SKIATOOK LAKE
HOMINY CREEK, OKLAHOMA
WATER CONTROL MANUAL

APPENDIX Y
TO
WATER CONTROL MASTER MANUAL
ARKANSAS RIVER BASIN

ORIGINAL EDITION – OCTOBER 1984
REVISED EDITION – SEPTEMBER 2011

DEPARTMENT OF THE ARMY
TULSA DISTRICT, CORPS OF ENGINEERS
OKLAHOMA

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 manual, unless noted otherwise, are in feet, NGVD29 (National Geodetic Vertical Datum 1929).

EMERGENCY REGULATION ASSISTANCE PROCEDURES

In the event that unusual conditions arise during duty hours and at various hours during weekends and holidays, contact can be made by telephone to the Water Management Section, Tulsa District Office (918) 669-7023. If the above office cannot be contacted, assistance can be achieved by contacting, in the order listed, one of persons shown below. Section VII of this Manual contains detailed instructions for emergency regulations. All project personnel associated with regulation of the project must be thoroughly familiar with the procedure outlined in this section.

EMERGENCY

PERSONNEL

ROSTER

TITLE AND NAME	RESIDENCE TELEPHONE
Coordinator	(b) (6)
Backup Coordinator	(b) (6)
Chief, Water Management Section	(b) (6)
Chief, Hydrology-Hydraulics Branch	(b) (6)

SKIATOOK DAM AND OUTLET WORKS

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PERTINENT DATA

LOCATION:
Skiatook Dam is located in Osage County, OK at R.M. 14.3 on Hominy Creek, about 5 miles west of the town of Skiatook, OK

DRAINAGE AREA:
354 square miles
One inch of runoff = 18,880 ac-ft

DAM:

Type: Earth Fill
Length: 3,590 feet
Max Height: 143 feet
Top Width: 32 feet

SPILLWAY:

Crest Elevation: 732.0 NGVD29
Length: 100 feet
Type: Uncontrolled
Location: Right Abutment

WET WELL: Dual wet wells with multilevel Gates on each side of the Upstream face of the outlet works

Intake: Six Levels
Level 1 - 646.0 feet NGVD29, 2 - 5 x 5 feet slide gates
Level 2 - 665.0 feet NGVD29, 1 - 5 x 5 feet slide gate
Level 3 - 675.0 feet NGVD29, 1 - 5 x 5 feet slide gate
Level 4 - 685.0 feet NGVD29, 1 - 5 x 5 feet slide gate
Level 5 - 693.0 feet NGVD29, 1 - 5 x 5 feet slide gate
Level 6 - 704.0 feet NGVD29, 2 - 5 X 8 feet Slide gates
Floor elevation: 611.0 feet NGVD29

LAND:

	Guide Contour Elev.	Area (acres)
Fee Simple	734.0	15,360
Easement	(1)	1,249 (2)

(1) Flowage easements were required in some extreme upper reaches affected by backwater.

(2) Includes easements for lake access roads

OUTLET WORKS:

Type: Gated Concrete Conduit

Location: Tunnel near right abutment
Dimension: 10’6” inside diameter (round)
Invert Elev: 620.0 feet, NGVD29
Control: Two service and two emergency 4.67 feet wide and 10.50 feet high Hydraulically operated wheel gates

DISCHARGE – WATER SUPPLY:
Size: 36 Inch Diameter

Location: 36 Inch Water passage between the Dual wet wells, then beneath the Flood control conduit
Control: Two 36 inch slide gates

Invert: 614.5 feet, NGVD29

LOW FLOW:

Size: 2.5 feet wide by 5.0 feet high

Location: 7’ by 8.5’ water passage between the Dual wet wells, then through the Splitter pier to the flood control conduit
Control: 2.5 feet by 6.0 feet slide gate

Invert: 635.0 feet NGVD29

Feature	Elevation Feet, NGVD29	Lake area (acres)	Lake Capacity			Spillway Capacity (c.f.s)	Outlet Works Capacity (c.f.s.)	Low Flow Outlet Capacity (c.f.s.)
			Accumulative (acre-feet) (1)	Runoff (inches)	Incremental (acre-feet)			
Top of dam	756.0							
Maximum pool	751.1	20,300	868,000	46.0	323,480	21,700	4,450	
Spillway crest	732.0	14,420	544,520	28.8	42,210	0	4,450	
Top of flood control pool	729.0	13,700	502,310	26.5	179,140	0	4,400	
Top of conservation pool	714.0	10,370	323,170	17.1	311,780	0	4,100	685
Top of inactive pool	657.0	1,470	11,390	0.6	11,390		2,775	335
Streambed	613.0							

(1) Based on 1995 sediment resurvey

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I - INTRODUCTION

1-01. Authorization. This manual is submitted in accordance with ER 1110-2-240 and prepared in accordance with EM 1110-2-3600 and ER 1110-2-8156.

1-02. Purpose and Scope. The purpose of this manual is to document the plan of water control; to present detailed information to higher authority; and to give guidance to personnel who will become concerned with, or responsible for, regulation of the lake during the life of the project.

1-03. Related Manuals. This manual is Appendix Y to the Arkansas River Basin Water Control Master Manual. Other related manuals important to the regulation of Skiatook Lake are:

Appendix D - Hulah
Appendix F - Birch
Appendix L - Oologah
Appendix S - Navigation System
Appendix W - Copan

The locations of existing and authorized projects are shown on Plate 1-1. Design memoranda important to the regulation of Skiatook Lake are shown in Table 1-1. Supplementary Pertinent Data is given in Exhibit A of this manual.

1-04. Project Owner. Skiatook Lake is owned by the U.S. Government.

1-05. Operating Agency. The U.S. Army Corps of Engineers is the operating agency for Skiatook Lake. The Lake Manager, Skiatook Lake, operating through the Operations Project Manager, Northern Area, and the Operations Division, Tulsa District, has the responsibility for project operations. The project will be manned 24 hours a day when the lake level is above elevation 725.0 feet, National Geodetic Vertical Datum of 1929 (NGVD29). Below elevation 725.0 feet, the project will be manned during normal work hours each day through the recreational season. When the recreational season is over, the project will be manned for the normal 5-day work week. However, when the project is in a flood control regulation, operation personnel will closely monitor the project and the downstream river reaches. The project has been furnished a list of the Water Management Section personnel to contact when necessary.

TABLE 1-1

PERTINENT REPORTS AND DESIGN MEMORANDA
FOR SKIATOOK DAM AND LAKE

Memorandum No.	Title	Date Submitted
1	Hydrology - Part I	10 Apr 1964
1	Hydrology - Part II	21 Jan 1966
2	General Design	11 Mar 1966
3A	Preliminary Master Plan	17 Jun 1966
3B	Master Plan (Revised)	15 Sep 1976
4-1	Real Estate - Dam site, Work Area, and Access Roads	9 Sep 1966
4-3	Real Estate - Remainder of Lake	21 Jun 1974
5	Left Abutment Access Road	15 Mar 1966
6	Embankment	7 May 1976
7	Outlet Works and Spillway	13 Apr 1978
8	Construction Materials (Concrete Aggregates)	6 Apr 1966
9	Project Buildings and Overlook	23 Mar 1966
23	Reservoir Clearing	18 Jun 1982
24	Sedimentation and Degradation Ranges	15 Jul 1974
26	Plugging Oil and Gas Wells	25 Feb 1980
27	Right Abutment Access Road	17 Jun 1980
28	Initial Filling	30 May 1984
	Drought Contingency Plan for the Lower Verdigris River, including Skiatook Lake	26 Nov 2002
	Operation and Maintenance Manual, Volume II, Skiatook Lake, Flood Emergency Plan	Mar 2011
	Skiatook Lake, Hominy Creek, Oklahoma Dam Safety Assurance Program Evaluation Report, Skiatook Spillway	Mar 1997

The Lake Manager will furnish the Water Management Section a list of project personnel, giving their office and home telephones and addresses. The Lake Manager resides as close to the project as is considered prudent to carry out his official duties.

1-06. Regulating Agencies. The regulating agency for Skiatook Lake is the Corps of Engineers, with the lake's regulation being the responsibility of the Water Management Section, Hydrology-Hydraulics Branch, Tulsa District. Presently, there are no other agencies involved in the functional responsibilities of Skiatook Lake.

II - DESCRIPTION OF PROJECT

2-01. Location. Skiatook Dam is located at river mile 14.3 on Hominy Creek about 5 miles west of the town of Skiatook in Osage County, Oklahoma. The project location is shown on Plate 2-1.

2-02. Purpose. Skiatook Lake is a multi-purpose project for flood control, water supply, water quality, recreation, and other beneficial uses, including fish & wildlife. The project was designed and is regulated to provide maximum benefits in conjunction with other reservoirs in the Bird Creek and Verdigris River systems.

2-03. Physical Components.

a. Embankment. The embankment is a rolled earth fill structure. It is about 3,590 feet long and has a maximum height of approximately 143 feet above the streambed. The top of dam is at elevation 756.0 feet. A 32-foot crest width was required to accommodate the relocation of Oklahoma Highway 97 across the dam, based on class "C" standards. The embankment contains an impervious core with a top width of 20 feet at elevation 750.0 feet and a maximum base width of approximately 220 feet. Compacted random fill was placed on each side of the impervious core to the required slopes. The upstream slope of the embankment is protected by 18-inch riprap placed on a 6-inch bedding layer from elevation 680.0 feet to elevation 736.0 feet. The downstream slope of the embankment is protected by grass sod. The general plan and typical embankment sections are shown on Plate 2-2.

b. Spillway. The uncontrolled spillway was excavated in the right abutment 560 feet south of the dam axis. The spillway channel is about 620 feet long and has a 100-foot-wide invert at elevation 732.0 feet. The side slopes of the spillway are 4V to 1H from the invert to the top of the limestone where a 10-foot berm is provided, then IV to 1H to natural ground. The crest is at elevation 732.0 feet and is protected by a 25-foot-wide sill and slab founded on shale. The approach channel has a slope of plus 0.2 percent and the exit channel has a super critical slope of minus 2.0 percent. The spillway operates only for floods greater than the standard project flood, a frequency of operation of once in over a hundred years. The spillway plan is shown on Plate 2-2. Spillway modification construction was performed in 2003. This construction modified the spillway with an anchored two-foot thick reinforced concrete chute to stop erosion problems. Plan view of modification is shown at Plate 2-3.

c. Outlet Works, The outlet works consists of a gate tower, tunnel, and stilling basin. The gate tower contains two 4.667-feet by 10.5-feet passages for flood releases controlled by hydraulically operated slide gates. Tandem gates are installed in each passage. The downstream gate operates as the service gate and the upstream gate functions as the emergency gate. A 10.5-foot inside diameter round reinforced concrete-lined tunnel extends from the gate tower transition 980 feet downstream to the stilling basin. The tunnel inlet invert elevation is 620.0 feet and the outlet invert elevation is

615.0 feet. Plates 2-4 through 2-6 show intake structure elevations and details and the outlet channel plan view.

d. Water Quality Facilities. Dual wet wells provide water supply and low flow requirements. Water quality in each wet well is controlled by four selective intakes controlled by stem-operated slide gates. The right wet well has a 5.0-foot by 8.0-foot opening at invert elevation 704.0 feet and three 5.0-feet by 5.0-feet openings at invert elevations 685.0, 665.0, and 646.0 feet. The left wet well has a 5.0-foot by foot 8.0-foot opening at invert elevation 704.0 feet and three 5.0-feet by 5.0-feet openings at invert elevations 693.0, 675.0, and 646.0 feet. A Y-shaped low flow sluice connects the two wet wells and exits into the flood control conduit through the splitter pier. The top of the "Y" connects the two wet wells with a 7.0-foot by 8.5-foot passage at invert elevation 635.0 feet. The bottom of the "Y" is a 2.5 foot by 5.0 foot gate controlled sluice. Downstream of the slide gate, the sluice enlarges to 2.5 feet by 6.0 feet. The low flow intake arrangement is shown on Plates 2-4 and 2-5.

e. Water Supply. The water supply facilities consist of a 36-inch diameter pipe with its intake from the two wet wells. The invert elevation at the entrance is 614.5 feet. A 36-inch by 36-inch slide gate in each wet well with inverts at elevation 614.5 provides closure for pipe repair or installation of a control valve in the manhole. The single pipe extends beneath the gate tower, outlet tunnel, and stilling basin before turning 45 degrees to the left 25 feet from the stilling basin end sill. The pipe extends 675 feet on the left bank before ending in a blind flange in the right blank of the old Hominy Creek channel.

f. Stilling Basin. The stilling basin is 143 feet long and transitions from a 10.5-foot width at the tunnel portal to 27 feet wide at a distance of 69 feet from the portal. The apron of the stilling basin slopes from elevation 606.5 feet to elevation 606.0 feet and the top of the end sill is elevation 611.0 feet. The stilling basin is connected to Hominy Creek by a riprap-lined channel about 1,050 feet long. The stilling basin is shown on Plate 2-6.

g. Sedimentation and Degradation Ranges. A combination range and contour survey method is used for measuring sediment deposition in Skiatook Lake. A total of twenty three (23) sedimentation ranges are in place for the lake area, their ends marked with permanent monuments. Sediment surveys of the ranges are performed periodically by Tulsa District personnel or by contract for the purpose of computing sediment deposition and new lake area and capacity data. Four (4) degradation ranges are downstream of Skiatook Dam. These ranges provide data on downstream channel conditions and effects of regulated releases from the dam. The sedimentation and degradation ranges are shown on Plate 2-7.

2-04. Related Control Facilities. None.

2-05. Real Estate Acquisition. The acquisition guideline, elevation 734.0 feet, was approved by 2d Endorsement, ENGCW-EZ, 6 Oct 1966, to letter SWTSD, 11 Mar 1966,

subject: Skiatook Dam and Reservoir, Hominy Creek, Oklahoma, Design Memorandum No. 2, General Design. The acquisition guideline is 5 feet above the flood control pool. The guideline in the upper reaches of the lake is at the above elevation or the envelope curve of backwater effects of the 50-year flood, whichever is higher. See Plate 2-8 for the 50-year flood backwater. The fee purchase line is based on a blocked perimeter encompassing the acquisition guideline with a minimum distance of 300 feet measured horizontally from the top of the flood pool, elevation 729.0 feet. Fee simple title has been acquired to land required for construction of the dam and for operation and maintenance. Flowage easements were obtained in some extreme upper reaches. There are 15,360 acres in fee simple title and 1,249 acres in easement.

2-06. Public Facilities. There are ten (10) public use and recreation areas. The public overlook shelter is located on the upstream side of the left abutment. There is a parking area, toilets, and potable water at the overlook area. The others are: Quapaw Park, Skiatook Point, Osage Park, Gouin Point, Bull Creek Peninsula, Hominy Landing, Twin Points, Black Dog Park, Tall Chief Cove, and Osage Nation Park and Marina. Plate 2-9 shows the locations of the public use and recreation areas.

III - HISTORY OF PROJECT

3-01. Authorization. Skiatook Lake was authorized for construction by the Flood Control Act approved 23 Oct 1962 (Public Law 87-874, 87th Congress, House Resolution 13273), in accordance with the plan outlined in House Document No. 563 (87th Congress, 2nd session).

3-02. Planning and Design. Senate Document No. 13, 85th Congress, 1st Session, published in 1957, considered the water use and control problems in the Arkansas-White-Red River Basins and presented a long-range plan of improvement for the three-basin area. This report included a multi-purpose plan for improvement of the lower Verdigris River Basin, designated as the Caney-Bird-Verdigris Project. At this time, Avant and Skiatook Lakes were proposed as the Bird Creek System. House Document No. 563, 87th Congress, 2nd Session, published in 1962, presented studies made on the Verdigris River Basin in Oklahoma and Kansas. It recommended construction of Skiatook, Sand, Copan, Birch, and Candy Lakes. This recommended plan of improvement was authorized by the Flood Control Act of 1962. A series of design memoranda have been prepared covering hydrology, recreation and wildlife, structural features of the plan, sedimentation and degradation ranges, reservoir clearing, relocation of roads and utilities, and real estate.

3-03. Construction. A resume of construction activities for Skiatook Lake is presented in Table 3-1.

TABLE 3-1

RESUME OF CONSTRUCTION ACTIVITIES

Activity	Date
Construction began	Jan 1974
Date of diversion	26 Jun 1981
Final storage began	27 Feb 1984
Conservation pool filled	19 Jul 1989

3-04. Related Projects. Skiatook Lake is a component of the multi-purpose Verdigris River and Arkansas River flood control and navigation system. The projects of the lower Verdigris River system are Oologah, Hulah, Copan, Birch, and Skiatook Lakes; Newt Graham and Chouteau Locks and Dams in operation. The Verdigris River system, in conjunction with other units in the Arkansas River system, is operated for the control of floods, navigation, and other beneficial uses on the Verdigris and Arkansas Rivers to Van Buren, Arkansas, and will provide only minor benefits on the lower Arkansas River.

3-05. Modification to Regulations - Temperature Regulation. Multiple-level intakes into a wet well were provided for temperature regulation.

3-06. Principal Regulation Problems. None.

IV - WATERSHED CHARACTERISTICS

4-01. General Characteristics. The Hominy Creek watershed is roughly elliptical in shape, with a maximum length of about 33 miles and a maximum width of about 16 miles. The drainage area above the Skiatook dam site is 354 square miles, all of which is considered to contribute to runoff. The total drainage area of Hominy Creek is 415 square miles. The basin ranges in elevation from about 610 feet to 1,050 feet. The vegetation consists of pasture, cultivated crops and considerable woodlands. The stream pattern consists of one principal stream with several major left bank tributaries. Slopes may vary from 3 feet per mile to above 100 feet per mile on some of the tributaries. Streambed profiles are shown on Plate 4-1.

4-02. Topography. The terrain is rolling to hilly and characterized by sandstone-capped cuestas with gentle slopes, matured streams, and valleys with broad alluvial flood plains. The drainage pattern of the area is dendritic with Hominy Creek as the main flow path. Land use consists of ranching, crop production, limited timber production and extraction of oil and gas.

4-03. Geology and Soils. Skiatook Lake is in the Osage Plains subdivision of the Interior Lowlands physiographic province. Bedrock strata are sedimentary rocks of upper Pennsylvanian age. Alluvial soil in the flood plain ranges in thickness from 10 to 35 feet while residual soil in the uplands exists as a thin mantle.

4-04. Sediment. The drainage basin above Skiatook Lake contributes relatively little sediment because of good ground cover and a clay type soil. The most recent sediment survey conducted in 1995 indicated a sedimentation rate of 0.2942 acre-feet per year from 1984 through 1995, which is approximately one-half of the estimated design rate. This rate will result in an approximate average annual accumulation of 220 acre-feet which required 22,000 acre-feet of storage for the 100-year sediment reserve. The 100-year sediment reserve is distributed as follows: 20 percent inactive pool, 71 percent conservation pool, and 9 percent flood pool.

4-05. Climate. The watershed above the Skiatook dam site lies in a region characterized by moderate winters and comparatively long summers with relatively high temperatures. The summer rains usually occur as thundershowers with intense rainfall, short duration, and limited aerial coverage. The winter rains are generally of low intensities but cover large areas. Climatic characteristics for the basin are shown in the following tabulation.

a. Temperature. (Period of Record is Jan 1930 through Dec 2009)

Mean annual	61 degrees F
Maximum recorded (Skiatook, Oklahoma, 10 Aug 1936)	115 degrees F
Minimum recorded (Skiatook, Oklahoma, 22 Jan 1930)	-16 degrees F

b. Rainfall. (Period of Record is Jan 1930 through Dec 2009)

Mean Annual (Jan 1930 – Dec 2009)	35 inches
Maximum annual (1973)	54 inches
Minimum annual (1956)	22 inches
Percent during growing season (Apr through Sep)	66 %

c. Snowfall. (Period of Record is Jan 1930 through Dec 2009)

Maximum (1970 and 1979)	21 inches
Minimum (Several years)	Zero
Mean Annual	10 inches

The average monthly and annual rainfall and runoff data are shown in Table 4-1. The locations of the precipitation and stream gaging stations used in the forecasting process are shown on Plate 5-1.

d. Evaporation. Following the construction of Skiatook Project, evaporation data was collected from an evaporation pan on site. In 1996, Tulsa District migrated from physical evaporation measurements to using an empirical formula, based on meteorology data collected on site. The formula incorporates electronically collected data for solar radiation, wind speed air temperature and relative humidity. The estimated monthly pan evaporation figures are shown in Table 4-2 for the period Jan 1982 through Dec 2009.

e. Wind. The prevailing wind is from a southerly direction, with the greatest wind movements occurring in the spring months. A study of available wind velocity data indicates that for 1-minute and 1-hour durations, the highest wind velocities that can reasonably be expected are 78 and 56 miles per hour, respectively.

4-06. Storms and Floods. Most of the flood producing storms over the watershed upstream of the dam site have been from 2 to 4 days in duration. The maximum storm during the 45-year period of record was 12.12 inches from 30 Sep through 5 Oct 1959. Storms with an average precipitation of 3 inches or more over the drainage area above the dam site are shown in Table 4-3. About 85 percent of these storms occurred during the months Apr through Sep. The averages were computed from available published records that do not necessarily show the actual center of intense storms over small areas. Because of this, and since antecedent rainfall, season of the year, and many other factors influence storm runoff, floods have frequently followed periods of relatively

small amounts of recorded rainfall. Conversely, longer storms of greater amounts of recorded rainfall may cause only minor flooding. Major floods at the Skiatook and Sperry gages are shown in Table 4-4.

TABLE 4-1

AVERAGE MONTHLY AND ANNUAL RAINFALL
AND RUNOFF UPSTREAM OF SKIATOOK DAM

Month	Average rainfall [1] (inches)	Percentage of average annual Rainfall	Average Runoff [2] [3]		Percent of average annual runoff
			(acre-feet)	(inches)	
Jan	1.34	4	6,220	0.33	4
Feb	1.45	4	9,290	0.49	6
Mar	2.55	7	21,280	1.13	13
Apr	3.30	9	23,180	1.23	14
May	4.77	14	31,490	1.67	19
Jun	4.35	12	21,550	1.14	13
Jul	3.11	9	8,990	0.48	5
Aug	3.20	9	4,220	0.22	3
Sep	4.22	12	10,030	0.53	6
Oct	2.99	9	11,370	0.60	7
Nov	2.33	7	10,100	0.54	6
Dec	1.42	4	6,970	0.37	4
Total	35.03	100	164,690	8.73	100

(1) Period of Record Jan 1930 through Dec 2009 (data extracted from Annual Report)
(2) Drainage area above Skiatook Lake = 354 square miles
(3) Period of Record Oct 1936 through Dec 2009 (data extracted from Annual Report)

TABLE 4-2

ESTIMATED MONTHLY EVAPORATION
SKIATOOK LAKE
(Period of Record Jan 1982 through Dec 2009)

Month	Evaporation (inches)
Jan	2.16
Feb	2.63
Mar	4.48
Apr	6.23
May	6.52
Jun	7.82
Jul	9.29
Aug	8.55
Sep	5.87
Oct	4.16
Nov	2.96
Dec	2.26
Annual Total	62.93

TABLE 4-3

SKIATOOK DAM SITE MAJOR STORMS
OCT 1935 THROUGH DEC 2009
HOMINY CREEK BASIN

Date of storm	Average rainfall (inches)	Date of storm	Average rainfall (inches)
5 - 7 Jun 1936	3.60	1 - 5 Oct 1955	3.82
15 - 18 Sep 1936	4.31	18 - 23 Apr 1957	6.23
6 - 9 Oct 1936	3.10	16 - 21 May 1957	6.48
7 - 10 Sep 1937	3.42	10 - 12 Jun 1957	3.38
14 - 19 Feb 1938	6.66	11 - 16 Sep 1957	4.24
26 - 31 Mar 1938	5.78	23 - 26 Sep 1959	3.99
15 - 17 Aug 1938	3.70	30 Sep - 5 Oct 1959	12.12
9 -11 Jun 1940	3.05	3 - 9 May 1961	4.54
2 - 5 Sep 1940	4.96	2 - 8 Jun 1961	3.49
19 - 26 Nov 1940	5.37	12 - 15 Jul 1961	4.52
13 - 16 Apr 1941	3.84	12 - 16 Aug 1961	5.33
20 - 23 May 1941	3.00	4 - 5 Sep 1961	3.02
12 - 14 Aug 1941	3.13	11 - 14 Sep 1961	4.16
8 - 9 Sep 1941	3.64	4 - 5 Apr 1964	5.54
29 Sep - 5 Oct 1941	3.86	20 - 21 Sep 1965	6.09
14 - 17 Oct 1941	4.21	2 - 3 Sep 1966	4.13
28 - 31 Oct 1941	5.40	24 - 25 Jun 1967	3.15
6 - 9 Apr 1942	4.06	11 - 14 Oct 1969	7.15
17 - 21 Apr 1942	4.38	30 Apr - 1 May 1970	3.30
20 - 22 Jun 1942	3.33	23 Sep 1970	3.92
13 - 15 Aug 1942	3.24	23 - 24 Jul 1971	3.90
7 - 10 May 1943	7.70	5 - 6 Sep 1971	8.51
16 -19 May 1943	10.30	18 - 19 Sep 1971	3.28
28 Sep - 2 Oct 1943	5.66	20 - 21 Oct 1971	4.75
22 - 24 Oct 1943	3.23	21 - 22 Oct 1972	4.99
27 - 28 Sep 1944	4.11	2 - 3 Jun 1973	4.87
1 Jul 1945	3.60	9 - 11 Mar 1974	6.37
21 - 30 Sep 1945	11.33	24 - 25 May 1974	3.27
1 - 6 Nov 1946	4.92	1 - 2 Sep 1974	3.28
12 - 16 May 1947	3.70	20 - 21 Sep 1974	4.13
24 - 25 Apr 1948	3.20	2 – 5 Nov 1974	5.36
20 - 23 Jun 1948	5.66	1 - 2 May 1977	3.52
8 - 15 Aug 1948	4.34	20 - 21 May 1977	3.26
14 - 21 May 1949	4.65	14 - 15 Aug 1977	3.59
7 - 9 Jul 1949	3.02	18 - 19 Jun 1978	3.29
7 - 11 May 1950	4.29	20 - 21 Nov 1979	3.75
9 - 11 Jul 1950	4.24	28 Jul - 4 Aug 81	4.95
5 - 10 Sep 1951	4.38	10 - 18 Oct 81	7.39
30 Apr - 2 May 1954	5.09	30 - 31 Jan 82	3.38
8 - 12 May 1955	3.00	12 - 15 May 82	3.80

TABLE 4-3 (continued)

Date of storm	Average rainfall (inches)	Date of storm	Average rainfall (inches)
17 - 21 Oct 1983	4.18	16 - 22 Jul 1997	3.40
25 - 28 Oct 1984	3.03	17 - 22 Aug 1997	3.80
13 - 17 Dec 1984	3.47	15 - 20 Mar 1998	4.01
21 - 24 Feb 1985	5.04	26 - 29 Apr 1998	5.01
30 Apr - 1 May 1985	3.19	1 - 6 Oct 1998	7.04
10 - 11 Jun 1985	3.37	24 - 27 Apr 1999	5.54
8 - 15 Oct 1985	3.00	19 - 25 Jun 1999	3.61
13 - 15 Nov 1985	4.03	29 Jun - 2 Jul 1999	3.17
27 May - 11 Jun 1986	3.50	3 - 5 Dec 1999	3.01
29 Sep - 4 Oct 1986	7.42	6 - 7 May 2000	3.34
28 - 29 Sep 1987	4.48	25 - 28 May 2000	4.16
Sep 15 - 24 1988	6.81	18 - 22 May 2001	3.30
19 - 23 Aug 1989	4.29	18 - 20 Mar 2003	3.14
11 - 12 Mar 1990	3.54	28 Aug - 2 Sep 2003	4.50
19 - 30 Apr 1990	3.92	3 - 5 Mar 2004	4.38
17 - 21 Sep 1990	3.17	27 Jun - 7 Jul 2004	3.56
28 Oct - 3 Nov 1991	4.62	10 - 12 Jul 2006	3.32
18 - 21 Jun 1992	3.23	6 - 12 May 2007	3.90
22 Oct 1992	3.40	24 May - 2 Jun 2007	3.72
11 - 13 Nov 1992	3.04	23 Jun - 3 Jul 2007	5.61
25 - 27 Feb 1993	8.48	8 - 11 Apr 2008	4.20
6 - 13 May 1993	5.42	9 - 10 Jun 2008	4.50
20 - 21 Aug 1994	3.40	16 - 20 Jun 2008	3.26
6 - 8 May 1995	3.36	6 - 14 Sep 2008	3.56
3 - 7 Jun 1995	3.90	1 - 11 May 2009	3.18
9 - 11 Jun 1995	3.05	16 - 21 Aug 2009	3.86
26 - 27 Sep 1996	3.30	4 - 9 Oct 2009	3.61

TABLE 4-4

TOP TWENTY ANNUAL PEAK FLOWS AT STREAM GAGES
Water Year 1 Oct – 30 Sep

Skiatook Gage - Discontinued			Sperry Gage		
DATE	DISCHARGE	STAGE	DATE	DISCHARGE	STAGE
3 Oct 1959	35,600	38.82	3 Oct 1959	90,000	32.60
4 Nov 1974	24,800	37.03	18 May 1943	72,200	31.68
6 Sep 1971	15,400	36.62	4 Nov 1974	54,700	31.45
12 Mar 1974	16,200	35.11	1 Oct 1986	31,500	30.82
10 Jul 1949	14,200	35.06	12 Mar 1974	45,600	30.75
18 May 1943	14,000	35.00	31 Oct 1941	45,700	30.14
21 May 1957	13,200	34.42	10 May 1993	30,600	29.88
15 Jul 1961	13,000	34.25	23 Feb 1985	28,400	29.49
1 Oct 1945	12,900	33.60	15 Sep 1961	32,100	29.09
1 May 1970	11,200	32.92	13 Jun 1957	31,400	29.03
22 Jun 1948	10,800	32.61	7 Sep 1971	18,900	29.02
20 Mar 1968	9,750	31.82	10 Jun 2008	25,000	28.97
22 Jun 1951	9,160	31.30	12 Apr 1994	21,700	28.93
26 Jul 1967	9,080	31.27	26 Apr 1999	21,500	28.89
11 Jul 1950	8,800	31.04	1 Oct 1945	24,300	28.84
15 Dec 1971	9,350	30.94	2 Jul 1945	25,200	28.73
16 Apr 1973	7,980	30.78	12 Mar 1990	20,300	28.66
16 May 1947	8,360	30.64	1 May 1970	18,900	28.63
4 Sep 1966	8,450	30.43	17 Apr 1973	21,000	28.58
21 Sep 1965	8,960	30.28	11 Jun 1941	23,000	28.46

Flood Stage = 29.0 feet
Period of Record
May 1943 – 26 Apr 1980

Flood Stage = 21.0 feet
Period of Record
11 Mar 1939 – Present

Note: Annual Peak Flows are the highest flow during a given water year (1 Oct to 30 Sept of following calendar year).

4-07. Runoff Characteristics. During design studies it was determined that the time to peak discharge at the Skiatook gage was about 26 hours from the time of the most intense rainfall. The time to peak inflow into Skiatook Lake should be less than this value; however, these times are highly dependent on the storm pattern. Storm studies indicate that 1/4 to 2 inches of rainfall generally were needed to satisfy initial losses before significant runoff begins, depending on antecedent rainfall. Pertinent data for stream gaging stations used for regulation of Skiatook Lake are given in Table 4-5. Estimated monthly and annual flows past the Skiatook Dam are shown in Table 4-6 in the Supplemental Tables Section. The inflow volume frequency by months is shown in Table 4-7. The flow duration curve is shown on Plate 4-2.

Peak inflows taken from monthly inflow computation records at the dam site for the period Jan 1940 through Dec 2008 were used to compute the maximum annual peak inflow probability. The inflow probability was derived in accordance with Bulletin 17B, "Guidelines for Determining Flood Flow Frequency," dated Sep 1981. The peak inflow probability curve is shown on Plate 4-3.

4-08. Water Quality. The quality of water in Hominy Creek is considered excellent and requires minimum treatment to be suitable for municipal and industrial use. Naturally occurring conditions may lead to water quality deterioration near the bottom of the lake for short periods in mid-summer; however, surface water remains of good quality. Water quality control is a project purpose, and downstream conditions require the release of water for this purpose. Natural constituents of the soil in the area can cause high values of calcium carbonate, chloride, iron, and manganese in the surface waters. Nutrients such as phosphates and nitrogen are sufficient to support algal blooms. The hardness of the impounded water is in the moderate to hard range. Historical data reveal some water quality criteria have been exceeded. With the exception of iron and manganese, all parameter means are well below established criteria. In well oxygenated lakes, iron and manganese form precipitates which fall into bottom deposits. During short periods in mid-summer, Skiatook Lake will weakly stratify. The lake may become anoxic near the bottom. High concentrations of iron, manganese, ammonia, and hydrogen sulfide are expected in the anoxic zone. This may become a problem since the water supply intake is near the bottom of the lake. To avoid anoxic releases, the low-flow releases are made through higher level intakes during these periods. Water withdrawn for municipal supplies is taken from above the anoxic zone, otherwise water quality criteria will be exceeded. Generally the anoxic water will cause only aesthetic problems such as unpleasant taste and odors and staining in water basins.

4-09. Channel and Flooding Characteristics. The channel capacity of Hominy Creek below Skiatook Dam is about 4,000 c.f.s. Bird creek has a channel capacity of 9,400 c.f.s. below its confluence with Hominy Creek. A rating curve for the Sperry gage is shown on Plate 4-4. Discharge rating curves used by the Water Management Section are adjusted for changing conditions and are maintained in current status. Hominy Creek has generally stable banks and flows through a wide valley. Crest travel time

TABLE 4-5

PERTINENT DATA FOR STREAM GAGING STATIONS

STATION	STREAM	MILES ABOVE MOUTH	GAGE ZERO (ft.,NGVD)	FLOOD STAGE (ft.) [1]	DRAINAGE AREA (sq. mi.)	MAXIMUM FLOOD OF RECORD		
						DATE	STAGE (ft.)	DISCHARGE (c.f.s.)
Skiatook, OK (Discontinued)	Hominy Creek	16.7	619.66	28.0	340	3 Oct 1959	38.82	35,600
Sperry, OK	Bird Creek	25.0	579.43	21.0	905	3 Oct 1959	32.60	90,000

STATION	STREAM	2nd LARGEST FLOOD OF RECORD			3rd LARGEST FLOOD OF RECORD			PERIOD OF RECORD
		DATE	STAGE (ft.)	DISCHARGE (c.f.s.)	DATE	STAGE (ft.)	DISCHARGE (c.f.s.)	(FLOW AND/OR STAGE)
Skiatook, OK (Discontinued)	Hominy Creek	4 Nov 1974	37.03	24,800	6 Sep 1971	36.62	15,400	May 1945 to 26 Apr 1980
Sperry, OK	Bird Creek	18 May 1943	31.68	72,200	4 Nov 1974	31.45	54,700	Mar 1939 to present

(1) Regulating Flood Stages

TABLE 4-7

INFLOW VOLUME FREQUENCY (Jan 1936 - Dec 2009)
MONTHLY INFLOW VOLUME IN ACRE-FEET

	Frequency of Occurrence in Years					
Month	2	5	10	25	50	100
Jan	1,740	10,300	21,200	34,900	68,400	101,000
Feb	2,310	14,000	29,800	45,700	108,000	169,000
Mar	10,400	36,400	40,500	82,400	144,000	185,000
Apr	14,000	44,500	64,000	91,000	183,000	200,000
May	18,200	50,000	82,200	135,700	188,000	250,000
Jun	10,300	36,200	40,400	82,000	134,000	171,000
Jul	2,230	13,000	26,200	45,300	84,500	126,000
Aug	1,000	5,050	12,100	34,800	59,500	100,000
Sep	2,260	13,100	29,400	45,500	107,000	128,000
Oct	10,500	36,500	40,600	90,100	180,000	190,000
Nov	2,320	14,300	36,700	60,246	121,000	170,000
Dec	1,750	11,000	24,500	45,200	84,000	124,000

from Skiatook dam to the Sperry gage is about 12 hours. Crest travel times are shown on Plate 4-5. This diagram should be used as a guide only, as the crest travel time depends on the magnitude of the flood, the antecedent flows and the time of year.

4-10. Upstream Structures. There are no upstream structures above Skiatook Lake in the Hominy Creek Basin.

4-11. Downstream Structures. Releases from Birch Lake which is physically located directly north of Skiatook Lake, contributes to flow into Bird Creek, immediately downstream of Skiatook Lake near Sperry, Oklahoma. Structures in the river system downstream of Skiatook Lake are Oologah Lake on the Verdigris River with a drainage area of 4,339 square miles; Hulah Lake on the Caney River with a drainage area of 732 Square miles; Copan Lake on the Little Caney River with a drainage area of 505 square miles; and the McClellan-Kerr Arkansas River Navigation System on the Verdigris and Arkansas Rivers. All the projects are regulated by the Corps of Engineers.

4-12. Economic Data.

a. Population. The population of counties and larger cities in the Bird Creek basin are shown in Table 4-8.

b. Agriculture. In the Hominy Creek and Bird Creek Basins, the climate, topography, and soil are all suitable for diversified farming, with the uplands used

principally for grazing livestock and for hay production. Principal crops grown in the region are wheat, soybeans, sorghums, corn, pecans, and garden truck. Production and annual value of the major crops in the flood plain below Skiatook Dam are shown in Table 4-9.

c. Industry. Manufacturing is the largest industry in the region, followed by Health Care and Social Assistance and Retail Trade. The primary manufacturing industries of the area are Fabricated Metal Manufacturing and Machinery Manufacturing. The largest companies in the area are located in Tulsa, Oklahoma, and are involved with the oil and natural gas industries. Tables 4-10A, 4-10B, and 4-10C display the major industries in Tulsa, Osage, and Rogers counties, along with corresponding data on number of establishments, sales, annual payroll and employees.

d. Flood Damages. The estimated average annual flood damages prevented by Skiatook Dam on Hominy Creek are presented in Table 4-11. The top five flood events, in terms of flood damages prevented, to pass through Skiatook Dam are presented in Table 4-12. Plate 4-6 shows the Structural Loss and Area curve for the area of the Skiatook dam site downstream to the mouth of the Hominy Creek. Plate 4-7 shows the Structural Loss and Area curve for the area of the mouth of the Hominy Creek downstream to the confluence with the Verdigris River. .

TABLE 4-8

POPULATION OF COUNTIES AND CITIES
DOWNSTREAM OF SKIATOOK DAM

County	Major Cities	U.S. Census Population			% Change (2000-2010)
		1990	2000	2010	
Osage County		41,645	44,437	47,472	6.83
	Hominy	2,342	2,584	3,565	37.96
	Pawhuska	3,825	3,629	3,584	-1.24
	Skiatook	4,910	5,396	5,267	-2.39
Rogers		55,170	70,641	86,905	23.02
	Claremore	13,280	15,873	18,581	17.06
	Catoosa	2,954	5,449	5,487	0.70
Tulsa County		503,341	563,299	603,403	7.12
	Tulsa	367,302	393,049	391,906	-0.29
	Owasso	11,151	18,502	26,301	42.15
	Sperry	937	981	1,177	19.98
1990 Census, 2000 Census, 2010 Census http://factfinder.census.gov/ and http://factfinder2.census.gov/					

4-12

TABLE 4-9

ANNUAL VALUE OF CROPS
DOWNSTREAM OF SKIATOOK DAM

Crops	Hominy Creek Skiatook Dam to Mouth		Bird Creek Hominy Creek to Mouth		Total	
	Acres	**Value ($)**	**Acres**	**Value ($)**	**Acres**	**Value ($)**
Alfalfa	410	91,230	1,710	380,510	2,120	471,740
Wheat	350	41,820	1,500	179,220	1,850	221,040
Grain Sorghum	250	56,990	1,070	243,930	1,320	300,930
Soybeans	760	99,410	2,140	279,910	2,900	379,320
Pecans	250	190,750	1,070	816,410	1,320	1,007,160
Pasture	3,040	297,280	13,910	1,360,260	16,950	1,657,540
Total	**5,060**	**777,480**	**21,400**	**3,260,240**	**26,460**	**4,037,730**
Yield Rates from Oklahoma State University Crop Enterprise Budgets 2009 2009 Current Normalized Prices						

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TABLE 4-10A

2002 ECONOMIC CENSUS FOR
TULSA COUNTY, OK

NAICS Code	Industry Description	Number of Establishments	Sales, Shipments, Receipts, or Revenue ($1,000's)	Annual Payroll ($1,000's)	Number of Employees
31-33	Manufacturing	1,103	9,713,750	1,530,587	41,309
42	Wholesale trade	1,341	9,859,729	690,015	16,650
44-45	Retail trade	2,458	7,298,312	709,855	36,958
51	Information	374	N	D	j
53	Real estate & rental & leasing	849	740,897	156,760	5,733
54	Professional, scientific, & technical services	2,294	1,752,442	716,907	16,900
56	Administrative & support & waste management & remediation service	981	1,256,713	550,487	27,828
61	Educational services	123	102,506	38,859	1,561
62	Health care & social assistance	1,766	3,088,367	1,254,084	37,415
71	Arts, entertainment, & recreation	224	186,942	48,538	3,278
72	Accommodation & food services	1,337	962,292	280,883	24,653
81	Other services (except public administration)	1,194	696,915	183,439	7,744

Source: U.S. Bureau of the Census, 2002 Economic Census, * 2006 County Business Patterns

Key to Table:
D = Withheld to avoid disclosing data for individual companies; data are included in higher totals
j = 10,000 to 24,999 employees
N = Not available or not comparable

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TABLE 4-10B

2002 ECONOMIC CENSUS FOR OSAGE COUNTY, OK

NAICS Code	Industry Description	Number of Establishments	Sales, Shipments, Receipts, or Revenue ($1,000's)	Annual Payroll ($1,000's)	Number of Employees
31-33	Manufacturing*	39	--	19,468	470
42	Wholesale trade	18	--	6,651	178
44-45	Retail trade	98	172,087	12,898	769
51	Information	10	N	D	b
53	Real estate & rental & leasing	18	D	D	b
54	Professional, scientific, & technical services	49	12,006	3,427	144
56	Administrative & support & waste management & remediation service	20	10,103	2,464	87
61	Educational services	5	D	D	b
62	Health care & social assistance	50	D	D	f
71	Arts, entertainment, & recreation	18	D	D	f
72	Accommodation & food services	44	18,150	4,846	606
81	Other services (except public administration)	29	5,896	1,320	76

Source: U.S. Bureau of the Census, 2007 Economic Census, * 2008 County Business Patterns

Key to Table:
b = 20 – 99 employees
D = Withheld to avoid disclosing data for individual companies; data are included in higher totals
f = 500 to 999 employees
N = Not available or not comparable

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TABLE 4-10C

2002 ECONOMIC CENSUS FOR ROGERS COUNTY, OK

NAICS Code	Industry Description	Number of Establishments	Sales, Shipments, Receipts, or Revenue ($1,000's)	Annual Payroll ($1,000's)	Number of Employees
31-33	Manufacturing	145	2,856,002	335,511	7,179
42	Wholesale trade*	71		46,015	979
44-45	Retail trade	210	663,785	57,962	2,575
51	Information	22	N	D	f
53	Real estate & rental & leasing	72	64,244	6,922	392
54	Professional, scientific, & technical services	129	49,142	19,321	570
56	Administrative & support & waste management & remediation service	100	72,457	29,273	1,375
61	Educational services	6	D	D	a
62	Health care & social assistance	172	186,602	80,394	2,431
71	Arts, entertainment, & recreation	22	D	D	g
72	Accommodation & food services	96	62,433	17,134	1,756
81	Other services (except public administration)	82	35,994	8,994	353

Source: U.S. Bureau of the Census, 2007 Economic Census,
* 2008 County Business Patterns
Key to Table:
a = 0 – 19 employees
D = Withheld to avoid disclosing data for individual companies; data are included in higher totals
f = 500 to 999 employees
g = 1,000 to 2,499 employees
N = Not available or not comparable

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TABLE 4-11

AVERAGE ANNUAL FLOOD DAMAGES PREVENTED
BELOW SKIATOOK DAM

Average Annual Flood Damages Prevented by Skiatook Dam		
Years in Operation	**Cumulative Damages (2008 $ 1,000's)**	**Average Annual Damages (2008 $ 1,000's)**
26	389,120	14,970

TABLE 4-12

TOP FIVE FLOOD EVENTS IN TERMS OF DAMAGES PREVENTED
BELOW SKIATOOK DAM

Top Five Flood Events		
Year	**Damages ($ 1,000's)**	**Damages (2008 $1,000's)**
1992	11,560	19,270
1999	15,740	21,590
1987	11,490	21,660
1988	12,110	21,800
1993	39,510	63,020

V - DATA COLLECTION AND COMMUNICATION NETWORKS

5-01. Hydrometeorological Stations.

a. Facilities. The Water Management Section, Hydrology-Hydraulics Branch, Tulsa District; the National Weather Service (NWS); and the U.S. Geological Survey (USGS) cooperate to collect data and maintain a reliable communication network. All pertinent reporting observation stations are shown on Plate 5-1. Pool elevation data are provided by a bubbler gage connected to a digital recorder and wired to a transmitting type data collection platform. This equipment is located in a gage house on the dam.

All stream gaging stations are automated gages consisting of float wells or bubbler gages connected to digital recorders and data collection platforms. There is one stream gage located upstream of Skiatook Lake on Hominy Creek. The following stream gages have been designated as key stations for regulation purposes: Bird Creek at Hominy and Sperry, and the Verdigris River at Claremore.

Automated stream gaging stations are equipped with automated rain gages that provide precipitation data transmitted along with stage data. The NWS also maintains a network of local observer stations throughout the Tulsa District (see Plate 5-1).

b. Reporting. The reporting procedures for precipitation and stream gaging stations are on a cooperative basis with the NWS and the USGS. The reporting of data from pool elevation and stream gaging stations has been automated by using Data Collection Platforms (DCP's) that record data hourly and transmit the data every hour or when a threshold value is exceeded. The data are transmitted via Geostationary Operational Environmental Satellite (GOES) to a downlink and computer facility owned and operated by the National Oceanic and Atmospheric Administration (NOAA) near Washington, D.C. The data are then transmitted to a domestic satellite (DOMSAT) that passes the data to the Tulsa District's Receive Only Terminal (DROT). The data from the NOAA computer facility may also be transferred via the Internet. When received, the river stage is converted to flow and lake elevation is converted to storage. All the data are then stored in a database on the Tulsa District Water Control Data System (WCDS) for access when needed. Data Collection Platforms also report rainfall data in the same way. In addition to the DCP data, observer rainfall data are collected and stored in the computer system for use in forecasting. Observers telephone the NWS offices in their region and the NWS then encodes the data into a Standard Hydrologic Exchange Format (SHEF). The data are then transferred to the WCDS by electronic data transmission from the Arkansas-Red Basin River Forecast Center. Once the data are received, they are decoded and handled similarly to the DCP data. Informative display of all data is possible by using several versatile computer programs developed for use on the WCDS. Table 5-1 contains a list of automated stream gage and rainfall stations. Detailed instructions on reporting criteria are presented in Exhibit B, Standing Instructions to Lake Manager.

