	6082.031
822	6104.888	6127.841	6150.859	6173.942	6197.090	6220.304	6243.610	6266.979	6290.412	6313.909
823	6337.471	6361.124	6384.840	6408.620	6432.465	6456.375	6480.376	6504.443	6528.577	6552.778
824	6577.048	6601.410	6625.839	6650.338	6674.906	6699.544	6724.281	6749.089	6773.968	6798.917
825	6823.939	6849.051	6874.232	6899.483	6924.804	6950.196	6975.689	7001.254	7026.893	7052.605
826	7078.390									

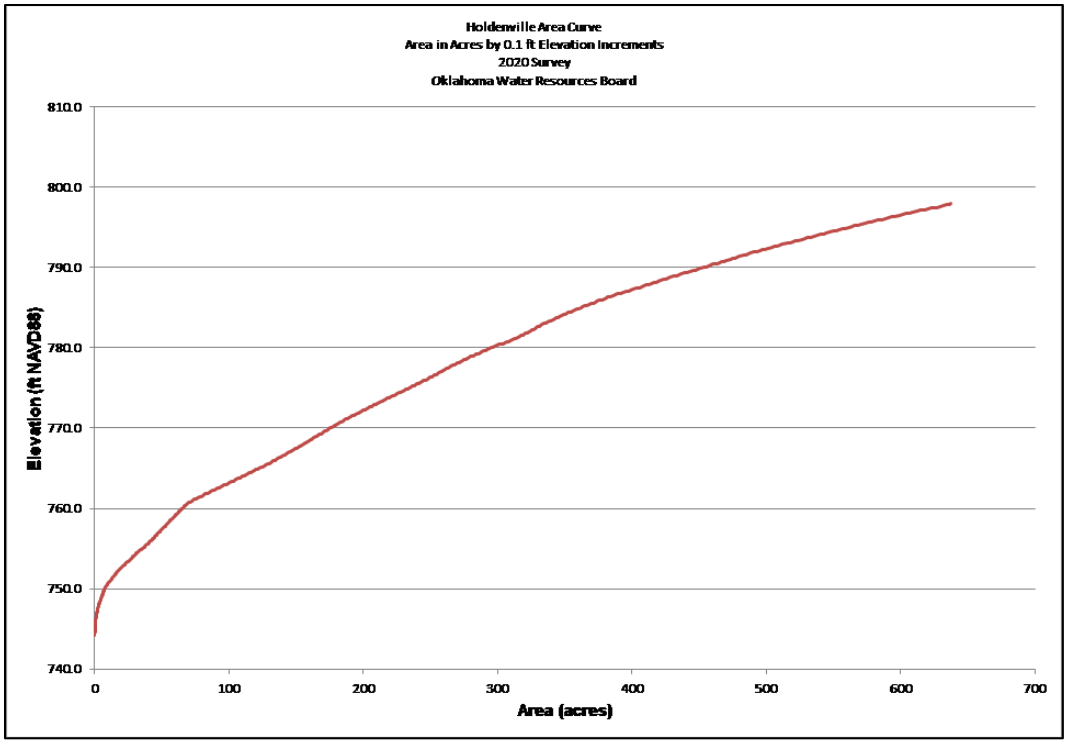

Figure A- 1: Area Curve for Holdenville Lake.

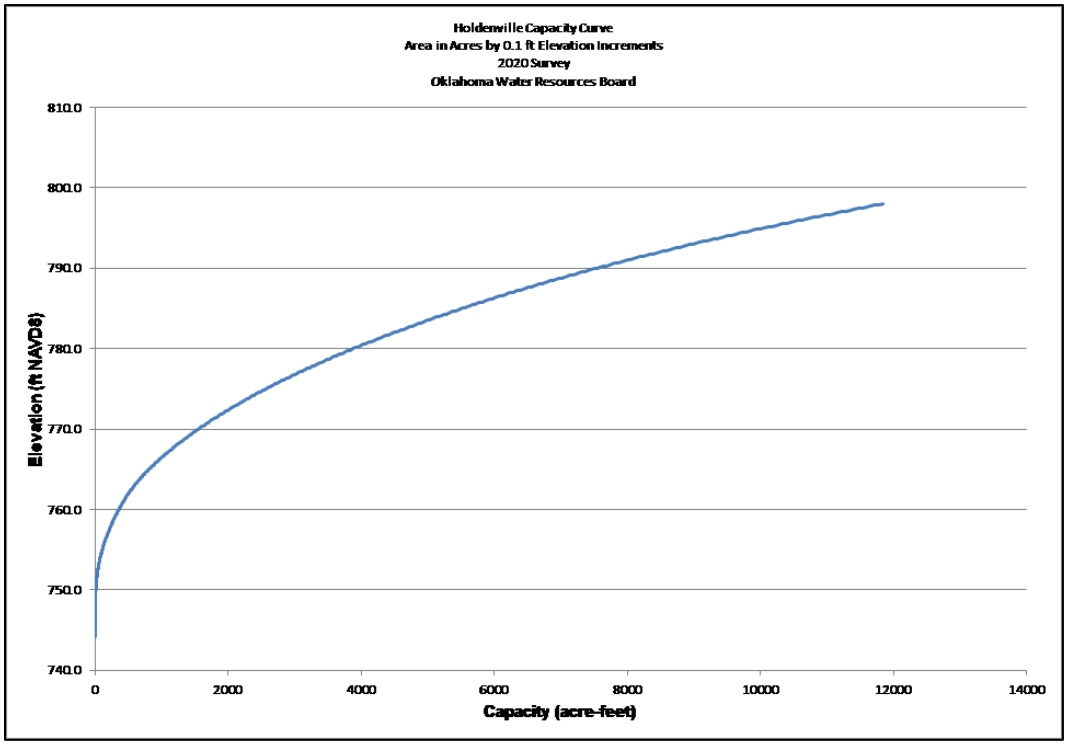

Figure A- 2: Cumulative Capacity Curve for Holdenville Lake.

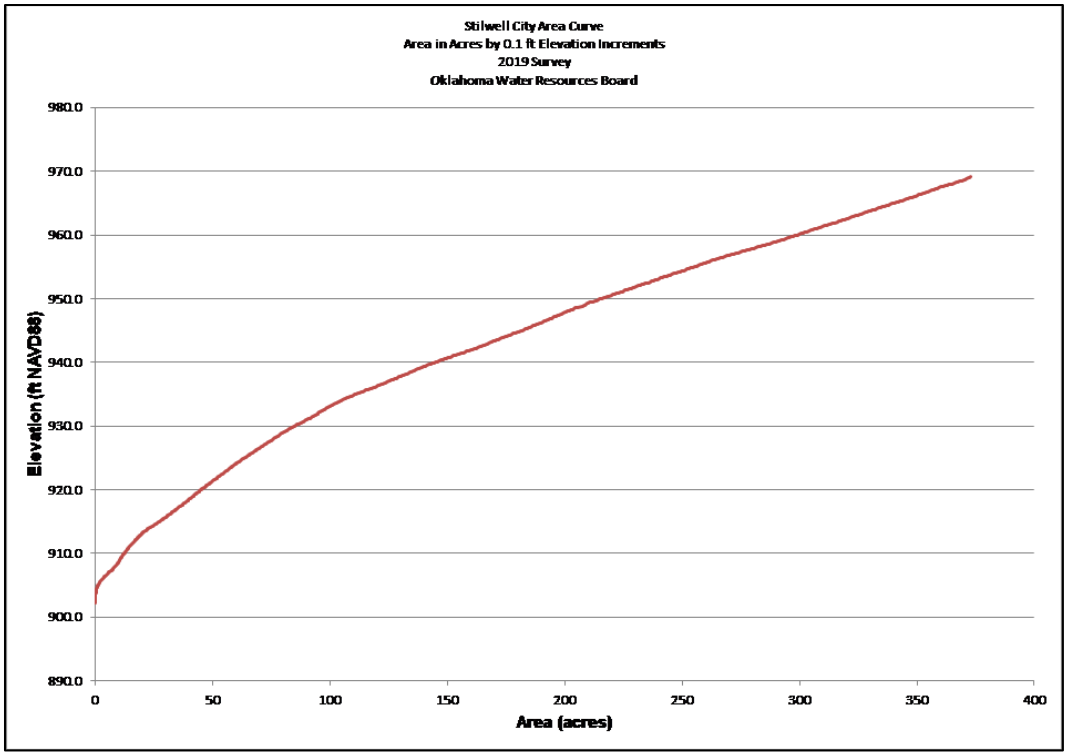

Figure A- 3: Area Curve for Stilwell City Lake.

