



US Army Corps
of Engineers ®

Fort Worth District

**RAY ROBERTS DAM AND LAKE
ELM FORK TRINITY RIVER
TRINITY RIVER BASIN, TEXAS**

**WATER CONTROL MANUAL
APPENDIX H
MASTER RESERVOIR REGULATION MANUAL**

**DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
FORT WORTH DISTRICT**

SEPTEMBER 2018

**ORIGINAL SEPTEMBER 1991
REVISED DECEMBER 1997**



RAY ROBERTS DAM AND LAKE

NOTICE TO USERS OF THIS MANUAL

Regulations specify that this Water Control Manual be used in loose-leaf form, and only those sections or parts thereof requiring changes will be revised and printed. Therefore, this copy should be preserved in good condition so that inserts can be made to keep the manual current. All elevations referred to in this Water Control Manual, unless noted otherwise, are in feet, National Geodetic Vertical Datum of 1929 (NGVD29). The datum conversion from NGVD29 to NAVD88 is: $\text{NGVD29} + 0.0 \text{ feet} = \text{NAVD88}$ for Ray Roberts Dam and Lake.

EMERGENCY REGULATION ASSISTANCE PROCEDURES

Assistance with the flood control regulations of Ray Roberts Dam will be provided during duty hours by the Fort Worth District Water Management Branch 817-886-1551. During non-duty hours, assistance can be obtained by contacting the Primary Regulator (817) 791-0973 cell number and in the order listed, one of the following persons:

EMERGENCY PERSONNEL ROSTER

Title and Name	Residence/Cell Telephone
Primary Regulator	817-791-0973
Chief, Water Resources Branch Redacted PII	817-886-1542
Chief, Water Management Section Redacted PII	817-886-1682
Chief, E&C Division Redacted PII	Redacted PII
Chief, Operations Division Redacted PII	Redacted PII
Manager, Trinity Regional Redacted PII	
Manager, Ray Roberts Lake Redacted PII	Redacted PII
Water Management Southwestern Division–Dallas CESWD-RBT-W (Water Management and Infrastructure Safety) Redacted PII, Ph. D. P.E.	Redacted PII
Hydraulic Engineer, Redacted PII	Redacted PII

**RAY ROBERTS DAM AND LAKE
TRINITY RIVER BASIN, TEXAS**

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Pertinent Data – Ray Roberts Dam and Lake
(See Exhibit A for Supplementary Pertinent Data)

LOCATION: In Denton County, R.M. 60.0 on the Elm Fork Trinity River, 30 miles upstream of Lewisville Dam, Texas, and 42 miles northwest of Dallas, Texas.

DRAINAGE AREA:

692 square miles
One inch of runoff 36,907 acre-feet

DAM:

Type: Rolled earth fill
Length (including spillway): 15,250 feet
Maximum Height: 141 feet
Top Width: 46 feet

SPILLWAY:

Crest Elev.: 645.5 feet NGVD29
Length of weir sill: 100 feet
Type: Broadcrested
Control: None

POWER FEATURE:

Units: 1-1,200 KW
Hydropower was discontinued 2003 and decommissioned in August 2014

INFLOW:

Spillway Design Flood peak, cfs (1974 Study) 494,200
Spillway Design Flood volume, ac-ft (1974 Study) 941,600
Spillway Design Flood runoff, inches (1974 Study) 25.28

Probable Maximum Flood peak, cfs (2012 Study) 969,500
Probable Maximum Flood volume, ac-ft (2012 Study) 1,118,700
Probable Maximum Flood runoff, inches (2012 Study) 30.30

OUTFLOW:

Total routed peak outflow, cfs (1975 Supplement to 1974 Study) 22,100
Probable Maximum Flood total, cfs (2012 Study) 43,500

OUTLET WORKS:

Type: One conduit with two inlets
Dimension: 13 feet diameter
Invert Elev.: 551 feet NGVD29
Control: 2 gates, 6 feet x 13 feet

LOW FLOW OUTLET:

Type: One concrete pipe
Dimension: 60 inch diameter
Lowest Invert Elev.: 574.5, 588.0, 603.0 and 618.0 feet NGVD29
Control: 4 selector gates

Feature	Elev Feet* (NGVD29)	Reservoir Area (acres)	Reservoir Capacity			Spillway Capacity (cfs)	Outlet Works Capacity (cfs)
			Accumulative (ac-ft)	Runoff (inches)	Incremental (ac-ft)		
Top of Dam	665.0	68,500					
PMF Design Water Surface (2012 Study)	667.2					35,600	7,900
Max. Design Water Surface (1974 Study)	658.8	59,620**	1,931,900**	52.35		14,500***	7,600
Spillway Crest	645.5	42,000**	1,261,500**	34.19			7,100
Top of Flood Control Pool	640.5	36,900**	1,064,600**	28.85			6,900
Top of Conservation Pool (2008 Survey)	632.5	28,646	788,490	21.36			6,600
Invert Elevations (2008 Survey)	618.0	18,929	444,702				
Streambed (2008 Survey)	524.0	0	0				

* The elevations listed on the pertinent data sheet is based on the datum of NGVD29. The datum conversion from NGVD29 to NAVD88 is: NGVD29 + 0.0 feet = NAVD88.

Area capacity data is for 1985 condition. Includes 54,600 acre-feet of storage for estimated 100-year sediment deposition, with 50,400 acre-feet below elevation 632.5 and 4,200 acre-feet between elevations 632.5 and 640.5 feet. *Plate 7-4 Spillway rating curve for 658.8 has been updated with a flow of 13,600 cfs.

AUTHORIZATION: River and Harbor Act, approved 27 Oct, 1965; PL 89-298) and (HD 276/89/1); PL 96-384 changed name from “Aubrey Lake” to “Ray Roberts Lake” on 06 October 1980.

PROJECT COST (FY 95):

Federal:	\$109,780,000
Non-Federal:	<u>\$207,670,000*</u>
Total:	\$317,450,000

ANNUAL O&M COST (FY 14)

Federal:	\$1,378,700
Non-Federal:	<u>\$511,000</u>
	\$1,889,700

COST ALLOCATION METHOD: Separable costs – remaining benefits

LOCAL AGENCY: The Cities of Dallas and Denton

LAND ACQUISITION:

	: Guide Contour (NGVD29)	: Area (Acres)
Fee Simple	645.5	47,051
Easement		<u>2,618</u>
Total		49,699

FLOOD DATA:

Date	Peak Discharge (cfs)
October 1981	200,000**
26 Apr 1990	107,500***
02 May 1990	106,500***
18 June 2007	171,700***
08 Sep 2010	60,450***
17 Jul 2014	62,450***
08 May 2015	144,000***
27 Nov 2015	74,850***

**1981 Flood discharges estimate is based on upstream gages. The remaining discharges are estimated based on change of contents in Ray Roberts Lake.

***Based on change in contents.

STATUS OF PROJECT: Construction began 31 May 1982. Main dam completed in 30 June 1987. Deliberate impoundment began 30 June 1987. Project is complete and operational.

*NON-FEDERAL PARTICIPATION AND LOCAL COOPERATION:

A contract with the City of Dallas was approved dated 16 September 1980 for water supply of 591,700 ac-ft (74 percent) of the conservation storage below elevation 632.5 ft at Ray Roberts Lake and 131,400 ac-ft (74 percent) of the conservation storage between elevations 515.0 ft and 522.0 ft at Lewisville Lake. A contract with the City of Denton was approved dated 16 September 1980 for water supply of 207,900 ac-ft (26 percent) of the conservation storage below elevation 632.5 ft at Ray Roberts Lake and 46,200 ac-ft (26 percent) of the conservation storage between elevations 515.0 ft and 522.0 ft at Lewisville Lake. Total estimated Non-Federal conservation storage cost is \$181,714,000. Total estimated Non-Federal recreation development cost is \$25,956,000.

REMARKS:

The City of Denton installed a hydropower facility at Ray Roberts Dam. The construction of the hydropower facility was completed on 21 July, 1991. The facility includes a horizontal Francis type turbine with direct shaft to the generator capable of producing 1,200 Kilowatts. The unit is a Run-of-river facility, where downstream water supply and small flood releases was to be used to generate power. Hydropower was discontinued and decommissioned in 2003.

Dependable Yield: 275 cfs, 177.7 MGD (Ray Roberts - Lewisville Lake system)

Net System Increase: 126 cfs, 81.4 MGD, based on critical drought period from 1950-1957 and 2020 year conditions.

Annual Visitation (10-year average, 2002-2012): 1,681,401

Shoreline at top of normal pool: 207 miles

**RAY ROBERTS DAM AND LAKE
ELM FORK TRINITY RIVER, TEXAS
WATER CONTROL MANUAL**

CHAPTER I – INTRODUCTION

1-01. Authorization. This manual is submitted as required by Engineering Regulation (ER) 1110-2-240, Water Control Management, dated 30 May 2016, and is prepared in accordance with ER 1110-2-8156, Engineering and Design, Preparation of Water Control Manuals, dated 31 August 1995.

1-02. Purpose and Scope. The purpose of this manual is to document the Ray Roberts Dam and Lake Regulation plan. This manual also provides a concise reference source for higher authority personnel who will be concerned with, or responsible for, reservoir regulations during the life of the project. This manual also includes the regulation plan for Ray Roberts Dam and Lake and the background material necessary to understand the purpose and application of the plan. Ray Roberts Dam and Lake were originally identified as “Aubrey Lake”.

1-03. Related Manuals and Reports. This manual is Appendix H to the Trinity River Basin Water Control Master Manual. The initiation and partial construction of Ray Roberts Dam and Lake on the Elm Fork Trinity River was authorized by the River and Harbor Act approved 27 October 1965 (Public Law 298, 89th Congress, 1st Session). The River and Harbor Act of 1965 was approved in accordance with recommendations made by the Chief of Engineers contained in House Document Number 276 (89th Congress, 1st Session). The preliminary design memorandum titled “Aubrey Lake Design Memorandum No. 1- Hydrology” was published on August 1972. Congressional authority for the modification of Lewisville Lake including the construction of Ray Roberts Lake (formerly Aubrey Lake) is contained in the River and Harbor Act of 1965 (PL 89 298) in accordance with the total plan of improvements for the Trinity River as presented in House Document No. 276 (89th Congress, 1st Session). In August 1980, a report titled “Ray Roberts Lake Foundation Report” was published which contains completion report of embankment, spillway and outlet works. In September 1991, the Fort Worth District (SWF) of the United States Army Corps of Engineers (USACE) published a reservoir regulation manual for Ray Roberts Lake. The manual contains plans and procedures for regulation of the reservoir during both normal and flood conditions. In addition, Operation and Maintenance Manual for Ray Roberts Lake was revised in December 1997.

The reports and design memorandums important to the regulation of Ray Roberts Dam and Lake are listed in Table 1-1.

TABLE 1-1**Related Manuals and Reports for Ray Roberts Dam and Lake**

Title	Date
1. Aubrey Lake - Design Memorandum No. 1 - Hydrology	August 1972
- Supplement No. 1	February 1973
- Supplement No. 2	September 1973
- Supplement No. 3	October 1974
2. Aubrey Lake - Design Memorandum No. 2 - General Site Selection (Relocations Construction Areas)	October 1973
- Supplement No. 1	April 1982
- Supplement No. 2	November 1984
- Supplement No. 3	July 1985
3. Design Memorandum No. 3 - Availability of Materials	June 1972
4. Design Memorandum No. 4 - Real Estate	November 1973
- Lands for Construction Areas	
5. Design Memorandum No. 4A - Real Estate - Lands for Lake Areas	May 1974
6. Design Memorandum No. 5 - Embankment and Spillway	July 1974
7. Revised Design Memorandum No. 5 - Embankment and Spillway	June 1976
8. Design Memorandum No. 6 - Outlet Works	September 1976
- Supplement No. 1	December 1981
9. Ray Roberts - Design Memorandum No. 7	August 1986
- Visitors Overlook and Access Road	
10. Design Memorandum No. 8 - Master Plan	January 1983
- Supplement No. 2	March 1989
11. Design Memorandum No. 9 - Relocations - F.M. Road 455	June 1976
- Supplement No. 1	February 1983
12. Design Memorandum No. 10	August 1982
- Relocation of F.M. Road A, Spur B and F.M. 372	
13. Design Memorandum No. 11 - Relocation of F.M. Road 922	April 1982
- Supplement No. 1	October 1982
14. Design Memorandum No. 12 - Relocation of U.S. Hwy. 377	June 1982
15. Design Memorandum No. 13 - Relocation of Missouri Pacific Railroad	February 1982
16. Design Memorandum No. 14	March 1976
- Relocations - Electric Transmission Lines (Cooke County Electric Co-op, Comm. Public Service Co., and Grayson Collin Electric Co-op)	

TABLE 1-1 (CONTINUED)

Related Manuals and Reports for Ray Roberts Dam and Lake

	Title	Date
17.	Design Memorandum No. 16 - Relocations of Electric Lines - Supplement No. 1 (Cooke Co. Electric Co-op, Denton Co. Electric Co-op, and Texas - New Mexico Power Co.)	January 1986 July 1986
18.	Design Memorandum No. 17 - Relocation of Arco Pipelines	July 1982
19.	Design Memorandum No. 18 - Relocation of Mountain Springs, Green Springs, and Bolivar Water Lines	December 1984
20.	Design Memorandum No. 19 - Relocation - - Central and Valley View Telephone Facilities	November 1985
21.	Design Memorandum No. 20 - Relocation of General Telephone Facilities	November 1985
22.	Design Memorandum No. 21 - Clearing and Sedimentation & Degradation Ranges	May 1983
23.	Design Memorandum No. 22 - Recreation Facilities (Volume No. 1) Design Memorandum No. 22 - Recreation Facilities (Volume No. 2) - Supplement No. 1	November 1985 November 1985 September 1987
24.	Design Memorandum No. 24 - Cost Allocation Report	May 1980
25.	Design Memorandum No. 25 - Relocation of Ensearch Gas Pipelines	August 1982
26.	Design Memorandum No. 26 - Relocation of Cemeteries	November 1982
27.	Design Memorandum No. 29 - Relocation of Denton, Cooke, and Grayson County Roads - Supplement Numbers 1 through Supplement No. 6	June 1982 March 1983 March 1991
28.	Design Memorandum No. 30 - Relocation of Tioga Sewage Treatment Plant	July 1984
29.	Design Memorandum No. 31 Plugging Oil, Gas, and Water Wells - Supplement No. 1 - Supplement No. 2	June 1984 November 1984 November 1985
30.	Design Memorandum No. 32 - Relocation - FM Rd. 423 at Lewisville Lake	November 1985
31.	Design Memorandum No. 33 Relocation Santa Fe Railroad - Supplement No. 1	June 1984 September 1987
32.	Design Memorandum No. 35 - Disposition Report on: - Collinsville, Cooke County, and Tioga Land Fills	June 1986
33.	Design Memorandum No. 36 - Reservoir Filling Plan	December 1985

TABLE 1-1 (CONTINUED)

Related Manuals and Reports for Ray Roberts Dam and Lake

	Title	Date
34.	Design Memorandum No. 37 - Disposition Report on Soil Conservation Dams	January 1989
35.	Design Memorandum No. 40 - Additional Lands for Flood Storage Reallocation (Lewisville Lake)	September 1985
36.	Design Memorandum No. 41- (Revised) - Reservoir Clearing for Pool Raise at Lewisville Lake	February 1987
37.	Design Memorandum No. 43 - Recreation Facilities at Hickory Creek Park (Lewisville Lake)	November 1987
38.	Aubrey Lake - Public Meeting (30 April 1971) - Site Selection for Aubrey Lake	April 1971
39.	Aubrey Lake - Public Meeting (27 October 1972) - Proposed Plan and Environmental Considerations	October 1972
40.	Aubrey Lake - Effect on Water Quality, prepared by Trinity River Authority	February 1973
41.	Final Environmental Impact Statement (E.I.S) - Aubrey Lake	January 1974
42.	Draft Supplement to Final E.I.S - Aubrey Lake	December 1974
43.	Aubrey Lake - Recreation Market Feasibility Study	December 1975
44.	Ray Roberts Lake - Foundation Report - Completion of Embankment, Spillway and Outlet Works	August 1980
45.	Greenbelt Corridor - (between Ray Roberts Lake and Lewisville Lake)	April 1985
46.	Ray Roberts Lake - Developed Wetlands	April 1991
47.	Ray Roberts Lake - Operation and Maintenance Manual	September 1991
48.	Ray Roberts Lake - Flood Emergency Plan	February 1993
49.	Ray Roberts Lake - Water Quality Report	May 1993
50.	Flood Insurance Study - Denton County, Texas - Unincorporated Areas - Revised	June 1994
51.	Ray Roberts Lake - Green Corridor - Recreation	February 1996
52.	Periodic Inspection Report No. 10	June 2016

1-04. Project Owner. USACE-SWF owns and operates Ray Roberts Dam and Lake.

1-05. Operating Agency. USACE-SWF is the operating agency for Ray Roberts Dam and Lake. The Lake Manager at Ray Roberts Dam has the responsibility for its operations and

management of the lake. The Fort Worth District Engineer, through the Water Resources Branch of the Engineering and Construction Division, directs water control activities.

The project is staffed during normal working hours throughout the year. The Lake Manager at Ray Roberts Dam has the responsibility for its operations. Park Rangers are also available on holidays and weekends to provide assistance with the lake operations. The project will be staffed 24 hours a day when the lake level is, or is forecast to rise above elevation 645.0 feet and upon observing any watch conditions.

The Lake Manager will have a current list of the Water Resources Branch personnel including home telephone numbers to contact when necessary. The Lake Manager will furnish the Water Resources Branch a list of project personnel, giving their office and home telephone numbers. The Lake Manager resides as close to the project as is considered prudent to carry out his official duties.

1-06. Regulating Agencies. USACE is the regulatory agency for Ray Roberts Dam and Lake. The regulation of the dam is the responsibility of the Water Resources Branch of the Engineering and Construction Division, Fort Worth District.

CHAPTER II – DESCRIPTION OF PROJECT

2-01. Location. Ray Roberts Dam and Lake are located on the Elm Fork of the Trinity River at river mile 60. The dam site is approximately 4 miles northwest of Aubrey, Texas, and 42 miles northwest of Dallas, Texas. The dam site is located within the Trinity River Basin, Denton County, Texas. The total drainage area above Ray Roberts Dam is 692 square miles. The location of the dam and lake are shown on Plates 2-1a and 2-1b, respectively.

2-02. Purpose. Ray Roberts Dam and Lake are a multi-purpose project used for flood control, water supply, hydropower, fish and wildlife, and recreation. The project is a unit of the Trinity River Basin System, which consists of eight USACE lakes and various channel improvements and levees operated to provide flood protection along the Trinity River. Ray Roberts Dam and Lake operates in conjunction with Lewisville Dam on the Elm Fork of the Trinity River to provide flood control to the Elm Fork Trinity River at Carrollton, Texas, and to supply water to the city of Denton, city of Dallas, Texas and surrounding areas. An aerial view of Ray Roberts Dam is shown in Figure 2-1.

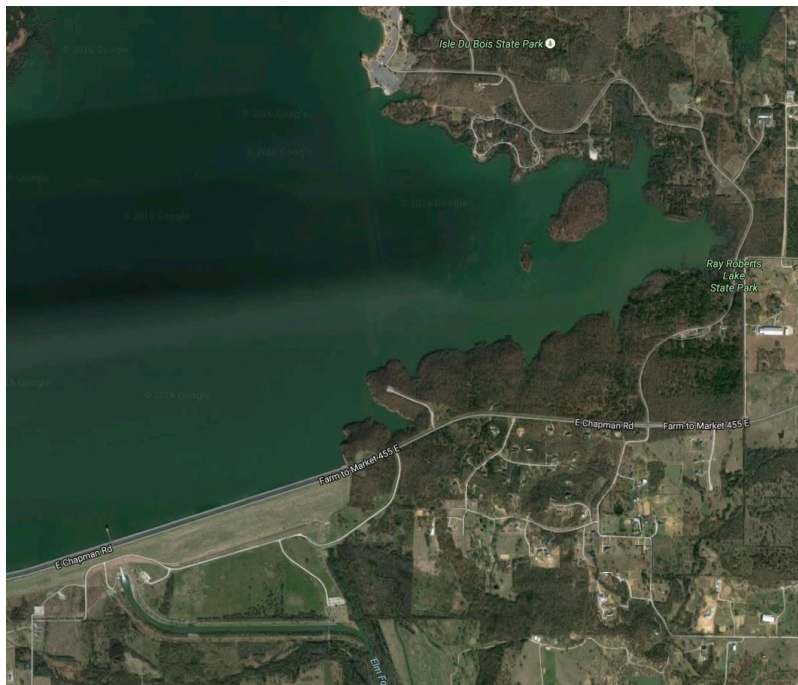


Figure 2-1. Aerial View of Ray Roberts Dam

2-03. Physical Components. Ray Roberts Dam consists of a compacted earthfill embankment, an uncontrolled broad-crested weir spillway, outlet works, and hydropower facility. The total length of the dam is 15,250 feet, including the uncontrolled spillway area. The length of the embankment excluding the spillway area is 14,980 feet. The general plan of the embankment

and spillway is shown on Plate 2-2. Additional information on Ray Roberts Dam and Lake is provided in Exhibit A, Supplementary Pertinent Data.

a. Embankment. The embankment consists of a 14,980 feet long rolled, earthfill embankment. The maximum height of the embankment is 141 feet. The top width of the embankment is 46 feet and accommodates F.M. Road 455. The embankment crest is at elevation 665.0 feet, 141 feet above the streambed. The core of the embankment is composed of impervious material up to elevation 640.5 feet. The embankment is capped with additional impervious material to elevation 665.0 feet. On the upstream face of the dam a wedge of impervious material extends down from the cap to elevation 620.0 feet. Where necessary, a cutoff trench extends to impervious foundation material beneath the dam. Concentric shells of random fill and semi-compacted fill enclose the impervious core. Upstream slope protection from station 14+50 to station 142+40 is as follows:

(1) 24-inches of riprap on 9 inches of bedding was placed from elevation 640.5 to elevation 654.0 feet.

(2) 18-inches of riprap on 6 inches of bedding was placed from elevation 654.0 to elevation 665.0 feet (top of dam).

In 1993, construction of additional riprap protection was begun, due to an unexpected progression of upstream slope erosion on the shore line bench. This riprap extends on a 1V to 4H slope from elevation 640.5 feet (the base of the original riprap) down to elevation 621.0 feet (11.5 feet below conservation pool). At the base is a substantial quantity of rock which forms an anchor key. The anchor key is a 3 feet wide trapezoidal trench at elevation 621.0 feet on a 1 to 1 slope. A maximum stone size of 40 inches was used for the anchor key and the lower riprap blanket repairs. The plan, profile, and typical embankment sections are shown on Plates 2-3 through 2-6. The upstream views of embankment are shown in Figures 2-2 and 2-3.

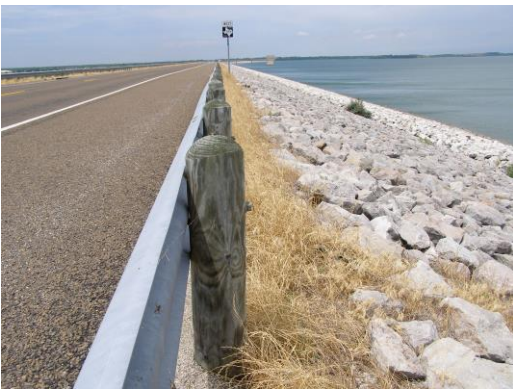


Figure 2-2. Upstream Embankment



Figure 2-3. Upstream Embankment

b. Spillway. The spillway consists of a 100 feet wide uncontrolled broad-crested weir located in the right abutment at elevation 645.5 feet. The spillway crest is at elevation 645.5 feet, perched 5 feet above the top of the flood control pool. The weir sill is 20 feet long. Plate 2-7 shows the spillway general plan, profile and section. The spillway crest is shown in Figures 2-4. The spillway concrete sill and riprap are shown in Figures 2-5 through 2-7.



Figure 2-4. Spillway Crest



Figure 2-5. Spillway Concrete Sill and Riprap



Figure 2-6. Spillway Crest



Figure 2-7. Spillway Concrete Sill and Riprap

c. Outlet Works. The outlet works consist of an approach channel, an intake structure with trash rack and gates, flood conduit, low flow conduit, stilling basin, and a discharge channel. The flood conduit is 13 feet in diameter and 708 feet long and passes through the embankment at station 93+00. The conduit intake and outlet inverts are at elevations 551.0 feet and 547.0 feet, respectively. Plate 2-8 shows the plan and section of the outlet works. Plate 2-9 shows outlet works intake structure elevations. The intake structure and service bridge are shown in Figure 2-8. Figures 2-9 and 2-10 show the outlet conduit, low flow conduit, stilling basin and discharge channel. Figure 2-11 shows the downstream view of discharge channel. The outlet retaining wall and riprap are shown in Figures 2-12 and 2-13, respectively.



Figure 2-8. Intake Tower and Service Bridge



Figure 2-9. Outlet Conduit and 5-foot diameter Low Flow Conduit



Figure 2-10. Discharge Tunnel and Stilling Basin



Figure 2-11. Discharge Channel



Figure 2-12 Retaining Wall and Powerhouse Platform

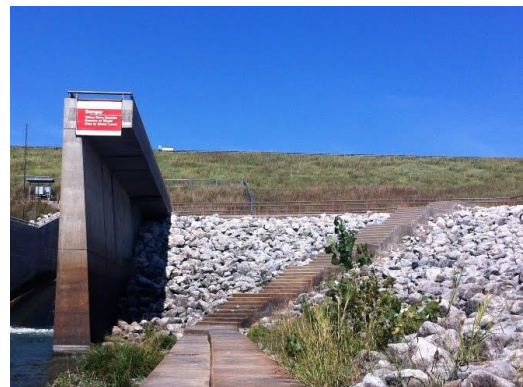


Figure 2-13. Retaining Wall and Riprap

d. Low Flow System. The low-flow system consists of four selector gates, wet well, transition conduit, and a concrete conduit. The four selector gates in the intake structure each measure 4 feet by 8 feet. From the gates low flow discharges fall into a single wet well located in the center of the intake structure. From the wet well, a 3 feet by 7 feet conduit, sloped at 1 to 1.5, transitions the flow into a 5 feet diameter conduit laying beneath the 13 feet flood conduit. Near the stilling basin, the 5 feet diameter conduit bends to the right before it divides. One branch of the conduit remains 5 feet in diameter and continues into the hydropower plant. The other branch reduces to a 48 inch diameter conduit that bends left toward its outlet in the stilling basin. The 5 feet diameter conduit was closed off by a blind flange near the bifurcation until the hydropower plant was installed.

Flow into the wet well is regulated by four selector gates, one at each orifice with sills at elevations 574.5, 588.0, 603.0 and 618.0 feet. The range of withdrawal elevations allows for selective releases designed to control water quality and temperature. Selector gate controls are located on the service deck. Each is operated by an electric motor-driven threaded stem. The push-button controls are equipped with a gate position indicator that stops the gate when it is fully open or fully closed. For emergency operation a hand wheel is used to open or close the gates.

Near the stilling basin, the 5-foot conduit bends to the right before it divides. One branch reduces to a 48-inch diameter conduit that bends left towards its outlet in the stilling basin. The flow into the stilling basin is controlled by a butterfly valve. The other branch of the conduit splits into two 5-foot diameter conduits. The left branch did provide water to the hydropower plant before it was decommissioned. The right branch continues to the city of Denton's water treatment plant. A schematic of the low flow system is shown on Plate 2-10.

e. Flood Gates. Flow through the outlet works is regulated by two 6 feet by 13 feet service gates. Each gate is controlled by a manually operated hydraulic control valve located on the service deck. The hydraulic cylinder gate operators are designed to raise or lower the gates with the lake level as high as the spillway crest, elevation 645.5 feet. Gate level indicators are next to the control valves. Hydraulic pressure for gate operation is produced by a single hydraulic power unit on the service deck. This unit is capable of operating a gate at the rate of 6 to 12 inches per minute. An electric double girder top running bridge crane on the deck allows gate removal and replacement for repairs or during emergencies.

f. Stilling Basin. The outlet works stilling basin is 220 feet long and 52 feet wide. The elevation of the conduit invert at the exit portal is 547.0 feet and the floor of the stilling basin is at elevation of 526.0 feet. The basin has two rows of baffle blocks and an end sill to assist in the dissipation of kinetic energy and reduce erosion velocities in the existing downstream channel.

g. Hydropower Facilities. The City of Denton constructed the hydroelectric facility at Ray Roberts Dam. Construction was completed on 21 July 1991. The basic components of the hydropower facility include a penstock, hydraulic unit, turbine, generator, control and switchgear,

and electrical distribution line. The 5 feet low-flow conduit serves as a penstock. The hydraulic unit operates as a valve to control the flow from a minimum 38 cubic feet per second (cfs) to a maximum 167 cfs discharge at 90 feet of head. The turbine is a Horizontal Francis type with direct shaft to the generator. The generator is a Horizontal Synchronous type rated at 1,200 kilowatts and 4,160 volts at 450 revolutions per minute. The hydropower units are shown on Plate 2-11. The hydropower facility was discontinued and decommissioned in 2003 due to economic viability. Portions of the hydropower facility have been physically removed.

h. **Water Supply Facilities.** Ray Roberts Lake contains 799,600 acre-feet of conservation storage for water supply and 54,600 acre-feet for sediment accumulation. Of the 799,600 acre-feet, the cities of Dallas and Denton have contracts with USACE for 591,700 acre-feet (74 percent) and 207,900 acre-feet (26 percent) respectively for the Ray Roberts Lake conservation storage below elevation 632.50.

These water supply contracts also include an additional 131,400 acre-feet (city of Dallas) and 46,200 acre-feet (city of Denton) of conservation storage at Lewisville Lake between elevations 515.0 and 522.0 feet. This contract was done at a cost of \$181,714,000 plus a share of annual operation, maintenance and recreation costs.

Water supply releases to a downstream pickup point will be made through either the low-flow system or the outlet works. Plans for future development include the possibility of using part of the low-flow system as a water supply intake or of building a pump station in the lake. The low-flow system now has the option to send water straight to Denton water treatment plant. Additional information on Ray Roberts Lake and Dam is provided in Exhibit A, Supplementary Pertinent Data.

2-04. Related Control Facilities. The Ray Roberts Dam and Lake Project is part of the USACE master plan for flood control on the Trinity River and its tributaries. The master plan presently consists of eight USACE dam and lake projects and various channelization and levee projects operated to control floods on the Trinity River Basin System. The Ray Roberts Dam and Lake Project is located on Elm Fork tributary of the Trinity River so it has control of floods which originate in the upper basin, and water conservation. Another unit of the system, is Lewisville Dam which is located on the Elm Fork of the Trinity River 30.0 miles downstream of Ray Roberts Dam. The flood control storage provided by the completion of Ray Roberts Dam allowed for the conservation pool of Lewisville Lake to be raised from 515.0 feet to 522.0 feet. This increased Lewisville Lake conservation storage from 367,000 acre-feet to 618,400 acre-feet for the conditions predicted in the year 2085.

2-05. Real Estate Acquisition. A total of 47,051 acres for fee simple and 2,618 acres for flood flowage easement were acquired for the construction of the Ray Roberts Dam and Lake. The real estate fee take line is based on a lake guide contour elevation of 645.5 feet (5 feet above the flood control pool and 13 feet above the conservation pool). This level was determined by routing the standard project flood through the reservoir starting at the Top of Conservation Pool elevation of

632.5 feet.

The guide taking line for land acquisition was based on the policy set forth in ER 405-2-150, dated 11 February 1966 and changes thereto, supplemented by message ENGCW-DC dated 13 July 1971, subject, "Real Estate Acquisition". The top of controlled storage in Aubrey Lake (Ray Roberts) is at elevation 645.5 feet. Since the proposed spillway is a high-level ungated structure, no freeboard is required and the guide taking line would be at elevation 645.5 feet in the flat pool area of the main part of the lake. This will provide five feet of freeboard above the top of the flood control pool (elevation 645.5) for adverse effects of saturation, wave action and bank erosion. If the five-foot freeboard does not provide a minimum of 300 feet horizontally from the top of conservation storage (elevation 632.5), the taking line will be increased to that extent. The guide contour elevation in the upper reaches of the main part of the reservoir and on the tributary arms is based upon the enveloping curve of backwater effect for the 50-year hypothetical flood operation or the top of controlled storage, whichever is higher. The enveloping curve of backwater effect indicates that the guide contour elevation of 645.5 feet established for the flat pool area would be applicable throughout the entire lake area.

2-06. Public Facilities. Eight recreation areas around the lake are operated by the Texas Parks and Wildlife Department for public use and access and one additional area is operated by USACE. The Sam Garrett Overlook is the only public area operated by USACE and it is picnic use only. The areas are listed in Table 2-1 and shown on Plate 2-12. Facilities provided at the park sites consist of roads, parking areas, boat ramps, camping and picnicking facilities and potable water and sanitary facilities.

TABLE 2-1

Recreation Areas at Ray Roberts Dam and Lake

1. Sam Garrett Overlook
2. Buck Creek*
3. Elm Fork (below dam)*
4. Isle Du Bois Park*
5. Johnson Branch Park*
6. Jordan Branch Park*
7. Pecan Creek*
8. Pond Creek Access*
9. Sanger Creek Access*

Note: * Indicates parks operated by Texas Parks and Wildlife Department (TPWD).

CHAPTER III – HISTORY OF PROJECT

3-01. Authorization. Congressional authorization for the initiation and construction of Ray Roberts Dam and Lake (formerly Aubrey Lake) on the Elm Fork of the Trinity River was authorized by the River and Harbor Act approved 27 October 1965 (Public Law 298, 89th Congress, 1st Session). The River and Harbor Act of 1965 was approved in accordance with the total plan of improvements for the Trinity River basin as outlined in House Document Number 276 (89th Congress, 1st Session). Public Law 384, 96th Congress, 1st Session on 06 October 1980 changed the name of the lake from "Aubrey Lake" to "Ray Roberts Lake" in honor of former U. S. Congressman Ray Roberts (1913-1992) of Denton.

3-02. Planning and Design. Ray Roberts Lake was authorized in 1965 as a multipurpose reservoir for flood control, water supply, water quality control, fish and wildlife, and recreation. The purpose of water quality control was later dropped when it did not meet with the approval of the Environmental Protection Agency (EPA). Subsequent investigation indicated that hydropower development at Ray Roberts Lake would be economically feasible and a provision for hydropower was added to the project.

The U.S. Study Commission of Texas made an inventory of the land and water resources in all the major river basins of Texas to formulate a plan to meet the water needs in the year 2020. Public hearings were held at Corsicana and Huntsville in 1960 to obtain the public's views on the proposed plan of improvement. The U.S. Study Commission of Texas submitted a report regarding the construction of Aubrey Lake in 1962. In December 1961, USACE held a public hearing to present its preliminary plan and to obtain the public's views and desires. This plan, which was submitted in 1962 and authorized in 1965, provided for the construction of Aubrey Lake. In July 1966, the Texas Water Development Board (TWDB) held a public meeting in Arlington, Texas, concerning the Trinity River plan. As a part of their comprehensive development of the State, TWDB proposed the construction of a dam in the same vicinity as Aubrey. USACE held a public meeting at Denton, Texas on 30 April 1971, to obtain the public's views and desires for the purpose of gathering data to make a final decision on the site location for the dam near Aubrey, Texas. On 18 August 1972, a coordination meeting was held at Denton, Texas, for the purpose of discussing the location of the proposed public-use areas and the cost-sharing requirements (under Public Law 89-72).

On 27 October 1972, a public meeting was held by USACE at Denton, Texas. The meeting was held to inform the nearly 400 attendees of the latest details concerning the Aubrey project, to present results of environmental studies, and to explain the alternative actions studied. The meeting also served as an opportunity to obtain information from, and ascertain the attitudes of, interested individuals and organizations.

Ray Roberts Dam and Lake is operated in conjunction with Lewisville Dam and Lake, a short distance downstream, to provide optimal flood control and water supply storage. The conservation pool, flood control pool and top of dam elevation were adjusted during the design process so that the best coordination with Lewisville Lake could be achieved. The planning and design of all aspects of the lake are discussed in Design Memorandums 1 through 43 and their Supplements.

3-03. Construction. The construction of Ray Roberts Dam began on 31 May 1982 and was completed on 30 June 1987. Deliberate impoundment began on 30 June 1987. The conservation pool was filled on 25 March 1990. The construction cost of the dam was \$317,450,000. The hydroelectric facility at Ray Roberts Dam was completed and went on-line on 21 July 1991. Table 3-1 outlines the important dates in the construction and repair of Ray Roberts Dam. Figure 3-1 through 3-8 shows different phases of dam construction.



Figure 3-1. Dam Construction – Outlet Works



Figure 3-2. Dam Construction – Outlet Works



Figure 3-3. Dam Construction – Outlet Works



Figure 3-4. Dam Construction – Outlet Works



Figure 3-5. Dam Construction



Figure 3-6. Dam Construction – Discharge Channel



Figure 3-7. Dam Construction – Discharge Channel



Figure 3-8. Dam Construction – Discharge Channel

TABLE 3-1

Resume of Construction Activities

Activity	Date
Construction began	31 May 1982
Embankment Closure	28 August 1984
Dedication of Dam	30 June 1987
Construction Completed	30 June 1987
Deliberate Impoundment	30 June 1987
Conservation Pool Filled	25 March 1990
Construction of relief wells and seepage collector system began	23 February 1990
Construction of relief wells and seepage collector system complete	23 July 1990
Construction of hydropower facility began	8 August 1990
Construction of hydropower facility completed	21 July 1991
Repair of upstream embankment began	15 September 1993
Repair of upstream embankment completed	19 July 1994
Hydropower facilities removed and decommissioned	2003 and Aug 2014

3-04. Related Projects. The Ray Roberts Dam and Lake Project is an integral part of USACE master plan for flood control and water conservation plan on the Trinity River basin. The plan presently consists of eight major USACE flood control projects, known as Benbrook Dam, Bardwell Dam, Grapevine Dam, Joe Pool Dam, Lavon Dam, Lewisville Dam, Navarro Mills Dam, and Ray Roberts Dam. Ray Roberts Dam is operated with Lewisville Dam to provide added flood control and conservation storage. The eight USACE dam projects in the Trinity River system contain approximately 1,591,300 acre-feet of flood control storage. Ray Roberts Dam controls 692 square miles of drainage area. The Trinity River Basin Master Reservoir Regulation Manual presents the proposed plan and individual projects in more detail.

The Trinity River Authority of Texas (TRA), an agency of the State of Texas, serves as a facilitator to assist federal, state, regional, and local entities develop water supply and wastewater projects based on the needs of their populations. In 1969, TRA completed construction on Lake Livingston to help the City of Houston satisfy its water demand. In addition, TRA acts as a local

sponsor for major water supply projects and four major USACE projects: Bardwell Lake, Joe Pool Lake, Navarro Mills Lake, and the Wallisville Saltwater Barrier.

The Natural Resources Conservation Service (NRCS), formally the United States Soil Conservation Service (SCS) has constructed 42 flood retarding structures in the Elm Fork of the Trinity River watershed upstream of Ray Roberts Lake. There are 42 NRCS Floodwater Retarding Sites, impacting runoff from about 106 square miles, and which have a cumulative flood control storage of about 32,245 acre-feet.

The dam and lake projects of Trinity River basin are listed in Table 3-2.

TABLE 3-2**Trinity River Basin Projects**

Project	Stream	Year of Completion / Status
Anahuac Channel	Trinity River	1914
Benbrook Dam	Clear Fork of the Trinity River	1952
Grapevine Dam	Denton Creek	1952
Lavon Dam	East Fork of the Trinity River	1953
Lewisville Dam	Elm Fork of the Trinity River	1955
Navarro Mills Dam	Richland Creek	1963
Bardwell Dam	Waxahachie Creek	1965
Big Fossil Creek Floodway	Big Fossil Creek	1968
Lake Livingston Dam, TRA Project	Trinity River	1969
Fort Worth Floodway	West and Clear Forks of the Trinity River	1970
Joe Pool Dam	Mountain Creek	1986
Ray Roberts Dam	Elm Fork of the Trinity River	1987
Wallisville Saltwater Barrier	Trinity River	1998
Duck Creek Channel Improvement	Duck Creek	1998
Dallas Floodway Extension	Trinity River	Under Construction
Liberty Local Flood Protection	Trinity River	Authorized

3-05. Modification to Regulations. No modifications to the original regulations have been made.

3-06. Principal Regulation Problems. A combination of east-west embankment orientation, prevailing north winter wind pattern, and a large fetch distance resulted in rapid upstream slope erosion. In 1993 the lake was lowered to allow the placement of 40 inch riprap along the entire length of the embankment from elevation 642.0 feet down to elevation 621.0 feet (11.5 feet below conservation pool).

CHAPTER IV – WATERSHED CHARACTERISTICS

4-01. General Characteristics. The Elm Fork of the Trinity River originates in eastern Montague County, Texas and flows in southeasterly directions for approximately 110 miles through Cooke, Denton and Dallas Counties to its confluence with the West Fork of the Trinity River in the City of Dallas. The watershed lies in the north central portion of Texas extending across the state between north latitudes 33°44' and 32°42' and west longitudes 96°43' and 97°50'. The watershed is comprised of parts of Montague, Cooke, Grayson, Collin, Wise, Tarrant, Denton and Dallas Counties. The watershed of Elm Fork of the Trinity River is about 80 miles long along its axis and has a maximum width of 60 miles, and the total drainage area is 2,577 square miles of which 1,660 square miles are upstream from Lewisville Dam. Ray Roberts Lake controls 692 square miles of the drainage area, or 42% of the drainage area above Lewisville Dam. The watershed of Ray Roberts is about 25 miles long along its axis and the maximum width is about 50 miles. It is predominately in Cooke County, but also drains portions of Montague, Grayson, and Denton Counties.

Ray Roberts Dam is located on the Elm Fork of the Trinity River at river mile 60.0. The river drops from an elevation of about 1,210 feet at its source to 524 feet at the Ray Roberts Dam site. The Elm Fork continues to drop to elevation 387 feet at its confluence with the West Fork in Irving/Dallas. The average slope of the stream bed is 7.5 feet per mile, and the average slope downstream of Ray Roberts Dam is 2.5 feet per mile.

The principal tributaries contributing to the Elm Fork of the Trinity River are the right bank tributaries, Denton Creek, Hickory Creek and Clear Creek, and the left bank tributaries, Isle Du Bois Creek and Little Elm Creek. Ray Roberts Dam is slightly downstream of the mouth of Isle Du Bois Creek, a major left bank tributary. Wolf Creek, Indian Creek, Timber Creek, Jordan Creek, Range Creek, and Buck Creek combine to form Isle Du Bois Creek. Spring Creek and the Elm Fork of the Trinity River are on the right arm of the lake. Downstream of Ray Roberts Lake, Little Elm Creek drains the left bank, while Clear Creek, Hickory Creek, and Denton Creek are major right bank tributaries. The watershed and the location of the dam are shown on Plate 4-1.

The Elm Fork basin has gently rolling hills and broad river valleys, with generally greater relief in the upper reaches. Basin vegetation is divided between the tall prairie grasses of the Grand Prairie physiographic region and the dense growth of Blackjack and Post Oaks of the Eastern Cross Timbers Region. The majority of the Ray Roberts Lake watershed lies within the Eastern Cross Timbers ecoregion to the east, and the Grand Prairie ecoregion to the west.¹ The Trinity River basin supports numerous industries, including trade, transportation and utilities, professional business service, and education and healthcare. The population of the counties in the basin was approximately 6,540,090 in 2010.

¹ <https://www.epa.gov/eco-research/ecoregion-download-files-state-region-6>

4-02. Topography. Ray Roberts Lake and its tributaries are located in the Grand Prairie and Eastern Cross Timbers subdivisions of the Gulf Coastal Plain physiographic province. The topography of the Elm Fork Watershed consists of gently rolling hills and broad river valleys. The basin topography is steeper and rougher in the upper reaches. The terrain is more gently rolling and flatter in the lower reaches. Some rough land occurs along the streams in the lower reaches.

In the Eastern Cross Timbers area, soils are mainly red and yellow sands that have been leached of nutrients. Post oaks and blackjack oaks have adapted to life in sandy soils and they dominate the overstory, with scattered honey mesquite and grasses, such as little bluestem and threeawn, growing beneath them. Although the rural land use is predominantly cattle grazing, there is some farming for peanuts, grain sorghum, pecans, peaches, and vegetables.

The Grand Prairie area is an undulating plain underlain by Lower Cretaceous limestones with interbedded marl and clay. Although the vegetation of the Grand Prairie is similar to the Northern Blackland Prairie, the limestone of the Grand Prairie is more resistant to weathering, which gives the topography a rougher appearance. The original vegetation was tallgrass prairie in the upland areas and elm, pecan, and hackberry in riparian areas where deeper soils have developed in floodplain deposits or where the underlying clays have been exposed by limestone erosion. The invasive species Ashe juniper and, to a lesser extent, honey mesquite have increased since settlement. Grand Prairie grasses include big bluestem, yellow Indiangrass, little bluestem, hairy grama, Texas wintergrass, sideoats grama, and Texas cupgrass. Some common Great Plains animals, such as black-tailed jackrabbit and the scissortail flycatcher, range farther east through the Grand Prairie, creating an overlap in Great Plains and eastern forest species. Present land uses include grazing on ridges with shallow soils and farming of corn, grain sorghum, and wheat on the deeper soils on the flats.

4-03. Geology and Soils. Ray Roberts Lake and its watershed are located in the Grand Prairie and Eastern Cross Timbers subdivisions of the Gulf Coastal Plain physiographic province.² The Grand Prairie region is underlain by limestones and clay shales belonging to the Fredericksburg and Washita groups of the Cretaceous age. The sands, sandstones, and clay shales of the Cretaceous Woodbine formation underlie the Eastern Cross Timbers area. The Cretaceous Woodbine formation consists of 70 to 80 feet of glauconitic shale with sand lenses, underlain by about 260 feet of sandstone. The sandstone beds are highly variable, featuring cross bedding, minor shale beds, tuffaceous clay lenses, carbonaceous clay, and lignite. No faulting or other structural anomalies, other than minor bending flexures, have been noted near the dam and lake.

Soils in the lake area include Quaternary terrace deposits and flood plain deposits, consisting primarily of clay and sandy clay mixed with minor amounts of sand and gravel. The deposits reach their maximum thickness of 50 feet in the flood plain.

² archive.epa.gov/wed/ecoregions/web/html/tx_eco.html

4-04. Sediment. A system of 34 sedimentation ranges and 5 degradation ranges were established and surveyed with monuments placed within the reservoir area and below the dam during the design of the dam. A schedule prepared in the Office of the Division Engineer, Southwestern Division Office (SWD) indicates that resurveys were planned for about 5-year intervals. However, currently sediment surveys are done periodically depending on need and available funding. The locations of ranges are shown on Plate 4-2.

In 1991, the Texas Legislature authorized the Texas Water Development Board (TWDB) to develop a non-profit, self-supporting, reservoir volumetric survey program, which is named the Hydrographic Survey Program. The program includes a standard volumetric survey and a sedimentation survey. Since 1992, the TWDB Hydrographic Survey Program has completed 161 hydrographic surveys on 106 unique reservoirs. This includes 85 of the 114 water supply reservoirs monitored for inclusion in TWDB's monthly Water Conditions Report. The TWDB web site is: (<http://www.twdb.texas.gov/surfacewater/surveys/index.asp>).

The TWDB last performed a standard volumetric survey for Ray Roberts Lake in 2008.³ Results from the survey indicate that Ray Roberts Lake encompasses 28,646 surface acres and contains a total volume of 788,490 acre-feet at conservation pool elevation 632.5 feet.

The original area-capacity up to elevation 660 feet was estimated based on using 1:24,000 scale, 10-foot contour, USGS maps of the reservoir area. The original data was the basis for the estimates of the 1985 area-capacity survey. Records indicate that Ray Roberts Lake had a total surface area of 29,350 acres and a volume of 799,600 acre-feet of water at the top of conservation pool elevation. The 2008 TWDB survey results indicate that Ray Roberts Lake lost 11,110 acre-feet of water or 1.38 percent of conservation storage space and 704 acres or 2.39 percent of the surface area compared to the original USACE 1985 survey. Due to differences in the methodologies used in this and previous surveys, comparison of these values is not recommended by TWDB. Comparisons between the 1985 USACE data and the 2008 TWDB volumetric survey are presented in Table 4-1.

For the original design it was estimated that 54,600 acre-feet of sediment would be deposited in Ray Roberts Lake within a 100-year period, with 50,400 acre-feet being deposited below elevation 632.5 feet. This equates to approximately 0.8 acre-feet of sediment per square mile per year. For a 31 year period (1987-2008), the rate of sedimentation would produce 15,624 acre-feet of sediment below elevation 632.5 feet. Using the capacity estimates for elevation 632.5 feet from the 1985 USACE survey (Ray Roberts Lake impoundment 1987) and the TWDB 2008 survey estimates, the loss in storage for that period is at 11,110 acre-feet. The indications are that the loss of storage is less than originally estimated, however the differences in the survey methods provide no confidence that the loss estimates are accurate.

³ https://www.twdb.texas.gov/hydro_survey/RayRoberts/2008-10/RayRoberts2008_FinalReport.pdf

TABLE 4-1**Area and Capacity Comparisons of Ray Roberts Lake**

Feature	USACE Data	TWDB Latest Survey
Year	1985	2008
Surface Area at Conservation Pool Elevation 632.5 feet NGVD29 (acres)	29,350	28,646
Volume at Conservation Pool Elevation 632.5 feet NGVD29 (acre-feet)	799,600	788,490

NOTE: Data is obtained from “Volumetric and Sedimentation Survey of Ray Roberts Lake, TWDB September-October 2008.”

4-05. Climate. The Elm Fork watershed is in the north central part of the state of Texas. The climate varies over the watershed from subtropical with cool winters and hot humid summers. Tropical maritime air masses from the Gulf of Mexico play a dominant role in the climate from late spring through early fall, while polar air masses determine the winter climate. Warm seasonal rainfall is largely the result of thunderstorm activity, with amounts varying considerably in both intensity and location.

a. **Temperature.** The mean annual temperature over the basin is about 65 degrees Fahrenheit. January, the coldest month, has an average minimum daily temperature of about 33 degrees. August, the warmest month, has an average maximum daily temperature of about 96 degrees. Temperatures in the watershed have ranged from a maximum of 118 degrees to a minimum of minus 7 degrees recorded at McKinney.⁴ The average length of the growing season between killing frosts varies from 226 days at Gainesville in the upper part of the watershed to 267 days at Dallas near the lower watershed boundary.⁵ Table 4-2 gives temperature data for several National Weather Service (NWS) stations in or near the Elm Fork Trinity River basin.

⁴ www.ncdc.noaa.gov/cdo-web/datasets

⁵ texasalmanac.com/sites/default/files/images/almanac-feature/countyweatherA.pdf

TABLE 4-2
Temperatures in/near the Elm Fork Trinity River Basin

Station	Period of Record	Temperatures (°F)				
		Mean Annual	Average January Minimum	Average August Maximum	Minimum Recorded	Maximum Recorded
Dallas FAA Airport	1939-2016	66.5	35.7	96.2	0	112
Denton 2 SE	1913-2016	64.7	33.2	95.9	-3	113
Gainesville 5 ENE*	1897-2016	63.6	30.5	96.1	-7	114
Sanger	1991-1999	64.2	32.2	93.6	0	109
McKinney Municipal Airport**	1903-2016	65.4	33.0	96.5	-7	118

*Period of available NOAA data (1897-1987) is retrieved from different stations named Gainesville.

**Period of available NOAA data (1903-2016) is retrieved from different stations named McKinney.

b. Precipitation. The normal annual precipitation over the Elm Fork Trinity River watershed varies from approximately 36 inches at Carrollton in the southeastern part of the watershed, to 41 inches at Pilot Point, in the north central portion of the watershed.⁶ Gainesville, in the center of the Ray Roberts Lake watershed, has experienced a maximum yearly rainfall of 87.7 inches and a minimum yearly rainfall of 16.2 inches. Across the watershed, precipitation levels are higher in the late-spring, early-summer months, peaking in May-June and lowest in November-February. Because of the preponderance of tropical maritime air, heavy showers of short duration may occur at any time during the year. The monthly distribution of the average annual precipitation at eight NWS stations in the watershed area is shown in Table 4-3.

⁶ www.ncdc.noaa.gov/cdo-web/datasets

TABLE 4-3**Average Monthly and Annual Rainfall in/near the Elm Fork Trinity River Basin**

Month	Precipitation (Inches)			
	Pilot Point Isla Du Bois 1916-2003	Denton 2 SE 1913-2016	Carrollton 1923-2016*	Gainesville 1897-2016**
January	2.09	1.93	2.18	1.90
February	2.70	2.42	2.53	2.21
March	3.44	2.74	2.90	3.03
April	3.97	3.80	4.00	3.73
May	5.79	4.97	5.25	5.06
June	4.27	3.26	3.36	3.85
July	2.44	2.20	2.28	2.58
August	2.50	2.21	1.90	2.46
September	3.86	3.02	2.89	3.47
October	3.96	3.76	3.54	3.60
November	3.07	3.30	2.75	2.48
December	2.52	2.59	2.60	2.27
Total	40.61	36.17	36.18	36.63
Precipitation Minimum Yearly	16.39 (2003)	15.11 (1963)	16.41 (1963)	16.19 (1963)
Precipitation Maximum Yearly	66.69 (1982)	65.07 (2015)	64.07 (2015)	87.72 (2015)

NOTES: 1. The total annual precipitation is computed by summation of the monthly averages.

2. Data reflect "Climatological Data" from the NWS. *Data from 2012-2016 were retrieved from Carrollton 2 NNE.

** Data from 1987-2016 were retrieved from Gainesville 5 ENE gage.

TABLE 4-3 (CONTINUED)**Average Monthly and Annual Rainfall in/near the Elm Fork Trinity River Basin**

Month	Precipitation (Inches)			
	Muenster 1941-2016	Gunter 5S 1948-2000	Valley View 1947-2002	Lewisville Dam 1949-2016
January	1.73	1.90	1.77	2.33
February	2.24	2.81	2.37	2.19
March	3.01	2.93	2.90	3.90
April	3.64	3.94	3.75	3.48
May	5.24	5.42	5.04	4.55
June	3.76	3.77	3.55	3.48
July	2.22	2.28	2.17	2.12
August	2.20	2.39	2.04	1.64
September	3.82	3.91	3.92	2.49
October	3.76	3.78	3.60	4.01
November	2.44	2.80	2.69	2.63
December	2.14	2.47	2.16	2.65
Total	36.21	38.42	35.95	35.48
Precipitation	19.06	18.61	19.69	13.91
Minimum Yearly	(1956)	(1963)	(1956)	(1963)
Precipitation	77.78	68.36	58.21	61.24
Maximum Yearly	(2015)	(1982)	(1957)	(1990)

NOTES: 1. The total annual precipitation is computed by summation of the monthly averages.

2. Data reflect "Climatological Data" from the NWS.

c. Snowfall. Minor accumulations of snowfall (about 2.5 inches) occur periodically during the winter months, however, snowfall does not contribute significantly to area precipitation or runoff.

d. Evaporation. There is no evaporation pan currently at Ray Roberts Lake. A NWS “Class A” evaporation pan at Grapevine Lake is used to estimate evaporation at Ray Roberts Lake since the two dams are close to each other. The evaporation pan at Grapevine Lake is 10-inch deep with 47.5-inch diameter (Figure 4-5). From measurements collected between August 1953 and September 2012, the estimated average annual evaporation from the lake is about 83 inches. The average monthly and annual evaporation from Ray Roberts Lake are given in Table 4-4A. The highest recorded annual evaporation was 113.4 inches in 1956, while the lowest was 69.59 in 2007. The highest evaporation during a single month was 13.86 inches in July 2011. The evaporation pan heats up much faster than the lake, thus pan evaporation is much higher than the actual evaporation, and a coefficient must be used to estimate actual lake evaporation.

The TWDB has also collected lake evaporation data from 1954 through 2015 from the National Oceanic and Atmospheric Administration (NOAA) and the National Climatic Data Center (NCDC).⁷ The average monthly and annual evaporation from TWDB data are given in Table 4-4B. The evaporation rates for the Elm Fork Trinity River watershed are computed using the pan coefficients in the ThEvap program for quadrangle 410.

Figures 4-1 through 4-5 show the instruments and equipment of weather station at Grapevine Lake.



Figure 4-1. Weather Station



Figure 4-2. Weather Station

⁷ www.twdb.texas.gov/surfacewater/conditions/evaporation/



Figure 4-3. Rain Gauge



Figure 4-4. Rain Gauge



Figure 4-5. Evaporation Pan

TABLE 4-4A

Ray Roberts Lake Average Monthly and Annual Evaporation (Aug 1953 - Sep 2012)

Month	Reservoir Evaporation (Inches)		
	Measured Pan Evaporation	Monthly Pan Coefficient	Calculated Reservoir Evaporation
January	2.85	0.73	2.08
February	3.76	0.70	2.63
March	5.97	0.69	4.12
April	7.29	0.67	4.88
May	8.67	0.60	5.20
June	10.21	0.67	6.84
July	11.89	0.69	8.20
August	11.33	0.70	7.93
September	8.21	0.73	5.99
October	6.36	0.77	4.90
November	4.12	0.80	3.30
<u>December</u>	<u>3.05</u>	<u>0.77</u>	<u>2.35</u>
Annual	83.21	0.71	58.42

NOTES: The Pan coefficients were developed by the USACE. The calculation was based on Grapevine Lake measured pan evaporation data, which is recorded approximately 25 miles to the southwest from Ray Roberts Dam.

Since 2017, the evaporation readings used at Ray Roberts Lake are calculated at Grapevine Dam by using an empirical formula (unmodified Hamom formula). This formula is based on a coefficient that uses historical readings that are based on day of year, latitude, and average temperature in order to calculate Ray Roberts Lake daily evaporation readings.

TABLE 4-4B

TWDB Average Monthly and Annual Evaporation Ray Roberts Lake, 1954-2015

Month	Lake Evaporation rate (inches)	Monthly Pan Coefficients for quadrangle 410 of ThEvap Program
January	2.04	0.73
February	2.40	0.70
March	3.90	0.69
April	4.74	0.67
May	4.93	0.60
June	6.64	0.67
July	7.62	0.69
August	7.47	0.70
September	5.66	0.73
October	4.58	0.77
November	3.15	0.80
<u>December</u>	<u>2.28</u>	<u>0.77</u>
Annual	55.40	0.71

e. Wind. The prevailing winds over the watershed are from the south during the spring, summer, and fall months, while northerly winds prevail during the winter months. Severe winds have been experienced near Ray Roberts Lake. Gusts as fast as 110 miles per hour have been recorded near the NWS Station in Denton, approximately 10 miles southwest of the dam site on 13 June 1989.⁸ (Data provided by NOAA NCDC for the period 1950–2016).

From the "Ray Roberts Lake, Elm Fork of Trinity River, Trinity River Basin, Texas, Dam Safety Assurance Study, Hydrologic Capacity Study, April 2012" report, the design wind speed for the PMF is 45 mph, the fetch for wind setup is 6.79 miles and the needed freeboard is 4.8 feet. The computed PMF elevation for the existing spillway is 667.2 feet. Since top of dam is at elevation 665.0, the freeboard is negative and inadequate. The average annual wind movement at Dallas, Texas, 42 miles southeast of the Ray Roberts Dam, is 83,220 miles, or an average wind speed of 9.5 miles per hour for entire year.⁹ Tornadoes are a somewhat rare occurrence in the watershed. In December 2015, a series of tornados reaching EF4 level left 13 people dead and injuring over 300 people across parts of North and Central Texas.

⁸ <http://www.ncdc.noaa.gov/stormevents/eventdetails.jsp?id=10137948>

⁹ <https://www.ncdc.noaa.gov/IPS/lcd/lcd.html>

4-06. Storms and Floods. The Elm Fork Trinity River watershed is subject to three general types of flood-producing rainfall: thunderstorms, frontal rainfall, and tropical cyclones. The topography, soils and typical rainfall patterns of the watershed lead to rapid runoff and sharp crested flood hydrographs. Floods occur frequently and at almost any time of year. Generally, the highest 24-hour and monthly precipitation periods have occurred during major thunderstorms. However, there are some instances of heavy precipitation resulting from local thunder storms. The maximum 24-hour rainfall reported in or adjacent to the basin was 13.00 inches, which occurred at Pilot Point on 13 May 1982. The maximum monthly rainfall reported was 30.30 inches for May 1982 at Pilot Point.¹⁰ Generally the Elm Fork Trinity River large floods are long-duration type having two or more peaks spaced as close as ten days apart. However, it is possible that large peak and volume floods could occur in about a two week duration. The major storms experienced over the watershed for which rainfall data are available, together with the average rainfall depths produced on the watershed above the dam, are listed in Table 4-5.

Table 4-6 lists the pertinent data for major lakes and dams and gages in the Elm Fork Trinity River basin. Table 4-7 gives stages and discharges for top 16 major floods recorded at gages in the Elm Fork Trinity River watershed.

¹⁰ www.ncdc.noaa.gov/cdo-web/datasets

TABLE 4-5**Major Storms on the Elm Fork Trinity River Watershed, 1908–2016**

Storm Date	Precipitation in Inches							
	Pilot Point Gage	Denton 2 SE Gage	Carroll- ton Gage	Gaines- ville Gage	Muen- ster Gage	Gunter 5S Gage	Valley View Gage	Lewisville Dam Gage
1908, May 22-26	—	—	—	8.29	—	—	—	—
1935, May	—	11.52	10.95	12.02				
1942, Apr 5-30	—	11.55	15.66	16.40	15.28	—	—	—
1957, Apr 18-May 5	14.01	13.39	14.62	11.81	12.72	17.26	13.33	13.33
1957, May 22-26	8.63	11.63	7.52	5.82	3.11	7.26	6.09	6.21
1958, Apr 26-May 3	6.38	8.52	6.68	9.09	7.41	7.81	6.78	7.62
1962, Sep 1-8	11.12	11.74	4.64	8.90	8.99	11.35	13.65	4.43
1964, Sep 15-28	11.34	10.76	18.29	8.36	10.68	9.57	10.10	15.51
1966, Apr 22-May 2	14.45	9.85	15.03	7.97	9.20	10.00	8.96	10.84
1971, Dec 1-10	6.80	7.17	8.96	6.36	4.42	6.67	5.80	7.29
1980, Sep 24-30	10.30	7.72	6.70	10.25	7.91	10.54	9.10	8.54
1981, Oct 6-18	15.35	16.94	7.85	20.71	19.23	16.03	14.90	13.11
1982, May 11-19	18.60	14.66	8.07	5.86	4.27	13.34	9.62	10.16
1986, Feb 3-10	7.60	8.67	—	3.05	2.42	7.34	3.50	1.58
1987, May 22-30	6.70	7.26	3.14	6.97	7.57	3.59	8.11	3.23
1989, May 3-Jun 15	18.80	13.57	24.19	25.07	19.60	15.42	19.67	20.19
1990, Apr 13-May 4	13.70	10.30	13.59	16.12	16.34	13.41	15.80	7.36
1991, Dec 18-23	5.80	4.27	6.14	5.79	4.58	6.41	6.11	6.61
1996, Nov 3-27	12.86	10.57	5.02	4.86	4.17	9.30	7.24	—
2000, Nov 3-24	7.34	7.16	7.20	6.45	6.23	4.84	6.34	6.20
2004, Jun 2-30	—	10.39	—	11.15	12.15	—	—	9.17
2007, Jun 4-30	—	12.21	—	20.01	12.98	—	—	12.00
2009, Oct 4-27	—	12.59	—	11.99	7.25	—	—	8.65
2015, May 6-31	—	13.52	17.71	28.90	23.92	—	—	9.67
2016, May 9-Jun 14	—	10.59	11.33	12.51	10.85	—	—	11.58

NOTE: The rainfall data were tabulated from published precipitation records from the NWS.

TABLE 4-6**Pertinent Data for Major Lakes and Dams and Gages in the Elm Fork Trinity River Basin**

Station	Stream	Period of Record	Miles Above Mouth	Datum (ft)	Drainage Area (Sq. Mi.)	Maximum Floods of Record		
						Date	Gage Height (ft)	Peak Discharge (cfs)
near Pilot Point	Isle Du Bois Creek	1949-1984	6.3	555.48	266	31 Oct 1974	29.43	40,000
						16 Oct 1981	29.84	39,900
						27 Mar 1977	28.91	29,900
near Sanger	Elm Fork	1949-1989	—	548.72	381	Oct 13 1981	33.50	150,000
						Oct 1974	29.10	50,000
						Feb 1966	27.71	35,000
near Carrollton	Elm Fork	1907-2015	18.2	431.40	2459	25 May 1908	17.00	145,000
						26 Apr 1942	14.50	90,700
						19 May 1935	13.00	82,100
near Sanger	Clear Creek	1949-2015	—	582.23	295	13 Oct 1981	35.70	104,000
						26 Apr 1990	29.94	24,300
						8 May 2015	28.92	18,900
Near Lewisville	Elm Fork	1950-2015	28.2	432.39	1,673	15 Sep 1950	30.75	21,700
						4 May 1990	30.15	19,600
						31 May 2015	30.98	18,600

NOTES: The information is derived from the United States Geological Survey (USGS) Annual Water-Data Reports. Refer to USGS historical records for details of datum changes.

TABLE 4-6 (CONTINUED)**Pertinent Data for Major Lakes and Dams and Gages in the Elm Fork Trinity River Basin**

Lake	Stream	Period of Record	Miles Above Mouth	Datum (ft)	Drainage Area (Sq. Mi.)	Maximum Lake Elevation		
						Date	Elev. (ft)	Volume (ac-ft)
Lewisville Lake	Elm Fork	1964-2016	30.0	—	1,660	30 May 2015	537.01	1,151,076
Ray Roberts Lake	Elm Fork	1987-2016	60.0	—	692	3 May 1990	644.44	1,219,000
Fraiser Dam	Elm Fork	1999-2016	3.5	—	2,557	31 May 2015	419.52	—

NOTES: The information is derived from the United States Geological Survey (USGS) Annual Water-Data Reports, and Fort Worth USACE historical records.

TABLE 4-7**Top 16 Recorded Major Floods on the Elm Fork Trinity River Watershed, 1908-2016**

Date	Isle du Bois Creek near Pilot Point		Elm Fork near Sanger		Elm Fork Trinity River near Carrollton*		Clear Creek near Sanger		Elm Fork Trinity River near Lewisville	
	Gage Height (ft)	Peak Discharge (cfs)	Gage Height (ft)	Peak Discharge (cfs)	Gage Height (ft)	Peak Discharge (cfs)	Gage Height (ft)	Peak Discharge (cfs)	Gage Height (ft)	Peak Discharge (cfs)
1908, May	—	—	30.70	—	17.00	145,000	36.50	—	—	—
1935, May	—	—	29.70	—	13.00	82,100	34.00	—	—	—
1942, Apr	—	—	—	—	14.50	90,700	—	—	—	—
1950, Sep	26.35	17,200	27.14	20,100	—	—	29.80	18,200	30.75	21,700
1957, Apr- Jun	27.08	22,700	27.40	20,800	8.54	13,700	29.27	16,100	26.72	11,400
1958, Apr- May	27.30	16,000	29.10	27,500	6.65	7,720	29.65	17,400	24.09	5,440
1962, Sep	27.81	19,000	28.10	22,500	—	—	29.30	16,200	—	—
1964, Nov	26.09	11,100	27.10	17,500	—	—	29.00	15,000	23.69	5,260
1974, Oct	29.43	40,000	29.10	50,000	—	—	28.82	14,500	—	—
1977, Mar- Apr	28.91	29,900	27.80	25,700	7.71	11,300	27.49	8,190	22.61	5,290
1981, Oct	29.84	39,900	33.50	150,000	—	—	35.70	104,000	—	—
1982, May	29.80	39,400	26.70	18,700	—	—	—	—	—	—
1990, May	—	—	—	—	13.48	27,600	—	—	30.15	19,600
2007, Jun	—	—	—	—	9.68	9,970	27.11	12,800	—	—
2015, May	—	—	—	—	13.12	26,700	28.92	18,900	30.98	18,600
2016, Jun	—	—	—	—	—	—	—	—	26.87	7,330

1. Data retrieved from USGS Peak Streamflow for Texas database. Refer to USGS historical records for details of datum changes.

2. The Top 16 floods were generally basin wide flood events at most of the gages, however certain gages may not have experienced a Top 16 Flood during the same event. For more details on all major floods refer to Table 4-8 (pg. 4.8-1).

*Peak flood flows at this gage were affected by impoundment of Lake Dallas from 1928-1954, by Lake Dallas and Grapevine Lake from July 1952 to November 1954, by Grapevine and Lewisville Lakes from November 1954 to 1987, and by Grapevine, Lewisville, and Ray Roberts Lakes from 1987-Present.

Historical descriptions of the major floods that have been experienced in the Elm Fork watershed are as follows:

a. Storm of May 1908. The storm of May 22-26 1908 was unique because it originated on the Pacific coast. The center of this storm was at Chattanooga in southern Oklahoma where rainfall of 9.4 inches was recorded for the storm period. This storm covered the entire headwaters of the Trinity River down to the mouth of the East Fork with the heaviest concentration over the Elm Fork watershed. Between 8 and 9 inches of rain fell over the upper portion of the Elm Fork watershed and from 4 to 8 inches over the greater part of the Trinity River above Dallas. Practically no rainfall was recorded on the Trinity River Basin below the mouth of the East Fork. Some of the rainfall amounts on the Upper Trinity River Basin were as follows: Gainesville, 8.02 inches; Fort Worth, 7.3 inches; Weatherford, 6.4 inches; and Dallas, 4.0 inches.

The maximum known discharge on the Elm Fork occurred on 25 May 1908. A stage of 30.7 feet at the Elm Fork gage near Sanger was estimated based on information provided by local residents. USACE estimated a stage equivalent to about 17.0 feet with a discharge of approximately 145,000 cfs at the present location of the Carrollton gage based on information provided by local residents. The peak discharge on the Trinity River at Dallas from the May 1908 storm is the maximum and has been estimated by the USGS to have been 184,000 cfs from a stage of 41.1 feet. The flood in 1866 reached about the same stage as the 1908 flood. Property damage exceeded \$5,000,000 and 11 lives were lost in the Dallas vicinity in the 1908 flood.

b. Storm of May 1935. The flood produced by the May 1935 storm reached stages of 29.70 feet at Elm Fork Trinity River near Sanger gage, 13.0 feet at Elm Fork Trinity River near Carrollton gage, and 34.0 feet at Clear Creek near Sanger gage. The recorded rainfalls for this storm were 12 inches near Denton 2 SE gage, 10 inches near Pilot Point gage, 13 inches near Gainesville gage, and 11 inches near Carrollton gage. The peak discharges at Elm Fork Trinity River near Carrollton gage was 82,100 cfs.

c. Storm of April 1942. This storm covered the entire Trinity River Basin. Storm centers were scattered throughout the basin; however, the heaviest concentration of rainfall was experienced in the upper basin. The storm of April 5-30, 1942 consisted of four distinct periods of rainfall. These periods were as follows: April 5-9, April 12-14, April 18-20, and April 23-30.

Precipitation during the first period fell at moderate rates on relatively dry ground and did not produce excessive runoff on the tributaries. The second period consisted of light rains of little significance. The third and fourth periods consisted of several short periods of intense precipitation and generally produced the high discharge experienced in the basin. Some of the rainfall amounts recorded in the basin during the total storm period of April 5-30 were as follows: Roanoke, 18.8 inches; Gainesville, 16.4 inches; Fort Worth, 17.0 inches; Dallas, 12.4 inches; McKinney, 17.1 inches; Rosser, 13.7 inches; Trinidad, 8.3 inches; Long Lake, 8.0 inches; and Liberty, 8.5 inches.

The maximum stage height as recorded by the Elm Fork Gage near Carrollton (1923 to present) was 14.5 ft. with a corresponding discharge of 90,700 cfs and occurred on April 26, 1942.

d. Storm of September 1950. The flood produced by the September 1950 storm reached stages of 26.35 feet at Isle du Bois near Pilot Point gage, 27.14 feet at Elm Fork Trinity River near Sanger gage, 29.80 feet at Clear Creek near Sanger gage, and 30.75 feet at Elm Fork Trinity River near Lewisville gage. The peak discharges at Isle du Bois near Pilot Point gage, Elm Fork Trinity River near Sanger gage, Clear Creek near Sanger gage, and Elm Fork Trinity River near Lewisville gage were 17,200, 20,100, 18,200, and 21,700 cfs, respectively.

e. Storm of April-June 1957. Torrential rains caused flooding throughout the area east of the Pecos River to the Sabine River. The storm which began over Texas on April 19 produced rainfalls during the month varying from about 8 inches in the lower Trinity River Basin, to about 10 inches in the center portion of the basin, and a maximum of about 20 inches in the upper basin near Lewisville Lake, formerly Garza Little Elm Reservoir. The storms continued into the month of May producing rainfalls varying from about 2 inches near the mouth to about 4 inches in the central basin near Oakwood to about 16 inches in the upper watershed. During May more than 4,000 people were evacuated from unprotected lowlands on the West Fork of the Trinity River above Fort Worth and along creeks in Fort Worth. The heavy general rains ended about June 5 and ranged from about 2 inches in the upper basin to about 10 inches at the extreme lower end of the basin.

The floods of April-June 1957 on the Trinity River Basin above Dallas produced about 3,888,000 acre feet of runoff (adjusted for storage in upstream reservoirs), whereas the floods of April-June 1908 produced only about 2,400,000 acre feet of runoff. This flood produced about one and one half times as much flood runoff as occurred in the 1908 flood, which produced the maximum known peak discharge at Dallas. The West Fork watershed above Fort Worth produced about 1,278,000 acre feet of runoff (adjusted for storage), during the April-June 1957 floods. This is about five times the flood volume of the April-June 1949 flood (255,000 acre-feet) which produced the maximum known peak discharge on the Clear Fork at Fort Worth.

f. Storm of April-May 1958. The flood produced by the April-May 1958 storm reached stages of 27.30 feet at Isle du Bois near Pilot Point gage, 29.10 feet at Elm Fork Trinity River near Sanger gage, 6.65 feet at Elm Fork Trinity River near Carrollton gage, 29.65 feet at Clear Creek near Sanger gage, and 24.09 feet at Elm Fork Trinity River near Lewisville gage. The peak discharges at Isle du Bois near Pilot Point gage, Elm Fork Trinity River near Sanger gage, Elm Fork Trinity River near Carrollton gage, Clear Creek near Sanger gage, and Elm Fork Trinity River near Lewisville gage were 16,000, 27,500, 7,720, 17,400, and 5,440 cfs, respectively.

g. Storm of September 1962. The flood produced by the September 1962 storm reached stages of 27.81 feet at Isle du Bois near Pilot Point gage, 28.10 feet at Elm Fork Trinity River near Sanger gage, and 29.30 feet at Clear Creek near Sanger gage. The peak discharges at Isle du Bois near Pilot Point gage, Elm Fork Trinity River near Sanger gage, and Clear Creek near Sanger gage were 19,000, 22,500, and 16,200 cfs, respectively.

h. Storm of November 1964. The flood produced by the November 1964 storm reached stages of 26.09 feet at Isle du Bois near Pilot Point gage, 27.10 feet at Elm Fork Trinity River near Sanger gage, 29.0 feet at Clear Creek near Sanger gage, and 23.69 feet at Elm Fork Trinity River near Lewisville gage. The peak discharges at Isle du Bois near Pilot Point gage, Elm Fork Trinity River near Sanger gage, Clear Creek near Sanger gage, and Elm Fork Trinity River near Lewisville gage were 11,000, 17,500, 15,000, and 5,260 cfs, respectively.

i. Storm of May-June 1967. The flood produced by the May-June 1967 Storm reached stages of 27.80 feet at Isle du Bois near Pilot Point gage. A stage height of 26.10 feet at Elm Fork Trinity River near Sanger gage, 5.64 feet at Elm Fork Trinity River near Carrollton gage, 27.70 feet at Clear Creek near Sanger gage, and 21.91 feet at Elm Fork Trinity River near Lewisville gage. The peak discharges at Isle du Bois near Pilot Point gage, Elm Fork Trinity River near Sanger gage, Elm Fork Trinity River near Carrollton gage, Clear Creek near Sanger gage, and Elm Fork Trinity River near Lewisville gage were 19,000, 12,600, 5,590, 11,500, and 4,510 cfs, respectively.

j. Storm of October 1974. The flood produced by the October 1974 storm reached stages of 29.43 feet at Isle du Bois near Pilot Point gage, 29.10 feet at Elm Fork Trinity River near Sanger gage, and 28.82 feet at Clear Creek near Sanger gage. The peak discharges at Isle du Bois near Pilot Point gage, Elm Fork Trinity River near Sanger gage, and Clear Creek near Sanger gage were 40,000, 50,000, and 14,500 cfs, respectively.

k. Storm of March-April 1977. The flood produced by the March-April 1977 storm reached stages of 28.91 feet at Isle du Bois near Pilot Point gage, 27.80 feet at Elm Fork Trinity River near Sanger gage, 7.71 feet at Elm Fork Trinity River near Carrollton gage, 27.49 feet at Clear Creek near Sanger gage, and 22.61 feet at Elm Fork Trinity River near Lewisville gage. The peak discharges at Isle du Bois near Pilot Point gage, Elm Fork Trinity River near Sanger gage, Elm Fork Trinity River near Carrollton gage, Clear Creek near Sanger gage, and Elm Fork Trinity River near Lewisville gage were 29,000, 25,700, 11,300, 8,190, and 5,290 cfs, respectively.

l. Storm of October 1981. Scattered rain prior to the major storm occurred on 6-9 October throughout North Central Texas. The rains ceased for 2 days and then resumed with widely scattered thundershowers developing over West Texas on 11 October. This activity moved into North Texas. Thunderstorm cell movement was southwest to northeast which resulted in several areas experiencing repeated thunderstorm activity. By the afternoon of 12 October, an outflow boundary from Hurricane Norma merged with the remains of the warm front and thunderstorms began developing between Fort Worth and Abilene. Thunderstorms continued through the night of 12 October. Once again thunderstorm cell movement was southwest to northeast and many areas experienced continuous thunderstorms. The thunderstorms were fed by high level moisture from Hurricane Norma and by low level moist air from the Gulf of Mexico. Thunderstorms and heavy rain continued throughout North Texas the morning of October 13. The remains of Hurricane Norma merged with a minor trough and an upper air disturbance over North Central Texas, thus causing additional severe thunderstorms. Rainfall in excess of 15 inches occurred over a widespread area in the Elm Fork watershed. With

the ground saturated from the earlier rains, followed by the intense rainfall which began on 11 October, excessive runoff was experienced in the Elm Fork of the Trinity River.

This flood produced the highest observed stage and discharge at the Sanger gage on the Elm Fork. The peak stage was 33.5 feet, with a measured flow of 150,000 cfs on 13 October 1981. This storm was also responsible for a peak inflow of approximately 284,000 cfs into Lewisville Lake. This inflow raised Lewisville Lake to an elevation of 535.62 feet, 3.62 feet over the spillway. The peak flow over the spillway was approximately 10,600 cfs. (Note: Due to the high lake level and a subsequent storm of approximately 3 inches of rain on 1 November, Lewisville Lake elevation peaked at an elevation of 536.48 feet, which is 4.48 feet over the spillway. The corresponding outflow peak was approximately 15,400 cfs). Due to the limited rainfall over the prior year, many area lakes in the Trinity Basin were low prior to the October rain. Many of the non-Corps lakes were built primarily for water supply and recreation and thus did not set aside a portion of their storage capacity for flood control purposes as is typically done on Corps lakes. This was a fortunate coincidence in that their low condition helped to reduce flooding downstream. Even so, many lake side homes were flooded at various non-Corps lakes.

As a result of the October storm, extensive flood losses occurred to numerous communities and rural areas in the North Central Texas area. Residential, commercial, and industrial properties together with streets, utilities, and public property were heavily damaged in many cities. In the rural areas, crops were destroyed, livestock drowned, county roads and bridges washed away, and numerous rural dwellings and related farm properties were severely damaged. Many individuals had to temporarily evacuate their homes until the floodwater receded. A total of seven deaths were attributed to the 11-13 October storm and resultant flooding.

m. Storm of November 1981. The flood produced by the November 1981 storm reached stages of 26.80 feet at Elm Fork Trinity River near Sanger gage, 10.65 feet at Elm Fork Trinity River near Carrollton gage, and 27.83 feet at Elm Fork Trinity River near Lewisville gage. The peak discharges at Elm Fork Trinity River near Sanger gage, Elm Fork Trinity River near Carrollton gage, and Elm Fork Trinity River near Lewisville gage were 14,900, 21,100, and 15,000 cfs, respectively.

n. Storm of May 1982. Heavy rains from a slow-moving cool front caused flash floods throughout North Central and northern East Texas. General rains of 10 to 12 inches caused widespread urban flooding north and northeast of the Dallas-Fort Worth area. Rainfall accumulations for the period between May 11-15 in the Elm Fork watershed were as follows; Carrollton 7.61 inches, Denton 14.44 inches, Pilot Point 13.30 inches, and the Lewisville Lake Project 8.78 inches. The gage on Isle Du Bois Creek near Pilot Point recorded a stage height of 29.8 feet with a flow of 39,400 cfs. The Elm Fork near Sanger gage peaked at 26.7 feet with a flow of 18,700 cfs. The peak inflow into Lewisville Lake was estimated at 286,000 cfs, approximately equal to the peak inflow from the 1981 flood. Lake Lewisville reached a peak elevation of 535.25 feet or 3.25 feet above the spillway. As a result of Grapevine and Lewisville Lakes and their storage capacity, the flow at the Carrollton gage was reduced to 17,400 cfs and the flow at the Dallas gage was reduced to 29,800 cfs.

o. Storm of May-June 1989. Scattered rains occurred throughout North Central Texas prior to the major storms which began on 3 May. There were three distinguishable rainfall periods; 3-5 May, 16-18 May, and 1-15 June. On 3-5 May the upper Trinity River Basin received in excess of 4 inches of rain with amounts of 5.5 inches reported in the Mid-cities. This rainfall saturated the watershed which resulted in most of the lakes levels approaching or going into the flood pool. On 16-17 May the 24 hour recorded rainfall was 5.34 inches at the DFW Airport. During the morning of 16 May, Bowie received 10.25 inches of rain. Most of the upper watershed received in excess of 6 inches of rain. Late May produced some light rains but these rains were insignificant. The rainfall, through 01 June 1989 for DFW Airport was 21.45 inches, or 7.56 inches above normal. The rainfall and run-off nearly filled all of the lakes in North Texas. Lewisville, Grapevine and Lavon Lakes went well into the flood pool.

Rains continued into June throughout North Texas. It rained somewhere in North and East Texas every day from 1-14 June. Rainfall amounts of 2 to 4 inches were common with isolated amounts of near 6 inches. The DFW Airport received 8.75 inches of rainfall in June. DFW Airport reported 30.21 inches in the first 6 months of 1989, where the average annual rainfall is 35.18 inches (1966-1995, 30 year average). The two month total, May to June, for Pilot Point was 23.93 inches and for the Lewisville Project Office was 19.03 inches.

Ray Roberts Lake stored 676,000 acre-feet of flood water and had a peak inflow of approximately 60,000 cfs. During the month of June, Benbrook, Grapevine, and Lewisville Dams all had water flowing through their service spillways concurrently. This was the first time this had happened in the history of the projects. The Trinity River at Dallas crested at 42.97 feet (flood stage is 30 feet) which was the highest crest since the construction of Benbrook, Lewisville, and Grapevine Dams. Flooding occurred in South Dallas where many families had to be relocated and major damage was experienced. The flood wave then proceeded downstream where the gage at Rosser crested at 36.15 feet (flood stage is 26 feet), Trinidad crested at 42.72 feet (flood stage is 28 feet), and Long Lake crested at 45.5 feet (flood stage is 35 feet). Downstream flooding forced many ranchers to move herds of livestock out of the floodplain. From newspaper accounts, 25 deaths were attributed to the flood.

p. Storm of April-May 1990. A large portion of State of Texas experienced above normal rainfall January through April and into May of 1990. The major storm systems in the latter part of April were the result of a cold front mixed with an upper level low and produced two frontal type storms which formed over north and west Texas from 17-20 April and 24-27 April 1990. The storm which occurred on 1-4 May 1990 was the result of cool surface air mixing with warm rising air from the south-southwest. The upper Trinity River Basin received 2 to 3 inches of rain from the April 17-20 storm. The April 24-27 storm was such that much of the upper basin received 6 to 8 inches. Precipitation at the Dallas/Fort Worth airport (DFW) for the first four months of 1990 was 22.05 inches (12.42 inches above normal). The April precipitation at DFW was 6.90 inches (3.27 inches above normal). The May 1-4 storm resulted in most of the upper Trinity Basin receiving 4 to 6 inches of rain. Some rainfall extremes for May were; Carrollton 6.55 inches, Frisco 7.04 inches, Gordonville 6.91 inches, Gunter 7.22 inches, and Pilot Point 6.1 inches.

Ray Roberts Lake peaked at elevation 644.44 feet or 157 percent of flood control storage on 03 May 1990, setting a new record elevation. This elevation is 3.94 feet above the top of the flood control pool and is only 1.06 feet below the spillway crest. The peak inflow into the lake was approximately 115,000 cfs. Lewisville Lake peaked at elevation 536.73 feet or 158 percent of flood control storage on 4 May 1990, setting a new record elevation. This elevation is 4.73 feet above the service spillway and produced an uncontrolled flow of 19,300 cfs as compared to peak inflow of approximately 235,000 cfs. Of the eight flood control lakes in the Trinity Basin, six attained new record peak elevations and four exceeded the top of their flood control pool.

The flooding resulted in the closing of many roads and bridges. Numerous levee systems along the Trinity River between Dallas County and Liberty County were overtopped and scoured. About 200 homes and businesses were flooded in the Rochester Park area of south Dallas. An estimated \$30 million in damages was caused by the flooding in Dallas County.

The Clear Creek gage near Sanger crested at 31 feet, which corresponded to a flow of approximately 15,000 cfs. The water level at this stage height was 6 feet above the top of bank. The Carrollton gage on the Elm Fork crested at 13.48 feet with a corresponding flow of 27,600 cfs. If it had not been for the three Corps lakes on the Elm Fork, it is estimated that the flow at Carrollton would have been 255,000 cfs. The Dallas gage peaked at 47 feet with an observed flow of 81,000 cfs. It was estimated that without the upstream reservoirs Dallas would have reached a stage of 60 feet with a corresponding flow of 260,000 cfs. Releases from Lake Livingston reached a maximum of 100,800 cfs. This release surpassed the previous high release of 75,000 cfs in the 1973 flood. These releases produced a flow of 106,000 cfs with a record crest elevation of 30.07 feet at Liberty in southeast Texas.

q. Storm of December 1991. An upper level low over Arizona forced the jet streams through Mexico and into Texas drawing moisture out of the Pacific. The moist air in the mid and upper layers of the system was the catalyst for the rains that occurred over the next several days. This resulted in some 100,000 square miles in the eastern-half of Texas receiving in excess of 4 inches of rainfall. The heaviest rainfall totals fell along the Edwards Plateau where 12 to 16 inches amounts were common. December also saw one of its largest floods in terms of water volume.

Most of the Trinity River Basin received rainfall amounts of between 4 to 6 inches during this 6 day period. Some of the recorded rainfall amounts in the Elm Fork watershed were as follows: Denton 2SE 4.27 inches, Forestburg 5.60 inches, Frisco 6.11 inches, Gunter 6.41 inches, Lewisville Dam 6.61 inches, Muenster 4.58 inches, Pilot Point 5.80 inches, Slidell 6.09 inches, and Valley View 6.11 inches. This rainfall produced about 175,000 acre-feet of runoff, which raised Ray Roberts Lake from elevation 633.89 feet to 638.74 feet. The peak inflow into the lake was approximately 57,600 cfs. This rainfall also produced about 250,000 acre-feet of runoff, which raised Lewisville Lake from elevation 523 feet to 530 feet. The peak inflow into the lake was approximately 82,000 cfs. The Carrollton Gage on the Elm Fork crested at 10.32 feet with a flow of 11,500 cfs. If it had not been for the three USACE lakes on the Elm Fork it is estimated the flow at the Carrollton Gage would have been 182,000 cfs.

r. Storm of June 2007. From 4 to 30 June 2007, heavy rains occurred over the Elm Fork Trinity River Basin, with 12.21, 20.01, 12.98, and 12.00 inches recorded at the Denton, Gainesville, Muenster, and Lewisville gages, respectively. The flood produced by the June 2007 Storm reached stages of 9.68 feet at Elm Fork Trinity River near Carrollton gage, and 27.11 feet at Clear Creek near Sanger gage. The peak discharges at Elm Fork Trinity River near Carrollton gage, and Clear Creek near Sanger gage were 9,970, and 12,800 cfs, respectively.

s. Storm of May 2015. Consistent rain in Central Texas during one of the wettest months on record led to widespread flooding in the Dallas-Fort Worth and Houston areas, killing a total 31 people in Texas and Oklahoma, and ending a four year-long drought. The statewide average monthly rainfall was a record 8.81 inches, and multiple local rainfall records were also set during the month. Stations in the Elm Fork Trinity River Basin received 9 to 28 inches in a 3-week period, with a center at Gainesville, which received 28.9 inches. The flood resulting from this storm reached a stage of 13.12 feet at Elm Fork Trinity River near Carrollton gage, 28.92 feet at Clear Creek near Sanger, and 30.98 feet at Elm Fork Trinity River near Lewisville. The peak discharges for this storm at Carrollton, Sanger, and Lewisville were 26,700, 18,900, and 18,600 cfs, respectively. Figures 4-6 through 4-15 show the inundation of USACE property at Ray Roberts Lake during the 2015 flood.

t. Storm of May-June 2016. A slow moving upper-level low pressure area caused significant rainfall followed by flood throughout North Texas during the first week of June 2016. Due to seemingly incessant rainfall in the Elm Fork Trinity River watershed, the elevation of Lewisville Lake was increased by almost four feet. The Lewisville Lake elevation increased from 523 feet to 527.12 feet from May 27 to June 3, and two feet of that increase took place in less than 24 hours. The elevation of the lake continued to rise at a rapid rate from excessive inflows from rain swollen streams and rivers. The flood resulting from this storm reached a stage of 26.87 feet at Elm Fork Trinity River near Lewisville. The recorded peak discharges for this storm at Lewisville was 7,330 cfs.

The USGS historical information of all Major Floods is listed in Supplementary Table 4-8 (pg. T4.8-1). The data shown in the table covers the period 1908 to 2016.

Figures 4-6 through 4-17 are scenes of 2015 and 2016 floods at Ray Roberts Lake.



Figure 4-6. 2015 Flood - Below the Lake Flood Gates



Figure 4-7. 2015 Flood - Inundation Area



Figure 4-8. 2015 Flood - Outlet Discharge



Figure 4-9. 2015 Flood - Boat Dock



Figure 4-10. 2015 Flood - High Water Level



Figure 4-11. 2015 Flood - Flooding in the Park



Figure 4-12. 2015 Flood - Isle Du Bois State Park



Figure 4-13. 2015 Flood - Isle Du Bois State Park



Figure 4-14. 2015 Flood - Isle Du Bois State Park

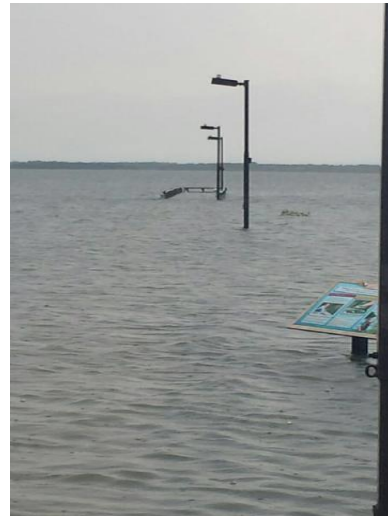


Figure 4-15. 2015 Flood - Isle Du Bois State Park



Figure 4-16. 2016 Flood - High Water Level

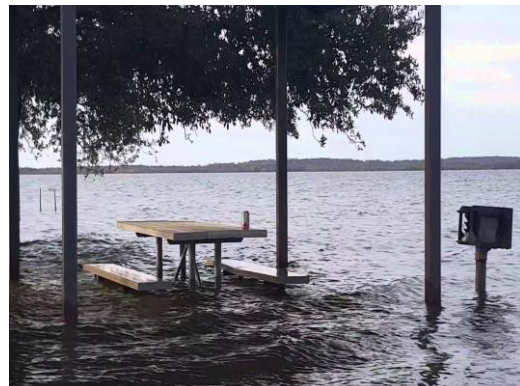


Figure 4-17. 2016 Flood - Picnic Area

4-07. Runoff Characteristics. Floods may occur at almost any time of year in the Elm Fork Trinity River watershed. Steep slopes in the upper part of the Elm Fork basin produce high runoff during periods of heavy rainfall. Initial rainfall losses range from 0.30 inches to 1.00 inches, with uniform infiltration rates between 0.04 to 0.15 inches per hour. Results of historical storm studies of the May-June 1989, April-May 1990, and December 1991 events indicate that the Snyder's values for a unit hydrograph are; C_t of 1.8 and a C_p of 0.75. Unit hydrographs for the sub-basins in the Ray Roberts watershed were developed using these C_t and C_p values.

The computed monthly and annual inflow volumes, based on change in lake storage, are shown in Table 4-9 (pg. T4.9-1). The monthly inflow volume exceedance frequency curves, based on data from 1940 to 2017 are shown on Plates 4-3 through 4-14. Table 4-10 shows the monthly inflow volume frequency for the 5-, 10-, 25-, and 50-year events.

TABLE 4-10
Ray Roberts Lake Monthly Inflow Volume Frequency

MONTH	Inflow Volume in Acre-Feet Frequency of Occurrence in Years			
	5	10	25	50
January	26,679	40,134	57,921	71,377
February	47,451	72,645	105,949	131,143
March	61,051	90,763	130,041	159,753
April	47,384	96,169	215,062	321,680
May	52,201	91,542	209,567	406,274
June	34,942	61,207	140,000	271,323
July	14,410	31,689	74,686	116,889
August	6,016	11,727	27,936	51,871
September	15,382	34,377	82,117	130,872
October	19,449	42,552	122,416	290,720
November	44,170	71,684	108,056	135,571
December	24,587	53,946	128,165	205,668

NOTE: Based on computed inflows for period January 1940 to June 2017.

4-08. Water Quality. Texas Commission on Environmental Quality (TCEQ) publishes the assessment reports for the quality of surface waters for Trinity River basin in the biennial Integrated Report (formerly called the "Texas Water Quality Inventory and 303(d) List") that evaluates the quality of all surface waters in Texas. The Integrated Report is prepared according

to Clean Water Act Sections 305(b) and 303(d). In the report, the TCEQ classifies water bodies based on the body's ability to support its designated uses, or its "Level of Support".¹¹

The designated uses for Ray Roberts Lake are flood control, water supply, aquatic habitat, and contact recreation. According to the 2014 TCEQ report, Ray Roberts Lake (Segment ID 0840) has a number of water quality concerns. In the report, Dissolved Oxygen, Ammonia Nitrogen, Nitrate and Phosphorous are classified as "Screening Level Concern". All other monitored parameters were classified as either "Fully Supporting" their designated uses of public water supply and fish consumption, "No Concern", or "Not Assessed". The results of the 2014 report are reproduced in Tables 4-11A and 4-11B.

The United States Environmental Protection Agency (EPA) also released the water body reports and water quality assessment for Ray Roberts Lake for period 2002 to 2010. The designated uses of the lake were assessed. In the 2002 Report, Elm Fork above Ray Roberts Lake (lower 7.5 miles of segment) was found to be "impaired". All others were found to be "good".¹²

The USGS sampled five sites for Ray Roberts Lake on three different occasions in 1998 (29 January 1998, 19 May 1998, 30 July 1998) for various biological and chemical parameters.¹³ The mean concentrations of the various parameters for four of those sites are shown in Table 4-11C. The sampling results indicate that the levels of the various biological and chemical constituents monitored are generally within the criteria set by the Texas Department of Water Resources, and do not have any present or potential water quality problems.

Temperature stratification will develop in Ray Roberts Lake during the spring and summer months. The stratification is usually greatest during June through August with a maximum temperature differential of 12 to 18 degrees Fahrenheit. During this period the water in the lower levels will be depleted of dissolved oxygen. This condition starts to occur at a depth 30 feet to 40 feet below the surface of the lake. The oxygen depletion forces the fish population to live in the top 20 feet of the lake during the summer months.

For calendar years 1995-1996, the turbidity readings taken by the Dallas Water Utilities are shown below in Table 4-11D. Turbidity is measured in Nephelometric Turbidity Units (NTU). An NTU count of less than 5 NTU's is not noticeable to the human eye. Based on the values for turbidity and previously discussed water quality samples, the water quality of Ray Roberts Lake is good for drinking and other municipal uses.

¹¹ <https://www.tceq.texas.gov/waterquality/assessment/14twqi/14txir>

¹²

https://iaspub.epa.gov/waters10/attains_watershed.control?p_huc=12030103&p_state=TX&p_cycle=2002&p_report_type=A

¹³ https://waterdata.usgs.gov/nwis/inventory?search_station_nm=ray%20roberts&search_station_nm_match_type=beginning&huc2_cd=12&format=station_list&group_key=NONE&list_of_search_criteria=huc2_cd%2Csearch_station_nm

Ray Roberts Lake receives effluent from nine municipal wastewater treatment plants under permits from the TCEQ. In addition, Ray Roberts Lake watershed has a substantial amount of agricultural production which contributes to nonpoint source pollution. The point source dischargers and nonpoint pollutant sources plus modest loadings of nitrogen and suspended solids from upstream tributaries supply sufficient nutrient concentrations to support substantial phytoplankton communities.

The phytoplankton populations are potentially responsible for occasional taste and odor problems in the water. Measured chlorophyll concentrations have indicated relatively high levels of phytoplankton. During several summer seasons phytoplankton productivity has been especially high. At those times, blue green algae generally predominated over green algae and diatoms. According to the Waterways Experiment Station (WES) Aquatic Plant Research Facility at Lewisville Lake, Hydrilla infestation exists in Ray Roberts Lake. In August 1997 the total area of infestation was estimated to be approximately 2,000 acres.

TABLE 4-11A**TCEQ Integrated Assessment Report General Use and Aquatic Life, 2014**

Major Constituents	Mean Concentration	LOS
Dissolved Oxygen Screening Level (mg/l)	3.4	CS
E. coli (colonies/100 ml)	3.7	NC
Total Dissolved Solids (mg/l)	168.4	FS
pH (Standard Units)	9.2	FS
Temperature (F)	32.4	FS
Ammonia Nitrogen (mg/l as N)	—	CS
Sulfate (SO ₄) (mg/l)	15.7	FS
Orthophosphorus (µg/l)	—	FS
Nitrate (NO ₃) (µg/l)	0.5	CS
Chloride (Cl ⁻) (mg/l)	14.8	FS
Chlorophyll-a	—	NC
Phosphorus (mg/l)	—	CS
Copper (µg/l)	1.4	FS
Zinc (µg/l)	5.9	FS

LOS: Level of Support

FS: Fully Supporting

NC: No Concern

CS: Screening Level Concern

TABLE 4-11B

TCEQ Integrated Assessment Report Public Water Supply Use and Fish Consumption Use,

2014

Major Constituents	Mean Concentration	LOS
Lead (µg/l)	0.5	FS
Barium (µg/l)	49.92	FS
Selenium (µg/l)	—	—
Arsenic (µg/l)	2.5	FS
Cadmium (µg/l)	0.2	FS
Nickel (µg/l)	1.9	FS
Nitrate (µg/l)	0.1	FS
Fluoride (µg/l)	0.1	FS
Chromium (µg/l)	2.5	FS

LOS: Level of Support

FS: Fully Supporting

TABLE 4-11C**USGS Water Quality Sampling, 1998**

Major Constituents	Mean Concentrations (1)			
	Station AC	Station AL	Station BC	Station DC
Dissolved Oxygen @ 1.0 ft depth	8.6	8.9	8.6	9.1
Dissolved Oxygen @ 10.0 ft depth	8.3	8.6	8.3	9.0
Specific Conductance (mho/cm)	286.7	286.3	284.0	285.0
Total Dissolved Solids (mg/l)	—	—	—	—
pH (Standard Units)	8.3	8.3	8.3	8.5
Temperature (F)	68.5	68.6	68.9	71.3
Carbon Dioxide (CO ₂)	1.2	—	—	0.8
Alkalinity (mg/l as CaCO ₃)	100.0	—	—	96.7
Hardness, non-carbonate (mg/l as CaCO ₃)	2.5	—	—	5.0
Transparency (Secchi disc, m)	1.5	—	—	0.9
Ammonia Nitrogen (mg/l as N)	0.4	—	—	
Sodium (dissolved) (mg/l as Na)	16.0	—	—	16.5
Potassium (dissolved) K (mg/l)	4.3	—	—	4.4
Chloride (CL) (mg/l)	16.4	—	—	16.6
Sulfate (SO ₄) (mg/l)	15.9	—	—	16.2
Calcium (Ca) (mg/l)	34.7	—	—	34.2
Magnesium (Mg) (mg/l)	3.8	—	—	3.8
Silica (SiO ₂) (mg/l)	1.5	—	—	1.9
Fluoride (F) (mg/l)	0.2	—	—	0.2
Manganese (Mn) (µg/L)	14.9	—	—	13.0
Fecal Coliform (2)	(colony count/100 ml)*			
Winter	E1	E12	—	40
Spring	E1	E10	—	E1
Summer	E1	E2	—	E1

(1) Measurements are in mg/L unless otherwise stated. Mean averages are taken at a 1.0-foot depth unless otherwise stated. The water quality sampling for all parameters was conducted on the following dates: Winter: 29 Jan 98; Spring: 19 May 98; and Summer: 30 Jul 98. (2) The Fecal Coliform with "E" indicates the data is estimated.

TABLE 4-11D**Dallas Water Utilities Turbidity Data, 1995-1996**

Station	R4 (Elm Fork Trinity Branch)	R5 (Isle Du Bois Branch)	R6 (Main Body of Lake)
Average NTU	12.45	9.25	14.20
Average NTU	20.15	20.65	56.00
Average NTU	4.40	3.30	6.90
Standard Deviation from Average	5.00	4.80	14.50

Note: Values for Standard Deviation are also in units of NTU's.

4-09. Channel and Floodway Characteristics. The Elm Fork of the Trinity River between Ray Roberts Dam and Lewisville Lake is shallow, with banks 2 to 5 feet above the valley floor, and is located in a broad flat flood plain. This channel is bounded by the Ray Roberts Greenbelt, a USACE project, on both sides between Ray Roberts Dam and the upper portion of Lewisville Lake. The existing channel capacities are shown in Table 4-12.

Based on estimates of channel roughness and a limited number of available cross-sections, it is estimated that the river channel will contain all discharges up to and including roughly 4,000 cfs. However, with a discharge of 6,000 cfs overbank flooding will occur along the left bank in the vicinity of the mouth of Bray Branch. The overbank flooding, extending from about river mile 56.5 to river mile 57.2, and upstream on Bray Branch for about a mile, will inundate about 200 acres of bottom lands. A discharge of 8,000 cfs will inundate some additional areas on top of those previously mentioned. Further downstream, channel capacities downstream of Lewisville Lake range from 7,000 cfs in the Elm Fork at Carrollton to 13,000 cfs at Dallas to 24,000 cfs in the Trinity River at Oakwood.

The locations of the USGS stream gages in the Trinity River basin are shown on Plates 5-1a through 5-1d. Discharge rating curves for the key control points are shown on Plates 4-15 through 4-18. These curves are only valid for rough use. The rating curves used by the Water Resources Branch are adjusted by the USGS for changing conditions and reflect the current stage-flow relationships at the gages.

TABLE 4-12**Channel Capacities on the Elm Fork and Trinity River**

Reach	Channel Capacity -Existing (cfs)
Elm Fork Lewisville Dam to Carrollton Gage	7,000
Carrollton Gage to mouth of Elm Fork*	7,000
Trinity River, Dallas Gage	13,000
Trinity River, Rosser Gage	15,000
Trinity River, Oakwood Gage	24,000

NOTE: *Flows above 5,500 are known to limit the use of the Indian Creek Golf Club), Dallas Gun Club, and Luna Vista Golf Course.

Table 4-13 and Plate 4-21 show flood peak travel times between upstream gages and Ray Roberts Lake and between Ray Roberts Dam and downstream gages on the Elm Fork Trinity River.

TABLE 4-13

Flood Peak Travel Times between Ray Roberts Lake and the
Trinity River near Oakwood Gage

Stream Gaging Station and Stream	Travel Time in Hours	Cumulative Travel Time in Hours
Ray Roberts Dam to Lewisville Lake	12	12
Lewisville Lake to the Elm Fork at Carrollton gage	8	20
The Elm Fork at Carrollton to the Trinity at Dallas gage	24	44
The Trinity at Dallas to the Trinity near Rosser gage	60	104
The Trinity near Rosser to the Trinity at Trinidad gage	72	176
Trinity at Trinidad to the Trinity near Oakwood gage	72	248

NOTE: Based on “Ray Roberts Dam and Lake Water Control Manual”, revised on December 1997.

4-10. Upstream Structures. The NRCS has constructed 42 flood retarding structures upstream of Ray Roberts Dam and has plans for one additional structure in the city of Denton. All 42 of these structures are located in the Elm Fork Trinity River watershed. These reservoirs have cumulative flood storage of 32,245 acre feet and partially control runoff from 106 square miles. These structures will have very little impact during high water flows into Ray Roberts Lake. However, they will reduce the inflow into the lake during normal and low flow periods. The SCS structures also trap sediment produced from upstream watersheds.

4-11. Downstream Structures. Ray Roberts Lake is part of the Trinity River basin system, which presently consists of eight major USACE flood control projects. Seven of these Corps projects are located downstream from Ray Roberts Lake, which are Lewisville Dam, Benbrook Dam, Bardwell Dam, Grapevine Dam, Joe Pool Dam, Lavon Dam, and Navarro Mills Dam.

Lewisville Dam is located 30.0 miles downstream from Ray Roberts Dam. The drainage area between the dams is 968 square miles. The total Ray Roberts Lake drainage area is 692 square miles. The total watershed drainage area for Lewisville Lake is 1,660 square miles including the Ray Roberts Lake watershed. Lewisville Lake is regulated by the USACE SWF District and is operated in conjunction with Ray Roberts Lake.

4-12. Economic Data. The Elm Fork watershed is predominantly urban, with an economy based on trade, transportation and utilities, professional business service, and education and healthcare. Medium sized metropolitan areas such as Denton are located within the basin.

Based on the information published by U.S. Census Bureau, the population within the Elm Fork basin has continually increased over the last 50 years in most counties. Counties that are more metropolitan have grown more rapidly than the rural counties - some of which have grown very little. Population projections indicate that growth is anticipated to continue. County Business Patterns (CBP), a database published by the U.S. Census Bureau, provides valuable information on the number of industrial and business establishments within a particular county.¹⁴ Sectors that are typically heavy consumers of water include: agriculture and livestock, steam-electric, mining, manufacturing, professional, scientific and technical services, health care and social assistance, accommodation and food services, and military installations. For some of the major counties in the basin, CBP data was reviewed for a 12-year period from 2000 to 2012. Water use in the watershed area is approximately 90 percent municipal, 3 percent manufacturing, and 7 percent mining, agricultural and steam-electric.¹⁵ The most concentrated water uses in the area are municipal use in Denton County and mining use in Wise County.

The following sections provide information on population, agricultural production, and industries in the counties within the Ray Roberts Lake watershed and surrounding areas.

¹⁴ www.census.gov/econ/cbp/

¹⁵ <http://www.twdb.texas.gov/waterplanning/rwp/regions/c/index.asp>

a. Population. Ray Roberts Lake watershed comprises parts of Denton, Cooke, Collin, Grayson, Montague and Wise Counties. Based on the 2016 U.S. Census Bureau data, Denton County has a population of 806,180, of which 17 percent (or 134,385) is in Denton, the county seat. Cooke County has a population of 39,266, of which 42 percent (or 16,320) is in Gainesville, the county seat. Grayson County has a population of 128,235, of which 32 percent (or 41,567) is in Sherman, the county seat. Gainesville is 18 miles north of the lake and Denton is 10 miles southwest of the lake.

The population growth of the 6 major counties within the Elm Fork basin over the past 50 years is shown in Table 4-14. Although varying proportions of the total population of the counties listed lie within the watershed boundaries, the entire population of each county is provided.

TABLE 4-14

Population Growth of Counties within the Elm Fork Basin

County	1960	1970	1980	1990	2000	2016
Cooke	22,560	23,471	27,656	30,777	36,462	39,266
Collin	41,247	66,920	144,576	264,036	491,675	939,585
Denton	47,432	75,633	143,126	273,525	432,976	806,180
Grayson	73,043	83,225	89,796	95,021	110,595	128,235
Montague	14,893	15,326	17,410	17,274	19,117	19,414
Wise	17,012	19,687	26,575	34,679	48,793	64,455

NOTE: Source: Census.gov

b. Agriculture. According to the 2016 Region C Water Plan, municipal supply comprises about 90 percent of the region's water use.¹⁶ This amount of water use is projected to grow in coming decades. It is interesting to note that Region C, with over 25 percent of Texas' population, had only 8.3 percent of the state's water use in 2011. Table 4-15 lists the acreage of cropland planted in each major crop, the total agricultural acreage, the quantity of livestock, and the agricultural income for each county during the year 2012.

¹⁶ www.twdb.texas.gov/waterplanning/rwp/regions/c

TABLE 4-15**Agricultural Production for Major Counties in the Ray Roberts Lake Watershed, 2012**

Product	Montague County	Cooke County	Grayson County	Wise County	Denton County	Collin County
Corn (acres)	D	1,173	19,644	D	4,782	20,379
Cotton (acres)	D	D	1,045	—	D	D
Oats (acres)	370	3,536	749	D	979	646
Sorghum (acres)	50	6,642	6,548	1,745	7,329	15,535
Wheat (acres)	5,633	19,706	48,010	7,745	29,580	36,529
Cropland Planted (acres)	74,027	132,431	176,390	114,295	131,894	136,635
Land in Farms and Ranches (acres)	488,672	503,827	431,268	487,078	383,533	312,806
Cattle (1000 head)	58	64	46	58	41	36
Crop Market Value*	8,419	18,507	66,859	16,410	35,317	50,811
Livestock Market Value*	36,512	44,812	25,089	33,457	101,679	27,001
All Agriculture Market Value*	44,931	63,319	91,948	49,867	136,995	77,812

- NOTES: 1. (D) Withheld to avoid disclosing data for individual farms.
 2. Data from 2012 Census of Agriculture, prepared by National Agricultural Statistics Service, U.S. Department of Agriculture.
 3. *Quantity given in \$1,000s.

c. Industry. Due to the size of the Elm Fork basin, a large variety of industries are represented in the area. According to U.S. Census employment data, the major industries in the region are wholesale and retail trade, manufacturing, and arts, leisure and hospitality. A 2012 U.S. Bureau of Labor Statistics report indicates that chemical, industrial, and electronics manufacturing, and food and beverage processing are the industries most concentrated in the watershed. According to the 2016 Region C Water Plan, municipal use comprises about 90% of the region's total water use, and is projected to increase to 60 percent by 2060.¹⁷ Table 4-16

¹⁷ www.twdb.texas.gov/waterplanning/rwp/regions/g/

gives the estimated number of people employed in various industries in each county, as compiled by the 2014 United States Census.

TABLE 4-16

Employment in Counties within the Elm Fork Basin, 2014

Industry	Number Employed					
	Cooke County	Collin County	Denton County	Grayson County	Montague County	Wise County
Agriculture, Forestry, Fishing & Hunting	2	20	77	100	0	0
Construction, Mining, Oil & Gas	1,981	16,200	9,908	1,980	1,352	5,804
Manufacturing	3,138	18,662	12,304	7,088	207	1,869
Trade, Transportation & Utilities	4,226	67,049	50,550	8,841	978	4,599
Finance, Insurance, & Real Estate	453	48,149	16,208	2,251	179	628
Professional, Scientific & Business Services	317	59,034	15,594	999	250	374
Education & Healthcare	1,129	46,786	27,733	9,219	528	2,684
Arts, Leisure & Hospitality	1,475	44,387	29,467	4,814	494	1,705
Communication & Information	118	12,897	3,637	428	30	70
Public Administration	330	25,991	15,732	2,559	0	617
Other Services	628	15,547	10,326	1,419	224	1,302
Total	13,797	354,722	191,536	39,698	4,242	19,652

NOTE: Data from the United States Census, 2014.

d. Flood Damages. The flood damages prevented in the Elm Fork Trinity River basin by Lewisville Dam and Lake and Ray Roberts Dam and Lake during fiscal year 2016 were estimated to be \$2,266,703,700. The cumulative damages prevented since the completion of the projects in 1951 and 1987 through 2016 are \$67,904,368,056.

CHAPTER V - DATA COLLECTION AND COMMUNICATION NETWORKS

5-01. Hydrometeorological Stations.

a. Facilities. The Water Resources Branch of the USACE, Fort Worth District, the NWS, and the USGS cooperate to collect hydrometeorological data and maintain a reliable communication network. Plate 5-1a shows the locations of the USGS stream gages in the Elm Fork Trinity River basin. Commercial television weather services provide current radar and forecasted weather conditions to assist the Water Resource Branch in monitoring storm events.

1. Precipitation Gages. The NWS and USGS maintain a network of rain gages and observers throughout the Trinity River basin. The NWS precipitation gages used to forecast runoff in the Elm Fork Trinity River watershed are listed in Table 5-1 and are shown on Plate 6-1, respectively.

TABLE 5-1
NWS Precipitation Gages

Name of Station	Description
Argyle 1.6 NNW	Discontinued
Carrollton	Recording
Celina 7.3 NE	Discontinued
Denton 2 SE	Recording
Flower Mound 2.3 NE	Recording
Forestburg 5.5	Recording
Frisco	Recording
Gainesville	Recording
Gunter 5S	Discontinued
Lewisville Dam	Recording
Little Elm 2.5 NE	Discontinued
Muenster	Recording
Oak Point	Recording
Pilot Point	Discontinued
Ray Roberts Lake	Discontinued
Sanger 1.8 WSW	Discontinued
Shady Shores 3.9N	Recording
Slidell	Discontinued
Valley View	Discontinued

2. Weather Radar Sites. The NWS maintains 12 Doppler radar sites across Texas for surveillance of immediate weather conditions. The NWS also cooperates with the Department of Defense to obtain radar information from four military sites in Texas.

3. Stream Gages. The USGS has maintained 35 stream gages in the Elm Fork Trinity River basin, a number of which have been discontinued. The gages are listed in Table 5-2A. The stream gages designated as stations for forecasting and regulating Ray Roberts Dam are listed in Table 5-2B. A hydrologic gage network was established for use in connection with the operation of the Ray Roberts Dam. The hydrologic gage network for the Elm Fork Trinity River basin is shown on Plate 5-1d. The travel times for flows is shown on Plate 5-2.

