BUREAU OF RECLAMATION

Technical Report No. ENV-2023-17

Guernsey Reservoir:
2022 Sedimentation Survey

North Platte Project, Wyoming and Nebraska
Missouri Basin and Arkansas-Rio Grande Texas Gulf Regions

U.S. Department of the Interior **December 2022**

Mission Statements

The U.S. Department of the Interior protects and manages the Nation's natural resources and cultural heritage; provides scientific and other information about those resources; honors its trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated Island Communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

Cover Photo – Guernsey Dam looking upstream at the spillway (downloaded from Reclamation Project website)

REPORT DOCUMENTATION PAGE	Form Approved OMB No. 0704-0188

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED
22-12-2022	Draft	March 18, 2022

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Technical Report No. ENV-2023-017 Guernsey Reservoir 2022 Sedimentation Survey North Platte Project, Wyoming and Nebraska Missouri Basin and Arkansas-Rio Grande-Texas Gulf Regions	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S) Robert Hilldale, D. Nate Bradley, Vincent Benoit	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)	8. PERFORMING ORGANIZATION REPORT NUMBER
Bureau of Reclamation, Technical Service Center Sedimentation and River Hydraulics Group Building 67, Mail Code: 86-68240 Denver, Colorado	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT

This and other survey reports are available at: https://www.usbr.gov/tsc/techreferences/reservoir.html

13. SUPPLEMENTARY NOTE

14. ABSTRACT

The 2022 lidar survey of Guernsey Reservoir was used to produce a digital surface of the reservoir bottom. Analysis of the 2022 data indicates that at the maximum water elevation (4420.0 feet, Reclamation Project Vertical Datum, RPVD), the reservoir has a surface area of 2,417 acres and a storage capacity of 46,237 acre-feet. Since the original filling in 1927, the reservoir is estimated to have lost 27,573 acre-feet of storage capacity (37.4 percent) due to sedimentation. The lowest elevation obtained by the lidar survey is 4377 ft (RPVD). As such, information regarding area-capacity changes below elevation 4377 ft (RPVD) of the reservoir is not available from this survey. The 1981 ACAP indicates a capacity of 126 acre-ft at elevation 4377, indicating that the total volume potentially not represented is negligible. Guernsey Reservoir was drawn down for repairs at the dam during winter 2021-2022. The reservoir began filling a short time before the 2022 lidar was collected and a small pool had formed near the dam. Discussions with WYAO staff (David Merrell, Matthew Wells) indicate the reservoir bottom elevation at the dam is believed to be approximately 4370 ft (RPVD), approximately equivalent to the sill elevation of the dam's north gate and the associated top of the inactive pool on the reservoir capacity allocation sheet. The dead pool likely filled with sediment soon after the 1957 survey. The north spillway crest is at elevation 4370.67 ft following an 8 inch sill concrete overlay in 1983.

15. SUBJECT TERMS

Guernsey Reservoir survey, sedimentation, capacity, ACAP, lidar

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
					Robert C. Hilldale
a. REPORT	b. ABSTRACT	a. THIS PAGE			19b. TELEPHONE NUMBER *(Include area code)*
U	U	U			303-445-3066

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Acronyms and Abbreviations

acre-feet/mi^2/year	acre feet per square mile per year
ACAP	AreaCAPacity
ft	feet
ft^3/s	cubic feet per second
GIS	Geographic Information System
GPS	Global Positioning System
HUC	Hydrologic Unit Code
lb/ft^3	pounds per cubic foot
MB&ART	Missouri Basin and Arkansas, Rio Grande, Texas
mi^2	square miles
NAD 1983	North American Datum, established 1983
NAVD88	1988 North American Vertical Datum, established 1988
NGS	National Geodetic Survey
NGVD29	1929 National Geodetic Vertical Datum, established 1929
NID	National Inventory of Dams
NRCS	Natural Resources Conservation Service
OPUS	Online Positioning User Service
QA/QC	Quality Assurance and Quality Control
Reclamation	Bureau of Reclamation
RM	River/Reservoir mile
RPVD	Reclamation Project Vertical Datum
RTK-GPS	real-time kinematic Global Positioning System
TSC	Technical Service Center
UNK	Unknown
USGS	U.S. Geological Survey
WYAO	Wyoming Area Office

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Executive Summary

Guernsey Dam and Reservoir are on the North Platte River about 2 miles northwest of Guernsey, WY. The delta of Guernsey Reservoir is approximately 22 river miles downstream from Glendo Reservoir. An aerial lidar survey of Guernsey Reservoir during drawdown was conducted on March 18, 2022 with these primary objectives:

1. Estimate reservoir sedimentation volume since the original reservoir filling began in 1927 and since the last survey in 1981.

2. Determine new reservoir surface area and storage capacity tables for the full elevation range of dam and reservoir operations.

The survey was conducted using only aerial lidar data flown on March 18, 2022, while the reservoir was nearly empty. The lidar data were processed into a digital surface of the reservoir bottom. The lowest elevation obtained by the lidar survey is 4377 ft (RPVD). As such, area-capacity information below 4377 ft Reclamation Project Vertical Datum (RPVD) are not available from the 2022 survey. During the lidar survey a pool existed near the dam, as reservoir operations called for filling to begin on March 16, 2022. Because there was a pool near the dam, there is no reservoir bottom elevation data in this area. However, the last ACAP table from 1981 indicates a minimal capacity of 126 acre-ft at elevation 4377 so the volume potentially not represented is negligible. The reservoir bottom elevation at the dam is presumed to be 4370 ft (RPVD) which approximately corresponds to the sill elevation of the dam's north gate and the top of dead pool (David Merrell, Matthew Wells, personal communication). In 1983 there was an overlay of the crest structure at the north spillway of 8 inches, making the crest elevation 4370.67 ft (RPVD) (Bureau of Reclamation 2018). The historical 1966 and 1981 area- capacity data at elevation 4370 ft documents a capacity of 170 and 0 acre-ft, respectively. The 1957 reservoir survey indicates a dead pool (4360 ft, RPVD) capacity of 2 acre-feet.

Analysis of the historical and March 2022 data set indicates the following results:

- At the maximum reservoir water surface elevation 4420 ft (RPVD) the reservoir surface area was 2,417 acres with a storage capacity of 46,237 acre-feet.

- Since the original filling of the reservoir in 1927, the reservoir is estimated to have lost 27,573 acre-feet of storage capacity (37.4 percent) due to sedimentation over 95 years (original capacity 73,810 acre-ft).

A summary description of the dam, reservoir, and survey results is presented in table ES-1.

Table ES-1.—Reservoir survey summary information

Reservoir information			
Reservoir name	Guernsey Reservoir	**Region**	MB&ART
Owner	Reclamation	**Area office**	Wyoming Area Office
Stream	North Platte River	**Vertical datum**	Reclamation Project Vertical Datum
County	Platte County	**Top of dam (ft)**	4430.0
State	Wyoming	**South spillway crest (ft)** **North spillway crest (ft)**	4405.50 (gates open) or 4420 (gates closed) 4370.67
Latitude (deg min sec)	42.2903	**Power penstock elevation (ft)**	4370.0
Longitude (deg min sec)	-104.7631	**Low-level outlet (ft)**	4360.0
HUC4*	1018	**Hydraulic height (ft)**	92.0
HUC8*	10180008	**Total drainage area (mi^2)**	15,853
NID ID*	WY01293	**Date storage began**	July 1927
Dam purpose	Irrigation and power	**Date for normal operations**	1927

* HUC = Hydrologic Unit Code; NID = National Inventory of Dams.

Original design				
Storage allocation	**Elevation (ft)**	**Surface area (acres)**	**Capacity (acre-feet)**	**Gross capacity (acre-feet)**
Active Conservation	4,420	2,405	68,045	73,810
Inactive	4,370	395	2,931	5765
Dead	4360	207	2,834	2834
Streambed at Dam Axis	4338	N/A	N/A	N/A

Survey summary‡							
Resurvey date	**Type of survey**	**Number of range lines or contour intervals**	**Contributing sediment drainage area (mi^2)**	**Period sedimentation volume (acre-feet)**	**Cumulative sedimentation (acre-feet)**	**Lowest reservoir elevation (ft)**	**Remaining portion of dead storage (%)**
1947	Bathymetric	5-ft	5,400*	24,660	24,660	4355	6.7
1957	Bathymetric	5-ft	5,400*	4,350	29,010	4360	0
1966	Bathymetric	5-ft	675†	-428	28,582	4365	0
1981	Bathymetric/ Photogrammetry	UNK	675†	-384	28,198	4370	0
2022	Lidar	N/A	675†	-624	27,574	4370**	0

‡ Resurveys of Guernsey reservoir also exist in 1931, 1933, 1935, 1937, 1939, 1941, and 1944. Records of these surveys are detailed in the 1966 sediment survey report (Lara 1967), a 1963 Reclamation sediment report, and a USGS survey database (RESSED, downloaded 11-22-2022).
* Sediment contributing watershed area between Alcova dam and Guernsey Dam. Construction of Alcova Dam was completed in 1938. Prior to 1938 sediment contributing drainage area was 5,500 sq. mi. (to Pathfinder Dam).
† Sediment contributing watershed area between Glendo and Guernsey Dams. Construction of Glendo Dam was completed in 1957.
** Presumed bottom elevation based on observations by WYAO staff (David Merrell and Matthew Wells).

1.0 Introduction

Guernsey Dam and Reservoir are on the North Platte River about 2 miles northwest of Guernsey, WY (figure 1). The dam and reservoir are operated by Reclamation's Wyoming Area Office (WYAO) as part of the North Platte Project. The project supplies irrigation water to downstream users as well as power generation and recreation benefits.

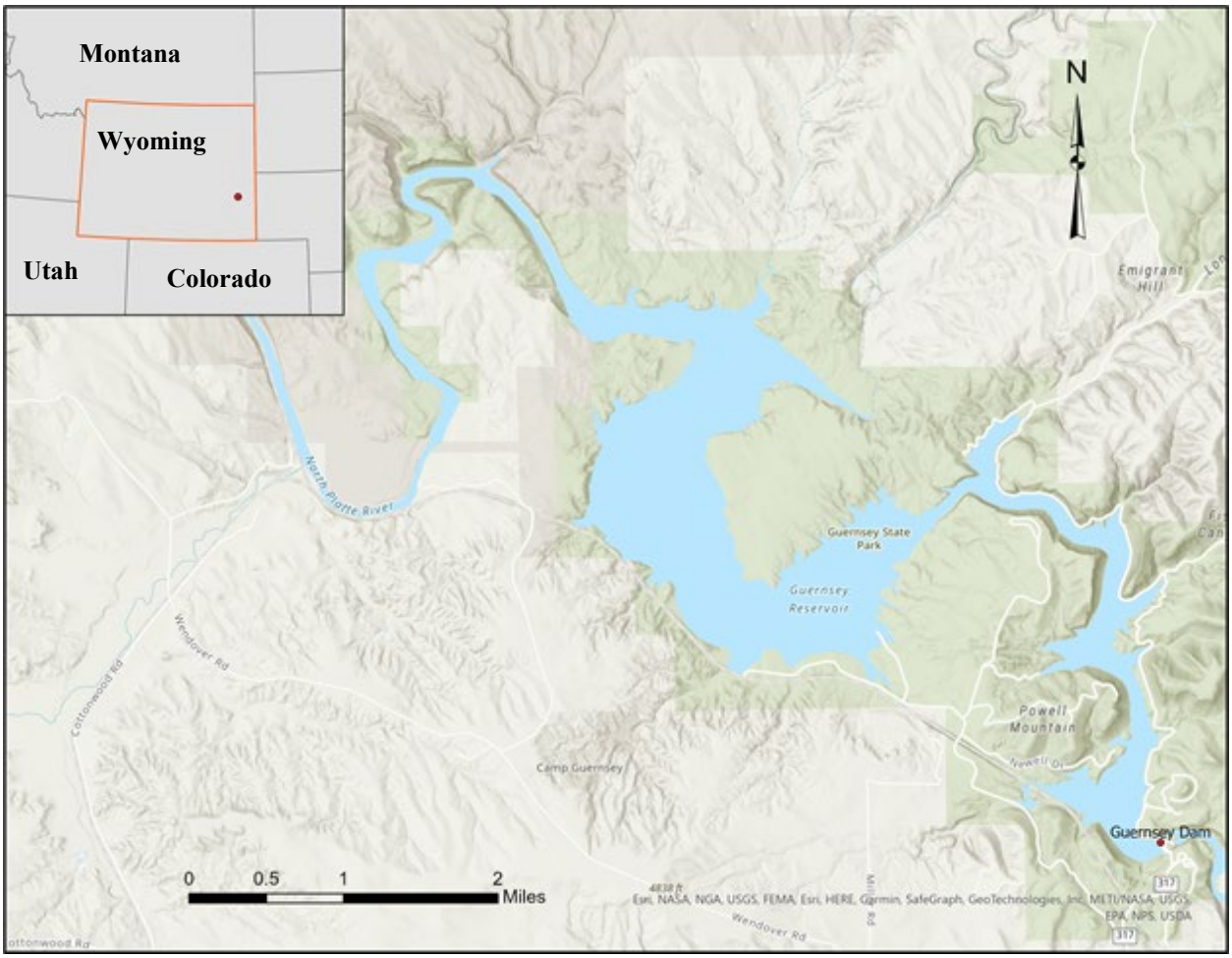

Figure 1.—Location map of Guernsey Dam and Guernsey Reservoir, 2 miles northwest from Guernsey Wyoming.

All rivers transport sediment particles (e.g., clay, silt, sand, gravel, and cobble) and reservoirs tend to trap sediment, diminishing the reservoir storage capacity over time. Reservoir sedimentation affects all elevations of the reservoir, even above and upstream of the full pool

elevations. Cobble, gravel, and sand particles tend to deposit first forming deltas at the upstream ends of the reservoir while silt and clay particles tend to deposit along the reservoir bottom between the delta and dam.

Periodic reservoir surveys measure the changing reservoir surface area and storage capacity and provide information for forecasting when important dam and reservoir facilities will be impacted by sedimentation.

As part of ongoing operations and sediment monitoring activities, the Wyoming Area Office and the Missouri Basin and Arkansas, Rio Grande, Texas (MB&ART) Region requested the Technical Service Center's (TSC) Sedimentation and River Hydraulics Group to administer a lidar and aerial photography contract to survey Guernsey Reservoir during draw down. This survey provides the necessary information to update the area and capacity tables. The lidar was flown on March 18, 2022 by Aero-Graphics. as a task order against Reclamation's aerial photography contract. The contract was with Woolpert Inc. but was subcontracted to Aero-Graphics to meet the desired timeline. At the time of the flight, the reservoir was drained to a point where the instruments in the reservoir were unable to record a level. On March 16, 2022 reservoir operations called for reservoir filling to begin, which resulted in a small pool upstream of the dam (Figure 2). Because of the existence of the pool, bottom elevations were not obtained in this area. This is where the lowest elevations of the reservoir bottom are likely to exist with original streambed at 4325 (RPVD) based on a historical longitudinal profile of the 1927 survey (current reservoir capacity allocation sheet shows streambed at 4338). Upstream of the small pool at the dam, incoming flow from Glendo Reservoir was approximately 26 ft^3/s(cfs), resulting in very shallow flow in the channel through the reservoir. The lowest surveyed lidar elevation of the reservoir bottom was 4377 ft (RPVD). The low-level outlet is 4360 ft (RPVD). The presumed bottom elevation is approximately at elevation 4370 ft (RPVD) (David Merrell, Matthew Wells, WYAO, pers. comm. 11/14/2022). The invert elevation of the north spillway was 4370 ft (RPVD). However, in 1983 there was an overlay of the crest structure at the north spillway of 8 inches, making the crest elevation 4370.67 ft (RPVD) (Bureau of Reclamation 2018).

The lidar survey was conducted on March 18, 2022 with these primary objectives:

- Estimate reservoir sedimentation volume since the original reservoir filling began in 1927 and since the last survey in 1981,

- Determine new reservoir surface area and storage capacity tables for the full elevation range of dam and reservoir operations, and

- Provide a report of findings.

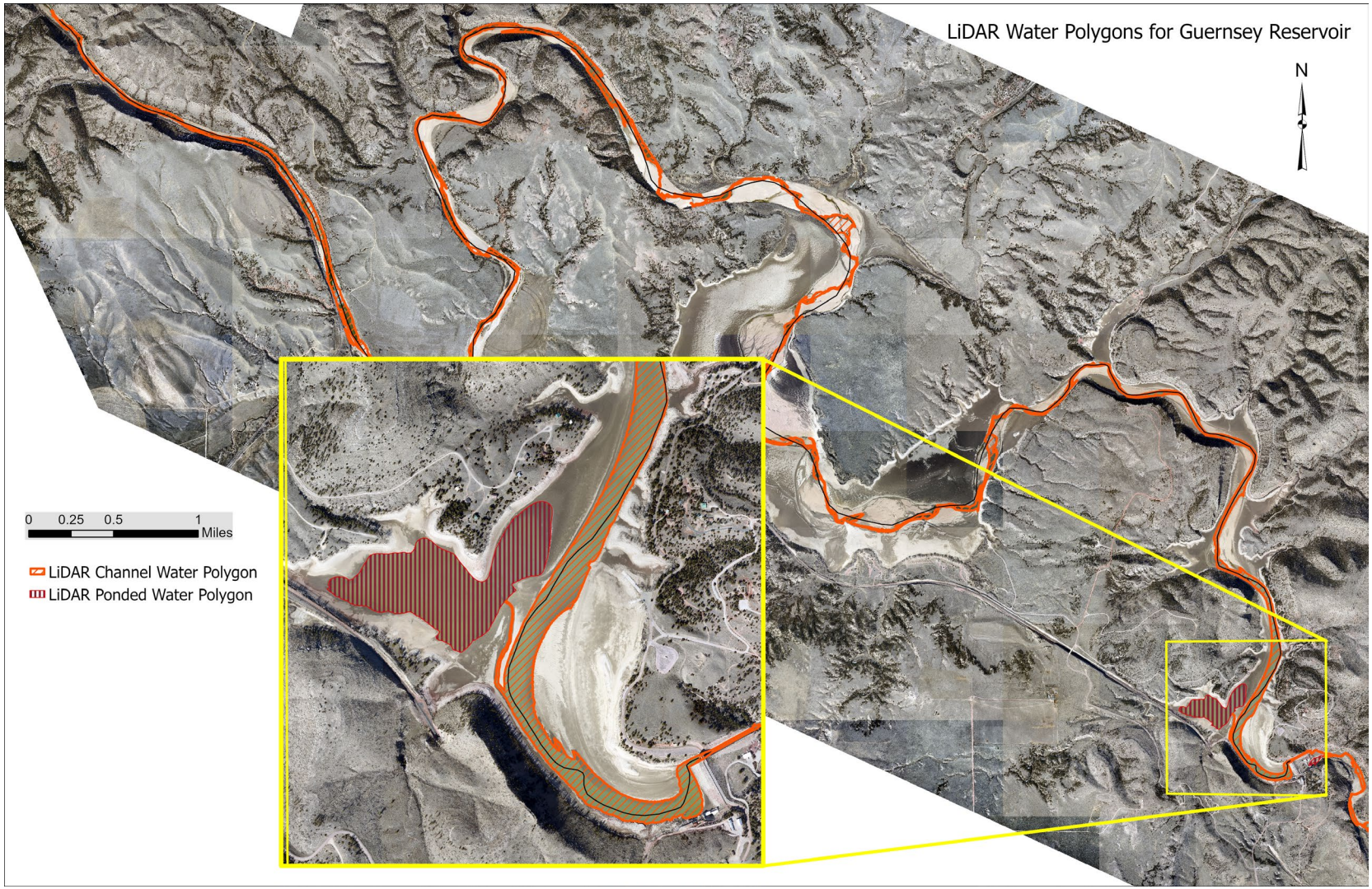

Figure 2.—Image showing the portions of the reservoir that were wet during the lidar data collection and do not have elevation data. The isolated pond northwest of the dam (shown in the inset) is approximately 27.6 acres.

2.0 Watershed Description

Location and Drainage

The watershed upstream from Guernsey Reservoir has a total contributing drainage area of 15,853 mi^2 (figure 3). Because of upstream lakes and reservoirs that trap sediment (as of 2022), the net sediment-contributing drainage area to Guernsey Dam is 675 mi^2 (figure 4). Four storage reservoirs upstream of Guernsey Dam operated by Reclamation include Pathfinder Reservoir completed in 1910, Alcova Reservoir completed in 1938, Seminoe Dam completed in 1939, and Glendo Reservoir completed in 1957. Horseshoe Creek to the north and Cottonwood Creek to the south are the two main tributaries to the North Platte between Glendo Dam and Guernsey Reservoir. Both streams have their headwaters in the Laramie Mountains to the west. The watershed elevation ranges from 10,275 feet at the top of Laramie Peak down to about 4400 feet at the confluence with Cottonwood Creek near the head of the reservoir. Land cover in the basin is mostly grass and shrublands with some evergreen forest at higher elevations (figure 5, table 1). Less than two percent of the basin is used for crop cultivation or hay production. These areas are mostly along Horseshoe and Cottonwood Creeks.

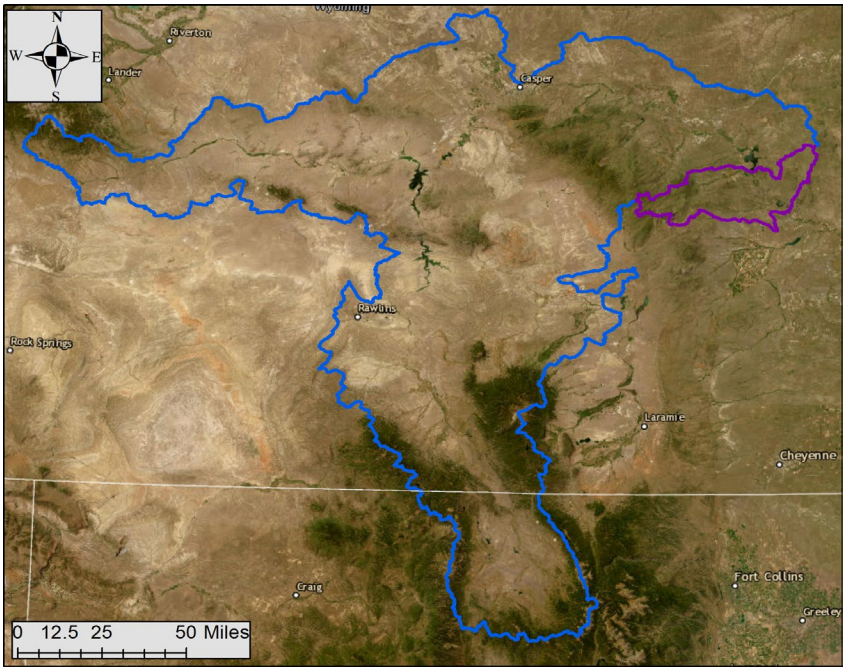

Figure 3.—The watershed above Guernsey Reservoir has a total drainage area of 15,853 mi^2 (blue outline) and a sediment-contributing drainage area of 675 mi^2 (purple outline). Dams upstream of Guernsey include Glendo, Alcova, Pathfinder, and Seminoe and trap sediment from most of the basin.

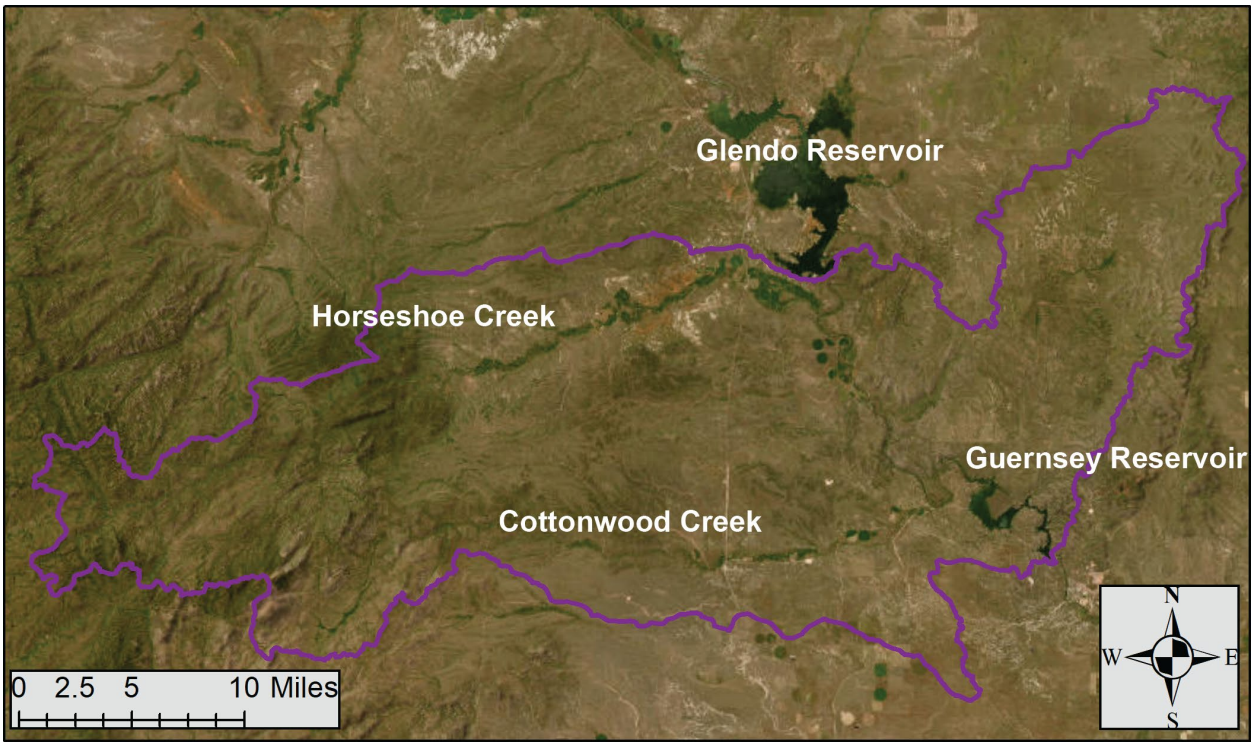

Figure 4.—The portion of the Guernsey watershed downstream of Glendo Reservoir.

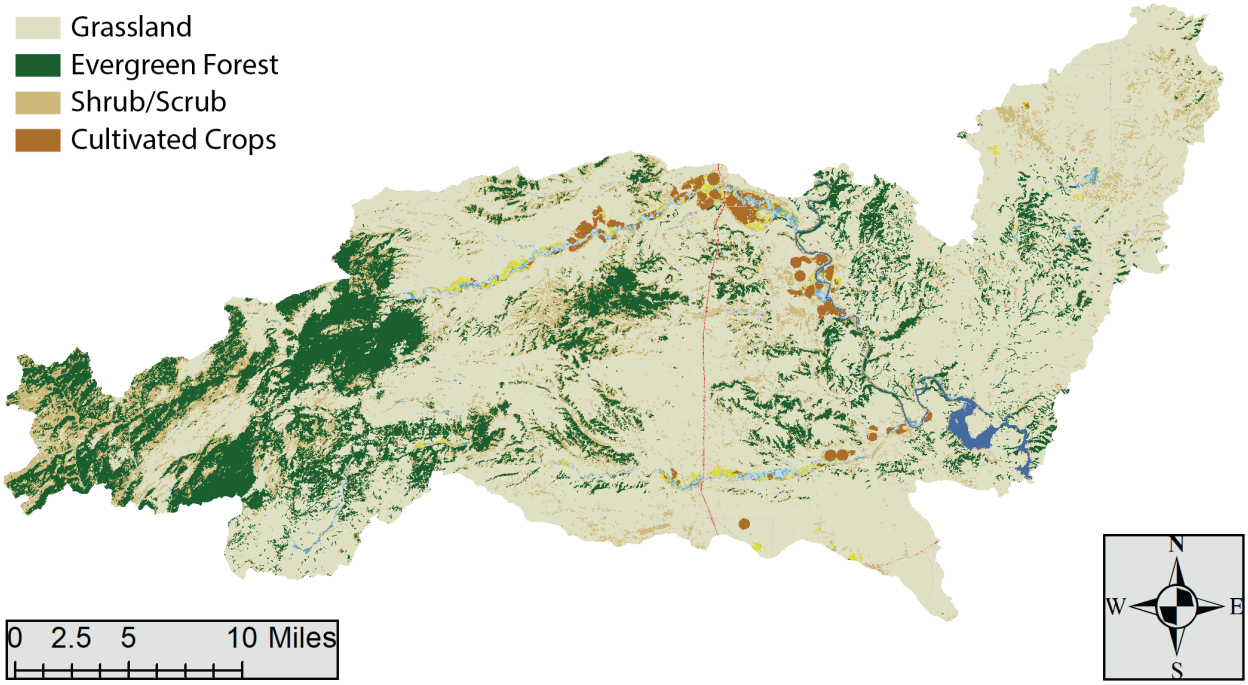

Figure 5.—Land cover in the basin according to the National Land Cover Database (Jin, et al., 2019).

Table 1.—Land cover in basin according to the National Land Cover Database (Jin, et al., 2019)

Percent of Basin Area	Land Use Class	Description
65.9%	Grassland/Herbaceous	Areas dominated by gramanoid or herbaceous vegetation, generally greater than 80% of total vegetation. These areas are not subject to intensive management such as tilling but can be utilized for grazing.
17.6%	Evergreen Forest	Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75% of the tree species maintain their leaves all year. Canopy is never without green foliage.
12.5%	Shrub/Scrub	Areas dominated by shrubs; less than 5 meters tall with shrub canopy typically greater than 20% of total vegetation. This class includes true shrubs, young trees in an early successional stage or trees stunted from environmental conditions.
1.1%	Cultivated Crops	Areas used for the production of annual crops, such as corn, soybeans, vegetables, tobacco, and cotton, and also perennial woody crops such as orchards and vineyards. Crop vegetation accounts for greater than 20% of total vegetation. This class also includes all land being actively tilled.
4.0%	Other	Including 0.7% woody wetlands, 0.6% pasture or hay production, 0.6% water, and 0.5% emergent herbaceous wetlands.

Potential Sediment Sources

The surficial geology of the watershed's sediment contributing drainage area is nearly 70 percent clastic sedimentary rocks (figure 6, table 2). Sandstone is most prevalent with finer grained siltstone, claystone, and shale. The headwaters in the Laramie Range are composed of intrusive igneous and metamorphic rocks and make up about 23 percent of the basin area. About 6.5 percent of the basin area is unconsolidated alluvium and colluvium, mostly in the valleys of Horseshoe and Cottonwood Creeks (Horton et al., 2017). These unconsolidated sediments are the most likely source of future reservoir sedimentation.

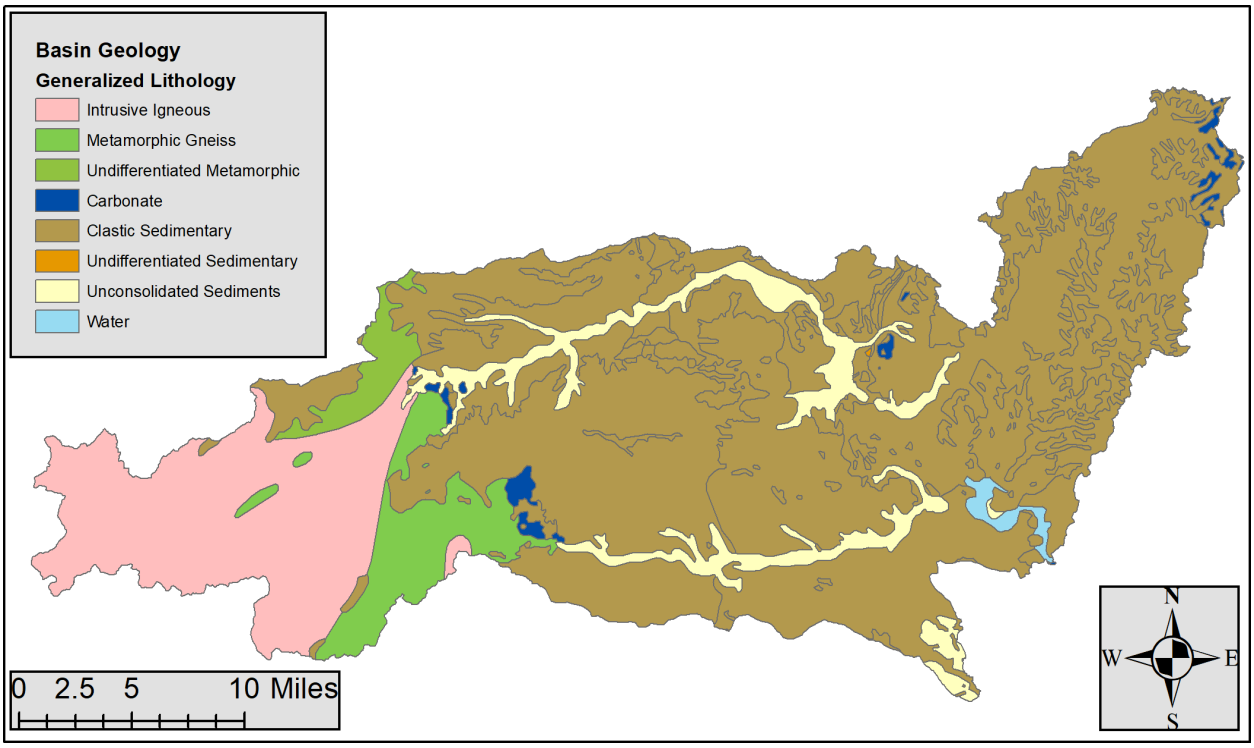

Figure 6.—Geologic map of the sediment contributing portion of the basin. Guernsey Reservoir is shown at the southeastern edge of the map in blue.

Table 2.—Surficial geology of the basin

Generalized Lithology	Total Area (sq. mi.)	Percentage of Basin Area
Clastic sedimentary rocks including sandstone, siltstone, claystone and shale	468.8	69.4%
Intrusive igneous rocks, mostly granitic	106.3	15.8%
Metamorphic rocks, mostly gneiss with some undifferentiated	34.3	6.9%
Unconsolidated alluvium and colluvium	43.9	6.5%
Other	9.5	1.4%

Climate and Runoff

Annual flow into the Guernsey Reservoir from Glendo Reservoir released into the North Platte River have averaged about 1.1 million acre-feet/year since closure in 1957 (figure 7). Peak discharge averages about 7,400 ft^3/s (figure 8) (USBR, 2022). None of the other tributaries to

the reservoir are gaged and the USGS StreamStats (USGS, 2017) tool that would normally be used to estimate runoff is not available for the state of Wyoming. Precipitation data for the town of Guernsey, WY just downstream of the dam is not readily available. Casper, WY, about 70 miles to the northwest, averages 12.2 inches of precipitation per year. Scottsbluff, NE, about 80 miles to the southeast, averages about 15.7 inches of precipitation per year [NOAA, 2022].

The climate in most of the basin is classified as cold arid steppe (BSk) in the Köppen-Geiger climate classification system (Beck et al. 2017). The lower elevations of the Laramie Mountains are classified as continental with no dry season and warm summers (Dfb). The highest elevations are classified as continental with no dry season and cold summers (Dfc) (Beck et al., 2017).