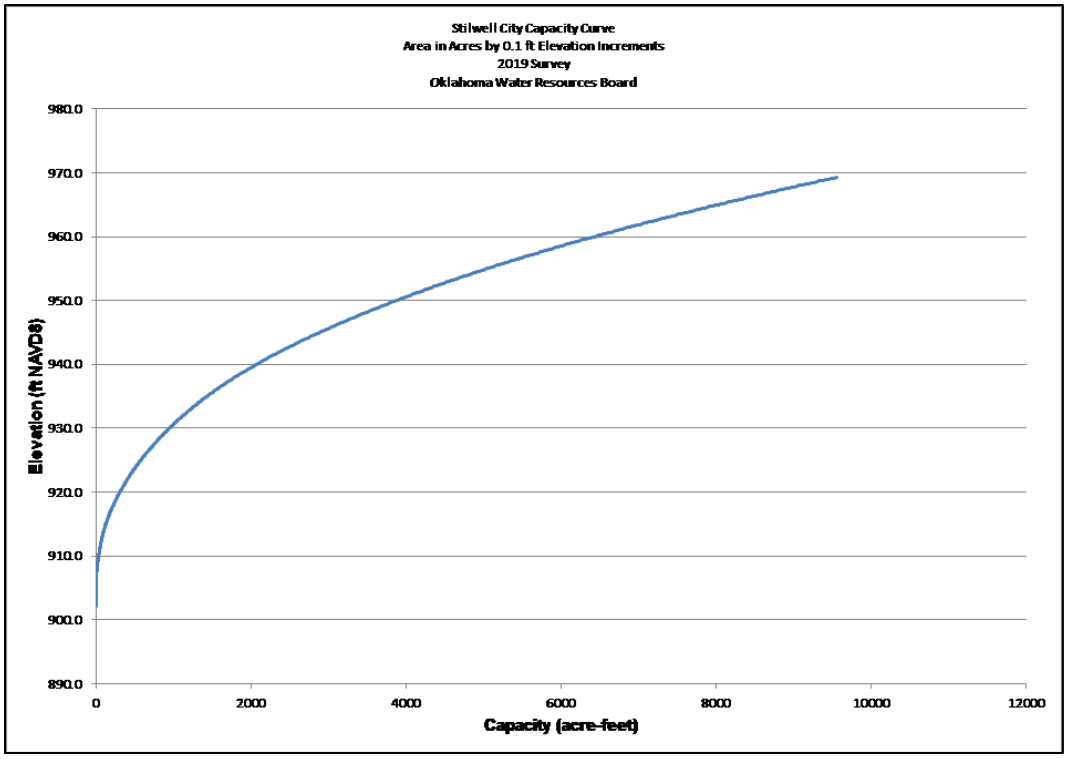

Figure A- 4: Cumulative Capacity Curve for Stilwell City Lake.

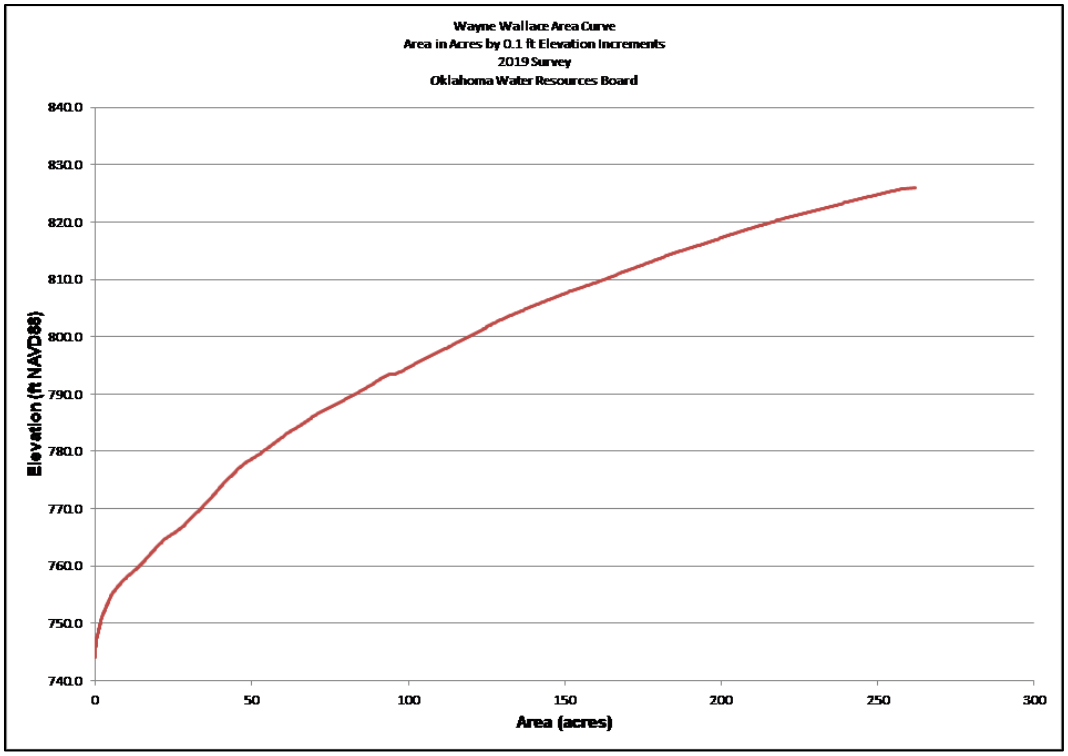

Figure A- 5: Area Curve for Lake Wayne Wallace.