TABLE 5-1

AUTOMATED GAGES

Station	Operating Agency	Tulsa ID	USGS ID	SHEF ID	LATITUDE NORTH (Deg Min Sec)	LONGITUDE WEST (Deg Min Sec)
Automated Stream Gages						
Caney River near Bartlesville, OK	USGS	BART	7174400	BVLO2	36 45 20	95 58 19
Hominy Creek near Hominy OK	USGS	HOMI	7176950	HMYO2	36 28 25	96 22 43
Verdigris River near Claremore, OK	USGS		7176000	CLRO2		
Little Hominy Creek below Skiatook Dam nr Skiatook, OK	USGS	SKIH	7174310	SKBO2	36 21 09	96 05 18
Automated Pool Gages						
Skiatook Lake	COE	SKIA	7174300	SKL02	36 21 04	96 05 34
Automated Rainfall Gages Used in the Skiatook Lake Forecast Model						
Bird Creek at Avant, Ok	USGS	AVAN	7176500	AVTO2	36 29 06	96 03 36
Birch Lake Dam	COE	BIRC	--	BIRO2	36 31 53	96 09 38
Caney River nr Collinsville, OK	USGS	COLL	7175550	CVLO2	36 23 42	95 48 36
Hallet, Oklahoma	COE	HALL	--	HLTO2	36 13 05	96 38 38
Arkansas R. at Ponca City, OK	USGS	KAWA	7148140	PCYO2	36 41 36	96 55 48
Keystone Lake Dam	COE	KEYS	--	KEYO2	36 09 05	96 15 05
Black Bear Cr at Pawnee, OK	USGS	PAWN	7153000	PAWO2	36 20 37	96 47 57

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TABLE 5-1 (continued)

Station	Operating Agency	Tulsa ID	USGS ID	SHEF ID	LATITUDE NORTH (Deg Min Sec)	LONGITUDE WEST (Deg Min Sec)
Arkansas R. at Ralston, OK	USGS	RALS	7152500	RLSO2	36 30 15	96 43 41
Caney R near Ramona, OK	USGS	RAMO	7175500	RAMO2	36 30 32	96 50 30
Bird Creek near Sperry, OK	USGS	SPER	7177500	SPEO2	36 16 42	95 57 14
Arkansas River at Tulsa, OK	USGS	TULA	7164500	TLSO2	36 08 26	96 00 22
Oilton, OK	MESO	DRSO2	DRSO2	--	36 01 52	96 29 50
Burbank, OK	MESO	FFSO2	FFSO2	--	36 38 04	96 48 37
Pawnee, OK	MESO	PNSO2	PNSO2	--	36 21 40	96 46 11
Foraker, OK	MESO	PWSO2	PWSO2	--	36 50 25	96 25 39
Skiatook, OK	MESO	SKSO2	SKSO2	--	36 24 55	96 02 13
Wynona, OK	MESO	WYSO2	WYSO2	--	36 31 05	96 20 31

5-3

c. Maintenance. Maintenance and repair of stream gages are the responsibility of the administering agency. Both the Corps of Engineers and the USGS have stream-gaging equipment in the Verdigris River Basin. The Water Management Section, Hydrology-Hydraulics Branch, Tulsa District, is charged with the responsibility for the equipment placed by the Corps of Engineers.

5-02. Water Quality Stations.

a. Facilities. Pertinent USGS reporting observation stations are shown in Table 5-2. Water quality samples are also taken on an as-needed basis to establish the chemical and biological quality of the lake water. All data are reported to Tulsa District.

b. Reporting. The reporting procedures for water quality stations are made in cooperation with the USGS. All stations report measurements and analyses to the USGS on a frequency specified in Table 5-2. Water quality reports will be prepared in accordance with ER 1110-2-8154.

c. Maintenance. Maintenance and repair of the Catoosa gage is done by the USGS with the cooperation from the City of Tulsa. Maintenance and repair of the Sperry gage is done by the USGS with the cooperation from the Tulsa District and the City of Tulsa.

5-03. Sediment Stations.

a. Facilities. The Corps has established 23 sedimentation ranges above Skiatook Dam and four degradation ranges downstream of Skiatook Dam to be used for sedimentation measurements (paragraph 4-04). These ranges are surveyed periodically to compute sediment deposition and new lake area/capacity data. The ranges are shown on Plate 2-6.

b. Reporting. Sediment surveys are made infrequently for Skiatook Lake. The last resurvey was in 1995.

c. Maintenance. Maintenance on the sediment ranges is performed by the Tulsa District.

5-04. Recording Hydrologic Data. Hydrologic information is recorded as it is received by the Water Management Section as follows:

a. Stages and Discharges. The raw data that the Water Management computer retrieves from the central computer are stored as they are received. These raw data are then sorted by station and stored again. Several computer programs convert the raw data into stage/pool elevation data and the corresponding flow/storage values as determined from rating curves. These processed data are then stored in two databases.

TABLE 5-2

PERTINENT REPORTING WATER QUALITY STATIONS

Name and Location	Type	Recording or Non-Recording	Period of Record	Frequency of Analysis	Operating Agency
Bird Creek near Catoosa, OK Station ID 07178050	1. Chemical Analysis 2. Water Temperature 3. Sediment	Non-Recording	1965 - Present	Daily	USGS
		Recording	1965 - Present	Continuous	USGS
		Non-Recording	1944 - Present	As Needed	Corps of Engineers
Bird Creek near Sperry, OK Station ID 07177500	1. Chemical Analysis 2. Water Temperature	Non-Recording	1951 - 1990	As Needed	USGS
		Recording	1993 - Present	Continuous	USGS

To prevent the databases from filling, they are periodically archived on tape for permanent storage. Stream flow measurements made by the USGS are reported to the Hydrology and Hydraulics Section. The measurements are entered into the database for storage.

b. Precipitation. Precipitation data from the DCP stations and the project are combined with NWS observer precipitation data that can then be used by computer programs for plotting distribution, determining basin rainfall, and forecasting runoff (see Section VI).

c. Water Quality Data. Water quality data have not been recorded with regularity for Skiatook Lake.

5-05. Communication Network. Wire facilities at the Skiatook Lake Project Office consist of local and long-distance telephone service. Radio communication is by a VHF-FM fixed station (call signal WUI-305) capable of reaching local mobile stations, the Tulsa District, stations on the local loop of the Tulsa District and other stations on the north and south loop of the Tulsa District via repeater relay. Maintenance of the telephone lines is the responsibility of the company leasing the lines to the Government. The Tulsa District radio technician makes quarterly inspections of the project's fixed equipment and makes repairs as conditions warrant. To alert the public of impending gate changes, warning horns are located on the conduit gate tower, on the downstream end of the conduit, and on the spillway. Control buttons for these devices are found on the gate control panels.

5-06. Communication With Project.

a. Water Management Section with Project Office. Instructions for the storage and release of water from the lake will be communicated by the Water Management Section to the responsible project operating personnel for the implementation of the provisions set forth in Section IX of this manual. This communication will normally be made by telephone, but could on occasion be made by VHF-FM radio. The reports by the project office, described in paragraph 5-07 and Exhibit B of this manual, will be communicated directly to the Water Management Section. Should communication between the project and the Tulsa District be disrupted, the Lake Manager will, on his or her own initiative, direct regulation of the lake according to emergency regulations as required in Section VII and Exhibit B of this manual. A chart, "Organization For Flood Control Regulation" is shown on Plate 5-2.

b. Between Project Office and Others. Communications between project personnel and other Federal, State, and local agencies will be sufficient to facilitate the coordination described in Section IX of this manual.

5-07. Project Reporting Instructions. Hydrologic data items affecting release of water, confirmation of change in releases as instructed, complaints, operating machinery failure, or out-of service times for maintenance shall be reported to the Water Management Section as they occur.

The following data should be included in the daily report to the Water Management Section (Hydrology-Hydraulics Branch, Tulsa District) from all flood control storage projects without hydropower. Data are typically reported by telephone, fax, or email. Data collected will be reviewed and input into the Water Management Section's data base before 10 a.m. and published to the lake data morning report located at http://www.swt-wc.usace.army.mil/old_resvrept.htm by 10 a.m. See Plate 5-3 for lake data reporting details.

a. As of 8 a.m. Each Weekday.

1) Pool elevations at 12 noon, 4 p.m. and 12 midnight of the previous day and the current 8 a.m. pool elevation and tailwater elevation (if available).

2) The total precipitation amounts for the previous 24-hour period (7 a.m. to 7 a.m. time period).

3) The current wind direction and wind speed (Beaufort scale).

4) Water supply withdrawal or release for previous day (if available).

5) The current gate setting and any gate changes made during the past 24-hour period, including the time and pool elevation and tailwater elevation if necessary when the change was made.

Note: Except for lakes without personnel or if data collection is automated.

b. As of 8 a.m. Each Monday.

1) The same data from the weekend as required in paragraph 5-07.a. above.

2) The current pool elevation readings from the pool gage, the recording chart or tape, the shaft encoder or data logger, and the wire weight or staff gage. If wind or weather prevents readings on Monday, then these readings can be taken on the next day that weather permits.

c. Weekends and Holidays.

1) Daily reports are not required to be submitted on weekends and holidays except during flood periods.

d. During Flood Periods.

1) During flood periods, weekend and holiday reports should include the same data as required in paragraph 5-07.a above as well as the 8 a.m. pool elevation from the pool gage.

2) In addition to the data in paragraphs 5-07.a., 5-07.b. and 5-07.c. above, additional reports of lake elevations may be requested by Water Management Section personnel.

5-08. Warnings. It is the responsibility of the Lake Manager to initiate a warning to the Tulsa District and local law enforcement agencies if emergency situations develop. He/she has the responsibility to properly recognize emergency situations and to seek assistance from supervisory offices, if time permits. They must be knowledgeable of conditions that constitute an emergency such as a dam failure possibility. The downstream population should be notified as early as possible of a potential problem. Initial notification by project personnel will include (listed by priority), Chief of Operations, Chief of Operations Technical Support, Chief of Engineering and Construction, Chief of Emergency Management, as set forth in the Operations and Maintenance Manual Volume II, Skiatook Lake, Flood Emergency Plan, dated Mar 2011. The Skiatook Lake project personnel have compiled a list of downstream contacts for use in emergency situations.

5-09. Frequency of Gate Changes. During flood periods, gate changes may be directed by the Water Management Section at any time. The initial transition to flood releases or vice versa may require gate changes every hour. When floodwater has significantly risen into the flood control pool, gate changes can be expected two or more times daily. Only under the most unusual circumstances will changes be ordered more frequently than once every three (3) hours. Frequency of gate changes during low flow operations will generally be less than once a day.

VI - HYDROLOGIC FORECASTS

6-01. General. Hydrologic forecasts are necessary in predicting stream flow upstream and downstream of Skiatook Lake to determine if and when releases should be made.

a. Role of Corps of Engineers. Hydrologic forecasts are made by the Water Management Section, Tulsa District, for use in the regulation of lakes for flood control and other authorized purposes and for the benefit of Corps of Engineers' construction projects and flood control activities. As distinguished from the NWS, who furnishes weather and flood forecasts to the public, the Tulsa District furnishes information on current and forecasted lake levels and lake releases, along with technical advice. The Water Management Section (lake levels recording), telephone number (918) 669-7521, is listed in the Tulsa telephone directory to provide the public a means of obtaining current lake information, such as pool levels and discharges. General news releases are made by the Public Affairs Office which is kept fully informed of the hydrologic situation as appropriate. Further discussion of the role of the Corps of Engineers in hydrologic forecasts is presented in Section V of the Arkansas River Basin Water Control Master Manual.

b. Role of Other Agencies. The NWS, Tulsa, Oklahoma, is the official agency making flood forecast information available to the public. This information is distributed by the NWS Automation of Field Operations and Services (AFOS) network to subscribing government agencies and the various news media. The NWS issues routine scheduled reports containing the following forecasts:

(1) Weather forecasts (daily, severe weather, and 5-day extended).

(2) National weather summaries and additional details for the five south-central states (four times daily).

(3) Quantitative precipitation forecasts (four times daily – one 24-hour and one 48-hour quantitative precipitation forecast and two 6-hour quantitative precipitation forecasts).

(4) Three-day river stage forecasts (when available).

(5) Rainfall required to produce bank full stages (weekly).

(6) Urgent priority messages such as severe weather warnings, watches, forecasts and statements, and instructions from Civil Defense during emergency conditions are transmitted immediately, regardless of scheduled traffic. Unscheduled traffic, including the following, is sent when appropriate.

(a) Damage reports.
(b) Road information and winter weather conditions.

(c) River and flood warning bulletins, forecasts, and statements.
(d) Thirty-day forecast.
(e) Road information and winter weather conditions.

(7) Percent chance of precipitation (twice daily).

6-02. Flood Conditions Forecasts.

a. Requirements. Flood condition forecasts are necessary whenever substantial rainfall has occurred on the basin upstream or downstream of Skiatook Dam. Personnel in the Water Management Section have developed a flood-forecasting model for Skiatook Lake. This model was calibrated to historical flood events. Basin subdivisions contained in the forecasting model are presented on Plate 6-1. To use this model the following data are required:

(1) Rainfall for stations listed in Table 5-1.

(2) Skiatook Lake pool elevation for time of forecast.

(3) Flood hydrographs for stream gages listed in Table 5-1.

(4) Releases from Skiatook Lake, including projected releases, from time of forecast until the end of the forecast period.

b. Methods. Inflow forecasts are made using a slightly modified HEC-1 computer program. Precipitation data are received from the NWS observers, the Data Collection Platforms (DCP) by the water control computer, the Oklahoma Mesonet, and also the NWS Stage III digital radar. The average precipitation over the project basin is computed by a computer program called VIEWRAIN. The VIEWRAIN program takes the DCP data and plots isohyetal maps of 24-hour rainfall. The VIEWRAIN program also computes the basin and subbasin average rainfalls for input into the HEC-1 forecasting model. The HEC-1 program uses the hourly DCP rainfalls to distribute the subbasin average rainfalls. Beginning loss rates are chosen based upon historical storm reproductions. Rainfall excess is computed by subtracting the applicable losses from the incremental rainfall amounts. One-hour unit hydrographs are computed using Snyder's coefficients or are entered directly into the data file for each subarea. Flood hydrographs are computed by applying the rainfall excess to the unit hydrographs. Computed flood hydrographs are compared with observed flood hydrographs for gages listed in Table 5-1. Loss rates are adjusted and the HEC-1 model is rerun until the computed and observed hydrographs converge. Calibrated loss rates are applied to ungaged subareas and flood hydrographs are combined and routed to compute an inflow hydrograph. Using projected releases from Skiatook Lake, the inflow hydrograph is routed through the lake to determine elevations. Flood control releases are projected based upon conditions on the Arkansas River System and following procedures described in section V of the Arkansas River Basin Water Control Master Manual. Unit hydrographs are presented on Plates 6-2 and 6-3. A sample inflow computation is shown on Plate 6-4.

6-03. Conservation Purpose Forecasts.

a. Requirements. Conservation forecasts may be requested by Project personnel to predict pool levels during fish spawning season, special recreation events, and water supply. Forecasts may also be requested for water quality.

b. Methods. Forecasts for conservation purposes during non-flood periods would rely largely on statistical interpretation of historical data. The flow duration curve, Plate 4-2, and the peak inflow probability curve, Plate 4-3, would be considered with NWS forecasts in making conservation forecasts during non-flood periods.

6-04. Long-Range Forecasts.

a. Requirements. The regulatory decision involved in evacuating stored floodwater, sustaining yield during low flow periods, and maintaining constant or slowly changing pool levels for conservation purposes is dependent on accurate estimates of the water volume that will pass through the reservoir.

b. Methods. Reliable methods for long range runoff forecasts are not presently available. The NWS publishes an "Average Monthly Weather Outlook" semi-monthly, which may be used as an estimate of the trend of the weather but should not be given too much weight for one forecast, especially for a specific point. The NWS forecasts described in paragraph 6-01.b. are more useful in a shorter range.

6-05. Drought Forecasts. Droughts can be forecast when runoff is dependent upon snowmelt by measuring snow pack in the mountains. However, on projects where runoff is a result of a rainfall event, as in the Tulsa District, no techniques are available at this time to forecast droughts.

VII - WATER CONTROL PLAN

7-01. General Objectives. The primary objectives of the Skiatook Lake project are flood control, water supply, water quality, recreation and fish and wildlife. Skiatook Lake is operated as a unit in a multi-purpose system for optimal flood control benefits and to provide benefits on the Arkansas River Basin. Flood releases from Skiatook Lake will be made in accordance with the predicted runoff from the uncontrolled area downstream, the allowable stage for the downstream control points, the predicted volume of inflow into the lake, and the proportion of available storage remaining in the various lakes in the system. All of the flood control storage will be utilized to provide optimal benefits, categorized as method “A” in paragraph 3-3.c.(2).(b). of EM 1110-02-3600.

7-02. Major Constraints. The channel capacity immediately downstream from the dam is about 4,450 c.f.s. while the outlet conduit is capable of discharging 4,100 c.f.s. at elevation 714.0 feet (top of conservation pool) and about 4,400 c.f.s. at the top of flood pool elevation 729.0 feet. The invert of the outlet works is at elevation 620.0 feet which is the lowest elevation that water can be released from the dam. A major constraint is to monitor the recession of the floodwaters on lower Hominy Creek and Bird Creek so as to coincide releases from the dam with the natural recession of the rivers to below bank full. The limiting non-damaging flow at Sperry gage on Bird Creek is about 11,700 c.f.s. (a stage of 21.0 feet).

7-03. Overall Plan for Water Control.

a. General. Skiatook Lake is regulated as a unit in a multi-purpose system for the benefit of water resources in the Arkansas River Basin. Development of these water resources is discussed in the Arkansas River Basin Water Control Master Manual, while the specific purposes of each of the various projects are detailed in the appropriate Exhibit. The Natural Resource Conservation Service (NRCS) has a program of soil and water conservation, flood prevention, and channel improvement within the upper reaches of the Hominy Creek watershed which are not recognized as a deterrent to flood flow.

b. System Regulation. Skiatook Lake is regulated for control of floods on Hominy and Bird Creeks; in a system with Birch Lake for control of floods on Bird Creek; in a system with Oologah Lake, Hulah Lake, and Copan Lake, for control of floods on the Verdigris River; and in the total Arkansas River system for control of floods on the Arkansas River to Van Buren, Arkansas. When floodwaters are being accumulated in the system, each lake shall be regulated to retain equivalent flood control capabilities, as much as possible, with priority for releases as shown on curve "C" Plate 7-57 of the Arkansas River Basin Water Control Master Manual, being made from the lake with the least amount of flood storage available, and considering predicted inflow into the lake and conditions downstream. Section VII of the Arkansas River Basin Water Control Master Manual provides detailed information on the Arkansas River System operation.

Skiatook Lake is operated in accordance with the system guidelines. This essentially means that Skiatook Lake can make flood releases when the system has available channel capacity. In addition, Skiatook Lake is regulated for the development of fish and wildlife, water quality and water supply, and other environmental enhancements downstream. The project is regulated to obtain maximum benefits downstream which include flood damage reduction.

c. Skiatook and Birch Lakes Sub-system Regulation. Releases from Skiatook and Birch Lakes are essentially as described in the previous paragraph. When the equivalent flood control storage of the two lakes is unbalanced, the lake with the highest equivalent flood control storage utilized will be given priority to available channel capacity of Bird Creek. If the release from the lake with the highest flood storage utilized is limited by immediate downstream channel capacity, the remaining capacity of Bird Creek will be available for releases from the lake with the lower flood storage utilized. After balancing of flood control storage is achieved, each lake will share the channel of Bird Creek proportionate to the equivalent flood control storage utilized and the limitations below each lake.

7-04. Standing Instructions to Lake Manager. During flood periods Skiatook Lake will be regulated in accordance with the normal regulations for flood control operation as directed in subparagraph 7-05.a. and Exhibit B of this manual. Instructions for the storage and discharge of flood water are to be issued by the Water Management Section. In the event communication with the Tulsa District is disrupted, the lake regulation is the responsibility of the Lake Manager and is to be regulated in accordance with subparagraph 7-05.b. and Exhibit B of this manual. In addition, the Lake Manager will immediately make every effort to re-establish communications with the Tulsa District. The Lake Manager will make daily observations of the weather station and pool level data and report those observations as directed in paragraph 5-07.a. through 5-07.d., and also repeated in Exhibit B. Should an emergency situation occur, in which communication is not lost, such as inoperable gates, a drowning accident, excessive trash in gates, a broken buoy line, or power outage, the Water Management Section will be notified immediately.

7-05. Flood Control.

a. Normal Flood Control Regulations. Skiatook Lake is regulated for optimal flood reductions on Hominy Creek from the dam to its confluence with Bird Creek and from that point in conjunction with flood control releases from Birch Lake and other systems on Bird Creek and the Verdigris and Arkansas Rivers. The following regulations as shown in Table 7-1 will govern releases from Skiatook Lake. During flood control regulation the conduit gates are to be operated at a uniform setting with no more than 1 foot difference in opening. NOTE: The conduit outlet and stilling basin must be visually monitored very closely during all high releases and during high tailwater events. If unusual conditions occur (such as riprap displacement, surging, submerged outlet, or the hydraulic jump moving out of the stilling basin), notify Water Management and Dam Safety Sections immediately.

TABLE 7-1

NORMAL FLOOD CONTROL REGULATION SCHEDULE
SKIATOOK LAKE
HOMINY CREEK, OKLAHOMA

LAKE STAGE	POOL CONDITIONS	REGULATION
Below 714.0	--	Releases will be made to maintain elevation 714.0 feet but will be sufficient to meet low flow requirements at Sperry as in Table 7- 4.
714.0 - 729.0	Rising	Make releases using the following schedule as a guide, except that the release, when combined with intervening flow downstream, shall not exceed 4,000 c.f.s. on Hominy Creek below the dam, or a 21.0 - foot stage (11,700 c.f.s.) on Bird Creek at the Sperry gage. If the flows exceed any of those listed above, no release will be made until the flows recede below flood stage. Regulation releases may be made at less than the maximum permissible rate. Releases will be modified to meet target discharges specified by the requirements in Chapter 7 of the Arkansas River Master Manual for the operation of the Arkansas River System.

Release Schedule

Pool Stages	Normal Maximum Release Rates (c.f.s.)
714.0 – 715.0	1,000
715.0 – 716.0	2,000
716.0 – 718.5	3,000
718.5 – 729.0	4,000

TABLE 7-1 (continued)

LAKE STAGE	POOL CONDITIONS	REGULATION
729.0 - 732.0	Rising	If the forecasted pool level will crest at or below 732.0 feet, a maximum release of 4,000 c.f.s. will be made. If the forecasted pool level will crest above 732.0 feet, the flood control conduit gates will be opened in increments of 750 c.f.s. each hour until both gates are fully open or until the pool is falling.
Above 732.0	Rising	Continue maximum release possible.
732.0 - 729.0	Falling	Continue maximum release attained during rising pool until pool level recedes to elevation 729.0 feet.
729.0 - 714.0	Falling	Make releases using the following schedule as a guide, except that the release, when combined with intervening area flows downstream, shall not exceed those stages listed under the above rising pool conditions.

Note: The conduit outlet and stilling basin must be visually monitored very closely during all high releases and during high tailwater events. If unusual conditions occur (such as riprap displacement, surging, submerged outlet, or the hydraulic jump moving out of the stilling basin), notify Water Management and Dam Safety Sections immediately.

Release Schedule

Pool Stages	Maximum Allowable Release Rates (c.f.s.)
729.0 -- 718.5	4,000
718.5 -- 716.0	3,000 + Inflow*
716.0 -- 715.0	2,000 + Inflow*
715.0 -- 714.5	1,000 + Inflow*
714.5 -- 714.0	Transition to downstream low flow requirements defined in Table 7-4, paragraph 7-07.

NOTE: Do not exceed 4,000 c.f.s.

*Forecasted inflow over a 2- to 5-day period.

b. Emergency Flood Control Regulations. When communication with the Tulsa District is disrupted, the Lake Manager will, on his or her own initiative, direct regulation of the lake in accordance with the schedule shown in Table 7-2 until communication is restored. In addition, the Lake Manager will make every effort to re-establish communication with the Tulsa District. The conduit gates shall be operated at a uniform opening as discussed in paragraph 7-05.a. NOTE: The conduit outlet and stilling basin must be visually monitored very closely during all high releases and during high tailwater events. If unusual conditions occur (such as riprap displacement, surging, submerged outlet, or the hydraulic jump moving out of the stilling basin), notify Water Management and Dam Safety Sections immediately.

c. Constraints. The regulation schedules provide that the channel capacity of 4,000 c.f.s. immediately below the dam is not to be exceeded insofar as practicable; however, the channel capacity in the vicinity of Sperry, Oklahoma, is 11,700 c.f.s. Floodwaters will be released as rapidly as practicable with consideration given to minimizing flooding of low-water crossings and low-lying farmland. The significance of the stages or discharges is shown on the stage-damage curves at the control points (see Plates 4-6 and 4-7).

TABLE 7-2

EMERGENCY FLOOD CONTROL
REGULATION SCHEDULE FOR SKIATOOK LAKE
HOMINY CREEK, OKLAHOMA

<table>
<tr><th>LAKE STAGE</th><th>POOL CONDITIONS</th><th>REGULATION</th></tr>
<tr><td>714.0 - 729.0</td><td>Rising</td><td>Continue the release being made prior to loss of communication for 48 hours after the last significant rainfall (over 0.5 inches). If the release is less than 900 c.f.s., the Lake Manager will visually check the downstream channel to assess available channel capacity. If channel capacity is evident, the Lake Manger will increase releases by 250 c.f.s., and again verify that downstream channel capacity is not exceeded. Every four hours, the Lake Manager will continue with increasing the release and visually verifying that downstream channel capacity is not exceeded until the total release is 900 c.f.s. or until the pool begins falling.</td></tr>
<tr><td>729.0 - 732.0</td><td>Rising</td><td>(1) Releases shall be made in accordance with the following schedule:

<u>Pool Elevation (feet)</u> — <u>Release Rate (c.f.s.)</u>

729.0 — 900
729.5 — 1,750
730.0 — 2,500
730.5 — 3,000
731.0 — 3,500
731.5 — 3,975
732.0 — 4,450

(2) Releases shall be increased for each one half (1/2) foot rise in pool elevation.

(3) If the outflow being made at the time the emergency regulations become effective is greater than the outflow indicated by the preceding schedule, continue the outflow until the pool level indicates an increase is required.</td></tr>
</table>

TABLE 7-2 (continued)

LAKE STAGE	POOL CONDITIONS	REGULATION
Above 732.0	Rising	If the conduit gates have not been fully opened when the lake water surface reaches elevation 732.0 feet, the release shall be increased 750 c.f.s. each half (1/2) hour until both gates are fully open and shall remain fully open until the pool level recedes to elevation 729.0 feet. Continue maximum release until the pool level recedes to elevation 729.0 feet.
729.0 - 715.0	Falling	Maintain release in effect at the time communication was lost or maintain release which was initiated under rising pool conditions. If the release is greater than 4,000 c.f.s, begin a gradual reduction of the release rate to 4,000 c.f.s. (not to exceed 750 c.f.s. reduction per 2 hours) making sure not to reduce the release below inflow. (See Plate 6-4 for inflow computation example).
715.0 - 714.0	Falling	Begin a gradual reduction of the release rate (not to exceed 500 c.f.s. per 2 hour reduction period) to stabilize the pool at conservation level (714.0 feet).

Note: The conduit outlet and stilling basin must be visually monitored very closely during all high releases and during high tailwater events. If unusual conditions occur (such as riprap displacement, surging, submerged outlet, or the hydraulic jump moving out of the stilling basin), notify Water Management and Dam Safety Sections immediately.

d. Operational Curves. The area-capacity curves, spillway rating curve, conduit rating curves (for one gate and for two gates), low-flow rating curves, tailwater rating curve, and the evaporation curves are shown on Plates 7-1 through 7-7, respectively. Rating curves used by the Water Management Section are adjusted for changing conditions and are maintained in current status. Table 7-3, located in the Supplemental Tables Section, shows Elevation vs. Area and Capacity curves for Skiatook Lake. Table 7-3 is to the nearest 0.1 foot; however, capacity values to the nearest 0.01 foot are available at the project office and Water Management Section, Tulsa District, for daily computation.

7-06. Recreation. Recreation is included as a project purpose; however, there is no storage or releases specifically designated for recreation. Requests for special releases are considered as the situation warrants. All recreation area access roads are constructed above elevation 720.0 feet. Some campsite facilities could be inundated above elevation 717.0 feet. Locations of the public facilities are listed in paragraph 2-06 of this manual and shown on Plate 2-8. Recreational features at the project include camping, picnicking, swimming, boating, hiking, and fishing. Management of the fish and wildlife resources is under the direction of the Oklahoma Department of Wildlife Conservation.

7-07. Water Quality.

a. General. The conservation storage of Skiatook Lake will provide a maximum ultimate dependable yield of 62 million gallons per day (m.g.d.) toward meeting the water quality needs of the area. The dependable yield for water quality at Skiatook Lake was determined during the design phase using procedures presented in the Civil Woks Investigations, Technical Report No. 1; Low Flow Frequency Analysis dated January 1964. This method determined dependable yields for 20-year drought and 50-year drought periods. Water supply dependable yield for Skiatook Lake was based on the 50-year drought period which represents the ultimate development of the stream based on drawing down and refilling the conservation pool within 5 years during the critical period of record. Water quality dependable yield for Skiatook Lake was based on the 20-year drought period. The low flow sluice has a capacity of 685 c.f.s. at the top of the conservation pool and 335 c.f.s. at the top of the inactive pool. Actual water quality releases will vary in accordance with downstream runoff to produce the minimum downstream flow. Low flow augmentation by water quality releases will be beneficial to the stream fishery, decomposition of natural debris, and the respiratory demands of the biota degrade water quality of the stream.

b. Present Regulation Procedure for Water Quality. Water quality profiles are made of the lake on an as needed basis for water quality releases. The 233,000 acre-feet of ultimate water quality storage in Skiatook Lake, based on 20-year frequency drought, has an average yield of 62 m.g.d. (96 c.f.s). Releases from Skiatook Lake for water quality control will be made together with releases from Birch Lake and runoff from the uncontrolled drainage areas below Birch and Skiatook Lakes to meet the flow schedule at the Sperry gage as shown in Table 7-4, or as modified by field evaluation to the extent possible. This flow schedule was developed for water quality releases at Sperry on November 10, 2004, by representatives from the City of Tulsa, Indian Nations Council of Governments, and the Tulsa District. The schedule was approved by the Oklahoma Water Resources Board. After year 2025, the flow requirements at Sperry will be re-evaluated. These flow requirements were included with information needed for the City of Tulsa's Northside Wastewater Treatment Plant Environmental Permit.

TABLE 7-4

LOW FLOW REQUIREMENTS
AT SPERRY, OK

Period	Monthly Flow (c.f.s.)
Oct 1 – Oct 15	154
Oct 16 – Mar 31	53
Apr 1 – May 31	130
Jun 1 – Sep 30	142
Average Annual	**99.7**

Except for emergencies, water quality and water supply releases shall not be made that will reduce the pool elevation in Skiatook Lake below elevation 657.0 feet. Additional releases shall be made as necessary to alleviate or respond to emergency conditions such as fish kills and flow augmentation for pollution abatement.

7-08. Fish and Wildlife. Fish and wildlife is included as a project purpose pursuant to Public Law 85-624; however, no storage or releases are specifically provided in the project. The low-flow release schedule shown in Table 7-4 will be sufficient to maintain and enhance downstream fisheries.

7-09. Water Supply.

a. General. Skiatook Lake will provide 62,900 acre-feet (after 100 years sediment) of storage with an estimated dependable yield of 14 million gallons per day (m.g.d.) for future municipal and industrial water supply. The dependable yield for water supply at Skiatook Lake was determined during the design phase using procedures presented in the Civil Woks Investigations, Technical Report No. 1, Low Flow Frequency Analysis dated January 1964. This method determined dependable yields for 20 –year drought and 50-year drought periods. Water supply dependable yield for Skiatook Lake was based on the 50-year drought period which represents the ultimate development of the stream based on drawing down and refilling the conservation pool within 5 years during the critical period of record. The water supply dependable yield for Skiatook Lake was based on the 50 year drought period. Assurances required to include water supply storage space in Skiatook Lake were furnished by the Oklahoma Water Resources Board 14 Sep 1965. Table 7-5 gives the current water supply contracts at the lake.

TABLE 7-5

SKIATOOK LAKE WATER SUPPLY CONTRACTS

User Name Skiatook Lake Conduit	Approval Date	Contract Type	Present Storage AC-FT	Future Storage AC-FT	Total User Storage AC-FT	Yield M.G.D.
Osage County RWD #15	16-Jan-1984	Conduit	0	0	0	0
Permanent Storage						
Not Under Agreement		Storage	0	24,659	24,659	5.488
Sapulpa Municipal Authority	12-Nov-2002	Storage	4,500	0	4,500	1.002
City of Sand Springs	15-Apr-2005	Storage	11,250	0	11,250	2.504
Osage County RWD #15	29-May-1987	Storage	0	2,000	2,000	0.445
Sand Springs Municipal Authority	13-Mar-1988	Storage	6,740	0	6,740	1.5
Sapulpa Municipal Authority	13-Mar-1988	Storage	4,490	0	4,490	1
Skiatook PWA	13-Mar-1988	Storage	2,018	0	2,018	0.449
Skiatook PWA	2-Jun-1998	Storage	2,743	0	2,743	0.61
Sapulpa Municipal Authority	29-Jun-2005	Storage	4,500	0	4,500	1.002
TOTAL SKIATOOK			**36,241**	**26,659**	**62,900**	**14**

b. Regulation Procedure for Water Supply. Withdrawals for municipal and industrial water supply can be made from the lake or released through a 36-inch water supply pipe. Water withdrawal from storage will be metered and read by the User and reported to the Water Supply Specialist by the 5th day of the month following usage.

c. Accounting Procedure for Water Supply. Accounting procedures for conservation storage in multipurpose projects have been developed by the Tulsa District and approved by the Southwestern Division (SWD) to regulate the withdrawal of water from lakes by each water supply user. No accounting is necessary where all conservation storage is contracted for by one user or when the Corps is not the contracting agency. Losses are charged to each user in proportion to the user's average

remaining storage. Inflows, after deductions for downstream water rights and users with vested rights and no storage, are credited to the storage account of the user in proportion to his contracted storage. When conservation pool refills all accounts are reset to 100%. When a user has 50 percent or less of contracted storage remaining, the contracting officer will be notified and will advise the user of this storage on a monthly basis, or more frequently if necessary, throughout the critical period. Should the storage of a user be depleted, no additional withdrawal from storage will be made. An example of the water storage accounting procedures is shown on Plate 7-8.

7-10. Water Rights.

a. General. The Oklahoma Water Resources Board (OWRB) has issued water rights on Hominy Creek downstream of Skiatook Lake and Bird Creek downstream of the confluence with Hominy Creek. Water right permits have been issued by the OWRB to the Users listed in Table 7-6, shown in the Supplemental Tables Section.

b. Regulation Procedure for Water Rights. Releases from inflow to satisfy downstream water rights will be made at the request of OWRB which will inform the Water Management Section as to the amount and time distribution of the required release. No withdrawal from storage in the lake will be made for downstream water rights unless the water-right holder has contracted storage available in the lake.

7-11. Hydroelectric Power. The entire stream yield has been allocated to water supply and water quality, so installation of hydroelectric power at Skiatook Lake is not being pursued at this time.

7-12. Navigation. Skiatook Lake, when regulated for flood control in conjunction with the navigation system of reservoirs, will help provide a tapered recession of flows along the Arkansas River navigation channel.

7-13. Sedimentation. There are no regulation procedures for sediment at this time.

7-14. Drought Contingency Plans. The Drought Contingency Plan for the Lower Verdigris River, including Skiatook Lake, updated on 26 Nov 2002, was prepared by the Water Management Section.

7-15. Flood Emergency Action Plans. A flood emergency action plan is outlined in the document “Operation and Maintenance Manual, Volume II, Skiatook Lake, Flood Emergency Plan, updated Mar 2011. The purpose of the manual is to specify procedures to protect the public from possible property damage or loss of life as a result of uncontrolled releases of water due to failure, or severe damage to the dam appurtenant works.

7-16. Deviation From Normal Flood Control Regulation. Deviation from normal flood control regulation of the lake is occasionally necessary. Prior approval for a deviation is

obtained from SWD, except as noted in subparagraph 7-16.a. shown below. Deviation requests fall into the following categories:

a. Emergencies. The water control plan is subject to temporary modification by the Corps if found necessary in time of emergency. Request for and actions on such modifications may be made by the fastest means of communication available. Also, the Lake Manager may temporarily deviate from the water control plan in the event an immediate short-term departure is deemed necessary for emergency reasons to avoid serious hazards. The Lake Manager may deviate from the water control plan whenever necessary to protect the safety of the dam. Such actions shall be immediately reported by the fastest means of communication available. Actions shall be confirmed in writing as soon as possible to the Water Management Section and shall include justification for the action. Continuation of the deviation will require the express approval of SWD. A written confirmation showing the deviation and conditions will be furnished by the Water Management Section to SWD.

b. Unplanned Minor Deviations. There are unplanned instances that create a temporary need for minor deviations from the normal regulations of the reservoir, although they are not considered emergencies. Construction accounts for the major portion of the incidents and include utility stream crossings, bridge work, and major construction contracts. Changes in releases are sometimes necessary for maintenance and inspection. Requests for changes of release rates are generally from a few hours to a few days. Each request is analyzed on its own merits. Consideration is given to upstream watershed conditions, potential flood threat, conditions of the lakes, and possible alternative measures. In the interest of maintaining good public relations, the requests are complied with providing there are no adverse effects on the overall operation of the project (or projects) for the authorized purposes. Approval for these minor deviations will normally be obtained by the Water Management Section from SWD by telephone or email. Normally, SWD is advised by telephone of these minor deviations with written follow-up to confirm the deviation.

c. Unplanned Major Deviations. There are unplanned instances that create a temporary need for major deviations from the normal regulation plan and may be considered, but are not, emergencies. Flood control releases account for the major portion of these incidents and typical examples include project pre-releases or exceeding downstream channel capacity, incidents that have a short window of opportunity in an effort to minimize damages or optimize benefits. Requests for changes in release rates generally involve time periods ranging from a few hours to a few days. Each request is analyzed on its own merits. In evaluating the proposed deviation, consideration must be given to upstream watershed conditions, potential flood threat, and condition of the lake, and alternative measures that can be taken. Approval for these major deviations normally will be obtained from SWD by telephone or email. Written confirmation explaining the deviation and its cause will be furnished to the SWD water control manager.

d. Planned Deviations. Advance approval of the SWD water control manager is required prior to any deviation from the plan of regulation prescribed or approved by the Corps in the interest of flood control, except in emergency conditions provided for in subparagraph 7-16.a. Each condition will be analyzed on its own merits. When conditions appear to warrant a prolonged deviation from the approved plan, the Water Management Section will investigate and evaluate the proposed deviation to insure that the overall integrity of the plan would not be unduly compromised. Approval of prolonged deviations will not be granted unless such investigation and evaluations have been conducted to the extent deemed necessary by the SWD water control manager.

7-17. Rate of Release Change. The increase and decrease in releases from Skiatook Lake shall be accomplished in a manner which minimizes damage to the reservoir area and downstream channel as shown in Table 7-7. Every reasonable precaution will be made to eliminate, if possible, bank sloughing, undercutting, excessive erosion, and danger to human and animal lives. Situations will arise which will not allow an orderly increase and/or decrease in releases. Examples of these situations are large flood releases, as described in paragraph 7-05.c., and drownings which occur downstream of the dam.

TABLE 7-7

RELEASE RATE CHANGES
INCREASING RELEASES TO CHANNEL CAPACITY (1)

Current Release Range (c.f.s.)	Maximum Increase (c.f.s.)	Minimum Time Between Changes (hours)
0 – 4,000	670	2

DECREASING RELEASES BELOW CHANNEL CAPACITY (1)

Current Release Range (c.f.s.)	Maximum Increase (c.f.s.)	Minimum Time Between Changes (hours)
4,000 - 0	670	3

(1) See paragraph 7-05.a. for releases that will exceed channel capacity and also decrease in releases above channel capacity during normal operations.

VIII - EFFECT OF WATER CONTROL PLAN

8-01. General. The effects of emergency flood control regulations (communication between Tulsa District and Project Office is disrupted) on the spillway design flood and the standard project flood and examples of the normal and emergency regulations of a historical major flood are presented in the following paragraphs. The floods were selected to show the effects of the flood control regulations for Skiatook Lake on a variety of possible flood conditions.

8-02. Flood Control.

a. Spillway Design Flood. The Spillway Design Flood (SDF) as discussed in Design Memorandum No. 1 was developed from the probable maximum precipitation storm in accordance with Hydro-meteorological Report No. 33. These criteria were adopted for the 354 square-mile drainage area above Skiatook dam site, and a reduction of the probable maximum precipitation was used for basin shape factor and maximum storm enveloping effects. The inflow into full pool was obtained by applying rainfall excess to the unit hydrograph for the reservoir area, the area immediately surrounding the reservoir on each side and the upper portion or the remaining area, and combining the resultant unit hydrographs together. The resulting flood has a peak inflow of 212,000 c.f.s. and a volume of 461,070 acre-feet including base flow. The maximum flood volume stored is 379,500 acre-feet above the top flood pool and the maximum discharge is 26,300 c.f.s. at the maximum pool elevation of 750.9 based on the lake operated under normal regulations. The routing of the SDF on an empty pool results in a maximum flood volume stored of 246,000 acre-feet above the top of flood pool and the maximum discharge is 14,700 c.f.s, at the maximum pool elevation of 743.9 feet. Plate 8-1 shows the operational hydrographs of the spillway design flood routed through Skiatook Lake operated under emergency regulations on empty and full flood control pool.

b. Standard Project Flood. The Standard Project Flood (SPF) was considered to be one-half of the Spillway Design Flood. The resulting flows were routed through the lake and were operated under normal regulations on an empty flood control pool. The peak inflow was 106,000 c.f.s. with a volume of 230,535 acre-feet. The maximum flood volume stored is 180,800 acre-feet (by extrapolation) above the top of the flood pool at the maximum pool elevation of 741.2 feet and a peak discharge of 11,100 c.f.s. through the outlet conduit and spillway. The routing of the SPF on an empty pool results in a maximum flood volume stored of 38,000 acre-feet above the top of flood pool and the maximum discharge is 4,000 c.f.s, at the maximum pool elevation of 731.7 feet. Hydrographs for the standard project flood routed through Skiatook Lake under emergency regulations on empty and full flood control pools are shown on Plate 8-2.

c. Probable Maximum Flood. The Probable Maximum Flood (PMF) was developed in 1980 by applying the probable maximum precipitation from Hydrometeorological Report No. 51 (HMR-51). The runoff hydrograph was determined

using the basin runoff module of the computer program QUIK II. The average basin rainfall for the 72-hour storm is 25.23 inches and a total volume of 476,430 acre-feet. The project design flood inflow was obtained by applying rainfall excess to unit hydrographs for each subarea and combining with the rainfall on the reservoir are into a full reservoir. Peak inflow for the computed PMF is 192,400 c.f.s. with a peak pool elevation of 751.1, routed from a full flood pool. The PMF inflow, outflow and pool elevation hydrographs for Skiatook Lake are shown on Plate 8-3.

d. Flood of Apr - May 1995. The Apr – May 1995 flood was chosen as an example to route through the lake and to make releases downstream in conjunction with Birch Lake. Skiatook and Birch Lakes must share the channel below the junction of Hominy and Bird Creeks. The channel capacities below Skiatook and Birch dams are 4,000 and 6,500 c.f.s, respectively. This flood had a hourly peak inflow into Skiatook Lake of 22,000 c.f.s. and a volume of 126,100 acre-feet. The peak discharge was 3,070 c.f.s. at the Skiatook dam site and a discharge of 17,500 c.f.s. with a stage of 27.4 feet were the peaks at the Sperry Gage on Bird Creek. Plate 8-4 shows the operational hydrograph regulated by using normal and emergency regulations for Skiatook Lake. Plate 8-5 shows the results of normal and emergency regulations and unregulated conditions at the Sperry Gage.

e. Flood of May – Jun 2008. The May – Jun 2008 flood was chosen as an example to route through the lake and to make releases downstream in conjunction with Birch Lake. Skiatook and Birch Lakes must share the channel below the junction of Hominy and Bird Creeks. The channel capacities below Skiatook and Birch dams are 4,000 and 6,500 c.f.s, respectively. This flood had a peak inflow into Skiatook Lake of 24,140 c.f.s. and a volume of 115,200 acre-feet. The peak discharge was 2,740 c.f.s. at the Skiatook dam site and a discharge of 21,620 c.f.s. with a stage of 27.7 feet were the peaks at the Sperry Gage on Bird Creek. Plate 8-6 shows the operational hydrographs regulated by using normal and emergency regulations for Skiatook Lake. Plate 8-7 shows the results of normal and emergency regulations and unregulated conditions at the Sperry Gage.

8-03. Recreation. Rock bluffs, rolling hills, and the timbered creeks make the lake an area of unique appeal for recreation. Ten public use areas are developed around the lake, which has 10,370 acres of surface area at the top of the conservation pool. Some areas start being inundated at elevation 717.0 feet and by elevation 720.0 feet all of the areas would be affected by the water. The minimum elevation for the top of boat ramps is elevation 720.0 feet. Releases for water supply, water quality, and fish and wildlife during drought conditions will cause the pool to be drawn down.

8-04. Water Quality. In an effort to maintain the quality of the water in Hominy Creek, multilevel intakes for the low flow pipe have been provided. During periods of flooding, large releases must be made through the conduit which is located at the bottom of the lake. During the drier summer months, there have been periods of zero flow on Hominy Creek at the dam site. With the lake, however, the present minimum flow would be about 5 c.f.s.

8-05. Fish and Wildlife. Skiatook Lake replaced the existing stream fishery with an improved reservoir-type fishery. The impoundment provides an excellent fishery and, being located in a scenic area, attracts fishermen from a widespread area. The downstream fishery will be improved by releases from the lake. Minimum releases required for water quality also aid the downstream fishery in periods of low flow. Waterfowl habitat has increased and the lake provides hunting opportunities for these species. There are some losses of squirrel and deer habitat. However, because of the vast acreages of these habitat types in the general area, the minor loss does not have significant effect on the hunting of these species in the area. The lake provides a greater diversification of fish and wildlife habitat and specific losses are replaced by wildlife management of the lake perimeter lands.

8-06. Water Supply. The quality of water in Hominy Creek is considered excellent, requiring only minimum treatment to be suitable for domestic and industrial use. Conservation storage has been provided to supply an estimated 14 million gallons per day for municipal water supply. Since the intake of the 36-inch-diameter water supply pipe is near the bottom of the lake, during periods of stratification the quality of water at this level may be poor. (See paragraph 4-08.)

8-07. Hydroelectric Power. Although hydropower is not a project purpose, incidental benefits may accrue to downstream hydropower projects as a result of the leveling effect on flows due to the flood control operation of Skiatook Lake.

8-08. Navigation. Like hydropower, navigation is not a project purpose of Skiatook Lake; however, incidental benefits may accrue to the downstream navigation system as a result of normal operations.

8-09. Frequencies.

a. Peak Inflow Probability. Estimated natural flows taken from “Riverware” run 2011-01 at the dam site for the period Jan 1940 through Dec 2008 were used to compute the maximum annual peak inflow probability. The inflow probability was derived in accordance with Bulletin 17B, "Guidelines for Determining Flood Flow Frequency," dated Sep 1981, with SWD requirements as stated in the Corps of Engineers Disposition Form (DF) dated 22 Aug 1979. The peak inflow probability curve (natural conditions) is shown on Plate 4-3.

b. Pool Elevation Duration and Probability. The pool elevation hydrographs resulting from the Arkansas River system routing of the computed flows at the dam site were used to compute maximum and minimum annual pool elevations which were converted to partial duration series. The computations were made using the general procedures presented in ER 1110-2-1450, dated 10 Oct 1962. The annual series was converted to a partial duration series by Langbein's conversion table described in "Transactions American Geophysical Union," Volume 30, Dec 1949. Plate 8-8 shows the pool elevation probability curve and Plate 8-9 shows the pool elevation duration curve. Plates 8-10 through 8-16 show pool elevations from operational hydrographs for the period of record Jan 1940 through Dec 2010.

c. Key Control Points. A discharge rating curve at the Sperry gage used in the regulation of Skiatook Lake is shown on Plate 4-4.