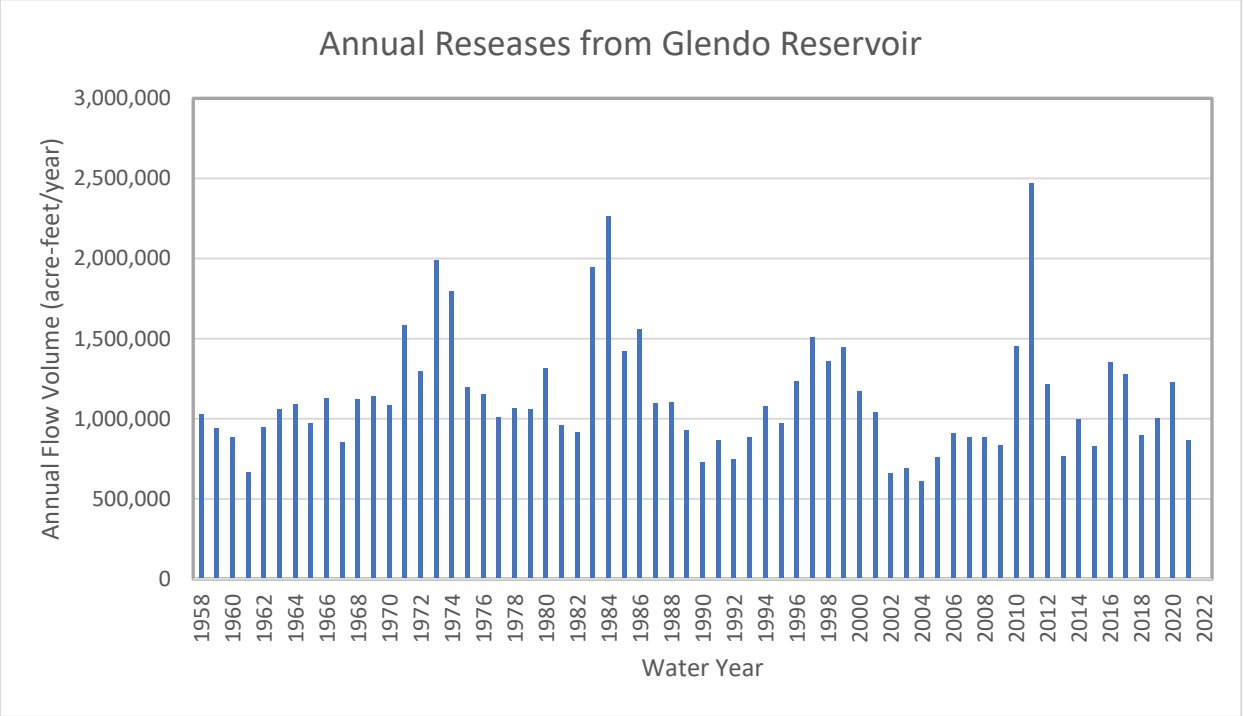

Figure 7.—Annual releases from Glendo Reservoir (USBR, 2022).

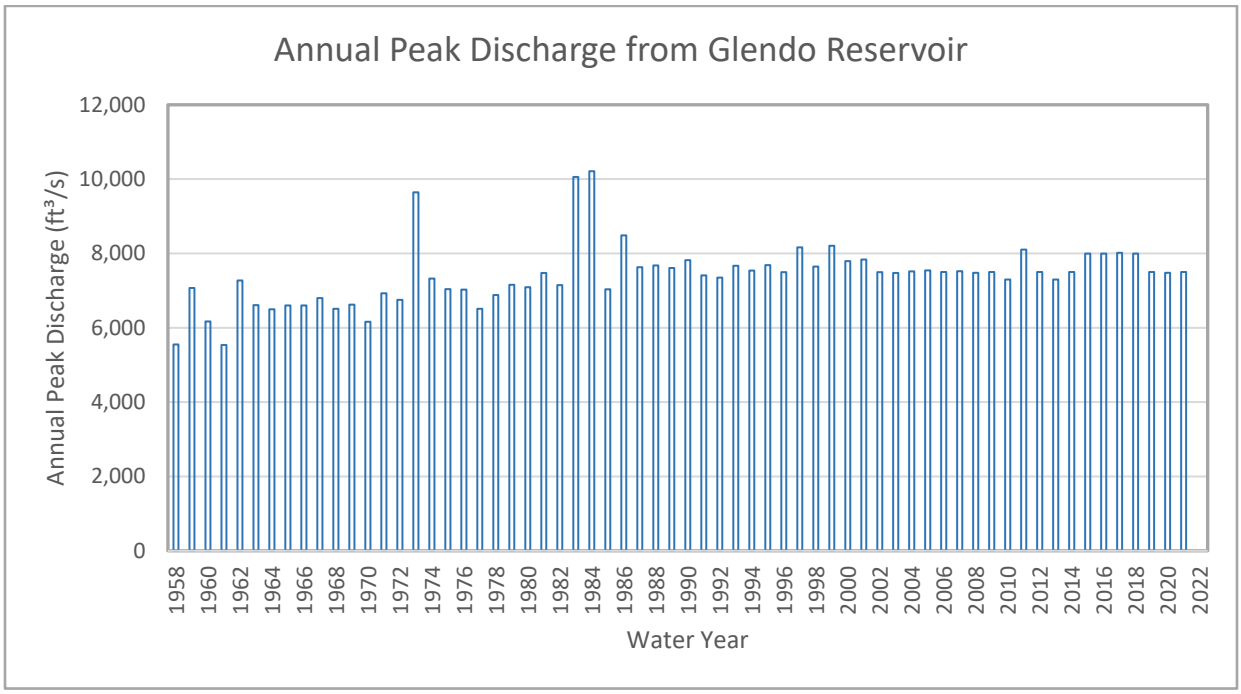

Figure 8.—Annual peak discharge from out of Glendo Reservoir (USBR, 2022).

Dam Operations and Reservoir Characteristics

Guernsey Dam is an earth embankment dam. Construction of this dam was completed in 1927 and began storing water that same year. Historical reservoir water surface elevation is presented in Figure 9. Annually, the reservoir water surface typically fluctuates about 31 to 45 ft. There is an annual silt run to evacuate sediment from the reservoir and flush it downstream to maintain irrigation canals. More details on the silt run are contained in Section 5 of this report.

The dam has a height above the original streambed of 92 ft and the reservoir had an original length of about 14.6 miles long at full pool. The reservoir's greatest width is approximately 5,000 ft, about 8 miles upstream of the dam. The narrowest width is approximately 410 ft at approximately 1.25 miles upstream of the dam.

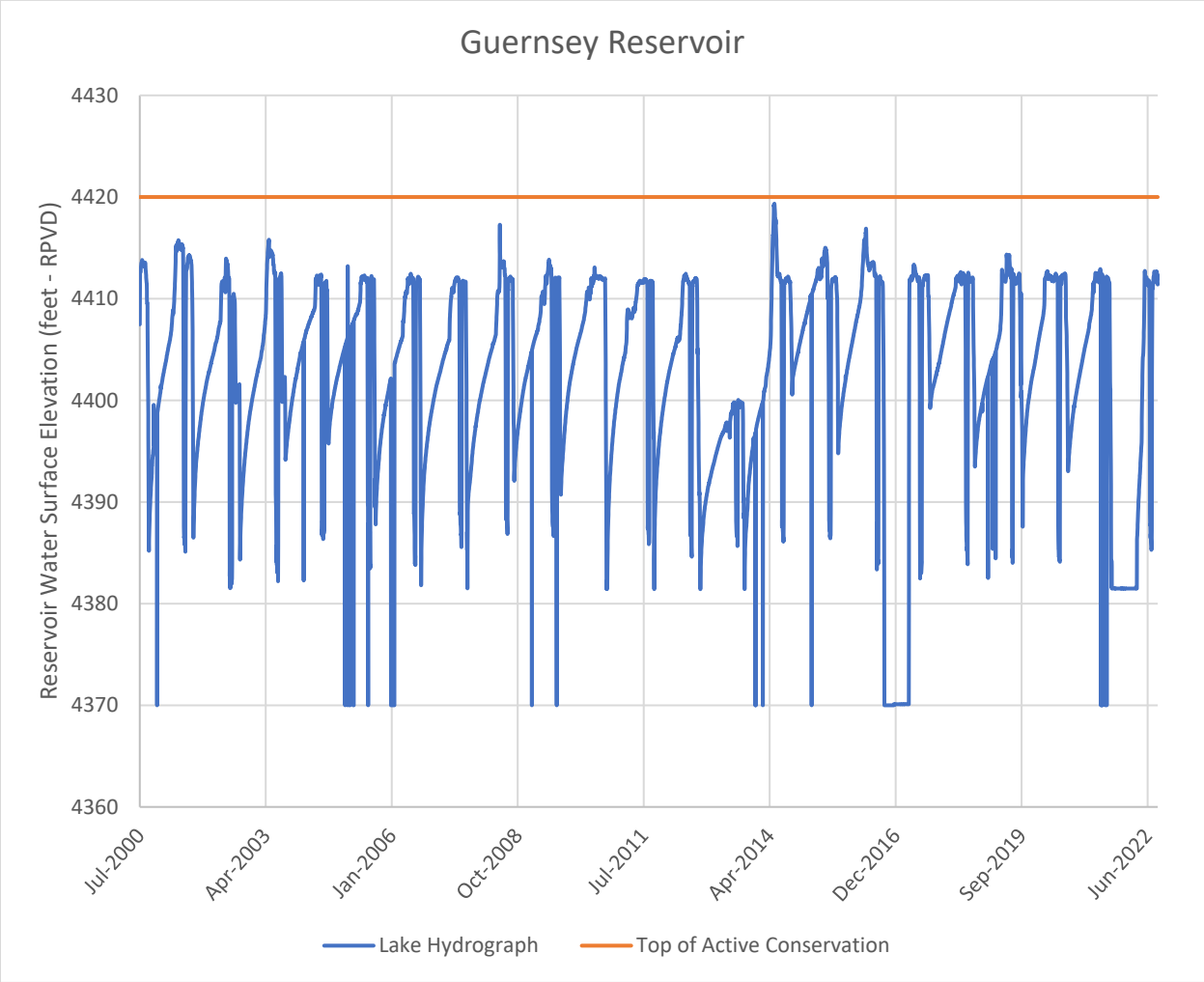

Figure 9.—Guernsey Reservoir water surface elevations since 2000 [Reclamation Hydromet: Period of Record Monthly Values for Guernsey Reservoir, WY (usbr.gov)]. The top of dead storage is now assumed to be approximately 4370 ft (RPVD).

3.0 Reservoir Surveys

A 1917 topographic survey with 10-ft contours was generated to inform the design of Guernsey Dam and Reservoir (Reclamation Drawing 20-703-120-RD-1_1917 TopoMap.TIF). Prior to dam closure and initial reservoir filling, a more detailed survey was conducted in 1927 to compute the original surface areas and corresponding storage capacities. Although the documentation summarizing the original survey methods has not been located for this analysis, plane table and level would have been the most likely survey methods for this time period. A 5-ft contour interval map was produced from this original survey.

Previous resurveys of this reservoir include 1947, 1953 (Reclamation Drawing 20-703-1025, Survey by North Platte River District), 1957 (Bureau of Reclamation 1958, Reclamation Drawings 20-703-1178-80), 1966 (Lara 1970), and 1981. The 1966 survey report (Lara 1970) and the USGS RESSED database documents additional surveys in 1931 (19 range lines), 1933 (18 range lines), 1935 (17 range lines), 1937 (17 range lines), 1939 (26 range lines), 1941 (19 range lines), and 1944 (26 range lines). A report for the 1980-1981 reservoir survey has not been located, although unpublished data supporting this survey has been located and was used in this report (above-water survey noted to be conducted by Hoffman & Company, Inc on Reclamation reservoir capacity allocation sheet). Past reservoir surveys are detailed in Table 3.

Table 3.—Previous reservoir surveys for which data exist

Survey year	Extent of survey	Survey method	Depth sounder	Above water survey	Documentation
1917	Full	Surface Mapping	N/A	N/A	Drawing
1927	Full	Surface mapping	Unknown	Plane table and level 1927	No data
1947	Full	Range line	Unknown	Plane table and level 1947	Drawing
1957	Full	Range line	Single Beam	Plane table and level 1957	Report
1966	Full	Range Line	Single Beam	Not stated	Report
1981	Full	Photogrammetry	Contours for elevation 4370 and 4375 from hydrographic survey	Photogrammetry (Hoffman & Company, Inc)	Some documentation available, no report
2022	Full	Lidar	N/A	Lidar 2022	Report

2022 Survey Data and Surface Assembly

Reclamation's TSC contracted an aerial survey that included lidar and photography with Woolpert, who then sub-contracted the work to Aero-Graphics in order to meet the desired schedule. The aerial survey was conducted on March 18, 2022 while the reservoir was nearly empty. Aerial lidar and photography were delivered in the Wyoming State Plane East projection, using the NAD83(2011), NAVD88 (GEOID18) datums. Data were delivered in bare earth LAS point format and a tiled raster (figure 10). The reported mean vertical error is 0.00 ft, with a minimum and maximum error of -0.07 ft and 0.06 ft, respectively. The sample size was 6 control points for this error analysis as well as 26 QA/QC check points in vegetated and non-vegetated areas. Appendix A contains the contractor's lidar data collection report.

Except for the locations covered by water, the coverage was complete. During the aerial data collection there was a small amount of water being released from Glendo Dam, approximately 26 ft^3/s. There is no gage to indicate additional discharge in the 22 miles of river between Glendo Dam and the delta of Guernsey Reservoir, including Horseshoe and Cottonwood Creeks. The lidar did not collect reservoir bottom elevations in the wetted portions of the channel through Guernsey Reservoir or at the small pool that formed near the dam (figure 2). For the purpose of determining reservoir capacity, the wetted areas that do not include reservoir bottom elevations were considered negligible. In most places the wetted width of the channel was 100 ft. With a very small discharge through a rather wide channel the flow depth is conservatively assumed to be less than 0.5 ft. For this reason, the water elevation in the channel is assumed to be the reservoir bottom elevation. Near the dam there is a small pool of water immediately upstream of the dam and a larger ponded area to the west (figure 2). The wetted area of the large pond near the dam (disconnected from incoming flow) is 27.5 acres. The depth of this pond is unknown and is considered to be dead storage because it's disconnected from the outlets at low water elevations. The lowest lidar elevation surveyed was 4377 ft (RPVD). The lowest bed elevation near the dam is presumed to be 4370 ft (RPVD) based on observations by David Merrell and Matthew Wells (pers. Comm. 11/14/2022). This information indicates that there is a maximum water depth at the dam of approximately 7 ft. The raster surface created from the point data set interpolated across all areas of no data (wetted areas), essentially providing a water surface elevation in the wetted portions of the raster.

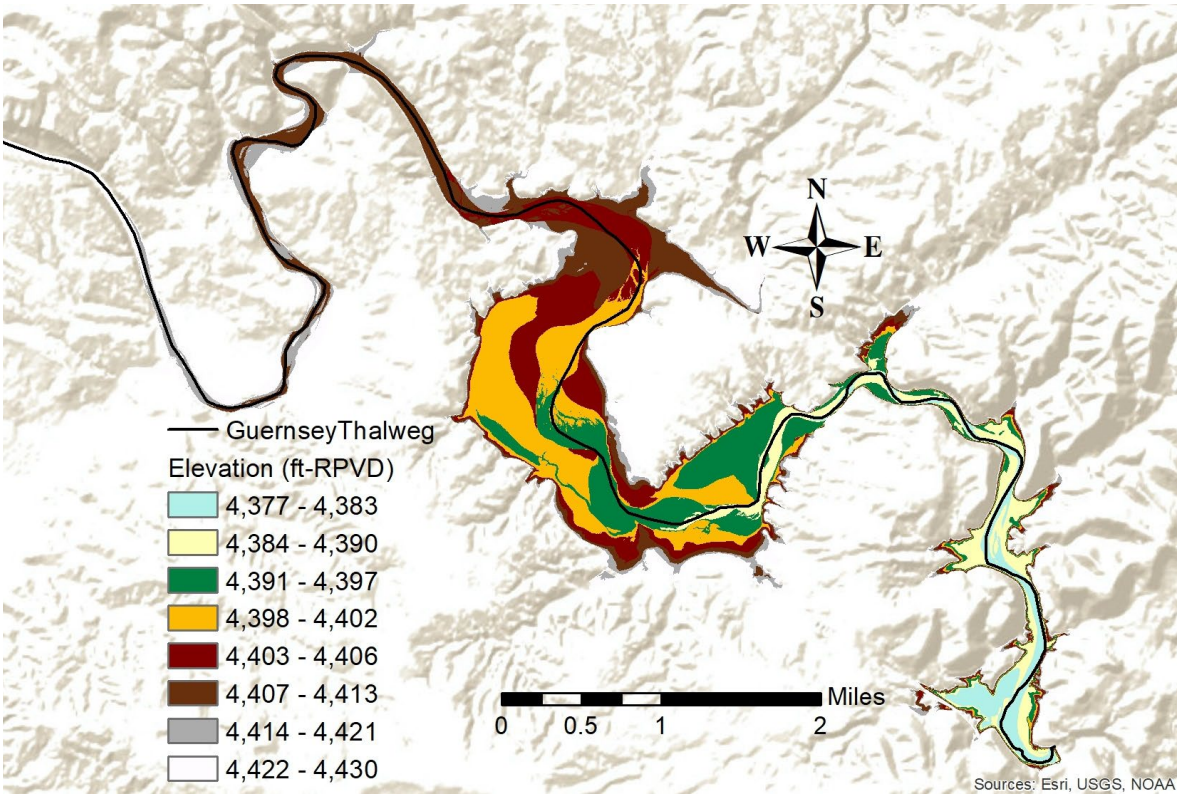

Figure 10.—Image showing the raster surface created from the 2022 aerial lidar data. The black line through the reservoir is the thalweg alignment used for the bed elevation profile.

Survey Control, Datum, and Monuments

For the 2022 survey, all lidar and Global Positioning System (GPS) control measurements were collected in North American Datum 1983 (NAD 1983) State Plane coordinates (horizontal), Wyoming East Zone, U.S. survey feet and North American Vertical Datum 1988 (NAVD 1988, geoid-18, US survey feet (vertical). During processing, all lidar and GPS measurements were converted to Reclamation Project Vertical Datum (RPVD) for calculations of area and capacity tables for Guernsey Dam.

The difference between the vertical datums NAVD88 and the RPVD at Guernsey Reservoir was determined from RTK-GPS measurements on the dam crest, nearby control points, and water surface elevations measured at the staff gage near the dam. This survey took place August 19, 2022. The surveyed points were compared to construction drawings of the dam that contained elevations for the specific points listed in Table 4. The RPVD was determined to be 0.56 ft lower than the NGVD 1988 (Geoid 18) datum. The survey to determine the difference between RPVD and NAVD 1988 at Guernsey Dam was processed using Trimble Business Center software by Reclamation staff from the Sedimentation and River Hydraulics Group, Denver TSC.

Table 4.—Table showing the points used to determine the shift from NAVD88 to RPVD. The horizontal coordinates listed are in NAD83 State Plane WY East and Vertical coordinates are in NAVD88

Points Used to Determine Vertical Datum Shift (NAVD88 to RPVD)			
Easting-ft	Northing-ft	Elevation (NAVD88)-ft	Name
6366515.255	16176244.57	4434.314	Base Station*
765013.094	652709.389	4430.399	SP-5
765051.821	652621.443	4430.492	MP-2
765099.471	652533.413	4430.577	MP-3
765147.093	652445.673	4430.463	MP-4
765194.954	652357.991	4430.553	MP-5
765138.536	652263.31	4412.332	WSE-STAFF (1139)
765320.186	652236.996	4463.365	CP2-LOU

* The GPS base station was located on a Reclamation brass cap on the northeast shoulder of Highway 317 approximately 62 ft north of the northwest corner of the gate house of the north spillway. The coordinates shown resulted from a static OPUS solution (www.ngs.noaa.gov/OPUS/).

4.0 Reservoir Surface Area and Storage Capacity

Tables of reservoir surface area and storage capacity were produced for the full range of reservoir elevations. Plots of the 2022 area and capacity curves are presented on figure 11, along with available curves from 1927, 1947, 1953 1957, 1966, and 1981 resurveys. For the 2022 resurvey, area and capacity curves are based on the 2022 lidar survey of the nearly empty reservoir. To supplement the time period from 1927 to 1947, documented change in total capacity (acre-ft) is; 73,810 (Feb. 1927), 67,840 (Jan. 1931), 65,050 (Jan. 1933), 62,940 (Jan. 1935), 60,930 (Feb. 1937), 58,430 (Feb. 1939), 56,600 (Jan. 1941), 53,180 (Jan. 1944), and 49,150 July (1947). These data were derived from the USGS RESSED sheet for Guernsey Dam, although detailed ACAP data were not located.

At the top of the active pool elevation (4420 feet, RPVD), the reservoir currently has a surface area of 2,417 acres and a storage capacity of 46,237 acre-feet. A brief area and capacity table at 5 ft increments is shown in Table 5 to compare values across the various resurveys. The full range of area and capacity for the 2022 resurvey is shown in Appendix B, which also contains details regarding the area and capacity calculation and methods.

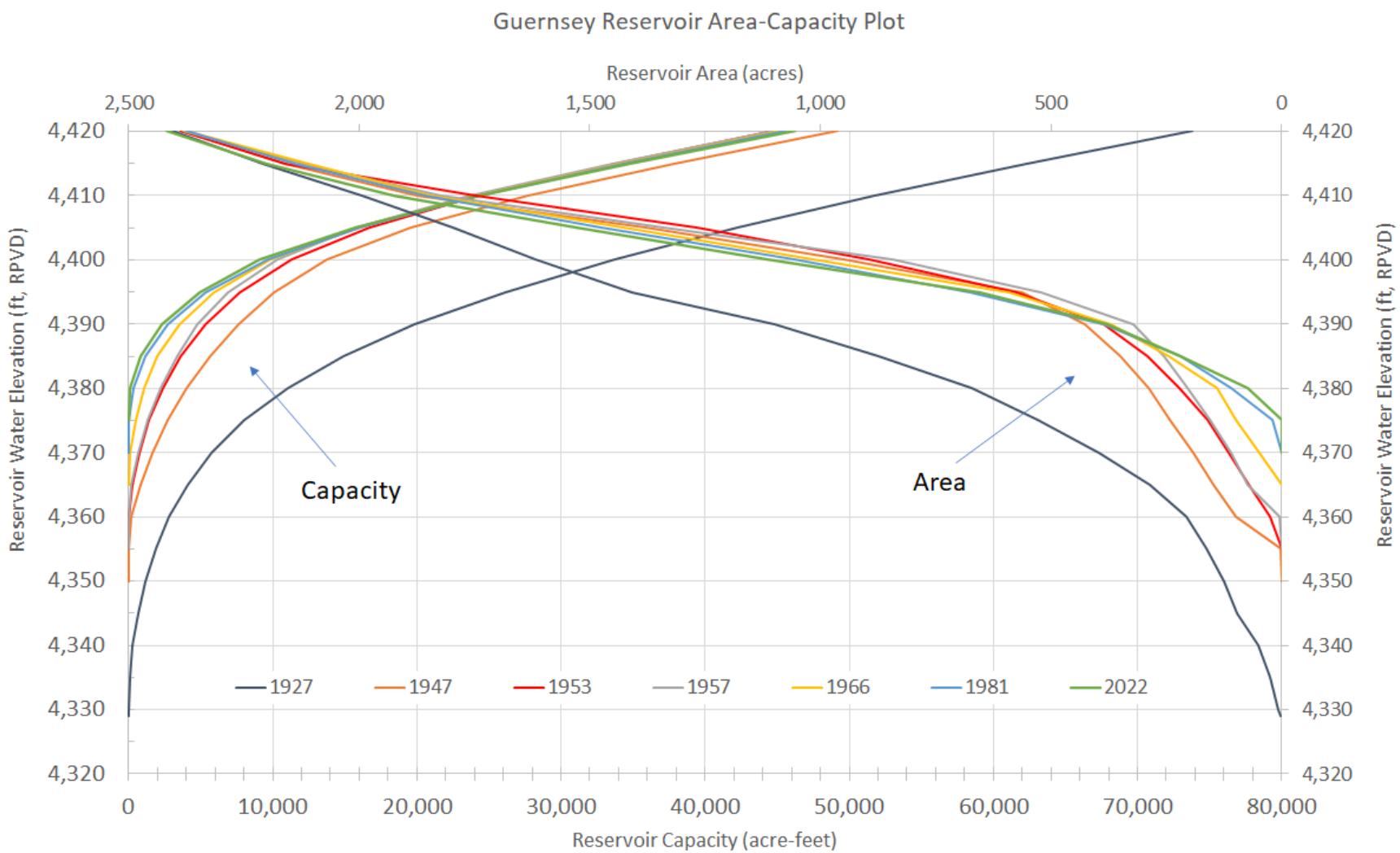

Figure 11.—Plot of Guernsey Reservoir surface area and storage capacity versus elevation (RPVD).

Table 5.—Table of Guernsey Reservoir area and capacity at 5-ft intervals for all survey years. In 2022, the lidar did not capture the lowest elevations near the dam. An assumed value of 0 capacity and area at elevation 4370 ft (RPVD) is made (verbal communication, David Merrell, November 2022). The value 'UNK' indicates unknown for elevation 4375 ft (RPVD) in this table

Elev. (ft)	Reservoir Storage Capacity (ac-ft)							Reservoir Surface Area (ac)						
	1927	1947	1953	1957	1966	1981	2022	1927	1947	1953	1957	1966	1981	2022
4,420*	73,810	49,150	44,800	44,800	45,228	45,612	46,237	2,405	2,386	2,386	2,382	2,377	2,375	2,417
4,415	62,250	37,770	33,750	33,540	34,042	34,325	34,720	2,208	2,159	2,159	2,122	2,109	2,140	2,200
4,410	51,730	27,680	24,210	23,680	24,136	24,337	24,347	1,994	1,874	1,746	1,822	1,842	1,855	1,925
4,405	42,240	19,570	16,710	15,775	15,939	16,012	15,700	1,797	1,376	1,268	1,340	1,425	1,475	1,528
4,400	33,690	13,790	11,330	10,315	9,840	9,687	9,121	1,618	948	893	844	1,014	1,055	1,113
4,395	26,110	10,050	7,700	6,905	5,871	5,362	4,888	1,409	561	574	520	589	675	655
4,390	19,850	7,588	5,310	4,800	3,529	2,712	2,298	1,098	425	386	322	371	385	378
4,385	14,920	5,650	3,630	3,360	2,009	1,200	820	873	350	290	254	245	220	219
4,380	11,060	4,052	2,360	2,215	1,065	375	66	671	289	221	204	139	110	73
4,375	8,069	2,726	1,400	1,320	477	50	UNK	528	242	161	154	100	20	UNK
4,370†	5,765	1,647	720	660	105	0	0	395	190	114	110	47	0	0
4,365	4,066	802	270	200	0	'-----	'-----	286	148	70	74	0	'-----	'-----
4,360‡	2,834	189	40	2	'-----	'-----	'-----	207	99	26	5	'-----	'-----	'-----
4,355	1,910	0.6	0	0	'-----	'-----	'-----	162	1.6	0	0	'-----	'-----	'-----
4,350	1,192	0	'-----	'-----	'-----	'-----	'-----	125	0	'-----	'-----	'-----	'-----	'-----
4,345	639	'-----	'-----	'-----	'-----	'-----	'-----	96	'-----	'-----	'-----	'-----	'-----	'-----
4,340	278	'-----	'-----	'-----	'-----	'-----	'-----	50	'-----	'-----	'-----	'-----	'-----	'-----
4,335	92	'-----	'-----	'-----	'-----	'-----	'-----	25	'-----	'-----	'-----	'-----	'-----	'-----
4,330	19	'-----	'-----	'-----	'-----	'-----	'-----	6	'-----	'-----	'-----	'-----	'-----	'-----
4,329	4	'-----	'-----	'-----	'-----	'-----	'-----	1	'-----	'-----	'-----	'-----	'-----	'-----

* Maximum water surface
† Top of inactive pool
‡ Top of dead pool

5.0 Reservoir Sedimentation Volume Spatial Distribution

A thalweg profile was created using the 2022 lidar data in Arc GIS along the alignment shown in Figure 10. The station-elevation data for the 2022 resurvey were plotted with thalweg profiles from previous resurveys. These profiles are shown on Figure 12.

There are a few notable observations viewing the thalweg elevation in the profile data. At the upper end of the reservoir in the delta (Stations R-0 and R-1, figure 12) it is noted that the channel has degraded compared to the original bed elevation in 1927. In the upper half of the reservoir (Stations R-2 through R-15A) the 2022 resurvey indicates some degradation of reservoir deposits. However, downstream of Station R-15A the 2022 resurvey indicates an aggrading thalweg. These observations affirm continued redistribution of reservoir sediment mentioned in previous studies (Bureau of Reclamation 1963, Lara 1970).

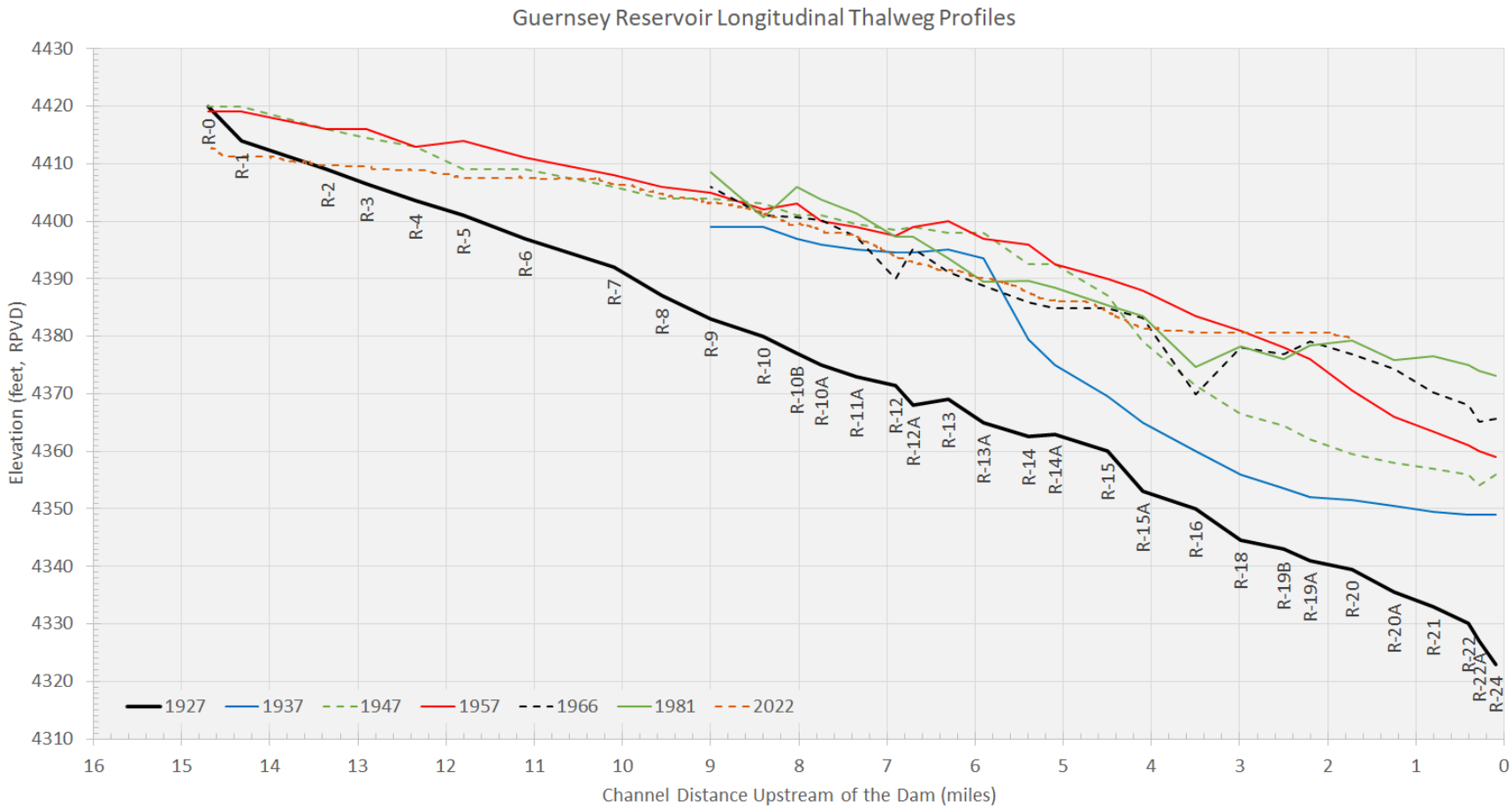

Figure 12.—Longitudinal profile for multiple survey years of Guernsey Reservoir bottom from the dam upstream to the confluence of Cottonwood Creek. Note the degradation of the channel below the original bed elevation at Stations R-0 and R-1. The degradation maximum at Station R-0 is approximately 7.3 ft. The 2022 bed profile has been cut off at RM 1.7 due to the pooled water near the dam.

Trends

Graphs of the historical reservoir sedimentation rates over time (figure 13) and cumulative reservoir sedimentation volume over time (figure 14) indicate a decreasing sedimentation rate due to the upstream construction of Glendo Reservoir. It appears as though the silt runs are evacuating sediment at approximately the current annual incoming sedimentation rate. Some of the differences in reservoir capacity may also be attributed to survey methods.

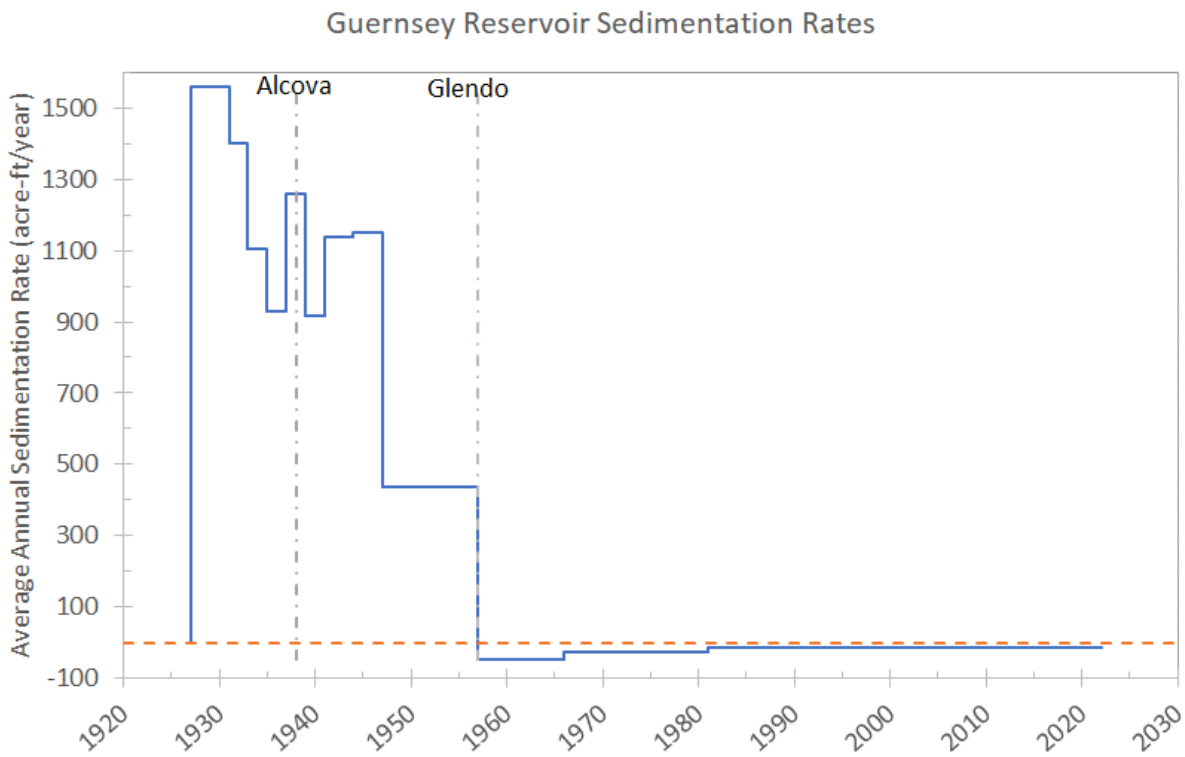

Figure 13.—Average annual reservoir sedimentation rates over time between surveys. Closure dates of Alcova and Glendo Dams are shown at the top of the graph. The dashed horizontal line indicates a sedimentation rate of zero.