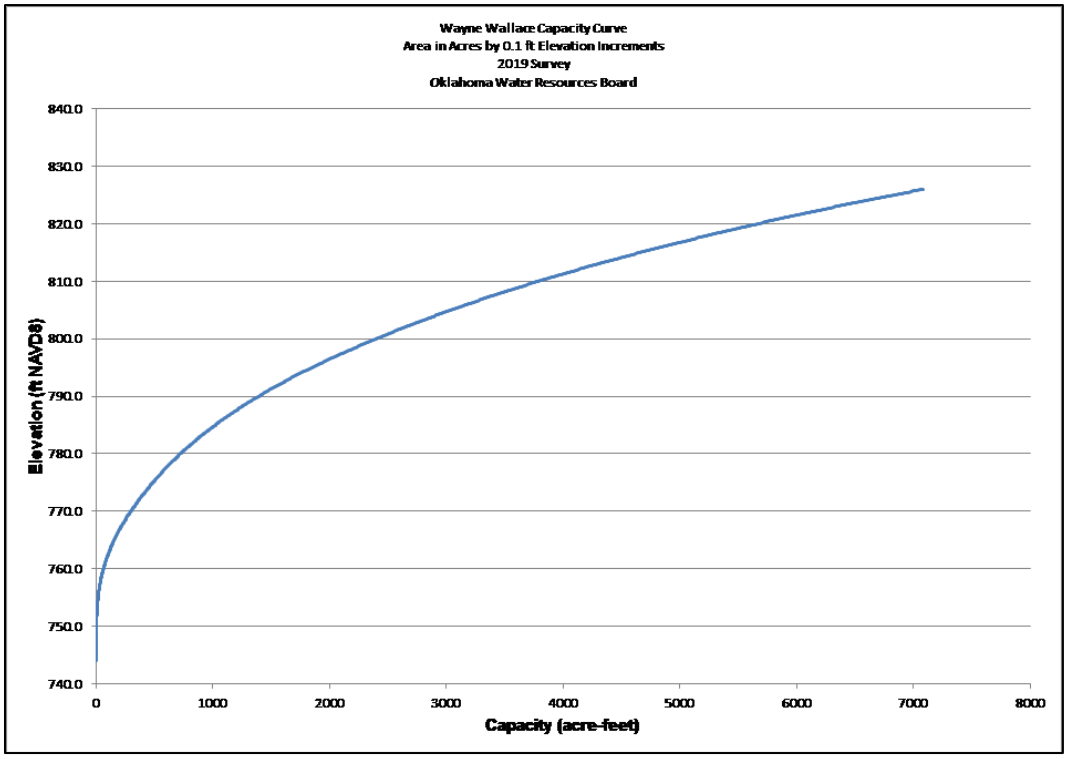

Figure A- 6: Cumulative Capacity Curve for Lake Wayne Wallace

APPENDIX B: Holdenville Lake Maps

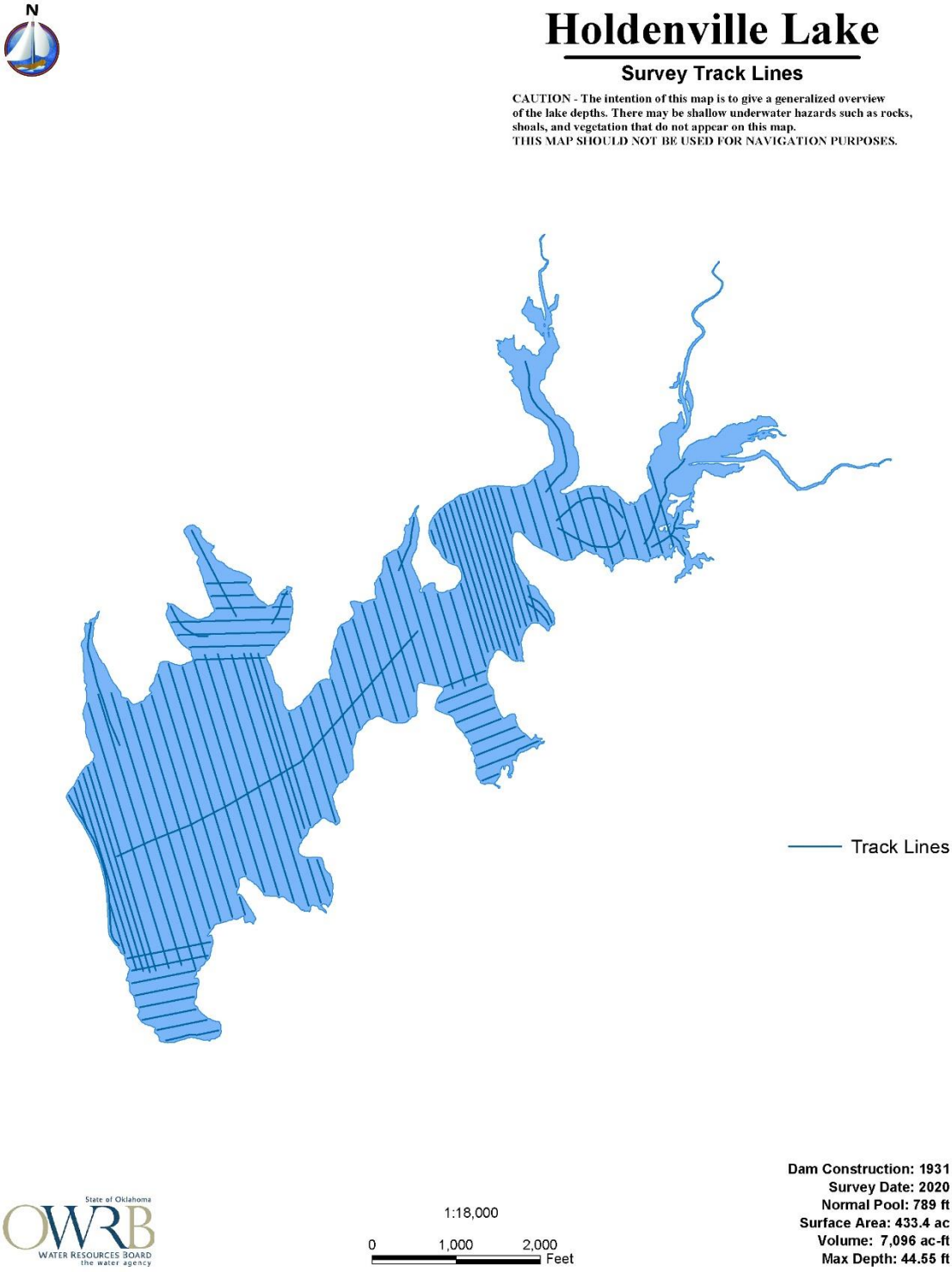

Figure B- 1: Holdenville Lake Survey Track Lines.