TABLE 5-2A

USGS Stream Gages in the Elm Fork Trinity River Basin

Station Number	Name of Station	Description
08050200	Elm Fork Trinity SWS No 6 near Muenster	Discontinued
08050300	Elm Fork Trinity River near Muenster	Discontinued
08050400	Elm Fork Trinity River at Gainesville	Recording
08050500	Elm Fork Trinity River near Sanger	Discontinued
08050800	Timber Creek near Collinsville	Recording
08050840	Range Creek near Collinsville	Recording
08051000	Isle Du Bois Creek near Pilot point	Discontinued
08051100	Ray Roberts Lake near Pilot Point	Recording
08051135	Elm Fork Trinity River at Greenbelt near Pilot Point	Recording
08051190	Elm Fork Trinity River Above Aubrey	Discontinued
08051500	Clear Creek near Sanger	Recording
08050200	Elm Fork Trinity River near Denton	Discontinued
08052630	Little Elm Creek SWS No 10 near Gunter	Discontinued
08052650	Little Elm Creek near Celina	Discontinued
08052700	Little Elm Creek near Aubrey	Recording
08052745	Doe Br at US Hwy 380 near Prosper	Recording
08052780	Hickory Creek at Denton	Recording
08052800	Lewisville Lake near Lewisville	Recording
08053000	Elm Fork Trinity River near Lewisville	Recording
08053009	Indian Creek at FM 2281, Carrollton	Recording
08053010	Indian Creek at Herbron Parkway, Carrollton	Discontinued
08053030	Furneaux Creek at Josey Lane, Carrollton	Discontinued
08053090	Hutton Branch at Broadway, Carrollton,	Discontinued
08053100	Jones Valley Creek Trib near Forestburg	Discontinued
08053430	Denton Creek At Cr 2513 near Decatur	Recording
08053500	Denton Creek near Justin	Recording
08054000	Denton Creek near Roanoke	Discontinued

TABLE 5-2A (CONTINUED)**USGS Stream Gages in the Elm Fork Trinity River Basin**

Station Number	Name of Station	Description
08054200	Gamble Branch near Argyle	Discontinued
08054500	Grapevine Lake near Grapevine	Recording
08055000	Denton Creek near Grapevine	Recording
08055500	Elm Fork Trinity River near Carrollton	Recording
08055560	Elm Fork Trinity River at Spur 348 Irving	Recording
08055600	Joes Creek at Dallas	Discontinued
08055700	Bachman Branch at Dallas	Discontinued
08056000	Elm Fork Trinity River at Frasier Dam	Recording

TABLE 5-2B**Regulating Stations for Ray Roberts Dam**

Station Number	USGS Gage Station	Method of Reporting
08055000	Denton Creek near Grapevine	Recording
08055500	Elm Fork Trinity River near Carrollton	Recording
08057000	Trinity River at Dallas	Recording
08062500	Trinity River near Rosser	Recording
08065000	Trinity River near Oakwood	Recording

b. Reporting. Data Collection Platforms (DCPs) have been installed at all USACE Fort Worth District lakes, and at numerous stream gages and precipitation stations. The DCPs transmit hydrometeorological data using the Geostationary Operational Environmental Satellite (GOES) to the NOAA Center in Wallops Island, Virginia. The data are then decoded and re-transmitted using Domestic Satellites (DOMSATs), making the data available for nationwide reception. The Water Management Office captures, processes, and stores the data in the Fort Worth District Water Control Data System (WCDS).

The Water Management Office collects and stores the majority of hydrometeorological data in the WCDS. Thus, hourly lake elevations and stream gage stages are stored in the WCDS network. Some meteorological and hydropower data are collected by telephone. Project personnel collect precipitation, evaporation, and, maximum and minimum air temperature data from weather stations. The information is reported to the Water Management Office by e-mail or sometimes by facsimile and telephone.

The Water Management Office personnel use the data in the WCDS to operate the 27 lakes that the Fort Worth District manages. All the data entered into the WCDS is stored in a database and used for water management decisions, to generate reports, and to conduct hydrologic studies. The Water Management Office also serves as a source of hydrologic data for state and local government agencies and the general public.

c. Maintenance. Maintenance costs are shared among the USGS, NWS, USACE, TWDB, and various river authorities. Maintenance and repair of the weather station instrumentation are the responsibilities of the NWS. Maintenance and repair of stream gaging stations are the responsibility of the USGS. Assistance in gage repair can be obtained by contacting the USGS in Fort Worth, Texas, at (817) 263-9545.

5-02. Water Quality Stations. The USGS collected data and monitored the water quality in Ray Roberts Lake at one station near the dam. In addition, TCEQ monitors water quality using 180 active monitoring stations throughout the Trinity River basin.¹⁸

a. Facilities. The ten designated sites where USGS water quality samples were taken for Ray Roberts Lake were Stations AC, AL, BC, CC, DC, EC, FC, GC, HC and JT. The chemical, biological, and field parameters were measured at these eight sites. Table 4-11C shows the most recent data for constituents sampled on Ray Roberts Lake. Funds are no longer available for the USGS sampling program.

The Trinity River basin is divided into 41 segmented water bodies by TCEQ to report water quality information. The Segment 0840, “Ray Roberts Lake”, is designated to provide the water quality data for the reservoir.

b. Reporting. The USGS summarizes and publishes its collected water quality data annually in the “Water Resources Data: Texas” book for its current sampling locations. However, Ray Roberts Lake is not sampled yearly and only years for which it was sampled are published in the yearly data book.

The “Texas Integrated Report of Surface Water Quality,” formerly called the “Texas Water Quality Inventory and 303(d) List,” evaluates the quality of surface waters in Texas, and provides resource managers with a tool for making informed decisions when directing agency programs. The TCEQ publishes the report every 2 years (in even-numbered years). The water quality assessment results for Ray Roberts Lake are included in the report.

The City of Dallas Water Utilities also has six water quality sites (Stations R1-R6) in and around Ray Roberts Lake. Three of these sites are located in Ray Roberts Lake. The other three locations are on tributaries that flow into the lake. Table 5-2C lists the locations of these six water quality sites by physical location and by Longitude and Latitude.

c. Maintenance. Maintenance and calibration of the equipment related to water quality are conducted or monitored by USGS and TCEQ.

¹⁸ <https://www.tceq.texas.gov/waterquality/assessment/02twqi/basins/trinity.html>

TABLE 5-2C**City of Dallas Water Quality Stations in/near Ray Roberts Dam**

Station Number	Watershed Locations	Coordinate
R1	Elm Fork Trinity at F.M. 2071 (South of Gainesville, TX).	Latitude 33°34'57" Longitude 97°07'49"
R2	Range Creek at U.S. Hwy 377	Latitude 33°30'17" Longitude 96°54'28"
R3	Buck Creek at U.S. Hwy 377 (Just South of Tioga, TX)	Latitude 33°26'48" Longitude 96°55'24"
R4	Ray Roberts Lake at F.M. 3002 crossing (In the Elm Fork Trinity arm)	Latitude 33°25'59" Longitude 97°06'28"
R5	Ray Roberts Lake at old F.M. 455 (In the Isle Du Bois arm)	Latitude 33°23'39" Longitude 97°01'28"
R6	Ray Roberts Lake, 100 yards north of the outlet works	Latitude 33°21'22" Long. 97°03'00"

5-03. Sedimentation and Degradation Ranges.

a. Facilities. The sedimentation ranges, which are needed to determine the rate of sedimentation and the location of sediment deposits, were established as directed in Engineer Regulation (ER) 1100-2-240 and Engineer Manual (EM) 1100-2-4000.

1. Sedimentation Ranges. There are 34 sedimentation ranges in the Ray Roberts Lake area (Plate 4-2). The ranges cross the lake normal to the original stream flow as practical. The elevations and locations of the monuments are referenced to appropriate datum systems established by other Federal agencies. Monuments are used at multiple locations for future survey at common reference points. The TWDB uses bathymetric survey independent of the USACE established sedimentation ranges.

2. Degradation Ranges. There are 5 degradation ranges downstream of Ray Roberts Dam (Plate 4-2). Each range consists of two or more permanent monuments placed at selected locations along the discharge channel downstream of the dam.

b. Reporting. The frequency of sedimentation surveys will depend on hydrologic conditions and the need for determining sediment deposition and storage depletion. Normally, a period of no more than 20 years would elapse between sedimentation surveys. However,

sedimentation surveys are currently done periodically depending on need and funding availability. Complete or partial surveys will be made of degradation ranges, as found necessary on the basis of reconnaissance.

Design area-capacity for Ray Roberts Lake up to elevation 660.0 feet was based on 1:24,000 scale, 10-foot contour USGS maps of the reservoir area. That data was compiled in a table dated 1985. In 2008, TWDB performed a volumetric survey of the lake up to approximately 632.0 feet. Estimates of area-capacity were made up to elevation 632.5 feet. The 2008 TWDB survey results indicated that the surface area had reduced from 29,350 acres in the original design to 28,646 acres and the volume reduced from 799,600 acre-feet of water in the 1985 data to 788,490 acre-feet of water at the top of the conservation pool elevation 632.5 feet.

c. Maintenance. Project personnel will inspect the survey monuments to determine their respective conditions. A report will be forwarded to the Water Management Office following the inspection that describes the condition of the monuments not found, destroyed, or otherwise disturbed. Monuments and witness points that have been damaged or are missing will be replaced and reset. Completion of monument surveys is dependent on funds and personnel availability.

5-04. Recording Hydrologic Data. Hydrologic information is recorded as the Water Management Office receives it. The recording procedures for each type of data are as follows:

a. Stages and Lake Elevations. Stream stage and lake stage data are recorded every 15 minutes and transmitted every hour by the DCPs through a GOES Satellite to Wallops Island, VA, then retransmitted to a DOMSAT. The District's WCDS accesses the data by a downlink. The recorded data and monthly data summaries are kept in the reservoir logbooks and in other Water Management Office files. Additional data sets from non-Corps reservoirs are received from the Internet, by facsimile, and/or by telephone.

b. Precipitation. Hourly precipitation data from numerous DCPs across the state are transmitted to the Water Management Office in the manner described in paragraph 5-04.a. The Water Management Office also receives precipitation data from the NWS and other precipitation observers through the Automated Field Observations and Services (AFOS) system and stores the data in the WCDS. The NWS daily state precipitation summary is filed and retained for approximately 1 year. The Water Management Office receives daily rainfall and weather reports from 22 of the 25 District lakes, including Ray Roberts Lake.

c. Temperature Data. The lake personnel record the daily maximum and minimum air temperatures at the lake.

d. Radar Reports. The Water Management Office receives radar images and weather information from commercial weather services by cable TV. This information is used primarily for short-term decision making. The weather reports are updated throughout the day by the NWS.

e. Hydropower. The Water Management Office requires hydropower release data and megawatts produced. The data is provided daily (Monday through Thursday) by email or fax from the powerhouse to the Water Management Office for hydropower generation occurring during the previous 24 hour period.

5-05. Communication Network. Ray Roberts Lake is served by telephone, facsimile, email, and cell phone. The telephone number for the Ray Roberts Lake project is at the Lewisville Lake project office and is (469) 645-9100.

The National Telecommunications and Information Administration (NTIA), Department of Commerce, assigned radio frequencies exclusively to the USACE. The assigned VHF FM frequencies are 163.5125 and 163.4375 MHz. Both of the VHF FM frequencies are maintained at most project offices and in some vehicles assigned to the Fort Worth District. The radio equipment using the VHF FM frequencies will only transmit about 20 miles. Therefore, radio communications cannot be made between the Lewisville Lake project office and the Fort Worth District Office, or between the other district lakes.

If necessary, the Fort Worth District Emergency Operation Center (EOC) can contact other districts in the SWD by HF side-band radio during an emergency. This radio frequency is good for communications between the EOCs in Fort Worth, Texas, Galveston, Texas, Little Rock, Arkansas, and Tulsa, Oklahoma.

5-06. Communication with the Project.

a. Water Resources Branch with Project Office. The primary mode of communication between the Ray Roberts Lake project office and the Water Resources Branch is by telephone. In addition, the project is served by facsimile, email, and cell phone as backups to the primary mode of telephone. Should communication between the project and the District be disrupted, the Lake Manager will direct regulation of the lake on his or her own initiative in accordance with the Emergency Rules and Regulations listed in Section 7-05 and Exhibit E of this manual.

b. Between Project Office and Others. The Lake Manager will maintain a current list of the residents and/or property endangered or inconvenienced by large and/or prolonged releases in order to give adequate warning before such releases. Warning of possible flood conditions can be conveyed by telephone, radio, television, citizens-band radio, use of law enforcement personnel, and civil defense agencies and their communications systems. National Guard, Reserve Military Units, and citizen volunteers may also be needed to convey warning messages. Plate 5-4 shows a schematic of the primary lines of communication for use in routine communications and in case of an emergency.

5-07. Project Reporting Instructions. Both daily lake operation information and emergency lake operation information will be submitted to the Water Management Office of the Fort Worth District.

a. Daily Operations. Daily reservoir data will be submitted to the Water Management Office on regular working days by facsimile or electronic mailing between 0800 and 0845 hours each morning for transmission of hydrologic data. For electronic mailing, the Internet Web site is: (<http://www.swf-wc.usace.army.mil>). Project personnel will confirm gate changes and promptly report all scheduled or unscheduled equipment outages affecting water control by telephone at (817) 886-1551 or by facsimile at (817) 886-6472 or by email at CESWF-OD-L@usace.army.mil. The Water Resources Branch may request additional information as needed.

Daily data reported to the District Office include the following: (1) As of 0800 hours – Reservoir elevation: number of gates open and increments of opening, precipitation and evaporation for the preceding 24 hours, weather conditions and maximum and minimum temperatures, if required. (2) Each gate operation – All changes in gate operation, including time of gate operation, increments of opening, and reservoir elevation at time of each gate operation for the preceding 24 hours. (3) Stage report – During flood periods, besides the regular 0800-hour reading from the reservoir and reporting gages, include the 0000-hour (midnight) reading, which may be read from the recorder charts.

b. Emergency Operations. In the event of an emergency or flood situation, the Lake Manager will notify key personnel in the Fort Worth District Water Management Office. A list of these names will be posted on the project bulletin board. These names are shown on page iii, Notice to Users of This Manual. If unusual conditions arise during non-working hours, one of the persons listed on page iii should be contacted.

5-08. Warnings. Before any major increase in discharge due to operation of the gates, warning of such operation shall be initiated. A warning horn will be sounded for 10 seconds to alert people immediately downstream of the dam at least 2 minutes before any appreciable increase or decrease in the release rate from the dam. After the horn sounds, the operator will observe the downstream area to ensure that no one remains there. Signs in the discharge area shall state the meaning of the warning signal. A warning horn will be sounded from the powerhouse only during the initial releases. The law enforcement agencies shown in Table 5-3 may also be contacted to assist in warning the public and evacuating downstream areas.

TABLE 5-3

Law Enforcement and Ray Roberts Dam and Lake Project Telephone Numbers

Agency	Telephone Number
Texas Department of Public Safety, Lewisville, Texas	(972) 221-8081
City of Lewisville Police	(972) 219-3600
City of Denton Police	(940) 349-8181
Ray Roberts Lake Manager	(469) 645-9100
Ray Roberts Lake Rangers	(877) 444-6777
TRA Office Dispatch	(817) 467-4343
Sheriff, Denton County	(940) 349-1700

CHAPTER VI – HYDROLOGIC FORECASTS

6-01. General. Hydrologic forecasts of stream flow amounts are made daily to maintain the current status of the Trinity River basin for flood control and water supply.

a. Role of Corps of Engineers. Hydrologic forecasts are made by the Water Management Office for use in the regulation of lakes to maximize flood control, water supply, and other authorized purposes. The forecasts are furnished to project personnel and other USACE personnel with a need for this information. Planned changes in the release rates are furnished to the National Weather Service River Forecast Center (NWS-RFC) in Fort Worth, Texas. The Public Affairs Office, which is kept informed of the lake conditions, makes news releases.

b. Role of Other Agencies. The NWS-RFC provides information about river flow and flood forecasts to the USACE and the general public. The NWS Weather Wire circuit disseminates this information to subscribing government agencies and news media. The National Weather Service–Weather Service Forecast Offices (NWS-WSFO) issues routine reports containing the following information:

1. Weather forecasts (daily forecasts, severe weather forecasts, and 5-day extended forecasts).
2. Quantitative precipitation forecasts: Four successive 6-hour precipitation forecasts are updated every 12 hours. Three successive 24-hour precipitation forecasts are updated every 12 hours.
3. Three-day river stage forecasts, when conditions warrant, from the NWS-RFC.
4. Urgent priority messages such as severe weather warnings, severe weather watches and statements, and instructions from civil defense centers during emergency situations.
5. Other information reports, on a periodic basis:
 - (a). Winter weather and road conditions
 - (b). River and flood warning bulletins
 - (c). Damage reports
 - (d). Thirty-day weather forecasts

6-02. Flood Control Forecasts.

a. Requirements. Flood forecasts are required whenever substantial rainfall has fallen above or below Ray Roberts Dam or during the evacuation of the flood pool from Ray Roberts Lake.

b. Methods. Water Managers continually monitor and adjust water releases at USACE projects based on ever-changing hydrometeorological conditions. The Corps Water Management System (CWMS) is the automated decision support tool developed for USACE Water Managers. CWMS tracks the hydrologic cycle and performs scenario-based forecasts that can include stage and flow forecasts, project release scheduling and release review, emergency activation alerts, inundation mapping and economic damage reporting. The CWMS Automated Information System was developed by USACE Hydrologic Engineering Center (HEC) under funding from the Water Management Community of Practice and has been implemented to varying degrees at various USACE Water Management Offices. A CWMS forecasting model has been developed for the Elm Fork Trinity River basin by the Fort Worth District, HEC, and USACE MMC (Modeling, Mapping, and Consequences) Production Center. The USACE makes the following forecasts with assistance from the NWS.

1. Predicting Inflow into Ray Roberts Lake. A rainfall-runoff HEC-HMS model was developed within CWMS by the Fort Worth District for the Trinity River basin above the Trinity River below Dallas gage. This model is used to predict the inflow into Ray Roberts Lake. The inflow forecasting model consists of HEC-METVUE and HEC-HMS models that are linked to real-time data with CWMS. Both models use a 1-hour time interval.

Precipitation estimates are available from two main sources: precipitation gages and radar. The NWS uses the data from these sources to produce a suite of hydrologic forecasts. Weather Surveillance Radar–1988 Doppler (WSR-88D), also known as Next Generation Weather Radar (NEXRAD), observes the presence of severe weather and calculates the speed and direction of the weather. The WSR-88D also provides estimated quantitative area precipitation amounts.

The NWS adds to the accuracy of the WSR-88D quantitative precipitation estimates (QPE) through a procedure for improving the radar estimates of rainfall that is referred to as “ground truthing.” The precipitation data set produced from the ground truthing is known as the Multi-sensor Precipitation Estimate (MPE). The NWS and other agencies may poll some automated gages on a 4-hour basis, and the poll results may also be used for ground truthing.

Hourly NWS gridded rainfall data is downloaded from the NWS West Gulf Forecasting Center in real-time and processed into HEC-DSS format using HEC-METVUE. The HEC-HMS model is then used to compute runoff from the gridded precipitation. Initial and uniform losses are adjusted to real-time basin conditions within CWMS. These losses are subtracted from the precipitation hyetograph at each subbasin grid cell to obtain the rainfall runoff hyetograph. Each grid cell hyetograph is then routed and combined by the HEC-HMS model to obtain the total

inflow hydrograph for Ray Roberts Lake. A map of the Elm Fork Trinity River Model subbasins is shown on Plate 4-1.

There is a DCP at Ray Roberts Lake which records the lake elevation. An inflow hydrograph can be computed using observed lake elevations, an elevation-capacity table, and hourly lake releases.

The HEC-HMS model is executed with forecast time and an initial estimate of loss rates as determined by the user. The computed hydrographs at Ray Roberts Lake are compared with observed runoff volume, shape, and time of peak. If the comparison is not favorable, then subbasin loss rates are adjusted accordingly and the HEC-HMS model is re-executed. This calibration process is repeated until the comparisons are favorable. This process ultimately results in a forecasted inflow into Ray Roberts Lake.

2. Predicting Lake Levels. The forecasted inflows as computed by the HEC-HMS model are routed into Ray Roberts Lake. The model will add the routed inflows to the storage in the lake and subtract the releases to forecast the lake elevations.

3. Predicting Flow at Downstream Control Points. The flood forecasting system is used to predict flows in the Elm Fork Trinity River at Carrollton, Dallas, Rosser, and Oakwood gages. The predicted flows for the control points located downstream of the project are computed by combining the estimated local flow in the river channel and the potential routed releases from Grapevine and Lewisville Lake. If the predicted flows exceed the downstream channel capacity, no releases will be made, unless the lake level is above 640.5 feet, where surcharge releases are required.

(a). Estimating Local Flow. Local flow forecasts can be obtained from two sources: the NWS-RFC's river forecast model or Water Management Office HEC-HMS model. If the latter method is used, the subbasin hydrographs for the uncontrolled areas above Lewisville Lake are computed using the same procedure discussed in paragraph 6-02.b.(1).

(b). Routing Reservoir Releases to Downstream Control Points. The HEC-HMS model is used to route releases from Ray Roberts Lake, Grapevine Lake, and Lewisville Lake to downstream points by using the Modified Puls and Muskingum flow routing methods. The releases are determined based on the predicted available channel capacity at the downstream control points. The determined releases are then incorporated into the HEC-HMS model. The observed flows at the downstream control points on the Elm Fork Trinity River are provided by stream gages. The downstream control points are located on the Trinity River at the Carrollton, Dallas, Rosser, and Oakwood gages. Plate 4-19 shows flood crest travel times in the Elm Fork Trinity River basin from the Ray Roberts Lake near Pilot Point to the Trinity River near Oakwood gage.

(c). Regulated Flow. The releases from Grapevine Lake and Lewisville Lake combine with flows from the local Elm Fork Trinity River watershed and are measured by

the gage on the Elm Fork Trinity River at Carrollton.

6-03. Conservation Purpose Forecast. The city of Dallas and the city of Denton have contracted for conservation water supply storage in Ray Roberts Lake of 591,700 acre-feet and 207,900 acre-feet below elevations 632.5 feet. The conservation storage was initially authorized for water supply, hydropower, fish and wildlife, and general recreation. The hydropower facility was discontinued in 2003 and decommissioned in August 2014. Conservation storage forecasts are made when needed based on forecasted inflow, historical average evaporation, and estimated demand.

6-04. Long-Range Forecast. Long-range weather forecasts are made by the NWS Climate Prediction Center, and available at the “Outlooks Index” in the website http://www.cpc.ncep.noaa.gov/products/OUTLOOKS_index.shtml. The Outlooks website contains both temperature and precipitation forecast for “Monthly to Seasonal” and “Extended Range” categories. Special products, such as current UV Index forecasts and soil moisture outlooks are also available on this website.

6-05. Drought Forecast. Appendix IX, Drought Contingency Plan, for the Trinity River Basin Master Manual provides information on historical droughts in the basin and methods to determine the severity of a drought. In general, the three factors used to determine the severity of a drought are the lake content, lake inflow, and the Palmer Drought Severity Index (PDSI). The PDSI reflects the cumulative excess or deficiency in moisture relative to seasonal norms and typically ranges from +4 to -4 but may exceed these values. A PDSI of -4 indicates that abnormally dry conditions have prevailed. The NWS publishes the PDSI about once a week. Drought conditions can be accessed at this website: http://www.cpc.ncep.noaa.gov/products/monitoring_and_data/drought.shtml

CHAPTER VII – WATER CONTROL PLAN

7-01. General Objectives. Ray Roberts Dam and Lake was authorized for flood control, water quality, water supply, Fish and Wildlife, and recreation on the Elm Fork Trinity River. Flood control releases from Ray Roberts Dam require coordination from the other flood control projects within the Trinity River basin to optimize maximum basin wide benefits. Emergency regulations must be coordinated with the Fort Worth District Water Management Office as discussed in paragraph 7-04.

All elevations referred to in Chapter 7, unless noted otherwise, are in feet, National Geodetic Vertical Datum of 1929 (NGVD29). The datum conversion from NGVD29 to North American Vertical Datum of 1988 (NAVD88) is: $NGVD29 + 0.0 \text{ feet} = NAVD88$ for Ray Roberts Dam and Lake.

7-02. Project Constraints. At elevation 632.5, with the two slide gates fully open, the discharge is 6,600 cfs. At the top of flood pool elevation 640.5 with the two slide gates fully open, the discharge is 6,900 cfs. The outlet works rating curves are shown on Plate 7-3.

a. **Outlet Works.** The outlet works consist of a 13.0 foot diameter conduit with an invert at elevation of 551.0 feet. The outflow is controlled by two 6.0' x 13.0' broome type gates. The rate of change in opening and closing the gates should not be more than 0.5 feet per half hour. The gates should be operated as symmetrical as practical with an allowable difference in gate openings not to exceed one foot. Short of full open, the maximum usable gate setting for sustained, controlled flood releases is 7.0 feet. Before fully opening the flood control gates, raise the gates from 7.0 feet to 7.5 feet to 8.0 feet in half hour time steps. Leave the gate settings at 8.0 feet for at least 2 hours before raising to the fully open position. This is to provide time for the tailwater to develop. Note that some surging from the conduit may occur at the 8.0 feet setting. Raise each gate in turn from 8.0 feet to full open in one continuous process. When closing the gates from the full open position, each gate in turn should be lowered from full open to a 7.0 feet setting in one continuous operation. Once both gates are set at 7.0 feet, additional reduction in gate opening height may proceed at the normal rate of closing.

The normal rates of change in release may be exceeded at the discretion of the Chief, Water Management Office. Additionally, the Fort Worth District Water Management Office, or the Lake Manager, at their discretion, may exceed the normal rates of change in release in the event of drowning, accidents, failure of operational facilities, severe weather, or other emergencies deemed to require a more rapid rate of increase or decrease in the rate of release. Should the Fort Worth District Water Management Office need to deviate from the reservoir regulation release plan, the Southwestern Division Water Management Office will need to be contacted for a deviation approval. Refer to Section 7-15 (Deviation from Normal Regulation) for more details regarding deviations.

b. Spillway. The perched uncontrolled overflow spillway consisting of a 20 feet in length and 100 feet in width concrete broad crested weir. Crest elevation is at 645.5 feet, which is 5 feet above the top of flood control pool elevation 640.5 feet. The spillway is located on the right abutment about one mile beyond the right end of the embankment. At elevation 658.8 feet, the 1974 maximum design water surface, the spillway discharge capacity was computed as 14,500 cfs. The updated flow according to the latest spillway rating curve has a value of 13,600 cfs. At elevation 667.2 feet, the Probable Maximum Flood elevation of the 2012 Study, the spillway discharge capacity is 35,600 cfs. A spillway rating curve is available on Plate 7-4.

7-03. Overall Plan for Water Control. There are eight multi-purpose projects operated by the Fort Worth District Water Management Office within the Trinity River basin. These eight projects are: Bardwell, Benbrook, Grapevine, Joe Pool, Lavon, Lewisville, Navarro Mills, and Ray Roberts. Ray Roberts Dam and Lake, on the Elm Fork of the Trinity River, is an integral part of the USACE master plan for flood control in the Trinity River Basin. Ray Roberts Lake flood control operations will be closely coordinated with Lewisville Lake flood control operations to maximize flood damage reduction benefits downstream of Lewisville Dam.

7-04. Standing Instructions to Project Personnel. The Fort Worth District Water Management Office will give instructions for making releases from Ray Roberts Dam to project personnel, as applicable. For gated releases, project personnel will make gate changes as necessary to provide the required rate of release. The Fort Worth District Water Management Office should be notified if irregularities are observed such as abnormal turbulence, abnormal flow patterns, riprap displacement, and/or significant erosion. The lake will normally be regulated in accordance with the plan of regulation presented in paragraph 7-05 of this chapter.

Should an emergency situation occur, such as a power outage, inoperable gates, drowning or other accident, the Fort Worth District Water Management Office will be notified immediately. In the event communications with the Fort Worth District Water Management Office are disrupted, the lake regulation will become the responsibility of the Lake Manager, in accordance with Plate 7-2, "Emergency Regulation Plan" and Exhibit D, "Standing Instruction for Lake Manager" of this manual. The Lake Manager will immediately make every effort to re-establish communications with the Fort Worth District Water Management Office.

7-05. Flood Control.

a. General. Release of flood water from Ray Roberts Dam and Lake will be coordinated with releases from the other eight Trinity River basin flood control projects to reduce flooding in the Trinity River basin. The lake levels will be lowered to their respective conservation pools at the earliest practical date in order to provide flood protection against potential subsequent storms.

By design, there are no significant flood damage reduction benefits to be realized along the reach of the Elm Fork of the Trinity River between Ray Roberts Dam and Lewisville Lake. The flood storage capacity in Ray Roberts Lake was designed to serve as a virtual extension of the Lewisville Lake flood storage capacity. Ray Roberts Dam will be operated in conjunction with

Lewisville Dam to maximize flood damage reduction benefits downstream of Lewisville Dam. This goal will generally be realized by operations that maximize the availability of flood storage space in Lewisville Lake.

The regulation of releases through Ray Roberts Dam is not subject to any downstream control point capacities. However, controlled releases through Ray Roberts Dam will not normally be made at rates which reduce the availability of flood storage space in Lewisville Lake. Therefore, the control point capacities shown in Table 7-1, which apply for regulated releases through Lewisville Dam, must be considered in determining maximum beneficial rates of release through Ray Roberts Dam. For downstream travel time to Lewisville Dam refer to Table 7-2.

Should the Fort Worth District Water Management Office need to deviate from the reservoir regulation release plan, the Southwestern Division Water Management Office will need to be contacted for a deviation approval. Refer to Section 7-15 (Deviation from Normal Regulation) for more details regarding deviations.

b. Normal Regulation for Flood Control. Ray Roberts Dam and Lake will be regulated to reduce flooding downstream from Lewisville Dam. Gates will normally be closed and will remain closed until it has been determined that the flow downstream from Lewisville Dam has crested or is forecast to crest below the control point capacities shown in Table 7-1. The Normal Regulation for Flood Control schedule is described below and is also shown on Plate 7-1.

TABLE 7-1

Downstream Control Points

River Channel and USGS Gaging Station	Control Capacity (cfs)
Elm Fork Trinity River near Carrollton	7,000
Trinity River below Dallas	13,000
Trinity River near Rosser	15,000
Trinity River near Oakwood	24,000

Table 7-2**Travel Times**

River Channel and USGS Gaging Station	Estimate Travel Time (Hrs.)	Cumulative Time (Hrs.)	Distance below Dam (river miles)
Lewisville Lake	12	12	30

TABLE 7-3**Low Flood Pool Release Guidance**

Pool Elevation Range (ft)	Flood Pool Range (%)	Release Rates* (cfs)
632.5 – 632.6	0.0 – 1.1	150
632.6 – 632.7	1.1 – 2.1	150 – 300
632.7 – 632.9	2.1 – 4.3	300 – 500

*Desired rate of release will vary with prevailing rates of inflow, lake evaporation, and water supply withdrawals. General objective is to evacuate from 4.3% to 2.1% of the flood pool in about one week, from 2.1% to 1.1% the following week, then from 1.1% to top of conservation pool (632.5) over an additional two to three week period.

General rules for making flood releases are listed below:

(a). **Lake elevation at or below 632.5.** No flood control releases will be made when the lake level is at or below the top of conservation pool (elevation 632.5). Releases from the conservation storage will be made as instructed by the Fort Worth District Water Management Office at the request of the city of Dallas and the city of Denton.

(b). **Lake elevation between 632.5 and 633.5.** If the lake elevation is between elevation 632.5 and elevation 633.5 feet (about 10 percent of flood pool), flood releases will be made not to exceed 4,000 cfs. These releases will be coordinated with other flows in the Elm Fork system so as not to exceed 4,000 cfs at the Carrollton gage on the Elm Fork and 13,000 cfs at Dallas, 15,000 cfs at Rosser and 24,000 cfs at Oakwood gages on the Trinity River.

(c). **Lake elevation between 633.5 and 635.5.** If the lake elevation is forecasted to rise to between elevation 633.5 and elevation 635.5 feet (about 35 percent of flood pool), releases will be made not to exceed 4,000 cfs. Releases when combined with downstream flows should not exceed 5,500 cfs at the Carrollton gage on the Elm Fork, and 13,000 cfs at

Dallas, 15,000 cfs at Rosser and 24,000 cfs at Oakwood gages on the Trinity River, respectively.

(d). Lake elevation between 635.5 and 640.5. If the lake elevation is forecasted to rise to between elevation 635.5 and elevation 640.5 feet (top of the flood pool), releases may be made with gates fully opened. However, releases should not cause the flow to exceed 7,000 cfs at the Carrollton gage on the Elm Fork, and 13,000 cfs at Dallas, 15,000 cfs at Rosser and 24,000 cfs at Oakwood gages on the Trinity River, respectively.

(e). Lake elevation between 640.5 and 645.5. When the lake elevation is in surcharge above top of flood control pool elevation 640.5 feet, and is forecasted to remain below elevation 645.5 feet, surcharge releases will normally be made at full open gate capacity without regard for downstream conditions. When Lewisville Lake is spilling or forecast to spill, consideration will be given to impacts at Ray Roberts Lake, Lewisville Lake, Grapevine Lake and areas downstream of Lewisville Dam in making release decisions.

(f). Lake elevation above 645.5. When the lake elevation is above 645.5 feet, the gates should be fully open. The gates will remain fully open until the lake elevation falls to elevation 645.5 feet, at which time adjust the releases according to (c) above.

c. Emergency Regulation for Flood Control. If communications between the Fort Worth District Water Management Office and the Project Office (located at Lewisville Dam) are disrupted, the Lake Manager, on his own initiative, will direct regulation of the reservoir as described in Exhibit C - Standing Instructions to Lake Manager until communication is restored. The term "emergency reservoir regulation" applies at any time when personnel at the dam have lost communications with the District Office personnel who normally direct regulation procedures. In the event of a communication failure during imminent failure of the dam due to any of the possible failure modes as described in Chapter 5 of the "Ray Roberts Dam - Operation and Maintenance Manual", the Project Manager may open or close the outlet work gates as deemed necessary in an attempt to prevent a dam failure. Continued efforts will be made to re-establish communications with the Fort Worth District Water Management Office. The Emergency Regulation Plan is shown on Plate 7-2.

d. Trinity River System Balancing.

1. Unbalanced System. In general, the Trinity River projects will be operated to approximately balance the percent flood pool utilized at each project. During the time that Trinity River projects are not balanced, priority of releases will be given to the project with the least amount of storage capacity left in percent of storage space. Next priority goes to the project having the second least amount of capacity in percent of storage space and so forth, until all lakes are balanced or all channel capacity in the Trinity River is used. For tandem projects (e.g., Ray Roberts Lake and Lewisville Lake), or projects which have significantly greater flood storage capacity, additional weighting may be given. These releases when combined with flows downstream will not exceed discharge as shown in Table 7-1.

2. **Balanced System.** Lakes in the system will be regulated insofar as practical, to maintain approximately the same available storage space (within +/- 5%) in their respective flood control pools as measured in terms of percent flood storage occupied. For tandem projects (e.g., Ray Roberts Lake and Lewisville Lake), or projects which have significantly greater flood storage capacity, additional weighting resulting in a beneficial imbalance may be given.

7-06. Recreation. Recreation is an authorized project purpose, however, there is no storage or releases specifically designated for recreation. Requests for special releases will be considered as the situation warrants. All recreation area access roads are constructed above the top of conservation pool, elevation 632.5. Access roads will be inundated as the lake level rises into the flood control pool but parks may still be accessible.

7-07. Water Quality. Water quality is an authorized project purpose. Ray Roberts Dam contains a multi-level low flow system. Lower flows are released through the low flow outlet works. Compliance with Public Law 92-500 requires that all federal facilities be managed, operated, and maintained to protect and enhance the quality of water and land resources through conformance with applicable federal, state, interstate, and local substantive standards.

7-08. Fish and Wildlife. The discharge from Ray Roberts Dam is expected to vary, with the local sponsors requesting varying amounts depending on their needs. By Memorandum of Agreement (Exhibit C) between the local sponsors, Cities of Dallas and Denton, and the U.S. Government, the minimum release from the project will average 15 cfs (10 MGD), in order to maintain the environmental quality to support fish and wildlife on the Elm Fork Trinity River. By agreement the release rate would be apportioned to the monthly flow rates in Table 7-3 as follows:

Table 7-4

Minimum Continuous Discharges (cfs)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
12	18	30	25	39	22	6	3	5	5	7	7

7-09. Water Supply. The cities of Dallas and Denton have water supply storage contracts dated 15 August 1980 and approved 16 September 1980 for 799,600 acre-feet below elevation 632.5 feet.

The city of Denton utilize the low flow system to divert water directly to their treatment plant. The amount of water pumped is reported daily to the Fort Worth District Water Management Office the following morning. Releases from the outlet works are made to supply water for Dallas. The city of Dallas requests releases from Ray Roberts Dam and Lake to the Fort Worth

District Water Management Office for water supply. The water supply contracts are shown in Exhibit B and C.

7-10. Hydroelectric Power. Hydropower was not authorized as a Federal project purpose for Ray Roberts Dam and Lake. The City of Denton constructed the hydroelectric facility at Ray Roberts Dam. Construction was completed on 21 July 1991. The turbine is capable of making releases at a rate between 36 and 167 cfs. The hydropower generation was discontinued in 2003 and the facility was decommissioned by removing the transformers in August of 2014. The FERC license was surrendered by the city of Denton in September 2014.

7-11. Navigation. Navigation is not a project purpose.

7-12. Drought Contingency Plans. When the Elm Fork Trinity River basin is in a drought condition and the lake levels are lower than normal, refer to the Drought Contingency Plan for the Elm Fork Trinity Basin, Appendix IX of the Trinity River Master Manual. The plan presents a broad outline of actions necessary to manage the water resources in the Fort Worth District Water Management Office during a drought.

7-13. Emergency Action Plan. The Emergency Action Plan (EAP) contains detailed instructions and procedures to be followed by USACE personnel at the Lewisville Dam Project Office to properly handle any event at the Ray Roberts project that could develop into an emergency condition. The most current edition of the EAP is located in the Geotechnical Branch, Fort Worth District and is dated December 2017. The contact information in the EAP is updated annually. Copies of this EAP are also available in the Fort Worth District Water Management Office and at the Lewisville Lake Project Office.

7-14. Other. There are no other issues associated with this project.

7-15. Deviation from Normal Regulation. There are occasions when it is necessary or desirable to deviate from the water control plan for short periods of time. Prior approval for a deviation is obtained from the Southwestern Division Water Management Office (CESWD-RBT-W). The requirement for prior approval of action from CESWD may be suspended in extreme emergencies. All deviations will be recorded and will be stored in electronic format. Analysis of the expected impacts of a proposed deviation will include consideration of its effect on dam safety. Deviation requests usually fall into the following categories:

a. **Emergencies.** Emergencies that can occur are drowning(s), failure of the operation facilities, and flushing of pollutants. Under emergency conditions necessary action is taken immediately by the Lake Manager, unless such an action creates an equal or worse condition. For emergencies, the Fort Worth District Water Management Office will be informed as soon as practicable as to the nature of the emergency and the subsequent response by telephone, email, or fax. Follow-up written documentation explaining the deviation will be furnished to the Southwestern Division Water Management Office as soon as practical.

b. Unplanned Minor Deviations. There are unplanned instances that create a temporary need for minor deviations from the normal regulation of the lake. These unplanned instances are not considered emergencies and require prior approval for deviations. Construction accounts for the majority of unplanned deviations. Possible reasons for unplanned deviations include stream crossings of pipelines, bridge work, embankment repair, utility placement, and other major construction contracts. Requests for changing release rates can vary from a few hours to a few days.

Each request is analyzed on its own merit. Consideration is given to upstream and downstream watershed conditions, potential flood threats, conditions of the lake, and possible alternative measures. In the interest of maintaining good public relations, the requests for deviation are usually approved, provided that there are no adverse effects on the overall operation of the project, or other projects. Approval of these minor deviations will be obtained from the Southwestern Division Water Management Office.

c. Unplanned Major Deviations. There are unplanned instances that may be considered for major deviations from the normal regulation plan, but are not emergencies. Requests for changes in release rates generally involve short time periods ranging from a few hours to a few days in an effort to minimize damages or optimize benefits. Flood control releases account for the major portion of these incidents and typical examples include project pre-releases or flows exceeding downstream channel capacity.

Each request is analyzed on its own merit. In evaluating the proposed deviation, consideration must be given to the upstream and downstream watershed conditions, potential flood threats, condition of the lakes, and possible alternative measures that can be taken. Approval of these major deviations will be obtained from the Southwestern Division Water Management Office.

d. Planned Deviations. Each planned deviation is analyzed on its own merit. Sufficient data on flood potential, lake and watershed conditions, possible alternate measures, benefits to be expected and possible effects on other authorized and useful purposes will be presented with each deviation. Each recommended deviation is submitted in writing to the Southwestern Division Water Management Office for review and approval. An example of a planned deviation is a need to maintain or inspect an aspect of the project. Approval of such deviations will only be granted when the evaluations have been fully reviewed and verified to be necessary. Any concerns with "Dam Safety" will be taken into consideration as well with deviation approvals.

7-16. Rates of Release Change. When practical, the change in opening of the outlet works will be limited to opening no more than 0.5 feet every 30 minutes. Once a gate is half-open, and it is necessary to open it further, gate shall be opened as quickly as possible to full open. The gates should be operated either fully open or at eight feet opening or less of their full opening. All gate operations should be as symmetrical as practicable with an allowable difference in gate openings not to exceed 1.0 feet. Decreasing changes in release rates shall be accomplished in a manner that minimizes damage to the downstream channel. The decreases will be at a rate not to exceed 0.5 feet every 30 minutes.

7-17. Operation Curves and Tables. The Spillway Rating Curve is shown on Plate 7-4. The Low Flow Outlets Rating Curves are shown on Plate 7-5. The Evaporation Curves are shown on Plate 7-6. The Tailwater Rating Curve for the outworks and the spillway are shown on Plates 7-7 and 7-8, respectively. The Area Capacity Curves are shown on Plate 7-9. The tabulated values are shown on pages T7.5-1 thru T7.5-62 of this water control manual.

CHAPTER VIII – EFFECT OF WATER CONTROL PLAN

8-01. General. Ray Roberts Lake is a multiple-purpose project that is designed for flood control regulation and is operated in conjunction with eight other USACE dams and various channel improvements and levees operated to provide flood protection along the Trinity River. Ray Roberts Dam and Lake operates in conjunction with Lewisville Dam on the Elm Fork of the Trinity River to provide flood control to the Elm Fork Trinity River at Carrollton, Texas, and to supply water to the City of Denton and City of Dallas, Texas areas.

8-02. Flood Control.

a. **Spillway Design Flood.** A Spillway Design Flood study was performed for Ray Roberts Dam at the time it was initially designed. A Design Memorandum No. 1 Hydrology on “Aubrey Lake, Elm Fork Trinity River, Texas” was prepared by USACE, Fort Worth District in October 1974 and revised in November 1975. The spillway design flood hydrographs for Ray Roberts Dam and Lake were discussed in Section IV, Supplements No. 1, No. 2, and No. 3 of the Memorandum.

1. **Spillway Design Storm.** The spillway design storm rainfall in the design of spillway at the Ray Roberts Dam site, and for testing the spillway at Lewisville Dam, were computed in accordance with a method described in Hydrometeorological Report No. 33, dated April 1956, subject, Seasonal Variations of the Probable Maximum Precipitation East of the 105th Meridian for Areas from 10 to 1,000 Square Miles and Durations of 6, 12, 24 and 48 hours. Because the two dam sites studied were near the boundary between Zone 4 and 5, it was deemed advisable to use a straight line interpolation between the two zones for depth-duration-area relation. Two storm patterns were considered: One with the storm centered above Ray Roberts Dam and the other centered on the area between Lewisville Lake and Ray Roberts Dam. A basin shape reduction factor of 10 percent was applied to the maximum probable rainfall for the two areas. The reduction factor of 10 percent is in accordance with criteria set forth in EC 1110-2-27, dated 7 August 1966, subject, Policies and Procedures Pertaining to Determination of Spillway Capacities and Freeboard Allowances for Dams. The total rainfall for the Spillway Design Storm was 28.00 inches in 48 hours.

2. **Minimum Infiltration Rates.** Runoff factors and infiltration indices which were computed for the Elm Fork Trinity River watershed upstream from Lewisville Dam in connection with preparation of the preconstruction planning studies on Lewisville Lake in 1947 were used in determining the initial loss and infiltration indices for the Elm Fork watershed above the proposed Ray Roberts dam site. In estimating the runoff from the Spillway Design Storm, an initial loss of 0.50 inch and a uniform infiltration rate of 0.05 inch per hour have been adopted. This gave an estimated run-off of 25.28 inches or 90.3 percent of the rainfall for the Spillway Design Storm. The rainfall excess for the Spillway Design Storm is shown on Plate 8-1.

3. Unit Hydrographs. Unit hydrograph determinations were computed for the Elm Fork watershed above Lake Dallas during preconstruction planning studies for the existing Lewisville Lake. Unit hydrograph determinations were used as basis for the adoption of a C_t of 1.95 and C_p640 of 508 for use in Snyder's equations for the derivation of synthetic unit hydrographs for the Elm Fork of Trinity River watershed above Ray Roberts Dam site. The drainage area of 692 square miles was divided into 10 areas each of which has different runoff characteristics, watershed constants and areas as follows: i) lake surface area, ii) area adjacent to the lake composed of numerous small areas with no well-defined drainage divided and the portions of the following eight tributaries above head of lake, iii) Spring Creek, iv) Elm Fork of Trinity River, v) Scott Creek, vi) Wolf Creek, vii) Indian Creek, viii) Buck Creek, ix) Timber Creek, and x) Range Creek. The methods used for developing the unit hydrograph for these areas were as follows:

(a). In the 1972 Hydrology DM No. 1, the lake area at the top of flood control storage (elevation 636.0 feet) was 32,000 acres or about 51 square miles. In the 1974 Hydrology DM No. 1 Supplement No. 3 (revised in September 1975), the top of flood control was raised to elevation 640.5 feet with a lake area at that elevation of 58.0 square miles. The runoff from the 57.7 square miles of the lake was not included in the unit hydrograph for flow into full pool, but runoff rates for the lake area were assumed equal to the rainfall rates and added directly to the computed Spillway Design Flood hydrograph.

(b). One unit hydrograph was constructed for the 90.3 square miles of area adjacent to the lake.

(c). One unit hydrograph was constructed for two areas of 15 and 13 square miles, one for two areas of 26 and 33 square miles, and one each for the four remaining areas of 60, 250, 66, and 81 square miles. The unit hydrographs for all areas listed above were developed using a C_t coefficient of 1.95 and C_p640 value of 508.

4. Spillway Design Flood Hydrographs. In order to determine the critical conditions of Spillway Design Flood at the Ray Roberts Dam site, the Spillway Design Storm was distributed uniformly over the watershed above Ray Roberts Dam and two flood hydrographs were computed. The first hydrograph was determined for natural flow at the dam site based on the distribution graph discussed in Section 8-02, a.3. The computed hydrograph has a peak discharge of 461,000 cfs and volume of 934,200 ac-ft. The second hydrograph representing flow into full reservoir was computed using the unit hydrograph derived for flow into full reservoir plus the run off from the 58.0 square miles reservoir surface at a rate equal to the rate of rainfall. The computed hydrograph with a peak discharge of 494,200 cfs and volume of 941,600 acre-feet was adopted as the Spillway Design Flood.

The routing computations showed that the lake would reach a maximum elevation of 658.8 feet and the peak outflow was 14,500 cfs over the spillway and 7,600 cfs discharge through the outlet works for a maximum total outflow of 22,100 cfs. The design water surface has been established

at elevation 658.8 feet. Plate 8-1 shows the lake elevation and Spillway Design Flood hydrographs computed in the 1974 study.

b. Standard Project Flood. In April 2012 (revised in August 2012), a Spillway Design Flood study for Ray Roberts Lake was prepared under the Dam Safety Assurance Program outlined in Draft ER 1130-2-417. The purpose of the study was to determine, in accordance with current applicable USACE guidance and regulation, if the Ray Roberts Dam existing combination of dam height and spillway discharge capacity is sufficient to pass the Probable Maximum Flood (PMF) while providing sufficient dam freeboard with respect to the hydrologic criteria provided in Hydrometeorological Report No. 51 (HMR-51/52), June 1978, subject: “Probable Maximum Precipitation Estimates, United States East of the 105th Meridian”. The study consisted of hydrologic analysis for Ray Roberts Dam PMF and Standard Project Flood (SPF), as discussed in the following sections. For the SPF study, it was assumed that a Standard Project Storm would occur 5 days prior to the Probable Maximum Storm (discussed in Section 8-02, c.1). Via iterative modeling, the antecedent Standard Project Storm was assumed to have a total rainfall amount equal to 59 percent of the full Probable Maximum Storm rainfall amount to produce approximately one-half the Ray Roberts Lake PMF inflow volume and peak rate of inflow. It was assumed that the Standard Project Storm was centered in the same location as the Probable Maximum Storm and possessed the same ellipse characteristics as the Probable Maximum Storm. The details of Probable Maximum Storm are discussed in Section 8-02, c.1.

The SPF hydrograph representing flow into full pool was computed using the same parameters as in the PMF analysis discussed in Section 8-02, c.4., except rainfall was 59 percent of the Probable Maximum Storm rainfall. The computed SPF hydrograph has a peak inflow of 476,000 cfs. The SPF was routed through Ray Roberts Lake through a series of flood control outlets. The reservoir level of Ray Roberts Lake continued to rise during passage of the SPF and had reached elevation 648.68 feet (3.18 feet above spillway crest) by the beginning of the Probable Maximum Storm.

c. Probable Maximum Flood. The following paragraphs describe the details of PMF analysis in the 2012 study.

1. Probable Maximum Storm. The Spillway Design Storm rainfall above the Lewisville Dam site has been previously determined from HMR-51 in support of the Lewisville Lake hydrologic capacity study. This data was used directly for the Ray Roberts Lake hydrologic capacity study since the distance between the centroids of the respective watersheds was less than 10 miles.

A delineation of the contributing watershed above Lewisville Dam with modeled sub-basins is shown on Plate 8-2. Relatively small sub-basins were used to better capture spatial variations in rainfall and soil infiltration characteristics (hydrologic soil group). The 692 square miles portion of the Elm Fork Basin upstream of Ray Roberts Dam was divided into 31 sub-basins ranging from 6 to 45 square miles in size for an average of about 22 square miles. The 968 square miles

portion of the Elm Fork Basin downstream of Ray Roberts Dam was divided into 32 sub-basins ranging from 13 to 52 square miles in size for an average of about 30 square mile.

Hourly gridded precipitation data from the NWS Next Generation Radar (NEXRAD) product was used to calibrate the model to available observed USGS stream flow and pool elevation hydrographs associated with the runoff events of February 2001, March 2002, June 2007, April-May 2009, and September 2010.

The Probable Maximum Precipitation depth-duration data obtained from HMR-51 of the Lewisville Lake hydrologic capacity study was used in conjunction with computer program HMR-52 to generate the Probable Maximum Storm for Ray Roberts Lake. The Probable Maximum Storm hyetographs were input into the calibrated HEC-HMS rainfall-runoff model for producing and routing of the Probable Maximum Flood (PMF) through Ray Roberts Lake.

The critical storm was determined to be about 5 miles southeast of the city of Gainesville, Texas at latitude 33°33'43" and longitude 97°06'13" with its major axis oriented at 280 degrees and a storm area of 700 square miles. The critical location of the maximum 6-hour period of rainfall within the 72-hour temporal distribution was determined to be hours 61 through 66. The critical storm produced both the maximum basin average rainfall and the maximum Ray Roberts Lake pool elevation. The critical storm produced a basin-wide average precipitation depth of 32.91 inches over the 692 square mile Ray Roberts Lake basin. Average depth for the 968 square mile area between Ray Roberts Dam and Lewisville Dam was 16.17 inches. Average depth for the entire 1660 square mile watershed above Lewisville Dam was 23.15 inches.

2. Minimum Infiltration Rates. Infiltration losses were modeled via the Deficit and Constant loss rate method, primarily to provide a means of deficit recovery via evapotranspiration when calibrating to multi-storm events. Average monthly potential evapotranspiration (PET) values for the Dallas-Fort Worth area, based on 26 years of record, were obtained from the Texas A&M University Irrigation Technology Center. The coefficients by which these respective potential values were multiplied for computation of observed evapotranspiration / deficit recovery were set to zero for single storm events (effectively resulting in zero evapotranspiration loss) and determined via calibration, as required, for multi-storm events.

Precipitation was applied directly to the pool areas with no losses. Base values of constant loss rate for each sub-basin were based on Hydrologic Soil Group (HSG) data contained in the NRCS Soil Survey Geographic Database (SSURGO) in conjunction with research relating the expected range of constant loss rate for respective HSGs (SCS, 1986; Skaggs and Khaleel, 1982). The average, or mid-range constant loss rate values were assigned to the respective HSGs and an area weighted average base value computed for each sub-basin.

The loss rates for the sub-basin in Probable Maximum Storm analysis were selected based on calibration results and the expectation of wet antecedent conditions associated with the onset of a Spillway Design Storm event. An initial deficit/loss of 0.50 inches was used in conjunction with

constant loss rates equal one-half the constant loss rate base values for the respective sub-basins shown on Plate 8-2. Initial base flow used at the onset of the Spillway Design Storm event was 8.92 cfs per square miles for the area above Ray Roberts Dam and 2.95 cfs per square mile for the area below Ray Roberts Dam, based on the respective Ray Roberts Lake inflow (5,498 cfs) and Lewisville Lake inflow (10,940 cfs) prevailing five days after the last significant rainfall of the antecedent event. A ratio to peak threshold of 0.05 was used in conjunction with a recession constant of 0.7 for modeling base flow recession.

3. Unit Hydrographs. A study of the relation of Snyder unit hydrograph parameters to typical basin physical characteristics (L, Lca, Sst) for eight gauged basins in the Dallas-Fort Worth area, ranging in size from 8 to 130 square miles, was performed by USACE Fort Worth District in 1970 (Nelson). Results of this study subsequently provided the basis for development of an equation for estimating Snyder Unit Hydrograph parameters that also included consideration of the effect of main watercourse channel bed type on travel time via the percentage of sand in the soils, and the effect of improved drainage via the percentage of urbanization in a basin. This method was used for initial estimates of the Snyder unit hydrograph time to peak parameter, Tp. Initial estimates of the Snyder peaking coefficient parameter, Cp, were based on engineering judgment.

The adopted base Unit Hydrograph time to peak parameters were based on the work Nelson (1970) performed for similar sized urban basins in the Dallas-Fort Worth area. Average peak runoff per square mile for the events from which Nelson derived the Snyder Tp relationship was about 260 cfs. The Spillway Design Storm for the Lewisville Lake watershed produced peak sub-basin runoff averaging about 1,300 cfs per square mile. The area-weighted average slope of the sub-basin main watercourses lying upstream of Ray Roberts Dam was about 16 feet per mile, and the average for those below Ray Roberts Dam was about 15 feet per mile. HEC-RAS hydraulic models based on a 10-meter digital elevation model (DEM) and the results of field inspections were developed for the respective main watercourses of two representative sub-basins for the purpose of determining the expected reduction in channel travel time for PMF type flows versus flow rates consistent with the peak runoff per square mile of the events from which the base Snyder Tp parameter relationship was developed. Results of the hydraulic analyses indicate channel travel times for PMF magnitude flows may be expected to be 30% to 40% less than channel travel times for flows of a magnitude consistent with the events from which the base Snyder Tp parameter relationship was developed.

For modeling the Spillway Design Storm, the base Unit Hydrographs were peaked by reducing the Snyder Tp by about 35%, producing Unit Hydrograph peaks having an area-weighted average peak discharge about 48% higher than the base Unit Hydrographs. Cp values determined via the calibration effort were used directly for the Probable Maximum Storm analysis.

4. Unit Hydrograph for Flow into Full Lake. The total drainage area of 692 square miles portion of the basin upstream of Ray Roberts Dam was divided into 31 sub-basins. The 968 square miles portion of the basin downstream of Ray Roberts Dam was divided into 32

sub-basins. The sub-basins layout is shown on Plate 8-2. Unit hydrographs for the sub-basins were determined using the method mentioned in Section 8-02, c.3.

5. Routing Reach Parameters. The routing reaches were used in the development of Ray Roberts Lake hydrologic model. Reach routings were performed using a modified puls method based upon storage-discharge relationships for each reach. The storage-discharge relationships were developed using hydraulic models at the respective stream and number of routing steps applicable for each reach estimated via calibration efforts. Hydraulic models previously developed for other studies were used where available. New hydraulic models were based on 10-meter NED (National Elevation Dataset) data and field inspections were developed for the remaining reaches.

6. Probable Maximum Flood Hydrographs. The PMF was generated by inputting applicable critical Spillway Design Storm hydrographs into the calibrated HEC-HMS rainfall-runoff model (as adjusted for PMP analyses). Controlled regulation releases were made through the flood gates as per the water control plan of regulation, which states flood gate releases will be made equal to inflow with no regard to downstream conditions when the pool exceeds top of flood pool elevation 640.5 feet. Gate operations were simulated generally in accordance with the water control plan, with the assumption of less than perfect forecast knowledge and physical operating conditions. The discharge-storage relationship used for Ray Roberts Lake reflected beginning to open the flood gates at pool elevation 639.0 feet, reaching about half open at elevation 645.0 feet, and full open at spillway crest elevation 645.5 feet. Hydrologic modeling of the PMS resulted in the PMF that produced 30.30 inches, or 1,118,700 acre-feet of direct runoff into Ray Roberts Lake, with an associated peak inflow of 969,500 cfs.

The routing computations through Ray Roberts Lake, assuming an infinite height dam, indicated that the lake would rise to a maximum level of 667.2 feet, 2.2 feet above top of dam elevation 665.0 feet, with an associated combined peak outflow of 43,500 cfs, including 7,900 cfs through the flood control outlet works 35,600 cfs over the uncontrolled emergency spillway. Plate 8-3 shows the PMF inflow-outflow hydrographs and the reservoir surface elevations.

Residual precipitation from the Ray Roberts Lake Spillway Design Storm produced an average of 16.17 inches over the 968 square mile downstream basin between Ray Roberts Dam and Lewisville Dam, resulting in 13.58 inches, or 701,100 acre-feet of direct runoff into Lewisville Lake in addition to Ray Roberts Dam releases. Resulting peak pool elevation was 545.7 feet, 13.7 feet above top of flood pool and spillway crest elevation 532.0 feet, with an associated peak discharge of 108,000 cfs.

d. Other Floods. Based on historical data, the maximum known flood elevation at the dam on the Elm Fork Trinity River occurred on 03 May 1990 with a peak elevation of 644.48 feet which is the highest record lake elevation from a computed peak inflow of 171,700 cfs. Additional information on historical floods can be found in Section 4-06 of this manual.

8-03. Recreation. Facilities such as public boat ramps, docks, restrooms, picnic shelters, fishing piers, and campsites have been provided. Refer to Table 2-1 and Plate 2-12 for more details on Ray Roberts Lake's public use areas. Public use of USACE lakes is governed by Title 36 of the Code of Federal Regulations. The 10-year average annual visitation to Ray Roberts Lake is 1,681,401.

A rise or fall in the lake elevation at Ray Roberts Lake has some effect on the lands surrounding the lake, recreational facilities, and project visitation. A rise above elevation 640.5 feet temporarily restricts the use of many recreational facilities due to inundation or loss of access. Other effects associated with high water levels include the accumulation of driftwood, the degradation of surrounding vegetation, and increased shoreline erosion.

A substantial lowering of the pool elevation, due to water supply or hydropower requirements or drought, exposes aesthetically unpleasing banks and mud flats, and creates a boating hazard due to increased shallow areas. Boat ramps and beaches may also become unusable during drawdown periods. Although fluctuation of the pool level is unavoidable, the effects on recreational opportunities can be reduced by placing roads, utilities, and recreational facilities in locations less prone to flooding.

8-04. Water Quality. Water quality is an authorized purpose at Ray Roberts Lake. Four inlet elevations are available to allow the best water quality for water supply flows. Available data indicates that generally good water quality conditions exist. Additional water quality data can be found in Section 4-08.

8-05. Fish and Wildlife. The management of fish and wildlife resources is conducted in cooperation with the Texas Parks and Wildlife Department and U.S. Fish and Wildlife. The species of fish that the Texas Parks and Wildlife Department has stocked the lake with are: largemouth bass, smallmouth bass, channel and blue catfish, flathead catfish, crappie, white bass, hybrid striped bass and sunfish. There are a number of small wildlife management areas surrounding the lake, within which hunting dove, waterfowl, quail, rabbit, squirrel, turkey, feral hog and deer are permitted. Other species of wildlife found in the area include white-tailed deer, gray and red foxes, coyotes, fox squirrels, armadillos, owls, and more than a hundred bird species. Zebra mussels have invaded the lake and there are significant concerns about impacts to plants and wildlife as well as infrastructure.

8-06. Water Supply. A contract with the city of Dallas was approved on 16 September 1980 for water supply of 591,700 acre-feet (74.0 percent) and with the city of Denton for water supply of 207,900 acre-feet (26.0 percent) of the conservation storage below elevation 632.5 feet at Ray Roberts Lake. This contract also included 131,400 acre-feet (74.0 percent) for the city of Dallas and 46,200 acre-feet (26.0 percent) for the city of Denton, for the conservation storage between elevations 515.0 feet and 522.0 feet at Lewisville Lake. Total estimated Non-Federal conservation storage cost for both projects combined is \$181,714,000. Total estimated Non-Federal recreation development cost is \$25,956,000.

The storage initially available in Ray Roberts Lake will produce a dependable yield of 152 cfs, under 1990 watershed development. However, the dependable yield of 152 cfs is based on the critical dry period of 1951 to 1957 and the 100 years of sediment storage. Under the expected 2085 conditions, the dependable yield would be 139 cfs. The combined yield from the Ray Roberts-Lewisville Lakes system was 275 cfs under 1985 conditions (152 cfs from Ray Roberts and 123 from Lewisville). The combined yield from Ray Roberts-Lewisville Lakes system expected under 2085 conditions would be 249 cfs (139 cfs for Ray Roberts and 110 cfs for Lewisville).

8-07. Hydroelectric Power. Hydropower was included as a non-federal project as shown in the original design plans of Ray Roberts Lake. Hydropower facilities installed at Ray Roberts Dam produced 2,146 megawatt hours of power in fiscal year 1996. The hydropower facility was discontinued in 2003 and decommissioned by removing the transformers in August 2014. The FERC license #3939 was officially surrendered by the city of Denton in September 2014.

8-08. Navigation. Navigation is not a project purpose.

8-09. Drought Contingency Plans. The purpose of the Drought Contingency Plan for the Trinity River basin, Appendix X of the Trinity River Master Manual, is to provide a basic reference for water management decisions and responses to a water shortage in the Trinity River basin due to a drought. The Drought Contingency Plan provides a plan for implementing actions necessary for conservation of water supply depending on the severity of the drought and the reservoir level. This plan enables the Water Resources Branch to effectively coordinate with the public and other district elements during drought conditions. The latest Drought Contingency Plan for Ray Roberts Lake is dated August 1991.

8-10. Emergency Action Plan. The Emergency Action Plan (EAP) contains detailed instructions and procedures to be followed by USACE personnel at the Ray Roberts Dam Project Office to properly handle any event at the project that could develop into an emergency condition. The most current edition of the EAP is located at the Geotechnical Office - Fort Worth District and is dated December 1985 and updated January 2014. Copies of this EAP are also available in the Fort Worth District Water Management Office and at the Ray Roberts Lake Project Office.

8-11. Frequencies. Ray Roberts Lake levels for the period of record, since deliberate impoundment began on 30 June 1987, are displayed on Plate 8-4.

a. Annual Peak Elevation Frequency. The annual peak lake levels for the period 1987 through 2017 were tabulated. The annual peak elevations were arranged in descending order and assigned median plotting positions. The elevation probability was derived from studies based on methods discussed in "Statistical Methods in Hydrology," by Leo R. Beard, dated January 1962.

During Fiscal Year 2017 an Issue Evaluation Study (IES) was performed to evaluate hydrologic hazards of US Army Corps of Engineers (USACE) Dams in the Trinity River Basin. A task of

the IES study included developing reservoir stage frequency relationships representing current conditions for each dam. These stage frequency relationships were determined by an inflow sampling stochastic model, Risk Management Center - Reservoir Frequency Analysis (RMC-RFA).

RMC-RFA can predict reservoir stage-frequencies with uncertainty bounds that are beyond the observed record. The model utilizes a deterministic flood routing model while treating the seasonal occurrence of the flood event, the antecedent reservoir stage, inflow volume, and the inflow flood hydrograph shape as uncertain variables rather than fixed values. Performance of the RMC-RFA stage frequency curve model is evaluated based on its goodness of fit to the corresponding empirical stage frequency curve.

Ray Roberts Dam RMC-RFA model input parameters incorporated RiverWare simulated reservoir elevation and inflow record (WY1941 - WY2016), and historical inflow estimate (WY1908). The annual peak elevation frequency curve is shown on Plate 8-5. Data from this analysis indicated that the 50-year and the 100-year flood frequency pool level to be 638.8 feet and 644.9 feet, respectively.

b. Lake Elevation Duration. The lake-elevation-duration curve shown on Plate 8-6 is based on the midnight lake elevations for the period 24 March 1990 to 1 July 2017. Ray Roberts Lake reached the current top of the conservation pool for the first time on 24 May 1990. The lake-elevation-duration curve shows the percent of time that the lake level equals or exceeds a given elevation.

c. Control Points. Control points with the dominant impact on Ray Roberts Lake releases are located at Elm Fork Trinity River near Carrollton gage, Trinity River at Dallas gage, Trinity River near Rosser gage, and Trinity River near Oakwood gage. Rating curves for the control points are shown on Plates 4-15 through 4-18, respectively.

8-12. Other Studies. The vision for the CWMS National Implementation Effort is to have all USACE watersheds fully modeled within CWMS. These models will be operated daily to provide decision support to local Water Managers and to have results automatically consolidated into standardized briefing tools within a CorpsMap for executive and public use. CorpsMap viewer supports visualization and analysis of the USACE infrastructure, and real-time display of atmospheric, coastal, critical infrastructure, and watershed data.

The CWMS Automated Information System was developed by the HEC under funding from the Water Management Community of Practice and has been implemented to varying degrees at USACE Water Management Offices. USACE offices apply CWMS data flow elements (data acquisition, verification, validation, transformation, storage, visualization, dissemination elements). For this effort, USACE Leadership, the Critical Infrastructure Protection and Resilience (CIPR) Program, and the Dam Safety Program have recognized the value of these watershed models to the Nation and have committed funding for watershed model development to support the needs of multiple programs.

CHAPTER IX - WATER CONTROL MANAGEMENT

9-01. Responsibilities and Organizations.

a. Corps of Engineers. Ray Roberts Lake is owned by the USACE. As the owner of the project, the Corps of Engineers is responsible for the overall operation and maintenance of the lake. The Lake Manager, operating through the Ray Roberts Lake Office, Lewisville, Texas, and the Engineering and Construction Division, is directly responsible for the Lake's maintenance and operation. Project reporting instructions are presented in Chapter V, and project operating instructions are presented in Chapter VII of this manual.

1. Responsibilities and Duties during Normal Operations. The Water Resources Branch, Engineering and Construction Division, Fort Worth District is charged with the following responsibilities and duties under the general supervision of the SWD Office in Dallas, Texas.

(a). Regulation of lakes and dissemination of data.

(b). Investigations and refinement of regulation procedures, including the following:

(1). Analysis of past floods.

(2). Reconnaissance to determine channel capacities.

(3). Improvement of forecasting techniques.

(4). Plan and coordinate the hydrometeorologic reporting network with the NWS and the USGS.

(c). Train personnel in flood control duties, including the following:

(1). Periodic visits to projects by the branch personnel to familiarize themselves with regulation facilities and become acquainted with the operating personnel.

(2). Instruct personnel of other branches in flood control procedures to supplement the Water Resources Branch during flood emergencies, when necessary.

(d). Prepare reports on lake regulation.

(1). Recurring reports.

(2). Water Control Manuals.

(3). Post Flood reports.

2. Responsibilities and Duties during Flood Emergencies. During flood emergency, the Water Resources Branch is responsible for the following:

(a). Evaluation of current meteorologic, hydrologic, and hydraulic data.

(b). Provide analysis of the storm and effects of the flooding to the District Engineer and other District personnel.

(c). When necessary, furnish personnel to assist lake personnel in flood regulations.

(d). Regulation of lakes in accordance with flood control schedules.

(e). Furnish information to higher authority, which will include:

(1). Initial reports to the SWD and Office of the Chief of Engineers by telephone or E-mail.

(2). Provide information for situation reports.

3. Assignment of Personnel. During non-flood periods, personnel of the Water Resources Branch issue instructions for the routine regulation of the lake. However, during flood periods, assistance from other personnel may be required to maintain effective regulation of the lakes. The area and magnitude of the flood will determine the number of people engaged in each particular activity. Plate 9-1 shows the organization during flood control regulation.

4. Provision for 24-Hour Alert. The NWS and Lake Manager have been provided with a list of names and telephone numbers of key personnel of the Engineering and Construction Division with instruction to provide warning if unusual conditions occur. Responsible personnel are on duty at the Fort Worth District Office 24 hours a day during flood emergencies and/or whenever project conditions warrant. Responsible personnel will be on duty or on call at the lake at all times.

5. Role of the Lake Manager. The Lake Manager will regulate the lake according to instructions issued by personnel of the Water Resources Branch. The instructions will follow the "Normal Regulations for Flood Control" and "Emergency Regulations for Flood Control" contained in Chapter VII and Exhibit E of this manual. If the Lake Manager loses communication with the District Office, he will immediately make every effort to reestablish communication while initiating emergency regulations for flood control. The Lake Manager will

make daily observations at the lake project weather station and report those observations as directed in paragraph 5-07.

b. Other Federal Agencies. The NWS is officially responsible for issuing flood warnings to the public. The NWS provides weather and river forecast information, which is used to make real time operation decisions for Ray Roberts Lake. The USGS develops and maintains stage versus discharge curves for each stream gage. The USGS also collects and maintains reservoir storage and water quality data for the USACE lakes in the Fort Worth District.

9-02. Interagency Coordination. The USACE, NWS, and the USGS cooperate to accumulate rainfall and streamflow data used in forecasting river stages, stream flows and lake levels. The Fort Worth District Supplement A to ER 500-1-1 lists the Federal Agencies with which the District will coordinate in emergencies. The City of Denton coordinates with USACE regarding releases from the project through the hydropower turbines.

a. Local Press and Corps Bulletins. The USACE, through their Public Affairs Office, makes press releases to the news media of flood situations in the area of concern. The Water Resources Branch may supplement this information with observed conditions and technical advice to enable local interests to obtain optimum flood protection and to perform rescue and relief functions. USACE further assists in flood fighting, through the office of the Emergency Operations, furnishing sandbags and other necessary equipment based on equipment on hand and need.

b. National Weather Service. The NWS and USACE exchange hydrometeorological data and reports in obtaining and disseminating data. This exchange of data is discussed in Chapter VI of this manual.

c. United States Geological Survey. The USGS and USACE cooperate in a program for the operation and maintenance of stream gages throughout the Fort Worth District. During floods, the USGS and USACE coordinate field activities to maximize the number of stream discharge measurements.

d. Other Federal, State, or Local Agencies. The Fort Worth District exchanges information with State government officials, Texas Department of Public Safety (TxDPS) Highway Patrol Division, and others during flood emergencies. The Fort Worth District also coordinates with State agencies concerning fish and wildlife throughout normal operation.

Releases from Ray Roberts Lake are coordinated with the releases from other reservoirs in the Trinity River basin system. These reservoirs are listed in Table 3-2.

9-03. Interagency Agreements. A contract with the city of Dallas was approved on 16 September 1980 for water supply of 591,700 acre-feet (74.0 percent) and with the city of Denton for water supply of 207,900 acre-feet (26.0 percent) of the conservation storage below elevation 632.5 feet at Ray Roberts Lake. This contract also included 131,400 acre-feet (74.0 percent) for

the city of Dallas and 46,200 acre-feet (26.0 percent) for the city of Denton, for the conservation storage between elevations 515.0 feet and 522.0 feet at Lewisville Lake.

A Memorandum of Agreement between Dallas, Denton, and the USACE was signed on 7 October 1980. The purpose of the agreement is to maintain minimum designed stream flows through water supply operation in the Elm Fork of the Trinity River from Ray Roberts Lake to Lewisville Lake to maintain the streams' environmental quality.

9-04. Commissions, River Authority, Compacts, and Committees. The TCEQ issues and regulates permits for water use in the State of Texas. The Cities of Dallas and Denton are informed of lake conditions and operations at Ray Roberts Lake, but exercises no authority over flood control operations.

9-05. Non-Federal Hydropower. The city of Denton, Texas was issued a license by the Federal Energy Regulatory Commission (FERC) for the operation of a 5 megawatt or less hydroelectric power project. The city is responsible for the operation and maintenance of the hydropower plant located just below Ray Roberts Dam. During flood conditions hydropower production can be curtailed if necessary, by the USACE to prevent further flooding and damages downstream of the project. The hydropower facility was discontinued in 2003 and decommissioned by removing the transformers in August 2014. The FERC license #3939 was officially surrendered by the city of Denton in September 2014.

9-06. Reports. Table 9-1 lists reports prepared by the Water Resources Branch. The tabulation also describes when each report is required and the regulation requiring the report.

TABLE 9-1
Tabulation of Reports

Name of Report	When Required	Regulation Requiring Report
<hr/>		
Daily Report	Daily	—
Monthly Reservoir Report	Monthly	ER 1110-2-240
Flood Situation Reports	During Floods	ER 500-1-1
Post Flood Reports	Following a Flood Causing Major Damage	ER 500-1-1
Annual Reports	Annually	ER 1110-2-240

a. Daily Report. The daily report is prepared by the Water Resources Branch. It contains water control information on most of the major lakes in the Fort Worth District. An example of daily report is shown on Plate 9-2. Copies of the report are sent to all subscribing offices and agencies. The daily report is also posted on the Internet at the following URL address: <http://www.swf-wc.usace.army.mil/>.

b. Monthly Reports. The Water Resources Branch prepares monthly reservoir reports in accordance with ER 1110-2-240. The monthly report, shown on Plate 9-3, is a tabular record of lake operations. It is prepared for all lakes under the supervision or of direct interest to the Fort Worth District.

c. Flood Situation Reports. The Water Resources Branch supplies the Emergency Operations Center (EOC) in the Fort Worth District with information in accordance with ER 500-1-1. This report contains hydrometeorological conditions for the area, the name of the lake, pertinent lake data, lake elevation, predicted maximum elevation and anticipated data, inflow and outflow rates in cfs, percent of flood control storage utilized to date, and any other data relevant to the flood situation. The EOC then provides the information to the appropriate government officials and community organizations concerned or effected by the flooding.

d. Post Flood Reports. The post flood reports are prepared in accordance with ER 500-1-1, when a flood has resulted in major damage. The report describes flood emergency operations performed by the USACE. Included are available hydrologic information, damage estimates, and other engineering data considered essential for flood control and flood plain studies performed to review possible damage claims against the United States. The report is prepared using information compiled by the Water Resources Branch and when completed, includes a paragraph on the final damage costs from the flood event, including damages to USACE property, parks, and other structures.

e. Annual Report. The Water Resources Branch prepares an annual report for the SWD Reservoir Control Center. The report summarizes general river basin conditions and the activities and accomplishments of the Water Resources Branch during the preceding year.

EXHIBIT A

SUPPLEMENTARY PERTINENT DATA

RAY ROBERTS DAM AND LAKE

EXHIBIT A

SUPPLEMENTARY PERTINENT DATA

RAY ROBERTS DAM AND LAKE

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1. GENERAL INFORMATION

Item	Description
Other Name for Project	Originally identified as “Aubrey Lake”, Public Law 96-384 changed the name to Ray Roberts Lake
Location	Trinity River Basin, Texas Elm Fork of Trinity River, at river mile 60.0
Type of Project	Dam and Lake
Objective of Regulations	Multipurpose lake project for Flood Control, Water Supply, Hydropower, Fish and Wildlife, and Recreation. The hydropower facility was discontinued in 2003.
Project Owner	USACE
Operating Agency	USACE The working hours of operation for weekdays are 0800 to 1645; Working hours for weekends and holiday vary. During flood emergency conditions 24-hour per day duty is the general procedure.
Regulating Agency	USACE
Water Supply Contracts	A contract with the city of Dallas was approved dated 16 September 1980 for water supply of 591,700 acre-feet (74.0 percent) of the conservation storage below elevation 632.5 feet at Ray Roberts Lake and 131,400 acre-feet (74.0 percent) of the conservation storage between elevations 515.0 feet and 522.0 feet at Lewisville Lake (Contract No. DACW63-80-C-0103 dated 16 September 1980).

1. GENERAL INFORMATION (CONTINUED)

Item	Description
Water Supply Contracts	A contract with the city of Denton was approved dated 16 September 1980 for water supply of 207,900 ac-ft (26.0 percent) of the conservation storage below elevation 632.5 ft at Ray Roberts Lake and 46,200 ac-ft (26.0 percent) of the conservation storage between elevations 515.0 ft and 522.0 ft at Lewisville Lake (Contract No. DACW63-80-C-0104 dated 14 May 1982).
Water Rights	Water rights are regulated by the Texas Natural Resources Conservation Commission (TNRCC)
Project Cost	\$317,450,000
Deliberate Impoundment Date	30 June 1987

2. LAKE INFORMATION

Feature	Elevation (Feet NGVD29)	Lake Area (Acres)	Storage (Acre-Feet)	Runoff (Inches)
Top of Dam	665.0	68,500	—	—
PMF Design Water Surface Elevation (2012 Study)	667.2			
Maximum Design Water Surface Elevation (1974 Study)	658.8	59,620	1,931,900	52.35
Spillway Crest (2008 Survey)	645.5	42,000	1,261,500	34.19
Top of Flood Control Pool (2008 Survey)	640.5	36,900	1,064,600	28.85
Top of Conservation Pool (2008 Survey)	632.5	28,646	788,490	21.36
Invert Low Flow Elevations (2008 Survey)	618.0	18,929	444,702	—
	603.0	11,194	221,375	—
	588.0	6,461	93,467	—
	574.5	3,045	29,933	—
Flood Control Outlet Works Invert Elev. (2008 survey)	551.0	113	323	—
Streambed (2008 Study)	524.0	0	0	—

2. LAKE INFORMATION (CONTINUED)

Item	Description
Real Estate (Fee Title)	Upper guide contour of elevation 645.5 feet. Fee simple title includes 47,051 acres
Real Estate (Flowage Easement)	Upper guide contour of elevation 645.5 feet. Flowage easement includes 2,618 acres
Range of Clearing	Trees below elevation 632.5 feet. Structures below elevation 640.5 feet
Lake length at top of conservation pool	15 river miles from the dam to the most upstream shoreline
Shoreline length at top of conservation pool	207 miles
Safety aspects	A warning horn will sound for 10 seconds to alert those downstream at least 2 minutes before significant changes in discharge releases through the outlet works begin.
Emergency Drawdown	Assuming an average inflow of 410 cfs and initial water surface at the spillway crest, the reservoir may be drawn to 10% of the initial storage at spillway crest in 113 days by releasing an average of 5200 cfs with both flood gates fully open. This meets the criteria set forth in ER 1110-2-50, dated 22 August 1975.
Datum	The elevations listed in the Appendix A is based on the datum conversion from NGVD29 to NAVD88: NGVD29 + 0.0 feet = NAVD88 for Ray Roberts Dam and Lake.

3. HYDROLOGY

Item	Description
Drainage Area	692 square miles
Volume from One-Inch Runoff	36,907 ac-ft
Spillway Design Flood (1974 Study)	
Design water surface elev.	658.8 feet
Duration of Storm	48 hours
Average Infiltration Rate	0.05 inches/hour
Total Volume of Rainfall	28.00 inches
Total Volume of Runoff	25.28 inches
Peak Inflow	494,200 cfs
Peak Outflow (Outlet works and spillway flow)	21,100 cfs
Storm Type	Spillway Design Storm (HMR 33)
Probable Maximum Flood (2012 Study)	
Maximum Water Design Surface elev.	667.2 feet
Duration of Storm	72 hours
Average Infiltration Rate	0.05 inches/hour
Total Rainfall	32.91 inches
Total Volume of Runoff	30.30 inches
Volume into full pool	1,118,700 ac-ft
Peak Inflow to full pool	969,500 cfs
Peak Outflow (reservoir level 667.2 feet)	
Total	43,500 cfs
Storm Type	Probable Maximum Storm determined from HMR- 51 and HMR-52 guidelines
Standard Project Flood (2012 Study)	
Maximum Design Water Surface elev.	648.68 feet
Duration of Storm	72 hours
Total Volume of Rainfall	19.42 inches
Peak Inflow	476,000 cfs
Total Volume	559,350 ac-ft
Climate	Moderate, with hot summers, and cool winters

3. HYDROLOGY (CONTINUED)

Item	Description
Average Precipitation (Gages listed in Table 4-3)	36.96 inches per year (1897-2016)
Average Evaporation from lake (Data listed in Table 4-4A)	58.42 inches per year (1953-2012)
Storm Type	Primarily local thunderstorms, frontal storms, and occasional Gulf Coast and Pacific Hurricanes
Flood Seasons	Primarily March through June, but floods can occur at any time of year
Low Flood Seasons	July, August and November through February
Minimum Monthly Inflow and Date of Occurrence	0 ac-ft (July 1978)
Minimum Annual Inflow and Date of Occurrence	29,264 ac-ft (in CY 1978)
Mean Annual Inflow	290,679 ac-ft (Jan 1940-Dec 2016 records)
Maximum Annual Inflow and Date of Occurrence	1,393,629 ac-ft (CY 2015)
Maximum Monthly Inflow and Date of Occurrence	602,845 ac-ft (May 2015)
Maximum Average Daily Inflow and Date of Occurrence	102,500 cfs (modeled) 60,349 cfs (Observed) (13 October 1981) (26 April 1990) with project pre-project
Maximum Instantaneous Inflow and Date of Occurrence	171,700 cfs 200,000 cfs (18 Jun 2007) (13 Oct 1981) with project pre-project
Maximum Flood Volume and Date of Occurrence	891,272 ac-ft April – June 2015

3. HYDROLOGY (CONTINUED)

Item	Description
Names and Locations of Key Stream Flow Stations	Upstream Timber Creek near Collinsville Elm Fork near Gainesville Downstream Elm Fork near Carrollton Trinity River at Dallas Trinity River near Rosser Trinity River near Oakwood
Type of Hydrometeorologic Data Recorded at Damsite	Automatic water stage recorders to furnish continuous records of lake levels and river stage below the dam. Tile staff gages provide lake level and tailwater elevations. NWS station use for Ray Roberts Lake is located at Lewisville Project office. It consists of: a rain gage, recording rain gage, Type A evaporation pan, anemometer and maximum-minimum thermometer.
Precipitation Stations Used in Hydrologic Forecasting (NWS)	Gainesville 5 ENE - Recording gage Muenster – Recording gage Pilot Point – Recording gage Valley View – Non-Recording gage
Number of Sediment Ranges	34 (Periodic surveys)
Number of Degradation Ranges	5 (Periodic surveys)

4. EMBANKMENTS

Item	Description
Location	Elm Fork of the Trinity River at river mile 60.0
Purpose	Impoundment
Type	Rolled earth fill
Type of Fill	Rock fill
Slope Protection	Rock riprap upstream, turf downstream
Height	141 feet above streambed
Length of dam (without spillway)	15,250 feet
Embankment length only	14,980 feet
Top Elevation	665.0 feet
Freeboard	6.2 feet (Spillway Design Flood, 1974 Study) -2.2 feet (overtopped by 2012 PMF)
Used for Roadway	Yes, FM 455
Elevation of Streambed	524.0 feet
Closure date	28 August 1984
Deliberate Impoundment	30 June 1987

5. SPILLWAY

Item	Description
Location	Right abutment, about 19,000 feet west of the streambed
Uncontrolled Spillway	
Crest Elevation	645.5 feet
Length of concrete sill	20 feet
Width of concrete sill (at elevation 645.5 feet)	100 feet
Type	Broad-crested weir
Capacity	14,500 cfs (1974 Study, Lake Elevation 658.8 feet) 35,600 cfs (2012 PMF, Lake Elevation 667.2 feet)
Total Routed Capacity (1974 Study, Lake elev. 658.8 feet)	22,100 cfs (includes flow over spillway and outlets)
Total Maximum Outflow (2012 Study, Lake elev. 667.2 feet)	43,500 cfs (includes flow over spillway and outlets)
Type of Energy Dissipator	Stilling basin with baffle blocks

6. OUTLET FACILITIES

Item	Description
A. <u>Control Gates</u>	
Location	At the base of outlet structure (in the lake 4,200 feet west of streambed)
Purpose	Regulation of outflow
Type	Gates are operated by hydraulic cylinder control valves and lead directly into a 13 feet diameter conduit located under the dam.
Number and Size of Gates	Two 6 feet by 13 feet rectangular gates
Entrance Invert Elevation	551.0 feet
Maximum Discharges at Pertinent Elevation	Top of conservation pool Elev. 632.5 feet - 6,600 cfs Top of flood control pool Elev. 640.5 feet - 6,900 cfs
Minimum Time Required to Open and Close Service Gates:	
Normal Conditions	The gates are opened, alternating at a rate of 0.5 feet per 30 minutes until they are half way open, and then at a rate of 1 foot per minute until fully open. Total opening time for both service gates is 14 hours and 10 minutes.
Emergency Condition	One service gate may be opened or closed in 20 minutes, both gates in 40 minutes. Bulkhead gates for service outlet are operated by an electric wire cable hoist on the service deck. A bulkhead is operated by the double girder bridge crane on the service deck.
Type of Energy Dissipator	Concrete baffled stilling basin

6. OUTLET FACILITIES (CONTINUED)

Item	Description
B. <u>Low Flow Outlet Works</u>	
Location	On north face of outlet structure
Purpose	Discharge for water supply and selection of water quality
Type	Low-flow outlets have selector gates operated by electric motor driven or hand cranked threaded stems
Number and Size of Gates	Four 4 feet by 8 feet rectangular selector gates. The inlets drop into a common wet well which leads to a 3 feet by 7 feet conduit and then transitions into a 5 feet diameter conduit.
Entrance Invert Elevations	Selector gate inverts are at elev: L.F. #2 – 618.0 feet L.F. #4 – 603.0 feet L.F. #1 – 588.0 feet L.F. #3 – 574.5 feet
Maximum Low flow Discharge At Pertinent Elevation	Top of conservation pool Elev. 632.5 feet - 600 cfs Top of flood control pool Elev. 640.5 feet - 620 cfs

7. HYDROELECTRIC POWER FACILITIES

Item	Description
Location	Adjacent to outlet works stilling basin. Low Flow conduit is used as a penstock
Purpose	Discharge for water supply and hydroelectric power generation
Type of Facility	Hydropower plant continuous runs to meet normal river flow
Maximum Output Capacity	1,200 Kilowatts generators
Type of Unit	One Horizontal France
Type of Generator	One Horizontal Synchronous
Power on Line Date	21 July, 1991
Normal Plan for Generation	Demand for downstream water supply and flood releases will be used to generate power
Speed	450 RPM
Rated Head	90 feet
Maximum Flow through Turbine	167 cfs
Minimum Flow through Turbine	36 cfs
Turbine Centerline Elevation	539.5 feet
Decommissioned dates	The hydropower facility was discontinued in 2003 and decommissioned by removing the transformers in August 2014. The FERC license was officially surrendered by the city of Denton in September 2014.

8. CONTROL POINTS

Item	Description
A. <u>Elm Fork of the Trinity River near Carrollton Gage, No. 08055500</u>	
Location	River mile 18.2 of the Elm Fork of Trinity River upstream of Carrollton Dam, near Carrollton, TX
Purpose of control	To indicate total flow at the gage, including releases from Grapevine and Lewisville Lakes and local runoff.
Channel description	The channel capacity in the reach below Carrollton gage is 7,000 cfs on Elm Fork of the Trinity River. The stream is slow moving, normally about 15 feet deep in black clay and sandy loam.
Drainage area	2,459 square miles
Treatment of Uncontrolled Runoff	Contributes to target flow at gage
Target Flow Rate	7,000 cfs
Time of Water Travel From Ray Roberts Lake	20 hours
Monitoring provisions	Recording river gage with DCP
Dikes or levees downstream	Dallas Floodway starting near the confluence of Elm and West Forks in the city of Dallas. Levees are grass covered earth, non-overtopping, built for flood protection. Further levee districts downstream of the Dallas Floodway have similar characteristics.
Related Control Structures	None

8. CONTROL POINTS (CONTINUED)

Item	Description
B. <u>Trinity River at Dallas Gage, No. 08057000</u>	
Location	River Mile 500.3 of the Trinity River downstream of Commerce Street viaduct and 5.2 miles downstream of confluence of the West Fork and Elm Fork in Dallas, TX
Purpose of control	To indicate the total flow at the gage, including releases from upstream reservoirs and local flow.
Channel description	The channel capacity in the reach near the Dallas gage is 13,000 cfs. The Dallas Floodway is composed of a grass lined levee and channel. The floodplain between the levees is heavily vegetated.
Drainage area	6,106 square miles
Treatment of uncontrolled runoff	Contributes to target flow at gage
Target Flow Rate	13,000 cfs
Time of Water Travel From Ray Roberts Lake	44 hours
Monitoring provisions	Recording river gage with DCP
Dikes or levees downstream	Dallas Floodway starting near from confluence of Elm and West Forks in the City of Dallas. Levees are grass covered earth, non-overtopping, built for flood protection
Related Control Structures	None

8. CONTROL POINTS (CONTINUED)

Item	Description
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C. <u>Trinity River near Rosser Gage, No. 08062500</u>	
Location	River mile 451.4 of the Trinity River and 8.5 miles downstream of East Fork Trinity River, 2.5 miles south of Rosser, Texas.
Purpose of control	To indicate the total flow at the gage, including releases from upstream reservoirs and local flow.
Channel description	Leveed channel and floodplain, with parallel levees 1,700 feet apart at the gage. Channel bed of clay overlain with sludge and silt, sand and gravel at some cross sections. The floodplain between the levees is heavily grown.
Drainage area	8,147 square miles
Treatment of uncontrolled runoff	Contributes to target flow at gage
Target Flow Rate	15,000 cfs
Time of Water Travel From Ray Roberts Lake	104 hours
Monitoring provisions	Recording river gage with DCP
Dikes or levees downstream	Levees are grass covered earth, built for flood protection and non-overtopping.
Related Control Structures	None

8. CONTROL POINTS (CONTINUED)

Item	Description
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D. <u>Trinity River near Oakwood Gage, No. 08065000</u>	
Location	River mile 313.4 of the Trinity River, downstream of U.S. Highways 79 and 84 near Oakwood, TX
Purpose of control	To indicate the total flow at the gage, including releases from upstream reservoirs and local flow.
Channel description	Streambed is in relatively stable clean sand and mud. Channel is straight for 0.25 miles upstream and downstream of gage.
Drainage area	12,833 square miles
Treatment of uncontrolled runoff	Contributes to target flow at gage
Target Flow Rate	24,000 cfs
Time of Water Travel From Ray Roberts Lake	248 hours
Monitoring provisions	Recording river gage with DCP
Dikes or levees downstream	Levees are grass covered earth, built for flood protection and non-overtopping.
Related Control Structures	None

9. DOWNSTREAM CONTROL STRUCTURES

Item	Description
A. <u>Lewisville Dam</u>	
Location	Elm Fork Trinity River, at river mile 30.0
Purpose	Multi-purpose project for flood control and water supply, fish and wildlife, and recreation.
Type	Rolled earthfill with impervious clay core. With an uncontrolled ogee spillway 560 feet long.
Outlet Control	Three 6.5 feet by 13 feet gated intakes into a 16 feet diameter discharge conduit. Two 5 feet diameter steel pipe low-flow outlets.
Flow Passage Inverts	Spillway crest is at 532.0 feet; Flood gate inverts are at 448.0 feet; Low flow inverts are at 481.0 feet (2 inverts), 496.0 feet and 503.0 feet.
Pertinent Discharge Capacities	Spillway Discharges at Design water surface 216,800 cfs Flood Gate Outlets; Design water surface 12,600 cfs Spillway Crest 10,700 cfs Top of Conservation Pool 9,920 cfs
Controlled Drainage Area	1,660 square miles
Regulating Agency	USACE
Operation	USACE

EXHIBIT B

CONTRACT BETWEEN CITY OF DALLAS

AND THE UNITED STATES DEPARTMENT OF THE ARMY, CORPS OF

ENGINEERS

FOR

WATER STORAGE SPACE IN RAY ROBERTS DAM AND LAKE, TEXAS

CONTRACT BETWEEN THE UNITED STATES OF AMERICA
AND
THE CITY OF DALLAS, TEXAS
FOR
WATER STORAGE SPACES IN AUBREY AND LEWISVILLE LAKES, TEXAS

THIS CONTRACT, entered into this 15th day of August 1960, by and between the United States of America (hereinafter called the Government), represented by the Contracting Officer executing this contract, and the City of Dallas, Dallas County, Texas (hereinafter called the City), WITNESSETH THAT:

WHEREAS, the River and Harbor Act of 1965 (Public Law 89-298, 79 Stat. 1091) authorized the construction, operation, and maintenance of Aubrey Lake including modification of Garza-Little Elm Reservoir, since renamed Lewisville Lake, (hereinafter called the Project) on the Elm Fork of the Trinity River in the State of Texas; and

WHEREAS, in accordance with the authorized modification, Lewisville Lake (located immediately downstream from the Aubrey Dam) will be modified to permit the transfer of flood control storage from Lewisville Lake to Aubrey Lake for an equivalent amount of water supply storage in Lewisville Lake for municipal and industrial uses; and

WHEREAS, the City desires to contract with the Government for the use of storage included in Aubrey Lake and the additional storage to be made available in Lewisville Lake for municipal and industrial water supply and for payment of the cost thereof in accordance with the provisions of the Water Supply Act of 1958, as amended (43 U.S.C. 390b); and

WHEREAS, the City is empowered so to contract with the Government and is vested with all the necessary powers for accomplishment of the purposes of this contract, including those required by Section 221 of the Flood Control Act of 1970 (42 U.S.C. 1962d-5b);

NOW, THEREFORE, the Government and the City agree as follows:

ARTICLE 1. Water storage space.

a. Project construction. The Government, subject to the directions of Federal law and any limitations imposed thereby, shall design and construct the Project so as to include in Aubrey Lake space for the storage of water by the City and space for the storage of floodwaters which will permit the reallocation of flood control storage in Lewisville Lake to municipal and industrial water supply storage, a portion of which will also be utilized by the City.

b. Rights of the City.

(1) The City shall have the right to utilize (a) an undivided 74.0 percent (estimated to contain 591,700 acre-feet gross storage, including storage for sediment deposits) of the total storage space in Aubrey Lake below

elevation 632.5 feet above mean sea level, which total storage space is estimated to contain 799,600 acre-feet gross storage, including storage for sediment deposits, and (b) an undivided 74.0 percent (estimated to contain 131,400 acre-feet gross storage, including storage for sediment deposits) of the total storage space in Lewisville Lake between elevations 515.0 feet above mean sea level and 522.0 feet above mean sea level, which total storage space is estimated to contain 177,600 acre-feet gross storage, including storage for sediment deposits. The storage space in Lewisville Lake is to be used to impound water for present demand or need for municipal and industrial water supply; and the storage space in Aubrey Lake is to be used to impound water for present and anticipated future demands or needs for municipal and industrial water supply. In Aubrey Lake, 52 percent (an estimated 307,700 acre-feet) of the space which the City has a right to utilize is for present use water storage, and 48 percent (an estimated 284,000 acre-feet) is for future use water storage.

(2) The City shall have the right to withdraw or transfer water from or transfer water into either or both of the two lakes, or to order releases to be made by the Government through the outlet works in the dams, subject to the provisions of Article 1c and to the extent the aforesaid storage spaces will provide. The City shall have the right to construct all such works, plants, pipelines, and appliances as may be necessary and convenient for the purpose of transfers or withdrawals, subject to the approval of the Contracting Officer as to design and location. The grant of rights-of-way across, in, and upon land of the Government at Aubrey Lake and at Lewisville Lake shall be by separate instrument in a form satisfactory to the Secretary of the Army, without additional cost to the City, under the authority of and in accordance with the provisions of 10 U.S.C. 2669. Subject to the conditions of such grants, the City shall have the right to use so much of Aubrey Lake and Lewisville Lake lands as may reasonably be required in the exercise of the rights and privileges herein granted.

c. Rights reserved. The Government reserves the right to lower the water in Aubrey Lake to elevation 632.5 feet above mean sea level and to lower the water in Lewisville Lake to elevation 522.0 feet above mean sea level during such periods of time as is deemed necessary, in its sole discretion, for flood control purposes. The Government further reserves the right to take such measures as may be necessary in the operation of Aubrey Lake and Lewisville Lake to preserve life or property.

d. Quality or availability of water. The City recognizes that this contract provides storage spaces for raw water only. The Government makes no representations with respect to the quality or availability of water and assumes no responsibility therefor or for the treatment of water.

ARTICLE 2. Regulation of and right to use of water. The regulation of the use of water withdrawn or released from or transferred to or from the aforesaid storage spaces shall be the sole responsibility of the City. The City has the full responsibility to acquire in accordance with State laws and regulations, and if necessary to establish or defend, any and all water rights needed for utilization of the storages provided under this contract. The Government shall not be responsible for withdrawals, transfers, or

diversions by others, nor will it become a party to any controversies involving the use of the storage spaces by the City except as such controversies may affect the operations of the Government.

ARTICLE 3. Operation and maintenance. The Government shall operate and maintain Aubrey Lake and Lewisville Lake, and the City shall pay to the Government a share of the costs of such operation and maintenance as provided in Article 5c. The City shall be responsible for operation and maintenance of all installations and facilities which it may construct for the transfer into or out of or withdrawal of water from either or both of the two lakes and shall bear all costs of construction, operation, and maintenance of such installations and facilities.

ARTICLE 4. Measurement of withdrawals and releases. The City agrees to furnish and install, without cost to the Government, suitable meters or measuring devices satisfactory to the Contracting Officer for the measurement of water which is transferred into Aubrey Lake or Lewisville Lake or is withdrawn or transferred from Aubrey Lake or Lewisville Lake by any means other than through Aubrey Lake or Lewisville Lake outlet works. The City shall furnish to the Government monthly statements of all such withdrawals or transfers. Releases from the water supply storage spaces through Aubrey Lake or Lewisville Lake outlet works shall be made in accordance with written schedules furnished by the City and approved by the Contracting Officer and shall be subject to Article 1c. The measure of all such releases shall be by means of a rating curve of the outlet works or by such other suitable means as may be agreed upon prior to use of the water supply storage space or spaces.

ARTICLE 5. Payments. In consideration of the right to utilize the aforesaid storage spaces in Aubrey Lake and Lewisville Lake for municipal and industrial water supply purposes, the City shall pay the following sums to the Government:

a. Project investment costs.

(1) The City shall repay to the Government, at the times and with interest on the unpaid balance as hereinafter specified, the amounts stated below which, as shown in Exhibit A of this contract, constitute the entire estimated amount of the construction costs, including interest during construction, allocated to the water storage rights acquired by the City under this contract. The interest rate to be used for purposes of computing interest during construction and interest on the unpaid balance will be determined by the Secretary of the Treasury as of the beginning of the Government fiscal year in which construction of the Project is initiated on the basis set forth in the Water Supply Act of 1958, as amended. Such interest rate at the time of negotiation of this contract (Government fiscal year 1980) is 7.210 percent. The City shall repay:

74 percent of the construction cost of specific water supply facilities, estimated at	\$ 161,300
52.34 percent of the total Project joint use construction cost, estimated at	92,965,500
Interest during construction, estimated at	<u>13,428,900</u>
Total estimated amount of Project investment cost allocated to 74 percent of the water supply	\$106,555,700

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(2) The Project investment costs allocated to the storage space indicated in Article 1(b)(1) as being provided for present demand is currently estimated at \$55,903,100, on the basis of the costs presented in Exhibit "A". The amount of the Project Investment costs allocated to the storage for present demand shall be paid in 50 consecutive annual installments, the first of which shall be due and payable within 30 days after the City is notified by the Contracting Officer that the Project is completed and operational for water supply purposes. Annual installments thereafter will be due and payable on the anniversary date of the first payment. Except for the first payment which will be applied solely to the retirement of principal, all installments shall include accrued interest on the unpaid balance at the rate provided above. The last annual installment shall be adjusted upward or downward when due to assure repayment of all of the investment costs allocated to the storage for present demand within 50 years.

(3) The Project investment cost allocated to the remaining portion of the storage space, that provided in Aubrey Lake for future use, is currently estimated at \$50,652,600 on the basis of the costs presented in Exhibit A of this contract. No principal or interest payment with respect to this storage for future water supply is required to be made during the first 10 years following the date the Project is operational for water supply purposes unless all or a portion of such storage is used for purposes of withdrawal of water from or transfer of water into Aubrey Lake during this period. The amount to be paid for any portion of such storage which is used shall be determined by multiplying the percentage of the total storage for future water supply which is placed in use by the total amount of the Project investment cost allocated to future water supply. Interest at the rate provided above will be charged on the amount of the Project investment cost allocated to the storage for future water supply which is not being used from the tenth (10th) year following the date the Project is operational for water supply purposes until the time when such storage is first used. The City may at its option pay the interest as it becomes due or allow the interest to accumulate until the storage is used. If this latter option is exercised, the interest will be compounded annually and added to the principal amount. When any portion of the storage for future water supply is used, the amount of the Project investment cost allocated thereto plus interest applicable to such portion as provided above will be due and payable on the date of first use of such portion. The said amount due shall be paid within the life of the Project in not to exceed 50 consecutive annual payments beginning on the next anniversary date established in accordance with the provisions of Article 5a(2) above. Annual payments thereafter for such portion will be due and payable on said anniversary date. For any portion, all payments shall include accrued interest on the unpaid balance at the rate provided above, with interest accruing from the said date of first use of such portion. The last annual payment for any portion shall be adjusted upward or downward when due to assure repayment of all the investment cost allocated to such portion within the repayment period.

(4) An estimated schedule of annual payments for the storages provided for present demand is attached as Exhibit B of this contract. The annual payments as provided therein shall be made until an interim estimated determination

of cost or a final determination of cost is made as provided in Article 6. Payment schedules for the storage provided for future water supply demands will be furnished by the Contracting Officer when use of such storage is started, and if based on estimated costs will be subject to revision, as provided in Article 6, until actual costs are known.

(5) The City shall have the right at any time it so elects to prepay the indebtedness under this Article 5a, in whole or in part, with accrued interest thereon to the date of such prepayment.

b. Major capital replacement costs and sedimentation resurveys costs. The City will be required to pay to the Government 74 percent of the cost for any major capital replacement of specific water supply facilities at Aubrey Lake. In addition, the City shall pay to the Government 19.240 percent of the costs of joint use major capital replacement items at Aubrey Lake until such time as the storage for future water supply is first used. As the storage provided for future water supply is used, the share of the joint use major capital replacement items costs, which the City will be required to pay in addition to the major capital replacement costs of the specific water supply facilities, will be increased commensurate with the percentage of the total water supply storage being used up to a total of 37.000 percent of such costs. The City will also be required to pay to the Government 28.902 percent of the costs of sedimentation resurveys at Aubrey Lake until such time as the storage for future water supply is used. As the storage provided for future water supply demands is used, the share of the sedimentation resurveys costs which the City will be required to pay will be increased commensurate with the percentage of the total water supply storage being used up to a total of 55.580 percent of such costs. Payment shall be made either in lump sum on demand at the time such costs are incurred or annually with interest on the unpaid balance. If paid annually, the City's share shall be paid within the life of the Project not to exceed 25 consecutive annual payments beginning on the next anniversary date established in accordance with the provisions of Article 5a(2) above following the date demand is made for payment of said major capital replacement costs or sedimentation resurveys costs. Annual payments thereafter will be due and payable on said anniversary date. All payments shall include accrued interest on the unpaid balance at the rate determined by the Secretary of the Treasury on the basis of the Water Supply Act of 1958, as amended, for use in the Government fiscal year in which major capital replacement is initiated, with interest accruing from the date said major capital replacement is initiated. The last annual payment shall be adjusted upward or downward when due to assure repayment of all the incurred costs within the repayment period.

c. Annual operation and maintenance costs.

(1) The City will be required to pay to the Government 74 percent of the annual experienced operation and maintenance costs of specific water supply facilities at Aubrey Lake. In addition, the City shall pay to the Government 22.084 percent of the annual experienced joint use operation and maintenance costs of Aubrey Lake until such time as the storage for future water supply is first used. As the storage provided for future water supply demands is used, the share of the annual experienced joint use operation and maintenance costs, which the City will be required to pay in addition to the operation and maintenance costs

of the specific water supply facilities, will be increased commensurate with the percentage of the total water supply storage being used up to a total of 42.469 percent of such costs. Twelve months prior to the expected date that the Contracting Officer shall notify the City that the Project is complete and operational for the water supply purpose, the Government shall provide the City an estimate of the first advance payment for operation and maintenance costs. The first payment for operation and maintenance costs of present use water supply storage in Aubrey Lake will be due and payable in advance within 90 days after the Contracting Officer notifies the City that the Project is completed and operational for water supply purposes, will be for the period beginning on the date the Project is operational for water supply purposes and ending on 30 September following, and will amount to the sum of the first payment for specific water supply facilities costs and the first payment for joint use costs. Annual payments thereafter, for each Government fiscal year ending 30 September, will be due and payable in advance on 2 January following the close of the prior Government fiscal year. Payment by the City and payment adjustments by the Government shall be in accordance with Exhibit A, IV, B.

(2) When each and any portion of the future water supply storage is placed in use, the first payment of the additional amount of the joint use operation and maintenance costs required to be paid for such storage use will be due and payable in advance within 30 days after first use of such storage and will be for the period beginning on the date of said first use and ending on 30 September following. Annual payments thereafter, for each Government fiscal year ending 30 September, will be due and payable in advance on 2 January following the close of the prior Government fiscal year.

d. Charges for delinquent payments. If the City shall fail to make any of the aforesaid payments when due, then the overdue payments shall bear interest compounded annually until paid. The interest rate to be used for overdue payments due under the provisions of Articles 5a, 5b, and 5c above shall be that determined by the Secretary of the Treasury on the basis of the Water Supply Act of 1958, as amended, for use in the Government fiscal year in which each period of delinquency occurs. The amount charged on payments overdue for a period of less than one year shall be figured on a monthly basis. For example, if the payment is made within the first month after being overdue (31 to 60 days after the anniversary date of the date of notification) one month's interest shall be charged. This provision shall not be construed as giving the City a choice of either making payments when due or paying interest, nor shall it be construed as waiving any other rights of the Government, at law or in equity, which might result from any default by the City.

e. Assurance of funds for contract payments. The City warrants that all payments contracted hereunder shall be secured by a pledge of surplus revenues of the City's combined Waterworks and Sanitary Sewer System remaining after payment of all expenses of operating and maintaining such system and after providing for payment of all debt service, reserve, or other requirements in connection with the City's Waterworks and Sanitary Sewer System Revenue Bonds now outstanding or those hereafter issued on a first lien basis or on such other basis as may be approved by the Contracting Officer, provided, that in the event such surplus revenues may become or are insufficient to meet the payments contracted hereunder, the City shall fix and collect such rates and charges for

services of said combined system as will make possible the prompt payment of all the aforementioned requirements including payments contracted hereunder. Payments made by the City as Project investment cost and as major capital replacement costs shall be regarded as capital expenditures. DR
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ARTICLE 6. Construction cost adjustments. All construction cost dollar amounts in this contract, including those in the Exhibits, are tentative only based on the Government's best estimates. They will be adjusted upward or downward by the Contracting Officer when final construction costs become known, and the contract will be modified to reflect the adjustments. Within two years after the Project is completed and operational for water supply purposes, the Contracting Officer shall make a revised interim estimated determination of construction costs, including interest during construction and taking into account the actual costs to the extent they are then known. In like manner, further interim determinations shall be made at two year intervals until all actual costs are known, at which time the Contracting Officer shall prepare a final cost determination, including interest during construction. On each occasion of an interim determination, or on final determination, the annual payments thereafter due shall be changed so as to provide for the payment of the balance due in equal payments during the remaining life of the repayment period; and a revised schedule, or schedules as necessary, of annual payments shall be furnished to the City.

ARTICLE 7. Duration of contract. This contract shall be effective when approved by the Secretary of the Army and shall continue in full force and effect for the life of Aubrey Lake and Lewisville Lake. Both Aubrey Lake and the additional storage to be made available in Lewisville Lake have been formulated on the basis of 100 years economic life.

ARTICLE 8. Permanent rights to storage. Upon completion of payments by the City as provided in Article 5a herein, the City shall have a permanent right, under the provisions of the Act of 16 October 1963 (Public Law 88-140, 43 U.S.C. 390e), to the use of the water supply storage spaces in Aubrey Lake and Lewisville Lake as provided in Article 1, subject to the following:

a. The City shall continue payment of its share, as provided in Article 5c, of the annual operation and maintenance costs allocated to water supply.

b. The City shall bear 74 percent of the costs allocated to (1) water supply for Aubrey Lake and (2) the total storage space between elevations 515.0 feet above mean sea level and 522.0 feet above mean sea level for Lewisville Lake of any necessary reconstruction, rehabilitation, or replacement of Aubrey Lake or Lewisville Lake features which may be required to continue satisfactory operation of Aubrey Lake or Lewisville Lake. Such costs will be established by the Contracting Officer and repayment arrangements shall be in writing in accordance with the terms and conditions set forth in Article 5(b) for major capital replacement costs.

c. Upon completion of payments by the City as provided in Article 5a herein, the Contracting Officer shall redetermine the storage space for municipal and industrial water supply in Aubrey Lake, taking into account such equitable reallocation of lake storage capacities among the purposes served

by Aubrey Lake as may be necessary due to sedimentation. Such findings, and the storage space allocated to municipal and industrial water supply, shall be defined and described in an exhibit which will be made a part of this contract. Following the same principle, such reallocation of lake storage capacities may be further adjusted from time to time as the result of sedimentation resurveys to reflect actual rates of sedimentation and the exhibit revised to show the revised storage space allocated to municipal and industrial water supply.

d. The permanent rights of the City under this contract shall be continued so long as the Government continues to operate Aubrey Lake and/or Lewisville Lake. In the event the Government no longer operates Aubrey Lake or Lewisville Lake, such rights may be continued subject to the execution of a separate contract, or supplemental agreement, providing for:

(1) Continued operation by the City of such part of the facility as is necessary for utilization of the water supply storage spaces allocated to it;

(2) Terms which will protect the public interest; and

(3) Effective absolvment of the Government by the City from all liability in connection with such continued operation.

ARTICLE 9. Release of claims. The City shall hold and save the Government, including its officers, agents, and employees, harmless from liability of any nature or kind for or on account of any claim for damages which may be filed or asserted as a result of the storages in Aubrey Lake and/or Lewisville Lake, or withdrawal or release of water from or transfer of water to or from Aubrey Lake or Lewisville Lake made or ordered by the City, or as a result of the construction, operation, or maintenance of the features and appurtenances owned and operated by the City, provided, that this shall not be construed as obligating the City to hold and save the Government harmless from damages or liability resulting from the sole negligence of the Government or its officers, agents, or employees and not involving negligence on the part of the City or its officers, agents, or employees.

ARTICLE 10. Assignment. The City shall not transfer or assign this contract or any rights acquired hereunder, nor sub-allot said water supply storage spaces or any part thereof, nor grant any interest, privilege, or license whatsoever in connection with this contract, without the approval of the Secretary of the Army, provided, that unless contrary to the public interest, this restriction shall not be construed to apply to any water that may be obtained from the water supply storage spaces by the City and furnished to any third party or parties, nor any method of allocation thereof.

ARTICLE 11. Officials not to benefit. No member of or delegate to Congress, or Resident Commissioner, shall be admitted to any share or part of this contract or to any benefit that may arise herefrom; but this provision shall not be construed to extend to this contract if made with a corporation for its general benefit.

ARTICLE 12. Covenant against contingent fees. The City warrants that no person or selling agency has been employed or retained to solicit or secure this contract upon agreement or understanding for a commission, percentage, brokerage, or contingent fee excepting bona fide employees or bona fide established commercial or selling agencies maintained by the City for the purpose of securing business. For breach or violation of this warranty, the Government shall have the right to annul this contract without liability or in its discretion to add to the contract price or consideration or otherwise recover the full amount of such commission, percentage, brokerage, or contingent fee.

ARTICLE 13. Environmental quality. During any construction, operation, and maintenance by the City of any facilities, specific actions will be taken to control environmental pollution which could result from such activity and to comply with applicable Federal, State, and local laws and regulations concerning environmental pollution. Particular attention should be given to (1) reduction of air pollution by control of burning, minimization of dust, containment of chemical vapors, and control of engine exhaust gases and smoke from temporary heaters; (2) reduction of water pollution by control of sanitary facilities, storage of fuels and other contaminants, and control of turbidity and siltation from erosion; (3) minimization of noise levels; (4) onsite and offsite disposal of waste and spoil; and (5) prevention of landscape defacement and damage.

ARTICLE 14. Federal and State laws.

a. In acting under its rights and obligations hereunder, the City agrees to comply with all applicable Federal and State laws and regulations, including but not limited to the provisions of the Davis-Bacon Act (40 U.S.C. 276a et seq.); the Contract Work Hours and Safety Standards Act (40 U.S.C. 327-333); and Title 29, Code of Federal Regulations, Part 3.

b. The City furnishes as part of this contract an assurance (Exhibit C) that it will comply with Title VI of the Civil Rights Act of 1964 (78 Stat. 241, 42 U.S.C. 2000d et seq.) and Department of Defense Directive 5500.11 issued pursuant thereto and published in Part 300 of Title 32, Code of Federal Regulations.

ARTICLE 15. Water conservation. There is a strong Federal interest in the efficient use of Federal projects, and this objective may be served by effective management of the use of water from the system into which a Federal project is integrated. Therefore, prior to the first use of storage space indicated in Article 1(b)(1), the City shall submit to the Contracting Officer for his approval a management plan which incorporates loss reduction measures and demand management practices which insure that the available supply is used in an economically efficient and environmentally sensitive manner. The plan shall contain a program for implementation of specific time-phased measures. At not-to-exceed five-year intervals, the City and the Contracting Officer shall review and modify the plan as the results of the implementation of measures are made apparent and as the system supplies and user demands change.