8-10. Other Studies.

a. Examples of Regulation. Studies are in progress to improve the forecasting techniques presented in Section VI of this manual. Computer programs have been developed to forecast inflows into the lake, the resulting pool elevations, and the effects of releases at the downstream gage. Use of these programs has greatly shortened the reaction time in preparing regulation schedules.

b. Channel and Floodway Improvement. A flood insurance study (FIS) for Tulsa County was published in the Federal Emergency Management Agency (FEMA) in 1980. Several subsequent updates to that study have been made, the latest of which was effective in Aug of 2009. Bird Creek is covered by those studies. The FIS reports include profiles of the 500-, 100-, 50-, and 10-year floods. No channelization projects exist below Skiatook Lake with the exception of the McClellan-Kerr Arkansas River Navigation System on the Verdigris River portion. Ground and aerial reconnaissance will be made as required to determine if revised channel capacities and maximum discharge limits are warranted.

IX - WATER CONTROL MANAGEMENT

9-01. Responsibilities and Organizations.

a. Corps of Engineers. Skiatook Lake is a Corps of Engineers project, with the Tulsa District prescribing and directing the flood control releases. Operation and Maintenance, as well as regulation of the conservation storage, is the responsibility of the Corps of Engineers. Project reporting instructions and an organization chart are presented in Section V, and project regulating instructions are presented in Section VII of this manual.

(1) Responsibilities and Duties During Normal Operations. The Water Management Section, Hydrology-Hydraulics Branch, Tulsa District, is charged with the following responsibilities and duties under general supervision of the Engineering and Construction Division.

(a) Routine regulation of lakes and distribution of routine data.

(b) Investigations and refinement of regulation procedures.

1). Analysis of past floods.

2). Reconnaissance to determine channel capacities.

3). Improvement of forecasting techniques.

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

(c) Train personnel in flood control duties.

1). Make periodic visits to projects by the Water Management Section personnel to familiarize themselves with regulation facilities, become acquainted with the operating personnel, discuss emergency regulation procedures with operating personnel, and provide the background for improving facilities and methods.

2). Instruct personnel of the Hydrology-Hydraulics Branch in flood control procedures to supplement the Water Management Section 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 emergencies, the Water Management Section is responsible for the following:

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

(b) Performing or obtaining reservoir forecasts.

(c) Presentation of storm and flood analysis to the District Commander and other interested Tulsa District personnel.

(d) When necessary, furnish personnel to help project operating personnel in flood regulations.

(e) Regulation of lakes according to flood control regulation schedules.

(f) Furnish information to higher authority.

1). Provide initial reports to SWD and the Office of the Chief of Engineers by telephone.

2). Provide hydrologic data for situation reports.

(g) Furnish information to the Reservoir Information Control Center. The duties of the Lake Manager under flood conditions are set forth in Section VII of this manual. The details of the overall procedures of the Tulsa District under emergency conditions are set forth in Tulsa District Supplement A, Natural Disaster Activities, to ER 500-1-1.

(3) Assignment of Personnel. During non-flood periods, the Water Management Section accomplishes the routine regulation of the lake. However, during flood periods, assistance of other personnel may be required to maintain effective regulation of the lake. Plate 5-2 shows the organization of the Water Management Section during a major flood. The area and size of the flood will determine the number of people engaged in each activity.

(4) Provision for 24-hour Alert. The NWS and project personnel are provided with a list of names, addresses, and telephone numbers of key personnel of the Engineering Division with instructions to provide warning if unusual conditions occur. Responsible personnel will be on duty at the Tulsa District 24 hours a day whenever basin and/or project conditions warrant and

during flood emergencies. Responsible personnel will be on duty at the project or on call at all times.

(5) Role of Lake Manager. The Lake Manager will regulate the lake during flood periods according to instructions issued by personnel of the Water Management Section. The instructions follow the "Normal Regulations for Flood Control," included in Section VII. If the Lake Manager loses communication with the Tulsa District, he will immediately attempt to reestablish communication with the Tulsa District while following the instructions outlined in the Section "Emergency Regulations for Flood Control" included in Section VII and Exhibit B of this manual. The Lake Manager will make daily observations as directed in paragraph 5-07.

b. Other Federal Agencies. The NWS and the U.S. Geological Survey (USGS) cooperate with the Water Management Section, Hydrology-Hydraulics Branch, Tulsa District, to accumulate rainfall and stream flow data. The Environmental Protection Agency, together with the State of Oklahoma, establishes the standards for water quality releases.

c. State Agencies. Management of the fish and wildlife resources of the Skiatook project is the responsibility of the Oklahoma Department of Wildlife Conservation.

d. Private Organizations. Presently, there are no privately owned flood control protection facilities at Skiatook Lake whose regulation is coordinated with the Corps of Engineers.

9-02. Interagency Coordination. Cooperative arrangements with other Federal agencies, State agencies and local interests are discussed in the following subparagraphs.

a. Local Press and Corps Bulletins. The Corps of Engineers, the NWS, and USGS coordinate in forecasting flood stages, stream flow, and pool elevations. The NWS is officially responsible for issuing flood warnings to the public. This information will be supplemented by the Corps of Engineers bulletins from the Public Affairs Office (PAO) on observed conditions and with technical advice to enable local interests, within the limits of their capabilities, to obtain optimal flood protection and to perform rescue and relief functions. The Corps of Engineers further assists in flood control through the office of the Emergency Operations Manager, who furnishes sandbags and other necessary equipment based on equipment on hand and need. To facilitate the distribution of these data, a Reservoir Information Control Center (RICC) is in operation when conditions warrant.

b. National Weather Service. The Tulsa District and the Arkansas-Red Basin River Forecast Center (NWS) exchange hydrometeorological data and reports to prevent duplication of effort in obtaining and distributing data. This exchange of data is discussed in greater detail in Section VI of this manual. The NWS is the responsible agency for issuing public forecasts of stream stages.

c. U.S. Geological Survey. The Corps of Engineers and the USGS cooperate in a program for the construction, maintenance, and operation of stream gaging stations throughout the Tulsa District. During floods, the Corps of Engineers and the USGS coordinate field activities to maximize the number of stream discharge measurements.

d. Power Marketing Agency. Presently, hydropower is not a project purpose.

e. Other Federal, State, or local agencies. The Tulsa District exchanges information with State government officials, the State Department of Transportation, State Highway Patrol, and others during flood emergencies. The Tulsa District also coordinates with State agencies concerning fish and wildlife throughout normal operations.

9-03. Interagency Agreements. There are presently no agreements.

9-04. Commissions, River Authorities, Compacts, and Committees.

There are no commissions or a river authority on Hominy Creek. Arkansas River basin compacts have been established between the states of Arkansas and Oklahoma and between Kansas and Oklahoma. The major purposes of these compacts are:

a. To promote interstate comity between Arkansas and Oklahoma and Kansas and Oklahoma.

b. To provide for an equitable apportionment of the waters of the Arkansas River between Arkansas and Oklahoma and Kansas and Oklahoma and to promote the orderly development thereof.

c. To provide an agency for administering the water apportionment agreed to in the compacts.

d. To encourage the maintenance of an active pollution abatement program in each of the three states and to seek the further reduction of both natural and manmade pollution in the waters of the Arkansas River Basin.

e. To facilitate the cooperation of the water administration agencies of Arkansas and Oklahoma and Kansas and Oklahoma in the total development and management of the water resources of the Arkansas River Basin.

The Arkansas River Basin Coordinating Committee is made up of State and Federal agencies interested in the water resources development within the Arkansas River Basin. The committee meets annually to discuss the previous year's activities and to exchange information and ideas to better serve specific project purposes.

9-05. Reports.

a. Daily Reports. In accordance with Tulsa District policy, this report is prepared following procedures outlined by the Water Management Section on a daily basis, except Saturday, Sunday, and holidays, to cover a period of 24-hours. The report provides data for use by personnel, whose work requires knowledge about the regulation of reservoirs, field investigations, stream gaging, and construction of flood control projects affected by releases from reservoirs, answering public inquiries, and preparing public releases. The report includes information on pool elevation, flood control storage, releases, inflow and rainfall. The report is completed and dispatched from the Hydrology-Hydraulics Branch by 10:00 a.m. daily under normal conditions.

b. Monthly Lake Reports. The Water Management Section prepares monthly reports in accordance with EM 1110-2-3600 and ER 1110-2-240. These reports are records for all flood control, navigation, and multiple-purpose storage lakes under supervision of or of direct interest to the Tulsa District. Supplemental information on the regulation of the reservoirs, such as explanation of deviations from approved schedules, is added as a note on the reports or as an attachment. These tabulations are promptly prepared each month and maintained in such form as to be readily available for transmittal to the Chief of Engineers or others, upon request. The monthly lake reports are also available on the Tulsa District Web Page from 1994 to the present at http://www.swt-wc.usace.army.mil/SKIAcharts.html .

c. Flood Situation Reports. The Water Management Section provides daily information to the Readiness and Security Branch for situation reports during floods in accordance with ER 500-1-1 and OM 500-1-6. The report contains various types of information about the floods. Pertinent data specifically required for reservoirs are as follows: name of reservoir, reservoir stage, predicted maximum stage, rates of inflow and outflow in c.f.s., percent of flood control storage used to date and at predicted maximum stage, and any special information particularly pertinent to the flood situation.

d. Post Flood Reports. This report is prepared according to ER 500-1-1 and OM 500-1-6 when practicable after a flood that has caused major damages. The report describes flood emergency operations by the Corps of Engineers and others. Included in summary form are: available hydrologic information, damage estimates, and other engineering data as are considered essential for flood control and flood plain studies or in the review of possible claims against the United States for damages. The Tulsa District Planning Division personnel, using information compiled and prepared by the Water Management Section, prepare the report. The report should be completed within approximately three months of the time of flooding, including a statement of final damages.

e. Annual Reports. The Water Management Section prepares this report. The report contains a summation of the general conditions of the river basins and the individual projects in the Tulsa District for the preceding fiscal year. The report also

presents the activities and accomplishments of the Water Management Section for the past year. The report is forwarded to the SWD Water Management Section for inclusion in the SWD's annual report.

f. Summary of Reports. Table 9-1 is a summary of the reports required in the regulation of the lakes in the Tulsa District.

TABLE 9-1

TABULATION OF REPORTS

Name of Report	**When Required**	**Regulation Requiring Reporting**
Daily Report	Daily, except Saturday, Sunday, and holidays	Tulsa District Policy
Monthly Lake Report	Monthly	ER 1110-2-3600 EM 1110-2-240
Flood Situation Report	During Floods	OM 500-1-6 ER 500-1-1
Post flood Report	Following a flood causing major damage	OM 500-1-6 ER 500-1-1
Annual Report	Annually	ER 1110-2-1400

SKIATOOK LAKE, HOMINY CREEK, OKLAHOMA
WATER CONTROL MANUAL
APPENDIX Y
TO
WATER CONTROL MASTER MANUAL
ARKANSAS RIVER BASIN

SUPPLEMENTAL TABLES

TABLE 4-6

SKIATOOK DAM SITE MONTHLY INFLOWS
(Acre-Feet)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1940	13	123	32	2,757	2,517	4,927	1,141	2,382	19,902	42	15,128	1,910	50,879
1941	2,654	5,564	1,047	34,654	21,779	34,245	1,672	325	3,001	149,963	25,032	7,561	292,497
1942	2,301	3,441	6,062	106,040	18,189	51,400	2,043	11,951	26,309	2,854	6,516	4,604	241,710
1943	1,549	1,533	3,049	1,795	257,694	19,849	339	163	885	14,458	421	3,832	305,657
1944	3,800	3,733	26,069	22,281	20,117	9,894	478	1,468	11,847	6,754	1,466	16,092	123,999
1945	774	2,557	31,238	36,114	7,771	7,151	12,292	450	53,120	22,312	395	363	174,537
1946	27,174	9,910	12,637	3,144	10,062	1,285	89	91	214	1,313	12,833	421	79,173
1947	272	115	537	44,391	35,838	13,439	827	139	266	34	20	73	101,001
1948	258	341	9,449	14,029	7,593	52,027	56,296	13,375	182	24	36	125	153,735
1949	14,729	13,546	5,641	6,016	72,630	20,006	43,903	1,214	752	922	167	317	189,843
1950	789	504	716	4,112	43,818	10,346	42,661	37,064	1,829	847	129	216	148,031
1951	415	6,651	1,414	1,946	15,239	48,850	35,370	3,237	16,586	10,606	23,205	1,557	165,076
1952	1,640	6,073	26,519	17,171	10,784	4,005	484	163	0	0	12	8	66,859
1953	26	597	6,895	10,322	16,191	1,628	3,794	182	3,295	206	71	234	43,441
1954	28	99	365	5,496	28,057	2,918	0	0	0	0	12	10	36,995
1955	134	169	8,640	1,408	33,519	3,011	48	716	54	3,691	0	0	51,440
1956	0	0	0	69	0	940	0	0	0	0	0	0	1,009
1957	0	0	430	60,088	133,355	125,155	5,032	325	2,759	109	976	363	328,592
1958	2,204	585	41,796	14,969	3,894	313	7,301	2,624	2,128	16	424	83	76,337
1959	139	377	2,817	4,100	36,401	4,711	33,535	1,196	13,131	148,136	2,323	9,394	256,310
1960	4,925	7,805	14,569	15,314	59,842	7,277	4,802	1,613	165	3,291	1,333	4,933	126,869
1961	472	891	5,109	4,197	54,330	32,420	57,906	20,305	58,622	7,210	33,928	16,235	296,625
1962	3,630	2,142	10,647	10,671	1,193	15,910	6,030	498	31,306	3,939	2,444	1,333	89,748
1963	4,475	694	6,807	1,597	512	58	904	44	0	0	0	0	15,091
1964	0	73	204	16,911	4,237	5,804	512	3,186	1,416	10	4,540	698	37,591
1965	6,502	1,271	3,669	13,550	6,833	180	3,227	22	26,129	218	121	593	67,315
1966	91	149	3,191	188	3,705	1,513	0	3,995	33,039	91	60	121	46,143
1967	1,222	244	109	7,849	10,501	12,934	55,100	1,095	10,021	3,761	2,227	1,067	106,130
1968	3,126	3,481	48,389	46,684	14,553	7,289	3,848	700	2	85	11,465	8,331	152,953
1969	3,227	9,098	23,876	10,233	3,332	47,578	895	38	7,234	22,362	262	1,105	134,240
1970	563	266	11,084	41,177	31,472	19,315	127	0	1,829	5,359	186	180	111,558
1971	3,959	5,292	791	865	2,747	7,307	2,329	367	99,711	31,133	2,487	51,018	208,006
1972	3,195	1,353	1,061	6,484	3,961	357	7,849	296	2,723	23,501	46,781	9,291	106,852
1973	41,667	11,504	104,931	63,103	13,476	25,807	2,575	780	8,239	9,892	41,993	21,065	350,082
1974	3,858	10,739	71,634	6,133	45,295	28,787	286	35,092	67,558	63,737	137,092	24,234	494,545
1975	29,900	39,900	48,900	9,900	70,800	26,000	1,900	4,000	2,800	1,300	1,600	1,800	238,800
1976	720	1,000	11,700	28,900	10,600	1,900	9,500	130	350	620	140	210	65,770
1977	270	1,100	3,900	610	41,500	2,600	4,100	14,500	11,800	270	3,500	420	84,570
1978	410	21,200	19,500	17,600	34,600	26,500	280	130	30	30	740	120	121,140
1979	14,300	1,800	17,400	11,200	10,900	19,800	690	120	400	20	5,600	300	82,530
1980	2,300	4,500	10,000	30,200	14,600	21,400	530	620	110	110	70	110	84,550
1981	310	160	430	410	3,200	4,800	360	3,300	90	360	11,300	1,300	26,020
1982	7,820	8,177	12,470	345	83,948	30,049	1,283	623	603	616	1,269	14,112	161,315
1983	2,717	43,170	16,095	44,509	76,300	9,209	1,785	444	442	23,006	3,484	491	221,652
1984	870	2,616	76,274	61,507	36,862	2,068	61	81	59	1,251	1,473	39,782	222,904

TABLE 4-6 (continued)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1985	20,745	85,786	52,651	61,547	17,087	66,604	2,052	416	1,949	24,069	61,904	3,411	398,221
1986	1,249	1,735	11,672	16,066	19,557	14,003	6,059	1,616	68,727	88,938	34,056	13,715	277,393
1987	24,168	73,923	32,628	4,085	22,512	3,411	9,574	2,033	25,213	882	10,962	44,243	253,634
1988	14,370	4,284	41,216	69,114	2,320	444	11,454	376	12,595	1,578	15,391	3,887	177,029
1989	5,583	6,049	31,973	4,175	15,252	45,401	14,975	40,938	18,019	4,571	59	0	186,995
1990	5,861	30,495	116,082	42,614	40,661	11,761	406	2,628	3,947	0	3,510	307	258,272
1991	4,224	644	2,042	17,742	27,570	19,299	773	158	1,757	7,388	14,927	41,305	137,829
1992	3,699	13,259	3,151	9,947	4,782	74,895	7,249	1,904	1,507	476	21,738	47,633	190,240
1993	26,766	28,671	21,887	34,859	136,105	14,350	2,915	2,401	2,885	0	1,438	3,550	275,827
1994	119	10,393	21,391	70,611	10,224	4,502	16,105	10,821	1,160	364	41,960	2,777	190,427
1995	1,140	10,046	29,117	83,157	94,731	126,050	10,542	6,129	2,440	0	0	902	364,254
1996	1,607	972	2,638	3,352	2,182	4,645	2,777	337	19,636	7,547	58,116	4,086	107,895
1997	1,210	44,628	6,050	42,625	7,448	10,939	15,570	30,684	5,038	3,570	2,717	36,912	207,391
1998	44,440	4,959	79,775	73,468	10,840	8,569	10,592	0	3,074	58,631	19,101	9,511	322,960
1999	32,826	14,757	41,197	87,669	82,225	63,531	21,898	0	5,635	20	52	19,041	368,851
2000	468	7,091	44,321	13,220	119,871	50,598	4,582	50	0	2,807	875	0	243,883
2001	0	29,167	11,574	7,379	46,403	12,357	0	0	0	278	2,132	375	109,665
2002	8,182	1,672	2,083	18,496	33,332	18,946	2,533	3,874	549	12	0	2,386	92,065
2003	248	2,023	38,896	4,998	6,873	6,823	835	6,046	6,190	9,896	2,596	9,360	94,784
2004	23,157	11,980	78,244	20,955	14,842	14,360	26,045	6,742	301	17,863	22,889	11,911	249,289
2005	34,167	16,790	6,456	5,203	5,369	11,564	1,904	3,888	2,700	0	0	0	88,041
2006	1,644	278	4,046	32,717	9,025	1,260	7,347	71	0	0	2,083	2,440	60,911
2007	3,965	668	31,993	18,536	75,174	94,651	16,790	319	9,431	3,977	210	6,397	262,111
2008	2,063	17,653	52,830	72,746	36,169	96,936	131	944	4,245	1,490	14,442	2,975	302,624
2009	218	14,559	45,808	32,231	29,950	8,608	6,754	7,557	3,511	37,755	4,493	4,036	195,480
2010	8,678	23,693	21,550	10,889	22,116	49,993	4,163	0	198	0	0	0	141,280
MIN	0	0	0	69	0	58	0	0	0	0	0	0	1,009
MAX	44,440	85,786	116,082	106,040	257,694	126,050	57,906	40,938	99,711	149,963	137,092	51,018	494,545
MEAN	6,623	9,728	21,681	23,936	32,498	22,640	8,707	4,211	10,164	11,783	10,407	7,284	170,387

TABLE 7-3
ELEVATION-AREA-CAPACITY DATA
SKIATOOK LAKE, OKLAHOMA
1995 RESURVEY

AREA IN 1000'S OF AC

ELEV	0	1	2	3	4	5	6	7	8	9
620	.000	.000	.000	.000	.003	.006	.009	.012	.015	.018
630	.021	.029	.037	.046	.054	.063	.077	.091	.106	.120
640	.134	.162	.191	.219	.248	.276	.345	.414	.482	.551
650	.619	.743	.867	.990	1.114	1.237	1.353	1.469	1.586	1.702
660	1.818	1.956	2.094	2.231	2.369	2.507	2.678	2.850	3.021	3.193
670	3.364	3.441	3.517	3.594	3.670	3.747	3.907	4.066	4.226	4.385
680	4.545	4.660	4.775	4.890	5.005	5.119	5.250	5.380	5.511	5.641
690	5.772	5.939	6.105	6.272	6.438	6.605	6.798	6.991	7.183	7.376
700	7.568	7.758	7.948	8.137	8.327	8.517	8.718	8.919	9.120	9.321
710	9.522	9.734	9.945	10.157	10.369	10.575	10.781	10.986	11.192	11.398
720	11.603	11.808	12.013	12.217	12.422	12.627	12.894	13.161	13.429	13.696
730	13.964	14.191	14.417	14.728	15.039	15.349	.000	.000	.000	.000

TABLE 7-3 (continued)
ELEVATION-AREA-CAPACITY DATA

CAPACITY IN 1000'S OF ACRE-FEET

ELEV	0	1	2	3	4	5	6	7	8	9
620	.000	.000	.000	.000	.002	.006	.014	.024	.038	.054
630	.074	.099	.132	.173	.223	.282	.352	.436	.534	.647
640	.774	.922	1.099	1.304	1.537	1.799	2.110	2.489	2.937	3.454
650	4.039	4.720	5.525	6.453	7.505	8.681	9.976	11.387	12.914	14.558
660	16.318	18.205	20.230	22.393	24.693	27.131	29.723	32.487	35.423	38.530
670	41.808	45.211	48.690	52.245	55.877	59.586	63.413	67.399	71.545	75.851
680	80.316	84.918	89.636	94.468	99.416	104.478	109.662	114.977	120.423	125.999
690	131.705	137.561	143.583	149.771	156.126	162.648	169.349	176.244	183.331	190.610
700	198.082	205.745	213.598	221.641	229.873	238.295	246.912	255.731	264.750	273.971
710	283.392	293.020	302.860	312.911	323.174	333.646	344.324	355.207	366.296	377.591
720	389.092	400.797	412.708	424.823	437.142	449.667	462.427	475.455	488.750	502.312
730	516.142	530.220	544.524	559.096	573.980	589.174	.000	.000	.000	.000

TABLE 7-3 (continued)
ELEVATION-AREA-CAPACITY DATA

POOL ELEV [FT. NGVD]	CAPACITY [1000'S OF ACRE-FEET]									
	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
620.0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
621.0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
622.0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
623.0	.000	.000	.000	.000	.000	.000	.001	.001	.001	.001
624.0	.002	.002	.002	.003	.003	.003	.004	.004	.005	.006
625.0	.006	.007	.007	.008	.009	.009	.010	.011	.012	.013
626.0	.014	.015	.015	.016	.017	.018	.020	.021	.022	.023
627.0	.024	.025	.027	.028	.029	.030	.032	.033	.035	.036
628.0	.038	.039	.041	.042	.044	.045	.047	.049	.051	.052
629.0	.054	.056	.058	.060	.062	.063	.065	.067	.069	.072
630.0	.074	.076	.078	.080	.083	.085	.088	.090	.093	.096
631.0	.099	.102	.105	.108	.111	.114	.117	.121	.124	.128
632.0	.132	.135	.139	.143	.147	.151	.155	.160	.164	.169
633.0	.173	.178	.182	.187	.192	.197	.202	.207	.212	.218
634.0	.223	.229	.234	.240	.245	.251	.257	.263	.269	.275
635.0	.282	.288	.294	.301	.308	.315	.322	.329	.336	.344
636.0	.352	.359	.367	.375	.384	.392	.400	.409	.418	.427
637.0	.436	.445	.454	.464	.473	.483	.493	.503	.513	.524
638.0	.534	.545	.556	.567	.578	.589	.600	.612	.623	.635
639.0	.647	.659	.671	.684	.696	.709	.722	.735	.748	.761
640.0	.774	.788	.801	.816	.830	.845	.860	.875	.890	.906
641.0	.922	.938	.955	.972	.989	1.007	1.025	1.043	1.061	1.080
642.0	1.099	1.118	1.137	1.157	1.177	1.198	1.218	1.239	1.260	1.282
643.0	1.304	1.326	1.348	1.371	1.394	1.417	1.440	1.464	1.488	1.512
644.0	1.537	1.562	1.587	1.613	1.639	1.665	1.691	1.718	1.744	1.772
645.0	1.799	1.827	1.856	1.885	1.915	1.946	1.977	2.009	2.042	2.075
646.0	2.110	2.144	2.180	2.216	2.253	2.291	2.329	2.368	2.408	2.448
647.0	2.489	2.531	2.573	2.616	2.660	2.705	2.750	2.796	2.842	2.889

TABLE 7-3 (continued)
ELEVATION-AREA-CAPACITY DATA

POOL ELEV [FT. NGVD]	CAPACITY [1000'S OF ACRE-FEET]									
	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
648.0	2.937	2.986	3.035	3.085	3.135	3.187	3.239	3.291	3.345	3.399
649.0	3.454	3.509	3.565	3.622	3.679	3.738	3.796	3.856	3.916	3.977
650.0	4.039	4.101	4.165	4.230	4.296	4.364	4.432	4.502	4.573	4.646
651.0	4.720	4.795	4.871	4.948	5.027	5.107	5.188	5.270	5.354	5.439
652.0	5.525	5.612	5.700	5.790	5.881	5.973	6.067	6.162	6.258	6.355
653.0	6.453	6.553	6.654	6.756	6.859	6.964	7.069	7.176	7.285	7.394
654.0	7.505	7.617	7.730	7.845	7.961	8.077	8.196	8.315	8.436	8.558
655.0	8.681	8.805	8.930	9.057	9.185	9.314	9.444	9.575	9.707	9.841
656.0	9.976	10.111	10.249	10.387	10.526	10.667	10.808	10.951	11.095	11.240
657.0	11.387	11.534	11.683	11.833	11.984	12.136	12.289	12.444	12.599	12.756
658.0	12.914	13.073	13.234	13.395	13.558	13.722	13.887	14.053	14.220	14.388
659.0	14.558	14.729	14.901	15.074	15.248	15.424	15.600	15.778	15.957	16.137
660.0	16.318	16.501	16.684	16.870	17.056	17.244	17.434	17.625	17.817	18.010
661.0	18.205	18.401	18.599	18.798	18.999	19.200	19.404	19.608	19.814	20.021
662.0	20.230	20.440	20.652	20.864	21.079	21.294	21.511	21.729	21.949	22.170
663.0	22.393	22.616	22.842	23.068	23.296	23.525	23.756	23.988	24.222	24.456
664.0	24.693	24.930	25.169	25.410	25.651	25.894	26.139	26.385	26.632	26.881
665.0	27.131	27.382	27.635	27.890	28.147	28.405	28.666	28.927	29.191	29.456
666.0	29.723	29.992	30.262	30.534	30.808	31.084	31.361	31.640	31.921	32.203
667.0	32.487	32.773	33.061	33.350	33.641	33.933	34.228	34.524	34.822	35.121
668.0	35.423	35.726	36.030	36.337	36.645	36.955	37.266	37.579	37.894	38.211
669.0	38.530	38.850	39.172	39.495	39.820	40.147	40.476	40.807	41.139	41.473
670.0	41.808	42.145	42.482	42.821	43.160	43.500	43.840	44.182	44.524	44.867
671.0	45.211	45.555	45.900	46.246	46.593	46.941	47.289	47.638	47.988	48.338
672.0	48.690	49.042	49.395	49.748	50.103	50.458	50.814	51.170	51.528	51.886
673.0	52.245	52.605	52.965	53.327	53.689	54.052	54.415	54.780	55.145	55.510

TABLE 7-3 (continued)
ELEVATION-AREA-CAPACITY DATA

POOL ELEV [FT. NGVD]	CAPACITY [1000'S OF ACRE-FEET]									
	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
674.0	55.877	56.244	56.613	56.982	57.351	57.722	58.093	58.465	58.838	59.211
675.0	59.586	59.961	60.338	60.717	61.097	61.479	61.863	62.248	62.634	63.023
676.0	63.413	63.804	64.197	64.592	64.988	65.386	65.785	66.186	66.589	66.993
677.0	67.399	67.806	68.215	68.626	69.038	69.452	69.868	70.285	70.703	71.123
678.0	71.545	71.968	72.393	72.820	73.248	73.678	74.109	74.542	74.977	75.413
679.0	75.851	76.290	76.731	77.173	77.617	78.063	78.510	78.959	79.410	79.862
680.0	80.316	80.771	81.227	81.684	82.143	82.602	83.063	83.525	83.988	84.453
681.0	84.918	85.385	85.852	86.321	86.791	87.262	87.735	88.208	88.683	89.159
682.0	89.636	90.114	90.593	91.073	91.555	92.037	92.521	93.006	93.492	93.980
683.0	94.468	94.958	95.448	95.940	96.433	96.927	97.423	97.919	98.417	98.916
684.0	99.416	99.917	100.419	100.922	101.427	101.932	102.439	102.947	103.456	103.966
685.0	104.478	104.990	105.504	106.019	106.536	107.053	107.573	108.093	108.615	109.138
686.0	109.662	110.188	110.715	111.243	111.772	112.303	112.835	113.369	113.904	114.440
687.0	114.977	115.516	116.056	116.597	117.140	117.683	118.229	118.775	119.323	119.872
688.0	120.423	120.974	121.527	122.082	122.637	123.194	123.753	124.312	124.873	125.435
689.0	125.999	126.563	127.129	127.697	128.265	128.835	129.407	129.979	130.553	131.129
690.0	131.705	132.283	132.863	133.444	134.027	134.612	135.198	135.786	136.376	136.968
691.0	137.561	138.155	138.752	139.350	139.949	140.551	141.154	141.759	142.365	142.973
692.0	143.583	144.194	144.807	145.422	146.038	146.656	147.276	147.897	148.520	149.145
693.0	149.771	150.399	151.029	151.660	152.293	152.928	153.564	154.202	154.842	155.483
694.0	156.126	156.771	157.417	158.065	158.715	159.366	160.019	160.674	161.330	161.988
695.0	162.648	163.309	163.972	164.638	165.305	165.974	166.645	167.318	167.993	168.670
696.0	169.349	170.030	170.713	171.397	172.084	172.772	173.463	174.155	174.849	175.545
697.0	176.244	176.944	177.646	178.350	179.055	179.763	180.473	181.184	181.898	182.613
698.0	183.331	184.050	184.771	185.494	186.219	186.946	187.675	188.406	189.139	189.873
699.0	190.610	191.349	192.089	192.832	193.576	194.322	195.070	195.820	196.572	197.326

TABLE 7-3 (continued)
ELEVATION-AREA-CAPACITY DATA

POOL ELEV [FT. NGVD]	CAPACITY [1000'S OF ACRE-FEET]									
	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
700.0	198.082	198.840	199.600	200.361	201.125	201.890	202.657	203.426	204.197	204.970
701.0	205.745	206.522	207.301	208.081	208.864	209.648	210.434	211.222	212.012	212.804
702.0	213.598	214.394	215.191	215.991	216.792	217.596	218.401	219.208	220.017	220.828
703.0	221.641	222.455	223.272	224.090	224.911	225.733	226.557	227.383	228.211	229.041
704.0	229.873	230.706	231.542	232.379	233.219	234.060	234.903	235.748	236.595	237.444
705.0	238.295	239.147	240.002	240.859	241.717	242.578	243.441	244.306	245.173	246.041
706.0	246.912	247.785	248.660	249.537	250.415	251.296	252.179	253.064	253.951	254.840
707.0	255.731	256.624	257.518	258.415	259.314	260.215	261.118	262.023	262.930	263.839
708.0	264.750	265.663	266.578	267.495	268.414	269.335	270.258	271.183	272.110	273.040
709.0	273.971	274.904	275.839	276.776	277.715	278.656	279.599	280.545	281.492	282.441
710.0	283.392	284.345	285.301	286.258	287.218	288.180	289.143	290.109	291.078	292.048
711.0	293.020	293.995	294.971	295.950	296.931	297.913	298.898	299.886	300.875	301.866
712.0	302.860	303.855	304.853	305.853	306.855	307.859	308.865	309.873	310.883	311.896
713.0	312.911	313.927	314.946	315.967	316.990	318.016	319.043	320.072	321.104	322.138
714.0	323.174	324.212	325.251	326.294	327.338	328.384	329.432	330.482	331.535	332.589
715.0	333.646	334.704	335.765	336.827	337.892	338.959	340.028	341.099	342.172	343.247
716.0	344.324	345.403	346.484	347.567	348.652	349.740	350.829	351.921	353.014	354.110
717.0	355.207	356.307	357.408	358.512	359.618	360.726	361.836	362.948	364.062	365.178
718.0	366.296	367.416	368.539	369.663	370.789	371.918	373.048	374.181	375.316	376.452
719.0	377.591	378.732	379.875	381.020	382.167	383.316	384.467	385.620	386.775	387.932
720.0	389.092	390.253	391.416	392.582	393.749	394.919	396.090	397.264	398.440	399.617
721.0	400.797	401.979	403.163	404.349	405.537	406.727	407.919	409.113	410.309	411.507
722.0	412.708	413.910	415.114	416.321	417.529	418.740	419.952	421.167	422.383	423.602
723.0	424.823	426.045	427.270	428.497	429.726	430.957	432.190	433.425	434.662	435.901
724.0	437.142	438.385	439.631	440.878	442.127	443.379	444.632	445.888	447.145	448.405
725.0	449.667	450.931	452.197	453.467	454.739	456.013	457.291	458.571	459.854	461.139
726.0	462.427	463.718	465.011	466.307	467.606	468.907	470.212	471.518	472.828	474.140
727.0	475.455	476.772	478.092	479.415	480.740	482.069	483.399	484.733	486.069	487.408

TABLE 7-3 (continued)
ELEVATION-AREA-CAPACITY DATA

POOL ELEV [FT. NGVD]	CAPACITY [1000'S OF ACRE-FEET]									
	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
728.0	488.750	490.094	491.441	492.790	494.143	495.497	496.855	498.215	499.578	500.944
729.0	502.312	503.683	505.057	506.433	507.812	509.194	510.578	511.965	513.355	514.747
730.0	516.142	517.540	518.939	520.341	521.746	523.152	524.561	525.973	527.386	528.802
731.0	530.220	531.640	533.062	534.487	535.914	537.343	538.775	540.209	541.645	543.083
732.0	544.524	545.967	547.413	548.863	550.315	551.771	553.230	554.692	556.157	557.625
733.0	559.096	560.570	562.048	563.529	565.012	566.499	567.989	569.482	570.978	572.477
734.0	573.980	575.485	576.994	578.505	580.020	581.538	583.059	584.583	586.110	587.640

TABLE 7-3 (continued)
ELEVATION-AREA-CAPACITY DATA

POOL ELEV [FT. NGVD]	CAPACITY [1000'S OF ACRE-FEET] AREA [1000'S OF ACRES]									
	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
620.0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
621.0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
622.0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
623.0	.000	.000	.000	.000	.000	.000	.001	.001	.001	.001
	.000	.000	.001	.001	.001	.002	.002	.002	.003	.003
624.0	.002	.002	.002	.003	.003	.003	.004	.004	.005	.006
	.003	.003	.004	.004	.004	.005	.005	.005	.006	.006
625.0	.006	.007	.007	.008	.009	.009	.010	.011	.012	.013
	.006	.006	.007	.007	.007	.008	.008	.008	.009	.009
626.0	.014	.015	.015	.016	.017	.018	.020	.021	.022	.023
	.009	.009	.010	.010	.010	.011	.011	.011	.012	.012
627.0	.024	.025	.027	.028	.029	.030	.032	.033	.035	.036
	.012	.012	.013	.013	.013	.014	.014	.014	.015	.015
628.0	.038	.039	.041	.042	.044	.045	.047	.049	.051	.052
	.015	.015	.016	.016	.016	.017	.017	.017	.018	.018
629.0	.054	.056	.058	.060	.062	.063	.065	.067	.069	.072
	.018	.018	.019	.019	.019	.020	.020	.020	.021	.021
630.0	.074	.076	.078	.080	.083	.085	.088	.090	.093	.096
	.021	.022	.023	.023	.024	.025	.026	.027	.027	.028
631.0	.099	.102	.105	.108	.111	.114	.117	.121	.124	.128
	.029	.030	.031	.032	.032	.033	.034	.035	.036	.036
632.0	.132	.135	.139	.143	.147	.151	.155	.160	.164	.169
	.037	.038	.039	.040	.041	.042	.043	.043	.044	.045
633.0	.173	.178	.182	.187	.192	.197	.202	.207	.212	.218
	.046	.047	.048	.049	.049	.050	.051	.052	.053	.053

TABLE 7-3 (continued)
ELEVATION-AREA-CAPACITY DATA

POOL ELEV [FT. NGVD]	CAPACITY [1000'S OF ACRE-FEET] AREA [1000'S OF ACRES] .0	.1	.2	.3	.4	.5	.6	.7	.8	.9
634.0	.223	.229	.234	.240	.245	.251	.257	.263	.269	.275
	.054	.055	.056	.057	.058	.059	.060	.060	.061	.062
635.0	.282	.288	.294	.301	.308	.315	.322	.329	.336	.344
	.063	.064	.066	.067	.069	.070	.072	.073	.074	.076
636.0	.352	.359	.367	.375	.384	.392	.400	.409	.418	.427
	.077	.079	.080	.081	.083	.084	.086	.087	.088	.090
637.0	.436	.445	.454	.464	.473	.483	.493	.503	.513	.524
	.091	.093	.094	.096	.097	.099	.100	.102	.103	.105
638.0	.534	.545	.556	.567	.578	.589	.600	.612	.623	.635
	.106	.108	.109	.110	.112	.113	.115	.116	.117	.119
639.0	.647	.659	.671	.684	.696	.709	.722	.735	.748	.761
	.120	.122	.123	.124	.126	.127	.128	.130	.131	.133
640.0	.774	.788	.801	.816	.830	.845	.860	.875	.890	.906
	.134	.137	.140	.142	.145	.148	.151	.154	.156	.159
641.0	.922	.938	.955	.972	.989	1.007	1.025	1.043	1.061	1.080
	.162	.165	.168	.171	.174	.177	.179	.182	.185	.188
642.0	1.099	1.118	1.137	1.157	1.177	1.198	1.218	1.239	1.260	1.282
	.191	.194	.197	.199	.202	.205	.208	.211	.214	.216
643.0	1.304	1.326	1.348	1.371	1.394	1.417	1.440	1.464	1.488	1.512
	.219	.222	.225	.228	.231	.234	.236	.239	.242	.245
644.0	1.537	1.562	1.587	1.613	1.639	1.665	1.691	1.718	1.744	1.772
	.248	.251	.254	.257	.259	.262	.265	.268	.271	.273
645.0	1.799	1.827	1.856	1.885	1.915	1.946	1.977	2.009	2.042	2.075
	.276	.283	.290	.297	.304	.311	.317	.324	.331	.338
646.0	2.110	2.144	2.180	2.216	2.253	2.291	2.329	2.368	2.408	2.448
	.345	.352	.359	.366	.373	.380	.387	.393	.400	.407
647.0	2.489	2.531	2.573	2.616	2.660	2.705	2.750	2.796	2.842	2.889
	.414	.421	.428	.435	.441	.448	.455	.462	.469	.475

TABLE 7-3 (continued)
ELEVATION-AREA-CAPACITY DATA

POOL ELEV [FT. NGVD]	CAPACITY [1000'S OF ACRE-FEET] AREA [1000'S OF ACRES] .0	.1	.2	.3	.4	.5	.6	.7	.8	.9
648.0	2.937	2.986	3.035	3.085	3.135	3.187	3.239	3.291	3.345	3.399
	.482	.489	.496	.503	.510	.517	.524	.530	.537	.544
649.0	3.454	3.509	3.565	3.622	3.679	3.738	3.796	3.856	3.916	3.977
	.551	.558	.565	.572	.578	.585	.592	.599	.605	.612
650.0	4.039	4.101	4.165	4.230	4.296	4.364	4.432	4.502	4.573	4.646
	.619	.632	.644	.656	.669	.681	.693	.706	.718	.731
651.0	4.720	4.795	4.871	4.948	5.027	5.107	5.188	5.270	5.354	5.439
	.743	.756	.768	.780	.793	.805	.817	.830	.842	.855
652.0	5.525	5.612	5.700	5.790	5.881	5.973	6.067	6.162	6.258	6.355
	.867	.879	.892	.904	.916	.929	.941	.953	.965	.978
653.0	6.453	6.553	6.654	6.756	6.859	6.964	7.069	7.176	7.285	7.394
	.990	1.003	1.015	1.027	1.040	1.052	1.064	1.077	1.089	1.102
654.0	7.505	7.617	7.730	7.845	7.961	8.077	8.196	8.315	8.436	8.558
	1.114	1.126	1.139	1.151	1.163	1.176	1.188	1.200	1.212	1.225
655.0	8.681	8.805	8.930	9.057	9.185	9.314	9.444	9.575	9.707	9.841
	1.237	1.249	1.260	1.272	1.283	1.295	1.307	1.318	1.330	1.342
656.0	9.976	10.111	10.249	10.387	10.526	10.667	10.808	10.951	11.095	11.240
	1.353	1.365	1.376	1.388	1.400	1.411	1.423	1.434	1.446	1.457
657.0	11.387	11.534	11.683	11.833	11.984	12.136	12.289	12.444	12.599	12.756
	1.469	1.481	1.492	1.504	1.516	1.528	1.539	1.551	1.563	1.574
658.0	12.914	13.073	13.234	13.395	13.558	13.722	13.887	14.053	14.220	14.388
	1.586	1.598	1.609	1.621	1.633	1.644	1.656	1.667	1.679	1.691
659.0	14.558	14.729	14.901	15.074	15.248	15.424	15.600	15.778	15.957	16.137
	1.702	1.714	1.725	1.737	1.748	1.760	1.772	1.783	1.795	1.806
660.0	16.318	16.501	16.684	16.870	17.056	17.244	17.434	17.625	17.817	18.010
	1.818	1.832	1.846	1.860	1.873	1.887	1.901	1.915	1.929	1.942

TABLE 7-3 (continued)
ELEVATION-AREA-CAPACITY DATA

POOL ELEV [FT. NGVD]	CAPACITY [1000'S OF ACRE-FEET] AREA [1000'S OF ACRES] .0	.1	.2	.3	.4	.5	.6	.7	.8	.9
661.0	18.205	18.401	18.599	18.798	18.999	19.200	19.404	19.608	19.814	20.021
	1.956	1.970	1.984	1.997	2.011	2.025	2.039	2.053	2.066	2.080
662.0	20.230	20.440	20.652	20.864	21.079	21.294	21.511	21.729	21.949	22.170
	2.094	2.108	2.122	2.135	2.149	2.163	2.176	2.190	2.204	2.217
663.0	22.393	22.616	22.842	23.068	23.296	23.525	23.756	23.988	24.222	24.456
	2.231	2.245	2.259	2.273	2.286	2.300	2.314	2.328	2.342	2.355
664.0	24.693	24.930	25.169	25.410	25.651	25.894	26.139	26.385	26.632	26.881
	2.369	2.383	2.397	2.411	2.424	2.438	2.452	2.466	2.480	2.493
665.0	27.131	27.382	27.635	27.890	28.147	28.405	28.666	28.927	29.191	29.456
	2.507	2.524	2.541	2.558	2.576	2.593	2.610	2.627	2.644	2.661
666.0	29.723	29.992	30.262	30.534	30.808	31.084	31.361	31.640	31.921	32.203
	2.678	2.695	2.713	2.730	2.747	2.764	2.781	2.799	2.816	2.833
667.0	32.487	32.773	33.061	33.350	33.641	33.933	34.228	34.524	34.822	35.121
	2.850	2.867	2.884	2.901	2.918	2.936	2.953	2.970	2.987	3.004
668.0	35.423	35.726	36.030	36.337	36.645	36.955	37.266	37.579	37.894	38.211
	3.021	3.038	3.056	3.073	3.090	3.107	3.124	3.141	3.159	3.176
669.0	38.530	38.850	39.172	39.495	39.820	40.147	40.476	40.807	41.139	41.473
	3.193	3.210	3.227	3.244	3.262	3.279	3.296	3.313	3.330	3.347
670.0	41.808	42.145	42.482	42.821	43.160	43.500	43.840	44.182	44.524	44.867
	3.364	3.372	3.379	3.387	3.395	3.403	3.410	3.418	3.426	3.433
671.0	45.211	45.555	45.900	46.246	46.593	46.941	47.289	47.638	47.988	48.338
	3.441	3.449	3.456	3.464	3.471	3.479	3.487	3.494	3.502	3.510
672.0	48.690	49.042	49.395	49.748	50.103	50.458	50.814	51.170	51.528	51.886
	3.517	3.525	3.533	3.540	3.548	3.556	3.563	3.571	3.579	3.586
673.0	52.245	52.605	52.965	53.327	53.689	54.052	54.415	54.780	55.145	55.510
	3.594	3.602	3.609	3.617	3.625	3.632	3.640	3.647	3.655	3.662
674.0	55.877	56.244	56.613	56.982	57.351	57.722	58.093	58.465	58.838	59.211
	3.670	3.678	3.685	3.693	3.701	3.709	3.716	3.724	3.732	3.739

TABLE 7-3 (continued)
ELEVATION-AREA-CAPACITY DATA

POOL ELEV [FT. NGVD]	CAPACITY [1000'S OF ACRE-FEET] AREA [1000'S OF ACRES]									
	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
675.0	59.586	59.961	60.338	60.717	61.097	61.479	61.863	62.248	62.634	63.023
	3.747	3.763	3.779	3.795	3.811	3.827	3.843	3.859	3.875	3.891
676.0	63.413	63.804	64.197	64.592	64.988	65.386	65.785	66.186	66.589	66.993
	3.907	3.923	3.939	3.955	3.971	3.987	4.003	4.018	4.034	4.050
677.0	67.399	67.806	68.215	68.626	69.038	69.452	69.868	70.285	70.703	71.123
	4.066	4.082	4.098	4.114	4.130	4.146	4.162	4.178	4.194	4.210
678.0	71.545	71.968	72.393	72.820	73.248	73.678	74.109	74.542	74.977	75.413
	4.226	4.242	4.258	4.274	4.290	4.306	4.321	4.337	4.353	4.369
679.0	75.851	76.290	76.731	77.173	77.617	78.063	78.510	78.959	79.410	79.862
	4.385	4.401	4.417	4.433	4.449	4.465	4.481	4.497	4.513	4.529
680.0	80.316	80.771	81.227	81.684	82.143	82.602	83.063	83.525	83.988	84.453
	4.545	4.557	4.568	4.580	4.591	4.603	4.614	4.626	4.637	4.649
681.0	84.918	85.385	85.852	86.321	86.791	87.262	87.735	88.208	88.683	89.159
	4.660	4.672	4.683	4.695	4.706	4.718	4.729	4.741	4.752	4.764
682.0	89.636	90.114	90.593	91.073	91.555	92.037	92.521	93.006	93.492	93.980
	4.775	4.787	4.798	4.810	4.821	4.833	4.844	4.856	4.867	4.879
683.0	94.468	94.958	95.448	95.940	96.433	96.927	97.423	97.919	98.417	98.916
	4.890	4.902	4.913	4.925	4.936	4.948	4.959	4.971	4.982	4.994
684.0	99.416	99.917	100.419	100.922	101.427	101.932	102.439	102.947	103.456	103.966
	5.005	5.016	5.028	5.039	5.051	5.062	5.074	5.085	5.096	5.108
685.0	104.478	104.990	105.504	106.019	106.536	107.053	107.573	108.093	108.615	109.138
	5.119	5.132	5.145	5.158	5.172	5.185	5.198	5.211	5.224	5.237
686.0	109.662	110.188	110.715	111.243	111.772	112.303	112.835	113.369	113.904	114.440
	5.250	5.263	5.276	5.289	5.302	5.315	5.328	5.341	5.354	5.367
687.0	114.977	115.516	116.056	116.597	117.140	117.683	118.229	118.775	119.323	119.872
	5.380	5.393	5.406	5.419	5.432	5.446	5.459	5.472	5.485	5.498
688.0	120.423	120.974	121.527	122.082	122.637	123.194	123.753	124.312	124.873	125.435
	5.511	5.524	5.537	5.550	5.563	5.576	5.589	5.602	5.615	5.628