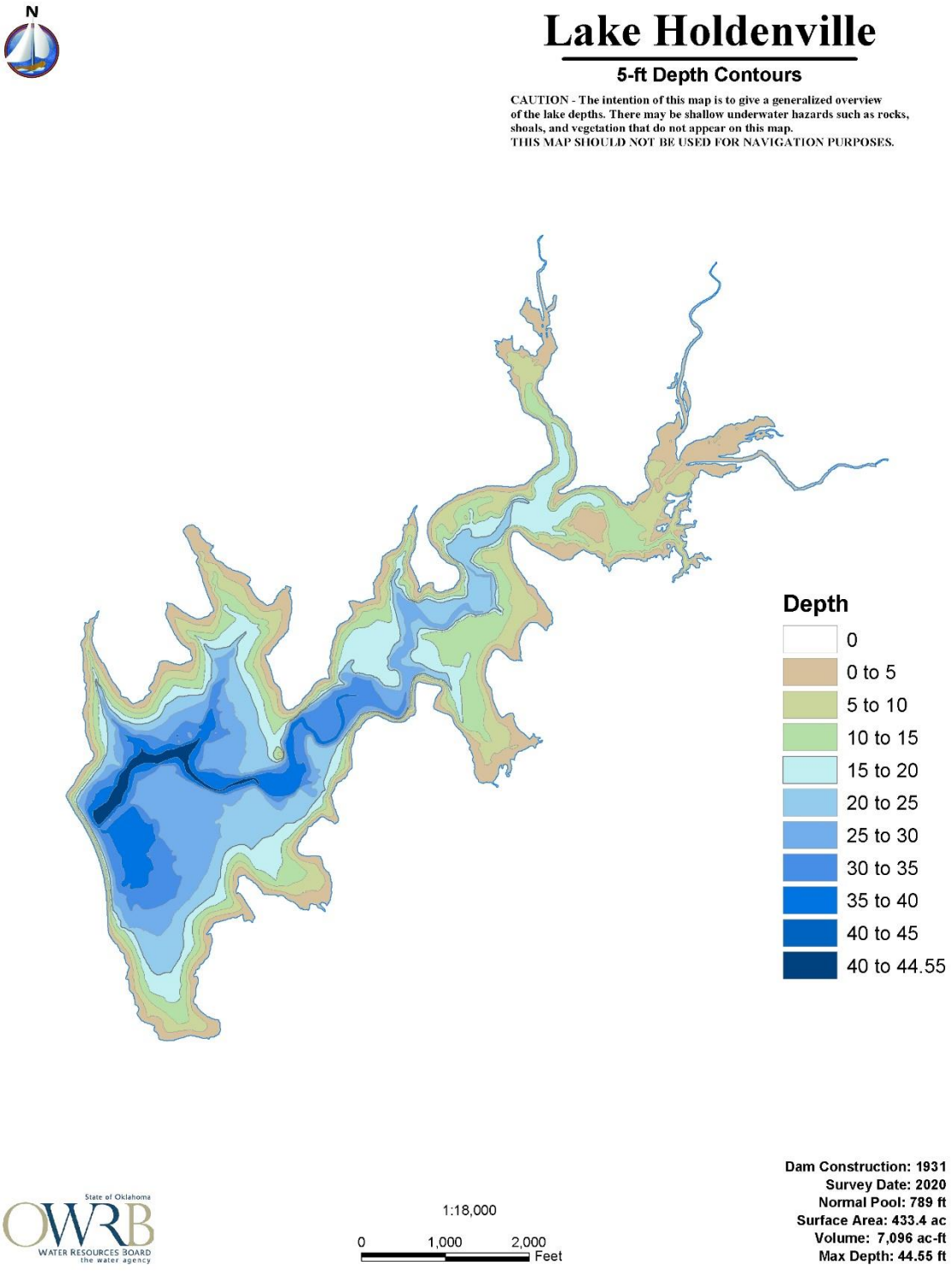

Figure B- 2: Holdenville Lake Contour Map with 5 ft Intervals.

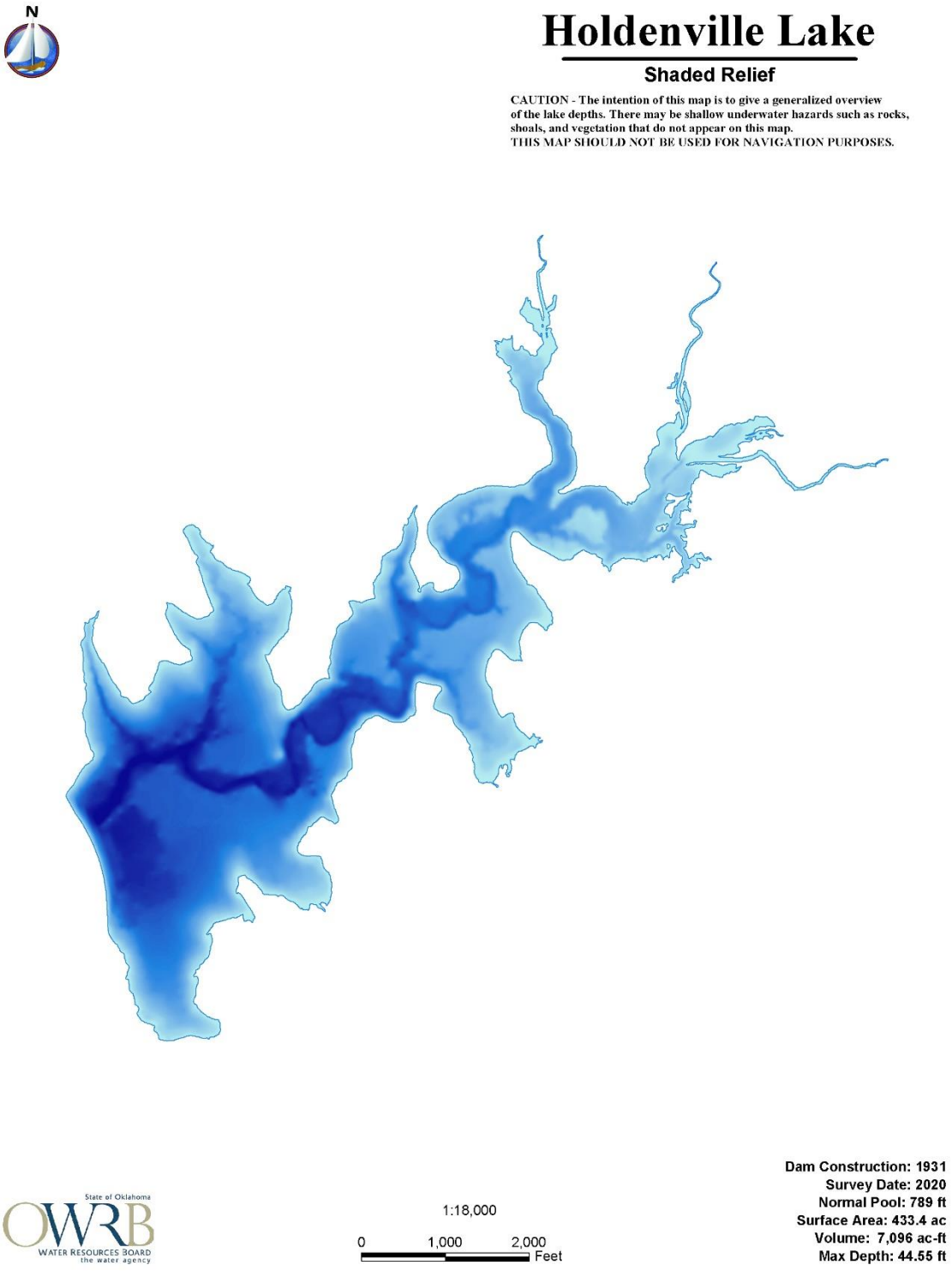

Figure B- 3: Holdenville Lake Shaded Relief Map.