ARTICLE 16. Definitions.

a. Joint use costs. The costs of features used for any two or more Project purposes.

b. Project investment costs. The initial cost of the Project, including: land acquisition; construction; interest during construction on the cost of land, labor, and materials used for planning and construction of the Project.


c. Specific costs. The costs of Project features normally serving only one particular Project purpose.

d. Interest during construction. An amount of interest which accrues on expenditures for the establishment of Project services during the period between the actual outlay and the time the Project is first made available to the City for water storage.

ARTICLE 17. Approval. This contract is subject to the written approval of the Secretary of the Army, and it shall not be binding until so approved.

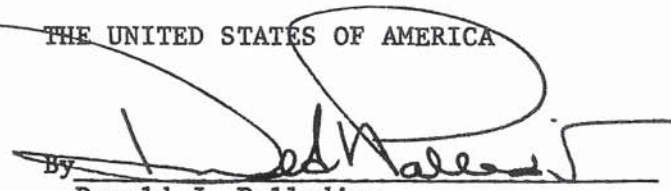
IN WITNESS WHEREOF, the parties hereto have executed this contract as of the day and year first above written.

APPROVED:


Assistant
Secretary of the Army (CW)

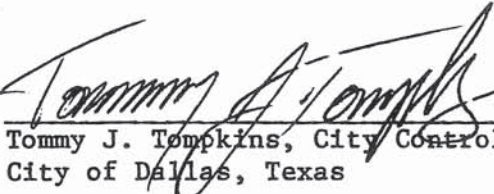
Date 16 SEP 1980

THE UNITED STATES OF AMERICA

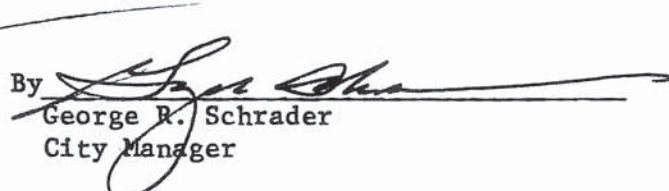
By 
Donald J. Palladino
Colonel, CE
Contracting Officer

Date 15 August 1980

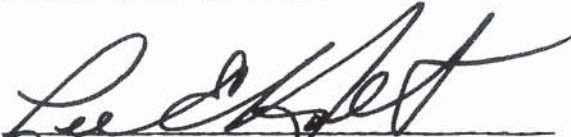
COUNTERSIGNED:


Tommy J. Tompkins, City Controller
City of Dallas, Texas

CITY OF DALLAS, TEXAS


By 
George R. Schrader
City Manager

APPROVED AS TO FORM:


Lee E. Holt, City Attorney
City of Dallas, Texas

I, Robert S. Sloan, certify that I am the City Secretary of the City of Dallas, Dallas County, Texas, named as City herein; that George R. Schrader who signed this contract on behalf of the City of Dallas was then City Manager of the City of Dallas, Texas; that said contract was duly signed for and on behalf of the City of Dallas, Texas by authority of its governing body and is within the scope of its legal powers.

IN WITNESS WHEREOF, I have hereunto affixed my hand and the seal of said City of Dallas, Texas this 8th day of August, 1980.


Robert S. Sloan
Secretary
City of Dallas, Texas

CORPORATE SEAL

B-12

Reviewed for Com. 10
Procurement Priorities
and Regulations R6

AUBREY AND LEWISVILLE LAKESEXHIBIT AI - LAKE STORAGESAubrey Lake

<u>Feature</u>	<u>Elevation (feet msl)</u>	<u>Gross storage (acre-feet)</u>	<u>Percent of gross storage</u>	<u>Percent of water supply storage</u>
Flood control	632.5-640.5	265,000	24.892	
Water supply	below 632.5	799,600	75.108	100.0
(City of Dallas)	below 632.5	(591,700)	(55.580)	(74.0)
(City of Denton)	below 632.5	(207,900)	(19.528)	(26.0)
Totals		1,064,600	100.000	

Lewisville Lake

<u>Feature</u>	<u>Elevation (feet msl)</u>	<u>Gross storage (1) (acre-feet)</u>	<u>Percent of gross storage (2)</u>	<u>Percent of water supply storage</u>
Flood control	522.0-532.0	336,100	65.427	
Water supply	515.0-522.0	177,600	34.573	100.0
(City of Dallas)	515.0-522.0	(131,400)	(25.579)	(74.0)
(City of Denton)	515.0-522.0	(46,200)	(8.994)	(26.0)
Totals		513,700(2)	100.000	

(1) 1985 condition.

(2) Between elevations 515.0 and 532.0 feet msl.

II - PROJECT ESTIMATED CONSTRUCTION INVESTMENT TO BE ALLOCATED

Federal construction cost	\$211,234,000
Nonreimbursable costs (unallocable) (1)	9,826,000
Project cost to be allocated	\$201,408,000
Interest during construction on allocable cost (2)	23,991,800
Project construction investment to be allocated	\$225,399,800

(1) Relocation of roads above replacement-in-kind standards.

(2) Interest rate for Federal share of recreation - 3.25%.

Interest rate for water supply and non-Federal share of recreation - 7.210%.

III - ALLOCATION OF ESTIMATED CONSTRUCTION INVESTMENT

(Separable costs - remaining benefits method)

	<u>Water supply</u>	<u>Recreation</u>	<u>Totals</u>
1. Specific facilities cost	\$ 218,000	\$23,566,000	\$ 23,784,000
Aubrey Lake	(218,000)	(19,985,000)	(20,203,000)
Lewisville Lake	(0)	(3,581,000)	(3,581,000)
2. Joint use facilities cost	125,629,000	51,995,000	177,624,000
Aubrey Lake	(124,413,200)	(51,491,800)	(175,905,000)
Lewisville Lake	(1,215,800)	(503,200)	(1,719,000)
Subtotals - cost	\$125,847,000	\$75,561,000	\$201,408,000
3. Interest during construction	18,147,100	5,844,700	23,991,800
Aubrey Lake	(17,971,800)	(5,437,400)	(23,409,200)
Lewisville Lake	(175,300)	(407,300)	(582,600)
4. Total allocation- investment	\$143,994,100	\$ 81,405,700	\$225,399,800
Aubrey Lake	(142,603,000)	(76,914,200)	(219,517,200)
Lewisville Lake	(1,391,100)	(4,491,500)	(5,882,600)

(1) Interest rate for water supply - 7.210% (fiscal year 1980). Interest rate for reimbursement for water supply storage will be set as of the beginning of the Government fiscal year in which construction of the Project is started.

(2) Investment cost to be repaid by:	<u>Lewisville Lake</u>	<u>Aubrey Lake</u>	<u>Totals</u>
City of Dallas - 74%	\$1,029,400	\$105,526,300	\$106,555,700
Present water supply	(1,029,400)	(54,873,700)	(55,903,100)
Future water supply	(0)	(50,652,600)	(50,652,600)
City of Denton - 26%	361,700	37,076,700	37,438,400
Present water supply	(361,700)	(19,279,900)	(19,641,600)
Future water supply	(0)	(17,796,800)	(17,796,800)
Totals	\$1,391,100	\$142,603,000	\$143,994,100

IV - ALLOCATION OF ESTIMATED OPERATION AND MAINTENANCE COSTS

Aubrey Lake

A. Allocation of estimated total annual costs:

	<u>Water supply</u>	<u>Recreation</u>	<u>Total</u>
1. Specific cost	\$ 70,400	\$642,000	\$712,400
2. Distribution of joint use cost (percent)	57.39	42.61	100.00
3. Allocated joint use cost	102,100	75,800	177,900
4. Total allocation	\$172,500	\$717,800	\$890,300

To be paid by the City of Dallas:

74% of specific cost for water supply facilities

\$ 52,100

Aubrey Lake joint use cost:

Present use w/s storage $(0.52 \times 0.74 \times 0.5739 \times \$177,900)$

39,300

Future use w/s storage $(0.48 \times 0.74 \times 0.5739 \times \$177,900)$

36,300

Total

\$127,700

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B. Annual payment adjustment:

Payment for the City of Dallas' share of the annual operation and maintenance costs allocated to water supply storage for each Government fiscal year will be made by the City in advance on 2 January following close of the prior Government fiscal year. For present use water supply storage, the first payment for such costs will be estimated based on the Contracting Officer's annual estimates therefor, prorated as necessary for a partial year of Project operation. Each annual payment thereafter will include (1) an advance payment for the current fiscal year, estimated based on the actual operation and maintenance costs incurred for the preceding fiscal year (except as noted for particular conditions), and (2) an amount (plus or minus) to adjust the estimated advance payment for the preceding fiscal year for the actual costs incurred for such preceding fiscal year. For future use water supply storage, all advance payments will be estimated based on the actual operation and maintenance costs incurred for the preceding fiscal year (except as noted for particular conditions). The first advance payment will be prorated as necessary for a partial year of storage use; and each annual payment thereafter will include an advance payment for the current fiscal year and an amount (plus or minus) to adjust the estimated advance payment for the preceding fiscal year for the actual costs incurred for such preceding fiscal year.

V - ALLOCATION OF ESTIMATED MAJOR CAPITAL REPLACEMENTS
COSTS AND SEDIMENTATION RESURVEYS COSTS

A. Major capital replacements costs: (1)

Aubrey Lake

	<u>Water supply</u>	<u>Recreation</u>	<u>Total</u>
1. Specific cost	\$21,900	\$133,000	\$154,900
2. Distribution of joint use cost (percent)	50.00	50.00	100.00
3. Allocated joint use cost	<u>7,100</u>	<u>7,100</u>	<u>14,200</u>
4. Total allocation	\$29,000	\$140,100	\$169,100

To be paid by the City of Dallas:

74% of specific cost for water supply facilities \$16,200

Aubrey Lake joint use cost:

Present use w/s storage $(0.52 \times 0.74 \times 0.5000 \times \$14,200)$ 2,700

Future use w/s storage $(0.48 \times 0.74 \times 0.5000 \times \$14,200) \quad (2)$ 2,500

Total \$21,400

- (1) Estimates of average annual charges are used for determination of allocated percentages. All charges will be based on the indicated percentages of actual costs if and when they are incurred.
- (2) Additional amounts of joint use cost required to be paid as future water supply storage is used will be computed as follows:

$$\frac{\text{Percent of future w/s storage placed in use}}{100} \times 0.48 \times 0.37000 \times \text{actual joint use cost}$$

B. Sedimentation resurveys costs:

Aubrey Lake

Sedimentation resurveys costs allocated to water supply and to be paid by the City of Dallas in accordance with Article 5c(3) are based on the percentage of the gross storage in Aubrey Lake represented by the storage right of the City - see section I of this Exhibit A.

Present use water supply storage = $0.52 \times 55.580\% = 28.902\%$

Future use water supply storage = $\frac{\text{Percent of future w/s storage placed in use}}{100} \times 26.678\%$

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VI - COMPUTATIONS FOR ANNUAL PAYMENTS FOR INTEREST AND AMORTIZATION

Present use water supply storage:

Amount to be amortized:

Lewisville Lake	\$ 1,391,100 x 0.74	\$ 1,029,400
Aubrey Lake	142,603,000 x 0.74 x 0.52	54,873,700
Total		<u>\$55,903,100</u>

Based on 50 equal payments, 49 of which bear interest on the unpaid balance at the rate of 7.210 percent.

$P = (A - P)(i + c)$	Where: P = annual payment
$P = (A - P)(.0745602419P)$	A = amount to be repaid = \$55,903,100
$P = 0.0745602419A - 0.0745602419P$	i = interest rate = 7.210%
$1.0745602419P = .0745602419A$	(i+c) = interest rate plus amortization
$P = \frac{.0745602419(\$55,903,100)}{1.0745602419}$	coefficient for 49 years = .0745602419
$P = \$3,878,934.37$	

EXHIBIT B

PMT. NO.	PAYMENT TO INTEREST	PAYMENT TO PRINCIPAL	TOTAL PAYMENT	BALANCE DUE
				55903100.00
1	0.00	3878934.37	3878934.37	52024165.63
2	3750942.34	127992.03	3878934.37	51896173.60
3	3741714.12	137220.25	3878934.37	51758953.35
4	3731820.54	147113.83	3878934.37	51611839.52
5	3721213.63	157720.74	3878934.37	51454118.78
6	3709841.96	169092.41	3878934.37	51285026.37
7	3697650.40	181283.97	3878934.37	51103742.40
8	3684579.83	194354.54	3878934.37	50909387.86
9	3670566.86	208367.51	3878934.37	50701020.35
10	3655543.57	223390.80	3878934.37	50477629.55
11	3639437.09	239497.28	3878934.37	50238132.27
12	3622169.34	256765.03	3878934.37	49981367.24
13	3603656.58	275277.79	3878934.37	49706089.45
14	3583809.05	295125.32	3878934.37	49410964.13
15	3562530.51	316403.86	3878934.37	49094560.27
16	3539717.80	339216.57	3878934.37	48755343.70
17	3515260.28	363674.09	3878934.37	48391669.61
18	3489039.38	389894.99	3878934.37	48001774.62
19	3460927.95	418006.42	3878934.37	47583768.20
20	3430789.69	448144.68	3878934.37	47135623.52
21	3398478.46	480455.91	3878934.37	46655167.61
22	3363837.58	515096.79	3878934.37	46140070.82
23	3326699.11	552235.26	3878934.37	45587835.56
24	3286882.94	592051.43	3878934.37	44995784.13
25	3244196.04	634738.33	3878934.37	44361045.80
26	3198431.40	680502.97	3878934.37	43680542.83
27	3149367.14	729567.23	3878934.37	42950975.60
28	3096765.34	782169.03	3878934.37	42168806.57
29	3040370.95	838563.42	3878934.37	41330243.15
30	2979910.53	899023.84	3878934.37	40431219.31
31	2915090.91	963843.46	3878934.37	39467375.85
32	2845597.80	1033336.57	3878934.37	38434039.28
33	2771094.23	1107840.14	3878934.37	37326199.14
34	2691218.96	1187715.41	3878934.37	36138483.73
35	2605584.68	1273349.69	3878934.37	34865134.04
36	2513776.16	1365158.21	3878934.37	33499975.83
37	2415348.26	1463586.11	3878934.37	32036389.72
38	2309823.70	1569110.67	3878934.37	30467279.05
39	2196690.82	1682243.55	3878934.37	28785035.50
40	2075401.06	1803533.31	3878934.37	26981502.19
41	1945366.31	1933568.06	3878934.37	25047934.13
42	1805956.05	2072978.32	3878934.37	22974955.81
43	1656494.31	2222440.06	3878934.37	20752515.75
44	1496256.39	2382677.98	3878934.37	18369837.77
45	1324465.30	2554469.07	3878934.37	15815368.70
46	1140288.08	2738646.29	3878934.37	13076722.41
47	942831.69	2936102.68	3878934.37	10140619.73
48	731138.68	3147795.69	3878934.37	6992824.04
49	504182.61	3374751.76	3878934.37	3618072.28
50	260863.01	3618072.28	3878935.29	0.00

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Contract No. DACW63-80-C-0103



AUBREY AND LEWISVILLE LAKES

EXHIBIT C

ASSURANCE OF COMPLIANCE WITH THE
DEPARTMENT OF DEFENSE DIRECTIVE UNDER
TITLE VI OF THE CIVIL RIGHTS ACT OF 1964

The City of Dallas, Dallas County, Texas (hereinafter called "Applicant-Recipient") HEREBY AGREES THAT it will comply with title VI of the Civil Rights Act of 1964 (Public Law 88-352) and all requirements imposed by or pursuant to the Directive of the Department of Defense (32 CFR Part 300, issued as Department of Defense Directive 5500.11, December 28, 1964) issued pursuant to that title, to the end that, in accordance with title VI of that Act and the Directive, no person in the United States shall, on the ground of race, color, or national origin be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under, any program or activity for which the Applicant-Recipient receives Federal financial assistance from the U. S. Army Corps of Engineers and HEREBY GIVES ASSURANCE THAT it will immediately take any measures necessary to effectuate this agreement.

If any real property or structure thereon is provided or improved with the aid of Federal financial assistance extended to the Applicant-Recipient by the U. S. Army Corps of Engineers, assurance shall obligate the Applicant-Recipient, or in the case of any transfer of such property, any transferee, for the period during which the real property or structure is used for a purpose for which Federal financial assistance is extended or for another purpose involving the provision of similar services or benefits. If any personal property is so provided this assurance shall obligate the Applicant-Recipient for the period during which it retains ownership or possession of the property. In all other cases, this assurance shall obligate the Applicant-Recipient for the period during which the Federal financial assistance is extended to it by the U. S. Army Corps of Engineers.


THIS ASSURANCE is given in consideration of and for the purpose of obtaining any and all Federal grants, loans, contracts, property, discounts, or other Federal financial assistance extended after the date hereof to the Applicant-Recipient by the Department, including installment payments after such date on account of arrangements for Federal financial assistance which were approved before such date.

The Applicant-Recipient recognizes and agrees that such Federal assistance will be extended in reliance on the representations and agreements made in this assurance, and that the United States shall have the right to seek

judicial enforcement of this assurance. This assurance is binding on the Applicant-Recipient, its successors, transferees, and assignees; and the person or persons whose signatures appear below are authorized to sign this assurance on behalf of the Applicant-Recipient.


THE CITY OF DALLAS, TEXAS

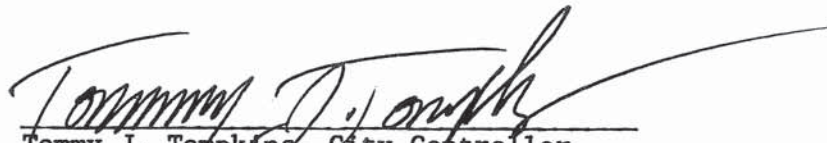
Dated 8 August 1980

By 
George R. Schrader
City Manager

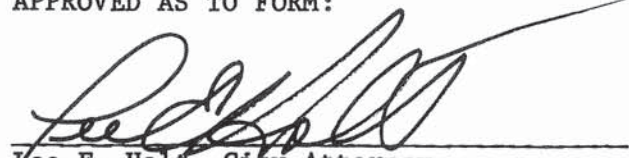
COUNTERSIGNED:

ATTEST:


Robert S. Sloan
Secretary
City of Dallas, Texas


Tommy J. Tompkins, City Controller
City of Dallas, Texas

APPROVED AS TO FORM:


Lee E. Holt, City Attorney
City of Dallas, Texas

Contract No. DACW63-80-C-0103


AUBREY AND LEWISVILLE LAKES

EXHIBIT D

OPINION OF COUNSEL

I have reviewed and approved contract number DACW63-80-C-0103 between the United States of America and the City of Dallas, Texas. Particularly I have considered the effect of Section 221 of Public Law 91-611 (42 U.S.C. 1962d-5b) and am of the opinion that the City of Dallas, Texas, has the requisite legal authority to enter into and comply with this agreement as required by the aforementioned statute.

Dated 11 August 1980



Lee E. Holt
City Attorney
City of Dallas, Texas

EXHIBIT C

CONTRACT BETWEEN CITY OF DENTON

AND THE UNITED STATES DEPARTMENT OF THE ARMY, CORPS OF

ENGINEERS

FOR

WATER STORAGE SPACE IN RAY ROBERTS LAKE, TEXAS

SUPPLEMENTAL AGREEMENT NO. P00001
TO
CONTRACT NO. DACW63-80-C-0104
(THE CITY OF DENTON AND THE
CORPS OF ENGINEERS DATED 15 AUGUST 1980)

THIS SUPPLEMENTAL AGREEMENT, entered into this 14th day of May 1982,
by and between the Government, represented by the Contracting Officer executing
this agreement, and the City, WITNESSETH:

WHEREAS, on the 15th day of August 1980, the parties hereto entered into
Contract No. DACW63-80-C-0104 for Water Storage Space in Aubrey and Lewisville
Lakes.

WHEREAS, Public Law 96-384, 94 STAT. 1527, changed the name of Aubrey Lake to
Ray Roberts Lake, effective January 4, 1981.

NOW, THEREFORE, the parties agree as follows:

1. Contract ARTICLE 15, Water Conservation, is deleted in its entirety.
2. All other terms and conditions of the original contract shall remain unchanged.

IN WITNESS WHEREOF, the parties hereto have executed this supplemental agreement
as of the day and year first above written.

CITY OF DENTON, TEXAS

By Richard O. Stewart
Richard O. Stewart
Mayor

THE UNITED STATES OF AMERICA

By Donald J. Palladino
Donald J. Palladino
Colonel, CE
Contracting Officer

Charlotte Allen

I, ~~XXXXXX~~, certify that I am the City Secretary of the City of Denton,
Denton County, Texas, named as City herein; that Richard O. Stewart who signed
this supplemental agreement on behalf of the City of Denton was then Mayor of
the City of Denton, Texas; that said supplemental agreement was duly signed for
and on behalf of the City of Denton, Texas by authority of its governing body
and is within the scope of its legal powers.

IN WITNESS WHEREOF, I have hereunto affixed my hand and the seal of said City
of Denton, Texas this 1st day of April, 1982.

Charlotte Allen
~~XXXXXX~~ Charlotte Allen
Secretary
City of Denton, Texas

CORPORATE SEAL

CONTRACT BETWEEN THE UNITED STATES OF AMERICA
AND
THE CITY OF DENTON, TEXAS
FOR
WATER STORAGE SPACES IN AUBREY AND LEWISVILLE LAKES, TEXAS

THIS CONTRACT, entered into this ^{15th} day of ^{August} 1980, by and between the United States of America (hereinafter called the Government), represented by the Contracting Officer executing this contract, and the City of Denton, Denton County, Texas (hereinafter called the City), WITNESSETH THAT:

WHEREAS, the River and Harbor Act of 1965 (Public Law 89-298, 79 Stat. 1091) authorized the construction, operation, and maintenance of Aubrey Lake including modification of Garza-Little Elm Reservoir, since renamed Lewisville Lake, (hereinafter called the Project) on the Elm Fork of the Trinity River in the State of Texas; and

WHEREAS, in accordance with the authorized modification, Lewisville Lake (located immediately downstream from the Aubrey Dam) will be modified to permit the transfer of flood control storage from Lewisville Lake to Aubrey Lake for an equivalent amount of water supply storage in Lewisville Lake for municipal and industrial uses; and

WHEREAS, the City desires to contract with the Government for the use of storage included in Aubrey Lake and the additional storage to be made available in Lewisville Lake for municipal and industrial water supply and for payment of the cost thereof in accordance with the provisions of the Water Supply Act of 1958, as amended (43 U.S.C. 390b); and

WHEREAS, the City is empowered so to contract with the Government and is vested with all the necessary powers for accomplishment of the purposes of this contract, including those required by Section 221 of the Flood Control Act of 1970 (42 U.S.C. 1962d-5b);

NOW, THEREFORE, the Government and the City agree as follows:

ARTICLE 1. Water storage space.

a. Project construction. The Government, subject to the directions of Federal law and any limitations imposed thereby, shall design and construct the Project so as to include in Aubrey Lake space for the storage of water by the City and space for the storage of floodwaters which will permit the reallocation of flood control storage in Lewisville Lake to municipal and industrial water supply storage, a portion of which will also be utilized by the City.

b. Rights of the City.

(1) The City shall have the right to utilize (a) an undivided 26.0 percent (estimated to contain 207,900 acre-feet gross storage, including storage for sediment deposits) of the total storage space in Aubrey Lake below

elevation 632.5 feet above mean sea level, which total storage space is estimated to contain 799,600 acre-feet gross storage, including storage for sediment deposits, and (b) an undivided 26.0 percent (estimated to contain 46,200 acre-feet gross storage, including storage for sediment deposits) of the total storage space in Lewisville Lake between elevations 515.0 feet above mean sea level and 522.0 feet above mean sea level, which total storage space is estimated to contain 177,600 acre-feet gross storage, including storage for sediment deposits. The storage space in Lewisville Lake is to be used to impound water for present demand or need for municipal and industrial water supply; and the storage space in Aubrey Lake is to be used to impound water for present and anticipated future demands or needs for municipal and industrial water supply. In Aubrey Lake, 52 percent (an estimated 108,100 acre-feet) of the space which the City has a right to utilize is for present use water storage and 48 percent (an estimated 99,800 acre-feet) is for future use water storage.

(2) The City shall have the right to withdraw or transfer water from or transfer water into either or both of the two lakes, or to order releases to be made by the Government through the outlet works in the dams, subject to the provisions of Article 1c and to the extent the aforesaid storage spaces will provide. The City shall have the right to construct all such works, plants, pipelines, and appliances as may be necessary and convenient for the purpose of transfers or withdrawals, subject to the approval of the Contracting Officer as to design and location. The grant of rights-of-way across, in, and upon land of the Government at Aubrey Lake and at Lewisville Lake shall be by separate instrument in a form satisfactory to the Secretary of the Army, without additional cost to the City, under the authority of and in accordance with the provisions of 10 U.S.C. 2669. Subject to the conditions of such grants, the City shall have the right to use so much of Aubrey Lake and Lewisville Lake lands as may reasonably be required in the exercise of the rights and privileges herein granted.

c. Rights reserved. The Government reserves the right to lower the water in Aubrey Lake to elevation 632.5 feet above mean sea level and to lower the water in Lewisville Lake to elevation 522.0 feet above mean sea level during such periods of time as is deemed necessary, in its sole discretion, for flood control purposes. The Government further reserves the right to take such measures as may be necessary in the operation of Aubrey Lake and Lewisville Lake to preserve life or property.

d. Quality or availability of water. The City recognizes that this contract provides storage spaces for raw water only. The Government makes no representations with respect to the quality or availability of water and assumes no responsibility therefor or for the treatment of water.

ARTICLE 2. Regulation of and right to use of water. The regulation of the use of water withdrawn or released from or transferred to or from the aforesaid storage spaces shall be the sole responsibility of the City. The City has the full responsibility to acquire in accordance with State laws and regulations, and if necessary to establish or defend, any and all water rights needed for utilization of the storages provided under this contract. The Government shall not be responsible for withdrawals, transfers, or diversions by others, nor will it become a party to any controversies

involving the use of the storage spaces by the City except as such controversies may affect the operations of the Government.

ARTICLE 3. Operation and maintenance. The Government shall operate and maintain Aubrey Lake and Lewisville Lake, and the City shall pay to the Government a share of the costs of such operation and maintenance as provided in Article 5c. The City shall be responsible for operation and maintenance of all installations and facilities which it may construct for the transfer into or out of or withdrawal of water from either or both of the two lakes and shall bear all costs of construction, operation, and maintenance of such installations and facilities.

ARTICLE 4. Measurement of withdrawals and releases. The City agrees to furnish and install, without cost to the Government, suitable meters or measuring devices satisfactory to the Contracting Officer for the measurement of water which is transferred into Aubrey Lake or Lewisville Lake or is withdrawn or transferred from Aubrey Lake or Lewisville Lake by any means other than through Aubrey Lake or Lewisville Lake outlet works. The City shall furnish to the Government monthly statements of all such withdrawals or transfers. Releases from the water supply storage spaces through Aubrey Lake or Lewisville Lake outlet works shall be made in accordance with written schedules furnished by the City and approved by the Contracting Officer and shall be subject to Article 1c. The measure of all such releases shall be by means of a rating curve of the outlet works or by such other suitable means as may be agreed upon prior to use of the water supply storage space or spaces.

ARTICLE 5. Payments. In consideration of the right to utilize the aforesaid storage spaces in Aubrey Lake and Lewisville Lake for municipal and industrial water supply purposes, the City shall pay the following sums to the Government:

a. Project investment costs.

(1) The City shall repay to the Government, at the times and with interest on the unpaid balance as hereinafter specified, the amounts stated below which, as shown in Exhibit A of this contract, constitute the entire estimated amount of the construction costs, including interest during construction, allocated to the water storage rights acquired by the City under this contract. The interest rate to be used for purposes of computing interest during construction and interest on the unpaid balance will be determined by the Secretary of the Treasury as of the beginning of the Government fiscal year in which construction of the Project is initiated on the basis set forth in the Water Supply Act of 1958, as amended. Such interest rate at the time of negotiation of this contract (Government fiscal year 1980) is 7.210 percent. The City shall repay:

26 percent of the construction cost of specific water supply facilities, estimated at	\$ 56,700
18.39 percent of the total Project joint use construction cost, estimated at	32,663,500
Interest during construction, estimated at	<u>4,718,200</u>
Total estimated amount of Project investment cost allocated to 26 percent of the water supply	\$37,438,400

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(2) The Project investment costs allocated to the storage space indicated in Article 1(b)(1) as being provided for present demand is currently estimated at \$19,641,600, on the basis of the costs presented in Exhibit "A". The amount of the Project Investment costs allocated to the storage for present demand shall be paid in 50 consecutive annual installments, the first of which shall be due and payable within 30 days after the City is notified by the Contracting Officer that the Project is completed and operational for water supply purposes. Annual installments thereafter will be due and payable on the anniversary date of the first payment. Except for the first payment which will be applied solely to the retirement of principal, all installments shall include accrued interest on the unpaid balance at the rate provided above. The last annual installment shall be adjusted upward or downward when due to assure repayment of all of the investment costs allocated to the storage for present demand within 50 years.

(3) The Project investment cost allocated to the remaining portion of the storage space, that provided in Aubrey Lake for future use, is currently estimated at \$17,796,800 on the basis of the costs presented in Exhibit A of this contract. No principal or interest payment with respect to this storage for future water supply is required to be made during the first 10 years following the date the Project is operational for water supply purposes unless all or a portion of such storage is used for purposes of withdrawal of water from or transfer of water into Aubrey Lake during this period. The amount to be paid for any portion of such storage which is used shall be determined by multiplying the percentage of the total storage for future water supply which is placed in use by the total amount of the Project investment cost allocated to future water supply. Interest at the rate provided above will be charged on the amount of the Project investment cost allocated to the storage for future water supply which is not being used from the tenth (10th) year following the date the Project is operational for water supply purposes until the time when such storage is first used. The City may at its option pay the interest as it becomes due or allow the interest to accumulate until the storage is used. If this latter option is exercised, the interest will be compounded annually and added to the principal amount. When any portion of the storage for future water supply is used, the amount of the Project investment cost allocated thereto plus interest applicable to such portion as provided above will be due and payable on the date of first use of such portion. The said amount due shall be paid within the life of the Project in not to exceed 50 consecutive annual payments beginning on the next anniversary date established in accordance with the provisions of Article 5a(2) above. Annual payments thereafter for such portion will be due and payable on said anniversary date. For any portion, all payments shall include accrued interest on the unpaid balance at the rate provided above, with interest accruing from the said date of first use of such portion. The last annual payment for any portion shall be adjusted upward or downward when due to assure repayment of all the investment cost allocated to such portion within the repayment period.

(4) An estimated schedule of annual payments for the storages provided for present demand is attached as Exhibit B of this contract. The annual payments as provided therein shall be made until an interim estimated determination of cost or a final determination of cost is made as provided in Article 6. Payment schedules for the storage provided for future water supply demands will

be furnished by the Contracting Officer when use of such storage is started, and if based on estimated costs will be subject to revision, as provided in Article 6, until actual costs are known.

(5) The City shall have the right at any time it so elects to prepay the indebtedness under this Article 5a, in whole or in part, with accrued interest thereon to the date of such prepayment.

b. Major capital replacement costs and resedimentation surveys costs. The City will be required to pay to the Government 26 percent of the cost for any major capital replacement of specific water supply facilities at Aubrey Lake. In addition, the City shall pay to the Government 6.760 percent of the costs of joint use major capital replacement items at Aubrey Lake until such time as the storage for future water supply is first used. As the storage provided for future water supply is used, the share of the joint use major capital replacement items costs, which the City will be required to pay in addition to the major capital replacement costs of the specific water supply facilities, will be increased commensurate with the percentage of the total water supply storage being used up to a total of 13.000 percent of such costs. The City will also be required to pay to the Government 10.155 percent of the costs of sedimentation resurveys at Aubrey Lake until such time as the storage for future water supply is used. As the storage provided for future water supply demands is used, the share of the sedimentation resurveys costs which the City will be required to pay will be increased commensurate with the percentage of the total water supply storage being used up to a total of 19.528 percent of such costs. Payment shall be made either in lump sum on demand at the time such costs are incurred or annually with interest on the unpaid balance. If paid annually, the City's share shall be paid within the life of the Project not to exceed 25 consecutive annual payments beginning on the next anniversary date established in accordance with the provisions of Article 5a(2) above following the date demand is made for payment of said major capital replacement costs and resedimentation surveys. Annual payments thereafter will be due and payable on said anniversary date. All payments shall include accrued interest on the unpaid balance at the rate determined by the Secretary of the Treasury on the basis of the Water Supply Act of 1958, as amended, for use in the Government fiscal year in which major capital replacement is initiated, with interest accruing from the date said major capital replacement is initiated. The last annual payment shall be adjusted upward or downward when due to assure repayment of all the incurred costs within the repayment period.

c. Annual operation and maintenance costs.

(1) The City will be required to pay to the Government 26 percent of the annual experienced operation and maintenance costs of specific water supply facilities at Aubrey Lake. In addition, the City shall pay to the Government 7.759 percent of the annual experienced joint use operation and maintenance costs of Aubrey Lake until such time as the storage for future water supply is first used. As the storage provided for future water supply demands is used, the share of the annual experienced joint use operation and maintenance costs, which the City will be required to pay in addition to the operation and maintenance costs of the specific water supply facilities, will be increased commensurate with the percentage of the total water supply storage being used

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up to a total of 14.921 percent of such costs. Twelve months prior to the expected date that the Contracting Officer shall notify the City that the Project is complete and operational for the water supply purpose, the Government shall provide the City an estimate of the first advance payment for operation and maintenance costs. The first payment for operation and maintenance costs of present use water supply storage in Aubrey Lake will be due and payable in advance within 90 days after the Contracting Officer notifies the City that the Project is completed and operational for water supply purposes, will be for the period beginning on the date the Project is operational for water supply purposes and ending on 30 September following, and will amount to the sum of the first payment for specific water supply facilities costs and the first payment for joint use costs. Annual payments thereafter, for each Government fiscal year ending 30 September, will be due and payable in advance on 2 January following the close of the prior Government fiscal year. Payment by the City and payment adjustments by the Government shall be in accordance with Exhibit A, IV, B.

(2) When each and any portion of the future water supply storage is placed in use, the first payment of the additional amount of the joint use operation and maintenance costs required to be paid for such storage use will be due and payable in advance within 30 days after first use of such storage and will be for the period beginning on the date of said first use and ending on 30 September following. Annual payments thereafter, for each Government fiscal year ending 30 September, will be due and payable in advance on 2 January following the close of the prior Government fiscal year.

d. Charges for delinquent payments. If the City shall fail to make any of the aforesaid payments when due, then the overdue payments shall bear interest compounded annually until paid. The interest rate to be used for overdue payments due under the provisions of Articles 5a, 5b, and 5c above shall be that determined by the Secretary of the Treasury on the basis of the Water Supply Act of 1958, as amended, for use in the Government fiscal year in which each period of delinquency occurs. The amount charged on payments overdue for a period of less than one year shall be figured on a monthly basis. For example, if the payment is made within the first month after being overdue (31 to 60 days after the anniversary date of the date of notification) one month's interest shall be charged. This provision shall not be construed as giving the City a choice of either making payments when due or paying interest, nor shall it be construed as waiving any other rights of the Government, at law or in equity, which might result from any default by the City.

e. Assurance of funds for contract payments. The City warrants that all payments contracted hereunder shall be secured by a pledge of surplus revenues of the City's combined Waterworks and Sanitary Sewer System remaining after payment of all expenses of operating and maintaining such system and after providing for payment of all debt service, reserve, or other requirements in connection with the City's Waterworks and Sanitary Sewer System Revenue Bonds now outstanding or those hereafter issued on a first lien basis or on such other basis as may be approved by the Contracting Officer, provided, that in the event such surplus revenues may become or are insufficient to meet the payments contracted hereunder, the City shall fix and collect such rates and charges for services of said combined system as will make possible the prompt payment of

all the aforementioned requirements including payments contracted hereunder. Payments made by the City as Project investment cost and as major capital replacement costs shall be regarded as capital expenditures.

ARTICLE 6. Construction cost adjustments. All construction cost dollar amounts in this contract, including those in the Exhibits, are tentative only based on the Government's best estimates. They will be adjusted upward or downward by the Contracting Officer when final construction costs become known, and the contract will be modified to reflect the adjustments. Within two years after the Project is completed and operational for water supply purposes, the Contracting Officer shall make a revised interim estimated determination of construction costs, including interest during construction and taking into account the actual costs to the extent they are then known. In like manner, further interim determinations shall be made at two year intervals until all actual costs are known, at which time the Contracting Officer shall prepare a final cost determination, including interest during construction. On each occasion of an interim determination, or on final determination, the annual payments thereafter due shall be changed so as to provide for the payment of the balance due in equal payments during the remaining life of the repayment period; and a revised schedule, or schedules as necessary, of annual payments shall be furnished to the City.

ARTICLE 7. Duration of contract. This contract shall be effective when approved by the Secretary of the Army and shall continue in full force and effect for the life of Aubrey Lake and Lewisville Lake. Both Aubrey Lake and the additional storage to be made available in Lewisville Lake have been formulated on the basis of 100 years economic life.

ARTICLE 8. Permanent rights to storage. Upon completion of payments by the City as provided in Article 5a herein, the City shall have a permanent right, under the provisions of the Act of 16 October 1963 (Public Law 88-140, 43 U.S.C. 390e), to the use of the water supply storage spaces in Aubrey Lake and Lewisville Lake as provided in Article 1, subject to the following:

a. The City shall continue payment of its share, as provided in Article 5c, of the annual operation and maintenance costs allocated to water supply.

b. The City shall bear 26 percent of the costs allocated to (1) water supply for Aubrey Lake and (2) the total storage space between elevations 515.0 feet above mean sea level and 522.0 feet above mean sea level for Lewisville Lake of any necessary reconstruction, rehabilitation, or replacement of Aubrey Lake or Lewisville Lake features which may be required to continue satisfactory operation of Aubrey Lake or Lewisville Lake. Such costs will be established by the Contracting Officer and repayment arrangements shall be in writing in accordance with the terms and conditions set forth in Article 5(b) for major capital replacement costs.

c. Upon completion of payments by the City as provided in Article 5a herein, the Contracting Officer shall redetermine the storage space for municipal and industrial water supply in Aubrey Lake, taking into account such equitable reallocation of lake storage capacities among the purposes served

by Aubrey Lake as may be necessary due to sedimentation. Such findings, and the storage space allocated to municipal and industrial water supply, shall be defined and described in an exhibit which will be made a part of this contract. Following the same principle, such reallocation of lake storage capacities may be further adjusted from time to time as the result of sedimentation resurveys to reflect actual rates of sedimentation and the exhibit revised to show the revised storage space allocated to municipal and industrial water supply.

d. The permanent rights of the City under this contract shall be continued so long as the Government continues to operate Aubrey Lake and/or Lewisville Lake. In the event the Government no longer operates Aubrey Lake or Lewisville Lake, such rights may be continued subject to the execution of a separate contract, or supplemental agreement, providing for:

(1) Continued operation by the City of such part of the facility as is necessary for utilization of the water supply storage spaces allocated to it;

(2) Terms which will protect the public interest; and

(3) Effective absolvment of the Government by the City from all liability in connection with such continued operation.

ARTICLE 9. Release of claims. The City shall hold and save the Government, including its officers, agents, and employees, harmless from liability of any nature or kind for or on account of any claim for damages which may be filed or asserted as a result of the storages in Aubrey Lake and/or Lewisville Lake, or withdrawal or release of water from or transfer of water to or from Aubrey Lake or Lewisville Lake made or ordered by the City, or as a result of the construction, operation, or maintenance of the features and appurtenances owned and operated by the City, provided, that this shall not be construed as obligating the City to hold and save the Government harmless from damages or liability resulting from the sole negligence of the Government or its officers, agents, or employees and not involving negligence on the part of the City or its officers, agents, or employees.

ARTICLE 10. Assignment. The City shall not transfer or assign this contract or any rights acquired hereunder, nor sub-allot said water supply storage spaces or any part thereof, nor grant any interest, privilege, or license whatsoever in connection with this contract, without the approval of the Secretary of the Army, provided, that unless contrary to the public interest, this restriction shall not be construed to apply to any water that may be obtained from the water supply storage spaces by the City and furnished to any third party or parties, nor any method of allocation thereof.

ARTICLE 11. Officials not to benefit. No member of or delegate to Congress, or Resident Commissioner, shall be admitted to any share or part of this contract or to any benefit that may arise herefrom; but this provision shall not be construed to extend to this contract if made with a corporation for its general benefit.

ARTICLE 12. Covenant against contingent fees. The City warrants that no person or selling agency has been employed or retained to solicit or secure this contract upon agreement or understanding for a commission, percentage, brokerage, or contingent fee excepting bona fide employees or bona fide established commercial or selling agencies maintained by the City for the purpose of securing business. For breach or violation of this warranty, the Government shall have the right to annul this contract without liability or in its discretion to add to the contract price or consideration or otherwise recover the full amount of such commission, percentage, brokerage, or contingent fee.

ARTICLE 13. Environmental quality. During any construction, operation, and maintenance by the City of any facilities, specific actions will be taken to control environmental pollution which could result from such activity and to comply with applicable Federal, State, and local laws and regulations concerning environmental pollution. Particular attention should be given to (1) reduction of air pollution by control of burning, minimization of dust, containment of chemical vapors, and control of engine exhaust gases and smoke from temporary heaters; (2) reduction of water pollution by control of sanitary facilities, storage of fuels and other contaminants, and control of turbidity and siltation from erosion; (3) minimization of noise levels; (4) onsite and offsite disposal of waste and spoil; and (5) prevention of landscape defacement and damage.

ARTICLE 14. Federal and State laws.

a. In acting under its rights and obligations hereunder, the City agrees to comply with all applicable Federal and State laws and regulations, including but not limited to the provisions of the Davis-Bacon Act (40 U.S.C. 276a et seq.); the Contract Work Hours and Safety Standards Act (40 U.S.C. 327-333); and Title 29, Code of Federal Regulations, Part 3.

b. The City furnishes as part of this contract an assurance (Exhibit C) that it will comply with Title VI of the Civil Rights Act of 1964 (78 Stat. 241, 42 U.S.C. 2000d et seq.) and Department of Defense Directive 5500.11 issued pursuant thereto and published in Part 300 of Title 32, Code of Federal Regulations.

ARTICLE 15. Water conservation. There is a strong Federal interest in the efficient use of Federal projects, and this objective may be served by effective management of the use of water from the system into which a Federal project is integrated. Therefore, prior to the first use of storage space indicated in Article 1(b)(1), the City shall submit to the Contracting Officer for his approval a management plan which incorporates loss reduction measures and demand management practices which insure that the available supply is used in an economically efficient and environmentally sensitive manner. The plan shall contain a program for implementation of specific time-phased measures. At not-to-exceed five-year intervals, the City and the Contracting Officer shall review and modify the plan as the results of the implementation of measures are made apparent and as the system supplies and user demands change.

ARTICLE 16. Definitions.

a. Joint use costs. The costs of features used for any two or more Project purposes.

b. Project investment costs. The initial cost of the Project, including: land acquisition; construction; interest during construction on the cost of land, labor, and materials used for planning and construction of the Project.

c. Specific costs. The costs of Project features normally serving only one particular Project purpose.

d. Interest during construction. An amount of interest which accrues on expenditures for the establishment of Project services during the period between the actual outlay and the time the Project is first made available to the City for water storage.

ARTICLE 17. Approval. This contract is subject to the written approval of the Secretary of the Army, and it shall not be binding until so approved.

IN WITNESS WHEREOF, the parties hereto have executed this contract as of the day and year first above written.

APPROVED:

Richard Blumefeld
Assistant
Secretary of the Army (CW)

Date 16 SEP 1980

THE UNITED STATES OF AMERICA

By Donald J. Palladino
Colonel, CE
Contracting Officer

Date 15 August 1980

CITY OF DENTON, TEXAS

By Richard O. Stewart
Richard O. Stewart
Mayor

I, Brooks Holt, certify that I am the City Secretary of the City of Denton, Denton County, Texas, named as City herein; that ^{Richard O. Stewart} who signed this contract on behalf of the City of Denton was then Mayor of the City of Denton, Texas; that said contract was duly signed for and on behalf of the City of Denton, Texas by authority of its governing body and is within the scope of its legal powers.

IN WITNESS WHEREOF, I have hereunto affixed my hand and the seal of said City of Denton, Texas this 5 day of August 1980.

Brooks Holt
Brooks Holt
Secretary
City of Denton, Texas

CORPORATE SEAL

Reviewed for Compliance
w/Procurement Principles
and Regulations RS

AUBREY AND LEWISVILLE LAKESEXHIBIT AI - LAKE STORAGESAubrey Lake

<u>Feature</u>	<u>Elevation (feet msl)</u>	<u>Gross storage (acre-feet)</u>	<u>Percent of gross storage</u>	<u>Percent of water supply storage</u>
Flood control	632.5-640.5	265,000	24.892	
Water supply	below 632.5	799,600	75.108	100.0
(City of Dallas)	below 632.5	(591,700)	(55.580)	(74.0)
(City of Denton)	below 632.5	(207,900)	(19.528)	(26.0)
Totals		1,064,600	100.000	

Lewisville Lake

<u>Feature</u>	<u>Elevation (feet msl)</u>	<u>Gross storage (1) (acre-feet)</u>	<u>Percent of gross storage (2)</u>	<u>Percent of water supply storage</u>
Flood control	522.0-532.0	336,100	65.427	
Water supply	515.0-522.0	177,600	34.573	100.0
(City of Dallas)	515.0-522.0	(131,400)	(25.579)	(74.0)
(City of Denton)	515.0-522.0	(46,200)	(8.994)	(26.0)
Totals		513,700 (2)	100.000	

(1) 1985 condition.

(2) Between elevations 515.0 and 532.0 feet msl.

II - PROJECT ESTIMATED CONSTRUCTION INVESTMENT TO BE ALLOCATED

Federal construction cost	\$211,234,000
Nonreimbursable costs (unallocable) (1)	9,826,000
Project cost to be allocated	\$201,408,000
Interest during construction on allocable cost (2)	23,991,800
Project construction investment to be allocated	\$225,399,800

(1) Relocation of roads above replacement-in-kind standards.

(2) Interest rate for Federal share of recreation - 3.25%.

Interest rate for water supply and non-Federal share of recreation - 7.210%.

III - ALLOCATION OF ESTIMATED CONSTRUCTION INVESTMENT
(Separable costs - remaining benefits method)

AUG 15 1980

	<u>Water supply</u>	<u>Recreation</u>	<u>Totals</u>
1. Specific facilities cost	\$ 218,000	\$23,566,000	\$ 23,784,000
Aubrey Lake	(218,000)	(19,985,000)	(20,203,000)
Lewisville Lake	(0)	(3,581,000)	(3,581,000)
2. Joint use facilities cost	125,629,000	51,995,000	177,624,000
Aubrey Lake	(124,413,200)	(51,491,800)	(175,905,000)
Lewisville Lake	(1,215,800)	(503,200)	(1,719,000)
Subtotals - cost	\$125,847,000	\$75,561,000	\$201,408,000
3. Interest during construction	18,147,100	5,844,700	23,991,800
Aubrey Lake	(17,971,800)	(5,437,400)	(23,409,200)
Lewisville Lake	(175,300)	(407,300)	(582,600)
4. Total allocation-investment	\$143,994,100	\$ 81,405,700	\$225,399,800
Aubrey Lake	(142,603,000)	(76,914,200)	(219,517,200)
Lewisville Lake	(1,391,100)	(4,491,500)	(5,882,600)

(1) Interest rate for water supply - 7.210% (fiscal year 1980). Interest rate for reimbursement for water supply storage will be set as of the beginning of the Government fiscal year in which construction of the Project is started.

(2) Investment cost to be repaid by:	<u>Lewisville Lake</u>	<u>Aubrey Lake</u>	<u>Totals</u>
City of Dallas - 74%	\$1,029,400	\$105,526,300	\$106,555,700
Present water supply	(1,029,400)	(54,873,700)	(55,903,100)
Future water supply	(0)	(50,652,600)	(50,652,600)
City of Denton - 26%	361,700	37,076,700	37,438,400
Present water supply	(361,700)	(19,279,900)	(19,641,600)
Future water supply	(0)	(17,796,800)	(17,796,800)
Totals	\$1,391,100	\$142,603,000	\$143,994,100

IV - ALLOCATION OF ESTIMATED OPERATION AND MAINTENANCE COSTS

Aubrey Lake

A. Allocation of estimated total annual costs:

	<u>Water supply</u>	<u>Recreation</u>	<u>Total</u>
1. Specific cost	\$ 70,400	\$642,000	\$712,400
2. Distribution of joint use cost (percent)	57.39	42.61	100.00
3. Allocated joint use cost	102,100	75,800	177,900
4. Total allocation	\$172,500	\$717,800	\$890,300

To be paid by the City of Denton:

26% of specific cost for water supply facilities

18,300

Aubrey Lake joint use cost:

 Present use w/s storage (0.52 x 0.26 x 0.5739 x \$177,900)

13,800

 Future use w/s storage (0.48 x 0.26 x 0.5739 x \$177,900)

12,700

 Total

\$ 44,800

B. Annual payment adjustment:

Payment for the City of Denton's share of the annual operation and maintenance costs allocated to water supply storage for each Government fiscal year will be made by the City in advance on 2 January following close of the prior Government fiscal year. For present use water supply storage, the first payment for such costs will be estimated based on the Contracting Officer's annual estimates therefor, prorated as necessary for a partial year of Project operation. Each annual payment thereafter will include (1) an advance payment for the current fiscal year, estimated based on the actual operation and maintenance costs incurred for the preceding fiscal year (except as noted for particular conditions), and (2) an amount (plus or minus) to adjust the estimated advance payment for the preceding fiscal year for the actual costs incurred for such preceding fiscal year. For future use water supply storage, all advance payments will be estimated based on the actual operation and maintenance costs incurred for the preceding fiscal year (except as noted for particular conditions). The first advance payment will be prorated as necessary for a partial year of storage use; and each annual payment thereafter will include an advance payment for the current fiscal year and an amount (plus or minus) to adjust the estimated advance payment for the preceding fiscal year for the actual costs incurred for such preceding fiscal year.

V - ALLOCATION OF ESTIMATED MAJOR CAPITAL REPLACEMENTS
COSTS AND SEDIMENTATION RESURVEYS COSTS

A. Major capital replacements costs: (1)

Aubrey Lake

	<u>Water supply</u>	<u>Recreation</u>	<u>Total</u>
1. Specific cost	\$21,900	\$133,000	\$154,900
2. Distribution of joint use cost (percent)	50.00	50.00	100.00
3. Allocated joint use cost	<u>7,100</u>	<u>7,100</u>	<u>14,200</u>
4. Total allocation	\$29,000	\$140,100	\$169,100

To be paid by the City of Denton:

26% of specific cost for water supply facilities 5,700

Aubrey Lake joint use cost:

Present use w/s storage $(0.52 \times 0.26 \times 0.5000 \times \$14,200)$ 1,000

Future use w/s storage $(0.48 \times 0.26 \times 0.5000 \times \$14,200)$ (2) 900

Total \$ 7,600

- (1) Estimates of average annual charges are used for determination of allocated percentages. All charges will be based on the indicated percentages of actual costs if and when they are incurred.
- (2) Additional amounts of joint use cost required to be paid as future water supply storage is used will be computed as follows:

$$\frac{\text{Percent of future w/s storage placed in use}}{100} \times 0.48 \times 0.13000 \times \text{actual joint use cost}$$

B. Sedimentation resurveys costs:

Aubrey Lake

Sedimentation resurveys costs allocated to water supply and to be paid by the City of Denton in accordance with Article 5c(3) are based on the percentage of the gross storage in Aubrey Lake represented by the storage right of the City - see section I of this Exhibit A.

Present use water supply storage = $0.52 \times 19.528\% = 10.155\%$

Future use water supply storage = $\frac{\text{Percent of future w/s storage placed in use}}{100} \times 9.373\%$

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VI - COMPUTATIONS FOR ANNUAL PAYMENTS FOR INTEREST AND AMORTIZATION

Present use water supply storage:

Amount to be amortized:

Lewisville Lake	\$ 1,391,100 x 0.26	\$ 361,700
Aubrey Lake	\$142,603,000 x 0.26 x 0.52	19,279,900
Total		<u>\$19,641,600</u>

Based on 50 equal payments, 49 of which bear interest on the unpaid balance at the rate of 7.210 percent.

$P = (A - P)(i + c)$ Where: P = annual payment
 $P = (A - P)(.0745602419P)$ A = amount to be repaid = \$19,641,600
 $P = .0745602419A - 0.0745602419P$ i = interest rate = 7.210%
 $1.0745602419P = 0.0745602419A$ (i+c) = interest rate plus amortization
 $P = \frac{.0745602419(\$19,641,600)}{1.0745602419}$ coefficient for 49 years = 0.0745602419
 $P = \$1,362,866.77$

EXHIBIT B

MT. D.	PAYMENT TO INTEREST	PAYMENT TO PRINCIPAL	TOTAL PAYMENT	BALANCE DUE
1	0.00	1362866.77	1362866.77	19641600.00
2	1317896.67	44970.10	1362866.77	18278733.23
3	1314654.32	48212.45	1362866.77	18233763.13
4	1311178.20	51688.57	1362866.77	18185550.68
5	1307451.46	55415.31	1362866.77	18133862.11
6	1303456.01	59410.76	1362866.77	18078446.80
7	1299172.50	63694.27	1362866.77	18019036.04
8	1294580.14	68286.63	1362866.77	17955341.77
9	1289656.68	73210.09	1362866.77	17887055.14
10	1284378.23	78488.54	1362866.77	17813845.05
11	1278719.20	84147.57	1362866.77	17735356.51
12	1272652.16	90214.61	1362866.77	17651208.94
13	1266147.69	96719.08	1362866.77	17560994.33
14	1259174.25	103692.52	1362866.77	17464275.25
15	1251698.01	111168.76	1362866.77	17360582.73
16	1243682.75	119184.02	1362866.77	17249413.97
17	1235089.58	127777.19	1362866.77	17130229.95
18	1225876.84	136989.93	1362866.77	17002452.76
19	1215999.87	146866.90	1362866.77	16865462.83
20	1205410.77	157456.00	1362866.77	16718595.93
21	1194058.19	168808.58	1362866.77	16561139.93
22	1181887.09	180979.68	1362866.77	16392331.35
23	1168838.46	194028.31	1362866.77	16211351.67
24	1154849.01	208017.76	1362866.77	16017323.36
25	1139850.93	223015.84	1362866.77	15809305.60
26	1123771.49	239095.28	1362866.77	15586289.76
27	1106532.72	256334.05	1362866.77	15347194.48
28	1088051.04	274815.73	1362866.77	15090860.43
29	1068236.82	294629.95	1362866.77	14816044.70
30	1046994.00	315872.77	1362866.77	14521414.75
31	1024219.58	338647.19	1362866.77	14205541.98
32	999803.11	363063.66	1362866.77	13866894.79
33	973626.22	389240.55	1362866.77	13503831.13
34	945561.98	417304.79	1362866.77	13114590.58
35	915474.31	447392.46	1362866.77	12697285.79
36	883217.31	479649.46	1362866.77	12249893.33
37	848634.58	514232.19	1362866.77	11770243.87
38	811558.44	551308.33	1362866.77	11256011.68
39	771809.11	591057.66	1362866.77	10704703.35
40	729193.85	633672.92	1362866.77	10113645.69
41	683506.04	679360.73	1362866.77	9479972.77
42	634524.13	728342.64	1362866.77	8800612.04
43	582010.62	780856.15	1362866.77	8072269.40
44	525710.90	837155.87	1362866.77	7291413.25
45	465351.96	897514.81	1362866.77	6454257.38
46	400641.14	962225.63	1362866.77	5556742.57
47	331264.67	1031602.10	1362866.77	4594516.94
48	256886.16	1105980.61	1362866.77	3562914.84
49	177144.96	1185721.81	1362866.77	2456934.23
50	91654.42	1271212.42	1362866.84	1271212.42
				0.00

AUBREY AND LEWISVILLE LAKES

EXHIBIT C

ASSURANCE OF COMPLIANCE WITH THE
DEPARTMENT OF DEFENSE DIRECTIVE UNDER
TITLE VI OF THE CIVIL RIGHTS ACT OF 1964

The City of Denton, Denton County, Texas (hereinafter called "Applicant-Recipient") HEREBY AGREES THAT it will comply with title VI of the Civil Rights Act of 1964 (Public Law 88-352) and all requirements imposed by or pursuant to the Directive of the Department of Defense (32 CFR Part 300, issued as Department of Defense Directive 5500.11, December 28, 1964) issued pursuant to that title, to the end that, in accordance with title VI of that Act and the Directive, no person in the United States shall, on the ground of race, color, or national origin be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under, any program or activity for which the Applicant-Recipient receives Federal financial assistance from the U. S. Army Corps of Engineers and HEREBY GIVES ASSURANCE THAT it will immediately take any measures necessary to effectuate this agreement.

If any real property or structure thereon is provided or improved with the aid of Federal financial assistance extended to the Applicant-Recipient by the U. S. Army Corps of Engineers, assurance shall obligate the Applicant-Recipient, or in the case of any transfer of such property, any transferee, for the period during which the real property or structure is used for a purpose for which Federal financial assistance is extended or for another purpose involving the provision of similar services or benefits. If any personal property is so provided, this assurance shall obligate the Applicant-Recipient for the period during which it retains ownership or possession of the property. In all other cases, this assurance shall obligate the Applicant-Recipient for the period during which the Federal financial assistance is extended to it by the U. S. Army Corps of Engineers.

THIS ASSURANCE is given in consideration of and for the purpose of obtaining any and all Federal grants, loans, contracts, property, discounts, or other Federal financial assistance extended after the date hereof to the Applicant-Recipient by the Department, including installment payments after such date on account of arrangements for Federal financial assistance which were approved before such date.

The Applicant-Recipient recognizes and agrees that such Federal assistance will be extended in reliance on the representations and agreements made in this assurance, and that the United States shall have the right to seek

judicial enforcement of this assurance. This assurance is binding on the Applicant-Recipient, its successors, transferees, and assignees; and the person or persons whose signatures appear below are authorized to sign this assurance on behalf of the Applicant-Recipient.

THE CITY OF DENTON, TEXAS

Dated

August 5, 1980

By

Richard O. Stewart
Richard O. Stewart
Mayor

ATTEST:

Brooks Holt
Brooks Holt
Secretary
City of Denton, Texas

Contract No. DACW63-80-C-0104

AUBREY AND LEWISVILLE LAKES

EXHIBIT D

OPINION OF COUNSEL

I have reviewed and approved contract number DACW63-80-C-0104 between the United States of America and the City of Denton, Texas. Particularly I have considered the effect of Section 221 of Public Law 91-611 (42 U.S.C. 1962d-5b) and am of the opinion that the City of Denton, Texas has the requisite legal authority to enter into and comply with this agreement as required by the aforementioned statute.

Dated August 5, 1980

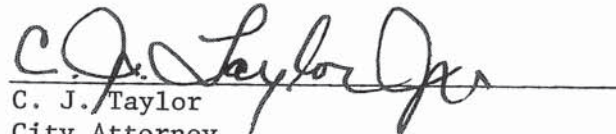

C. J. Taylor
City Attorney
City of Denton, Texas

EXHIBIT D
STANDING INSTRUCTIONS TO LAKE MANAGER

RAY ROBERTS DAM AND LAKE

EXHIBIT D

STANDING INSTRUCTIONS TO LAKE MANAGER

RAY ROBERTS DAM AND LAKE

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STANDING INSTRUCTIONS TO LAKE MANAGER RAY ROBERTS DAM AND LAKE

I. GENERAL

1. Instructions. Detailed instructions to the project personnel at Ray Roberts Dam and Lake are presented below.

a. **Regulation.** The Fort Worth District Water Management Office will normally issue instructions for the storage and discharge of water. In the event communications with the Fort Worth District Water Management Office are disrupted, the Lake Manager will direct regulation in accordance with the Emergency Regulation guidance provided in Section II of this exhibit.

b. **Data Reporting.** The Water Management Office is staffed from 0700 hours to 1600 hours daily, and 0700 hours to 1100 hours on weekends and holidays (except Christmas Day). During these hours reservoir regulators may be reached via telephone at 817-886-1551, via e-mail at ceswf-od-1@usace.army.mil, or (as a backup) via FAX at 817-886-6472. Outside of these hours the Water Management Office Duty Regulator may be reached via mobile telephone at 817-791-0973, or, as a backup, via the above e-mail address.

(1). **Daily Report.** Each day lake and hydrometeorological data will be submitted to the Fort Worth District Water Management Office between 0800 and 0830 hours. The primary means of submission will be the Internet at <http://www.swf-wc.usace.army.mil>. The secondary means of submission will be via telephone, and FAX may be used as a backup. The following data should be included in the daily report.

(a). **Weather.** For the 24-hour period preceding 0800 hours each day, report cumulative precipitation and evaporation values, in inches, and the maximum and minimum experienced temperature readings.

(b). **Gate Settings.** Gate number of each open gate, with the height of opening in feet as of 0800 hours on the date of report.

(c). **Spillway Discharge.** In the event discharge occurs over the tainter gate spillway, report the respective dates and times discharge begins and ends.

(d). **Hydropower.** Hydropower release information will be included in the daily report.

(2). **Reporting Severe Weather.** During normal project duty hours, including weekends as applicable, severe weather will be reported as it develops, to include information and data that may be requested by the Water Management Office. Severe weather conditions outside of normal project duty hours will be reported when and as requested by the Water Management

Office.

(3). Reporting Gate Operations. Upon completion of any change in gate settings, details of the gate operations will be reported to the Water Management Office via telephone, e-mail, or FAX (as backup), and to the Ray Roberts Powerhouse Duty Operator via telephone or FAX. The report shall include the gate settings prior to change, the date and time of beginning of change, the date and time of completion of change, and the gate settings upon completion of change.

c. Reporting Unusual Events. Events or conditions not normally encountered in the routine operation of the dam and lake that might endanger the integrity of the dam or necessitate temporary or permanent revision of the operating procedures shall be promptly reported to the Operations Division and the Water Management Office. Settlement, movement, or cracking of the earth embankment or abutments, unusual change in seepage rates or development of new seepage areas, landslides, rockslides, displacement of riprap, or indication of an impending movement should be reported to the Dam Safety Program Manager in the Geotechnical Office. Any changes to the outlet works or spillway including structural settlement or movement, cracking, or vibrations; mechanical malfunction or failure shall be reported immediately to the Water Management Office and the Dam Safety Coordinator. Reference the Ray Roberts Dam Emergency Action Plan (EAP) should an event occur indicating any degree of jeopardy to the safety of the dam or to the safety of the public. The stilling basin and protected/armored downstream areas must be visually monitored closely during all high releases. Outside of normal duty hours, one of the persons listed on the Fort Worth District Notification List for Ray Roberts Lake will be notified, and the Duty Regulator of the Water Management Office will be notified at mobile phone 817-791-0973.

d. Warnings. It is the responsibility of the Lake Manager to maintain a list in current status of residents, and/or property, which would be endangered or inconvenienced by large and/or prolonged releases, and to give adequate warning of such impending releases. Notification will be made by whatever means are available, in accordance with current Fort Worth District emergency notifications protocol. In every case, before an increase in release rate is made, a warning horn shall be sounded and the area immediately below the stilling basin visually checked for person(s) in a dangerous area.

e. Gate Changes. Gate changes will normally be directed by the Water Management Office. In the event communications with the Fort Worth District Office are disrupted, the Lake Manager will direct gate changes. During flood periods, gate changes may be required as often as every half hour. Only under unusual circumstances will gate changes be required more frequently than every half hour. Examples of such unusual circumstances include unexpectedly high rates of change in inflow to the reservoir, or a required response to a dam safety issue. The gates will be operated in a manner prescribed by the manufacturer. A complete log of all gate operations will be kept for each gate.

II. REGULATION PROCEDURES

1. Normal Regulation. Normally, instructions for storage and release of water for conservation and flood control purposes will be issued by the Water Management Office in accordance with the plan of regulation prescribed in Chapter 7 of this water control manual.

2. Emergency Regulation. In the event of disruption of communications with the Fort Worth District Water Management Office, the Lake Manager will, on his own initiative, direct operation of the reservoir in accordance with the rules outlined below:

a. Make conservation releases in accordance with the current request from the City of Dallas as last related by the Water Management Office prior to loss of communications. Since conservation release requirements are commonly met via hydropower generation at Ray Roberts generating station, which is operated remotely from the Ray Roberts Dam powerhouse, ensuring continuance of the conservation release may require direct coordination with the Ray Roberts Dam powerhouse Duty Operator.

b. Take immediate steps to re-establish communication with the Fort Worth District Water Management Office.

c. Until communications are restored, regulate the reservoir in accordance with Chapter 7, Ray Robert Dam Reservoir Emergency Regulation Plan on Plate 7-2, Surcharge storage for elevation 640.5 to 645.5 feet, make releases to hold lake level as long as possible. During the passage of flood waters, gate changes will be required at frequent intervals in order to maintain the pool in its normal operating range, insofar as possible. When induced surcharge operation begins, both frequent gate changes and close monitoring of the event will be required to ensure that the tailwater elevation is built up sufficiently to prevent excess velocities when flow over the uncontrolled spillway begins.

3. Temporary Deviations. During the course of normal or emergency regulation of the reservoir, the Lake Manager may temporarily deviate from the current release rates in the event an immediate short-term departure is deemed necessary to protect the safety of the dam, or to avoid serious hazards to life. As soon as practicable, the Fort Worth District Water Management Office will be informed via telephone, e-mail, or FAX, as to the nature of the emergency and the subsequent response. If the deviation is conducted in the interest of dam safety, the Dam Safety Coordinator will also be notified as soon as practicable. Such actions shall be confirmed in writing, as soon as practicable, to the Fort Worth District Water Management Office and the Southwestern Division Water Management Office, and shall include justification for the action.

EXHIBIT E

URS-FNI-HZ TEAM

QUALITY MANAGEMENT SYSTEM (QMS) FORMS

EXHIBIT E

URS-FNI-HZ TEAM

QUALITY MANAGEMENT SYSTEM (QMS) FORMS

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IE QMS - Americas

Detail Check

Project Name	Update Water Control Manual for Ray Roberts Dam and Lake	Client	USACE Fort Worth District
Project Location	Denton County, Texas	PM	Jinwei Qiu, PE
Project Number	60440846	PIC	

(This section is to be completed by the Project Manager or the PM's Designee.)

Assigned Checker: Janis Murphy, PE Comments Required by: July 6, 2017

Work Product Originator: Jinwei Qiu, Rifat Alam and Dawit Zeweldi

Work Product to be Checked: Ray Roberts Dam and Lake Water Control Manual Chapters 1 to 3

☒ This Detail Check is a check for correctness, completeness and technical accuracy.
☐ This Detail Check is only a technical edit for format, spelling, grammar, pagination and readability.

Specific Instructions: Enter specific instructions for the work product.

Submitted by: Jinwei Qiu 06/29/2017
Project Manager Signature Date

(This Section is to be completed by the Checker.)

Select:

A. ☐ Checker has no comments.

or

B. ☒ Comments have been provided on:

☒ Marked directly on work product
☐ Comment and Disposition Form 3-5
☐ Other; Specify: Click here to enter text.

Janis C. Murphy 7/6/17
Checker Signature Date

(This section is to be completed by the Checker after verification of comment incorporation, if box B is checked off above.)

Select:

C. ☐ Verification of comment incorporation has been performed by Checker. There are no outstanding issues.

or

D. ☒ Verification of comment incorporation has been performed by Checker. Unresolved issues have been submitted to the Project Manager or Designee for final resolution.

and

E. ☒ Checker asserts that the work product review is complete.

Janis C. Murphy 6/26/18
Checker Signature Date

APPROVAL and DISTRIBUTION

☒ Detail Check is complete.

Jinwei Qiu 06/27/2018
Project Manager or Designee Signature Date

Distribution:

Project Central File - Quality File Folder

Other - Specify: Enter names here.

Quality - It's Good Business		QMS Form 3-6 (MM) Rev. 2013 QMS Date: 28 Feb 2013	
IE QMS - Americas		Independent Technical Review	
Project Name	Update Water Control Manual for Ray Roberts Dam and Lake	Client	USACE Fort Worth District
Project Location	Denton County, Texas	PM	Jinwei Qiu, PE
Project Number	60440846	PIC	Enter PIC Name

Identifying Information	<p style="text-align: center; font-size: small;">(This section is to be completed by the Project Manager or the PM's Designee.)</p> <p>Assigned Reviewer: Anand Prakash, PE Comments Required by: July 6, 2017</p> <p>Work Product Originator: Jinwei Qiu, Rifat Alam and Dawit Zeweldi</p> <p>Work Product to be Reviewed: Ray Roberts Dam and Lake Water Control Manual Chapters 1 to 3</p> <p>Review Scope: Review for correctness, completeness and technical accuracy</p> <p>Specific Instructions: <small>Enter specific instructions for the work product</small></p> <p>Submitted by: <u></u> <u>06/29/2017</u></p> <p style="text-align: center;">Project Manager Signature Date</p>
Comments	<p style="text-align: center; font-size: small;">(This Section is to be completed by the Reviewer.)</p> <p>Select:</p> <p>A. <input type="checkbox"/> Reviewer has no comments.</p> <p>or</p> <p>B. <input checked="" type="checkbox"/> Comments have been provided on:</p> <p style="margin-left: 20px;"> <input checked="" type="checkbox"/> Marked directly on work product <input type="checkbox"/> Comment and Disposition Form 3-5 <input type="checkbox"/> Other, Specify: <small>Click to enter text</small> </p> <p style="text-align: center;"><u></u> <u>07/05/2017</u></p> <p style="text-align: center;">Reviewer Signature Date</p>
Verification	<p style="text-align: center; font-size: small;">(This section is to be completed by the Reviewer after verification of comment incorporation, if box B is checked off above.)</p> <p>Select:</p> <p>C. <input checked="" type="checkbox"/> Verification of comment incorporation has been performed by Reviewer. There are no outstanding issues.</p> <p>or</p> <p>D. <input type="checkbox"/> Verification of comment incorporation has been performed by Reviewer. Unresolved issues have been submitted to the Project Manager or Designee for resolution.</p> <p>and</p> <p>E. <input checked="" type="checkbox"/> Reviewer asserts that the work product ITR is complete.</p> <p style="text-align: center;"><u></u> <u>10/18/2018</u></p> <p style="text-align: center;">Reviewer Signature Date</p>

APPROVAL and DISTRIBUTION	
<p><input checked="" type="checkbox"/> ITR is complete.</p> <p style="text-align: center;"><u></u> <u>10/18/2018</u></p> <p style="text-align: center;">Project Manager or Designee Signature Date</p>	
<p>Distribution:</p> <p>Project Central File – Quality File Folder</p> <p>Other – Specify: <small>Enter name and title</small></p>	



IE QMS - Americas

Detail Check

Project Name	Update Water Control Manual for Ray Roberts Dam and Lake	Client	USACE Fort Worth District
Project Location	Denton County, Texas	PM	Jinwei Qiu, PE
Project Number	60440846	PIC	

Identifying Information

(This section is to be completed by the Project Manager or the PM's Designee.)

Assigned Checker: Janis Murphy, PE

Comments Required by: May 11, 2018

Work Product Originator: Jinwei Qiu, Rifat Alam and Dawit Zeweldi

Work Product to be Checked: Ray Roberts Dam and Lake Water Control Manual Chapters 4 to 9

☒ This Detail Check is a check for correctness, completeness and technical accuracy.☐ This Detail Check is only a technical edit for format, spelling, grammar, pagination and readability.

Specific Instructions: Enter specific instructions for the work product

Submitted by:

Project Manager Signature

05/07/2018

Date

Comments

(This Section is to be completed by the Checker.)

Select:

A. ☐ Checker has no comments.

or

B. ☒ Comments have been provided on:☒ Marked directly on work product☐ Comment and Disposition Form 3-5☐ Other; Specify: Click here to enter text

Checker Signature

5/9/18

Date

Verification

(This section is to be completed by the Checker after verification of comment incorporation, if box B is checked off above.)

Select:

C. ☐ Verification of comment incorporation has been performed by Checker. There are no outstanding issues.

or

D. ☒ Verification of comment incorporation has been performed by Checker. Unresolved issues have been submitted to the Project Manager or Designee for final resolution.

and

E. ☒ Checker asserts that the work product review is complete.

Checker Signature

6/26/18

Date

APPROVAL and DISTRIBUTION

☒ Detail Check is complete.

Project Manager or Designee Signature

Click here to enter a date

06/27/2018

Date

Distribution:

Project Central File – Quality File Folder

Other – Specify: Enter names here.



IE QMS - Americas

Independent Technical Review

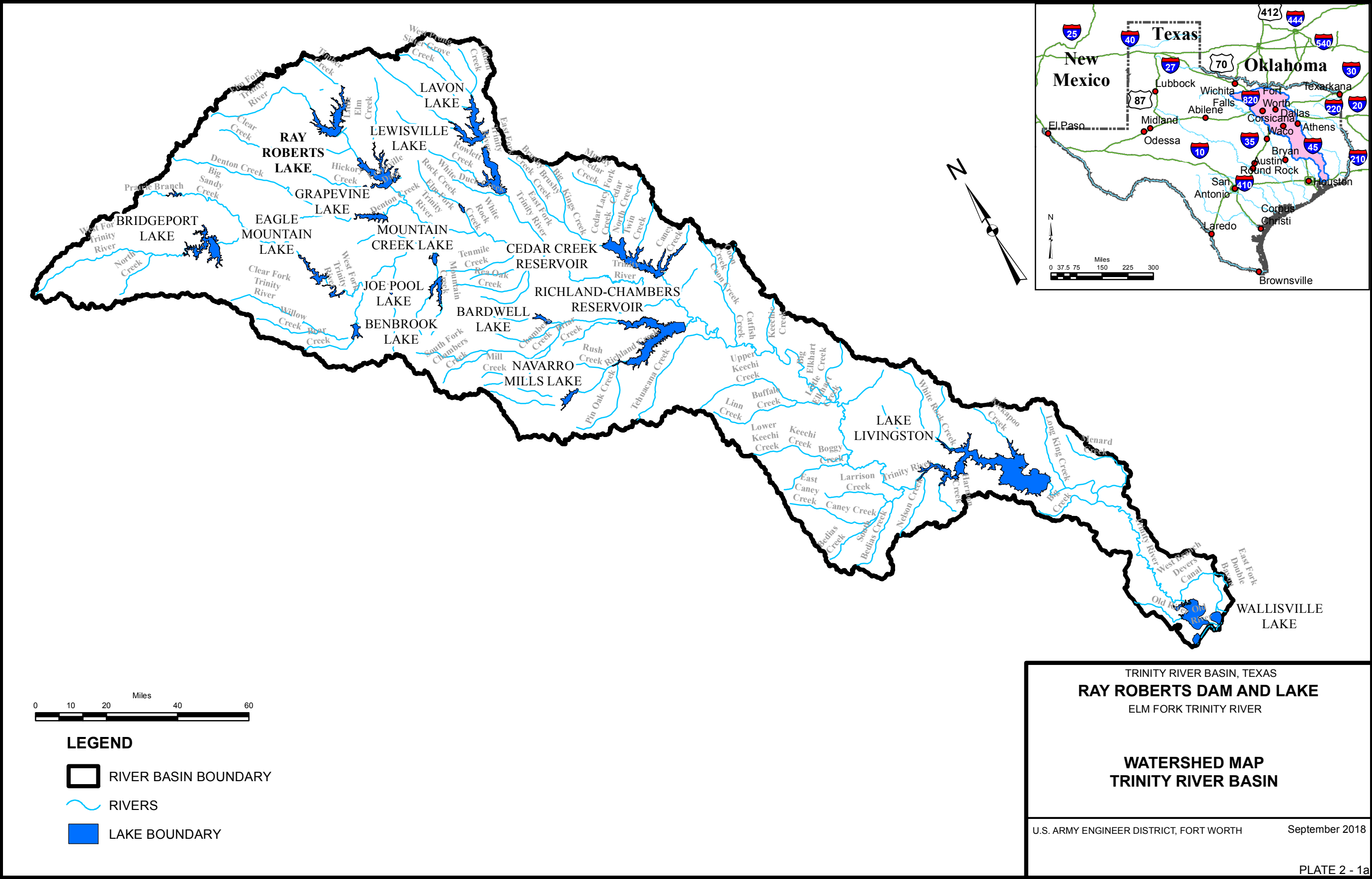
Project Name	Update Water Control Manual for Ray Roberts Dam and Lake	Client	USACE Fort Worth District
Project Location	Denton County, Texas	PM	Jinwei Qiu, PE
Project Number	60440846	PIC	or PIC Name

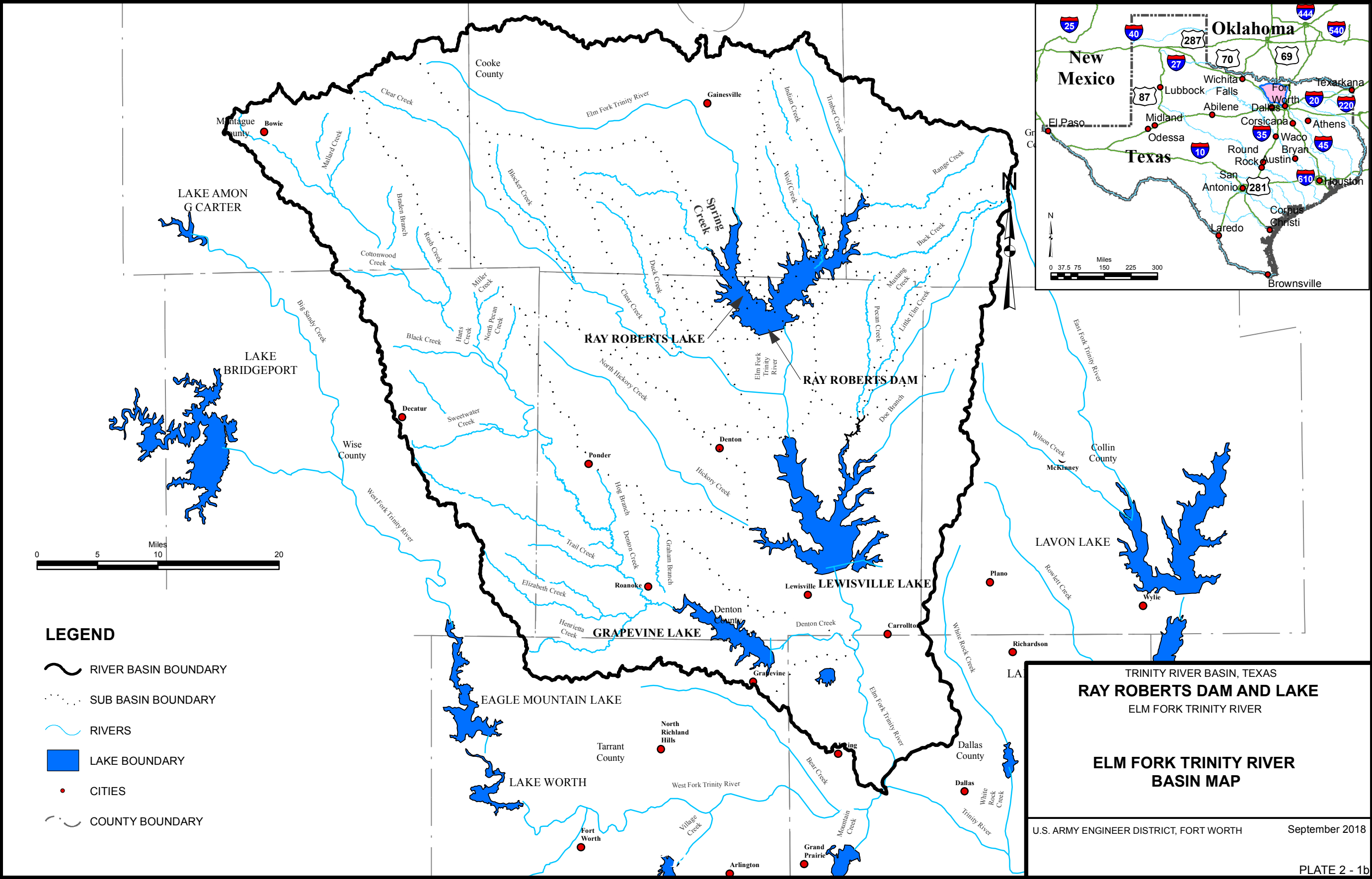
Identifying Information	(This section is to be completed by the Project Manager or the PM's Designee.)	
	Assigned Reviewer: Anand Prakash, PE	Comments Required by: May 11, 2018
	Work Product Originator: Jinwei Qiu, Rifat Alam and Dawit Zeweldi	
	Work Product to be Reviewed: Ray Roberts Dam and Lake Water Control Manual Chapters 4 to 9	
	Review Scope: Review for correctness, completeness and technical accuracy	
	Specific Instructions: <i>For completion instructions for the work product.</i>	
Submitted by:	<u><i>Jinwei Qiu</i></u>	<u>05/07/2018</u>
	Project Manager Signature	Date

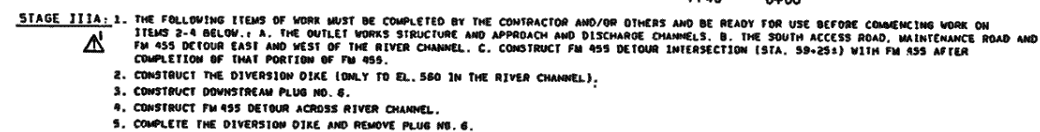
Comments	(This Section is to be completed by the Reviewer.)	
	Select:	
	A. <input type="checkbox"/> Reviewer has no comments.	
	or	
	B. <input checked="" type="checkbox"/> Comments have been provided on:	
	<input checked="" type="checkbox"/> Marked directly on work product <input type="checkbox"/> Comment and Disposition Form 3-5 <input type="checkbox"/> Other; Specify: <i>Click to enter text.</i>	
	<u><i>Anand Prakash</i></u>	<u>05/11/2018</u>
	Reviewer Signature	Date

Verification	(This section is to be completed by the Reviewer after verification of comment incorporation, if box B is checked off above.)	
	Select:	
	C. <input checked="" type="checkbox"/> Verification of comment incorporation has been performed by Reviewer. There are no outstanding issues.	
	or	
	D. <input type="checkbox"/> Verification of comment incorporation has been performed by Reviewer. Unresolved issues have been submitted to the Project Manager or Designee for resolution.	
	and	
E. <input checked="" type="checkbox"/> Reviewer asserts that the work product ITR is complete.		
	<u><i>Anand Prakash</i></u>	<u>10/18/2018</u>
	Reviewer Signature	Date

APPROVAL and DISTRIBUTION	
<input checked="" type="checkbox"/> ITR is complete.	
<u><i>Jinwei Qiu</i></u>	<u>10/18/2018</u>
Project Manager or Designee Signature	Date
Distribution:	
Project Central File – Quality File Folder	
Other – Specify: <i>Enter names here.</i>	







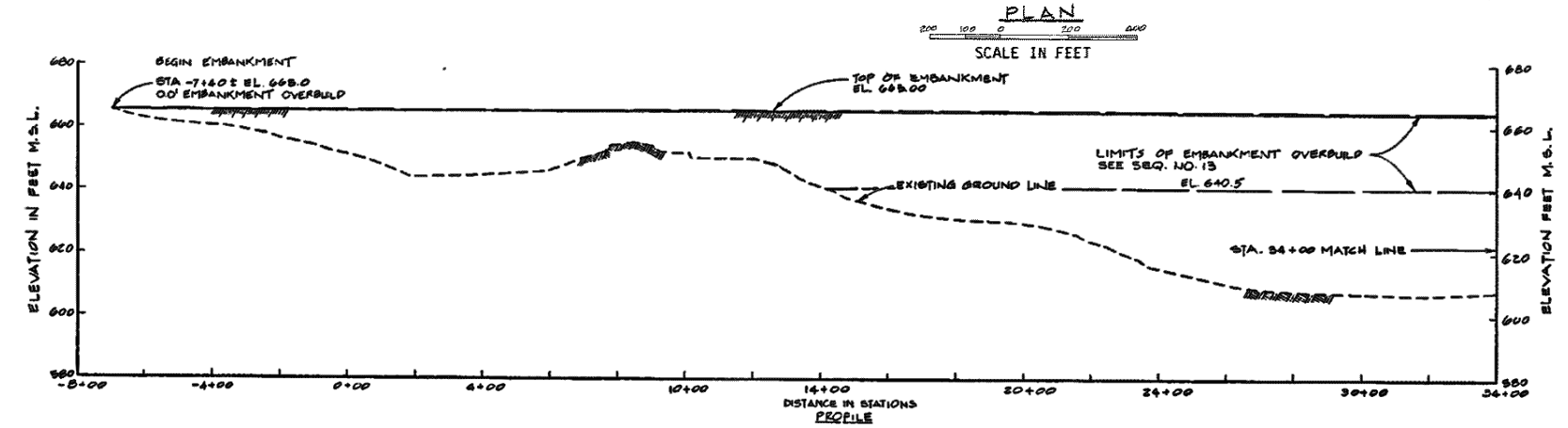
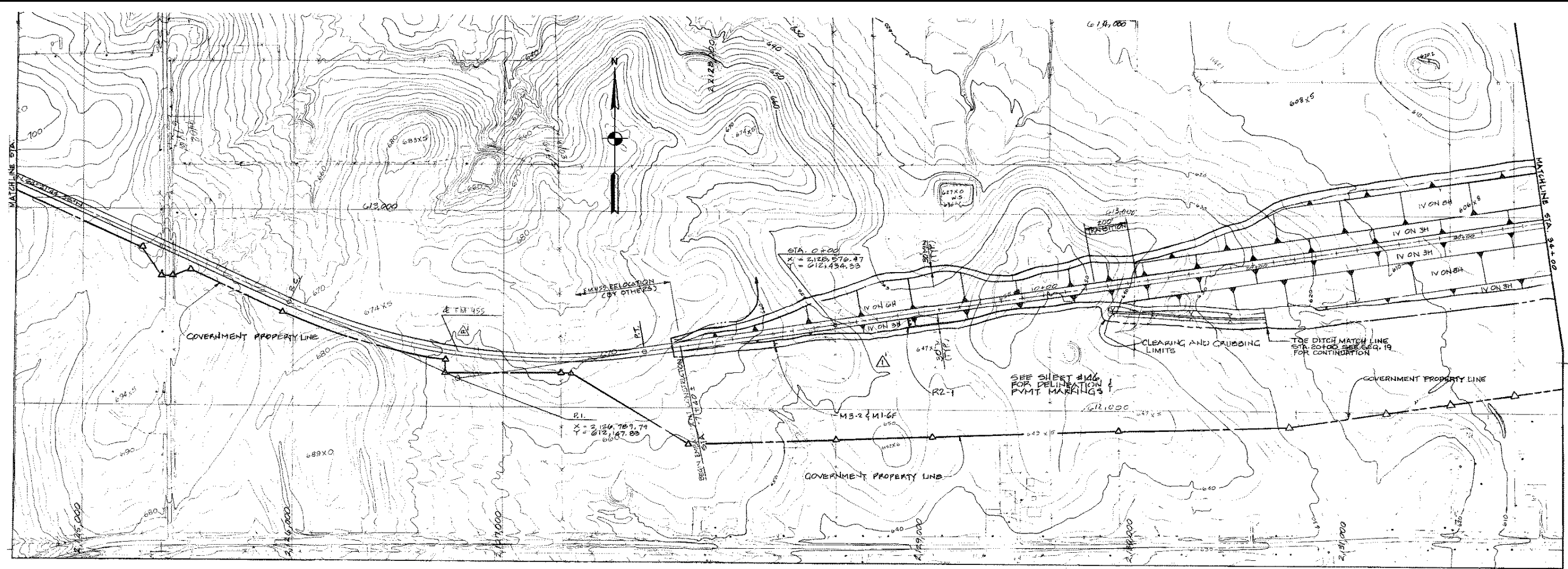
A ¹	C0855	CO.#P00015	10 FEB 84	REVISED STAGE NOTE 2 & RELOCATED Q.S. PLUG #6
A ²		AM#0002	7 APR 82	REVISED TO REFLECT WRITE-IN CHANGE
A ³		AM#0001	2 APR 82	ADDED NOTE & RELOCATED CONTRACTOR WORK AREA
SYM	DO	NO	ACTION	DATE
				DESCRIPTION OF REVISION

TRINITY RIVER BASIN, TEXAS
RAY ROBERTS DAM AND LAKE
ELM FORK TRINITY RIVER

GENERAL EMBANKMENT PLAN AND PROFILE

U.S. ARMY ENGINEER DISTRICT, FORT WORTH

September 2018



SYMBOL NO.	ACTION	DATE	DESCRIPTION OF REVISION
1	P.M.	4 APR 85	ADDED TRAFFIC SIGN
2	A.M.*0001	2 APR 82	REVISED TO REFLECT WRITE-IN CHANGE

ALL ELEVATIONS REFERRED TO ON THIS PLATE, UNLESS NOTED OTHERWISE, ARE IN FEET, NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD29). THE DATUM CONVERSION FROM NGVD29 TO NAVD88 IS: NGVD29 + 0.0 FEET = NAVD88 FOR RAY ROBERTS DAM AND LAKE.

TRINITY RIVER BASIN, TEXAS

RAY ROBERTS DAM AND LAKE

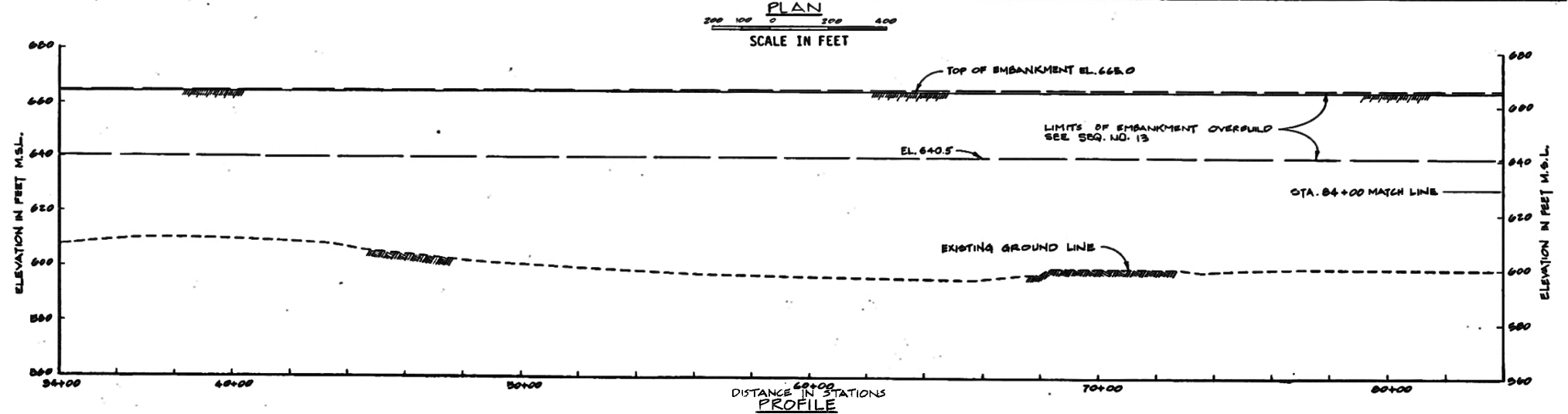
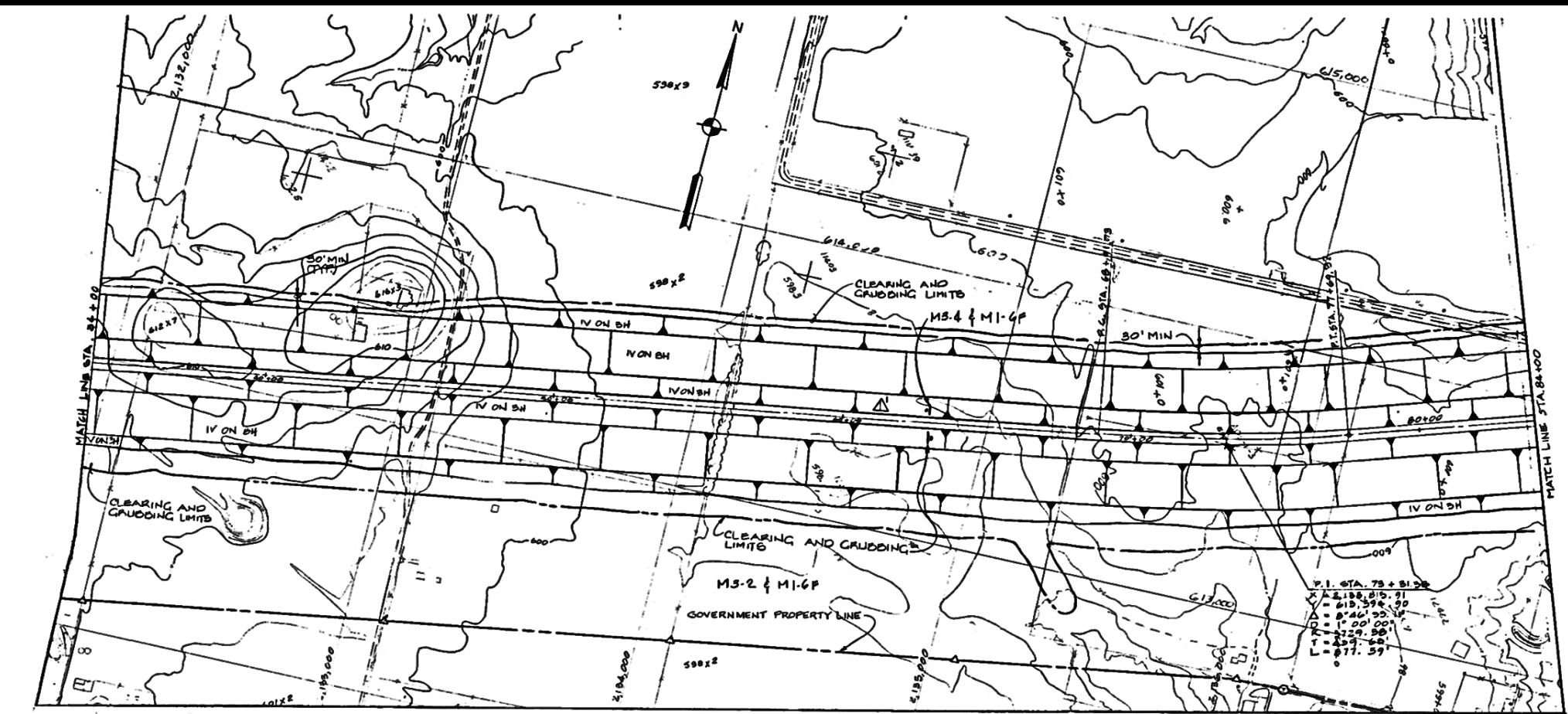
ELM FORK TRINITY RIVER

**EMBANKMENT
PLAN AND PROFILE**

U.S. ARMY ENGINEER DISTRICT, FORT WORTH

September 2018

PLATE 2 - 3



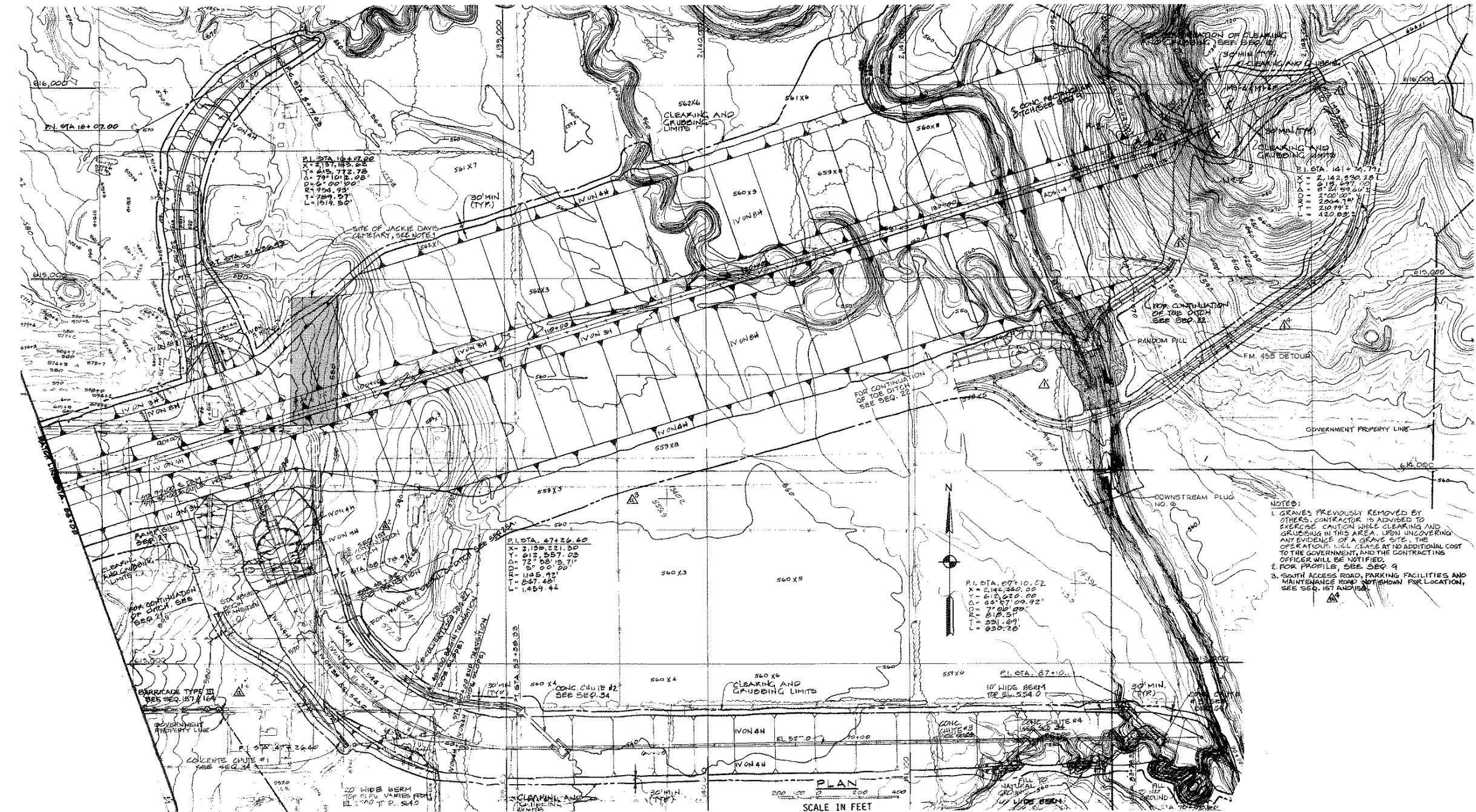
REV. NO.	ACTION	DATE	DESCRIPTION OF REVISION
1	PM	4 APR 85	ADDED TRAFFIC SIGNS

ALL ELEVATIONS REFERRED TO ON THIS PLATE, UNLESS NOTED OTHERWISE, ARE IN FEET, NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD29). THE DATUM CONVERSION FROM NGVD29 TO NAVD88 IS: NGVD29 + 0.0 FEET = NAVD88 FOR RAY ROBERTS DAM AND LAKE.

TRINITY RIVER BASIN, TEXAS
RAY ROBERTS DAM AND LAKE
ELM FORK TRINITY RIVER

**EMBANKMENT
PLAN AND PROFILE**

U.S. ARMY ENGINEER DISTRICT, FORT WORTH September 2018



- NOTES:
1. GRAVES PREVIOUSLY REMOVED BY OTHERS. CONTRACTOR IS ADVISED TO EXERCISE CAUTION WHILE CLEARING AND GRUBBING IN THIS AREA. UPON UNCOVERING ANY EVIDENCE OF A GRAVE SITE, THE OPERATIONS WILL CEASE AT NO ADDITIONAL COST TO THE GOVERNMENT, AND THE CONTRACTING OFFICER WILL BE NOTIFIED.
 2. FOR PROFILE, SEE SEQ. 4
 3. SOUTH ACCESS ROAD, PARKING FACILITIES AND MAINTENANCE ROAD NOT SHOWN FOR LOCATION, SEE SER. 1ST AND 2ND.

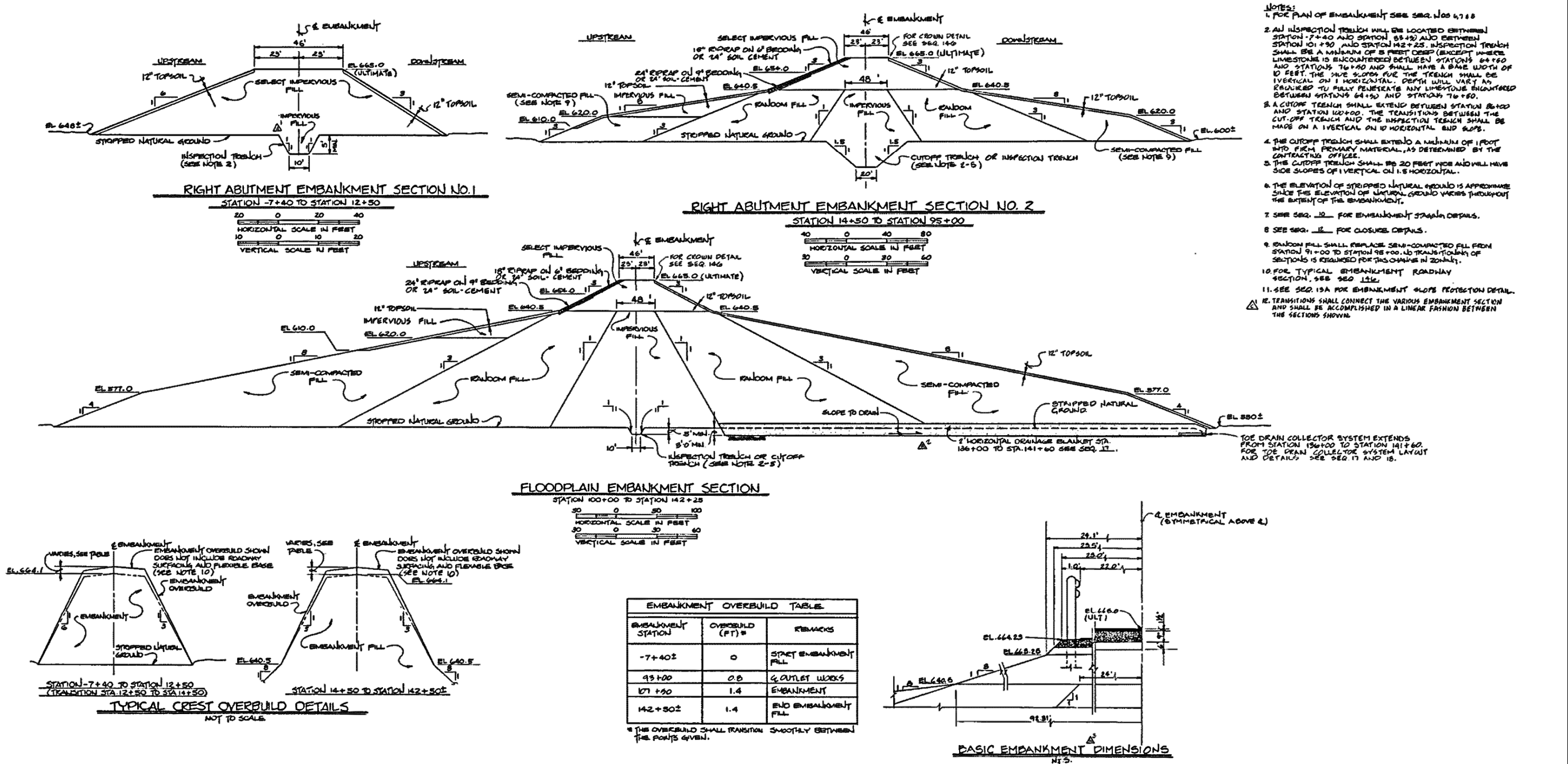
	PM	4APR85	ADDED TRAFFIC SIGNS
C8555	CO#P00013	10FEB84	ADD FM445 DETOUR AND REV. PLUG NO6
	AM#0001	2APR82	REMOVE RD, REVISE ROW, ADDED NOTES
SYM. DC. NO.	ACTION	DATE	DESCRIPTION OF REVISION

ALL ELEVATIONS REFERRED TO ON THIS PLATE, UNLESS NOTED OTHERWISE, ARE IN FEET, NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD29). THE DATUM CONVERSION FROM NGVD29 TO NAVD88 IS: NGVD29 + 0.0 FEET = NAVD88 FOR RAY ROBERTS DAM AND LAKE.

TRINITY RIVER BASIN, TEXAS
RAY ROBERTS DAM AND LAKE
ELM FORK TRINITY RIVER

**EMBANKMENT
PLAN AND PROFILE**

U.S. ARMY ENGINEER DISTRICT, FORT WORTH September 2018



AM#0003	8 APR 82	REVISED TO REFLECT WRITE-IN CHANGE
AM#0001	2 APR 82	DELETED DRAIN COLLECTOR FROM FLOODPLAIN EMB. SECT. REV. SECT. 16 ADDED BASIC EMB. DIM.
SYM. LOG. NO.	ACTION	DATE
		DESCRIPTION OF REVISION

ALL ELEVATIONS REFERRED TO ON THIS PLATE, UNLESS NOTED OTHERWISE, ARE IN FEET, NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD29). THE DATUM CONVERSION FROM NGVD29 TO NAVD88 IS: NGVD29 + 0.0 FEET = NAVD88 FOR RAY ROBERTS DAM AND LAKE.

TRINITY RIVER BASIN, TEXAS

RAY ROBERTS DAM AND LAKE

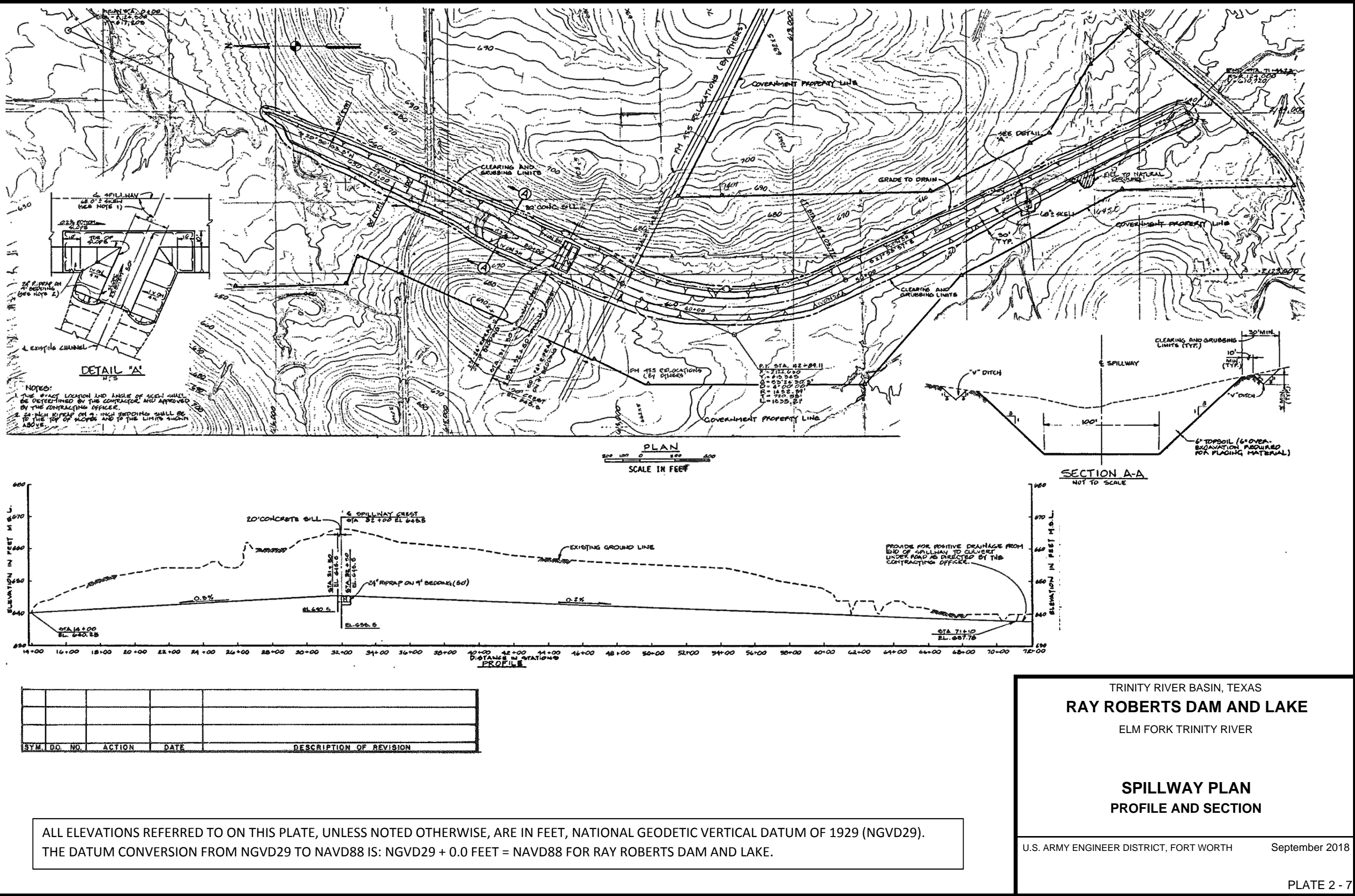
ELM FORK TRINITY RIVER

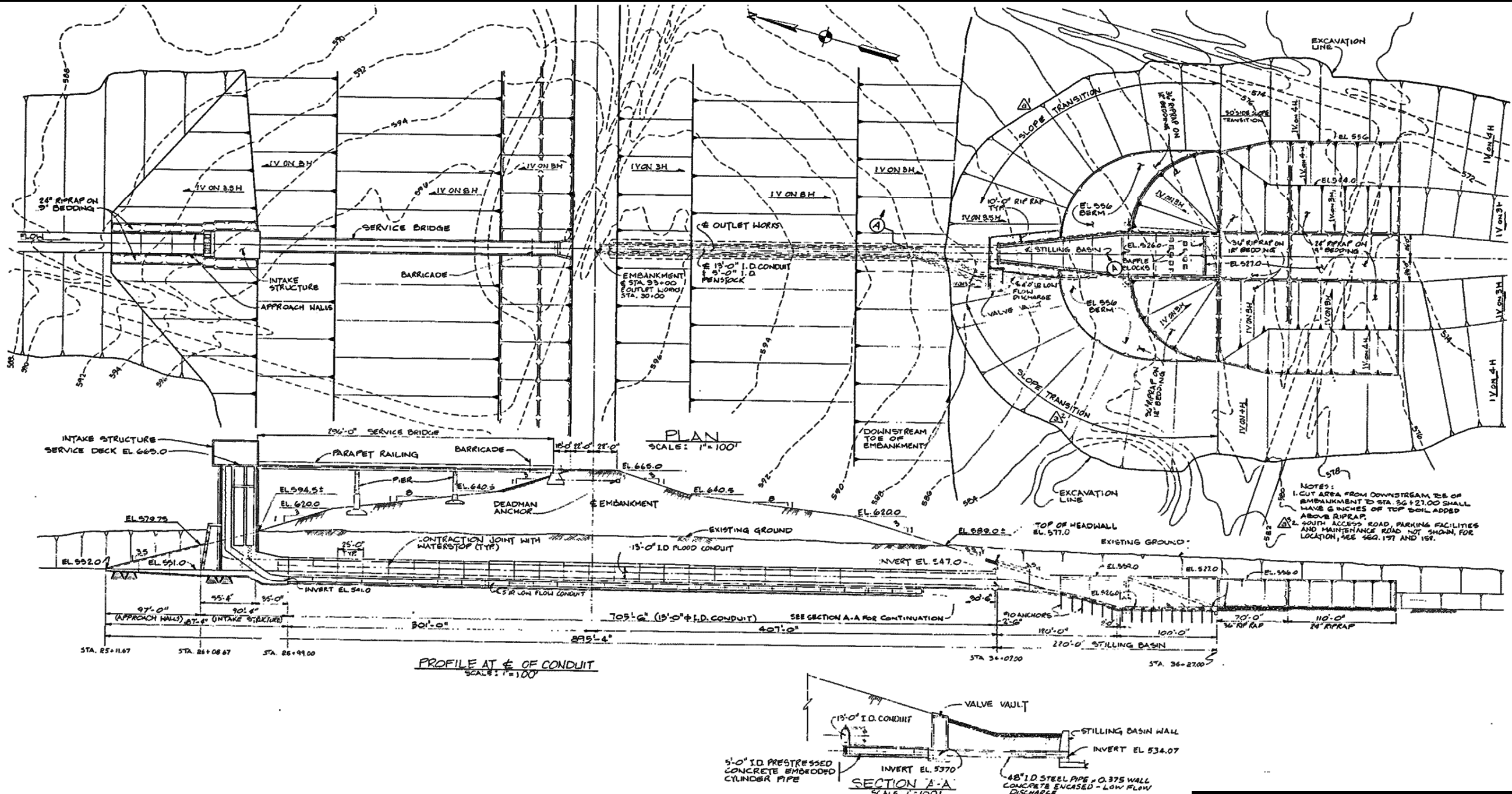
TYPICAL EMBANKMENT SECTIONS

U.S. ARMY ENGINEER DISTRICT, FORT WORTH

September 2018

PLATE 2 - 6





REV.	DATE	DESCRIPTION OF REVISION
1	2 APR 82	REVISED TOP OF CUT & ADDED NOTE 2.