TABLE 7-3 (continued)
ELEVATION-AREA-CAPACITY DATA

POOL ELEV [FT. NGVD]	CAPACITY [1000'S OF ACRE-FEET] AREA [1000'S OF ACRES] .0	.1	.2	.3	.4	.5	.6	.7	.8	.9
689.0	125.999	126.563	127.129	127.697	128.265	128.835	129.407	129.979	130.553	131.129
	5.641	5.654	5.667	5.680	5.694	5.707	5.720	5.733	5.746	5.759
690.0	131.705	132.283	132.863	133.444	134.027	134.612	135.198	135.786	136.376	136.968
	5.772	5.789	5.806	5.822	5.839	5.856	5.872	5.889	5.906	5.922
691.0	137.561	138.155	138.752	139.350	139.949	140.551	141.154	141.759	142.365	142.973
	5.939	5.956	5.972	5.989	6.005	6.022	6.039	6.055	6.072	6.089
692.0	143.583	144.194	144.807	145.422	146.038	146.656	147.276	147.897	148.520	149.145
	6.105	6.122	6.139	6.155	6.172	6.189	6.205	6.222	6.239	6.255
693.0	149.771	150.399	151.029	151.660	152.293	152.928	153.564	154.202	154.842	155.483
	6.272	6.289	6.305	6.322	6.339	6.355	6.372	6.388	6.405	6.422
694.0	156.126	156.771	157.417	158.065	158.715	159.366	160.019	160.674	161.330	161.988
	6.438	6.455	6.471	6.488	6.505	6.522	6.538	6.555	6.572	6.588
695.0	162.648	163.309	163.972	164.638	165.305	165.974	166.645	167.318	167.993	168.670
	6.605	6.624	6.644	6.663	6.682	6.702	6.721	6.740	6.760	6.779
696.0	169.349	170.030	170.713	171.397	172.084	172.772	173.463	174.155	174.849	175.545
	6.798	6.817	6.837	6.856	6.875	6.895	6.914	6.933	6.952	6.972
697.0	176.244	176.944	177.646	178.350	179.055	179.763	180.473	181.184	181.898	182.613
	6.991	7.010	7.030	7.049	7.068	7.087	7.106	7.126	7.145	7.164
698.0	183.331	184.050	184.771	185.494	186.219	186.946	187.675	188.406	189.139	189.873
	7.183	7.202	7.222	7.241	7.260	7.280	7.299	7.318	7.338	7.357
699.0	190.610	191.349	192.089	192.832	193.576	194.322	195.070	195.820	196.572	197.326
	7.376	7.395	7.415	7.434	7.453	7.472	7.491	7.510	7.530	7.549
700.0	198.082	198.840	199.600	200.361	201.125	201.890	202.657	203.426	204.197	204.970
	7.568	7.587	7.606	7.625	7.644	7.663	7.682	7.701	7.720	7.739
701.0	205.745	206.522	207.301	208.081	208.864	209.648	210.434	211.222	212.012	212.804
	7.758	7.777	7.796	7.815	7.834	7.853	7.872	7.891	7.910	7.929
702.0	213.598	214.394	215.191	215.991	216.792	217.596	218.401	219.208	220.017	220.828
	7.948	7.967	7.986	8.005	8.024	8.043	8.061	8.080	8.099	8.118

TABLE 7-3 (continued)
ELEVATION-AREA-CAPACITY DATA

POOL ELEV [FT. NGVD]	CAPACITY [1000'S OF ACRE-FEET] AREA [1000'S OF ACRES]									
	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
703.0	221.641	222.455	223.272	224.090	224.911	225.733	226.557	227.383	228.211	229.041
	8.137	8.156	8.175	8.194	8.213	8.232	8.251	8.270	8.289	8.308
704.0	229.873	230.706	231.542	232.379	233.219	234.060	234.903	235.748	236.595	237.444
	8.327	8.346	8.365	8.384	8.403	8.422	8.441	8.460	8.479	8.498
705.0	238.295	239.147	240.002	240.859	241.717	242.578	243.441	244.306	245.173	246.041
	8.517	8.537	8.557	8.577	8.597	8.618	8.638	8.658	8.678	8.698
706.0	246.912	247.785	248.660	249.537	250.415	251.296	252.179	253.064	253.951	254.840
	8.718	8.738	8.758	8.778	8.799	8.819	8.839	8.859	8.879	8.899
707.0	255.731	256.624	257.518	258.415	259.314	260.215	261.118	262.023	262.930	263.839
	8.919	8.939	8.959	8.979	9.000	9.020	9.040	9.060	9.080	9.100
708.0	264.750	265.663	266.578	267.495	268.414	269.335	270.258	271.183	272.110	273.040
	9.120	9.140	9.160	9.180	9.200	9.221	9.241	9.261	9.281	9.301
709.0	273.971	274.904	275.839	276.776	277.715	278.656	279.599	280.545	281.492	282.441
	9.321	9.341	9.361	9.381	9.401	9.422	9.442	9.462	9.482	9.502
710.0	283.392	284.345	285.301	286.258	287.218	288.180	289.143	290.109	291.078	292.048
	9.522	9.543	9.564	9.586	9.607	9.628	9.649	9.670	9.692	9.713
711.0	293.020	293.995	294.971	295.950	296.931	297.913	298.898	299.886	300.875	301.866
	9.734	9.755	9.776	9.797	9.818	9.840	9.861	9.882	9.903	9.924
712.0	302.860	303.855	304.853	305.853	306.855	307.859	308.865	309.873	310.883	311.896
	9.945	9.966	9.988	10.009	10.030	10.051	10.072	10.094	10.115	10.136
713.0	312.911	313.927	314.946	315.967	316.990	318.016	319.043	320.072	321.104	322.138
	10.157	10.178	10.200	10.221	10.242	10.263	10.284	10.306	10.327	10.348
714.0	323.174	324.212	325.251	326.294	327.338	328.384	329.432	330.482	331.535	332.589
	10.369	10.390	10.410	10.431	10.451	10.472	10.493	10.513	10.534	10.554
715.0	333.646	334.704	335.765	336.827	337.892	338.959	340.028	341.099	342.172	343.247
	10.575	10.596	10.616	10.637	10.658	10.678	10.699	10.719	10.740	10.760
716.0	344.324	345.403	346.484	347.567	348.652	349.740	350.829	351.921	353.014	354.110
	10.781	10.802	10.822	10.843	10.863	10.884	10.904	10.925	10.945	10.966

TABLE 7-3 (continued)
ELEVATION-AREA-CAPACITY DATA

POOL ELEV [FT. NGVD]	CAPACITY [1000'S OF ACRE-FEET] / AREA [1000'S OF ACRES] .0	.1	.2	.3	.4	.5	.6	.7	.8	.9
717.0	355.207	356.307	357.408	358.512	359.618	360.726	361.836	362.948	364.062	365.178
	10.986	11.007	11.027	11.048	11.068	11.089	11.110	11.130	11.151	11.172
718.0	366.296	367.416	368.539	369.663	370.789	371.918	373.048	374.181	375.316	376.452
	11.192	11.213	11.233	11.254	11.274	11.295	11.316	11.336	11.357	11.377
719.0	377.591	378.732	379.875	381.020	382.167	383.316	384.467	385.620	386.775	387.932
	11.398	11.419	11.439	11.460	11.480	11.501	11.521	11.542	11.562	11.583
720.0	389.092	390.253	391.416	392.582	393.749	394.919	396.090	397.264	398.440	399.617
	11.603	11.624	11.644	11.665	11.685	11.706	11.726	11.747	11.767	11.788
721.0	400.797	401.979	403.163	404.349	405.537	406.727	407.919	409.113	410.309	411.507
	11.808	11.829	11.849	11.870	11.890	11.911	11.931	11.952	11.972	11.993
722.0	412.708	413.910	415.114	416.321	417.529	418.740	419.952	421.167	422.383	423.602
	12.013	12.033	12.054	12.074	12.095	12.115	12.135	12.156	12.176	12.197
723.0	424.823	426.045	427.270	428.497	429.726	430.957	432.190	433.425	434.662	435.901
	12.217	12.238	12.258	12.279	12.299	12.320	12.340	12.361	12.381	12.402
724.0	437.142	438.385	439.631	440.878	442.127	443.379	444.632	445.888	447.145	448.405
	12.422	12.443	12.463	12.484	12.504	12.525	12.545	12.566	12.586	12.607
725.0	449.667	450.931	452.197	453.467	454.739	456.013	457.291	458.571	459.854	461.139
	12.627	12.654	12.681	12.707	12.734	12.761	12.787	12.814	12.841	12.867
726.0	462.427	463.718	465.011	466.307	467.606	468.907	470.212	471.518	472.828	474.140
	12.894	12.921	12.948	12.974	13.001	13.028	13.054	13.081	13.108	13.134
727.0	475.455	476.772	478.092	479.415	480.740	482.069	483.399	484.733	486.069	487.408
	13.161	13.188	13.215	13.241	13.268	13.295	13.322	13.349	13.375	13.402
728.0	488.750	490.094	491.441	492.790	494.143	495.497	496.855	498.215	499.578	500.944
	13.429	13.456	13.483	13.509	13.536	13.563	13.589	13.616	13.643	13.669
729.0	502.312	503.683	505.057	506.433	507.812	509.194	510.578	511.965	513.355	514.747
	13.696	13.723	13.750	13.776	13.803	13.830	13.857	13.884	13.910	13.937
730.0	516.142	517.540	518.939	520.341	521.746	523.152	524.561	525.973	527.386	528.802
	13.964	13.987	14.009	14.032	14.055	14.078	14.100	14.123	14.146	14.168

TABLE 7-3 (continued)
ELEVATION-AREA-CAPACITY DATA

POOL ELEV [FT. NGVD]	CAPACITY [1000'S OF ACRE-FEET] AREA [1000'S OF ACRES]									
	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
731.0	530.220	531.640	533.062	534.487	535.914	537.343	538.775	540.209	541.645	543.083
	14.191	14.214	14.236	14.259	14.281	14.304	14.327	14.349	14.372	14.394
732.0	544.524	545.967	547.413	548.863	550.315	551.771	553.230	554.692	556.157	557.625
	14.417	14.448	14.479	14.510	14.542	14.573	14.604	14.635	14.666	14.697
733.0	559.096	560.570	562.048	563.529	565.012	566.499	567.989	569.482	570.978	572.477
	14.728	14.759	14.790	14.821	14.852	14.884	14.915	14.946	14.977	15.008
734.0	573.980	575.485	576.994	578.505	580.020	581.538	583.059	584.583	586.110	587.640
	15.039	15.070	15.101	15.132	15.163	15.194	15.225	15.256	15.287	15.318

TABLE 7-6

ACTIVE SURFACE WATER PERMITS
From Skiatook Lake, Hominy Creek and Bird Creek
To Confluence with Verdigris River

Permit #	Purpose	Entity Name	Legal Description of Diversion(s)						County	Amt (AF/YR)	Date Filed	Date Issued
19250007	Industrial	Baker Petrolite Corporation	SE	SW	NE	07	24N	11E	Osage	18	1-Jan-1925	9-May-1967
19550007	Public Supply	Pawhuska, City of			SE	05	25N	09E	Osage	955	1-Mar-1955	9-May-1967
					W2	08	25N	09E	Osage			
19560762	Public Supply	Pawhuska, City of			SE	25	26N	08E	Osage	385	10-Oct-1956	9-May-1967
					NE	36	26N	08E	Osage			
19630190	Irrigation	West Family Lim. Partnership				11	20N	14E	Rogers	320	9-Jul-1963	9-Jun-1964
						12	20N	14E	Rogers			
						13	20N	14E	Rogers			
						14	20N	14E	Rogers			
19640113	Irrigation	Cherokee Hills Golf Club		NE	NE	24	20N	14E	Rogers	89	24-Feb-1964	12-May-1964
19660293	Public Supply	Sand Springs, City of				26	22N	11E	Osage	7,840	8-Jun-1966	9-Aug-1966
19690095	Public Supply	Osage Co Rwd #15		SE	SE	26	22N	11E	Osage	109	14-Feb-1969	8-Jul-1969
19710410	Irrigation	(b) (6)			NE	03	23N	11E	Osage	4	27-Jul-1971	9-Nov-1971
					SW	03	23N	11E	Osage			
					SE	04	23N	11E	Osage			
					SW	04	23N	11E	Osage			
					NE	10	23N	11E	Osage			
19730117	Public Supply	Skiatook, Town of			SE	26	22N	11E	Osage	1,870	2-Apr-1973	12-Aug-1975
19740120	Public Supply	Sapulpa, City of				26	22N	11E	Osage	3,360	21-Mar-1974	12-Aug-1975
19740120A	Public Supply	Sand Springs, City of				26	22N	11E	Osage	5,600	21-Mar-1974	8-Oct-1985
19750080	Power	Public Service Co of Okla	NW	SE	SE	26	22N	11E	Osage	25,000	16-Sep-1975	12-Oct-1976
19780091	Public Supply	Skiatook, Town of	NE	SW	SE	26	22N	11E	Osage	1,890	8-Aug-1978	13-Jan-2004
19810148	Public Supply	Pawhuska, City of	SW	NW	SW	04	25N	09E	Osage	1,615	14-Jul-1981	13-Oct-1981

TABLE 7-6 (continued)

Permit #	Purpose	Entity Name	Legal Description of Diversion(s)						County	Amt (AF/YR)	Date Filed	Date Issued
19990032	Irrigation	(b) (6)	NW	NW	NE	11	20N	13E	Tulsa	60	7-Sep-1999	14-Dec-1999
			SE	NW	NE	11	20N	13E	Tulsa			
20000005	Irrigation	(b) (6)	NE	NE	NE	05	20N	13E	Tulsa	675	31-Jan-2000	11-Apr-2000
			SW	SE	NE	32	21N	13E	Tulsa			
20000012	Irrigation	Cherokee Hills Golf Club	NE	NE	NE	24	20N	14E	Rogers	190	27-Apr-2000	8-Aug-2000
20030019	Industrial	Baker Petrolite Corporation	SW	NW	NE	07	24N	11E	Osage	104	1-May-2003	9-Sep-2003
20060069	Irrigation	(b) (6)	SW	SE	NE	19	21N	13E	Tulsa	700	20-Dec-2006	12-Jun-2007
			NW	NW	SW	20	21N	13E	Tulsa			
			SE	SE	NE	30	21N	13E	Tulsa			
20070031	Irrigation	Selman Trust	SW	SE	NW	24	22N	12E	Tulsa	128	17-Apr-2007	11-Sep-2007

EXHIBIT A

SUPPLEMENTARY PERTINENT DATA

SKIATOOK LAKE

EXHIBIT A

SUPPLEMENTARY PERTINENT DATA

SKIATOOK LAKE

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EXHIBIT A
SUPPLEMENTARY PERTINENT DATA
SKIATOOK LAKE

1 - GENERAL INFORMATION

Other names for project	None
Location	(State of Oklahoma) Bird Creek Basin, Hominy Creek, river mile 14.3.
Type of project	Dam and Lake
Objectives of regulation	Multipurpose - Flood control, water supply, fish and wildlife, water quality, recreation and stream-flow aesthetics.
Project owner	US Government
Operating agency	US Army Corps of Engineers. The normal working hours of operation for weekdays are 7:45 a.m. to 4:30 p.m. Working hours for weekends, holidays and nights vary. Working hours under flood emergency conditions are 24 hours.
Regulating agency	US Army Corps of Engineers.
Water supply contracts	Contract dated 29 May 1987 with Osage County, Oklahoma for 2,000 acre-feet of storage, with a yield of 0.445 m.g.d. Contract dated 12 Nov 2002 with Sapulpa Municipal Authority for 4,500 acre-feet of storage, with a yield of 1.002 m.g.d. Contract dated 15 Apr 2005 with the City of Sand Springs for 11,250 acre-feet of storage, with a yield of 2.504 m.g.d. Contract dated 13 Mar 1988 with the City of Sand Springs for 6,740 acre-feet of storage, with a yield of 1.5 m.g.d.

Water supply contracts (continued)	Contract dated 13 Mar 1988 with Sapulpa Municipal Authority for 4,490 acre-feet of storage, with a yield of 1 m.g.d. Contract dated 13 Mar 1988 with Skiatook PWA for 2,018 acre-feet of storage, with a yield of 0.449 m.g.d. Contract dated 2 Jun 1998 with Skiatook PWA for 2,743 acre-feet of storage, with a yield of 0.61 m.g.d. Contract with Sapulpa Municipal Authority dated 29 Jun 2005 for 4,500 acre-feet of storage, with a yield of 1.002 m.g.d.
Water rights	Water rights have been granted on Bird Creek and Hominy Creek downstream of Skiatook Dam in the amount of 64.84 m.g.d. Releases may be required from Skiatook Lakes to meet downstream water rights of 50,910 acre-feet. .
Code of Federal Regulations, Title 33 (applies to Section 7 Project)	Does not apply
Federal Energy Regulatory Commission	No power recommended for this project
Other inter-agency agreement	None
Project cost	$ 132,026,765
Closure date	Feb 1984
Special project features	None
Other	None

2 - LAKE INFORMATION

ELEVATIONS, AREAS, AND STORAGES

Feature	Elevation (feet, NGVD29)	Area (acres)	Storage (acre-feet)	Runoff (inches) (1)
Top of dam	756.0	-	—	_
Maximum design pool	751.1	20,300	868,000	46.0
Top of spillway crest	732.0	14,420	544,520	28.8
Top of flood control pool	729.0	13,700	502,310	26.5
Top of conservation pool	714.0	10,370	323,170	17.1
Top of inactive pool	657.0	1,470	11,390	0.6
Streambed	613.0	-	-	-
100-year sediment	-	-	22,000(2)	-
Water supply storage	-	-	62,900(3)	-
Water quality storage	-	-	233,000(4)	-

(1) Drainage area is 354 square miles.
(2) 15,620 acre-feet in the conservation pool – 1,980 acre-feet in the flood control pool -- and 4,400 acre-feet in the inactive pool.
(3) 62,900 acre-feet has estimated yield of 14 m.g.d.
(4) 233,000 acre-feet has estimated yield of 62 m.g.d.

MAJOR FLOODS INTO SKIATOOK LAKE

Date	Peak Hourly Inflow (c.f.s.) (1)	Volume (acre-feet)	Runoff (inches) (2)
2 May – 31 May 1993	44,600	132,600	7.02
16 Apr – 10 May 1995	22,000	126,100	6.68
23 May – 20 Jun 2008	39,300	115,200	6.10
23 Apr – 6 May 1999	44,700	114,700	6.08
6 -19 Mar 1990	53,500	98,800	5.23

(1) Computed Values
(2) One inch of runoff = 18,880 acre-feet.

Real estate taking for land fee title	Fee simple title has been acquired to land required for construction of the dam and for operation and maintenance purposes in the area designated as the dam site and public-use area. In the reservoir area, the acquisition guideline is elevation 734.0 feet, NGVD29. The fee purchase limits in the main body of the lake generally encompass the acquisition guideline with a minimum distance of 300 feet measured horizontally from the top of the flood control pool, elevation 729.0 feet, NGVD29. This contains 15,360 acres.
Real estate taking for easement	Flowage easements were obtained in some extreme upper reaches encompassing 1,249 acres.
Range of clearing	Lower limit – 675.0 feet, NGVD29. Upper limit – 714.0 feet, NGVD29.
Pool elevation corresponding to discharge capability of maximum non-damaging flow rate downstream	Non-damaging channel capacity immediately downstream of Skiatook Dam is estimated at 4,000 c.f.s. This flow rate can be discharged when the lake level is at elevation 710.0 feet NGVD29 and above.
Reservoir length at top of conservation pool	13.7 miles
Reservoir length at top of flood pool	16.5 miles
Shoreline length at top of conservation pool	160 miles
Safety aspects, possibly requiring warning	All access roads are constructed above elevation 729.0 feet NGVD29 (about 50-year flood frequency). Some campsite facilities, picnic facilities, vault toilets, and change houses will be inundated above elevation 718.0 feet NGVD29 (about 5-year flood frequency). The Park Manager will make every effort to inform campsite users when roads and campsites are closed.

Emergency drawdown	The outlet works facilities will provide emergency drawdown capacity capable of lowering the pool from the spillway crest, elevation 732.0 feet NGVD29, to elevation 638.0 feet NGVD29 within 84 days. These facilities will also lower the pool from the top of the Flood Control Pool, elevation 729.0 feet NGVD29, to elevation 673.0 feet NGVD29 within 62 days.

3 – HYDROLOGY

Drainage area	354 square miles
Spillway Design Flood	
Maximum water surface elev.	751.1 feet, NGVD29
Peak inflow (into full pool)	212,000 c.f.s.
Peak inflow (natural channel flow)	147,800 c.f.s.
Total storm runoff (into full pool)	24.42 inches
Volume (into full pool)	461,070 acre-feet
Maximum outflow	26,300 c.f.s.
Duration of flood	4 days
Standard Project Flood	
Maximum water surface elev.	741.2 feet, NGVD29
Peak inflow (into full pool)	106,000 c.f.s.
Total storm runoff	12.21 inches
Volume (into full pool)	230,535 acre-feet
Maximum outflow	11,100 c.f.s.
Duration of flood	4 days
Climate	Moderate
One inch of runoff	18,880 acre-feet
Storm types	Mainly thunderstorms
Flood seasons	Primary flood period March through July with a secondary flood period of September through November; however, floods have occurred in every month of the year.

Low flow season	August, December through February; however, low flow can occur at any time of the year.
Minimum daily flow	Period 1940 through 2010 zero flow has occurred on many occasions.
Minimum monthly flow	Period 1940 through 2010 zero flow has occurred on many occasions.
Minimum annual flow and year	1,009 acre-feet in 1956
Average annual flow	170,580 acre-feet (1940-2010)
Maximum annual flow and year	494,545 acre-feet 1974 from records (1940-2010)
Maximum monthly inflow and date	257,684 acre-feet in May 1943
Maximum daily inflow and date	30,000 day second feet on 3-Oct-1959
Maximum instantaneous inflow and date	35,600 c.f.s. on 3-Oct-1959
Maximum flood volume and date	240,300 acre-feet, flood of May 1943
Name and location of key stream flow stations	Sperry, Oklahoma, Bird Creek (river mile 25.0).
Type of hydro-meteorological data recorded at dam site	Maximum and minimum temperatures, recording and standard rainfall measurements, wind speed and direction, pool elevations (recording), and tailwater stages (recording and staff).
Number of precipitation stations used in hydrologic forecasting inflow	Sixteen recording, six Mesonet.
Number of sediment ranges	23
Number of degradation ranges	4

4 – EMBANKMENT

Location	Hominy Creek, river mile 14.3.
Purpose	Flood control, water supply, fish and wildlife, water quality, recreation and stream flow aesthetics.
Type	Non-overflow embankment
Type of fill	Rolled earth fill with impervious core
Slope protection	Riprap on upstream face; grassed on downstream face.
Height	143 feet above streambed
Length	3,590 feet
Top elevation	756.0 feet, NGVD29
Design Flood	Probable Maximum Flood
Freeboard	4.9 feet above maximum pool
Used for roadway	Yes, a 24-foot-wide double bituminous surfaced roadway across the embankment and spillway.
Elevation of stream bed	613.0 feet, NGVD29

5 – SPILLWAY

Location	Near right abutment
Type	Uncontrolled broad-crested weir
Crest elevation	732.0 feet, NGVD29
Net overflow length	100 feet
Design head	19.1 feet
Maximum discharge capacity	21,700 c.f.s.
Frequency of Operation	In excess of 100 years (Standard Project Flood pool)

6 - OUTLET FACILITIES

a. CONDUIT

Location	Tunnel: Through the right abutment Low Flow Sluice: splitter pier Water supply conduit: under tunnel
Purpose	Flood Control
Type of outlet and size	Circular Tunnel,10.5 feet diameter
Type of gate	Hydraulically operated slide gates
Number and size of gates	Two service and two emergency 4.67 feet wide and 10.50 feet high.
Entrance invert elevation	620.0 feet, NGVD29
Discharge at pertinent elev.	Top of flood control pool (elev. 729.0 feet) 4,400 c.f.s Top of conservation pool (elev. 714.0 feet) 4,100 c.f.s Bottom of conservation pool (elev. 657.0 feet) 2,740 c.f.s

Minimum time required to open/close gates	21 minutes. The service gates will raise or Lower at the rate of 1 foot per minute for one gate or 0.5 foot per minute for two gates
Type emergency closure and time required	Hydraulically operated slide gates which require 21 minutes to close
Type energy dissipater	Concrete baffles staggered in two rows

b. <u>SLUICE</u>

Purpose	Low flow water quality release
Type of outlet and size	Rectangular sluice, 2.5 feet by 5 feet
Type of service gate	Slide gate in the splitter pier
Number and size of gates	One slide gate – 2.5 feet by 5 feet
Entrance invert elevation	635.0 feet, NGVD29
Multilevel intake elevations	646.0, 665.0, 675.0, 685.0, and 704.0 feet, NGVD29
Discharge at pertinent elevations	Top of flood control pool (elev. 729.0 feet) 760 c.f.s Top of conservation pool (elev. 714.0 feet) 685 c.f.s
Minimum pool elevation when Inoperative	646.0 feet, NGVD29
Minimum time required to open/ close slide gate	Approximately 6 minutes to close slide gate
Type emergency closure and time required	Approximately 6 minutes to close
Type energy dissipater	Concrete baffles staggered in two rows

c. WATER SUPPLY

Purpose	Water supply
Type outlet	Circular
Size of outlet	36-inch diameter pipe
Type and size of gate	Two slide gates, 3 feet by 3 feet
Entrance invert elevation	614.5 feet, NGVD29
Multilevel intake elevations	646.0, 665.0, 675.0, 685.0, 693.0, and 704.0 feet, NGVD29

8 - CONTROL POINTS

a. SPERRY GAGE

Location	At river mile 25.0 on Bird Creek. Located 1 mile south and 2-1/8 miles east of Sperry, Oklahoma on County Highway bridge (86th St. North).
Purpose of gage	Used by Corps of Engineers to regulate Birch and Skiatook Lakes and determine benefits.
Channel and floodplain description	The channel is well defined, crooked and laden with drift along its sloping, caving, and sloughing sides. The flood plain is broad, with trees, cultivated crops, oil wells and some urban development.
Uncontrolled drainage area	485 square miles
Treatment of uncontrolled runoff	Contributes to flood control target flows
Target flow rate	Bank full stage 21.0 feet, 11,700 c.f.s (current rating).

Time of crest travel	Skiatook Dam to Sperry gage -24 hours.
Monitoring provisions	Water surface elevation is recorded by electronic logger. The gage can be polled by satellite platform . Sediment measurements are also made.
Channel usage	Water supply, fishing and fish spawning.

EXHIBIT B

STANDING INSTRUCTIONS TO LAKE MANAGER

SKIATOOK LAKE

EXHIBIT B

STANDING INSTRUCTIONS TO LAKE MANAGER

SKIATOOK LAKE

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EXHIBIT B
STANDING INSTRUCTIONS TO LAKE MANAGER
SKIATOOK LAKE

I - GENERAL

1. Operation. The lake will be regulated in accordance with the normal regulations for flood control as directed in Section VII of this Manual or Paragraph II-1.a. of this Exhibit. Instructions for the storage and discharge of floodwater will be issued by the Water Management Section. In the event communications with the Tulsa District are disrupted, the lake will be regulated in accordance with the schedule of emergency regulations for flood control (see Section VII of this Manual or paragraph II-1.b. of this Exhibit). In addition, the Lake Manager will immediately make every effort to re-establish communications with the Tulsa District.

2. Project Reporting Instructions. Hydrologic data items affecting release of water, confirmation of change in releases as instructed, complaints, operating machinery failure, or out-of service times for maintenance shall be reported to the Water Management Section as they occur.

The following data should be included in the daily report to the Water Management Section (Hydrology-Hydraulics Branch, Tulsa District) from all flood control storage projects without hydropower. Data is typically reported by telephone, fax, or email. Data collected will be reviewed and input into the Water Management Section's data base before 10 a.m. and published to the lake data morning report located at www.swt-wc.usace.army.mil by 10 a.m. See Plate 5-3 for lake data reporting details.

a. As of 8 a.m. Each Weekday.

1) Pool elevations at 12 noon, 4 p.m. and 12 midnight of the previous day and the current 8 a.m. pool elevation and tailwater elevation (if available).

2) The total precipitation amounts for the previous 24-hour period (7 a.m. to 7 a.m. time period).

3) The current wind direction and wind speed (Beaufort scale).

4) Water supply withdrawal or release for previous day (if available).

5) The current gate setting and any gate changes made during the past 24-hour period, including the time and pool elevation and tailwater elevation if necessary when the change was made.

Note: Except for lakes without personnel or if data collection is automated.

b. As of 8 a.m. Each Monday.

1) The same data from the weekend as required in paragraph 5-07.a. above.

2) The current pool elevation readings from the pool gage, the recording chart or tape, the shaft encoder or data logger, and the wire weight or staff gage. If wind or weather prevents readings on Monday, then these readings can be taken on the next day that weather permits.

c. Weekends and Holidays.

1) Daily reports are not required to be submitted on weekends and holidays except during flood periods.

d. During Flood Periods.

1) During flood periods, weekend and holiday reports should include the same data as required in paragraph 5-07.a above as well as the 8 a.m. pool elevation from the pool gage.

2) In addition to the data in paragraphs 5-07.a., 5-07.b. and 5-07.c. above, additional reports of lake elevations may be requested by Water Management Section personnel.

3. Reporting Unusual Events. Events or conditions not normally encountered in the routine operation of the dam and lake which might endanger the dam or necessitate temporary or permanent revision of the operating procedures such as settlement, movement, or cracking of the earth embankment or abutments; unusual change in seepage rates, or development of new seepage areas; mechanical malfunction or failure; structural settlement, movement, cracking, or vibration; landslides, rockslides, or indications of an impending movement; or an occurrence indicating any degree of jeopardy to the safety of the dam, or to the safety of the public shall be reported promptly to the Water Management Section, Hydrology-Hydraulics Branch.

4. Warnings. It is the responsibility of the Lake Manager and project personnel authorized to make gate changes to maintain a list in current status of residents and/or property which might be endangered or inconvenienced by large and/or prolonged releases. If damaging releases are expected to occur, notification will be made by telephone, or oral warning by Corps employees. Notification will be made in accordance with the Tulsa District supplements to ER 500-1-1. This would include media such as radio, television, telephone, citizens band radio, use of law enforcement and civil defense agencies and their communication system, National Guard and reserve units, supplemented by oral warning by Corps employees. Studies have been made to determine the possible downstream flood conditions that could exist in the event of a maximum spillway release or failure of the dam at maximum pool. Approximate water surface profiles and flooded area maps giving the results of these studies are kept in

the Skiatook Lake Operation and Maintenance Manual, Volume II, Flood Emergency Plan. In every case, when a gate change is made a horn is blown to give warning to people immediately downstream of Skiatook Dam.

5. Frequency of Gate Changes. During flood periods, gate changes may be directed by the Water Management Section at any time. When the floodwaters have significantly risen into the flood control pool, gate changes can be expected two or three times daily. When the pool level is at or above the top of the flood control pool, gate changes may occur every hour. Only under the most unusual circumstances will changes be ordered more frequently than once every hour. Frequency of gate changes during low flow operation will generally be less than once a day.

II - REGULATION PROCEDURES

1. Regulating River Stages and Discharges. The regulation schedules provide that the channel capacity of 4,000 c.f.s is not to be exceeded insofar as practicable. Flood waters will be released -as rapidly as practicable with consideration given to minimizing flooding of low-water crossings and low-lying farmland. Factors considered in the determination of releases are: maximum inflow into the reservoir during a rise, general climatic conditions, season of the year with respect to the probability of floods, status of crops in low-lying farmlands, and minimum stages or discharges.

a. Normal flood control regulations. Skiatook Lake will be regulated for optimal flood reductions on Hominy Creek from the dam to its confluence with Bird Creek and from that point in conjunction with flood control releases from Birch Lake and other systems on Bird Creek and the Verdigris and Arkansas Rivers. The following regulations as shown in Table 7-1 will govern releases from Skiatook Lake. During flood control regulation the conduit gates are to be operated at a uniform setting with no more than 1 foot difference in opening. NOTE: The conduit outlet and stilling basin must be visually monitored very closely during all high releases and during high tailwater events. If unusual conditions occur (such as riprap displacement, surging, submerged outlet, or the hydraulic jump moving out of the stilling basin), notify Water Management and Dam Safety Sections immediately.

b. Emergency flood control regulations. When communication with the Tulsa District is disrupted, the Lake Manager will, on his or her own initiative, direct regulation of the lake in accordance with the schedule shown in Table 7-2 until communication is restored. In addition, the Project Manager will make every effort to re-establish communication with the Tulsa District. The conduit gates shall be operated at a uniform opening as discussed in paragraph 7-05a. NOTE: The conduit outlet and stilling basin must be visually monitored very closely during all high releases and during high tailwater events. If unusual conditions occur (such as riprap displacement, surging, submerged outlet, or the hydraulic jump moving out of the stilling basin), notify Water Management and Dam Safety Sections immediately.

2. During Emergency Events. The Lake Manager may temporarily deviate from the current release rates in the event an immediate short-term departure is deemed necessary for emergency reasons to protect the safety of dam, or to avoid serious hazards to life. Such actions shall be immediately reported by the fastest means of communication available. Actions shall be confirmed in writing the same day to the Water Management Section and shall include justification for the action. Continuation of the deviation will require the express approval of the Water Management Section and SWD.

TABLE B -1

NORMAL FLOOD CONTROL REGULATION SCHEDULE
SKIATOOK LAKE
HOMINY CREEK, OKLAHOMA

LAKE STAGE	POOL CONDITIONS	REGULATION
Below 714.0	--	Releases will be made to maintain elevation 714.0 feet but will be sufficient to meet low flow requirements at Sperry as in Table 7-4.
714.0 - 729.0	Rising	Make releases using the following schedule as a guide, except that the release, when combined with intervening flow downstream, shall not exceed 4,000 c.f.s. on Hominy Creek below the dam, or a 21.0 - foot stage (11,700 c.f.s.) on Bird Creek at the Sperry gage. If the flows exceed any of those listed above, no release will be made until the flows recede below flood stage. Regulation releases may be made at less than the maximum permissible rate. Releases will be modified to meet target discharges specified by the requirements in Chapter 7 of the Arkansas River Master Manual for the operation of the Arkansas River System.

RELEASE SCHEDULE

Pool Stages	Normal Maximum Release Rates (c.f.s.)
714.0 – 715.0	1,000
715.0 – 716.0	2,000
716.0 – 718.5	3,000
718.5 – 729.0	4,000

TABLE B -1 (continued)

LAKE STAGE	POOL CONDITIONS	REGULATION
729.0 - 732.0	Rising	If the forecasted pool level will crest at or below 732.0 feet, a maximum release of 4,000 c.f.s. will be made. If the forecasted pool level will crest above 732.0 feet, the flood control conduit gates will be opened in increments of 750 c.f.s. each hour until both gates are fully open or until the pool is falling.
Above 732.0	Rising	Continue maximum release possible.
732.0 - 729.0	Falling	Continue maximum release attained during rising pool until pool level recedes to elevation 729.0 feet.
729.0 - 714.0	Falling	Make releases using the following schedule as a guide, except that the release, when combined with intervening area flows downstream, shall not exceed those stages listed under the above rising pool conditions.

Note: The conduit outlet and stilling basin must be visually monitored very closely during all high releases and during high tailwater events. If unusual conditions occur (such as riprap displacement, surging, submerged outlet, or the hydraulic jump moving out of the stilling basin), notify Water Management and Dam Safety Sections immediately.

RELEASE SCHEDULE

Pool Stages	Maximum Allowable Release Rates (c.f.s.)
729.0 – 718.5	4,000
718.5 – 716.0	3,000 + Inflow*
716.0 – 715.0	2,000 + Inflow*
715.0 – 714.5	1,000 + Inflow*
714.5 – 714.0	Transition to downstream low flow requirements defined in Table 7-4, paragraph 7-07.

NOTE: Do not exceed 4,000 c.f.s.

*Forecasted inflow over a 2- to 5-day period.

TABLE B – 2

EMERGENCY FLOOD CONTROL
REGULATION SCHEDULE FOR SKIATOOK LAKE
HOMINY CREEK, OKLAHOMA

<table>
<tr><th>LAKE STAGE</th><th>POOL CONDITIONS</th><th>REGULATION</th></tr>
<tr><td>714.0 - 729.0</td><td>Rising</td><td>Continue the release being made prior to loss of communication for 48 hours after the last significant rainfall (over 0.5 inches). If the release is less than 900 c.f.s., the Lake Manager will visually check the downstream channel to assess available channel capacity. If channel capacity is evident, the Lake Manger will increase releases by 250 c.f.s., and again verify that downstream channel capacity is not exceeded. Every four hours, the Lake Manager will continue with increasing the release and visually verifying that downstream channel capacity is not exceeded until the total release is 900 c.f.s. or until the pool begins falling.</td></tr>
<tr><td>729.0 - 732.0</td><td>Rising</td><td>(1) Releases shall be made in accordance with the following schedule:

<u>Pool Elevation (feet)</u> <u>Release Rate (c.f.s.)</u>

729.0 900
729.5 1,750
730.0 2,500
730.5 3,000
731.0 3,500
731.5 3,975
732.0 4,450

(2) Releases shall be increased for each one half (1/2) foot rise in pool elevation.

(3) If the outflow being made at the time the emergency regulations become effective is greater than the outflow indicated by the preceding schedule, continue the outflow until the pool level indicates an increase is required.</td></tr>
</table>

TABLE B – 2 (continued)

LAKE STAGE	POOL CONDITIONS	REGULATION
Above 732.0	Rising	If the conduit gates have not been fully opened when the lake water surface reaches elevation 732.0 feet, the release shall be increased 750 c.f.s. each half (1/2) hour until both gates are fully open and shall remain fully open until the pool level recedes to elevation 729.0 feet. Continue maximum release until the pool level recedes to elevation 729.0 feet.
729.0 - 715.0	Falling	Maintain release in effect at the time communication was lost or maintain release which was initiated under rising pool conditions. If the release is greater than 4,000 c.f.s, begin a gradual reduction of the release rate to 4,000 c.f.s. (not to exceed 750 c.f.s. reduction per 2 hours) making sure not to reduce the release below inflow. (See Plate 6-4 for inflow computation example).
715.0 - 714.0	Falling	Begin a gradual reduction of the release rate (not to exceed 500 c.f.s. per 2 hour reduction period) to stabilize the pool at conservation level (714.0 feet).

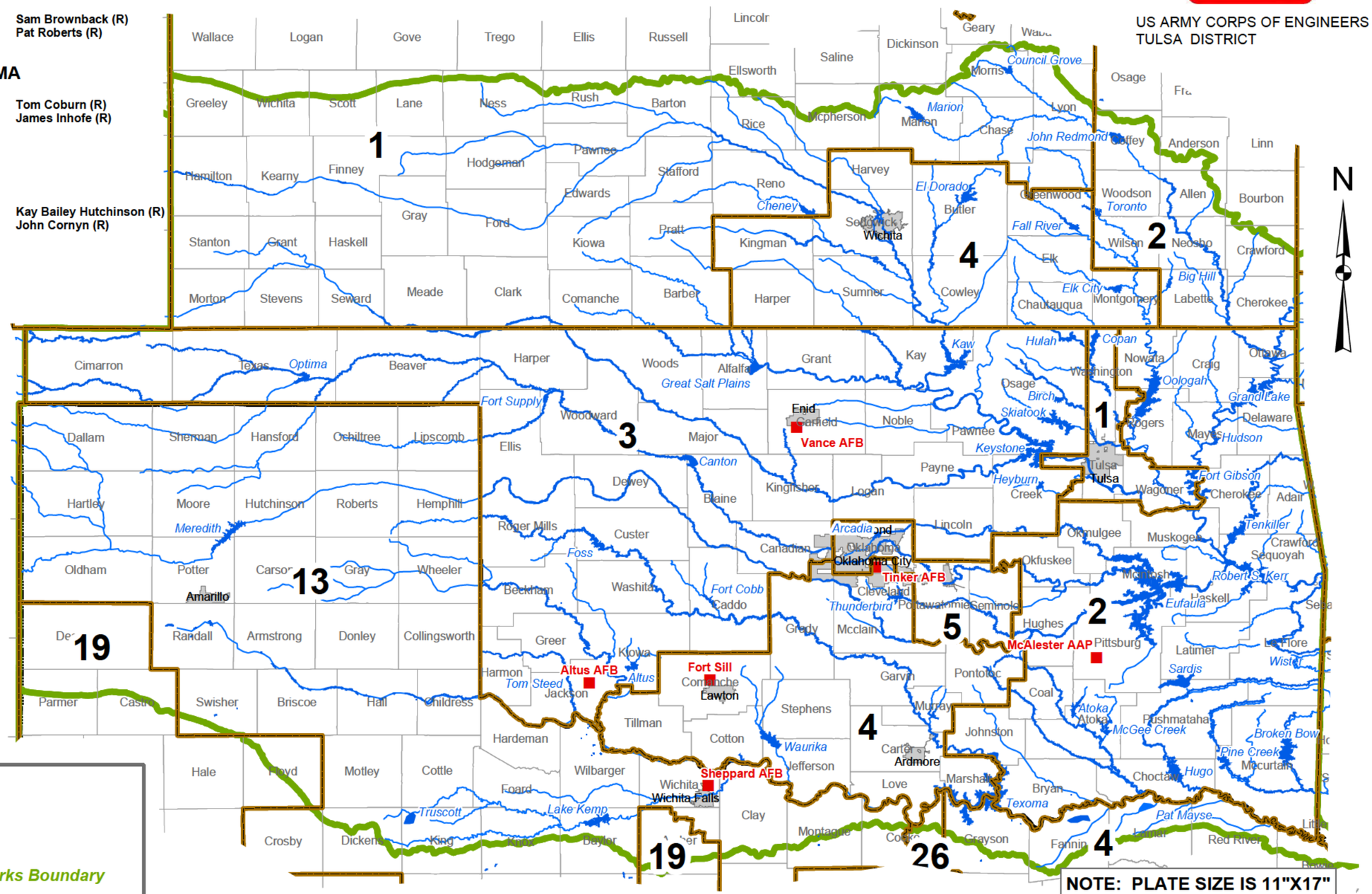
Note: The conduit outlet and stilling basin must be visually monitored very closely during all high releases and during high tailwater events. If unusual conditions occur (such as riprap displacement, surging, submerged outlet, or the hydraulic jump moving out of the stilling basin), notify Water Management and Dam Safety Sections immediately.