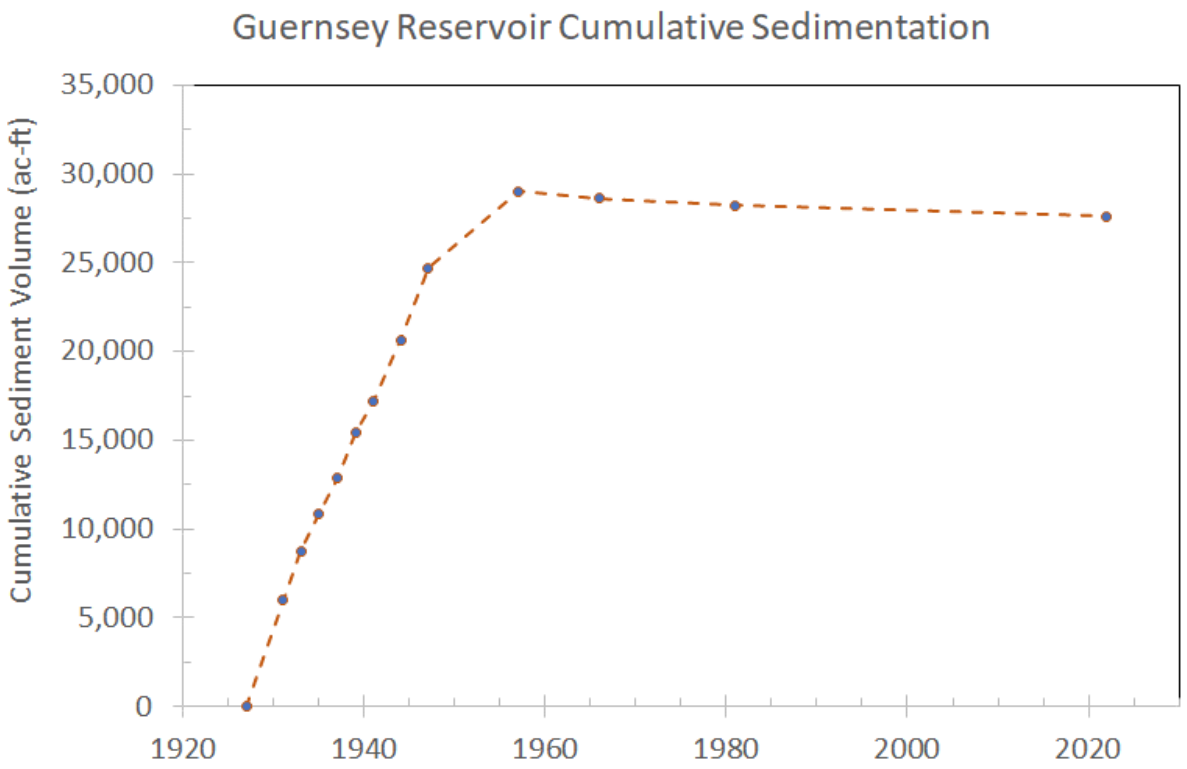

Figure 14.—Cumulative reservoir sedimentation over time. Operation of Glendo Reservoir began in 1957.

Sediment accumulates at all reservoir elevations and against the dam. Near the dam, sedimentation has been increasing the lowest reservoir bottom elevation over time (figure 15), which also has diminished the dead storage capacity (Figure 16). The historical rates of sedimentation indicate that the dead storage capacity was lost soon after the 1957 resurvey.

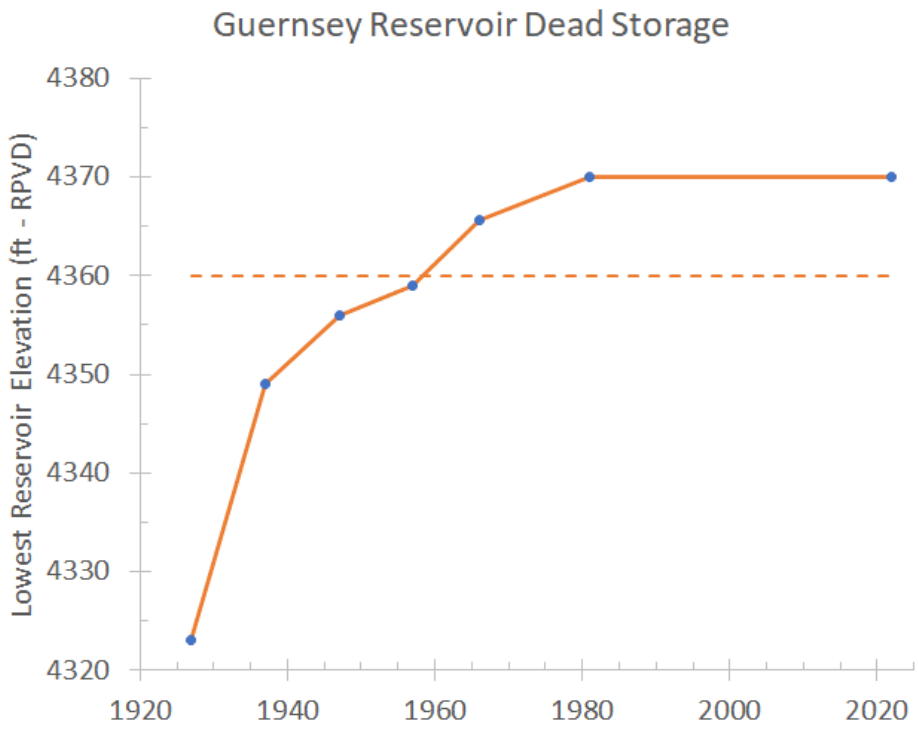

Figure 15.—Sedimentation near the dam over time.

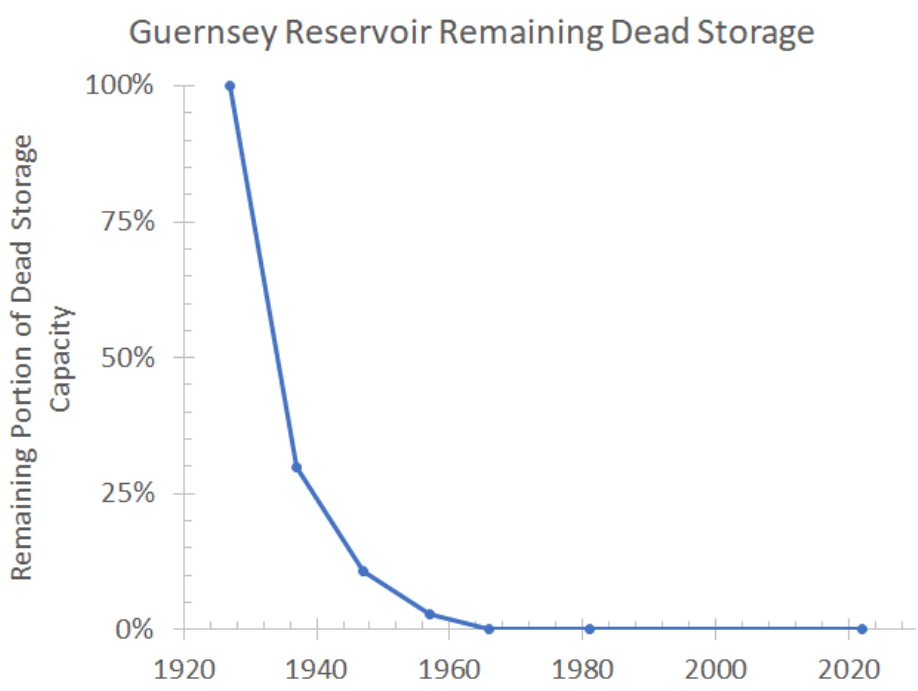

Figure 16.—Sedimentation near the dam decreases the dead storage capacity over time.

Reservoir Sediment Management

In 1936, intentional evacuation of sediment from Guernsey Reservoir began. This practice began as an inexpensive means to combat the erosion and seepage problems that were plaguing the canals downstream from Guernsey Dam. The intent of the sediment release was to increase sediment concentrations in the water downstream of Guernsey Dam so that "the silt in the water would blanket or infiltrate the canal bottom and sides, making the sides more stable and reducing the seepage" (Howe 1981). This practice continued intermittently until 1958 and became known as the 'silt run' (Howe 1981).

In 1959 it was noted that the Interstate and Fort Laramie canals were sloughing and weakening. The benefits of the past silt runs were discussed (Howe 1981) and the silt runs began again, this time intended to be performed on an annual basis into the future. The annual silt runs continue to present day.

Multiple studies have taken place in the 1950s, 60s, 70s, and 80s (Bureau of Reclamation 1958, Bureau of Reclamation 1963, Lara 1970, Lara 1973, Howe 1981) that document sediment sampling efforts upstream, within, and downstream from Guernsey Reservoir. These studies are in addition to or in conjunction with efforts to update reservoir area and capacity. These sediment sampling efforts consist of core samples from the reservoir; suspended sediment concentrations upstream, within, and downstream of the reservoir; as well as turbidity measurements. As part of historical sediment surveys in Guernsey Reservoir, twenty-one reservoir sediment samples were collected and a gamma probe was used to measure wet bulk densities at 20 reservoir range lines (Lara, 1970). Analyses of samples collected in 1947, 1957, and 1966 showed an average unit weight of 54 lb/ft^3. Size analyses of samples collected during the 3 surveys resulted in an average breakdown of 43% clay, 44% silt, and 13% sand (Lara, 1970). The suspended sediment sampling for concentration and grain size took place in the North Fork of the Platte River upstream and downstream of the reservoir and in the Interstate and Fort Laramie canals, as far downstream as Scotts Bluff, NE. In a search of available historical data on Guernsey Reservoir there was some sediment data that was not in formal reports, but referenced in Reclamation drawings, the USGS RESSED database, or in supplemental material. Reports for this work likely existed at one time but appear to be no longer available. Reports that contain sediment information are; Bureau of Reclamation 1957, Bureau of Reclamation 1963, Lara 1970, Lara 1973, and Howe 1981. These reports also include information regarding sediment loads entering Guernsey reservoir and sediment loads being released. The report by Reclamation (1963) noted that 117 acre-ft of sediment were released downstream during silt runs between 1957 and 1962. The report by Howe (1981) indicates that in 1979 and 1981, 41 acre-ft and 71 acre-ft were removed during the silt run in those years, respectively.

In 1957 the upstream construction of Glendo Dam was complete, reducing the sediment contributing watershed into Guernsey Reservoir from 5,400 sq. mi. (below Alcova Dam) to 675 sq. mi. The engineering design for Glendo Reservoir provides space for storing 115,000 acre-feet of sediment, an estimated 100-year accumulation. Reports indicate "clear water" being released. This is corroborated by David Merrell and Matthew Wells (WYAO, pers. Comm. 11/14/2022) stating that very little, if any, sediment is being released from Glendo Dam. Since

1957 the capacity of Guernsey Reservoir at elevation 4420 ft (RPVD) has remained nearly constant at approximately 45,000 acre-ft. There is a slight trend of increasing reservoir capacity at elevation 4420 ft (RPVD). The presence of Glendo Reservoir 22 miles upstream of Guernsey Dam has resulted in the lack of increasing sedimentation of Guernsey Reservoir. It is unknown how much to credit the silt runs for the mostly steady state of the reservoir capacity at full pool. Past reporting on the sedimentation of Guernsey Reservoir indicate that the silt runs are responsible for the redistribution of sediment within the reservoir (Bureau of Reclamation 1963, Lara 1970). This redistribution continues, with a trend of sediment moving toward the dam.

6.0 Conclusions and Recommendations

Survey Methods and Data Analysis

The 2022 LiDAR dataset has been used to produce an accurate digital surface of the reservoir bottom between elevation 4377 and 4420 ft (RPVD). Elevations below 4377 ft were unable to be surveyed due to remaining water within the reservoir.

Reservoir surface areas were computed from this digital surface at 1-ft intervals to determine the 2022 storage capacity. Surface area and storage capacity were then interpolated at 0.1-ft, and 0.01-ft intervals (Appendix B). The difference in reservoir surfaces over time can be attributed to sedimentation, but also the differences in survey methods.

Sedimentation Progression and Location

Over the span of 95 years, sedimentation has filled in 37 percent of the original storage capacity. The 2022 reservoir survey indicates that most of this sedimentation is located downstream of Range Line 15A (Reservoir Mile 4) (Figure 12). This location is coincident with reservoir elevation 4380 ft (RPVD) based on the thalweg profile. Upstream of this location the sediment in the thalweg has largely decreased as a result of the silt runs. Downstream of Range Line 15A thalweg elevations and sedimentation continue to increase, reflecting the redistribution of sediment within the reservoir due to the silt runs.

However, the reservoir capacity values over the various resurveys (Table 5) indicate an increase in capacity upstream of Range Line 9 (Reservoir Mile 9, reservoir elevation 4405 ft). Another way to look at this is to examine the capacity at various elevations, as opposed to the thalweg elevations. Although the total reservoir capacity at and above elevation 4405 ft (RPVD) has remained relatively constant since the 1957 resurvey, capacity below elevation 4405 ft (RPVD) continues to decrease slightly.

Future sedimentation of Guernsey Reservoir is dependent on the trap efficiency of upstream dams. Since the closure of Glendo Dam on October 18, 1957, about 33,979 acre-feet of estimated change has occurred below elevation 4,653.0 resulting in a 4.26 percent loss in reservoir volume (Ferrari, 2005). The original estimation of the sedimentation rate was 1,150 acre-ft per year, although the measured sedimentation rate reported by Ferrari (2005) is 739 acre-ft per year, 1957 – 2003. Based on the estimate reported by Ferrari (2005) Glendo could begin passing sediment in approximately 90 years, which would be 155 years after construction. This is assuming the past trends continue well into the future. Considering climate change and likely changes in sediment delivery, there is a potential change in operations sometime in the future. This could change the rate of sedimentation in the coming decades. Under the current condition of Glendo Reservoir trapping nearly all the sediment and current operation of Guernsey Reservoir that includes annual silt runs, Guernsey reservoir is not likely to see a large loss of reservoir storage.

Recommendation for Next Survey

Based on the progression of sedimentation toward the dam and the former pattern of decadal resurveys, the next survey of Guernsey Reservoir is recommended in approximately 10 years, 2032. Given that silt runs and reservoir drawdown occur annually, lidar can once again be used to survey the mostly empty reservoir. Prior planning for the concomitant reservoir drawdown and lidar survey should begin one year ahead of the intended data collection. This will provide ample time for contracting and appropriate mobilization of the equipment and crew to ensure the data are collected at the lowest possible reservoir elevations.

Other Recommendations

Examining the past 20 years of annual low water elevations (Figure 9), there is an apparent correlation with the pivot point in the thalweg elevations (Figure 12). In most years the reservoir is only drawn down to elevations between 4386 ft and 4381 ft (RPVD). It stands to reason that this has a significant influence on where and how the redistribution of sediment is taking place.

An additional observation is that releases from Glendo Reservoir during the silt run are extremely small. This is likely an effort to conserve water in the system within Glendo Reservoir while Guernsey is drawn down for the silt run. There may be opportunity to reevaluate the operations of Glendo and Guernsey Dams (and perhaps other dams within the system) to improve the effectiveness of the silt run by increasing discharge through Guernsey Reservoir. It is also possible that increased discharge through Guernsey Reservoir during the silt run may have detrimental effects on Guernsey sediment redistribution, moving more sediment to the dam but not flushing it. In either case, the data contained in this report will help inform such decisions.

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8.0 Acknowledgments

The TSC would like to acknowledge the assistance of David Merrell during the survey to determine the shift from NAVD88 to RPVD in August 2022. We would also like to acknowledge multiple informative conversations with Mahonri Williams, David Merrell, Matthew Wells (WYAO) and Patrick Erger and Dale Lentz (MB&ART Regional Office). The authors appreciate the thoughtful comments of the outside TSC peer reviewers, Patrick Erger and Dale Lentz. Funding for the lidar data collection, the contracting, and reporting was provided by Patrick Erger (MB&ART Regional Office).

Appendix A

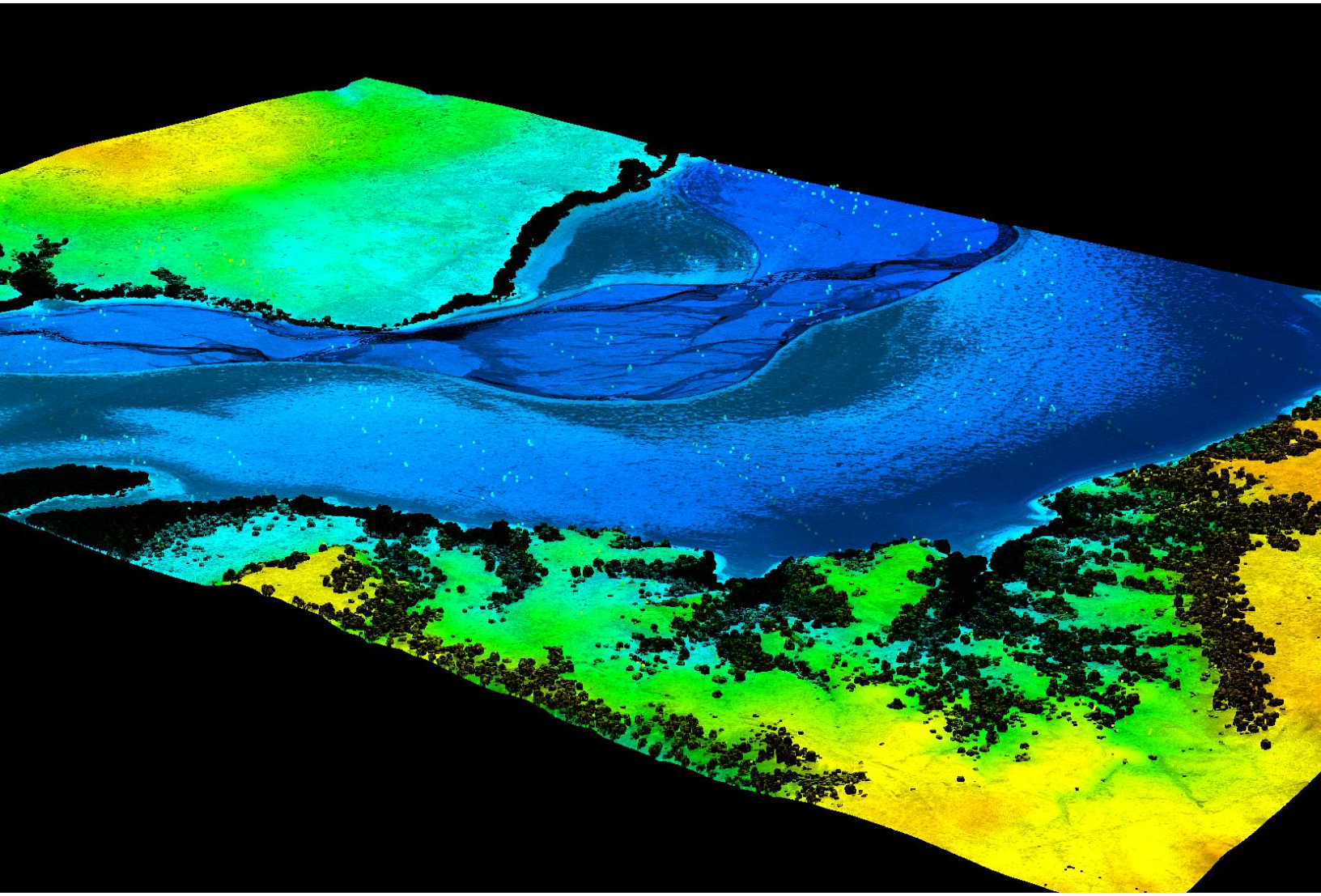
Lidar report from Woolpert

LiDAR report will be entered in the PDF version

TECHNICAL PROJECT REPORT

GUERSNEY RESERVOIR AERIAL SURVEY

Platte County, WY



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aero-graphics

Technical Project Report

Guernsey Reservoir Aerial Survey

TABLE OF CONTENTS

1. Overview

1.1 Project Area

Aero-Graphics was contracted to perform aerial LiDAR scanning and imagery acquisition over the Guernsey Reservoir project area in Platte County, WY. The project area covers approximately 26.9 square miles. This report describes the planning, acquisition, and processing of the LiDAR dataset as well as other deliverables.

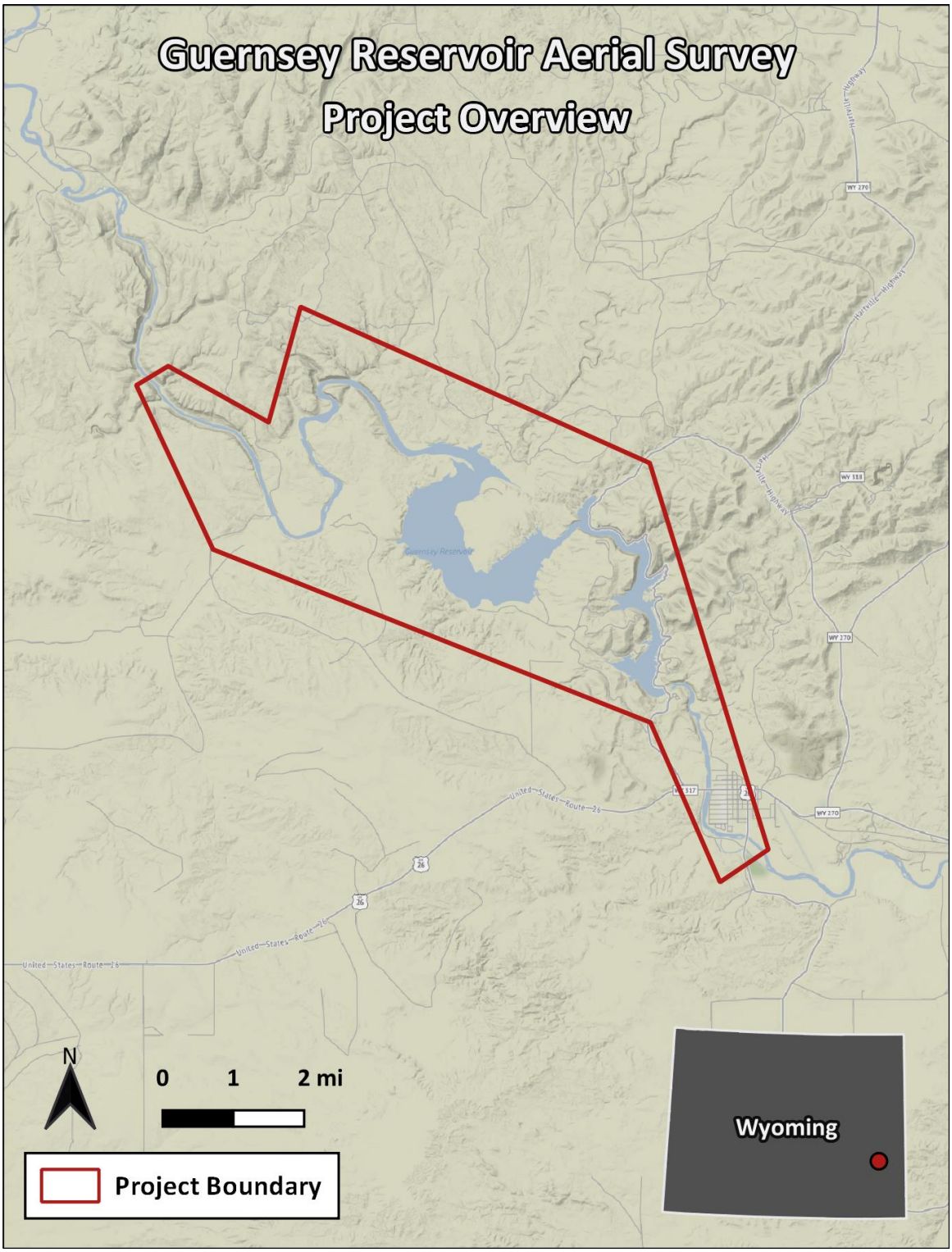
1.2 Project Deliverables

LiDAR Data	▪ Raw and classified LiDAR point data in LAS v1.4 format
Raster Data	▪ 3-band color orthorectified imagery in .TIF with a pixel resolution of 0.5' ▪ Hydro-flattened bare-earth DEM and intensity rasters in IMG format
Vector Data	▪ ArcGIS shape files for project boundary, tile index, trajectories, and hydro breaklines
Report of Survey and Metadata	▪ FGDC fully-compliant LiDAR product and flight line metadata in .xml format ▪ Technical Project Report including methodology, accuracy, and results

1.3 Projection, Datum, Units

Projection		Wyoming State Plane East Zone
EPSG		6612
Datum	Vertical	NAVD88
	Horizontal	NAD83 (2011)
Units		US Survey Feet

<u>Exhibit 1:</u> Guernsey Reservoir project boundary



2. Acquisition

2.1 Flight Planning

Aero-Graphics created a unique flight plan for this project using Optech's Airborne Mission Manager (AMM) flight planning software. AMM simulates flight plans based on the project area's terrain, as well as the sensor's model, mount, and settings. These features helped ensure that this project's specifications were met in the most efficient way possible. A summary of this project's flight parameters and sensor settings are outlined in **Exhibit 2**.

Exhibit 2: Summary of planned flight parameters and sensor settings

Planned Specifications		
Aircraft		Cessna 206
Altitude (ft above ground level)		4,350
Speed (kts)		120
LiDAR Sensor		Optech Galaxy Prime
PRF (kHz)		300
Scan frequency (Hz)		66
Laser power		High
Scan Angle	Full	39°
	From nadir	± 19.5°
Planned Average Point Density (p/m²)		4.48
Planned Aggregate Point Density (p/m²)		8.96
Post Spacing at Nadir	Cross Track (m)	0.48
	Down Track (m)	0.47
Swath Width (m)		926
Sidelap (%)		60
No. of Flightlines		27
Aerial Camera		PhaseOne iXU-RS 1000
No. of Images		739
Ground Sampling Distance	cm	12.2
	in	4.8

2.2 Data Acquisition

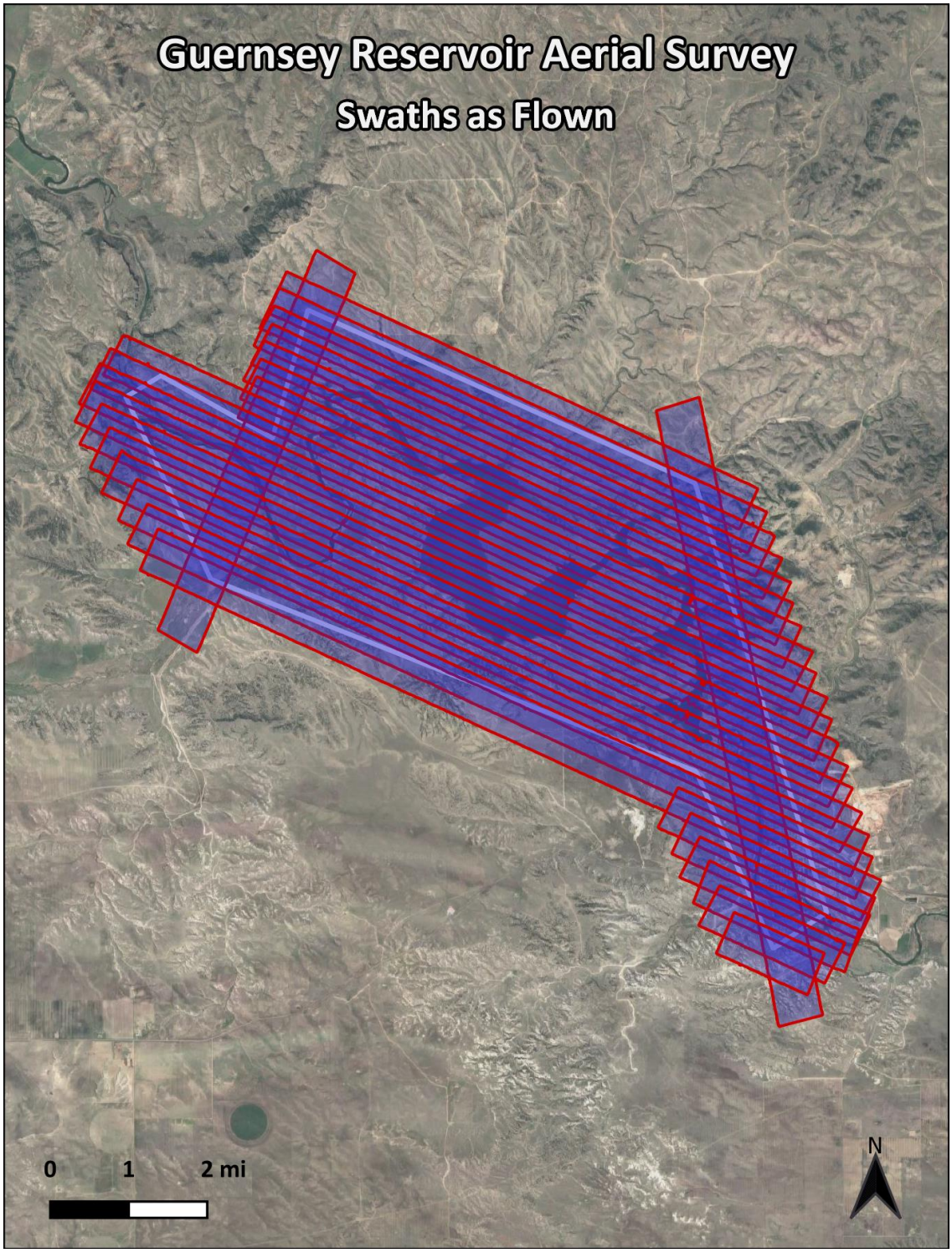
Aero-Graphics acquired LiDAR data and aerial imagery on March 18, 2022 with a turbocharged Cessna 206 (**Exhibit 3**). The stability of this platform is ideal for efficient data collection at high and low altitudes and at a variety of airspeeds. Additionally, our Cessna 206 has been customized to house a variety of airborne sensors, and the power system and avionics have been upgraded specifically to meet aerial survey needs.

Exhibit 3: A Cessna 206 was the acquisition platform for this project

The Optech Galaxy Prime was selected for this project on account of its high accuracy and efficiency (**Exhibit 4**). This sensor uses SwathTrak technology, which dynamically adjusts the scan field of view in real time to maintain a constant swath width over a variety of terrains. It also features up to 8 returns per pulse, which increases the vertical resolution of complex terrains. The sensor is complemented with the use of FMS Nav, which allowed the system operator to monitor the point density and swath attributes of this project in real time, ensuring quality data and full coverage, as shown in **Exhibit 5**. More information about point density can be found in Section 5.5.

Exhibit 4: The Optech Galaxy Prime was used for data acquisition

<u>Exhibit 5:</u> Swath data for the Guernsey Reservoir project was recorded and viewed real-time by the sensor operator.



2.3 Ground Control and Check Point Survey

Aero-Graphics' professional land surveyor identified, targeted, and surveyed 6 ground control points (**Exhibit 6**) for use in data calibration as well as 26 QC check points in Non-Vegetated (NVA) and Vegetated (VVA) land cover classification (**Exhibits 7 and 8**) as an independent test of accuracy for this project. A combination of precise GPS surveying methods, including static and RTK observations were used to establish the 3D position of ground control points and QC check points. Ground control coordinates can be found in Appendix A. A summary of LiDAR calibration control vertical accuracy can be found in Section 5.2 with a more detailed report in Appendix B.

Exhibit 6: Static ground control for the Guernsey Reservoir project

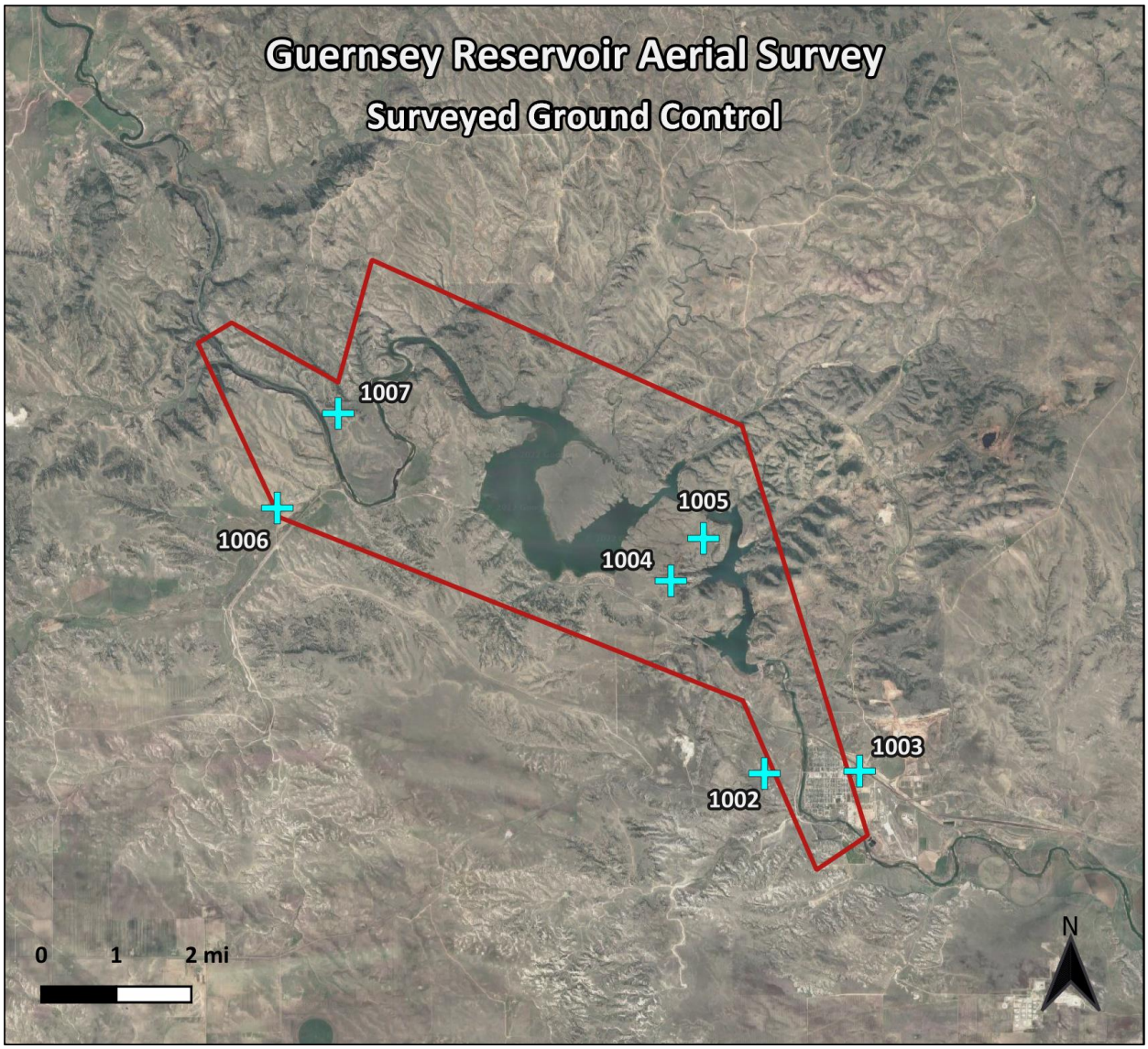


Exhibit 7: **Non-Vegetated Check Points for the Guernsey Reservoir project**

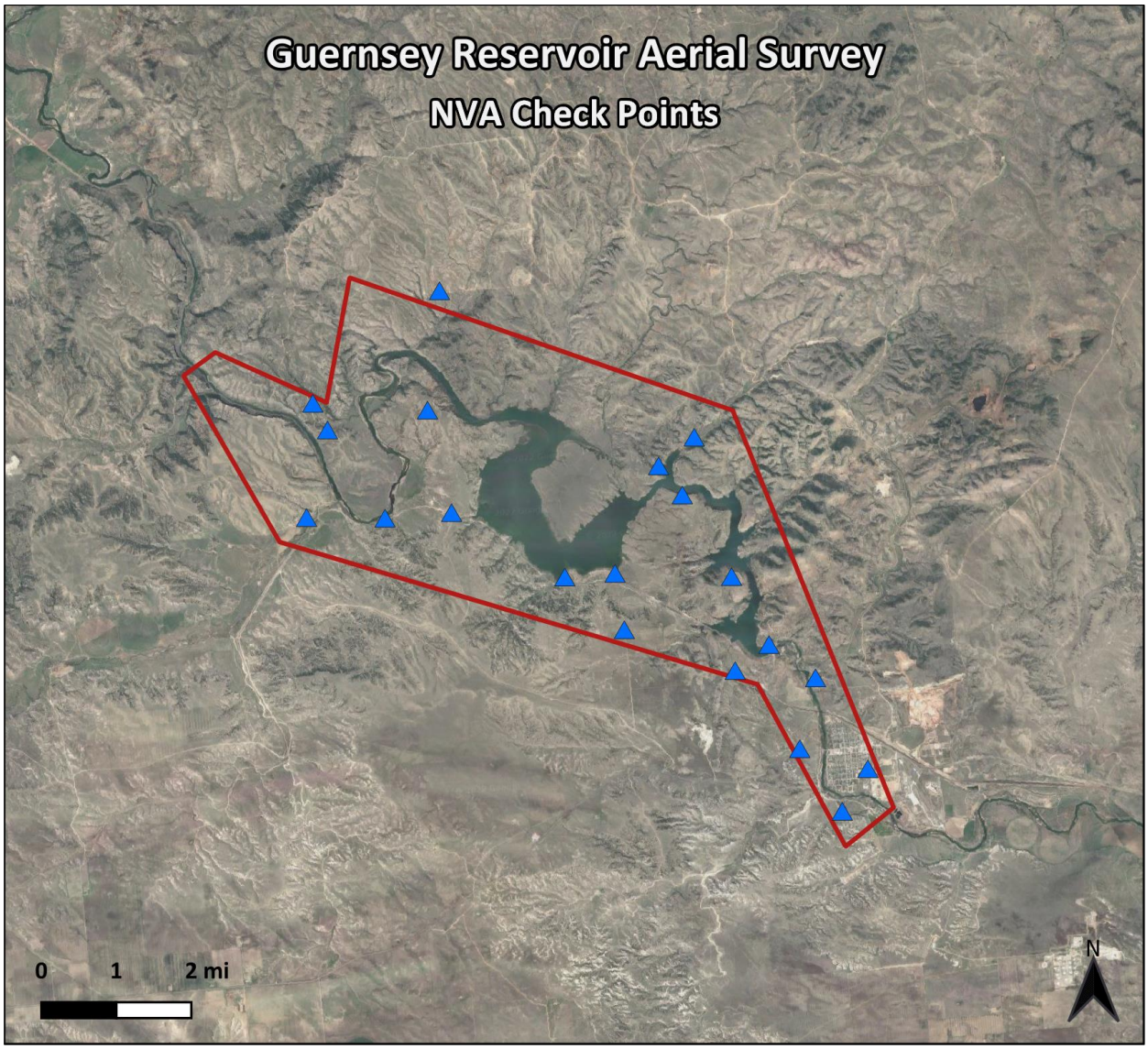
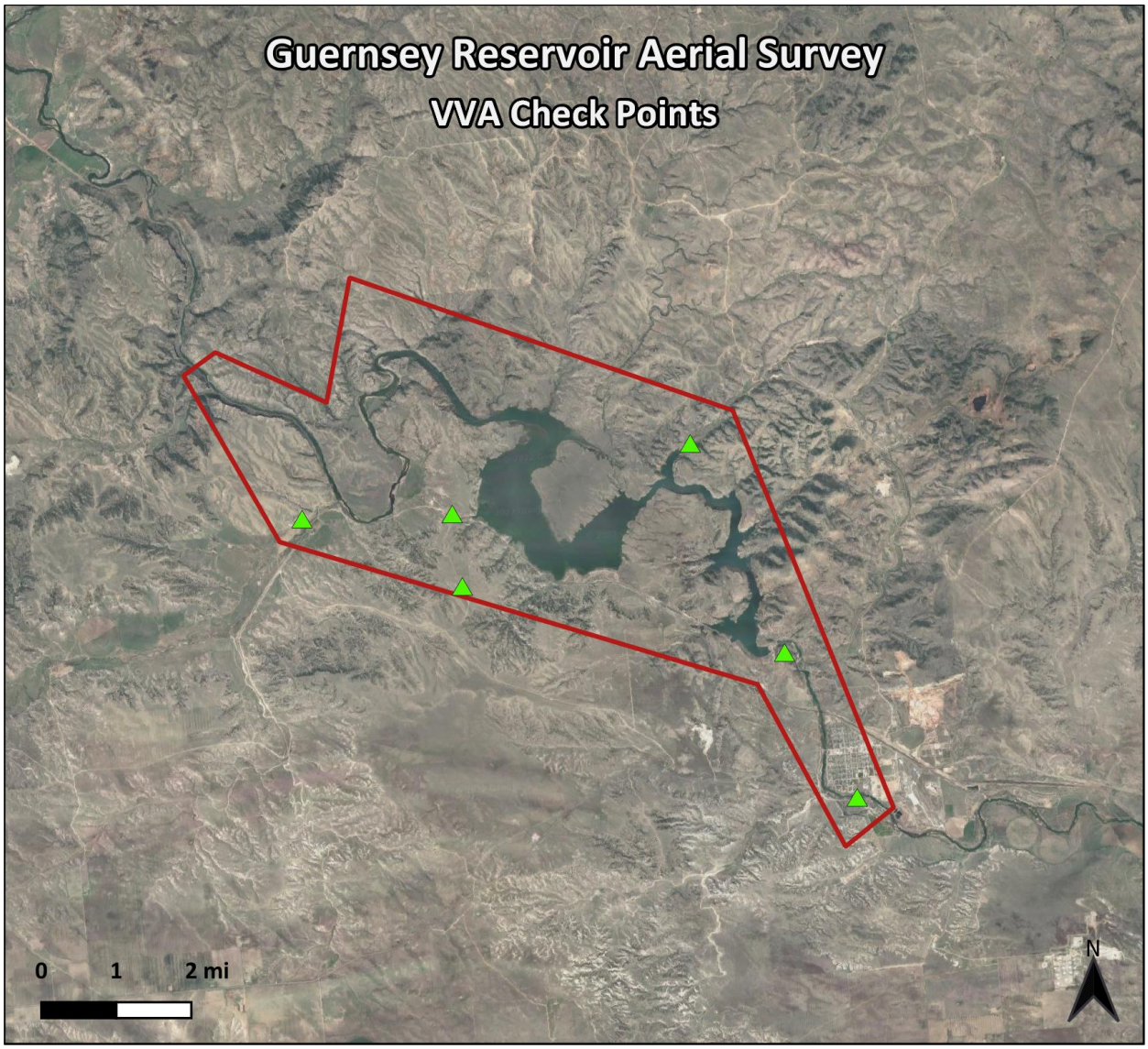