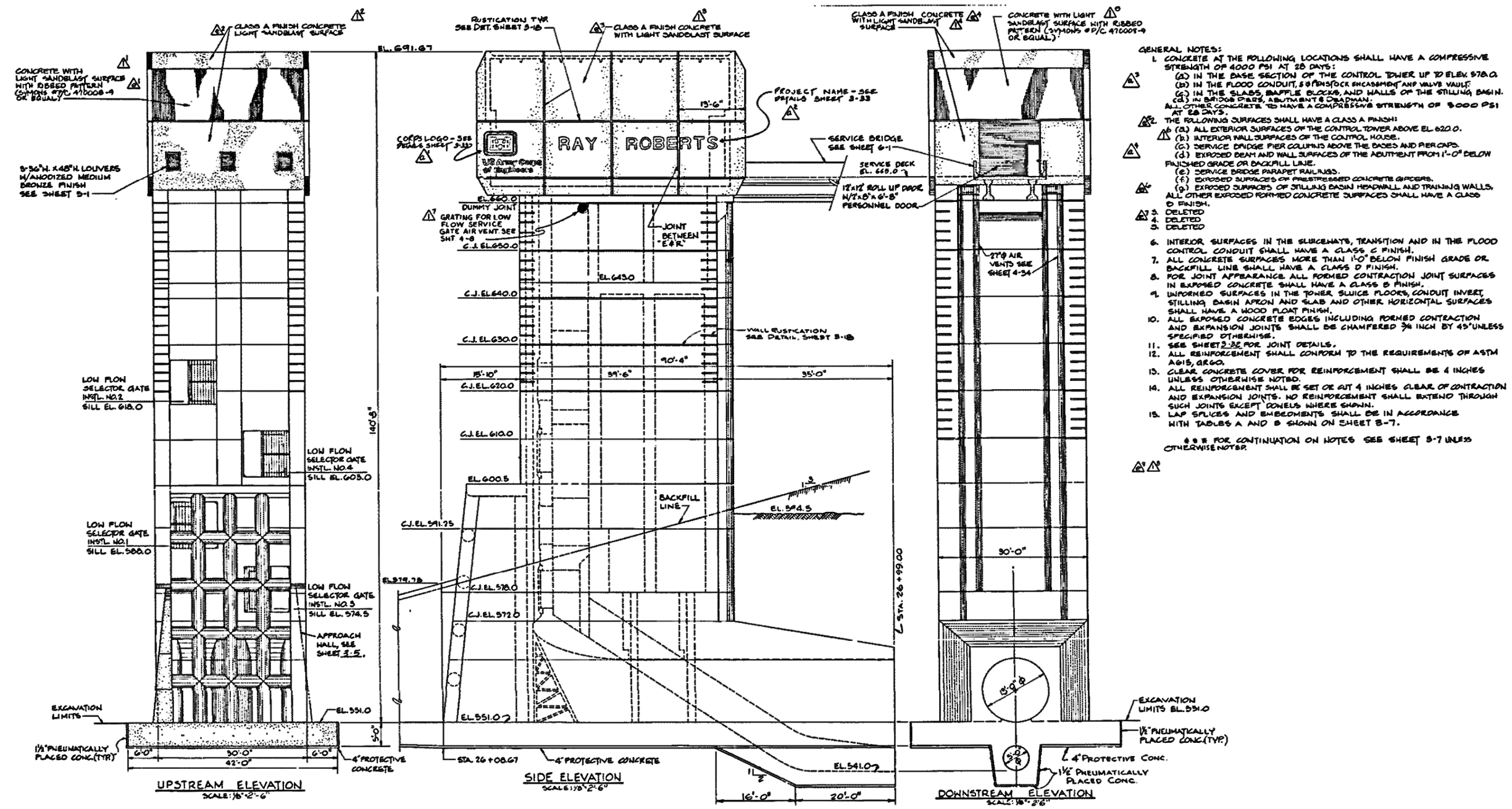
ALL ELEVATIONS REFERRED TO ON THIS PLATE, UNLESS NOTED OTHERWISE, ARE IN FEET, NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD29). THE DATUM CONVERSION FROM NGVD29 TO NAVD88 IS: NGVD29 + 0.0 FEET = NAVD88 FOR RAY ROBERTS DAM AND LAKE.

TRINITY RIVER BASIN, TEXAS
RAY ROBERTS DAM AND LAKE
ELM FORK TRINITY RIVER

OUTLET WORKS
GENERAL PLAN AND SECTION

U.S. ARMY ENGINEER DISTRICT, FORT WORTH September 2018

PLATE 2 - 8



CTB334	CO# P00006	7 APR 82	DEL. BUFF COLORED COATING CALLOUT; CLARIFIED CLASSES OF FINISH; ADD AIR VENT GRILL LOCATION AND CALLOUT.
AM#0005	9 APR 82	REVISED TO REFLECT WRITE-IN CHANGES	
AM#0001	2 APR 82	DELETED & ADDED NOTES	
REV. NO.	ACTION	DATE	DESCRIPTION OF REVISION

ALL ELEVATIONS REFERRED TO ON THIS PLATE, UNLESS NOTED OTHERWISE, ARE IN FEET, NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD29). THE DATUM CONVERSION FROM NGVD29 TO NAVD88 IS: NGVD29 + 0.0 FEET = NAVD88 FOR RAY ROBERTS DAM AND LAKE.

TRINITY RIVER BASIN, TEXAS

RAY ROBERTS DAM AND LAKE

ELM FORK TRINITY RIVER

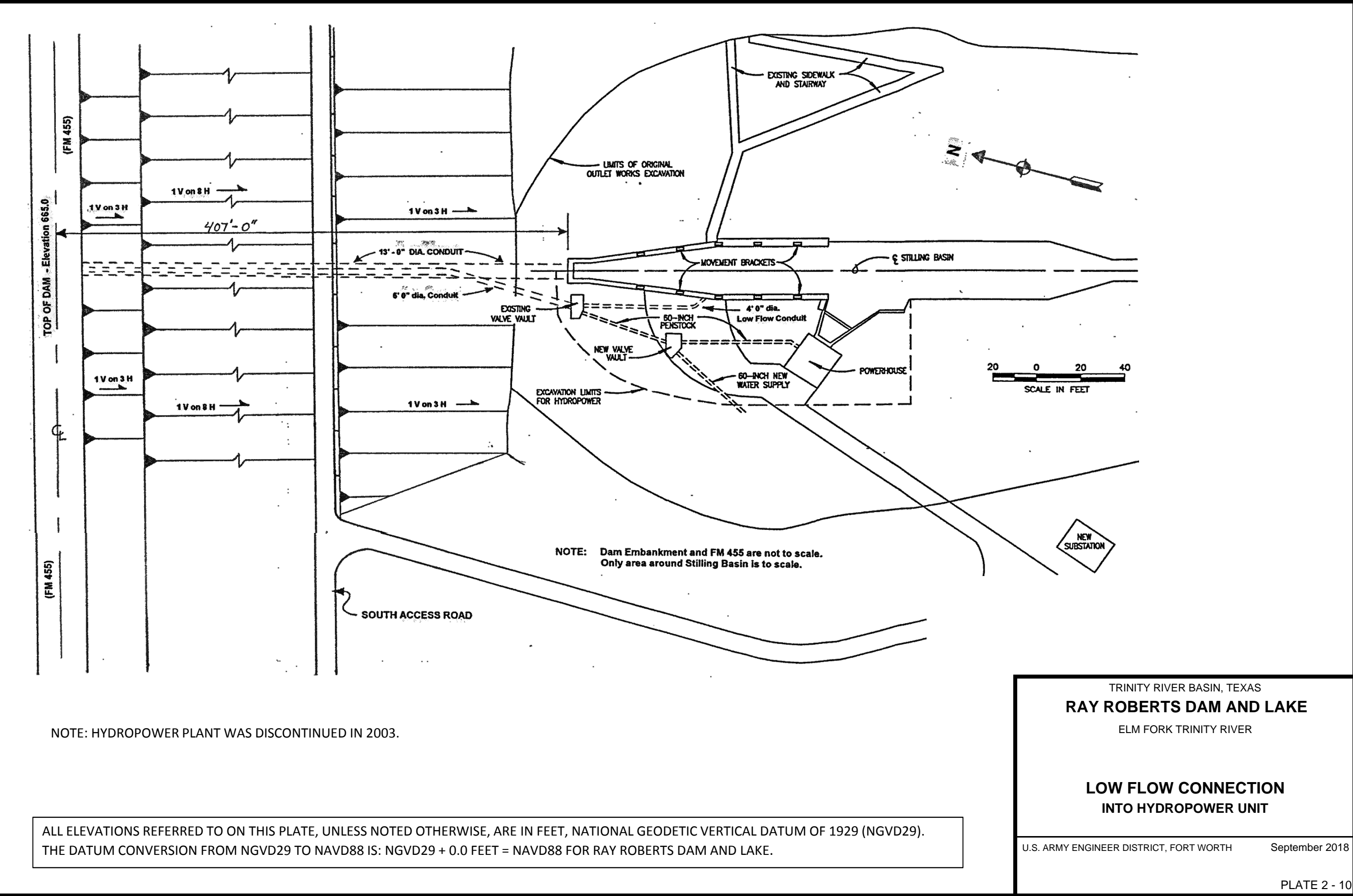
OUTLET WORKS

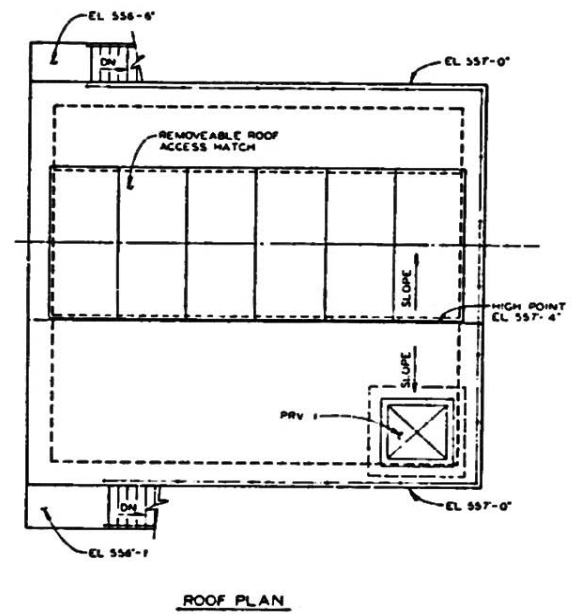
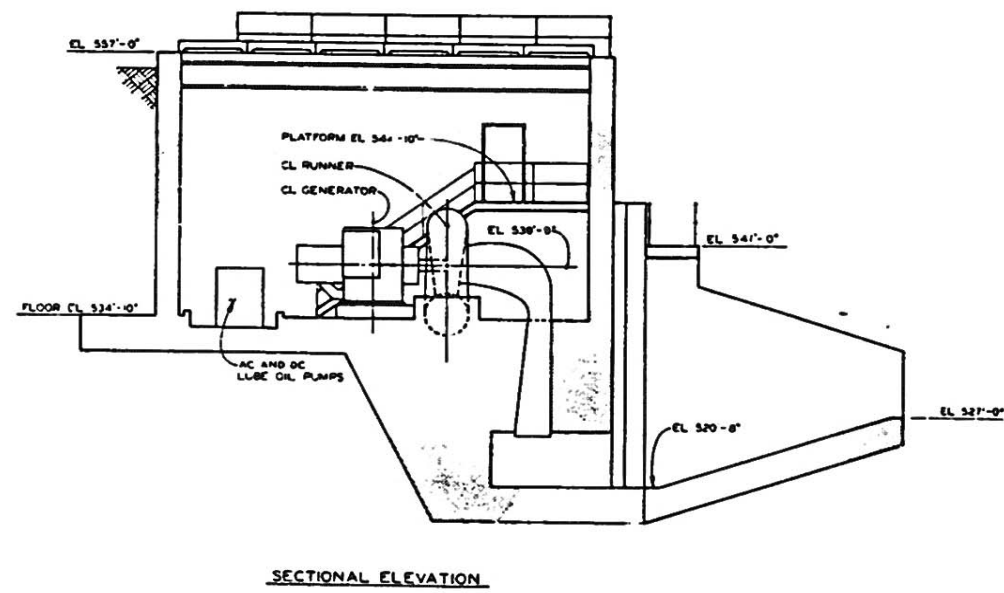
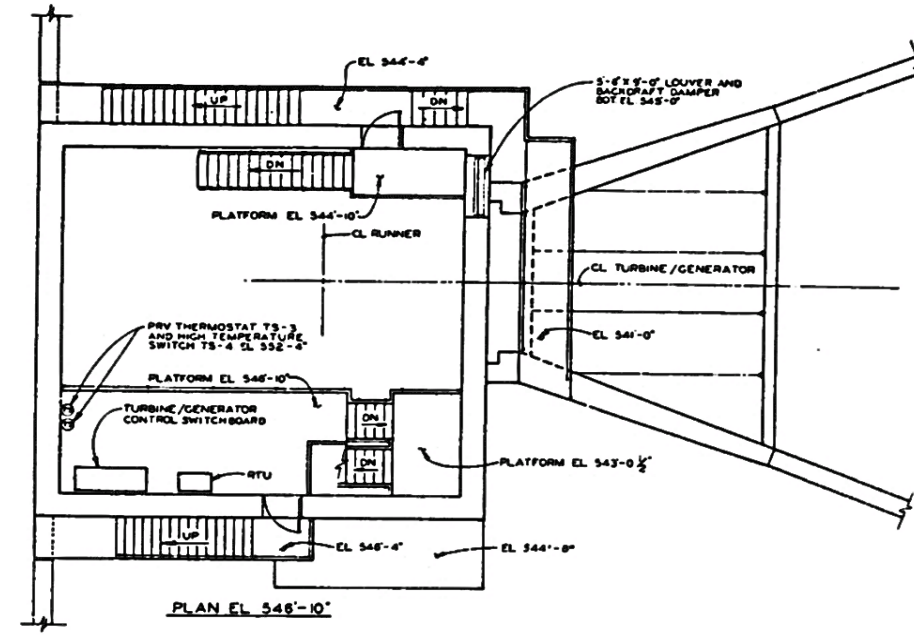
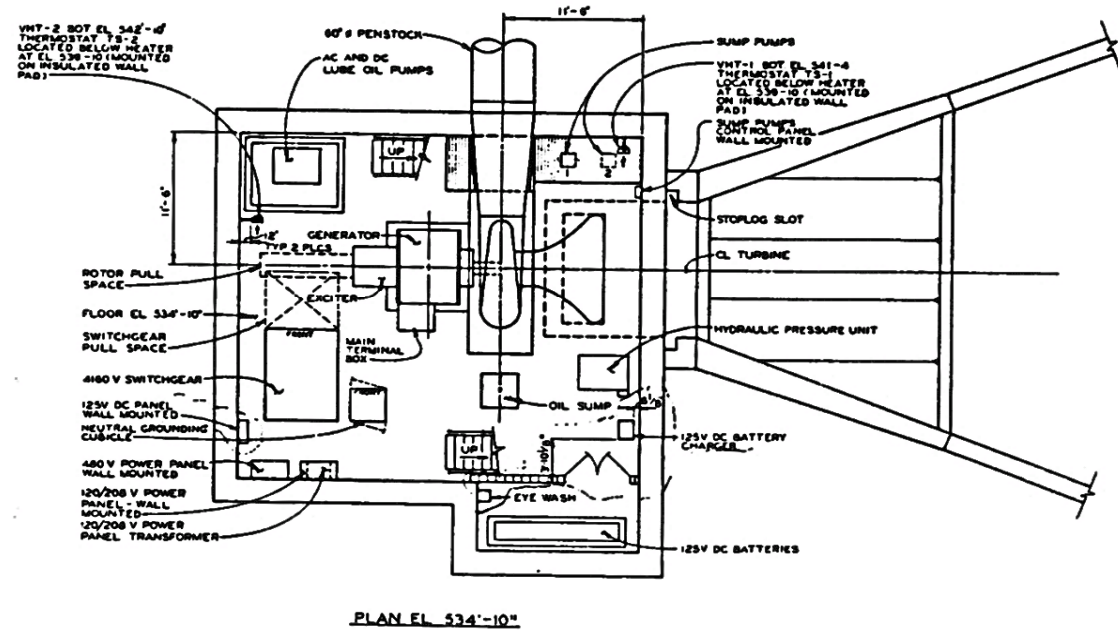
INTAKE STRUCTURE ELEVATIONS

U.S. ARMY ENGINEER DISTRICT, FORT WORTH

September 2018

PLATE 2 - 9





NOTE: HYDROPOWER PLANT WAS DISCONTINUED IN 2003.

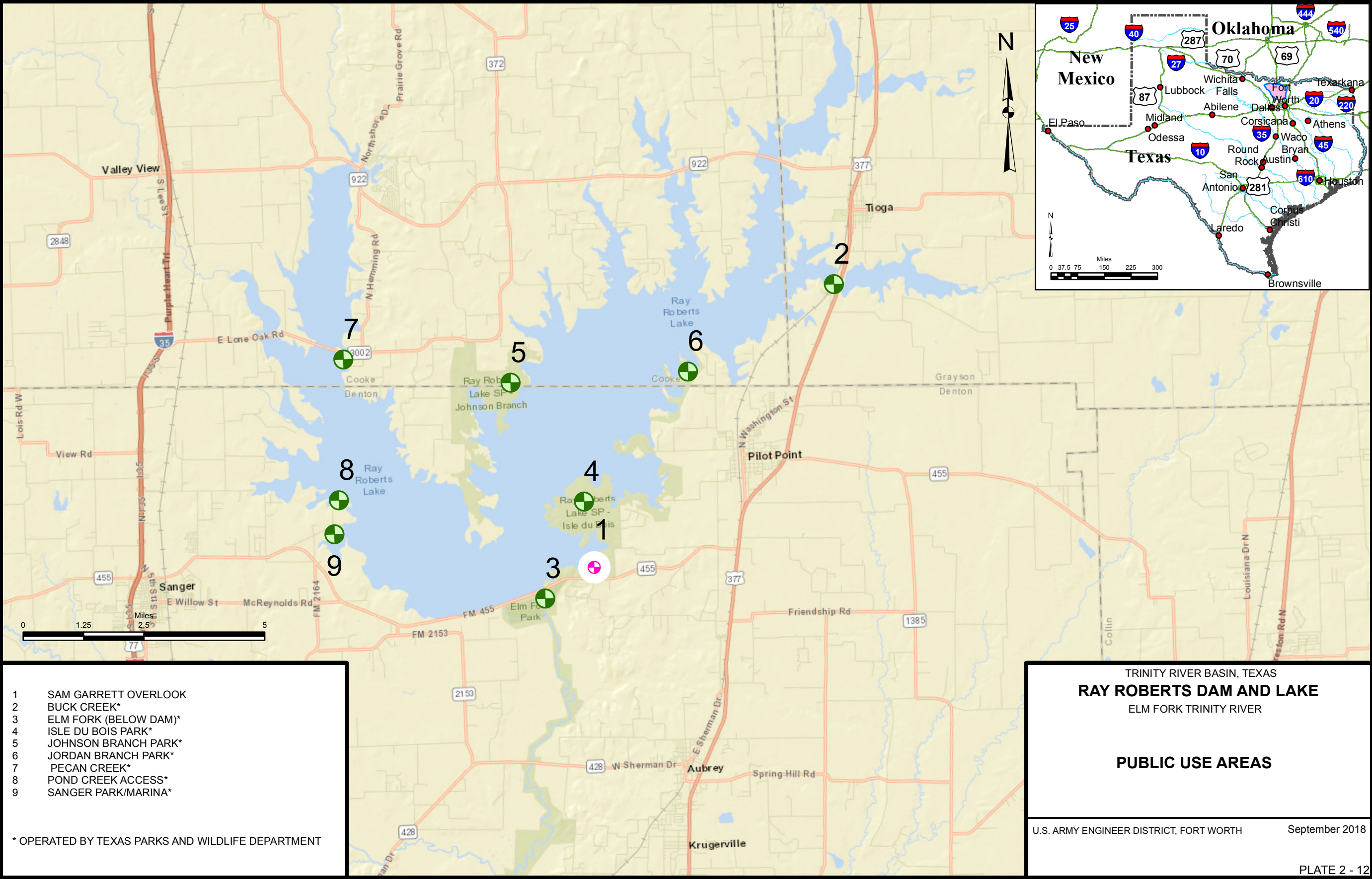
ALL ELEVATIONS REFERRED TO ON THIS PLATE, UNLESS NOTED OTHERWISE, ARE IN FEET, NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD29). THE DATUM CONVERSION FROM NGVD29 TO NAVD88 IS: NGVD29 + 0.0 FEET = NAVD88 FOR RAY ROBERTS DAM AND LAKE.

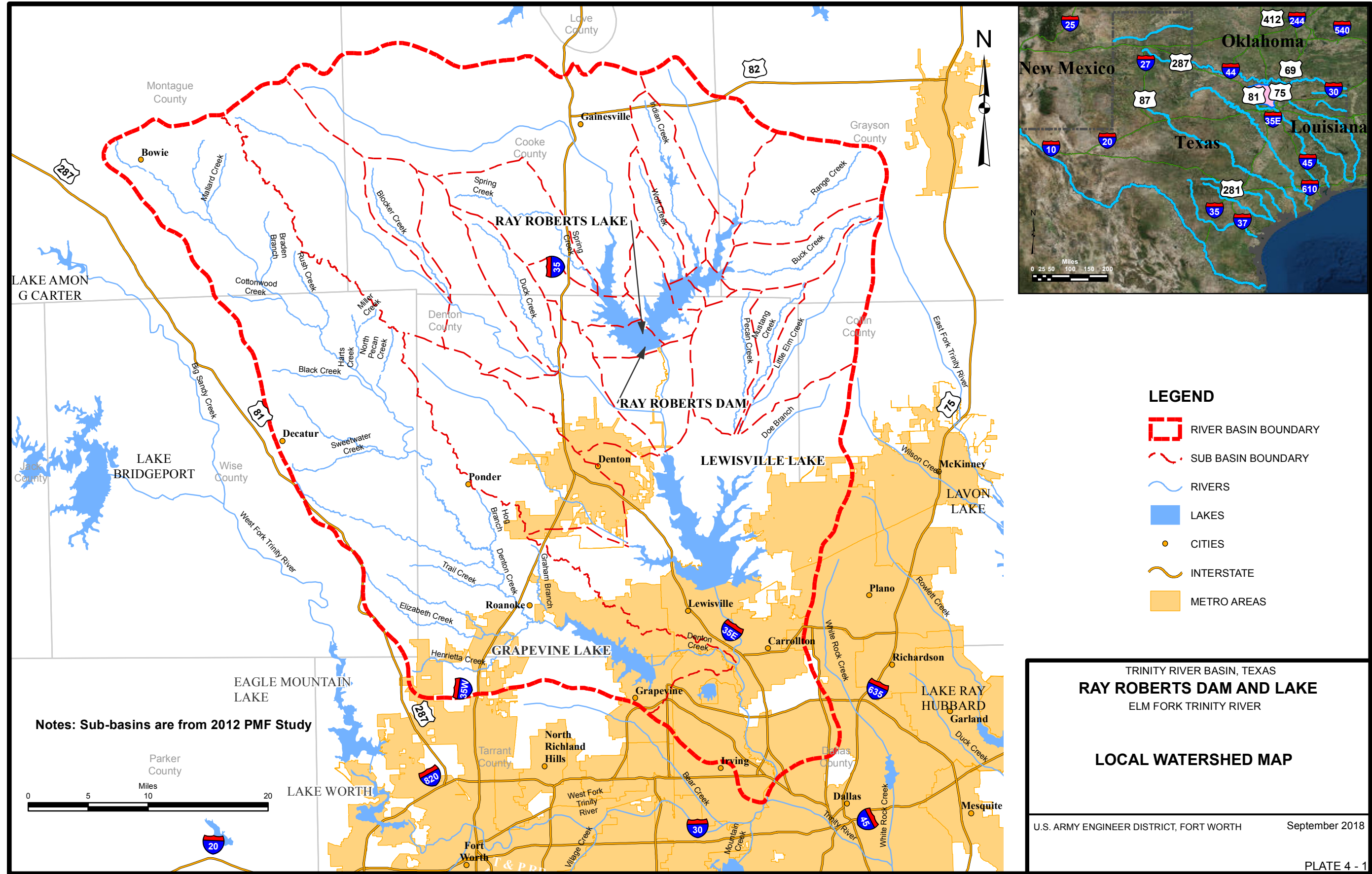
TRINITY RIVER BASIN, TEXAS
RAY ROBERTS DAM AND LAKE
ELM FORK TRINITY RIVER

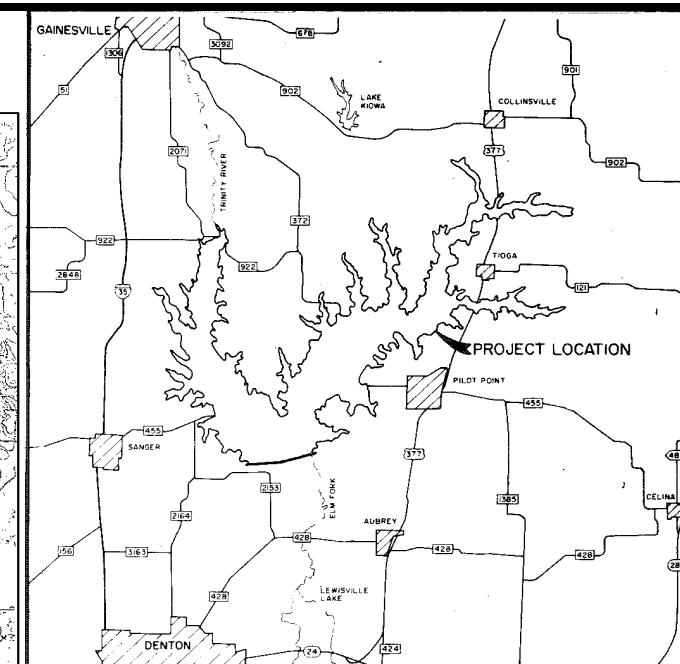
HYDROPOWER UNIT

U.S. ARMY ENGINEER DISTRICT, FORT WORTH

September 2018







VICINITY MAP

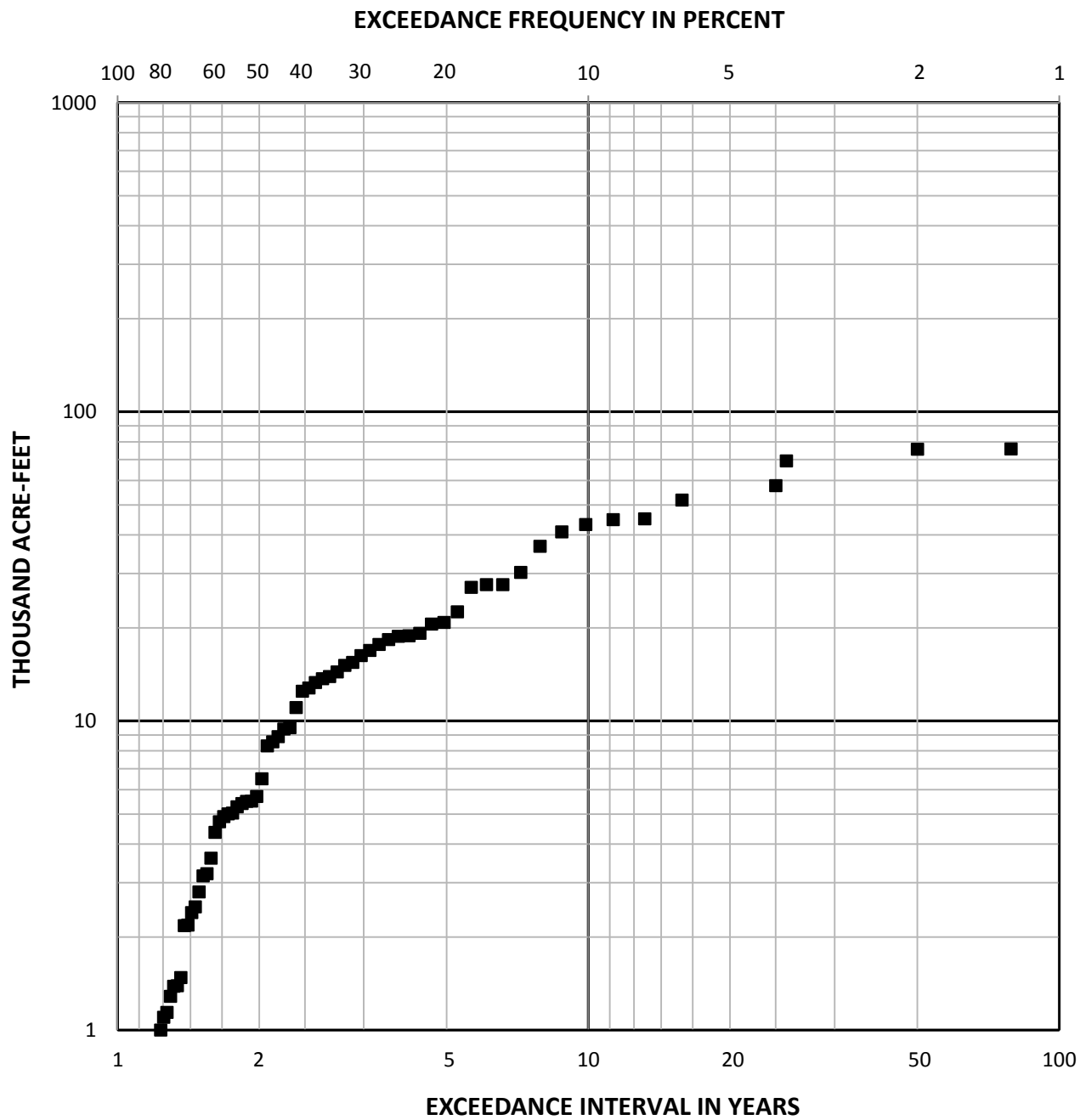
TRINITY RIVER BASIN, TEXAS
RAY ROBERTS DAM AND LAKE
ELM FORK TRINITY RIVER

SEDIMENTATION AND DEGRADATION RANGES

ALL ELEVATIONS REFERRED TO ON THIS PLATE, UNLESS NOTED OTHERWISE, ARE IN FEET, NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD29). THE DATUM CONVERSION FROM NGVD29 TO NAVD88 IS: $NGVD29 + 0.2 \text{ FEET} = NAVD88$ FOR RAY ROBERTS DAM AND LAKE.

U.S. ARMY ENGINEER DISTRICT, FORT WORTH

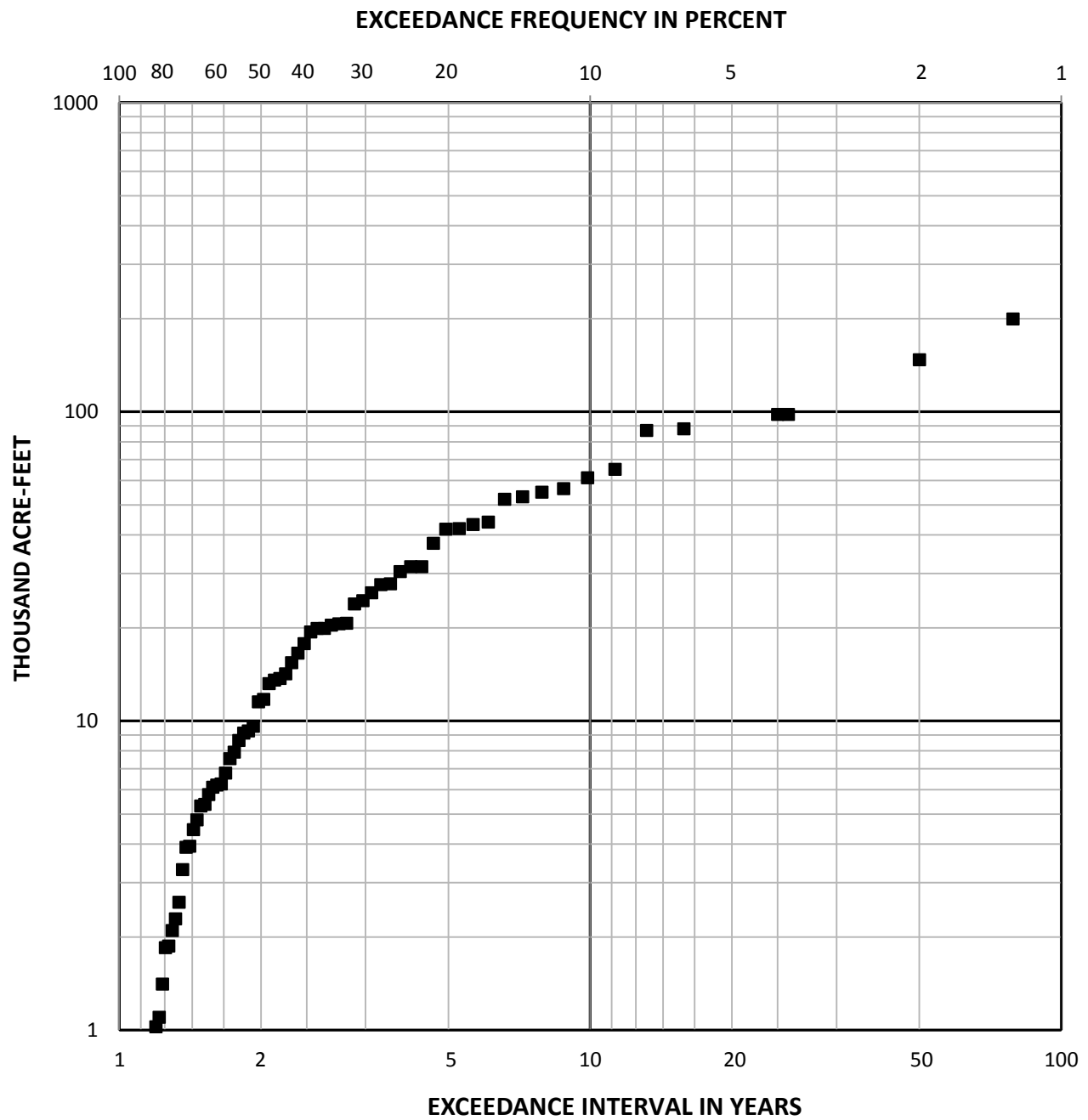
September 2018



TRINITY RIVER BASIN, TEXAS
RAY ROBERTS DAM AND LAKE
ELM FORK TRINITY RIVER

JANUARY INFLOW FREQUENCY
1940-2017

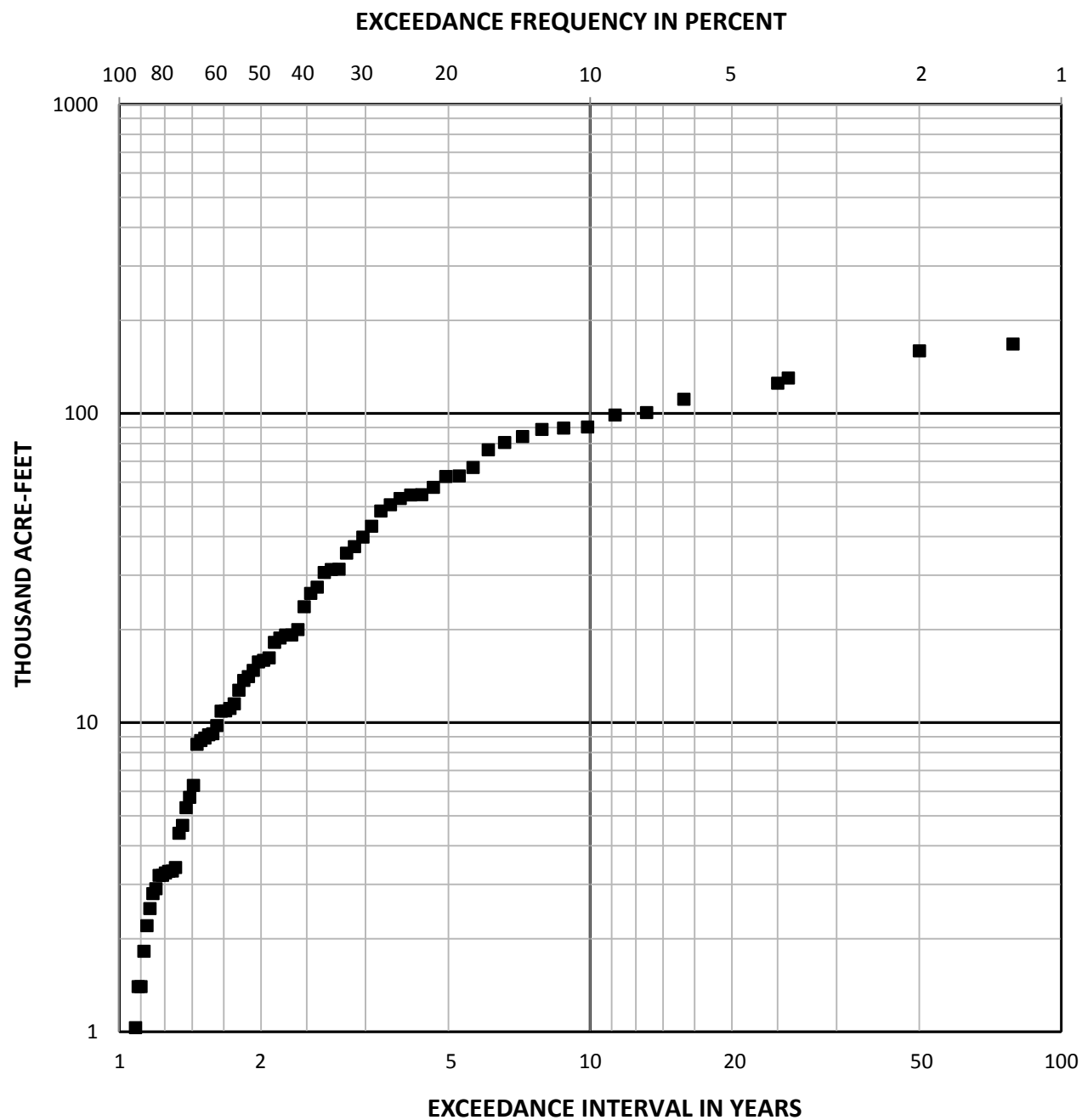
U.S. ARMY ENGINEER DISTRICT, FORT WORTH September 2018



TRINITY RIVER BASIN, TEXAS
RAY ROBERTS DAM AND LAKE
ELM FORK TRINITY RIVER

FEBRUARY INFLOW FREQUENCY
1940-2017

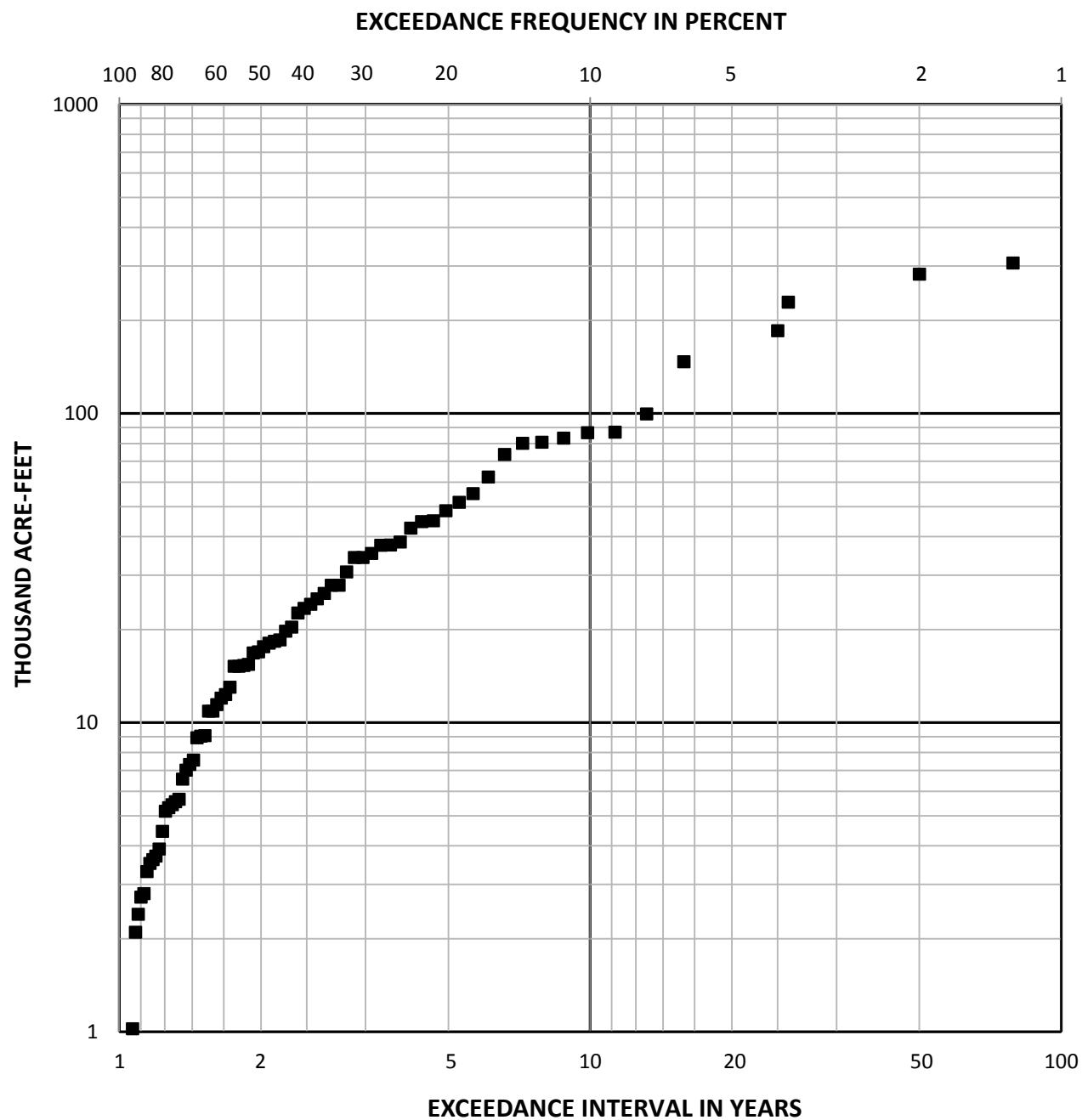
U.S. ARMY ENGINEER DISTRICT, FORT WORTH September 2018



TRINITY RIVER BASIN, TEXAS
RAY ROBERTS DAM AND LAKE
ELM FORK TRINITY RIVER

MARCH INFLOW FREQUENCY
1940-2017

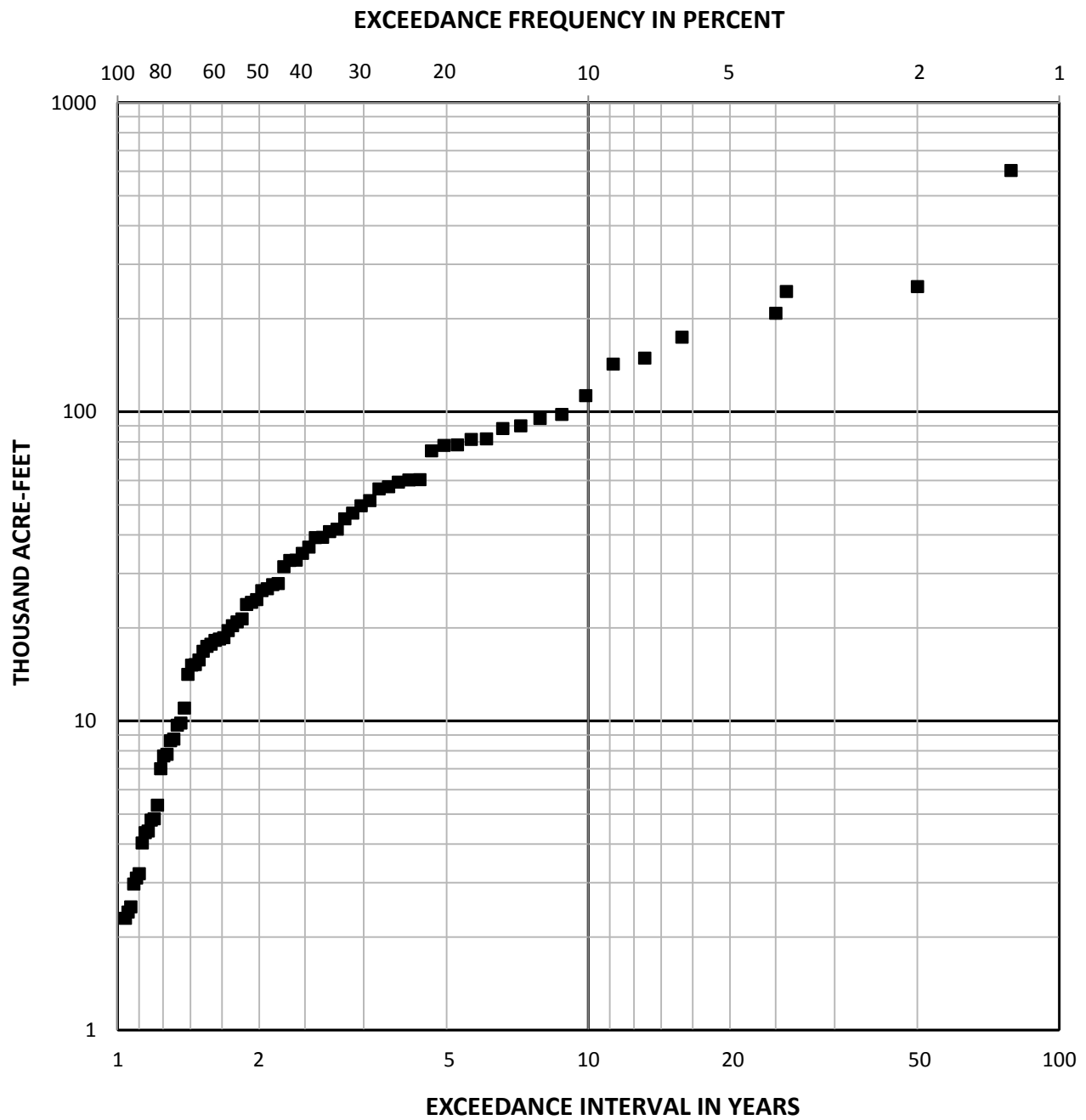
U.S. ARMY ENGINEER DISTRICT, FORT WORTH September 2018



TRINITY RIVER BASIN, TEXAS
RAY ROBERTS DAM AND LAKE
ELM FORK TRINITY RIVER

APRIL INFLOW FREQUENCY
1940-2017

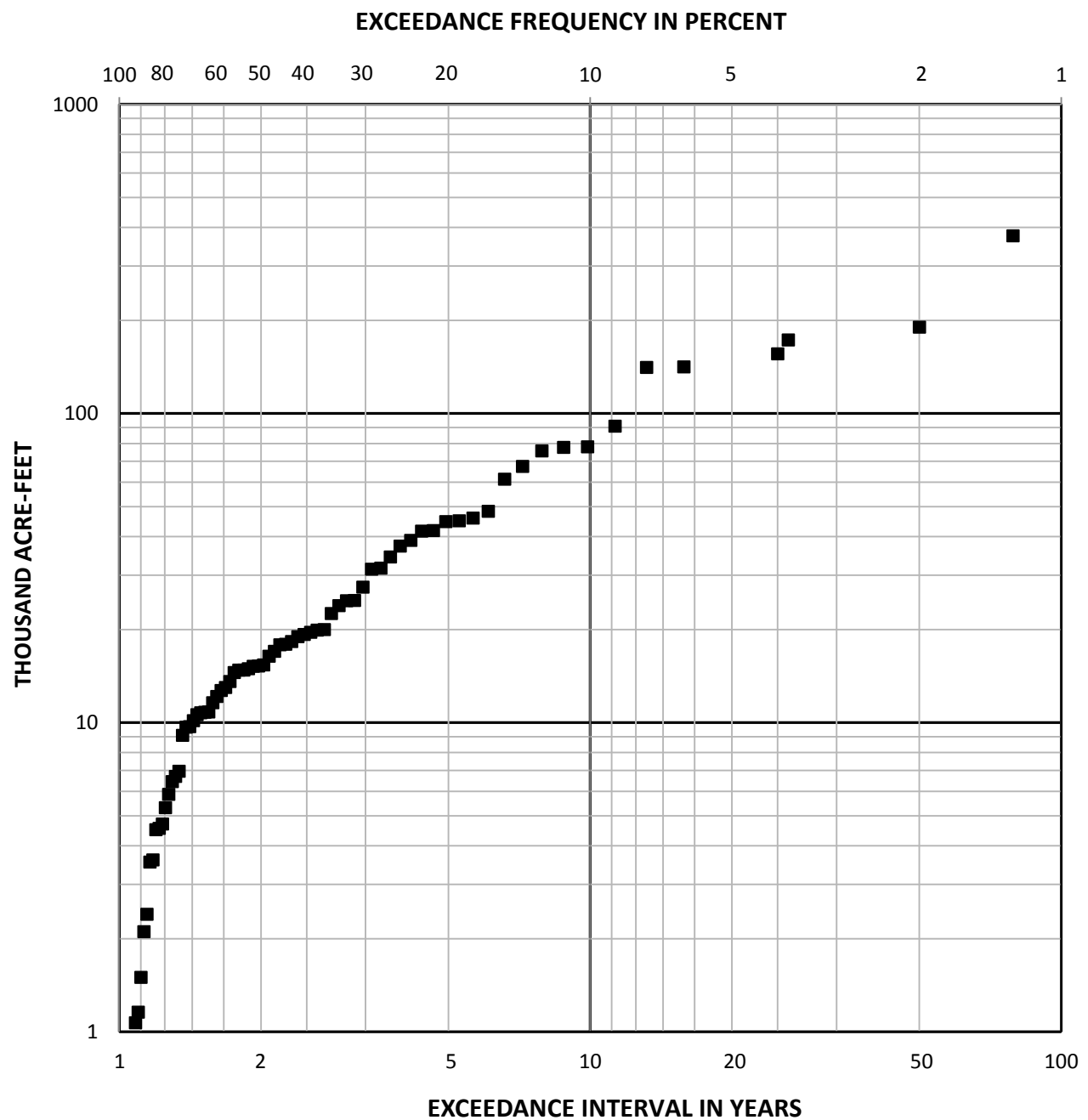
U.S. ARMY ENGINEER DISTRICT, FORT WORTH September 2018



TRINITY RIVER BASIN, TEXAS
RAY ROBERTS DAM AND LAKE
ELM FORK TRINITY RIVER

MAY INFLOW FREQUENCY
1940-2017

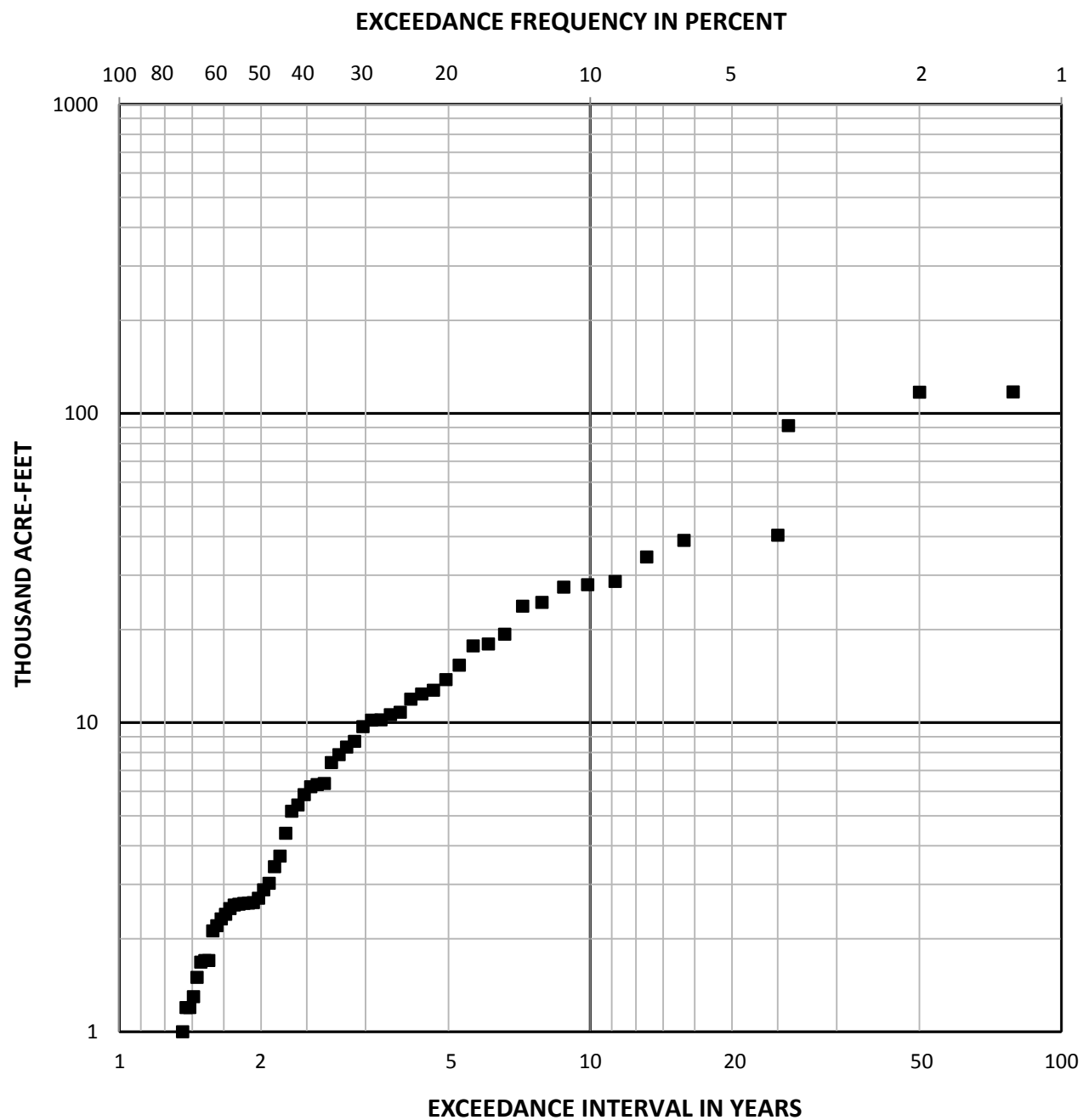
U.S. ARMY ENGINEER DISTRICT, FORT WORTH September 2018



TRINITY RIVER BASIN, TEXAS
RAY ROBERTS DAM AND LAKE
ELM FORK TRINITY RIVER

JUNE INFLOW FREQUENCY
1940-2017

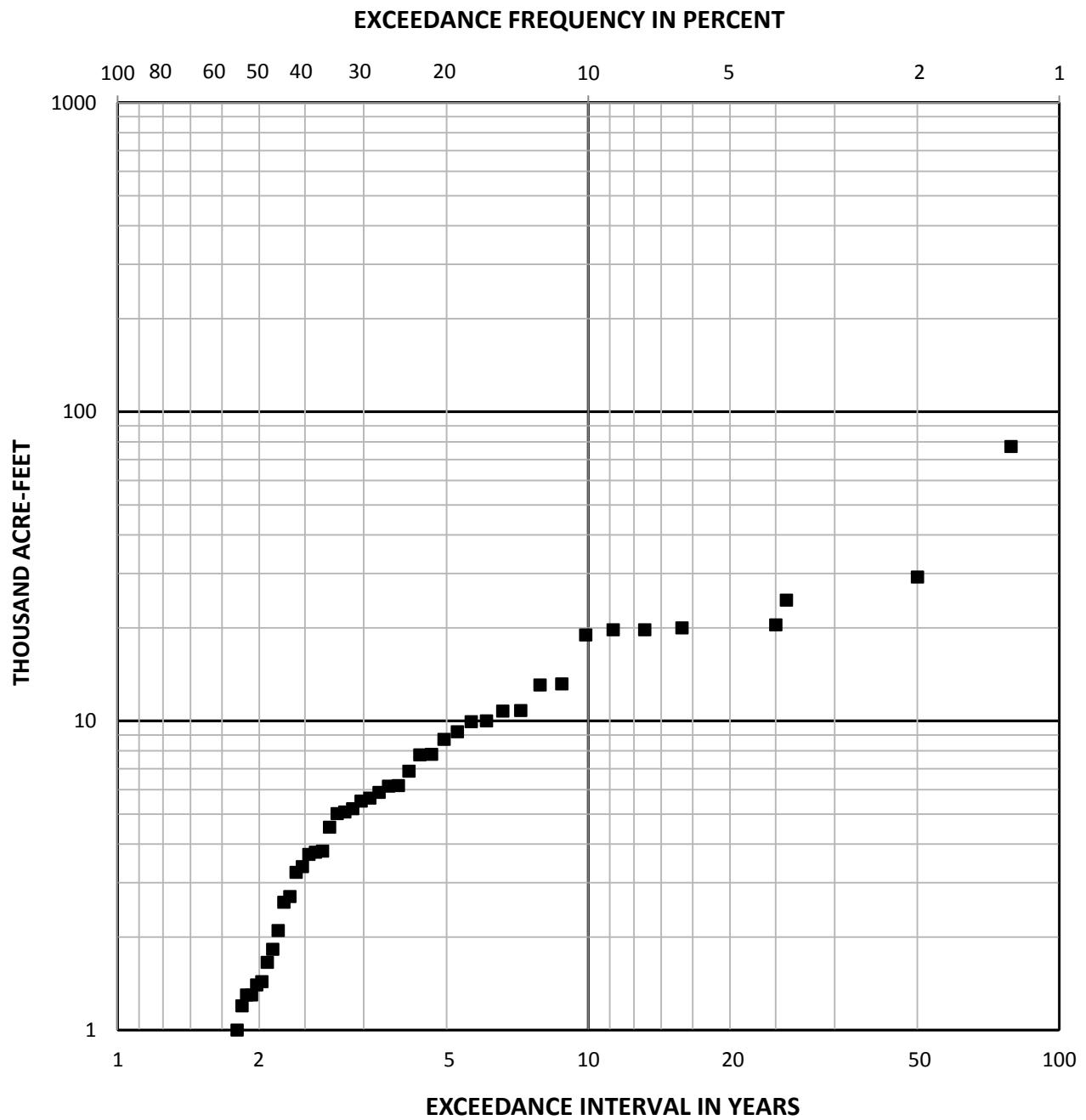
U.S. ARMY ENGINEER DISTRICT, FORT WORTH September 2018



TRINITY RIVER BASIN, TEXAS
RAY ROBERTS DAM AND LAKE
ELM FORK TRINITY RIVER

JULY INFLOW FREQUENCY
1940-2017

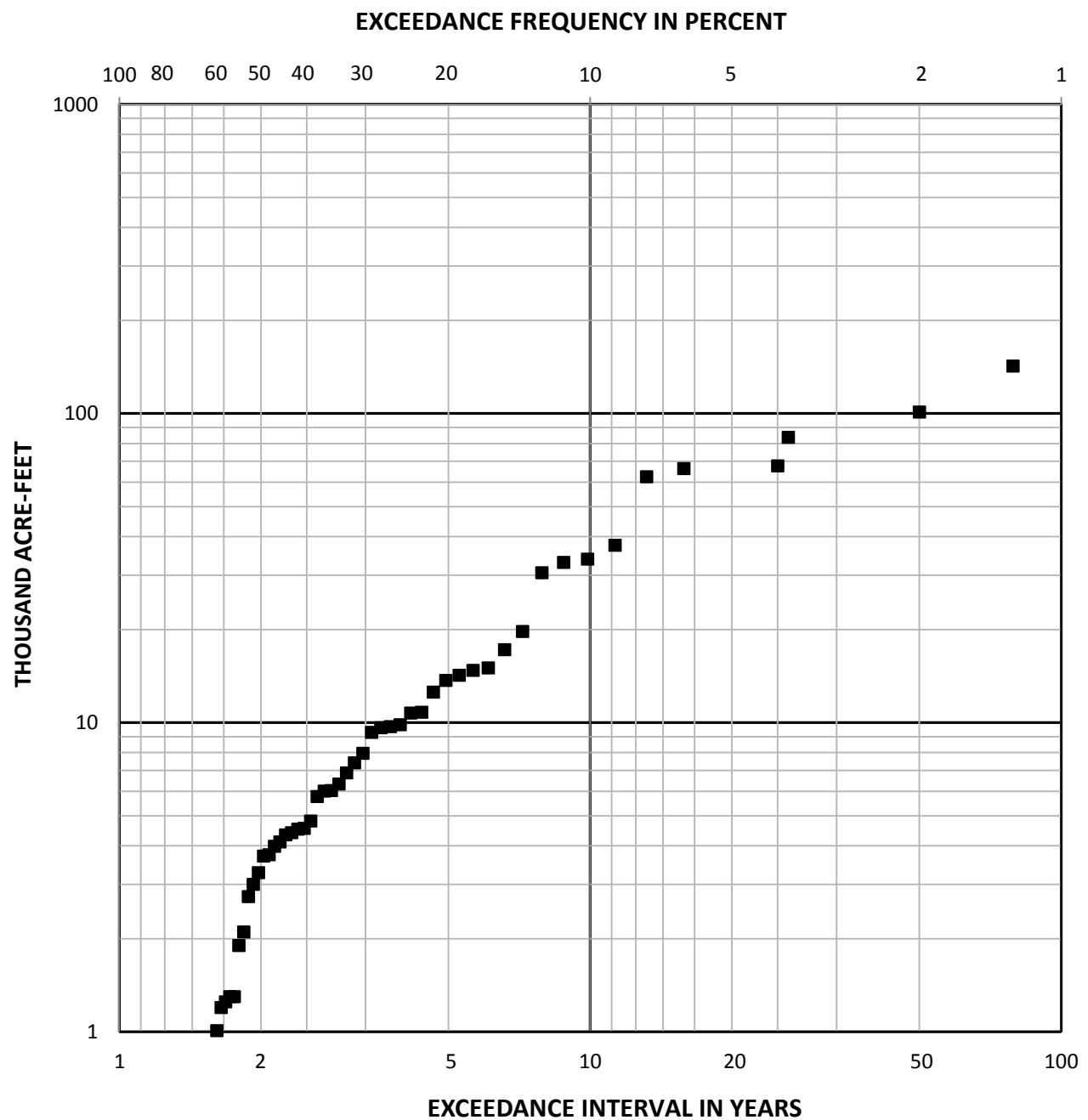
U.S. ARMY ENGINEER DISTRICT, FORT WORTH September 2018



TRINITY RIVER BASIN, TEXAS
RAY ROBERTS DAM AND LAKE
ELM FORK TRINITY RIVER

AUGUST INFLOW FREQUENCY
1940-2017

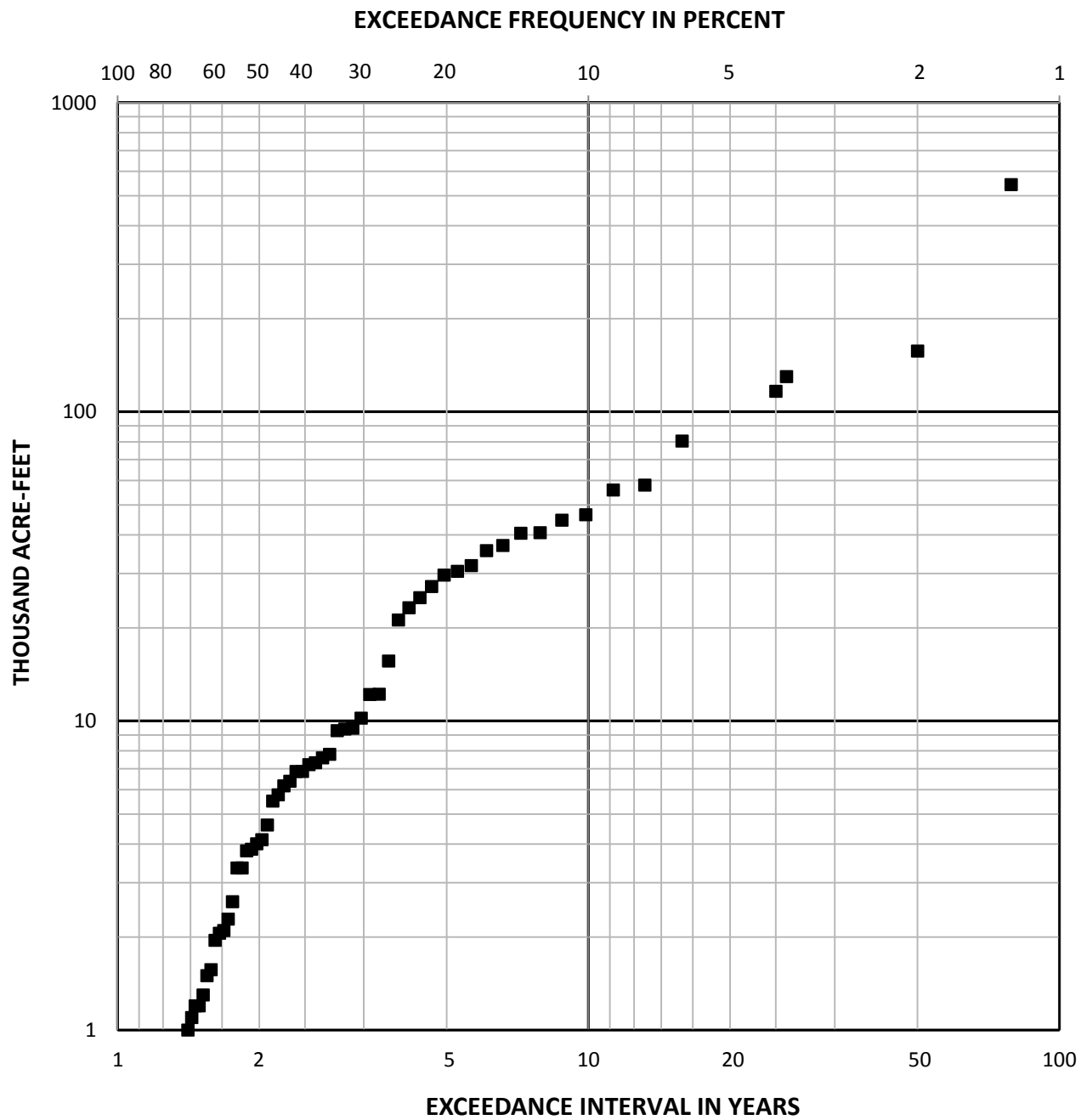
U.S. ARMY ENGINEER DISTRICT, FORT WORTH September 2018



TRINITY RIVER BASIN, TEXAS
RAY ROBERTS DAM AND LAKE
ELM FORK TRINITY RIVER

SEPTEMBER INFLOW FREQUENCY
1940-2017

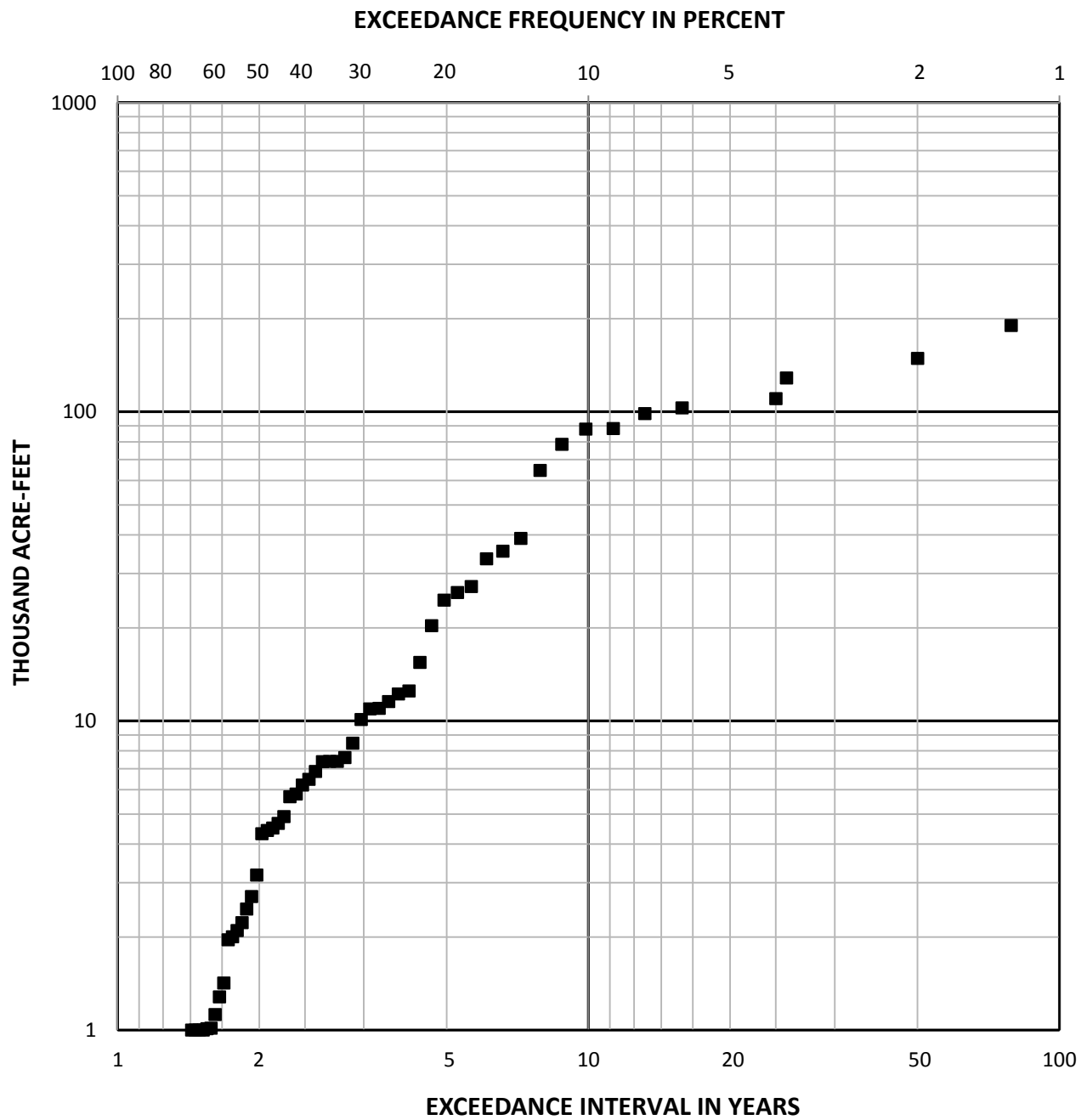
U.S. ARMY ENGINEER DISTRICT, FORT WORTH September 2018



TRINITY RIVER BASIN, TEXAS
RAY ROBERTS DAM AND LAKE
ELM FORK TRINITY RIVER

OCTOBER INFLOW FREQUENCY
1940-2017

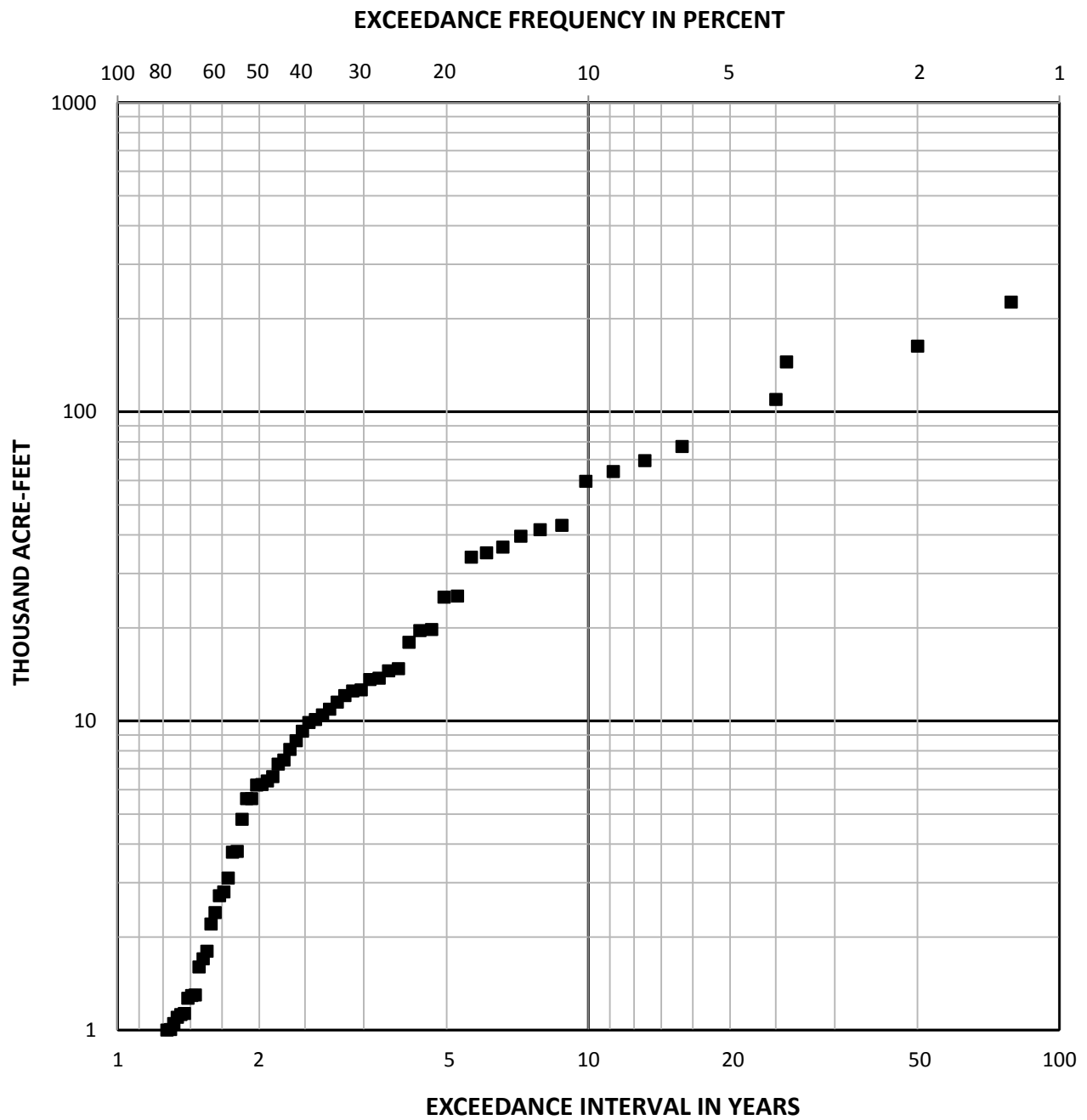
U.S. ARMY ENGINEER DISTRICT, FORT WORTH September 2018



TRINITY RIVER BASIN, TEXAS
RAY ROBERTS DAM AND LAKE
ELM FORK TRINITY RIVER

NOVEMBER INFLOW FREQUENCY
1940-2017

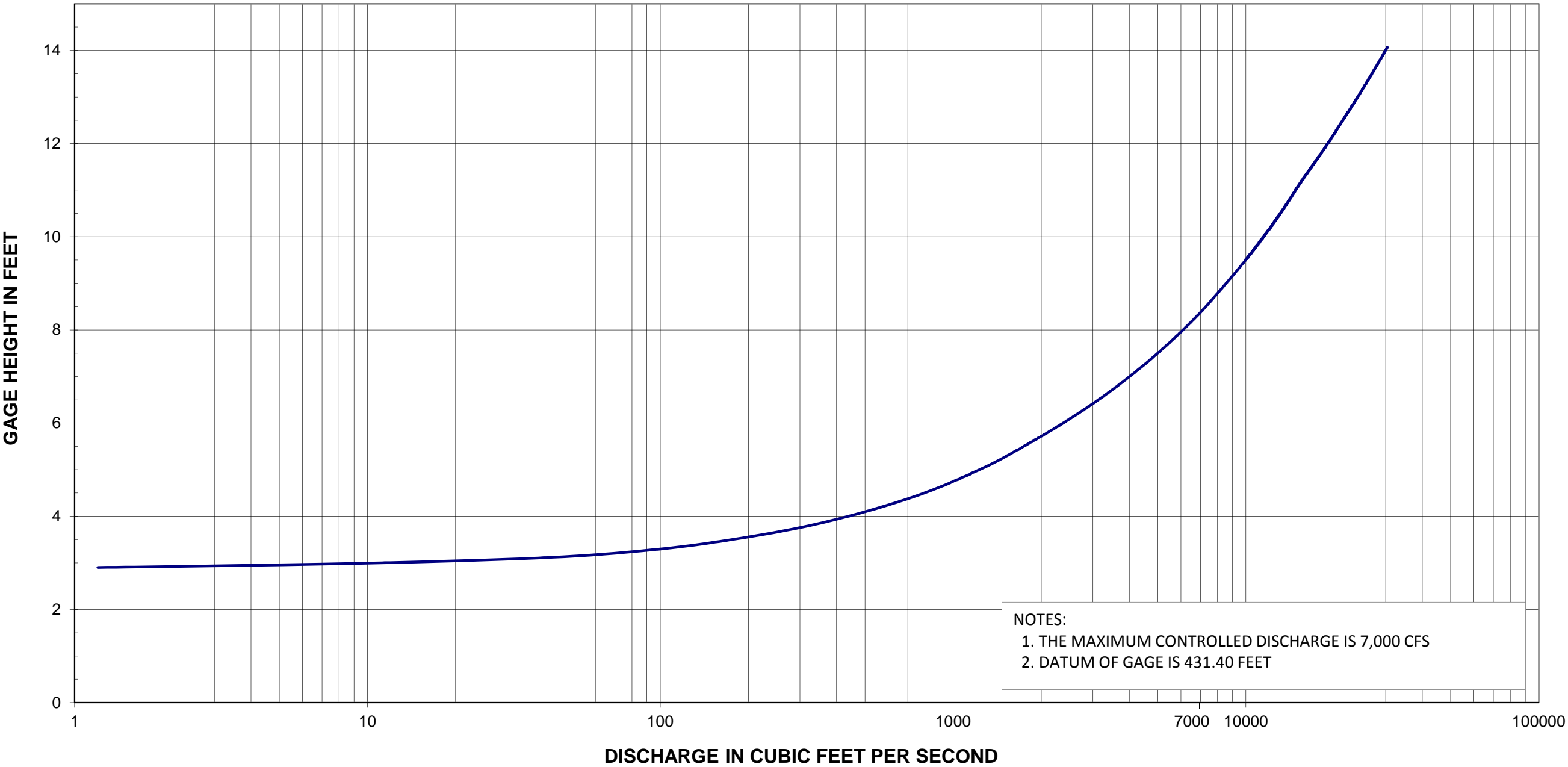
U.S. ARMY ENGINEER DISTRICT, FORT WORTH September 2018



TRINITY RIVER BASIN, TEXAS
RAY ROBERTS DAM AND LAKE
ELM FORK TRINITY RIVER

DECEMBER INFLOW FREQUENCY
1940-2017

U.S. ARMY ENGINEER DISTRICT, FORT WORTH September 2018



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TRINITY RIVER BASIN, TEXAS

RAY ROBERTS DAM AND LAKE

ELM FORK TRINITY RIVER

RATING CURVE

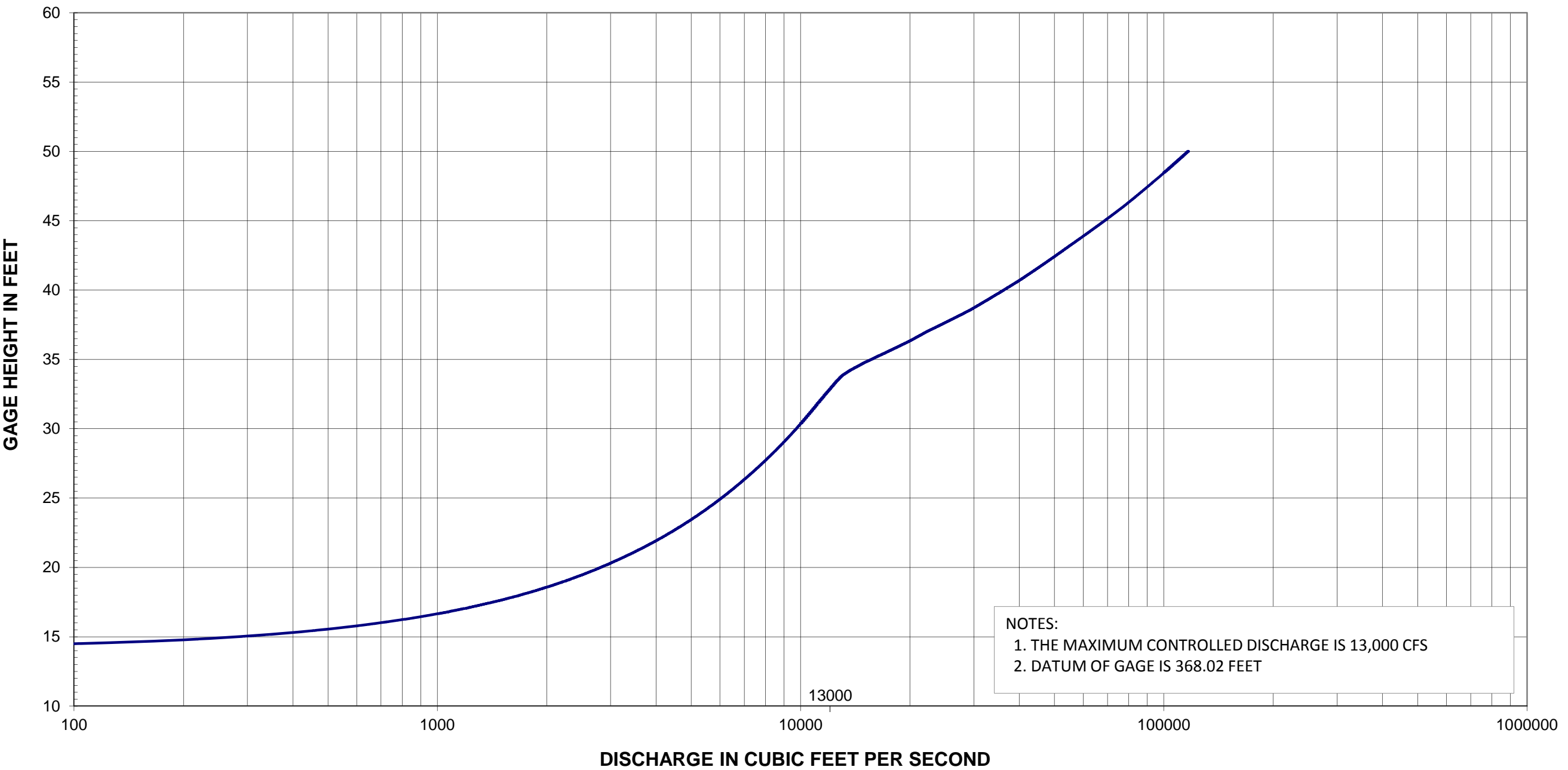
ELM FORK TRINITY RIVER NEAR CARROLLTON

USGS GAGE NO. 08055500

U.S. ARMY ENGINEER DISTRICT, FORT WORTH

September 2018

PLATE 4 - 15



ALL ELEVATIONS REFERRED TO ON THIS PLATE, UNLESS NOTED OTHERWISE, ARE IN FEET, NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD29).
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TRINITY RIVER BASIN, TEXAS

RAY ROBERTS DAM AND LAKE

ELM FORK TRINITY RIVER

RATING CURVE

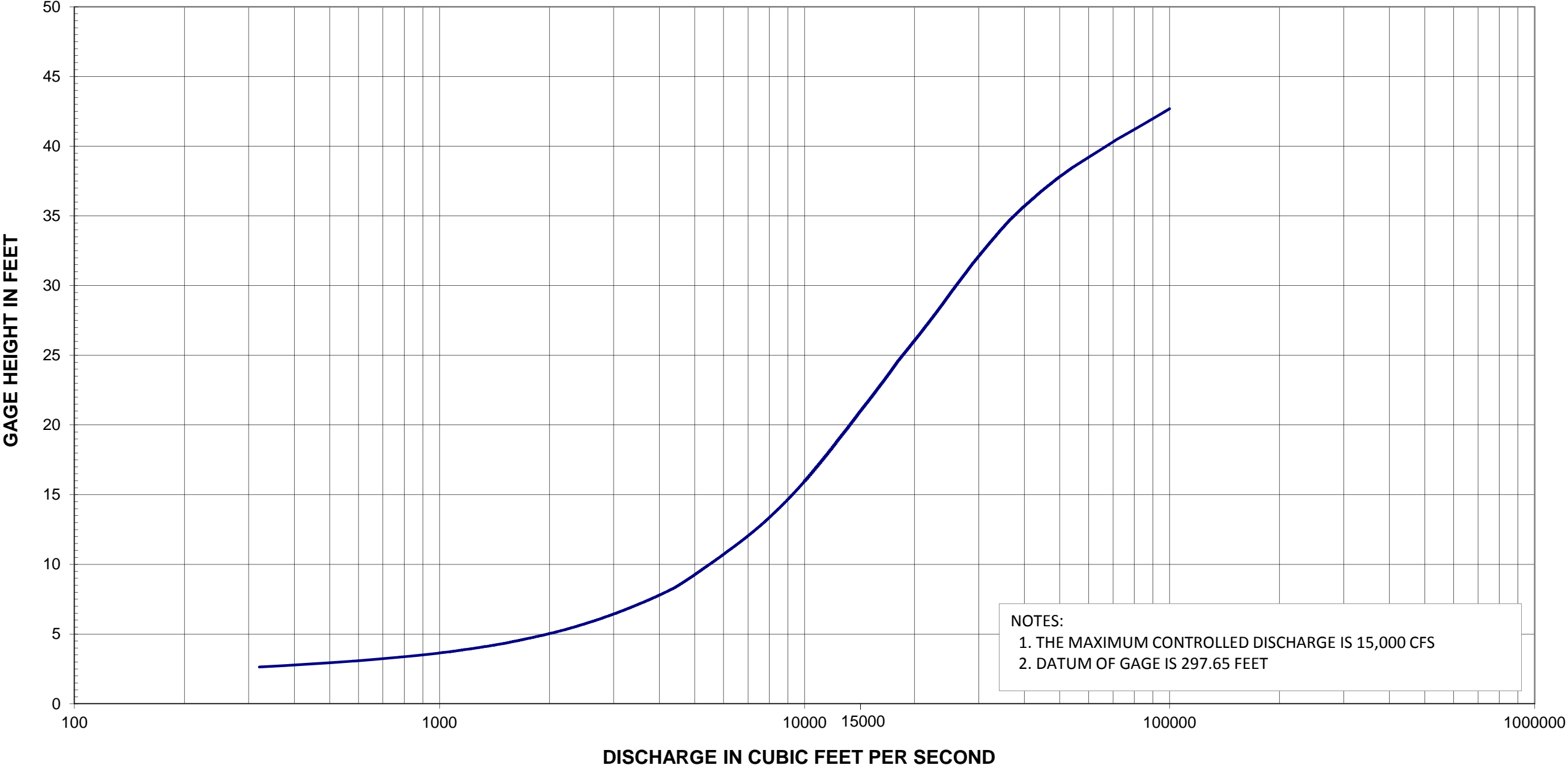
TRINITY RIVER AT DALLAS

USGS GAGE NO. 08057000

U.S. ARMY ENGINEER DISTRICT, FORT WORTH

September 2018

PLATE 4 - 16



ALL ELEVATIONS REFERRED TO ON THIS PLATE, UNLESS NOTED OTHERWISE, ARE IN FEET, NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD29).
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TRINITY RIVER BASIN, TEXAS

RAY ROBERTS DAM AND LAKE

ELM FORK TRINITY RIVER

RATING CURVE

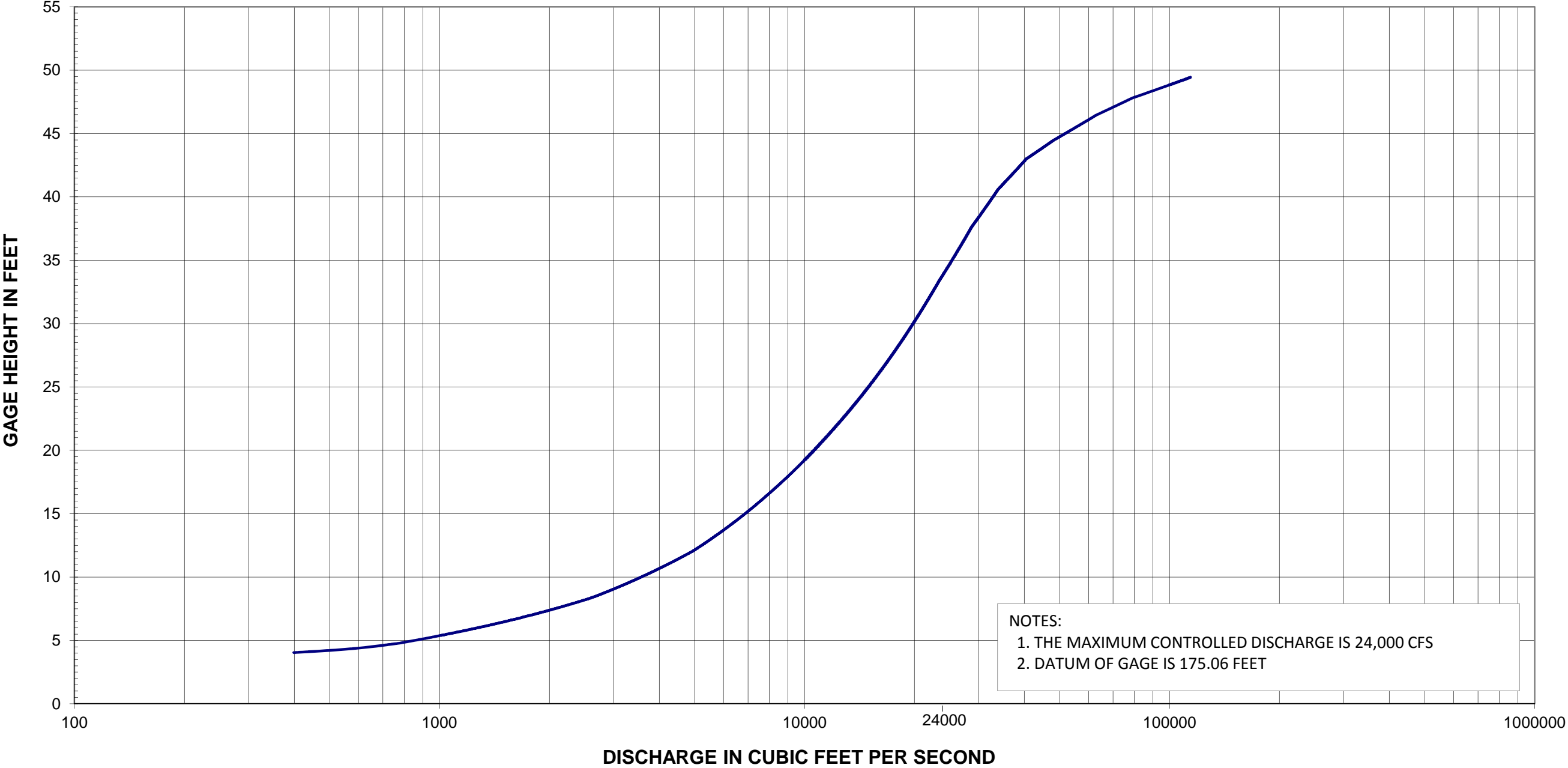
TRINITY RIVER NEAR ROSSER

USGS GAGE NO. 08062500

U.S. ARMY ENGINEER DISTRICT, FORT WORTH

September 2018

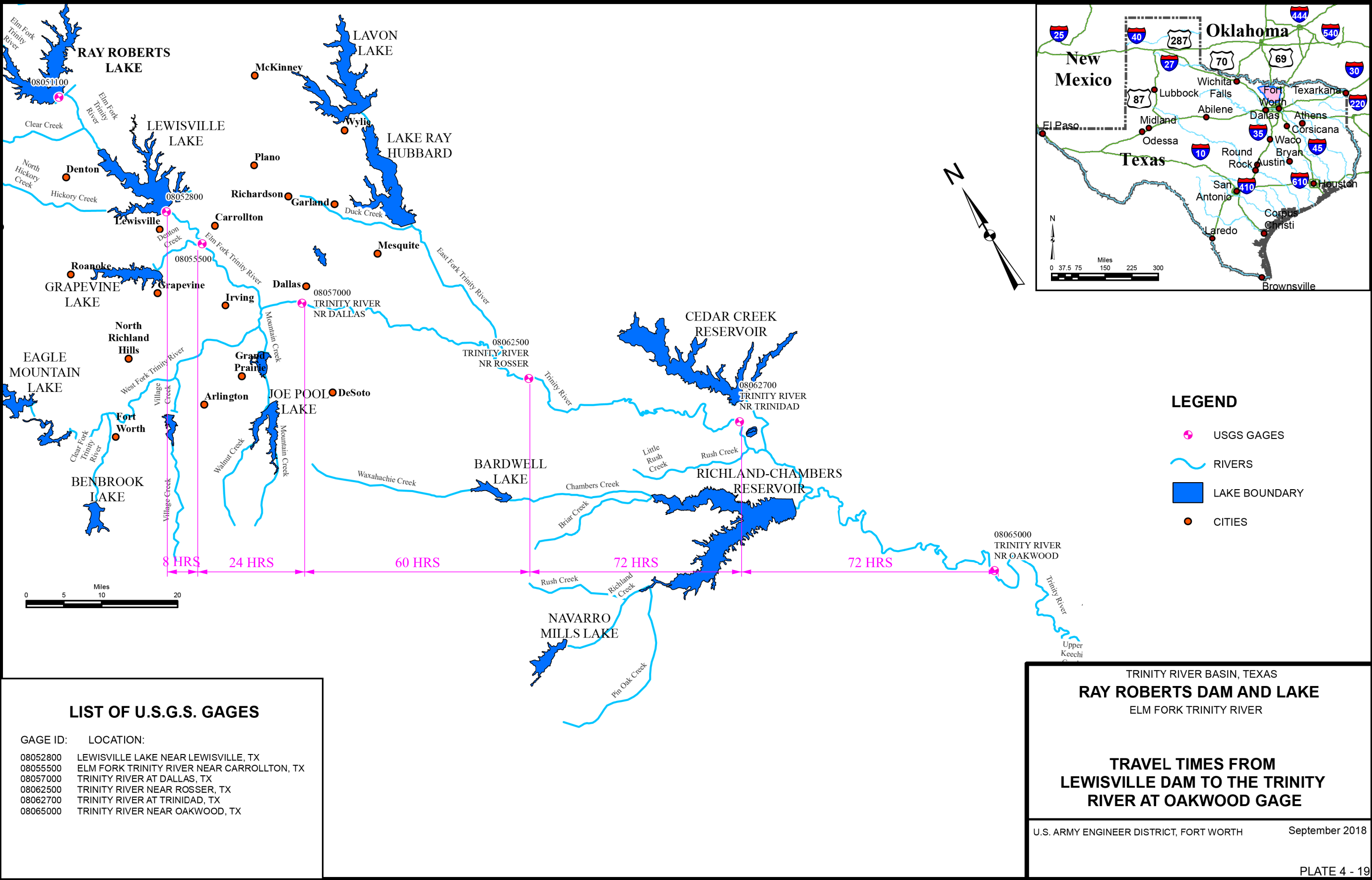
PLATE 4 - 17

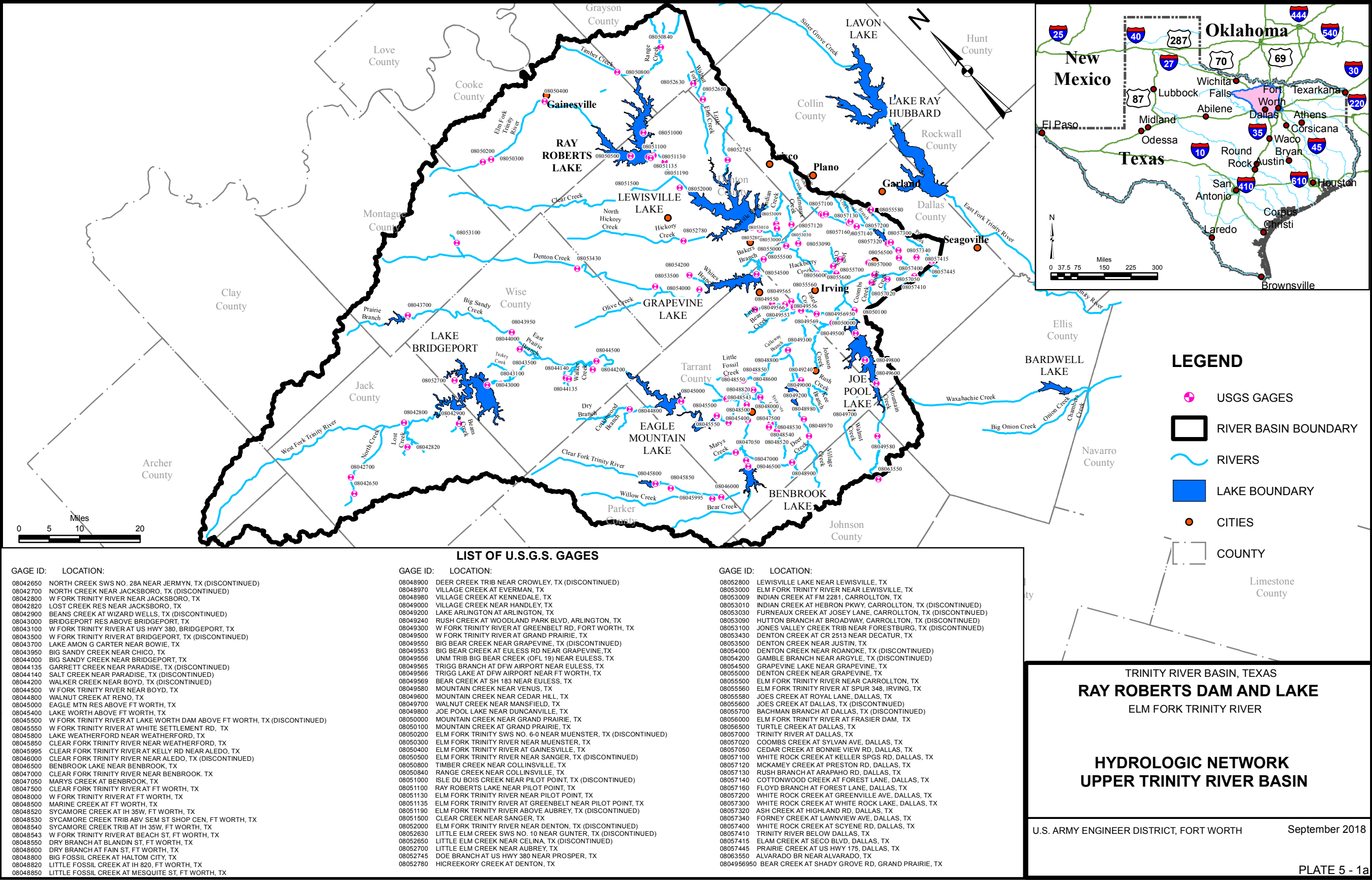


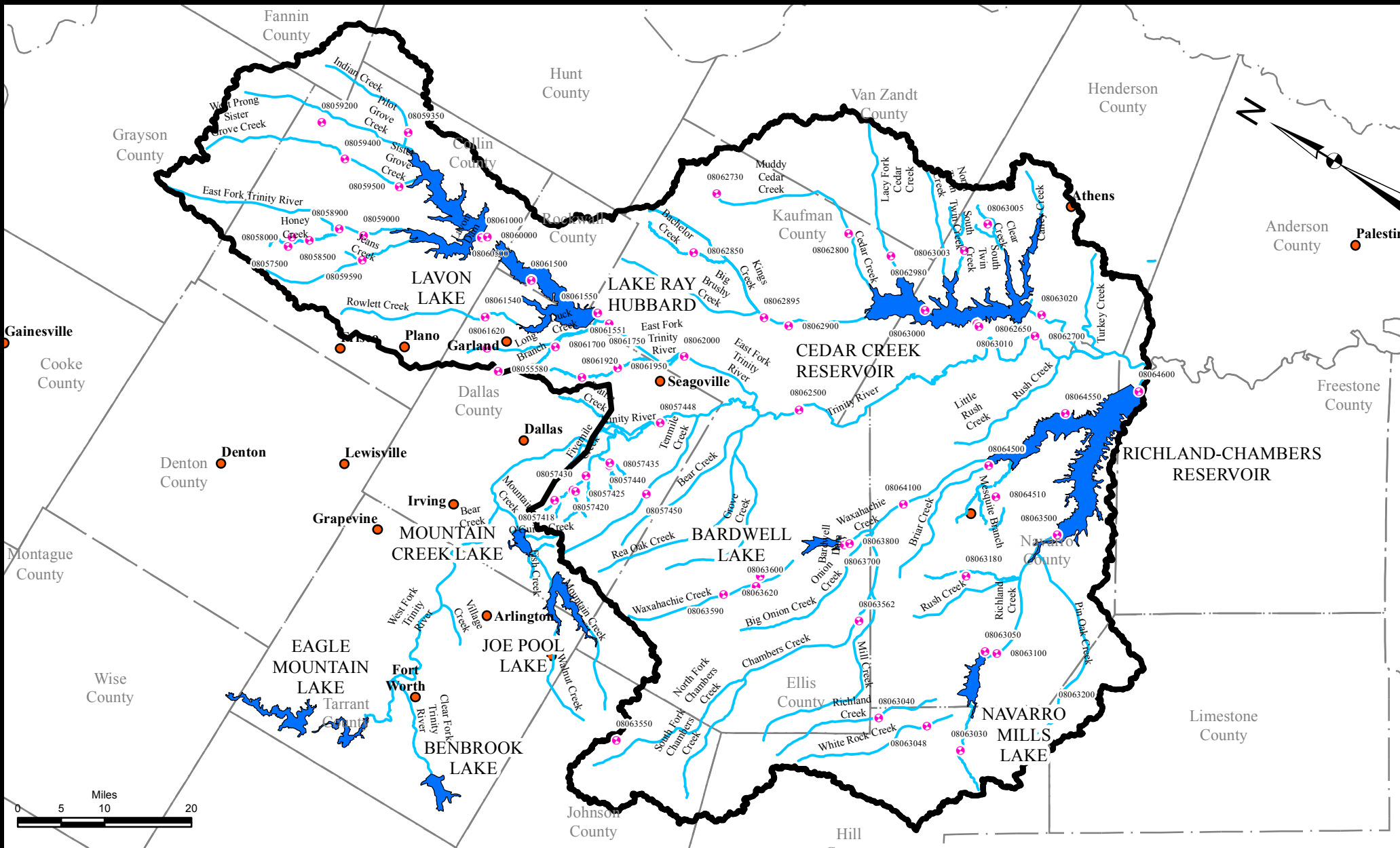
ALL ELEVATIONS REFERRED TO ON THIS PLATE, UNLESS NOTED OTHERWISE, ARE IN FEET, NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD29).
THE DATUM CONVERSION FROM NGVD29 TO NAVD88 IS: NGVD29 + 0.0 FEET = NAVD88 FOR RAY ROBERTS DAM AND LAKE.