PLATES AND DRAWINGS

SKIATOOK LAKE

US ARMY CORPS OF ENGINEERS
TULSA DISTRICT

U.S. Representative	U.S. Senator
KANSAS	
1 Jerry Moran (R)	Sam Brownback (R)
2 Lynn Jenkins (R)	Pat Roberts (R)
4 Todd Tiahirt (R)	
OKLAHOMA	
1 John Sullivan (R)	Tom Coburn (R)
2 Dan Boren (D)	James Inhofe (R)
3 Frank Lucas (R)	
4 Tom Cole (R)	
5 James Lankford (R)	
TEXAS	
4 Ralph M. Hall (R)	Kay Bailey Hutchinson (R)
13 Mac Thornberry (R)	John Cornyn (R)
19 Randy Neugebauer (R)	
26 Michael C. Burgess (R)	



NOTE: PLATE SIZE IS 11"X17"

PLATE 1 - 1

N

Skiatook Lake Basin

Tulsa

Oklahoma City

VICINITY MAP

Watershed Boundary

Little Hominy Creek

Bird Creek

Pawhuska

Hominy

SKIATOOK LAKE

Skiatook

Hominy Creek

Pawnee

Lone Chimney

KEYSTONE LAKE

Sand Springs

Tulsa

CANEY

99

75

169

0 2 4 8 12 Miles

Plate Size is 11" x 17"

ARKANSAS RIVER WATERSHED HOMINY CREEK, OKLAHOMA

SKIATOOK LAKE

PROJECT LOCATION AND VICINITY MAP

DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2011
DRAWN: RKB
CHECKED: JRL

PLATE 2 - 1

(b) (7)(F)

ARKANSAS RIVER WATERSHED HOMINY CREEK, OKLAHOMA

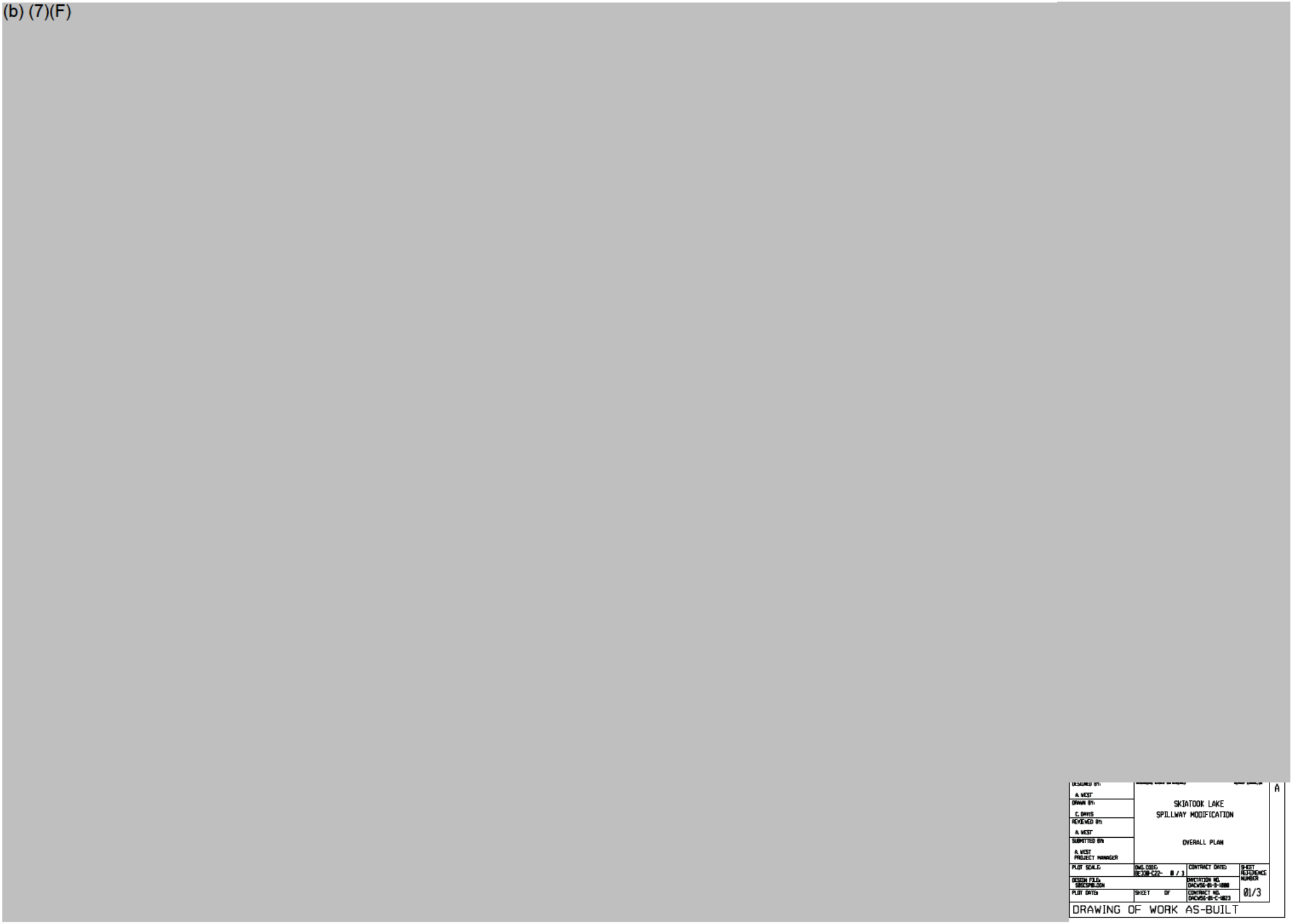
SKIATOOK LAKE

GENERAL PLAN AND SECTIONS

DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2011
DRAWN: RKB
CHECKED: JRL

PLATE 2 - 2

(b) (7)(F)


A. WEST
DRAWN BY:
C. DAVIS
REVIEWED BY:
A. WEST
SUBMITTED BY:
A. WEST
PROJECT MANAGER
SKIATOOK LAKE
SPILLWAY MODIFICATION
OVERALL PLAN
A
PLOT SCALE:
DWG CODE:
RE30B-C22- 0 / 3
CONTRACT DATE:
SHEET REFERENCE NUMBER
DESIGN FILE:
SIMULATION
DRAWING NO.
SWCW56-00-D-1008
PLOT DATE:
SHEET OF
CONTRACT NO.
SWCW56-00-C-1023
01/3
DRAWING OF WORK AS-BUILT

(b) (7)(F)

ARKANSAS RIVER WATERSHED HOMINY CREEK, OKLAHOMA

SKIATOOK LAKE

INTAKE STRUCTURE ELEVATION

(1 OF 2)

DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2011
DRAWN: RKB
CHECKED: JRL

PLATE 2 - 4

(b) (7)(F)

ARKANSAS RIVER WATERSHED HOMINY CREEK, OKLAHOMA

SKIATOOK LAKE

INTAKE STRUCTURE ELEVATION

(2 OF 2)

DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2011
DRAWN: RKB
CHECKED: JRL

PLATE 2 - 5

(b) (7)(F)

ARKANSAS RIVER WATERSHED HOMINY CREEK, OKLAHOMA

SKIATOOK LAKE

OUTLET CHANNEL

PLAN, SECTIONS AND DETAILS

DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2011
DRAWN: RKB
CHECKED: JRL

PLATE 2 - 6

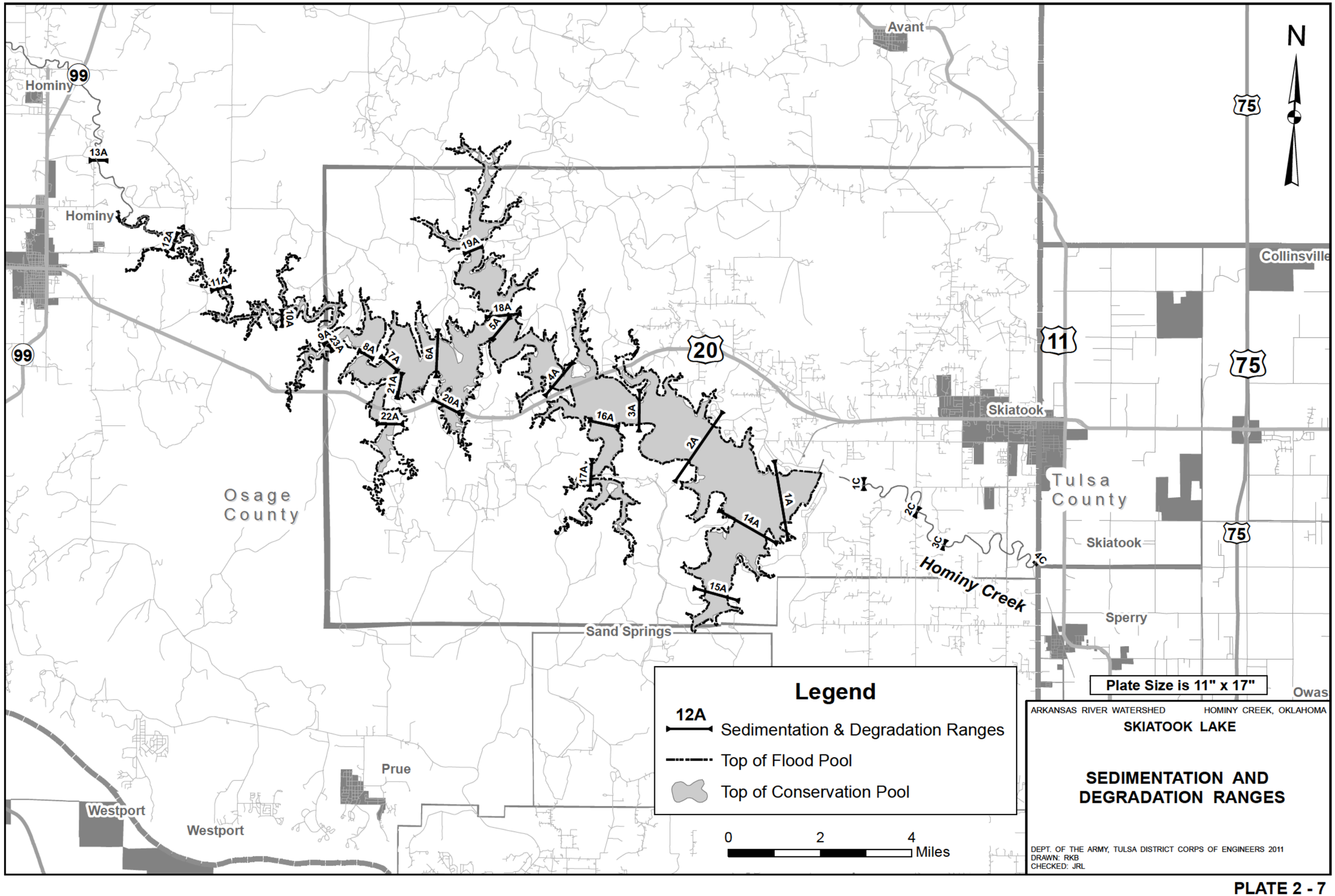
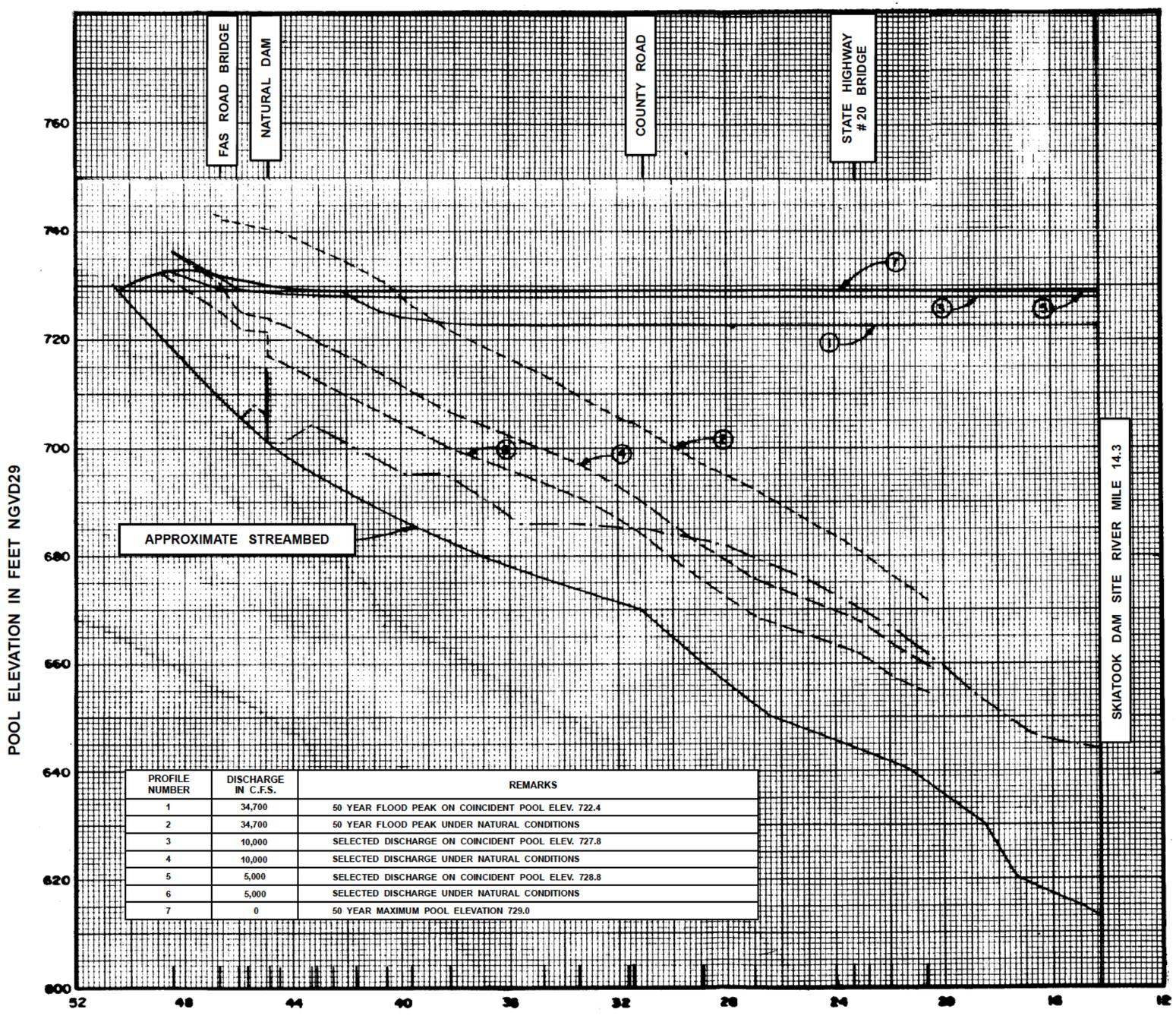

N
Avant
Hominy
99
13A
Hominy
12A
11A
10A
9A
23A
8A
17A
6A
19A
18A
5A
21A
20A
22A
4A
16A
3A
2A
1A
14A
15A
17A
20
11
75
Collinsville
Skiatook
Tulsa
County
1C
2C
3C
4C
Hominy Creek
Skiatook
Sperry
Owas
Osage
County
Sand Springs
Prue
Westport
Westport
Legend
12A
Sedimentation & Degradation Ranges
Top of Flood Pool
Top of Conservation Pool
0
2
4
Miles
Plate Size is 11" x 17"
ARKANSAS RIVER WATERSHED
HOMINY CREEK, OKLAHOMA
SKIATOOK LAKE
SEDIMENTATION AND
DEGRADATION RANGES
DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2011
DRAWN: RKB
CHECKED: JRL

PLATE 2 - 7



PROFILE NUMBER	DISCHARGE IN C.F.S.	REMARKS
1	34,700	50 YEAR FLOOD PEAK ON COINCIDENT POOL ELEV. 722.4
2	34,700	50 YEAR FLOOD PEAK UNDER NATURAL CONDITIONS
3	10,000	SELECTED DISCHARGE ON COINCIDENT POOL ELEV. 727.8
4	10,000	SELECTED DISCHARGE UNDER NATURAL CONDITIONS
5	5,000	SELECTED DISCHARGE ON COINCIDENT POOL ELEV. 728.8
6	5,000	SELECTED DISCHARGE UNDER NATURAL CONDITIONS
7	0	50 YEAR MAXIMUM POOL ELEVATION 729.0

LEGEND

- NATURAL PROFILE
- PROFILE WITH DAM PLACE
- ENVELOPE CURVE OF BACKWATER EFFECTS
- 100 YEAR SEDIMENT PROFILE

Plate Size is 11" x 17"

ARKANSAS RIVER WATERSHED — HOMINY CREEK, OKLAHOMA

SKIATOOK LAKE

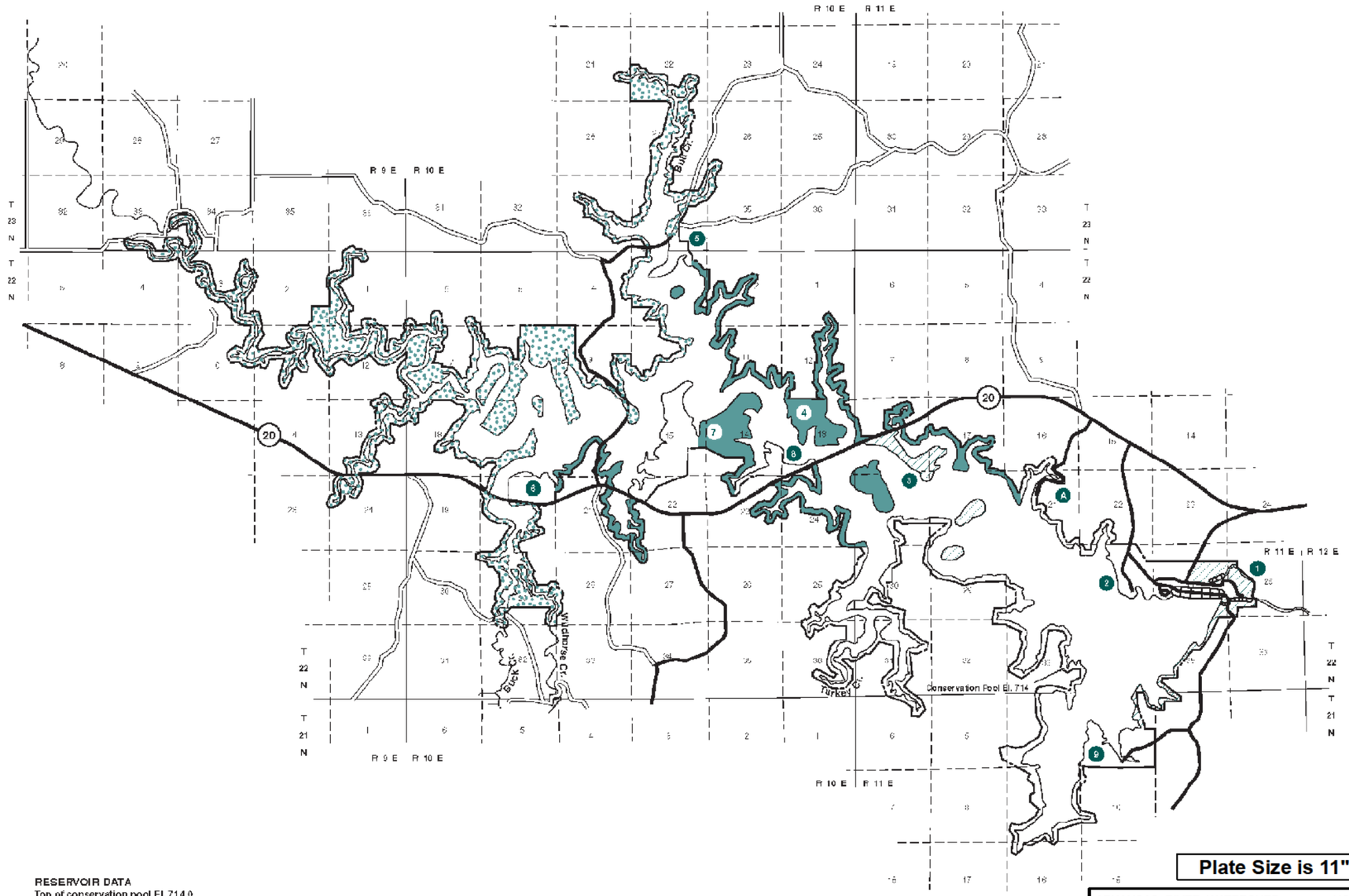
ENVELOPE CURVE OF BACKWATER EFFECTS 100 YEARS SEDIMENT

DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2011
DRAWN: RKB
CHECKED: JRL

PLATE 2 - 8

SKIATOOK LAKE

PUBLIC HUNTING AREA



PUBLIC USE AREAS

1. Quapaw Park
2. Skiatook Point
3. Osage Park
4. Gouin Point
5. Bull Creek Peninsula
6. Hominy Landing
7. Twin Points
8. Black Dog Park
9. Tall Chief Cove
A. Osage Nation Park & Marina

LEGEND

- Paved Road
- Improved Road
- Project Boundary
- Corps Areas Open For Hunting
- State Areas Open For Hunting
- See Restrictions

4000 2000 0 4000

Scale of Feet

RESERVOIR DATA
Top of conservation pool El. 714.0
180 shoreline miles at El. 714.0
Total project land & water acreage 17996

Plate Size is 11" x 17"

ARKANSAS RIVER WATERSHED HOMINY CREEK, OKLAHOMA

SKIATOOK LAKE

PUBLIC USE AREAS

DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2011
DRAWN: RKB
CHECKED: JRL

PLATE 2 - 9

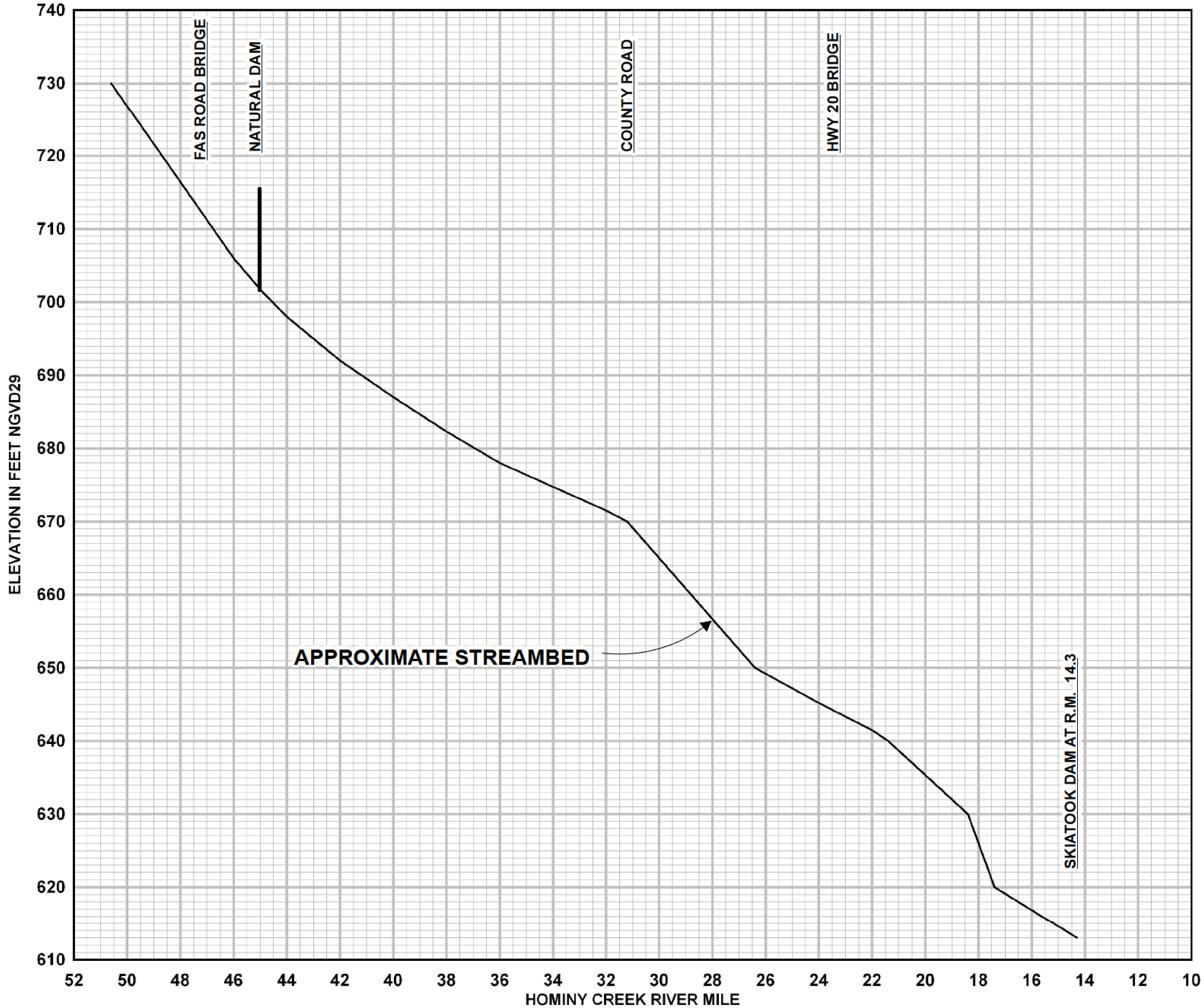


Plate Size is 11" x 17"

ARKANSAS RIVER WATERSHED HOMINY CREEK, OKLAHOMA

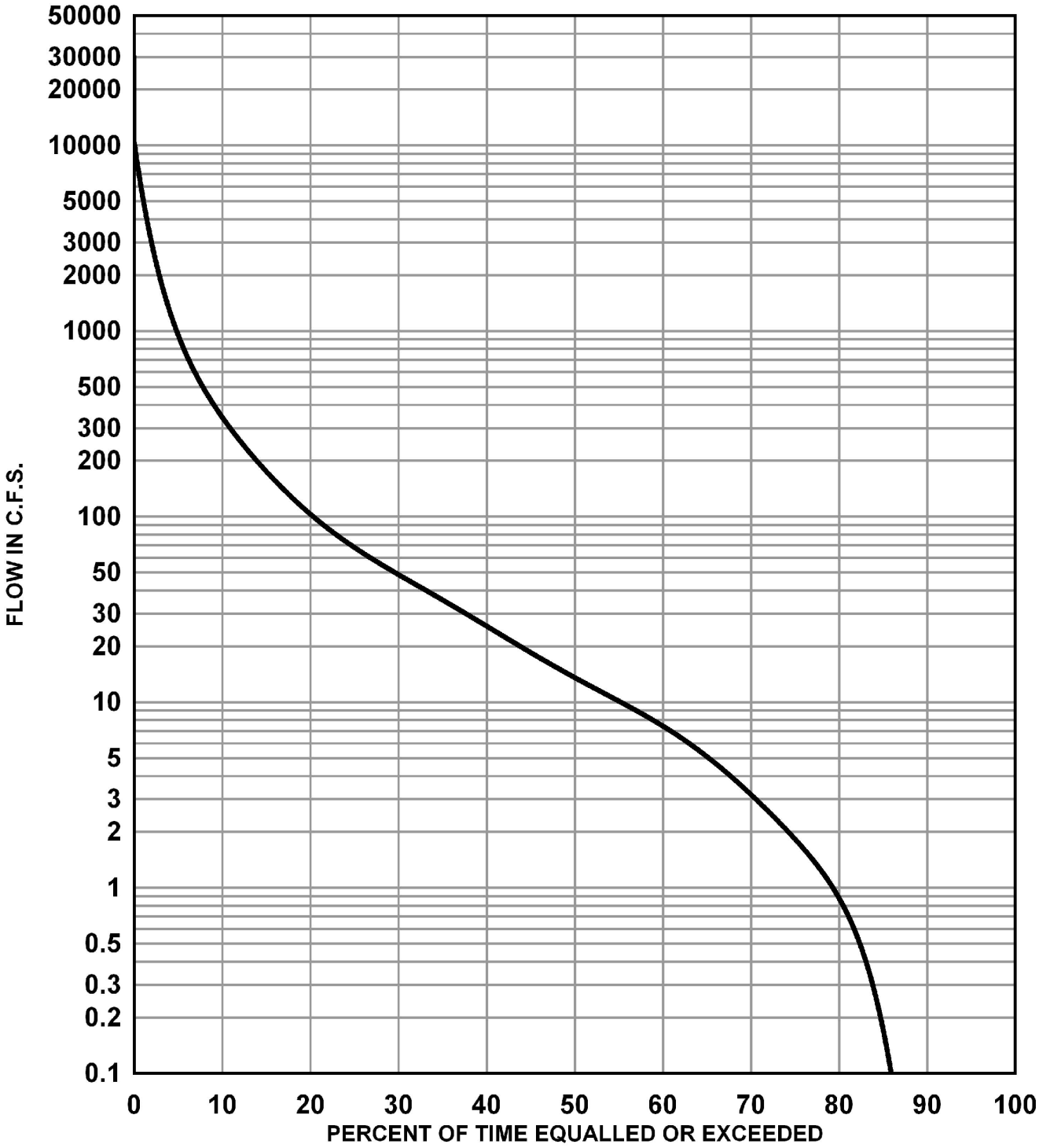
SKIATOOK LAKE

STREAMBED PROFILE

HOMINY CREEK

DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2011
DRAWN: RKB
CHECKED: JRL

PLATE 4 - 1



NOTE:
BASED ON PERIOD OF RECORD
JAN 1940 THRU DEC 2008
FROM RIVERWARE RUN 5.2.1.0.

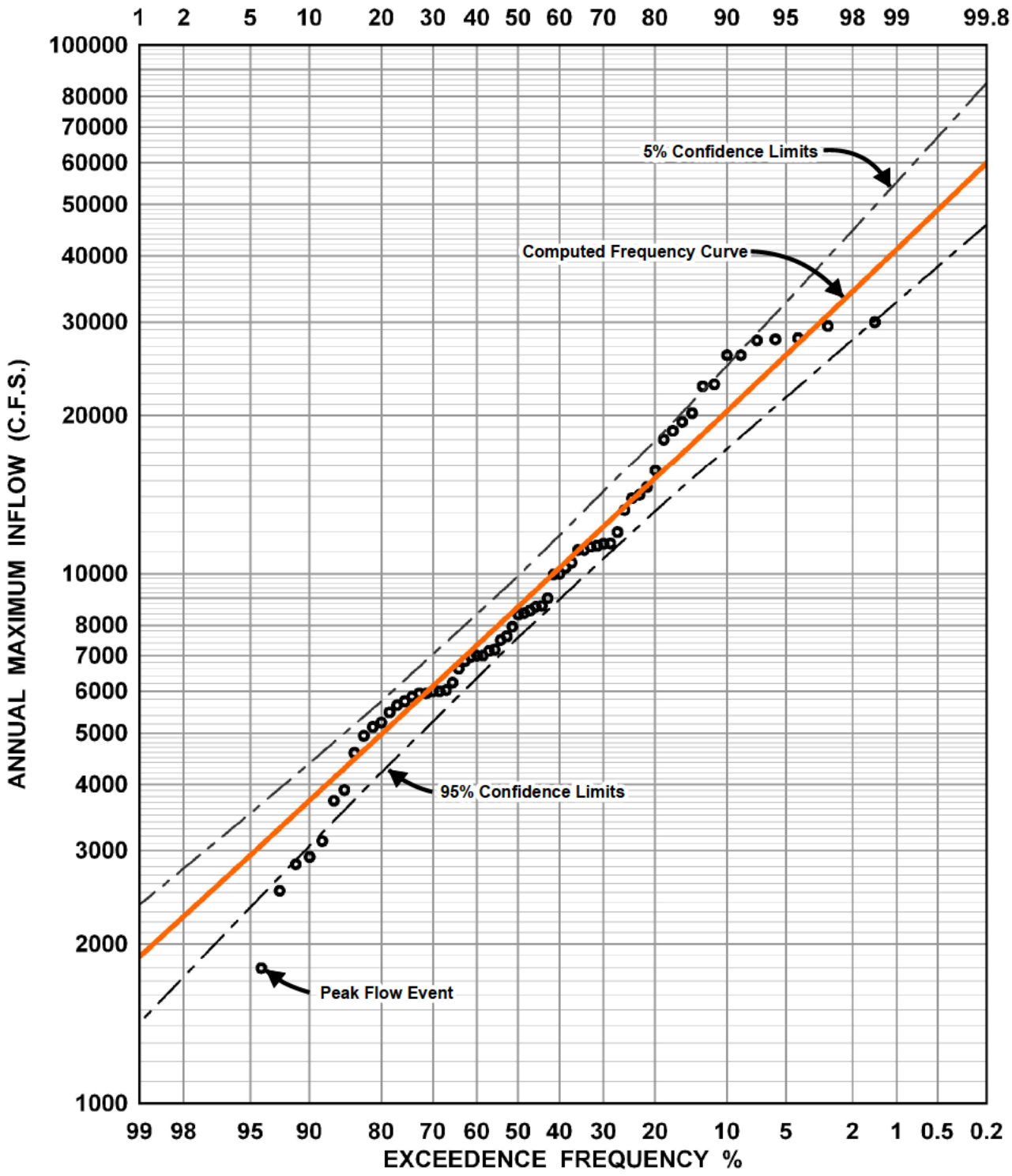
ARKANSAS RIVER WATERSHED HOMINY CREEK, OKLAHOMA

SKIATOOK LAKE

FLOW DURATION CURVE

DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2011
DRAWN: RKB
CHECKED: JRL

PLATE 4 - 2



NOTES:

1. BASED ON PERIOD SEP 1940 THRU DEC 2008
2. BULLETIN NO. 17B FLOOD FLOW FREQUENCY GUIDELINES WERE USED.
3. SKEW COEFFIECIENT OF ZERO WAS USED.

ARKANSAS RIVER WATERSHED HOMINY CREEK, OKLAHOMA

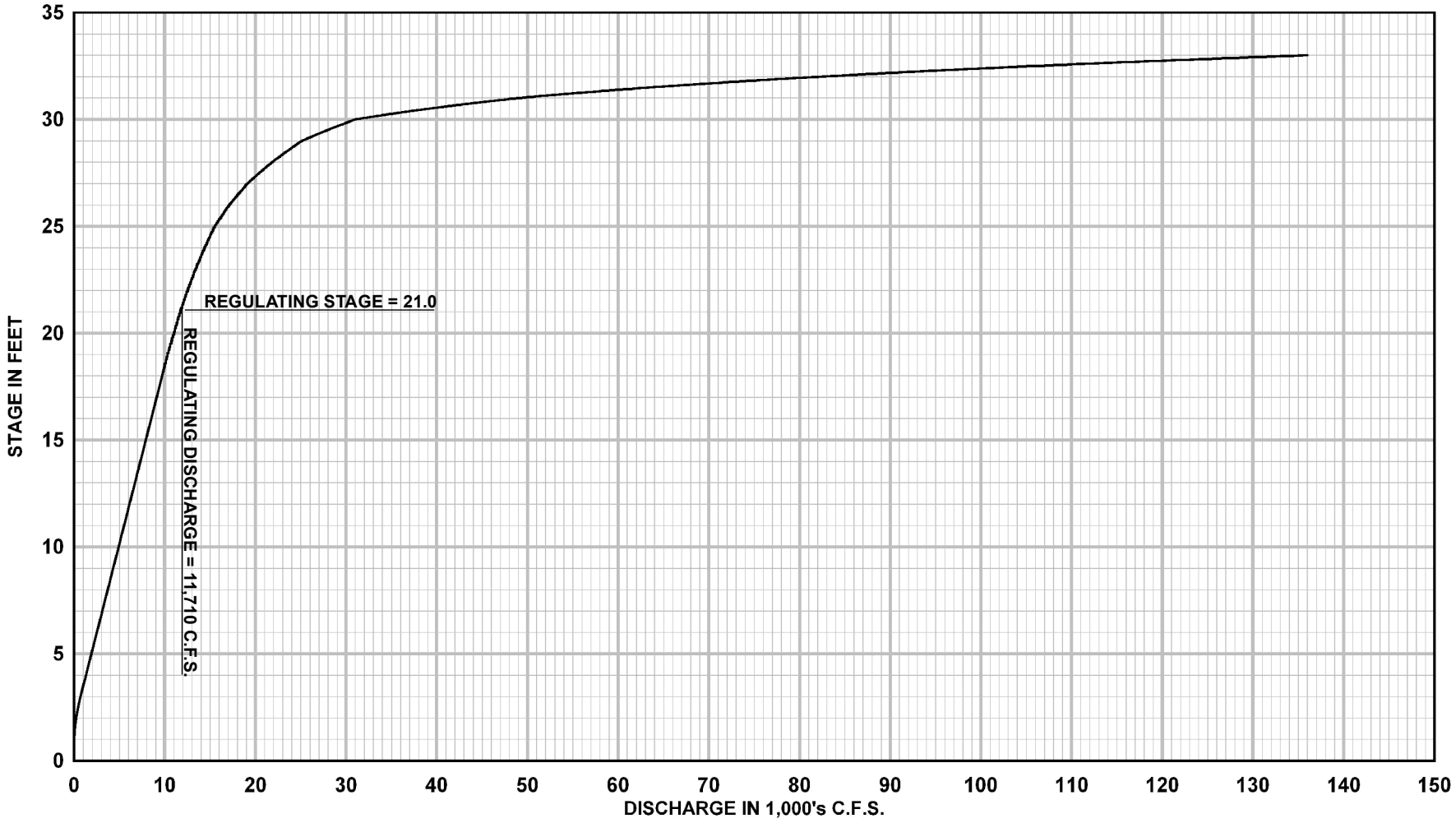
SKIATOOK LAKE

PEAK INFLOW PROBABILITY CURVE

(NATURAL CONDITIONS)

DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2011
DRAWN: RKB
CHECKED: JRL

PLATE 4 - 3



ARKANSAS RIVER WATERSHED HOMINY CREEK, OKLAHOMA

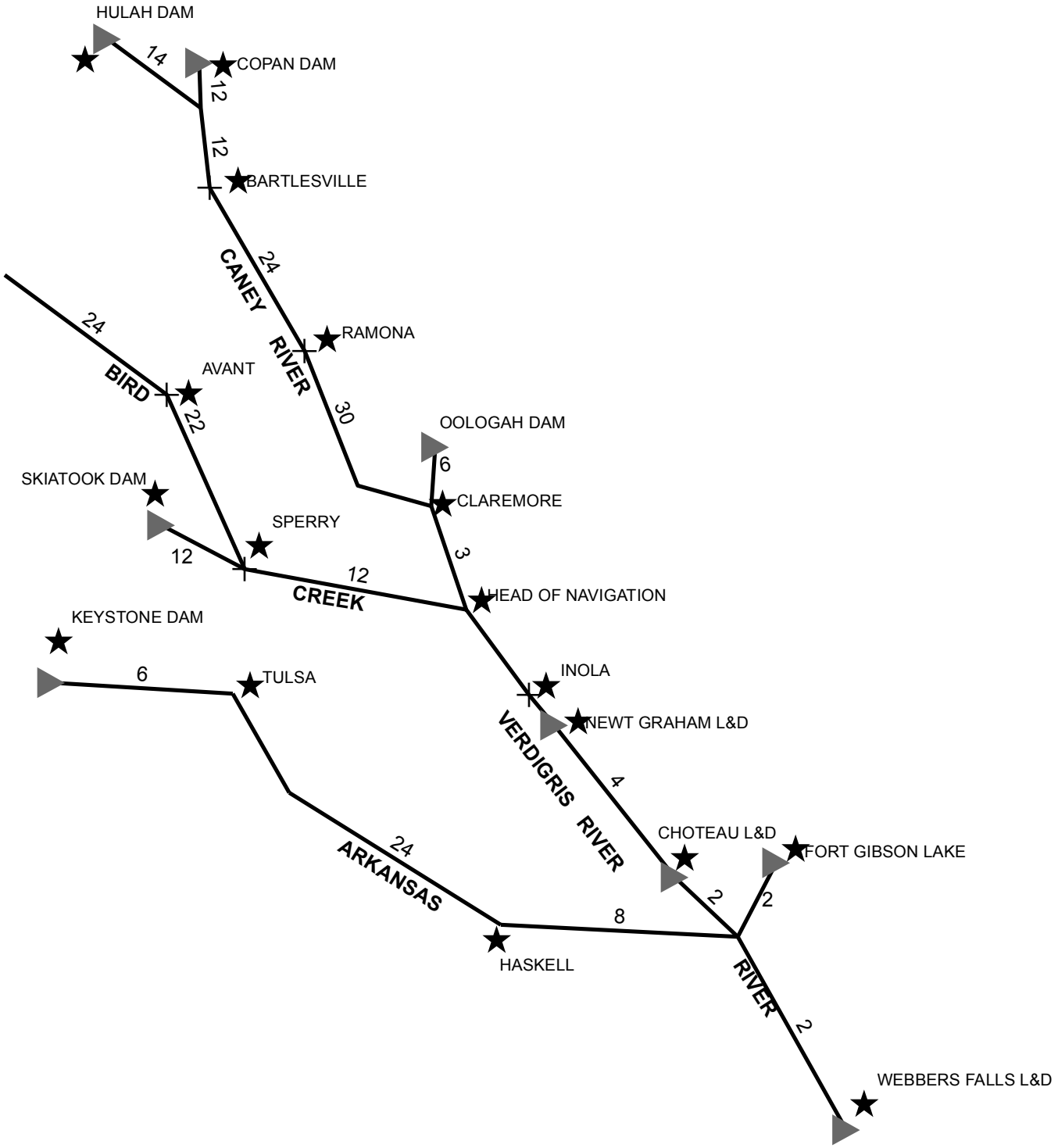
SKIATOOK LAKE

DISCHARGE RATING CURVE

SPERRY GAGE

DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENG NEERS 2011
DRAWN: RKB
CHECKED: JRL

PLATE 4 - 4



NOTES:

1. **TIME OF TRAVEL IN HOURS FOR LARGE RISES IS SHOWN BETWEEN STARS (*24*)**
2. **TIME SHOWN ABOVE UPSTRAM STATION IS AVERAGE TIME TO CREST AFTER BEGINNING OF RUNOFF.**

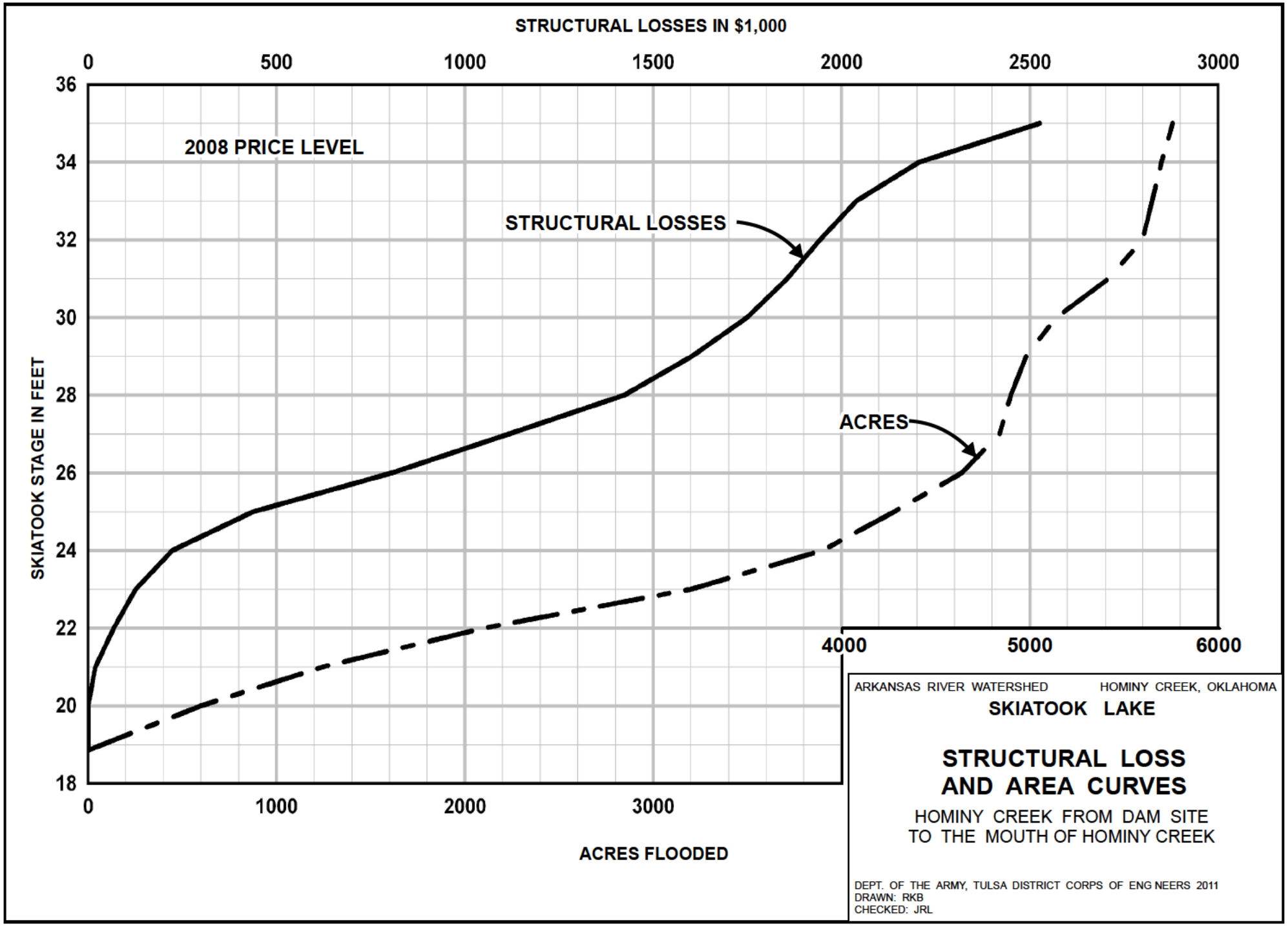
ARKANSAS RIVER WATERSHED HOMINY CREEK, OKLAHOMA

SKIATOOK LAKE

TIME OF CREST TRAVEL

DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENG NEERS 2011
DRAWN: RKB
CHECKED: JRL

PLATE 4 - 5



ARKANSAS RIVER WATERSHED HOMINY CREEK, OKLAHOMA

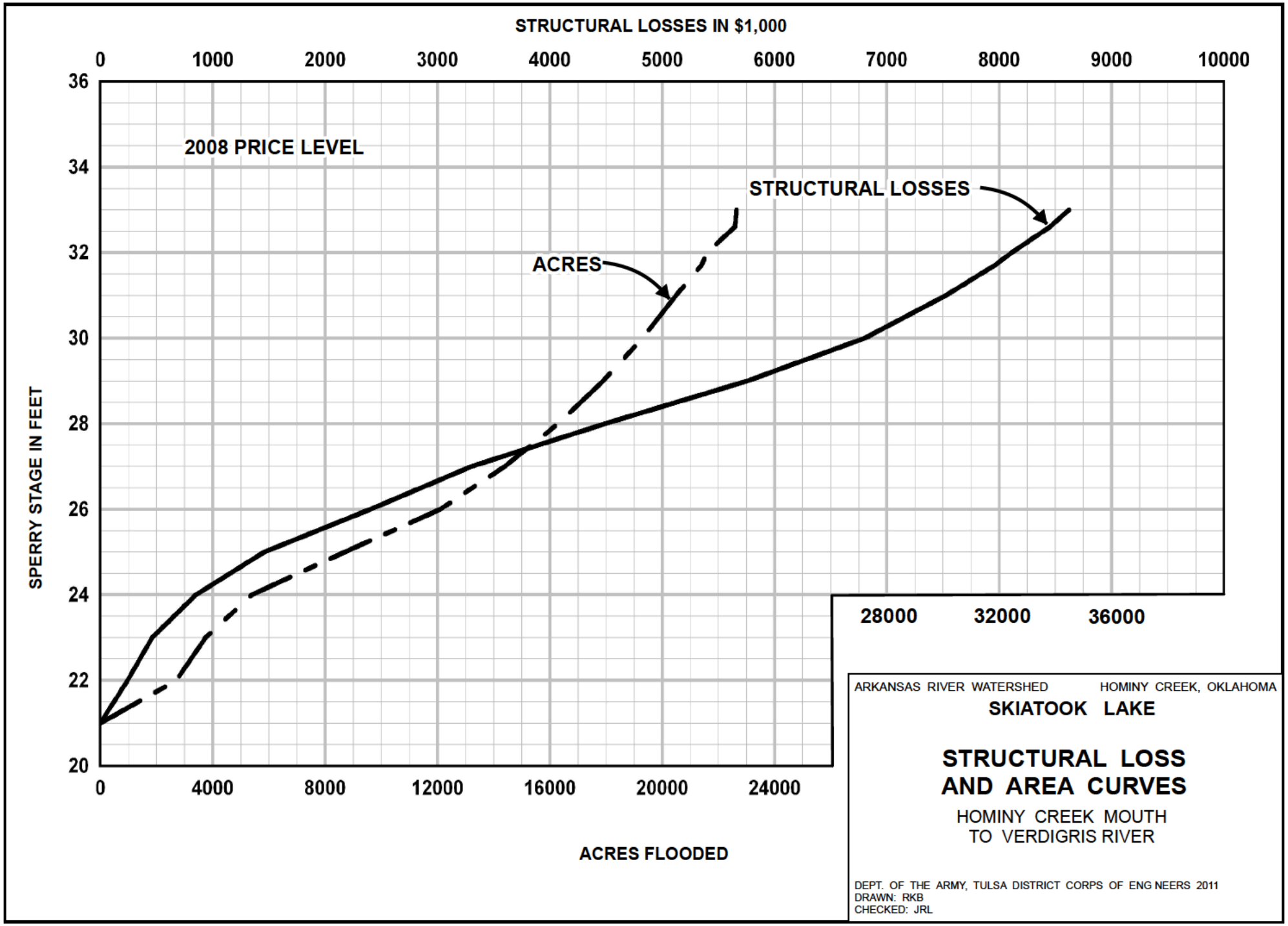
SKIATOOK LAKE

STRUCTURAL LOSS AND AREA CURVES

HOMINY CREEK FROM DAM SITE
TO THE MOUTH OF HOMINY CREEK

DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENG NEERS 2011
DRAWN: RKB
CHECKED: JRL

PLATE 4 - 6



ARKANSAS RIVER WATERSHED HOMINY CREEK, OKLAHOMA

SKIATOOK LAKE

STRUCTURAL LOSS AND AREA CURVES

HOMINY CREEK MOUTH
TO VERDIGRIS RIVER

DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2011
DRAWN: RKB
CHECKED: JRL

PLATE 4 - 7

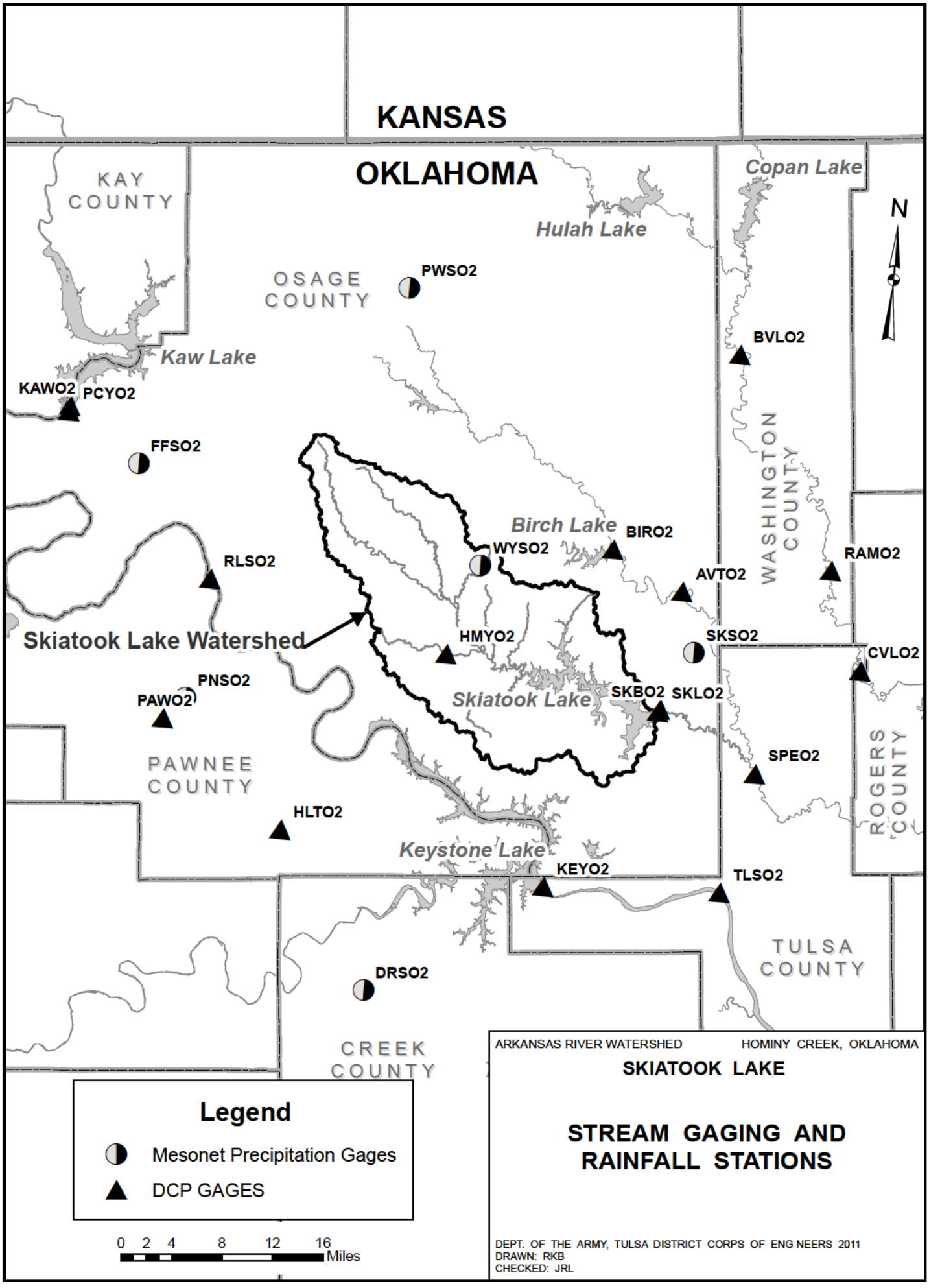
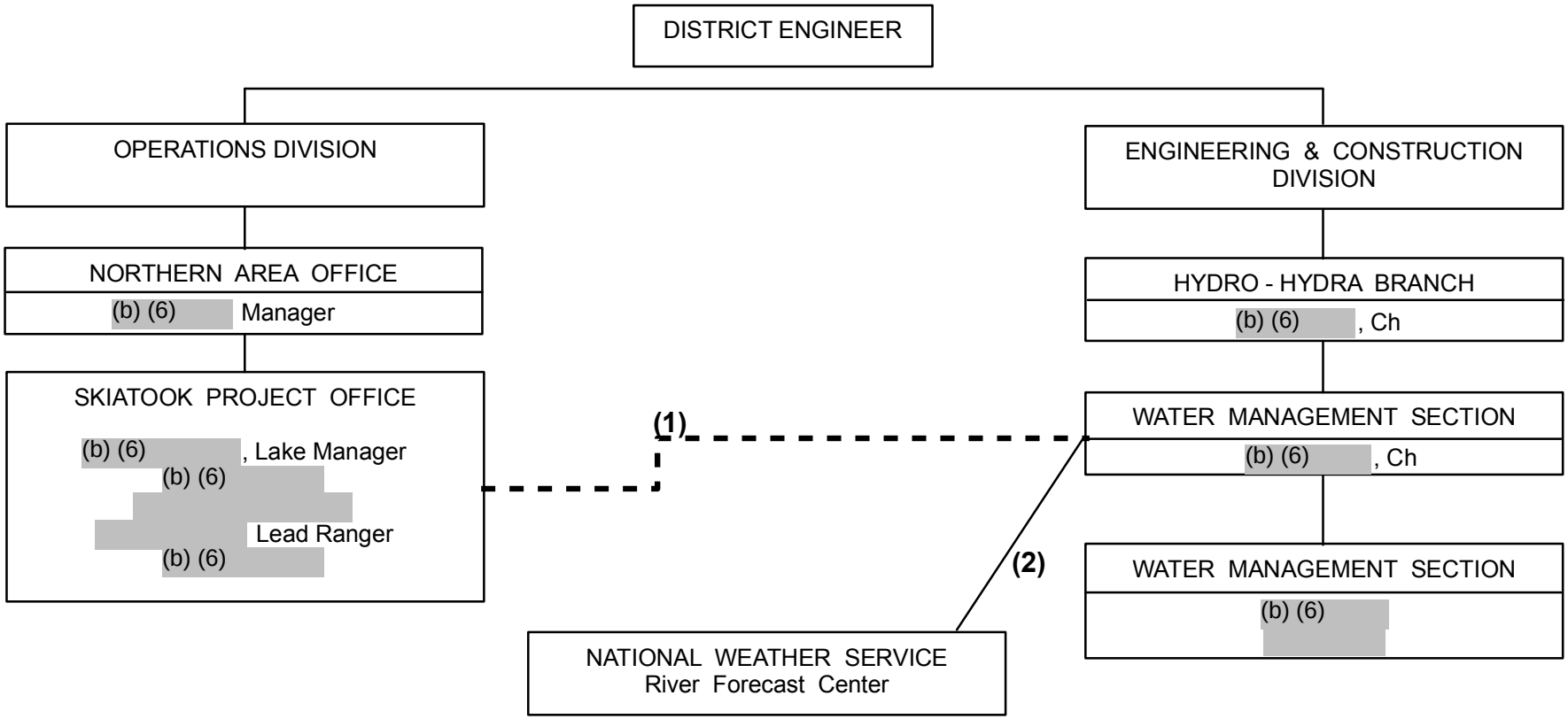

KANSAS
OKLAHOMA
KAY COUNTY
OSAGE COUNTY
WASHINGTON COUNTY
ROGERS COUNTY
PAWNEE COUNTY
CREEK COUNTY
TULSA COUNTY
Copan Lake
Hulah Lake
Kaw Lake
Birch Lake
Skiatook Lake
Keystone Lake
Skiatook Lake Watershed
N
PWSO2
BVLO2
KAWO2
PCYO2
FFSO2
BIRO2
WYSO2
RAMO2
AVTO2
RLSO2
HMYO2
SKSO2
CVLO2
PNSO2
PAWO2
SKBO2
SKLO2
SPEO2
HLTO2
KEYO2
TLSO2
DRSO2
Legend
Mesonet Precipitation Gages
DCP GAGES
0 2 4 8 12 16 Miles
ARKANSAS RIVER WATERSHED
HOMINY CREEK, OKLAHOMA
SKIATOOK LAKE
STREAM GAGING AND RAINFALL STATIONS
DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2011
DRAWN: RKB
CHECKED: JRL

PLATE 5 - 1

U.S. ARMY CORPS OF ENGINEERS
TULSA DISTRICT



1. DIRECT COMMUNICATIONS ARE MAINTAINED BETWEEN SKIATOOK PROJECT OFFICE AND THE WATER MANAGEMENT SECTION FOR TRANSMISSION OF RESERVOIR DATA, REGULATIONS AND INSTRUCTIONS.