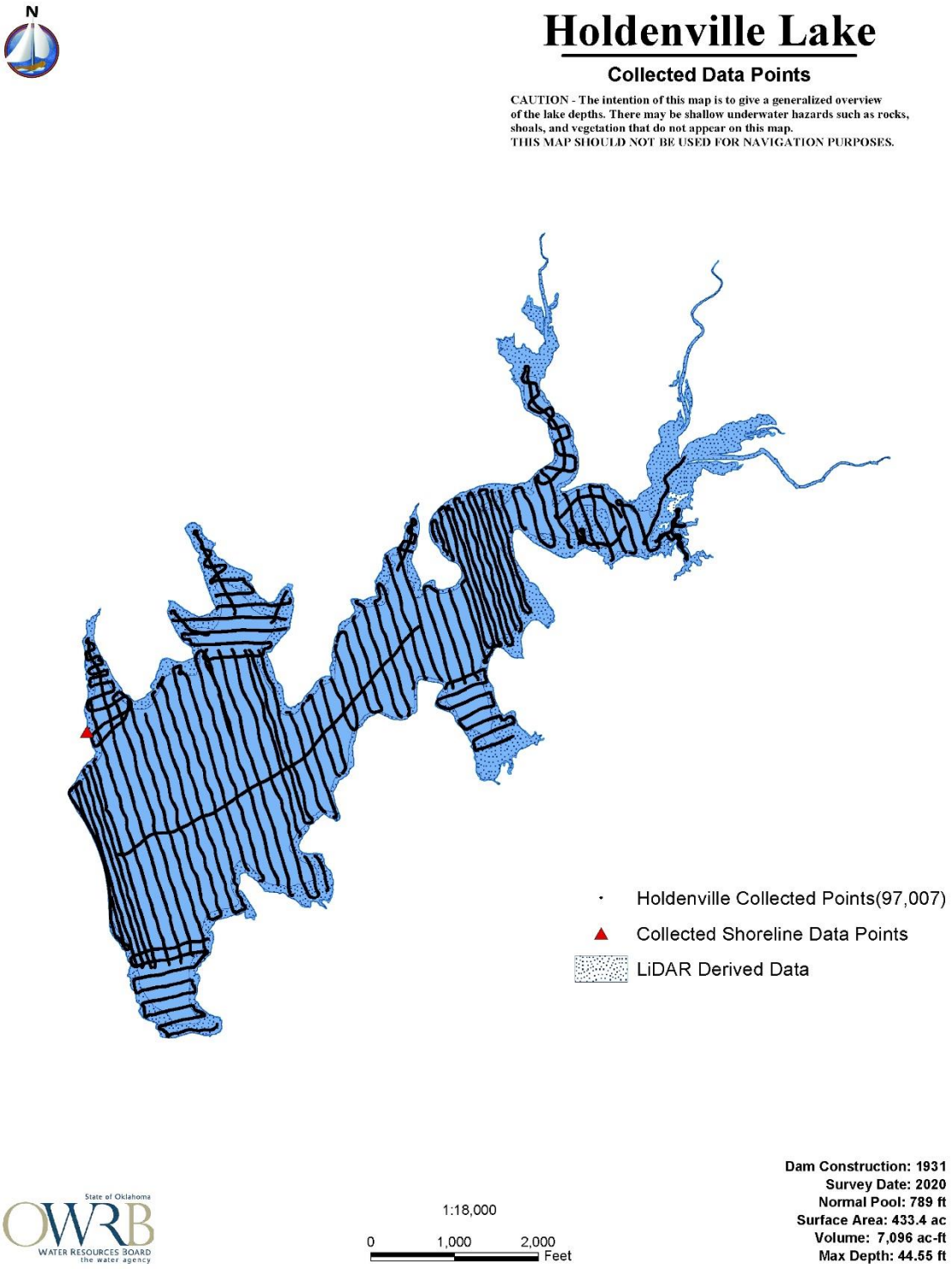

Figure B- 4: Holdenville Lake Collected Data Points Map.

APPENDIX C: Stilwell City Lake Maps

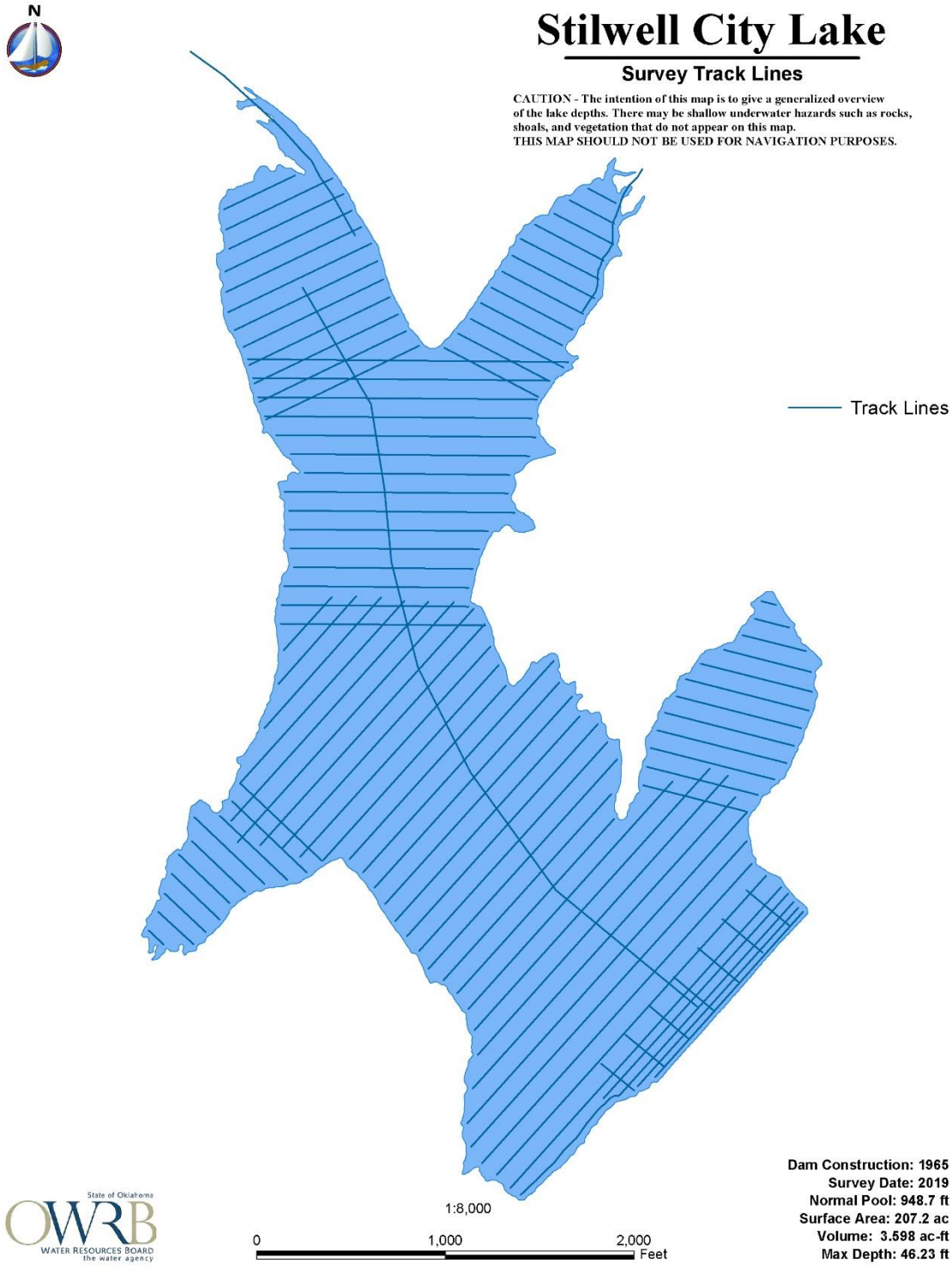

Figure C- 1: Stilwell City Lake Survey Track Lines Map.