TRINITY RIVER BASIN, TEXAS
RAY ROBERTS DAM AND LAKE
ELM FORK TRINITY RIVER

RATING CURVE
TRINITY RIVER NEAR OAKWOOD
USGS GAGE NO. 08065000







LEGEND

- USGS GAGES
- RIVER BASIN BOUNDARY
- RIVERS
- LAKE BOUNDARY
- CITIES
- COUNTY

LIST OF U.S.G.S. GAGES

GAGE ID: LOCATION:

08055580 JOES CREEK AT ROYAL LANE, DALLAS, TX (DISCONTINUED)
08057418 FIVEMILE CREEK AT KEST BLVD, DALLAS, TX (DISCONTINUED)
08057420 FIVEMILE CREEK AT US HWY 77W, DALLAS, TX (DISCONTINUED)
08057425 WOODY BR AT US HWY 77, DALLAS, TX (DISCONTINUED)
08057430 FIVEMILE CREEK AT LANCASTER RD, DALLAS, TX (DISCONTINUED)
08057435 NEWTON CREEK AT IH 635, DALLAS, TX (DISCONTINUED)
08057440 WHITES BRANCH AT IH 625, DALLAS, TX (DISCONTINUED)
08057448 TRINITY RIVER NEAR WILMER, TX (DISCONTINUED)
08057450 TENMILE CREEK AT SH 342, LANCASTER, TX (DISCONTINUED)
08057500 HONEY CREEK SWS NO. 11 NEAR MCKINNEY, TX (DISCONTINUED)
08058000 HONEY CREEK SWS NO. 12 NEAR MCKINNEY, TX (DISCONTINUED)
08058500 HONEY CREEK NEAR MCKINNEY, TX (DISCONTINUED)
08058900 E FORK TRINITY RIVER AT MCKINNEY, TX (DISCONTINUED)
08059000 E FORK TRINITY RIVER NEAR MCKINNEY, TX
08059200 ARLS BRANCH NEAR WESTMINSTER, TX (DISCONTINUED)
08059350 INDIAN CREEK AT SH 78 NEAR FARMERSVILLE, TX
08059400 SISTER GROVE CREEK NEAR BLUE RIDGE, TX
08059500 SISTER GROVE CREEK NEAR PRINCETON, TX (DISCONTINUED)
08059590 WILSON CREEK DWS OF HWY 75 AT MCKEENINNEY, TX
08060000 E FORK TRINITY RIVER ABOVE PILOT GROVE NEAR LAVON, TX (DISCONTINUED)
08060500 LAVON LAKE NEAR LAVON, TX
08061000 E FORK TRINITY RIVER NEAR LAVON, TX (DISCONTINUED)

GAGE ID: LOCATION:

08061500 E FORK TRINITY RIVER NEAR ROCKWALL, TX (DISCONTINUED)
08061540 ROWLETT CREEK NEAR SACHSE, TX
08061620 DUCK CREEK AT BUCKINGHAM RD, GARLAND, TX (DISCONTINUED)
08061700 DUCK CREEK NEAR GARLAND, TX (DISCONTINUED)
08061750 E FORK TRINITY RIVER NEAR FORNEY, TX
08061920 S MESQUITE CREEK AT SH 352, MESQUITE, TX (DISCONTINUED)
08061950 S MESQUITE CREEK AT MERCURY RD, N MESQUITE, TX (DISCONTINUED)
08062000 E FORK TRINITY RIVER NEAR CRANDAL, TX
08062500 TRINITY RIVER NEAR ROSSER, TX
08062650 CEDAR CREEK RESERVOIR SPILLWAY OUTFLOW NEAR TRINIDAD, TX (DISCONTINUED)
08062700 TRINITY RIVER AT TRINIDAD, TX
08062730 NEW TERRELL CITY LAKE NEAR TERRELL, TX
08062800 CEDAR CREEK NEAR KEMP, TX
08062850 BACHELOR CREEK NEAR TERRELL, TX (DISCONTINUED)
08062895 KINGS CREEK AT SH 34 NEAR KAUFMAN, TX
08062900 KINGS CREEK NEAR KAUFMAN, TX (DISCONTINUED)
08062980 LACEY FORK NEAR MABANK, TX (DISCONTINUED)
08063000 CEDAR CREEK NEAR MABANK, TX (DISCONTINUED)
08063003 S TWIN CREEK NEAR EUSTACE, TX (DISCONTINUED)
08063005 RED OAK BRANCH NEAR EUSTACE, TX (DISCONTINUED)
08063010 CEDAR CREEK RES NEAR TRINIDAD, TX (DISCONTINUED)
08063020 CEDAR CREEK AT TRINIDAD, TX

GAGE ID: LOCATION:

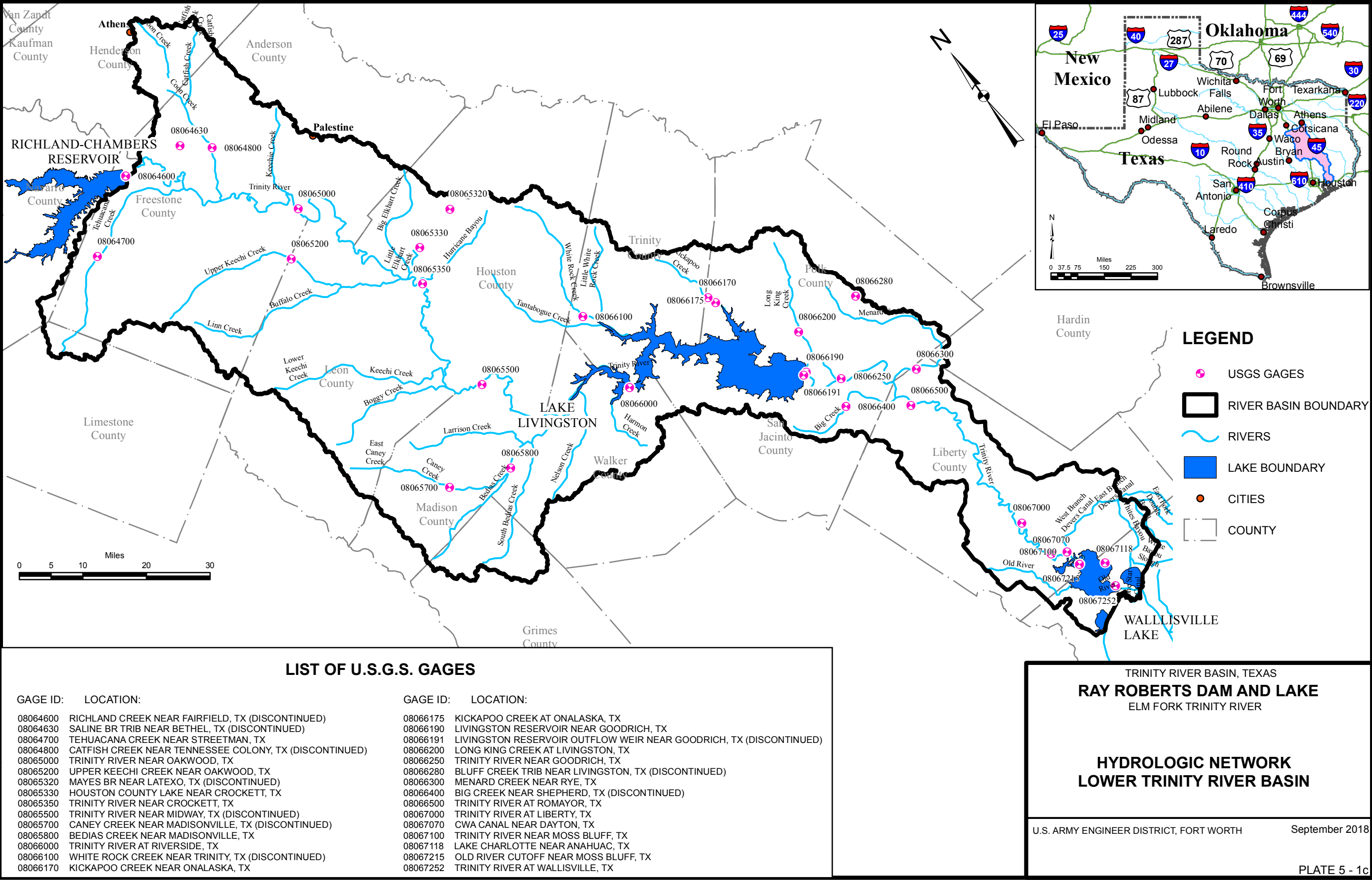
08063030 ASH CREEK AT HWY 171 NEAR MALONE, TX
08061550 LAKE RAY HUBBARD NEAR FORNEY, TX
08061551 E FORK TRINITY RIVER BELOW LAKE RAY HUBBARD, TX
08063040 RICHLAND CREEK AT HWY 22 NEAR MERTENS, TX
08063048 WHITE ROCK CREEK AT FM 308 NEAR IRENE, TX
08063050 NAVARRO MILLS LAKE NEAR DAWSON, TX
08063100 RICHLAND CREEK NEAR DAWSON, TX
08063180 BRIAR CREEK TRIB NEAR CORSICANA, TX (DISCONTINUED)
08063200 PIN OAK CREEK NEAR HUBBARD, TX (DISCONTINUED)
08063500 RICHLAND CREEK NEAR RICHLAND, TX (DISCONTINUED)
08063550 ALVARADO BRANCH NEAR ALVARADO, TX (DISCONTINUED)
08063562 CHAMBERS CREEK AT FM 55 NEAR AVALON, TX
08063590 WAXAHACHIE CREEK AT WAXAHACHIE, TX
08063600 LAKE WAXAHACHIE NEAR WAXAHACHIE, TX
08063620 KINGS BRANCH NEAR REAGOR SPRINGS, TX (DISCONTINUED)
08063700 BARDWELL LAKE NEAR ENNIS, TX
08063800 WAXAHACHIE CREEK NEAR BARDWELL, TX
08064100 CHAMBERS CREEK NEAR RICE, TX
08064500 CHAMBERS CREEK NEAR CORSICANA, TX (DISCONTINUED)
08064510 HALBERT LAKE NEAR CORSICANA, TX
08064550 RICHLAND-CHAMBERS RES NEAR KERENS, TX
08064600 RICHLAND CREEK NEAR FAIRFIELD, TX (DISCONTINUED)

TRINITY RIVER BASIN, TEXAS
RAY ROBERTS DAM AND LAKE
ELM FORK TRINITY RIVER

HYDROLOGIC NETWORK
MIDDLE TRINITY RIVER BASIN








U.S. ARMY ENGINEER DISTRICT, FORT WORTH

September 2018





LEGEND

-  USGS GAGES
-  RIVER BASIN BOUNDARY
-  SUB BASIN BOUNDARY
-  RIVERS
-  LAKE BOUNDARY
-  CITIES
-  COUNTY BOUNDARY

LIST OF U.S.G.S. GAGES

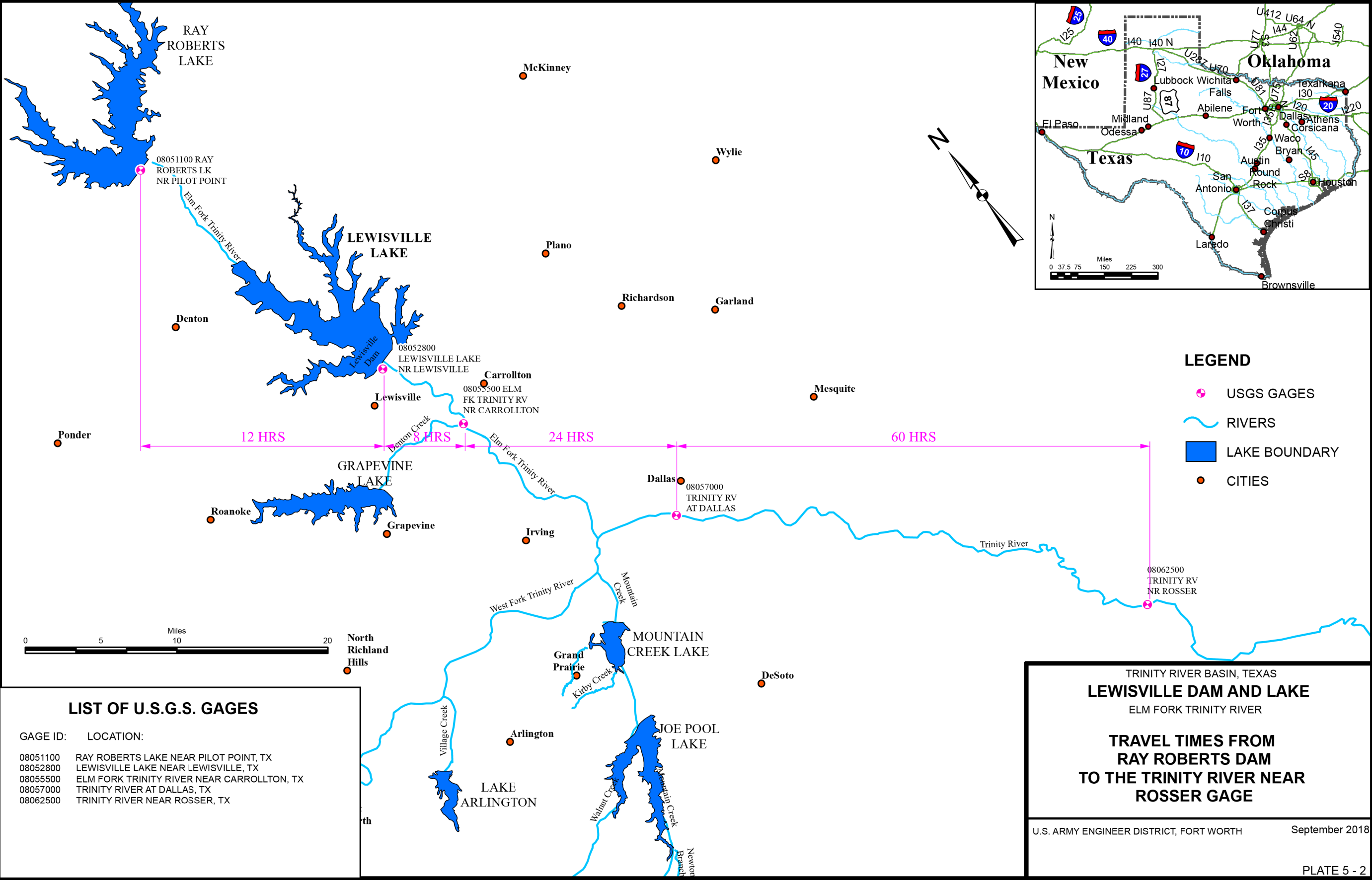
GAGE ID:	LOCATION:	GAGE ID:	LOCATION:
08050200	ELM FORK TRINITY SWS NO 6 NEAR MUENSTER, TX (DISCONTINUED)	08053000	ELM FK TRINITY RIVER NEAR LEWISVILLE, TX
08050300	ELM FORK TRINITY RIVER NEAR MUENSTER, TX (DISCONTINUED)	08053009	INDIAN CREEK AT FM 2281 CARROLLTON, TX
08050400	ELM FORK TRINITY RIVER AT GAINESVILLE, TX	08053010	INDIAN CREEK AT HEBRON PKWY, CARROLLTON, TX (DISCONTINUED)
08050500	ELM FORK TRINITY RIVER NEAR SANGER, TX (DISCONTINUED)	08053030	FURNEAUX CREEK AT JOSEY LANE, CARROLLTON, TX (DISCONTINUED)
08050800	TIMBER CREEK NEAR COLLINSVILLE, TX	08053090	HUTTON BRANCH AT BROADWAY, CARROLLTON, TX (DISCONTINUED)
08050840	RANGE CREEK NEAR COLLINSVILLE, TX	08053100	JONES VALLEY CREEK TRIB NEAR FORESTBURG, TX (DISCONTINUED)
08051000	ISLE DU BOIS CREEK NEAR PILOT POINT, TX (DISCONTINUED)	08053430	DENTON CREEK AT CR 2513 NEAR DECATUR, TX
08051100	RAY ROBERTS LAKE NEAR PILOT POINT, TX	08053500	DENTON CREEK NEAR JUSTIN, TX
08051135	ELM FORK TRINITY RIVER AT GREENBELT NEAR PILOT POINT, TX	08054000	DENTON CREEK NEAR ROANOKE, TX (DISCONTINUED)
08051190	ELM FORK TRINITY RIVER ABOVE AUBREY, TX (DISCONTINUED)	08054200	GAMBLE BRANCH NEAR ARGYLE, TX (DISCONTINUED)
08051500	CLEAR CREEK NEAR SANGER, TX	08054500	GRAPEVINE LAKE NEAR GRAPEVINE, TX
08052000	ELM FORK TRINITY RIVER NEAR DENTON, TX (DISCONTINUED)	08055000	DENTON CREEK NEAR GRAPEVINE, TX
08052630	LITTLE ELM CREEK SWS NO 10 NEAR GUNTER, TX (DISCONTINUED)	08055500	ELM FORK TRINITY RIVER NEAR CARROLLTON, TX
08052650	LITTLE ELM CREEK NEAR CELINA, TX (DISCONTINUED)	08055560	ELM FORK TRINITY RIVER AT SPUR 348 IRVING, TX
08052700	LITTLE ELM CREEK NEAR AUBREY, TX	08055600	JOES CREEK AT DALLAS, TX (DISCONTINUED)
08052745	DOE BR AT US HWY 380 NR PROSPER, TX	08055700	BACHMAN BRANCH AT DALLAS, TX (DISCONTINUED)
08052780	HICKORY CREEK AT DENTON, TX	08056000	ELM FORK TRINITY RIVER AT FRASIER DAM DALLAS, TX
08052800	LEWISVILLE LAKE NEAR LEWISVILLE, TX		

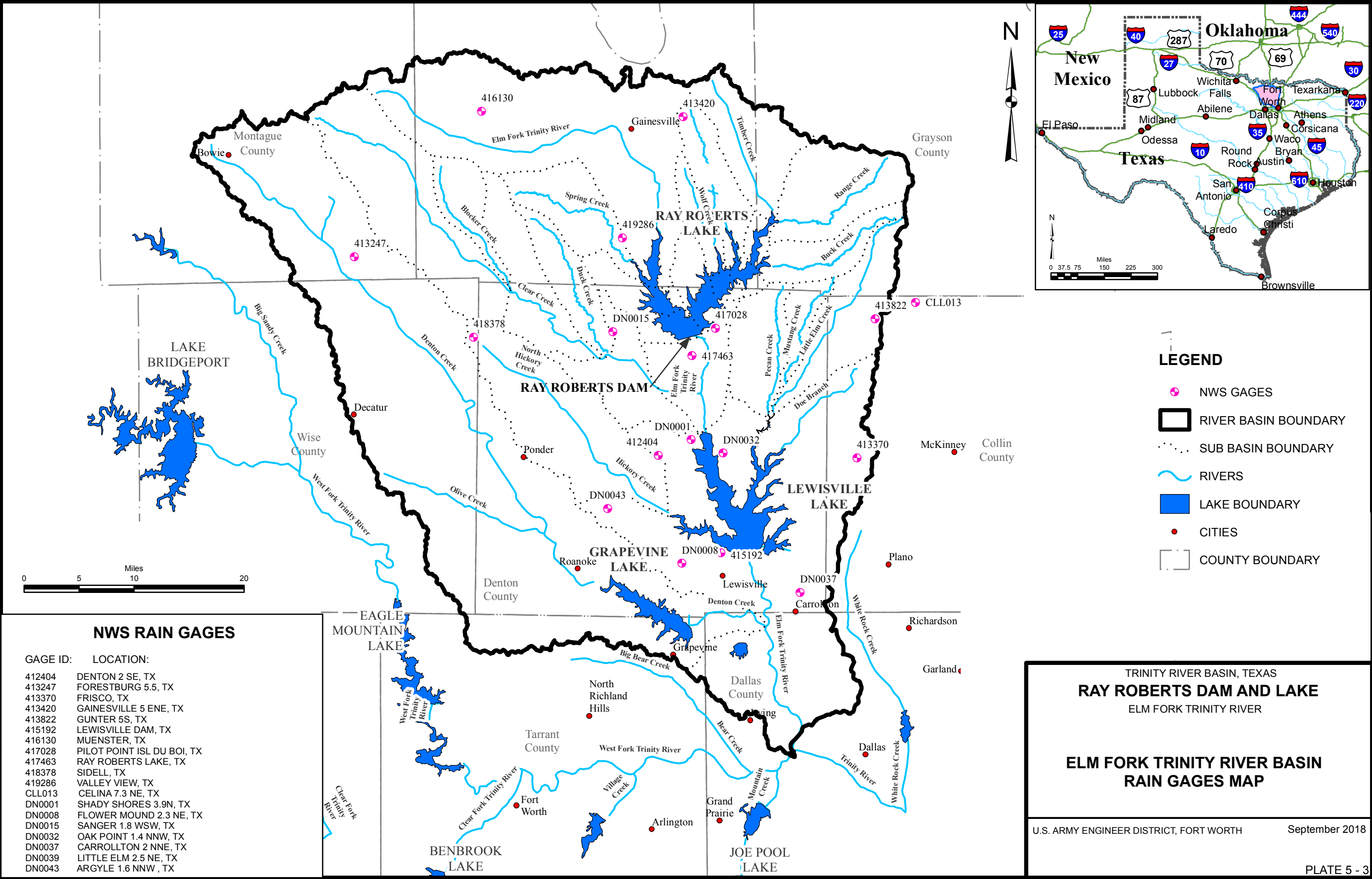
TRINITY RIVER BASIN, TEXAS
RAY ROBERTS DAM AND LAKE
ELM FORK TRINITY RIVER

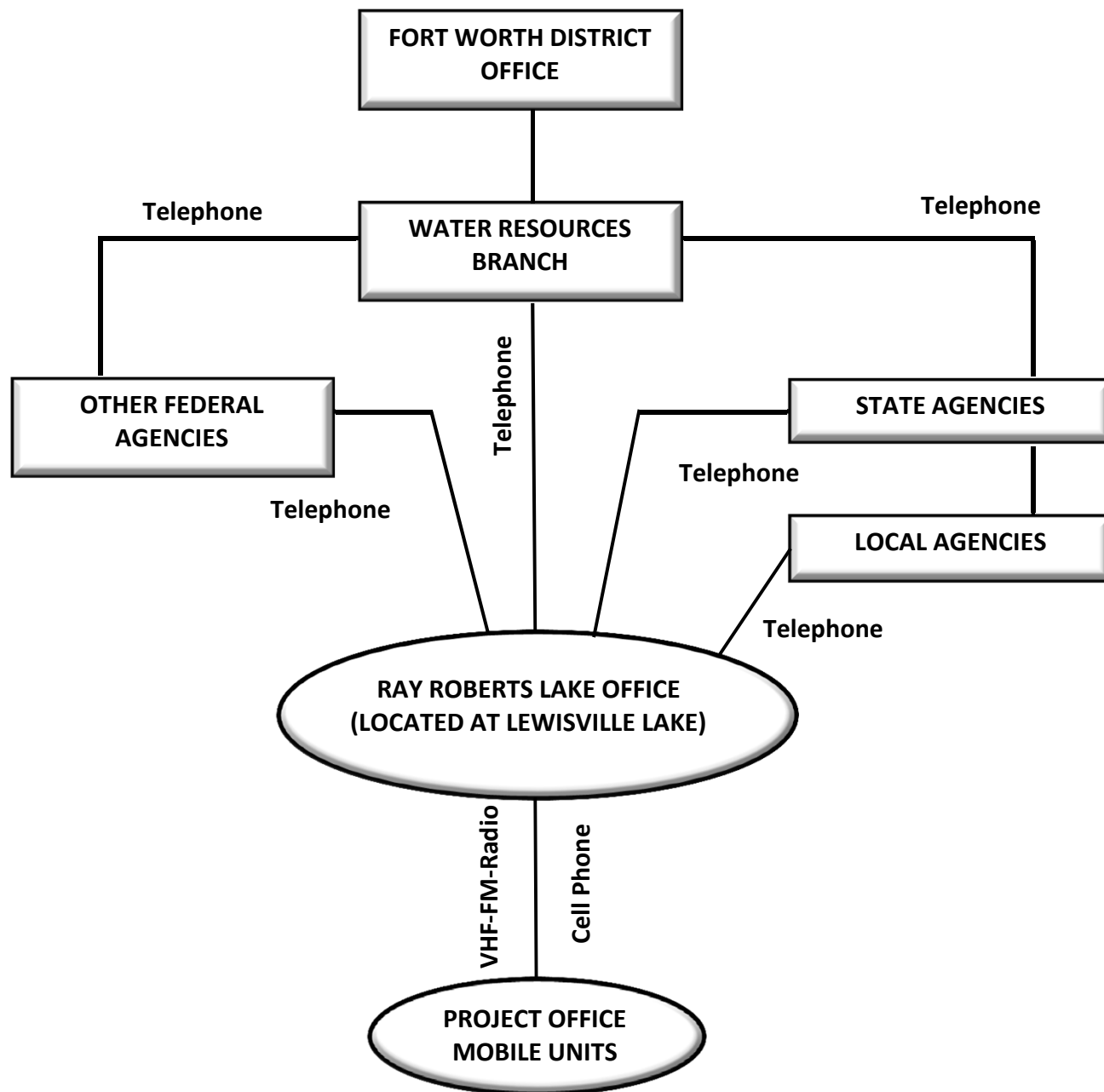
HYDROLOGIC NETWORK ELM FORK TRINITY RIVER BASIN

U.S. ARMY ENGINEER DISTRICT, FORT WORTH September 2018

PLATE 5 - 1d







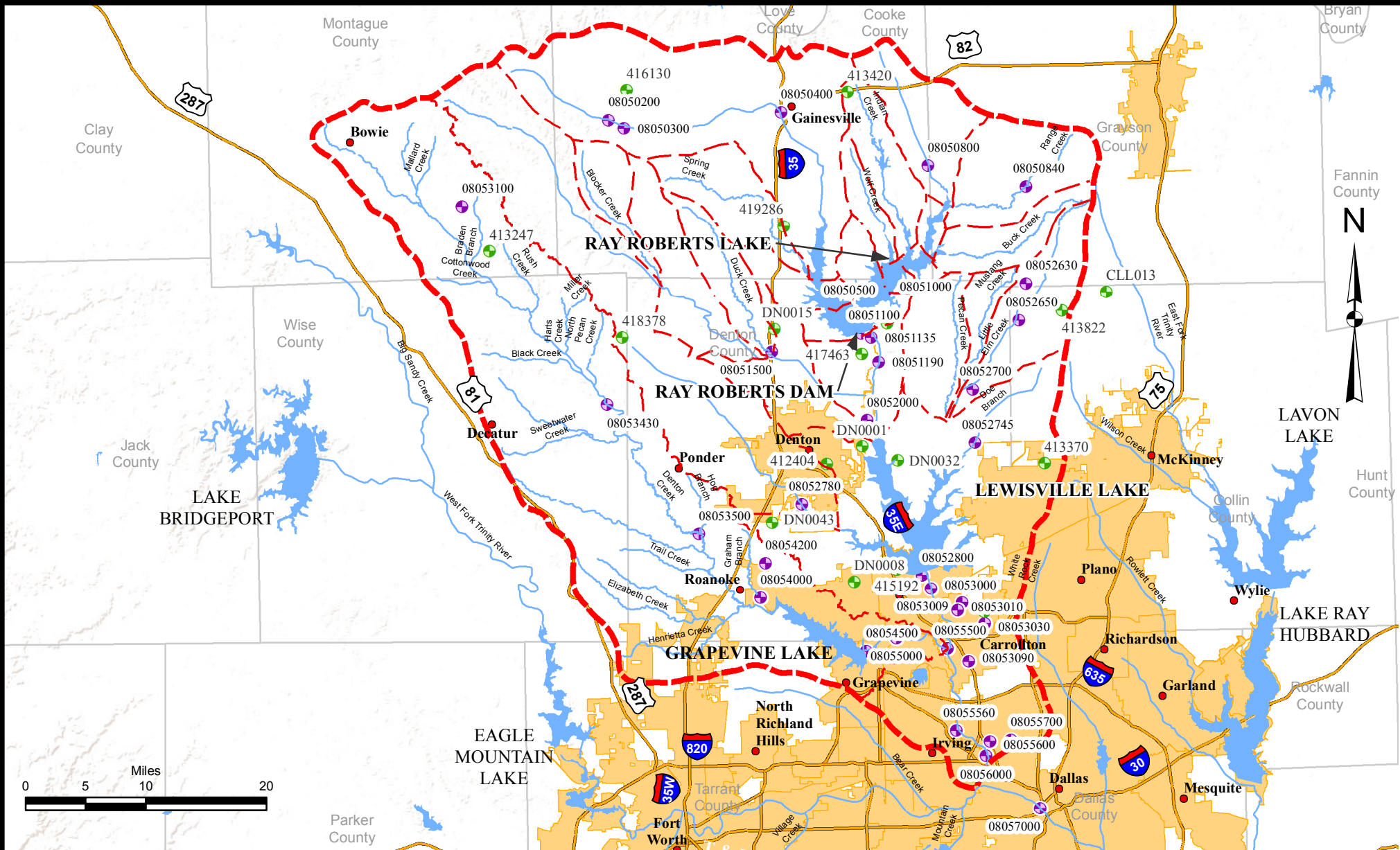
TRINITY RIVER BASIN, TEXAS

RAY ROBERTS DAM AND LAKE

ELM FORK TRINITY RIVER

LINES OF COMMUNICATION

U.S. ARMY ENGINEER DISTRICT, FORT WORTH September 2018



LEGEND

- RIVER BASIN BOUNDARY
- SUB BASIN BOUNDARY
- RIVERS
- LAKES
- NWS GAGES
- USGS GAGES
- CITIES
- INTERSTATE
- METRO AREAS

NWS RAIN GAGES

GAGE ID:	LOCATION:
412404	DENTON 2 SE, TX
413247	FORESTBURG 5.5, TX
413370	FRISCO, TX
413420	GAINESVILLE 5 ENE, TX
413822	GUNTER 5S, TX
415192	LEWISVILLE DAM, TX
416130	MUENSTER, TX
417028	PILOT POINT ISL DU BOI, TX
417463	RAY ROBERTS LAKE, TX
418378	SIDELL, TX
419286	VALLEY VIEW, TX
CLL013	CELINA 7.3 NE, TX
DN0001	SHADY SHORES 3.9N, TX
DN0008	FLOWER MOUND 2.3 NE, TX
DN0015	SANGER 1.8 WSW, TX
DN0032	OAK POINT 1.4 NNW, TX
DN0037	CARROLLTON 2 NNE, TX
DN0039	LITTLE ELM 2.5 NE, TX
DN0043	ARGYLE 1.6 NNW, TX

LIST OF U.S.G.S. GAGES

GAGE ID:	LOCATION:	GAGE ID:	LOCATION:
08050200	ELM FORK TRINITY SWS NO 6 NEAR MUENSTER, TX (DISCONTINUED)	08053000	ELM FK TRINITY RIVER NEAR LEWISVILLE, TX
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08050500	ELM FORK TRINITY RIVER NEAR SANGER, TX (DISCONTINUED)	08053030	FURNEAUX CREEK AT JOSEY LANE, CARROLLTON, TX (DISCONTINUED)
08050800	TIMBER CREEK NEAR COLLINSVILLE, TX	08053090	HUTTON BRANCH AT BROADWAY, CARROLLTON, TX (DISCONTINUED)
08050840	RANGE CREEK NEAR COLLINSVILLE, TX	08053100	JONES VALLEY CREEK TRIB NEAR FORESTBURG, TX (DISCONTINUED)
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08051500	CLEAR CREEK NEAR SANGER, TX	08054500	GRAPEVINE LAKE NEAR GRAPEVINE, TX
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08052650	LITTLE ELM CREEK NEAR CELINA, TX (DISCONTINUED)	08055560	ELM FORK TRINITY RIVER AT SPUR 348 IRVING, TX
08052700	LITTLE ELM CREEK NEAR AUBREY, TX	08055600	JOES CREEK AT DALLAS, TX (DISCONTINUED)
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08052800	LEWISVILLE LAKE NEAR LEWISVILLE, TX		

TRINITY RIVER BASIN, TEXAS
RAY ROBERTS DAM AND LAKE
ELM FORK TRINITY RIVER

REAL TIME WATER CONTROL
BASE MAP

U.S. ARMY ENGINEER DISTRICT, FORT WORTH September 2018

RAY ROBERTS DAM AND LAKE
NORMAL SCHEDULE FOR LAKE REGULATION

FORECASTED LAKE ELEVATION	DOWNSTREAM CONTROL DISCHARGES	SCHEDULE OF CONTROL OPERATIONS
1. CONSERVATION WATER CONTROL		
Below 632.50	No flood control releases will be made at or below the top of conservation pool (elevation 632.5).	No flood control releases will be made when the lake level is at or below the top of conservation pool (elevation 632.5). Releases from the conservation storage will be made as instructed from the Fort Worth District Water Management Office at the request of the City of Dallas and the City of Denton.
2. Floodwater Control Conditions		
Forecasted Lake Elevation	Downstream Control Discharges	Schedule of Control Operations
a. Above 632.50 below 633.50	4,000 cfs @ Carrolllton or 13,000 cfs @ Dallas or 15,000 cfs @ Rosser or 24,000 cfs @ Rosser	Flood-water Evacuation: Initiate releases in amount not to exceed flows stated and return to elevation 632.50. Releases will be made through low flow gates. Consider turbine releases, 36-167 cfs for hydropower generation.
b. Above 633.50 below 635.50	5,500 cfs @ Carrolllton or 13,000 cfs @ Dallas or 15,000 cfs @ Rosser or 24,000 cfs @ Oakwood	Flood-water Evacuation: Initiate release not to exceed gaged flows stated; maintain until lake stage returns to elevation 633.50; then adjust release to Schedule 2.a.
c. Above 635.50 below 640.50	7,000 cfs @ Carrolllton or 13,000 cfs @ Dallas or 25,000 cfs @ Rosser or 24,000 cfs @ Oakwood	Flood-water Evacuation: Initiate release not to exceed gaged flows stated; maintain until lake stage returns to elevation 635.50; then adjust Schedule 2.b.
d. Above 640.50 below 645.50	Releases are made in the amount equal to the peak inflow regardless of downstream conditions	Surcharge-water evacuation: Initiate releases to equal inflows. As downstream flows recede, releases may be increased above inflow rates if combined downstream flows do not exceed the amounts stated in Schedule 2.c. NOTE: Do not decrease release rate until lake stage has returned to elevation 640.50; then adjust releases to Schedule 2.c.
e. At or above 645.50	Releases are made regard- less of downstream flows	Surcharge-water evacuation: Releases will be made with flood gates fully open until lake stage returns to elevation 640.50; then adjust releases to Schedule 2.c.

TABLE 7-1

TABLE 7-3

Downstream Control Points		Low Flood Pool Release Guidance		
River Channel and USGS Gaging Station	Control Capacity (cfs)	Pool Elevation Range (ft)	Flood Pool Range (%)	Release Rates* (cfs)
Elm Fork Trinity River near Carrolllton	7,000	632.5 – 632.6	0.0 – 1.1	150
Trinity River below Dallas	13,000	632.6 – 632.7	1.1 – 2.1	150 – 300
Trinity River near Rosser	15,000	632.7 – 632.9	2.1 – 4.3	300 – 500
Trinity River near Oakwood	24,000	*Desired rate of release will vary with prevailing rates of inflow, lake evaporation, and water supply withdrawals. General objective is to evacuate from 4.3% to 2.1% of the flood pool in about one week, from 2.1% to 1.1% the following week, then from 1.1% to top of conservation pool (632.5) over an additional two to three week period.		

TRINITY RIVER BASIN, TEXAS
RAY ROBERTS LAKE
ELM FORK TRINITY RIVER

NORMAL REGULATION PLAN
AND FLOOD CONTROL

U.S. ENGINEER DISTRICT, FORT WORTHSeptember 2018

PLATE 7 - 1

RAY ROBERTS DAM AND LAKE
EMERGENCY REGULATION PLAN
INSTRUCTIONS TO LAKE MANAGER FOR USE WHEN COMMUNICATIONS WITH DISTRICT OFFICE FAIL

LAKE STAGE	LAKE CONDITIONS	OPERATION
A. Below elevation 632.5	Rising, Standing, or Falling	Continue the releases from the conservation pool as previously instructed by Fort Worth District Water Management Office.
B. Lake elevation between 632.5 and 640.5	Rising, Standing, or Falling	Maintain releases in effect at the time communications was lost. The Lake Manager will initiate gate closing operations as soon as one of the following conditions occurs: 1. Should the Lake Manager have knowledge of pending flood condition on the Elm Fork Trinity River below the project, or 2. Two or more inches of rain has been recorded at the dam in a two hour period or less, or 3. Six hours of time has elapsed after losing communications.
C. Lake elevation between 640.5 and 645.5	Rising, Standing, or Falling	Begin flood releases in accordance with Table E-2 until communications are restored. Gate changes may be made more frequently than half hour intervals. Once the gates have been opened, <u>do not reduce releases</u> until the lake level falls below elevation 640.5.
D. Above elevation 645.5	Rising, Standing, or Falling	Flood gates will be fully open at elevation 645.5 and above. <u>Do not reduce releases</u> until the lake level falls below elevation 640.5

TABLE E-2
TABLE FOR GATE OPENING SCHEDULE

Elevation feet NGVD	Flood Control Gate Opening in Feet Gate 1	Gate Opening in Feet Gate 2	Approximate Release (cfs)
640.5	0.5		166
640.7		0.5	332
640.9	1.0		498
641.1		1.0	664
641.3	1.5		830
641.5		1.5	996
641.7	2.0		1163
641.9		2.0	1330
642.1	2.5		1497
642.3		2.5	1663
642.5	3.0		1832
642.7		3.0	2000
642.9	3.5		2167
643.1		3.5	2334
643.3	4.0		2505
643.5		4.0	2676
643.7	4.5		2848
643.9		4.5	3020
644.1	5.0		3190
644.3		5.0	3360
644.5	5.5		3520
644.7		5.5	3680
644.9	6.0		3873
645.1		6.0	4066
645.3	Fully open		5413
645.5		Fully Open	6900

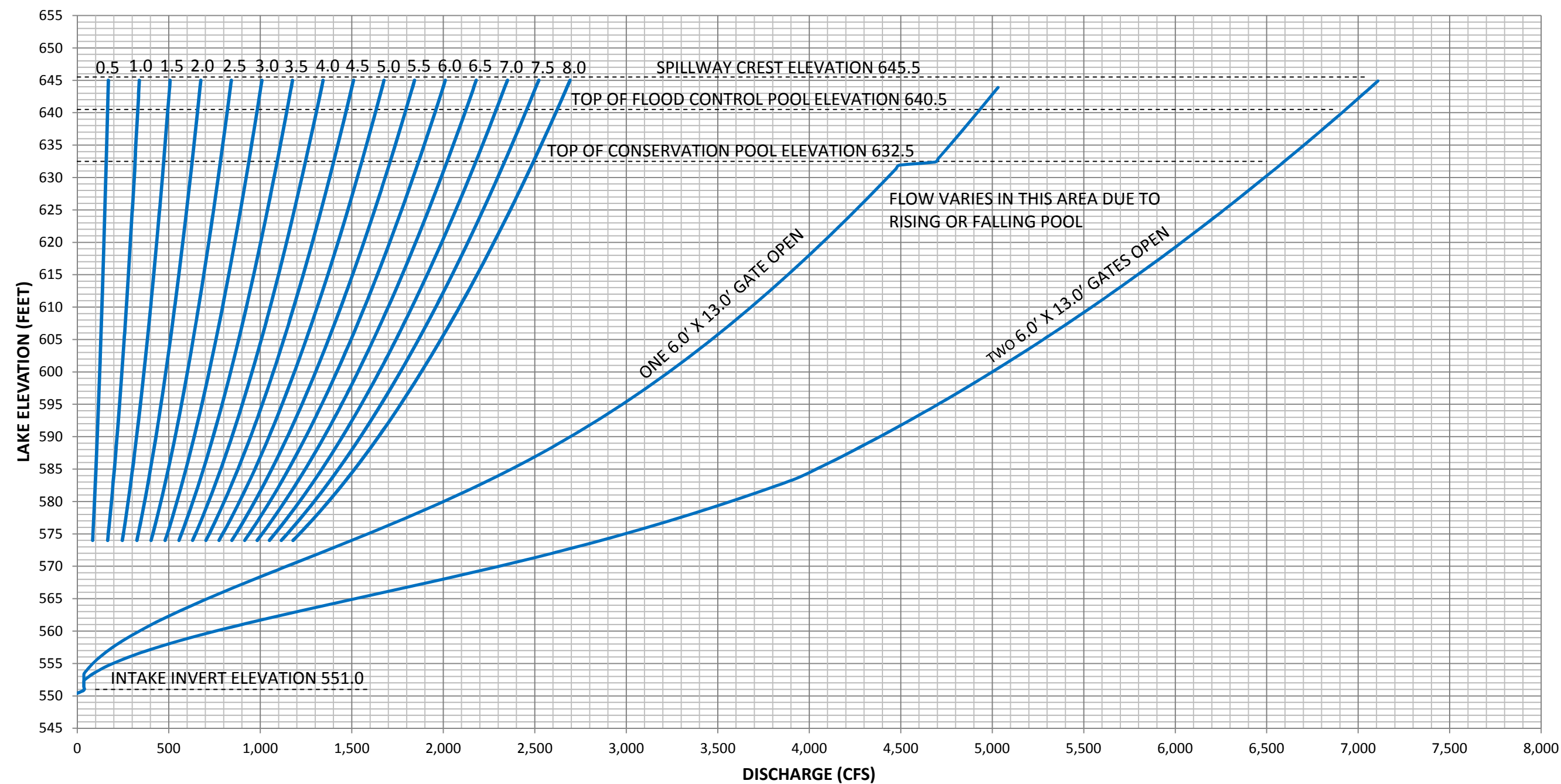
Note: Gate changes are limited to a maximum rate of one-half a foot per half hour for lake elevations up to 640.5 feet. Once the gates have been closed, they will remain closed until communications have been restored with the Fort Worth District Water Management Office.

TRINITY RIVER BASIN, TEXAS
RAY ROBERTS LAKE
ELM FORK TRINITY RIVER

EMERGENCY REGULATION PLAN
FOR CONSERVATION AND
FLOOD CONTROL OPERATIONS

U.S. ENGINEER DISTRICT, FORT WORTHSeptember 2018

PLATE 7 - 2



THE OUTLET WORKS CONSISTS OF ONE 13-FOOT DIAMETER CONDUIT CONTROLLED BY TWO 6.0' X 13.0' GATES. THE LENGTH OF THE CONDUIT IS 708 FEET.

ALL ELEVATIONS REFERRED TO ON THIS PLATE, UNLESS NOTED OTHERWISE, ARE IN FEET, NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD29). THE DATUM CONVERSION FROM NGVD29 TO NAVD88 FOR RAY ROBERTS DAM AND LAKE IS: NGVD29 + 0.0 FEET = NAVD88.

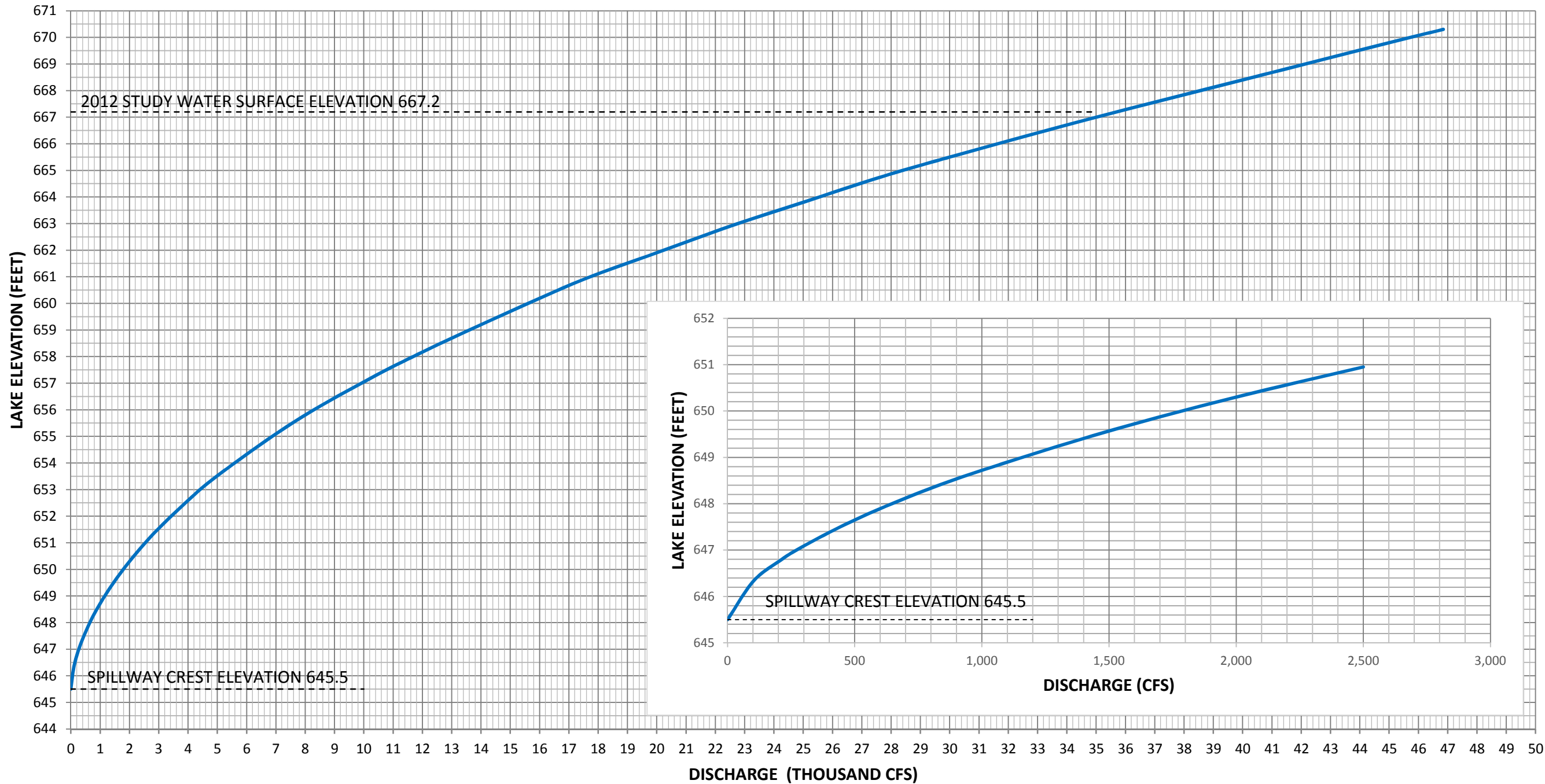
TRINITY RIVER BASIN, TEXAS
RAY ROBERTS LAKE
ELM FORK TRINITY RIVER

OUTLET WORKS RATING CURVE

U.S. ENGINEER DISTRICT, FORT WORTH

September 2018

PLATE 7 - 3



THE SPILLWAY IS A 100-FOOT WIDE, UNCONTROLLED, TRAPEZOIDAL BROADCRESTED WEIR. THE RATING CURVE IS BASED ON A BACKWATER MODEL DEVELOPED BY CESWF-EC-HH IN APRIL 2013.

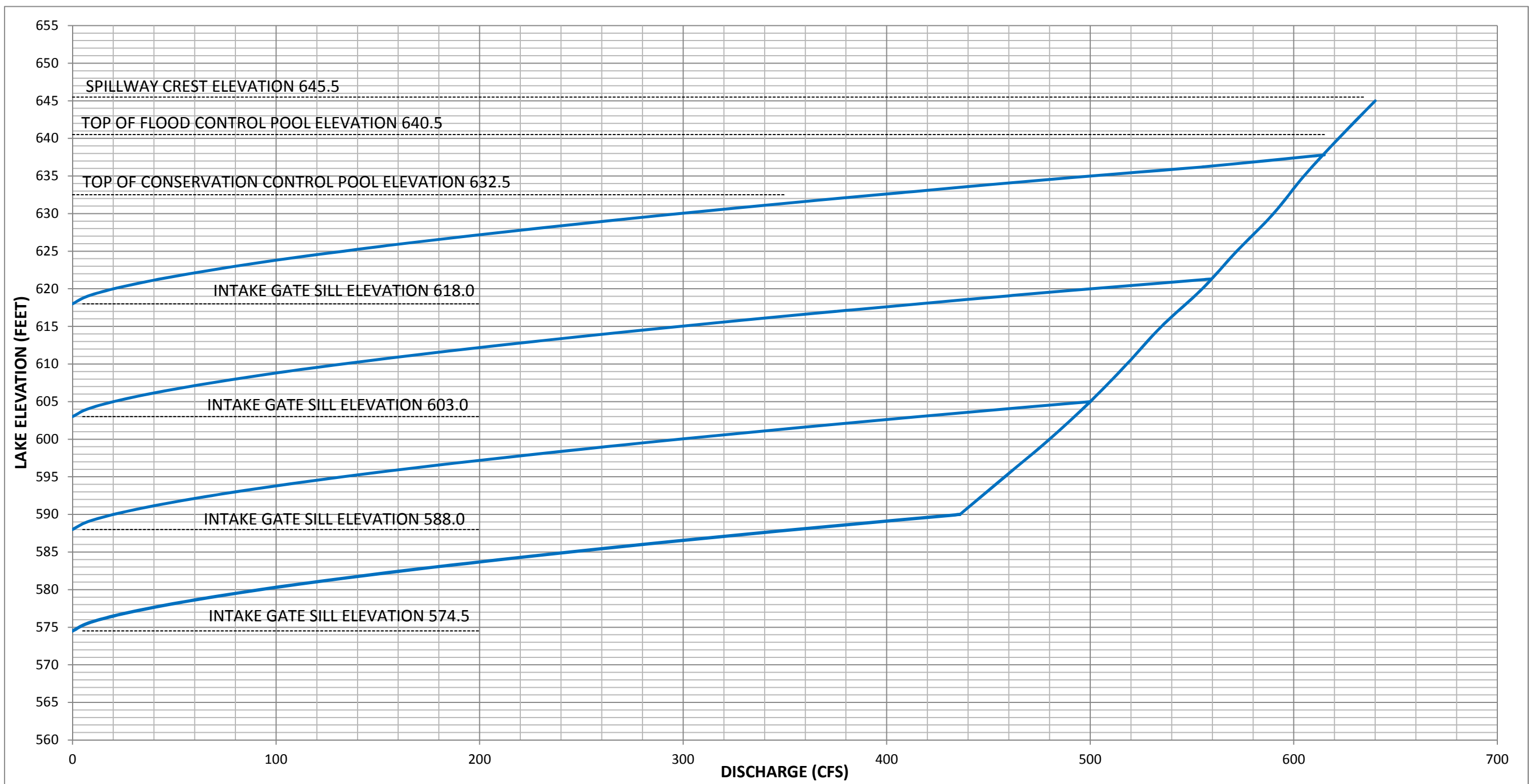
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TRINITY RIVER BASIN, TEXAS
RAY ROBERTS LAKE
ELM FORK TRINITY RIVER

SPILLWAY RATING CURVE

U.S. ENGINEER DISTRICT, FORT WORTHSeptember 2018

PLATE 7 - 4



THE LOW FLOW OUTLETS CONSIST OF FOUR 4' X 8' INLETS FROM LAKE TO WET WELL CONTROLLED BY A 3' X 7' SERVICE GATE FOR A CONDUIT THROUGH THE FLOOD CONTROL GATE PIER, AND DISCHARGES INTO A 5' DIAMETER CONDUIT BENEATH THE MAIN CONDUIT, CONTINUED TO A BIFURCATION WITH A 4' DIAMETER CONDUIT THAT DISCHARGES INTO THE STILLING BASIN. ALL FLOWS ARE ASSUMED TO CORRESPOND TO A FULLY OPEN CONDITION FOR ALL 4 SELECTOR GATES.

ALL ELEVATIONS REFERRED TO ON THIS PLATE, UNLESS NOTED OTHERWISE, ARE IN FEET, NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD29). THE DATUM CONVERSION FROM NGVD29 TO NAVD88 FOR RAY ROBERTS DAM AND LAKE IS: NGVD29 + 0.0 FEET = NAVD88.

TRINITY RIVER BASIN, TEXAS

RAY ROBERTS LAKE

ELM FORK TRINITY RIVER

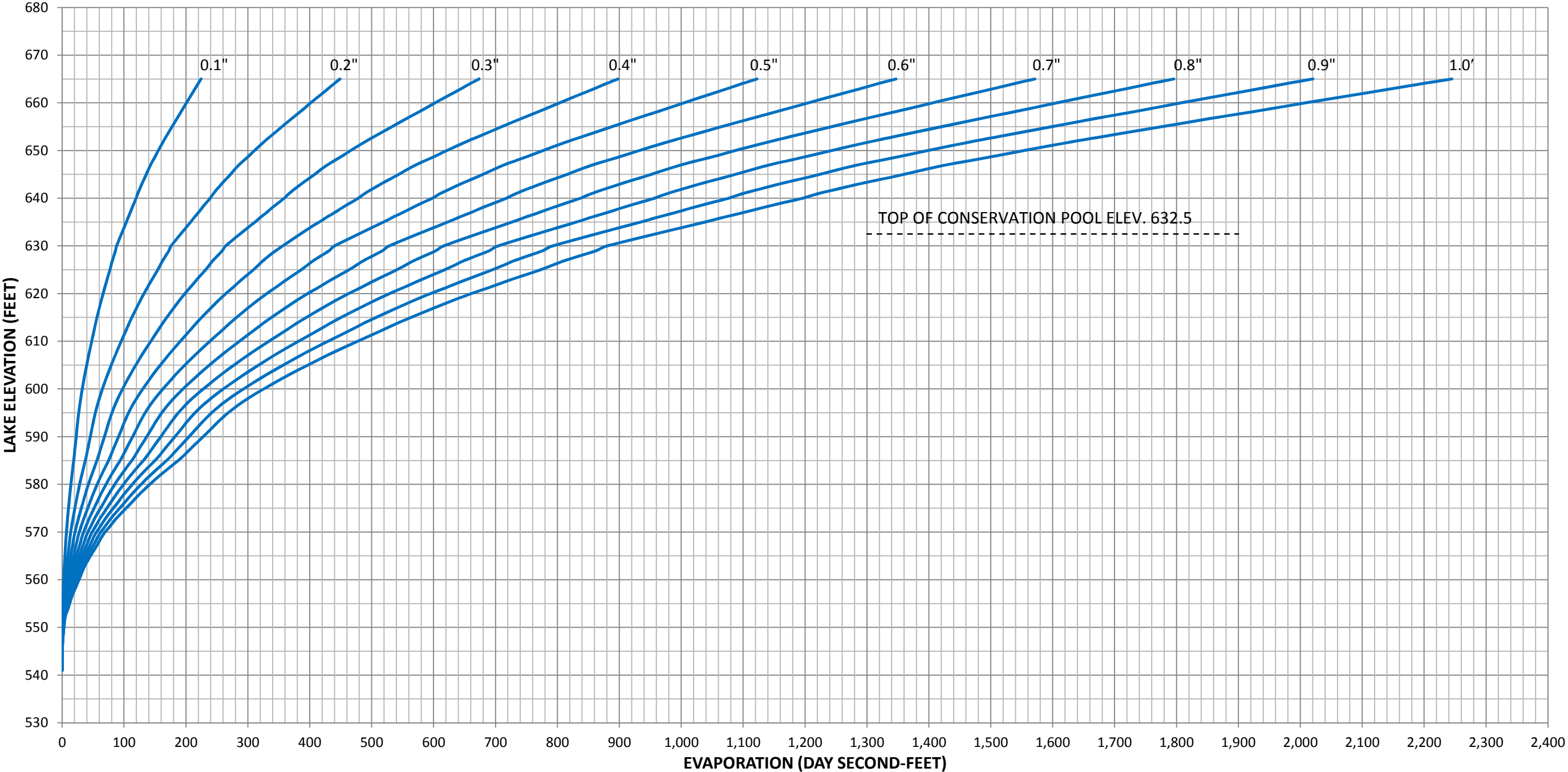
LOW FLOW OUTLETS

RATING CURVES

U.S. ENGINEER DISTRICT, FORT WORTH

September 2018

PLATE 7 - 5



ONE DAY SECOND-FEET = 1.9835 ACRE FEET

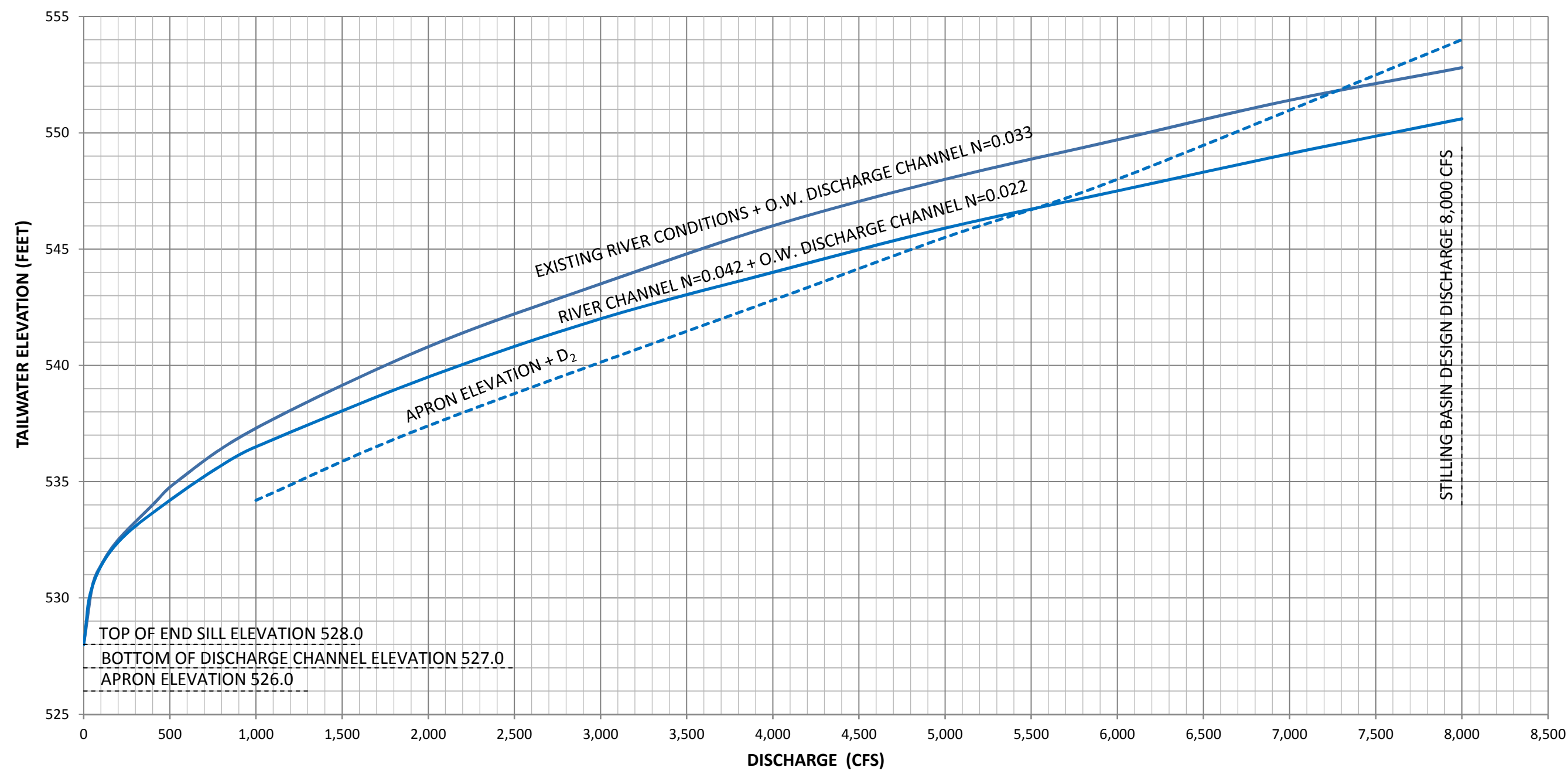
ALL ELEVATIONS REFERRED TO ON THIS PLATE, UNLESS NOTED OTHERWISE, ARE IN FEET, NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD29). THE DATUM CONVERSION FROM NGVD29 TO NAVD88 FOR RAY ROBERTS DAM AND LAKE IS: NGVD29 + 0.0 FEET = NAVD88.

TRINITY RIVER BASIN, TEXAS
RAY ROBERTS LAKE
ELM FORK TRINITY RIVER

LAKE EVAPORATION CURVES

U.S. ENGINEER DISTRICT, FORT WORTH

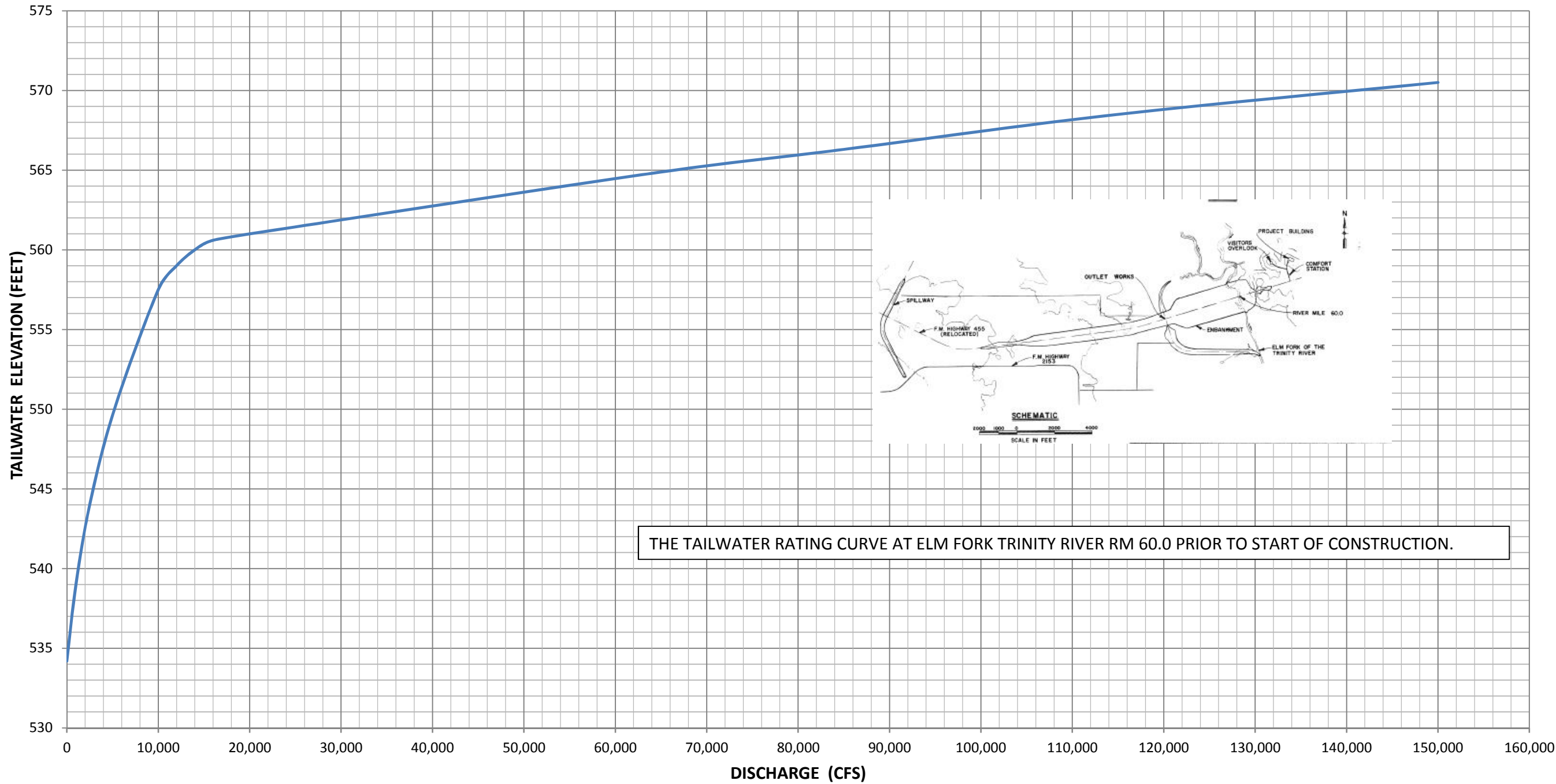
September 2018



ALL ELEVATIONS REFERRED TO ON THIS PLATE, UNLESS NOTED OTHERWISE, ARE IN FEET, NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD29). THE DATUM CONVERSION FROM NGVD29 TO NAVD88 FOR RAY ROBERTS DAM AND LAKE IS: NGVD29 + 0.0 FEET = NAVD88.

TRINITY RIVER BASIN, TEXAS
RAY ROBERTS LAKE
ELM FORK TRINITY RIVER

**TAILWATER RATING CURVES
OUTLET WORKS**



THE TAILWATER RATING CURVE AT ELM FORK TRINITY RIVER RM 60.0 PRIOR TO START OF CONSTRUCTION.

ALL ELEVATIONS REFERRED TO ON THIS PLATE, UNLESS NOTED OTHERWISE, ARE IN FEET, NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD29). THE DATUM CONVERSION FROM NGVD29 TO NAVD88 FOR RAY ROBERTS DAM AND LAKE IS: NGVD29 + 0.0 FEET = NAVD88.

TRINITY RIVER BASIN, TEXAS

RAY ROBERTS LAKE

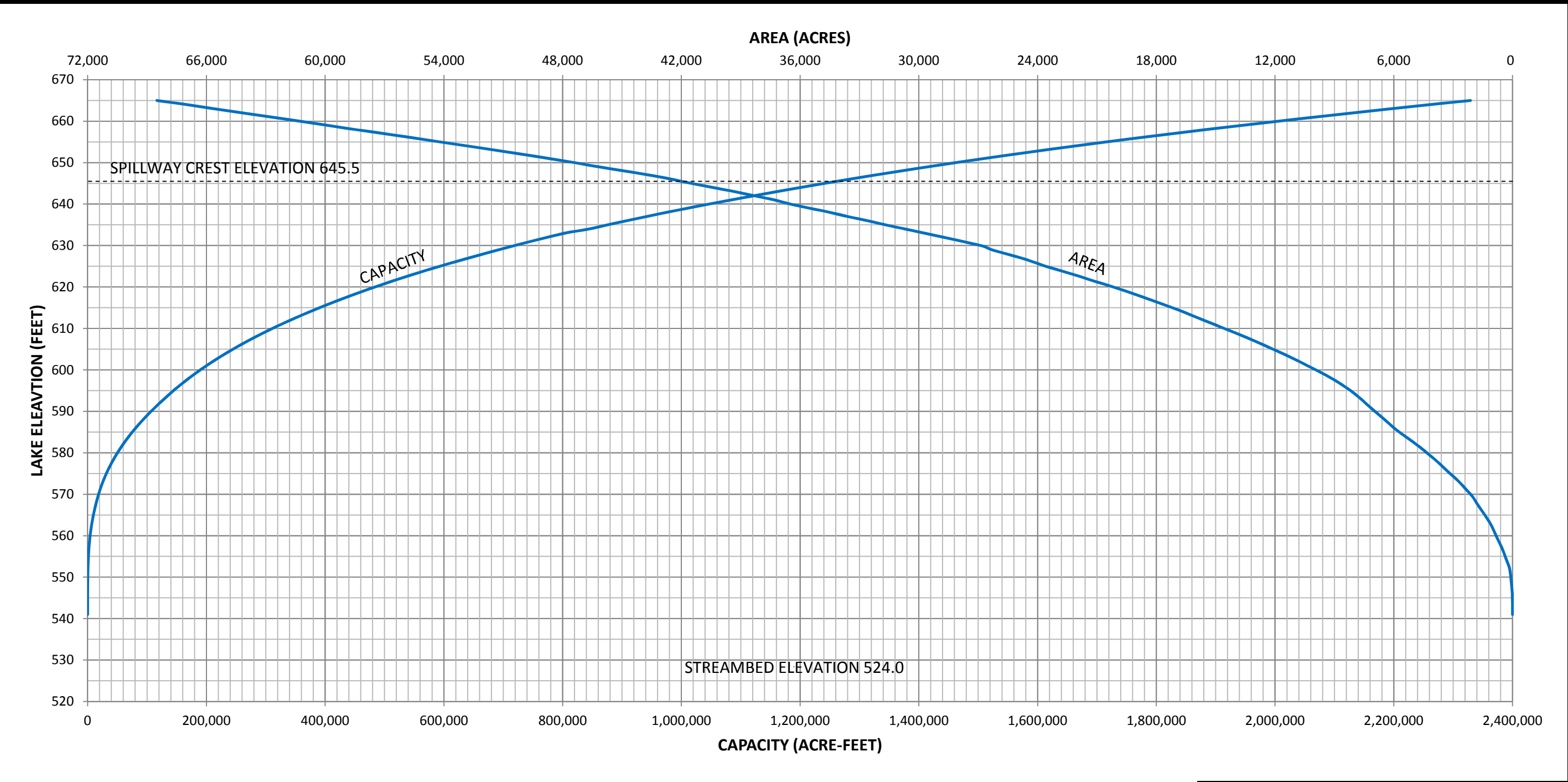
ELM FORK TRINITY RIVER

**TAILWATER RATING CURVE
AT DAM (RM 60.0)**

U.S. ENGINEER DISTRICT, FORT WORTH

September 2018

PLATE 7 - 8



RAY ROBERTS LAKE VOLUMETRIC AND SEDIMENT SURVEY PERFORMED BY THE TEXAS WATER DEVELOPMENT BOARD IN 2008.

ALL ELEVATIONS REFERRED TO ON THIS PLATE, UNLESS NOTED OTHERWISE, ARE IN FEET, NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD29). THE DATUM CONVERSION FROM NGVD29 TO NAVD88 FOR RAY ROBERTS DAM AND LAKE IS: NGVD29 + 0.0 FEET = NAVD88.

TRINITY RIVER BASIN, TEXAS

RAY ROBERTS LAKE

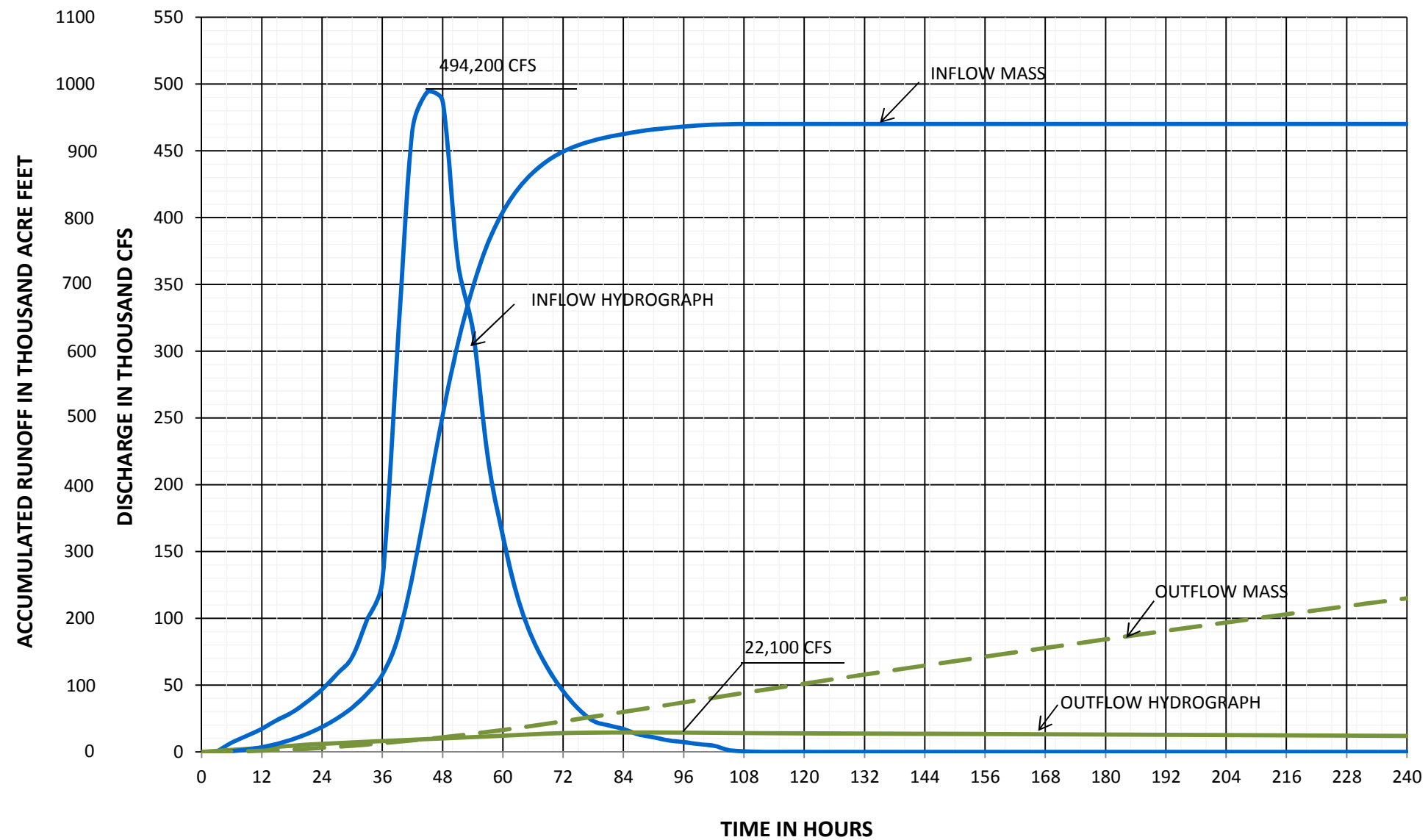
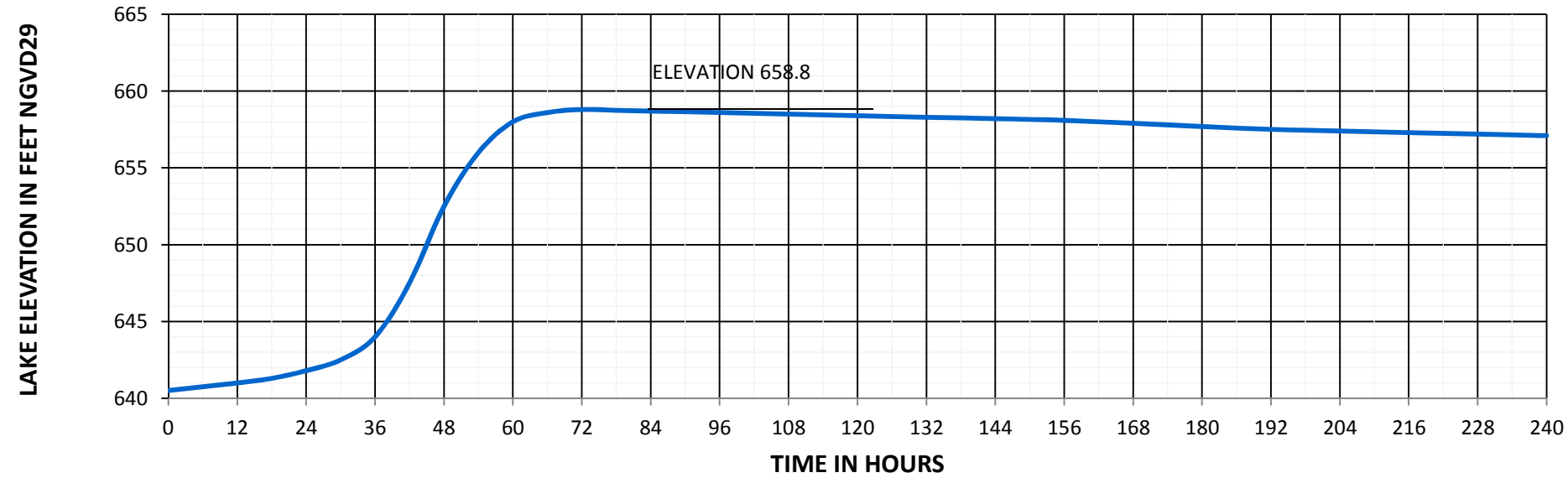
ELM FORK TRINITY RIVER

AREA AND CAPACITY CURVES

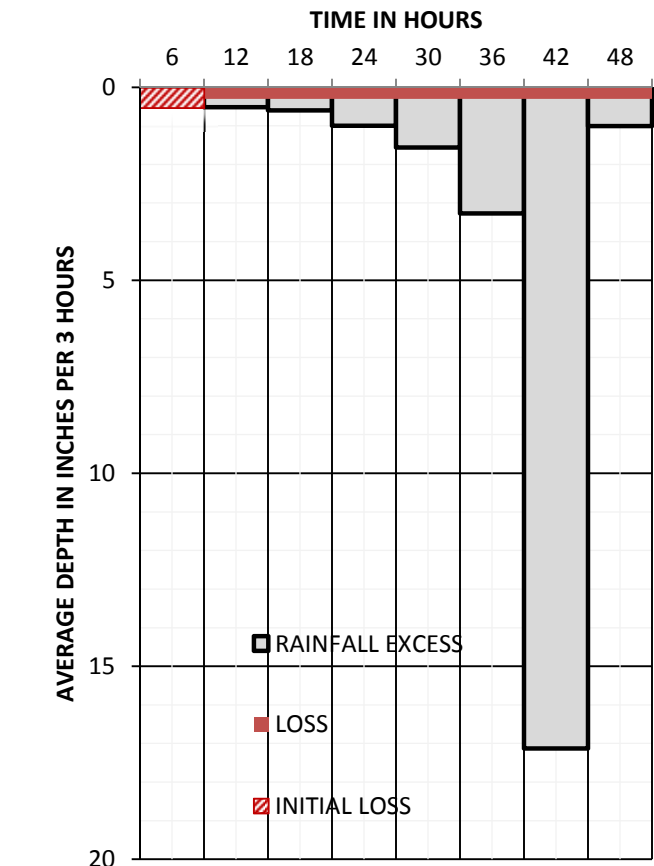
U.S. ENGINEER DISTRICT, FORT WORTH

September 2018

PLATE 7 -9



HYETOGRAPH (INCHES)	
RAINFALL TOTAL-----	28.00
LOSS TOTAL-----	2.71
RAINFALL - EXCESS TOTAL-----	25.28
INITIAL LOSS-----	0.50
INFILTRATION INDEX (F.A.V.G.) (IN/HR) -----	0.05



NOTE: DATA IS FROM 1974 "DESIGN MEMORANDUM NO.1 , AUBREY LAKE, HYDROLOGY, SUPPLEMENT NO. 3, TRINITY RIVER BASIN, ELM FORK, TRINITY RIVER, TEXAS".

TRINITY RIVER BASIN, TEXAS

RAY ROBERTS DAM AND LAKE

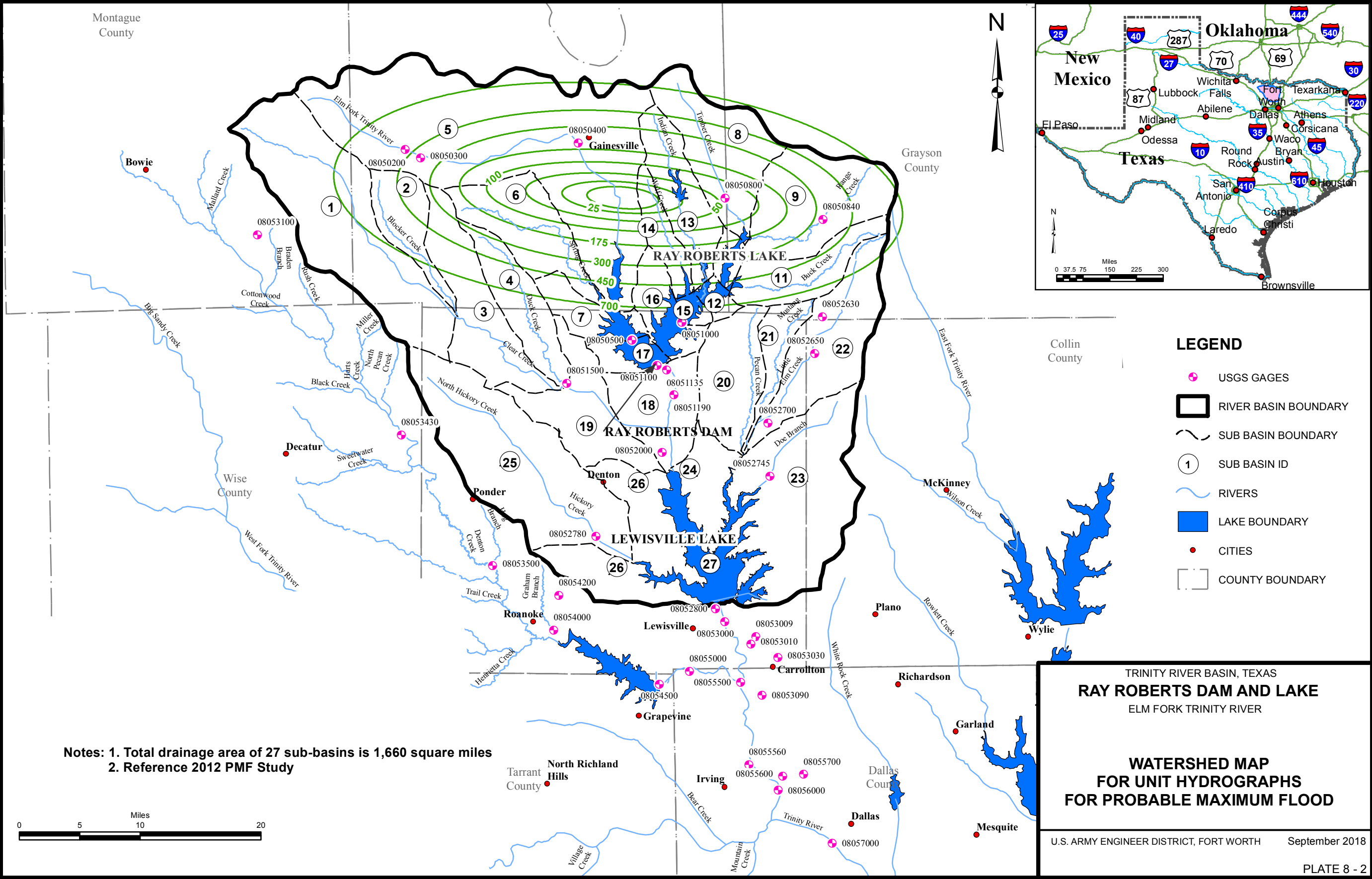
ELM FORK TRINITY RIVER

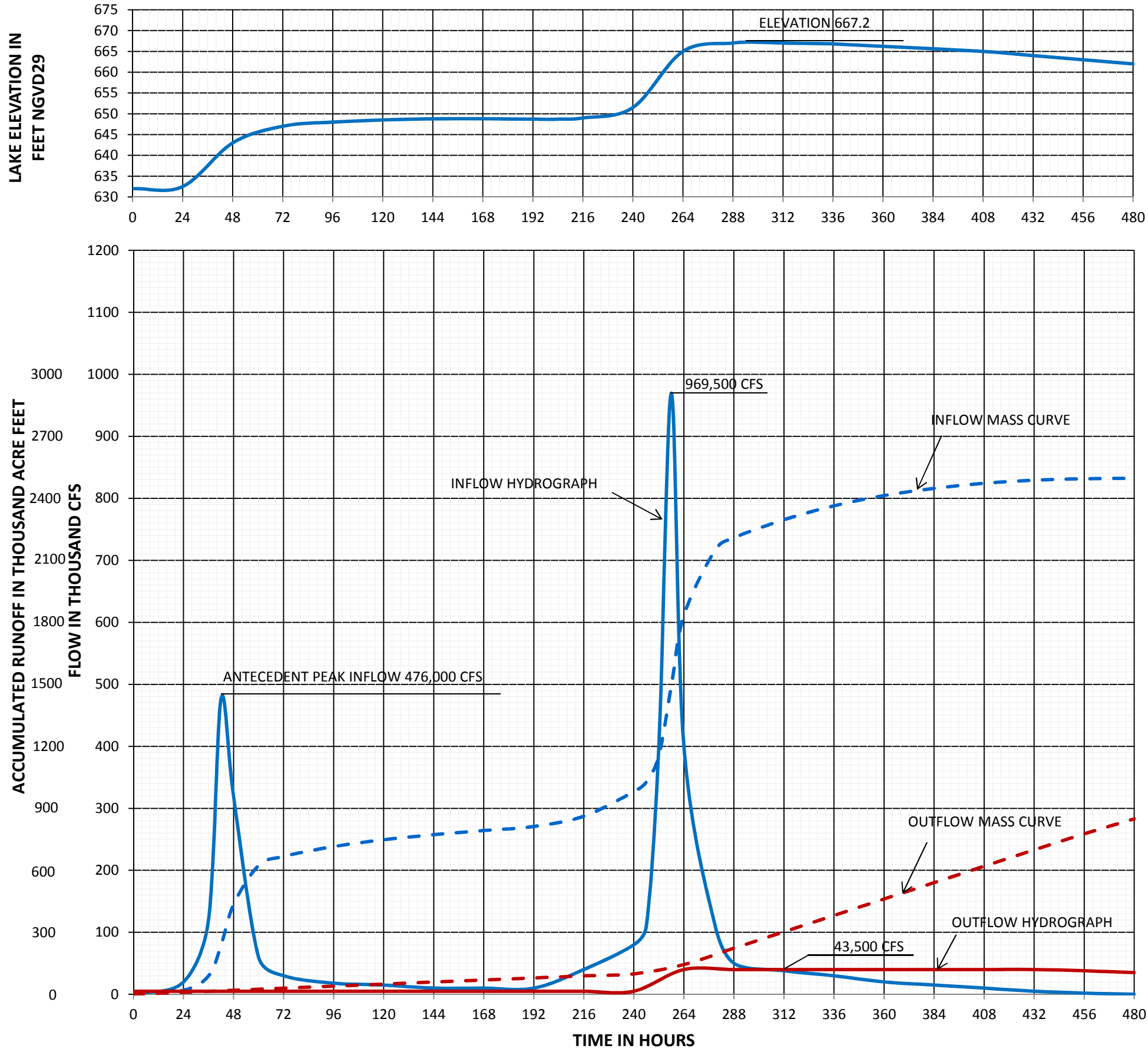
SPILLWAY DESIGN FLOOD

U.S. ARMY ENGINEER DISTRICT, FORT WORTH

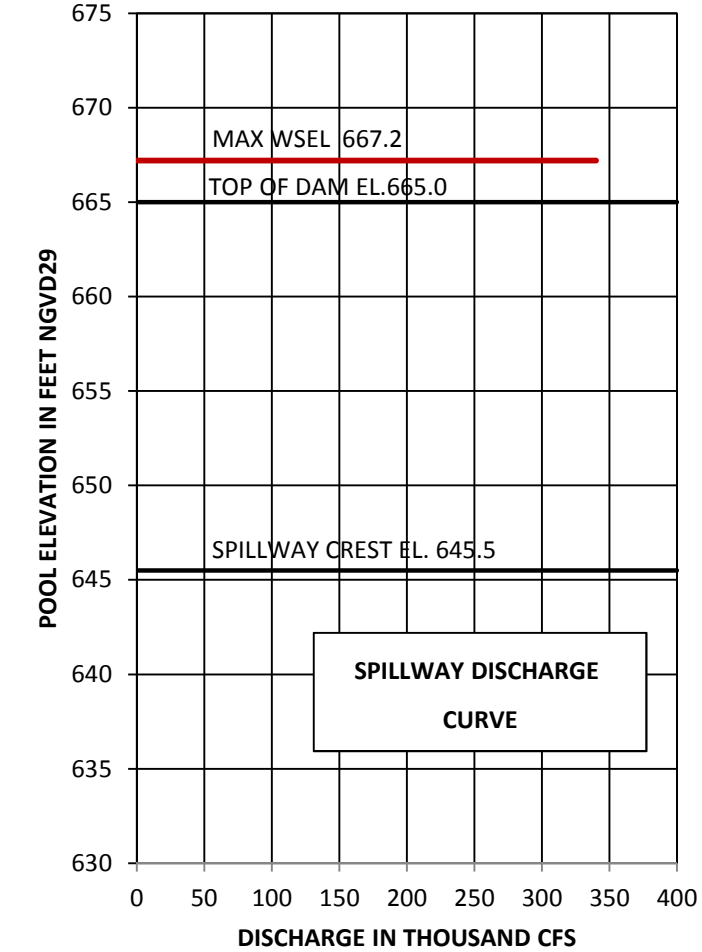
September 2018

PLATE 8 - 1





HYETOGRAPH (INCHES)	
RAINFALL AVERAGE-----	32.91
LOSS AVERAGE-----	2.61
RAINFALL - EXCESS -----	30.30
INITIAL LOSS -----	0.50
INFILTRATION INDEX (F.A.V.G.) (IN/HR) ----	0.05



NOTE: FROM "RAY ROBERTS LAKE DAM SAFETY HYDROLOGIC CAPACITY STUDY, ELM FORK OF TRINITY RIVER, APRIL 2012".

TRINITY RIVER BASIN, TEXAS

RAY ROBERTS DAM AND LAKE

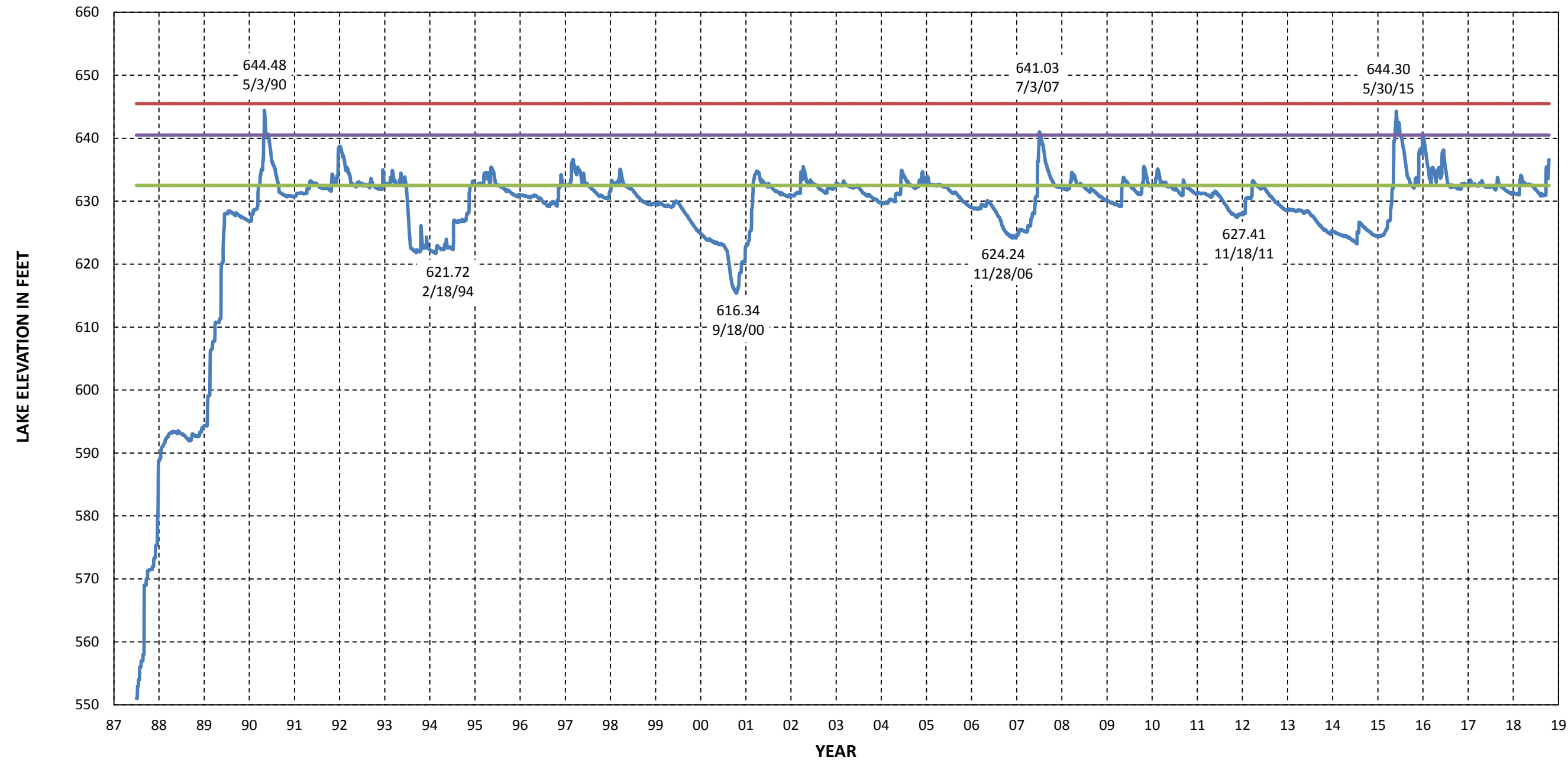
ELM FORK TRINITY RIVER

**PROBABLE MAXIMUM FLOOD
INFLOW-OUTFLOW HYDROGRAPHS**

U.S. ARMY ENGINEER DISTRICT, FORT WORTH

September 2018

PLATE 8 - 3



- LAKE ELEVATION
- SPILLWAY CREST ELEVATION 645.5
- TOP OF FLOOD CONTROL POOL ELEVATION 640.5
- TOP OF CONSERVATION POOL ELEVATION 632.5

DELIBERATE IMPOUNDMENT BEGAN: 6/30/1987

RECORD LAKE ELEVATION AND DATE: 644.48 NGVD29, 05/03/1990

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TRINITY RIVER BASIN, TEXAS

RAY ROBERTS DAM AND LAKE

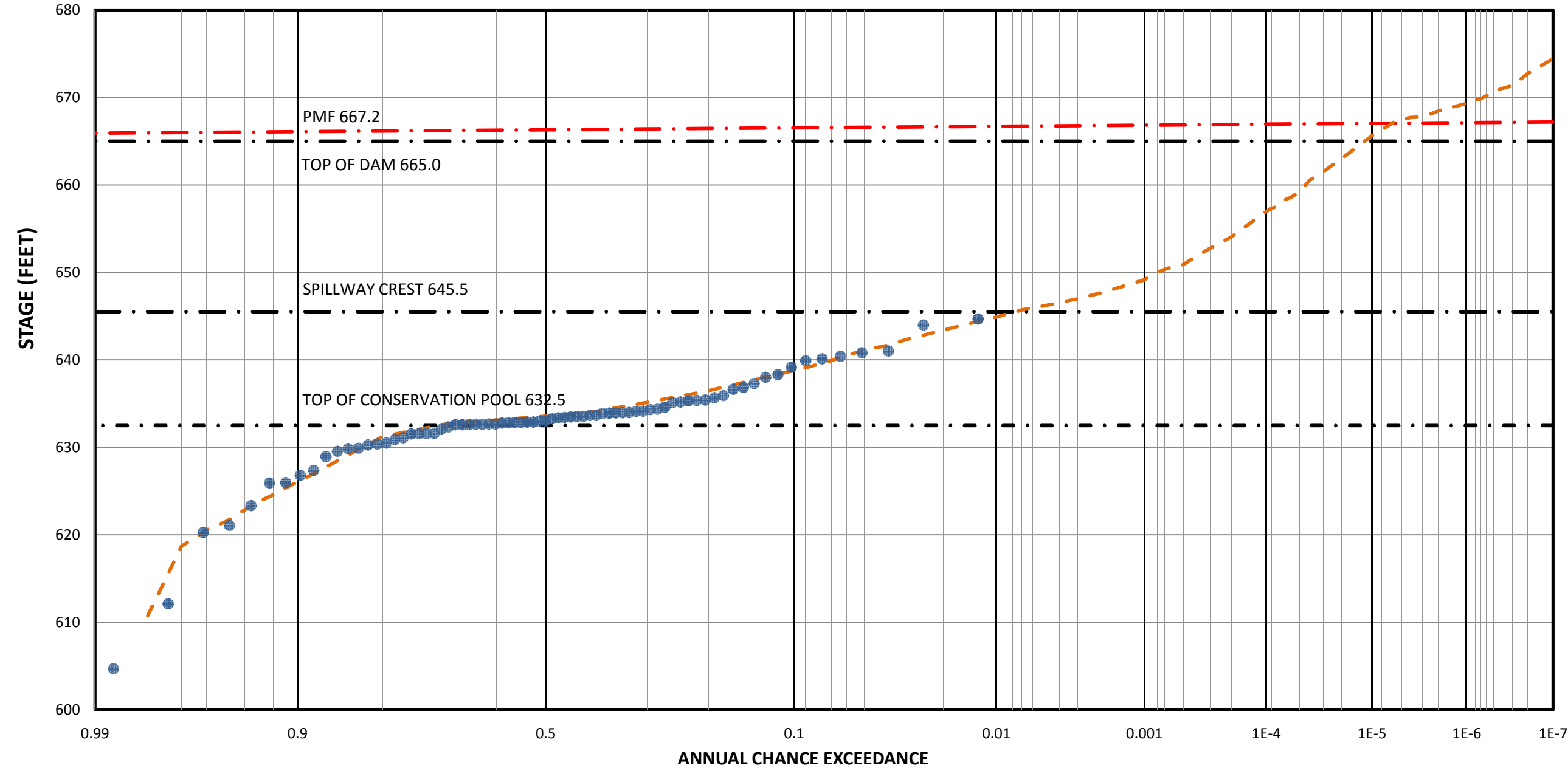
ELM FORK TRINITY RIVER

PERIOD OF RECORD LAKE LEVEL

U.S. ARMY ENGINEER DISTRICT, FORT WORTH

September 2018

RAY ROBERTS DAM STAGE FREQUENCY



— • TOP OF DAM — • SPILLWAY CREST — • TOP OF CONSERVATION — • PMF ELEVATION • ANNUAL EVENTS — GRAPHIC FREQUENCY CURVES

ALL ELEVATIONS REFERRED TO ON THIS PLATE, UNLESS NOTED OTHERWISE, ARE IN FEET, NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD29).
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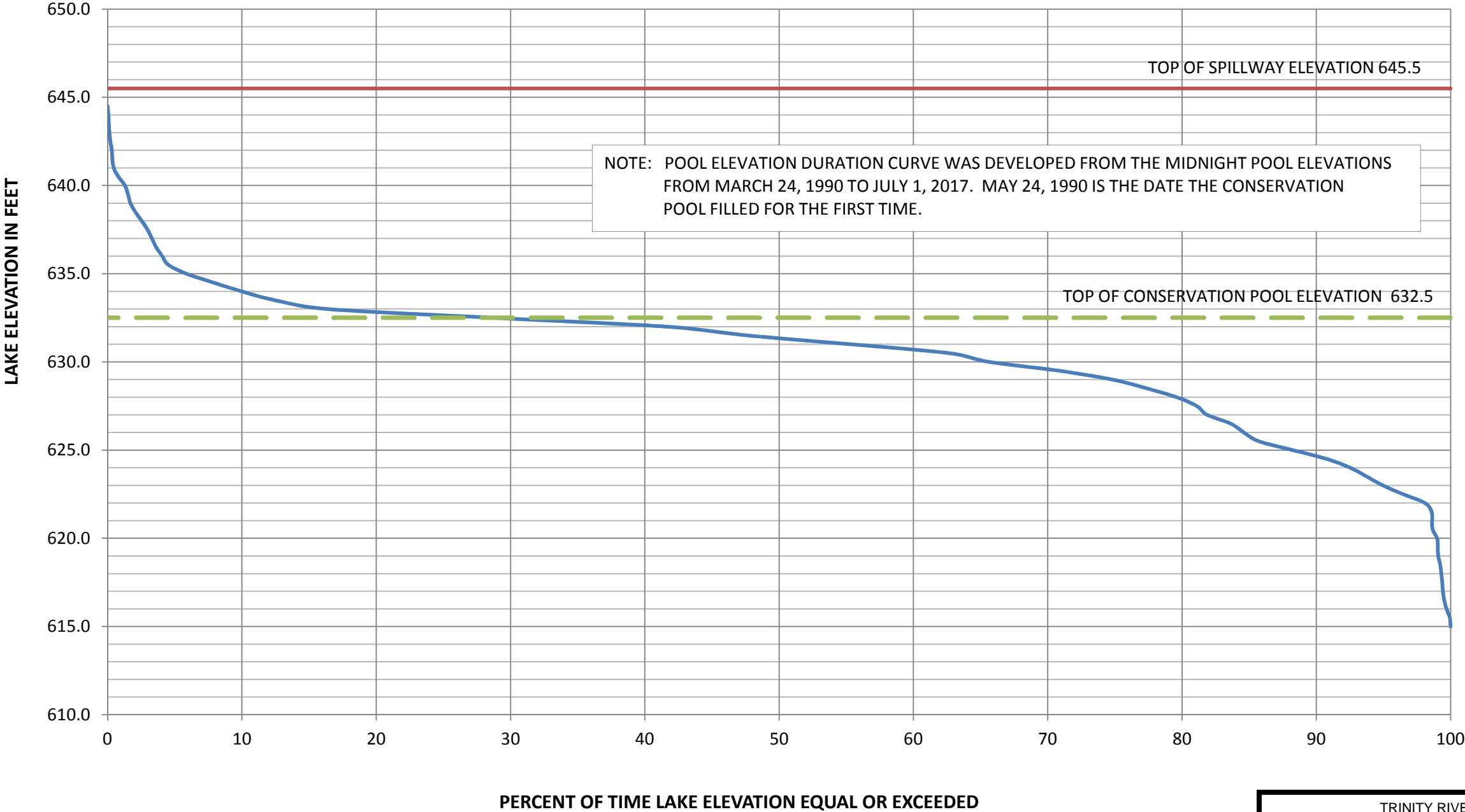
TRINITY RIVER BASIN, TEXAS
RAY ROBERTS DAM AND LAKE
ELM FORK TRINITY RIVER

**ANNUAL PEAK
ELEVATION FREQUENCY**

U.S. ARMY ENGINEER DISTRICT, FORT WORTH

September 2018

RAY ROBERTS LAKE



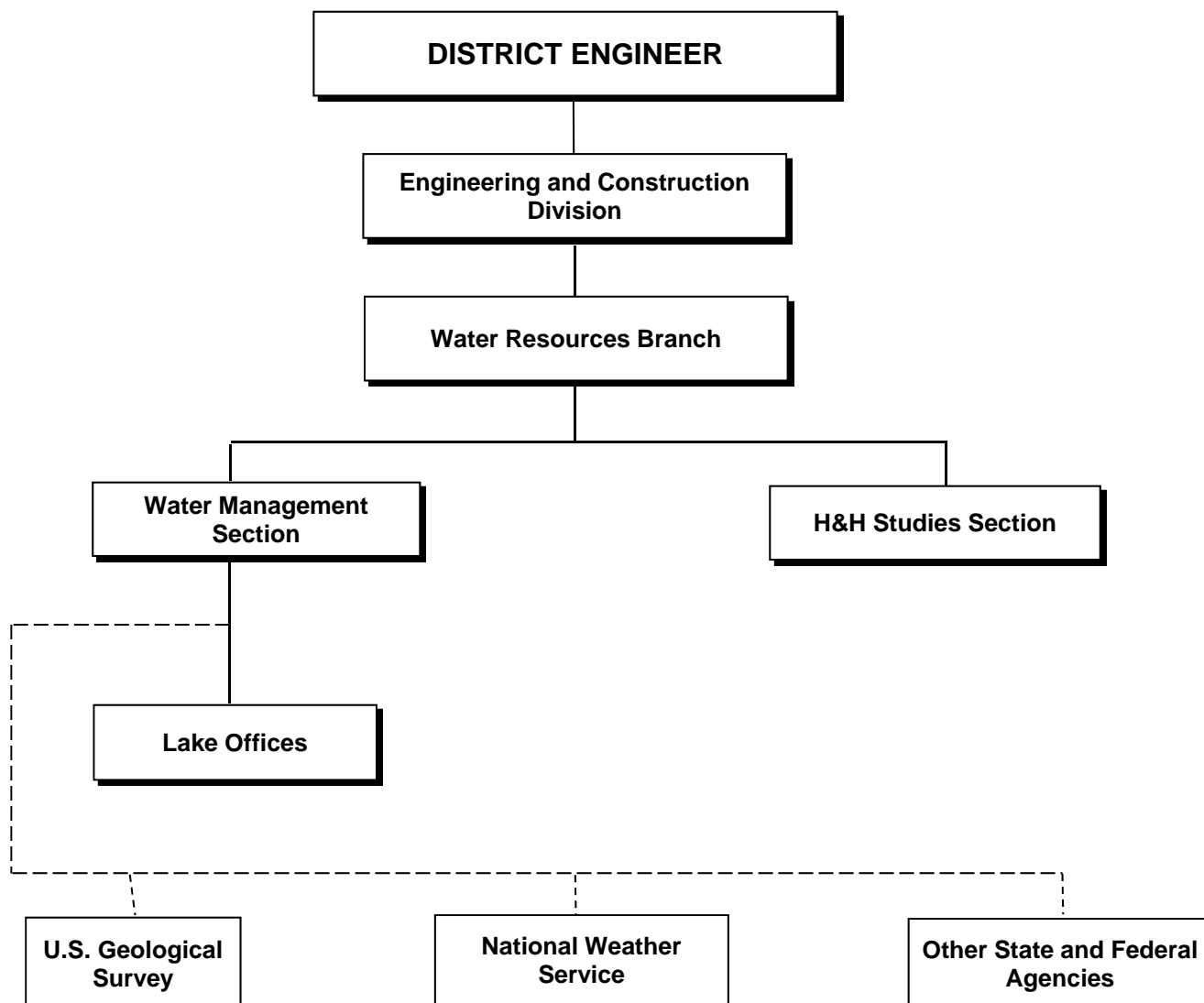
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TRINITY RIVER BASIN, TEXAS
RAY ROBERTS DAM AND LAKE
ELM FORK TRINITY RIVER

LAKE ELEVATION DURATION

U.S. ARMY ENGINEER DISTRICT, FORT WORTHSeptember 2018

PLATE 8 - 6

**FORT WORTH DISTRICT
ORGANIZATION FOR LAKE REGULATION**

——— LINES OF COMMAND AUTHORITY

----- LINES OF DIRECT COMMUNICATION

TRINITY RIVER BASIN, TEXAS
RAY ROBERTS DAM AND LAKE
ELM FORK TRINITY RIVER

**ORGANIZATION FOR
FLOOD CONTROL REGULATION**

U.S. ARMY ENGINEER DISTRICT, FORT WORTH September 2018

FORT WORTH DISTRICT CORPS OF ENGINEERS
RESERVOIR REPORT FOR SATURDAY 01AUG2015

RESERVOIR	ELEVATION 0800 FT-NGVD	TOP CONS POOL	MEAN INFLOW DSF	MEAN TURBINE DSF	DAILY PUMP MGD	OTHER DSF	RELEASES INCHES	RAIN EVAP INCHES	0800 RELEASE CFS	POOL OCCUPIED %	A-F
RED RIVER BASIN											
Cooper	439.78	440.0	-162	--	18.618	5	0.00	.31	5	98 C	256411
Wright Patm	235.53	226.3	9205	--	49.706	9907	0.00	.16	10352	16 F	367034
Bob Sandlin	337.08	337.5	-239	--	--	0	--	--	0	98 C	198196
Lake O Pine	230.81	230.0	-221	--	--	301	0.00	--	301	3 F	16271
Caddo	169.30	168.5	1962	--	--	3141	0.00	--	2918	8 S	22059
NECHES RIVER BASIN											
Sam Rayburn	166.72	164.4	3597	1671	--	9487	0.00	.23	12744	25 F	251677
B.A. Steinh	82.06	83.0	9841	872	--	10477	0.32	.49	10886	86 C	57375
TRINITY RIVER BASIN											
Bridgeport	835.67	836.0	-494	--	--	0	0.02	--	0	99 C	356972
Eagle Mount	648.96	649.0	168	--	61.781	169	0.00	--	169	100 C	181265
Lake Worth	593.14	594.0	106	--	82.316	0	0.00	--	0	92 C	33791
Benbrook	695.18	694.0	-21	--	167.659	0	0.00	.64	0	6 F	4443
Joe Pool	532.15	522.0	23	--	9.236	358	0.00	.34	358	69 F	87158
Mountain Ck	458.14	457.0	307	--	--	0	--	--	794	-- S	3312
Ray Roberts	637.82	632.5	-273	--	11.629	1939	--	--	1938	64 F	169234
Lewisville	528.47	522.0	2092	0	76.759	4844	0.00	--	4839	61 F	207643
Grapevine	553.33	535.0	-927	--	--	1898	0.00	.37	1894	68 F	164553
Lavon	492.66	492.0	-123	--	410.157	394	0.00	.25	393	5 F	13893
Ray Hubbard	435.45	435.5	153	--	212.700	0	0.00	--	0	100 C	488563
Cedar Creek	321.39	322.0	50	--	28.040	0	0.00	--	0	97 C	648093
Navarro Mill	429.39	424.5	-294	--	9.420	1484	0.00	.52	1464	19 F	28189
Bardwell	421.51	421.0	-4	--	6.470	173	0.00	.40	91	2 F	1674
Richland Cr	315.32	315.0	2191	--	63.240	1870	0.00	--	1864	-- S	13463
BRAZOS RIVER BASIN											
Possum King	999.34	999.0	422	--	--	201	0.00	.29	201	-- C	5522
Granbury	692.64	692.7	-161	--	72.250	2	0.00	.34	2	100 C	126327
Whitney	532.96	533.0	277	846	--	25	0.00	.34	25	100 P	232827
Aquilla	537.22	537.5	-14	--	--	1	--	--	1	97 C	30412
Waco	461.92	462.0	81	--	46.791	60	0.00	.30	60	100 C	180188
Proctor	1168.98	1162.0	111	--	3.176	1456	0.00	.41	1410	12 F	37753
Belton	594.92	594.0	1089	--	58.305	1293	--	--	1031	2 F	11271
Stillhouse	622.11	622.0	-19	--	0.000	1	0.00	.41	1	0 F	714
Georgetown	790.27	791.0	6	--	51.045	0	0.00	.27	0	97 C	35900
Granger	504.48	504.0	56	--	4.408	121	0.00	.47	91	1 F	2054
Somerville	247.68	238.0	122	--	4.377	2166	0.00	.34	2159	39 F	136049
Limestone	362.08	363.0	-137	--	--	29	0.00	.05	28	94 C	192490
COLORADO RIVER BASIN											
Twin Buttes	1900.36	1940.2	-9	--	--	0	0.00	--	0	9 C	15073
O.C. Fisher	1873.74	1908.0	-9	--	0.000	0	0.00	.45	0	39 D	14239
O.H. Ivie	1510.48	1551.5	--	--	--	--	--	--	--	16 C	90730
Hords Creek	1886.20	1900.0	1	--	0.000	1	0.00	.44	1	27 C	1820
Buchanan	1007.43	1020.5	--	--	--	--	--	--	--	68 C	571665
Marshall Fo	670.40	681.0	-216	202	--	0	0.00	.34	0	83 C	927623
GUADALUPE RIVER BASIN											
Canyon	909.27	909.0	176	260	--	0	0.17	.17	256	1 F	2246

Pumpage below dam (MGD): Grapevine 7.515, and Belton 24.453.
Total outflow includes this and pumpage tabulated.
Preliminary data--Inflow not adjusted for wind effect, etc.

D = Sediment Pool
C = Conservation Pool
P = Power Pool
F = Flood Pool
S = Surcharge Pool
nr = Not reported today

TRINITY RIVER BASIN, TEXAS
RAY ROBERTS DAM AND LAKE
ELM FORK TRINITY RIVER

DAILY REPORT

U.S. ARMY ENGINEER DISTRICT, FORT WORTH September 2018

Ray Roberts
Monthly Report
SEP2013

DAY:	ELEVATIONS		:STORAGE:	EVAP:	PUMP:	RELEASES		: ADJ. :	RAIN
:	0800	: 2400	: 2400	:	:	:TURBINE:	OTHER	:INFLOW:	:
:	FEET-NGVD		: A-F :	DSF:	DSF:	DSF	: DSF	: DSF	: INCH
1	626.54	626.55	630443	226	25.0	0	65	16	0.00
2	626.55	626.53	629952	335	24.3	0	65	16	0.00
3	626.53	626.55	630443	299	22.8	0	65	635	0.00
4	626.51	626.52	629707	190	19.9	0	65	37	0.00
5	626.48	626.49	628971	299	20.2	0	65	1	0.00
6	626.45	626.46	628236	498	23.5	0	65	19	0.00
7	626.43	626.44	627746	208	23.3	0	65	4	0.00
8	626.40	626.39	626523	361	23.6	0	65	2	0.00
9	626.37	626.38	626279	433	23.3	0	65	399	0.00
10	626.34	626.34	625302	316	23.4	0	65	23	0.00
11	626.31	626.32	624813	261	22.8	0	65	9	0.00
12	626.29	626.30	624326	324	22.3	0	65	15	0.00
13	626.27	626.28	623838	315	22.3	0	65	14	0.00
14	626.29	626.27	623350	333	22.3	0	65	16	0.00
15	626.20	626.22	622376	360	23.0	0	65	10	0.00
16	626.18	626.19	621646	296	23.1	0	65	1	0.00
17	626.17	626.17	621160	215	23.4	0	65	5	0.00
18	626.13	626.14	620431	251	22.9	0	65	3	0.00
19	626.10	626.11	619703	278	22.6	0	109	3	0.00
20	626.21	626.10	619460	89	19.5	0	125	10	0.00
21	626.20	626.21	622133	98	14.4	0	115	1576	0.00
22	626.16	626.17	621160	53	10.8	0	115	94	0.00
23	626.11	626.13	620188	206	15.2	0	115	61	0.00
24	626.09	626.09	619218	358	18.6	0	118	0	0.00
25	626.05	626.06	618490	268	18.5	0	120	3	0.00
26	626.02	626.03	617763	259	17.5	0	120	2	0.00
27	625.99	626.00	617037	331	18.5	0	120	9	0.00
28	625.95	625.96	616070	134	18.2	0	120	6	0.00
29	626.01	626.02	617521	89	16.7	0	120	958	0.00
30	625.98	625.99	616795	187	17.1	0	120	57	0.00
MONTHLY TOTAL	(DSF)			7887	618	0.	2587.	4017.	0.00
	(A-F)	-13413	15644	1227		0	5131	7968	

TRINITY RIVER BASIN, TEXAS
RAY ROBERTS DAM AND LAKE
ELM FORK TRINITY RIVER

MONTHLY RESERVOIR REPORT

U.S. ARMY ENGINEER DISTRICT, FORT WORTH September 2018

TABLE 4-8

All Recorded Major Floods at USGS Gages in the Elm Fork Trinity River Watershed, 1908-2016

Table 4-8 All Recorded Major Floods at USGS Gages in the Elm Fork Watershed, 1908-2016

Date	Isle du Bois Creek near Pilot Point*		Elm Fork near Sanger*		Elm Fork Trinity River near Carrollton**	
	(1908-1984)		(1908-1982)		(1908-2015)	
	Gage Height (ft)	Peak Discharge (cfs)	Gage Height (ft)	Peak Discharge (cfs)	Gage Height (ft)	Peak Discharge (cfs)
1908, May	29.30	—	30.7	—	19.00	145,000
1923, Dec 14	—	—	—	—	12.75	76,000
1925, May 10	—	—	—	—	7.80	12,200
1926, Jul. 29	—	—	—	—	6.74	8,660
1927, Jul 15	—	—	—	—	8.60	15,200
1928, Apr 06	—	—	—	—	5.70	6,190
1929, May 15	—	—	—	—	9.40	19,000
1930, May 14	—	—	—	—	7.20	10,100
1930, Dec 05	—	—	—	—	6.46	8,100
1932, Jan 23	—	—	—	—	11.30	30,600
1933, Mar 06	—	—	—	—	7.33	10,900
1934, Mar 01	—	—	—	—	6.10	7,460
1935, May	—	—	29.70	—	13.00	82,100
1936, Sep 29	—	—	—	—	8.90	16,000
1936, Oct 26	—	—	—	—	7.28	10,500
1938, Feb 18	—	—	—	—	12.10	56,700
1939, Apr 18	—	—	—	—	12.78	10,700
1940, Jun 17	—	—	—	—	12.33	8,980
1941, Jun 12	—	—	—	—	20.53	76,400
1942, Apr 26	—	—	—	—	16.50	90,700
1943, Mar 26	—	—	—	—	14.13	18,600
1944, May 3	—	—	—	—	13.31	13,600
1945, Feb 22	—	—	—	—	16.96	37,800
1946, Jun 02	—	—	—	—	18.11	42,800
1946, Dec 13	—	—	—	—	14.95	23,000
1948, Feb 27	—	—	—	—	16.59	27,600
1949, May 17-18	—	5,700	—	—	15.36	23,600
1950, May 4	—	—	—	—	15.17	22,300

Table 4-8 All Recorded Major Floods at USGS Gages in the Elm Fork Watershed, 1908-2016 (Continued)

Date	Isle du Bois Creek near Pilot Point* (1908-1984)		Elm Fork near Sanger* (1908-1982)		Elm Fork Trinity River near Carrollton** (1908-2015)	
	Gage Height (ft)	Peak Discharge (cfs)	Gage Height (ft)	Peak Discharge (cfs)	Gage Height (ft)	Peak Discharge (cfs)
1950, Sep 13-15	26.35	17,200	27.14	20,100	—	—
1951, Jun 12-13	21.62	3,480	—	—	11.30	6,030
1952, Apr 22-24	21.05	3,130	—	—	10.84	5,740
1953, Apr 29- May 16	20.65	3,570	—	—	11.42	6,130
1953, Oct 26	—	—	—	—	—	—
1954, May 13-14	19.87	3,280	—	—	8.12	4,370
1954, Oct 2	—	—	—	—	—	—
1955, Mar 20	—	—	—	—	3.23	1,180
1955, May 19-21	21.65	4,100	26.2	11,000	—	—
1956, May 1-2	9.91	754	—	—	3.66	2,740
1957, Apr 26- Jun 05	27.08	22,700	27.4	20,800	8.54	13,700
1957, Nov	—	—	26.0	12,200	—	—
1958, Apr 27- May 17	27.30	16,000	29.1	27,500	6.65	7,720
1959, Jun 23-27	17.82	2,700	27.59	20,000	—	—
1959, Jul 20	—	—	—	—	4.04	2,960
1959, Oct 4-5	22.92	5,060	—	—	4.95	4,200
1960, Jan 22	—	—	—	—	—	—
1961, Jan 8	12.84	1,470	—	—	—	—
1961, Mar 22-26	—	—	—	—	4.25	3,080
1962, Jul 27	—	—	—	—	7.32	9,540
1962, Sep 8	27.81	19,000	28.1	22,500	—	—
1962, Oct 08	—	—	—	—	5.26	4,800
1962, Nov 26-27	23.49	5,710	—	—	—	—
1962, Sep 14	—	—	—	—	—	—
1963, May 10	—	—	—	—	—	—
1964, Sep 21-22	21.43	4,050	—	—	10.95	33,000
1964, Nov 18-25	26.09	11,100	27.1	17,500	—	—

Table 4-8 All Recorded Major Floods at USGS Gages in the Elm Fork Watershed, 1908-2016 (Continued)

Date	Isle du Bois Creek near Pilot Point* (1908-1984)		Elm Fork near Sanger* (1908-1982)		Elm Fork Trinity River near Carrollton** (1908-2015)	
	Gage Height (ft)	Peak Discharge (cfs)	Gage Height (ft)	Peak Discharge (cfs)	Gage Height (ft)	Peak Discharge (cfs)
1965, Feb 09	—	—	—	—	6.70	7,960
1966, Feb 9	—	—	27.71	35,000	—	—
1966, Apr 30	27.62	19,800	26.9	20,400	7.41	9,820
1966, May 21-31	27.79	19,000	—	—	—	—
1967, May 31- Jun 9	—	—	26.1	12,600	5.64	5,590
1968, Mar 20-31	25.08	8,360	—	—	7.06	8,980
1968, Apr 19	—	—	26.14	12,000	—	—
1969, May 7-27	25.17	9,170	26.3	13,400	7.49	10,100
1970, Apr 25-26	26.71	13,500	—	—	—	—
1970, May 31- Jun 6	—	—	—	—	5.60	6,330
1970, Sep-Oct 2	—	—	26.4	14,300	4.76	4,400
1971, Aug 14-15	12.50	1,400	—	—	—	—
1971, Oct 20	—	—	—	—	6.95	9,530
1971, Dec 10-29	25.67	9,860	26.5	15,100	—	—
1973, Apr 24	—	—	26.54	15,900	6.95	8,980
1973, Jul 30- Aug 7	—	—	—	—	—	—
1973, Sep 28	24.13	6,700	—	—	—	—
1973, Oct 13-21	18.50	2,930	—	—	6.01	7,270
1974, Oct 31	29.43	40,000	29.1	50,000	—	—
1974, Nov 10	—	—	—	—	7.32	10,300
1976, April 20- Jun 1	18.71	3,000	—	—	2.50	992
1976, Aug 10	—	—	—	—	—	—
1977, Mar 27- Apr 6	28.91	29,900	27.8	25,700	7.71	11,300
1977, Oct 28	—	—	—	—	—	—
1978, Apr 11- Jun 6	8.74	725	—	—	2.31	795
1979, May 22-30	25.79	10,300	—	—	5.28	5,360
1980, Jan 22	—	—	—	—	2.26	778
1980, Aug 21	—	—	—	—	—	—
1980, Sep 29	25.96	10,700	26.0	11,000	—	—

Table 4-8 All Recorded Major Floods at USGS Gages in the Elm Fork Watershed, 1908-2016 (Continued)

Date	Isle du Bois Creek near Pilot Point*		Elm Fork near Sanger*		Elm Fork Trinity River near Carrollton**	
	(1908-1984)		(1908-1982)		(1908-2015)	
	Gage Height (ft)	Peak Discharge (cfs)	Gage Height (ft)	Peak Discharge (cfs)	Gage Height (ft)	Peak Discharge (cfs)
1981, May 27- Jun 20	20.67	4,180	—	—	5.06	4,970
1981, Oct 13-16	29.84	39,900	33.5	150,000	—	—
1981, Nov 02	—	—	26.8	14,900	10.65	21,100
1982, May	29.80	39,400	26.7	18,700		
1983, Jan 31	—	—	—	—	3.79	2,560
1983, Feb 1-5	16.10	2,370	—	—	—	—
1983, Mar 5	—	—	—	—	—	—
1983, Oct 8	—	—	—	—	—	—
1984, Mar 19	12.19	1,570	—	—		
1984, May 1-2	—	—	—	—	3.70	2,420
1984, Nov 2	19.50	3,360	—	—		
1985, Mar 20	—	—	—	—	—	—
1985, Apr 28	—	—	—	—	5.64	6,170
1985, May 31	—	—	—	—	—	—
1986, Jun 2-20	—	—	—	—	5.97	6,750
1987, May 29- Jun 16	—	—	—	—	5.40	5,750
1987, Dec 26	—	—	—	—	5.33	1,670
1988, Apr 30	—	—	—	—	—	—
1989, May 17	—	—	—	—	9.73	8,720
1989, Jul 3	—	—	—	—	—	—
1990, Apr 26	—	—	—	—	—	—
1990, May 4-5	—	—	—	—	13.48	27,600
1991, Apr 12	—	—	—	—	—	—
1991, Jun 2-3	—	—	—	—	6.39	3,620
1991, Dec. 20	—	—	—	—	10.32	11,500
1992, Jan 27	—	—	—	—	—	—
1993, Feb 25	—	—	—	—	8.33	7,460
1993, Mar 16	—	—	—	—	—	—
1993, Jun 9	—	—	—	—	—	—

Table 4-8 All Recorded Major Floods at USGS Gages in the Elm Fork Watershed, 1908-2016 (Continued)

Date	Isle du Bois Creek near Pilot Point* (1908-1984)		Elm Fork near Sanger* (1908-1982)		Elm Fork Trinity River near Carrollton** (1908-2015)	
	Gage Height (ft)	Peak Discharge (cfs)	Gage Height (ft)	Peak Discharge (cfs)	Gage Height (ft)	Peak Discharge (cfs)
1993, Oct 19	—	—	—	—	—	—
1994, Jul 11-15	—	—	—	—	9.58	7,520
1995, Mar 13	—	—	—	—	8.54	7,880
1995, May 8-14	—	—	—	—	—	—
1996, Jan 8	—	—	—	—	—	—
1996, Aug 31	—	—	—	—	5.26	1,800
1996, Sep 15	—	—	—	—	—	—
1997, Feb 19-20	—	—	—	—	8.29	7,240
1997, Mar 8	—	—	—	—	—	—
1998, Jan 05	—	—	—	—	8.92	8,640
1998, Mar 2-16	—	—	—	—	—	—
1998, Dec 4	—	—	—	—	6.73	4,310
1999, Mar 10	—	—	—	—	—	—
2000, Feb. 23	—	—	—	—	6.29	3,420
2000, Mar 10	—	—	—	—	—	—
2000, May 19	—	—	—	—	—	—
2001, Feb 16	—	—	—	—	—	—
2001, Mar 24	—	—	—	—	8.33	7,140
2001, Apr 23	—	—	—	—	—	—
2002, Mar 19	—	—	—	—	9.69	9,990
2002, Apr 7-8	—	—	—	—	—	—
2002, Oct 19	—	—	—	—	8.10	6,420
2003, Jun 15	—	—	—	—	—	—
2004, Jun 7	—	—	—	—	—	—
2004, Jul 29	—	—	—	—	8.08	6,380
2004, Aug 4	—	—	—	—	—	—
2004, Nov 30- Dec 7	—	—	—	—	7.61	5,460
2005, Apr	—	—	—	—	—	—
2006, Mar 19	—	—	—	—	7.27	4,830

Table 4-8 All Recorded Major Floods at USGS Gages in the Elm Fork Watershed, 1908-2016 (Continued)

Date	Isle du Bois Creek near Pilot Point* (1908-1984)		Elm Fork near Sanger* (1908-1982)		Elm Fork Trinity River near Carrollton** (1908-2015)	
	Gage Height (ft)	Peak Discharge (cfs)	Gage Height (ft)	Peak Discharge (cfs)	Gage Height (ft)	Peak Discharge (cfs)
2006, Apr 29	—	—	—	—	—	—
2007, Jun 26-27	—	—	—	—	9.68	9,970
2007, Jul 21	—	—	—	—	—	—
2007, Oct 3	—	—	—	—	—	—
2008, Mar 18	—	—	—	—	8.21	6,650
2009, Apr 30	—	—	—	—	—	—
2009, May 3-21	—	—	—	—	6.86	4,130
2009, Nov 2	—	—	—	—	—	—
2010, Sep 8	—	—	—	—	10.22	11,300
2011, May 2-26	—	—	—	—	6.53	3,600
2012, Jan 25	—	—	—	—	8.53	7,340
2012, Mar 20-31	—	—	—	—	—	—
2013, Jan 9	—	—	—	—	7.21	4,730
2013, Jun 6	—	—	—	—	—	—
2014, Jul 17	—	—	—	—	—	—
2014, Aug 17	—	—	—	—	7.38	5,060
2015, May 8-31	—	—	—	—	13.12	26,700
2015, Nov 27	—	—	—	—	10.82	12,800

Table 4-8 All Recorded Major Floods at USGS Gages in the Elm Fork Watershed, 1908-2016 (Continued)

Date	Clear Creek near Sanger (1908-2015)		Elm Fork Trinity River near Lewisville (1950-2016)	
	Gage Height (ft)	Peak Discharge (cfs)	Gage Height (ft)	Peak Discharge (cfs)
1908, May	36.50	—	—	—
1923, Dec 14	—	—	—	—
1925, May 10	—	—	—	—
1926, Jul. 29	—	—	—	—
1927, Jul 15	—	—	—	—
1928, Apr 06	—	—	—	—
1929, May 15	—	—	—	—
1930, May 14	—	—	—	—
1930, Dec 05	—	—	—	—
1932, Jan 23	—	—	—	—
1933, Mar 06	—	—	—	—
1934, Mar 01	—	—	—	—
1935, May	34.00	—	—	—
1936, Sep 29	—	—	—	—
1936, Oct 26	—	—	—	—
1938, Feb 18	—	—	—	—
1939, Apr 18	—	—	—	—
1940, Jun 17	—	—	—	—
1941, Jun 12	—	—	—	—
1942, Apr 26	—	—	—	—
1943, Mar 26	—	—	—	—
1944, May 3	—	—	—	—
1945, Feb 22	—	—	—	—
1946, Jun 02	—	—	—	—
1946, Dec 13	—	—	—	—
1948, Feb 27	—	—	—	—
1949, May 17-18	26.10	6,880	—	—
1950, May 4	—	—	—	—
1950, Sep 13-15	29.80	18,200	30.75	21,700

Table 4-8 All Recorded Major Floods at USGS Gages in the Elm Fork Watershed, 1908-2016 (Continued)

Date	Clear Creek near Sanger (1908-2015)		Elm Fork Trinity River near Lewisville (1950-2016)	
	Gage Height (ft)	Peak Discharge (cfs)	Gage Height (ft)	Peak Discharge (cfs)
1951, Jun 12-13	14.95	1,950	26.34	6,840
1952, Apr 22-24	14.16	1,710	25.63	6,180
1953, Apr 29- May 16	16.58	2,510	27.00	6,880
1953, Oct 26	23.10	5,250	—	—
1954, May 13-14	—	—	22.95	4,600
1954, Oct 2	—	—	10.32	874
1955, Mar 20	—	—	—	—
1955, May 19-21	27.81	11,000	—	—
1956, May 1-2	8.31	224	8.58	595
1957, Apr 26- Jun 05	29.27	16,100	26.72	11,400
1957, Nov				
1958, Apr 27- May 17	29.65	17,400	24.09	5,440
1959, Jun 23-27	26.00	7,210	—	—
1959, Jul 20	—	—	8.93	666
1959, Oct 4-5	25.70	8,280	—	—
1960, Jan 22	—	—	20.31	3,820
1961, Jan 8	—	—	—	—
1961, Mar 22-26	16.16	2,330	18.45	3,100
1962, Jul 27	—	—	—	—
1962, Sep 8	29.30	16,200	—	—
1962, Oct 08	—	—	—	—
1962, Nov 26-27	24.74	7,780	—	—
1962, Sep 14	—	—	20.82	3,700
1963, May 10	—	—	20.28	3,630
1964, Sep 21-22	19.37	4,130	22.17	4,630
1964, Nov 18-25	29.00	15,000	23.69	5,260
1965, Feb 09	—	—	—	—
1966, Feb 9	27.35	11,200	—	—
1966, Apr 30	—	—	—	—

Table 4-8 All Recorded Major Floods at USGS Gages in the Elm Fork Watershed, 1908-2016 (Continued)

Date	Clear Creek near Sanger (1908-2015)		Elm Fork Trinity River near Lewisville (1950-2016)	
	Gage Height (ft)	Peak Discharge (cfs)	Gage Height (ft)	Peak Discharge (cfs)
1966, May 21-31	—	—	24.58	5,680
1967, May 31- Jun 9	27.70	11,500	21.91	4,510
1968, Mar 20-31	—	—	21.94	4,960
1968, Apr 19	25.35	7,860	—	—
1969, May 7-27	26.23	8,720	20.93	4,780
1970, Apr 25-26	24.42	6,620	—	—
1970, May 31- Jun 6	—	—	20.27	4,460
1970, Sep-Oct 2	—	—	17.94	3,260
1971, Aug 14-15	10.08	710	—	—
1971, Oct 20	—	—	—	—
1971, Dec 10-29	25.95	8,340	22.02	5,010
1973, Apr 24	—	—	—	—
1973, Jul 30- Aug 7	25.16	7,390	25.77	6,360
1973, Sep 28	—	—	—	—
1973, Oct 13-21	19.82	3,550	24.80	6,370
1974, Oct 31	28.83	14,500	—	—
1974, Nov 10	—	—	24.70	5,820
1976, April 20- Jun 1	11.80	858	—	—
1976, Aug 10	—	—	7.57	609
1977, Mar 27- Apr 6	27.49	8,190	22.61	5,290
1977, Oct 28	—	—	7.30	503
1978, Apr 11- Jun 6	10.25	515	—	—
1979, May 22-30	22.47	3,970	22.58	5,280
1980, Jan 22	—	—	—	—
1980, Aug 21	—	—	7.13	462
1980, Sep 29	12.58	984	—	—
1981, May 27- Jun 20	25.09	5,460	19.98	4,110
1981, Oct 13-16	35.70	104,000	—	—
1981, Nov 02	—	—	27.83	15,000

Table 4-8 All Recorded Major Floods at USGS Gages in the Elm Fork Watershed, 1908-2016 (Continued)

Date	Clear Creek near Sanger (1908-2015)		Elm Fork Trinity River near Lewisville (1950-2016)	
	Gage Height (ft)	Peak Discharge (cfs)	Gage Height (ft)	Peak Discharge (cfs)
1982, May	—	—	—	—
1983, Jan 31	—	—	—	—
1983, Feb 1-5	—	—	10.43	1,070
1983, Mar 5	9.59	401	—	—
1983, Oct 8	16.15	2,190	—	—
1984, Mar 19	—	—	—	—
1984, May 1-2	—	—	9.19	814
1984, Nov 2	—	—	—	—
1985, Mar 20	18.78	3,130	—	—
1985, Apr 28	—	—	—	—
1985, May 31	—	—	20.12	4,250
1986, Jun 2-20	23.42	5,020	20.50	4,420
1987, May 29- Jun 16	26.44	7,600	20.11	4,250
1987, Dec 26	15.92	2,470	—	—
1988, Apr 30	—	—	11.62	1,350
1989, May 17	28.32	11,300	—	—
1989, Jul 3	—	—	23.04	5,880
1990, Apr 26	29.94	24,300	—	—
1990, May 4-5	—	—	30.15	19,600
1991, Apr 12	22.75	5,880	—	—
1991, Jun 2-3	—	—	10.88	1,130
1991, Dec. 20	26.96	11,300	—	—
1992, Jan 27	—	—	23.55	7,300
1993, Feb 25	—	—	—	—
1993, Mar 16	—	—	20.28	4,320
1993, Jun 9	24.12	6,970	—	—
1993, Oct 19	19.71	4,380	—	—
1994, Jul 11-15	—	—	22.21	5,320
1995, Mar 13	—	—	—	—

Table 4-8 All Recorded Major Floods at USGS Gages in the Elm Fork Watershed, 1908-2016 (Continued)

Date	Clear Creek near Sanger (1908-2015)		Elm Fork Trinity River near Lewisville (1950-2016)	
	Gage Height (ft)	Peak Discharge (cfs)	Gage Height (ft)	Peak Discharge (cfs)
1995, May 8-14	22.92	7,970	20.62	4,480
1996, Jan 8	—	—	16.38	2,750
1996, Aug 31	—	—	—	—
1996, Sep 15	10.57	1,080	—	—
1997, Feb 19-20	26.14	12,200	—	—
1997, Mar 8	—	—	22.40	5,440
1998, Jan 05	—	—	—	—
1998, Mar 2-16	20.47	6,040	19.19	3,850
1998, Dec 4	—	—	11.34	1,280
1999, Mar 10	12.51	1,790	—	—
2000, Feb. 23	—	—	—	—
2000, Mar 10	9.65	778	—	—
2000, May 19	—	—	9.42	900
2001, Feb 16	24.07	8,800	—	—
2001, Mar 24	—	—	—	—
2001, Apr 23	—	—	19.32	4,240
2002, Mar 19	—	—	—	—
2002, Apr 7-8	21.36	6,280	21.66	5,120
2002, Oct 19	—	—	13.41	1,930
2003, Jun 15	11.46	1,190	—	—
2004, Jun 7	22.99	8,190	—	—
2004, Jul 29	—	—	—	—
2004, Aug 4	—	—	18.33	3,550
2004, Nov 30- Dec 7	—	—	21.43	5,330
2005, Apr	17.35	4,120	—	—
2006, Mar 19	—	—	11.55	1,540
2006, Apr 29	14.26	2,540	—	—

Table 4-8 All Recorded Major Floods at USGS Gages in the Elm Fork Watershed, 1908-2016 (Continued)

Date	Clear Creek near Sanger (1908-2015)		Elm Fork Trinity River near Lewisville (1950-2016)	
	Gage Height (ft)	Peak Discharge (cfs)	Gage Height (ft)	Peak Discharge (cfs)
2007, Jun 26-27	27.11	12,800	—	—
2007, Jul 21	—	—	26.05	7,290
2007, Oct 3	—	—	20.16	3,950
2008, Mar 18	19.75	4,480	—	—
2009, Apr 30	19.09	4,140	—	—
2009, May 3-21	—	—	14.88	2,330
2009, Nov 2	—	—	23.53	5,820
2010, Sep 8	24.71	8,430	—	—
2011, May 2-26	10.65	1,020	10.63	1,270
2012, Jan 25	—	—	—	—
2012, Mar 20-31	22.29	6,180	20.00	3,900
2013, Jan 9	—	—	8.36	781
2013, Jun 6	11.78	1,500	—	—
2014, Jul 17	26.87	9,720	—	—
2014, Aug 17	—	—	11.62	1,500
2015, May 8-31	28.92	18,900	30.98	18,600
2015, Nov 28	25.07	8,940	—	—
2016, Jun 17	—	—	26.87	7,330

Notes:

1. *Gage was removed in 1984.
2. **River stages at the Elm Fork near Carrollton Gage were effected by reduced flows due to the impoundment of Lake Dallas from 1928 to 1954, by Lake Dallas and Grapevine Lake from July 1952 to November 1954, and by Grapevine and Lewisville Lakes from November 1954 to 1987, and by Grapevine, Lewisville, and Ray Roberts Lakes from 1987 to Present.