2. PRECIPITATION AND STREAM GAGE DATA ARE SHARED BY THE NATIONAL WEATHER SERVICE, RIVER FORECAST CENTER.

ARKANSAS RIVER WATERSHED HOMINY CREEK, OKLAHOMA

SKIATOOK LAKE

ORGANIZATION FOR FLOOD CONTROL REGULATION

DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2011
DRAWN: RKB
CHECKED: JRL

PLATE 5 - 2

PROJECT **SKIA # 42** **LAKE DATA** **DATE :**

LINE #	ITEM		TIME									
1	POOL ELEVATION		12N									
2	POOL ELEVATION		4PM									
3	POOL ELEVATION		12M									
4	POOL ELEVATION		8AM									
5	TAILWATER ELEVATION		8AM									
6	24 HR AVG POWER DISCHARGE		12M									
7	24 HR AVG TOTAL DISCHARGE		12M									
8	NET POWER GENERATION		12M									
9	GEN#1 HRS OF USE		12M									
	GEN#2 HRS OF USE		12M									
	GEN#3 HRS OF USE		12M									
	GEN#4 HRS OF USE		12M									
10	INSTANTANEOUS POWER DISCHARGE		8AM									
11	INSTANTANEOUS TOTAL DISCHARGE		8AM									
12/13	LAKE	WEATHER	8AM									
14	TOTAL PRECEDING 6 HR PRECIPITATION ENDING AT		1PM									
			7PM									
			1AM									
			7AM									
15	TOTAL 24 HOUR PRECIPITATION		7AM									
16	COMMENTS ON PRECIP. DIST.											
17	EVAPORATION 24 HOURS		8AM									
18/19	WIND DIRECTION AND VELOCITY		8AM		B-		B-		B-		B-		B-		B-		B-
20	WATER SUPPLY											
21	GATE SETTINGS NO. TYPE AND OPENING		8AM									
22	GATE CHANGES	DATE TIME										
23	POOL ELEVATION											
24	FROM	GATE SETTING										
25	TO	GATE SETTING										
26	GATE CHANGES	DATE TIME										
27	POOL ELEVATION											
28	FROM	GATE SETTING										
29	TO	GATE SETTING										
30	GATE CHANGES	DATE TIME										
31	POOL EVEVATION											
32	FROM	GATE SETTING										
33	TO	GATE SETTING										

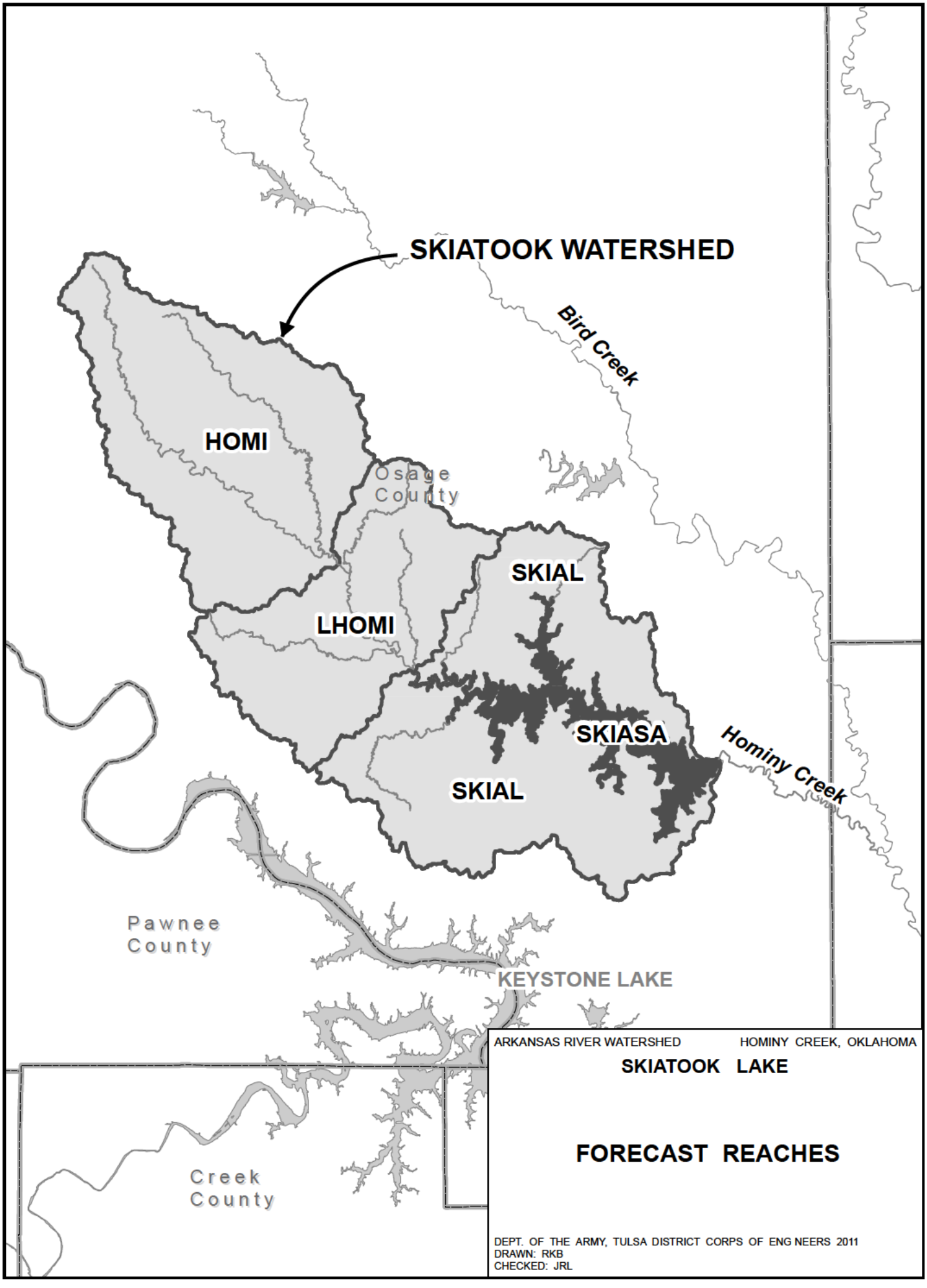
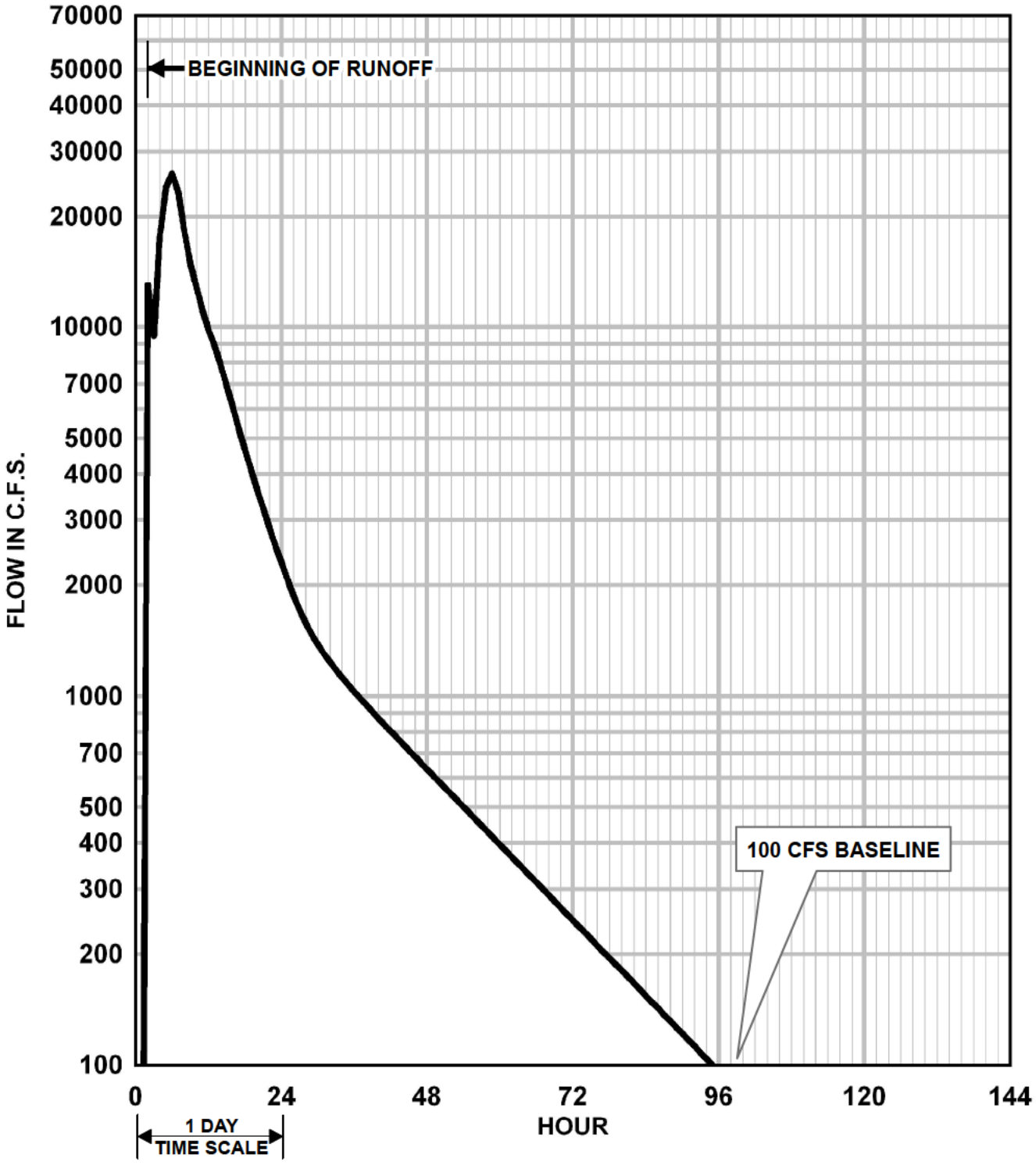

SKIATOOK WATERSHED
Bird Creek
HOMI
Osage
County
SKIAL
LHOMI
SKIASA
Hominy Creek
SKIAL
Pawnee
County
KEYSTONE LAKE
Creek
County
ARKANSAS RIVER WATERSHED
HOMINY CREEK, OKLAHOMA
SKIATOOK LAKE
FORECAST REACHES
DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2011
DRAWN: RKB
CHECKED: JRL

PLATE 6 - 1



DRAINAGE AREA = 354 SQ. MI.
1" RUNOFF = 18,880 AC. FT.
PEAK FLOW = 26,175 C.F.S.

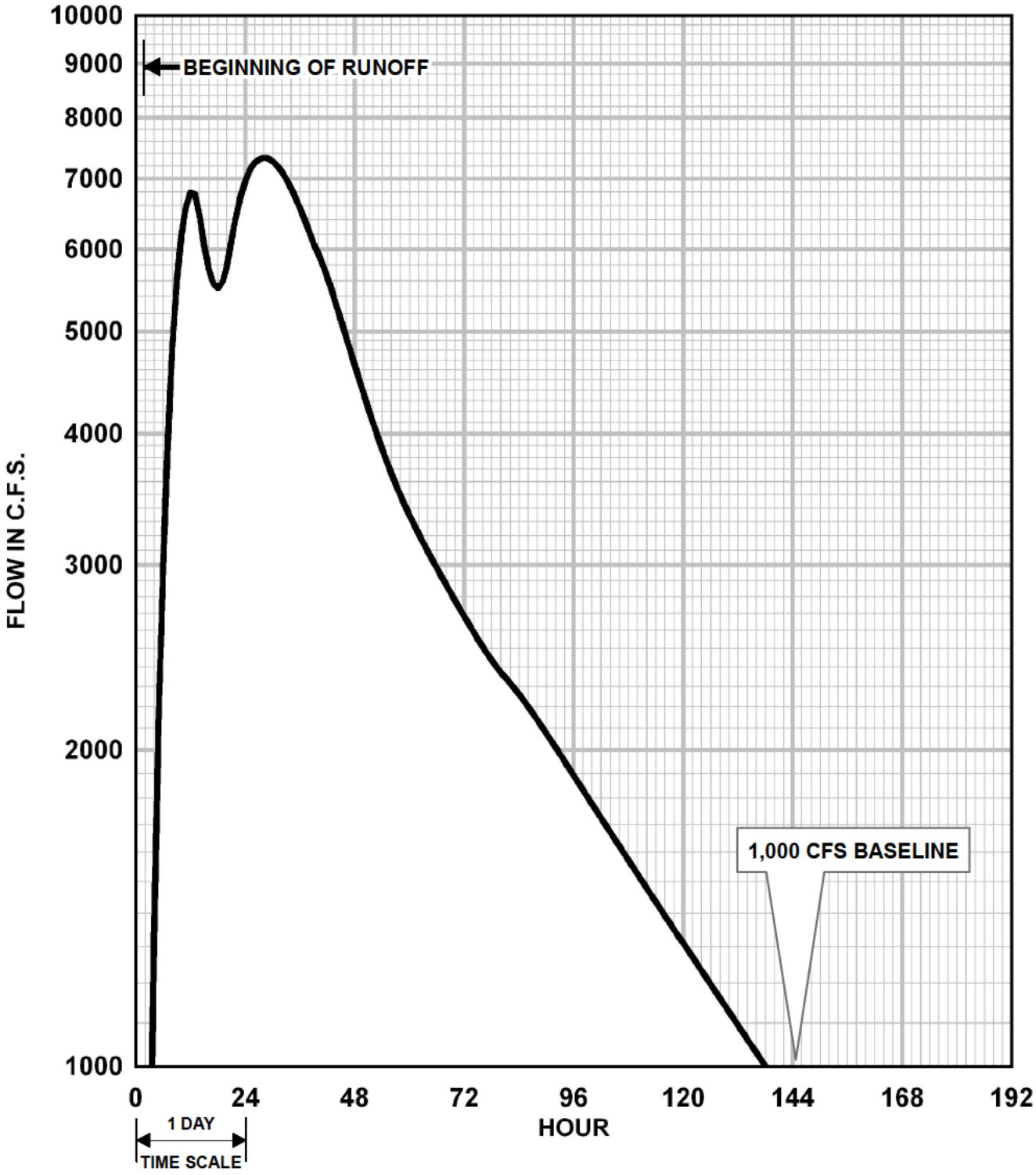
ARKANSAS RIVER WATERSHED HOMINY CREEK, OKLAHOMA

SKIATOOK LAKE

UNIT HYDROGRAPH FOR AREA ABOVE SKIATOOK DAM

DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2011
DRAWN: RKB
CHECKED: JRL

PLATE 6 - 2



DRAINAGE AREA = 551 SQ. MI.
1" RUNOFF = 29,390 AC. FT.
PEAK FLOW = 7,325 C.F.S.

ARKANSAS RIVER WATERSHED — HOMINY CREEK, OKLAHOMA

SKIATOOK LAKE

UNIT HYDROGRAPH FOR AREA BELOW SKIATOOK DAM AND ABOVE SPERRY

DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2011
DRAWN: RKB
CHECKED: JRL

PLATE 6 - 3

SWD Form 156
25 Nov 52

Page _____ of _____

SKIATOOK RESERVOIR

DISCHARGE AND INFLOW COMPUTATION

Computed by _____ Date _____ Checked by _____ Date _____ Book No. _____

Date	Time	Pool Elevation	Storage (1000's A.F.)	Δ Storage (1000's A.F.)	Δ Storage c.f.s.	Gates Operating No. & Type	Gates Operating Opening	Discharge in c.f.s. Instantaneous Flood Control	Instantaneous Power	Instantaneous Total	Average Flood Control	Average Power	Average Evap.	Average Total	Inflow
May													.10		
3	M	716.12	353.9			2CG	2.0'	1070					42		
4	8A	716.45	357.7	8/3.8	8/5700	2CG	2.0'	1070			8/1070			8/1070	8/6770
	10A	716.55				2CG	2.0'	1070							
	10A	.55	358.8	2/1.1	2/6600	2CG	3.0'	1600			2/1070			2/1070	2/7670
	N	716.62													
	4P	716.76											.10		
	M	717.05	364.3	24/10.4	24/5200	2CG	3.0'	1600			24/1379		42	24/1421	24/6621
5	8A	717.08													
	N	717.09													
	4P	717.10											.10		
	M	717.12	365.1	24/0.8	24/400	2CG	3.0'	1600			24/1600		42	24/1642	24/2042
6	8A	717.08	364.7	8/-0.4	8/-600	2CG	3.0'	1600			8/1600			8/1600	8/1000
				(1)	(2)	(3)		(4)			(5)		(6)		(7)

(1) RESERVOIR CAPACITY TABLE.

(2) SUBTRACT STORAGE AT BEGINNING OF PERIOD FROM STORAGE AT END OF PERIOD. IF POOL IS RISING, CHANGE IN STORAGE IS POSITIVE (+), IF FALLING NEGATIVE (-).

(3) CHANGE IN STORAGE (A.F.) x 12 / NO. OF HOURS IN PERIOD = CHANGE IN STORAGE IN C.F.S.

(4) FROM DISCHARGE RATING CURVES.

(5) AVERAGE DISCHARGE DURING PERIOD.

(6) PAN EVAPORATION APPLIED TO EVAPORATION CURVES.

(7) INFLOW = CHANGE IN STORAGE (C.F.S) + AVERAGE DISCHARGE + EVAPORATION.

NOTE DURING FLOOD PERIODS EVAPORATIONS IF USUALLY NEGLECTED IN PRELIMINARY INFLOW CALCULATIONS.
NUMBER OF HOURS FOR THE INFLOW PERIOD IS INDICATED BY 4/

ARKANSAS RIVER WATERSHED HOMINY CREEK, OKLAHOMA

SKIATOOK LAKE

SAMPLE INFLOW COMPUTATION

DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2011
DRAWN: RKB
CHECKED: JRL

PLATE 6 - 4

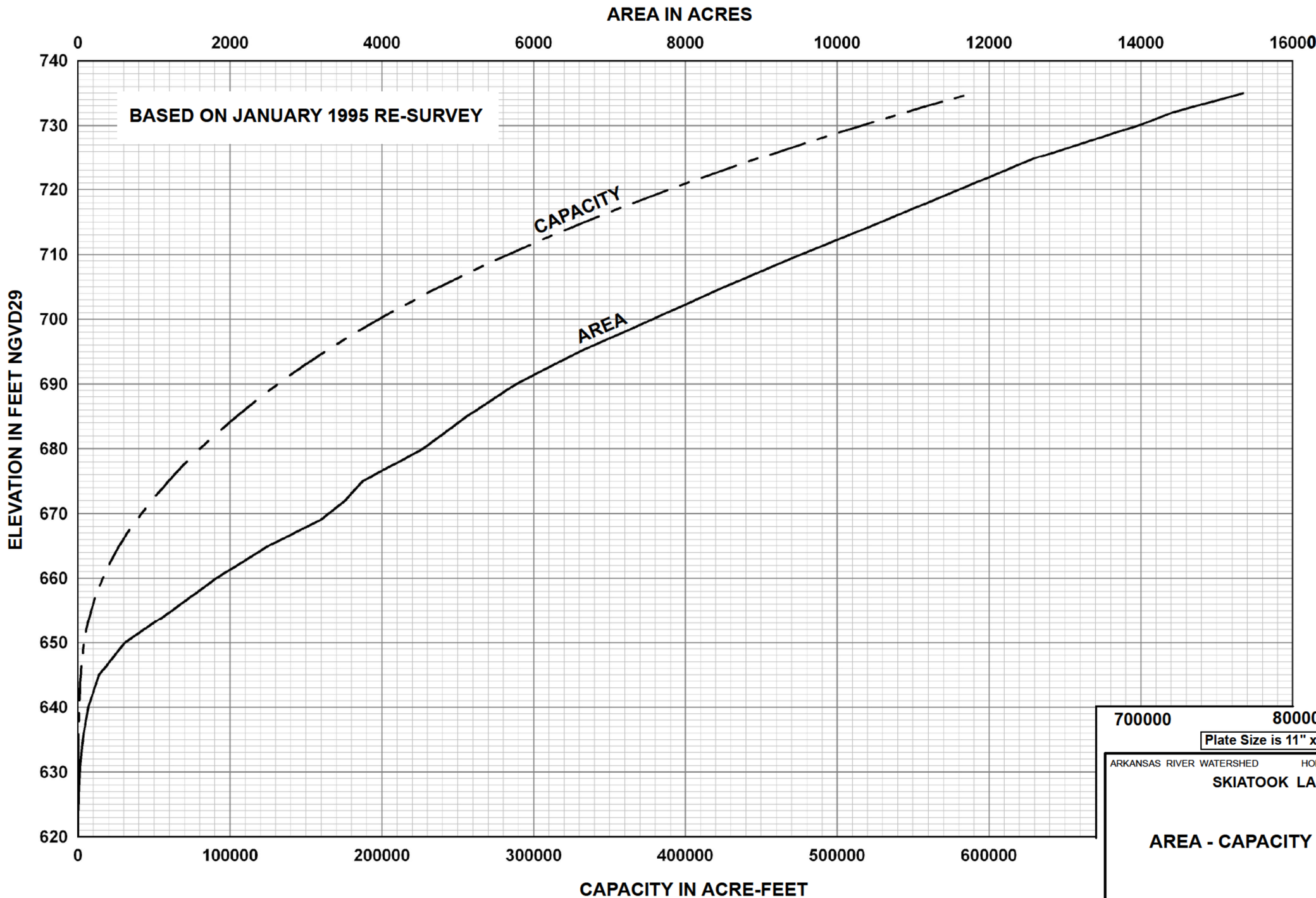


Plate Size is 11" x 17"

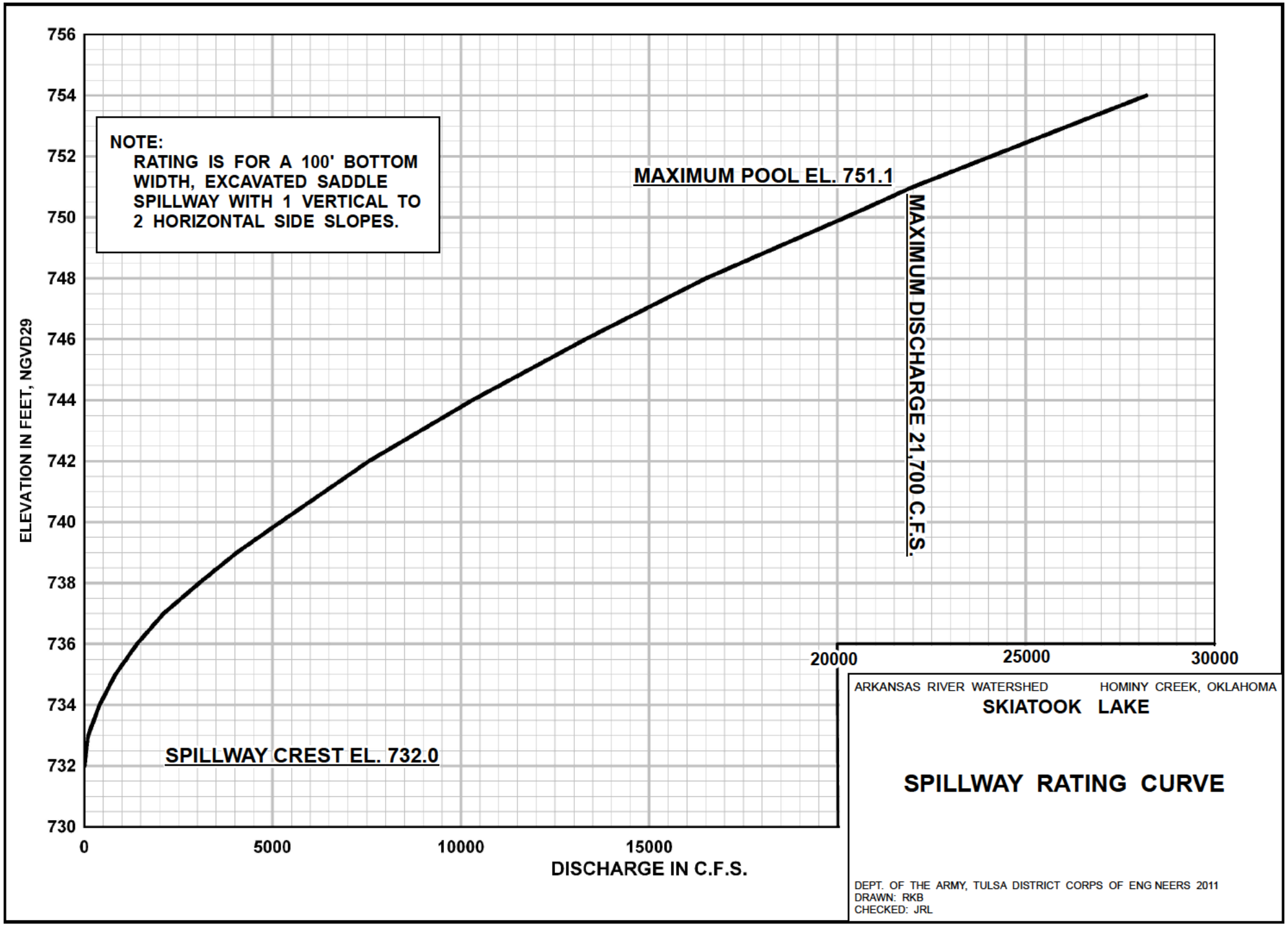
ARKANSAS RIVER WATERSHED HOMINY CREEK, OKLAHOMA

SKIATOOK LAKE

AREA - CAPACITY CURVES

DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2011
DRAWN: RKB
CHECKED: JRL

PLATE 7-1



ARKANSAS RIVER WATERSHED HOMINY CREEK, OKLAHOMA

SKIATOOK LAKE

SPILLWAY RATING CURVE

DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENG NEERS 2011
DRAWN: RKB
CHECKED: JRL

PLATE 7 - 2

GATE OPENING IN FEET

0.5' 1.0' 2.0' 3.0' 4.0' 5.0' 6.0' 7.0'

TOP OF FLOOD CONTROL
POOL ELEV. 729.0

TOP OF CONSERVATION
POOL ELEV. 714.0

GATE FULLY OPEN

TOP OF INACTIVE POOL ELEV. 657.0

INTRANCE INVERT ELEV. 620.0

ELEVATION IN FEET, NGVD29

760 750 740 730 720 710 700 690 680 670 660 650 640 630 620

0 200 400 600 800 1000 1200 1400 1600 1800 2000 2200 2400

DISCHARGE IN C.F.S.

Plate Size is 11" x 17"

ARKANSAS RIVER WATERSHED HOMINY CREEK, OKLAHOMA

SKIATOOK LAKE

CONDUIT RATING CURVES

PARTIAL GATE OPENING
1 - (4.67 X 10.5) GATE

DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2011
DRAWN: RKB
CHECKED: JRL

PLATE 7 - 3

GATE OPENING IN FEET

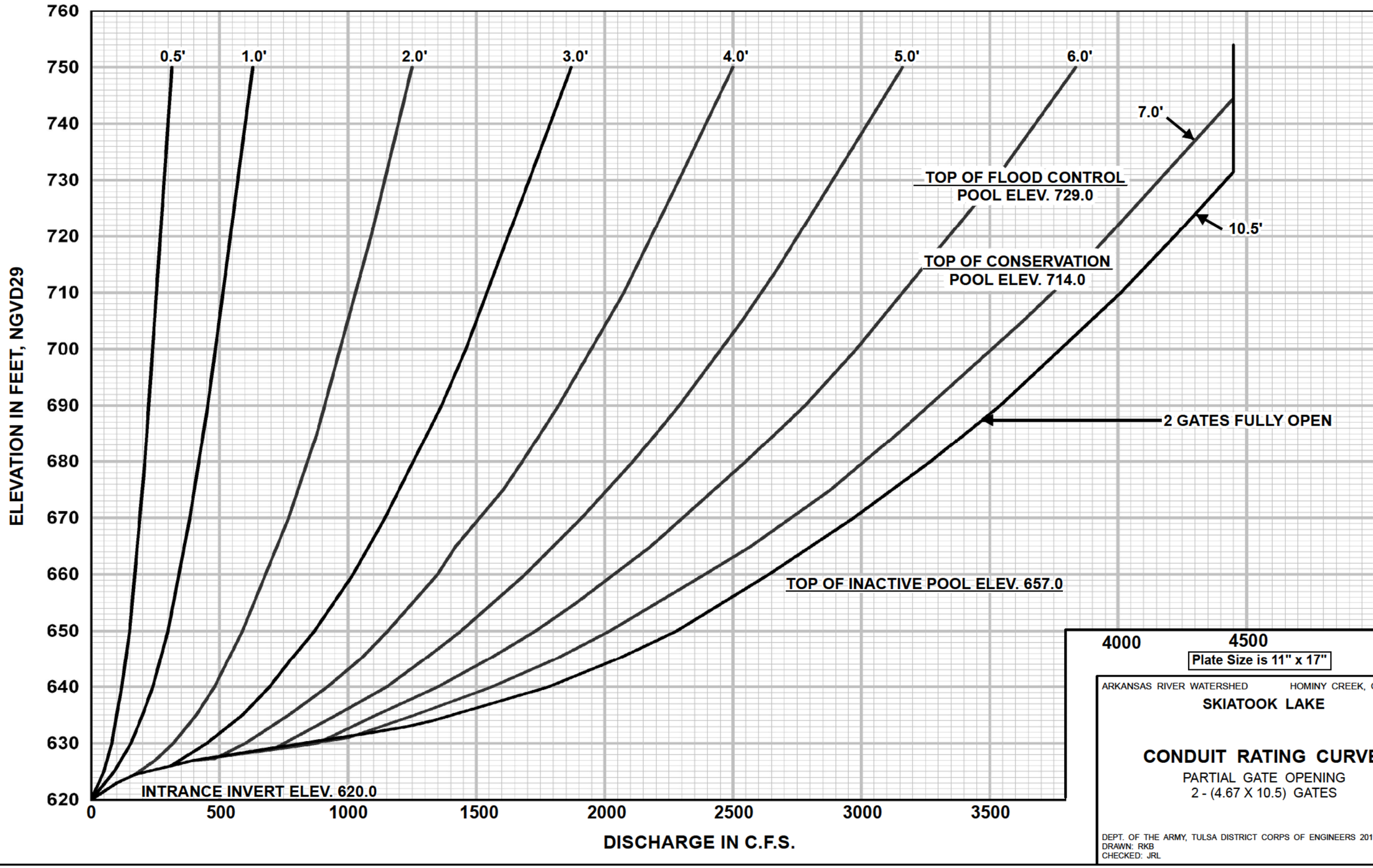


Plate Size is 11" x 17"

ARKANSAS RIVER WATERSHED HOMINY CREEK, OKLAHOMA

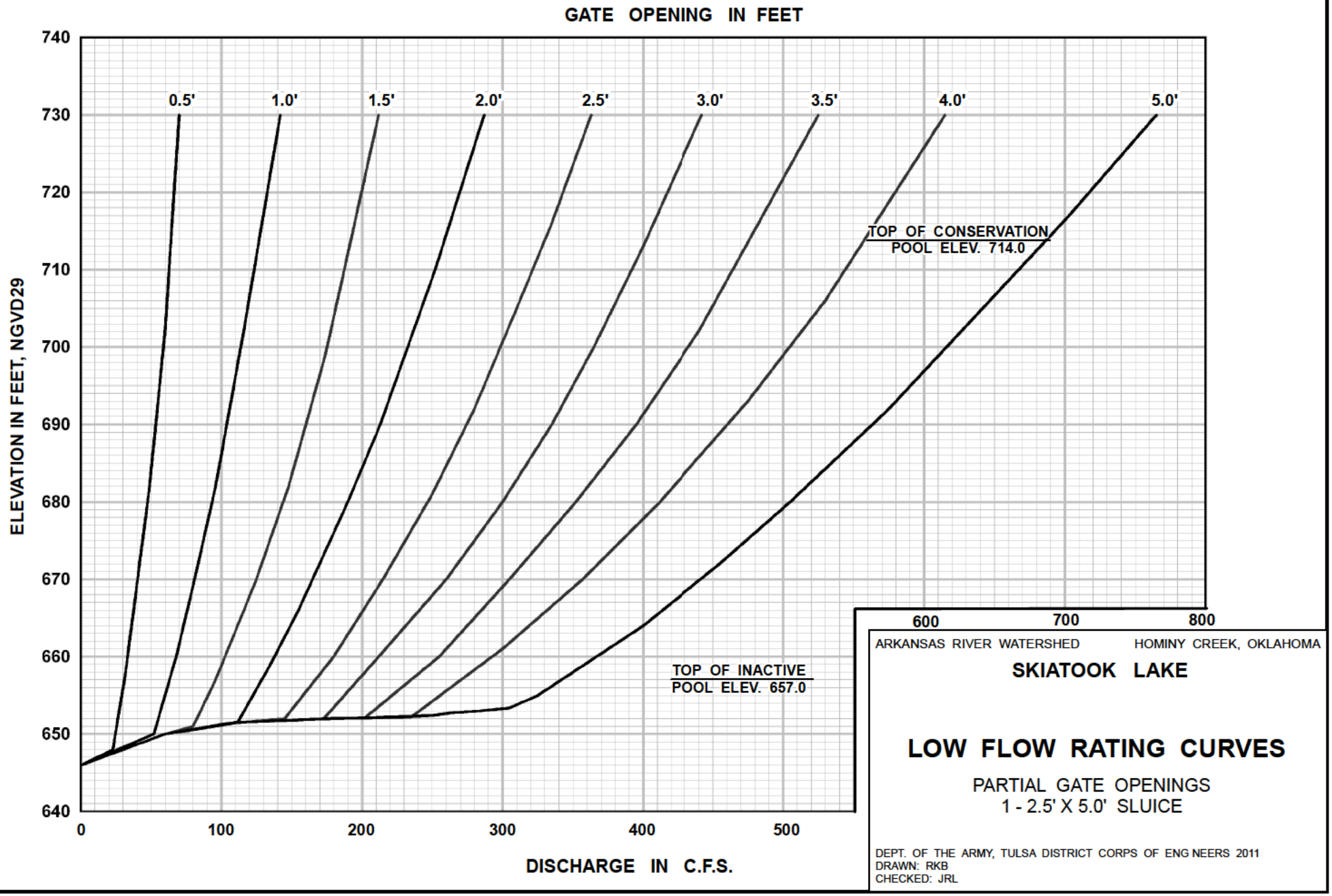
SKIATOOK LAKE

CONDUIT RATING CURVES

PARTIAL GATE OPENING
2 - (4.67 X 10.5) GATES

DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2011
DRAWN: RKB
CHECKED: JRL

PLATE 7 - 4



ARKANSAS RIVER WATERSHED HOMINY CREEK, OKLAHOMA

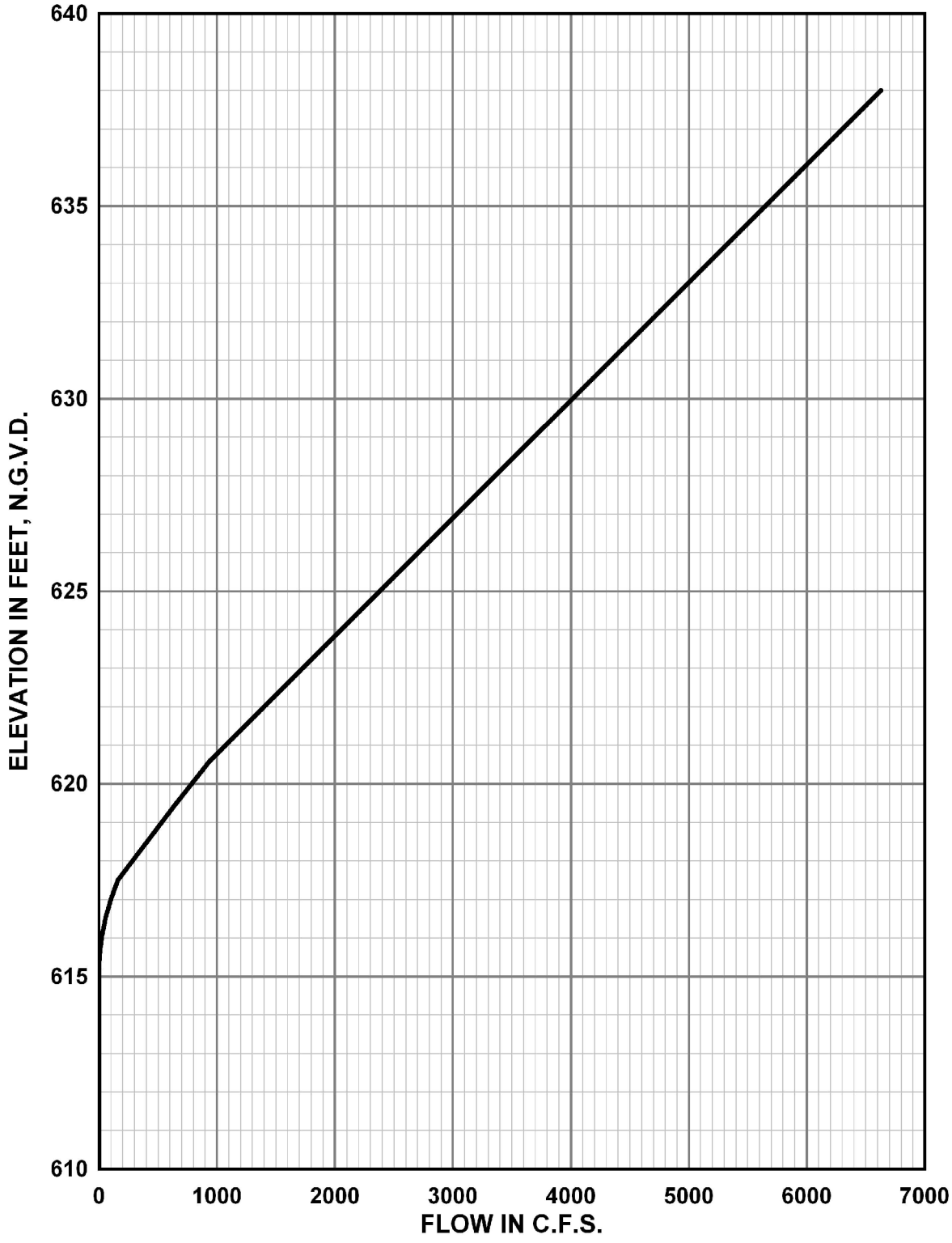
SKIATOOK LAKE

LOW FLOW RATING CURVES

PARTIAL GATE OPENINGS
1 - 2.5' X 5.0' SLUICE

DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENG NEERS 2011
DRAWN: RKB
CHECKED: JRL

PLATE 7 - 5



ARKANSAS RIVER WATERSHED HOMINY CREEK, OKLAHOMA

SKIATOOK LAKE

TAILWATER RATING CURVE

DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2011
DRAWN: RKB
CHECKED: JRL

PLATE 7 - 6

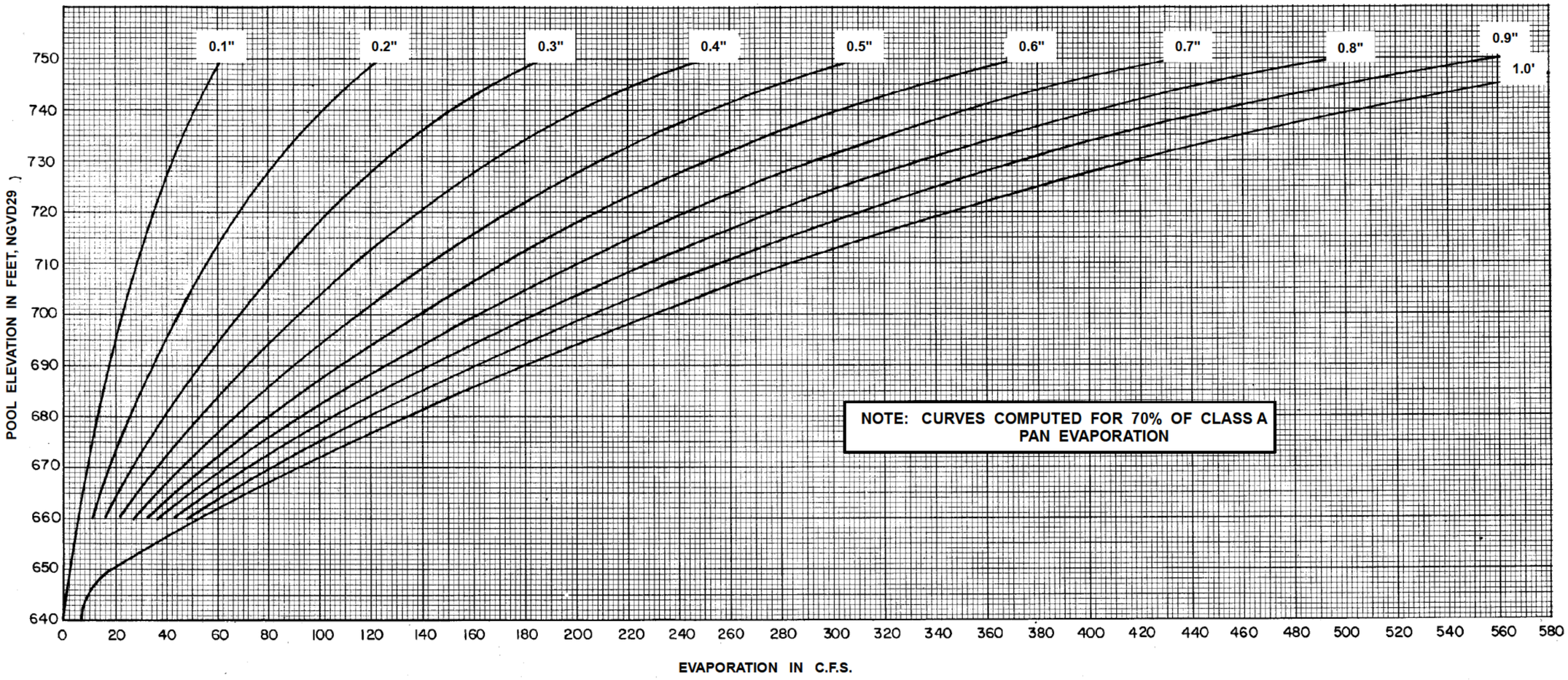


Plate Size is 11" x 17"

ARKANSAS RIVER WATERSHED HOMINY CREEK, OKLAHOMA

SKIATOOK LAKE

EVAPORATION CURVES

DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2011
DRAWN: RKB
CHECKED: JRL

PLATE 7 - 7

WATER SUPPLY STORAGE ACCOUNTING
SKIATOOK LAKE

**CONSERVATION STORAGE	311,780 A.F.
CONTRACTED STORAGE USER NO. 1	2,000 A.F.
CONTRACTED STORAGE USER NO. 2	13,490 A.F.
CONTRACTED STORAGE USER NO. 3	17,990 A.F.
CONTRACTED STORAGE USER NO. 4	4,761 A.F.
CONTRACTED STORAGE USER NO. 5	233,000 A.F.
CONTRACTED STORAGE USER NO. 6	16,120 A.F.
NOT UNDER AGREEMENT	24,659 A.F.