Exhibit 8: **Vegetated Check Points for the Guernsey Reservoir project**



3. LiDAR Processing Workflow

1. **Kinematic Air Point Processing** The airborne GPS positions (collected at 1-second intervals) were post-processed using Applanix's POSPac MMS GNSS Inertial software (PP-RTX). A smoothed best estimate of trajectory (SBET) was developed by combining the corrected GPS positions with 1/200-second inertial measurement unit (IMU) data, which tracked the plane's roll, pitch, and yaw throughout the flight.

2. **Raw LiDAR Point Processing (Calibration)** The SBET and LiDAR range data were combined to solve for the real-world positions of each laser point. Point cloud data was produced by flight strip in ASPRS v1.4 LAS format. Flight strips were output in the project's coordinate system.

3. **Absolute Sensor Calibration** The raw laser point cloud was adjusted for differences in roll, pitch, heading, and scale through a comparison to the surveyed ground control points.

4. **Relative Calibration** The raw laser point cloud was adjusted for differences in comparison to the surveyed ground control. These results are presented in Section 5.1.
    a. A **Dz Ortho Raster** was generated as part of this process (**Exhibit 9**). This raster identifies clusters of large residuals and differences in measured elevations between overlapping flightlines. These errors are usually caused by topographic relief or environmental factors and require manual adjustments to correct. In most cases, multiple iterations of the Dz ortho raster are created to aid in fine tuning relative calibration parameters.

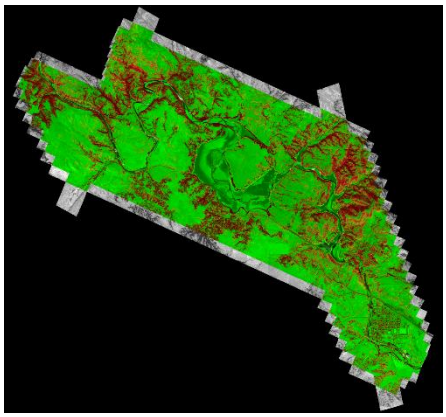


Exhibit 9: The dz ortho raster generated for the Guernsey Reservoir project

5. **Vertical Accuracy Assessment** Height differences between each static survey point and the laser point surface were identified through comparative tests. Results are presented in Section 5.2.

6. **Tiling & Long/Short Filtering** Data was clipped to match the project-specified tiles. Extremely long and short returns were also filtered out as outliers.

7. **Classification & QA/QC** Classification algorithms were run on all points within each tile to separate the cloud into bare earth and unclassified points. Areas that were not completely classified by the algorithms were manually corrected.

4. Imagery Processing Workflow

1. **Acquisition QA/QC and Image Processing** Following acquisition, the images were reviewed for flight and environmental issues such as excessive off-nadir plane rotation and cloud shadows. Photo centers were ingested into a spatial database and project-wide acquisition was reviewed for completeness. Any failed images were flagged for reflight. The raw images were then processed to standard TIFF format for further processing.

2. **Aerotriangulation** Trimble-Inpho's Match-AT software was used to perform digital aerotriangulation. During this process, tie points and ground control points were identified in each stereo pair. These points were processed with the exterior orientation parameters of each image (roll, pitch, yaw, and latitude, longitude, altitude) to complete the final bundle adjustment and minimize error throughout the image block. Quality control was performed on the image block using Inpho DTMaster by reviewing each control and tie point in stereo for proper positioning, with no points floating or digging. All parallax was cleared before the data moved to the next stage.

3. **Orthorectification** A bare-earth gridded surface was generated for orthorectification in TerraSolid's TerraScan software. Horizontal positioning was checked for proper tolerances by reviewing the relative positioning between images as well as the positioning relative to higher order control.

4. **Radiometric Balancing and Mosaicking** To compensate for visual effects within individual images, subtle radiometric adjustments were made on the orthorectified imagery in Inpho's OrthoVista software. Next, a block-wide contrast and color balance was performed to achieve a uniform appearance across the project. Individual orthophotos were combined into a seamless, geometrically-perfect orthomosaic. After this, the project was tiled according to project requirements, and a tile index was created.

5. **Final QC and Delivery Prep** Compression, reprojection into the project coordinate system, metadata, and other project specifications were completed as needed. A final review for completeness was performed in preparation for data delivery to the client.

5. Results

5.1 Relative Calibration Accuracy Results

Inter-swath relative accuracy is defined as the elevation difference in the overlapping area of parallel swaths. The statistics below are based on the elevation differences calculated between swaths.

Guernsey Reservoir project area: (25 flightlines, > 2 billion points)

- Inter-swath relative accuracy **average** of 0.07 ft

5.2 Calibration Control Vertical Accuracy

Vertical absolute accuracy reports were generated as a quality assurance check. The location of each control point is displayed in the Surveyed Ground Control map in **Exhibit 6**. Detailed results for each point are included in **Appendix B**.

Exhibit 10: Calibration control vertical accuracy results summary

Calibration Control Accuracy$_z$: Guernsey Reservoir Project Area	
Average Error = 0.00 ft	Average Magnitude = 0.03 ft
Minimum Error = -0.07 ft	RMSE = 0.04 ft
Maximum Error = +0.06 ft	σ = 0.04 ft
Survey Sample Size: n = 6	

5.3 Point Cloud Testing

The project specifications require that only Non-Vegetated Vertical Accuracy (NVA) be computed for raw LiDAR point cloud swath files. NVA is defined as the elevation difference between the LiDAR surface and ground surveyed static points collected in open terrain (bare soil, sand, rocks, and short grass) as well as urban terrain (asphalt and concrete surfaces). The NVA for this project was tested with 20 check points. These check points were not used in the calibration or post processing of the LiDAR point cloud data. Elevations from the unclassified LiDAR surface were measured for the xy location of each check point. Elevations interpolated from the LiDAR surface were then compared to the elevation values of the surveyed control points.

Raw Non-vegetated Vertical Accuracy (Raw NVA): The tested Raw NVA for this dataset was found to be 0.018 meters in terms of the RMSEz. The resulting NVA stated as the 95% confidence level (RMSEz x 1.96) is 0.035 meters. Therefore, this dataset meets the required NVA of 0.196 meters at the 95% confidence level as defined by the National Standards for Spatial Data Accuracy (NSSDA).

5.4 Digital Elevation Model Testing

The project specifications require the accuracy of the derived DEM be calculated and reported in two ways: (1) Non-Vegetated Vertical Accuracy (NVA) calculated at a 95% confidence level in "bare earth" and "urban" land cover classes and (2) Vegetated Vertical Accuracy (VVA) in all vegetated land cover classes combined calculated based on the 95th percentile error. The NVA for this project was tested with 20 check points. The VVA was tested with 5 check points.

The tested Non-Vegetated Vertical Accuracy (NVA) for this dataset captured from the DEM using bi-linear interpolation to derive the DEM elevations was found to be 0.024 meters in terms of the RMSEz. The resulting accuracy stated as the 95% confidence level (RMSEz x 1.96) is 0.047 meters. Therefore, this dataset meets the required NVA of 0.196 meters at the 95% confidence level.

The tested Vegetated Vertical Accuracy (VVA) for this dataset captured from the DEM using bi-linear interpolation for all classes was found to be 0.140 meters. Therefore, this dataset meets the required VVA of 0.294 meters based on the 95th percentile error.

5.5 Orthophoto Accuracy

Horizontal accuracy of the orthophoto is dependent upon the quality of the ground control, aerotriangulation solution, and the resulting ortho surface creation. Each bundle-adjusted AT solution is checked visually with the stereo imagery to ensure the surveyed control point falls directly on the center of the target and within a specified vertical tolerance (one-quarter the equivalent contour interval). If these tolerances are met, horizontal accuracy is usually acceptable. Aero-Graphics utilized the project's survey grade control throughout the block to verify the integrity of each stereomodel. The orthorectified imagery was designed to meet ASPRS Accuracy Standards for the 15cm horizontal accuracy class.

5.6 Data Density

The goal for this project was to achieve a minimum LiDAR point density of **8.0** points per square meter. First return density is the best representation of the quality of the acquisition because the density of first returns is independent of vegetation and other random factors that could increase the overall point density. The acquisition mission achieved an actual average of **13.0** points per square meter for first returns. The following two exhibits show the density of first return points. Please note that loss of point density over water is to be expected.

Exhibit 11: Guernsey Reservoir Project– First returns laser point density by frequency, points/m². This figure displays the percentage of points in a given density range

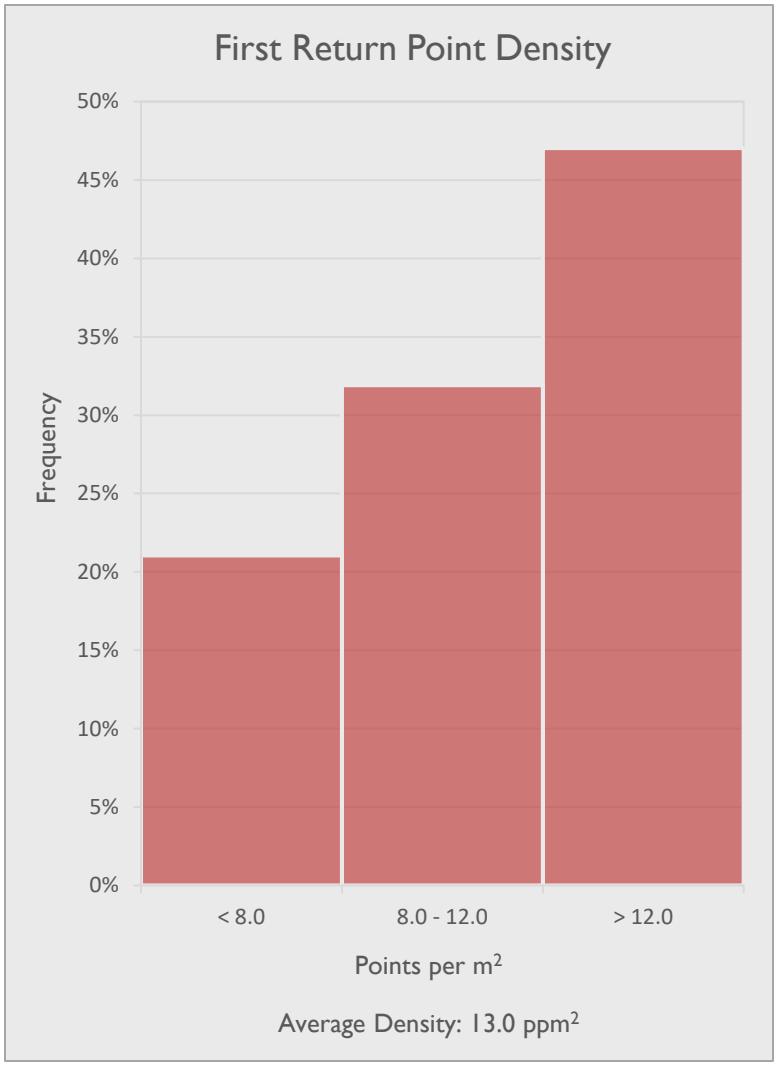
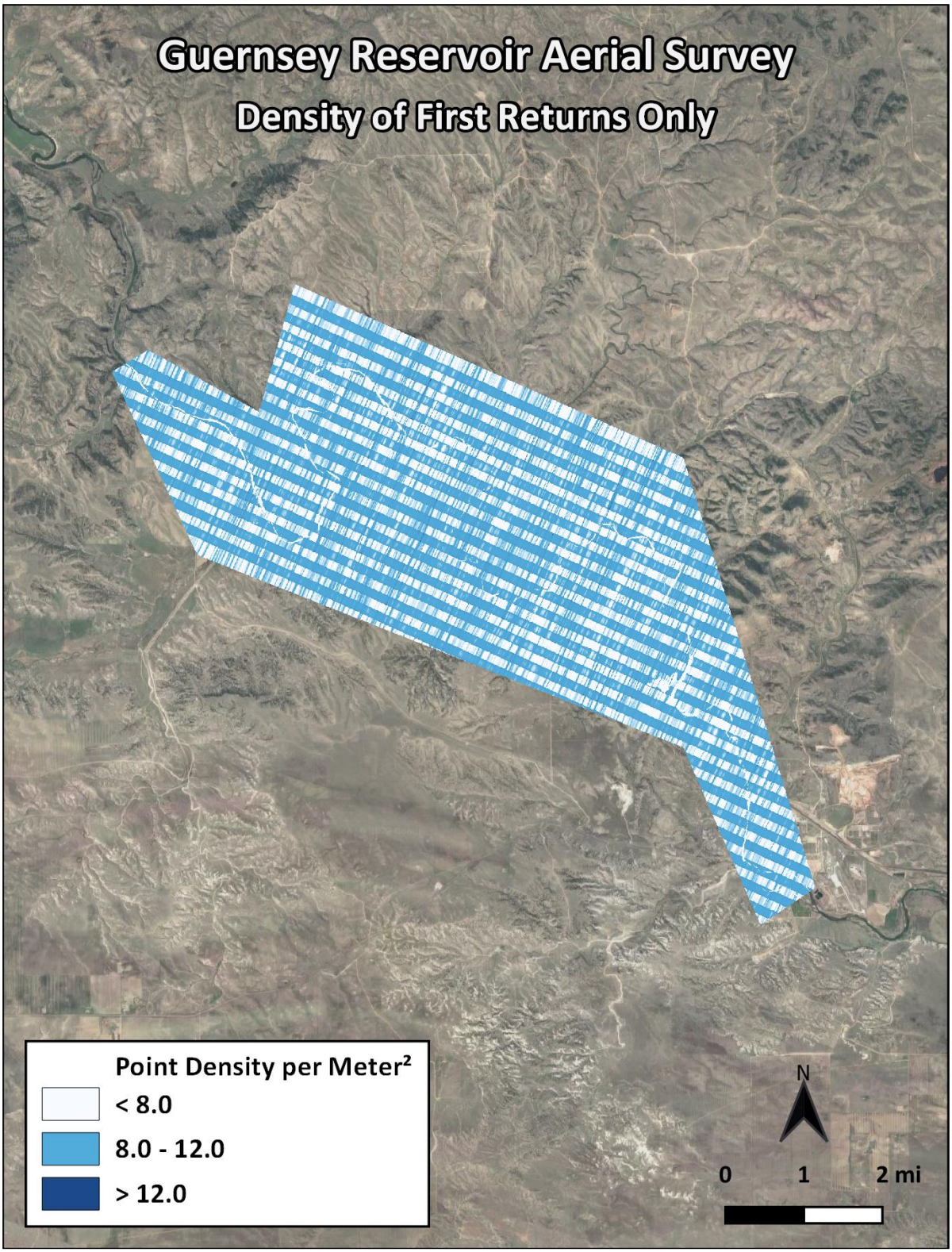


Exhibit 12: **Laser Point Density of First Returns, points/m²**



Appendix A – Ground Control Coordinates

Survey Point	Guernsey Reservoir Aerial Survey		
	Easting	Northing	Elevation (ft)
1002	765527.889	644996.866	4367.68
1003	772228.807	645167.347	4349.53
1004	758942.514	658552.548	4570.58
1005	761235.284	661538.113	4688.27
1006	731227.658	663675.467	4489.66
1007	735517.376	670334.545	4565.92

Appendix B – Calibration Control Accuracy Report

Guernsey Reservoir Aerial Survey			
Survey Point	Known Z (ft)	Laser Z (ft)	Dz (ft)
1002	4367.68	4367.69	0.01
1003	4349.53	4349.46	-0.07
1004	4570.58	4570.56	-0.02
1005	4688.27	4688.30	0.03
1006	4489.66	4489.65	-0.01
1007	4565.92	4565.98	0.06
Average Dz (ft)	0.00		
Minimum Dz (ft)	-0.07		
Maximum Dz (ft)	+0.06		
Average Magnitude (ft)	0.03		
RMS (ft)	0.04		
Std. Deviation (ft)	0.04		

Appendix B

Computation of Reservoir Surface Area, Storage Capacity, and Sedimentation Volume

Appendix B

Computation of Reservoir Surface Area, Storage Capacity, and Sedimentation Volume

A digital surface of the reservoir bottom was generated in GIS using March 2022 lidar data. Horizontal surface areas were then computed at 1-foot (ft) increments, using functions within ArcGIS Pro, for the complete range of reservoir elevations (4,377 to 4,420 feet, RPVD). These reservoir surface areas were then used in Reclamation's Area-CAPacity (ACAP) Program Version 2.0, to compute the storage capacity at these increments and then interpolate surface areas and storage capacities at 0.01-ft increments between each 1-ft interval.

ACAP 2.0 is an ESRI ArcGIS toolbox based on the Surface Volume geoprocessing tool. The Surface Volume tool computes the volume enclosed by a plane intersecting a digital elevation surface at a specified elevation and the surface area of the intersected plane. The digital surface can be a raster, a triangular irregular network (TIN), or an ESRI terrain (https://desktop.arcgis.com/en/arcmap/10.6/tools/3d-analyst-toolbox/surface-volume.htm). ACAP 2.0 uses the Surface Volume tool to compute the reservoir area and capacity at 1-foot increments over a range of elevations specified by the user and then interpolates area and capacity at 0.1 ft and 0.01 ft elevation increments.
The reservoir storage capacity at the ith elevation increment between 1-foot intervals is interpolated using the following equation:

$$V_i = V_b + A_b(y_i - y_b) + C(y_i - y_b)^m \tag{1}$$

where: V_i = storage capacity (acre-feet)

y_i = reservoir elevation,

y_b = reservoir elevation at bottom of elevation increment,

V_b = Storage capacity at elevation y_b (acre-feet),

A_b = Surface area at elevation y_b (acres)

C= Coefficient for nonlinear rate of increase in storage capacity

m= Exponent of nonlinearity in the increase in storage capacity

Surface area is the derivative of the volume equation with respect to y_i:

$$A_i = A_b + Cm(y_i - y_b)^{m-1} \tag{2}$$

where: A_i= Surface area (acres),

A_b = Area at elevation y_b

The coefficient C and exponent m are chosen so that the surface areas and the corresponding storage capacities interpolated at 0.1 and 0.01 ft elevation intervals transition smoothly to the values computed at the 1 ft intervals. Enforcing that the storage volume (V_t) at the top of the elevation increment equals that from the GIS analysis and then solving equation (1) for C gives:

$$C = \frac{V_t - V_b - A_b \Delta y}{\Delta y^m}$$

where $\Delta y = y_t - y_b$, and y_t is the elevation at the top of the elevation increment. Enforcing that the surface area (A_t) at the top of the elevation increment equals that from the GIS analysis and then substituting into equation (2) gives the equation for m:

$$m = \frac{(A_t - A_b)\Delta y}{V_t - V_b - A_b \Delta y}$$

Table of coefficients used in determining the interpolation of area and capacity values.

NUMBER	BASE	V	A	C	M
1	4377	0.957	0.037	3.294	3.2298
2	4378	4.288	10.676	10.845	2.0144
3	4379	25.809	32.522	8.002	5.0736
4	4380	66.333	73.121	16.821	2.2247
5	4381	156.275	110.542	13.569	1.965
6	4382	280.386	137.205	13.246	2.1465
7	4383	430.837	165.637	16.563	1.7979
8	4384	613.037	195.416	11.179	2.1439
9	4385	819.632	219.383	13.07	2.1083
10	4386	1052.085	246.939	18.343	1.8871
11	4387	1317.367	281.554	15.413	1.938
12	4388	1614.334	311.424	14.166	2.0541
13	4389	1939.924	340.522	17.299	2.1619
14	4390	2297.745	377.92	21.444	1.979
15	4391	2697.109	420.358	28.784	2.3069
16	4392	3146.251	486.76	33.533	1.9796
17	4393	3666.544	553.143	33.328	1.8904
18	4394	4253.015	616.147	19.212	2.0004
19	4395	4888.374	654.579	20.455	2.023
20	4396	5563.408	695.96	37.5	2.1723
21	4397	6296.868	777.422	54.383	1.9657
22	4398	7128.673	884.324	53.65	2.0575
23	4399	8066.647	994.71	59.689	1.9758
24	4400	9121.046	1112.646	45.993	1.9417
25	4401	10279.69	1201.949	38.364	2.0857

Table continues on the next page.

NUMBER	BASE	V	A	C	M
26	4402	11520	1281.965	36.669	1.9124
27	4403	12838.63	1352.092	35.225	2.0351
28	4404	14225.95	1423.78	50.164	2.0852
29	4405	15699.89	1528.382	47.551	1.8173
30	4406	17275.83	1614.798	33.629	1.9841
31	4407	18924.25	1681.52	44.306	2.0763
32	4408	20650.08	1773.512	34.726	2.0861
33	4409	22458.32	1845.955	42.9	1.8451
34	4410	24347.17	1925.11	29.881	1.9909
35	4411	26302.16	1984.601	36.356	1.9408
36	4412	28323.12	2055.161	27.767	2.0109
37	4413	30406.05	2110.998	23.944	1.9565
38	4414	32540.99	2157.844	21.33	1.9719
39	4415	34720.16	2199.904	20.648	1.9831
40	4416	36940.72	2240.852	19.45	2.0305
41	4417	39201.02	2280.345	20.109	2.0172
42	4418	41501.47	2320.909	20.107	2.0371
43	4419	43842.49	2361.869	32.581	1.6875

Area Table at 1-Foot Increments

The area table is in acres with an elevation increment of one foot.

ELEV. FEET	0	1	2	3	4	5	6	7	8	9
4370								0.	11.	33.
4380	73.	111.	137.	166.	195.	219.	247.	282.	311.	341.
4390	378.	420.	487.	553.	616.	655.	696.	777.	884.	995.
4400	1113.	1202.	1282.	1352.	1424.	1528.	1615.	1682.	1774.	1846.
4410	1925.	1985.	2055.	2111.	2158.	2200.	2241.	2280.	2321.	2362.
4420	2417.									

Capacity Table at 1-Foot Increments

The capacity table is in acre feet with an elevation increment of one foot

ELEV. FEET	0	1	2	3	4	5	6	7	8	9
4370								1.	4.	26.
4380	66.	156.	280.	431.	613.	820.	1052.	1317.	1614.	1940.
4390	2298.	2697.	3146.	3667.	4253.	4888.	5563.	6297.	7129.	8067.
4400	9121.	10280.	11520.	12839.	14226.	15700.	17276.	18924.	20650.	22458.
4410	24347.	26302.	28323.	30406.	32541.	34720.	36941.	39201.	41501.	43842.
4420	46237.									

Area Table at 0.1-Foot increments

The area table is in acres with an elevation increment of one-tenth of a foot.

ELEV. FEET	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
4377	0.0	0.1	0.3	0.8	1.4	2.3	3.4	4.8	6.5	8.4
4378	10.7	12.8	14.9	17.1	19.3	21.5	23.7	25.9	28.1	30.3
4379	32.5	32.5	32.6	32.8	33.5	34.9	37.6	42.0	48.9	59.0
4380	73.1	75.4	78.3	81.7	85.3	89.1	93.1	97.3	101.6	106.0
4381	110.5	113.4	116.2	118.9	121.6	124.2	126.8	129.4	132.0	134.6
4382	137.2	139.2	141.7	144.4	147.1	150.0	153.0	156.1	159.2	162.4
4383	165.6	170.4	173.9	177.0	180.0	182.8	185.4	188.0	190.6	193.0
4384	195.4	197.1	199.2	201.5	203.8	206.3	208.8	211.4	214.0	216.7
4385	219.4	221.5	224.0	226.6	229.4	232.2	235.0	237.9	240.9	243.9
4386	246.9	251.4	255.2	258.8	262.3	265.7	268.9	272.2	275.3	278.5
4387	281.6	285.0	288.2	291.2	294.2	297.1	300.1	302.9	305.8	308.6
4388	311.4	314.0	316.8	319.6	322.5	325.4	328.4	331.4	334.4	337.5
4389	340.5	343.1	346.3	349.8	353.4	357.2	361.2	365.2	369.4	373.6
4390	377.9	382.4	386.7	391.0	395.2	399.4	403.7	407.8	412.0	416.2
4391	420.4	423.6	428.5	434.1	440.4	447.2	454.4	462.0	470.0	478.2
4392	486.8	493.7	500.5	507.2	513.8	520.4	527.0	533.6	540.1	546.6
4393	553.1	561.3	568.2	574.7	581.0	587.1	593.1	599.0	604.8	610.5
4394	616.1	620.0	623.8	627.7	631.5	635.4	639.2	643.0	646.9	650.7
4395	654.6	658.5	662.6	666.7	670.8	674.9	679.1	683.3	687.5	691.7
4396	696.0	701.4	708.3	715.8	723.8	732.1	740.7	749.6	758.7	768.0
4397	777.4	789.0	800.0	810.8	821.5	832.2	842.7	853.2	863.6	874.0
4398	884.3	894.0	904.4	915.2	926.2	937.4	948.6	960.0	971.5	983.1
4399	994.7	1007.2	1019.2	1031.1	1042.9	1054.7	1066.4	1078.0	1089.6	1101.1
4400	1112.6	1122.9	1132.3	1141.4	1150.3	1159.1	1167.8	1176.5	1185.0	1193.5
4401	1201.9	1208.5	1215.9	1223.6	1231.5	1239.6	1247.9	1256.3	1264.7	1273.3
4402	1282.0	1290.5	1298.1	1305.3	1312.4	1319.2	1326.0	1332.6	1339.2	1345.7
4403	1352.1	1358.7	1365.6	1372.7	1379.9	1387.1	1394.3	1401.6	1409.0	1416.4
4404	1423.8	1432.4	1442.0	1452.1	1462.5	1473.1	1483.9	1494.8	1505.9	1517.1
4405	1528.4	1541.5	1551.6	1560.7	1569.2	1577.4	1585.3	1592.9	1600.4	1607.7
4406	1614.8	1621.7	1628.5	1635.2	1641.9	1648.5	1655.2	1661.8	1668.4	1674.9
4407	1681.5	1689.2	1697.8	1706.7	1715.8	1725.1	1734.6	1744.2	1753.9	1763.7
4408	1773.5	1779.5	1786.1	1793.1	1800.3	1807.6	1815.1	1822.7	1830.4	1838.1
4409	1846.0	1857.3	1866.3	1874.6	1882.4	1890.0	1897.4	1904.5	1911.5	1918.4

ELEV. FEET	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
4410	1925.1	1931.2	1937.2	1943.2	1949.1	1955.0	1961.0	1966.9	1972.8	1978.7
4411	1984.6	1992.7	2000.1	2007.3	2014.4	2021.4	2028.2	2035.0	2041.8	2048.5
4412	2055.2	2060.6	2066.1	2071.7	2077.3	2082.9	2088.5	2094.1	2099.7	2105.4
4413	2111.0	2116.2	2121.0	2125.8	2130.5	2135.1	2139.7	2144.3	2148.8	2153.4
4414	2157.8	2162.3	2166.6	2170.9	2175.1	2179.3	2183.4	2187.6	2191.7	2195.8
4415	2199.9	2204.2	2208.3	2212.4	2216.5	2220.6	2224.7	2228.7	2232.8	2236.8
4416	2240.9	2244.5	2248.4	2252.3	2256.2	2260.2	2264.2	2268.2	2272.2	2276.3
4417	2280.3	2284.2	2288.2	2292.3	2296.3	2300.4	2304.5	2308.6	2312.7	2316.8
4418	2320.9	2324.7	2328.6	2332.7	2336.7	2340.9	2345.0	2349.2	2353.4	2357.6
4419	2361.9	2373.2	2380.1	2385.9	2391.2	2396.0	2400.6	2404.9	2409.0	2413.0
4420	2416.9									

Capacity Table at 0.1-Foot Increments

The capacity table is in acre feet with an elevation increment of one-tenth of one foot.

ELEV. FEET	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
4377	1.0	1.0	1.0	1.0	1.1	1.3	1.6	2.0	2.6	3.3
4378	4.3	5.5	6.8	8.5	10.3	12.3	14.6	17.0	19.7	22.7
4379	25.8	29.1	32.3	35.6	38.9	42.3	45.9	49.9	54.4	59.8
4380	66.3	73.7	81.4	89.4	97.8	106.5	115.6	125.1	135.1	145.4
4381	156.3	167.5	179.0	190.7	202.7	215.0	227.6	240.4	253.5	266.8
4382	280.4	294.2	308.2	322.5	337.1	352.0	367.1	382.6	398.4	414.4
4383	430.8	447.7	464.9	482.4	500.3	518.4	536.8	555.5	574.4	593.6
4384	613.0	632.7	652.5	672.5	692.8	713.3	734.0	755.0	776.3	797.8
4385	819.6	841.7	863.9	886.5	909.3	932.4	955.7	979.4	1003.3	1027.5
4386	1052.1	1077.0	1102.4	1128.1	1154.1	1180.5	1207.2	1234.3	1261.7	1289.4
4387	1317.4	1345.7	1374.4	1403.3	1432.6	1462.2	1492.0	1522.2	1552.6	1583.3
4388	1614.3	1645.6	1677.1	1709.0	1741.1	1773.5	1806.1	1839.1	1872.4	1906.0
4389	1939.9	1974.1	2008.6	2043.4	2078.5	2114.1	2150.0	2186.3	2223.0	2260.2
4390	2297.7	2335.8	2374.2	2413.1	2452.4	2492.1	2532.3	2572.9	2613.9	2655.3
4391	2697.1	2739.3	2781.9	2825.0	2868.7	2913.1	2958.2	3004.0	3050.6	3098.0
4392	3146.3	3195.3	3245.0	3295.4	3346.4	3398.1	3450.5	3503.5	3557.2	3611.6
4393	3666.5	3722.3	3778.8	3835.9	3893.7	3952.1	4011.1	4070.7	4130.9	4191.7
4394	4253.0	4314.8	4377.0	4439.6	4502.5	4565.9	4629.6	4693.7	4758.2	4823.1
4395	4888.4	4954.0	5020.1	5086.5	5153.4	5220.7	5288.4	5356.5	5425.1	5494.0
4396	5563.4	5633.3	5703.7	5774.9	5846.9	5919.7	5993.3	6067.9	6143.3	6219.6
4397	6296.9	6375.2	6454.7	6535.2	6616.8	6699.5	6783.2	6868.0	6953.9	7040.8
4398	7128.7	7217.6	7307.5	7398.5	7490.5	7583.7	7678.0	7773.5	7870.0	7967.8
4399	8066.6	8166.7	8268.1	8370.6	8474.3	8579.2	8685.2	8792.4	8900.8	9010.4
4400	9121.0	9232.8	9345.6	9459.3	9573.9	9689.3	9805.7	9922.9	10041.0	10159.9
4401	10279.7	10400.2	10521.4	10643.4	10766.1	10889.7	11014.1	11139.3	11265.3	11392.2
4402	11520.0	11648.6	11778.1	11908.3	12039.1	12170.7	12303.0	12435.9	12569.5	12703.7
4403	12838.6	12974.2	13110.4	13247.3	13384.9	13523.3	13662.3	13802.1	13942.7	14083.9
4404	14225.9	14368.7	14512.5	14657.2	14802.9	14949.7	15097.5	15246.4	15396.5	15547.6
4405	15699.9	15853.5	16008.1	16163.7	16320.2	16477.6	16635.7	16794.6	16954.3	17114.7
4406	17275.8	17437.7	17600.2	17763.4	17927.2	18091.7	18256.9	18422.8	18589.3	18756.4
4407	18924.3	19092.8	19262.1	19432.3	19603.5	19775.5	19948.5	20122.4	20297.3	20473.2
4408	20650.1	20827.7	21006.0	21185.0	21364.6	21545.0	21726.1	21908.0	22090.7	22274.1
4409	22458.3	22643.5	22829.7	23016.8	23204.6	23393.2	23582.6	23772.7	23963.5	24155.0

ELEV. FEET	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
4410	24347.2	24540.0	24733.4	24927.4	25122.0	25317.2	25513.0	25709.4	25906.4	26104.0
4411	26302.2	26501.0	26700.7	26901.1	27102.1	27303.9	27506.4	27709.6	27913.4	28117.9
4412	28323.1	28528.9	28735.2	28942.1	29149.6	29357.6	29566.2	29775.3	29985.0	30195.2
4413	30406.0	30617.4	30829.3	31041.6	31254.4	31467.7	31681.5	31895.7	32110.3	32325.4
4414	32541.0	32757.0	32973.5	33190.3	33407.6	33625.3	33843.5	34062.0	34281.0	34500.4
4415	34720.2	34940.4	35161.0	35382.0	35603.5	35825.3	36047.6	36270.3	36493.4	36716.8
4416	36940.7	37165.0	37389.6	37614.7	37840.1	38065.9	38292.1	38518.7	38745.8	38973.2
4417	39201.0	39429.2	39657.9	39886.9	40116.3	40346.2	40576.4	40807.1	41038.1	41269.6
4418	41501.5	41733.7	41966.4	42199.5	42432.9	42666.8	42901.1	43135.8	43371.0	43606.5
4419	43842.5	44079.3	44317.0	44555.3	44794.2	45033.5	45273.4	45513.6	45754.3	45995.4
4420	46236.9									

Area Table at 0.01-Foot Increments

The area table is in acres with an elevation increment of one-hundredth of one foot.