TABLE 4-9

Ray Roberts Dam and Lake Monthly and Annual Inflow Volumes in Acre-feet

TABLE 4-9**Ray Roberts Dam and Lake Monthly and Annual Inflow Volumes in Acre-feet**

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1940	3,200	0	499	24,100	31,500	45,798	23,798	2,098	0	0	27,200	42,899	201,092
1941	6,500	31,500	10,900	54,999	18,198	172,700	3,699	3,700	0	24,998	10,100	5,599	342,893
1942	2,398	2,099	3,200	281,900	46,998	41,600	2,398	399	3,700	10,198	4,498	6,199	405,587
1943	0	799	39,798	11,998	32,999	11,600	699	0	0	1,198	0	2,200	101,291
1944	3,597	43,899	19,198	15,200	60,299	3,598	1,198	2,701	799	1,198	7,399	19,599	178,685
1945	9,399	97,998	167,499	79,998	7,000	38,799	34,298	1,299	17,199	31,801	4,899	1,298	491,487
1946	19,198	56,399	19,999	13,000	81,300	77,999	1,700	1,299	1,299	0	64,499	64,000	400,692
1947	5,698	1,099	9,200	16,797	27,598	19,598	397	1,198	0	0	0	41,499	123,084
1948	20,799	61,100	19,198	2,398	34,799	6,699	6,198	0	0	0	0	0	151,191
1949	8,298	23,899	15,699	3,899	33,098	16,400	0	0	9,299	36,899	800	899	149,190
1950	22,499	52,099	3,200	3,699	77,699	23,899	27,398	77,200	100,899	2,099	1,000	1,000	392,691
1951	1,099	6,099	2,200	2,099	3,098	48,199	9,699	0	0	0	0	0	72,493
1952	0	100	3,399	23,400	7,700	100	0	0	0	0	1,000	1,798	37,497
1953	198	0	2,901	27,799	20,299	0	1,000	99	799	5,499	7,398	2,798	68,790
1954	5,399	198	0	0	19,598	9,700	0	0	0	1,098	0	1,599	37,592
1955	1,000	3,299	2,798	2,799	39,200	14,499	0	0	0	0	0	0	63,595
1956	0	0	0	0	0	0	0	0	0	0	0	0	0
1957	0	3,899	8,499	228,900	244,600	44,899	2,499	99	5,998	7,799	102,799	10,100	660,091
1958	27,000	6,198	31,300	34,200	149,100	17,900	19,300	1,398	1,298	898	99	0	288,691
1959	198	299	1,398	299	3,200	31,599	8,700	398	1,198	40,400	2,098	25,099	114,886
1960	43,099	9,598	8,900	3,499	4,399	2,397	11,899	1,000	1,898	1,000	0	4,798	92,487
1961	13,300	13,197	23,699	5,299	2,299	5,300	1,299	400	2,100	3,798	2,700	6,599	79,990
1962	999	501	2,499	30,698	2,499	31,299	2,700	598	142,199	3,999	35,400	11,499	264,890
1963	2,799	0	3,299	15,199	15,199	1,500	0	0	0	0	0	0	37,996
1964	299	99	11,100	15,299	7,799	4,699	198	300	67,599	1,499	110,199	12,498	231,588
1965	16,899	30,399	5,300	3,298	27,798	15,199	899	999	30,499	2,599	5,800	799	140,488
1966	2,499	54,899	11,499	185,098	51,599	4,499	1,500	10,798	9,700	1,299	1,000	898	335,288
1967	899	800	1,398	18,300	59,200	22,499	1,197	500	599	300	399	1,099	107,190
1968	18,300	5,300	90,299	44,898	89,898	27,397	6,300	899	2,998	4,600	7,598	1,700	300,187
1969	14,398	41,699	66,799	22,600	142,600	16,999	1,699	799	899	15,598	1,000	25,300	350,390
1970	5,492	43,105	48,302	83,157	24,689	10,787	723	583	66,325	3,343	1,009	1,122	288,637
1971	1,386	1,867	950	1,021	4,772	976	2,201	13,165	6,324	55,766	6,852	144,720	240,000
1972	5,276	2,587	1,822	3,601	9,835	710	213	526	911	27,205	20,329	1,293	74,308
1973	18,779	24,482	43,182	80,626	26,391	41,768	40,368	5,628	32,965	46,423	24,557	9,882	395,051
1974	3,149	6,779	3,264	16,941	17,686	17,823	356	5,193	33,761	129,945	88,231	6,388	329,516
1975	15,116	65,117	54,463	35,246	41,649	34,350	2,582	3,236	967	536	662	1,003	254,927
1976	645	757	1,031	9,077	24,177	18,953	12,708	470	1,250	7,322	1,014	2,399	79,803
1977	8,891	19,900	129,998	18,064	4,820	5,860	741	5,870	383	294	196	260	195,277
1978	412	1,848	4,651	6,564	5,333	3,540	167	199	115	53	6,199	183	29,264
1979	5,029	7,549	76,276	25,115	60,107	12,152	5,169	874	569	551	378	1,050	194,819
1980	660	2,288	655	581	696	1,156	191	63	37,408	23,210	1,121	8,614	76,643
1981	1,139	1,408	37,055	8,928	56,215	24,748	2,317	283	4,106	542,004	87,844	7,467	773,514
1982	16,250	41,866	18,157	5,648	253,748	90,836	28,592	1,656	533	654	10,937	13,730	482,607
1983	8,550	19,381	14,738	5,168	4,029	14,770	2,602	749	253	12,166	1,957	877	85,240
1984	1,286	13,533	35,316	5,550	2,409	4,548	186	641	170	9,292	38,939	39,514	151,384
1985	27,562	31,524	57,616	44,676	45,059	37,219	2,878	1,825	4,518	57,895	10,980	3,780	325,532
1986	1,389	53,002	3,306	38,340	57,129	77,563	1,679	486	10,740	12,187	4,657	7,244	267,722
1987	27,596	19,898	89,628	9,039	18,566	75,571	149	16	0	2,057	6,462	77,170	326,152
1988	17,673	11,522	9,785	5,425	2,967	2,104	2,618	1,434	13,682	722	8,468	10,453	86,853
1989	44,736	88,069	62,752	7,014	174,169	189,950	24,490	5,074	14,208	6,155	1,279	1,267	619,163
1990	36,661	25,948	159,309	306,342	208,212	44,660	38,859	20,428	4,332	3,842	12,216	1,131	861,940
1991	18,833	7,916	8,737	34,150	49,601	19,982	7,424	10,745	9,610	80,300	25,990	226,175	499,463
1992	69,339	37,482	30,552	17,600	40,939	67,374	17,961	7,797	62,425	6,375	3,168	109,408	470,420
1993	20,547	97,939	62,540	51,569	88,186	61,298	12,363	9,935	14,739	116,441	12,496	69,434	617,487
1994	0	27,715	31,292	26,135	74,663	10,598	116,997	19,690	15,029	40,604	128,620	33,803	525,146
1995	12,762	9,267	84,180	62,280	112,762	12,992	17,681	4,526	9,836	3,342	841	12,072	342,541
1996	4,356	4,447	14,071	18,498	9,677	10,760	10,195	24,578	19,688	35,548	148,628	10,911	311,357
1997	4,713	147,263	50,643	86,512	78,065	19,883	3,418	3,792	415	9,400	258	36,439	440,801
1998	75,571	27,557	111,062	2,725	8,618	14,791	6,353	7,763	4,403	4,122	5,681	8,087	276,733
1999	13,896	1,025	4,384	15,404	36,453	13,575	2,120	6,879	248	2,283	0	3,102	99,369
2000	2,182	5,774	10,876	10,883	14,138	15,352	2,604	0	764	21,208	78,434	59,479	221,694
2001	57,611	199,425	80,479	20,361	26,742	19,274	7,867	6,147	4,544	7,593	2,460	13,591	446,094
2002	11,042	14,196	125,107	99,556	18,373	24,806	13,777	5,006	1,008	30,461	7,373	34,951	385,656
2003	4,996	20,678	18,756	7,557	17,403	14,922	111	6,167	12,540	383	4,316	69	107,898
2004	4,899	15,424	15,884	37,536	20,892	155,891	27,936	10,003	2,733	29,586	98,647	14,511	433,942
2005	51,809	16,538	12,720	10,885	10,991	6,438	5,411	19,978	3,269	0	0	619	138,658
2006	9,511	8,640	26,178	19,760	21,354	1,069	4,388	18,976	3,735	6,863	15,446	17,955	153,875
2007	30,225	3,933	27,410	42,534	98,068	375,488	117,328	3,376	7,402	1,567	2,224	5,603	715,158
2008	1,478	13,702	98,731	37,470	23,806	10,144	10,792	29,159	3,981	0	4,417	700	234,380
2009	2,174	6,254	9,134	86,953	81,637	12,698	10,189	2,590	10,792	157,008	1,418	12,601	393,448

TABLE 4-9 (CONTINUED)**Ray Roberts Dam and Lake Monthly and Annual Inflow Volumes in Acre-feet**

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
2010	45,041	86,959	54,532	27,809	16,774	9,654	15,327	9,215	83,626	1,950	464	9,259	360,610
2011	5,502	9,120	5,730	12,304	39,174	6,958	2,569	8,717	716	7,214	11,548	14,733	124,285
2012	75,807	11,740	88,770	4,443	15,737	18,262	3,021	5,502	6,030	296	454	6,222	236,284
2013	12,476	4,786	13,692	7,325	15,130	15,219	8,337	3,755	7,954	5,758	625	19,742	114,799
2014	268	5,363	6,262	11,431	8,733	10,810	91,287	13,063	5,768	6,857	2,001	3,755	165,598
2015	13,692	20,618	53,001	146,956	602,845	141,471	10,600	0	6,871	44,571	189,964	163,040	1,393,629
2016	15,461	20,388	100,589	73,669	94,968	140,870	5,839	19,718	4,806	9,465	33,414	2,719	521,908
2017	40,807	17,778	16,181	48,455	4,348	9,088							
TOTAL	1,102,646	1,871,833	2,599,427	2,908,555	4,014,308	2,687,086	872,356	433,657	937,431	1,769,594	1,511,059	1,520,303	
AVG	14,381	24,215	34,053	37,230	52,166	32,481	11,265	5,705	12,499	23,261	19,650	19,624	287,301

TABLE 7-5

Tabulated Area and Capacity Curves

TABLE 7-5**Tabulated Area and Capacity Curves****RAY ROBERTS DAM AND LAKE - ELEVATION vs. AREA**

ELEVATIONS IN FEET-NGVD, AREA (IN ACRES)

ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
541.0	0.000	0.010	0.020	0.030	0.040	0.050	0.060	0.070	0.080	0.090
541.1	0.100	0.110	0.120	0.130	0.140	0.150	0.160	0.170	0.180	0.190
541.2	0.200	0.210	0.220	0.230	0.240	0.250	0.260	0.270	0.280	0.290
541.3	0.300	0.310	0.320	0.330	0.340	0.350	0.360	0.370	0.380	0.390
541.4	0.400	0.410	0.420	0.430	0.440	0.450	0.460	0.470	0.480	0.490
541.5	0.500	0.510	0.520	0.530	0.540	0.550	0.560	0.570	0.580	0.590
541.6	0.600	0.610	0.620	0.630	0.640	0.650	0.660	0.670	0.680	0.690
541.7	0.700	0.710	0.720	0.730	0.740	0.750	0.760	0.770	0.780	0.790
541.8	0.800	0.810	0.820	0.830	0.840	0.850	0.860	0.870	0.880	0.890
541.9	0.900	0.910	0.920	0.930	0.940	0.950	0.960	0.970	0.980	0.990
542.0	1.000	1.020	1.040	1.060	1.080	1.100	1.120	1.140	1.160	1.180
542.1	1.200	1.220	1.240	1.260	1.280	1.300	1.320	1.340	1.360	1.380
542.2	1.400	1.420	1.440	1.460	1.480	1.500	1.520	1.540	1.560	1.580
542.3	1.600	1.620	1.640	1.660	1.680	1.700	1.720	1.740	1.760	1.780
542.4	1.800	1.820	1.840	1.860	1.880	1.900	1.920	1.940	1.960	1.980
542.5	2.000	2.020	2.040	2.060	2.080	2.100	2.120	2.140	2.160	2.180
542.6	2.200	2.220	2.240	2.260	2.280	2.300	2.320	2.340	2.360	2.380
542.7	2.400	2.420	2.440	2.460	2.480	2.500	2.520	2.540	2.560	2.580
542.8	2.600	2.620	2.640	2.660	2.680	2.700	2.720	2.740	2.760	2.780
542.9	2.800	2.820	2.840	2.860	2.880	2.900	2.920	2.940	2.960	2.980
543.0	3.000	3.030	3.060	3.090	3.120	3.150	3.180	3.210	3.240	3.270
543.1	3.300	3.330	3.360	3.390	3.420	3.450	3.480	3.510	3.540	3.570
543.2	3.600	3.630	3.660	3.690	3.720	3.750	3.780	3.810	3.840	3.870
543.3	3.900	3.930	3.960	3.990	4.020	4.050	4.080	4.110	4.140	4.170
543.4	4.200	4.230	4.260	4.290	4.320	4.350	4.380	4.410	4.440	4.470
543.5	4.500	4.530	4.560	4.590	4.620	4.650	4.680	4.710	4.740	4.770
543.6	4.800	4.830	4.860	4.890	4.920	4.950	4.980	5.010	5.040	5.070
543.7	5.100	5.130	5.160	5.190	5.220	5.250	5.280	5.310	5.340	5.370
543.8	5.400	5.430	5.460	5.490	5.520	5.550	5.580	5.610	5.640	5.670
543.9	5.700	5.730	5.760	5.790	5.820	5.850	5.880	5.910	5.940	5.970
544.0	6.000	6.030	6.060	6.090	6.120	6.150	6.180	6.210	6.240	6.270
544.1	6.300	6.330	6.360	6.390	6.420	6.450	6.480	6.510	6.540	6.570
544.2	6.600	6.630	6.660	6.690	6.720	6.750	6.780	6.810	6.840	6.870
544.3	6.900	6.930	6.960	6.990	7.020	7.050	7.080	7.110	7.140	7.170
544.4	7.200	7.230	7.260	7.290	7.320	7.350	7.380	7.410	7.440	7.470
544.5	7.500	7.530	7.560	7.590	7.620	7.650	7.680	7.710	7.740	7.770
544.6	7.800	7.830	7.860	7.890	7.920	7.950	7.980	8.010	8.040	8.070
544.7	8.100	8.130	8.160	8.190	8.220	8.250	8.280	8.310	8.340	8.370
544.8	8.400	8.430	8.460	8.490	8.520	8.550	8.580	8.610	8.640	8.670
544.9	8.700	8.730	8.760	8.790	8.820	8.850	8.880	8.910	8.940	8.970
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. AREA**

ELEVATIONS IN FEET-NGVD, AREA (IN ACRES)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
545.0	9.000	9.070	9.140	9.210	9.280	9.350	9.420	9.490	9.560	9.630
545.1	9.700	9.770	9.840	9.910	9.980	10.050	10.120	10.190	10.260	10.330
545.2	10.400	10.470	10.540	10.610	10.680	10.750	10.820	10.890	10.960	11.030
545.3	11.100	11.170	11.240	11.310	11.380	11.450	11.520	11.590	11.660	11.730
545.4	11.800	11.870	11.940	12.010	12.080	12.150	12.220	12.290	12.360	12.430
545.5	12.500	12.570	12.640	12.710	12.780	12.850	12.920	12.990	13.060	13.130
545.6	13.200	13.270	13.340	13.410	13.480	13.550	13.620	13.690	13.760	13.830
545.7	13.900	13.970	14.040	14.110	14.180	14.250	14.320	14.390	14.460	14.530
545.8	14.600	14.670	14.740	14.810	14.880	14.950	15.020	15.090	15.160	15.230
545.9	15.300	15.370	15.440	15.510	15.580	15.650	15.720	15.790	15.860	15.930
546.0	16.000	16.120	16.240	16.360	16.480	16.600	16.720	16.840	16.960	17.080
546.1	17.200	17.320	17.440	17.560	17.680	17.800	17.920	18.040	18.160	18.280
546.2	18.400	18.520	18.640	18.760	18.880	19.000	19.120	19.240	19.360	19.480
546.3	19.600	19.720	19.840	19.960	20.080	20.200	20.320	20.440	20.560	20.680
546.4	20.800	20.920	21.040	21.160	21.280	21.400	21.520	21.640	21.760	21.880
546.5	22.000	22.120	22.240	22.360	22.480	22.600	22.720	22.840	22.960	23.080
546.6	23.200	23.320	23.440	23.560	23.680	23.800	23.920	24.040	24.160	24.280
546.7	24.400	24.520	24.640	24.760	24.880	25.000	25.120	25.240	25.360	25.480
546.8	25.600	25.720	25.840	25.960	26.080	26.200	26.320	26.440	26.560	26.680
546.9	26.800	26.920	27.040	27.160	27.280	27.400	27.520	27.640	27.760	27.880
547.0	28.000	28.170	28.340	28.510	28.680	28.850	29.020	29.190	29.360	29.530
547.1	29.700	29.870	30.040	30.210	30.380	30.550	30.720	30.890	31.060	31.230
547.2	31.400	31.570	31.740	31.910	32.080	32.250	32.420	32.590	32.760	32.930
547.3	33.100	33.270	33.440	33.610	33.780	33.950	34.120	34.290	34.460	34.630
547.4	34.800	34.970	35.140	35.310	35.480	35.650	35.820	35.990	36.160	36.330
547.5	36.500	36.670	36.840	37.010	37.180	37.350	37.520	37.690	37.860	38.030
547.6	38.200	38.370	38.540	38.710	38.880	39.050	39.220	39.390	39.560	39.730
547.7	39.900	40.070	40.240	40.410	40.580	40.750	40.920	41.090	41.260	41.430
547.8	41.600	41.770	41.940	42.110	42.280	42.450	42.620	42.790	42.960	43.130
547.9	43.300	43.470	43.640	43.810	43.980	44.150	44.320	44.490	44.660	44.830
548.0	45.000	45.240	45.480	45.720	45.960	46.200	46.440	46.680	46.920	47.160
548.1	47.400	47.640	47.880	48.120	48.360	48.600	48.840	49.080	49.320	49.560
548.2	49.800	50.040	50.280	50.520	50.760	51.000	51.240	51.480	51.720	51.960
548.3	52.200	52.440	52.680	52.920	53.160	53.400	53.640	53.880	54.120	54.360
548.4	54.600	54.840	55.080	55.320	55.560	55.800	56.040	56.280	56.520	56.760
548.5	57.000	57.240	57.480	57.720	57.960	58.200	58.440	58.680	58.920	59.160
548.6	59.400	59.640	59.880	60.120	60.360	60.600	60.840	61.080	61.320	61.560
548.7	61.800	62.040	62.280	62.520	62.760	63.000	63.240	63.480	63.720	63.960
548.8	64.200	64.440	64.680	64.920	65.160	65.400	65.640	65.880	66.120	66.360
548.9	66.600	66.840	67.080	67.320	67.560	67.800	68.040	68.280	68.520	68.760
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. AREA**

ELEVATIONS IN FEET-NGVD, AREA (IN ACRES)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
549.0	69.000	69.220	69.440	69.660	69.880	70.100	70.320	70.540	70.760	70.980
549.1	71.200	71.420	71.640	71.860	72.080	72.300	72.520	72.740	72.960	73.180
549.2	73.400	73.620	73.840	74.060	74.280	74.500	74.720	74.940	75.160	75.380
549.3	75.600	75.820	76.040	76.260	76.480	76.700	76.920	77.140	77.360	77.580
549.4	77.800	78.020	78.240	78.460	78.680	78.900	79.120	79.340	79.560	79.780
549.5	80.000	80.220	80.440	80.660	80.880	81.100	81.320	81.540	81.760	81.980
549.6	82.200	82.420	82.640	82.860	83.080	83.300	83.520	83.740	83.960	84.180
549.7	84.400	84.620	84.840	85.060	85.280	85.500	85.720	85.940	86.160	86.380
549.8	86.600	86.820	87.040	87.260	87.480	87.700	87.920	88.140	88.360	88.580
549.9	88.800	89.020	89.240	89.460	89.680	89.900	90.120	90.340	90.560	90.780
550.0	91.000	91.220	91.440	91.660	91.880	92.100	92.320	92.540	92.760	92.980
550.1	93.200	93.420	93.640	93.860	94.080	94.300	94.520	94.740	94.960	95.180
550.2	95.400	95.620	95.840	96.060	96.280	96.500	96.720	96.940	97.160	97.380
550.3	97.600	97.820	98.040	98.260	98.480	98.700	98.920	99.140	99.360	99.580
550.4	99.800	100.020	100.240	100.460	100.680	100.900	101.120	101.340	101.560	101.780
550.5	102.000	102.220	102.440	102.660	102.880	103.100	103.320	103.540	103.760	103.980
550.6	104.200	104.420	104.640	104.860	105.080	105.300	105.520	105.740	105.960	106.180
550.7	106.400	106.620	106.840	107.060	107.280	107.500	107.720	107.940	108.160	108.380
550.8	108.600	108.820	109.040	109.260	109.480	109.700	109.920	110.140	110.360	110.580
550.9	110.800	111.020	111.240	111.460	111.680	111.900	112.120	112.340	112.560	112.780
551.0	113.000	113.340	113.680	114.020	114.360	114.700	115.040	115.380	115.720	116.060
551.1	116.400	116.740	117.080	117.420	117.760	118.100	118.440	118.780	119.120	119.460
551.2	119.800	120.140	120.480	120.820	121.160	121.500	121.840	122.180	122.520	122.860
551.3	123.200	123.540	123.880	124.220	124.560	124.900	125.240	125.580	125.920	126.260
551.4	126.600	126.940	127.280	127.620	127.960	128.300	128.640	128.980	129.320	129.660
551.5	130.000	130.340	130.680	131.020	131.360	131.700	132.040	132.380	132.720	133.060
551.6	133.400	133.740	134.080	134.420	134.760	135.100	135.440	135.780	136.120	136.460
551.7	136.800	137.140	137.480	137.820	138.160	138.500	138.840	139.180	139.520	139.860
551.8	140.200	140.540	140.880	141.220	141.560	141.900	142.240	142.580	142.920	143.260
551.9	143.600	143.940	144.280	144.620	144.960	145.300	145.640	145.980	146.320	146.660
552.0	147.000	147.610	148.220	148.830	149.440	150.050	150.660	151.270	151.880	152.490
552.1	153.100	153.710	154.320	154.930	155.540	156.150	156.760	157.370	157.980	158.590
552.2	159.200	159.810	160.420	161.030	161.640	162.250	162.860	163.470	164.080	164.690
552.3	165.300	165.910	166.520	167.130	167.740	168.350	168.960	169.570	170.180	170.790
552.4	171.400	172.010	172.620	173.230	173.840	174.450	175.060	175.670	176.280	176.890
552.5	177.500	178.110	178.720	179.330	179.940	180.550	181.160	181.770	182.380	182.990
552.6	183.600	184.210	184.820	185.430	186.040	186.650	187.260	187.870	188.480	189.090
552.7	189.700	190.310	190.920	191.530	192.140	192.750	193.360	193.970	194.580	195.190
552.8	195.800	196.410	197.020	197.630	198.240	198.850	199.460	200.070	200.680	201.290
552.9	201.900	202.510	203.120	203.730	204.340	204.950	205.560	206.170	206.780	207.390
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. AREA**

ELEVATIONS IN FEET-NGVD, AREA (IN ACRES)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
553.0	208.000	208.870	209.740	210.610	211.480	212.350	213.220	214.090	214.960	215.830
553.1	216.700	217.570	218.440	219.310	220.180	221.050	221.920	222.790	223.660	224.530
553.2	225.400	226.270	227.140	228.010	228.880	229.750	230.620	231.490	232.360	233.230
553.3	234.100	234.970	235.840	236.710	237.580	238.450	239.320	240.190	241.060	241.930
553.4	242.800	243.670	244.540	245.410	246.280	247.150	248.020	248.890	249.760	250.630
553.5	251.500	252.370	253.240	254.110	254.980	255.850	256.720	257.590	258.460	259.330
553.6	260.200	261.070	261.940	262.810	263.680	264.550	265.420	266.290	267.160	268.030
553.7	268.900	269.770	270.640	271.510	272.380	273.250	274.120	274.990	275.860	276.730
553.8	277.600	278.470	279.340	280.210	281.080	281.950	282.820	283.690	284.560	285.430
553.9	286.300	287.170	288.040	288.910	289.780	290.650	291.520	292.390	293.260	294.130
554.0	295.000	295.800	296.600	297.400	298.200	299.000	299.800	300.600	301.400	302.200
554.1	303.000	303.800	304.600	305.400	306.200	307.000	307.800	308.600	309.400	310.200
554.2	311.000	311.800	312.600	313.400	314.200	315.000	315.800	316.600	317.400	318.200
554.3	319.000	319.800	320.600	321.400	322.200	323.000	323.800	324.600	325.400	326.200
554.4	327.000	327.800	328.600	329.400	330.200	331.000	331.800	332.600	333.400	334.200
554.5	335.000	335.800	336.600	337.400	338.200	339.000	339.800	340.600	341.400	342.200
554.6	343.000	343.800	344.600	345.400	346.200	347.000	347.800	348.600	349.400	350.200
554.7	351.000	351.800	352.600	353.400	354.200	355.000	355.800	356.600	357.400	358.200
554.8	359.000	359.800	360.600	361.400	362.200	363.000	363.800	364.600	365.400	366.200
554.9	367.000	367.800	368.600	369.400	370.200	371.000	371.800	372.600	373.400	374.200
555.0	375.000	375.690	376.380	377.070	377.760	378.450	379.140	379.830	380.520	381.210
555.1	381.900	382.590	383.280	383.970	384.660	385.350	386.040	386.730	387.420	388.110
555.2	388.800	389.490	390.180	390.870	391.560	392.250	392.940	393.630	394.320	395.010
555.3	395.700	396.390	397.080	397.770	398.460	399.150	399.840	400.530	401.220	401.910
555.4	402.600	403.290	403.980	404.670	405.360	406.050	406.740	407.430	408.120	408.810
555.5	409.500	410.190	410.880	411.570	412.260	412.950	413.640	414.330	415.020	415.710
555.6	416.400	417.090	417.780	418.470	419.160	419.850	420.540	421.230	421.920	422.610
555.7	423.300	423.990	424.680	425.370	426.060	426.750	427.440	428.130	428.820	429.510
555.8	430.200	430.890	431.580	432.270	432.960	433.650	434.340	435.030	435.720	436.410
555.9	437.100	437.790	438.480	439.170	439.860	440.550	441.240	441.930	442.620	443.310
556.0	444.000	444.900	445.800	446.700	447.600	448.500	449.400	450.300	451.200	452.100
556.1	453.000	453.900	454.800	455.700	456.600	457.500	458.400	459.300	460.200	461.100
556.2	462.000	462.900	463.800	464.700	465.600	466.500	467.400	468.300	469.200	470.100
556.3	471.000	471.900	472.800	473.700	474.600	475.500	476.400	477.300	478.200	479.100
556.4	480.000	480.900	481.800	482.700	483.600	484.500	485.400	486.300	487.200	488.100
556.5	489.000	489.900	490.800	491.700	492.600	493.500	494.400	495.300	496.200	497.100
556.6	498.000	498.900	499.800	500.700	501.600	502.500	503.400	504.300	505.200	506.100
556.7	507.000	507.900	508.800	509.700	510.600	511.500	512.400	513.300	514.200	515.100
556.8	516.000	516.900	517.800	518.700	519.600	520.500	521.400	522.300	523.200	524.100
556.9	525.000	525.900	526.800	527.700	528.600	529.500	530.400	531.300	532.200	533.100
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. AREA**

ELEVATIONS IN FEET-NGVD, AREA (IN ACRES)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
557.0	534.000	534.970	535.940	536.910	537.880	538.850	539.820	540.790	541.760	542.730
557.1	543.700	544.670	545.640	546.610	547.580	548.550	549.520	550.490	551.460	552.430
557.2	553.400	554.370	555.340	556.310	557.280	558.250	559.220	560.190	561.160	562.130
557.3	563.100	564.070	565.040	566.010	566.980	567.950	568.920	569.890	570.860	571.830
557.4	572.800	573.770	574.740	575.710	576.680	577.650	578.620	579.590	580.560	581.530
557.5	582.500	583.470	584.440	585.410	586.380	587.350	588.320	589.290	590.260	591.230
557.6	592.200	593.170	594.140	595.110	596.080	597.050	598.020	598.990	599.960	600.930
557.7	601.900	602.870	603.840	604.810	605.780	606.750	607.720	608.690	609.660	610.630
557.8	611.600	612.570	613.540	614.510	615.480	616.450	617.420	618.390	619.360	620.330
557.9	621.300	622.270	623.240	624.210	625.180	626.150	627.120	628.090	629.060	630.030
558.0	631.000	632.040	633.080	634.120	635.160	636.200	637.240	638.280	639.320	640.360
558.1	641.400	642.440	643.480	644.520	645.560	646.600	647.640	648.680	649.720	650.760
558.2	651.800	652.840	653.880	654.920	655.960	657.000	658.040	659.080	660.120	661.160
558.3	662.200	663.240	664.280	665.320	666.360	667.400	668.440	669.480	670.520	671.560
558.4	672.600	673.640	674.680	675.720	676.760	677.800	678.840	679.880	680.920	681.960
558.5	683.000	684.040	685.080	686.120	687.160	688.200	689.240	690.280	691.320	692.360
558.6	693.400	694.440	695.480	696.520	697.560	698.600	699.640	700.680	701.720	702.760
558.7	703.800	704.840	705.880	706.920	707.960	709.000	710.040	711.080	712.120	713.160
558.8	714.200	715.240	716.280	717.320	718.360	719.400	720.440	721.480	722.520	723.560
558.9	724.600	725.640	726.680	727.720	728.760	729.800	730.840	731.880	732.920	733.960
559.0	735.000	735.950	736.900	737.850	738.800	739.750	740.700	741.650	742.600	743.550
559.1	744.500	745.450	746.400	747.350	748.300	749.250	750.200	751.150	752.100	753.050
559.2	754.000	754.950	755.900	756.850	757.800	758.750	759.700	760.650	761.600	762.550
559.3	763.500	764.450	765.400	766.350	767.300	768.250	769.200	770.150	771.100	772.050
559.4	773.000	773.950	774.900	775.850	776.800	777.750	778.700	779.650	780.600	781.550
559.5	782.500	783.450	784.400	785.350	786.300	787.250	788.200	789.150	790.100	791.050
559.6	792.000	792.950	793.900	794.850	795.800	796.750	797.700	798.650	799.600	800.550
559.7	801.500	802.450	803.400	804.350	805.300	806.250	807.200	808.150	809.100	810.050
559.8	811.000	811.950	812.900	813.850	814.800	815.750	816.700	817.650	818.600	819.550
559.9	820.500	821.450	822.400	823.350	824.300	825.250	826.200	827.150	828.100	829.050
560.0	830.000	830.960	831.920	832.880	833.840	834.800	835.760	836.720	837.680	838.640
560.1	839.600	840.560	841.520	842.480	843.440	844.400	845.360	846.320	847.280	848.240
560.2	849.200	850.160	851.120	852.080	853.040	854.000	854.960	855.920	856.880	857.840
560.3	858.800	859.760	860.720	861.680	862.640	863.600	864.560	865.520	866.480	867.440
560.4	868.400	869.360	870.320	871.280	872.240	873.200	874.160	875.120	876.080	877.040
560.5	878.000	878.960	879.920	880.880	881.840	882.800	883.760	884.720	885.680	886.640
560.6	887.600	888.560	889.520	890.480	891.440	892.400	893.360	894.320	895.280	896.240
560.7	897.200	898.160	899.120	900.080	901.040	902.000	902.960	903.920	904.880	905.840
560.8	906.800	907.760	908.720	909.680	910.640	911.600	912.560	913.520	914.480	915.440
560.9	916.400	917.360	918.320	919.280	920.240	921.200	922.160	923.120	924.080	925.040
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. AREA**

ELEVATIONS IN FEET-NGVD, AREA (IN ACRES)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
561.0	926.000	926.970	927.940	928.910	929.880	930.850	931.820	932.790	933.760	934.730
561.1	935.700	936.670	937.640	938.610	939.580	940.550	941.520	942.490	943.460	944.430
561.2	945.400	946.370	947.340	948.310	949.280	950.250	951.220	952.190	953.160	954.130
561.3	955.100	956.070	957.040	958.010	958.980	959.950	960.920	961.890	962.860	963.830
561.4	964.800	965.770	966.740	967.710	968.680	969.650	970.620	971.590	972.560	973.530
561.5	974.500	975.470	976.440	977.410	978.380	979.350	980.320	981.290	982.260	983.230
561.6	984.200	985.170	986.140	987.110	988.080	989.050	990.020	990.990	991.960	992.930
561.7	993.900	994.870	995.840	996.810	997.780	998.750	999.720	1000.690	1001.660	1002.630
561.8	1003.600	1004.570	1005.540	1006.510	1007.480	1008.450	1009.420	1010.390	1011.360	1012.330
561.9	1013.300	1014.270	1015.240	1016.210	1017.180	1018.150	1019.120	1020.090	1021.060	1022.030
562.0	1023.000	1024.060	1025.120	1026.180	1027.240	1028.300	1029.360	1030.420	1031.480	1032.540
562.1	1033.600	1034.660	1035.720	1036.780	1037.840	1038.900	1039.960	1041.020	1042.080	1043.140
562.2	1044.200	1045.260	1046.320	1047.380	1048.440	1049.500	1050.560	1051.620	1052.680	1053.740
562.3	1054.800	1055.860	1056.920	1057.980	1059.040	1060.100	1061.160	1062.220	1063.280	1064.340
562.4	1065.400	1066.460	1067.520	1068.580	1069.640	1070.700	1071.760	1072.820	1073.880	1074.940
562.5	1076.000	1077.060	1078.120	1079.180	1080.240	1081.300	1082.360	1083.420	1084.480	1085.540
562.6	1086.600	1087.660	1088.720	1089.780	1090.840	1091.900	1092.960	1094.020	1095.080	1096.140
562.7	1097.200	1098.260	1099.320	1100.380	1101.440	1102.500	1103.560	1104.620	1105.680	1106.740
562.8	1107.800	1108.860	1109.920	1110.980	1112.040	1113.100	1114.160	1115.220	1116.280	1117.340
562.9	1118.400	1119.460	1120.520	1121.580	1122.640	1123.700	1124.760	1125.820	1126.880	1127.940
563.0	1129.000	1130.340	1131.680	1133.020	1134.360	1135.700	1137.040	1138.380	1139.720	1141.060
563.1	1142.400	1143.740	1145.080	1146.420	1147.760	1149.100	1150.440	1151.780	1153.120	1154.460
563.2	1155.800	1157.140	1158.480	1159.820	1161.160	1162.500	1163.840	1165.180	1166.520	1167.860
563.3	1169.200	1170.540	1171.880	1173.220	1174.560	1175.900	1177.240	1178.580	1179.920	1181.260
563.4	1182.600	1183.940	1185.280	1186.620	1187.960	1189.300	1190.640	1191.980	1193.320	1194.660
563.5	1196.000	1197.340	1198.680	1200.020	1201.360	1202.700	1204.040	1205.380	1206.720	1208.060
563.6	1209.400	1210.740	1212.080	1213.420	1214.760	1216.100	1217.440	1218.780	1220.120	1221.460
563.7	1222.800	1224.140	1225.480	1226.820	1228.160	1229.500	1230.840	1232.180	1233.520	1234.860
563.8	1236.200	1237.540	1238.880	1240.220	1241.560	1242.900	1244.240	1245.580	1246.920	1248.260
563.9	1249.600	1250.940	1252.280	1253.620	1254.960	1256.300	1257.640	1258.980	1260.320	1261.660
564.0	1263.000	1264.430	1265.860	1267.290	1268.720	1270.150	1271.580	1273.010	1274.440	1275.870
564.1	1277.300	1278.730	1280.160	1281.590	1283.020	1284.450	1285.880	1287.310	1288.740	1290.170
564.2	1291.600	1293.030	1294.460	1295.890	1297.320	1298.750	1300.180	1301.610	1303.040	1304.470
564.3	1305.900	1307.330	1308.760	1310.190	1311.620	1313.050	1314.480	1315.910	1317.340	1318.770
564.4	1320.200	1321.630	1323.060	1324.490	1325.920	1327.350	1328.780	1330.210	1331.640	1333.070
564.5	1334.500	1335.930	1337.360	1338.790	1340.220	1341.650	1343.080	1344.510	1345.940	1347.370
564.6	1348.800	1350.230	1351.660	1353.090	1354.520	1355.950	1357.380	1358.810	1360.240	1361.670
564.7	1363.100	1364.530	1365.960	1367.390	1368.820	1370.250	1371.680	1373.110	1374.540	1375.970
564.8	1377.400	1378.830	1380.260	1381.690	1383.120	1384.550	1385.980	1387.410	1388.840	1390.270
564.9	1391.700	1393.130	1394.560	1395.990	1397.420	1398.850	1400.280	1401.710	1403.140	1404.570
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. AREA**

ELEVATIONS IN FEET-NGVD, AREA (IN ACRES)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
565.0	1406.000	1407.390	1408.780	1410.170	1411.560	1412.950	1414.340	1415.730	1417.120	1418.510
565.1	1419.900	1421.290	1422.680	1424.070	1425.460	1426.850	1428.240	1429.630	1431.020	1432.410
565.2	1433.800	1435.190	1436.580	1437.970	1439.360	1440.750	1442.140	1443.530	1444.920	1446.310
565.3	1447.700	1449.090	1450.480	1451.870	1453.260	1454.650	1456.040	1457.430	1458.820	1460.210
565.4	1461.600	1462.990	1464.380	1465.770	1467.160	1468.550	1469.940	1471.330	1472.720	1474.110
565.5	1475.500	1476.890	1478.280	1479.670	1481.060	1482.450	1483.840	1485.230	1486.620	1488.010
565.6	1489.400	1490.790	1492.180	1493.570	1494.960	1496.350	1497.740	1499.130	1500.520	1501.910
565.7	1503.300	1504.690	1506.080	1507.470	1508.860	1510.250	1511.640	1513.030	1514.420	1515.810
565.8	1517.200	1518.590	1519.980	1521.370	1522.760	1524.150	1525.540	1526.930	1528.320	1529.710
565.9	1531.100	1532.490	1533.880	1535.270	1536.660	1538.050	1539.440	1540.830	1542.220	1543.610
566.0	1545.000	1546.500	1548.000	1549.500	1551.000	1552.500	1554.000	1555.500	1557.000	1558.500
566.1	1560.000	1561.500	1563.000	1564.500	1566.000	1567.500	1569.000	1570.500	1572.000	1573.500
566.2	1575.000	1576.500	1578.000	1579.500	1581.000	1582.500	1584.000	1585.500	1587.000	1588.500
566.3	1590.000	1591.500	1593.000	1594.500	1596.000	1597.500	1599.000	1600.500	1602.000	1603.500
566.4	1605.000	1606.500	1608.000	1609.500	1611.000	1612.500	1614.000	1615.500	1617.000	1618.500
566.5	1620.000	1621.500	1623.000	1624.500	1626.000	1627.500	1629.000	1630.500	1632.000	1633.500
566.6	1635.000	1636.500	1638.000	1639.500	1641.000	1642.500	1644.000	1645.500	1647.000	1648.500
566.7	1650.000	1651.500	1653.000	1654.500	1656.000	1657.500	1659.000	1660.500	1662.000	1663.500
566.8	1665.000	1666.500	1668.000	1669.500	1671.000	1672.500	1674.000	1675.500	1677.000	1678.500
566.9	1680.000	1681.500	1683.000	1684.500	1686.000	1687.500	1689.000	1690.500	1692.000	1693.500
567.0	1695.000	1696.320	1697.640	1698.960	1700.280	1701.600	1702.920	1704.240	1705.560	1706.880
567.1	1708.200	1709.520	1710.840	1712.160	1713.480	1714.800	1716.120	1717.440	1718.760	1720.080
567.2	1721.400	1722.720	1724.040	1725.360	1726.680	1728.000	1729.320	1730.640	1731.960	1733.280
567.3	1734.600	1735.920	1737.240	1738.560	1739.880	1741.200	1742.520	1743.840	1745.160	1746.480
567.4	1747.800	1749.120	1750.440	1751.760	1753.080	1754.400	1755.720	1757.040	1758.360	1759.680
567.5	1761.000	1762.320	1763.640	1764.960	1766.280	1767.600	1768.920	1770.240	1771.560	1772.880
567.6	1774.200	1775.520	1776.840	1778.160	1779.480	1780.800	1782.120	1783.440	1784.760	1786.080
567.7	1787.400	1788.720	1790.040	1791.360	1792.680	1794.000	1795.320	1796.640	1797.960	1799.280
567.8	1800.600	1801.920	1803.240	1804.560	1805.880	1807.200	1808.520	1809.840	1811.160	1812.480
567.9	1813.800	1815.120	1816.440	1817.760	1819.080	1820.400	1821.720	1823.040	1824.360	1825.680
568.0	1827.000	1828.290	1829.580	1830.870	1832.160	1833.450	1834.740	1836.030	1837.320	1838.610
568.1	1839.900	1841.190	1842.480	1843.770	1845.060	1846.350	1847.640	1848.930	1850.220	1851.510
568.2	1852.800	1854.090	1855.380	1856.670	1857.960	1859.250	1860.540	1861.830	1863.120	1864.410
568.3	1865.700	1866.990	1868.280	1869.570	1870.860	1872.150	1873.440	1874.730	1876.020	1877.310
568.4	1878.600	1879.890	1881.180	1882.470	1883.760	1885.050	1886.340	1887.630	1888.920	1890.210
568.5	1891.500	1892.790	1894.080	1895.370	1896.660	1897.950	1899.240	1900.530	1901.820	1903.110
568.6	1904.400	1905.690	1906.980	1908.270	1909.560	1910.850	1912.140	1913.430	1914.720	1916.010
568.7	1917.300	1918.590	1919.880	1921.170	1922.460	1923.750	1925.040	1926.330	1927.620	1928.910
568.8	1930.200	1931.490	1932.780	1934.070	1935.360	1936.650	1937.940	1939.230	1940.520	1941.810
568.9	1943.100	1944.390	1945.680	1946.970	1948.260	1949.550	1950.840	1952.130	1953.420	1954.710
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. AREA**

ELEVATIONS IN FEET-NGVD, AREA (IN ACRES)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
569.0	1956.000	1957.630	1959.260	1960.890	1962.520	1964.150	1965.780	1967.410	1969.040	1970.670
569.1	1972.300	1973.930	1975.560	1977.190	1978.820	1980.450	1982.080	1983.710	1985.340	1986.970
569.2	1988.600	1990.230	1991.860	1993.490	1995.120	1996.750	1998.380	2000.010	2001.640	2003.270
569.3	2004.900	2006.530	2008.160	2009.790	2011.420	2013.050	2014.680	2016.310	2017.940	2019.570
569.4	2021.200	2022.830	2024.460	2026.090	2027.720	2029.350	2030.980	2032.610	2034.240	2035.870
569.5	2037.500	2039.130	2040.760	2042.390	2044.020	2045.650	2047.280	2048.910	2050.540	2052.170
569.6	2053.800	2055.430	2057.060	2058.690	2060.320	2061.950	2063.580	2065.210	2066.840	2068.470
569.7	2070.100	2071.730	2073.360	2074.990	2076.620	2078.250	2079.880	2081.510	2083.140	2084.770
569.8	2086.400	2088.030	2089.660	2091.290	2092.920	2094.550	2096.180	2097.810	2099.440	2101.070
569.9	2102.700	2104.330	2105.960	2107.590	2109.220	2110.850	2112.480	2114.110	2115.740	2117.370
570.0	2119.000	2121.030	2123.060	2125.090	2127.120	2129.150	2131.180	2133.210	2135.240	2137.270
570.1	2139.300	2141.330	2143.360	2145.390	2147.420	2149.450	2151.480	2153.510	2155.540	2157.570
570.2	2159.600	2161.630	2163.660	2165.690	2167.720	2169.750	2171.780	2173.810	2175.840	2177.870
570.3	2179.900	2181.930	2183.960	2185.990	2188.020	2190.050	2192.080	2194.110	2196.140	2198.170
570.4	2200.200	2202.230	2204.260	2206.290	2208.320	2210.350	2212.380	2214.410	2216.440	2218.470
570.5	2220.500	2222.530	2224.560	2226.590	2228.620	2230.650	2232.680	2234.710	2236.740	2238.770
570.6	2240.800	2242.830	2244.860	2246.890	2248.920	2250.950	2252.980	2255.010	2257.040	2259.070
570.7	2261.100	2263.130	2265.160	2267.190	2269.220	2271.250	2273.280	2275.310	2277.340	2279.370
570.8	2281.400	2283.430	2285.460	2287.490	2289.520	2291.550	2293.580	2295.610	2297.640	2299.670
570.9	2301.700	2303.730	2305.760	2307.790	2309.820	2311.850	2313.880	2315.910	2317.940	2319.970
571.0	2322.000	2323.820	2325.640	2327.460	2329.280	2331.100	2332.920	2334.740	2336.560	2338.380
571.1	2340.200	2342.020	2343.840	2345.660	2347.480	2349.300	2351.120	2352.940	2354.760	2356.580
571.2	2358.400	2360.220	2362.040	2363.860	2365.680	2367.500	2369.320	2371.140	2372.960	2374.780
571.3	2376.600	2378.420	2380.240	2382.060	2383.880	2385.700	2387.520	2389.340	2391.160	2392.980
571.4	2394.800	2396.620	2398.440	2400.260	2402.080	2403.900	2405.720	2407.540	2409.360	2411.180
571.5	2413.000	2414.820	2416.640	2418.460	2420.280	2422.100	2423.920	2425.740	2427.560	2429.380
571.6	2431.200	2433.020	2434.840	2436.660	2438.480	2440.300	2442.120	2443.940	2445.760	2447.580
571.7	2449.400	2451.220	2453.040	2454.860	2456.680	2458.500	2460.320	2462.140	2463.960	2465.780
571.8	2467.600	2469.420	2471.240	2473.060	2474.880	2476.700	2478.520	2480.340	2482.160	2483.980
571.9	2485.800	2487.620	2489.440	2491.260	2493.080	2494.900	2496.720	2498.540	2500.360	2502.180
572.0	2504.000	2505.980	2507.960	2509.940	2511.920	2513.900	2515.880	2517.860	2519.840	2521.820
572.1	2523.800	2525.780	2527.760	2529.740	2531.720	2533.700	2535.680	2537.660	2539.640	2541.620
572.2	2543.600	2545.580	2547.560	2549.540	2551.520	2553.500	2555.480	2557.460	2559.440	2561.420
572.3	2563.400	2565.380	2567.360	2569.340	2571.320	2573.300	2575.280	2577.260	2579.240	2581.220
572.4	2583.200	2585.180	2587.160	2589.140	2591.120	2593.100	2595.080	2597.060	2599.040	2601.020
572.5	2603.000	2604.980	2606.960	2608.940	2610.920	2612.900	2614.880	2616.860	2618.840	2620.820
572.6	2622.800	2624.780	2626.760	2628.740	2630.720	2632.700	2634.680	2636.660	2638.640	2640.620
572.7	2642.600	2644.580	2646.560	2648.540	2650.520	2652.500	2654.480	2656.460	2658.440	2660.420
572.8	2662.400	2664.380	2666.360	2668.340	2670.320	2672.300	2674.280	2676.260	2678.240	2680.220
572.9	2682.200	2684.180	2686.160	2688.140	2690.120	2692.100	2694.080	2696.060	2698.040	2700.020
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. AREA**

ELEVATIONS IN FEET-NGVD, AREA (IN ACRES)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
573.0	2702.000	2704.240	2706.480	2708.720	2710.960	2713.200	2715.440	2717.680	2719.920	2722.160
573.1	2724.400	2726.640	2728.880	2731.120	2733.360	2735.600	2737.840	2740.080	2742.320	2744.560
573.2	2746.800	2749.040	2751.280	2753.520	2755.760	2758.000	2760.240	2762.480	2764.720	2766.960
573.3	2769.200	2771.440	2773.680	2775.920	2778.160	2780.400	2782.640	2784.880	2787.120	2789.360
573.4	2791.600	2793.840	2796.080	2798.320	2800.560	2802.800	2805.040	2807.280	2809.520	2811.760
573.5	2814.000	2816.240	2818.480	2820.720	2822.960	2825.200	2827.440	2829.680	2831.920	2834.160
573.6	2836.400	2838.640	2840.880	2843.120	2845.360	2847.600	2849.840	2852.080	2854.320	2856.560
573.7	2858.800	2861.040	2863.280	2865.520	2867.760	2870.000	2872.240	2874.480	2876.720	2878.960
573.8	2881.200	2883.440	2885.680	2887.920	2890.160	2892.400	2894.640	2896.880	2899.120	2901.360
573.9	2903.600	2905.840	2908.080	2910.320	2912.560	2914.800	2917.040	2919.280	2921.520	2923.760
574.0	2926.000	2928.280	2930.560	2932.840	2935.120	2937.400	2939.680	2941.960	2944.240	2946.520
574.1	2948.800	2951.080	2953.360	2955.640	2957.920	2960.200	2962.480	2964.760	2967.040	2969.320
574.2	2971.600	2973.880	2976.160	2978.440	2980.720	2983.000	2985.280	2987.560	2989.840	2992.120
574.3	2994.400	2996.680	2998.960	3001.240	3003.520	3005.800	3008.080	3010.360	3012.640	3014.920
574.4	3017.200	3019.480	3021.760	3024.040	3026.320	3028.600	3030.880	3033.160	3035.440	3037.720
574.5	3040.000	3042.280	3044.560	3046.840	3049.120	3051.400	3053.680	3055.960	3058.240	3060.520
574.6	3062.800	3065.080	3067.360	3069.640	3071.920	3074.200	3076.480	3078.760	3081.040	3083.320
574.7	3085.600	3087.880	3090.160	3092.440	3094.720	3097.000	3099.280	3101.560	3103.840	3106.120
574.8	3108.400	3110.680	3112.960	3115.240	3117.520	3119.800	3122.080	3124.360	3126.640	3128.920
574.9	3131.200	3133.480	3135.760	3138.040	3140.320	3142.600	3144.880	3147.160	3149.440	3151.720
575.0	3154.000	3156.350	3158.700	3161.050	3163.400	3165.750	3168.100	3170.450	3172.800	3175.150
575.1	3177.500	3179.850	3182.200	3184.550	3186.900	3189.250	3191.600	3193.950	3196.300	3198.650
575.2	3201.000	3203.350	3205.700	3208.050	3210.400	3212.750	3215.100	3217.450	3219.800	3222.150
575.3	3224.500	3226.850	3229.200	3231.550	3233.900	3236.250	3238.600	3240.950	3243.300	3245.650
575.4	3248.000	3250.350	3252.700	3255.050	3257.400	3259.750	3262.100	3264.450	3266.800	3269.150
575.5	3271.500	3273.850	3276.200	3278.550	3280.900	3283.250	3285.600	3287.950	3290.300	3292.650
575.6	3295.000	3297.350	3299.700	3302.050	3304.400	3306.750	3309.100	3311.450	3313.800	3316.150
575.7	3318.500	3320.850	3323.200	3325.550	3327.900	3330.250	3332.600	3334.950	3337.300	3339.650
575.8	3342.000	3344.350	3346.700	3349.050	3351.400	3353.750	3356.100	3358.450	3360.800	3363.150
575.9	3365.500	3367.850	3370.200	3372.550	3374.900	3377.250	3379.600	3381.950	3384.300	3386.650
576.0	3389.000	3391.180	3393.360	3395.540	3397.720	3399.900	3402.080	3404.260	3406.440	3408.620
576.1	3410.800	3412.980	3415.160	3417.340	3419.520	3421.700	3423.880	3426.060	3428.240	3430.420
576.2	3432.600	3434.780	3436.960	3439.140	3441.320	3443.500	3445.680	3447.860	3450.040	3452.220
576.3	3454.400	3456.580	3458.760	3460.940	3463.120	3465.300	3467.480	3469.660	3471.840	3474.020
576.4	3476.200	3478.380	3480.560	3482.740	3484.920	3487.100	3489.280	3491.460	3493.640	3495.820
576.5	3498.000	3500.180	3502.360	3504.540	3506.720	3508.900	3511.080	3513.260	3515.440	3517.620
576.6	3519.800	3521.980	3524.160	3526.340	3528.520	3530.700	3532.880	3535.060	3537.240	3539.420
576.7	3541.600	3543.780	3545.960	3548.140	3550.320	3552.500	3554.680	3556.860	3559.040	3561.220
576.8	3563.400	3565.580	3567.760	3569.940	3572.120	3574.300	3576.480	3578.660	3580.840	3583.020
576.9	3585.200	3587.380	3589.560	3591.740	3593.920	3596.100	3598.280	3600.460	3602.640	3604.820
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. AREA**

ELEVATIONS IN FEET-NGVD, AREA (IN ACRES)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
577.0	3607.000	3609.220	3611.440	3613.660	3615.880	3618.100	3620.320	3622.540	3624.760	3626.980
577.1	3629.200	3631.420	3633.640	3635.860	3638.080	3640.300	3642.520	3644.740	3646.960	3649.180
577.2	3651.400	3653.620	3655.840	3658.060	3660.280	3662.500	3664.720	3666.940	3669.160	3671.380
577.3	3673.600	3675.820	3678.040	3680.260	3682.480	3684.700	3686.920	3689.140	3691.360	3693.580
577.4	3695.800	3698.020	3700.240	3702.460	3704.680	3706.900	3709.120	3711.340	3713.560	3715.780
577.5	3718.000	3720.220	3722.440	3724.660	3726.880	3729.100	3731.320	3733.540	3735.760	3737.980
577.6	3740.200	3742.420	3744.640	3746.860	3749.080	3751.300	3753.520	3755.740	3757.960	3760.180
577.7	3762.400	3764.620	3766.840	3769.060	3771.280	3773.500	3775.720	3777.940	3780.160	3782.380
577.8	3784.600	3786.820	3789.040	3791.260	3793.480	3795.700	3797.920	3800.140	3802.360	3804.580
577.9	3806.800	3809.020	3811.240	3813.460	3815.680	3817.900	3820.120	3822.340	3824.560	3826.780
578.0	3829.000	3831.510	3834.020	3836.530	3839.040	3841.550	3844.060	3846.570	3849.080	3851.590
578.1	3854.100	3856.610	3859.120	3861.630	3864.140	3866.650	3869.160	3871.670	3874.180	3876.690
578.2	3879.200	3881.710	3884.220	3886.730	3889.240	3891.750	3894.260	3896.770	3899.280	3901.790
578.3	3904.300	3906.810	3909.320	3911.830	3914.340	3916.850	3919.360	3921.870	3924.380	3926.890
578.4	3929.400	3931.910	3934.420	3936.930	3939.440	3941.950	3944.460	3946.970	3949.480	3951.990
578.5	3954.500	3957.010	3959.520	3962.030	3964.540	3967.050	3969.560	3972.070	3974.580	3977.090
578.6	3979.600	3982.110	3984.620	3987.130	3989.640	3992.150	3994.660	3997.170	3999.680	4002.190
578.7	4004.700	4007.210	4009.720	4012.230	4014.740	4017.250	4019.760	4022.270	4024.780	4027.290
578.8	4029.800	4032.310	4034.820	4037.330	4039.840	4042.350	4044.860	4047.370	4049.880	4052.390
578.9	4054.900	4057.410	4059.920	4062.430	4064.940	4067.450	4069.960	4072.470	4074.980	4077.490
579.0	4080.000	4082.490	4084.980	4087.470	4089.960	4092.450	4094.940	4097.430	4099.920	4102.410
579.1	4104.900	4107.390	4109.880	4112.370	4114.860	4117.350	4119.840	4122.330	4124.820	4127.310
579.2	4129.800	4132.290	4134.780	4137.270	4139.760	4142.250	4144.740	4147.230	4149.720	4152.210
579.3	4154.700	4157.190	4159.680	4162.170	4164.660	4167.150	4169.640	4172.130	4174.620	4177.110
579.4	4179.600	4182.090	4184.580	4187.070	4189.560	4192.050	4194.540	4197.030	4199.520	4202.010
579.5	4204.500	4206.990	4209.480	4211.970	4214.460	4216.950	4219.440	4221.930	4224.420	4226.910
579.6	4229.400	4231.890	4234.380	4236.870	4239.360	4241.850	4244.340	4246.830	4249.320	4251.810
579.7	4254.300	4256.790	4259.280	4261.770	4264.260	4266.750	4269.240	4271.730	4274.220	4276.710
579.8	4279.200	4281.690	4284.180	4286.670	4289.160	4291.650	4294.140	4296.630	4299.120	4301.610
579.9	4304.100	4306.590	4309.080	4311.570	4314.060	4316.550	4319.040	4321.530	4324.020	4326.510
580.0	4329.000	4331.540	4334.080	4336.620	4339.160	4341.700	4344.240	4346.780	4349.320	4351.860
580.1	4354.400	4356.940	4359.480	4362.020	4364.560	4367.100	4369.640	4372.180	4374.720	4377.260
580.2	4379.800	4382.340	4384.880	4387.420	4389.960	4392.500	4395.040	4397.580	4400.120	4402.660
580.3	4405.200	4407.740	4410.280	4412.820	4415.360	4417.900	4420.440	4422.980	4425.520	4428.060
580.4	4430.600	4433.140	4435.680	4438.220	4440.760	4443.300	4445.840	4448.380	4450.920	4453.460
580.5	4456.000	4458.540	4461.080	4463.620	4466.160	4468.700	4471.240	4473.780	4476.320	4478.860
580.6	4481.400	4483.940	4486.480	4489.020	4491.560	4494.100	4496.640	4499.180	4501.720	4504.260
580.7	4506.800	4509.340	4511.880	4514.420	4516.960	4519.500	4522.040	4524.580	4527.120	4529.660
580.8	4532.200	4534.740	4537.280	4539.820	4542.360	4544.900	4547.440	4549.980	4552.520	4555.060
580.9	4557.600	4560.140	4562.680	4565.220	4567.760	4570.300	4572.840	4575.380	4577.920	4580.460
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. AREA**

ELEVATIONS IN FEET-NGVD, AREA (IN ACRES)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
581.0	4583.000	4585.740	4588.480	4591.220	4593.960	4596.700	4599.440	4602.180	4604.920	4607.660
581.1	4610.400	4613.140	4615.880	4618.620	4621.360	4624.100	4626.840	4629.580	4632.320	4635.060
581.2	4637.800	4640.540	4643.280	4646.020	4648.760	4651.500	4654.240	4656.980	4659.720	4662.460
581.3	4665.200	4667.940	4670.680	4673.420	4676.160	4678.900	4681.640	4684.380	4687.120	4689.860
581.4	4692.600	4695.340	4698.080	4700.820	4703.560	4706.300	4709.040	4711.780	4714.520	4717.260
581.5	4720.000	4722.740	4725.480	4728.220	4730.960	4733.700	4736.440	4739.180	4741.920	4744.660
581.6	4747.400	4750.140	4752.880	4755.620	4758.360	4761.100	4763.840	4766.580	4769.320	4772.060
581.7	4774.800	4777.540	4780.280	4783.020	4785.760	4788.500	4791.240	4793.980	4796.720	4799.460
581.8	4802.200	4804.940	4807.680	4810.420	4813.160	4815.900	4818.640	4821.380	4824.120	4826.860
581.9	4829.600	4832.340	4835.080	4837.820	4840.560	4843.300	4846.040	4848.780	4851.520	4854.260
582.0	4857.000	4859.840	4862.680	4865.520	4868.360	4871.200	4874.040	4876.880	4879.720	4882.560
582.1	4885.400	4888.240	4891.080	4893.920	4896.760	4899.600	4902.440	4905.280	4908.120	4910.960
582.2	4913.800	4916.640	4919.480	4922.320	4925.160	4928.000	4930.840	4933.680	4936.520	4939.360
582.3	4942.200	4945.040	4947.880	4950.720	4953.560	4956.400	4959.240	4962.080	4964.920	4967.760
582.4	4970.600	4973.440	4976.280	4979.120	4981.960	4984.800	4987.640	4990.480	4993.320	4996.160
582.5	4999.000	5001.840	5004.680	5007.520	5010.360	5013.200	5016.040	5018.880	5021.720	5024.560
582.6	5027.400	5030.240	5033.080	5035.920	5038.760	5041.600	5044.440	5047.280	5050.120	5052.960
582.7	5055.800	5058.640	5061.480	5064.320	5067.160	5070.000	5072.840	5075.680	5078.520	5081.360
582.8	5084.200	5087.040	5089.880	5092.720	5095.560	5098.400	5101.240	5104.080	5106.920	5109.760
582.9	5112.600	5115.440	5118.280	5121.120	5123.960	5126.800	5129.640	5132.480	5135.320	5138.160
583.0	5141.000	5143.900	5146.800	5149.700	5152.600	5155.500	5158.400	5161.300	5164.200	5167.100
583.1	5170.000	5172.900	5175.800	5178.700	5181.600	5184.500	5187.400	5190.300	5193.200	5196.100
583.2	5199.000	5201.900	5204.800	5207.700	5210.600	5213.500	5216.400	5219.300	5222.200	5225.100
583.3	5228.000	5230.900	5233.800	5236.700	5239.600	5242.500	5245.400	5248.300	5251.200	5254.100
583.4	5257.000	5259.900	5262.800	5265.700	5268.600	5271.500	5274.400	5277.300	5280.200	5283.100
583.5	5286.000	5288.900	5291.800	5294.700	5297.600	5300.500	5303.400	5306.300	5309.200	5312.100
583.6	5315.000	5317.900	5320.800	5323.700	5326.600	5329.500	5332.400	5335.300	5338.200	5341.100
583.7	5344.000	5346.900	5349.800	5352.700	5355.600	5358.500	5361.400	5364.300	5367.200	5370.100
583.8	5373.000	5375.900	5378.800	5381.700	5384.600	5387.500	5390.400	5393.300	5396.200	5399.100
583.9	5402.000	5404.900	5407.800	5410.700	5413.600	5416.500	5419.400	5422.300	5425.200	5428.100
584.0	5431.000	5433.950	5436.900	5439.850	5442.800	5445.750	5448.700	5451.650	5454.600	5457.550
584.1	5460.500	5463.450	5466.400	5469.350	5472.300	5475.250	5478.200	5481.150	5484.100	5487.050
584.2	5490.000	5492.950	5495.900	5498.850	5501.800	5504.750	5507.700	5510.650	5513.600	5516.550
584.3	5519.500	5522.450	5525.400	5528.350	5531.300	5534.250	5537.200	5540.150	5543.100	5546.050
584.4	5549.000	5551.950	5554.900	5557.850	5560.800	5563.750	5566.700	5569.650	5572.600	5575.550
584.5	5578.500	5581.450	5584.400	5587.350	5590.300	5593.250	5596.200	5599.150	5602.100	5605.050
584.6	5608.000	5610.950	5613.900	5616.850	5619.800	5622.750	5625.700	5628.650	5631.600	5634.550
584.7	5637.500	5640.450	5643.400	5646.350	5649.300	5652.250	5655.200	5658.150	5661.100	5664.050
584.8	5667.000	5669.950	5672.900	5675.850	5678.800	5681.750	5684.700	5687.650	5690.600	5693.550
584.9	5696.500	5699.450	5702.400	5705.350	5708.300	5711.250	5714.200	5717.150	5720.100	5723.050
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. AREA**

ELEVATIONS IN FEET-NGVD, AREA (IN ACRES)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
585.0	5726.000	5728.630	5731.260	5733.890	5736.520	5739.150	5741.780	5744.410	5747.040	5749.670
585.1	5752.300	5754.930	5757.560	5760.190	5762.820	5765.450	5768.080	5770.710	5773.340	5775.970
585.2	5778.600	5781.230	5783.860	5786.490	5789.120	5791.750	5794.380	5797.010	5799.640	5802.270
585.3	5804.900	5807.530	5810.160	5812.790	5815.420	5818.050	5820.680	5823.310	5825.940	5828.570
585.4	5831.200	5833.830	5836.460	5839.090	5841.720	5844.350	5846.980	5849.610	5852.240	5854.870
585.5	5857.500	5860.130	5862.760	5865.390	5868.020	5870.650	5873.280	5875.910	5878.540	5881.170
585.6	5883.800	5886.430	5889.060	5891.690	5894.320	5896.950	5899.580	5902.210	5904.840	5907.470
585.7	5910.100	5912.730	5915.360	5917.990	5920.620	5923.250	5925.880	5928.510	5931.140	5933.770
585.8	5936.400	5939.030	5941.660	5944.290	5946.920	5949.550	5952.180	5954.810	5957.440	5960.070
585.9	5962.700	5965.330	5967.960	5970.590	5973.220	5975.850	5978.480	5981.110	5983.740	5986.370
586.0	5989.000	5991.310	5993.620	5995.930	5998.240	6000.550	6002.860	6005.170	6007.480	6009.790
586.1	6012.100	6014.410	6016.720	6019.030	6021.340	6023.650	6025.960	6028.270	6030.580	6032.890
586.2	6035.200	6037.510	6039.820	6042.130	6044.440	6046.750	6049.060	6051.370	6053.680	6055.990
586.3	6058.300	6060.610	6062.920	6065.230	6067.540	6069.850	6072.160	6074.470	6076.780	6079.090
586.4	6081.400	6083.710	6086.020	6088.330	6090.640	6092.950	6095.260	6097.570	6099.880	6102.190
586.5	6104.500	6106.810	6109.120	6111.430	6113.740	6116.050	6118.360	6120.670	6122.980	6125.290
586.6	6127.600	6129.910	6132.220	6134.530	6136.840	6139.150	6141.460	6143.770	6146.080	6148.390
586.7	6150.700	6153.010	6155.320	6157.630	6159.940	6162.250	6164.560	6166.870	6169.180	6171.490
586.8	6173.800	6176.110	6178.420	6180.730	6183.040	6185.350	6187.660	6189.970	6192.280	6194.590
586.9	6196.900	6199.210	6201.520	6203.830	6206.140	6208.450	6210.760	6213.070	6215.380	6217.690
587.0	6220.000	6222.410	6224.820	6227.230	6229.640	6232.050	6234.460	6236.870	6239.280	6241.690
587.1	6244.100	6246.510	6248.920	6251.330	6253.740	6256.150	6258.560	6260.970	6263.380	6265.790
587.2	6268.200	6270.610	6273.020	6275.430	6277.840	6280.250	6282.660	6285.070	6287.480	6289.890
587.3	6292.300	6294.710	6297.120	6299.530	6301.940	6304.350	6306.760	6309.170	6311.580	6313.990
587.4	6316.400	6318.810	6321.220	6323.630	6326.040	6328.450	6330.860	6333.270	6335.680	6338.090
587.5	6340.500	6342.910	6345.320	6347.730	6350.140	6352.550	6354.960	6357.370	6359.780	6362.190
587.6	6364.600	6367.010	6369.420	6371.830	6374.240	6376.650	6379.060	6381.470	6383.880	6386.290
587.7	6388.700	6391.110	6393.520	6395.930	6398.340	6400.750	6403.160	6405.570	6407.980	6410.390
587.8	6412.800	6415.210	6417.620	6420.030	6422.440	6424.850	6427.260	6429.670	6432.080	6434.490
587.9	6436.900	6439.310	6441.720	6444.130	6446.540	6448.950	6451.360	6453.770	6456.180	6458.590
588.0	6461.000	6463.510	6466.020	6468.530	6471.040	6473.550	6476.060	6478.570	6481.080	6483.590
588.1	6486.100	6488.610	6491.120	6493.630	6496.140	6498.650	6501.160	6503.670	6506.180	6508.690
588.2	6511.200	6513.710	6516.220	6518.730	6521.240	6523.750	6526.260	6528.770	6531.280	6533.790
588.3	6536.300	6538.810	6541.320	6543.830	6546.340	6548.850	6551.360	6553.870	6556.380	6558.890
588.4	6561.400	6563.910	6566.420	6568.930	6571.440	6573.950	6576.460	6578.970	6581.480	6583.990
588.5	6586.500	6589.010	6591.520	6594.030	6596.540	6599.050	6601.560	6604.070	6606.580	6609.090
588.6	6611.600	6614.110	6616.620	6619.130	6621.640	6624.150	6626.660	6629.170	6631.680	6634.190
588.7	6636.700	6639.210	6641.720	6644.230	6646.740	6649.250	6651.760	6654.270	6656.780	6659.290
588.8	6661.800	6664.310	6666.820	6669.330	6671.840	6674.350	6676.860	6679.370	6681.880	6684.390
588.9	6686.900	6689.410	6691.920	6694.430	6696.940	6699.450	6701.960	6704.470	6706.980	6709.490
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. AREA**

ELEVATIONS IN FEET-NGVD, AREA (IN ACRES)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
589.0	6712.000	6714.420	6716.840	6719.260	6721.680	6724.100	6726.520	6728.940	6731.360	6733.780
589.1	6736.200	6738.620	6741.040	6743.460	6745.880	6748.300	6750.720	6753.140	6755.560	6757.980
589.2	6760.400	6762.820	6765.240	6767.660	6770.080	6772.500	6774.920	6777.340	6779.760	6782.180
589.3	6784.600	6787.020	6789.440	6791.860	6794.280	6796.700	6799.120	6801.540	6803.960	6806.380
589.4	6808.800	6811.220	6813.640	6816.060	6818.480	6820.900	6823.320	6825.740	6828.160	6830.580
589.5	6833.000	6835.420	6837.840	6840.260	6842.680	6845.100	6847.520	6849.940	6852.360	6854.780
589.6	6857.200	6859.620	6862.040	6864.460	6866.880	6869.300	6871.720	6874.140	6876.560	6878.980
589.7	6881.400	6883.820	6886.240	6888.660	6891.080	6893.500	6895.920	6898.340	6900.760	6903.180
589.8	6905.600	6908.020	6910.440	6912.860	6915.280	6917.700	6920.120	6922.540	6924.960	6927.380
589.9	6929.800	6932.220	6934.640	6937.060	6939.480	6941.900	6944.320	6946.740	6949.160	6951.580
590.0	6954.000	6956.390	6958.780	6961.170	6963.560	6965.950	6968.340	6970.730	6973.120	6975.510
590.1	6977.900	6980.290	6982.680	6985.070	6987.460	6989.850	6992.240	6994.630	6997.020	6999.410
590.2	7001.800	7004.190	7006.580	7008.970	7011.360	7013.750	7016.140	7018.530	7020.920	7023.310
590.3	7025.700	7028.090	7030.480	7032.870	7035.260	7037.650	7040.040	7042.430	7044.820	7047.210
590.4	7049.600	7051.990	7054.380	7056.770	7059.160	7061.550	7063.940	7066.330	7068.720	7071.110
590.5	7073.500	7075.890	7078.280	7080.670	7083.060	7085.450	7087.840	7090.230	7092.620	7095.010
590.6	7097.400	7099.790	7102.180	7104.570	7106.960	7109.350	7111.740	7114.130	7116.520	7118.910
590.7	7121.300	7123.690	7126.080	7128.470	7130.860	7133.250	7135.640	7138.030	7140.420	7142.810
590.8	7145.200	7147.590	7149.980	7152.370	7154.760	7157.150	7159.540	7161.930	7164.320	7166.710
590.9	7169.100	7171.490	7173.880	7176.270	7178.660	7181.050	7183.440	7185.830	7188.220	7190.610
591.0	7193.000	7195.370	7197.740	7200.110	7202.480	7204.850	7207.220	7209.590	7211.960	7214.330
591.1	7216.700	7219.070	7221.440	7223.810	7226.180	7228.550	7230.920	7233.290	7235.660	7238.030
591.2	7240.400	7242.770	7245.140	7247.510	7249.880	7252.250	7254.620	7256.990	7259.360	7261.730
591.3	7264.100	7266.470	7268.840	7271.210	7273.580	7275.950	7278.320	7280.690	7283.060	7285.430
591.4	7287.800	7290.170	7292.540	7294.910	7297.280	7299.650	7302.020	7304.390	7306.760	7309.130
591.5	7311.500	7313.870	7316.240	7318.610	7320.980	7323.350	7325.720	7328.090	7330.460	7332.830
591.6	7335.200	7337.570	7339.940	7342.310	7344.680	7347.050	7349.420	7351.790	7354.160	7356.530
591.7	7358.900	7361.270	7363.640	7366.010	7368.380	7370.750	7373.120	7375.490	7377.860	7380.230
591.8	7382.600	7384.970	7387.340	7389.710	7392.080	7394.450	7396.820	7399.190	7401.560	7403.930
591.9	7406.300	7408.670	7411.040	7413.410	7415.780	7418.150	7420.520	7422.890	7425.260	7427.630
592.0	7430.000	7432.320	7434.640	7436.960	7439.280	7441.600	7443.920	7446.240	7448.560	7450.880
592.1	7453.200	7455.520	7457.840	7460.160	7462.480	7464.800	7467.120	7469.440	7471.760	7474.080
592.2	7476.400	7478.720	7481.040	7483.360	7485.680	7488.000	7490.320	7492.640	7494.960	7497.280
592.3	7499.600	7501.920	7504.240	7506.560	7508.880	7511.200	7513.520	7515.840	7518.160	7520.480
592.4	7522.800	7525.120	7527.440	7529.760	7532.080	7534.400	7536.720	7539.040	7541.360	7543.680
592.5	7546.000	7548.320	7550.640	7552.960	7555.280	7557.600	7559.920	7562.240	7564.560	7566.880
592.6	7569.200	7571.520	7573.840	7576.160	7578.480	7580.800	7583.120	7585.440	7587.760	7590.080
592.7	7592.400	7594.720	7597.040	7599.360	7601.680	7604.000	7606.320	7608.640	7610.960	7613.280
592.8	7615.600	7617.920	7620.240	7622.560	7624.880	7627.200	7629.520	7631.840	7634.160	7636.480
592.9	7638.800	7641.120	7643.440	7645.760	7648.080	7650.400	7652.720	7655.040	7657.360	7659.680
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. AREA**

ELEVATIONS IN FEET-NGVD, AREA (IN ACRES)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
593.0	7662.000	7664.540	7667.080	7669.620	7672.160	7674.700	7677.240	7679.780	7682.320	7684.860
593.1	7687.400	7689.940	7692.480	7695.020	7697.560	7700.100	7702.640	7705.180	7707.720	7710.260
593.2	7712.800	7715.340	7717.880	7720.420	7722.960	7725.500	7728.040	7730.580	7733.120	7735.660
593.3	7738.200	7740.740	7743.280	7745.820	7748.360	7750.900	7753.440	7755.980	7758.520	7761.060
593.4	7763.600	7766.140	7768.680	7771.220	7773.760	7776.300	7778.840	7781.380	7783.920	7786.460
593.5	7789.000	7791.540	7794.080	7796.620	7799.160	7801.700	7804.240	7806.780	7809.320	7811.860
593.6	7814.400	7816.940	7819.480	7822.020	7824.560	7827.100	7829.640	7832.180	7834.720	7837.260
593.7	7839.800	7842.340	7844.880	7847.420	7849.960	7852.500	7855.040	7857.580	7860.120	7862.660
593.8	7865.200	7867.740	7870.280	7872.820	7875.360	7877.900	7880.440	7882.980	7885.520	7888.060
593.9	7890.600	7893.140	7895.680	7898.220	7900.760	7903.300	7905.840	7908.380	7910.920	7913.460
594.0	7916.000	7918.690	7921.380	7924.070	7926.760	7929.450	7932.140	7934.830	7937.520	7940.210
594.1	7942.900	7945.590	7948.280	7950.970	7953.660	7956.350	7959.040	7961.730	7964.420	7967.110
594.2	7969.800	7972.490	7975.180	7977.870	7980.560	7983.250	7985.940	7988.630	7991.320	7994.010
594.3	7996.700	7999.390	8002.080	8004.770	8007.460	8010.150	8012.840	8015.530	8018.220	8020.910
594.4	8023.600	8026.290	8028.980	8031.670	8034.360	8037.050	8039.740	8042.430	8045.120	8047.810
594.5	8050.500	8053.190	8055.880	8058.570	8061.260	8063.950	8066.640	8069.330	8072.020	8074.710
594.6	8077.400	8080.090	8082.780	8085.470	8088.160	8090.850	8093.540	8096.230	8098.920	8101.610
594.7	8104.300	8106.990	8109.680	8112.370	8115.060	8117.750	8120.440	8123.130	8125.820	8128.510
594.8	8131.200	8133.890	8136.580	8139.270	8141.960	8144.650	8147.340	8150.030	8152.720	8155.410
594.9	8158.100	8160.790	8163.480	8166.170	8168.860	8171.550	8174.240	8176.930	8179.620	8182.310
595.0	8185.000	8188.020	8191.040	8194.060	8197.080	8200.100	8203.120	8206.140	8209.160	8212.180
595.1	8215.200	8218.220	8221.240	8224.260	8227.280	8230.300	8233.320	8236.340	8239.360	8242.380
595.2	8245.400	8248.420	8251.440	8254.460	8257.480	8260.500	8263.520	8266.540	8269.560	8272.580
595.3	8275.600	8278.620	8281.640	8284.660	8287.680	8290.700	8293.720	8296.740	8299.760	8302.780
595.4	8305.800	8308.820	8311.840	8314.860	8317.880	8320.900	8323.920	8326.940	8329.960	8332.980
595.5	8336.000	8339.020	8342.040	8345.060	8348.080	8351.100	8354.120	8357.140	8360.160	8363.180
595.6	8366.200	8369.220	8372.240	8375.260	8378.280	8381.300	8384.320	8387.340	8390.360	8393.380
595.7	8396.400	8399.420	8402.440	8405.460	8408.480	8411.500	8414.520	8417.540	8420.560	8423.580
595.8	8426.600	8429.620	8432.640	8435.660	8438.680	8441.700	8444.720	8447.740	8450.760	8453.780
595.9	8456.800	8459.820	8462.840	8465.860	8468.880	8471.900	8474.920	8477.940	8480.960	8483.980
596.0	8487.000	8490.150	8493.300	8496.450	8499.600	8502.750	8505.900	8509.050	8512.200	8515.350
596.1	8518.500	8521.650	8524.800	8527.950	8531.100	8534.250	8537.400	8540.550	8543.700	8546.850
596.2	8550.000	8553.150	8556.300	8559.450	8562.600	8565.750	8568.900	8572.050	8575.200	8578.350
596.3	8581.500	8584.650	8587.800	8590.950	8594.100	8597.250	8600.400	8603.550	8606.700	8609.850
596.4	8613.000	8616.150	8619.300	8622.450	8625.600	8628.750	8631.900	8635.050	8638.200	8641.350
596.5	8644.500	8647.650	8650.800	8653.950	8657.100	8660.250	8663.400	8666.550	8669.700	8672.850
596.6	8676.000	8679.150	8682.300	8685.450	8688.600	8691.750	8694.900	8698.050	8701.200	8704.350
596.7	8707.500	8710.650	8713.800	8716.950	8720.100	8723.250	8726.400	8729.550	8732.700	8735.850
596.8	8739.000	8742.150	8745.300	8748.450	8751.600	8754.750	8757.900	8761.050	8764.200	8767.350
596.9	8770.500	8773.650	8776.800	8779.950	8783.100	8786.250	8789.400	8792.550	8795.700	8798.850
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. AREA**

ELEVATIONS IN FEET-NGVD, AREA (IN ACRES)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
597.0	8802.000	8805.570	8809.140	8812.710	8816.280	8819.850	8823.420	8826.990	8830.560	8834.130
597.1	8837.700	8841.270	8844.840	8848.410	8851.980	8855.550	8859.120	8862.690	8866.260	8869.830
597.2	8873.400	8876.970	8880.540	8884.110	8887.680	8891.250	8894.820	8898.390	8901.960	8905.530
597.3	8909.100	8912.670	8916.240	8919.810	8923.380	8926.950	8930.520	8934.090	8937.660	8941.230
597.4	8944.800	8948.370	8951.940	8955.510	8959.080	8962.650	8966.220	8969.790	8973.360	8976.930
597.5	8980.500	8984.070	8987.640	8991.210	8994.780	8998.350	9001.920	9005.490	9009.060	9012.630
597.6	9016.200	9019.770	9023.340	9026.910	9030.480	9034.050	9037.620	9041.190	9044.760	9048.330
597.7	9051.900	9055.470	9059.040	9062.610	9066.180	9069.750	9073.320	9076.890	9080.460	9084.030
597.8	9087.600	9091.170	9094.740	9098.310	9101.880	9105.450	9109.020	9112.590	9116.160	9119.730
597.9	9123.300	9126.870	9130.440	9134.010	9137.580	9141.150	9144.720	9148.290	9151.860	9155.430
598.0	9159.000	9162.760	9166.520	9170.280	9174.040	9177.800	9181.560	9185.320	9189.080	9192.840
598.1	9196.600	9200.360	9204.120	9207.880	9211.640	9215.400	9219.160	9222.920	9226.680	9230.440
598.2	9234.200	9237.960	9241.720	9245.480	9249.240	9253.000	9256.760	9260.520	9264.280	9268.040
598.3	9271.800	9275.560	9279.320	9283.080	9286.840	9290.600	9294.360	9298.120	9301.880	9305.640
598.4	9309.400	9313.160	9316.920	9320.680	9324.440	9328.200	9331.960	9335.720	9339.480	9343.240
598.5	9347.000	9350.760	9354.520	9358.280	9362.040	9365.800	9369.560	9373.320	9377.080	9380.840
598.6	9384.600	9388.360	9392.120	9395.880	9399.640	9403.400	9407.160	9410.920	9414.680	9418.440
598.7	9422.200	9425.960	9429.720	9433.480	9437.240	9441.000	9444.760	9448.520	9452.280	9456.040
598.8	9459.800	9463.560	9467.320	9471.080	9474.840	9478.600	9482.360	9486.120	9489.880	9493.640
598.9	9497.400	9501.160	9504.920	9508.680	9512.440	9516.200	9519.960	9523.720	9527.480	9531.240
599.0	9535.000	9539.040	9543.080	9547.120	9551.160	9555.200	9559.240	9563.280	9567.320	9571.360
599.1	9575.400	9579.440	9583.480	9587.520	9591.560	9595.600	9599.640	9603.680	9607.720	9611.760
599.2	9615.800	9619.840	9623.880	9627.920	9631.960	9636.000	9640.040	9644.080	9648.120	9652.160
599.3	9656.200	9660.240	9664.280	9668.320	9672.360	9676.400	9680.440	9684.480	9688.520	9692.560
599.4	9696.600	9700.640	9704.680	9708.720	9712.760	9716.800	9720.840	9724.880	9728.920	9732.960
599.5	9737.000	9741.040	9745.080	9749.120	9753.160	9757.200	9761.240	9765.280	9769.320	9773.360
599.6	9777.400	9781.440	9785.480	9789.520	9793.560	9797.600	9801.640	9805.680	9809.720	9813.760
599.7	9817.800	9821.840	9825.880	9829.920	9833.960	9838.000	9842.040	9846.080	9850.120	9854.160
599.8	9858.200	9862.240	9866.280	9870.320	9874.360	9878.400	9882.440	9886.480	9890.520	9894.560
599.9	9898.600	9902.640	9906.680	9910.720	9914.760	9918.800	9922.840	9926.880	9930.920	9934.960
600.0	9939.000	9943.120	9947.240	9951.360	9955.480	9959.600	9963.720	9967.840	9971.960	9976.080
600.1	9980.200	9984.320	9988.440	9992.560	9996.680	10000.800	10004.920	10009.040	10013.160	10017.280
600.2	10021.400	10025.520	10029.640	10033.760	10037.880	10042.000	10046.120	10050.240	10054.360	10058.480
600.3	10062.600	10066.720	10070.840	10074.960	10079.080	10083.200	10087.320	10091.440	10095.560	10099.680
600.4	10103.800	10107.920	10112.040	10116.160	10120.280	10124.400	10128.520	10132.640	10136.760	10140.880
600.5	10145.000	10149.120	10153.240	10157.360	10161.480	10165.600	10169.720	10173.840	10177.960	10182.080
600.6	10186.200	10190.320	10194.440	10198.560	10202.680	10206.800	10210.920	10215.040	10219.160	10223.280
600.7	10227.400	10231.520	10235.640	10239.760	10243.880	10248.000	10252.120	10256.240	10260.360	10264.480
600.8	10268.600	10272.720	10276.840	10280.960	10285.080	10289.200	10293.320	10297.440	10301.560	10305.680
600.9	10309.800	10313.920	10318.040	10322.160	10326.280	10330.400	10334.520	10338.640	10342.760	10346.880
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. AREA**

ELEVATIONS IN FEET-NGVD, AREA (IN ACRES)

ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
601.0	10351.000	10355.170	10359.340	10363.510	10367.680	10371.850	10376.020	10380.190	10384.360	10388.530
601.1	10392.700	10396.870	10401.040	10405.210	10409.380	10413.550	10417.720	10421.890	10426.060	10430.230
601.2	10434.400	10438.570	10442.740	10446.910	10451.080	10455.250	10459.420	10463.590	10467.760	10471.930
601.3	10476.100	10480.270	10484.440	10488.610	10492.780	10496.950	10501.120	10505.290	10509.460	10513.630
601.4	10517.800	10521.970	10526.140	10530.310	10534.480	10538.650	10542.820	10546.990	10551.160	10555.330
601.5	10559.500	10563.670	10567.840	10572.010	10576.180	10580.350	10584.520	10588.690	10592.860	10597.030
601.6	10601.200	10605.370	10609.540	10613.710	10617.880	10622.050	10626.220	10630.390	10634.560	10638.730
601.7	10642.900	10647.070	10651.240	10655.410	10659.580	10663.750	10667.920	10672.090	10676.260	10680.430
601.8	10684.600	10688.770	10692.940	10697.110	10701.280	10705.450	10709.620	10713.790	10717.960	10722.130
601.9	10726.300	10730.470	10734.640	10738.810	10742.980	10747.150	10751.320	10755.490	10759.660	10763.830
602.0	10768.000	10772.260	10776.520	10780.780	10785.040	10789.300	10793.560	10797.820	10802.080	10806.340
602.1	10810.600	10814.860	10819.120	10823.380	10827.640	10831.900	10836.160	10840.420	10844.680	10848.940
602.2	10853.200	10857.460	10861.720	10865.980	10870.240	10874.500	10878.760	10883.020	10887.280	10891.540
602.3	10895.800	10900.060	10904.320	10908.580	10912.840	10917.100	10921.360	10925.620	10929.880	10934.140
602.4	10938.400	10942.660	10946.920	10951.180	10955.440	10959.700	10963.960	10968.220	10972.480	10976.740
602.5	10981.000	10985.260	10989.520	10993.780	10998.040	11002.300	11006.560	11010.820	11015.080	11019.340
602.6	11023.600	11027.860	11032.120	11036.380	11040.640	11044.900	11049.160	11053.420	11057.680	11061.940
602.7	11066.200	11070.460	11074.720	11078.980	11083.240	11087.500	11091.760	11096.020	11100.280	11104.540
602.8	11108.800	11113.060	11117.320	11121.580	11125.840	11130.100	11134.360	11138.620	11142.880	11147.140
602.9	11151.400	11155.660	11159.920	11164.180	11168.440	11172.700	11176.960	11181.220	11185.480	11189.740
603.0	11194.000	11198.460	11202.920	11207.380	11211.840	11216.300	11220.760	11225.220	11229.680	11234.140
603.1	11238.600	11243.060	11247.520	11251.980	11256.440	11260.900	11265.360	11269.820	11274.280	11278.740
603.2	11283.200	11287.660	11292.120	11296.580	11301.040	11305.500	11309.960	11314.420	11318.880	11323.340
603.3	11327.800	11332.260	11336.720	11341.180	11345.640	11350.100	11354.560	11359.020	11363.480	11367.940
603.4	11372.400	11376.860	11381.320	11385.780	11390.240	11394.700	11399.160	11403.620	11408.080	11412.540
603.5	11417.000	11421.460	11425.920	11430.380	11434.840	11439.300	11443.760	11448.220	11452.680	11457.140
603.6	11461.600	11466.060	11470.520	11474.980	11479.440	11483.900	11488.360	11492.820	11497.280	11501.740
603.7	11506.200	11510.660	11515.120	11519.580	11524.040	11528.500	11532.960	11537.420	11541.880	11546.340
603.8	11550.800	11555.260	11559.720	11564.180	11568.640	11573.100	11577.560	11582.020	11586.480	11590.940
603.9	11595.400	11599.860	11604.320	11608.780	11613.240	11617.700	11622.160	11626.620	11631.080	11635.540
604.0	11640.000	11644.700	11649.400	11654.100	11658.800	11663.500	11668.200	11672.900	11677.600	11682.300
604.1	11687.000	11691.700	11696.400	11701.100	11705.800	11710.500	11715.200	11719.900	11724.600	11729.300
604.2	11734.000	11738.700	11743.400	11748.100	11752.800	11757.500	11762.200	11766.900	11771.600	11776.300
604.3	11781.000	11785.700	11790.400	11795.100	11799.800	11804.500	11809.200	11813.900	11818.600	11823.300
604.4	11828.000	11832.700	11837.400	11842.100	11846.800	11851.500	11856.200	11860.900	11865.600	11870.300
604.5	11875.000	11879.700	11884.400	11889.100	11893.800	11898.500	11903.200	11907.900	11912.600	11917.300
604.6	11922.000	11926.700	11931.400	11936.100	11940.800	11945.500	11950.200	11954.900	11959.600	11964.300
604.7	11969.000	11973.700	11978.400	11983.100	11987.800	11992.500	11997.200	12001.900	12006.600	12011.300
604.8	12016.000	12020.700	12025.400	12030.100	12034.800	12039.500	12044.200	12048.900	12053.600	12058.300
604.9	12063.000	12067.700	12072.400	12077.100	12081.800	12086.500	12091.200	12095.900	12100.600	12105.300
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. AREA**

ELEVATIONS IN FEET-NGVD, AREA (IN ACRES)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
605.0	12110.000	12114.600	12119.200	12123.800	12128.400	12133.000	12137.600	12142.200	12146.800	12151.400
605.1	12156.000	12160.600	12165.200	12169.800	12174.400	12179.000	12183.600	12188.200	12192.800	12197.400
605.2	12202.000	12206.600	12211.200	12215.800	12220.400	12225.000	12229.600	12234.200	12238.800	12243.400
605.3	12248.000	12252.600	12257.200	12261.800	12266.400	12271.000	12275.600	12280.200	12284.800	12289.400
605.4	12294.000	12298.600	12303.200	12307.800	12312.400	12317.000	12321.600	12326.200	12330.800	12335.400
605.5	12340.000	12344.600	12349.200	12353.800	12358.400	12363.000	12367.600	12372.200	12376.800	12381.400
605.6	12386.000	12390.600	12395.200	12399.800	12404.400	12409.000	12413.600	12418.200	12422.800	12427.400
605.7	12432.000	12436.600	12441.200	12445.800	12450.400	12455.000	12459.600	12464.200	12468.800	12473.400
605.8	12478.000	12482.600	12487.200	12491.800	12496.400	12501.000	12505.600	12510.200	12514.800	12519.400
605.9	12524.000	12528.600	12533.200	12537.800	12542.400	12547.000	12551.600	12556.200	12560.800	12565.400
606.0	12570.000	12574.750	12579.500	12584.250	12589.000	12593.750	12598.500	12603.250	12608.000	12612.750
606.1	12617.500	12622.250	12627.000	12631.750	12636.500	12641.250	12646.000	12650.750	12655.500	12660.250
606.2	12665.000	12669.750	12674.500	12679.250	12684.000	12688.750	12693.500	12698.250	12703.000	12707.750
606.3	12712.500	12717.250	12722.000	12726.750	12731.500	12736.250	12741.000	12745.750	12750.500	12755.250
606.4	12760.000	12764.750	12769.500	12774.250	12779.000	12783.750	12788.500	12793.250	12798.000	12802.750
606.5	12807.500	12812.250	12817.000	12821.750	12826.500	12831.250	12836.000	12840.750	12845.500	12850.250
606.6	12855.000	12859.750	12864.500	12869.250	12874.000	12878.750	12883.500	12888.250	12893.000	12897.750
606.7	12902.500	12907.250	12912.000	12916.750	12921.500	12926.250	12931.000	12935.750	12940.500	12945.250
606.8	12950.000	12954.750	12959.500	12964.250	12969.000	12973.750	12978.500	12983.250	12988.000	12992.750
606.9	12997.500	13002.250	13007.000	13011.750	13016.500	13021.250	13026.000	13030.750	13035.500	13040.250
607.0	13045.000	13049.840	13054.680	13059.520	13064.360	13069.200	13074.040	13078.880	13083.720	13088.560
607.1	13093.400	13098.240	13103.080	13107.920	13112.760	13117.600	13122.440	13127.280	13132.120	13136.960
607.2	13141.800	13146.640	13151.480	13156.320	13161.160	13166.000	13170.840	13175.680	13180.520	13185.360
607.3	13190.200	13195.040	13199.880	13204.720	13209.560	13214.400	13219.240	13224.080	13228.920	13233.760
607.4	13238.600	13243.440	13248.280	13253.120	13257.960	13262.800	13267.640	13272.480	13277.320	13282.160
607.5	13287.000	13291.840	13296.680	13301.520	13306.360	13311.200	13316.040	13320.880	13325.720	13330.560
607.6	13335.400	13340.240	13345.080	13349.920	13354.760	13359.600	13364.440	13369.280	13374.120	13378.960
607.7	13383.800	13388.640	13393.480	13398.320	13403.160	13408.000	13412.840	13417.680	13422.520	13427.360
607.8	13432.200	13437.040	13441.880	13446.720	13451.560	13456.400	13461.240	13466.080	13470.920	13475.760
607.9	13480.600	13485.440	13490.280	13495.120	13499.960	13504.800	13509.640	13514.480	13519.320	13524.160
608.0	13529.000	13534.100	13539.200	13544.300	13549.400	13554.500	13559.600	13564.700	13569.800	13574.900
608.1	13580.000	13585.100	13590.200	13595.300	13600.400	13605.500	13610.600	13615.700	13620.800	13625.900
608.2	13631.000	13636.100	13641.200	13646.300	13651.400	13656.500	13661.600	13666.700	13671.800	13676.900
608.3	13682.000	13687.100	13692.200	13697.300	13702.400	13707.500	13712.600	13717.700	13722.800	13727.900
608.4	13733.000	13738.100	13743.200	13748.300	13753.400	13758.500	13763.600	13768.700	13773.800	13778.900
608.5	13784.000	13789.100	13794.200	13799.300	13804.400	13809.500	13814.600	13819.700	13824.800	13829.900
608.6	13835.000	13840.100	13845.200	13850.300	13855.400	13860.500	13865.600	13870.700	13875.800	13880.900
608.7	13886.000	13891.100	13896.200	13901.300	13906.400	13911.500	13916.600	13921.700	13926.800	13931.900
608.8	13937.000	13942.100	13947.200	13952.300	13957.400	13962.500	13967.600	13972.700	13977.800	13982.900
608.9	13988.000	13993.100	13998.200	14003.300	14008.400	14013.500	14018.600	14023.700	14028.800	14033.900
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. AREA**

ELEVATIONS IN FEET-NGVD, AREA (IN ACRES)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
609.0	14039.000	14044.370	14049.740	14055.110	14060.480	14065.850	14071.220	14076.590	14081.960	14087.330
609.1	14092.700	14098.070	14103.440	14108.810	14114.180	14119.550	14124.920	14130.290	14135.660	14141.030
609.2	14146.400	14151.770	14157.140	14162.510	14167.880	14173.250	14178.620	14183.990	14189.360	14194.730
609.3	14200.100	14205.470	14210.840	14216.210	14221.580	14226.950	14232.320	14237.690	14243.060	14248.430
609.4	14253.800	14259.170	14264.540	14269.910	14275.280	14280.650	14286.020	14291.390	14296.760	14302.130
609.5	14307.500	14312.870	14318.240	14323.610	14328.980	14334.350	14339.720	14345.090	14350.460	14355.830
609.6	14361.200	14366.570	14371.940	14377.310	14382.680	14388.050	14393.420	14398.790	14404.160	14409.530
609.7	14414.900	14420.270	14425.640	14431.010	14436.380	14441.750	14447.120	14452.490	14457.860	14463.230
609.8	14468.600	14473.970	14479.340	14484.710	14490.080	14495.450	14500.820	14506.190	14511.560	14516.930
609.9	14522.300	14527.670	14533.040	14538.410	14543.780	14549.150	14554.520	14559.890	14565.260	14570.630
610.0	14576.000	14581.050	14586.100	14591.150	14596.200	14601.250	14606.300	14611.350	14616.400	14621.450
610.1	14626.500	14631.550	14636.600	14641.650	14646.700	14651.750	14656.800	14661.850	14666.900	14671.950
610.2	14677.000	14682.050	14687.100	14692.150	14697.200	14702.250	14707.300	14712.350	14717.400	14722.450
610.3	14727.500	14732.550	14737.600	14742.650	14747.700	14752.750	14757.800	14762.850	14767.900	14772.950
610.4	14778.000	14783.050	14788.100	14793.150	14798.200	14803.250	14808.300	14813.350	14818.400	14823.450
610.5	14828.500	14833.550	14838.600	14843.650	14848.700	14853.750	14858.800	14863.850	14868.900	14873.950
610.6	14879.000	14884.050	14889.100	14894.150	14899.200	14904.250	14909.300	14914.350	14919.400	14924.450
610.7	14929.500	14934.550	14939.600	14944.650	14949.700	14954.750	14959.800	14964.850	14969.900	14974.950
610.8	14980.000	14985.050	14990.100	14995.150	15000.200	15005.250	15010.300	15015.350	15020.400	15025.450
610.9	15030.500	15035.550	15040.600	15045.650	15050.700	15055.750	15060.800	15065.850	15070.900	15075.950
611.0	15081.000	15086.330	15091.660	15096.990	15102.320	15107.650	15112.980	15118.310	15123.640	15128.970
611.1	15134.300	15139.630	15144.960	15150.290	15155.620	15160.950	15166.280	15171.610	15176.940	15182.270
611.2	15187.600	15192.930	15198.260	15203.590	15208.920	15214.250	15219.580	15224.910	15230.240	15235.570
611.3	15240.900	15246.230	15251.560	15256.890	15262.220	15267.550	15272.880	15278.210	15283.540	15288.870
611.4	15294.200	15299.530	15304.860	15310.190	15315.520	15320.850	15326.180	15331.510	15336.840	15342.170
611.5	15347.500	15352.830	15358.160	15363.490	15368.820	15374.150	15379.480	15384.810	15390.140	15395.470
611.6	15400.800	15406.130	15411.460	15416.790	15422.120	15427.450	15432.780	15438.110	15443.440	15448.770
611.7	15454.100	15459.430	15464.760	15470.090	15475.420	15480.750	15486.080	15491.410	15496.740	15502.070
611.8	15507.400	15512.730	15518.060	15523.390	15528.720	15534.050	15539.380	15544.710	15550.040	15555.370
611.9	15560.700	15566.030	15571.360	15576.690	15582.020	15587.350	15592.680	15598.010	15603.340	15608.670
612.0	15614.000	15619.130	15624.260	15629.390	15634.520	15639.650	15644.780	15649.910	15655.040	15660.170
612.1	15665.300	15670.430	15675.560	15680.690	15685.820	15690.950	15696.080	15701.210	15706.340	15711.470
612.2	15716.600	15721.730	15726.860	15731.990	15737.120	15742.250	15747.380	15752.510	15757.640	15762.770
612.3	15767.900	15773.030	15778.160	15783.290	15788.420	15793.550	15798.680	15803.810	15808.940	15814.070
612.4	15819.200	15824.330	15829.460	15834.590	15839.720	15844.850	15849.980	15855.110	15860.240	15865.370
612.5	15870.500	15875.630	15880.760	15885.890	15891.020	15896.150	15901.280	15906.410	15911.540	15916.670
612.6	15921.800	15926.930	15932.060	15937.190	15942.320	15947.450	15952.580	15957.710	15962.840	15967.970
612.7	15973.100	15978.230	15983.360	15988.490	15993.620	15998.750	16003.880	16009.010	16014.140	16019.270
612.8	16024.400	16029.530	16034.660	16039.790	16044.920	16050.050	16055.180	16060.310	16065.440	16070.570
612.9	16075.700	16080.830	16085.960	16091.090	16096.220	16101.350	16106.480	16111.610	16116.740	16121.870
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. AREA**

ELEVATIONS IN FEET-NGVD, AREA (IN ACRES)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
613.0	16127.000	16132.110	16137.220	16142.330	16147.440	16152.550	16157.660	16162.770	16167.880	16172.990
613.1	16178.100	16183.210	16188.320	16193.430	16198.540	16203.650	16208.760	16213.870	16218.980	16224.090
613.2	16229.200	16234.310	16239.420	16244.530	16249.640	16254.750	16259.860	16264.970	16270.080	16275.190
613.3	16280.300	16285.410	16290.520	16295.630	16300.740	16305.850	16310.960	16316.070	16321.180	16326.290
613.4	16331.400	16336.510	16341.620	16346.730	16351.840	16356.950	16362.060	16367.170	16372.280	16377.390
613.5	16382.500	16387.609	16392.721	16397.830	16402.939	16408.051	16413.160	16418.270	16423.381	16428.490
613.6	16433.600	16438.711	16443.820	16448.930	16454.039	16459.150	16464.260	16469.369	16474.480	16479.590
613.7	16484.699	16489.811	16494.920	16500.029	16505.141	16510.250	16515.359	16520.471	16525.580	16530.689
613.8	16535.801	16540.910	16546.020	16551.131	16556.240	16561.350	16566.461	16571.570	16576.680	16581.789
613.9	16586.900	16592.010	16597.119	16602.230	16607.340	16612.449	16617.561	16622.670	16627.779	16632.891
614.0	16638.000	16643.561	16649.119	16654.680	16660.240	16665.801	16671.359	16676.920	16682.480	16688.039
614.1	16693.600	16699.160	16704.721	16710.279	16715.840	16721.400	16726.961	16732.520	16738.080	16743.641
614.2	16749.199	16754.760	16760.320	16765.881	16771.439	16777.000	16782.561	16788.119	16793.680	16799.240
614.3	16804.801	16810.359	16815.920	16821.480	16827.039	16832.600	16838.160	16843.721	16849.279	16854.840
614.4	16860.400	16865.961	16871.520	16877.080	16882.641	16888.199	16893.760	16899.320	16904.881	16910.439
614.5	16916.000	16921.561	16927.119	16932.680	16938.240	16943.801	16949.359	16954.920	16960.480	16966.039
614.6	16971.600	16977.160	16982.721	16988.279	16993.840	16999.400	17004.961	17010.520	17016.080	17021.641
614.7	17027.199	17032.760	17038.320	17043.881	17049.439	17055.000	17060.561	17066.119	17071.680	17077.240
614.8	17082.801	17088.359	17093.920	17099.480	17105.039	17110.600	17116.160	17121.721	17127.279	17132.840
614.9	17138.400	17143.961	17149.520	17155.080	17160.641	17166.199	17171.760	17177.320	17182.881	17188.439
615.0	17194.000	17199.641	17205.279	17210.920	17216.561	17222.199	17227.840	17233.480	17239.119	17244.760
615.1	17250.400	17256.039	17261.680	17267.320	17272.961	17278.600	17284.240	17289.881	17295.520	17301.160
615.2	17306.801	17312.439	17318.080	17323.721	17329.359	17335.000	17340.641	17346.279	17351.920	17357.561
615.3	17363.199	17368.840	17374.480	17380.119	17385.760	17391.400	17397.039	17402.680	17408.320	17413.961
615.4	17419.600	17425.240	17430.881	17436.520	17442.160	17447.801	17453.439	17459.080	17464.721	17470.359
615.5	17476.000	17481.641	17487.279	17492.920	17498.561	17504.199	17509.840	17515.480	17521.119	17526.760
615.6	17532.400	17538.039	17543.680	17549.320	17554.961	17560.600	17566.240	17571.881	17577.520	17583.160
615.7	17588.801	17594.439	17600.080	17605.721	17611.359	17617.000	17622.641	17628.279	17633.920	17639.561
615.8	17645.199	17650.840	17656.480	17662.119	17667.760	17673.400	17679.039	17684.680	17690.320	17695.961
615.9	17701.600	17707.240	17712.881	17718.520	17724.160	17729.801	17735.439	17741.080	17746.721	17752.359
616.0	17758.000	17763.930	17769.859	17775.789	17781.721	17787.650	17793.580	17799.510	17805.439	17811.369
616.1	17817.301	17823.230	17829.160	17835.090	17841.020	17846.949	17852.881	17858.811	17864.740	17870.670
616.2	17876.600	17882.529	17888.461	17894.391	17900.320	17906.250	17912.180	17918.109	17924.039	17929.971
616.3	17935.900	17941.830	17947.760	17953.689	17959.619	17965.551	17971.480	17977.410	17983.340	17989.270
616.4	17995.199	18001.131	18007.061	18012.990	18018.920	18024.850	18030.779	18036.711	18042.641	18048.570
616.5	18054.500	18060.430	18066.359	18072.289	18078.221	18084.150	18090.080	18096.010	18101.939	18107.869
616.6	18113.801	18119.730	18125.660	18131.590	18137.520	18143.449	18149.381	18155.311	18161.240	18167.170
616.7	18173.100	18179.029	18184.961	18190.891	18196.820	18202.750	18208.680	18214.609	18220.539	18226.471
616.8	18232.400	18238.330	18244.260	18250.189	18256.119	18262.051	18267.980	18273.910	18279.840	18285.770
616.9	18291.699	18297.631	18303.561	18309.490	18315.420	18321.350	18327.279	18333.211	18339.141	18345.070
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. AREA**