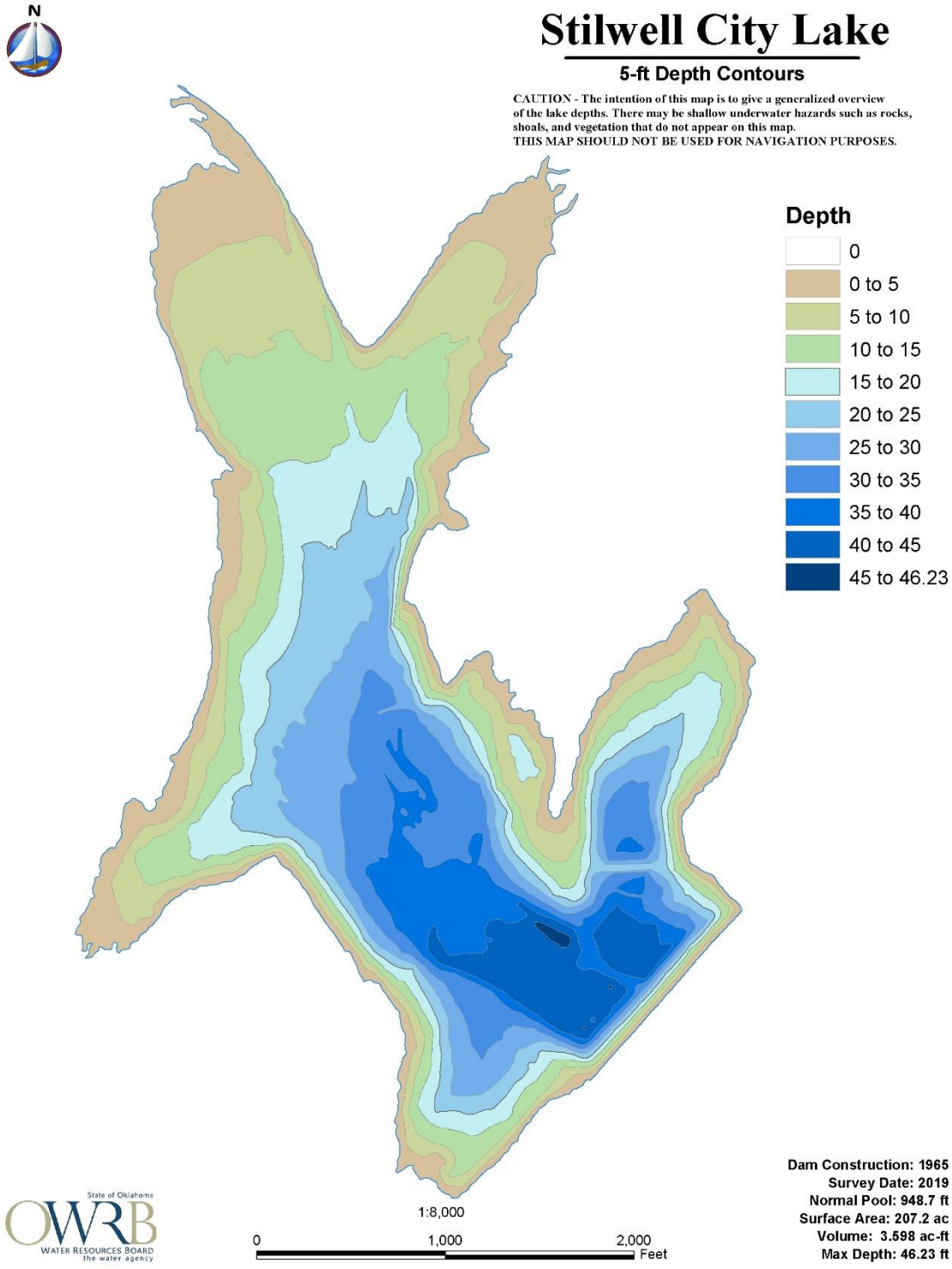

Figure C- 2: Stilwell City Lake Contour Map with 5 ft Intervals.

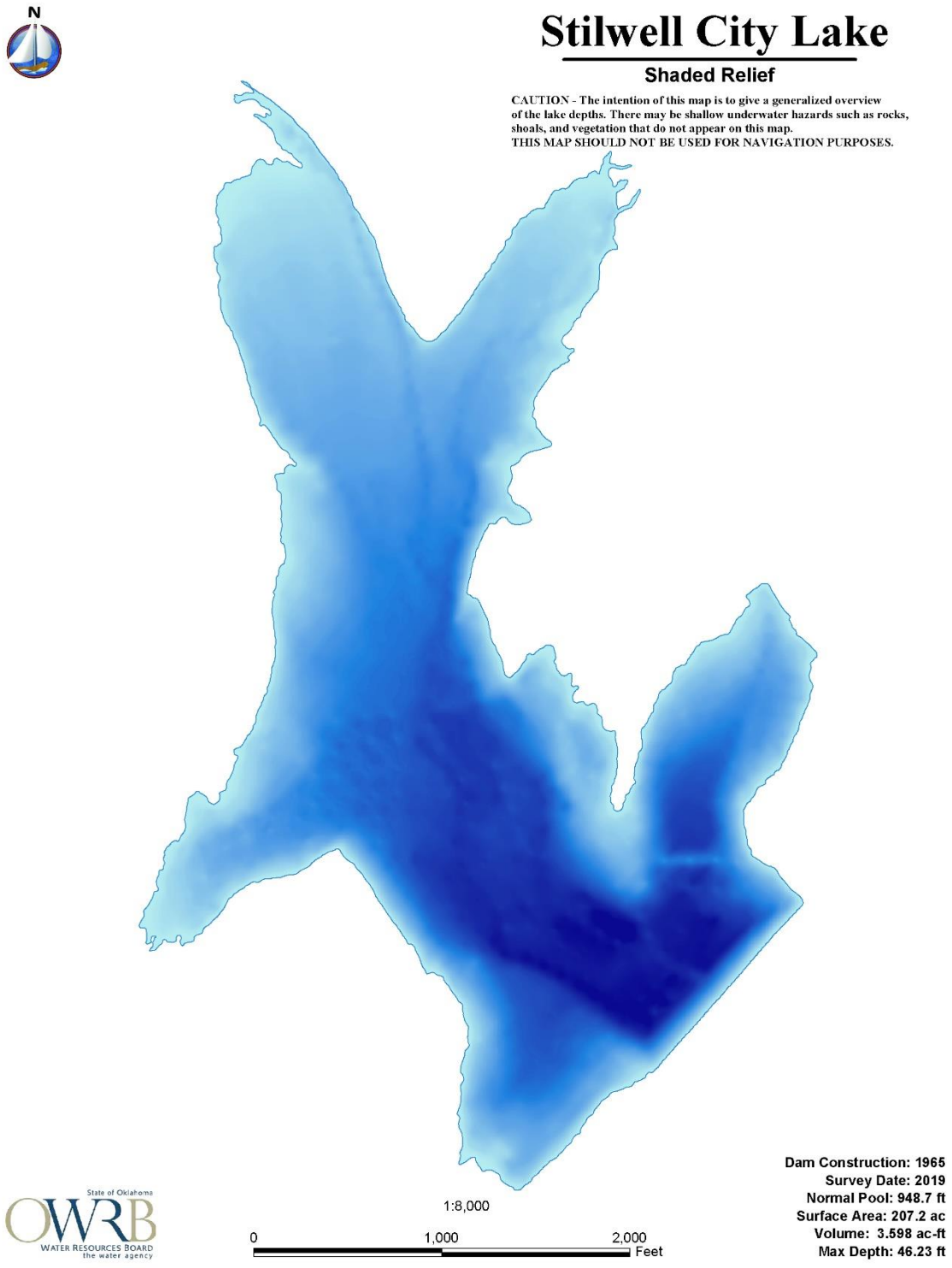

Figure C- 3: Stilwell City Lake Shaded Relief Map.

Figure C- 4: Stilwell City Lake Collected Data Points Map.