ELEV. FEET	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
4377.0	0.04	0.04	0.04	0.04	0.05	0.05	0.06	0.07	0.08	0.09
4377.1	0.10	0.11	0.13	0.15	0.17	0.19	0.22	0.24	0.27	0.30
4377.2	0.33	0.36	0.40	0.44	0.48	0.52	0.56	0.61	0.66	0.71
4377.3	0.76	0.82	0.88	0.94	1.00	1.06	1.13	1.20	1.27	1.34
4377.4	1.42	1.49	1.57	1.66	1.74	1.83	1.92	2.01	2.11	2.21
4377.5	2.31	2.41	2.51	2.62	2.73	2.84	2.96	3.07	3.19	3.32
4377.6	3.44	3.57	3.70	3.83	3.97	4.11	4.25	4.39	4.54	4.69
4377.7	4.84	4.99	5.15	5.31	5.47	5.64	5.81	5.98	6.15	6.33
4377.8	6.51	6.69	6.87	7.06	7.25	7.44	7.64	7.84	8.04	8.24
4377.9	8.45	8.66	8.87	9.09	9.30	9.53	9.75	9.98	10.21	10.44
4378.0	10.68	10.88	11.09	11.30	11.51	11.72	11.93	12.15	12.36	12.58
4378.1	12.79	13.00	13.22	13.43	13.65	13.86	14.08	14.30	14.51	14.73
4378.2	14.95	15.16	15.38	15.60	15.81	16.03	16.25	16.46	16.68	16.90
4378.3	17.12	17.34	17.55	17.77	17.99	18.21	18.43	18.64	18.86	19.08
4378.4	19.30	19.52	19.74	19.96	20.18	20.39	20.61	20.83	21.05	21.27
4378.5	21.49	21.71	21.93	22.15	22.37	22.59	22.81	23.03	23.25	23.47
4378.6	23.69	23.91	24.13	24.35	24.57	24.79	25.01	25.23	25.45	25.67
4378.7	25.89	26.11	26.33	26.55	26.77	26.99	27.21	27.43	27.66	27.88
4378.8	28.10	28.32	28.54	28.76	28.98	29.20	29.42	29.64	29.87	30.09
4378.9	30.31	30.53	30.75	30.97	31.19	31.41	31.64	31.86	32.08	32.30
4379.0	32.52	32.52	32.52	32.52	32.52	32.52	32.52	32.52	32.52	32.52
4379.1	32.53	32.53	32.53	32.53	32.54	32.54	32.55	32.55	32.56	32.57
4379.2	32.58	32.59	32.61	32.62	32.64	32.67	32.69	32.72	32.75	32.78
4379.3	32.82	32.87	32.91	32.97	33.02	33.09	33.15	33.23	33.31	33.40
4379.4	33.49	33.60	33.71	33.83	33.95	34.09	34.24	34.40	34.56	34.74
4379.5	34.93	35.14	35.35	35.58	35.82	36.08	36.35	36.63	36.94	37.25
4379.6	37.59	37.94	38.31	38.70	39.11	39.54	39.99	40.47	40.96	41.48
4379.7	42.02	42.58	43.17	43.79	44.43	45.10	45.80	46.52	47.28	48.06
4379.8	48.88	49.73	50.61	51.53	52.48	53.46	54.48	55.54	56.64	57.78
4379.9	58.95	60.17	61.43	62.73	64.08	65.47	66.90	68.38	69.91	71.49

ELEV. FEET	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
4380.0	73.12	73.25	73.43	73.63	73.85	74.08	74.31	74.56	74.82	75.08
4380.1	75.35	75.63	75.91	76.20	76.49	76.79	77.09	77.39	77.70	78.02
4380.2	78.33	78.66	78.98	79.31	79.64	79.97	80.31	80.65	80.99	81.34
4380.3	81.69	82.04	82.39	82.75	83.11	83.47	83.83	84.19	84.56	84.93
4380.4	85.30	85.68	86.05	86.43	86.81	87.19	87.58	87.96	88.35	88.74
4380.5	89.13	89.53	89.92	90.32	90.72	91.12	91.52	91.92	92.33	92.73
4380.6	93.14	93.55	93.96	94.37	94.79	95.20	95.62	96.04	96.46	96.88
4380.7	97.30	97.72	98.15	98.57	99.00	99.43	99.86	100.29	100.72	101.16
4380.8	101.59	102.03	102.47	102.91	103.35	103.79	104.23	104.67	105.12	105.57
4380.9	106.01	106.46	106.91	107.36	107.81	108.26	108.72	109.17	109.63	110.08
4381.0	110.54	110.86	111.15	111.45	111.74	112.02	112.31	112.59	112.87	113.15
4381.1	113.43	113.71	113.99	114.26	114.54	114.82	115.09	115.36	115.64	115.91
4381.2	116.18	116.46	116.73	117.00	117.27	117.54	117.81	118.08	118.35	118.62
4381.3	118.89	119.15	119.42	119.69	119.96	120.22	120.49	120.76	121.02	121.29
4381.4	121.55	121.82	122.09	122.35	122.62	122.88	123.14	123.41	123.67	123.94
4381.5	124.20	124.46	124.73	124.99	125.25	125.52	125.78	126.04	126.30	126.57
4381.6	126.83	127.09	127.35	127.61	127.88	128.14	128.40	128.66	128.92	129.18
4381.7	129.44	129.70	129.96	130.22	130.48	130.74	131.00	131.26	131.52	131.78
4381.8	132.04	132.30	132.56	132.82	133.08	133.33	133.59	133.85	134.11	134.37
4381.9	134.63	134.89	135.14	135.40	135.66	135.92	136.18	136.43	136.69	136.95
4382.0	137.21	137.35	137.53	137.72	137.91	138.12	138.33	138.55	138.78	139.00
4382.1	139.23	139.47	139.71	139.95	140.19	140.44	140.68	140.93	141.19	141.44
4382.2	141.70	141.96	142.22	142.48	142.74	143.01	143.27	143.54	143.81	144.08
4382.3	144.36	144.63	144.90	145.18	145.46	145.74	146.02	146.30	146.58	146.86
4382.4	147.15	147.43	147.72	148.01	148.30	148.59	148.88	149.17	149.46	149.75
4382.5	150.05	150.34	150.64	150.94	151.23	151.53	151.83	152.13	152.43	152.73
4382.6	153.03	153.34	153.64	153.95	154.25	154.56	154.86	155.17	155.48	155.79
4382.7	156.09	156.40	156.71	157.03	157.34	157.65	157.96	158.28	158.59	158.90
4382.8	159.22	159.54	159.85	160.17	160.49	160.80	161.12	161.44	161.76	162.08
4382.9	162.40	162.72	163.05	163.37	163.69	164.01	164.34	164.66	164.99	165.31
4383.0	165.64	166.39	166.95	167.45	167.92	168.36	168.79	169.20	169.61	170.00
4383.1	170.38	170.75	171.12	171.48	171.84	172.19	172.54	172.88	173.22	173.55
4383.2	173.88	174.21	174.53	174.85	175.17	175.49	175.80	176.11	176.42	176.73
4383.3	177.03	177.33	177.63	177.93	178.23	178.52	178.82	179.11	179.40	179.69
4383.4	179.97	180.26	180.54	180.82	181.10	181.38	181.66	181.94	182.22	182.49

ELEV. FEET	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
4383.5	182.77	183.04	183.31	183.58	183.85	184.12	184.39	184.65	184.92	185.18
4383.6	185.45	185.71	185.97	186.23	186.49	186.75	187.01	187.27	187.53	187.78
4383.7	188.04	188.30	188.55	188.80	189.06	189.31	189.56	189.81	190.06	190.31
4383.8	190.56	190.81	191.05	191.30	191.55	191.79	192.04	192.28	192.53	192.77
4383.9	193.01	193.26	193.50	193.74	193.98	194.22	194.46	194.70	194.94	195.18
4384.0	195.42	195.54	195.69	195.85	196.02	196.19	196.38	196.56	196.75	196.94
4384.1	197.14	197.33	197.54	197.74	197.94	198.15	198.36	198.57	198.79	199.00
4384.2	199.22	199.44	199.66	199.88	200.10	200.32	200.55	200.78	201.00	201.23
4384.3	201.46	201.69	201.93	202.16	202.39	202.63	202.86	203.10	203.34	203.58
4384.4	203.82	204.06	204.30	204.54	204.79	205.03	205.28	205.52	205.77	206.01
4384.5	206.26	206.51	206.76	207.01	207.26	207.51	207.76	208.02	208.27	208.52
4384.6	208.78	209.03	209.29	209.54	209.80	210.06	210.32	210.57	210.83	211.09
4384.7	211.35	211.61	211.88	212.14	212.40	212.66	212.93	213.19	213.45	213.72
4384.8	213.98	214.25	214.52	214.78	215.05	215.32	215.58	215.85	216.12	216.39
4384.9	216.66	216.93	217.20	217.47	217.74	218.02	218.29	218.56	218.84	219.11
4385.0	219.38	219.55	219.74	219.95	220.16	220.38	220.60	220.83	221.06	221.29
4385.1	221.53	221.77	222.01	222.26	222.50	222.75	223.00	223.25	223.50	223.76
4385.2	224.01	224.27	224.53	224.79	225.05	225.31	225.57	225.84	226.10	226.37
4385.3	226.64	226.91	227.18	227.45	227.72	227.99	228.26	228.54	228.81	229.09
4385.4	229.36	229.64	229.92	230.20	230.48	230.76	231.04	231.32	231.60	231.88
4385.5	232.16	232.45	232.73	233.02	233.30	233.59	233.87	234.16	234.45	234.74
4385.6	235.03	235.32	235.61	235.90	236.19	236.48	236.77	237.06	237.35	237.65
4385.7	237.94	238.24	238.53	238.82	239.12	239.42	239.71	240.01	240.31	240.60
4385.8	240.90	241.20	241.50	241.80	242.10	242.40	242.70	243.00	243.30	243.60
4385.9	243.90	244.20	244.51	244.81	245.11	245.42	245.72	246.02	246.33	246.63
4386.0	246.94	247.52	248.02	248.48	248.93	249.37	249.79	250.21	250.62	251.03
4386.1	251.43	251.82	252.22	252.60	252.99	253.37	253.75	254.13	254.50	254.87
4386.2	255.24	255.61	255.97	256.34	256.70	257.06	257.42	257.77	258.13	258.48
4386.3	258.84	259.19	259.54	259.89	260.23	260.58	260.92	261.27	261.61	261.95
4386.4	262.29	262.63	262.97	263.31	263.65	263.99	264.32	264.66	264.99	265.32
4386.5	265.66	265.99	266.32	266.65	266.98	267.31	267.63	267.96	268.29	268.62
4386.6	268.94	269.27	269.59	269.91	270.24	270.56	270.88	271.20	271.52	271.85
4386.7	272.17	272.48	272.80	273.12	273.44	273.76	274.07	274.39	274.71	275.02
4386.8	275.34	275.65	275.97	276.28	276.59	276.91	277.22	277.53	277.84	278.15
4386.9	278.47	278.78	279.09	279.40	279.71	280.01	280.32	280.63	280.94	281.25

ELEV. FEET	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
4387.0	281.55	281.95	282.32	282.67	283.01	283.35	283.69	284.02	284.35	284.68
4387.1	285.00	285.32	285.64	285.96	286.28	286.59	286.91	287.22	287.53	287.84
4387.2	288.15	288.46	288.77	289.08	289.39	289.69	290.00	290.30	290.60	290.91
4387.3	291.21	291.51	291.81	292.11	292.41	292.71	293.01	293.31	293.61	293.90
4387.4	294.20	294.50	294.79	295.09	295.38	295.68	295.97	296.27	296.56	296.85
4387.5	297.15	297.44	297.73	298.02	298.31	298.60	298.89	299.18	299.47	299.76
4387.6	300.05	300.34	300.63	300.92	301.21	301.50	301.78	302.07	302.36	302.64
4387.7	302.93	303.22	303.50	303.79	304.07	304.36	304.65	304.93	305.21	305.50
4387.8	305.78	306.07	306.35	306.63	306.92	307.20	307.48	307.77	308.05	308.33
4387.9	308.61	308.90	309.18	309.46	309.74	310.02	310.30	310.58	310.86	311.14
4388.0	311.42	311.65	311.89	312.15	312.40	312.66	312.92	313.19	313.45	313.72
4388.1	313.99	314.26	314.54	314.81	315.09	315.36	315.64	315.92	316.20	316.48
4388.2	316.76	317.04	317.32	317.61	317.89	318.17	318.46	318.74	319.03	319.32
4388.3	319.60	319.89	320.18	320.47	320.76	321.05	321.34	321.63	321.92	322.21
4388.4	322.50	322.79	323.09	323.38	323.67	323.96	324.26	324.55	324.85	325.14
4388.5	325.44	325.73	326.03	326.33	326.62	326.92	327.22	327.51	327.81	328.11
4388.6	328.41	328.71	329.00	329.30	329.60	329.90	330.20	330.50	330.80	331.10
4388.7	331.40	331.70	332.01	332.31	332.61	332.91	333.21	333.52	333.82	334.12
4388.8	334.42	334.73	335.03	335.33	335.64	335.94	336.25	336.55	336.85	337.16
4388.9	337.46	337.77	338.07	338.38	338.69	338.99	339.30	339.60	339.91	340.22
4389.0	340.52	340.70	340.92	341.16	341.41	341.67	341.94	342.22	342.51	342.80
4389.1	343.10	343.40	343.71	344.02	344.33	344.65	344.97	345.29	345.62	345.95
4389.2	346.29	346.62	346.96	347.30	347.65	347.99	348.34	348.69	349.04	349.40
4389.3	349.75	350.11	350.47	350.84	351.20	351.57	351.93	352.30	352.67	353.05
4389.4	353.42	353.79	354.17	354.55	354.93	355.31	355.69	356.08	356.46	356.85
4389.5	357.24	357.63	358.02	358.41	358.80	359.19	359.59	359.98	360.38	360.78
4389.6	361.18	361.58	361.98	362.39	362.79	363.19	363.60	364.01	364.41	364.82
4389.7	365.23	365.64	366.05	366.47	366.88	367.29	367.71	368.13	368.54	368.96
4389.8	369.38	369.80	370.22	370.64	371.06	371.49	371.91	372.33	372.76	373.18
4389.9	373.61	374.04	374.47	374.90	375.33	375.76	376.19	376.62	377.05	377.49
4390.0	377.92	378.39	378.84	379.29	379.74	380.18	380.62	381.06	381.50	381.94
4390.1	382.37	382.81	383.24	383.68	384.11	384.54	384.98	385.41	385.84	386.27
4390.2	386.70	387.13	387.56	387.99	388.41	388.84	389.27	389.70	390.12	390.55
4390.3	390.98	391.40	391.83	392.25	392.68	393.10	393.53	393.95	394.38	394.80
4390.4	395.22	395.65	396.07	396.49	396.92	397.34	397.76	398.18	398.61	399.03

ELEV. FEET	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
4390.5	399.45	399.87	400.29	400.71	401.13	401.56	401.98	402.40	402.82	403.24
4390.6	403.66	404.08	404.50	404.92	405.34	405.76	406.17	406.59	407.01	407.43
4390.7	407.85	408.27	408.69	409.10	409.52	409.94	410.36	410.78	411.19	411.61
4390.8	412.03	412.45	412.86	413.28	413.70	414.12	414.53	414.95	415.37	415.78
4390.9	416.20	416.61	417.03	417.45	417.86	418.28	418.70	419.11	419.53	419.94
4391.0	420.36	420.52	420.76	421.04	421.35	421.68	422.04	422.41	422.80	423.21
4391.1	423.63	424.07	424.51	424.97	425.44	425.92	426.41	426.91	427.42	427.94
4391.2	428.46	429.00	429.54	430.09	430.64	431.21	431.78	432.35	432.94	433.53
4391.3	434.12	434.73	435.34	435.95	436.57	437.20	437.83	438.47	439.11	439.76
4391.4	440.41	441.07	441.73	442.40	443.07	443.74	444.43	445.11	445.80	446.50
4391.5	447.20	447.90	448.61	449.32	450.04	450.76	451.48	452.21	452.94	453.68
4391.6	454.42	455.16	455.91	456.66	457.42	458.17	458.94	459.70	460.47	461.24
4391.7	462.02	462.80	463.58	464.37	465.16	465.95	466.75	467.55	468.35	469.15
4391.8	469.96	470.78	471.59	472.41	473.23	474.05	474.88	475.71	476.54	477.38
4391.9	478.22	479.06	479.90	480.75	481.60	482.45	483.31	484.17	485.03	485.89
4392.0	486.76	487.49	488.20	488.90	489.60	490.29	490.98	491.67	492.35	493.04
4392.1	493.72	494.40	495.08	495.76	496.43	497.11	497.79	498.46	499.13	499.81
4392.2	500.48	501.15	501.82	502.49	503.16	503.83	504.50	505.17	505.84	506.50
4392.3	507.17	507.84	508.50	509.17	509.83	510.50	511.16	511.82	512.49	513.15
4392.4	513.81	514.48	515.14	515.80	516.46	517.12	517.78	518.44	519.10	519.76
4392.5	520.42	521.08	521.74	522.40	523.06	523.72	524.38	525.03	525.69	526.35
4392.6	527.01	527.66	528.32	528.98	529.63	530.29	530.95	531.60	532.26	532.91
4392.7	533.57	534.22	534.88	535.53	536.19	536.84	537.49	538.15	538.80	539.45
4392.8	540.11	540.76	541.41	542.07	542.72	543.37	544.02	544.68	545.33	545.98
4392.9	546.63	547.28	547.94	548.59	549.24	549.89	550.54	551.19	551.84	552.49
4393.0	553.14	554.19	555.08	555.92	556.73	557.52	558.29	559.05	559.79	560.53
4393.1	561.25	561.97	562.68	563.39	564.08	564.78	565.47	566.15	566.83	567.50
4393.2	568.17	568.84	569.51	570.17	570.82	571.48	572.13	572.78	573.43	574.07
4393.3	574.71	575.35	575.99	576.62	577.25	577.88	578.51	579.14	579.76	580.39
4393.4	581.01	581.63	582.24	582.86	583.47	584.09	584.70	585.31	585.92	586.53
4393.5	587.13	587.74	588.34	588.94	589.54	590.14	590.74	591.34	591.93	592.53
4393.6	593.12	593.71	594.31	594.90	595.49	596.07	596.66	597.25	597.83	598.42
4393.7	599.00	599.59	600.17	600.75	601.33	601.91	602.49	603.07	603.64	604.22
4393.8	604.79	605.37	605.94	606.51	607.09	607.66	608.23	608.80	609.37	609.94
4393.9	610.50	611.07	611.64	612.20	612.77	613.33	613.90	614.46	615.02	615.58

ELEV. FEET	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
4394.0	616.15	616.53	616.91	617.30	617.68	618.07	618.45	618.83	619.22	619.60
4394.1	619.99	620.37	620.75	621.14	621.52	621.91	622.29	622.68	623.06	623.44
4394.2	623.83	624.21	624.60	624.98	625.37	625.75	626.13	626.52	626.90	627.29
4394.3	627.67	628.06	628.44	628.82	629.21	629.59	629.98	630.36	630.75	631.13
4394.4	631.51	631.90	632.28	632.67	633.05	633.44	633.82	634.20	634.59	634.97
4394.5	635.36	635.74	636.13	636.51	636.89	637.28	637.66	638.05	638.43	638.82
4394.6	639.20	639.59	639.97	640.35	640.74	641.12	641.51	641.89	642.28	642.66
4394.7	643.05	643.43	643.81	644.20	644.58	644.97	645.35	645.74	646.12	646.51
4394.8	646.89	647.27	647.66	648.04	648.43	648.81	649.20	649.58	649.97	650.35
4394.9	650.73	651.12	651.50	651.89	652.27	652.66	653.04	653.43	653.81	654.19
4395.0	654.58	654.95	655.34	655.72	656.12	656.51	656.91	657.30	657.70	658.10
4395.1	658.50	658.91	659.31	659.71	660.12	660.52	660.93	661.33	661.74	662.15
4395.2	662.55	662.96	663.37	663.78	664.19	664.60	665.01	665.42	665.83	666.24
4395.3	666.65	667.07	667.48	667.89	668.30	668.72	669.13	669.54	669.96	670.37
4395.4	670.79	671.20	671.62	672.03	672.45	672.86	673.28	673.69	674.11	674.53
4395.5	674.94	675.36	675.78	676.19	676.61	677.03	677.45	677.86	678.28	678.70
4395.6	679.12	679.54	679.95	680.37	680.79	681.21	681.63	682.05	682.47	682.89
4395.7	683.31	683.73	684.15	684.57	684.99	685.41	685.83	686.25	686.67	687.09
4395.8	687.51	687.94	688.36	688.78	689.20	689.62	690.04	690.46	690.89	691.31
4395.9	691.73	692.15	692.58	693.00	693.42	693.84	694.27	694.69	695.11	695.54
4396.0	695.96	696.33	696.79	697.30	697.83	698.39	698.97	699.57	700.18	700.80
4396.1	701.44	702.09	702.74	703.41	704.09	704.77	705.46	706.16	706.87	707.59
4396.2	708.31	709.03	709.77	710.50	711.25	712.00	712.75	713.51	714.28	715.05
4396.3	715.82	716.60	717.38	718.17	718.96	719.75	720.55	721.36	722.16	722.97
4396.4	723.79	724.60	725.42	726.25	727.08	727.91	728.74	729.58	730.42	731.26
4396.5	732.11	732.95	733.81	734.66	735.52	736.38	737.24	738.11	738.97	739.85
4396.6	740.72	741.59	742.47	743.35	744.24	745.12	746.01	746.90	747.79	748.69
4396.7	749.58	750.48	751.38	752.29	753.19	754.10	755.01	755.92	756.84	757.75
4396.8	758.67	759.59	760.51	761.44	762.36	763.29	764.22	765.15	766.08	767.02
4396.9	767.96	768.89	769.84	770.78	771.72	772.67	773.61	774.56	775.51	776.47
4397.0	777.42	778.67	779.87	781.04	782.20	783.35	784.49	785.62	786.75	787.87
4397.1	788.99	790.11	791.22	792.33	793.43	794.54	795.64	796.73	797.83	798.92
4397.2	800.02	801.11	802.19	803.28	804.37	805.45	806.53	807.61	808.69	809.77
4397.3	810.84	811.92	812.99	814.07	815.14	816.21	817.28	818.35	819.42	820.48
4397.4	821.55	822.61	823.68	824.74	825.80	826.86	827.92	828.98	830.04	831.10

ELEV. FEET	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
4397.5	832.16	833.22	834.27	835.33	836.38	837.44	838.49	839.54	840.59	841.65
4397.6	842.70	843.75	844.80	845.85	846.89	847.94	848.99	850.04	851.08	852.13
4397.7	853.17	854.22	855.26	856.31	857.35	858.39	859.43	860.48	861.52	862.56
4397.8	863.60	864.64	865.68	866.72	867.76	868.80	869.83	870.87	871.91	872.94
4397.9	873.98	875.02	876.05	877.09	878.12	879.16	880.19	881.22	882.26	883.29
4398.0	884.32	885.17	886.09	887.03	887.99	888.97	889.96	890.96	891.96	892.97
4398.1	893.99	895.02	896.05	897.09	898.13	899.17	900.22	901.27	902.33	903.39
4398.2	904.45	905.52	906.58	907.66	908.73	909.81	910.88	911.97	913.05	914.14
4398.3	915.22	916.31	917.41	918.50	919.60	920.70	921.80	922.90	924.00	925.11
4398.4	926.21	927.32	928.43	929.54	930.65	931.77	932.88	934.00	935.12	936.24
4398.5	937.36	938.48	939.61	940.73	941.86	942.98	944.11	945.24	946.37	947.50
4398.6	948.64	949.77	950.91	952.04	953.18	954.32	955.46	956.60	957.74	958.88
4398.7	960.02	961.17	962.31	963.46	964.61	965.75	966.90	968.05	969.20	970.35
4398.8	971.51	972.66	973.81	974.97	976.12	977.28	978.44	979.59	980.75	981.91
4398.9	983.07	984.23	985.39	986.55	987.72	988.88	990.05	991.21	992.38	993.54
4399.0	994.71	996.03	997.30	998.56	999.81	1001.05	1002.28	1003.51	1004.74	1005.96
4399.1	1007.18	1008.39	1009.61	1010.82	1012.03	1013.23	1014.44	1015.64	1016.84	1018.04
4399.2	1019.23	1020.43	1021.62	1022.82	1024.01	1025.20	1026.39	1027.58	1028.76	1029.95
4399.3	1031.14	1032.32	1033.50	1034.69	1035.87	1037.05	1038.23	1039.41	1040.59	1041.76
4399.4	1042.94	1044.12	1045.29	1046.47	1047.64	1048.82	1049.99	1051.16	1052.33	1053.50
4399.5	1054.67	1055.84	1057.01	1058.18	1059.35	1060.52	1061.69	1062.85	1064.02	1065.18
4399.6	1066.35	1067.52	1068.68	1069.84	1071.01	1072.17	1073.33	1074.49	1075.66	1076.82
4399.7	1077.98	1079.14	1080.30	1081.46	1082.62	1083.78	1084.94	1086.10	1087.25	1088.41
4399.8	1089.57	1090.72	1091.88	1093.04	1094.19	1095.35	1096.50	1097.66	1098.81	1099.97
4399.9	1101.12	1102.27	1103.43	1104.58	1105.73	1106.89	1108.04	1109.19	1110.34	1111.49
4400.0	1112.65	1113.81	1114.89	1115.93	1116.96	1117.96	1118.96	1119.95	1120.92	1121.89
4400.1	1122.86	1123.82	1124.77	1125.72	1126.67	1127.61	1128.55	1129.48	1130.41	1131.34
4400.2	1132.26	1133.19	1134.11	1135.02	1135.94	1136.85	1137.76	1138.67	1139.58	1140.48
4400.3	1141.39	1142.29	1143.19	1144.08	1144.98	1145.88	1146.77	1147.66	1148.55	1149.44
4400.4	1150.33	1151.21	1152.10	1152.98	1153.87	1154.75	1155.63	1156.51	1157.39	1158.26
4400.5	1159.14	1160.01	1160.89	1161.76	1162.63	1163.51	1164.38	1165.25	1166.11	1166.98
4400.6	1167.85	1168.71	1169.58	1170.44	1171.31	1172.17	1173.03	1173.89	1174.75	1175.61
4400.7	1176.47	1177.33	1178.19	1179.05	1179.90	1180.76	1181.61	1182.47	1183.32	1184.17
4400.8	1185.03	1185.88	1186.73	1187.58	1188.43	1189.28	1190.13	1190.97	1191.82	1192.67
4400.9	1193.52	1194.36	1195.21	1196.05	1196.90	1197.74	1198.58	1199.43	1200.27	1201.11

ELEV. FEET	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
4401.0	1201.95	1202.49	1203.09	1203.73	1204.38	1205.04	1205.72	1206.41	1207.10	1207.81
4401.1	1208.52	1209.23	1209.96	1210.68	1211.41	1212.15	1212.89	1213.64	1214.38	1215.14
4401.2	1215.89	1216.65	1217.41	1218.17	1218.94	1219.71	1220.48	1221.26	1222.04	1222.82
4401.3	1223.60	1224.39	1225.17	1225.96	1226.75	1227.54	1228.34	1229.14	1229.94	1230.74
4401.4	1231.54	1232.34	1233.15	1233.96	1234.76	1235.57	1236.39	1237.20	1238.02	1238.83
4401.5	1239.65	1240.47	1241.29	1242.11	1242.94	1243.76	1244.59	1245.41	1246.24	1247.07
4401.6	1247.90	1248.73	1249.57	1250.40	1251.24	1252.07	1252.91	1253.75	1254.59	1255.43
4401.7	1256.27	1257.12	1257.96	1258.81	1259.65	1260.50	1261.35	1262.20	1263.05	1263.90
4401.8	1264.75	1265.60	1266.46	1267.31	1268.17	1269.02	1269.88	1270.74	1271.60	1272.46
4401.9	1273.32	1274.18	1275.04	1275.90	1276.77	1277.63	1278.50	1279.36	1280.23	1281.10
4402.0	1281.96	1283.01	1283.94	1284.83	1285.68	1286.52	1287.35	1288.16	1288.96	1289.76
4402.1	1290.54	1291.32	1292.10	1292.87	1293.63	1294.39	1295.14	1295.89	1296.63	1297.38
4402.2	1298.11	1298.85	1299.58	1300.31	1301.04	1301.76	1302.48	1303.20	1303.92	1304.63
4402.3	1305.34	1306.05	1306.76	1307.47	1308.17	1308.87	1309.57	1310.27	1310.97	1311.67
4402.4	1312.36	1313.05	1313.74	1314.43	1315.12	1315.81	1316.49	1317.18	1317.86	1318.54
4402.5	1319.22	1319.90	1320.58	1321.26	1321.93	1322.61	1323.28	1323.95	1324.63	1325.30
4402.6	1325.97	1326.63	1327.30	1327.97	1328.63	1329.30	1329.96	1330.63	1331.29	1331.95
4402.7	1332.61	1333.27	1333.93	1334.59	1335.25	1335.90	1336.56	1337.21	1337.87	1338.52
4402.8	1339.17	1339.83	1340.48	1341.13	1341.78	1342.43	1343.08	1343.72	1344.37	1345.02
4402.9	1345.66	1346.31	1346.95	1347.60	1348.24	1348.88	1349.53	1350.17	1350.81	1351.45
4403.0	1352.09	1352.70	1353.34	1353.99	1354.65	1355.32	1355.99	1356.66	1357.34	1358.02
4403.1	1358.70	1359.39	1360.08	1360.77	1361.46	1362.15	1362.85	1363.54	1364.24	1364.94
4403.2	1365.64	1366.34	1367.05	1367.75	1368.46	1369.16	1369.87	1370.58	1371.29	1372.00
4403.3	1372.71	1373.42	1374.13	1374.85	1375.56	1376.27	1376.99	1377.71	1378.42	1379.14
4403.4	1379.86	1380.58	1381.30	1382.02	1382.74	1383.46	1384.18	1384.90	1385.63	1386.35
4403.5	1387.07	1387.80	1388.52	1389.25	1389.97	1390.70	1391.43	1392.15	1392.88	1393.61
4403.6	1394.34	1395.07	1395.80	1396.53	1397.26	1397.99	1398.72	1399.45	1400.18	1400.92
4403.7	1401.65	1402.38	1403.11	1403.85	1404.58	1405.32	1406.05	1406.79	1407.52	1408.26
4403.8	1408.99	1409.73	1410.47	1411.20	1411.94	1412.68	1413.42	1414.16	1414.89	1415.63
4403.9	1416.37	1417.11	1417.85	1418.59	1419.33	1420.07	1420.81	1421.55	1422.29	1423.04
4404.0	1423.78	1424.49	1425.28	1426.11	1426.96	1427.83	1428.72	1429.62	1430.53	1431.45
4404.1	1432.38	1433.31	1434.26	1435.21	1436.17	1437.13	1438.10	1439.07	1440.05	1441.03
4404.2	1442.02	1443.01	1444.01	1445.01	1446.01	1447.02	1448.03	1449.04	1450.06	1451.08
4404.3	1452.10	1453.13	1454.16	1455.19	1456.22	1457.26	1458.30	1459.34	1460.38	1461.43
4404.4	1462.48	1463.53	1464.58	1465.64	1466.70	1467.76	1468.82	1469.88	1470.95	1472.01

ELEV. FEET	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
4404.5	1473.08	1474.15	1475.23	1476.30	1477.38	1478.45	1479.53	1480.61	1481.70	1482.78
4404.6	1483.87	1484.96	1486.04	1487.14	1488.23	1489.32	1490.42	1491.51	1492.61	1493.71
4404.7	1494.81	1495.91	1497.01	1498.12	1499.22	1500.33	1501.44	1502.55	1503.66	1504.77
4404.8	1505.89	1507.00	1508.12	1509.23	1510.35	1511.47	1512.59	1513.71	1514.83	1515.96
4404.9	1517.08	1518.21	1519.33	1520.46	1521.59	1522.72	1523.85	1524.98	1526.11	1527.25
4405.0	1528.38	1530.39	1531.91	1533.30	1534.61	1535.85	1537.05	1538.21	1539.35	1540.46
4405.1	1541.54	1542.61	1543.66	1544.69	1545.71	1546.71	1547.71	1548.69	1549.66	1550.62
4405.2	1551.57	1552.52	1553.45	1554.38	1555.30	1556.21	1557.12	1558.02	1558.91	1559.80
4405.3	1560.68	1561.56	1562.43	1563.30	1564.16	1565.02	1565.88	1566.72	1567.57	1568.41
4405.4	1569.25	1570.08	1570.91	1571.74	1572.56	1573.38	1574.19	1575.00	1575.81	1576.62
4405.5	1577.42	1578.22	1579.02	1579.81	1580.61	1581.40	1582.18	1582.97	1583.75	1584.53
4405.6	1585.30	1586.08	1586.85	1587.62	1588.39	1589.15	1589.91	1590.67	1591.43	1592.19
4405.7	1592.95	1593.70	1594.45	1595.20	1595.95	1596.69	1597.43	1598.18	1598.92	1599.65
4405.8	1600.39	1601.12	1601.86	1602.59	1603.32	1604.05	1604.77	1605.50	1606.22	1606.95
4405.9	1607.67	1608.39	1609.10	1609.82	1610.54	1611.25	1611.96	1612.67	1613.38	1614.09
4406.0	1614.80	1615.52	1616.22	1616.91	1617.61	1618.30	1618.98	1619.67	1620.35	1621.04
4406.1	1621.72	1622.40	1623.08	1623.76	1624.44	1625.11	1625.79	1626.47	1627.14	1627.81
4406.2	1628.49	1629.16	1629.83	1630.51	1631.18	1631.85	1632.52	1633.19	1633.86	1634.53
4406.3	1635.20	1635.87	1636.54	1637.21	1637.88	1638.54	1639.21	1639.88	1640.55	1641.21
4406.4	1641.88	1642.55	1643.21	1643.88	1644.54	1645.21	1645.87	1646.54	1647.20	1647.87
4406.5	1648.53	1649.19	1649.86	1650.52	1651.18	1651.85	1652.51	1653.17	1653.83	1654.50
4406.6	1655.16	1655.82	1656.48	1657.14	1657.81	1658.47	1659.13	1659.79	1660.45	1661.11
4406.7	1661.77	1662.43	1663.09	1663.75	1664.41	1665.07	1665.73	1666.39	1667.05	1667.71
4406.8	1668.37	1669.03	1669.68	1670.34	1671.00	1671.66	1672.32	1672.98	1673.63	1674.29
4406.9	1674.95	1675.61	1676.26	1676.92	1677.58	1678.24	1678.89	1679.55	1680.21	1680.86
4407.0	1681.52	1682.17	1682.89	1683.63	1684.40	1685.18	1685.97	1686.78	1687.59	1688.41
4407.1	1689.24	1690.07	1690.91	1691.76	1692.60	1693.46	1694.32	1695.18	1696.05	1696.92
4407.2	1697.79	1698.67	1699.55	1700.43	1701.32	1702.21	1703.10	1704.00	1704.89	1705.79
4407.3	1706.70	1707.60	1708.51	1709.42	1710.33	1711.24	1712.15	1713.07	1713.99	1714.91
4407.4	1715.83	1716.76	1717.68	1718.61	1719.54	1720.47	1721.40	1722.34	1723.27	1724.21
4407.5	1725.15	1726.09	1727.03	1727.97	1728.91	1729.86	1730.81	1731.75	1732.70	1733.65
4407.6	1734.61	1735.56	1736.51	1737.47	1738.42	1739.38	1740.34	1741.30	1742.26	1743.22
4407.7	1744.19	1745.15	1746.12	1747.08	1748.05	1749.02	1749.99	1750.96	1751.93	1752.90
4407.8	1753.87	1754.85	1755.82	1756.80	1757.77	1758.75	1759.73	1760.71	1761.69	1762.67
4407.9	1763.65	1764.63	1765.62	1766.60	1767.59	1768.57	1769.56	1770.55	1771.53	1772.52