ELEVATIONS IN FEET-NGVD, AREA (IN ACRES)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
617.0	18351.000	18356.779	18362.561	18368.340	18374.119	18379.900	18385.680	18391.461	18397.240	18403.020
617.1	18408.801	18414.580	18420.359	18426.141	18431.920	18437.699	18443.480	18449.260	18455.039	18460.820
617.2	18466.600	18472.381	18478.160	18483.939	18489.721	18495.500	18501.279	18507.061	18512.840	18518.619
617.3	18524.400	18530.180	18535.961	18541.740	18547.520	18553.301	18559.080	18564.859	18570.641	18576.420
617.4	18582.199	18587.980	18593.760	18599.539	18605.320	18611.100	18616.881	18622.660	18628.439	18634.221
617.5	18640.000	18645.779	18651.561	18657.340	18663.119	18668.900	18674.680	18680.461	18686.240	18692.020
617.6	18697.801	18703.580	18709.359	18715.141	18720.920	18726.699	18732.480	18738.260	18744.039	18749.820
617.7	18755.600	18761.381	18767.160	18772.939	18778.721	18784.500	18790.279	18796.061	18801.840	18807.619
617.8	18813.400	18819.180	18824.961	18830.740	18836.520	18842.301	18848.080	18853.859	18859.641	18865.420
617.9	18871.199	18876.980	18882.760	18888.539	18894.320	18900.100	18905.881	18911.660	18917.439	18923.221
618.0	18929.000	18935.051	18941.100	18947.150	18953.199	18959.250	18965.301	18971.350	18977.400	18983.449
618.1	18989.500	18995.551	19001.600	19007.650	19013.699	19019.750	19025.801	19031.850	19037.900	19043.949
618.2	19050.000	19056.051	19062.100	19068.150	19074.199	19080.250	19086.301	19092.350	19098.400	19104.449
618.3	19110.500	19116.551	19122.600	19128.650	19134.699	19140.750	19146.801	19152.850	19158.900	19164.949
618.4	19171.000	19177.051	19183.100	19189.150	19195.199	19201.250	19207.301	19213.350	19219.400	19225.449
618.5	19231.500	19237.551	19243.600	19249.650	19255.699	19261.750	19267.801	19273.850	19279.900	19285.949
618.6	19292.000	19298.051	19304.100	19310.150	19316.199	19322.250	19328.301	19334.350	19340.400	19346.449
618.7	19352.500	19358.551	19364.600	19370.650	19376.699	19382.750	19388.801	19394.850	19400.900	19406.949
618.8	19413.000	19419.051	19425.100	19431.150	19437.199	19443.250	19449.301	19455.350	19461.400	19467.449
618.9	19473.500	19479.551	19485.600	19491.650	19497.699	19503.750	19509.801	19515.850	19521.900	19527.949
619.0	19534.000	19540.311	19546.619	19552.930	19559.240	19565.551	19571.859	19578.170	19584.480	19590.789
619.1	19597.100	19603.410	19609.721	19616.029	19622.340	19628.650	19634.961	19641.270	19647.580	19653.891
619.2	19660.199	19666.510	19672.820	19679.131	19685.439	19691.750	19698.061	19704.369	19710.680	19716.990
619.3	19723.301	19729.609	19735.920	19742.230	19748.539	19754.850	19761.160	19767.471	19773.779	19780.090
619.4	19786.400	19792.711	19799.020	19805.330	19811.641	19817.949	19824.260	19830.570	19836.881	19843.189
619.5	19849.500	19855.811	19862.119	19868.430	19874.740	19881.051	19887.359	19893.670	19899.980	19906.289
619.6	19912.600	19918.910	19925.221	19931.529	19937.840	19944.150	19950.461	19956.770	19963.080	19969.391
619.7	19975.699	19982.010	19988.320	19994.631	20000.939	20007.250	20013.561	20019.869	20026.180	20032.490
619.8	20038.801	20045.109	20051.420	20057.730	20064.039	20070.350	20076.660	20082.971	20089.279	20095.590
619.9	20101.900	20108.211	20114.520	20120.830	20127.141	20133.449	20139.760	20146.070	20152.381	20158.689
620.0	20165.000	20171.971	20178.939	20185.910	20192.881	20199.850	20206.820	20213.789	20220.760	20227.730
620.1	20234.699	20241.670	20248.641	20255.609	20262.580	20269.551	20276.520	20283.490	20290.461	20297.430
620.2	20304.400	20311.369	20318.340	20325.311	20332.279	20339.250	20346.221	20353.189	20360.160	20367.131
620.3	20374.100	20381.070	20388.039	20395.010	20401.980	20408.949	20415.920	20422.891	20429.859	20436.830
620.4	20443.801	20450.770	20457.740	20464.711	20471.680	20478.650	20485.619	20492.590	20499.561	20506.529
620.5	20513.500	20520.471	20527.439	20534.410	20541.381	20548.350	20555.320	20562.289	20569.260	20576.230
620.6	20583.199	20590.170	20597.141	20604.109	20611.080	20618.051	20625.020	20631.990	20638.961	20645.930
620.7	20652.900	20659.869	20666.840	20673.811	20680.779	20687.750	20694.721	20701.689	20708.660	20715.631
620.8	20722.600	20729.570	20736.539	20743.510	20750.480	20757.449	20764.420	20771.391	20778.359	20785.330
620.9	20792.301	20799.270	20806.240	20813.211	20820.180	20827.150	20834.119	20841.090	20848.061	20855.029
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. AREA**

ELEVATIONS IN FEET-NGVD, AREA (IN ACRES)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
621.0	20862.000	20868.590	20875.180	20881.770	20888.359	20894.949	20901.539	20908.131	20914.721	20921.311
621.1	20927.900	20934.490	20941.080	20947.670	20954.260	20960.850	20967.439	20974.029	20980.619	20987.211
621.2	20993.801	21000.391	21006.980	21013.570	21020.160	21026.750	21033.340	21039.930	21046.520	21053.109
621.3	21059.699	21066.289	21072.881	21079.471	21086.061	21092.650	21099.240	21105.830	21112.420	21119.010
621.4	21125.600	21132.189	21138.779	21145.369	21151.961	21158.551	21165.141	21171.730	21178.320	21184.910
621.5	21191.500	21198.090	21204.680	21211.270	21217.859	21224.449	21231.039	21237.631	21244.221	21250.811
621.6	21257.400	21263.990	21270.580	21277.170	21283.760	21290.350	21296.939	21303.529	21310.119	21316.711
621.7	21323.301	21329.891	21336.480	21343.070	21349.660	21356.250	21362.840	21369.430	21376.020	21382.609
621.8	21389.199	21395.789	21402.381	21408.971	21415.561	21422.150	21428.740	21435.330	21441.920	21448.510
621.9	21455.100	21461.689	21468.279	21474.869	21481.461	21488.051	21494.641	21501.230	21507.820	21514.410
622.0	21521.000	21527.580	21534.160	21540.740	21547.320	21553.900	21560.480	21567.061	21573.641	21580.221
622.1	21586.801	21593.381	21599.961	21606.539	21613.119	21619.699	21626.279	21632.859	21639.439	21646.020
622.2	21652.600	21659.180	21665.760	21672.340	21678.920	21685.500	21692.080	21698.660	21705.240	21711.820
622.3	21718.400	21724.980	21731.561	21738.141	21744.721	21751.301	21757.881	21764.461	21771.039	21777.619
622.4	21784.199	21790.779	21797.359	21803.939	21810.520	21817.100	21823.680	21830.260	21836.840	21843.420
622.5	21850.000	21856.580	21863.160	21869.740	21876.320	21882.900	21889.480	21896.061	21902.641	21909.221
622.6	21915.801	21922.381	21928.961	21935.539	21942.119	21948.699	21955.279	21961.859	21968.439	21975.020
622.7	21981.600	21988.180	21994.760	22001.340	22007.920	22014.500	22021.080	22027.660	22034.240	22040.820
622.8	22047.400	22053.980	22060.561	22067.141	22073.721	22080.301	22086.881	22093.461	22100.039	22106.619
622.9	22113.199	22119.779	22126.359	22132.939	22139.520	22146.100	22152.680	22159.260	22165.840	22172.420
623.0	22179.000	22186.010	22193.020	22200.029	22207.039	22214.051	22221.061	22228.070	22235.080	22242.090
623.1	22249.100	22256.109	22263.119	22270.131	22277.141	22284.150	22291.160	22298.170	22305.180	22312.189
623.2	22319.199	22326.211	22333.221	22340.230	22347.240	22354.250	22361.260	22368.270	22375.279	22382.289
623.3	22389.301	22396.311	22403.320	22410.330	22417.340	22424.350	22431.359	22438.369	22445.381	22452.391
623.4	22459.400	22466.410	22473.420	22480.430	22487.439	22494.449	22501.461	22508.471	22515.480	22522.490
623.5	22529.500	22536.510	22543.520	22550.529	22557.539	22564.551	22571.561	22578.570	22585.580	22592.590
623.6	22599.600	22606.609	22613.619	22620.631	22627.641	22634.650	22641.660	22648.670	22655.680	22662.689
623.7	22669.699	22676.711	22683.721	22690.730	22697.740	22704.750	22711.760	22718.770	22725.779	22732.789
623.8	22739.801	22746.811	22753.820	22760.830	22767.840	22774.850	22781.859	22788.869	22795.881	22802.891
623.9	22809.900	22816.910	22823.920	22830.930	22837.939	22844.949	22851.961	22858.971	22865.980	22872.990
624.0	22880.000	22887.090	22894.180	22901.270	22908.359	22915.449	22922.539	22929.631	22936.721	22943.811
624.1	22950.900	22957.990	22965.080	22972.170	22979.260	22986.350	22993.439	23000.529	23007.619	23014.711
624.2	23021.801	23028.891	23035.980	23043.070	23050.160	23057.250	23064.340	23071.430	23078.520	23085.609
624.3	23092.699	23099.789	23106.881	23113.971	23121.061	23128.150	23135.240	23142.330	23149.420	23156.510
624.4	23163.600	23170.689	23177.779	23184.869	23191.961	23199.051	23206.141	23213.230	23220.320	23227.410
624.5	23234.500	23241.590	23248.680	23255.770	23262.859	23269.949	23277.039	23284.131	23291.221	23298.311
624.6	23305.400	23312.490	23319.580	23326.670	23333.760	23340.850	23347.939	23355.029	23362.119	23369.211
624.7	23376.301	23383.391	23390.480	23397.570	23404.660	23411.750	23418.840	23425.930	23433.020	23440.109
624.8	23447.199	23454.289	23461.381	23468.471	23475.561	23482.650	23489.740	23496.830	23503.920	23511.010
624.9	23518.100	23525.189	23532.279	23539.369	23546.461	23553.551	23560.641	23567.730	23574.820	23581.910
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. AREA**

ELEVATIONS IN FEET-NGVD, AREA (IN ACRES)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
625.0	23589.000	23595.109	23601.221	23607.330	23613.439	23619.551	23625.660	23631.770	23637.881	23643.990
625.1	23650.100	23656.211	23662.320	23668.430	23674.539	23680.650	23686.760	23692.869	23698.980	23705.090
625.2	23711.199	23717.311	23723.420	23729.529	23735.641	23741.750	23747.859	23753.971	23760.080	23766.189
625.3	23772.301	23778.410	23784.520	23790.631	23796.740	23802.850	23808.961	23815.070	23821.180	23827.289
625.4	23833.400	23839.510	23845.619	23851.730	23857.840	23863.949	23870.061	23876.170	23882.279	23888.391
625.5	23894.500	23900.609	23906.721	23912.830	23918.939	23925.051	23931.160	23937.270	23943.381	23949.490
625.6	23955.600	23961.711	23967.820	23973.930	23980.039	23986.150	23992.260	23998.369	24004.480	24010.590
625.7	24016.699	24022.811	24028.920	24035.029	24041.141	24047.250	24053.359	24059.471	24065.580	24071.689
625.8	24077.801	24083.910	24090.020	24096.131	24102.240	24108.350	24114.461	24120.570	24126.680	24132.789
625.9	24138.900	24145.010	24151.119	24157.230	24163.340	24169.449	24175.561	24181.670	24187.779	24193.891
626.0	24200.000	24206.340	24212.680	24219.020	24225.359	24231.699	24238.039	24244.381	24250.721	24257.061
626.1	24263.400	24269.740	24276.080	24282.420	24288.760	24295.100	24301.439	24307.779	24314.119	24320.461
626.2	24326.801	24333.141	24339.480	24345.820	24352.160	24358.500	24364.840	24371.180	24377.520	24383.859
626.3	24390.199	24396.539	24402.881	24409.221	24415.561	24421.900	24428.240	24434.580	24440.920	24447.260
626.4	24453.600	24459.939	24466.279	24472.619	24478.961	24485.301	24491.641	24497.980	24504.320	24510.660
626.5	24517.000	24523.340	24529.680	24536.020	24542.359	24548.699	24555.039	24561.381	24567.721	24574.061
626.6	24580.400	24586.740	24593.080	24599.420	24605.760	24612.100	24618.439	24624.779	24631.119	24637.461
626.7	24643.801	24650.141	24656.480	24662.820	24669.160	24675.500	24681.840	24688.180	24694.520	24700.859
626.8	24707.199	24713.539	24719.881	24726.221	24732.561	24738.900	24745.240	24751.580	24757.920	24764.260
626.9	24770.600	24776.939	24783.279	24789.619	24795.961	24802.301	24808.641	24814.980	24821.320	24827.660
627.0	24834.000	24843.619	24853.240	24862.859	24872.480	24882.100	24891.721	24901.340	24910.961	24920.580
627.1	24930.199	24939.820	24949.439	24959.061	24968.680	24978.301	24987.920	24997.539	25007.160	25016.779
627.2	25026.400	25036.020	25045.641	25055.260	25064.881	25074.500	25084.119	25093.740	25103.359	25112.980
627.3	25122.600	25132.221	25141.840	25151.461	25161.080	25170.699	25180.320	25189.939	25199.561	25209.180
627.4	25218.801	25228.420	25238.039	25247.660	25257.279	25266.900	25276.520	25286.141	25295.760	25305.381
627.5	25315.000	25324.619	25334.240	25343.859	25353.480	25363.100	25372.721	25382.340	25391.961	25401.580
627.6	25411.199	25420.820	25430.439	25440.061	25449.680	25459.301	25468.920	25478.539	25488.160	25497.779
627.7	25507.400	25517.020	25526.641	25536.260	25545.881	25555.500	25565.119	25574.740	25584.359	25593.980
627.8	25603.600	25613.221	25622.840	25632.461	25642.080	25651.699	25661.320	25670.939	25680.561	25690.180
627.9	25699.801	25709.420	25719.039	25728.660	25738.279	25747.900	25757.520	25767.141	25776.760	25786.381
628.0	25796.000	25801.330	25806.660	25811.990	25817.320	25822.650	25827.980	25833.311	25838.641	25843.971
628.1	25849.301	25854.631	25859.961	25865.289	25870.619	25875.949	25881.279	25886.609	25891.939	25897.270
628.2	25902.600	25907.930	25913.260	25918.590	25923.920	25929.250	25934.580	25939.910	25945.240	25950.570
628.3	25955.900	25961.230	25966.561	25971.891	25977.221	25982.551	25987.881	25993.211	25998.539	26003.869
628.4	26009.199	26014.529	26019.859	26025.189	26030.520	26035.850	26041.180	26046.510	26051.840	26057.170
628.5	26062.500	26067.830	26073.160	26078.490	26083.820	26089.150	26094.480	26099.811	26105.141	26110.471
628.6	26115.801	26121.131	26126.461	26131.789	26137.119	26142.449	26147.779	26153.109	26158.439	26163.770
628.7	26169.100	26174.430	26179.760	26185.090	26190.420	26195.750	26201.080	26206.410	26211.740	26217.070
628.8	26222.400	26227.730	26233.061	26238.391	26243.721	26249.051	26254.381	26259.711	26265.039	26270.369
628.9	26275.699	26281.029	26286.359	26291.689	26297.020	26302.350	26307.680	26313.010	26318.340	26323.670
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. AREA**

ELEVATIONS IN FEET-NGVD, AREA (IN ACRES)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
629.0	26329.000	26334.391	26339.779	26345.170	26350.561	26355.949	26361.340	26366.730	26372.119	26377.510
629.1	26382.900	26388.289	26393.680	26399.070	26404.461	26409.850	26415.240	26420.631	26426.020	26431.410
629.2	26436.801	26442.189	26447.580	26452.971	26458.359	26463.750	26469.141	26474.529	26479.920	26485.311
629.3	26490.699	26496.090	26501.480	26506.869	26512.260	26517.650	26523.039	26528.430	26533.820	26539.211
629.4	26544.600	26549.990	26555.381	26560.770	26566.160	26571.551	26576.939	26582.330	26587.721	26593.109
629.5	26598.500	26603.891	26609.279	26614.670	26620.061	26625.449	26630.840	26636.230	26641.619	26647.010
629.6	26652.400	26657.789	26663.180	26668.570	26673.961	26679.350	26684.740	26690.131	26695.520	26700.910
629.7	26706.301	26711.689	26717.080	26722.471	26727.859	26733.250	26738.641	26744.029	26749.420	26754.811
629.8	26760.199	26765.590	26770.980	26776.369	26781.760	26787.150	26792.539	26797.930	26803.320	26808.711
629.9	26814.100	26819.490	26824.881	26830.270	26835.660	26841.051	26846.439	26851.830	26857.221	26862.609
630.0	26868.000	26873.619	26879.240	26884.859	26890.480	26896.100	26901.721	26907.340	26912.961	26918.580
630.1	26924.199	26929.820	26935.439	26941.061	26946.680	26952.301	26957.920	26963.539	26969.160	26974.779
630.2	26980.400	26986.020	26991.641	26997.260	27002.881	27008.500	27014.119	27019.740	27025.359	27030.980
630.3	27036.600	27042.221	27047.840	27053.461	27059.080	27064.699	27070.320	27075.939	27081.561	27087.180
630.4	27092.801	27098.420	27104.039	27109.660	27115.279	27120.900	27126.520	27132.141	27137.760	27143.381
630.5	27149.000	27154.619	27160.240	27165.859	27171.480	27177.100	27182.721	27188.340	27193.961	27199.580
630.6	27205.199	27210.820	27216.439	27222.061	27227.680	27233.301	27238.920	27244.539	27250.160	27255.779
630.7	27261.400	27267.020	27272.641	27278.260	27283.881	27289.500	27295.119	27300.740	27306.359	27311.980
630.8	27317.600	27323.221	27328.840	27334.461	27340.080	27345.699	27351.320	27356.939	27362.561	27368.180
630.9	27373.801	27379.420	27385.039	27390.660	27396.279	27401.900	27407.520	27413.141	27418.760	27424.381
631.0	27430.000	27436.039	27442.080	27448.119	27454.160	27460.199	27466.240	27472.279	27478.320	27484.359
631.1	27490.400	27496.439	27502.480	27508.520	27514.561	27520.600	27526.641	27532.680	27538.721	27544.760
631.2	27550.801	27556.840	27562.881	27568.920	27574.961	27581.000	27587.039	27593.080	27599.119	27605.160
631.3	27611.199	27617.240	27623.279	27629.320	27635.359	27641.400	27647.439	27653.480	27659.520	27665.561
631.4	27671.600	27677.641	27683.680	27689.721	27695.760	27701.801	27707.840	27713.881	27719.920	27725.961
631.5	27732.000	27738.039	27744.080	27750.119	27756.160	27762.199	27768.240	27774.279	27780.320	27786.359
631.6	27792.400	27798.439	27804.480	27810.520	27816.561	27822.600	27828.641	27834.680	27840.721	27846.760
631.7	27852.801	27858.840	27864.881	27870.920	27876.961	27883.000	27889.039	27895.080	27901.119	27907.160
631.8	27913.199	27919.240	27925.279	27931.320	27937.359	27943.400	27949.439	27955.480	27961.520	27967.561
631.9	27973.600	27979.641	27985.680	27991.721	27997.760	28003.801	28009.840	28015.881	28021.920	28027.961
632.0	28034.000	28051.660	28069.320	28086.980	28104.641	28122.301	28139.961	28157.619	28175.279	28192.939
632.1	28210.600	28228.260	28245.920	28263.580	28281.240	28298.900	28316.561	28334.221	28351.881	28369.539
632.2	28387.199	28404.859	28422.520	28440.180	28457.840	28475.500	28493.160	28510.820	28528.480	28546.141
632.3	28563.801	28581.461	28599.119	28616.779	28634.439	28652.100	28669.760	28687.420	28705.080	28722.740
632.4	28740.400	28758.061	28775.721	28793.381	28811.039	28828.699	28846.359	28864.020	28881.680	28899.340
632.5	28917.000	28934.660	28952.320	28969.980	28987.641	29005.301	29022.961	29040.619	29058.279	29075.939
632.6	29093.600	29111.260	29128.920	29146.580	29164.240	29181.900	29199.561	29217.221	29234.881	29252.539
632.7	29270.199	29287.859	29305.520	29323.180	29340.840	29358.500	29376.160	29393.820	29411.480	29429.141
632.8	29446.801	29464.461	29482.119	29499.779	29517.439	29535.100	29552.760	29570.420	29588.080	29605.740
632.9	29623.400	29641.061	29658.721	29676.381	29694.039	29711.699	29729.359	29747.020	29764.680	29782.340
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. AREA**

ELEVATIONS IN FEET-NGVD, AREA (IN ACRES)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
633.0	29800.000	29809.000	29818.000	29827.000	29836.000	29845.000	29854.000	29863.000	29872.000	29881.000
633.1	29890.000	29899.000	29908.000	29917.000	29926.000	29935.000	29944.000	29953.000	29962.000	29971.000
633.2	29980.000	29989.000	29998.000	30007.000	30016.000	30025.000	30034.000	30043.000	30052.000	30061.000
633.3	30070.000	30079.000	30088.000	30097.000	30106.000	30115.000	30124.000	30133.000	30142.000	30151.000
633.4	30160.000	30169.000	30178.000	30187.000	30196.000	30205.000	30214.000	30223.000	30232.000	30241.000
633.5	30250.000	30259.000	30268.000	30277.000	30286.000	30295.000	30304.000	30313.000	30322.000	30331.000
633.6	30340.000	30349.000	30358.000	30367.000	30376.000	30385.000	30394.000	30403.000	30412.000	30421.000
633.7	30430.000	30439.000	30448.000	30457.000	30466.000	30475.000	30484.000	30493.000	30502.000	30511.000
633.8	30520.000	30529.000	30538.000	30547.000	30556.000	30565.000	30574.000	30583.000	30592.000	30601.000
633.9	30610.000	30619.000	30628.000	30637.000	30646.000	30655.000	30664.000	30673.000	30682.000	30691.000
634.0	30700.000	30710.000	30720.000	30730.000	30740.000	30750.000	30760.000	30770.000	30780.000	30790.000
634.1	30800.000	30810.000	30820.000	30830.000	30840.000	30850.000	30860.000	30870.000	30880.000	30890.000
634.2	30900.000	30910.000	30920.000	30930.000	30940.000	30950.000	30960.000	30970.000	30980.000	30990.000
634.3	31000.000	31010.000	31020.000	31030.000	31040.000	31050.000	31060.000	31070.000	31080.000	31090.000
634.4	31100.000	31110.000	31120.000	31130.000	31140.000	31150.000	31160.000	31170.000	31180.000	31190.000
634.5	31200.000	31210.000	31220.000	31230.000	31240.000	31250.000	31260.000	31270.000	31280.000	31290.000
634.6	31300.000	31310.000	31320.000	31330.000	31340.000	31350.000	31360.000	31370.000	31380.000	31390.000
634.7	31400.000	31410.000	31420.000	31430.000	31440.000	31450.000	31460.000	31470.000	31480.000	31490.000
634.8	31500.000	31510.000	31520.000	31530.000	31540.000	31550.000	31560.000	31570.000	31580.000	31590.000
634.9	31600.000	31610.000	31620.000	31630.000	31640.000	31650.000	31660.000	31670.000	31680.000	31690.000
635.0	31700.000	31709.000	31718.000	31727.000	31736.000	31745.000	31754.000	31763.000	31772.000	31781.000
635.1	31790.000	31799.000	31808.000	31817.000	31826.000	31835.000	31844.000	31853.000	31862.000	31871.000
635.2	31880.000	31889.000	31898.000	31907.000	31916.000	31925.000	31934.000	31943.000	31952.000	31961.000
635.3	31970.000	31979.000	31988.000	31997.000	32006.000	32015.000	32024.000	32033.000	32042.000	32051.000
635.4	32060.000	32069.000	32078.000	32087.000	32096.000	32105.000	32114.000	32123.000	32132.000	32141.000
635.5	32150.000	32159.000	32168.000	32177.000	32186.000	32195.000	32204.000	32213.000	32222.000	32231.000
635.6	32240.000	32249.000	32258.000	32267.000	32276.000	32285.000	32294.000	32303.000	32312.000	32321.000
635.7	32330.000	32339.000	32348.000	32357.000	32366.000	32375.000	32384.000	32393.000	32402.000	32411.000
635.8	32420.000	32429.000	32438.000	32447.000	32456.000	32465.000	32474.000	32483.000	32492.000	32501.000
635.9	32510.000	32519.000	32528.000	32537.000	32546.000	32555.000	32564.000	32573.000	32582.000	32591.000
636.0	32600.000	32610.000	32620.000	32630.000	32640.000	32650.000	32660.000	32670.000	32680.000	32690.000
636.1	32700.000	32710.000	32720.000	32730.000	32740.000	32750.000	32760.000	32770.000	32780.000	32790.000
636.2	32800.000	32810.000	32820.000	32830.000	32840.000	32850.000	32860.000	32870.000	32880.000	32890.000
636.3	32900.000	32910.000	32920.000	32930.000	32940.000	32950.000	32960.000	32970.000	32980.000	32990.000
636.4	33000.000	33010.000	33020.000	33030.000	33040.000	33050.000	33060.000	33070.000	33080.000	33090.000
636.5	33100.000	33110.000	33120.000	33130.000	33140.000	33150.000	33160.000	33170.000	33180.000	33190.000
636.6	33200.000	33210.000	33220.000	33230.000	33240.000	33250.000	33260.000	33270.000	33280.000	33290.000
636.7	33300.000	33310.000	33320.000	33330.000	33340.000	33350.000	33360.000	33370.000	33380.000	33390.000
636.8	33400.000	33410.000	33420.000	33430.000	33440.000	33450.000	33460.000	33470.000	33480.000	33490.000
636.9	33500.000	33510.000	33520.000	33530.000	33540.000	33550.000	33560.000	33570.000	33580.000	33590.000
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. AREA**

ELEVATIONS IN FEET-NGVD, AREA (IN ACRES)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
637.0	33600.000	33609.000	33618.000	33627.000	33636.000	33645.000	33654.000	33663.000	33672.000	33681.000
637.1	33690.000	33699.000	33708.000	33717.000	33726.000	33735.000	33744.000	33753.000	33762.000	33771.000
637.2	33780.000	33789.000	33798.000	33807.000	33816.000	33825.000	33834.000	33843.000	33852.000	33861.000
637.3	33870.000	33879.000	33888.000	33897.000	33906.000	33915.000	33924.000	33933.000	33942.000	33951.000
637.4	33960.000	33969.000	33978.000	33987.000	33996.000	34005.000	34014.000	34023.000	34032.000	34041.000
637.5	34050.000	34059.000	34068.000	34077.000	34086.000	34095.000	34104.000	34113.000	34122.000	34131.000
637.6	34140.000	34149.000	34158.000	34167.000	34176.000	34185.000	34194.000	34203.000	34212.000	34221.000
637.7	34230.000	34239.000	34248.000	34257.000	34266.000	34275.000	34284.000	34293.000	34302.000	34311.000
637.8	34320.000	34329.000	34338.000	34347.000	34356.000	34365.000	34374.000	34383.000	34392.000	34401.000
637.9	34410.000	34419.000	34428.000	34437.000	34446.000	34455.000	34464.000	34473.000	34482.000	34491.000
638.0	34500.000	34510.000	34520.000	34530.000	34540.000	34550.000	34560.000	34570.000	34580.000	34590.000
638.1	34600.000	34610.000	34620.000	34630.000	34640.000	34650.000	34660.000	34670.000	34680.000	34690.000
638.2	34700.000	34710.000	34720.000	34730.000	34740.000	34750.000	34760.000	34770.000	34780.000	34790.000
638.3	34800.000	34810.000	34820.000	34830.000	34840.000	34850.000	34860.000	34870.000	34880.000	34890.000
638.4	34900.000	34910.000	34920.000	34930.000	34940.000	34950.000	34960.000	34970.000	34980.000	34990.000
638.5	35000.000	35010.000	35020.000	35030.000	35040.000	35050.000	35060.000	35070.000	35080.000	35090.000
638.6	35100.000	35110.000	35120.000	35130.000	35140.000	35150.000	35160.000	35170.000	35180.000	35190.000
638.7	35200.000	35210.000	35220.000	35230.000	35240.000	35250.000	35260.000	35270.000	35280.000	35290.000
638.8	35300.000	35310.000	35320.000	35330.000	35340.000	35350.000	35360.000	35370.000	35380.000	35390.000
638.9	35400.000	35410.000	35420.000	35430.000	35440.000	35450.000	35460.000	35470.000	35480.000	35490.000
639.0	35500.000	35510.000	35520.000	35530.000	35540.000	35550.000	35560.000	35570.000	35580.000	35590.000
639.1	35600.000	35610.000	35620.000	35630.000	35640.000	35650.000	35660.000	35670.000	35680.000	35690.000
639.2	35700.000	35710.000	35720.000	35730.000	35740.000	35750.000	35760.000	35770.000	35780.000	35790.000
639.3	35800.000	35810.000	35820.000	35830.000	35840.000	35850.000	35860.000	35870.000	35880.000	35890.000
639.4	35900.000	35910.000	35920.000	35930.000	35940.000	35950.000	35960.000	35970.000	35980.000	35990.000
639.5	36000.000	36010.000	36020.000	36030.000	36040.000	36050.000	36060.000	36070.000	36080.000	36090.000
639.6	36100.000	36110.000	36120.000	36130.000	36140.000	36150.000	36160.000	36170.000	36180.000	36190.000
639.7	36200.000	36210.000	36220.000	36230.000	36240.000	36250.000	36260.000	36270.000	36280.000	36290.000
639.8	36300.000	36310.000	36320.000	36330.000	36340.000	36350.000	36360.000	36370.000	36380.000	36390.000
639.9	36400.000	36410.000	36420.000	36430.000	36440.000	36450.000	36460.000	36470.000	36480.000	36490.000
640.0	36500.000	36508.000	36516.000	36524.000	36532.000	36540.000	36548.000	36556.000	36564.000	36572.000
640.1	36580.000	36588.000	36596.000	36604.000	36612.000	36620.000	36628.000	36636.000	36644.000	36652.000
640.2	36660.000	36668.000	36676.000	36684.000	36692.000	36700.000	36708.000	36716.000	36724.000	36732.000
640.3	36740.000	36748.000	36756.000	36764.000	36772.000	36780.000	36788.000	36796.000	36804.000	36812.000
640.4	36820.000	36828.000	36836.000	36844.000	36852.000	36860.000	36868.000	36876.000	36884.000	36892.000
640.5	36900.000	36908.000	36916.000	36924.000	36932.000	36940.000	36948.000	36956.000	36964.000	36972.000
640.6	36980.000	36988.000	36996.000	37004.000	37012.000	37020.000	37028.000	37036.000	37044.000	37052.000
640.7	37060.000	37068.000	37076.000	37084.000	37092.000	37100.000	37108.000	37116.000	37124.000	37132.000
640.8	37140.000	37148.000	37156.000	37164.000	37172.000	37180.000	37188.000	37196.000	37204.000	37212.000
640.9	37220.000	37228.000	37236.000	37244.000	37252.000	37260.000	37268.000	37276.000	37284.000	37292.000
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. AREA**

ELEVATIONS IN FEET-NGVD, AREA (IN ACRES)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
641.0	37300.000	37310.000	37320.000	37330.000	37340.000	37350.000	37360.000	37370.000	37380.000	37390.000
641.1	37400.000	37410.000	37420.000	37430.000	37440.000	37450.000	37460.000	37470.000	37480.000	37490.000
641.2	37500.000	37510.000	37520.000	37530.000	37540.000	37550.000	37560.000	37570.000	37580.000	37590.000
641.3	37600.000	37610.000	37620.000	37630.000	37640.000	37650.000	37660.000	37670.000	37680.000	37690.000
641.4	37700.000	37710.000	37720.000	37730.000	37740.000	37750.000	37760.000	37770.000	37780.000	37790.000
641.5	37800.000	37810.000	37820.000	37830.000	37840.000	37850.000	37860.000	37870.000	37880.000	37890.000
641.6	37900.000	37910.000	37920.000	37930.000	37940.000	37950.000	37960.000	37970.000	37980.000	37990.000
641.7	38000.000	38010.000	38020.000	38030.000	38040.000	38050.000	38060.000	38070.000	38080.000	38090.000
641.8	38100.000	38110.000	38120.000	38130.000	38140.000	38150.000	38160.000	38170.000	38180.000	38190.000
641.9	38200.000	38210.000	38220.000	38230.000	38240.000	38250.000	38260.000	38270.000	38280.000	38290.000
642.0	38300.000	38310.000	38320.000	38330.000	38340.000	38350.000	38360.000	38370.000	38380.000	38390.000
642.1	38400.000	38410.000	38420.000	38430.000	38440.000	38450.000	38460.000	38470.000	38480.000	38490.000
642.2	38500.000	38510.000	38520.000	38530.000	38540.000	38550.000	38560.000	38570.000	38580.000	38590.000
642.3	38600.000	38610.000	38620.000	38630.000	38640.000	38650.000	38660.000	38670.000	38680.000	38690.000
642.4	38700.000	38710.000	38720.000	38730.000	38740.000	38750.000	38760.000	38770.000	38780.000	38790.000
642.5	38800.000	38810.000	38820.000	38830.000	38840.000	38850.000	38860.000	38870.000	38880.000	38890.000
642.6	38900.000	38910.000	38920.000	38930.000	38940.000	38950.000	38960.000	38970.000	38980.000	38990.000
642.7	39000.000	39010.000	39020.000	39030.000	39040.000	39050.000	39060.000	39070.000	39080.000	39090.000
642.8	39100.000	39110.000	39120.000	39130.000	39140.000	39150.000	39160.000	39170.000	39180.000	39190.000
642.9	39200.000	39210.000	39220.000	39230.000	39240.000	39250.000	39260.000	39270.000	39280.000	39290.000
643.0	39300.000	39311.000	39322.000	39333.000	39344.000	39355.000	39366.000	39377.000	39388.000	39399.000
643.1	39410.000	39421.000	39432.000	39443.000	39454.000	39465.000	39476.000	39487.000	39498.000	39509.000
643.2	39520.000	39531.000	39542.000	39553.000	39564.000	39575.000	39586.000	39597.000	39608.000	39619.000
643.3	39630.000	39641.000	39652.000	39663.000	39674.000	39685.000	39696.000	39707.000	39718.000	39729.000
643.4	39740.000	39751.000	39762.000	39773.000	39784.000	39795.000	39806.000	39817.000	39828.000	39839.000
643.5	39850.000	39861.000	39872.000	39883.000	39894.000	39905.000	39916.000	39927.000	39938.000	39949.000
643.6	39960.000	39971.000	39982.000	39993.000	40004.000	40015.000	40026.000	40037.000	40048.000	40059.000
643.7	40070.000	40081.000	40092.000	40103.000	40114.000	40125.000	40136.000	40147.000	40158.000	40169.000
643.8	40180.000	40191.000	40202.000	40213.000	40224.000	40235.000	40246.000	40257.000	40268.000	40279.000
643.9	40290.000	40301.000	40312.000	40323.000	40334.000	40345.000	40356.000	40367.000	40378.000	40389.000
644.0	40400.000	40411.000	40422.000	40433.000	40444.000	40455.000	40466.000	40477.000	40488.000	40499.000
644.1	40510.000	40521.000	40532.000	40543.000	40554.000	40565.000	40576.000	40587.000	40598.000	40609.000
644.2	40620.000	40631.000	40642.000	40653.000	40664.000	40675.000	40686.000	40697.000	40708.000	40719.000
644.3	40730.000	40741.000	40752.000	40763.000	40774.000	40785.000	40796.000	40807.000	40818.000	40829.000
644.4	40840.000	40851.000	40862.000	40873.000	40884.000	40895.000	40906.000	40917.000	40928.000	40939.000
644.5	40950.000	40961.000	40972.000	40983.000	40994.000	41005.000	41016.000	41027.000	41038.000	41049.000
644.6	41060.000	41071.000	41082.000	41093.000	41104.000	41115.000	41126.000	41137.000	41148.000	41159.000
644.7	41170.000	41181.000	41192.000	41203.000	41214.000	41225.000	41236.000	41247.000	41258.000	41269.000
644.8	41280.000	41291.000	41302.000	41313.000	41324.000	41335.000	41346.000	41357.000	41368.000	41379.000
644.9	41390.000	41401.000	41412.000	41423.000	41434.000	41445.000	41456.000	41467.000	41478.000	41489.000
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. AREA**

ELEVATIONS IN FEET-NGVD, AREA (IN ACRES)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
645.0	41500.000	41510.000	41520.000	41530.000	41540.000	41550.000	41560.000	41570.000	41580.000	41590.000
645.1	41600.000	41610.000	41620.000	41630.000	41640.000	41650.000	41660.000	41670.000	41680.000	41690.000
645.2	41700.000	41710.000	41720.000	41730.000	41740.000	41750.000	41760.000	41770.000	41780.000	41790.000
645.3	41800.000	41810.000	41820.000	41830.000	41840.000	41850.000	41860.000	41870.000	41880.000	41890.000
645.4	41900.000	41910.000	41920.000	41930.000	41940.000	41950.000	41960.000	41970.000	41980.000	41990.000
645.5	42000.000	42010.000	42020.000	42030.000	42040.000	42050.000	42060.000	42070.000	42080.000	42090.000
645.6	42100.000	42110.000	42120.000	42130.000	42140.000	42150.000	42160.000	42170.000	42180.000	42190.000
645.7	42200.000	42210.000	42220.000	42230.000	42240.000	42250.000	42260.000	42270.000	42280.000	42290.000
645.8	42300.000	42310.000	42320.000	42330.000	42340.000	42350.000	42360.000	42370.000	42380.000	42390.000
645.9	42400.000	42410.000	42420.000	42430.000	42440.000	42450.000	42460.000	42470.000	42480.000	42490.000
646.0	42500.000	42511.000	42522.000	42533.000	42544.000	42555.000	42566.000	42577.000	42588.000	42599.000
646.1	42610.000	42621.000	42632.000	42643.000	42654.000	42665.000	42676.000	42687.000	42698.000	42709.000
646.2	42720.000	42731.000	42742.000	42753.000	42764.000	42775.000	42786.000	42797.000	42808.000	42819.000
646.3	42830.000	42841.000	42852.000	42863.000	42874.000	42885.000	42896.000	42907.000	42918.000	42929.000
646.4	42940.000	42951.000	42962.000	42973.000	42984.000	42995.000	43006.000	43017.000	43028.000	43039.000
646.5	43050.000	43061.000	43072.000	43083.000	43094.000	43105.000	43116.000	43127.000	43138.000	43149.000
646.6	43160.000	43171.000	43182.000	43193.000	43204.000	43215.000	43226.000	43237.000	43248.000	43259.000
646.7	43270.000	43281.000	43292.000	43303.000	43314.000	43325.000	43336.000	43347.000	43358.000	43369.000
646.8	43380.000	43391.000	43402.000	43413.000	43424.000	43435.000	43446.000	43457.000	43468.000	43479.000
646.9	43490.000	43501.000	43512.000	43523.000	43534.000	43545.000	43556.000	43567.000	43578.000	43589.000
647.0	43600.000	43613.000	43626.000	43639.000	43652.000	43665.000	43678.000	43691.000	43704.000	43717.000
647.1	43730.000	43743.000	43756.000	43769.000	43782.000	43795.000	43808.000	43821.000	43834.000	43847.000
647.2	43860.000	43873.000	43886.000	43899.000	43912.000	43925.000	43938.000	43951.000	43964.000	43977.000
647.3	43990.000	44003.000	44016.000	44029.000	44042.000	44055.000	44068.000	44081.000	44094.000	44107.000
647.4	44120.000	44133.000	44146.000	44159.000	44172.000	44185.000	44198.000	44211.000	44224.000	44237.000
647.5	44250.000	44263.000	44276.000	44289.000	44302.000	44315.000	44328.000	44341.000	44354.000	44367.000
647.6	44380.000	44393.000	44406.000	44419.000	44432.000	44445.000	44458.000	44471.000	44484.000	44497.000
647.7	44510.000	44523.000	44536.000	44549.000	44562.000	44575.000	44588.000	44601.000	44614.000	44627.000
647.8	44640.000	44653.000	44666.000	44679.000	44692.000	44705.000	44718.000	44731.000	44744.000	44757.000
647.9	44770.000	44783.000	44796.000	44809.000	44822.000	44835.000	44848.000	44861.000	44874.000	44887.000
648.0	44900.000	44913.000	44926.000	44939.000	44952.000	44965.000	44978.000	44991.000	45004.000	45017.000
648.1	45030.000	45043.000	45056.000	45069.000	45082.000	45095.000	45108.000	45121.000	45134.000	45147.000
648.2	45160.000	45173.000	45186.000	45199.000	45212.000	45225.000	45238.000	45251.000	45264.000	45277.000
648.3	45290.000	45303.000	45316.000	45329.000	45342.000	45355.000	45368.000	45381.000	45394.000	45407.000
648.4	45420.000	45433.000	45446.000	45459.000	45472.000	45485.000	45498.000	45511.000	45524.000	45537.000
648.5	45550.000	45563.000	45576.000	45589.000	45602.000	45615.000	45628.000	45641.000	45654.000	45667.000
648.6	45680.000	45693.000	45706.000	45719.000	45732.000	45745.000	45758.000	45771.000	45784.000	45797.000
648.7	45810.000	45823.000	45836.000	45849.000	45862.000	45875.000	45888.000	45901.000	45914.000	45927.000
648.8	45940.000	45953.000	45966.000	45979.000	45992.000	46005.000	46018.000	46031.000	46044.000	46057.000
648.9	46070.000	46083.000	46096.000	46109.000	46122.000	46135.000	46148.000	46161.000	46174.000	46187.000
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. AREA**

ELEVATIONS IN FEET-NGVD, AREA (IN ACRES)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
649.0	46200.000	46212.000	46224.000	46236.000	46248.000	46260.000	46272.000	46284.000	46296.000	46308.000
649.1	46320.000	46332.000	46344.000	46356.000	46368.000	46380.000	46392.000	46404.000	46416.000	46428.000
649.2	46440.000	46452.000	46464.000	46476.000	46488.000	46500.000	46512.000	46524.000	46536.000	46548.000
649.3	46560.000	46572.000	46584.000	46596.000	46608.000	46620.000	46632.000	46644.000	46656.000	46668.000
649.4	46680.000	46692.000	46704.000	46716.000	46728.000	46740.000	46752.000	46764.000	46776.000	46788.000
649.5	46800.000	46812.000	46824.000	46836.000	46848.000	46860.000	46872.000	46884.000	46896.000	46908.000
649.6	46920.000	46932.000	46944.000	46956.000	46968.000	46980.000	46992.000	47004.000	47016.000	47028.000
649.7	47040.000	47052.000	47064.000	47076.000	47088.000	47100.000	47112.000	47124.000	47136.000	47148.000
649.8	47160.000	47172.000	47184.000	47196.000	47208.000	47220.000	47232.000	47244.000	47256.000	47268.000
649.9	47280.000	47292.000	47304.000	47316.000	47328.000	47340.000	47352.000	47364.000	47376.000	47388.000
650.0	47400.000	47413.000	47426.000	47439.000	47452.000	47465.000	47478.000	47491.000	47504.000	47517.000
650.1	47530.000	47543.000	47556.000	47569.000	47582.000	47595.000	47608.000	47621.000	47634.000	47647.000
650.2	47660.000	47673.000	47686.000	47699.000	47712.000	47725.000	47738.000	47751.000	47764.000	47777.000
650.3	47790.000	47803.000	47816.000	47829.000	47842.000	47855.000	47868.000	47881.000	47894.000	47907.000
650.4	47920.000	47933.000	47946.000	47959.000	47972.000	47985.000	47998.000	48011.000	48024.000	48037.000
650.5	48050.000	48063.000	48076.000	48089.000	48102.000	48115.000	48128.000	48141.000	48154.000	48167.000
650.6	48180.000	48193.000	48206.000	48219.000	48232.000	48245.000	48258.000	48271.000	48284.000	48297.000
650.7	48310.000	48323.000	48336.000	48349.000	48362.000	48375.000	48388.000	48401.000	48414.000	48427.000
650.8	48440.000	48453.000	48466.000	48479.000	48492.000	48505.000	48518.000	48531.000	48544.000	48557.000
650.9	48570.000	48583.000	48596.000	48609.000	48622.000	48635.000	48648.000	48661.000	48674.000	48687.000
651.0	48700.000	48713.000	48726.000	48739.000	48752.000	48765.000	48778.000	48791.000	48804.000	48817.000
651.1	48830.000	48843.000	48856.000	48869.000	48882.000	48895.000	48908.000	48921.000	48934.000	48947.000
651.2	48960.000	48973.000	48986.000	48999.000	49012.000	49025.000	49038.000	49051.000	49064.000	49077.000
651.3	49090.000	49103.000	49116.000	49129.000	49142.000	49155.000	49168.000	49181.000	49194.000	49207.000
651.4	49220.000	49233.000	49246.000	49259.000	49272.000	49285.000	49298.000	49311.000	49324.000	49337.000
651.5	49350.000	49363.000	49376.000	49389.000	49402.000	49415.000	49428.000	49441.000	49454.000	49467.000
651.6	49480.000	49493.000	49506.000	49519.000	49532.000	49545.000	49558.000	49571.000	49584.000	49597.000
651.7	49610.000	49623.000	49636.000	49649.000	49662.000	49675.000	49688.000	49701.000	49714.000	49727.000
651.8	49740.000	49753.000	49766.000	49779.000	49792.000	49805.000	49818.000	49831.000	49844.000	49857.000
651.9	49870.000	49883.000	49896.000	49909.000	49922.000	49935.000	49948.000	49961.000	49974.000	49987.000
652.0	50000.000	50014.000	50028.000	50042.000	50056.000	50070.000	50084.000	50098.000	50112.000	50126.000
652.1	50140.000	50154.000	50168.000	50182.000	50196.000	50210.000	50224.000	50238.000	50252.000	50266.000
652.2	50280.000	50294.000	50308.000	50322.000	50336.000	50350.000	50364.000	50378.000	50392.000	50406.000
652.3	50420.000	50434.000	50448.000	50462.000	50476.000	50490.000	50504.000	50518.000	50532.000	50546.000
652.4	50560.000	50574.000	50588.000	50602.000	50616.000	50630.000	50644.000	50658.000	50672.000	50686.000
652.5	50700.000	50714.000	50728.000	50742.000	50756.000	50770.000	50784.000	50798.000	50812.000	50826.000
652.6	50840.000	50854.000	50868.000	50882.000	50896.000	50910.000	50924.000	50938.000	50952.000	50966.000
652.7	50980.000	50994.000	51008.000	51022.000	51036.000	51050.000	51064.000	51078.000	51092.000	51106.000
652.8	51120.000	51134.000	51148.000	51162.000	51176.000	51190.000	51204.000	51218.000	51232.000	51246.000
652.9	51260.000	51274.000	51288.000	51302.000	51316.000	51330.000	51344.000	51358.000	51372.000	51386.000
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. AREA**

ELEVATIONS IN FEET-NGVD, AREA (IN ACRES)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
653.0	51400.000	51414.000	51428.000	51442.000	51456.000	51470.000	51484.000	51498.000	51512.000	51526.000
653.1	51540.000	51554.000	51568.000	51582.000	51596.000	51610.000	51624.000	51638.000	51652.000	51666.000
653.2	51680.000	51694.000	51708.000	51722.000	51736.000	51750.000	51764.000	51778.000	51792.000	51806.000
653.3	51820.000	51834.000	51848.000	51862.000	51876.000	51890.000	51904.000	51918.000	51932.000	51946.000
653.4	51960.000	51974.000	51988.000	52002.000	52016.000	52030.000	52044.000	52058.000	52072.000	52086.000
653.5	52100.000	52114.000	52128.000	52142.000	52156.000	52170.000	52184.000	52198.000	52212.000	52226.000
653.6	52240.000	52254.000	52268.000	52282.000	52296.000	52310.000	52324.000	52338.000	52352.000	52366.000
653.7	52380.000	52394.000	52408.000	52422.000	52436.000	52450.000	52464.000	52478.000	52492.000	52506.000
653.8	52520.000	52534.000	52548.000	52562.000	52576.000	52590.000	52604.000	52618.000	52632.000	52646.000
653.9	52660.000	52674.000	52688.000	52702.000	52716.000	52730.000	52744.000	52758.000	52772.000	52786.000
654.0	52800.000	52814.000	52828.000	52842.000	52856.000	52870.000	52884.000	52898.000	52912.000	52926.000
654.1	52940.000	52954.000	52968.000	52982.000	52996.000	53010.000	53024.000	53038.000	53052.000	53066.000
654.2	53080.000	53094.000	53108.000	53122.000	53136.000	53150.000	53164.000	53178.000	53192.000	53206.000
654.3	53220.000	53234.000	53248.000	53262.000	53276.000	53290.000	53304.000	53318.000	53332.000	53346.000
654.4	53360.000	53374.000	53388.000	53402.000	53416.000	53430.000	53444.000	53458.000	53472.000	53486.000
654.5	53500.000	53514.000	53528.000	53542.000	53556.000	53570.000	53584.000	53598.000	53612.000	53626.000
654.6	53640.000	53654.000	53668.000	53682.000	53696.000	53710.000	53724.000	53738.000	53752.000	53766.000
654.7	53780.000	53794.000	53808.000	53822.000	53836.000	53850.000	53864.000	53878.000	53892.000	53906.000
654.8	53920.000	53934.000	53948.000	53962.000	53976.000	53990.000	54004.000	54018.000	54032.000	54046.000
654.9	54060.000	54074.000	54088.000	54102.000	54116.000	54130.000	54144.000	54158.000	54172.000	54186.000
655.0	54200.000	54214.000	54228.000	54242.000	54256.000	54270.000	54284.000	54298.000	54312.000	54326.000
655.1	54340.000	54354.000	54368.000	54382.000	54396.000	54410.000	54424.000	54438.000	54452.000	54466.000
655.2	54480.000	54494.000	54508.000	54522.000	54536.000	54550.000	54564.000	54578.000	54592.000	54606.000
655.3	54620.000	54634.000	54648.000	54662.000	54676.000	54690.000	54704.000	54718.000	54732.000	54746.000
655.4	54760.000	54774.000	54788.000	54802.000	54816.000	54830.000	54844.000	54858.000	54872.000	54886.000
655.5	54900.000	54914.000	54928.000	54942.000	54956.000	54970.000	54984.000	54998.000	55012.000	55026.000
655.6	55040.000	55054.000	55068.000	55082.000	55096.000	55110.000	55124.000	55138.000	55152.000	55166.000
655.7	55180.000	55194.000	55208.000	55222.000	55236.000	55250.000	55264.000	55278.000	55292.000	55306.000
655.8	55320.000	55334.000	55348.000	55362.000	55376.000	55390.000	55404.000	55418.000	55432.000	55446.000
655.9	55460.000	55474.000	55488.000	55502.000	55516.000	55530.000	55544.000	55558.000	55572.000	55586.000
656.0	55600.000	55614.000	55628.000	55642.000	55656.000	55670.000	55684.000	55698.000	55712.000	55726.000
656.1	55740.000	55754.000	55768.000	55782.000	55796.000	55810.000	55824.000	55838.000	55852.000	55866.000
656.2	55880.000	55894.000	55908.000	55922.000	55936.000	55950.000	55964.000	55978.000	55992.000	56006.000
656.3	56020.000	56034.000	56048.000	56062.000	56076.000	56090.000	56104.000	56118.000	56132.000	56146.000
656.4	56160.000	56174.000	56188.000	56202.000	56216.000	56230.000	56244.000	56258.000	56272.000	56286.000
656.5	56300.000	56314.000	56328.000	56342.000	56356.000	56370.000	56384.000	56398.000	56412.000	56426.000
656.6	56440.000	56454.000	56468.000	56482.000	56496.000	56510.000	56524.000	56538.000	56552.000	56566.000
656.7	56580.000	56594.000	56608.000	56622.000	56636.000	56650.000	56664.000	56678.000	56692.000	56706.000
656.8	56720.000	56734.000	56748.000	56762.000	56776.000	56790.000	56804.000	56818.000	56832.000	56846.000
656.9	56860.000	56874.000	56888.000	56902.000	56916.000	56930.000	56944.000	56958.000	56972.000	56986.000
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. AREA**

ELEVATIONS IN FEET-NGVD, AREA (IN ACRES)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
657.0	57000.000	57015.000	57030.000	57045.000	57060.000	57075.000	57090.000	57105.000	57120.000	57135.000
657.1	57150.000	57165.000	57180.000	57195.000	57210.000	57225.000	57240.000	57255.000	57270.000	57285.000
657.2	57300.000	57315.000	57330.000	57345.000	57360.000	57375.000	57390.000	57405.000	57420.000	57435.000
657.3	57450.000	57465.000	57480.000	57495.000	57510.000	57525.000	57540.000	57555.000	57570.000	57585.000
657.4	57600.000	57615.000	57630.000	57645.000	57660.000	57675.000	57690.000	57705.000	57720.000	57735.000
657.5	57750.000	57765.000	57780.000	57795.000	57810.000	57825.000	57840.000	57855.000	57870.000	57885.000
657.6	57900.000	57915.000	57930.000	57945.000	57960.000	57975.000	57990.000	58005.000	58020.000	58035.000
657.7	58050.000	58065.000	58080.000	58095.000	58110.000	58125.000	58140.000	58155.000	58170.000	58185.000
657.8	58200.000	58215.000	58230.000	58245.000	58260.000	58275.000	58290.000	58305.000	58320.000	58335.000
657.9	58350.000	58365.000	58380.000	58395.000	58410.000	58425.000	58440.000	58455.000	58470.000	58485.000
658.0	58500.000	58514.000	58528.000	58542.000	58556.000	58570.000	58584.000	58598.000	58612.000	58626.000
658.1	58640.000	58654.000	58668.000	58682.000	58696.000	58710.000	58724.000	58738.000	58752.000	58766.000
658.2	58780.000	58794.000	58808.000	58822.000	58836.000	58850.000	58864.000	58878.000	58892.000	58906.000
658.3	58920.000	58934.000	58948.000	58962.000	58976.000	58990.000	59004.000	59018.000	59032.000	59046.000
658.4	59060.000	59074.000	59088.000	59102.000	59116.000	59130.000	59144.000	59158.000	59172.000	59186.000
658.5	59200.000	59214.000	59228.000	59242.000	59256.000	59270.000	59284.000	59298.000	59312.000	59326.000
658.6	59340.000	59354.000	59368.000	59382.000	59396.000	59410.000	59424.000	59438.000	59452.000	59466.000
658.7	59480.000	59494.000	59508.000	59522.000	59536.000	59550.000	59564.000	59578.000	59592.000	59606.000
658.8	59620.000	59634.000	59648.000	59662.000	59676.000	59690.000	59704.000	59718.000	59732.000	59746.000
658.9	59760.000	59774.000	59788.000	59802.000	59816.000	59830.000	59844.000	59858.000	59872.000	59886.000
659.0	59900.000	59914.000	59928.000	59942.000	59956.000	59970.000	59984.000	59998.000	60012.000	60026.000
659.1	60040.000	60054.000	60068.000	60082.000	60096.000	60110.000	60124.000	60138.000	60152.000	60166.000
659.2	60180.000	60194.000	60208.000	60222.000	60236.000	60250.000	60264.000	60278.000	60292.000	60306.000
659.3	60320.000	60334.000	60348.000	60362.000	60376.000	60390.000	60404.000	60418.000	60432.000	60446.000
659.4	60460.000	60474.000	60488.000	60502.000	60516.000	60530.000	60544.000	60558.000	60572.000	60586.000
659.5	60600.000	60614.000	60628.000	60642.000	60656.000	60670.000	60684.000	60698.000	60712.000	60726.000
659.6	60740.000	60754.000	60768.000	60782.000	60796.000	60810.000	60824.000	60838.000	60852.000	60866.000
659.7	60880.000	60894.000	60908.000	60922.000	60936.000	60950.000	60964.000	60978.000	60992.000	61006.000
659.8	61020.000	61034.000	61048.000	61062.000	61076.000	61090.000	61104.000	61118.000	61132.000	61146.000
659.9	61160.000	61174.000	61188.000	61202.000	61216.000	61230.000	61244.000	61258.000	61272.000	61286.000
660.0	61300.000	61314.000	61328.000	61342.000	61356.000	61370.000	61384.000	61398.000	61412.000	61426.000
660.1	61440.000	61454.000	61468.000	61482.000	61496.000	61510.000	61524.000	61538.000	61552.000	61566.000
660.2	61580.000	61594.000	61608.000	61622.000	61636.000	61650.000	61664.000	61678.000	61692.000	61706.000
660.3	61720.000	61734.000	61748.000	61762.000	61776.000	61790.000	61804.000	61818.000	61832.000	61846.000
660.4	61860.000	61874.000	61888.000	61902.000	61916.000	61930.000	61944.000	61958.000	61972.000	61986.000
660.5	62000.000	62014.000	62028.000	62042.000	62056.000	62070.000	62084.000	62098.000	62112.000	62126.000
660.6	62140.000	62154.000	62168.000	62182.000	62196.000	62210.000	62224.000	62238.000	62252.000	62266.000
660.7	62280.000	62294.000	62308.000	62322.000	62336.000	62350.000	62364.000	62378.000	62392.000	62406.000
660.8	62420.000	62434.000	62448.000	62462.000	62476.000	62490.000	62504.000	62518.000	62532.000	62546.000
660.9	62560.000	62574.000	62588.000	62602.000	62616.000	62630.000	62644.000	62658.000	62672.000	62686.000
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. AREA**

ELEVATIONS IN FEET-NGVD, AREA (IN ACRES)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
661.0	62700.000	62715.000	62730.000	62745.000	62760.000	62775.000	62790.000	62805.000	62820.000	62835.000
661.1	62850.000	62865.000	62880.000	62895.000	62910.000	62925.000	62940.000	62955.000	62970.000	62985.000
661.2	63000.000	63015.000	63030.000	63045.000	63060.000	63075.000	63090.000	63105.000	63120.000	63135.000
661.3	63150.000	63165.000	63180.000	63195.000	63210.000	63225.000	63240.000	63255.000	63270.000	63285.000
661.4	63300.000	63315.000	63330.000	63345.000	63360.000	63375.000	63390.000	63405.000	63420.000	63435.000
661.5	63450.000	63465.000	63480.000	63495.000	63510.000	63525.000	63540.000	63555.000	63570.000	63585.000
661.6	63600.000	63615.000	63630.000	63645.000	63660.000	63675.000	63690.000	63705.000	63720.000	63735.000
661.7	63750.000	63765.000	63780.000	63795.000	63810.000	63825.000	63840.000	63855.000	63870.000	63885.000
661.8	63900.000	63915.000	63930.000	63945.000	63960.000	63975.000	63990.000	64005.000	64020.000	64035.000
661.9	64050.000	64065.000	64080.000	64095.000	64110.000	64125.000	64140.000	64155.000	64170.000	64185.000
662.0	64200.000	64214.000	64228.000	64242.000	64256.000	64270.000	64284.000	64298.000	64312.000	64326.000
662.1	64340.000	64354.000	64368.000	64382.000	64396.000	64410.000	64424.000	64438.000	64452.000	64466.000
662.2	64480.000	64494.000	64508.000	64522.000	64536.000	64550.000	64564.000	64578.000	64592.000	64606.000
662.3	64620.000	64634.000	64648.000	64662.000	64676.000	64690.000	64704.000	64718.000	64732.000	64746.000
662.4	64760.000	64774.000	64788.000	64802.000	64816.000	64830.000	64844.000	64858.000	64872.000	64886.000
662.5	64900.000	64914.000	64928.000	64942.000	64956.000	64970.000	64984.000	64998.000	65012.000	65026.000
662.6	65040.000	65054.000	65068.000	65082.000	65096.000	65110.000	65124.000	65138.000	65152.000	65166.000
662.7	65180.000	65194.000	65208.000	65222.000	65236.000	65250.000	65264.000	65278.000	65292.000	65306.000
662.8	65320.000	65334.000	65348.000	65362.000	65376.000	65390.000	65404.000	65418.000	65432.000	65446.000
662.9	65460.000	65474.000	65488.000	65502.000	65516.000	65530.000	65544.000	65558.000	65572.000	65586.000
663.0	65600.000	65614.000	65628.000	65642.000	65656.000	65670.000	65684.000	65698.000	65712.000	65726.000
663.1	65740.000	65754.000	65768.000	65782.000	65796.000	65810.000	65824.000	65838.000	65852.000	65866.000
663.2	65880.000	65894.000	65908.000	65922.000	65936.000	65950.000	65964.000	65978.000	65992.000	66006.000
663.3	66020.000	66034.000	66048.000	66062.000	66076.000	66090.000	66104.000	66118.000	66132.000	66146.000
663.4	66160.000	66174.000	66188.000	66202.000	66216.000	66230.000	66244.000	66258.000	66272.000	66286.000
663.5	66300.000	66314.000	66328.000	66342.000	66356.000	66370.000	66384.000	66398.000	66412.000	66426.000
663.6	66440.000	66454.000	66468.000	66482.000	66496.000	66510.000	66524.000	66538.000	66552.000	66566.000
663.7	66580.000	66594.000	66608.000	66622.000	66636.000	66650.000	66664.000	66678.000	66692.000	66706.000
663.8	66720.000	66734.000	66748.000	66762.000	66776.000	66790.000	66804.000	66818.000	66832.000	66846.000
663.9	66860.000	66874.000	66888.000	66902.000	66916.000	66930.000	66944.000	66958.000	66972.000	66986.000
664.0	67000.000	67015.000	67030.000	67045.000	67060.000	67075.000	67090.000	67105.000	67120.000	67135.000
664.1	67150.000	67165.000	67180.000	67195.000	67210.000	67225.000	67240.000	67255.000	67270.000	67285.000
664.2	67300.000	67315.000	67330.000	67345.000	67360.000	67375.000	67390.000	67405.000	67420.000	67435.000
664.3	67450.000	67465.000	67480.000	67495.000	67510.000	67525.000	67540.000	67555.000	67570.000	67585.000
664.4	67600.000	67615.000	67630.000	67645.000	67660.000	67675.000	67690.000	67705.000	67720.000	67735.000
664.5	67750.000	67765.000	67780.000	67795.000	67810.000	67825.000	67840.000	67855.000	67870.000	67885.000
664.6	67900.000	67915.000	67930.000	67945.000	67960.000	67975.000	67990.000	68005.000	68020.000	68035.000
664.7	68050.000	68065.000	68080.000	68095.000	68110.000	68125.000	68140.000	68155.000	68170.000	68185.000
664.8	68200.000	68215.000	68230.000	68245.000	68260.000	68275.000	68290.000	68305.000	68320.000	68335.000
664.9	68350.000	68365.000	68380.000	68395.000	68410.000	68425.000	68440.000	68455.000	68470.000	68485.000
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. CAPACITY**

ELEVATIONS IN FEET-NGVD, CAPACITY (IN ACRE-FEET)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
541.0	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
541.1	0.10	0.11	0.12	0.13	0.14	0.15	0.16	0.17	0.18	0.19
541.2	0.20	0.21	0.22	0.23	0.24	0.25	0.26	0.27	0.28	0.29
541.3	0.30	0.31	0.32	0.33	0.34	0.35	0.36	0.37	0.38	0.39
541.4	0.40	0.41	0.42	0.43	0.44	0.45	0.46	0.47	0.48	0.49
541.5	0.50	0.51	0.52	0.53	0.54	0.55	0.56	0.57	0.58	0.59
541.6	0.60	0.61	0.62	0.63	0.64	0.65	0.66	0.67	0.68	0.69
541.7	0.70	0.71	0.72	0.73	0.74	0.75	0.76	0.77	0.78	0.79
541.8	0.80	0.81	0.82	0.83	0.84	0.85	0.86	0.87	0.88	0.89
541.9	0.90	0.91	0.92	0.93	0.94	0.95	0.96	0.97	0.98	0.99
542.0	1.00	1.01	1.02	1.03	1.04	1.05	1.06	1.07	1.08	1.09
542.1	1.10	1.11	1.12	1.13	1.14	1.15	1.16	1.17	1.18	1.19
542.2	1.20	1.21	1.22	1.23	1.24	1.25	1.26	1.27	1.28	1.29
542.3	1.30	1.31	1.32	1.33	1.34	1.35	1.36	1.37	1.38	1.39
542.4	1.40	1.41	1.42	1.43	1.44	1.45	1.46	1.47	1.48	1.49
542.5	1.50	1.51	1.52	1.53	1.54	1.55	1.56	1.57	1.58	1.59
542.6	1.60	1.61	1.62	1.63	1.64	1.65	1.66	1.67	1.68	1.69
542.7	1.70	1.71	1.72	1.73	1.74	1.75	1.76	1.77	1.78	1.79
542.8	1.80	1.81	1.82	1.83	1.84	1.85	1.86	1.87	1.88	1.89
542.9	1.90	1.91	1.92	1.93	1.94	1.95	1.96	1.97	1.98	1.99
543.0	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45
543.1	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95
543.2	3.00	3.05	3.10	3.15	3.20	3.25	3.30	3.35	3.40	3.45
543.3	3.50	3.55	3.60	3.65	3.70	3.75	3.80	3.85	3.90	3.95
543.4	4.00	4.05	4.10	4.15	4.20	4.25	4.30	4.35	4.40	4.45
543.5	4.50	4.55	4.60	4.65	4.70	4.75	4.80	4.85	4.90	4.95
543.6	5.00	5.05	5.10	5.15	5.20	5.25	5.30	5.35	5.40	5.45
543.7	5.50	5.55	5.60	5.65	5.70	5.75	5.80	5.85	5.90	5.95
543.8	6.00	6.05	6.10	6.15	6.20	6.25	6.30	6.35	6.40	6.45
543.9	6.50	6.55	6.60	6.65	6.70	6.75	6.80	6.85	6.90	6.95
544.0	7.00	7.07	7.14	7.21	7.28	7.35	7.42	7.49	7.56	7.63
544.1	7.70	7.77	7.84	7.91	7.98	8.05	8.12	8.19	8.26	8.33
544.2	8.40	8.47	8.54	8.61	8.68	8.75	8.82	8.89	8.96	9.03
544.3	9.10	9.17	9.24	9.31	9.38	9.45	9.52	9.59	9.66	9.73
544.4	9.80	9.87	9.94	10.01	10.08	10.15	10.22	10.29	10.36	10.43
544.5	10.50	10.57	10.64	10.71	10.78	10.85	10.92	10.99	11.06	11.13
544.6	11.20	11.27	11.34	11.41	11.48	11.55	11.62	11.69	11.76	11.83
544.7	11.90	11.97	12.04	12.11	12.18	12.25	12.32	12.39	12.46	12.53
544.8	12.60	12.67	12.74	12.81	12.88	12.95	13.02	13.09	13.16	13.23
544.9	13.30	13.37	13.44	13.51	13.58	13.65	13.72	13.79	13.86	13.93
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. CAPACITY**

ELEVATIONS IN FEET-NGVD, CAPACITY (IN ACRE-FEET)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
545.0	14.00	14.13	14.26	14.39	14.52	14.65	14.78	14.91	15.04	15.17
545.1	15.30	15.43	15.56	15.69	15.82	15.95	16.08	16.21	16.34	16.47
545.2	16.60	16.73	16.86	16.99	17.12	17.25	17.38	17.51	17.64	17.77
545.3	17.90	18.03	18.16	18.29	18.42	18.55	18.68	18.81	18.94	19.07
545.4	19.20	19.33	19.46	19.59	19.72	19.85	19.98	20.11	20.24	20.37
545.5	20.50	20.63	20.76	20.89	21.02	21.15	21.28	21.41	21.54	21.67
545.6	21.80	21.93	22.06	22.19	22.32	22.45	22.58	22.71	22.84	22.97
545.7	23.10	23.23	23.36	23.49	23.62	23.75	23.88	24.01	24.14	24.27
545.8	24.40	24.53	24.66	24.79	24.92	25.05	25.18	25.31	25.44	25.57
545.9	25.70	25.83	25.96	26.09	26.22	26.35	26.48	26.61	26.74	26.87
546.0	27.00	27.21	27.42	27.63	27.84	28.05	28.26	28.47	28.68	28.89
546.1	29.10	29.31	29.52	29.73	29.94	30.15	30.36	30.57	30.78	30.99
546.2	31.20	31.41	31.62	31.83	32.04	32.25	32.46	32.67	32.88	33.09
546.3	33.30	33.51	33.72	33.93	34.14	34.35	34.56	34.77	34.98	35.19
546.4	35.40	35.61	35.82	36.03	36.24	36.45	36.66	36.87	37.08	37.29
546.5	37.50	37.71	37.92	38.13	38.34	38.55	38.76	38.97	39.18	39.39
546.6	39.60	39.81	40.02	40.23	40.44	40.65	40.86	41.07	41.28	41.49
546.7	41.70	41.91	42.12	42.33	42.54	42.75	42.96	43.17	43.38	43.59
546.8	43.80	44.01	44.22	44.43	44.64	44.85	45.06	45.27	45.48	45.69
546.9	45.90	46.11	46.32	46.53	46.74	46.95	47.16	47.37	47.58	47.79
547.0	48.00	48.36	48.72	49.08	49.44	49.80	50.16	50.52	50.88	51.24
547.1	51.60	51.96	52.32	52.68	53.04	53.40	53.76	54.12	54.48	54.84
547.2	55.20	55.56	55.92	56.28	56.64	57.00	57.36	57.72	58.08	58.44
547.3	58.80	59.16	59.52	59.88	60.24	60.60	60.96	61.32	61.68	62.04
547.4	62.40	62.76	63.12	63.48	63.84	64.20	64.56	64.92	65.28	65.64
547.5	66.00	66.36	66.72	67.08	67.44	67.80	68.16	68.52	68.88	69.24
547.6	69.60	69.96	70.32	70.68	71.04	71.40	71.76	72.12	72.48	72.84
547.7	73.20	73.56	73.92	74.28	74.64	75.00	75.36	75.72	76.08	76.44
547.8	76.80	77.16	77.52	77.88	78.24	78.60	78.96	79.32	79.68	80.04
547.9	80.40	80.76	81.12	81.48	81.84	82.20	82.56	82.92	83.28	83.64
548.0	84.00	84.57	85.14	85.71	86.28	86.85	87.42	87.99	88.56	89.13
548.1	89.70	90.27	90.84	91.41	91.98	92.55	93.12	93.69	94.26	94.83
548.2	95.40	95.97	96.54	97.11	97.68	98.25	98.82	99.39	99.96	100.53
548.3	101.10	101.67	102.24	102.81	103.38	103.95	104.52	105.09	105.66	106.23
548.4	106.80	107.37	107.94	108.51	109.08	109.65	110.22	110.79	111.36	111.93
548.5	112.50	113.07	113.64	114.21	114.78	115.35	115.92	116.49	117.06	117.63
548.6	118.20	118.77	119.34	119.91	120.48	121.05	121.62	122.19	122.76	123.33
548.7	123.90	124.47	125.04	125.61	126.18	126.75	127.32	127.89	128.46	129.03
548.8	129.60	130.17	130.74	131.31	131.88	132.45	133.02	133.59	134.16	134.73
548.9	135.30	135.87	136.44	137.01	137.58	138.15	138.72	139.29	139.86	140.43
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. CAPACITY**

ELEVATIONS IN FEET-NGVD, CAPACITY (IN ACRE-FEET)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
549.0	141.00	141.80	142.60	143.40	144.20	145.00	145.80	146.60	147.40	148.20
549.1	149.00	149.80	150.60	151.40	152.20	153.00	153.80	154.60	155.40	156.20
549.2	157.00	157.80	158.60	159.40	160.20	161.00	161.80	162.60	163.40	164.20
549.3	165.00	165.80	166.60	167.40	168.20	169.00	169.80	170.60	171.40	172.20
549.4	173.00	173.80	174.60	175.40	176.20	177.00	177.80	178.60	179.40	180.20
549.5	181.00	181.80	182.60	183.40	184.20	185.00	185.80	186.60	187.40	188.20
549.6	189.00	189.80	190.60	191.40	192.20	193.00	193.80	194.60	195.40	196.20
549.7	197.00	197.80	198.60	199.40	200.20	201.00	201.80	202.60	203.40	204.20
549.8	205.00	205.80	206.60	207.40	208.20	209.00	209.80	210.60	211.40	212.20
549.9	213.00	213.80	214.60	215.40	216.20	217.00	217.80	218.60	219.40	220.20
550.0	221.00	222.02	223.04	224.06	225.08	226.10	227.12	228.14	229.16	230.18
550.1	231.20	232.22	233.24	234.26	235.28	236.30	237.32	238.34	239.36	240.38
550.2	241.40	242.42	243.44	244.46	245.48	246.50	247.52	248.54	249.56	250.58
550.3	251.60	252.62	253.64	254.66	255.68	256.70	257.72	258.74	259.76	260.78
550.4	261.80	262.82	263.84	264.86	265.88	266.90	267.92	268.94	269.96	270.98
550.5	272.00	273.02	274.04	275.06	276.08	277.10	278.12	279.14	280.16	281.18
550.6	282.20	283.22	284.24	285.26	286.28	287.30	288.32	289.34	290.36	291.38
550.7	292.40	293.42	294.44	295.46	296.48	297.50	298.52	299.54	300.56	301.58
550.8	302.60	303.62	304.64	305.66	306.68	307.70	308.72	309.74	310.76	311.78
550.9	312.80	313.82	314.84	315.86	316.88	317.90	318.92	319.94	320.96	321.98
551.0	323.00	324.28	325.56	326.84	328.12	329.40	330.68	331.96	333.24	334.52
551.1	335.80	337.08	338.36	339.64	340.92	342.20	343.48	344.76	346.04	347.32
551.2	348.60	349.88	351.16	352.44	353.72	355.00	356.28	357.56	358.84	360.12
551.3	361.40	362.68	363.96	365.24	366.52	367.80	369.08	370.36	371.64	372.92
551.4	374.20	375.48	376.76	378.04	379.32	380.60	381.88	383.16	384.44	385.72
551.5	387.00	388.28	389.56	390.84	392.12	393.40	394.68	395.96	397.24	398.52
551.6	399.80	401.08	402.36	403.64	404.92	406.20	407.48	408.76	410.04	411.32
551.7	412.60	413.88	415.16	416.44	417.72	419.00	420.28	421.56	422.84	424.12
551.8	425.40	426.68	427.96	429.24	430.52	431.80	433.08	434.36	435.64	436.92
551.9	438.20	439.48	440.76	442.04	443.32	444.60	445.88	447.16	448.44	449.72
552.0	451.00	452.74	454.48	456.22	457.96	459.70	461.44	463.18	464.92	466.66
552.1	468.40	470.14	471.88	473.62	475.36	477.10	478.84	480.58	482.32	484.06
552.2	485.80	487.54	489.28	491.02	492.76	494.50	496.24	497.98	499.72	501.46
552.3	503.20	504.94	506.68	508.42	510.16	511.90	513.64	515.38	517.12	518.86
552.4	520.60	522.34	524.08	525.82	527.56	529.30	531.04	532.78	534.52	536.26
552.5	538.00	539.74	541.48	543.22	544.96	546.70	548.44	550.18	551.92	553.66
552.6	555.40	557.14	558.88	560.62	562.36	564.10	565.84	567.58	569.32	571.06
552.7	572.80	574.54	576.28	578.02	579.76	581.50	583.24	584.98	586.72	588.46
552.8	590.20	591.94	593.68	595.42	597.16	598.90	600.64	602.38	604.12	605.86
552.9	607.60	609.34	611.08	612.82	614.56	616.30	618.04	619.78	621.52	623.26
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. CAPACITY**

ELEVATIONS IN FEET-NGVD, CAPACITY (IN ACRE-FEET)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
553.0	625.00	627.52	630.04	632.56	635.08	637.60	640.12	642.64	645.16	647.68
553.1	650.20	652.72	655.24	657.76	660.28	662.80	665.32	667.84	670.36	672.88
553.2	675.40	677.92	680.44	682.96	685.48	688.00	690.52	693.04	695.56	698.08
553.3	700.60	703.12	705.64	708.16	710.68	713.20	715.72	718.24	720.76	723.28
553.4	725.80	728.32	730.84	733.36	735.88	738.40	740.92	743.44	745.96	748.48
553.5	751.00	753.52	756.04	758.56	761.08	763.60	766.12	768.64	771.16	773.68
553.6	776.20	778.72	781.24	783.76	786.28	788.80	791.32	793.84	796.36	798.88
553.7	801.40	803.92	806.44	808.96	811.48	814.00	816.52	819.04	821.56	824.08
553.8	826.60	829.12	831.64	834.16	836.68	839.20	841.72	844.24	846.76	849.28
553.9	851.80	854.32	856.84	859.36	861.88	864.40	866.92	869.44	871.96	874.48
554.0	877.00	880.36	883.72	887.08	890.44	893.80	897.16	900.52	903.88	907.24
554.1	910.60	913.96	917.32	920.68	924.04	927.40	930.76	934.12	937.48	940.84
554.2	944.20	947.56	950.92	954.28	957.64	961.00	964.36	967.72	971.08	974.44
554.3	977.80	981.16	984.52	987.88	991.24	994.60	997.96	1001.32	1004.68	1008.04
554.4	1011.40	1014.76	1018.12	1021.48	1024.84	1028.20	1031.56	1034.92	1038.28	1041.64
554.5	1045.00	1048.36	1051.72	1055.08	1058.44	1061.80	1065.16	1068.52	1071.88	1075.24
554.6	1078.60	1081.96	1085.32	1088.68	1092.04	1095.40	1098.76	1102.12	1105.48	1108.84
554.7	1112.20	1115.56	1118.92	1122.28	1125.64	1129.00	1132.36	1135.72	1139.08	1142.44
554.8	1145.80	1149.16	1152.52	1155.88	1159.24	1162.60	1165.96	1169.32	1172.68	1176.04
554.9	1179.40	1182.76	1186.12	1189.48	1192.84	1196.20	1199.56	1202.92	1206.28	1209.64
555.0	1213.00	1217.09	1221.18	1225.27	1229.36	1233.45	1237.54	1241.63	1245.72	1249.81
555.1	1253.90	1257.99	1262.08	1266.17	1270.26	1274.35	1278.44	1282.53	1286.62	1290.71
555.2	1294.80	1298.89	1302.98	1307.07	1311.16	1315.25	1319.34	1323.43	1327.52	1331.61
555.3	1335.70	1339.79	1343.88	1347.97	1352.06	1356.15	1360.24	1364.33	1368.42	1372.51
555.4	1376.60	1380.69	1384.78	1388.87	1392.96	1397.05	1401.14	1405.23	1409.32	1413.41
555.5	1417.50	1421.59	1425.68	1429.77	1433.86	1437.95	1442.04	1446.13	1450.22	1454.31
555.6	1458.40	1462.49	1466.58	1470.67	1474.76	1478.85	1482.94	1487.03	1491.12	1495.21
555.7	1499.30	1503.39	1507.48	1511.57	1515.66	1519.75	1523.84	1527.93	1532.02	1536.11
555.8	1540.20	1544.29	1548.38	1552.47	1556.56	1560.65	1564.74	1568.83	1572.92	1577.01
555.9	1581.10	1585.19	1589.28	1593.37	1597.46	1601.55	1605.64	1609.73	1613.82	1617.91
556.0	1622.00	1626.88	1631.76	1636.64	1641.52	1646.40	1651.28	1656.16	1661.04	1665.92
556.1	1670.80	1675.68	1680.56	1685.44	1690.32	1695.20	1700.08	1704.96	1709.84	1714.72
556.2	1719.60	1724.48	1729.36	1734.24	1739.12	1744.00	1748.88	1753.76	1758.64	1763.52
556.3	1768.40	1773.28	1778.16	1783.04	1787.92	1792.80	1797.68	1802.56	1807.44	1812.32
556.4	1817.20	1822.08	1826.96	1831.84	1836.72	1841.60	1846.48	1851.36	1856.24	1861.12
556.5	1866.00	1870.88	1875.76	1880.64	1885.52	1890.40	1895.28	1900.16	1905.04	1909.92
556.6	1914.80	1919.68	1924.56	1929.44	1934.32	1939.20	1944.08	1948.96	1953.84	1958.72
556.7	1963.60	1968.48	1973.36	1978.24	1983.12	1988.00	1992.88	1997.76	2002.64	2007.52
556.8	2012.40	2017.28	2022.16	2027.04	2031.92	2036.80	2041.68	2046.56	2051.44	2056.32
556.9	2061.20	2066.08	2070.96	2075.84	2080.72	2085.60	2090.48	2095.36	2100.24	2105.12
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. CAPACITY**

ELEVATIONS IN FEET-NGVD, CAPACITY (IN ACRE-FEET)

ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
557.0	2110.00	2115.83	2121.66	2127.49	2133.32	2139.15	2144.98	2150.81	2156.64	2162.47
557.1	2168.30	2174.13	2179.96	2185.79	2191.62	2197.45	2203.28	2209.11	2214.94	2220.77
557.2	2226.60	2232.43	2238.26	2244.09	2249.92	2255.75	2261.58	2267.41	2273.24	2279.07
557.3	2284.90	2290.73	2296.56	2302.39	2308.22	2314.05	2319.88	2325.71	2331.54	2337.37
557.4	2343.20	2349.03	2354.86	2360.69	2366.52	2372.35	2378.18	2384.01	2389.84	2395.67
557.5	2401.50	2407.33	2413.16	2418.99	2424.82	2430.65	2436.48	2442.31	2448.14	2453.97
557.6	2459.80	2465.63	2471.46	2477.29	2483.12	2488.95	2494.78	2500.61	2506.44	2512.27
557.7	2518.10	2523.93	2529.76	2535.59	2541.42	2547.25	2553.08	2558.91	2564.74	2570.57
557.8	2576.40	2582.23	2588.06	2593.89	2599.72	2605.55	2611.38	2617.21	2623.04	2628.87
557.9	2634.70	2640.53	2646.36	2652.19	2658.02	2663.85	2669.68	2675.51	2681.34	2687.17
558.0	2693.00	2699.81	2706.62	2713.43	2720.24	2727.05	2733.86	2740.67	2747.48	2754.29
558.1	2761.10	2767.91	2774.72	2781.53	2788.34	2795.15	2801.96	2808.77	2815.58	2822.39
558.2	2829.20	2836.01	2842.82	2849.63	2856.44	2863.25	2870.06	2876.87	2883.68	2890.49
558.3	2897.30	2904.11	2910.92	2917.73	2924.54	2931.35	2938.16	2944.97	2951.78	2958.59
558.4	2965.40	2972.21	2979.02	2985.83	2992.64	2999.45	3006.26	3013.07	3019.88	3026.69
558.5	3033.50	3040.31	3047.12	3053.93	3060.74	3067.55	3074.36	3081.17	3087.98	3094.79
558.6	3101.60	3108.41	3115.22	3122.03	3128.84	3135.65	3142.46	3149.27	3156.08	3162.89
558.7	3169.70	3176.51	3183.32	3190.13	3196.94	3203.75	3210.56	3217.37	3224.18	3230.99
558.8	3237.80	3244.61	3251.42	3258.23	3265.04	3271.85	3278.66	3285.47	3292.28	3299.09
558.9	3305.90	3312.71	3319.52	3326.33	3333.14	3339.95	3346.76	3353.57	3360.38	3367.19
559.0	3374.00	3381.83	3389.66	3397.49	3405.32	3413.15	3420.98	3428.81	3436.64	3444.47
559.1	3452.30	3460.13	3467.96	3475.79	3483.62	3491.45	3499.28	3507.11	3514.94	3522.77
559.2	3530.60	3538.43	3546.26	3554.09	3561.92	3569.75	3577.58	3585.41	3593.24	3601.07
559.3	3608.90	3616.73	3624.56	3632.39	3640.22	3648.05	3655.88	3663.71	3671.54	3679.37
559.4	3687.20	3695.03	3702.86	3710.69	3718.52	3726.35	3734.18	3742.01	3749.84	3757.67
559.5	3765.50	3773.33	3781.16	3788.99	3796.82	3804.65	3812.48	3820.31	3828.14	3835.97
559.6	3843.80	3851.63	3859.46	3867.29	3875.12	3882.95	3890.78	3898.61	3906.44	3914.27
559.7	3922.10	3929.93	3937.76	3945.59	3953.42	3961.25	3969.08	3976.91	3984.74	3992.57
559.8	4000.40	4008.23	4016.06	4023.89	4031.72	4039.55	4047.38	4055.21	4063.04	4070.87
559.9	4078.70	4086.53	4094.36	4102.19	4110.02	4117.85	4125.68	4133.51	4141.34	4149.17
560.0	4157.00	4165.79	4174.58	4183.37	4192.16	4200.95	4209.74	4218.53	4227.32	4236.11
560.1	4244.90	4253.69	4262.48	4271.27	4280.06	4288.85	4297.64	4306.43	4315.22	4324.01
560.2	4332.80	4341.59	4350.38	4359.17	4367.96	4376.75	4385.54	4394.33	4403.12	4411.91
560.3	4420.70	4429.49	4438.28	4447.07	4455.86	4464.65	4473.44	4482.23	4491.02	4499.81
560.4	4508.60	4517.39	4526.18	4534.97	4543.76	4552.55	4561.34	4570.13	4578.92	4587.71
560.5	4596.50	4605.29	4614.08	4622.87	4631.66	4640.45	4649.24	4658.03	4666.82	4675.61
560.6	4684.40	4693.19	4701.98	4710.77	4719.56	4728.35	4737.14	4745.93	4754.72	4763.51
560.7	4772.30	4781.09	4789.88	4798.67	4807.46	4816.25	4825.04	4833.83	4842.62	4851.41
560.8	4860.20	4868.99	4877.78	4886.57	4895.36	4904.15	4912.94	4921.73	4930.52	4939.31
560.9	4948.10	4956.89	4965.68	4974.47	4983.26	4992.05	5000.84	5009.63	5018.42	5027.21
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. CAPACITY**

ELEVATIONS IN FEET-NGVD, CAPACITY (IN ACRE-FEET)

ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
561.0	5036.00	5045.74	5055.48	5065.22	5074.96	5084.70	5094.44	5104.18	5113.92	5123.66
561.1	5133.40	5143.14	5152.88	5162.62	5172.36	5182.10	5191.84	5201.58	5211.32	5221.06
561.2	5230.80	5240.54	5250.28	5260.02	5269.76	5279.50	5289.24	5298.98	5308.72	5318.46
561.3	5328.20	5337.94	5347.68	5357.42	5367.16	5376.90	5386.64	5396.38	5406.12	5415.86
561.4	5425.60	5435.34	5445.08	5454.82	5464.56	5474.30	5484.04	5493.78	5503.52	5513.26
561.5	5523.00	5532.74	5542.48	5552.22	5561.96	5571.70	5581.44	5591.18	5600.92	5610.66
561.6	5620.40	5630.14	5639.88	5649.62	5659.36	5669.10	5678.84	5688.58	5698.32	5708.06
561.7	5717.80	5727.54	5737.28	5747.02	5756.76	5766.50	5776.24	5785.98	5795.72	5805.46
561.8	5815.20	5824.94	5834.68	5844.42	5854.16	5863.90	5873.64	5883.38	5893.12	5902.86
561.9	5912.60	5922.34	5932.08	5941.82	5951.56	5961.30	5971.04	5980.78	5990.52	6000.26
562.0	6010.00	6020.76	6031.52	6042.28	6053.04	6063.80	6074.56	6085.32	6096.08	6106.84
562.1	6117.60	6128.36	6139.12	6149.88	6160.64	6171.40	6182.16	6192.92	6203.68	6214.44
562.2	6225.20	6235.96	6246.72	6257.48	6268.24	6279.00	6289.76	6300.52	6311.28	6322.04
562.3	6332.80	6343.56	6354.32	6365.08	6375.84	6386.60	6397.36	6408.12	6418.88	6429.64
562.4	6440.40	6451.16	6461.92	6472.68	6483.44	6494.20	6504.96	6515.72	6526.48	6537.24
562.5	6548.00	6558.76	6569.52	6580.28	6591.04	6601.80	6612.56	6623.32	6634.08	6644.84
562.6	6655.60	6666.36	6677.12	6687.88	6698.64	6709.40	6720.16	6730.92	6741.68	6752.44
562.7	6763.20	6773.96	6784.72	6795.48	6806.24	6817.00	6827.76	6838.52	6849.28	6860.04
562.8	6870.80	6881.56	6892.32	6903.08	6913.84	6924.60	6935.36	6946.12	6956.88	6967.64
562.9	6978.40	6989.16	6999.92	7010.68	7021.44	7032.20	7042.96	7053.72	7064.48	7075.24
563.0	7086.00	7097.92	7109.84	7121.76	7133.68	7145.60	7157.52	7169.44	7181.36	7193.28
563.1	7205.20	7217.12	7229.04	7240.96	7252.88	7264.80	7276.72	7288.64	7300.56	7312.48
563.2	7324.40	7336.32	7348.24	7360.16	7372.08	7384.00	7395.92	7407.84	7419.76	7431.68
563.3	7443.60	7455.52	7467.44	7479.36	7491.28	7503.20	7515.12	7527.04	7538.96	7550.88
563.4	7562.80	7574.72	7586.64	7598.56	7610.48	7622.40	7634.32	7646.24	7658.16	7670.08
563.5	7682.00	7693.92	7705.84	7717.76	7729.68	7741.60	7753.52	7765.44	7777.36	7789.28
563.6	7801.20	7813.12	7825.04	7836.96	7848.88	7860.80	7872.72	7884.64	7896.56	7908.48
563.7	7920.40	7932.32	7944.24	7956.16	7968.08	7980.00	7991.92	8003.84	8015.76	8027.68
563.8	8039.60	8051.52	8063.44	8075.36	8087.28	8099.20	8111.12	8123.04	8134.96	8146.88
563.9	8158.80	8170.72	8182.64	8194.56	8206.48	8218.40	8230.32	8242.24	8254.16	8266.08
564.0	8278.00	8291.36	8304.72	8318.08	8331.44	8344.80	8358.16	8371.52	8384.88	8398.24
564.1	8411.60	8424.96	8438.32	8451.68	8465.04	8478.40	8491.76	8505.12	8518.48	8531.84
564.2	8545.20	8558.56	8571.92	8585.28	8598.64	8612.00	8625.36	8638.72	8652.08	8665.44
564.3	8678.80	8692.16	8705.52	8718.88	8732.24	8745.60	8758.96	8772.32	8785.68	8799.04
564.4	8812.40	8825.76	8839.12	8852.48	8865.84	8879.20	8892.56	8905.92	8919.28	8932.64
564.5	8946.00	8959.36	8972.72	8986.08	8999.44	9012.80	9026.16	9039.52	9052.88	9066.24
564.6	9079.60	9092.96	9106.32	9119.68	9133.04	9146.40	9159.76	9173.12	9186.48	9199.84
564.7	9213.20	9226.56	9239.92	9253.28	9266.64	9280.00	9293.36	9306.72	9320.08	9333.44
564.8	9346.80	9360.16	9373.52	9386.88	9400.24	9413.60	9426.96	9440.32	9453.68	9467.04
564.9	9480.40	9493.76	9507.12	9520.48	9533.84	9547.20	9560.56	9573.92	9587.28	9600.64
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. CAPACITY**

ELEVATIONS IN FEET-NGVD, CAPACITY (IN ACRE-FEET)

ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
565.0	9614.00	9628.76	9643.52	9658.28	9673.04	9687.80	9702.56	9717.32	9732.08	9746.84
565.1	9761.60	9776.36	9791.12	9805.88	9820.64	9835.40	9850.16	9864.92	9879.68	9894.44
565.2	9909.20	9923.96	9938.72	9953.48	9968.24	9983.00	9997.76	10012.52	10027.28	10042.04
565.3	10056.80	10071.56	10086.32	10101.08	10115.84	10130.60	10145.36	10160.12	10174.88	10189.64
565.4	10204.40	10219.16	10233.92	10248.68	10263.44	10278.20	10292.96	10307.72	10322.48	10337.24
565.5	10352.00	10366.76	10381.52	10396.28	10411.04	10425.80	10440.56	10455.32	10470.08	10484.84
565.6	10499.60	10514.36	10529.12	10543.88	10558.64	10573.40	10588.16	10602.92	10617.68	10632.44
565.7	10647.20	10661.96	10676.72	10691.48	10706.24	10721.00	10735.76	10750.52	10765.28	10780.04
565.8	10794.80	10809.56	10824.32	10839.08	10853.84	10868.60	10883.36	10898.12	10912.88	10927.64
565.9	10942.40	10957.16	10971.92	10986.68	11001.44	11016.20	11030.96	11045.72	11060.48	11075.24
566.0	11090.00	11106.19	11122.38	11138.57	11154.76	11170.95	11187.14	11203.33	11219.52	11235.71
566.1	11251.90	11268.09	11284.28	11300.47	11316.66	11332.85	11349.04	11365.23	11381.42	11397.61
566.2	11413.80	11429.99	11446.18	11462.37	11478.56	11494.75	11510.94	11527.13	11543.32	11559.51
566.3	11575.70	11591.89	11608.08	11624.27	11640.46	11656.65	11672.84	11689.03	11705.22	11721.41
566.4	11737.60	11753.79	11769.98	11786.17	11802.36	11818.55	11834.74	11850.93	11867.12	11883.31
566.5	11899.50	11915.69	11931.88	11948.07	11964.26	11980.45	11996.64	12012.83	12029.02	12045.21
566.6	12061.40	12077.59	12093.78	12109.97	12126.16	12142.35	12158.54	12174.73	12190.92	12207.11
566.7	12223.30	12239.49	12255.68	12271.87	12288.06	12304.25	12320.44	12336.63	12352.82	12369.01
566.8	12385.20	12401.39	12417.58	12433.77	12449.96	12466.15	12482.34	12498.53	12514.72	12530.91
566.9	12547.10	12563.29	12579.48	12595.67	12611.86	12628.05	12644.24	12660.43	12676.62	12692.81
567.0	12709.00	12726.62	12744.24	12761.86	12779.48	12797.10	12814.72	12832.34	12849.96	12867.58
567.1	12885.20	12902.82	12920.44	12938.06	12955.68	12973.30	12990.92	13008.54	13026.16	13043.78
567.2	13061.40	13079.02	13096.64	13114.26	13131.88	13149.50	13167.12	13184.74	13202.36	13219.98
567.3	13237.60	13255.22	13272.84	13290.46	13308.08	13325.70	13343.32	13360.94	13378.56	13396.18
567.4	13413.80	13431.42	13449.04	13466.66	13484.28	13501.90	13519.52	13537.14	13554.76	13572.38
567.5	13590.00	13607.62	13625.24	13642.86	13660.48	13678.10	13695.72	13713.34	13730.96	13748.58
567.6	13766.20	13783.82	13801.44	13819.06	13836.68	13854.30	13871.92	13889.54	13907.16	13924.78
567.7	13942.40	13960.02	13977.64	13995.26	14012.88	14030.50	14048.12	14065.74	14083.36	14100.98
567.8	14118.60	14136.22	14153.84	14171.46	14189.08	14206.70	14224.32	14241.94	14259.56	14277.18
567.9	14294.80	14312.42	14330.04	14347.66	14365.28	14382.90	14400.52	14418.14	14435.76	14453.38
568.0	14471.00	14489.90	14508.80	14527.70	14546.60	14565.50	14584.40	14603.30	14622.20	14641.10
568.1	14660.00	14678.90	14697.80	14716.70	14735.60	14754.50	14773.40	14792.30	14811.20	14830.10
568.2	14849.00	14867.90	14886.80	14905.70	14924.60	14943.50	14962.40	14981.30	15000.20	15019.10
568.3	15038.00	15056.90	15075.80	15094.70	15113.60	15132.50	15151.40	15170.30	15189.20	15208.10
568.4	15227.00	15245.90	15264.80	15283.70	15302.60	15321.50	15340.40	15359.30	15378.20	15397.10
568.5	15416.00	15434.90	15453.80	15472.70	15491.60	15510.50	15529.40	15548.30	15567.20	15586.10
568.6	15605.00	15623.90	15642.80	15661.70	15680.60	15699.50	15718.40	15737.30	15756.20	15775.10
568.7	15794.00	15812.90	15831.80	15850.70	15869.60	15888.50	15907.40	15926.30	15945.20	15964.10
568.8	15983.00	16001.90	16020.80	16039.70	16058.60	16077.50	16096.40	16115.30	16134.20	16153.10
568.9	16172.00	16190.90	16209.80	16228.70	16247.60	16266.50	16285.40	16304.30	16323.20	16342.10
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. CAPACITY**

ELEVATIONS IN FEET-NGVD, CAPACITY (IN ACRE-FEET)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
569.0	16361.00	16381.31	16401.62	16421.93	16442.24	16462.55	16482.86	16503.17	16523.48	16543.79
569.1	16564.10	16584.41	16604.72	16625.03	16645.34	16665.65	16685.96	16706.27	16726.58	16746.89
569.2	16767.20	16787.51	16807.82	16828.13	16848.44	16868.75	16889.06	16909.37	16929.68	16949.99
569.3	16970.30	16990.61	17010.92	17031.23	17051.54	17071.85	17092.16	17112.47	17132.78	17153.09
569.4	17173.40	17193.71	17214.02	17234.33	17254.64	17274.95	17295.26	17315.57	17335.88	17356.19
569.5	17376.50	17396.81	17417.12	17437.43	17457.74	17478.05	17498.36	17518.67	17538.98	17559.29
569.6	17579.60	17599.91	17620.22	17640.53	17660.84	17681.15	17701.46	17721.77	17742.08	17762.39
569.7	17782.70	17803.01	17823.32	17843.63	17863.94	17884.25	17904.56	17924.87	17945.18	17965.49
569.8	17985.80	18006.11	18026.42	18046.73	18067.04	18087.35	18107.66	18127.97	18148.28	18168.59
569.9	18188.90	18209.21	18229.52	18249.83	18270.14	18290.45	18310.76	18331.07	18351.38	18371.69
570.0	18392.00	18414.21	18436.42	18458.63	18480.84	18503.05	18525.26	18547.47	18569.68	18591.89
570.1	18614.10	18636.31	18658.52	18680.73	18702.94	18725.15	18747.36	18769.57	18791.78	18813.99
570.2	18836.20	18858.41	18880.62	18902.83	18925.04	18947.25	18969.46	18991.67	19013.88	19036.09
570.3	19058.30	19080.51	19102.72	19124.93	19147.14	19169.35	19191.56	19213.77	19235.98	19258.19
570.4	19280.40	19302.61	19324.82	19347.03	19369.24	19391.45	19413.66	19435.87	19458.08	19480.29
570.5	19502.50	19524.71	19546.92	19569.13	19591.34	19613.55	19635.76	19657.97	19680.18	19702.39
570.6	19724.60	19746.81	19769.02	19791.23	19813.44	19835.65	19857.86	19880.07	19902.28	19924.49
570.7	19946.70	19968.91	19991.12	20013.33	20035.54	20057.75	20079.96	20102.17	20124.38	20146.59
570.8	20168.80	20191.01	20213.22	20235.43	20257.64	20279.85	20302.06	20324.27	20346.48	20368.69
570.9	20390.90	20413.11	20435.32	20457.53	20479.74	20501.95	20524.16	20546.37	20568.58	20590.79
571.0	20613.00	20637.12	20661.24	20685.36	20709.48	20733.60	20757.72	20781.84	20805.96	20830.08
571.1	20854.20	20878.32	20902.44	20926.56	20950.68	20974.80	20998.92	21023.04	21047.16	21071.28
571.2	21095.40	21119.52	21143.64	21167.76	21191.88	21216.00	21240.12	21264.24	21288.36	21312.48
571.3	21336.60	21360.72	21384.84	21408.96	21433.08	21457.20	21481.32	21505.44	21529.56	21553.68
571.4	21577.80	21601.92	21626.04	21650.16	21674.28	21698.40	21722.52	21746.64	21770.76	21794.88
571.5	21819.00	21843.12	21867.24	21891.36	21915.48	21939.60	21963.72	21987.84	22011.96	22036.08
571.6	22060.20	22084.32	22108.44	22132.56	22156.68	22180.80	22204.92	22229.04	22253.16	22277.28
571.7	22301.40	22325.52	22349.64	22373.76	22397.88	22422.00	22446.12	22470.24	22494.36	22518.48
571.8	22542.60	22566.72	22590.84	22614.96	22639.08	22663.20	22687.32	22711.44	22735.56	22759.68
571.9	22783.80	22807.92	22832.04	22856.16	22880.28	22904.40	22928.52	22952.64	22976.76	23000.88
572.0	23025.00	23051.03	23077.06	23103.09	23129.12	23155.15	23181.18	23207.21	23233.24	23259.27
572.1	23285.30	23311.33	23337.36	23363.39	23389.42	23415.45	23441.48	23467.51	23493.54	23519.57
572.2	23545.60	23571.63	23597.66	23623.69	23649.72	23675.75	23701.78	23727.81	23753.84	23779.87
572.3	23805.90	23831.93	23857.96	23883.99	23910.02	23936.05	23962.08	23988.11	24014.14	24040.17
572.4	24066.20	24092.23	24118.26	24144.29	24170.32	24196.35	24222.38	24248.41	24274.44	24300.47
572.5	24326.50	24352.53	24378.56	24404.59	24430.62	24456.65	24482.68	24508.71	24534.74	24560.77
572.6	24586.80	24612.83	24638.86	24664.89	24690.92	24716.95	24742.98	24769.01	24795.04	24821.07
572.7	24847.10	24873.13	24899.16	24925.19	24951.22	24977.25	25003.28	25029.31	25055.34	25081.37
572.8	25107.40	25133.43	25159.46	25185.49	25211.52	25237.55	25263.58	25289.61	25315.64	25341.67
572.9	25367.70	25393.73	25419.76	25445.79	25471.82	25497.85	25523.88	25549.91	25575.94	25601.97
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. CAPACITY**

ELEVATIONS IN FEET-NGVD, CAPACITY (IN ACRE-FEET)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
573.0	25628.00	25656.13	25684.26	25712.39	25740.52	25768.65	25796.78	25824.91	25853.04	25881.17
573.1	25909.30	25937.43	25965.56	25993.69	26021.82	26049.95	26078.08	26106.21	26134.34	26162.47
573.2	26190.60	26218.73	26246.86	26274.99	26303.12	26331.25	26359.38	26387.51	26415.64	26443.77
573.3	26471.90	26500.03	26528.16	26556.29	26584.42	26612.55	26640.68	26668.81	26696.94	26725.07
573.4	26753.20	26781.33	26809.46	26837.59	26865.72	26893.85	26921.98	26950.11	26978.24	27006.37
573.5	27034.50	27062.63	27090.76	27118.89	27147.02	27175.15	27203.28	27231.41	27259.54	27287.67
573.6	27315.80	27343.93	27372.06	27400.19	27428.32	27456.45	27484.58	27512.71	27540.84	27568.97
573.7	27597.10	27625.23	27653.36	27681.49	27709.62	27737.75	27765.88	27794.01	27822.14	27850.27
573.8	27878.40	27906.53	27934.66	27962.79	27990.92	28019.05	28047.18	28075.31	28103.44	28131.57
573.9	28159.70	28187.83	28215.96	28244.09	28272.22	28300.35	28328.48	28356.61	28384.74	28412.87
574.0	28441.00	28471.43	28501.86	28532.29	28562.72	28593.15	28623.58	28654.01	28684.44	28714.87
574.1	28745.30	28775.73	28806.16	28836.59	28867.02	28897.45	28927.88	28958.31	28988.74	29019.17
574.2	29049.60	29080.03	29110.46	29140.89	29171.32	29201.75	29232.18	29262.61	29293.04	29323.47
574.3	29353.90	29384.33	29414.76	29445.19	29475.62	29506.05	29536.48	29566.91	29597.34	29627.77
574.4	29658.20	29688.63	29719.06	29749.49	29779.92	29810.35	29840.78	29871.21	29901.64	29932.07
574.5	29962.50	29992.93	30023.36	30053.79	30084.22	30114.65	30145.08	30175.51	30205.94	30236.37
574.6	30266.80	30297.23	30327.66	30358.09	30388.52	30418.95	30449.38	30479.81	30510.24	30540.67
574.7	30571.10	30601.53	30631.96	30662.39	30692.82	30723.25	30753.68	30784.11	30814.54	30844.97
574.8	30875.40	30905.83	30936.26	30966.69	30997.12	31027.55	31057.98	31088.41	31118.84	31149.27
574.9	31179.70	31210.13	31240.56	31270.99	31301.42	31331.85	31362.28	31392.71	31423.14	31453.57
575.0	31484.00	31516.68	31549.36	31582.04	31614.72	31647.40	31680.08	31712.76	31745.44	31778.12
575.1	31810.80	31843.48	31876.16	31908.84	31941.52	31974.20	32006.88	32039.56	32072.24	32104.92
575.2	32137.60	32170.28	32202.96	32235.64	32268.32	32301.00	32333.68	32366.36	32399.04	32431.72
575.3	32464.40	32497.08	32529.76	32562.44	32595.12	32627.80	32660.48	32693.16	32725.84	32758.52
575.4	32791.20	32823.88	32856.56	32889.24	32921.92	32954.60	32987.28	33019.96	33052.64	33085.32
575.5	33118.00	33150.68	33183.36	33216.04	33248.72	33281.40	33314.08	33346.76	33379.44	33412.12
575.6	33444.80	33477.48	33510.16	33542.84	33575.52	33608.20	33640.88	33673.56	33706.24	33738.92
575.7	33771.60	33804.28	33836.96	33869.64	33902.32	33935.00	33967.68	34000.36	34033.04	34065.72
575.8	34098.40	34131.08	34163.76	34196.44	34229.12	34261.80	34294.48	34327.16	34359.84	34392.52
575.9	34425.20	34457.88	34490.56	34523.24	34555.92	34588.60	34621.28	34653.96	34686.64	34719.32
576.0	34752.00	34787.02	34822.04	34857.06	34892.08	34927.10	34962.12	34997.14	35032.16	35067.18
576.1	35102.20	35137.22	35172.24	35207.26	35242.28	35277.30	35312.32	35347.34	35382.36	35417.38
576.2	35452.40	35487.42	35522.44	35557.46	35592.48	35627.50	35662.52	35697.54	35732.56	35767.58
576.3	35802.60	35837.62	35872.64	35907.66	35942.68	35977.70	36012.72	36047.74	36082.76	36117.78
576.4	36152.80	36187.82	36222.84	36257.86	36292.88	36327.90	36362.92	36397.94	36432.96	36467.98
576.5	36503.00	36538.02	36573.04	36608.06	36643.08	36678.10	36713.12	36748.14	36783.16	36818.18
576.6	36853.20	36888.22	36923.24	36958.26	36993.28	37028.30	37063.32	37098.34	37133.36	37168.38
576.7	37203.40	37238.42	37273.44	37308.46	37343.48	37378.50	37413.52	37448.54	37483.56	37518.58
576.8	37553.60	37588.62	37623.64	37658.66	37693.68	37728.70	37763.72	37798.74	37833.76	37868.78
576.9	37903.80	37938.82	37973.84	38008.86	38043.88	38078.90	38113.92	38148.94	38183.96	38218.98
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. CAPACITY**

ELEVATIONS IN FEET-NGVD, CAPACITY (IN ACRE-FEET)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
577.0	38254.00	38291.12	38328.24	38365.36	38402.48	38439.60	38476.72	38513.84	38550.96	38588.08
577.1	38625.20	38662.32	38699.44	38736.56	38773.68	38810.80	38847.92	38885.04	38922.16	38959.28
577.2	38996.40	39033.52	39070.64	39107.76	39144.88	39182.00	39219.12	39256.24	39293.36	39330.48
577.3	39367.60	39404.72	39441.84	39478.96	39516.08	39553.20	39590.32	39627.44	39664.56	39701.68
577.4	39738.80	39775.92	39813.04	39850.16	39887.28	39924.40	39961.52	39998.64	40035.76	40072.88
577.5	40110.00	40147.12	40184.24	40221.36	40258.48	40295.60	40332.72	40369.84	40406.96	40444.08
577.6	40481.20	40518.32	40555.44	40592.56	40629.68	40666.80	40703.92	40741.04	40778.16	40815.28
577.7	40852.40	40889.52	40926.64	40963.76	41000.88	41038.00	41075.12	41112.24	41149.36	41186.48
577.8	41223.60	41260.72	41297.84	41334.96	41372.08	41409.20	41446.32	41483.44	41520.56	41557.68
577.9	41594.80	41631.92	41669.04	41706.16	41743.28	41780.40	41817.52	41854.64	41891.76	41928.88
578.0	41966.00	42005.56	42045.12	42084.68	42124.24	42163.80	42203.36	42242.92	42282.48	42322.04
578.1	42361.60	42401.16	42440.72	42480.28	42519.84	42559.40	42598.96	42638.52	42678.08	42717.64
578.2	42757.20	42796.76	42836.32	42875.88	42915.44	42955.00	42994.56	43034.12	43073.68	43113.24
578.3	43152.80	43192.36	43231.92	43271.48	43311.04	43350.60	43390.16	43429.72	43469.28	43508.84
578.4	43548.40	43587.96	43627.52	43667.08	43706.64	43746.20	43785.76	43825.32	43864.88	43904.44
578.5	43944.00	43983.56	44023.12	44062.68	44102.24	44141.80	44181.36	44220.92	44260.48	44300.04
578.6	44339.60	44379.16	44418.72	44458.28	44497.84	44537.40	44576.96	44616.52	44656.08	44695.64
578.7	44735.20	44774.76	44814.32	44853.88	44893.44	44933.00	44972.56	45012.12	45051.68	45091.24
578.8	45130.80	45170.36	45209.92	45249.48	45289.04	45328.60	45368.16	45407.72	45447.28	45486.84
578.9	45526.40	45565.96	45605.52	45645.08	45684.64	45724.20	45763.76	45803.32	45842.88	45882.44
579.0	45922.00	45964.06	46006.12	46048.18	46090.24	46132.30	46174.36	46216.42	46258.48	46300.54
579.1	46342.60	46384.66	46426.72	46468.78	46510.84	46552.90	46594.96	46637.02	46679.08	46721.14
579.2	46763.20	46805.26	46847.32	46889.38	46931.44	46973.50	47015.56	47057.62	47099.68	47141.74
579.3	47183.80	47225.86	47267.92	47309.98	47352.04	47394.10	47436.16	47478.22	47520.28	47562.34
579.4	47604.40	47646.46	47688.52	47730.58	47772.64	47814.70	47856.76	47898.82	47940.88	47982.94
579.5	48025.00	48067.06	48109.12	48151.18	48193.24	48235.30	48277.36	48319.42	48361.48	48403.54
579.6	48445.60	48487.66	48529.72	48571.78	48613.84	48655.90	48697.96	48740.02	48782.08	48824.14
579.7	48866.20	48908.26	48950.32	48992.38	49034.44	49076.50	49118.56	49160.62	49202.68	49244.74
579.8	49286.80	49328.86	49370.92	49412.98	49455.04	49497.10	49539.16	49581.22	49623.28	49665.34
579.9	49707.40	49749.46	49791.52	49833.58	49875.64	49917.70	49959.76	50001.82	50043.88	50085.94
580.0	50128.00	50172.52	50217.04	50261.56	50306.08	50350.60	50395.12	50439.64	50484.16	50528.68
580.1	50573.20	50617.72	50662.24	50706.76	50751.28	50795.80	50840.32	50884.84	50929.36	50973.88
580.2	51018.40	51062.92	51107.44	51151.96	51196.48	51241.00	51285.52	51330.04	51374.56	51419.08
580.3	51463.60	51508.12	51552.64	51597.16	51641.68	51686.20	51730.72	51775.24	51819.76	51864.28
580.4	51908.80	51953.32	51997.84	52042.36	52086.88	52131.40	52175.92	52220.44	52264.96	52309.48
580.5	52354.00	52398.52	52443.04	52487.56	52532.08	52576.60	52621.12	52665.64	52710.16	52754.68
580.6	52799.20	52843.72	52888.24	52932.76	52977.28	53021.80	53066.32	53110.84	53155.36	53199.88
580.7	53244.40	53288.92	53333.44	53377.96	53422.48	53467.00	53511.52	53556.04	53600.56	53645.08
580.8	53689.60	53734.12	53778.64	53823.16	53867.68	53912.20	53956.72	54001.24	54045.76	54090.28
580.9	54134.80	54179.32	54223.84	54268.36	54312.88	54357.40	54401.92	54446.44	54490.96	54535.48
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. CAPACITY**

ELEVATIONS IN FEET-NGVD, CAPACITY (IN ACRE-FEET)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
581.0	54580.00	54627.18	54674.36	54721.54	54768.72	54815.90	54863.08	54910.26	54957.44	55004.62
581.1	55051.80	55098.98	55146.16	55193.34	55240.52	55287.70	55334.88	55382.06	55429.24	55476.42
581.2	55523.60	55570.78	55617.96	55665.14	55712.32	55759.50	55806.68	55853.86	55901.04	55948.22
581.3	55995.40	56042.58	56089.76	56136.94	56184.12	56231.30	56278.48	56325.66	56372.84	56420.02
581.4	56467.20	56514.38	56561.56	56608.74	56655.92	56703.10	56750.28	56797.46	56844.64	56891.82
581.5	56939.00	56986.18	57033.36	57080.54	57127.72	57174.90	57222.08	57269.26	57316.44	57363.62
581.6	57410.80	57457.98	57505.16	57552.34	57599.52	57646.70	57693.88	57741.06	57788.24	57835.42
581.7	57882.60	57929.78	57976.96	58024.14	58071.32	58118.50	58165.68	58212.86	58260.04	58307.22
581.8	58354.40	58401.58	58448.76	58495.94	58543.12	58590.30	58637.48	58684.66	58731.84	58779.02
581.9	58826.20	58873.38	58920.56	58967.74	59014.92	59062.10	59109.28	59156.46	59203.64	59250.82
582.0	59298.00	59348.03	59398.06	59448.09	59498.12	59548.15	59598.18	59648.21	59698.24	59748.27
582.1	59798.30	59848.33	59898.36	59948.39	59998.42	60048.45	60098.48	60148.51	60198.54	60248.57
582.2	60298.60	60348.63	60398.66	60448.69	60498.72	60548.75	60598.78	60648.81	60698.84	60748.87
582.3	60798.90	60848.93	60898.96	60948.99	60999.02	61049.05	61099.08	61149.11	61199.14	61249.17
582.4	61299.20	61349.23	61399.26	61449.29	61499.32	61549.35	61599.38	61649.41	61699.44	61749.47
582.5	61799.50	61849.53	61899.56	61949.59	61999.62	62049.65	62099.68	62149.71	62199.74	62249.77
582.6	62299.80	62349.83	62399.86	62449.89	62499.92	62549.95	62599.98	62650.01	62700.04	62750.07
582.7	62800.10	62850.13	62900.16	62950.19	63000.22	63050.25	63100.28	63150.31	63200.34	63250.37
582.8	63300.40	63350.43	63400.46	63450.49	63500.52	63550.55	63600.58	63650.61	63700.64	63750.67
582.9	63800.70	63850.73	63900.76	63950.79	64000.82	64050.85	64100.88	64150.91	64200.94	64250.97
583.0	64301.00	64353.80	64406.60	64459.40	64512.20	64565.00	64617.80	64670.60	64723.40	64776.20
583.1	64829.00	64881.80	64934.60	64987.40	65040.20	65093.00	65145.80	65198.60	65251.40	65304.20
583.2	65357.00	65409.80	65462.60	65515.40	65568.20	65621.00	65673.80	65726.60	65779.40	65832.20
583.3	65885.00	65937.80	65990.60	66043.40	66096.20	66149.00	66201.80	66254.60	66307.40	66360.20
583.4	66413.00	66465.80	66518.60	66571.40	66624.20	66677.00	66729.80	66782.60	66835.40	66888.20
583.5	66941.00	66993.80	67046.60	67099.40	67152.20	67205.00	67257.80	67310.60	67363.40	67416.20
583.6	67469.00	67521.80	67574.60	67627.40	67680.20	67733.00	67785.80	67838.60	67891.40	67944.20
583.7	67997.00	68049.80	68102.60	68155.40	68208.20	68261.00	68313.80	68366.60	68419.40	68472.20
583.8	68525.00	68577.80	68630.60	68683.40	68736.20	68789.00	68841.80	68894.60	68947.40	69000.20
583.9	69053.00	69105.80	69158.60	69211.40	69264.20	69317.00	69369.80	69422.60	69475.40	69528.20
584.0	69581.00	69636.82	69692.64	69748.46	69804.28	69860.10	69915.92	69971.74	70027.56	70083.38
584.1	70139.20	70195.02	70250.84	70306.66	70362.48	70418.30	70474.12	70529.94	70585.76	70641.58
584.2	70697.40	70753.22	70809.04	70864.86	70920.68	70976.50	71032.32	71088.14	71143.96	71199.78
584.3	71255.60	71311.42	71367.24	71423.06	71478.88	71534.70	71590.52	71646.34	71702.16	71757.98
584.4	71813.80	71869.62	71925.44	71981.26	72037.08	72092.90	72148.72	72204.54	72260.36	72316.18
584.5	72372.00	72427.82	72483.64	72539.46	72595.28	72651.10	72706.92	72762.74	72818.56	72874.38
584.6	72930.20	72986.02	73041.84	73097.66	73153.48	73209.30	73265.12	73320.94	73376.76	73432.58
584.7	73488.40	73544.22	73600.04	73655.86	73711.68	73767.50	73823.32	73879.14	73934.96	73990.78
584.8	74046.60	74102.42	74158.24	74214.06	74269.88	74325.70	74381.52	74437.34	74493.16	74548.98
584.9	74604.80	74660.62	74716.44	74772.26	74828.08	74883.90	74939.72	74995.54	75051.36	75107.18
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. CAPACITY**