APPENDIX D: Lake Wayne Wallace Maps

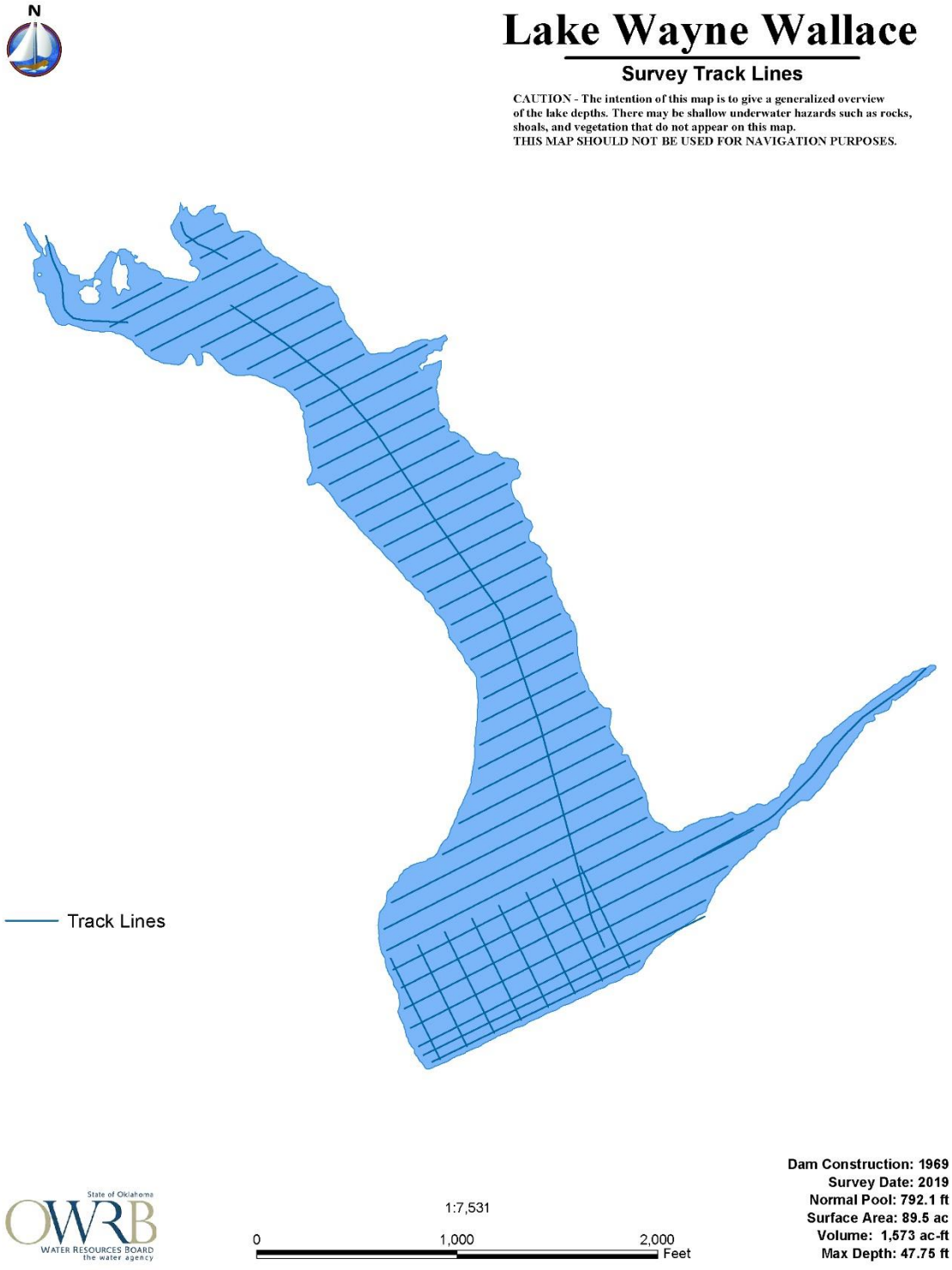

Figure D- 1: Lake Wayne Wallace Survey Track Lines Map.

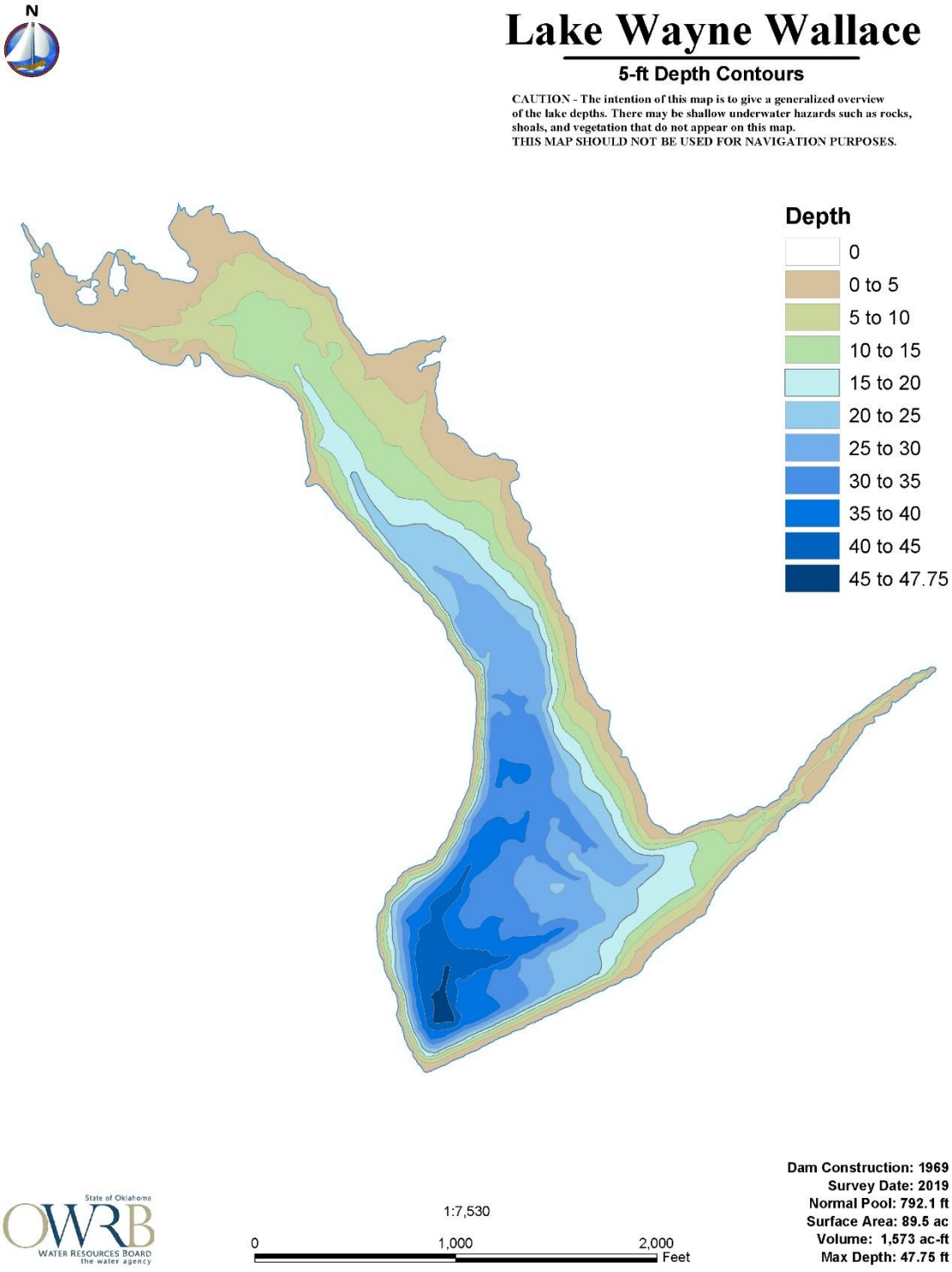

Figure D- 2: Lake Wayne Wallace Contour Map with 5 ft Intervals.