ELEV. FEET	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
4408.0	1773.51	1774.00	1774.55	1775.12	1775.71	1776.31	1776.92	1777.55	1778.17	1778.81
4408.1	1779.45	1780.10	1780.75	1781.41	1782.07	1782.74	1783.41	1784.08	1784.76	1785.44
4408.2	1786.13	1786.81	1787.50	1788.19	1788.89	1789.58	1790.28	1790.99	1791.69	1792.40
4408.3	1793.10	1793.81	1794.53	1795.24	1795.96	1796.68	1797.40	1798.12	1798.84	1799.56
4408.4	1800.29	1801.02	1801.75	1802.48	1803.21	1803.94	1804.68	1805.42	1806.15	1806.89
4408.5	1807.63	1808.38	1809.12	1809.86	1810.61	1811.36	1812.10	1812.85	1813.60	1814.35
4408.6	1815.11	1815.86	1816.61	1817.37	1818.13	1818.88	1819.64	1820.40	1821.16	1821.93
4408.7	1822.69	1823.45	1824.22	1824.98	1825.75	1826.51	1827.28	1828.05	1828.82	1829.59
4408.8	1830.36	1831.13	1831.91	1832.68	1833.46	1834.23	1835.01	1835.79	1836.56	1837.34
4408.9	1838.12	1838.90	1839.68	1840.46	1841.25	1842.03	1842.81	1843.60	1844.38	1845.17
4409.0	1845.95	1847.57	1848.86	1850.04	1851.17	1852.25	1853.30	1854.32	1855.32	1856.30
4409.1	1857.26	1858.21	1859.15	1860.07	1860.98	1861.88	1862.78	1863.66	1864.54	1865.41
4409.2	1866.27	1867.12	1867.97	1868.81	1869.65	1870.48	1871.31	1872.13	1872.95	1873.76
4409.3	1874.57	1875.37	1876.17	1876.97	1877.76	1878.55	1879.34	1880.12	1880.90	1881.67
4409.4	1882.45	1883.21	1883.98	1884.75	1885.51	1886.26	1887.02	1887.77	1888.52	1889.27
4409.5	1890.02	1890.76	1891.50	1892.24	1892.98	1893.71	1894.45	1895.18	1895.91	1896.63
4409.6	1897.36	1898.08	1898.80	1899.52	1900.24	1900.96	1901.67	1902.38	1903.09	1903.80
4409.7	1904.51	1905.22	1905.92	1906.62	1907.33	1908.03	1908.73	1909.42	1910.12	1910.81
4409.8	1911.51	1912.20	1912.89	1913.58	1914.27	1914.95	1915.64	1916.32	1917.00	1917.69
4409.9	1918.37	1919.05	1919.72	1920.40	1921.08	1921.75	1922.43	1923.10	1923.77	1924.44
4410.0	1925.11	1925.73	1926.34	1926.95	1927.56	1928.17	1928.77	1929.38	1929.98	1930.58
4410.1	1931.18	1931.79	1932.39	1932.99	1933.59	1934.19	1934.79	1935.39	1935.99	1936.59
4410.2	1937.18	1937.78	1938.38	1938.98	1939.57	1940.17	1940.77	1941.36	1941.96	1942.56
4410.3	1943.15	1943.75	1944.35	1944.94	1945.54	1946.13	1946.73	1947.32	1947.92	1948.51
4410.4	1949.11	1949.70	1950.29	1950.89	1951.48	1952.08	1952.67	1953.26	1953.86	1954.45
4410.5	1955.04	1955.64	1956.23	1956.82	1957.42	1958.01	1958.60	1959.19	1959.79	1960.38
4410.6	1960.97	1961.56	1962.15	1962.75	1963.34	1963.93	1964.52	1965.11	1965.71	1966.30
4410.7	1966.89	1967.48	1968.07	1968.66	1969.25	1969.84	1970.44	1971.03	1971.62	1972.21
4410.8	1972.80	1973.39	1973.98	1974.57	1975.16	1975.75	1976.34	1976.93	1977.52	1978.11
4410.9	1978.70	1979.29	1979.88	1980.47	1981.06	1981.65	1982.24	1982.83	1983.42	1984.01
4411.0	1984.60	1985.53	1986.38	1987.21	1988.02	1988.81	1989.60	1990.38	1991.16	1991.92
4411.1	1992.69	1993.45	1994.20	1994.95	1995.70	1996.44	1997.18	1997.92	1998.66	1999.39
4411.2	2000.12	2000.85	2001.58	2002.30	2003.03	2003.75	2004.47	2005.19	2005.90	2006.62
4411.3	2007.33	2008.04	2008.76	2009.47	2010.17	2010.88	2011.59	2012.29	2012.99	2013.70
4411.4	2014.40	2015.10	2015.80	2016.50	2017.19	2017.89	2018.59	2019.28	2019.97	2020.67

ELEV. FEET	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
4411.5	2021.36	2022.05	2022.74	2023.43	2024.12	2024.81	2025.49	2026.18	2026.87	2027.55
4411.6	2028.24	2028.92	2029.60	2030.29	2030.97	2031.65	2032.33	2033.01	2033.69	2034.37
4411.7	2035.05	2035.72	2036.40	2037.08	2037.75	2038.43	2039.10	2039.78	2040.45	2041.13
4411.8	2041.80	2042.47	2043.14	2043.82	2044.49	2045.16	2045.83	2046.50	2047.17	2047.83
4411.9	2048.50	2049.17	2049.84	2050.50	2051.17	2051.84	2052.50	2053.17	2053.83	2054.50
4412.0	2055.16	2055.69	2056.23	2056.77	2057.32	2057.86	2058.41	2058.96	2059.51	2060.06
4412.1	2060.61	2061.16	2061.71	2062.26	2062.81	2063.37	2063.92	2064.47	2065.03	2065.58
4412.2	2066.13	2066.69	2067.24	2067.80	2068.35	2068.91	2069.47	2070.02	2070.58	2071.14
4412.3	2071.69	2072.25	2072.81	2073.37	2073.92	2074.48	2075.04	2075.60	2076.16	2076.71
4412.4	2077.27	2077.83	2078.39	2078.95	2079.51	2080.07	2080.63	2081.19	2081.75	2082.31
4412.5	2082.87	2083.43	2083.99	2084.55	2085.11	2085.67	2086.23	2086.79	2087.35	2087.92
4412.6	2088.48	2089.04	2089.60	2090.16	2090.72	2091.28	2091.85	2092.41	2092.97	2093.53
4412.7	2094.10	2094.66	2095.22	2095.78	2096.34	2096.91	2097.47	2098.03	2098.60	2099.16
4412.8	2099.72	2100.28	2100.85	2101.41	2101.97	2102.54	2103.10	2103.67	2104.23	2104.79
4412.9	2105.36	2105.92	2106.48	2107.05	2107.61	2108.18	2108.74	2109.30	2109.87	2110.43
4413.0	2111.00	2111.57	2112.11	2112.63	2113.15	2113.67	2114.17	2114.68	2115.18	2115.68
4413.1	2116.18	2116.67	2117.16	2117.65	2118.14	2118.63	2119.12	2119.60	2120.08	2120.57
4413.2	2121.05	2121.53	2122.01	2122.48	2122.96	2123.44	2123.91	2124.39	2124.86	2125.34
4413.3	2125.81	2126.28	2126.75	2127.22	2127.69	2128.16	2128.63	2129.10	2129.56	2130.03
4413.4	2130.50	2130.96	2131.43	2131.90	2132.36	2132.82	2133.29	2133.75	2134.21	2134.68
4413.5	2135.14	2135.60	2136.06	2136.52	2136.98	2137.44	2137.90	2138.36	2138.82	2139.28
4413.6	2139.74	2140.20	2140.65	2141.11	2141.57	2142.02	2142.48	2142.94	2143.39	2143.85
4413.7	2144.30	2144.76	2145.21	2145.67	2146.12	2146.58	2147.03	2147.48	2147.94	2148.39
4413.8	2148.84	2149.29	2149.75	2150.20	2150.65	2151.10	2151.55	2152.00	2152.45	2152.90
4413.9	2153.35	2153.80	2154.25	2154.70	2155.15	2155.60	2156.05	2156.50	2156.95	2157.40
4414.0	2157.84	2158.32	2158.78	2159.24	2159.69	2160.13	2160.58	2161.02	2161.46	2161.89
4414.1	2162.33	2162.77	2163.20	2163.63	2164.07	2164.50	2164.93	2165.36	2165.79	2166.22
4414.2	2166.65	2167.07	2167.50	2167.93	2168.35	2168.78	2169.20	2169.63	2170.05	2170.47
4414.3	2170.90	2171.32	2171.74	2172.16	2172.58	2173.01	2173.43	2173.85	2174.27	2174.69
4414.4	2175.11	2175.53	2175.95	2176.36	2176.78	2177.20	2177.62	2178.04	2178.45	2178.87
4414.5	2179.29	2179.70	2180.12	2180.54	2180.95	2181.37	2181.78	2182.20	2182.62	2183.03
4414.6	2183.45	2183.86	2184.27	2184.69	2185.10	2185.52	2185.93	2186.34	2186.76	2187.17
4414.7	2187.58	2188.00	2188.41	2188.82	2189.23	2189.65	2190.06	2190.47	2190.88	2191.29
4414.8	2191.70	2192.12	2192.53	2192.94	2193.35	2193.76	2194.17	2194.58	2194.99	2195.40
4414.9	2195.81	2196.22	2196.63	2197.04	2197.45	2197.86	2198.27	2198.68	2199.09	2199.50

ELEV. FEET	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
4415.0	2199.90	2200.35	2200.78	2201.21	2201.63	2202.06	2202.48	2202.90	2203.32	2203.74
4415.1	2204.16	2204.58	2205.00	2205.41	2205.83	2206.25	2206.66	2207.08	2207.49	2207.91
4415.2	2208.32	2208.73	2209.15	2209.56	2209.97	2210.38	2210.80	2211.21	2211.62	2212.03
4415.3	2212.44	2212.85	2213.26	2213.67	2214.08	2214.49	2214.90	2215.31	2215.72	2216.13
4415.4	2216.54	2216.95	2217.36	2217.76	2218.17	2218.58	2218.99	2219.40	2219.80	2220.21
4415.5	2220.62	2221.03	2221.43	2221.84	2222.25	2222.65	2223.06	2223.47	2223.87	2224.28
4415.6	2224.69	2225.09	2225.50	2225.90	2226.31	2226.71	2227.12	2227.52	2227.93	2228.34
4415.7	2228.74	2229.15	2229.55	2229.95	2230.36	2230.76	2231.17	2231.57	2231.98	2232.38
4415.8	2232.79	2233.19	2233.59	2234.00	2234.40	2234.80	2235.21	2235.61	2236.02	2236.42
4415.9	2236.82	2237.23	2237.63	2238.03	2238.43	2238.84	2239.24	2239.64	2240.05	2240.45
4416.0	2240.85	2241.20	2241.55	2241.92	2242.28	2242.65	2243.03	2243.40	2243.78	2244.15
4416.1	2244.53	2244.91	2245.29	2245.68	2246.06	2246.44	2246.83	2247.21	2247.60	2247.99
4416.2	2248.37	2248.76	2249.15	2249.54	2249.93	2250.32	2250.71	2251.10	2251.49	2251.88
4416.3	2252.27	2252.67	2253.06	2253.45	2253.85	2254.24	2254.63	2255.03	2255.42	2255.82
4416.4	2256.21	2256.61	2257.01	2257.40	2257.80	2258.20	2258.59	2258.99	2259.39	2259.79
4416.5	2260.19	2260.58	2260.98	2261.38	2261.78	2262.18	2262.58	2262.98	2263.38	2263.78
4416.6	2264.18	2264.58	2264.98	2265.38	2265.79	2266.19	2266.59	2266.99	2267.39	2267.80
4416.7	2268.20	2268.60	2269.00	2269.41	2269.81	2270.21	2270.62	2271.02	2271.42	2271.83
4416.8	2272.23	2272.64	2273.04	2273.45	2273.85	2274.26	2274.66	2275.07	2275.47	2275.88
4416.9	2276.28	2276.69	2277.09	2277.50	2277.91	2278.31	2278.72	2279.12	2279.53	2279.94
4417.0	2280.34	2280.72	2281.10	2281.49	2281.88	2282.27	2282.66	2283.06	2283.45	2283.85
4417.1	2284.24	2284.64	2285.04	2285.44	2285.84	2286.23	2286.63	2287.03	2287.43	2287.84
4417.2	2288.24	2288.64	2289.04	2289.44	2289.84	2290.25	2290.65	2291.05	2291.46	2291.86
4417.3	2292.26	2292.67	2293.07	2293.48	2293.88	2294.29	2294.69	2295.10	2295.50	2295.91
4417.4	2296.32	2296.72	2297.13	2297.54	2297.94	2298.35	2298.76	2299.16	2299.57	2299.98
4417.5	2300.39	2300.79	2301.20	2301.61	2302.02	2302.43	2302.84	2303.24	2303.65	2304.06
4417.6	2304.47	2304.88	2305.29	2305.70	2306.11	2306.52	2306.93	2307.34	2307.75	2308.16
4417.7	2308.57	2308.98	2309.39	2309.80	2310.21	2310.62	2311.03	2311.44	2311.85	2312.26
4417.8	2312.67	2313.08	2313.49	2313.91	2314.32	2314.73	2315.14	2315.55	2315.96	2316.37
4417.9	2316.79	2317.20	2317.61	2318.02	2318.43	2318.85	2319.26	2319.67	2320.08	2320.50
4418.0	2320.91	2321.25	2321.62	2321.99	2322.36	2322.74	2323.12	2323.51	2323.89	2324.28
4418.1	2324.67	2325.06	2325.45	2325.85	2326.24	2326.64	2327.03	2327.43	2327.83	2328.23
4418.2	2328.63	2329.03	2329.43	2329.83	2330.23	2330.64	2331.04	2331.44	2331.85	2332.25
4418.3	2332.66	2333.07	2333.47	2333.88	2334.29	2334.70	2335.11	2335.52	2335.92	2336.33
4418.4	2336.75	2337.16	2337.57	2337.98	2338.39	2338.80	2339.22	2339.63	2340.04	2340.46

ELEV. FEET	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
4418.5	2340.87	2341.28	2341.70	2342.11	2342.53	2342.94	2343.36	2343.77	2344.19	2344.61
4418.6	2345.02	2345.44	2345.86	2346.28	2346.69	2347.11	2347.53	2347.95	2348.37	2348.78
4418.7	2349.20	2349.62	2350.04	2350.46	2350.88	2351.30	2351.72	2352.14	2352.56	2352.99
4418.8	2353.41	2353.83	2354.25	2354.67	2355.09	2355.52	2355.94	2356.36	2356.78	2357.21
4418.9	2357.63	2358.05	2358.48	2358.90	2359.32	2359.75	2360.17	2360.60	2361.02	2361.44
4419.0	2361.87	2364.19	2365.60	2366.80	2367.88	2368.88	2369.82	2370.70	2371.55	2372.37
4419.1	2373.16	2373.92	2374.67	2375.39	2376.10	2376.79	2377.47	2378.13	2378.78	2379.42
4419.2	2380.05	2380.67	2381.28	2381.89	2382.48	2383.07	2383.65	2384.22	2384.78	2385.34
4419.3	2385.90	2386.45	2386.99	2387.52	2388.06	2388.58	2389.11	2389.62	2390.14	2390.65
4419.4	2391.15	2391.65	2392.15	2392.65	2393.14	2393.62	2394.11	2394.59	2395.06	2395.54
4419.5	2396.01	2396.48	2396.94	2397.40	2397.86	2398.32	2398.77	2399.23	2399.68	2400.12
4419.6	2400.57	2401.01	2401.45	2401.89	2402.32	2402.76	2403.19	2403.62	2404.04	2404.47
4419.7	2404.89	2405.31	2405.73	2406.15	2406.57	2406.98	2407.40	2407.81	2408.22	2408.62
4419.8	2409.03	2409.43	2409.84	2410.24	2410.64	2411.04	2411.43	2411.83	2412.22	2412.62
4419.9	2413.01	2413.40	2413.79	2414.17	2414.56	2414.94	2415.33	2415.71	2416.09	2416.47
4420.0	2416.85									

Capacity Table at 0.01-Foot Increments

The capacity table is in acre feet with an elevation increment of one hundredth of one foot.

ELEV. FEET	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
4377.0	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
4377.1	0.96	0.96	0.96	0.97	0.97	0.97	0.97	0.97	0.98	0.98
4377.2	0.98	0.99	0.99	0.99	1.00	1.00	1.01	1.01	1.02	1.03
4377.3	1.04	1.04	1.05	1.06	1.07	1.08	1.09	1.10	1.12	1.13
4377.4	1.14	1.16	1.17	1.19	1.21	1.22	1.24	1.26	1.28	1.30
4377.5	1.33	1.35	1.37	1.40	1.43	1.46	1.48	1.51	1.55	1.58
4377.6	1.61	1.65	1.68	1.72	1.76	1.80	1.84	1.89	1.93	1.98
4377.7	2.02	2.07	2.12	2.18	2.23	2.29	2.34	2.40	2.46	2.52
4377.8	2.59	2.65	2.72	2.79	2.86	2.94	3.01	3.09	3.17	3.25
4377.9	3.33	3.42	3.51	3.60	3.69	3.78	3.88	3.98	4.08	4.18
4378.0	4.29	4.40	4.51	4.62	4.73	4.85	4.97	5.09	5.21	5.33
4378.1	5.46	5.59	5.72	5.85	5.99	6.13	6.27	6.41	6.55	6.70
4378.2	6.85	7.00	7.15	7.31	7.46	7.62	7.78	7.95	8.11	8.28
4378.3	8.45	8.62	8.80	8.97	9.15	9.33	9.52	9.70	9.89	10.08
4378.4	10.27	10.46	10.66	10.86	11.06	11.26	11.47	11.68	11.88	12.10
4378.5	12.31	12.53	12.74	12.96	13.19	13.41	13.64	13.87	14.10	14.33
4378.6	14.57	14.81	15.05	15.29	15.53	15.78	16.03	16.28	16.53	16.79
4378.7	17.05	17.31	17.57	17.83	18.10	18.37	18.64	18.91	19.19	19.47
4378.8	19.75	20.03	20.31	20.60	20.89	21.18	21.47	21.77	22.07	22.37
4378.9	22.67	22.97	23.28	23.59	23.90	24.21	24.53	24.84	25.16	25.48
4379.0	25.81	26.13	26.46	26.78	27.11	27.44	27.76	28.09	28.41	28.74
4379.1	29.06	29.39	29.71	30.04	30.36	30.69	31.01	31.34	31.66	31.99
4379.2	32.32	32.64	32.97	33.29	33.62	33.95	34.27	34.60	34.93	35.26
4379.3	35.58	35.91	36.24	36.57	36.90	37.23	37.56	37.89	38.23	38.56
4379.4	38.89	39.23	39.57	39.90	40.24	40.58	40.92	41.27	41.61	41.96
4379.5	42.31	42.66	43.01	43.37	43.72	44.08	44.44	44.81	45.18	45.55
4379.6	45.92	46.30	46.68	47.07	47.45	47.85	48.25	48.65	49.05	49.47
4379.7	49.88	50.31	50.74	51.17	51.61	52.06	52.51	52.98	53.44	53.92
4379.8	54.41	54.90	55.40	55.91	56.43	56.96	57.50	58.05	58.61	59.18
4379.9	59.77	60.36	60.97	61.59	62.23	62.87	63.54	64.21	64.90	65.61

ELEV. FEET	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
4380.0	66.33	67.06	67.80	68.53	69.27	70.01	70.75	71.50	72.24	72.99
4380.1	73.75	74.50	75.26	76.02	76.78	77.55	78.32	79.09	79.87	80.64
4380.2	81.43	82.21	83.00	83.79	84.59	85.38	86.18	86.99	87.80	88.61
4380.3	89.42	90.24	91.07	91.89	92.72	93.55	94.39	95.23	96.07	96.92
4380.4	97.77	98.63	99.49	100.35	101.21	102.08	102.96	103.84	104.72	105.60
4380.5	106.49	107.39	108.28	109.18	110.09	111.00	111.91	112.83	113.75	114.68
4380.6	115.60	116.54	117.48	118.42	119.36	120.31	121.27	122.23	123.19	124.15
4380.7	125.13	126.10	127.08	128.06	129.05	130.04	131.04	132.04	133.05	134.06
4380.8	135.07	136.09	137.11	138.14	139.17	140.20	141.24	142.29	143.34	144.39
4380.9	145.45	146.51	147.58	148.65	149.72	150.80	151.89	152.98	154.07	155.17
4381.0	156.28	157.38	158.49	159.61	160.72	161.84	162.96	164.09	165.21	166.34
4381.1	167.48	168.61	169.75	170.89	172.04	173.18	174.33	175.48	176.64	177.80
4381.2	178.96	180.12	181.29	182.46	183.63	184.80	185.98	187.16	188.34	189.52
4381.3	190.71	191.90	193.09	194.29	195.49	196.69	197.89	199.10	200.31	201.52
4381.4	202.73	203.95	205.17	206.39	207.62	208.84	210.07	211.31	212.54	213.78
4381.5	215.02	216.26	217.51	218.76	220.01	221.26	222.52	223.78	225.04	226.31
4381.6	227.57	228.84	230.11	231.39	232.67	233.95	235.23	236.52	237.80	239.09
4381.7	240.39	241.68	242.98	244.28	245.59	246.89	248.20	249.51	250.83	252.14
4381.8	253.46	254.78	256.11	257.43	258.76	260.10	261.43	262.77	264.11	265.45
4381.9	266.79	268.14	269.49	270.84	272.20	273.56	274.92	276.28	277.65	279.02
4382.0	280.39	281.76	283.13	284.51	285.89	287.27	288.65	290.03	291.42	292.81
4382.1	294.20	295.59	296.99	298.39	299.79	301.19	302.60	304.01	305.42	306.83
4382.2	308.25	309.66	311.08	312.51	313.93	315.36	316.79	318.23	319.67	321.10
4382.3	322.55	323.99	325.44	326.89	328.34	329.80	331.26	332.72	334.18	335.65
4382.4	337.12	338.59	340.07	341.55	343.03	344.51	346.00	347.49	348.99	350.48
4382.5	351.98	353.48	354.99	356.49	358.01	359.52	361.04	362.56	364.08	365.60
4382.6	367.13	368.67	370.20	371.74	373.28	374.82	376.37	377.92	379.47	381.03
4382.7	382.59	384.15	385.72	387.29	388.86	390.43	392.01	393.59	395.18	396.76
4382.8	398.35	399.95	401.55	403.15	404.75	406.36	407.96	409.58	411.19	412.81
4382.9	414.44	416.06	417.69	419.32	420.96	422.60	424.24	425.88	427.53	429.18
4383.0	430.84	432.50	434.16	435.84	437.51	439.19	440.88	442.57	444.26	445.96
4383.1	447.66	449.37	451.08	452.79	454.51	456.23	457.95	459.68	461.41	463.14
4383.2	464.88	466.62	468.37	470.11	471.86	473.62	475.37	477.13	478.89	480.66
4383.3	482.43	484.20	485.98	487.75	489.53	491.32	493.11	494.89	496.69	498.48
4383.4	500.28	502.08	503.89	505.69	507.50	509.32	511.13	512.95	514.77	516.59

ELEV. FEET	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
4383.5	518.42	520.25	522.08	523.91	525.75	527.59	529.43	531.28	533.13	534.98
4383.6	536.83	538.69	540.54	542.41	544.27	546.14	548.00	549.88	551.75	553.63
4383.7	555.51	557.39	559.27	561.16	563.05	564.94	566.83	568.73	570.63	572.53
4383.8	574.44	576.34	578.25	580.16	582.08	583.99	585.91	587.84	589.76	591.69
4383.9	593.62	595.55	597.48	599.42	601.36	603.30	605.24	607.19	609.13	611.08
4384.0	613.04	614.99	616.95	618.91	620.86	622.83	624.79	626.75	628.72	630.69
4384.1	632.66	634.63	636.61	638.58	640.56	642.54	644.52	646.51	648.49	650.48
4384.2	652.47	654.47	656.46	658.46	660.46	662.46	664.47	666.47	668.48	670.49
4384.3	672.51	674.52	676.54	678.56	680.58	682.61	684.64	686.67	688.70	690.73
4384.4	692.77	694.81	696.85	698.90	700.94	702.99	705.04	707.10	709.15	711.21
4384.5	713.27	715.34	717.40	719.47	721.54	723.62	725.70	727.77	729.86	731.94
4384.6	734.03	736.11	738.21	740.30	742.40	744.50	746.60	748.70	750.81	752.92
4384.7	755.03	757.15	759.26	761.38	763.51	765.63	767.76	769.89	772.02	774.16
4384.8	776.30	778.44	780.58	782.73	784.88	787.03	789.19	791.34	793.50	795.66
4384.9	797.83	800.00	802.17	804.34	806.52	808.70	810.88	813.06	815.25	817.44
4385.0	819.63	821.83	824.02	826.22	828.42	830.62	832.83	835.04	837.25	839.46
4385.1	841.67	843.89	846.11	848.33	850.55	852.78	855.01	857.24	859.47	861.71
4385.2	863.95	866.19	868.43	870.68	872.93	875.18	877.44	879.69	881.95	884.21
4385.3	886.48	888.75	891.02	893.29	895.57	897.85	900.13	902.41	904.70	906.99
4385.4	909.28	911.57	913.87	916.17	918.48	920.78	923.09	925.40	927.72	930.03
4385.5	932.35	934.68	937.00	939.33	941.66	944.00	946.34	948.68	951.02	953.36
4385.6	955.71	958.07	960.42	962.78	965.14	967.50	969.87	972.24	974.61	976.98
4385.7	979.36	981.74	984.13	986.51	988.90	991.30	993.69	996.09	998.49	1000.90
4385.8	1003.30	1005.71	1008.13	1010.54	1012.96	1015.39	1017.81	1020.24	1022.67	1025.11
4385.9	1027.54	1029.98	1032.43	1034.87	1037.32	1039.78	1042.23	1044.69	1047.15	1049.62
4386.0	1052.09	1054.56	1057.04	1059.52	1062.00	1064.50	1066.99	1069.49	1072.00	1074.50
4386.1	1077.02	1079.53	1082.05	1084.58	1087.11	1089.64	1092.17	1094.71	1097.26	1099.80
4386.2	1102.35	1104.91	1107.46	1110.03	1112.59	1115.16	1117.73	1120.31	1122.89	1125.47
4386.3	1128.06	1130.65	1133.24	1135.84	1138.44	1141.04	1143.65	1146.26	1148.88	1151.49
4386.4	1154.12	1156.74	1159.37	1162.00	1164.63	1167.27	1169.91	1172.56	1175.21	1177.86
4386.5	1180.51	1183.17	1185.83	1188.50	1191.17	1193.84	1196.51	1199.19	1201.87	1204.56
4386.6	1207.24	1209.93	1212.63	1215.33	1218.03	1220.73	1223.44	1226.15	1228.86	1231.58
4386.7	1234.30	1237.02	1239.75	1242.48	1245.21	1247.95	1250.69	1253.43	1256.17	1258.92
4386.8	1261.68	1264.43	1267.19	1269.95	1272.71	1275.48	1278.25	1281.03	1283.80	1286.58
4386.9	1289.37	1292.15	1294.94	1297.73	1300.53	1303.33	1306.13	1308.93	1311.74	1314.55

ELEV. FEET	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
4387.0	1317.37	1320.18	1323.01	1325.83	1328.66	1331.49	1334.33	1337.16	1340.01	1342.85
4387.1	1345.70	1348.55	1351.41	1354.26	1357.13	1359.99	1362.86	1365.73	1368.60	1371.48
4387.2	1374.36	1377.24	1380.13	1383.02	1385.91	1388.81	1391.70	1394.61	1397.51	1400.42
4387.3	1403.33	1406.24	1409.16	1412.08	1415.00	1417.93	1420.85	1423.79	1426.72	1429.66
4387.4	1432.60	1435.54	1438.49	1441.44	1444.39	1447.35	1450.30	1453.27	1456.23	1459.20
4387.5	1462.17	1465.14	1468.12	1471.09	1474.08	1477.06	1480.05	1483.04	1486.03	1489.03
4387.6	1492.03	1495.03	1498.03	1501.04	1504.05	1507.07	1510.08	1513.10	1516.12	1519.15
4387.7	1522.18	1525.21	1528.24	1531.28	1534.32	1537.36	1540.40	1543.45	1546.50	1549.56
4387.8	1552.61	1555.67	1558.73	1561.80	1564.87	1567.94	1571.01	1574.09	1577.17	1580.25
4387.9	1583.33	1586.42	1589.51	1592.60	1595.70	1598.80	1601.90	1605.00	1608.11	1611.22
4388.0	1614.33	1617.45	1620.57	1623.69	1626.81	1629.94	1633.06	1636.19	1639.33	1642.46
4388.1	1645.60	1648.74	1651.89	1655.03	1658.18	1661.34	1664.49	1667.65	1670.81	1673.97
4388.2	1677.14	1680.31	1683.48	1686.65	1689.83	1693.01	1696.19	1699.38	1702.57	1705.76
4388.3	1708.96	1712.15	1715.35	1718.56	1721.76	1724.97	1728.18	1731.40	1734.62	1737.84
4388.4	1741.06	1744.29	1747.52	1750.75	1753.98	1757.22	1760.46	1763.71	1766.95	1770.20
4388.5	1773.46	1776.71	1779.97	1783.23	1786.50	1789.77	1793.04	1796.31	1799.59	1802.87
4388.6	1806.15	1809.43	1812.72	1816.01	1819.31	1822.61	1825.91	1829.21	1832.52	1835.83
4388.7	1839.14	1842.46	1845.77	1849.10	1852.42	1855.75	1859.08	1862.41	1865.75	1869.09
4388.8	1872.43	1875.78	1879.13	1882.48	1885.83	1889.19	1892.55	1895.91	1899.28	1902.65
4388.9	1906.02	1909.40	1912.78	1916.16	1919.55	1922.94	1926.33	1929.72	1933.12	1936.52
4389.0	1939.92	1943.33	1946.74	1950.15	1953.56	1956.98	1960.39	1963.82	1967.24	1970.67
4389.1	1974.10	1977.53	1980.96	1984.40	1987.84	1991.29	1994.74	1998.19	2001.64	2005.10
4389.2	2008.56	2012.03	2015.49	2018.97	2022.44	2025.92	2029.40	2032.89	2036.37	2039.87
4389.3	2043.36	2046.86	2050.36	2053.87	2057.38	2060.89	2064.41	2067.93	2071.46	2074.99
4389.4	2078.52	2082.06	2085.59	2089.14	2092.69	2096.24	2099.79	2103.35	2106.91	2110.48
4389.5	2114.05	2117.62	2121.20	2124.79	2128.37	2131.96	2135.56	2139.15	2142.75	2146.36
4389.6	2149.97	2153.58	2157.20	2160.82	2164.45	2168.08	2171.71	2175.35	2178.99	2182.64
4389.7	2186.29	2189.94	2193.60	2197.27	2200.93	2204.60	2208.28	2211.96	2215.64	2219.33
4389.8	2223.02	2226.72	2230.42	2234.12	2237.83	2241.54	2245.26	2248.98	2252.71	2256.44
4389.9	2260.17	2263.91	2267.65	2271.40	2275.15	2278.90	2282.66	2286.43	2290.20	2293.97
4390.0	2297.74	2301.53	2305.31	2309.10	2312.90	2316.70	2320.50	2324.31	2328.12	2331.94
4390.1	2335.76	2339.59	2343.42	2347.25	2351.09	2354.94	2358.78	2362.63	2366.49	2370.35
4390.2	2374.22	2378.09	2381.96	2385.84	2389.72	2393.60	2397.50	2401.39	2405.29	2409.19
4390.3	2413.10	2417.01	2420.93	2424.85	2428.77	2432.70	2436.64	2440.57	2444.51	2448.46
4390.4	2452.41	2456.37	2460.32	2464.29	2468.25	2472.22	2476.20	2480.18	2484.16	2488.15

ELEV. FEET	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
4390.5	2492.14	2496.14	2500.14	2504.15	2508.16	2512.17	2516.19	2520.21	2524.24	2528.27
4390.6	2532.30	2536.34	2540.38	2544.43	2548.48	2552.54	2556.60	2560.66	2564.73	2568.80
4390.7	2572.88	2576.96	2581.04	2585.13	2589.22	2593.32	2597.42	2601.53	2605.64	2609.75
4390.8	2613.87	2617.99	2622.12	2626.25	2630.38	2634.52	2638.67	2642.81	2646.97	2651.12
4390.9	2655.28	2659.45	2663.61	2667.79	2671.96	2676.14	2680.33	2684.52	2688.71	2692.91
4391.0	2697.11	2701.31	2705.52	2709.73	2713.94	2718.16	2722.37	2726.60	2730.82	2735.05
4391.1	2739.29	2743.53	2747.77	2752.02	2756.27	2760.52	2764.79	2769.05	2773.32	2777.60
4391.2	2781.88	2786.17	2790.46	2794.76	2799.06	2803.37	2807.69	2812.01	2816.34	2820.67
4391.3	2825.01	2829.35	2833.70	2838.06	2842.42	2846.79	2851.16	2855.55	2859.93	2864.33
4391.4	2868.73	2873.14	2877.55	2881.97	2886.40	2890.83	2895.27	2899.72	2904.18	2908.64
4391.5	2913.11	2917.58	2922.06	2926.55	2931.05	2935.55	2940.06	2944.58	2949.11	2953.64
4391.6	2958.18	2962.73	2967.29	2971.85	2976.42	2981.00	2985.58	2990.18	2994.78	2999.39
4391.7	3004.00	3008.63	3013.26	3017.90	3022.54	3027.20	3031.86	3036.54	3041.21	3045.90
4391.8	3050.60	3055.30	3060.01	3064.73	3069.46	3074.20	3078.94	3083.70	3088.46	3093.23
4391.9	3098.00	3102.79	3107.59	3112.39	3117.20	3122.02	3126.85	3131.69	3136.53	3141.39
4392.0	3146.25	3151.12	3156.00	3160.89	3165.78	3170.68	3175.58	3180.50	3185.42	3190.34
4392.1	3195.28	3200.22	3205.17	3210.12	3215.08	3220.05	3225.02	3230.00	3234.99	3239.99
4392.2	3244.99	3250.00	3255.01	3260.03	3265.06	3270.10	3275.14	3280.19	3285.24	3290.30
4392.3	3295.37	3300.45	3305.53	3310.62	3315.71	3320.81	3325.92	3331.04	3336.16	3341.29
4392.4	3346.42	3351.56	3356.71	3361.87	3367.03	3372.19	3377.37	3382.55	3387.74	3392.93
4392.5	3398.13	3403.34	3408.56	3413.78	3419.00	3424.24	3429.48	3434.72	3439.98	3445.24
4392.6	3450.51	3455.78	3461.06	3466.35	3471.64	3476.94	3482.24	3487.56	3492.88	3498.20
4392.7	3503.53	3508.87	3514.22	3519.57	3524.93	3530.29	3535.67	3541.04	3546.43	3551.82
4392.8	3557.22	3562.62	3568.03	3573.45	3578.87	3584.31	3589.74	3595.19	3600.64	3606.09
4392.9	3611.56	3617.02	3622.50	3627.98	3633.47	3638.97	3644.47	3649.98	3655.49	3661.02
4393.0	3666.54	3672.08	3677.63	3683.18	3688.75	3694.32	3699.90	3705.48	3711.08	3716.68
4393.1	3722.29	3727.90	3733.53	3739.16	3744.79	3750.44	3756.09	3761.75	3767.41	3773.08
4393.2	3778.76	3784.45	3790.14	3795.84	3801.54	3807.25	3812.97	3818.70	3824.43	3830.17
4393.3	3835.91	3841.66	3847.42	3853.18	3858.95	3864.72	3870.51	3876.29	3882.09	3887.89
4393.4	3893.70	3899.51	3905.33	3911.16	3916.99	3922.82	3928.67	3934.52	3940.37	3946.24
4393.5	3952.11	3957.98	3963.86	3969.75	3975.64	3981.54	3987.44	3993.35	3999.27	4005.19
4393.6	4011.12	4017.05	4022.99	4028.94	4034.89	4040.85	4046.81	4052.78	4058.76	4064.74
4393.7	4070.73	4076.72	4082.72	4088.72	4094.73	4100.75	4106.77	4112.80	4118.83	4124.87
4393.8	4130.92	4136.97	4143.02	4149.09	4155.15	4161.23	4167.31	4173.39	4179.48	4185.58
4393.9	4191.68	4197.79	4203.90	4210.02	4216.15	4222.28	4228.41	4234.56	4240.70	4246.86