MONTH	USER	BEGINNING STORAGE A.F.	INFLOW SHARE A.F.	TOTAL LOSSES A.F.	WITH-DRAWN A.F.	ENDING STORAGE A.F.
JAN	LAKE	311,780	0	2,410	23,350	286,020
	1	2,000	0	15	180	1,805
	2	13,490	0	104	360	13,026
	3	17,990	0	139	1,000	16,851
	4	4,761	0	37	500	4,224
	5	233,000	0	1,799	20,950	210,251
	6	16,120	0	124	360	15,636
	NUA	24,419	0	192	0	24,227
FEB	LAKE	286,020	0	2,510	10,950	272,560
	1	1,805	0	16	90	1,699
	2	13,026	0	113	360	12,553
	3	16,851	0	147	500	16,204
	4	4,224	0	37	0	4,187
	5	210,251	0	1,832	10,000	198,419
	6	15,636	0	137	0	15,499
	NUA	24,227	0	228	0	23,999
MAR	LAKE	272,560	430	1,740	4,640	266,610
	1	1,699	3	11	0	1,691
	2	12,553	21	83	500	11,991
	3	16,204	27	107	500	15,624
	4	4,187	7	28	140	4,026
	5	198,419	324	1,236	3,000	194,507
	6	15,499	26	103	0	15,422
	NUA	23,999	22	172	500	23,349
APR	LAKE	266,610	60,090	500	14,420	311,780
	1	1,691	394	3	82	2,000
	2	11,991	2,885	24	1,362	13,490
	3	15,624	3670	31	1,273	17,990
	4	4,026	970	8	227	4,761
	5	194,507	42,487	377	3,617	233,000
	6	15,422	3,590	30	2,343	16,639
	NUA	23,349	6,094	27	4,997	24,419

*** *USERS ARE EXAMPLE ONLY**

SKIATOOK LAKE
Top of Inactive Pool 657.0 NGVD
Inactive Storage 320 Ac. - Ft.
Top of Cons. Pool 714.0 NGVD
Cons. Storage 311,780 Ac. - Ft.

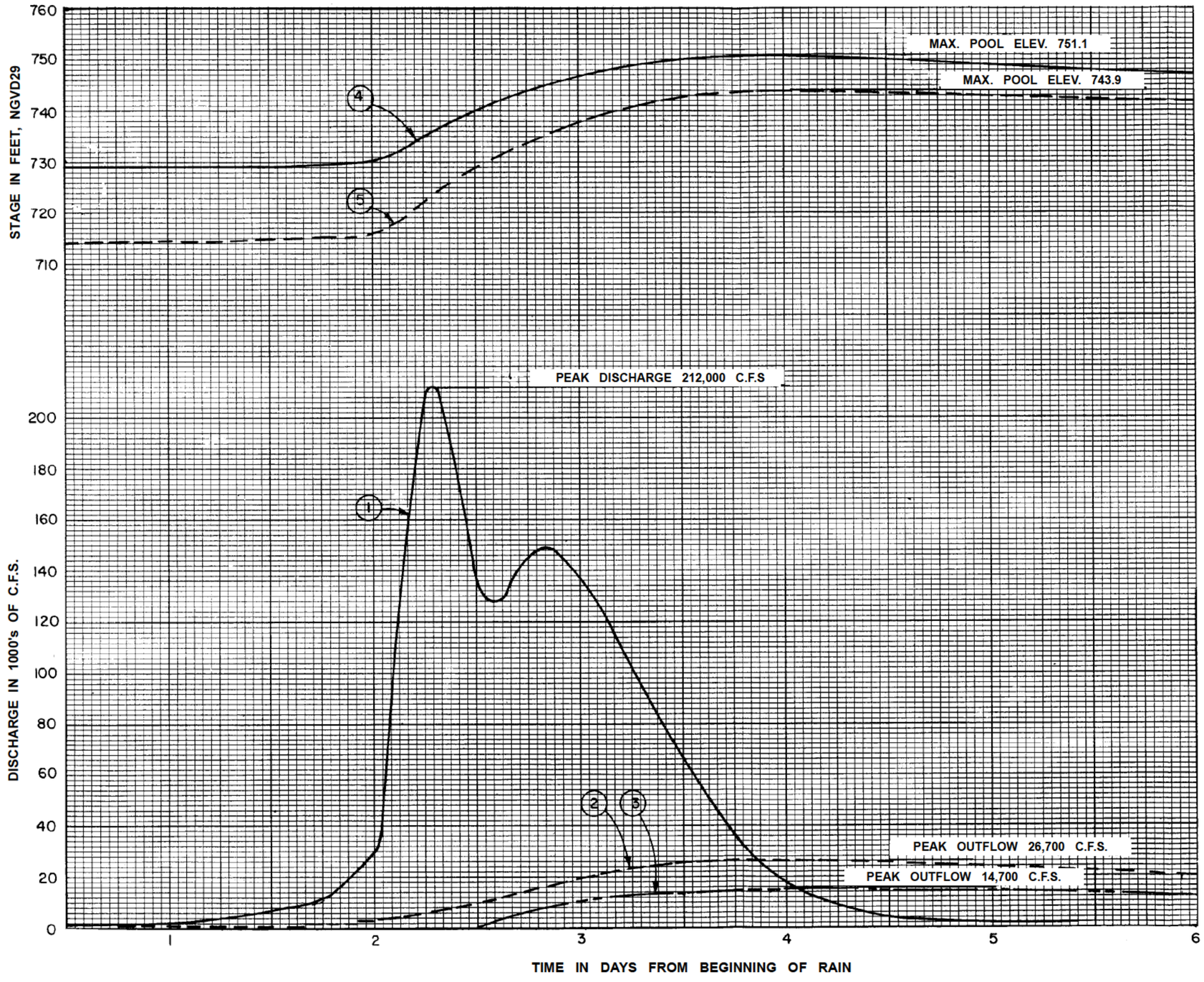
ARKANSAS RIVER WATERSHED — HOMINY CREEK, OKLAHOMA

SKIATOOK LAKE

EXAMPLE WATER SUPPLY STORAGE ACCOUNTING

DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2011
DRAWN: RKB
CHECKED: JRL

PLATE 7 - 8



NOTES:

THE TOP OF FLOOD CONTROL POOL ROUTING; THE FLOOD POOL WOULD HAVE EMPTIED IN APPROXIMATELY 46 DAYS FROM BEGINNING OF RAIN.

THE TOP OF CONSERVATION POOL ROUTING; THE FLOOD POOL WOULD HAVE EMPTIED IN APPROXIMATELY 42 DAYS FROM BEGINNING OF RAIN.

NOTES: EMERGENCY OPERATIONS

1. **INFLOW HYDROGRAPH**
2. **OUTFLOW - FLOOD ON FULL POOL**
3. **OUTFLOW - FLOOD ON EMPTY POOL**
4. **POOL STAGE - FLOOD ON FULL POOL**
5. **POOL STAGE - FLOOD ON EMPTY POOL**

Plate Size is 11" x 17"

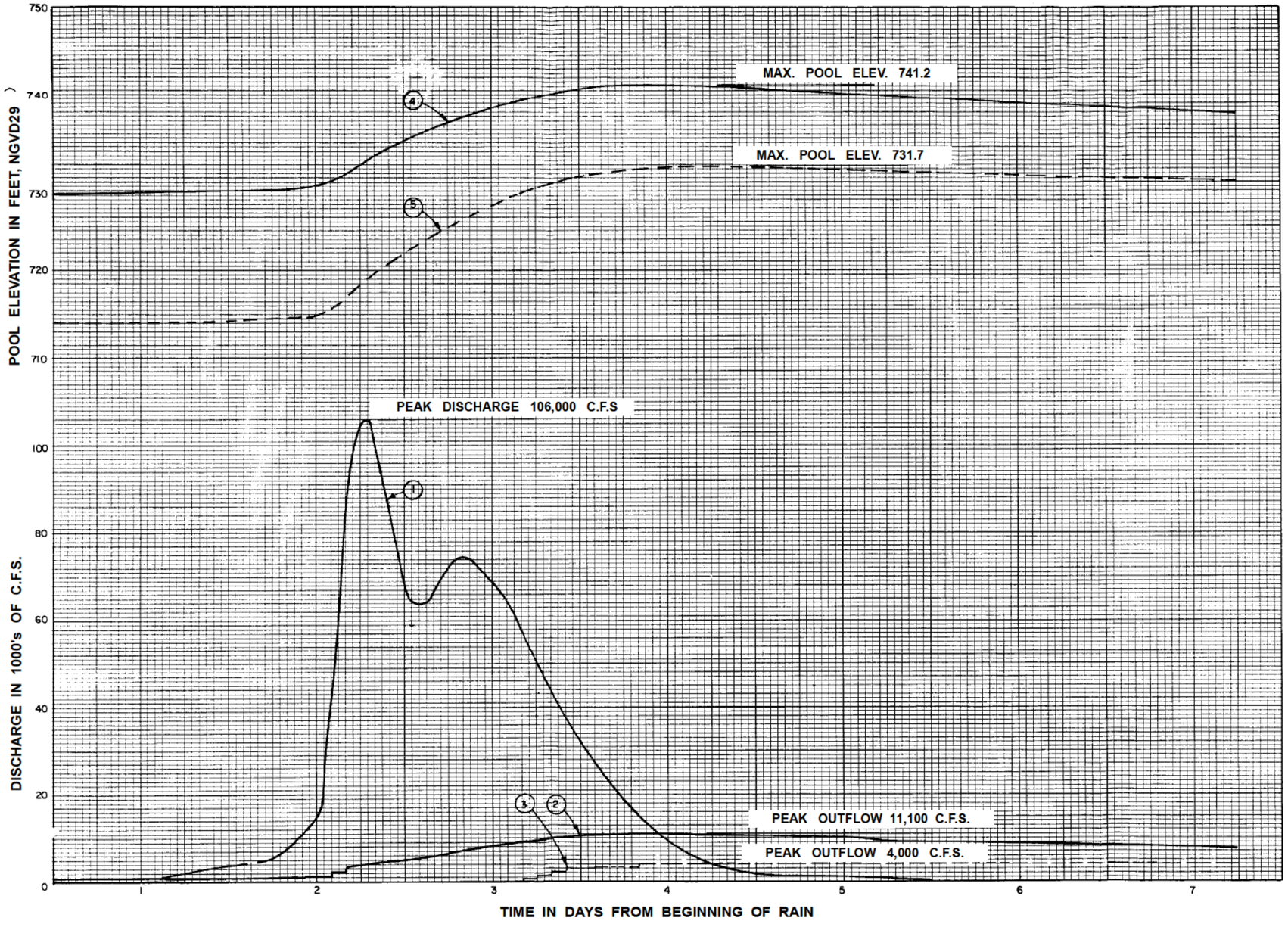
ARKANSAS RIVER WATERSHED HOMINY CREEK, OKLAHOMA

SKIATOOK LAKE

OPERATIONAL HYDROGRAPHS SPILLWAY DESIGN FLOOD

DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2011
DRAWN: RKB
CHECKED: JRL

PLATE 8 - 1



NOTES:
THE TOP OF FLOOD CONTROL POOL ROUTING; THE FLOOD POOL WOULD HAVE EMPTIED IN APPROXIMATELY 34 DAYS FROM BEGINNING OF RAIN.

THE TOP OF CONSERVATION POOL ROUTING; THE FLOOD POOL WOULD HAVE EMPTIED IN APPROXIMATELY 32 DAYS FROM BEGINNING OF RAIN.

NOTES: EMERGENCY OPERATIONS

1. **INFLOW HYDROGRAPH**
2. **OUTFLOW - FLOOD ON FULL POOL**
3. **OUTFLOW - FLOOD ON EMPTY POOL**
4. **POOL STAGE - FLOOD ON FULL POOL**
5. **POOL STAGE - FLOOD ON EMPTY POOL**

Plate Size is 11" x 17"

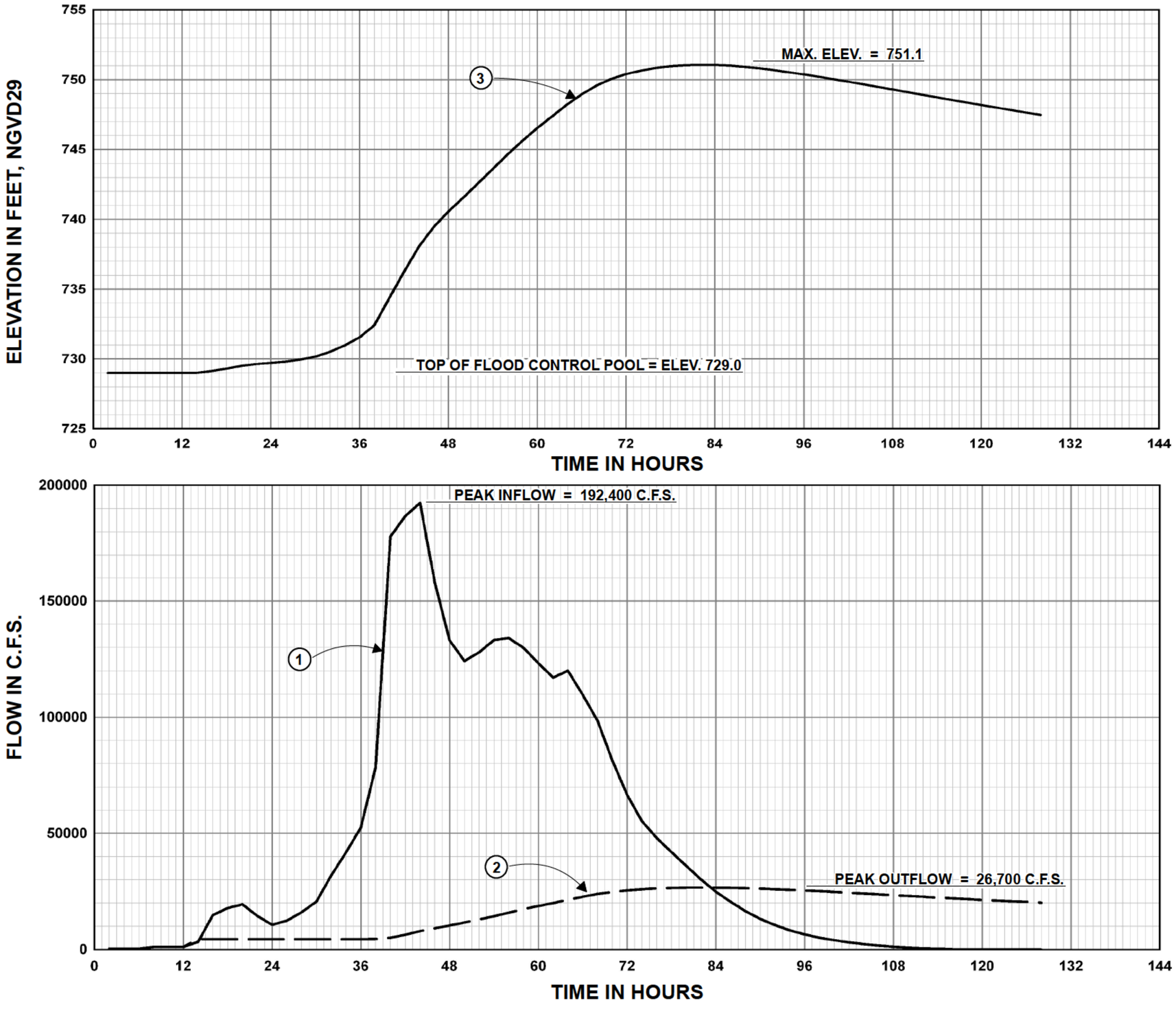
ARKANSAS RIVER WATERSHED HOMINY CREEK, OKLAHOMA

SKIATOOK LAKE

OPERATIONAL HYDROGRAPHS STANDARD PROJECT FLOOD

DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2011
DRAWN: RKB
CHECKED: JRL

PLATE 8 - 2



NOTE: EMERGENCY OPERATIONS

PMF DEVELOPED IN 1980 FROM HMR No. 51

DATA FOR FLOOD AND OUTFLOW ON EMPTY POOL ARE UNAVAILABLE

① INFLOW HYDROGRAPH
② OUTFLOW - FLOOD ON FULL POOL
③ POOL STAGE - FLOOD ON FULL POOL

Plate Size is 11" x 17"

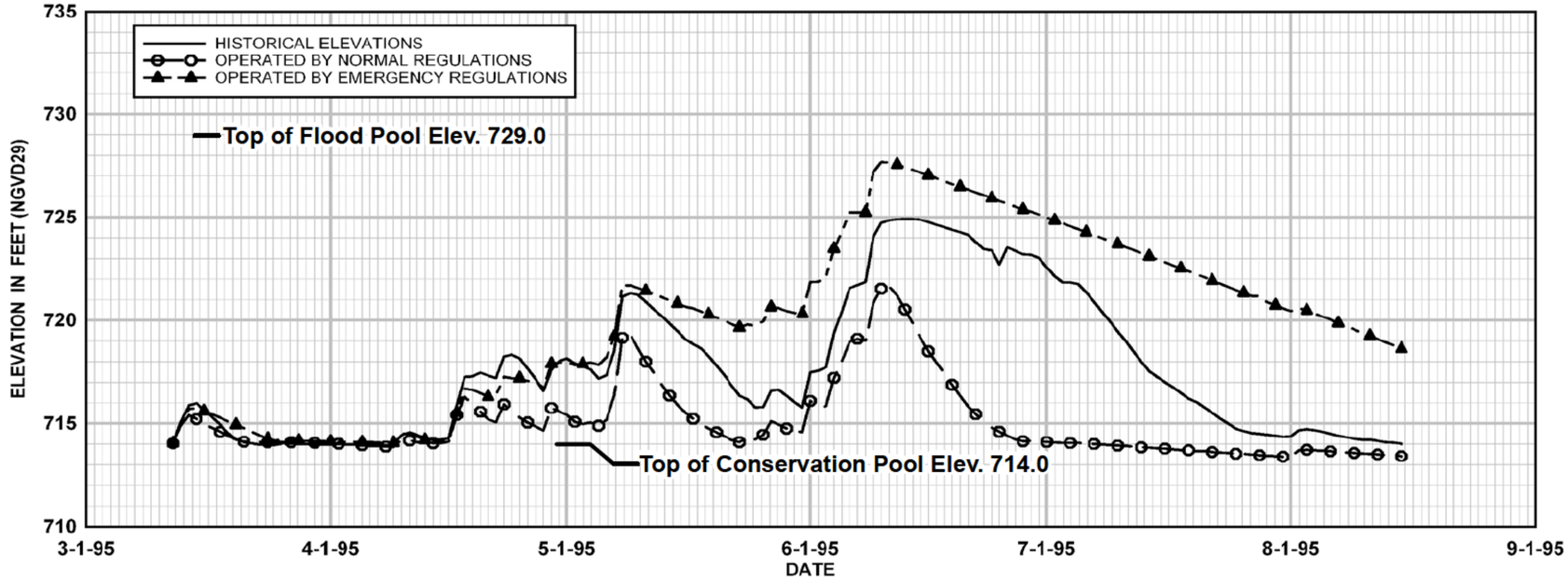
ARKANSAS RIVER WATERSHED HOMINY CREEK, OKLAHOMA

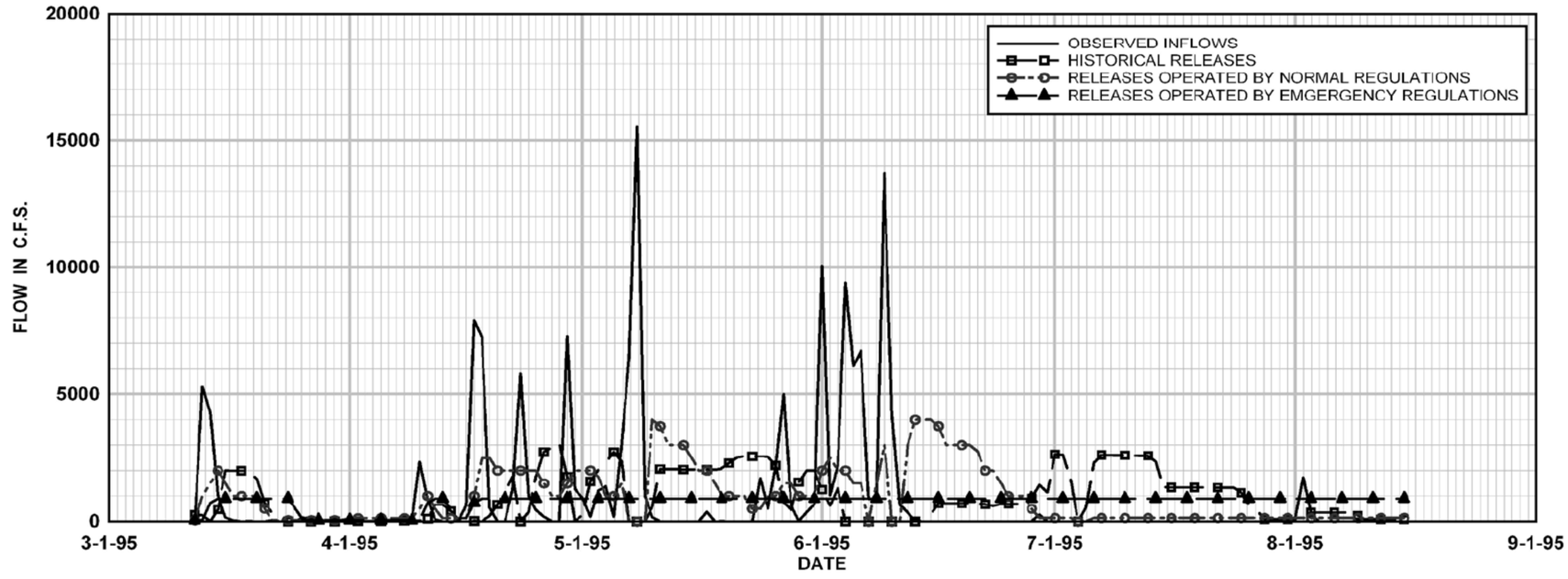
SKIATOOK LAKE

OPERATIONAL HYDROGRAPHS PROBABLE MAXIMUM FLOOD

DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2011
DRAWN: RKB
CHECKED: JRL

PLATE 8 - 3





NOTES:

1. REGULATING CAPACITY IMMEDIATELY BELOW THE DAM IS 4,000 C.F.S.
2. MAXIMUM INFLOW WAS 22,000 C.F.S. ON 8 MAY 1995
3. MAXIMUM POOL ELEVATION WAS 724.93 ON 14 JUN 1995
4. FLOOD VOLUME FROM 16 APR 1995 TO 10 MAY 1995 WAS 126,100 AC.-FT.
5. EMERGENCY OPERATIONS STARTED ON 12 MAR 1995
6. EMERGENCY OPERATIONS AT SKIATOOK WOULD HAVE EMPTIED THE FLOOD CONTROL POOL ON 15 AUG 1995

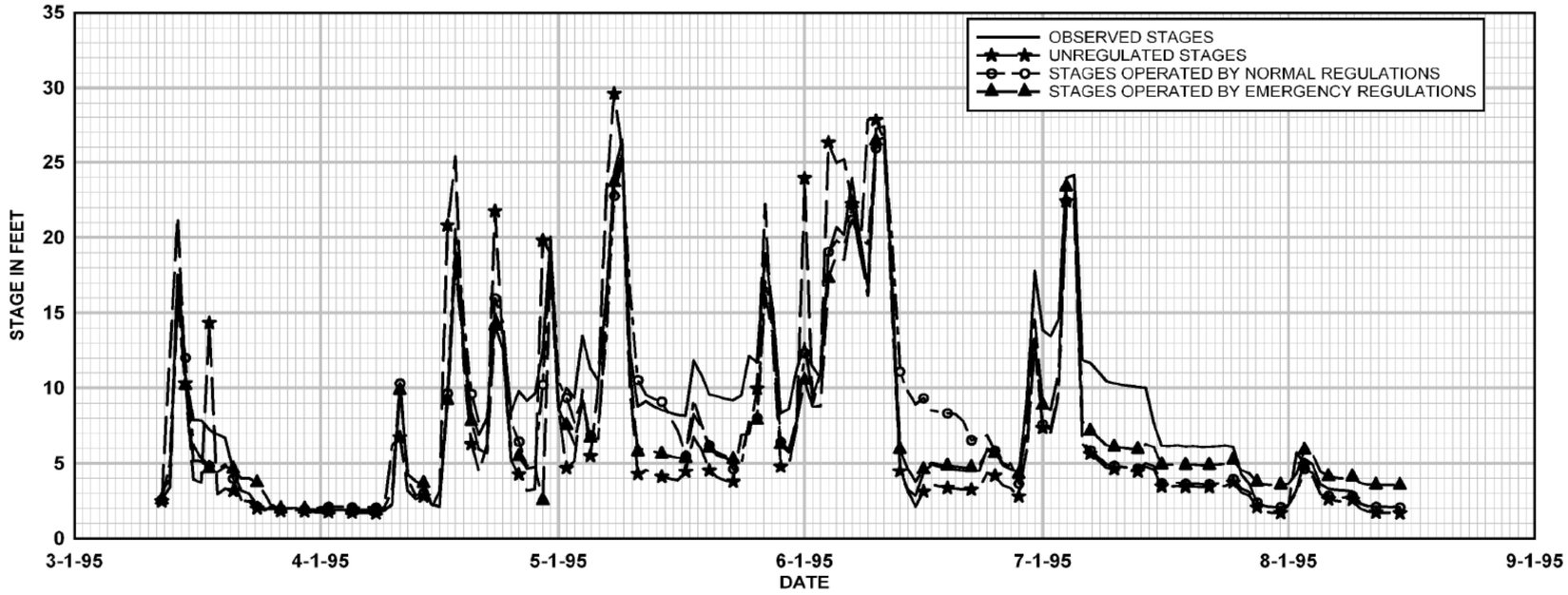
Note: Plate size is 11" x 17"

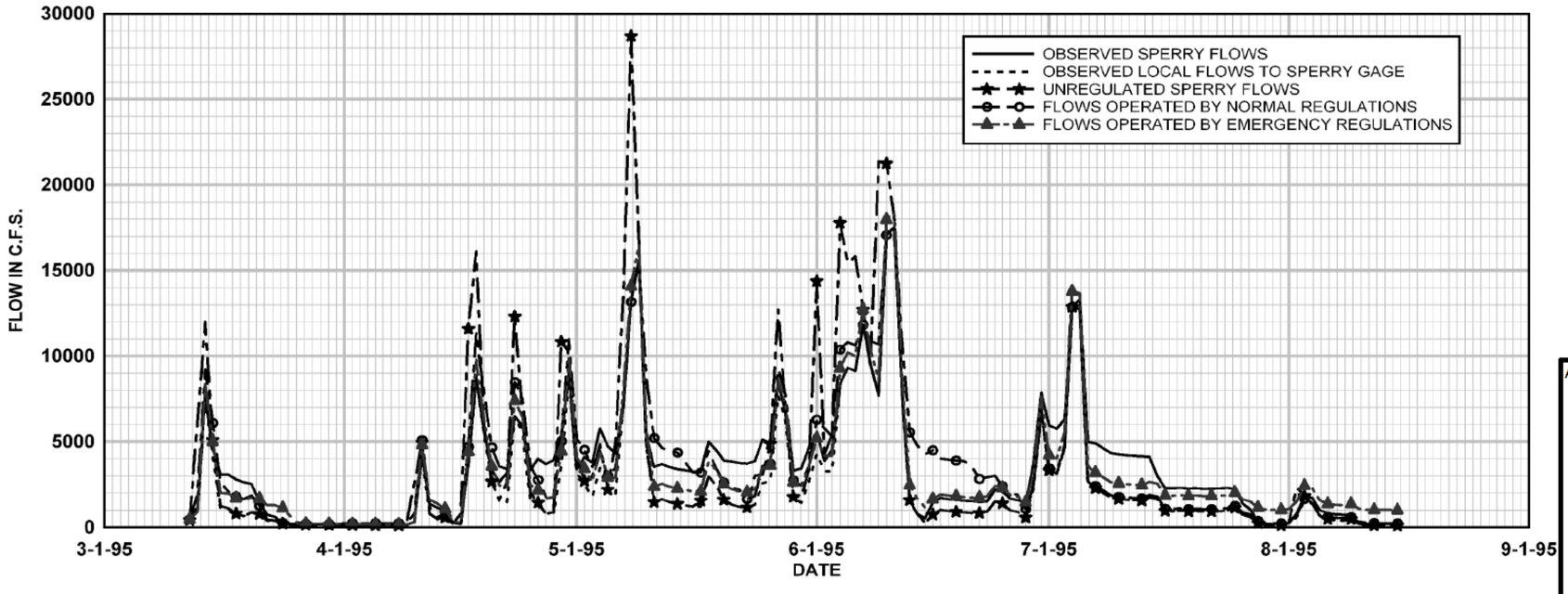
ARKANSAS RIVER WATERSHED — HOMINY CREEK, OKLAHOMA

SKIATOOK LAKE

OPERATIONAL HYDROGRAPH FLOOD OF APR - MAY 1995 AT SKIATOOK DAMSITE

DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2011
DRAWN: RKB
CHECKED: JRL





NOTES:

1. **REGULATING STAGE AT THE SPERRY GAGE IS 21 FEET (APPROX. 11,700 C.F.S.)**
2. **MAXIMUM OBSERVED STAGE WAS 27.38 FEET (APPROX. 21,500 C.F.S.) ON 11 JUNE 1995**
3. **MAXIMUM STAGE WAS 29.63 FEET (APPROX. 28,700 C.F.S.) ON 8 MAY 1995 FOR UNREGULATED FLOW**
4. **MAXIMUM STAGE WAS 26.18 FEET (APPROX. 17,500 C.F.S.) ON 11 JUNE 1995 FOR NORMAL OPERATIONS 5. MAXIMUM STAGE WAS 27.89 FEET (APPROX. 21,500 C.F.S.) ON 11 JUNE 1995 FOR EMERGENCY OPERATIONS**

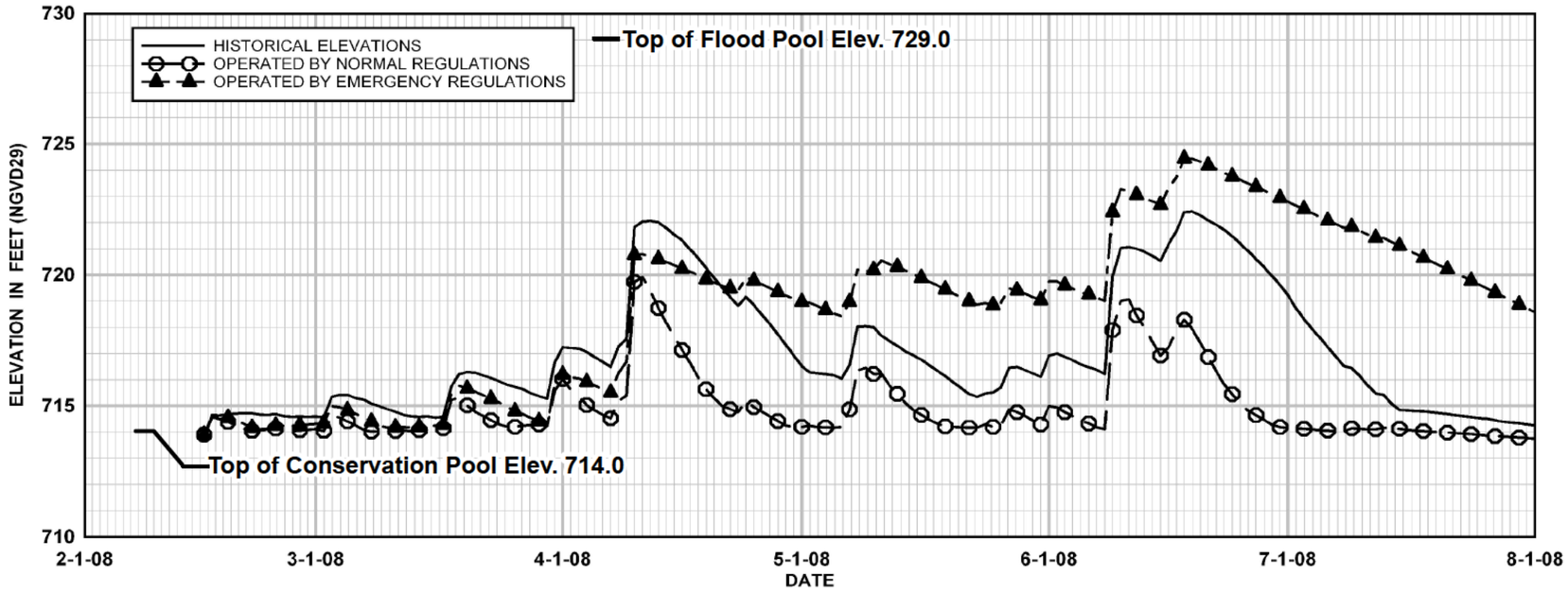
Note: Plate size is 11" x 17"

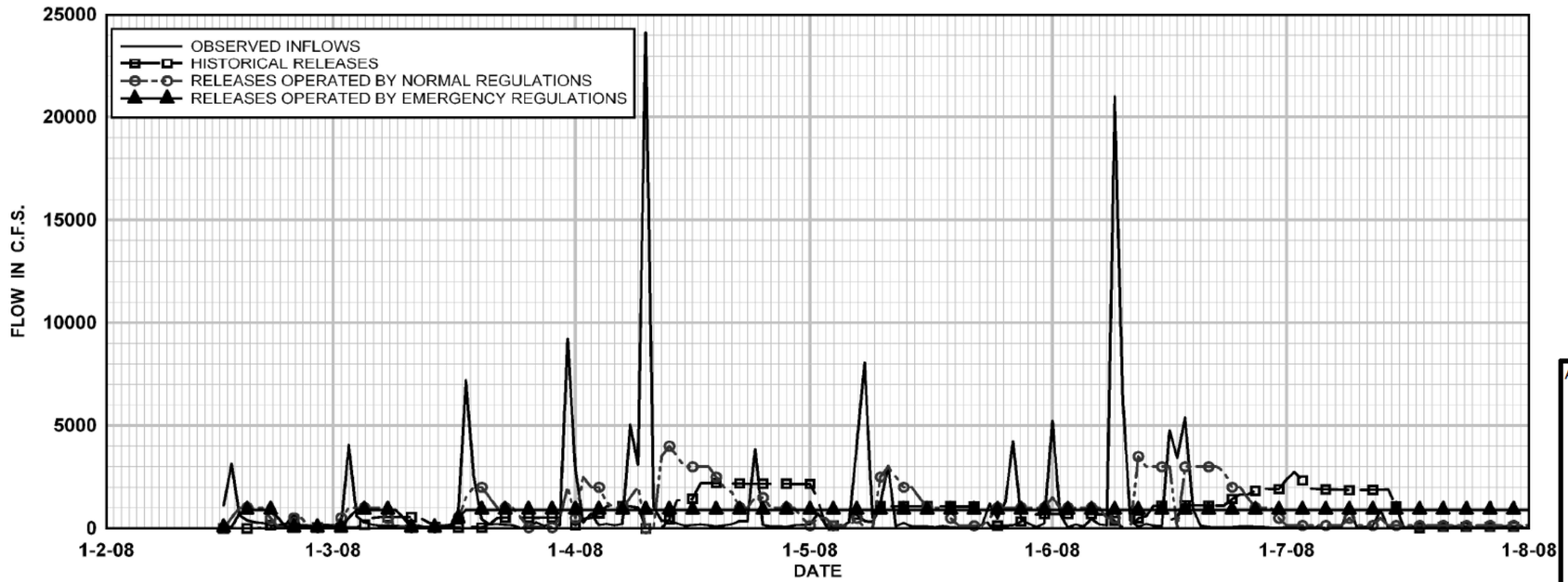
ARKANSAS RIVER WATERSHED — HOMINY CREEK, OKLAHOMA

SKIATOOK LAKE

OPERATIONAL HYDROGRAPH FLOOD OF APR - MAY 1995 AT SPERRY GAGE

DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2011
DRAWN: RKB
CHECKED: JRL





NOTES:

1. REGULATING CAPACITY IMMEDIATELY BELOW THE DAM IS 4,000 C.F.S.
2. MAXIMUM INFLOW WAS 39,300 C.F.S. ON 10 APR 2008
3. MAXIMUM POOL ELEVATION WAS 722.48 ON 19 JUN 2008
4. FLOOD VOLUME FROM 23 MAY 2008 TO 20 JUN 2008 WAS 115,200 AC.-FT.
5. EMERGENCY OPERATIONS STARTED ON 11 MAY 2008
6. EMERGENCY OPERATIONS AT SKIATOOK WOULD HAVE EMPTIED THE FLOOD CONTROL POOL ON 3 SEP 2008

Note: Plate size is 11" x 17"

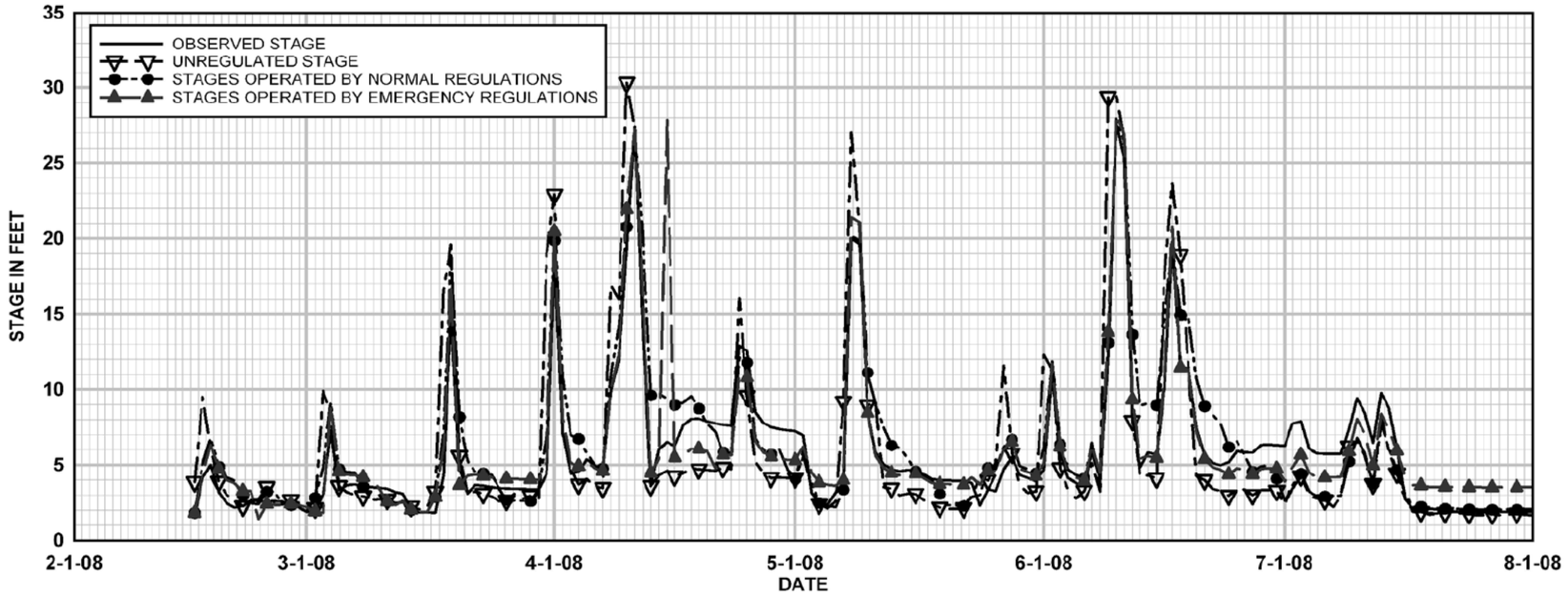
ARKANSAS RIVER WATERSHED — HOMINY CREEK, OKLAHOMA

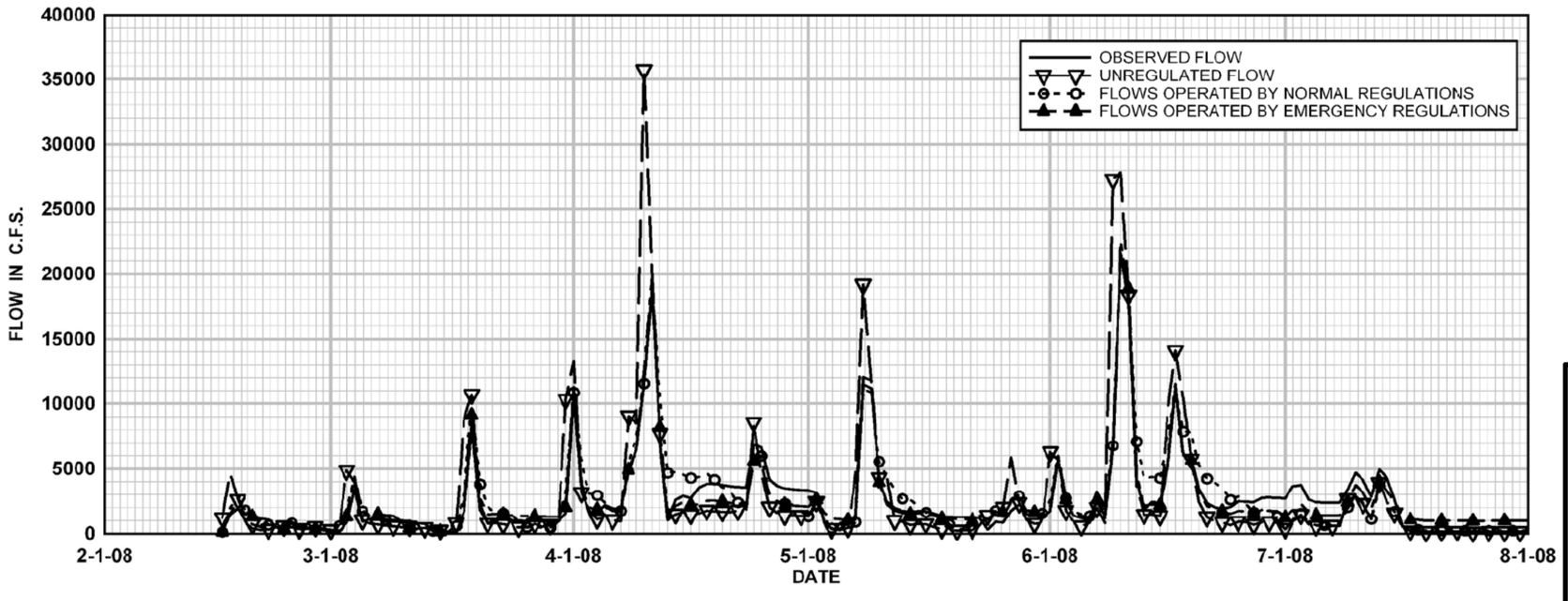
SKIATOOK LAKE

OPERATIONAL HYDROGRAPH FLOOD OF MAY - JUNE 2008 AT SKIATOOK DAMSITE

DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2011
DRAWN: RKB
CHECKED: JRL

PLATE 8 - 6





NOTES:

1. **REGULATING STAGE AT THE SPERRY GAGE IS 21 FEET (APPROX. 11,700 C.F.S.)**
2. **MAXIMUM OBSERVED STAGE WAS 27.7 FEET (APPROX. 21,600 C.F.S.) ON 10 JUNE 2008**
3. **MAXIMUM STAGE WAS 30.30 FEET (APPROX. 35,700 C.F.S.) ON 10 APRIL 2008 FOR UNREGULATED FLOW**
4. **MAXIMUM STAGE WAS 27.93 FEET (APPROX. 21,600 C.F.S.) ON 10 JUNE 2008 FOR NORMAL OPERATIONS**
5. **MAXIMUM STAGE WAS 28.87 FEET (APPROX. 24,700 C.F.S.) ON 10 JUNE 2008 FOR EMERGENCY OPERATIONS**

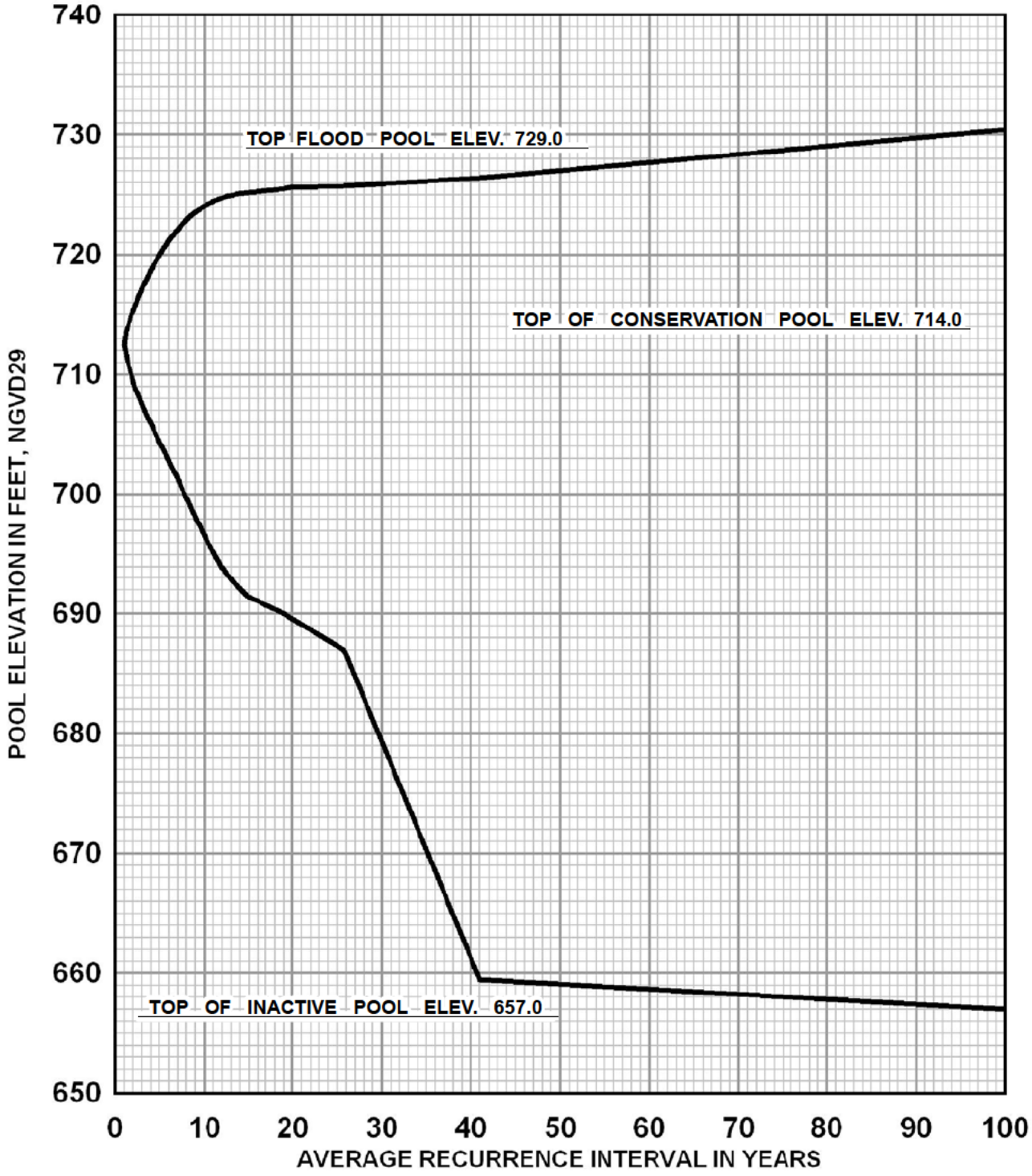
Note: Plate size is 11" x 17"