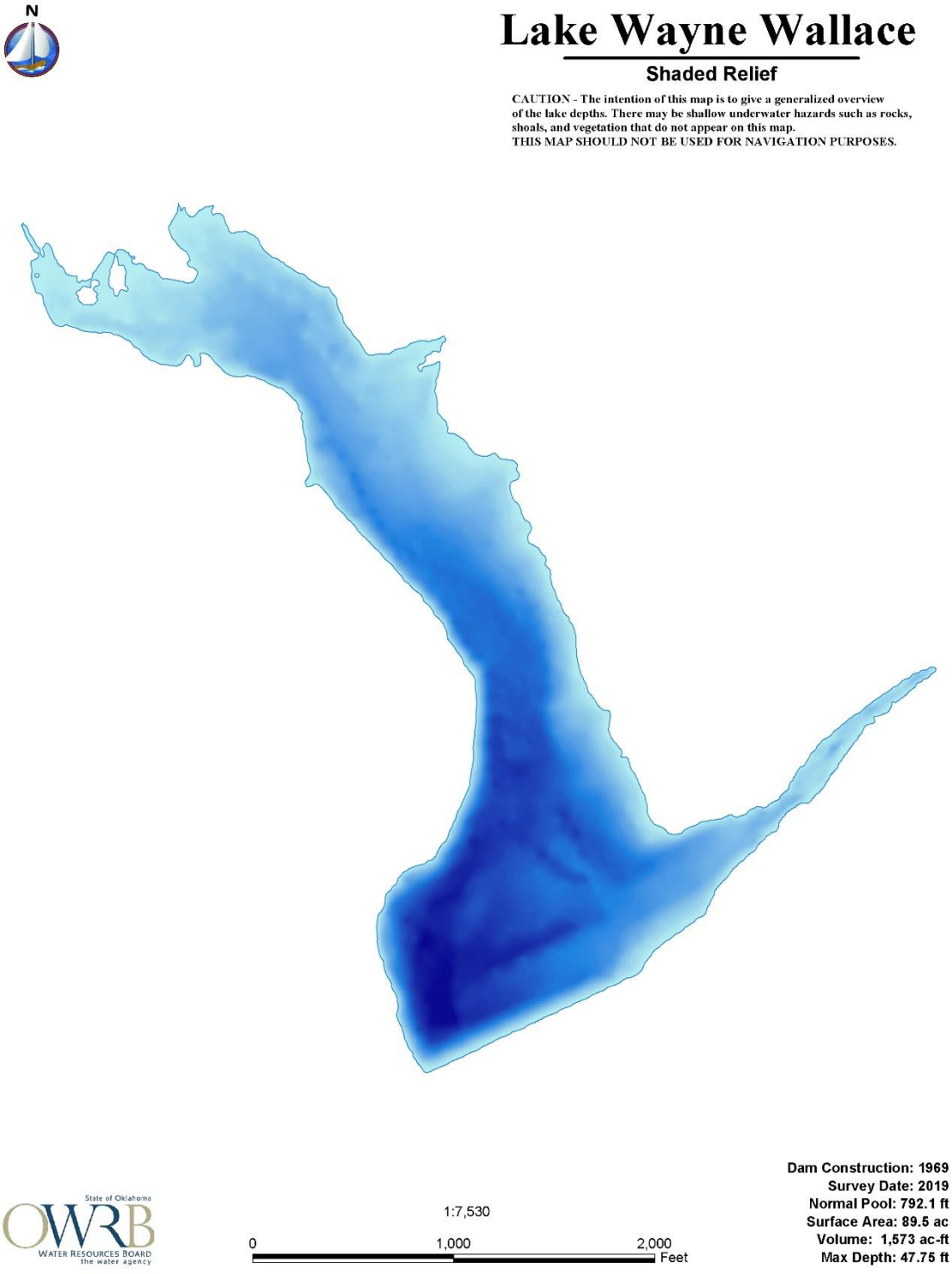

Figure D- 3: Lake Wayne Wallace Shaded Relief Map.

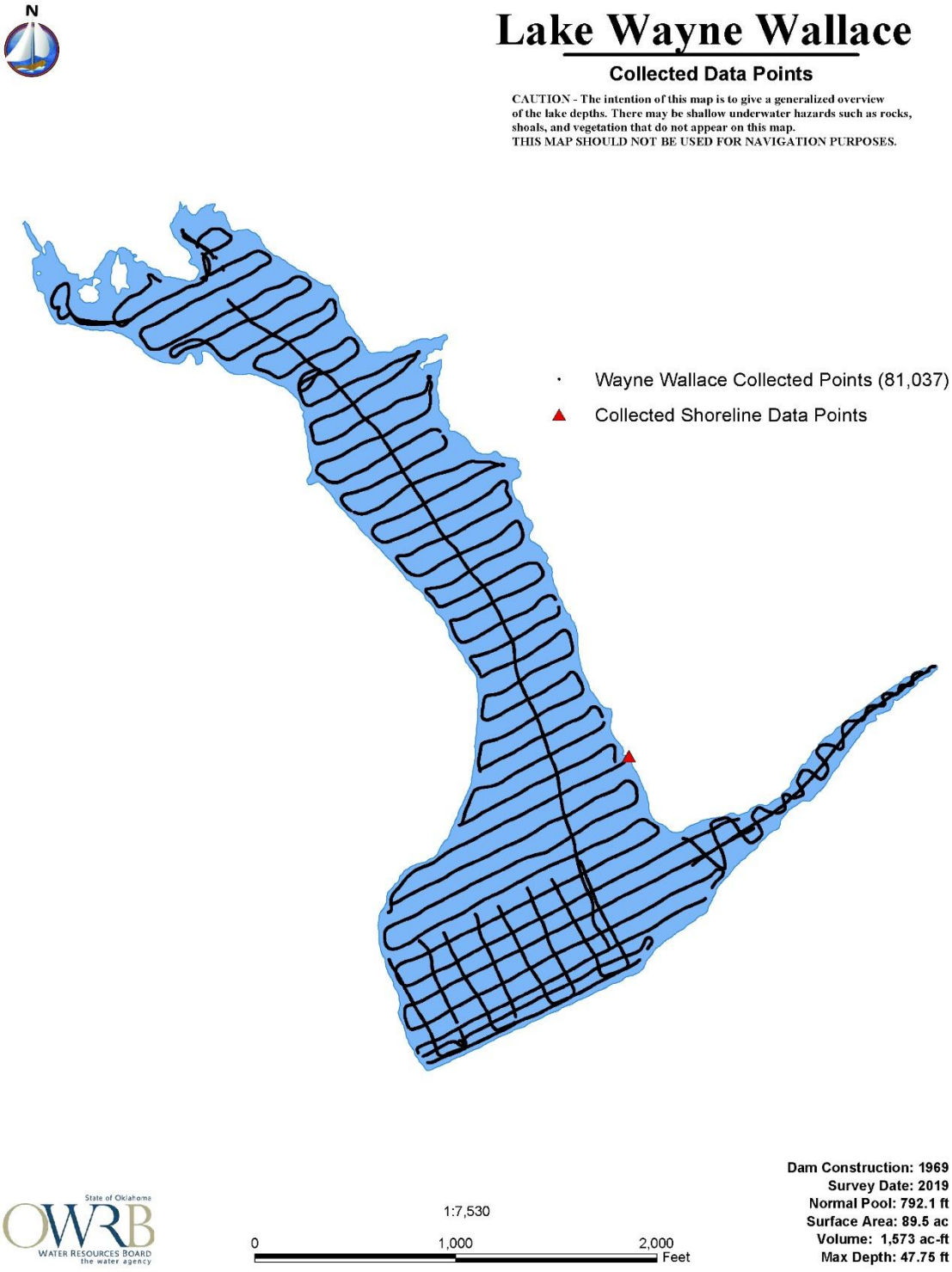

Figure D- 4: Lake Wayne Wallace Collected Data Points Map.

APPENDIX E: Additional Survey Data Tables.

Table E- 1: Survey offsets used during the calibration and editing process.

Survey Offsets			
Lake	Holdenville Lake (03/19/19)	Stilwell City Lake (12/5/17)	Lake Wayne Wallace (12/6/17)
Static Draft (ft)	0.9	0.75	0.85
Average SOS (m/s)	1447.09	1435.90	1444.70
Echosounder SOS (m/s)	1447.19	1435.90	1444.75
Latency Offset (sec)	0.25	0.25	0.25

Table E- 2: Cross check statistic results showing accuracy of the survey data sets.

Cross Check Statistics			
Lake	Holdenville Lake	Stilwell City Lake	Lake Wayne Wallace
# of Intersections	123	114	121
Arithmetic Mean (ft)	0.015	0.066	0.054
Standard Deviation (ft)	0.208	0.287	0.310