ELEV. FEET	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
4394.0	4253.02	4259.18	4265.35	4271.52	4277.69	4283.87	4290.05	4296.24	4302.43	4308.62
4394.1	4314.82	4321.02	4327.23	4333.44	4339.65	4345.87	4352.09	4358.31	4364.54	4370.78
4394.2	4377.01	4383.25	4389.50	4395.74	4402.00	4408.25	4414.51	4420.77	4427.04	4433.31
4394.3	4439.59	4445.87	4452.15	4458.43	4464.72	4471.02	4477.32	4483.62	4489.92	4496.23
4394.4	4502.55	4508.86	4515.18	4521.51	4527.84	4534.17	4540.51	4546.85	4553.19	4559.54
4394.5	4565.89	4572.25	4578.61	4584.97	4591.34	4597.71	4604.08	4610.46	4616.84	4623.23
4394.6	4629.62	4636.01	4642.41	4648.81	4655.22	4661.63	4668.04	4674.46	4680.88	4687.30
4394.7	4693.73	4700.16	4706.60	4713.04	4719.48	4725.93	4732.38	4738.84	4745.30	4751.76
4394.8	4758.23	4764.70	4771.17	4777.65	4784.13	4790.62	4797.11	4803.60	4810.10	4816.60
4394.9	4823.11	4829.62	4836.13	4842.65	4849.17	4855.69	4862.22	4868.75	4875.29	4881.83
4395.0	4888.37	4894.92	4901.47	4908.03	4914.59	4921.15	4927.72	4934.29	4940.86	4947.44
4395.1	4954.03	4960.61	4967.20	4973.80	4980.40	4987.00	4993.61	5000.22	5006.84	5013.45
4395.2	5020.08	5026.71	5033.34	5039.97	5046.61	5053.26	5059.91	5066.56	5073.21	5079.87
4395.3	5086.54	5093.21	5099.88	5106.56	5113.24	5119.92	5126.61	5133.31	5140.00	5146.70
4395.4	5153.41	5160.12	5166.83	5173.55	5180.27	5187.00	5193.73	5200.47	5207.21	5213.95
4395.5	5220.70	5227.45	5234.20	5240.96	5247.73	5254.50	5261.27	5268.04	5274.83	5281.61
4395.6	5288.40	5295.19	5301.99	5308.79	5315.60	5322.41	5329.22	5336.04	5342.86	5349.69
4395.7	5356.52	5363.36	5370.19	5377.04	5383.89	5390.74	5397.59	5404.45	5411.32	5418.19
4395.8	5425.06	5431.94	5438.82	5445.71	5452.60	5459.49	5466.39	5473.29	5480.20	5487.11
4395.9	5494.02	5500.94	5507.87	5514.79	5521.73	5528.66	5535.60	5542.55	5549.50	5556.45
4396.0	5563.41	5570.37	5577.33	5584.31	5591.28	5598.26	5605.25	5612.24	5619.24	5626.25
4396.1	5633.26	5640.27	5647.30	5654.33	5661.37	5668.41	5675.46	5682.52	5689.58	5696.66
4396.2	5703.74	5710.82	5717.92	5725.02	5732.13	5739.24	5746.37	5753.50	5760.64	5767.78
4396.3	5774.94	5782.10	5789.27	5796.45	5803.63	5810.83	5818.03	5825.24	5832.46	5839.68
4396.4	5846.92	5854.16	5861.41	5868.67	5875.93	5883.21	5890.49	5897.78	5905.08	5912.39
4396.5	5919.71	5927.03	5934.37	5941.71	5949.06	5956.42	5963.79	5971.16	5978.55	5985.94
4396.6	5993.35	6000.76	6008.18	6015.61	6023.05	6030.49	6037.95	6045.41	6052.89	6060.37
4396.7	6067.86	6075.36	6082.87	6090.39	6097.92	6105.45	6113.00	6120.55	6128.12	6135.69
4396.8	6143.27	6150.86	6158.46	6166.07	6173.69	6181.32	6188.96	6196.60	6204.26	6211.93
4396.9	6219.60	6227.28	6234.98	6242.68	6250.39	6258.12	6265.85	6273.59	6281.34	6289.10
4397.0	6296.87	6304.65	6312.44	6320.25	6328.06	6335.89	6343.73	6351.58	6359.44	6367.31
4397.1	6375.20	6383.09	6391.00	6398.92	6406.85	6414.79	6422.74	6430.70	6438.67	6446.66
4397.2	6454.65	6462.66	6470.67	6478.70	6486.74	6494.79	6502.85	6510.92	6519.00	6527.09
4397.3	6535.20	6543.31	6551.43	6559.57	6567.72	6575.87	6584.04	6592.22	6600.41	6608.61
4397.4	6616.82	6625.04	6633.27	6641.51	6649.76	6658.03	6666.30	6674.58	6682.88	6691.19

ELEV. FEET	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
4397.5	6699.50	6707.83	6716.17	6724.51	6732.87	6741.24	6749.62	6758.01	6766.41	6774.82
4397.6	6783.25	6791.68	6800.12	6808.57	6817.04	6825.51	6834.00	6842.49	6851.00	6859.51
4397.7	6868.04	6876.58	6885.12	6893.68	6902.25	6910.83	6919.42	6928.02	6936.63	6945.25
4397.8	6953.88	6962.52	6971.17	6979.83	6988.51	6997.19	7005.88	7014.58	7023.30	7032.02
4397.9	7040.76	7049.50	7058.26	7067.02	7075.80	7084.59	7093.38	7102.19	7111.01	7119.83
4398.0	7128.67	7137.52	7146.38	7155.24	7164.12	7173.00	7181.90	7190.80	7199.72	7208.64
4398.1	7217.58	7226.52	7235.48	7244.44	7253.42	7262.40	7271.40	7280.41	7289.43	7298.45
4398.2	7307.49	7316.54	7325.60	7334.68	7343.76	7352.85	7361.95	7371.07	7380.19	7389.33
4398.3	7398.48	7407.63	7416.80	7425.98	7435.17	7444.37	7453.59	7462.81	7472.04	7481.29
4398.4	7490.55	7499.81	7509.09	7518.38	7527.68	7537.00	7546.32	7555.65	7565.00	7574.36
4398.5	7583.72	7593.10	7602.49	7611.89	7621.31	7630.73	7640.17	7649.61	7659.07	7668.54
4398.6	7678.02	7687.51	7697.02	7706.53	7716.06	7725.60	7735.15	7744.71	7754.28	7763.86
4398.7	7773.45	7783.06	7792.68	7802.31	7811.95	7821.60	7831.26	7840.94	7850.62	7860.32
4398.8	7870.03	7879.75	7889.48	7899.23	7908.98	7918.75	7928.53	7938.32	7948.12	7957.93
4398.9	7967.76	7977.60	7987.44	7997.30	8007.17	8017.06	8026.95	8036.86	8046.78	8056.71
4399.0	8066.65	8076.60	8086.57	8096.55	8106.54	8116.54	8126.56	8136.59	8146.63	8156.68
4399.1	8166.75	8176.83	8186.92	8197.02	8207.13	8217.26	8227.40	8237.55	8247.71	8257.89
4399.2	8268.07	8278.27	8288.48	8298.70	8308.94	8319.18	8329.44	8339.71	8349.99	8360.29
4399.3	8370.59	8380.91	8391.24	8401.58	8411.93	8422.30	8432.67	8443.06	8453.46	8463.87
4399.4	8474.30	8484.73	8495.18	8505.64	8516.11	8526.59	8537.08	8547.59	8558.11	8568.64
4399.5	8579.18	8589.73	8600.29	8610.87	8621.46	8632.06	8642.67	8653.29	8663.92	8674.57
4399.6	8685.23	8695.90	8706.58	8717.27	8727.98	8738.69	8749.42	8760.16	8770.91	8781.67
4399.7	8792.45	8803.23	8814.03	8824.84	8835.66	8846.49	8857.33	8868.19	8879.05	8889.93
4399.8	8900.82	8911.72	8922.64	8933.56	8944.50	8955.45	8966.41	8977.38	8988.36	8999.35
4399.9	9010.36	9021.37	9032.40	9043.44	9054.49	9065.56	9076.63	9087.72	9098.82	9109.93
4400.0	9121.05	9132.18	9143.32	9154.48	9165.64	9176.82	9188.00	9199.19	9210.40	9221.61
4400.1	9232.84	9244.07	9255.31	9266.57	9277.83	9289.10	9300.38	9311.67	9322.97	9334.28
4400.2	9345.60	9356.92	9368.26	9379.61	9390.96	9402.32	9413.70	9425.08	9436.47	9447.87
4400.3	9459.28	9470.70	9482.13	9493.56	9505.01	9516.46	9527.93	9539.40	9550.88	9562.37
4400.4	9573.87	9585.37	9596.89	9608.42	9619.95	9631.49	9643.05	9654.61	9666.18	9677.75
4400.5	9689.34	9700.94	9712.54	9724.15	9735.78	9747.41	9759.05	9770.70	9782.35	9794.02
4400.6	9805.69	9817.37	9829.07	9840.77	9852.47	9864.19	9875.92	9887.65	9899.40	9911.15
4400.7	9922.91	9934.68	9946.45	9958.24	9970.04	9981.84	9993.65	10005.47	10017.30	10029.14
4400.8	10040.98	10052.84	10064.70	10076.57	10088.45	10100.34	10112.24	10124.14	10136.06	10147.98
4400.9	10159.91	10171.85	10183.80	10195.75	10207.72	10219.69	10231.67	10243.66	10255.66	10267.67

ELEV. FEET	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
4401.0	10279.68	10291.71	10303.73	10315.77	10327.81	10339.86	10351.91	10363.97	10376.04	10388.11
4401.1	10400.19	10412.28	10424.38	10436.48	10448.59	10460.71	10472.84	10484.97	10497.11	10509.26
4401.2	10521.41	10533.57	10545.74	10557.92	10570.11	10582.30	10594.50	10606.71	10618.93	10631.15
4401.3	10643.38	10655.62	10667.87	10680.13	10692.39	10704.66	10716.94	10729.23	10741.52	10753.83
4401.4	10766.14	10778.46	10790.79	10803.12	10815.47	10827.82	10840.18	10852.54	10864.92	10877.30
4401.5	10889.70	10902.10	10914.51	10926.92	10939.35	10951.78	10964.22	10976.67	10989.13	11001.60
4401.6	11014.07	11026.56	11039.05	11051.55	11064.06	11076.57	11089.10	11101.63	11114.17	11126.72
4401.7	11139.28	11151.85	11164.42	11177.01	11189.60	11202.20	11214.81	11227.43	11240.05	11252.69
4401.8	11265.33	11277.98	11290.64	11303.31	11315.99	11328.68	11341.37	11354.07	11366.79	11379.51
4401.9	11392.23	11404.97	11417.72	11430.47	11443.24	11456.01	11468.79	11481.58	11494.38	11507.18
4402.0	11520.00	11532.82	11545.66	11558.50	11571.35	11584.22	11597.08	11609.96	11622.85	11635.74
4402.1	11648.64	11661.55	11674.47	11687.39	11700.33	11713.27	11726.21	11739.17	11752.13	11765.10
4402.2	11778.08	11791.06	11804.06	11817.06	11830.06	11843.08	11856.10	11869.13	11882.16	11895.20
4402.3	11908.25	11921.31	11934.38	11947.45	11960.53	11973.61	11986.70	11999.80	12012.91	12026.02
4402.4	12039.14	12052.27	12065.40	12078.54	12091.69	12104.85	12118.01	12131.18	12144.35	12157.53
4402.5	12170.72	12183.92	12197.12	12210.33	12223.54	12236.77	12250.00	12263.23	12276.48	12289.73
4402.6	12302.98	12316.24	12329.51	12342.79	12356.07	12369.36	12382.66	12395.96	12409.27	12422.59
4402.7	12435.91	12449.24	12462.58	12475.92	12489.27	12502.62	12515.99	12529.36	12542.73	12556.11
4402.8	12569.50	12582.90	12596.30	12609.71	12623.12	12636.54	12649.97	12663.40	12676.84	12690.29
4402.9	12703.74	12717.20	12730.67	12744.14	12757.62	12771.11	12784.60	12798.10	12811.60	12825.11
4403.0	12838.63	12852.16	12865.69	12879.22	12892.77	12906.32	12919.87	12933.44	12947.01	12960.58
4403.1	12974.17	12987.76	13001.35	13014.96	13028.57	13042.19	13055.81	13069.44	13083.08	13096.73
4403.2	13110.38	13124.04	13137.71	13151.38	13165.06	13178.75	13192.45	13206.15	13219.86	13233.58
4403.3	13247.30	13261.03	13274.77	13288.51	13302.26	13316.02	13329.79	13343.56	13357.34	13371.13
4403.4	13384.93	13398.73	13412.54	13426.35	13440.18	13454.01	13467.85	13481.69	13495.55	13509.41
4403.5	13523.27	13537.15	13551.03	13564.92	13578.81	13592.72	13606.63	13620.55	13634.47	13648.40
4403.6	13662.34	13676.29	13690.24	13704.21	13718.17	13732.15	13746.13	13760.13	13774.12	13788.13
4403.7	13802.14	13816.16	13830.19	13844.22	13858.27	13872.32	13886.37	13900.44	13914.51	13928.59
4403.8	13942.67	13956.77	13970.87	13984.98	13999.09	14013.22	14027.35	14041.48	14055.63	14069.78
4403.9	14083.94	14098.11	14112.28	14126.47	14140.66	14154.85	14169.06	14183.27	14197.49	14211.71
4404.0	14225.95	14240.19	14254.44	14268.70	14282.96	14297.24	14311.52	14325.81	14340.11	14354.42
4404.1	14368.74	14383.07	14397.41	14411.75	14426.11	14440.48	14454.85	14469.24	14483.63	14498.04
4404.2	14512.45	14526.88	14541.31	14555.76	14570.21	14584.68	14599.16	14613.64	14628.14	14642.64
4404.3	14657.16	14671.68	14686.22	14700.77	14715.32	14729.89	14744.47	14759.06	14773.66	14788.26
4404.4	14802.88	14817.51	14832.16	14846.81	14861.47	14876.14	14890.82	14905.52	14920.22	14934.94

ELEV. FEET	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
4404.5	14949.66	14964.40	14979.14	14993.90	15008.67	15023.45	15038.24	15053.04	15067.85	15082.67
4404.6	15097.51	15112.35	15127.21	15142.07	15156.95	15171.84	15186.74	15201.64	15216.57	15231.50
4404.7	15246.44	15261.39	15276.36	15291.33	15306.32	15321.32	15336.33	15351.35	15366.38	15381.42
4404.8	15396.47	15411.54	15426.61	15441.70	15456.80	15471.91	15487.03	15502.16	15517.30	15532.46
4404.9	15547.62	15562.80	15577.98	15593.18	15608.39	15623.62	15638.85	15654.09	15669.35	15684.61
4405.0	15699.89	15715.19	15730.50	15745.83	15761.17	15776.52	15791.88	15807.26	15822.65	15838.05
4405.1	15853.46	15868.88	15884.31	15899.75	15915.20	15930.66	15946.14	15961.62	15977.11	15992.61
4405.2	16008.12	16023.64	16039.17	16054.71	16070.26	16085.82	16101.38	16116.96	16132.54	16148.14
4405.3	16163.74	16179.35	16194.97	16210.60	16226.24	16241.88	16257.54	16273.20	16288.87	16304.55
4405.4	16320.24	16335.94	16351.64	16367.36	16383.08	16398.81	16414.54	16430.29	16446.04	16461.81
4405.5	16477.58	16493.35	16509.14	16524.94	16540.74	16556.55	16572.37	16588.19	16604.02	16619.87
4405.6	16635.72	16651.57	16667.44	16683.31	16699.19	16715.08	16730.97	16746.87	16762.79	16778.70
4405.7	16794.63	16810.56	16826.50	16842.45	16858.41	16874.37	16890.34	16906.32	16922.30	16938.30
4405.8	16954.30	16970.31	16986.32	17002.34	17018.37	17034.41	17050.45	17066.50	17082.56	17098.63
4405.9	17114.70	17130.78	17146.87	17162.96	17179.07	17195.17	17211.29	17227.41	17243.54	17259.68
4406.0	17275.83	17291.98	17308.14	17324.30	17340.47	17356.65	17372.84	17389.03	17405.23	17421.44
4406.1	17437.65	17453.88	17470.10	17486.34	17502.58	17518.83	17535.08	17551.34	17567.61	17583.88
4406.2	17600.17	17616.45	17632.75	17649.05	17665.36	17681.67	17698.00	17714.32	17730.66	17747.00
4406.3	17763.35	17779.71	17796.07	17812.44	17828.81	17845.19	17861.58	17877.98	17894.38	17910.79
4406.4	17927.20	17943.63	17960.06	17976.49	17992.93	18009.38	18025.84	18042.30	18058.77	18075.24
4406.5	18091.73	18108.21	18124.71	18141.21	18157.72	18174.23	18190.76	18207.29	18223.82	18240.36
4406.6	18256.91	18273.46	18290.03	18306.59	18323.17	18339.75	18356.34	18372.93	18389.53	18406.14
4406.7	18422.76	18439.38	18456.01	18472.64	18489.28	18505.93	18522.58	18539.24	18555.91	18572.58
4406.8	18589.26	18605.95	18622.64	18639.34	18656.05	18672.76	18689.48	18706.21	18722.94	18739.68
4406.9	18756.43	18773.18	18789.94	18806.71	18823.48	18840.26	18857.04	18873.84	18890.64	18907.44
4407.0	18924.25	18941.07	18957.90	18974.73	18991.57	19008.42	19025.27	19042.14	19059.01	19075.89
4407.1	19092.78	19109.67	19126.58	19143.49	19160.41	19177.34	19194.28	19211.23	19228.19	19245.15
4407.2	19262.12	19279.11	19296.10	19313.10	19330.11	19347.12	19364.15	19381.19	19398.23	19415.28
4407.3	19432.35	19449.42	19466.50	19483.59	19500.69	19517.79	19534.91	19552.04	19569.17	19586.32
4407.4	19603.47	19620.63	19637.81	19654.99	19672.18	19689.38	19706.59	19723.81	19741.03	19758.27
4407.5	19775.52	19792.78	19810.04	19827.32	19844.60	19861.89	19879.20	19896.51	19913.83	19931.16
4407.6	19948.51	19965.86	19983.22	20000.59	20017.97	20035.36	20052.75	20070.16	20087.58	20105.01
4407.7	20122.44	20139.89	20157.35	20174.81	20192.29	20209.77	20227.27	20244.77	20262.29	20279.81
4407.8	20297.35	20314.89	20332.44	20350.01	20367.58	20385.16	20402.75	20420.36	20437.97	20455.59
4407.9	20473.22	20490.86	20508.51	20526.18	20543.85	20561.53	20579.22	20596.92	20614.63	20632.35

ELEV. FEET	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
4408.0	20650.08	20667.82	20685.56	20703.31	20721.06	20738.82	20756.59	20774.36	20792.14	20809.92
4408.1	20827.72	20845.51	20863.32	20881.13	20898.95	20916.77	20934.60	20952.44	20970.28	20988.13
4408.2	21005.99	21023.86	21041.73	21059.61	21077.49	21095.38	21113.28	21131.19	21149.10	21167.02
4408.3	21184.95	21202.88	21220.83	21238.78	21256.73	21274.69	21292.66	21310.64	21328.63	21346.62
4408.4	21364.62	21382.63	21400.64	21418.66	21436.69	21454.72	21472.77	21490.82	21508.88	21526.94
4408.5	21545.01	21563.09	21581.18	21599.28	21617.38	21635.49	21653.61	21671.73	21689.86	21708.00
4408.6	21726.15	21744.30	21762.47	21780.64	21798.81	21817.00	21835.19	21853.39	21871.60	21889.82
4408.7	21908.04	21926.27	21944.51	21962.75	21981.01	21999.27	22017.54	22035.81	22054.10	22072.39
4408.8	22090.69	22109.00	22127.31	22145.64	22163.97	22182.31	22200.65	22219.01	22237.37	22255.74
4408.9	22274.11	22292.50	22310.89	22329.29	22347.70	22366.12	22384.54	22402.97	22421.41	22439.86
4409.0	22458.32	22476.79	22495.27	22513.76	22532.27	22550.79	22569.31	22587.85	22606.40	22624.96
4409.1	22643.53	22662.10	22680.69	22699.29	22717.89	22736.51	22755.13	22773.76	22792.40	22811.05
4409.2	22829.71	22848.38	22867.05	22885.74	22904.43	22923.13	22941.84	22960.56	22979.28	22998.01
4409.3	23016.76	23035.51	23054.26	23073.03	23091.80	23110.58	23129.37	23148.17	23166.98	23185.79
4409.4	23204.61	23223.44	23242.27	23261.12	23279.97	23298.83	23317.69	23336.57	23355.45	23374.34
4409.5	23393.24	23412.14	23431.05	23449.97	23468.90	23487.83	23506.77	23525.72	23544.67	23563.64
4409.6	23582.61	23601.58	23620.57	23639.56	23658.56	23677.56	23696.58	23715.60	23734.62	23753.66
4409.7	23772.70	23791.75	23810.80	23829.87	23848.94	23868.01	23887.10	23906.19	23925.29	23944.39
4409.8	23963.50	23982.62	24001.75	24020.88	24040.02	24059.16	24078.32	24097.48	24116.64	24135.82
4409.9	24155.00	24174.18	24193.38	24212.58	24231.79	24251.00	24270.22	24289.45	24308.68	24327.92
4410.0	24347.17	24366.43	24385.69	24404.95	24424.23	24443.50	24462.79	24482.08	24501.38	24520.68
4410.1	24539.99	24559.30	24578.62	24597.95	24617.28	24636.62	24655.97	24675.32	24694.68	24714.04
4410.2	24733.41	24752.78	24772.16	24791.55	24810.94	24830.34	24849.75	24869.16	24888.57	24908.00
4410.3	24927.42	24946.86	24966.30	24985.75	25005.20	25024.66	25044.12	25063.59	25083.07	25102.55
4410.4	25122.04	25141.53	25161.03	25180.54	25200.05	25219.57	25239.09	25258.62	25278.16	25297.70
4410.5	25317.24	25336.80	25356.36	25375.92	25395.49	25415.07	25434.65	25454.24	25473.84	25493.44
4410.6	25513.05	25532.66	25552.28	25571.90	25591.53	25611.17	25630.81	25650.46	25670.11	25689.77
4410.7	25709.44	25729.11	25748.79	25768.47	25788.16	25807.86	25827.56	25847.27	25866.98	25886.70
4410.8	25906.42	25926.15	25945.89	25965.63	25985.38	26005.14	26024.90	26044.66	26064.44	26084.21
4410.9	26104.00	26123.79	26143.58	26163.39	26183.19	26203.01	26222.83	26242.65	26262.48	26282.32
4411.0	26302.16	26322.01	26341.87	26361.74	26381.62	26401.50	26421.39	26441.29	26461.20	26481.12
4411.1	26501.04	26520.97	26540.91	26560.85	26580.81	26600.77	26620.74	26640.71	26660.69	26680.69
4411.2	26700.68	26720.69	26740.70	26760.72	26780.75	26800.78	26820.82	26840.87	26860.92	26880.99
4411.3	26901.06	26921.13	26941.22	26961.31	26981.41	27001.51	27021.62	27041.74	27061.87	27082.00
4411.4	27102.14	27122.29	27142.45	27162.61	27182.78	27202.95	27223.13	27243.32	27263.52	27283.72

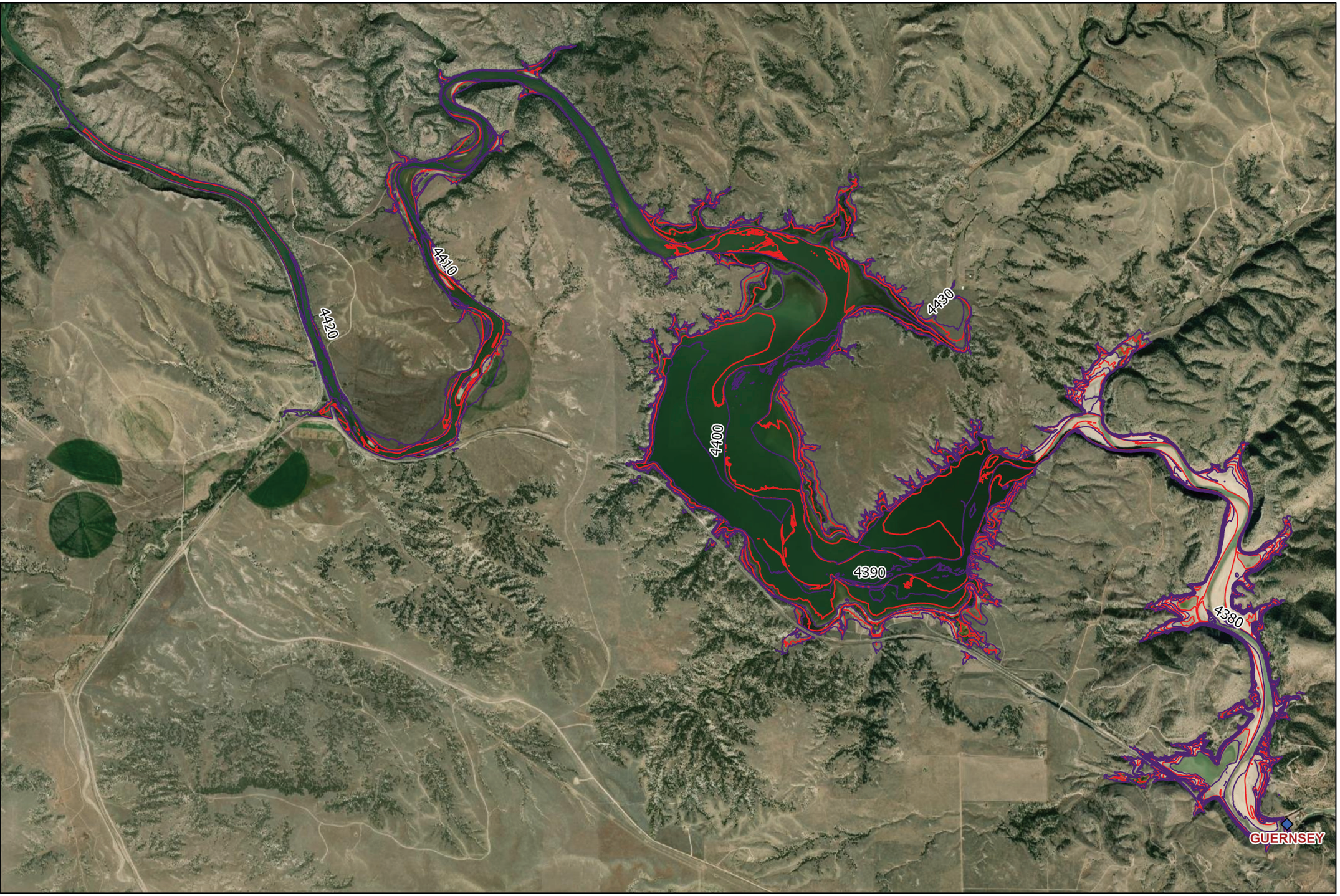
ELEV. FEET	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
4411.5	27303.93	27324.15	27344.37	27364.61	27384.84	27405.09	27425.34	27445.60	27465.86	27486.13
4411.6	27506.41	27526.70	27546.99	27567.29	27587.60	27607.91	27628.23	27648.56	27668.89	27689.23
4411.7	27709.58	27729.93	27750.29	27770.66	27791.03	27811.42	27831.80	27852.20	27872.60	27893.01
4411.8	27913.42	27933.84	27954.27	27974.71	27995.15	28015.59	28036.05	28056.51	28076.98	28097.45
4411.9	28117.94	28138.42	28158.92	28179.42	28199.93	28220.45	28240.97	28261.50	28282.03	28302.57
4412.0	28323.12	28343.67	28364.23	28384.80	28405.37	28425.95	28446.53	28467.11	28487.71	28508.30
4412.1	28528.91	28549.52	28570.13	28590.75	28611.38	28632.01	28652.64	28673.28	28693.93	28714.58
4412.2	28735.24	28755.91	28776.58	28797.25	28817.93	28838.62	28859.31	28880.01	28900.71	28921.42
4412.3	28942.13	28962.85	28983.58	29004.31	29025.05	29045.79	29066.54	29087.29	29108.05	29128.81
4412.4	29149.58	29170.36	29191.14	29211.93	29232.72	29253.52	29274.32	29295.13	29315.94	29336.76
4412.5	29357.59	29378.42	29399.26	29420.10	29440.95	29461.80	29482.66	29503.53	29524.40	29545.28
4412.6	29566.16	29587.04	29607.94	29628.84	29649.74	29670.65	29691.57	29712.49	29733.42	29754.35
4412.7	29775.29	29796.23	29817.18	29838.13	29859.09	29880.06	29901.03	29922.01	29942.99	29963.98
4412.8	29984.98	30005.98	30026.98	30047.99	30069.01	30090.03	30111.06	30132.10	30153.13	30174.18
4412.9	30195.23	30216.29	30237.35	30258.42	30279.49	30300.57	30321.65	30342.74	30363.84	30384.94
4413.0	30406.05	30427.16	30448.28	30469.40	30490.53	30511.67	30532.81	30553.95	30575.10	30596.25
4413.1	30617.41	30638.58	30659.75	30680.92	30702.10	30723.28	30744.47	30765.67	30786.86	30808.07
4413.2	30829.27	30850.49	30871.71	30892.93	30914.16	30935.39	30956.62	30977.87	30999.11	31020.36
4413.3	31041.62	31062.88	31084.14	31105.41	31126.69	31147.97	31169.25	31190.54	31211.83	31233.13
4413.4	31254.43	31275.74	31297.05	31318.37	31339.69	31361.02	31382.35	31403.68	31425.02	31446.37
4413.5	31467.72	31489.07	31510.43	31531.79	31553.16	31574.53	31595.91	31617.29	31638.67	31660.07
4413.6	31681.46	31702.86	31724.26	31745.67	31767.09	31788.50	31809.93	31831.35	31852.79	31874.22
4413.7	31895.66	31917.11	31938.56	31960.01	31981.47	32002.93	32024.40	32045.88	32067.35	32088.83
4413.8	32110.32	32131.81	32153.31	32174.81	32196.31	32217.82	32239.33	32260.85	32282.37	32303.90
4413.9	32325.43	32346.97	32368.51	32390.05	32411.60	32433.15	32454.71	32476.27	32497.84	32519.41
4414.0	32540.99	32562.57	32584.16	32605.75	32627.34	32648.94	32670.54	32692.15	32713.76	32735.38
4414.1	32757.00	32778.63	32800.26	32821.89	32843.53	32865.17	32886.82	32908.47	32930.13	32951.79
4414.2	32973.45	32995.12	33016.79	33038.47	33060.15	33081.84	33103.53	33125.22	33146.92	33168.62
4414.3	33190.33	33212.04	33233.76	33255.47	33277.20	33298.93	33320.66	33342.40	33364.14	33385.88
4414.4	33407.63	33429.38	33451.14	33472.90	33494.67	33516.44	33538.21	33559.99	33581.77	33603.56
4414.5	33625.35	33647.14	33668.94	33690.75	33712.55	33734.37	33756.18	33778.00	33799.83	33821.65
4414.6	33843.49	33865.32	33887.16	33909.01	33930.86	33952.71	33974.57	33996.43	34018.29	34040.16
4414.7	34062.04	34083.92	34105.80	34127.68	34149.57	34171.47	34193.37	34215.27	34237.18	34259.09
4414.8	34281.00	34302.92	34324.84	34346.77	34368.70	34390.64	34412.58	34434.52	34456.47	34478.42
4414.9	34500.38	34522.34	34544.30	34566.27	34588.24	34610.22	34632.20	34654.19	34676.17	34698.17

ELEV. FEET	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
4415.0	34720.16	34742.17	34764.17	34786.18	34808.20	34830.21	34852.24	34874.26	34896.29	34918.33
4415.1	34940.37	34962.41	34984.46	35006.51	35028.57	35050.63	35072.69	35094.76	35116.84	35138.91
4415.2	35160.99	35183.08	35205.17	35227.26	35249.36	35271.46	35293.57	35315.68	35337.79	35359.91
4415.3	35382.03	35404.16	35426.29	35448.42	35470.56	35492.71	35514.85	35537.00	35559.16	35581.32
4415.4	35603.48	35625.65	35647.82	35670.00	35692.18	35714.36	35736.55	35758.74	35780.93	35803.13
4415.5	35825.34	35847.55	35869.76	35891.98	35914.20	35936.42	35958.65	35980.88	36003.12	36025.36
4415.6	36047.60	36069.85	36092.11	36114.36	36136.62	36158.89	36181.16	36203.43	36225.71	36247.99
4415.7	36270.28	36292.56	36314.86	36337.16	36359.46	36381.76	36404.07	36426.39	36448.70	36471.03
4415.8	36493.35	36515.68	36538.02	36560.35	36582.70	36605.04	36627.39	36649.75	36672.10	36694.47
4415.9	36716.83	36739.20	36761.58	36783.96	36806.34	36828.72	36851.11	36873.51	36895.91	36918.31
4416.0	36940.72	36963.13	36985.54	37007.96	37030.38	37052.80	37075.23	37097.66	37120.10	37142.54
4416.1	37164.98	37187.43	37209.88	37232.34	37254.79	37277.26	37299.72	37322.19	37344.67	37367.15
4416.2	37389.63	37412.11	37434.60	37457.10	37479.59	37502.09	37524.60	37547.11	37569.62	37592.14
4416.3	37614.66	37637.18	37659.71	37682.24	37704.78	37727.32	37749.87	37772.41	37794.97	37817.52
4416.4	37840.08	37862.65	37885.22	37907.79	37930.36	37952.94	37975.53	37998.12	38020.71	38043.30
4416.5	38065.90	38088.51	38111.11	38133.73	38156.34	38178.96	38201.59	38224.21	38246.85	38269.48
4416.6	38292.12	38314.76	38337.41	38360.06	38382.72	38405.38	38428.04	38450.71	38473.38	38496.06
4416.7	38518.74	38541.42	38564.11	38586.80	38609.50	38632.20	38654.90	38677.61	38700.32	38723.04
4416.8	38745.76	38768.49	38791.21	38813.95	38836.68	38859.42	38882.17	38904.92	38927.67	38950.43
4416.9	38973.19	38995.95	39018.72	39041.49	39064.27	39087.05	39109.84	39132.63	39155.42	39178.22
4417.0	39201.02	39223.82	39246.63	39269.45	39292.26	39315.08	39337.91	39360.74	39383.57	39406.41
4417.1	39429.25	39452.09	39474.94	39497.79	39520.65	39543.51	39566.37	39589.24	39612.11	39634.99
4417.2	39657.87	39680.75	39703.64	39726.53	39749.43	39772.33	39795.24	39818.14	39841.06	39863.97
4417.3	39886.89	39909.82	39932.75	39955.68	39978.62	40001.56	40024.50	40047.45	40070.40	40093.36
4417.4	40116.32	40139.29	40162.26	40185.23	40208.21	40231.19	40254.18	40277.16	40300.16	40323.16
4417.5	40346.16	40369.16	40392.17	40415.19	40438.21	40461.23	40484.25	40507.29	40530.32	40553.36
4417.6	40576.40	40599.45	40622.50	40645.55	40668.61	40691.68	40714.74	40737.81	40760.89	40783.97
4417.7	40807.05	40830.14	40853.23	40876.33	40899.43	40922.53	40945.64	40968.75	40991.87	41014.99
4417.8	41038.11	41061.24	41084.38	41107.51	41130.65	41153.80	41176.95	41200.10	41223.26	41246.42
4417.9	41269.59	41292.76	41315.93	41339.11	41362.29	41385.48	41408.67	41431.86	41455.06	41478.26
4418.0	41501.47	41524.68	41547.90	41571.12	41594.34	41617.56	41640.79	41664.02	41687.26	41710.50
4418.1	41733.75	41757.00	41780.25	41803.51	41826.77	41850.03	41873.30	41896.57	41919.85	41943.13
4418.2	41966.41	41989.70	42012.99	42036.29	42059.59	42082.89	42106.20	42129.51	42152.83	42176.15
4418.3	42199.48	42222.80	42246.14	42269.47	42292.81	42316.16	42339.51	42362.86	42386.22	42409.58
4418.4	42432.95	42456.31	42479.69	42503.07	42526.45	42549.83	42573.22	42596.62	42620.02	42643.42