ARKANSAS RIVER WATERSHED — HOMINY CREEK, OKLAHOMA

SKIATOOK LAKE

OPERATIONAL HYDROGRAPH FLOOD OF MAY - JUNE 2008 AT SPERRY GAGE

DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2011
DRAWN: RKB
CHECKED: JRL



NOTES:

CURVE IS BASED ON PERIOD OF RECORD JAN 1940 THRU DEC 2008 FROM RIVERWARE RUN

ARKANSAS RIVER WATERSHED HOMINY CREEK, OKLAHOMA

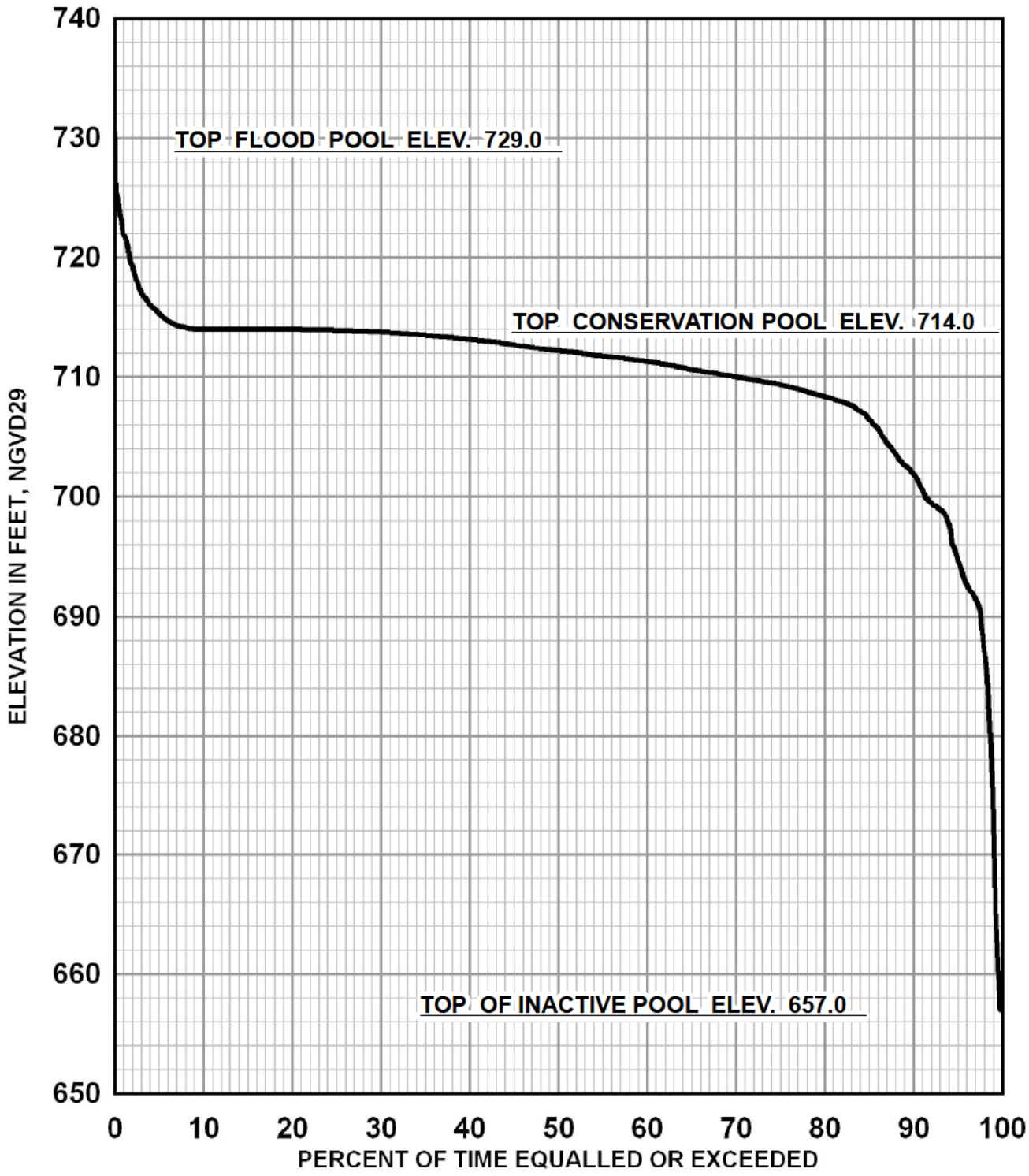
SKIATOOK LAKE

POOL ELEVATION PROBABILITY CURVE

(INITIAL CONDITIONS)

DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2011
DRAWN: RKB
CHECKED: JRL

PLATE 8 - 8



NOTES:

CURVE IS BASED ON PERIOD OF RECORD JAN. 1940 THRU DEC. 2008 FROM RIVERWARE RUN

ARKANSAS RIVER WATERSHED HOMINY CREEK, OKLAHOMA

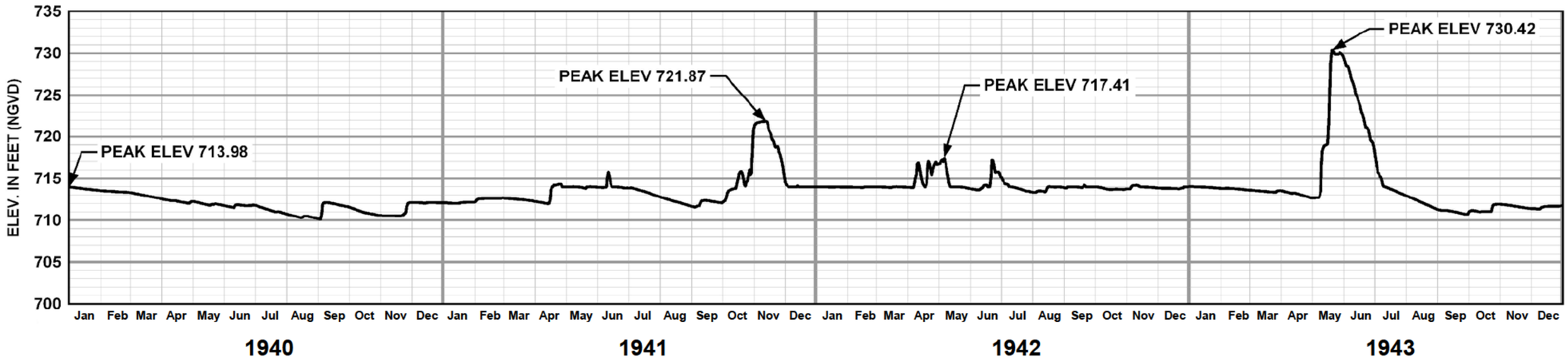
SKIATOOK LAKE

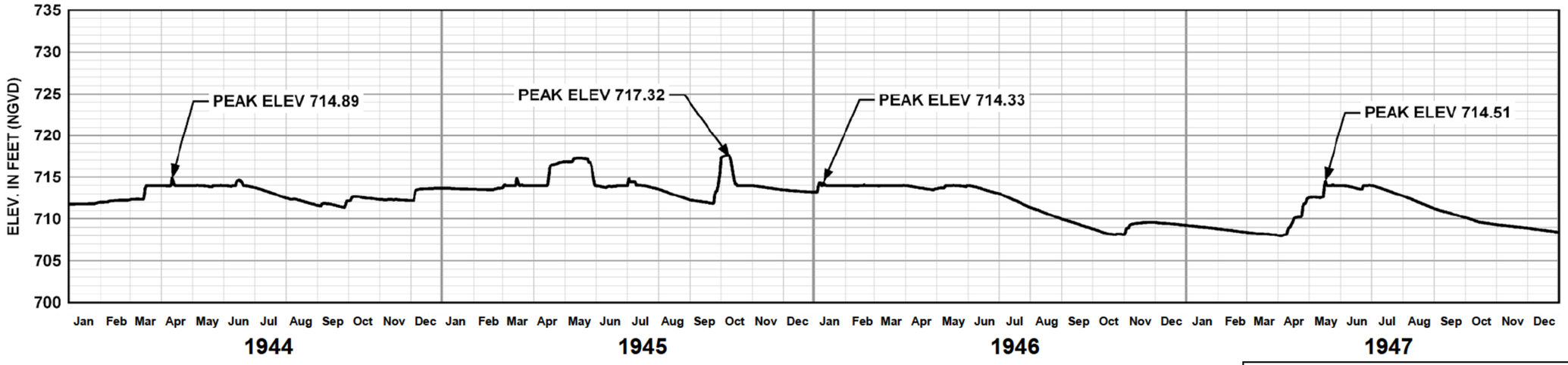
POOL ELEVATION DURATION CURVE

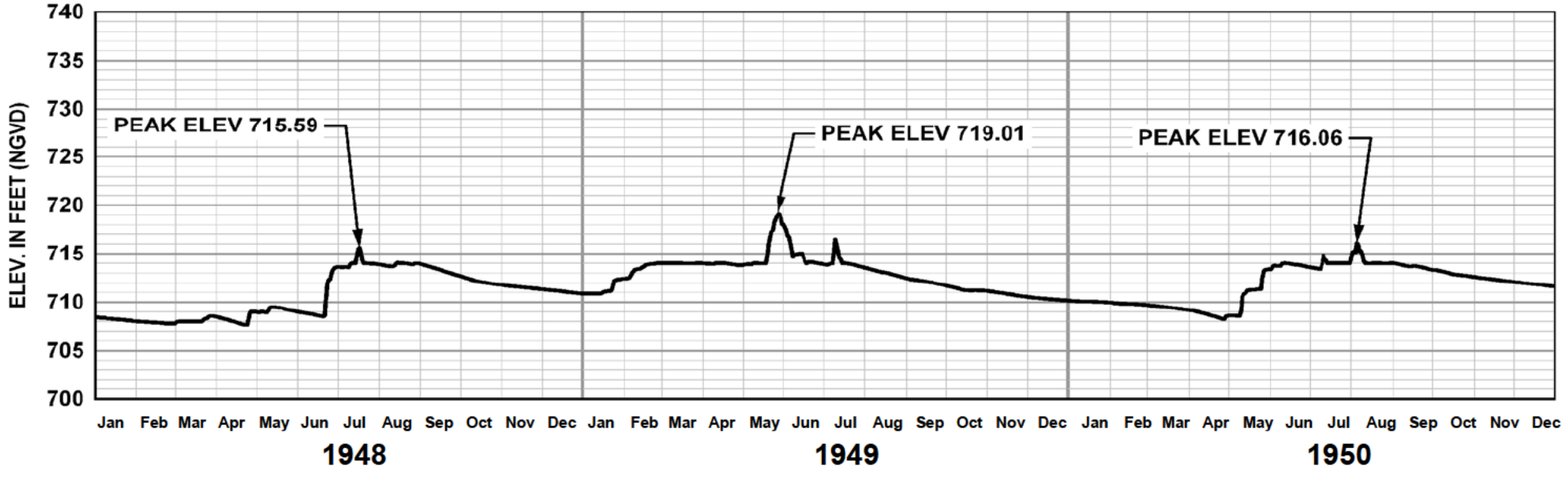
(INITIAL CONDITIONS)

DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2011
DRAWN: RKB
CHECKED: JRL

PLATE 8 - 9







NOTE: All elevations are in NGVD 1929 datum.
Pool elevations for Jan 1940 through Dec 31, 1983 are based on a simulation using the RiverWare computer program. Elevations for Jan 1, 1984 through Dec 2010 are actual historical values.

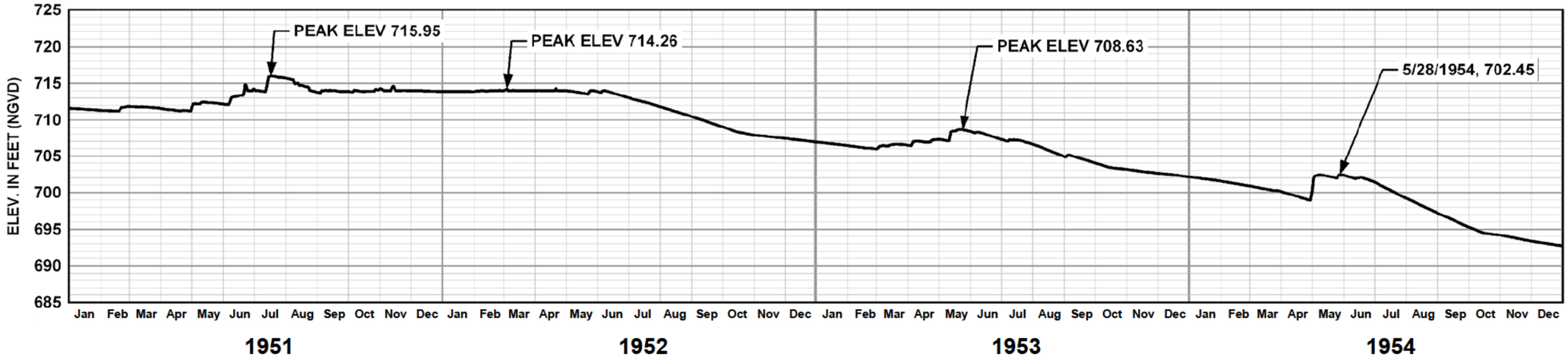
Note: Plate size is 11" x 17"

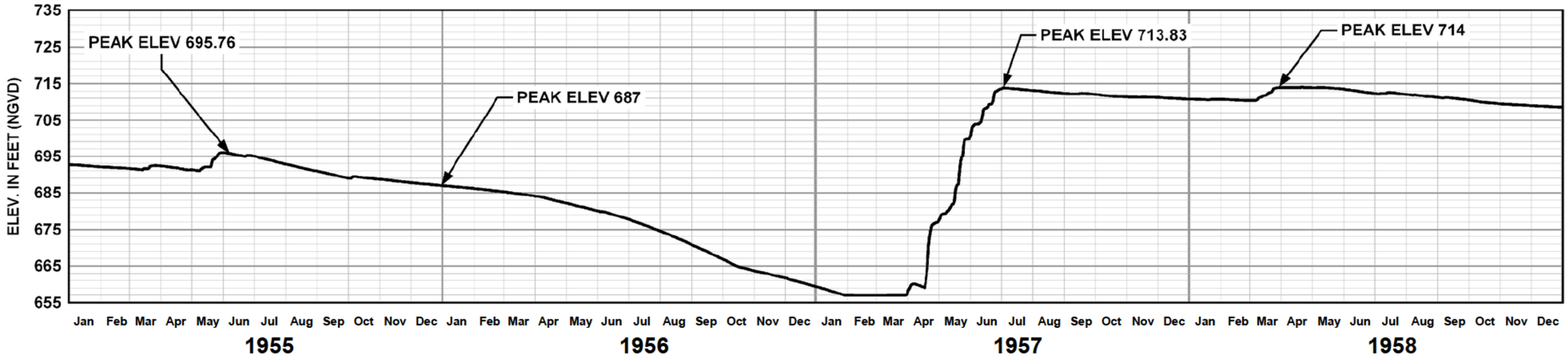
ARKANSAS RIVER WATERSHED HOMINY CREEK, OKLAHOMA

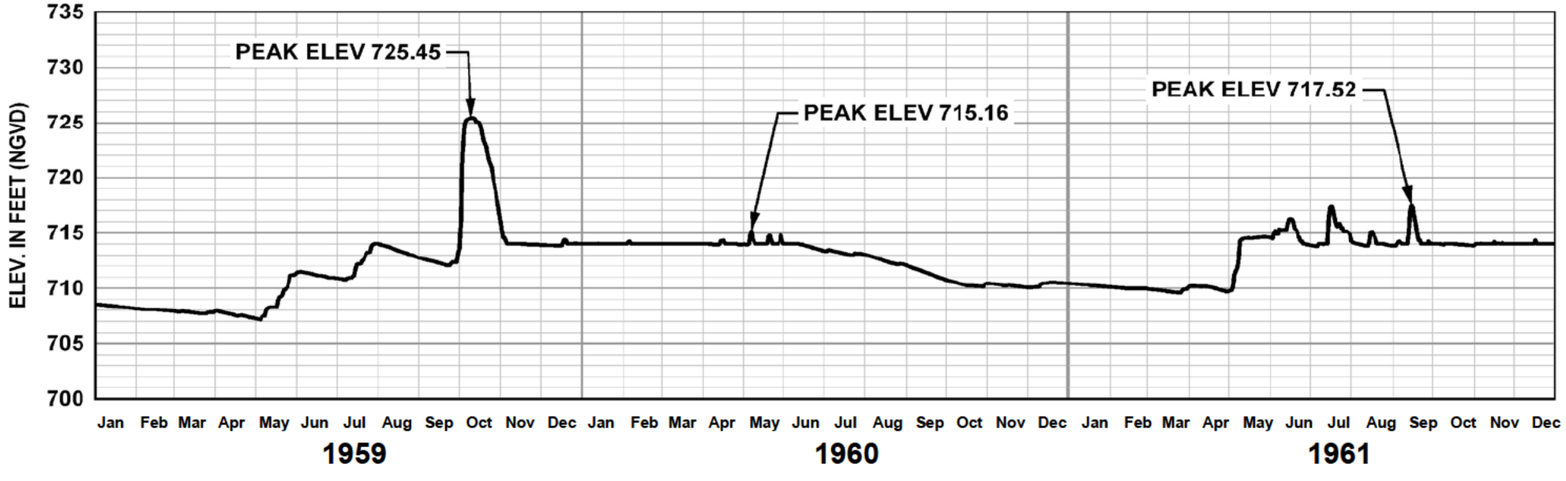
SKIATOOK LAKE

POOL ELEVATION HYDROGRAPHS 1940 - 1950

DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2011
DRAWN: RKB
CHECKED: JRL







NOTE: All elevations are in NGVD 1929 datum. Pool elevations for Jan 1940 through Dec 31, 1983 are based on a simulation using the RiverWare computer program. Elevations for Jan 1, 1984 through Dec 2010 are actual historical values.

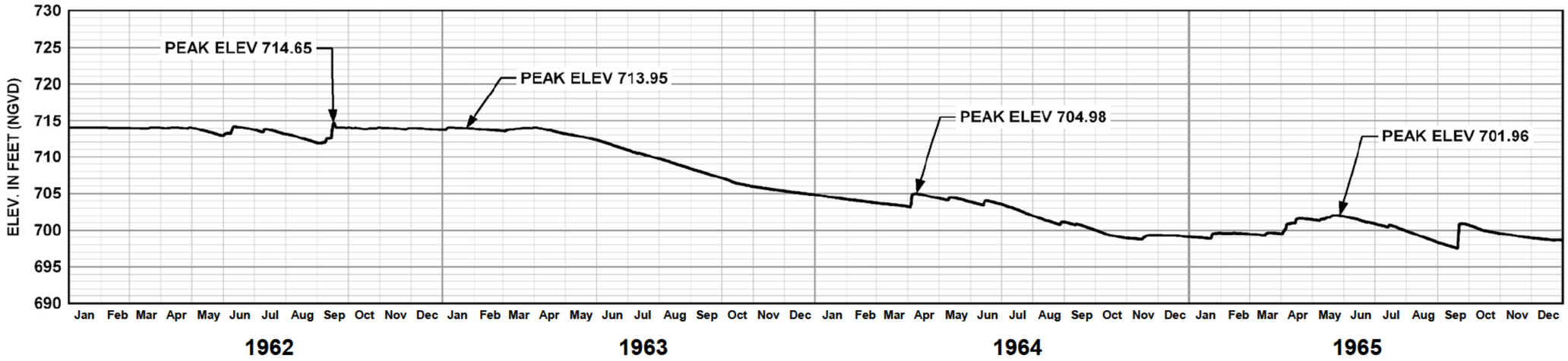
Note: Plate size is 11" x 17"

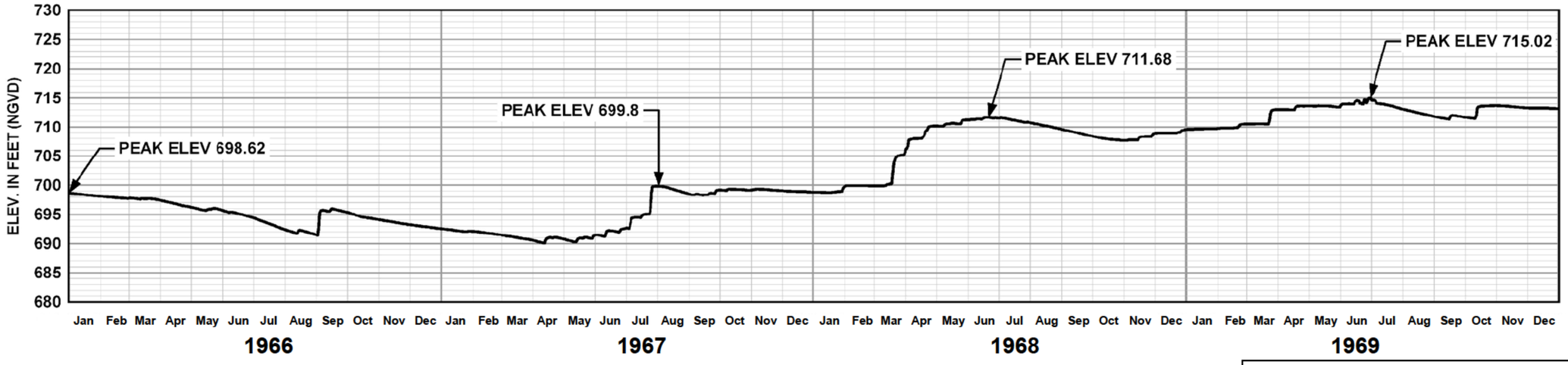
ARKANSAS RIVER WATERSHED HOMINY CREEK, OKLAHOMA

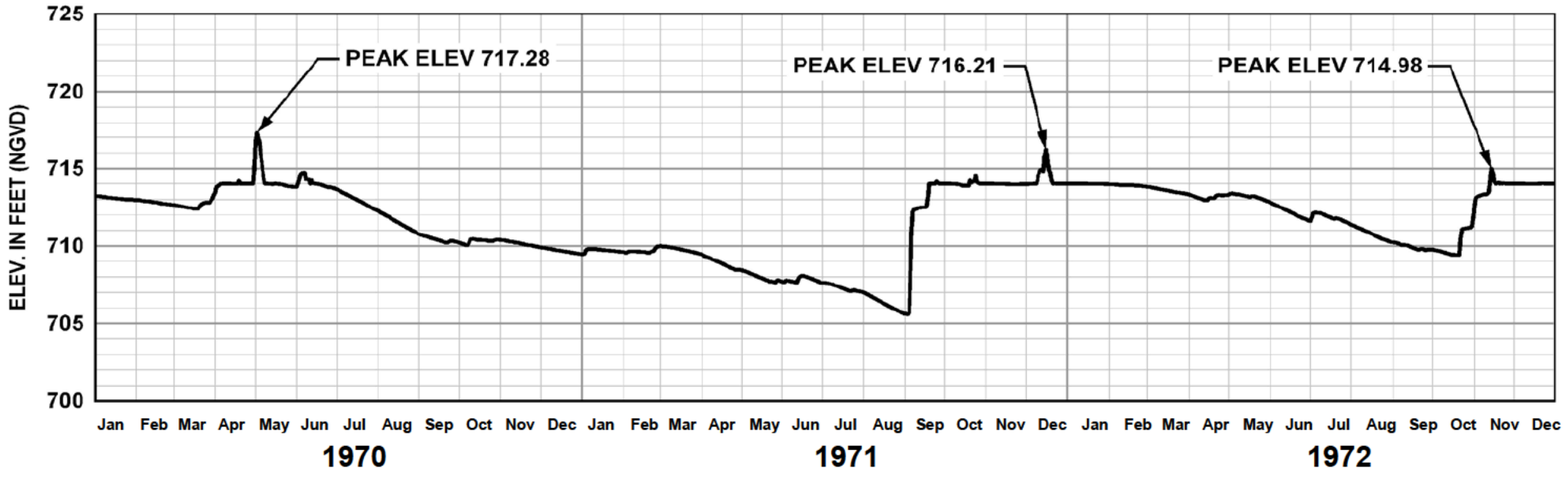
SKIATOOK LAKE

POOL ELEVATION HYDROGRAPHS 1951 - 1961

DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2010
DRAWN: RKB
CHECKED: JRL







NOTE: All elevations are in NGVD 1929 datum. Pool elevations for Jan 1940 through Dec 31, 1983 are based on a simulation using the RiverWare computer program. Elevations for Jan 1, 1984 through Dec 2010 are actual historical values.

Note: Plate size is 11" x 17"

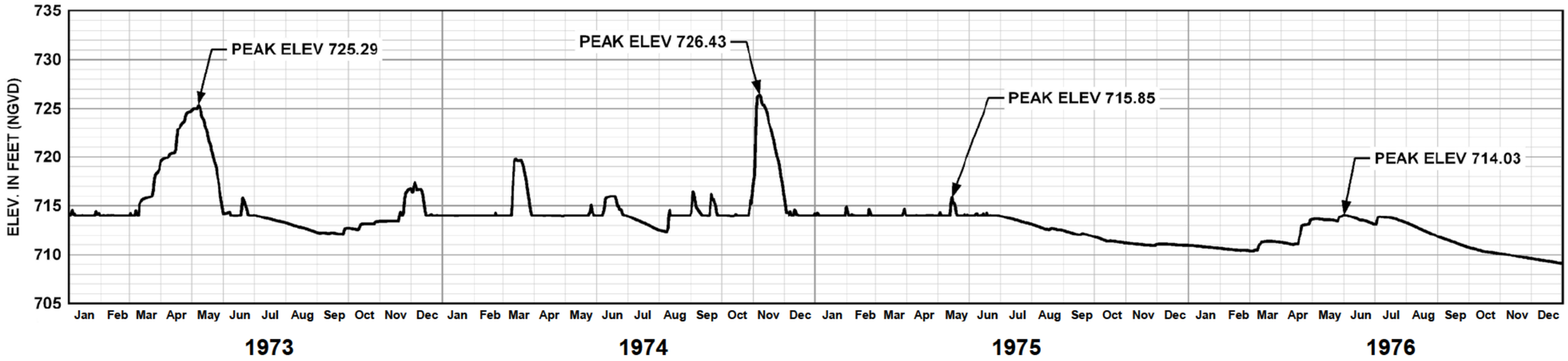
ARKANSAS RIVER WATERSHED HOMINY CREEK, OKLAHOMA

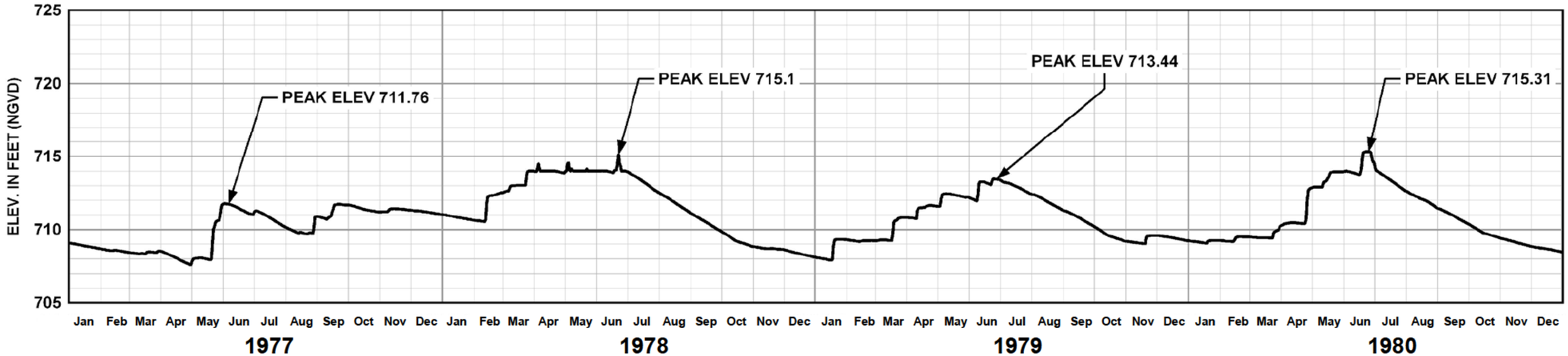
SKIATOOK LAKE

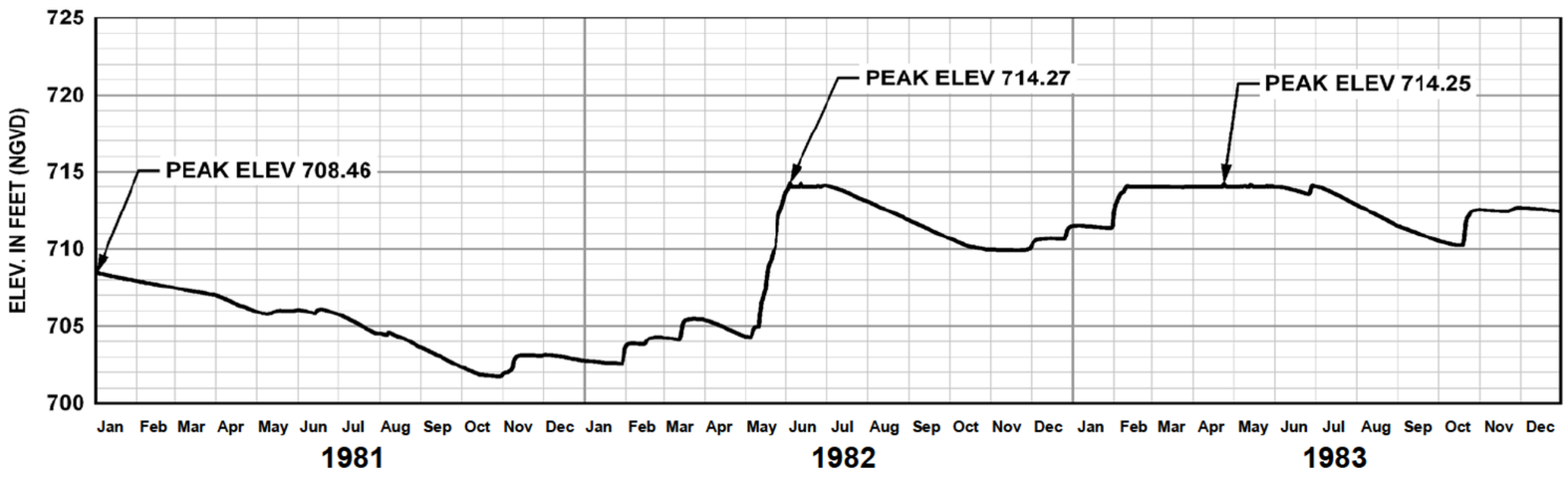
POOL ELEVATION HYDROGRAPHS 1962 - 1972

DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2011
DRAWN: RKB
CHECKED: JRL

PLATE 8 - 12







NOTE: All elevations are in NGVD 1929 datum. Pool elevations for Jan 1940 through Dec 31, 1983 are based on a simulation using the RiverWare computer program. Elevations for Jan 1, 1984 through Dec 2010 are actual historical values.

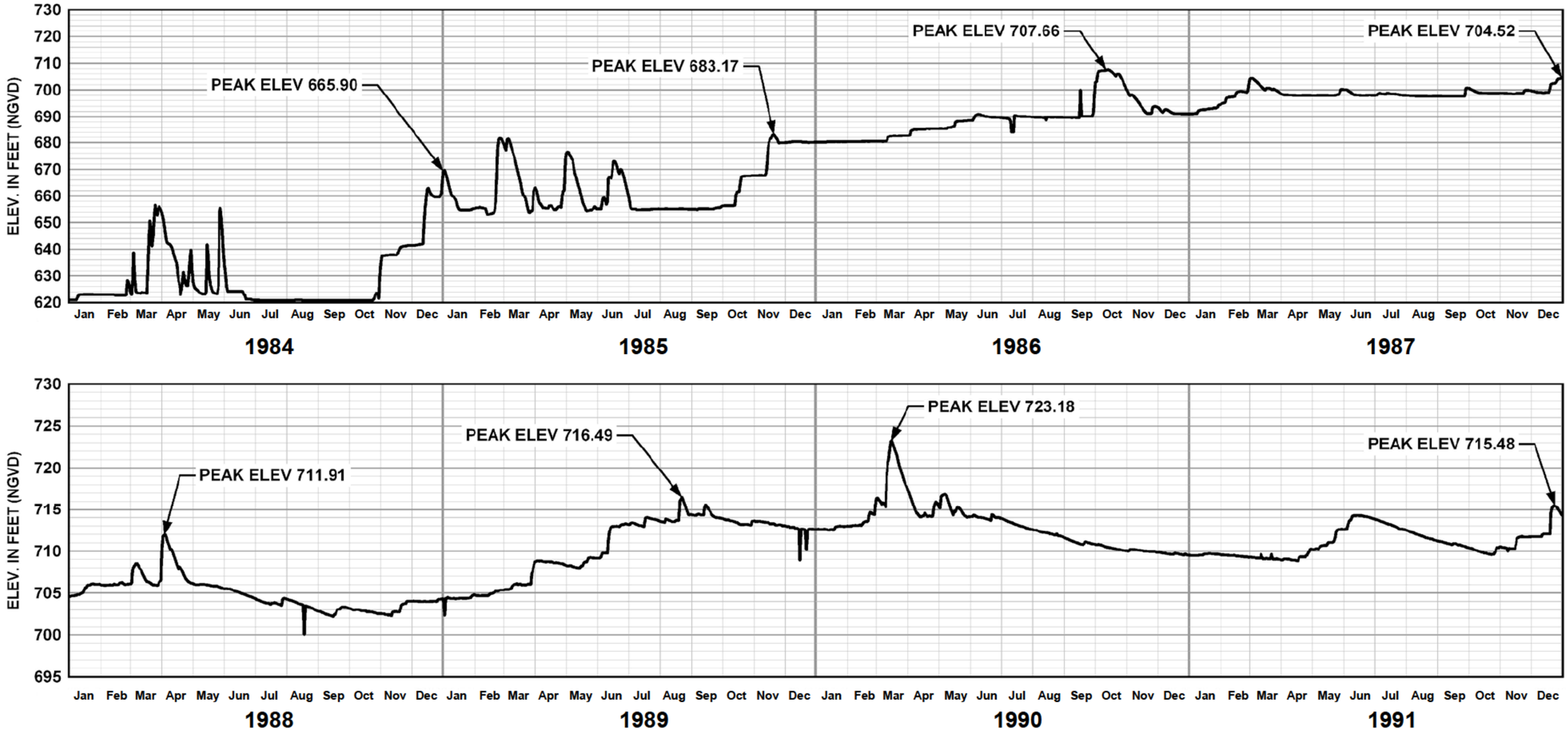
Note: Plate size is 11" x 17"

ARKANSAS RIVER WATERSHED HOMINY CREEK, OKLAHOMA

SKIATOOK LAKE

POOL ELEVATION HYDROGRAPHS 1973 - 1983

DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2011
DRAWN: RKB
CHECKED: JRL



NOTE: All elevations are in NGVD 1929 datum. Pool elevations for Jan 1940 through Dec 31, 1983 are based on a simulation using the RiverWare computer program. Elevations for Jan 1, 1984 through Dec 2010 are actual historical values.

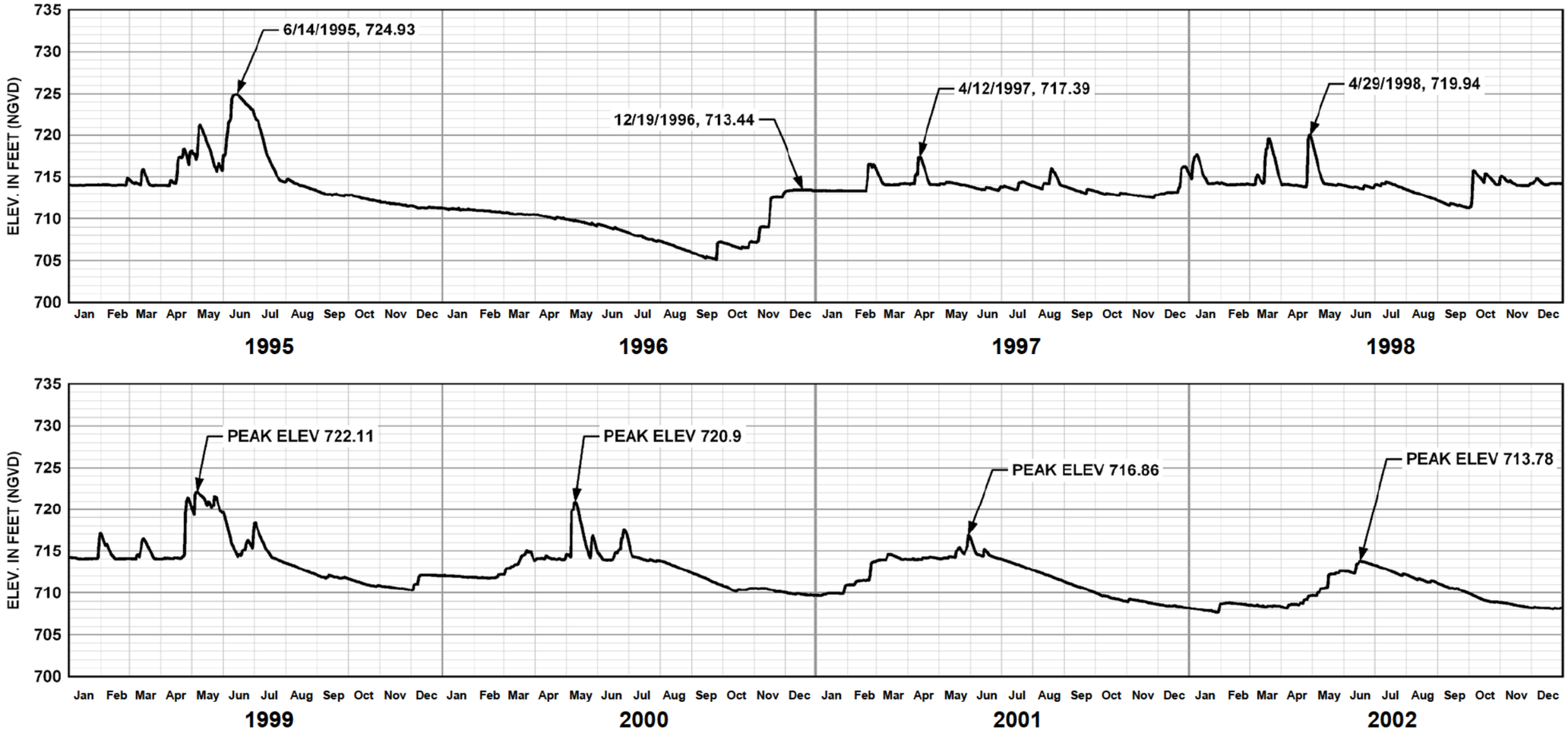
Note: Plate size is 11" x 17"

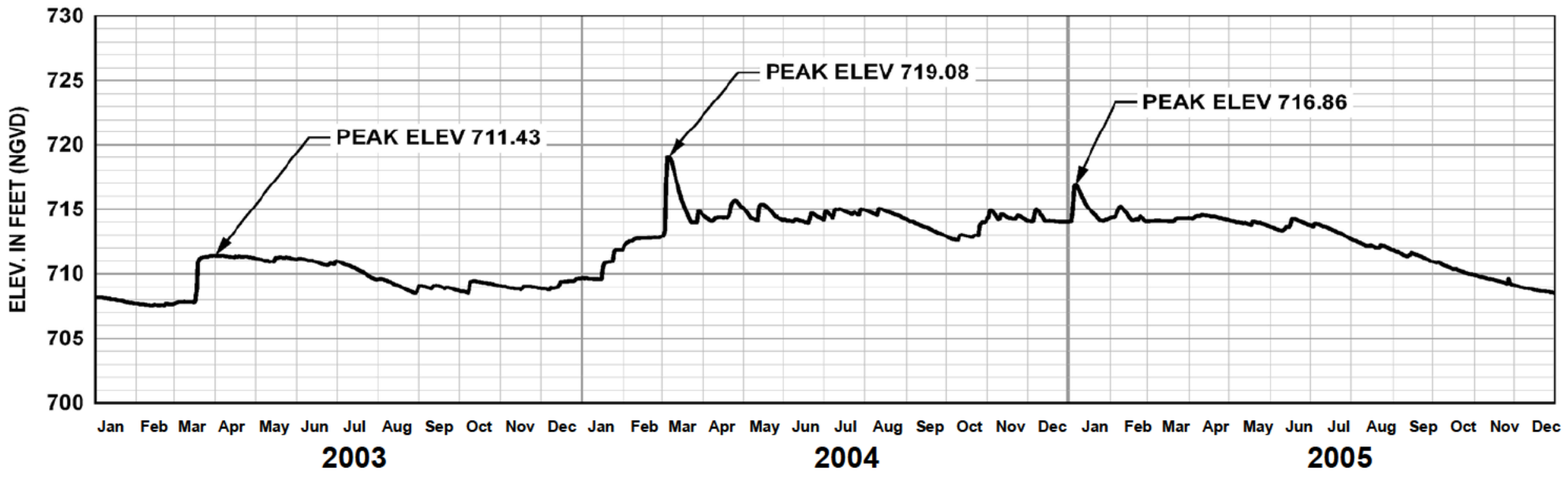
ARKANSAS RIVER WATERSHED — HOMINY CREEK, OKLAHOMA

SKIATOOK LAKE

POOL ELEVATION HYDROGRAPHS 1984 - 1994

DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2011
DRAWN: RKB
CHECKED: JRL





NOTE: All elevations are in NGVD 1929 datum. Pool elevations for Jan 1940 through Dec 31, 1983 are based on a simulation using the RiverWare computer program. Elevations for Jan 1, 1984 through Dec 2010 are actual historical values.

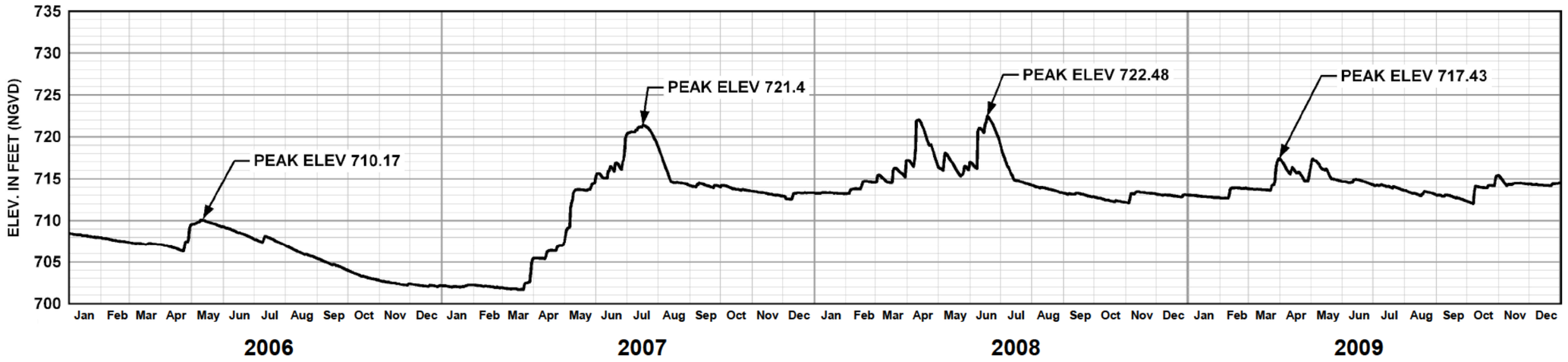
Note: Plate size is 11" x 17"

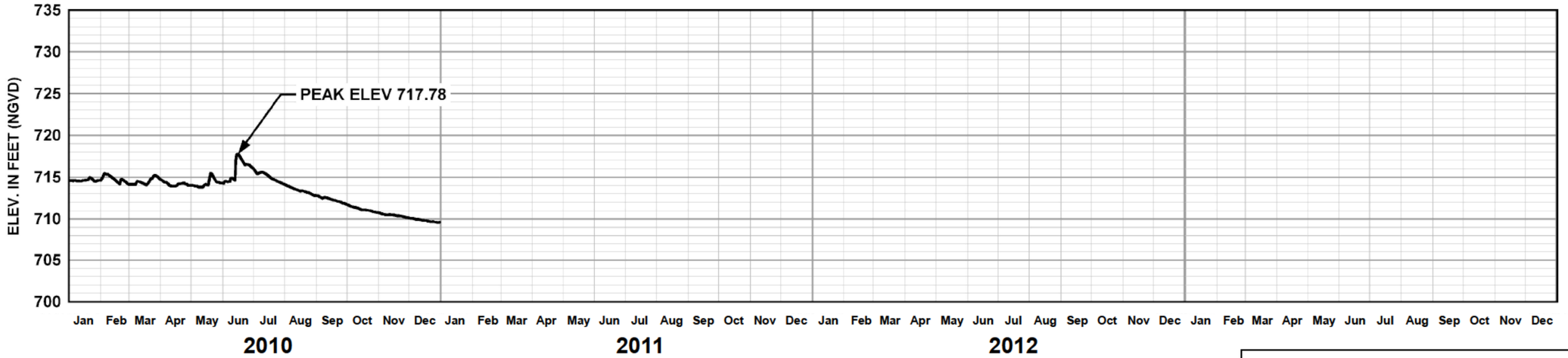
ARKANSAS RIVER WATERSHED HOMINY CREEK, OKLAHOMA

SKIATOOK LAKE

POOL ELEVATION HYDROGRAPHS 1995 - 2005

DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2011
DRAWN: RKB
CHECKED: JRL





NOTE: All elevations are in NGVD 1929 datum. Pool elevations for Jan 1940 through Dec 31, 1983 are based on a simulation using the RiverWare computer program. Elevations for Jan 1, 1984 through Dec 2010 are actual historical values.

Note: Plate size is 11" x 17"

ARKANSAS RIVER WATERSHED HOMINY CREEK, OKLAHOMA

SKIATOOK LAKE

POOL ELEVATION HYDROGRAPHS 2006 - 2010

DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2011
DRAWN: RKB
CHECKED: JRL

PLATE 8 - 16