ELEVATIONS IN FEET-NGVD, CAPACITY (IN ACRE-FEET)

ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
585.0	75163.00	75221.61	75280.22	75338.83	75397.44	75456.05	75514.66	75573.27	75631.88	75690.49
585.1	75749.10	75807.71	75866.32	75924.93	75983.54	76042.15	76100.76	76159.37	76217.98	76276.59
585.2	76335.20	76393.81	76452.42	76511.03	76569.64	76628.25	76686.86	76745.47	76804.08	76862.69
585.3	76921.30	76979.91	77038.52	77097.13	77155.74	77214.35	77272.96	77331.57	77390.18	77448.79
585.4	77507.40	77566.01	77624.62	77683.23	77741.84	77800.45	77859.06	77917.67	77976.28	78034.89
585.5	78093.50	78152.11	78210.72	78269.33	78327.94	78386.55	78445.16	78503.77	78562.38	78620.99
585.6	78679.60	78738.21	78796.82	78855.43	78914.04	78972.65	79031.26	79089.87	79148.48	79207.09
585.7	79265.70	79324.31	79382.92	79441.53	79500.14	79558.75	79617.36	79675.97	79734.58	79793.19
585.8	79851.80	79910.41	79969.02	80027.63	80086.24	80144.85	80203.46	80262.07	80320.68	80379.29
585.9	80437.90	80496.51	80555.12	80613.73	80672.34	80730.95	80789.56	80848.17	80906.78	80965.39
586.0	81024.00	81085.05	81146.10	81207.15	81268.20	81329.25	81390.30	81451.35	81512.40	81573.45
586.1	81634.50	81695.55	81756.60	81817.65	81878.70	81939.75	82000.80	82061.85	82122.90	82183.95
586.2	82245.00	82306.05	82367.10	82428.15	82489.20	82550.25	82611.30	82672.35	82733.40	82794.45
586.3	82855.50	82916.55	82977.60	83038.65	83099.70	83160.75	83221.80	83282.85	83343.90	83404.95
586.4	83466.00	83527.05	83588.10	83649.15	83710.20	83771.25	83832.30	83893.35	83954.40	84015.45
586.5	84076.50	84137.55	84198.60	84259.65	84320.70	84381.75	84442.80	84503.85	84564.90	84625.95
586.6	84687.00	84748.05	84809.10	84870.15	84931.20	84992.25	85053.30	85114.35	85175.40	85236.45
586.7	85297.50	85358.55	85419.60	85480.65	85541.70	85602.75	85663.80	85724.85	85785.90	85846.95
586.8	85908.00	85969.05	86030.10	86091.15	86152.20	86213.25	86274.30	86335.35	86396.40	86457.45
586.9	86518.50	86579.55	86640.60	86701.65	86762.70	86823.75	86884.80	86945.85	87006.90	87067.95
587.0	87129.00	87192.38	87255.76	87319.14	87382.52	87445.90	87509.28	87572.66	87636.04	87699.42
587.1	87762.80	87826.18	87889.56	87952.94	88016.32	88079.70	88143.08	88206.46	88269.84	88333.22
587.2	88396.60	88459.98	88523.36	88586.74	88650.12	88713.50	88776.88	88840.26	88903.64	88967.02
587.3	89030.40	89093.78	89157.16	89220.54	89283.92	89347.30	89410.68	89474.06	89537.44	89600.82
587.4	89664.20	89727.58	89790.96	89854.34	89917.72	89981.10	90044.48	90107.86	90171.24	90234.62
587.5	90298.00	90361.38	90424.76	90488.14	90551.52	90614.90	90678.28	90741.66	90805.04	90868.42
587.6	90931.80	90995.18	91058.56	91121.94	91185.32	91248.70	91312.08	91375.46	91438.84	91502.22
587.7	91565.60	91628.98	91692.36	91755.74	91819.12	91882.50	91945.88	92009.26	92072.64	92136.02
587.8	92199.40	92262.78	92326.16	92389.54	92452.92	92516.30	92579.68	92643.06	92706.44	92769.82
587.9	92833.20	92896.58	92959.96	93023.34	93086.72	93150.10	93213.48	93276.86	93340.24	93403.62
588.0	93467.00	93532.86	93598.72	93664.58	93730.44	93796.30	93862.16	93928.02	93993.88	94059.74
588.1	94125.60	94191.46	94257.32	94323.18	94389.04	94454.90	94520.76	94586.62	94652.48	94718.34
588.2	94784.20	94850.06	94915.92	94981.78	95047.64	95113.50	95179.36	95245.22	95311.08	95376.94
588.3	95442.80	95508.66	95574.52	95640.38	95706.24	95772.10	95837.96	95903.82	95969.68	96035.54
588.4	96101.40	96167.26	96233.12	96298.98	96364.84	96430.70	96496.56	96562.42	96628.28	96694.14
588.5	96760.00	96825.86	96891.72	96957.58	97023.44	97089.30	97155.16	97221.02	97286.88	97352.74
588.6	97418.60	97484.46	97550.32	97616.18	97682.04	97747.90	97813.76	97879.62	97945.48	98011.34
588.7	98077.20	98143.06	98208.92	98274.78	98340.64	98406.50	98472.36	98538.22	98604.08	98669.94
588.8	98735.80	98801.66	98867.52	98933.38	98999.24	99065.10	99130.96	99196.82	99262.68	99328.54
588.9	99394.40	99460.26	99526.12	99591.98	99657.84	99723.70	99789.56	99855.42	99921.28	99987.14
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. CAPACITY**

ELEVATIONS IN FEET-NGVD, CAPACITY (IN ACRE-FEET)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
589.0	100053.00	100121.33	100189.66	100257.99	100326.32	100394.65	100462.98	100531.31	100599.64	100667.97
589.1	100736.30	100804.63	100872.96	100941.29	101009.62	101077.95	101146.28	101214.61	101282.94	101351.27
589.2	101419.60	101487.93	101556.26	101624.59	101692.92	101761.25	101829.58	101897.91	101966.24	102034.57
589.3	102102.90	102171.23	102239.56	102307.89	102376.22	102444.55	102512.88	102581.21	102649.54	102717.87
589.4	102786.20	102854.53	102922.86	102991.19	103059.52	103127.85	103196.18	103264.51	103332.84	103401.17
589.5	103469.50	103537.83	103606.16	103674.49	103742.82	103811.15	103879.48	103947.81	104016.14	104084.47
589.6	104152.80	104221.13	104289.46	104357.79	104426.12	104494.45	104562.78	104631.11	104699.44	104767.77
589.7	104836.10	104904.43	104972.76	105041.09	105109.42	105177.75	105246.08	105314.41	105382.74	105451.07
589.8	105519.40	105587.73	105656.06	105724.39	105792.72	105861.05	105929.38	105997.71	106066.04	106134.37
589.9	106202.70	106271.03	106339.36	106407.69	106476.02	106544.35	106612.68	106681.01	106749.34	106817.67
590.0	106886.00	106956.73	107027.46	107098.19	107168.92	107239.65	107310.38	107381.11	107451.84	107522.57
590.1	107593.30	107664.03	107734.76	107805.49	107876.22	107946.95	108017.68	108088.41	108159.14	108229.87
590.2	108300.60	108371.33	108442.06	108512.79	108583.52	108654.25	108724.98	108795.71	108866.44	108937.17
590.3	109007.90	109078.63	109149.36	109220.09	109290.82	109361.55	109432.28	109503.01	109573.74	109644.47
590.4	109715.20	109785.93	109856.66	109927.39	109998.12	110068.85	110139.58	110210.31	110281.04	110351.77
590.5	110422.50	110493.23	110563.96	110634.69	110705.42	110776.15	110846.88	110917.61	110988.34	111059.07
590.6	111129.80	111200.53	111271.26	111341.99	111412.72	111483.45	111554.18	111624.91	111695.64	111766.37
590.7	111837.10	111907.83	111978.56	112049.29	112120.02	112190.75	112261.48	112332.21	112402.94	112473.67
590.8	112544.40	112615.13	112685.86	112756.59	112827.32	112898.05	112968.78	113039.51	113110.24	113180.97
590.9	113251.70	113322.43	113393.16	113463.89	113534.62	113605.35	113676.08	113746.81	113817.54	113888.27
591.0	113959.00	114032.13	114105.26	114178.39	114251.52	114324.65	114397.78	114470.91	114544.04	114617.17
591.1	114690.30	114763.43	114836.56	114909.69	114982.82	115055.95	115129.08	115202.21	115275.34	115348.47
591.2	115421.60	115494.73	115567.86	115640.99	115714.12	115787.25	115860.38	115933.51	116006.64	116079.77
591.3	116152.90	116226.03	116299.16	116372.29	116445.42	116518.55	116591.68	116664.81	116737.94	116811.07
591.4	116884.20	116957.33	117030.46	117103.59	117176.72	117249.85	117322.98	117396.11	117469.24	117542.37
591.5	117615.50	117688.63	117761.76	117834.89	117908.02	117981.15	118054.28	118127.41	118200.54	118273.67
591.6	118346.80	118419.93	118493.06	118566.19	118639.32	118712.45	118785.58	118858.71	118931.84	119004.97
591.7	119078.10	119151.23	119224.36	119297.49	119370.62	119443.75	119516.88	119590.01	119663.14	119736.27
591.8	119809.40	119882.53	119955.66	120028.79	120101.92	120175.05	120248.18	120321.31	120394.44	120467.57
591.9	120540.70	120613.83	120686.96	120760.09	120833.22	120906.35	120979.48	121052.61	121125.74	121198.87
592.0	121272.00	121347.45	121422.90	121498.35	121573.80	121649.25	121724.70	121800.15	121875.60	121951.05
592.1	122026.50	122101.95	122177.40	122252.85	122328.30	122403.75	122479.20	122554.65	122630.10	122705.55
592.2	122781.00	122856.45	122931.90	123007.35	123082.80	123158.25	123233.70	123309.15	123384.60	123460.05
592.3	123535.50	123610.95	123686.40	123761.85	123837.30	123912.75	123988.20	124063.65	124139.10	124214.55
592.4	124290.00	124365.45	124440.90	124516.35	124591.80	124667.25	124742.70	124818.15	124893.60	124969.05
592.5	125044.50	125119.95	125195.40	125270.85	125346.30	125421.75	125497.20	125572.65	125648.10	125723.55
592.6	125799.00	125874.45	125949.90	126025.35	126100.80	126176.25	126251.70	126327.15	126402.60	126478.05
592.7	126553.50	126628.95	126704.40	126779.85	126855.30	126930.75	127006.20	127081.65	127157.10	127232.55
592.8	127308.00	127383.45	127458.90	127534.35	127609.80	127685.25	127760.70	127836.15	127911.60	127987.05
592.9	128062.50	128137.95	128213.40	128288.85	128364.30	128439.75	128515.20	128590.65	128666.10	128741.55
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. CAPACITY**

ELEVATIONS IN FEET-NGVD, CAPACITY (IN ACRE-FEET)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
593.0	128817.00	128894.87	128972.74	129050.61	129128.48	129206.35	129284.22	129362.09	129439.96	129517.83
593.1	129595.70	129673.57	129751.44	129829.31	129907.18	129985.05	130062.92	130140.79	130218.66	130296.53
593.2	130374.40	130452.27	130530.14	130608.01	130685.88	130763.75	130841.62	130919.49	130997.36	131075.23
593.3	131153.09	131230.97	131308.84	131386.70	131464.58	131542.45	131620.31	131698.19	131776.06	131853.94
593.4	131931.80	132009.67	132087.55	132165.41	132243.28	132321.16	132399.02	132476.89	132554.77	132632.62
593.5	132710.50	132788.38	132866.23	132944.11	133021.98	133099.84	133177.72	133255.59	133333.45	133411.33
593.6	133489.20	133567.06	133644.94	133722.81	133800.69	133878.55	133956.42	134034.30	134112.16	134190.03
593.7	134267.91	134345.77	134423.64	134501.52	134579.38	134657.25	134735.12	134812.98	134890.86	134968.73
593.8	135046.59	135124.47	135202.34	135280.20	135358.08	135435.95	135513.81	135591.69	135669.56	135747.44
593.9	135825.30	135903.17	135981.05	136058.91	136136.78	136214.66	136292.52	136370.39	136448.27	136526.12
594.0	136604.00	136684.48	136764.95	136845.44	136925.92	137006.41	137086.88	137167.36	137247.84	137328.31
594.1	137408.80	137489.28	137569.77	137650.23	137730.72	137811.20	137891.69	137972.16	138052.64	138133.12
594.2	138213.59	138294.08	138374.56	138455.05	138535.52	138616.00	138696.48	138776.95	138857.44	138937.92
594.3	139018.41	139098.88	139179.36	139259.84	139340.31	139420.80	139501.28	139581.77	139662.23	139742.72
594.4	139823.20	139903.69	139984.16	140064.64	140145.12	140225.59	140306.08	140386.56	140467.05	140547.52
594.5	140628.00	140708.48	140788.95	140869.44	140949.92	141030.41	141110.88	141191.36	141271.84	141352.31
594.6	141432.80	141513.28	141593.77	141674.23	141754.72	141835.20	141915.69	141996.16	142076.64	142157.12
594.7	142237.59	142318.08	142398.56	142479.05	142559.52	142640.00	142720.48	142800.95	142881.44	142961.92
594.8	143042.41	143122.88	143203.36	143283.84	143364.31	143444.80	143525.28	143605.77	143686.23	143766.72
594.9	143847.20	143927.69	144008.16	144088.64	144169.12	144249.59	144330.08	144410.56	144491.05	144571.52
595.0	144652.00	144735.33	144818.66	144901.98	144985.31	145068.66	145151.98	145235.31	145318.64	145401.97
595.1	145485.30	145568.62	145651.95	145735.30	145818.62	145901.95	145985.28	146068.61	146151.94	146235.27
595.2	146318.59	146401.94	146485.27	146568.59	146651.92	146735.25	146818.58	146901.91	146985.23	147068.56
595.3	147151.91	147235.23	147318.56	147401.89	147485.22	147568.55	147651.88	147735.20	147818.55	147901.88
595.4	147985.20	148068.53	148151.86	148235.19	148318.52	148401.84	148485.19	148568.52	148651.84	148735.17
595.5	148818.50	148901.83	148985.16	149068.48	149151.81	149235.16	149318.48	149401.81	149485.14	149568.47
595.6	149651.80	149735.12	149818.45	149901.80	149985.12	150068.45	150151.78	150235.11	150318.44	150401.77
595.7	150485.09	150568.44	150651.77	150735.09	150818.42	150901.75	150985.08	151068.41	151151.73	151235.06
595.8	151318.41	151401.73	151485.06	151568.39	151651.72	151735.05	151818.38	151901.70	151985.05	152068.38
595.9	152151.70	152235.03	152318.36	152401.69	152485.02	152568.34	152651.69	152735.02	152818.34	152901.67
596.0	152985.00	153071.44	153157.88	153244.31	153330.77	153417.20	153503.64	153590.08	153676.52	153762.95
596.1	153849.41	153935.84	154022.28	154108.72	154195.16	154281.59	154368.05	154454.48	154540.92	154627.36
596.2	154713.80	154800.23	154886.69	154973.12	155059.56	155146.00	155232.44	155318.88	155405.31	155491.77
596.3	155578.20	155664.64	155751.08	155837.52	155923.95	156010.41	156096.84	156183.28	156269.72	156356.16
596.4	156442.59	156529.05	156615.48	156701.92	156788.36	156874.80	156961.23	157047.69	157134.12	157220.56
596.5	157307.00	157393.44	157479.88	157566.31	157652.77	157739.20	157825.64	157912.08	157998.52	158084.95
596.6	158171.41	158257.84	158344.28	158430.72	158517.16	158603.59	158690.05	158776.48	158862.92	158949.36
596.7	159035.80	159122.23	159208.69	159295.12	159381.56	159468.00	159554.44	159640.88	159727.31	159813.77
596.8	159900.20	159986.64	160073.08	160159.52	160245.95	160332.41	160418.84	160505.28	160591.72	160678.16
596.9	160764.59	160851.05	160937.48	161023.92	161110.36	161196.80	161283.23	161369.69	161456.12	161542.56
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. CAPACITY**

ELEVATIONS IN FEET-NGVD, CAPACITY (IN ACRE-FEET)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
597.0	161629.00	161718.80	161808.58	161898.38	161988.16	162077.95	162167.73	162257.53	162347.31	162437.11
597.1	162526.91	162616.69	162706.48	162796.27	162886.06	162975.84	163065.64	163155.44	163245.22	163335.02
597.2	163424.80	163514.59	163604.38	163694.17	163783.95	163873.75	163963.55	164053.33	164143.12	164232.91
597.3	164322.70	164412.48	164502.28	164592.06	164681.86	164771.66	164861.44	164951.23	165041.02	165130.81
597.4	165220.59	165310.39	165400.19	165489.97	165579.77	165669.55	165759.34	165849.12	165938.92	166028.70
597.5	166118.50	166208.30	166298.08	166387.88	166477.66	166567.45	166657.23	166747.03	166836.81	166926.61
597.6	167016.41	167106.19	167195.98	167285.77	167375.56	167465.34	167555.14	167644.94	167734.72	167824.52
597.7	167914.30	168004.09	168093.88	168183.67	168273.45	168363.25	168453.05	168542.83	168632.62	168722.41
597.8	168812.20	168901.98	168991.78	169081.56	169171.36	169261.16	169350.94	169440.73	169530.52	169620.31
597.9	169710.09	169799.89	169889.69	169979.47	170069.27	170159.05	170248.84	170338.62	170428.42	170518.20
598.0	170608.00	170701.45	170794.92	170888.38	170981.84	171075.30	171168.77	171262.22	171355.69	171449.14
598.1	171542.59	171636.06	171729.52	171822.98	171916.44	172009.91	172103.36	172196.81	172290.28	172383.73
598.2	172477.20	172570.66	172664.12	172757.58	172851.05	172944.50	173037.95	173131.42	173224.88	173318.34
598.3	173411.80	173505.27	173598.72	173692.19	173785.64	173879.09	173972.56	174066.02	174159.48	174252.94
598.4	174346.41	174439.86	174533.31	174626.78	174720.23	174813.70	174907.16	175000.62	175094.08	175187.55
598.5	175281.00	175374.45	175467.92	175561.38	175654.84	175748.30	175841.77	175935.22	176028.69	176122.14
598.6	176215.59	176309.06	176402.52	176495.98	176589.44	176682.91	176776.36	176869.81	176963.28	177056.73
598.7	177150.20	177243.66	177337.12	177430.58	177524.05	177617.50	177710.95	177804.42	177897.88	177991.34
598.8	178084.80	178178.27	178271.72	178365.19	178458.64	178552.09	178645.56	178739.02	178832.48	178925.94
598.9	179019.41	179112.86	179206.31	179299.78	179393.23	179486.70	179580.16	179673.62	179767.08	179860.55
599.0	179954.00	180051.38	180148.73	180246.11	180343.48	180440.84	180538.22	180635.59	180732.95	180830.33
599.1	180927.70	181025.06	181122.44	181219.81	181317.19	181414.55	181511.92	181609.30	181706.66	181804.03
599.2	181901.41	181998.77	182096.14	182193.52	182290.88	182388.25	182485.62	182582.98	182680.36	182777.73
599.3	182875.09	182972.47	183069.84	183167.20	183264.58	183361.95	183459.31	183556.69	183654.06	183751.44
599.4	183848.80	183946.17	184043.55	184140.91	184238.28	184335.66	184433.02	184530.39	184627.77	184725.12
599.5	184822.50	184919.88	185017.23	185114.61	185211.98	185309.34	185406.72	185504.09	185601.45	185698.83
599.6	185796.20	185893.56	185990.94	186088.31	186185.69	186283.05	186380.42	186477.80	186575.16	186672.53
599.7	186769.91	186867.27	186964.64	187062.02	187159.38	187256.75	187354.12	187451.48	187548.86	187646.23
599.8	187743.59	187840.97	187938.34	188035.70	188133.08	188230.45	188327.81	188425.19	188522.56	188619.94
599.9	188717.30	188814.67	188912.05	189009.41	189106.78	189204.16	189301.52	189398.89	189496.27	189593.62
600.0	189691.00	189792.44	189893.88	189995.31	190096.77	190198.20	190299.64	190401.08	190502.52	190603.95
600.1	190705.41	190806.84	190908.28	191009.72	191111.16	191212.59	191314.05	191415.48	191516.92	191618.36
600.2	191719.80	191821.23	191922.69	192024.12	192125.56	192227.00	192328.44	192429.88	192531.31	192632.77
600.3	192734.20	192835.64	192937.08	193038.52	193139.95	193241.41	193342.84	193444.28	193545.72	193647.16
600.4	193748.59	193850.05	193951.48	194052.92	194154.36	194255.80	194357.23	194458.69	194560.12	194661.56
600.5	194763.00	194864.44	194965.88	195067.31	195168.77	195270.20	195371.64	195473.08	195574.52	195675.95
600.6	195777.41	195878.84	195980.28	196081.72	196183.16	196284.59	196386.05	196487.48	196588.92	196690.36
600.7	196791.80	196893.23	196994.69	197096.12	197197.56	197299.00	197400.44	197501.88	197603.31	197704.77
600.8	197806.20	197907.64	198009.08	198110.52	198211.95	198313.41	198414.84	198516.28	198617.72	198719.16
600.9	198820.59	198922.05	199023.48	199124.92	199226.36	199327.80	199429.23	199530.69	199632.12	199733.56
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. CAPACITY**

ELEVATIONS IN FEET-NGVD, CAPACITY (IN ACRE-FEET)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
601.0	199835.00	199940.59	200046.19	200151.77	200257.36	200362.95	200468.55	200574.12	200679.72	200785.31
601.1	200890.91	200996.48	201102.08	201207.67	201313.27	201418.84	201524.44	201630.03	201735.62	201841.20
601.2	201946.80	202052.39	202157.98	202263.56	202369.16	202474.75	202580.34	202685.94	202791.52	202897.11
601.3	203002.70	203108.30	203213.88	203319.47	203425.06	203530.66	203636.23	203741.83	203847.42	203953.02
601.4	204058.59	204164.19	204269.78	204375.38	204480.95	204586.55	204692.14	204797.73	204903.31	205008.91
601.5	205114.50	205220.09	205325.69	205431.27	205536.86	205642.45	205748.05	205853.62	205959.22	206064.81
601.6	206170.41	206275.98	206381.58	206487.17	206592.77	206698.34	206803.94	206909.53	207015.12	207120.70
601.7	207226.30	207331.89	207437.48	207543.06	207648.66	207754.25	207859.84	207965.44	208071.02	208176.61
601.8	208282.20	208387.80	208493.38	208598.97	208704.56	208810.16	208915.73	209021.33	209126.92	209232.52
601.9	209338.09	209443.69	209549.28	209654.88	209760.45	209866.05	209971.64	210077.23	210182.81	210288.41
602.0	210394.00	210503.81	210613.62	210723.44	210833.23	210943.05	211052.86	211162.67	211272.48	211382.30
602.1	211492.09	211601.91	211711.72	211821.53	211931.34	212041.16	212150.95	212260.77	212370.58	212480.39
602.2	212590.20	212700.02	212809.81	212919.62	213029.44	213139.25	213249.06	213358.88	213468.69	213578.48
602.3	213688.30	213798.11	213907.92	214017.73	214127.55	214237.34	214347.16	214456.97	214566.78	214676.59
602.4	214786.41	214896.20	215006.02	215115.83	215225.64	215335.45	215445.27	215555.06	215664.88	215774.69
602.5	215884.50	215994.31	216104.12	216213.94	216323.73	216433.55	216543.36	216653.17	216762.98	216872.80
602.6	216982.59	217092.41	217202.22	217312.03	217421.84	217531.66	217641.45	217751.27	217861.08	217970.89
602.7	218080.70	218190.52	218300.31	218410.12	218519.94	218629.75	218739.56	218849.38	218959.19	219068.98
602.8	219178.80	219288.61	219398.42	219508.23	219618.05	219727.84	219837.66	219947.47	220057.28	220167.09
602.9	220276.91	220386.70	220496.52	220606.33	220716.14	220825.95	220935.77	221045.56	221155.38	221265.19
603.0	221375.00	221489.17	221603.34	221717.52	221831.69	221945.84	222060.02	222174.19	222288.36	222402.53
603.1	222516.70	222630.88	222745.05	222859.20	222973.38	223087.55	223201.72	223315.89	223430.06	223544.23
603.2	223658.41	223772.56	223886.73	224000.91	224115.08	224229.25	224343.42	224457.59	224571.77	224685.94
603.3	224800.09	224914.27	225028.44	225142.61	225256.78	225370.95	225485.12	225599.30	225713.45	225827.62
603.4	225941.80	226055.97	226170.14	226284.31	226398.48	226512.66	226626.81	226740.98	226855.16	226969.33
603.5	227083.50	227197.67	227311.84	227426.02	227540.19	227654.34	227768.52	227882.69	227996.86	228111.03
603.6	228225.20	228339.38	228453.55	228567.70	228681.88	228796.05	228910.22	229024.39	229138.56	229252.73
603.7	229366.91	229481.06	229595.23	229709.41	229823.58	229937.75	230051.92	230166.09	230280.27	230394.44
603.8	230508.59	230622.77	230736.94	230851.11	230965.28	231079.45	231193.62	231307.80	231421.95	231536.12
603.9	231650.30	231764.47	231878.64	231992.81	232106.98	232221.16	232335.31	232449.48	232563.66	232677.83
604.0	232792.00	232910.73	233029.48	233148.22	233266.95	233385.70	233504.44	233623.19	233741.92	233860.66
604.1	233979.41	234098.14	234216.88	234335.62	234454.36	234573.09	234691.84	234810.58	234929.31	235048.06
604.2	235166.80	235285.55	235404.28	235523.02	235641.77	235760.50	235879.23	235997.98	236116.72	236235.45
604.3	236354.20	236472.94	236591.69	236710.42	236829.16	236947.91	237066.64	237185.38	237304.12	237422.86
604.4	237541.59	237660.34	237779.08	237897.81	238016.56	238135.30	238254.05	238372.78	238491.52	238610.27
604.5	238729.00	238847.73	238966.48	239085.22	239203.95	239322.70	239441.44	239560.19	239678.92	239797.66
604.6	239916.41	240035.14	240153.88	240272.62	240391.36	240510.09	240628.84	240747.58	240866.31	240985.06
604.7	241103.80	241222.55	241341.28	241460.02	241578.77	241697.50	241816.23	241934.98	242053.72	242172.45
604.8	242291.20	242409.94	242528.69	242647.42	242766.16	242884.91	243003.64	243122.38	243241.12	243359.86
604.9	243478.59	243597.34	243716.08	243834.81	243953.56	244072.30	244191.05	244309.78	244428.52	244547.27
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. CAPACITY**

ELEVATIONS IN FEET-NGVD, CAPACITY (IN ACRE-FEET)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
605.0	244666.00	244789.41	244912.81	245036.23	245159.64	245283.05	245406.45	245529.88	245653.28	245776.69
605.1	245900.09	246023.52	246146.92	246270.33	246393.73	246517.16	246640.56	246763.97	246887.38	247010.80
605.2	247134.20	247257.61	247381.02	247504.44	247627.84	247751.25	247874.66	247998.06	248121.48	248244.89
605.3	248368.30	248491.70	248615.12	248738.53	248861.94	248985.34	249108.77	249232.17	249355.58	249478.98
605.4	249602.41	249725.81	249849.22	249972.62	250096.05	250219.45	250342.86	250466.27	250589.69	250713.09
605.5	250836.50	250959.91	251083.31	251206.73	251330.14	251453.55	251576.95	251700.38	251823.78	251947.19
605.6	252070.59	252194.02	252317.42	252440.83	252564.23	252687.66	252811.06	252934.47	253057.88	253181.30
605.7	253304.70	253428.11	253551.52	253674.94	253798.34	253921.75	254045.16	254168.56	254291.98	254415.39
605.8	254538.80	254662.20	254785.62	254909.03	255032.44	255155.84	255279.27	255402.67	255526.08	255649.48
605.9	255772.91	255896.31	256019.72	256143.12	256266.55	256389.95	256513.36	256636.77	256760.19	256883.59
606.0	257007.00	257135.05	257263.08	257391.12	257519.16	257647.20	257775.23	257903.28	258031.31	258159.36
606.1	258287.41	258415.44	258543.48	258671.52	258799.56	258927.59	259055.64	259183.69	259311.72	259439.77
606.2	259567.80	259695.84	259823.88	259951.92	260079.95	260208.00	260336.05	260464.08	260592.12	260720.16
606.3	260848.20	260976.23	261104.28	261232.31	261360.36	261488.41	261616.44	261744.48	261872.52	262000.56
606.4	262128.59	262256.62	262384.69	262512.72	262640.75	262768.81	262896.84	263024.88	263152.91	263280.97
606.5	263409.00	263537.03	263665.09	263793.12	263921.16	264049.19	264177.25	264305.28	264433.31	264561.38
606.6	264689.41	264817.44	264945.47	265073.53	265201.56	265329.59	265457.62	265585.69	265713.72	265841.75
606.7	265969.81	266097.84	266225.88	266353.91	266481.97	266610.00	266738.03	266866.09	266994.12	267122.16
606.8	267250.19	267378.25	267506.28	267634.31	267762.38	267890.41	268018.44	268146.47	268274.53	268402.56
606.9	268530.59	268658.62	268786.69	268914.72	269042.75	269170.81	269298.84	269426.88	269554.91	269682.97
607.0	269811.00	269943.84	270076.69	270209.56	270342.41	270475.25	270608.09	270740.94	270873.81	271006.66
607.1	271139.50	271272.34	271405.19	271538.06	271670.91	271803.75	271936.59	272069.44	272202.31	272335.16
607.2	272468.00	272600.84	272733.69	272866.56	272999.41	273132.25	273265.09	273397.94	273530.81	273663.66
607.3	273796.50	273929.34	274062.19	274195.06	274327.91	274460.75	274593.59	274726.44	274859.31	274992.16
607.4	275125.00	275257.84	275390.69	275523.56	275656.41	275789.25	275922.09	276054.94	276187.81	276320.66
607.5	276453.50	276586.34	276719.19	276852.06	276984.91	277117.75	277250.59	277383.44	277516.31	277649.16
607.6	277782.00	277914.84	278047.69	278180.56	278313.41	278446.25	278579.09	278711.94	278844.81	278977.66
607.7	279110.50	279243.34	279376.19	279509.06	279641.91	279774.75	279907.59	280040.44	280173.31	280306.16
607.8	280439.00	280571.84	280704.69	280837.56	280970.41	281103.25	281236.09	281368.94	281501.81	281634.66
607.9	281767.50	281900.34	282033.19	282166.06	282298.91	282431.75	282564.59	282697.44	282830.31	282963.16
608.0	283096.00	283233.84	283371.66	283509.50	283647.31	283785.16	283922.97	284060.81	284198.62	284336.47
608.1	284474.31	284612.12	284749.97	284887.78	285025.62	285163.44	285301.28	285439.12	285576.94	285714.78
608.2	285852.59	285990.44	286128.25	286266.09	286403.91	286541.75	286679.59	286817.41	286955.25	287093.06
608.3	287230.91	287368.72	287506.56	287644.38	287782.22	287920.06	288057.88	288195.72	288333.53	288471.38
608.4	288609.19	288747.03	288884.88	289022.69	289160.53	289298.34	289436.19	289574.00	289711.84	289849.66
608.5	289987.50	290125.34	290263.16	290401.00	290538.81	290676.66	290814.47	290952.31	291090.12	291227.97
608.6	291365.81	291503.62	291641.47	291779.28	291917.12	292054.94	292192.78	292330.62	292468.44	292606.28
608.7	292744.09	292881.94	293019.75	293157.59	293295.41	293433.25	293571.09	293708.91	293846.75	293984.56
608.8	294122.41	294260.22	294398.06	294535.88	294673.72	294811.56	294949.38	295087.22	295225.03	295362.88
608.9	295500.69	295638.53	295776.38	295914.19	296052.03	296189.84	296327.69	296465.50	296603.34	296741.16
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. CAPACITY**

ELEVATIONS IN FEET-NGVD, CAPACITY (IN ACRE-FEET)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
609.0	296879.00	297022.12	297165.25	297308.38	297451.53	297594.66	297737.78	297880.91	298024.03	298167.16
609.1	298310.31	298453.44	298596.56	298739.69	298882.81	299025.94	299169.09	299312.22	299455.34	299598.47
609.2	299741.59	299884.72	300027.88	300171.00	300314.12	300457.25	300600.38	300743.50	300886.62	301029.78
609.3	301172.91	301316.03	301459.16	301602.28	301745.41	301888.56	302031.69	302174.81	302317.94	302461.06
609.4	302604.19	302747.34	302890.47	303033.59	303176.72	303319.84	303462.97	303606.12	303749.25	303892.38
609.5	304035.50	304178.62	304321.75	304464.88	304608.03	304751.16	304894.28	305037.41	305180.53	305323.66
609.6	305466.81	305609.94	305753.06	305896.19	306039.31	306182.44	306325.59	306468.72	306611.84	306754.97
609.7	306898.09	307041.22	307184.38	307327.50	307470.62	307613.75	307756.88	307900.00	308043.12	308186.28
609.8	308329.41	308472.53	308615.66	308758.78	308901.91	309045.06	309188.19	309331.31	309474.44	309617.56
609.9	309760.69	309903.84	310046.97	310190.09	310333.22	310476.34	310619.47	310762.62	310905.75	311048.88
610.0	311192.00	311340.28	311488.53	311636.81	311785.09	311933.34	312081.62	312229.88	312378.16	312526.44
610.1	312674.69	312822.97	312971.25	313119.50	313267.78	313416.06	313564.31	313712.59	313860.88	314009.12
610.2	314157.41	314305.66	314453.94	314602.22	314750.47	314898.75	315047.03	315195.28	315343.56	315491.84
610.3	315640.09	315788.38	315936.62	316084.91	316233.19	316381.44	316529.72	316678.00	316826.25	316974.53
610.4	317122.81	317271.06	317419.34	317567.62	317715.88	317864.16	318012.41	318160.69	318308.97	318457.22
610.5	318605.50	318753.78	318902.03	319050.31	319198.59	319346.84	319495.12	319643.38	319791.66	319939.94
610.6	320088.19	320236.47	320384.75	320533.00	320681.28	320829.56	320977.81	321126.09	321274.38	321422.62
610.7	321570.91	321719.16	321867.44	322015.72	322163.97	322312.25	322460.53	322608.78	322757.06	322905.34
610.8	323053.59	323201.88	323350.12	323498.41	323646.69	323794.94	323943.22	324091.50	324239.75	324388.03
610.9	324536.31	324684.56	324832.84	324981.12	325129.38	325277.66	325425.91	325574.19	325722.47	325870.72
611.0	326019.00	326172.47	326325.97	326479.44	326632.91	326786.41	326939.88	327093.38	327246.84	327400.31
611.1	327553.81	327707.28	327860.75	328014.25	328167.72	328321.19	328474.69	328628.16	328781.62	328935.12
611.2	329088.59	329242.09	329395.56	329549.03	329702.53	329856.00	330009.47	330162.97	330316.44	330469.91
611.3	330623.41	330776.88	330930.38	331083.84	331237.31	331390.81	331544.28	331697.75	331851.25	332004.72
611.4	332158.19	332311.69	332465.16	332618.62	332772.12	332925.59	333079.09	333232.56	333386.03	333539.53
611.5	333693.00	333846.47	333999.97	334153.44	334306.91	334460.41	334613.88	334767.38	334920.84	335074.31
611.6	335227.81	335381.28	335534.75	335688.25	335841.72	335995.19	336148.69	336302.16	336455.62	336609.12
611.7	336762.59	336916.09	337069.56	337223.03	337376.53	337530.00	337683.47	337836.97	337990.44	338143.91
611.8	338297.41	338450.88	338604.38	338757.84	338911.31	339064.81	339218.28	339371.75	339525.25	339678.72
611.9	339832.19	339985.69	340139.16	340292.62	340446.12	340599.59	340753.09	340906.56	341060.03	341213.53
612.0	341367.00	341525.69	341684.41	341843.09	342001.81	342160.50	342319.19	342477.91	342636.59	342795.31
612.1	342954.00	343112.69	343271.41	343430.09	343588.81	343747.50	343906.19	344064.91	344223.59	344382.31
612.2	344541.00	344699.69	344858.41	345017.09	345175.81	345334.50	345493.19	345651.91	345810.59	345969.31
612.3	346128.00	346286.69	346445.41	346604.09	346762.81	346921.50	347080.19	347238.91	347397.59	347556.31
612.4	347715.00	347873.69	348032.41	348191.09	348349.81	348508.50	348667.19	348825.91	348984.59	349143.31
612.5	349302.00	349460.69	349619.41	349778.09	349936.81	350095.50	350254.19	350412.91	350571.59	350730.31
612.6	350889.00	351047.69	351206.41	351365.09	351523.81	351682.50	351841.19	351999.91	352158.59	352317.31
612.7	352476.00	352634.69	352793.41	352952.09	353110.81	353269.50	353428.19	353586.91	353745.59	353904.31
612.8	354063.00	354221.69	354380.41	354539.09	354697.81	354856.50	355015.19	355173.91	355332.59	355491.31
612.9	355650.00	355808.69	355967.41	356126.09	356284.81	356443.50	356602.19	356760.91	356919.59	357078.31
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. CAPACITY**

ELEVATIONS IN FEET-NGVD, CAPACITY (IN ACRE-FEET)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
613.0	357237.00	357400.84	357564.66	357728.50	357892.31	358056.16	358219.97	358383.81	358547.62	358711.47
613.1	358875.31	359039.12	359202.97	359366.78	359530.62	359694.44	359858.28	360022.12	360185.94	360349.78
613.2	360513.59	360677.44	360841.25	361005.09	361168.91	361332.75	361496.59	361660.41	361824.25	361988.06
613.3	362151.91	362315.72	362479.56	362643.38	362807.22	362971.06	363134.88	363298.72	363462.53	363626.38
613.4	363790.19	363954.03	364117.88	364281.69	364445.53	364609.34	364773.19	364937.00	365100.84	365264.66
613.5	365428.50	365592.34	365756.16	365920.00	366083.81	366247.66	366411.47	366575.31	366739.12	366902.97
613.6	367066.81	367230.62	367394.47	367558.28	367722.12	367885.94	368049.78	368213.62	368377.44	368541.28
613.7	368705.09	368868.94	369032.75	369196.59	369360.41	369524.25	369688.09	369851.91	370015.75	370179.56
613.8	370343.41	370507.22	370671.06	370834.88	370998.72	371162.56	371326.38	371490.22	371654.03	371817.88
613.9	371981.69	372145.53	372309.38	372473.19	372637.03	372800.84	372964.69	373128.50	373292.34	373456.16
614.0	373620.00	373789.12	373958.22	374127.34	374296.44	374465.56	374634.66	374803.78	374972.88	375142.00
614.1	375311.09	375480.22	375649.31	375818.44	375987.53	376156.66	376325.75	376494.88	376663.97	376833.09
614.2	377002.19	377171.31	377340.41	377509.53	377678.62	377847.75	378016.88	378185.97	378355.09	378524.19
614.3	378693.31	378862.41	379031.53	379200.62	379369.75	379538.84	379707.97	379877.06	380046.19	380215.28
614.4	380384.41	380553.50	380722.62	380891.72	381060.84	381229.94	381399.06	381568.16	381737.28	381906.38
614.5	382075.50	382244.62	382413.72	382582.84	382751.94	382921.06	383090.16	383259.28	383428.38	383597.50
614.6	383766.59	383935.72	384104.81	384273.94	384443.03	384612.16	384781.25	384950.38	385119.47	385288.59
614.7	385457.69	385626.81	385795.91	385965.03	386134.12	386303.25	386472.38	386641.47	386810.59	386979.69
614.8	387148.81	387317.91	387487.03	387656.12	387825.25	387994.34	388163.47	388332.56	388501.69	388670.78
614.9	388839.91	389009.00	389178.12	389347.22	389516.34	389685.44	389854.56	390023.66	390192.78	390361.88
615.0	390531.00	390705.75	390880.50	391055.25	391230.00	391404.75	391579.50	391754.25	391929.00	392103.75
615.1	392278.50	392453.25	392628.00	392802.75	392977.50	393152.25	393327.00	393501.75	393676.50	393851.25
615.2	394026.00	394200.75	394375.50	394550.25	394725.00	394899.75	395074.50	395249.25	395424.00	395598.75
615.3	395773.50	395948.25	396123.00	396297.75	396472.50	396647.25	396822.00	396996.75	397171.50	397346.25
615.4	397521.00	397695.75	397870.50	398045.25	398220.00	398394.75	398569.50	398744.25	398919.00	399093.75
615.5	399268.50	399443.25	399618.00	399792.75	399967.50	400142.25	400317.00	400491.75	400666.50	400841.25
615.6	401016.00	401190.75	401365.50	401540.25	401715.00	401889.75	402064.50	402239.25	402414.00	402588.75
615.7	402763.50	402938.25	403113.00	403287.75	403462.50	403637.25	403812.00	403986.75	404161.50	404336.25
615.8	404511.00	404685.75	404860.50	405035.25	405210.00	405384.75	405559.50	405734.25	405909.00	406083.75
615.9	406258.50	406433.25	406608.00	406782.75	406957.50	407132.25	407307.00	407481.75	407656.50	407831.25
616.0	408006.00	408186.53	408367.06	408547.59	408728.12	408908.66	409089.19	409269.72	409450.25	409630.78
616.1	409811.31	409991.84	410172.38	410352.88	410533.41	410713.94	410894.47	411075.00	411255.53	411436.06
616.2	411616.59	411797.12	411977.66	412158.19	412338.72	412519.25	412699.78	412880.31	413060.84	413241.38
616.3	413421.91	413602.44	413782.97	413963.50	414144.03	414324.56	414505.09	414685.62	414866.12	415046.66
616.4	415227.19	415407.72	415588.25	415768.78	415949.31	416129.84	416310.38	416490.91	416671.44	416851.97
616.5	417032.50	417213.03	417393.56	417574.09	417754.62	417935.16	418115.69	418296.22	418476.75	418657.28
616.6	418837.81	419018.34	419198.88	419379.38	419559.91	419740.44	419920.97	420101.50	420282.03	420462.56
616.7	420643.09	420823.62	421004.16	421184.69	421365.22	421545.75	421726.28	421906.81	422087.34	422267.88
616.8	422448.41	422628.94	422809.47	422990.00	423170.53	423351.06	423531.59	423712.12	423892.62	424073.16
616.9	424253.69	424434.22	424614.75	424795.28	424975.81	425156.34	425336.88	425517.41	425697.94	425878.47
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. CAPACITY**

ELEVATIONS IN FEET-NGVD, CAPACITY (IN ACRE-FEET)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
617.0	426059.00	426245.44	426431.88	426618.28	426804.72	426991.16	427177.59	427364.00	427550.44	427736.88
617.1	427923.31	428109.72	428296.16	428482.59	428669.03	428855.44	429041.88	429228.31	429414.75	429601.16
617.2	429787.59	429974.03	430160.47	430346.88	430533.31	430719.75	430906.19	431092.62	431279.03	431465.47
617.3	431651.91	431838.34	432024.75	432211.19	432397.62	432584.06	432770.47	432956.91	433143.34	433329.78
617.4	433516.19	433702.62	433889.06	434075.50	434261.91	434448.34	434634.78	434821.22	435007.62	435194.06
617.5	435380.50	435566.94	435753.38	435939.78	436126.22	436312.66	436499.09	436685.50	436871.94	437058.38
617.6	437244.81	437431.22	437617.66	437804.09	437990.53	438176.94	438363.38	438549.81	438736.25	438922.66
617.7	439109.09	439295.53	439481.97	439668.38	439854.81	440041.25	440227.69	440414.12	440600.53	440786.97
617.8	440973.41	441159.84	441346.25	441532.69	441719.12	441905.56	442091.97	442278.41	442464.84	442651.28
617.9	442837.69	443024.12	443210.56	443397.00	443583.41	443769.84	443956.28	444142.72	444329.12	444515.56
618.0	444702.00	444894.25	445086.50	445278.75	445471.00	445663.25	445855.50	446047.75	446240.00	446432.25
618.1	446624.50	446816.75	447009.00	447201.25	447393.50	447585.75	447778.00	447970.25	448162.50	448354.75
618.2	448547.00	448739.25	448931.50	449123.75	449316.00	449508.25	449700.50	449892.75	450085.00	450277.25
618.3	450469.50	450661.75	450854.00	451046.25	451238.50	451430.75	451623.00	451815.25	452007.50	452199.75
618.4	452392.00	452584.25	452776.50	452968.75	453161.00	453353.25	453545.50	453737.75	453930.00	454122.25
618.5	454314.50	454506.75	454699.00	454891.25	455083.50	455275.75	455468.00	455660.25	455852.50	456044.75
618.6	456237.00	456429.25	456621.50	456813.75	457006.00	457198.25	457390.50	457582.75	457775.00	457967.25
618.7	458159.50	458351.75	458544.00	458736.25	458928.50	459120.75	459313.00	459505.25	459697.50	459889.75
618.8	460082.00	460274.25	460466.50	460658.75	460851.00	461043.25	461235.50	461427.75	461620.00	461812.25
618.9	462004.50	462196.75	462389.00	462581.25	462773.50	462965.75	463158.00	463350.25	463542.50	463734.75
619.0	463927.00	464125.47	464323.91	464522.38	464720.84	464919.31	465117.75	465316.22	465514.69	465713.12
619.1	465911.59	466110.06	466308.53	466506.97	466705.44	466903.91	467102.38	467300.81	467499.28	467697.75
619.2	467896.19	468094.66	468293.12	468491.59	468690.03	468888.50	469086.97	469285.41	469483.88	469682.34
619.3	469880.81	470079.25	470277.72	470476.19	470674.62	470873.09	471071.56	471270.03	471468.47	471666.94
619.4	471865.41	472063.88	472262.31	472460.78	472659.25	472857.69	473056.16	473254.62	473453.09	473651.53
619.5	473850.00	474048.47	474246.91	474445.38	474643.84	474842.31	475040.75	475239.22	475437.69	475636.12
619.6	475834.59	476033.06	476231.53	476429.97	476628.44	476826.91	477025.38	477223.81	477422.28	477620.75
619.7	477819.19	478017.66	478216.12	478414.59	478613.03	478811.50	479009.97	479208.41	479406.88	479605.34
619.8	479803.81	480002.25	480200.72	480399.19	480597.62	480796.09	480994.56	481193.03	481391.47	481589.94
619.9	481788.41	481986.88	482185.31	482383.78	482582.25	482780.69	482979.16	483177.62	483376.09	483574.53
620.0	483773.00	483978.09	484183.19	484388.31	484593.41	484798.50	485003.59	485208.69	485413.81	485618.91
620.1	485824.00	486029.09	486234.19	486439.31	486644.41	486849.50	487054.59	487259.69	487464.81	487669.91
620.2	487875.00	488080.09	488285.19	488490.31	488695.41	488900.50	489105.59	489310.69	489515.81	489720.91
620.3	489926.00	490131.09	490336.19	490541.31	490746.41	490951.50	491156.59	491361.69	491566.81	491771.91
620.4	491977.00	492182.09	492387.19	492592.31	492797.41	493002.50	493207.59	493412.69	493617.81	493822.91
620.5	494028.00	494233.09	494438.19	494643.31	494848.41	495053.50	495258.59	495463.69	495668.81	495873.91
620.6	496079.00	496284.09	496489.19	496694.31	496899.41	497104.50	497309.59	497514.69	497719.81	497924.91
620.7	498130.00	498335.09	498540.19	498745.31	498950.41	499155.50	499360.59	499565.69	499770.81	499975.91
620.8	500181.00	500386.09	500591.19	500796.31	501001.41	501206.50	501411.59	501616.69	501821.81	502026.91
620.9	502232.00	502437.09	502642.19	502847.31	503052.41	503257.50	503462.59	503667.69	503872.81	504077.91
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. CAPACITY**

ELEVATIONS IN FEET-NGVD, CAPACITY (IN ACRE-FEET)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
621.0	504283.00	504494.94	504706.88	504918.81	505130.75	505342.69	505554.62	505766.59	505978.53	506190.47
621.1	506402.41	506614.34	506826.28	507038.22	507250.16	507462.09	507674.03	507885.97	508097.91	508309.88
621.2	508521.81	508733.75	508945.69	509157.62	509369.56	509581.50	509793.44	510005.38	510217.31	510429.25
621.3	510641.19	510853.12	511065.09	511277.03	511488.97	511700.91	511912.84	512124.78	512336.72	512548.66
621.4	512760.59	512972.53	513184.47	513396.41	513608.38	513820.31	514032.25	514244.19	514456.12	514668.06
621.5	514880.00	515091.94	515303.88	515515.81	515727.75	515939.69	516151.62	516363.59	516575.53	516787.47
621.6	516999.41	517211.34	517423.28	517635.22	517847.16	518059.09	518271.03	518482.97	518694.91	518906.88
621.7	519118.81	519330.75	519542.69	519754.62	519966.56	520178.50	520390.44	520602.38	520814.31	521026.25
621.8	521238.19	521450.12	521662.09	521874.03	522085.97	522297.91	522509.84	522721.78	522933.72	523145.66
621.9	523357.59	523569.53	523781.47	523993.41	524205.38	524417.31	524629.25	524841.19	525053.12	525265.06
622.0	525477.00	525695.50	525914.00	526132.50	526351.00	526569.50	526788.00	527006.50	527225.00	527443.50
622.1	527662.00	527880.50	528099.00	528317.50	528536.00	528754.50	528973.00	529191.50	529410.00	529628.50
622.2	529847.00	530065.50	530284.00	530502.50	530721.00	530939.50	531158.00	531376.50	531595.00	531813.50
622.3	532032.00	532250.50	532469.00	532687.50	532906.00	533124.50	533343.00	533561.50	533780.00	533998.50
622.4	534217.00	534435.50	534654.00	534872.50	535091.00	535309.50	535528.00	535746.50	535965.00	536183.50
622.5	536402.00	536620.50	536839.00	537057.50	537276.00	537494.50	537713.00	537931.50	538150.00	538368.50
622.6	538587.00	538805.50	539024.00	539242.50	539461.00	539679.50	539898.00	540116.50	540335.00	540553.50
622.7	540772.00	540990.50	541209.00	541427.50	541646.00	541864.50	542083.00	542301.50	542520.00	542738.50
622.8	542957.00	543175.50	543394.00	543612.50	543831.00	544049.50	544268.00	544486.50	544705.00	544923.50
622.9	545142.00	545360.50	545579.00	545797.50	546016.00	546234.50	546453.00	546671.50	546890.00	547108.50
623.0	547327.00	547552.25	547777.50	548002.75	548227.94	548453.19	548678.44	548903.69	549128.94	549354.19
623.1	549579.38	549804.62	550029.88	550255.12	550480.38	550705.62	550930.81	551156.06	551381.31	551606.56
623.2	551831.81	552057.06	552282.25	552507.50	552732.75	552958.00	553183.25	553408.50	553633.75	553858.94
623.3	554084.19	554309.44	554534.69	554759.94	554985.19	555210.38	555435.62	555660.88	555886.12	556111.38
623.4	556336.62	556561.81	556787.06	557012.31	557237.56	557462.81	557688.06	557913.25	558138.50	558363.75
623.5	558589.00	558814.25	559039.50	559264.75	559489.94	559715.19	559940.44	560165.69	560390.94	560616.19
623.6	560841.38	561066.62	561291.88	561517.12	561742.38	561967.62	562192.81	562418.06	562643.31	562868.56
623.7	563093.81	563319.06	563544.25	563769.50	563994.75	564220.00	564445.25	564670.50	564895.75	565120.94
623.8	565346.19	565571.44	565796.69	566021.94	566247.19	566472.38	566697.62	566922.88	567148.12	567373.38
623.9	567598.62	567823.81	568049.06	568274.31	568499.56	568724.81	568950.06	569175.25	569400.50	569625.75
624.0	569851.00	570083.38	570315.75	570548.19	570780.56	571012.94	571245.31	571477.75	571710.12	571942.50
624.1	572174.88	572407.31	572639.69	572872.06	573104.44	573336.88	573569.25	573801.62	574034.00	574266.44
624.2	574498.81	574731.19	574963.56	575196.00	575428.38	575660.75	575893.12	576125.50	576357.94	576590.31
624.3	576822.69	577055.06	577287.50	577519.88	577752.25	577984.62	578217.06	578449.44	578681.81	578914.19
624.4	579146.62	579379.00	579611.38	579843.75	580076.19	580308.56	580540.94	580773.31	581005.75	581238.12
624.5	581470.50	581702.88	581935.25	582167.69	582400.06	582632.44	582864.81	583097.25	583329.62	583562.00
624.6	583794.38	584026.81	584259.19	584491.56	584723.94	584956.38	585188.75	585421.12	585653.50	585885.94
624.7	586118.31	586350.69	586583.06	586815.50	587047.88	587280.25	587512.62	587745.00	587977.44	588209.81
624.8	588442.19	588674.56	588907.00	589139.38	589371.75	589604.12	589836.56	590068.94	590301.31	590533.69
624.9	590766.12	590998.50	591230.88	591463.25	591695.69	591928.06	592160.44	592392.81	592625.25	592857.62
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. CAPACITY**

ELEVATIONS IN FEET-NGVD, CAPACITY (IN ACRE-FEET)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
625.0	593090.00	593329.00	593568.06	593807.06	594046.06	594285.12	594524.12	594763.12	595002.19	595241.19
625.1	595480.19	595719.25	595958.25	596197.25	596436.25	596675.31	596914.31	597153.31	597392.38	597631.38
625.2	597870.38	598109.44	598348.44	598587.44	598826.50	599065.50	599304.50	599543.56	599782.56	600021.56
625.3	600260.62	600499.62	600738.62	600977.69	601216.69	601455.69	601694.75	601933.75	602172.75	602411.75
625.4	602650.81	602889.81	603128.81	603367.88	603606.88	603845.88	604084.94	604323.94	604562.94	604802.00
625.5	605041.00	605280.00	605519.06	605758.06	605997.06	606236.12	606475.12	606714.12	606953.19	607192.19
625.6	607431.19	607670.25	607909.25	608148.25	608387.25	608626.31	608865.31	609104.31	609343.38	609582.38
625.7	609821.38	610060.44	610299.44	610538.44	610777.50	611016.50	611255.50	611494.56	611733.56	611972.56
625.8	612211.62	612450.62	612689.62	612928.69	613167.69	613406.69	613645.75	613884.75	614123.75	614362.75
625.9	614601.81	614840.81	615079.81	615318.88	615557.88	615796.88	616035.94	616274.94	616513.94	616753.00
626.0	616992.00	617237.06	617482.12	617727.19	617972.25	618217.38	618462.44	618707.50	618952.56	619197.62
626.1	619442.69	619687.75	619932.81	620177.94	620423.00	620668.06	620913.12	621158.19	621403.25	621648.31
626.2	621893.38	622138.50	622383.56	622628.62	622873.69	623118.75	623363.81	623608.88	623853.94	624099.00
626.3	624344.12	624589.19	624834.25	625079.31	625324.38	625569.44	625814.50	626059.56	626304.69	626549.75
626.4	626794.81	627039.88	627284.94	627530.00	627775.06	628020.12	628265.25	628510.31	628755.38	629000.44
626.5	629245.50	629490.56	629735.62	629980.69	630225.75	630470.88	630715.94	630961.00	631206.06	631451.12
626.6	631696.19	631941.25	632186.31	632431.44	632676.50	632921.56	633166.62	633411.69	633656.75	633901.81
626.7	634146.88	634392.00	634637.06	634882.12	635127.19	635372.25	635617.31	635862.38	636107.44	636352.50
626.8	636597.62	636842.69	637087.75	637332.81	637577.88	637822.94	638068.00	638313.06	638558.19	638803.25
626.9	639048.31	639293.38	639538.44	639783.50	640028.56	640273.62	640518.75	640763.81	641008.88	641253.94
627.0	641499.00	641752.56	642006.12	642259.69	642513.25	642766.88	643020.44	643274.00	643527.56	643781.12
627.1	644034.69	644288.25	644541.81	644795.44	645049.00	645302.56	645556.12	645809.69	646063.25	646316.81
627.2	646570.38	646824.00	647077.56	647331.12	647584.69	647838.25	648091.81	648345.38	648598.94	648852.50
627.3	649106.12	649359.69	649613.25	649866.81	650120.38	650373.94	650627.50	650881.06	651134.69	651388.25
627.4	651641.81	651895.38	652148.94	652402.50	652656.06	652909.62	653163.25	653416.81	653670.38	653923.94
627.5	654177.50	654431.06	654684.62	654938.19	655191.75	655445.38	655698.94	655952.50	656206.06	656459.62
627.6	656713.19	656966.75	657220.31	657473.94	657727.50	657981.06	658234.62	658488.19	658741.75	658995.31
627.7	659248.88	659502.50	659756.06	660009.62	660263.19	660516.75	660770.31	661023.88	661277.44	661531.00
627.8	661784.62	662038.19	662291.75	662545.31	662798.88	663052.44	663306.00	663559.56	663813.19	664066.75
627.9	664320.31	664573.88	664827.44	665081.00	665334.56	665588.12	665841.75	666095.31	666348.88	666602.44
628.0	666856.00	667116.62	667377.25	667637.88	667898.50	668159.12	668419.75	668680.44	668941.06	669201.69
628.1	669462.31	669722.94	669983.56	670244.19	670504.81	670765.44	671026.06	671286.69	671547.31	671808.00
628.2	672068.62	672329.25	672589.88	672850.50	673111.12	673371.75	673632.38	673893.00	674153.62	674414.25
628.3	674674.88	674935.50	675196.19	675456.81	675717.44	675978.06	676238.69	676499.31	676759.94	677020.56
628.4	677281.19	677541.81	677802.44	678063.06	678323.75	678584.38	678845.00	679105.62	679366.25	679626.88
628.5	679887.50	680148.12	680408.75	680669.38	680930.00	681190.62	681451.25	681711.94	681972.56	682233.19
628.6	682493.81	682754.44	683015.06	683275.69	683536.31	683796.94	684057.56	684318.19	684578.81	684839.50
628.7	685100.12	685360.75	685621.38	685882.00	686142.62	686403.25	686663.88	686924.50	687185.12	687445.75
628.8	687706.38	687967.00	688227.69	688488.31	688748.94	689009.56	689270.19	689530.81	689791.44	690052.06
628.9	690312.69	690573.31	690833.94	691094.56	691355.25	691615.88	691876.50	692137.12	692397.75	692658.38
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. CAPACITY**

ELEVATIONS IN FEET-NGVD, CAPACITY (IN ACRE-FEET)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
629.0	692919.00	693185.00	693450.94	693716.94	693982.88	694248.88	694514.81	694780.81	695046.75	695312.75
629.1	695578.69	695844.69	696110.62	696376.62	696642.56	696908.56	697174.50	697440.50	697706.44	697972.44
629.2	698238.38	698504.38	698770.31	699036.31	699302.25	699568.25	699834.25	700100.19	700366.19	700632.12
629.3	700898.12	701164.06	701430.06	701696.00	701962.00	702227.94	702493.94	702759.88	703025.88	703291.81
629.4	703557.81	703823.75	704089.75	704355.69	704621.69	704887.62	705153.62	705419.56	705685.56	705951.50
629.5	706217.50	706483.50	706749.44	707015.44	707281.38	707547.38	707813.31	708079.31	708345.25	708611.25
629.6	708877.19	709143.19	709409.12	709675.12	709941.06	710207.06	710473.00	710739.00	711004.94	711270.94
629.7	711536.88	711802.88	712068.81	712334.81	712600.75	712866.75	713132.75	713398.69	713664.69	713930.62
629.8	714196.62	714462.56	714728.56	714994.50	715260.50	715526.44	715792.44	716058.38	716324.38	716590.31
629.9	716856.31	717122.25	717388.25	717654.19	717920.19	718186.12	718452.12	718718.06	718984.06	719250.00
630.0	719516.00	719787.50	720058.94	720330.44	720601.88	720873.38	721144.81	721416.31	721687.75	721959.25
630.1	722230.69	722502.19	722773.62	723045.12	723316.56	723588.06	723859.50	724131.00	724402.44	724673.94
630.2	724945.38	725216.88	725488.31	725759.81	726031.25	726302.75	726574.25	726845.69	727117.19	727388.62
630.3	727660.12	727931.56	728203.06	728474.50	728746.00	729017.44	729288.94	729560.38	729831.88	730103.31
630.4	730374.81	730646.25	730917.75	731189.19	731460.69	731732.12	732003.62	732275.06	732546.56	732818.00
630.5	733089.50	733361.00	733632.44	733903.94	734175.38	734446.88	734718.31	734989.81	735261.25	735532.75
630.6	735804.19	736075.69	736347.12	736618.62	736890.06	737161.56	737433.00	737704.50	737975.94	738247.44
630.7	738518.88	738790.38	739061.81	739333.31	739604.75	739876.25	740147.75	740419.19	740690.69	740962.12
630.8	741233.62	741505.06	741776.56	742048.00	742319.50	742590.94	742862.44	743133.88	743405.38	743676.81
630.9	743948.31	744219.75	744491.25	744762.69	745034.19	745305.62	745577.12	745848.56	746120.06	746391.50
631.0	746663.00	746940.25	747217.50	747494.75	747772.06	748049.31	748326.56	748603.81	748881.06	749158.31
631.1	749435.62	749712.88	749990.12	750267.38	750544.62	750821.88	751099.19	751376.44	751653.69	751930.94
631.2	752208.19	752485.44	752762.75	753040.00	753317.25	753594.50	753871.75	754149.00	754426.25	754703.56
631.3	754980.81	755258.06	755535.31	755812.56	756089.81	756367.12	756644.38	756921.62	757198.88	757476.12
631.4	757753.38	758030.69	758307.94	758585.19	758862.44	759139.69	759416.94	759694.25	759971.50	760248.75
631.5	760526.00	760803.25	761080.50	761357.75	761635.06	761912.31	762189.56	762466.81	762744.06	763021.31
631.6	763298.62	763575.88	763853.12	764130.38	764407.62	764684.88	764962.19	765239.44	765516.69	765793.94
631.7	766071.19	766348.44	766625.75	766903.00	767180.25	767457.50	767734.75	768012.00	768289.25	768566.56
631.8	768843.81	769121.06	769398.31	769675.56	769952.81	770230.12	770507.38	770784.62	771061.88	771339.12
631.9	771616.38	771893.69	772170.94	772448.19	772725.44	773002.69	773279.94	773557.25	773834.50	774111.75
632.0	774389.00	774682.50	774976.00	775269.50	775563.00	775856.50	776150.00	776443.50	776737.00	777030.50
632.1	777324.00	777617.50	777911.00	778204.50	778498.00	778791.50	779085.00	779378.50	779672.00	779965.50
632.2	780259.00	780552.50	780846.00	781139.50	781433.00	781726.50	782020.00	782313.50	782607.00	782900.50
632.3	783194.00	783487.50	783781.00	784074.50	784368.00	784661.50	784955.00	785248.50	785542.00	785835.50
632.4	786129.00	786422.50	786716.00	787009.50	787303.00	787596.50	787890.00	788183.50	788477.00	788770.50
632.5	789064.00	789357.50	789651.00	789944.50	790238.00	790531.50	790825.00	791118.50	791412.00	791705.50
632.6	791999.00	792292.50	792586.00	792879.50	793173.00	793466.50	793760.00	794053.50	794347.00	794640.50
632.7	794934.00	795227.50	795521.00	795814.50	796108.00	796401.50	796695.00	796988.50	797282.00	797575.50
632.8	797869.00	798162.50	798456.00	798749.50	799043.00	799336.50	799630.00	799923.50	800217.00	800510.50
632.9	800804.00	801097.50	801391.00	801684.50	801978.00	802271.50	802565.00	802858.50	803152.00	803445.50
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. CAPACITY**

ELEVATIONS IN FEET-NGVD, CAPACITY (IN ACRE-FEET)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
633.0	803739.00	804149.44	804559.94	804970.38	805380.81	805791.31	806201.75	806612.25	807022.69	807433.12
633.1	807843.62	808254.06	808664.50	809075.00	809485.44	809895.88	810306.38	810716.81	811127.25	811537.75
633.2	811948.19	812358.69	812769.12	813179.56	813590.06	814000.50	814410.94	814821.44	815231.88	815642.31
633.3	816052.81	816463.25	816873.75	817284.19	817694.62	818105.12	818515.56	818926.00	819336.50	819746.94
633.4	820157.38	820567.88	820978.31	821388.75	821799.25	822209.69	822620.19	823030.62	823441.06	823851.56
633.5	824262.00	824672.44	825082.94	825493.38	825903.81	826314.31	826724.75	827135.25	827545.69	827956.12
633.6	828366.62	828777.06	829187.50	829598.00	830008.44	830418.88	830829.38	831239.81	831650.25	832060.75
633.7	832471.19	832881.69	833292.12	833702.56	834113.06	834523.50	834933.94	835344.44	835754.88	836165.31
633.8	836575.81	836986.25	837396.75	837807.19	838217.62	838628.12	839038.56	839449.00	839859.50	840269.94
633.9	840680.38	841090.88	841501.31	841911.75	842322.25	842732.69	843143.19	843553.62	843964.06	844374.56
634.0	844785.00	845097.00	845409.00	845721.00	846033.00	846345.00	846657.00	846969.00	847281.00	847593.00
634.1	847905.00	848217.00	848529.00	848841.00	849153.00	849465.00	849777.00	850089.00	850401.00	850713.00
634.2	851025.00	851337.00	851649.00	851961.00	852273.00	852585.00	852897.00	853209.00	853521.00	853833.00
634.3	854145.00	854457.00	854769.00	855081.00	855393.00	855705.00	856017.00	856329.00	856641.00	856953.00
634.4	857265.00	857577.00	857889.00	858201.00	858513.00	858825.00	859137.00	859449.00	859761.00	860073.00
634.5	860385.00	860697.00	861009.00	861321.00	861633.00	861945.00	862257.00	862569.00	862881.00	863193.00
634.6	863505.00	863817.00	864129.00	864441.00	864753.00	865065.00	865377.00	865689.00	866001.00	866313.00
634.7	866625.00	866937.00	867249.00	867561.00	867873.00	868185.00	868497.00	868809.00	869121.00	869433.00
634.8	869745.00	870057.00	870369.00	870681.00	870993.00	871305.00	871617.00	871929.00	872241.00	872553.00
634.9	872865.00	873177.00	873489.00	873801.00	874113.00	874425.00	874737.00	875049.00	875361.00	875673.00
635.0	875985.00	876306.50	876628.00	876949.50	877271.00	877592.50	877914.00	878235.50	878557.00	878878.50
635.1	879200.00	879521.50	879843.00	880164.50	880486.00	880807.50	881129.00	881450.50	881772.00	882093.50
635.2	882415.00	882736.50	883058.00	883379.50	883701.00	884022.50	884344.00	884665.50	884987.00	885308.50
635.3	885630.00	885951.50	886273.00	886594.50	886916.00	887237.50	887559.00	887880.50	888202.00	888523.50
635.4	888845.00	889166.50	889488.00	889809.50	890131.00	890452.50	890774.00	891095.50	891417.00	891738.50
635.5	892060.00	892381.50	892703.00	893024.50	893346.00	893667.50	893989.00	894310.50	894632.00	894953.50
635.6	895275.00	895596.50	895918.00	896239.50	896561.00	896882.50	897204.00	897525.50	897847.00	898168.50
635.7	898490.00	898811.50	899133.00	899454.50	899776.00	900097.50	900419.00	900740.50	901062.00	901383.50
635.8	901705.00	902026.50	902348.00	902669.50	902991.00	903312.50	903634.00	903955.50	904277.00	904598.50
635.9	904920.00	905241.50	905563.00	905884.50	906206.00	906527.50	906849.00	907170.50	907492.00	907813.50
636.0	908135.00	908466.00	908797.00	909128.00	909459.00	909790.00	910121.00	910452.00	910783.00	911114.00
636.1	911445.00	911776.00	912107.00	912438.00	912769.00	913100.00	913431.00	913762.00	914093.00	914424.00
636.2	914755.00	915086.00	915417.00	915748.00	916079.00	916410.00	916741.00	917072.00	917403.00	917734.00
636.3	918065.00	918396.00	918727.00	919058.00	919389.00	919720.00	920051.00	920382.00	920713.00	921044.00
636.4	921375.00	921706.00	922037.00	922368.00	922699.00	923030.00	923361.00	923692.00	924023.00	924354.00
636.5	924685.00	925016.00	925347.00	925678.00	926009.00	926340.00	926671.00	927002.00	927333.00	927664.00
636.6	927995.00	928326.00	928657.00	928988.00	929319.00	929650.00	929981.00	930312.00	930643.00	930974.00
636.7	931305.00	931636.00	931967.00	932298.00	932629.00	932960.00	933291.00	933622.00	933953.00	934284.00
636.8	934615.00	934946.00	935277.00	935608.00	935939.00	936270.00	936601.00	936932.00	937263.00	937594.00
636.9	937925.00	938256.00	938587.00	938918.00	939249.00	939580.00	939911.00	940242.00	940573.00	940904.00\
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. CAPACITY**

ELEVATIONS IN FEET-NGVD, CAPACITY (IN ACRE-FEET)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
637.0	941235.00	941575.50	941916.00	942256.50	942597.00	942937.50	943278.00	943618.50	943959.00	944299.50
637.1	944640.00	944980.50	945321.00	945661.50	946002.00	946342.50	946683.00	947023.50	947364.00	947704.50
637.2	948045.00	948385.50	948726.00	949066.50	949407.00	949747.50	950088.00	950428.50	950769.00	951109.50
637.3	951450.00	951790.50	952131.00	952471.50	952812.00	953152.50	953493.00	953833.50	954174.00	954514.50
637.4	954855.00	955195.50	955536.00	955876.50	956217.00	956557.50	956898.00	957238.50	957579.00	957919.50
637.5	958260.00	958600.50	958941.00	959281.50	959622.00	959962.50	960303.00	960643.50	960984.00	961324.50
637.6	961665.00	962005.50	962346.00	962686.50	963027.00	963367.50	963708.00	964048.50	964389.00	964729.50
637.7	965070.00	965410.50	965751.00	966091.50	966432.00	966772.50	967113.00	967453.50	967794.00	968134.50
637.8	968475.00	968815.50	969156.00	969496.50	969837.00	970177.50	970518.00	970858.50	971199.00	971539.50
637.9	971880.00	972220.50	972561.00	972901.50	973242.00	973582.50	973923.00	974263.50	974604.00	974944.50
638.0	975285.00	975635.00	975985.00	976335.00	976685.00	977035.00	977385.00	977735.00	978085.00	978435.00
638.1	978785.00	979135.00	979485.00	979835.00	980185.00	980535.00	980885.00	981235.00	981585.00	981935.00
638.2	982285.00	982635.00	982985.00	983335.00	983685.00	984035.00	984385.00	984735.00	985085.00	985435.00
638.3	985785.00	986135.00	986485.00	986835.00	987185.00	987535.00	987885.00	988235.00	988585.00	988935.00
638.4	989285.00	989635.00	989985.00	990335.00	990685.00	991035.00	991385.00	991735.00	992085.00	992435.00
638.5	992785.00	993135.00	993485.00	993835.00	994185.00	994535.00	994885.00	995235.00	995585.00	995935.00
638.6	996285.00	996635.00	996985.00	997335.00	997685.00	998035.00	998385.00	998735.00	999085.00	999435.00
638.7	999785.00	1000135.00	1000485.00	1000835.00	1001185.00	1001535.00	1001885.00	1002235.00	1002585.00	1002935.00
638.8	1003285.00	1003635.00	1003985.00	1004335.00	1004685.00	1005035.00	1005385.00	1005735.00	1006085.00	1006435.00
638.9	1006785.00	1007135.00	1007485.00	1007835.00	1008185.00	1008535.00	1008885.00	1009235.00	1009585.00	1009935.00
639.0	1010285.00	1010645.00	1011005.00	1011365.00	1011725.00	1012085.00	1012445.00	1012805.00	1013165.00	1013525.00
639.1	1013885.00	1014245.00	1014605.00	1014965.00	1015325.00	1015685.00	1016045.00	1016405.00	1016765.00	1017125.00
639.2	1017485.00	1017845.00	1018205.00	1018565.00	1018925.00	1019285.00	1019645.00	1020005.00	1020365.00	1020725.00
639.3	1021085.00	1021445.00	1021805.00	1022165.00	1022525.00	1022885.00	1023245.00	1023605.00	1023965.00	1024325.00
639.4	1024685.00	1025045.00	1025405.00	1025765.00	1026125.00	1026485.00	1026845.00	1027205.00	1027565.00	1027925.00
639.5	1028285.00	1028645.00	1029005.00	1029365.00	1029725.00	1030085.00	1030445.00	1030805.00	1031165.00	1031525.00
639.6	1031885.00	1032245.00	1032605.00	1032965.00	1033325.00	1033685.00	1034045.00	1034405.00	1034765.00	1035125.00
639.7	1035485.00	1035845.00	1036205.00	1036565.00	1036925.00	1037285.00	1037645.00	1038005.00	1038365.00	1038725.00
639.8	1039085.00	1039445.00	1039805.00	1040165.00	1040525.00	1040885.00	1041245.00	1041605.00	1041965.00	1042325.00
639.9	1042685.00	1043045.00	1043405.00	1043765.00	1044125.00	1044485.00	1044845.00	1045205.00	1045565.00	1045925.00
640.0	1046285.00	1046654.00	1047023.00	1047392.00	1047761.00	1048130.00	1048499.00	1048868.00	1049237.00	1049606.00
640.1	1049975.00	1050344.00	1050713.00	1051082.00	1051451.00	1051820.00	1052189.00	1052558.00	1052927.00	1053296.00
640.2	1053665.00	1054034.00	1054403.00	1054772.00	1055141.00	1055510.00	1055879.00	1056248.00	1056617.00	1056986.00
640.3	1057355.00	1057724.00	1058093.00	1058462.00	1058831.00	1059200.00	1059569.00	1059938.00	1060307.00	1060676.00
640.4	1061045.00	1061414.00	1061783.00	1062152.00	1062521.00	1062890.00	1063259.00	1063628.00	1063997.00	1064366.00
640.5	1064735.00	1065104.00	1065473.00	1065842.00	1066211.00	1066580.00	1066949.00	1067318.00	1067687.00	1068056.00
640.6	1068425.00	1068794.00	1069163.00	1069532.00	1069901.00	1070270.00	1070639.00	1071008.00	1071377.00	1071746.00
640.7	1072115.00	1072484.00	1072853.00	1073222.00	1073591.00	1073960.00	1074329.00	1074698.00	1075067.00	1075436.00
640.8	1075805.00	1076174.00	1076543.00	1076912.00	1077281.00	1077650.00	1078019.00	1078388.00	1078757.00	1079126.00
640.9	1079495.00	1079864.00	1080233.00	1080602.00	1080971.00	1081340.00	1081709.00	1082078.00	1082447.00	1082816.00
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. CAPACITY**

ELEVATIONS IN FEET-NGVD, CAPACITY (IN ACRE-FEET)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
641.0	1083185.00	1083563.00	1083941.00	1084319.00	1084697.00	1085075.00	1085453.00	1085831.00	1086209.00	1086587.00
641.1	1086965.00	1087343.00	1087721.00	1088099.00	1088477.00	1088855.00	1089233.00	1089611.00	1089989.00	1090367.00
641.2	1090745.00	1091123.00	1091501.00	1091879.00	1092257.00	1092635.00	1093013.00	1093391.00	1093769.00	1094147.00
641.3	1094525.00	1094903.00	1095281.00	1095659.00	1096037.00	1096415.00	1096793.00	1097171.00	1097549.00	1097927.00
641.4	1098305.00	1098683.00	1099061.00	1099439.00	1099817.00	1100195.00	1100573.00	1100951.00	1101329.00	1101707.00
641.5	1102085.00	1102463.00	1102841.00	1103219.00	1103597.00	1103975.00	1104353.00	1104731.00	1105109.00	1105487.00
641.6	1105865.00	1106243.00	1106621.00	1106999.00	1107377.00	1107755.00	1108133.00	1108511.00	1108889.00	1109267.00
641.7	1109645.00	1110023.00	1110401.00	1110779.00	1111157.00	1111535.00	1111913.00	1112291.00	1112669.00	1113047.00
641.8	1113425.00	1113803.00	1114181.00	1114559.00	1114937.00	1115315.00	1115693.00	1116071.00	1116449.00	1116827.00
641.9	1117205.00	1117583.00	1117961.00	1118339.00	1118717.00	1119095.00	1119473.00	1119851.00	1120229.00	1120607.00
642.0	1120985.00	1121373.00	1121761.00	1122149.00	1122537.00	1122925.00	1123313.00	1123701.00	1124089.00	1124477.00
642.1	1124865.00	1125253.00	1125641.00	1126029.00	1126417.00	1126805.00	1127193.00	1127581.00	1127969.00	1128357.00
642.2	1128745.00	1129133.00	1129521.00	1129909.00	1130297.00	1130685.00	1131073.00	1131461.00	1131849.00	1132237.00
642.3	1132625.00	1133013.00	1133401.00	1133789.00	1134177.00	1134565.00	1134953.00	1135341.00	1135729.00	1136117.00
642.4	1136505.00	1136893.00	1137281.00	1137669.00	1138057.00	1138445.00	1138833.00	1139221.00	1139609.00	1139997.00
642.5	1140385.00	1140773.00	1141161.00	1141549.00	1141937.00	1142325.00	1142713.00	1143101.00	1143489.00	1143877.00
642.6	1144265.00	1144653.00	1145041.00	1145429.00	1145817.00	1146205.00	1146593.00	1146981.00	1147369.00	1147757.00
642.7	1148145.00	1148533.00	1148921.00	1149309.00	1149697.00	1150085.00	1150473.00	1150861.00	1151249.00	1151637.00
642.8	1152025.00	1152413.00	1152801.00	1153189.00	1153577.00	1153965.00	1154353.00	1154741.00	1155129.00	1155517.00
642.9	1155905.00	1156293.00	1156681.00	1157069.00	1157457.00	1157845.00	1158233.00	1158621.00	1159009.00	1159397.00
643.0	1159785.00	1160183.50	1160582.00	1160980.50	1161379.00	1161777.50	1162176.00	1162574.50	1162973.00	1163371.50
643.1	1163770.00	1164168.50	1164567.00	1164965.50	1165364.00	1165762.50	1166161.00	1166559.50	1166958.00	1167356.50
643.2	1167755.00	1168153.50	1168552.00	1168950.50	1169349.00	1169747.50	1170146.00	1170544.50	1170943.00	1171341.50
643.3	1171740.00	1172138.50	1172537.00	1172935.50	1173334.00	1173732.50	1174131.00	1174529.50	1174928.00	1175326.50
643.4	1175725.00	1176123.50	1176522.00	1176920.50	1177319.00	1177717.50	1178116.00	1178514.50	1178913.00	1179311.50
643.5	1179710.00	1180108.50	1180507.00	1180905.50	1181304.00	1181702.50	1182101.00	1182499.50	1182898.00	1183296.50
643.6	1183695.00	1184093.50	1184492.00	1184890.50	1185289.00	1185687.50	1186086.00	1186484.50	1186883.00	1187281.50
643.7	1187680.00	1188078.50	1188477.00	1188875.50	1189274.00	1189672.50	1190071.00	1190469.50	1190868.00	1191266.50
643.8	1191665.00	1192063.50	1192462.00	1192860.50	1193259.00	1193657.50	1194056.00	1194454.50	1194853.00	1195251.50
643.9	1195650.00	1196048.50	1196447.00	1196845.50	1197244.00	1197642.50	1198041.00	1198439.50	1198838.00	1199236.50
644.0	1199635.00	1200044.50	1200454.00	1200863.50	1201273.00	1201682.50	1202092.00	1202501.50	1202911.00	1203320.50
644.1	1203730.00	1204139.50	1204549.00	1204958.50	1205368.00	1205777.50	1206187.00	1206596.50	1207006.00	1207415.50
644.2	1207825.00	1208234.50	1208644.00	1209053.50	1209463.00	1209872.50	1210282.00	1210691.50	1211101.00	1211510.50
644.3	1211920.00	1212329.50	1212739.00	1213148.50	1213558.00	1213967.50	1214377.00	1214786.50	1215196.00	1215605.50
644.4	1216015.00	1216424.50	1216834.00	1217243.50	1217653.00	1218062.50	1218472.00	1218881.50	1219291.00	1219700.50
644.5	1220110.00	1220519.50	1220929.00	1221338.50	1221748.00	1222157.50	1222567.00	1222976.50	1223386.00	1223795.50
644.6	1224205.00	1224614.50	1225024.00	1225433.50	1225843.00	1226252.50	1226662.00	1227071.50	1227481.00	1227890.50
644.7	1228300.00	1228709.50	1229119.00	1229528.50	1229938.00	1230347.50	1230757.00	1231166.50	1231576.00	1231985.50
644.8	1232395.00	1232804.50	1233214.00	1233623.50	1234033.00	1234442.50	1234852.00	1235261.50	1235671.00	1236080.50
644.9	1236490.00	1236899.50	1237309.00	1237718.50	1238128.00	1238537.50	1238947.00	1239356.50	1239766.00	1240175.50
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. CAPACITY**

ELEVATIONS IN FEET-NGVD, CAPACITY (IN ACRE-FEET)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
645.0	1240585.00	1241005.00	1241425.00	1241845.00	1242265.00	1242685.00	1243105.00	1243525.00	1243945.00	1244365.00
645.1	1244785.00	1245205.00	1245625.00	1246045.00	1246465.00	1246885.00	1247305.00	1247725.00	1248145.00	1248565.00
645.2	1248985.00	1249405.00	1249825.00	1250245.00	1250665.00	1251085.00	1251505.00	1251925.00	1252345.00	1252765.00
645.3	1253185.00	1253605.00	1254025.00	1254445.00	1254865.00	1255285.00	1255705.00	1256125.00	1256545.00	1256965.00
645.4	1257385.00	1257805.00	1258225.00	1258645.00	1259065.00	1259485.00	1259905.00	1260325.00	1260745.00	1261165.00
645.5	1261585.00	1262005.00	1262425.00	1262845.00	1263265.00	1263685.00	1264105.00	1264525.00	1264945.00	1265365.00
645.6	1265785.00	1266205.00	1266625.00	1267045.00	1267465.00	1267885.00	1268305.00	1268725.00	1269145.00	1269565.00
645.7	1269985.00	1270405.00	1270825.00	1271245.00	1271665.00	1272085.00	1272505.00	1272925.00	1273345.00	1273765.00
645.8	1274185.00	1274605.00	1275025.00	1275445.00	1275865.00	1276285.00	1276705.00	1277125.00	1277545.00	1277965.00
645.9	1278385.00	1278805.00	1279225.00	1279645.00	1280065.00	1280485.00	1280905.00	1281325.00	1281745.00	1282165.00
646.0	1282585.00	1283015.50	1283446.00	1283876.50	1284307.00	1284737.50	1285168.00	1285598.50	1286029.00	1286459.50
646.1	1286890.00	1287320.50	1287751.00	1288181.50	1288612.00	1289042.50	1289473.00	1289903.50	1290334.00	1290764.50
646.2	1291195.00	1291625.50	1292056.00	1292486.50	1292917.00	1293347.50	1293778.00	1294208.50	1294639.00	1295069.50
646.3	1295500.00	1295930.50	1296361.00	1296791.50	1297222.00	1297652.50	1298083.00	1298513.50	1298944.00	1299374.50
646.4	1299805.00	1300235.50	1300666.00	1301096.50	1301527.00	1301957.50	1302388.00	1302818.50	1303249.00	1303679.50
646.5	1304110.00	1304540.50	1304971.00	1305401.50	1305832.00	1306262.50	1306693.00	1307123.50	1307554.00	1307984.50
646.6	1308415.00	1308845.50	1309276.00	1309706.50	1310137.00	1310567.50	1310998.00	1311428.50	1311859.00	1312289.50
646.7	1312720.00	1313150.50	1313581.00	1314011.50	1314442.00	1314872.50	1315303.00	1315733.50	1316164.00	1316594.50
646.8	1317025.00	1317455.50	1317886.00	1318316.50	1318747.00	1319177.50	1319608.00	1320038.50	1320469.00	1320899.50
646.9	1321330.00	1321760.50	1322191.00	1322621.50	1323052.00	1323482.50	1323913.00	1324343.50	1324774.00	1325204.50
647.0	1325635.00	1326077.50	1326520.00	1326962.50	1327405.00	1327847.50	1328290.00	1328732.50	1329175.00	1329617.50
647.1	1330060.00	1330502.50	1330945.00	1331387.50	1331830.00	1332272.50	1332715.00	1333157.50	1333600.00	1334042.50
647.2	1334485.00	1334927.50	1335370.00	1335812.50	1336255.00	1336697.50	1337140.00	1337582.50	1338025.00	1338467.50
647.3	1338910.00	1339352.50	1339795.00	1340237.50	1340680.00	1341122.50	1341565.00	1342007.50	1342450.00	1342892.50
647.4	1343335.00	1343777.50	1344220.00	1344662.50	1345105.00	1345547.50	1345990.00	1346432.50	1346875.00	1347317.50
647.5	1347760.00	1348202.50	1348645.00	1349087.50	1349530.00	1349972.50	1350415.00	1350857.50	1351300.00	1351742.50
647.6	1352185.00	1352627.50	1353070.00	1353512.50	1353955.00	1354397.50	1354840.00	1355282.50	1355725.00	1356167.50
647.7	1356610.00	1357052.50	1357495.00	1357937.50	1358380.00	1358822.50	1359265.00	1359707.50	1360150.00	1360592.50
647.8	1361035.00	1361477.50	1361920.00	1362362.50	1362805.00	1363247.50	1363690.00	1364132.50	1364575.00	1365017.50
647.9	1365460.00	1365902.50	1366345.00	1366787.50	1367230.00	1367672.50	1368115.00	1368557.50	1369000.00	1369442.50
648.0	1369885.00	1370340.50	1370796.00	1371251.50	1371707.00	1372162.50	1372618.00	1373073.50	1373529.00	1373984.50
648.1	1374440.00	1374895.50	1375351.00	1375806.50	1376262.00	1376717.50	1377173.00	1377628.50	1378084.00	1378539.50
648.2	1378995.00	1379450.50	1379906.00	1380361.50	1380817.00	1381272.50	1381728.00	1382183.50	1382639.00	1383094.50
648.3	1383550.00	1384005.50	1384461.00	1384916.50	1385372.00	1385827.50	1386283.00	1386738.50	1387194.00	1387649.50
648.4	1388105.00	1388560.50	1389016.00	1389471.50	1389927.00	1390382.50	1390838.00	1391293.50	1391749.00	1392204.50
648.5	1392660.00	1393115.50	1393571.00	1394026.50	1394482.00	1394937.50	1395393.00	1395848.50	1396304.00	1396759.50
648.6	1397215.00	1397670.50	1398126.00	1398581.50	1399037.00	1399492.50	1399948.00	1400403.50	1400859.00	1401314.50
648.7	1401770.00	1402225.50	1402681.00	1403136.50	1403592.00	1404047.50	1404503.00	1404958.50	1405414.00	1405869.50
648.8	1406325.00	1406780.50	1407236.00	1407691.50	1408147.00	1408602.50	1409058.00	1409513.50	1409969.00	1410424.50
648.9	1410880.00	1411335.50	1411791.00	1412246.50	1412702.00	1413157.50	1413613.00	1414068.50	1414524.00	1414979.50
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. CAPACITY**

ELEVATIONS IN FEET-NGVD, CAPACITY (IN ACRE-FEET)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
649.0	1415435.00	1415903.00	1416371.00	1416839.00	1417307.00	1417775.00	1418243.00	1418711.00	1419179.00	1419647.00
649.1	1420115.00	1420583.00	1421051.00	1421519.00	1421987.00	1422455.00	1422923.00	1423391.00	1423859.00	1424327.00
649.2	1424795.00	1425263.00	1425731.00	1426199.00	1426667.00	1427135.00	1427603.00	1428071.00	1428539.00	1429007.00
649.3	1429475.00	1429943.00	1430411.00	1430879.00	1431347.00	1431815.00	1432283.00	1432751.00	1433219.00	1433687.00
649.4	1434155.00	1434623.00	1435091.00	1435559.00	1436027.00	1436495.00	1436963.00	1437431.00	1437899.00	1438367.00
649.5	1438835.00	1439303.00	1439771.00	1440239.00	1440707.00	1441175.00	1441643.00	1442111.00	1442579.00	1443047.00
649.6	1443515.00	1443983.00	1444451.00	1444919.00	1445387.00	1445855.00	1446323.00	1446791.00	1447259.00	1447727.00
649.7	1448195.00	1448663.00	1449131.00	1449599.00	1450067.00	1450535.00	1451003.00	1451471.00	1451939.00	1452407.00
649.8	1452875.00	1453343.00	1453811.00	1454279.00	1454747.00	1455215.00	1455683.00	1456151.00	1456619.00	1457087.00
649.9	1457555.00	1458023.00	1458491.00	1458959.00	1459427.00	1459895.00	1460363.00	1460831.00	1461299.00	1461767.00
650.0	1462235.00	1462715.50	1463196.00	1463676.50	1464157.00	1464637.50	1465118.00	1465598.50	1466079.00	1466559.50
650.1	1467040.00	1467520.50	1468001.00	1468481.50	1468962.00	1469442.50	1469923.00	1470403.50	1470884.00	1471364.50
650.2	1471845.00	1472325.50	1472806.00	1473286.50	1473767.00	1474247.50	1474728.00	1475208.50	1475689.00	1476169.50
650.3	1476650.00	1477130.50	1477611.00	1478091.50	1478572.00	1479052.50	1479533.00	1480013.50	1480494.00	1480974.50
650.4	1481455.00	1481935.50	1482416.00	1482896.50	1483377.00	1483857.50	1484338.00	1484818.50	1485299.00	1485779.50
650.5	1486260.00	1486740.50	1487221.00	1487701.50	1488182.00	1488662.50	1489143.00	1489623.50	1490104.00	1490584.50
650.6	1491065.00	1491545.50	1492026.00	1492506.50	1492987.00	1493467.50	1493948.00	1494428.50	1494909.00	1495389.50
650.7	1495870.00	1496350.50	1496831.00	1497311.50	1497792.00	1498272.50	1498753.00	1499233.50	1499714.00	1500194.50
650.8	1500675.00	1501155.50	1501636.00	1502116.50	1502597.00	1503077.50	1503558.00	1504038.50	1504519.00	1504999.50
650.9	1505480.00	1505960.50	1506441.00	1506921.50	1507402.00	1507882.50	1508363.00	1508843.50	1509324.00	1509804.50
651.0	1510285.00	1510778.50	1511272.00	1511765.50	1512259.00	1512752.50	1513246.00	1513739.50	1514233.00	1514726.50
651.1	1515220.00	1515713.50	1516207.00	1516700.50	1517194.00	1517687.50	1518181.00	1518674.50	1519168.00	1519661.50
651.2	1520155.00	1520648.50	1521142.00	1521635.50	1522129.00	1522622.50	1523116.00	1523609.50	1524103.00	1524596.50
651.3	1525090.00	1525583.50	1526077.00	1526570.50	1527064.00	1527557.50	1528051.00	1528544.50	1529038.00	1529531.50
651.4	1530025.00	1530518.50	1531012.00	1531505.50	1531999.00	1532492.50	1532986.00	1533479.50	1533973.00	1534466.50
651.5	1534960.00	1535453.50	1535947.00	1536440.50	1536934.00	1537427.50	1537921.00	1538414.50	1538908.00	1539401.50
651.6	1539895.00	1540388.50	1540882.00	1541375.50	1541869.00	1542362.50	1542856.00	1543349.50	1543843.00	1544336.50
651.7	1544830.00	1545323.50	1545817.00	1546310.50	1546804.00	1547297.50	1547791.00	1548284.50	1548778.00	1549271.50
651.8	1549765.00	1550258.50	1550752.00	1551245.50	1551739.00	1552232.50	1552726.00	1553219.50	1553713.00	1554206.50
651.9	1554700.00	1555193.50	1555687.00	1556180.50	1556674.00	1557167.50	1557661.00	1558154.50	1558648.00	1559141.50
652.0	1559635.00	1560142.00	1560649.00	1561156.00	1561663.00	1562170.00	1562677.00	1563184.00	1563691.00	1564198.00
652.1	1564705.00	1565212.00	1565719.00	1566226.00	1566733.00	1567240.00	1567747.00	1568254.00	1568761.00	1569268.00
652.2	1569775.00	1570282.00	1570789.00	1571296.00	1571803.00	1572310.00	1572817.00	1573324.00	1573831.00	1574338.00
652.3	1574845.00	1575352.00	1575859.00	1576366.00	1576873.00	1577380.00	1577887.00	1578394.00	1578901.00	1579408.00
652.4	1579915.00	1580422.00	1580929.00	1581436.00	1581943.00	1582450.00	1582957.00	1583464.00	1583971.00	1584478.00
652.5	1584985.00	1585492.00	1585999.00	1586506.00	1587013.00	1587520.00	1588027.00	1588534.00	1589041.00	1589548.00
652.6	1590055.00	1590562.00	1591069.00	1591576.00	1592083.00	1592590.00	1593097.00	1593604.00	1594111.00	1594618.00
652.7	1595125.00	1595632.00	1596139.00	1596646.00	1597153.00	1597660.00	1598167.00	1598674.00	1599181.00	1599688.00
652.8	1600195.00	1600702.00	1601209.00	1601716.00	1602223.00	1602730.00	1603237.00	1603744.00	1604251.00	1604758.00
652.9	1605265.00	1605772.00	1606279.00	1606786.00	1607293.00	1607800.00	1608307.00	1608814.00	1609321.00	1609828.00
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. CAPACITY**

ELEVATIONS IN FEET-NGVD, CAPACITY (IN ACRE-FEET)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
653.0	1610335.00	1610856.00	1611377.00	1611898.00	1612419.00	1612940.00	1613461.00	1613982.00	1614503.00	1615024.00
653.1	1615545.00	1616066.00	1616587.00	1617108.00	1617629.00	1618150.00	1618671.00	1619192.00	1619713.00	1620234.00
653.2	1620755.00	1621276.00	1621797.00	1622318.00	1622839.00	1623360.00	1623881.00	1624402.00	1624923.00	1625444.00
653.3	1625965.00	1626486.00	1627007.00	1627528.00	1628049.00	1628570.00	1629091.00	1629612.00	1630133.00	1630654.00
653.4	1631175.00	1631696.00	1632217.00	1632738.00	1633259.00	1633780.00	1634301.00	1634822.00	1635343.00	1635864.00
653.5	1636385.00	1636906.00	1637427.00	1637948.00	1638469.00	1638990.00	1639511.00	1640032.00	1640553.00	1641074.00
653.6	1641595.00	1642116.00	1642637.00	1643158.00	1643679.00	1644200.00	1644721.00	1645242.00	1645763.00	1646284.00
653.7	1646805.00	1647326.00	1647847.00	1648368.00	1648889.00	1649410.00	1649931.00	1650452.00	1650973.00	1651494.00
653.8	1652015.00	1652536.00	1653057.00	1653578.00	1654099.00	1654620.00	1655141.00	1655662.00	1656183.00	1656704.00
653.9	1657225.00	1657746.00	1658267.00	1658788.00	1659309.00	1659830.00	1660351.00	1660872.00	1661393.00	1661914.00
654.0	1662435.00	1662970.00	1663505.00	1664040.00	1664575.00	1665110.00	1665645.00	1666180.00	1666715.00	1667250.00
654.1	1667785.00	1668320.00	1668855.00	1669390.00	1669925.00	1670460.00	1670995.00	1671530.00	1672065.00	1672600.00
654.2	1673135.00	1673670.00	1674205.00	1674740.00	1675275.00	1675810.00	1676345.00	1676880.00	1677415.00	1677950.00
654.3	1678485.00	1679020.00	1679555.00	1680090.00	1680625.00	1681160.00	1681695.00	1682230.00	1682765.00	1683300.00
654.4	1683835.00	1684370.00	1684905.00	1685440.00	1685975.00	1686510.00	1687045.00	1687580.00	1688115.00	1688650.00
654.5	1689185.00	1689720.00	1690255.00	1690790.00	1691325.00	1691860.00	1692395.00	1692930.00	1693465.00	1694000.00
654.6	1694535.00	1695070.00	1695605.00	1696140.00	1696675.00	1697210.00	1697745.00	1698280.00	1698815.00	1699350.00
654.7	1699885.00	1700420.00	1700955.00	1701490.00	1702025.00	1702560.00	1703095.00	1703630.00	1704165.00	1704700.00
654.8	1705235.00	1705770.00	1706305.00	1706840.00	1707375.00	1707910.00	1708445.00	1708980.00	1709515.00	1710050.00
654.9	1710585.00	1711120.00	1711655.00	1712190.00	1712725.00	1713260.00	1713795.00	1714330.00	1714865.00	1715400.00
655.0	1715935.00	1716484.00	1717033.00	1717582.00	1718131.00	1718680.00	1719229.00	1719778.00	1720327.00	1720876.00
655.1	1721425.00	1721974.00	1722523.00	1723072.00	1723621.00	1724170.00	1724719.00	1725268.00	1725817.00	1726366.00
655.2	1726915.00	1727464.00	1728013.00	1728562.00	1729111.00	1729660.00	1730209.00	1730758.00	1731307.00	1731856.00
655.3	1732405.00	1732954.00	1733503.00	1734052.00	1734601.00	1735150.00	1735699.00	1736248.00	1736797.00	1737346.00
655.4	1737895.00	1738444.00	1738993.00	1739542.00	1740091.00	1740640.00	1741189.00	1741738.00	1742287.00	1742836.00
655.5	1743385.00	1743934.00	1744483.00	1745032.00	1745581.00	1746130.00	1746679.00	1747228.00	1747777.00	1748326.00
655.6	1748875.00	1749424.00	1749973.00	1750522.00	1751071.00	1751620.00	1752169.00	1752718.00	1753267.00	1753816.00
655.7	1754365.00	1754914.00	1755463.00	1756012.00	1756561.00	1757110.00	1757659.00	1758208.00	1758757.00	1759306.00
655.8	1759855.00	1760404.00	1760953.00	1761502.00	1762051.00	1762600.00	1763149.00	1763698.00	1764247.00	1764796.00
655.9	1765345.00	1765894.00	1766443.00	1766992.00	1767541.00	1768090.00	1768639.00	1769188.00	1769737.00	1770286.00
656.0	1770835.00	1771398.00	1771961.00	1772524.00	1773087.00	1773650.00	1774213.00	1774776.00	1775339.00	1775902.00
656.1	1776465.00	1777028.00	1777591.00	1778154.00	1778717.00	1779280.00	1779843.00	1780406.00	1780969.00	1781532.00
656.2	1782095.00	1782658.00	1783221.00	1783784.00	1784347.00	1784910.00	1785473.00	1786036.00	1786599.00	1787162.00
656.3	1787725.00	1788288.00	1788851.00	1789414.00	1789977.00	1790540.00	1791103.00	1791666.00	1792229.00	1792792.00
656.4	1793355.00	1793918.00	1794481.00	1795044.00	1795607.00	1796170.00	1796733.00	1797296.00	1797859.00	1798422.00
656.5	1798985.00	1799548.00	1800111.00	1800674.00	1801237.00	1801800.00	1802363.00	1802926.00	1803489.00	1804052.00
656.6	1804615.00	1805178.00	1805741.00	1806304.00	1806867.00	1807430.00	1807993.00	1808556.00	1809119.00	1809682.00
656.7	1810245.00	1810808.00	1811371.00	1811934.00	1812497.00	1813060.00	1813623.00	1814186.00	1814749.00	1815312.00
656.8	1815875.00	1816438.00	1817001.00	1817564.00	1818127.00	1818690.00	1819253.00	1819816.00	1820379.00	1820942.00
656.9	1821505.00	1822068.00	1822631.00	1823194.00	1823757.00	1824320.00	1824883.00	1825446.00	1826009.00	1826572.00
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. CAPACITY**

ELEVATIONS IN FEET-NGVD, CAPACITY (IN ACRE-FEET)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
657.0	1827135.00	1827712.50	1828290.00	1828867.50	1829445.00	1830022.50	1830600.00	1831177.50	1831755.00	1832332.50
657.1	1832910.00	1833487.50	1834065.00	1834642.50	1835220.00	1835797.50	1836375.00	1836952.50	1837530.00	1838107.50
657.2	1838685.00	1839262.50	1839840.00	1840417.50	1840995.00	1841572.50	1842150.00	1842727.50	1843305.00	1843882.50
657.3	1844460.00	1845037.50	1845615.00	1846192.50	1846770.00	1847347.50	1847925.00	1848502.50	1849080.00	1849657.50
657.4	1850235.00	1850812.50	1851390.00	1851967.50	1852545.00	1853122.50	1853700.00	1854277.50	1854855.00	1855432.50
657.5	1856010.00	1856587.50	1857165.00	1857742.50	1858320.00	1858897.50	1859475.00	1860052.50	1860630.00	1861207.50
657.6	1861785.00	1862362.50	1862940.00	1863517.50	1864095.00	1864672.50	1865250.00	1865827.50	1866405.00	1866982.50
657.7	1867560.00	1868137.50	1868715.00	1869292.50	1869870.00	1870447.50	1871025.00	1871602.50	1872180.00	1872757.50
657.8	1873335.00	1873912.50	1874490.00	1875067.50	1875645.00	1876222.50	1876800.00	1877377.50	1877955.00	1878532.50
657.9	1879110.00	1879687.50	1880265.00	1880842.50	1881420.00	1881997.50	1882575.00	1883152.50	1883730.00	1884307.50
658.0	1884885.00	1885477.00	1886069.00	1886661.00	1887253.00	1887845.00	1888437.00	1889029.00	1889621.00	1890213.00
658.1	1890805.00	1891397.00	1891989.00	1892581.00	1893173.00	1893765.00	1894357.00	1894949.00	1895541.00	1896133.00
658.2	1896725.00	1897317.00	1897909.00	1898501.00	1899093.00	1899685.00	1900277.00	1900869.00	1901461.00	1902053.00
658.3	1902645.00	1903237.00	1903829.00	1904421.00	1905013.00	1905605.00	1906197.00	1906789.00	1907381.00	1907973.00
658.4	1908565.00	1909157.00	1909749.00	1910341.00	1910933.00	1911525.00	1912117.00	1912709.00	1913301.00	1913893.00
658.5	1914485.00	1915077.00	1915669.00	1916261.00	1916853.00	1917445.00	1918037.00	1918629.00	1919221.00	1919813.00
658.6	1920405.00	1920997.00	1921589.00	1922181.00	1922773.00	1923365.00	1923957.00	1924549.00	1925141.00	1925733.00
658.7	1926325.00	1926917.00	1927509.00	1928101.00	1928693.00	1929285.00	1929877.00	1930469.00	1931061.00	1931653.00
658.8	1932245.00	1932837.00	1933429.00	1934021.00	1934613.00	1935205.00	1935797.00	1936389.00	1936981.00	1937573.00
658.9	1938165.00	1938757.00	1939349.00	1939941.00	1940533.00	1941125.00	1941717.00	1942309.00	1942901.00	1943493.00
659.0	1944085.00	1944691.00	1945297.00	1945903.00	1946509.00	1947115.00	1947721.00	1948327.00	1948933.00	1949539.00
659.1	1950145.00	1950751.00	1951357.00	1951963.00	1952569.00	1953175.00	1953781.00	1954387.00	1954993.00	1955599.00
659.2	1956205.00	1956811.00	1957417.00	1958023.00	1958629.00	1959235.00	1959841.00	1960447.00	1961053.00	1961659.00
659.3	1962265.00	1962871.00	1963477.00	1964083.00	1964689.00	1965295.00	1965901.00	1966507.00	1967113.00	1967719.00
659.4	1968325.00	1968931.00	1969537.00	1970143.00	1970749.00	1971355.00	1971961.00	1972567.00	1973173.00	1973779.00
659.5	1974385.00	1974991.00	1975597.00	1976203.00	1976809.00	1977415.00	1978021.00	1978627.00	1979233.00	1979839.00
659.6	1980445.00	1981051.00	1981657.00	1982263.00	1982869.00	1983475.00	1984081.00	1984687.00	1985293.00	1985899.00
659.7	1986505.00	1987111.00	1987717.00	1988323.00	1988929.00	1989535.00	1990141.00	1990747.00	1991353.00	1991959.00
659.8	1992565.00	1993171.00	1993777.00	1994383.00	1994989.00	1995595.00	1996201.00	1996807.00	1997413.00	1998019.00
659.9	1998625.00	1999231.00	1999837.00	2000443.00	2001049.00	2001655.00	2002261.00	2002867.00	2003473.00	2004079.00
660.0	2004685.00	2005305.00	2005925.00	2006545.00	2007165.00	2007785.00	2008405.00	2009025.00	2009645.00	2010265.00
660.1	2010885.00	2011505.00	2012125.00	2012745.00	2013365.00	2013985.00	2014605.00	2015225.00	2015845.00	2016465.00
660.2	2017085.00	2017705.00	2018325.00	2018945.00	2019565.00	2020185.00	2020805.00	2021425.00	2022045.00	2022665.00
660.3	2023285.00	2023905.00	2024525.00	2025145.00	2025765.00	2026385.00	2027005.00	2027625.00	2028245.00	2028865.00
660.4	2029485.00	2030105.00	2030725.00	2031345.00	2031965.00	2032585.00	2033205.00	2033825.00	2034445.00	2035065.00
660.5	2035685.00	2036305.00	2036925.00	2037545.00	2038165.00	2038785.00	2039405.00	2040025.00	2040645.00	2041265.00
660.6	2041885.00	2042505.00	2043125.00	2043745.00	2044365.00	2044985.00	2045605.00	2046225.00	2046845.00	2047465.00
660.7	2048085.00	2048705.00	2049325.00	2049945.00	2050565.00	2051185.00	2051805.00	2052425.00	2053045.00	2053665.00
660.8	2054285.00	2054905.00	2055525.00	2056145.00	2056765.00	2057385.00	2058005.00	2058625.00	2059245.00	2059865.00
660.9	2060485.00	2061105.00	2061725.00	2062345.00	2062965.00	2063585.00	2064205.00	2064825.00	2065445.00	2066065.00
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09

TABLE 7-5 (Continued)**RAY ROBERTS DAM AND LAKE - ELEVATION vs. CAPACITY**

ELEVATIONS IN FEET-NGVD, CAPACITY (IN ACRE-FEET)										
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
661.0	2066685.00	2067319.50	2067954.00	2068588.50	2069223.00	2069857.50	2070492.00	2071126.50	2071761.00	2072395.50
661.1	2073030.00	2073664.50	2074299.00	2074933.50	2075568.00	2076202.50	2076837.00	2077471.50	2078106.00	2078740.50
661.2	2079375.00	2080009.50	2080644.00	2081278.50	2081913.00	2082547.50	2083182.00	2083816.50	2084451.00	2085085.50
661.3	2085720.00	2086354.50	2086989.00	2087623.50	2088258.00	2088892.50	2089527.00	2090161.50	2090796.00	2091430.50
661.4	2092065.00	2092699.50	2093334.00	2093968.50	2094603.00	2095237.50	2095872.00	2096506.50	2097141.00	2097775.50
661.5	2098410.00	2099044.50	2099679.00	2100313.50	2100948.00	2101582.50	2102217.00	2102851.50	2103486.00	2104120.50
661.6	2104755.00	2105389.50	2106024.00	2106658.50	2107293.00	2107927.50	2108562.00	2109196.50	2109831.00	2110465.50
661.7	2111100.00	2111734.50	2112369.00	2113003.50	2113638.00	2114272.50	2114907.00	2115541.50	2116176.00	2116810.50
661.8	2117445.00	2118079.50	2118714.00	2119348.50	2119983.00	2120617.50	2121252.00	2121886.50	2122521.00	2123155.50
661.9	2123790.00	2124424.50	2125059.00	2125693.50	2126328.00	2126962.50	2127597.00	2128231.50	2128866.00	2129500.50
662.0	2130135.00	2130784.00	2131433.00	2132082.00	2132731.00	2133380.00	2134029.00	2134678.00	2135327.00	2135976.00
662.1	2136625.00	2137274.00	2137923.00	2138572.00	2139221.00	2139870.00	2140519.00	2141168.00	2141817.00	2142466.00
662.2	2143115.00	2143764.00	2144413.00	2145062.00	2145711.00	2146360.00	2147009.00	2147658.00	2148307.00	2148956.00
662.3	2149605.00	2150254.00	2150903.00	2151552.00	2152201.00	2152850.00	2153499.00	2154148.00	2154797.00	2155446.00
662.4	2156095.00	2156744.00	2157393.00	2158042.00	2158691.00	2159340.00	2159989.00	2160638.00	2161287.00	2161936.00
662.5	2162585.00	2163234.00	2163883.00	2164532.00	2165181.00	2165830.00	2166479.00	2167128.00	2167777.00	2168426.00
662.6	2169075.00	2169724.00	2170373.00	2171022.00	2171671.00	2172320.00	2172969.00	2173618.00	2174267.00	2174916.00
662.7	2175565.00	2176214.00	2176863.00	2177512.00	2178161.00	2178810.00	2179459.00	2180108.00	2180757.00	2181406.00
662.8	2182055.00	2182704.00	2183353.00	2184002.00	2184651.00	2185300.00	2185949.00	2186598.00	2187247.00	2187896.00
662.9	2188545.00	2189194.00	2189843.00	2190492.00	2191141.00	2191790.00	2192439.00	2193088.00	2193737.00	2194386.00
663.0	2195035.00	2195698.00	2196361.00	2197024.00	2197687.00	2198350.00	2199013.00	2199676.00	2200339.00	2201002.00
663.1	2201665.00	2202328.00	2202991.00	2203654.00	2204317.00	2204980.00	2205643.00	2206306.00	2206969.00	2207632.00
663.2	2208295.00	2208958.00	2209621.00	2210284.00	2210947.00	2211610.00	2212273.00	2212936.00	2213599.00	2214262.00
663.3	2214925.00	2215588.00	2216251.00	2216914.00	2217577.00	2218240.00	2218903.00	2219566.00	2220229.00	2220892.00
663.4	2221555.00	2222218.00	2222881.00	2223544.00	2224207.00	2224870.00	2225533.00	2226196.00	2226859.00	2227522.00
663.5	2228185.00	2228848.00	2229511.00	2230174.00	2230837.00	2231500.00	2232163.00	2232826.00	2233489.00	2234152.00
663.6	2234815.00	2235478.00	2236141.00	2236804.00	2237467.00	2238130.00	2238793.00	2239456.00	2240119.00	2240782.00
663.7	2241445.00	2242108.00	2242771.00	2243434.00	2244097.00	2244760.00	2245423.00	2246086.00	2246749.00	2247412.00
663.8	2248075.00	2248738.00	2249401.00	2250064.00	2250727.00	2251390.00	2252053.00	2252716.00	2253379.00	2254042.00
663.9	2254705.00	2255368.00	2256031.00	2256694.00	2257357.00	2258020.00	2258683.00	2259346.00	2260009.00	2260672.00
664.0	2261335.00	2262012.50	2262690.00	2263367.50	2264045.00	2264722.50	2265400.00	2266077.50	2266755.00	2267432.50
664.1	2268110.00	2268787.50	2269465.00	2270142.50	2270820.00	2271497.50	2272175.00	2272852.50	2273530.00	2274207.50
664.2	2274885.00	2275562.50	2276240.00	2276917.50	2277595.00	2278272.50	2278950.00	2279627.50	2280305.00	2280982.50
664.3	2281660.00	2282337.50	2283015.00	2283692.50	2284370.00	2285047.50	2285725.00	2286402.50	2287080.00	2287757.50
664.4	2288435.00	2289112.50	2289790.00	2290467.50	2291145.00	2291822.50	2292500.00	2293177.50	2293855.00	2294532.50
664.5	2295210.00	2295887.50	2296565.00	2297242.50	2297920.00	2298597.50	2299275.00	2299952.50	2300630.00	2301307.50
664.6	2301985.00	2302662.50	2303340.00	2304017.50	2304695.00	2305372.50	2306050.00	2306727.50	2307405.00	2308082.50
664.7	2308760.00	2309437.50	2310115.00	2310792.50	2311470.00	2312147.50	2312825.00	2313502.50	2314180.00	2314857.50
664.8	2315535.00	2316212.50	2316890.00	2317567.50	2318245.00	2318922.50	2319600.00	2320277.50	2320955.00	2321632.50
664.9	2322310.00	2322987.50	2323665.00	2324342.50	2325020.00	2325697.50	2326375.00	2327052.50	2327730.00	2328407.50
ELEV	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09