ELEV. FEET	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
4418.5	42666.83	42690.24	42713.65	42737.07	42760.49	42783.92	42807.35	42830.79	42854.23	42877.67
4418.6	42901.12	42924.57	42948.03	42971.49	42994.95	43018.42	43041.90	43065.37	43088.86	43112.34
4418.7	43135.83	43159.33	43182.82	43206.33	43229.83	43253.34	43276.86	43300.38	43323.90	43347.43
4418.8	43370.96	43394.50	43418.04	43441.58	43465.13	43488.68	43512.24	43535.80	43559.37	43582.94
4418.9	43606.51	43630.09	43653.67	43677.26	43700.85	43724.45	43748.05	43771.65	43795.26	43818.87
4419.0	43842.49	43866.12	43889.77	43913.43	43937.11	43960.79	43984.48	44008.19	44031.90	44055.62
4419.1	44079.34	44103.08	44126.82	44150.57	44174.33	44198.09	44221.87	44245.64	44269.43	44293.22
4419.2	44317.02	44340.82	44364.63	44388.45	44412.27	44436.10	44459.93	44483.77	44507.61	44531.46
4419.3	44555.32	44579.18	44603.05	44626.92	44650.80	44674.68	44698.57	44722.47	44746.36	44770.27
4419.4	44794.18	44818.09	44842.01	44865.93	44889.86	44913.80	44937.74	44961.68	44985.63	45009.58
4419.5	45033.54	45057.50	45081.47	45105.44	45129.42	45153.40	45177.38	45201.37	45225.37	45249.37
4419.6	45273.37	45297.38	45321.39	45345.41	45369.43	45393.45	45417.48	45441.52	45465.55	45489.60
4419.7	45513.64	45537.69	45561.75	45585.81	45609.87	45633.94	45658.01	45682.09	45706.17	45730.25
4419.8	45754.34	45778.43	45802.53	45826.63	45850.73	45874.84	45898.96	45923.07	45947.19	45971.32
4419.9	45995.44	46019.58	46043.71	46067.85	46092.00	46116.14	46140.29	46164.45	46188.61	46212.77
4420.0	46236.94									

Appendix C

Reservoir Contour Maps



Guernsey Reservoir Wyoming Elevation Contour Map

Overview Map

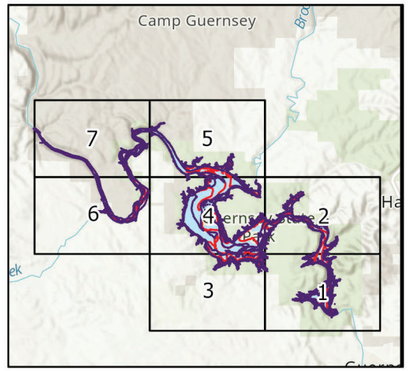
Map Prepared By:
Geographic Applications & Analysis Group
Bureau of Reclamation
Technical Service Center - 12/16/22

Horizontal: NAD 1983 2011 Wyoming East ft
US+ NAVD88 height Geoid18 US Feet
5 ft contour interval

N

Scale 1:35,000

0 1,250 2,500 5,000 Feet



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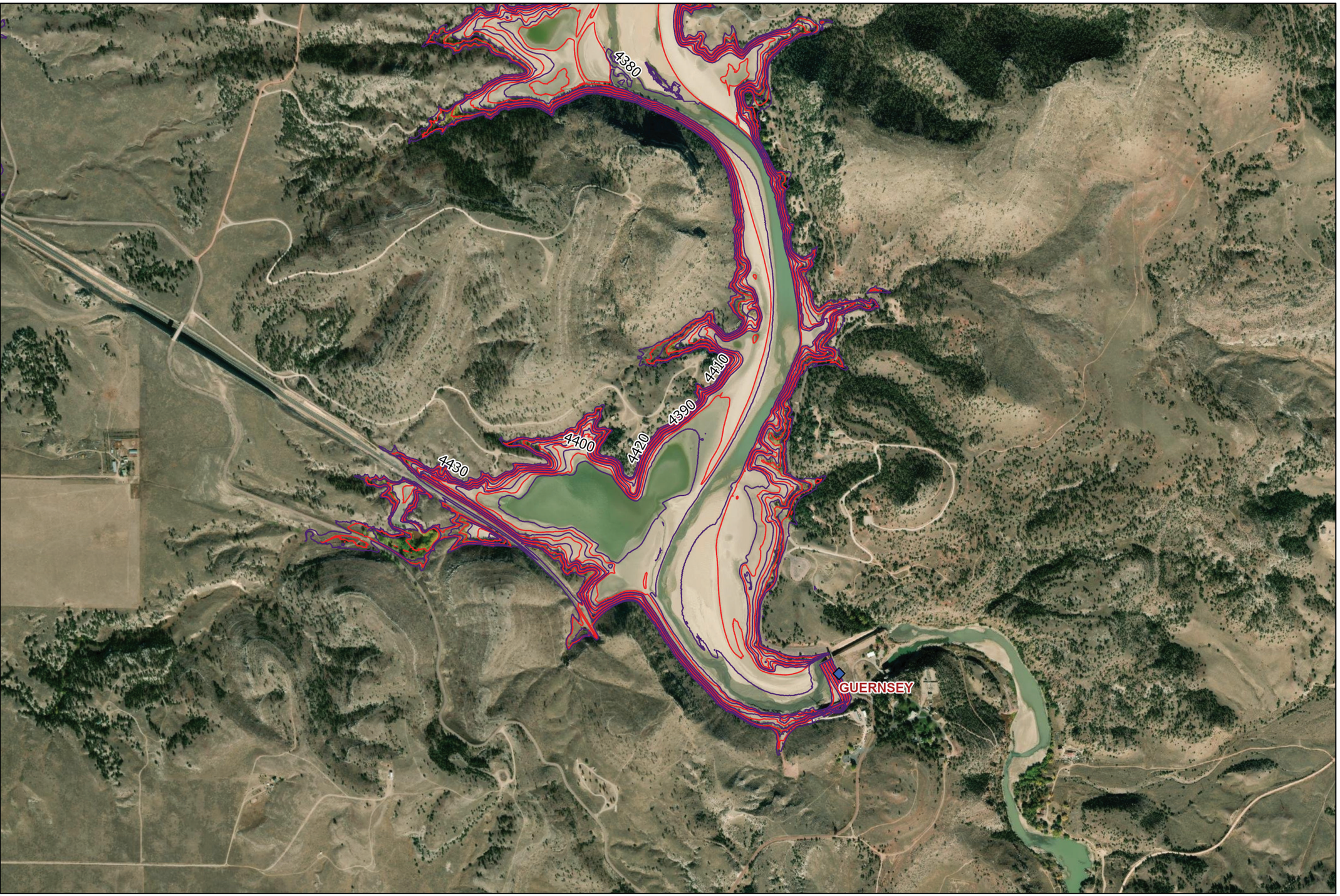


Guernsey Reservoir Wyoming Elevation Contour Map

Sheet 1

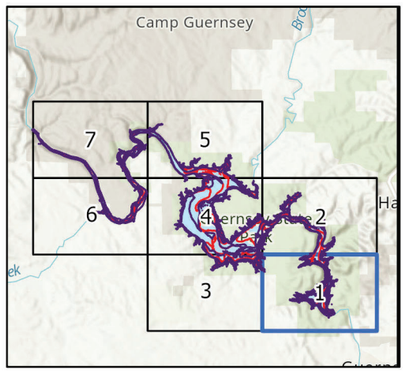
Map Prepared By:
Geographic Applications & Analysis Group
Bureau of Reclamation
Technical Service Center - 12/16/22

Horizontal: NAD 1983 2011 Wyoming East ft
US+ NAVD88 height Geoid18 US Feet
5 ft contour interval

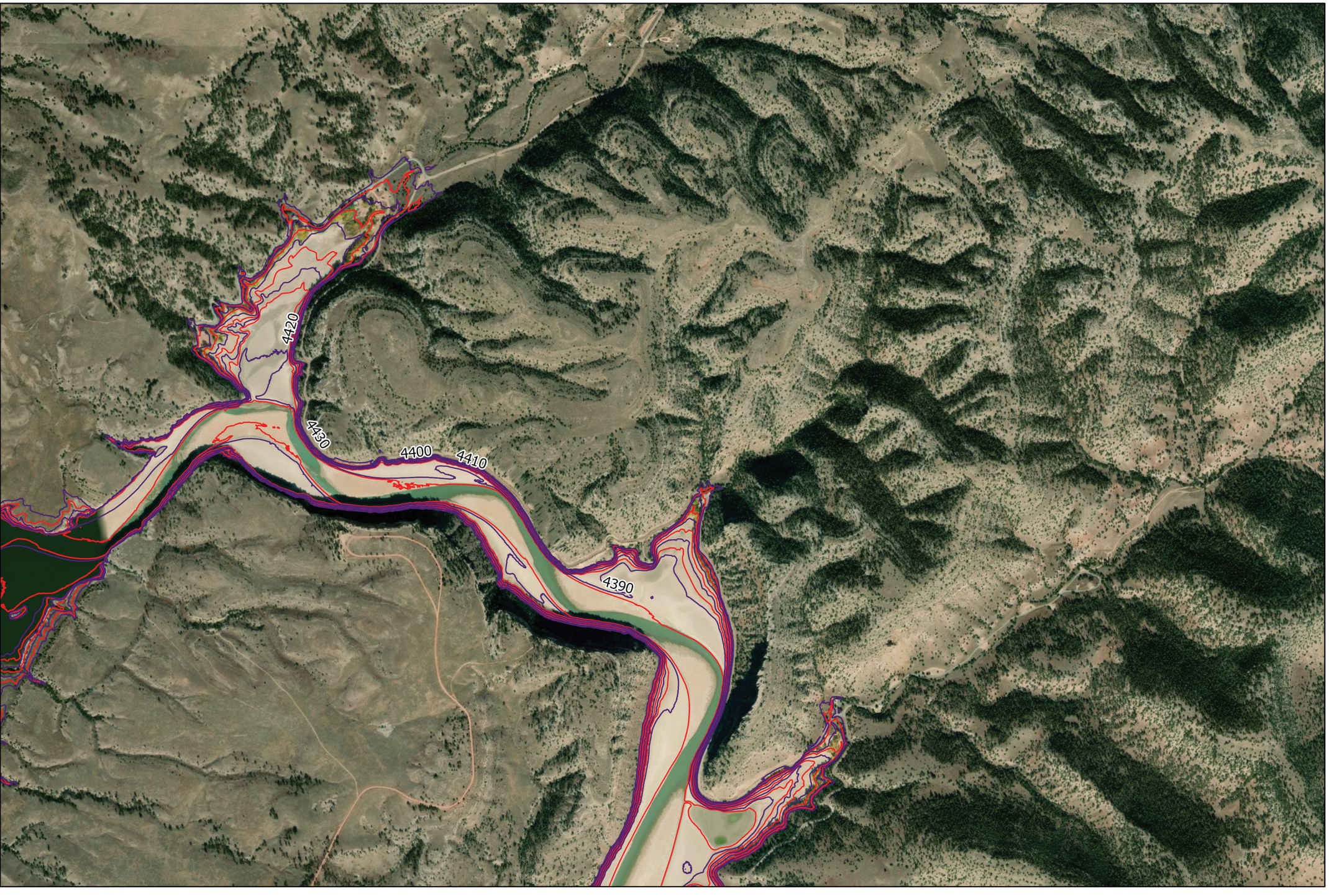
N

Scale 1:12,500

0 375 750 1,500 Feet



BUREAU OF RECLAMATION



Guernsey Reservoir Wyoming Elevation Contour Map

Sheet 2

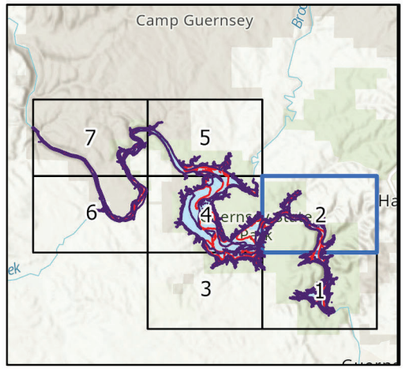
Map Prepared By:
Geographic Applications & Analysis Group
Bureau of Reclamation
Technical Service Center - 12/16/22

Horizontal: NAD 1983 2011 Wyoming East ft
US+ NAVD88 height Geoid18 US Feet
5 ft contour interval

N

Scale 1:12,500

0 375 750 1,500 Feet



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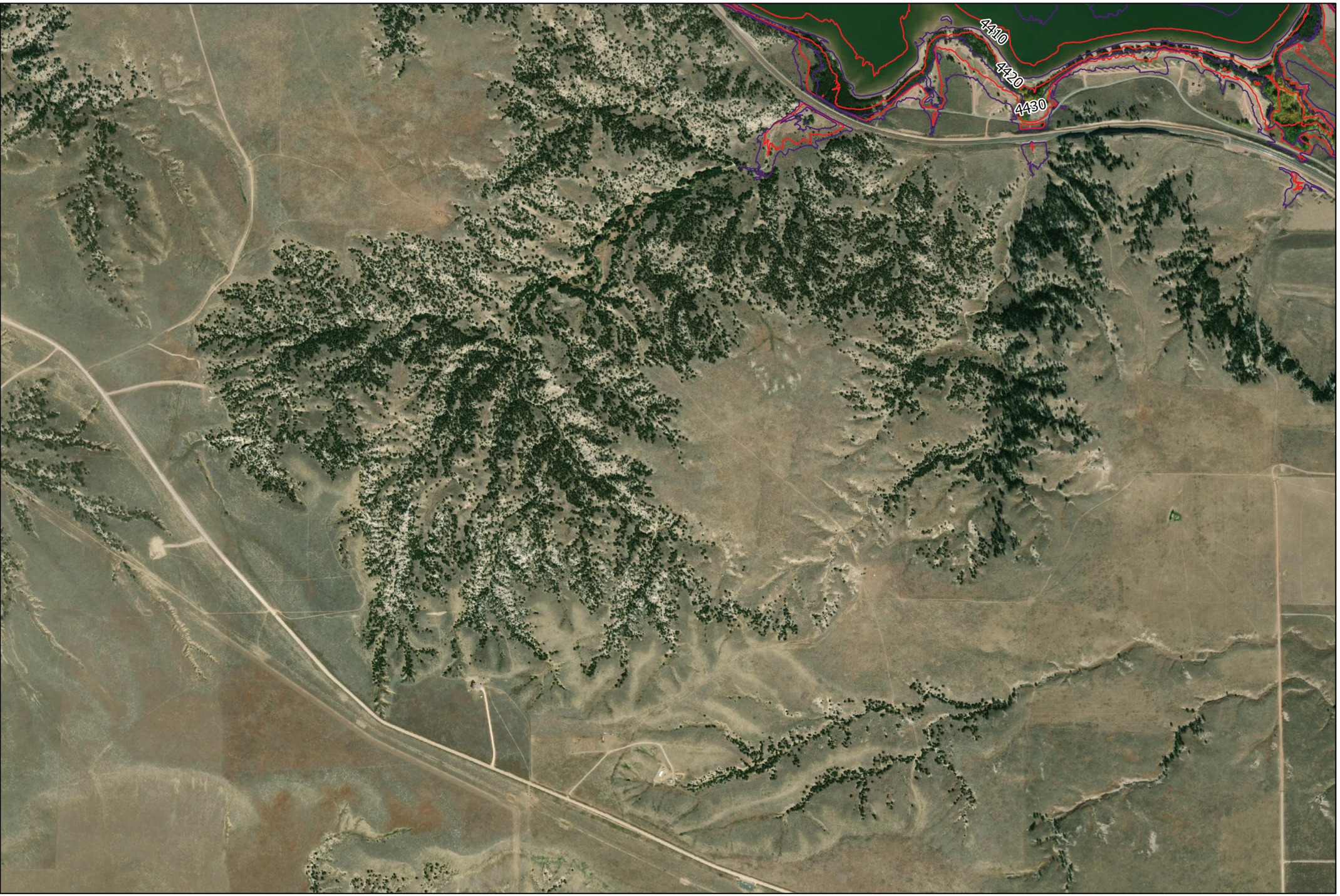

Guernsey Reservoir Wyoming Elevation Contour Map

Sheet 3

Map Prepared By:
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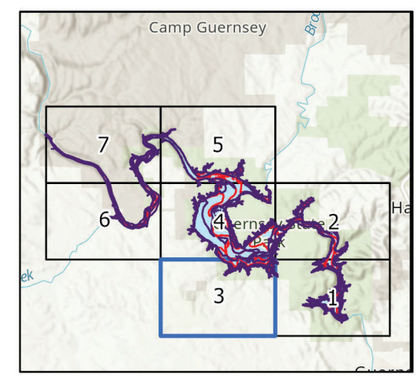
Bureau of Reclamation
Technical Service Center - 12/16/22

Horizontal: NAD 1983 2011 Wyoming East ft
US+ NAVD88 height Geoid18 US Feet
5 ft contour interval

N

Scale 1:12,500

0 375 750 1,500 Feet



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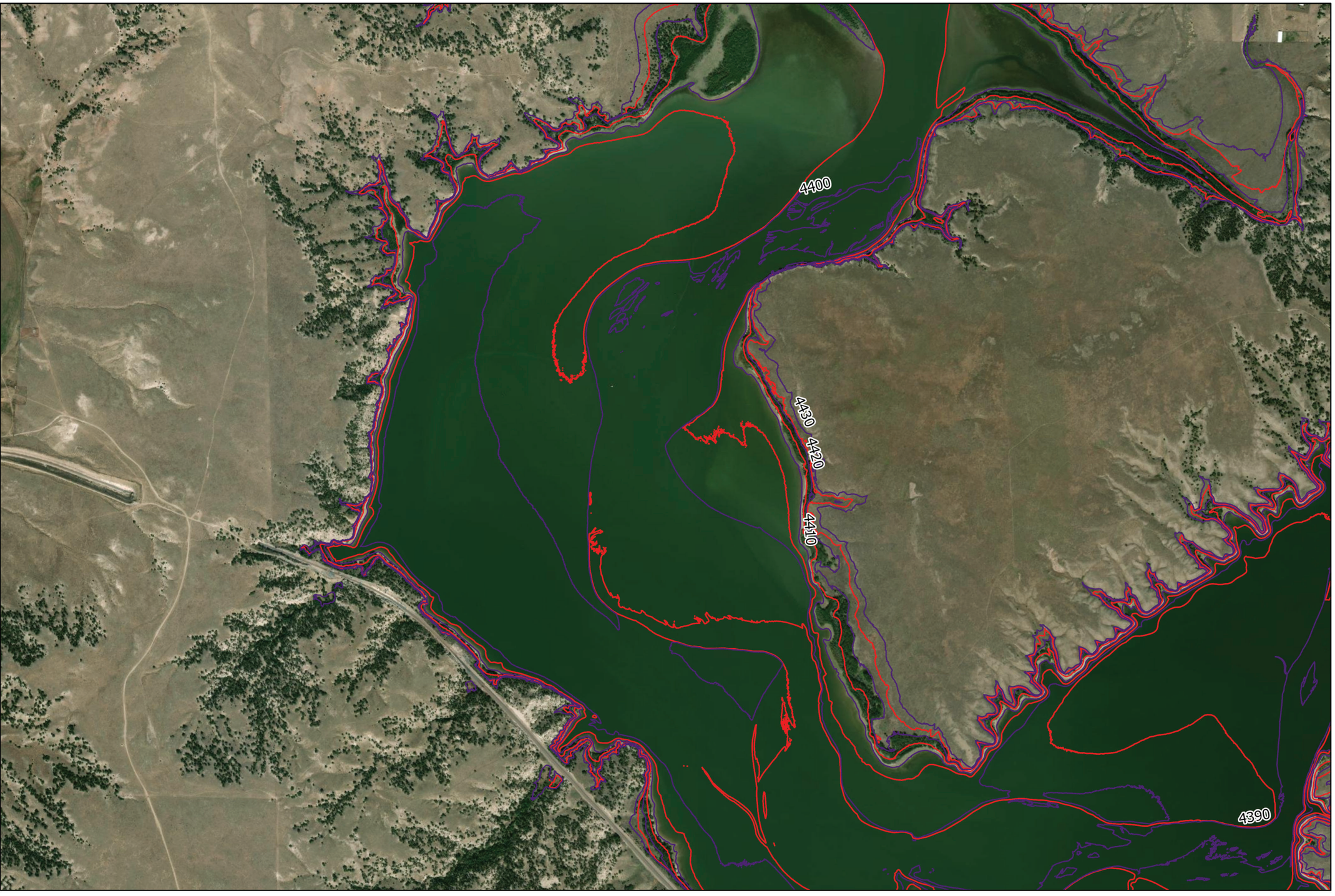


Guernsey Reservoir Wyoming Elevation Contour Map

Sheet 4

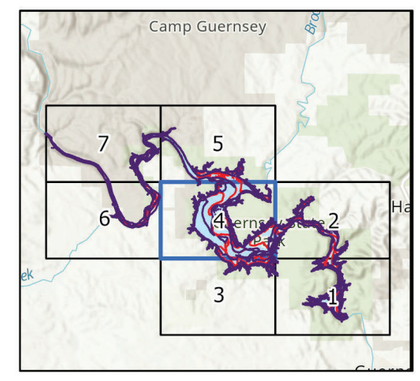
Map Prepared By:
Geographic Applications & Analysis Group
Bureau of Reclamation
Technical Service Center - 12/16/22

Horizontal: NAD 1983 2011 Wyoming East ft US+ NAVD88 height Geoid18 US Feet
5 ft contour interval

N

Scale 1:12,500

0 375 750 1,500 Feet



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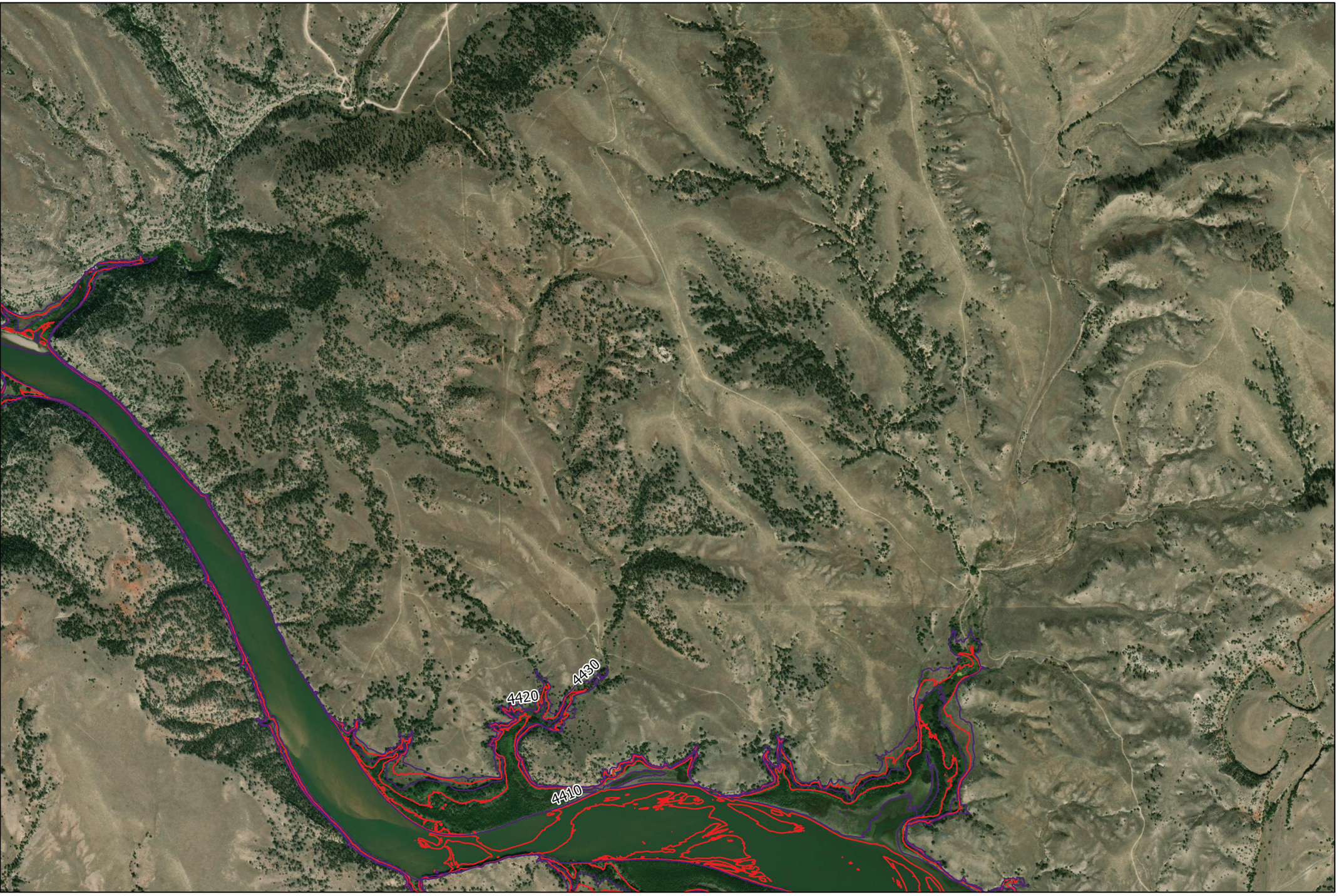


Guernsey Reservoir Wyoming Elevation Contour Map

Sheet 5

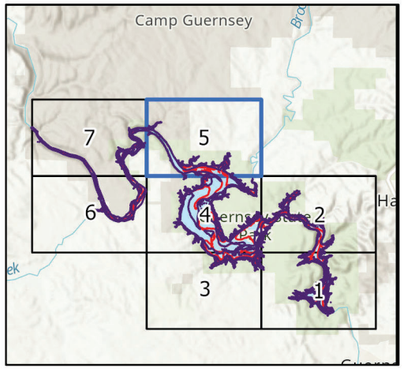
Map Prepared By:
Geographic Applications & Analysis Group
Bureau of Reclamation
Technical Service Center - 12/16/22

Horizontal: NAD 1983 2011 Wyoming East ft US+ NAVD88 height Geoid18 US Feet
5 ft contour interval

N

Scale 1:12,500

0 375 750 1,500 Feet



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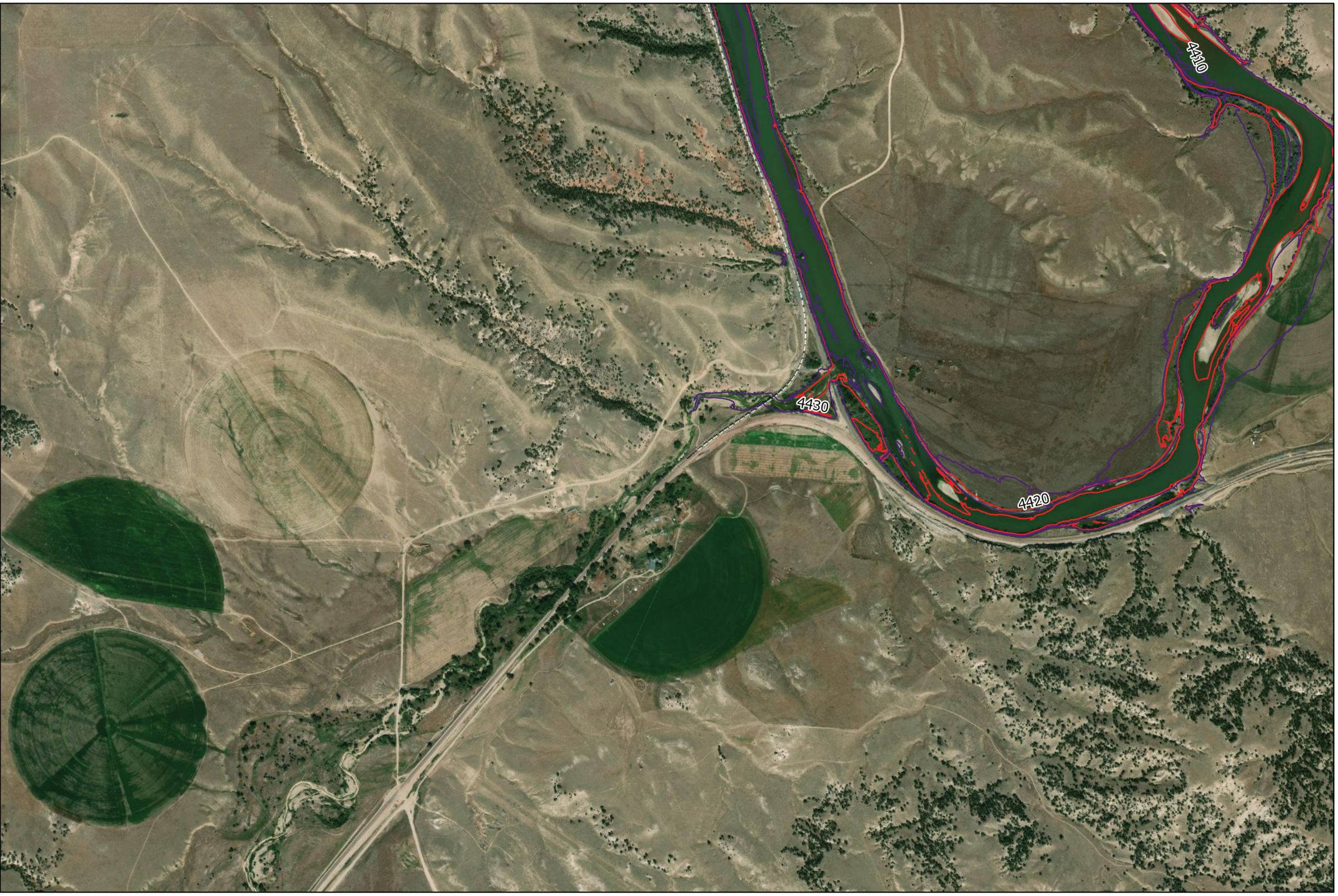


Guernsey Reservoir Wyoming Elevation Contour Map

Sheet 6

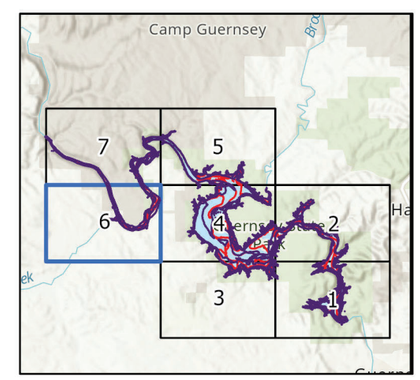
Map Prepared By:
Geographic Applications & Analysis Group
Bureau of Reclamation
Technical Service Center - 12/16/22

Horizontal: NAD 1983 2011 Wyoming East ft US+ NAVD88 height Geoid18 US Feet
5 ft contour interval

N

Scale 1:12,500

0 375 750 1,500 Feet



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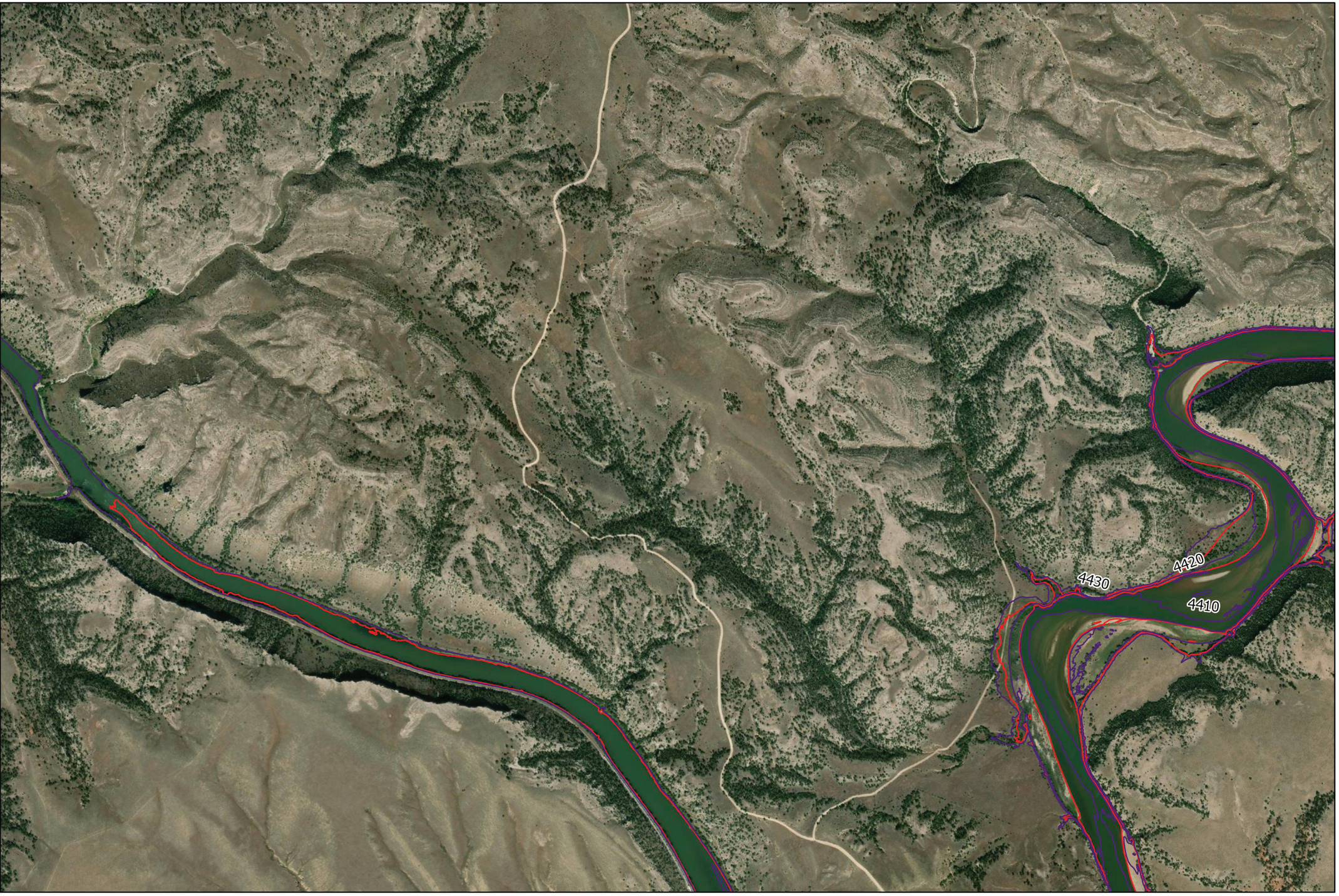


Guernsey Reservoir Wyoming Elevation Contour Map

Sheet 7

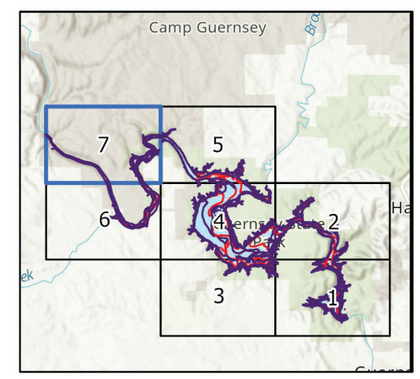
Map Prepared By:
Geographic Applications & Analysis Group
Bureau of Reclamation
Technical Service Center - 12/16/22

Horizontal: NAD 1983 2011 Wyoming East ft US+ NAVD88 height Geoid18 US Feet
5 ft contour interval

N

Scale 1:12,500

0 375 750 1,500 Feet



BUREAU OF RECLAMATION