WISTER LAKE
POTEAU RIVER, OKLAHOMA

WATER CONTROL MANUAL

APPENDIX J

TO

WATER CONTROL MASTER MANUAL
ARKANSAS RIVER BASIN

MARCH 1974
Revised JULY 2004

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. Changes to individual pages must carry the date-of-revision, which is the Division's approval date. All elevations referenced to in this manual, unless noted otherwise, are in feet, NGVD (National Geodetic Vertical Datum).

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) 669-7097, or the District VHF-FM radio (call signal WUI-3, Hydraulics). If the above office cannot be contacted, assistance can be achieved by contacting, in the order listed, one of the persons shown below. Chapter 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 chapter. A separate copy of this chapter has been provided the project office and must be displayed on the bulletin board at all times.

EMERGENCY PERSONNEL ROSTER

Title and Name	Residence Telephone
Coordinator (b) (6)	(b) (6)
Backup Coordinator (b) (6)	
Chief, Water Management Section (Vacant - (b) (6) acting)	
Backup Coordinator (b) (6)	
Backup Coordinator (b) (6)	
Chief, Hydrology-Hydraulics Branch (b) (6)	(b) (6)

PERTINENT DATA
WISTER LAKE

LOCATION:	Poteau River at river mile 60.9, about 2 miles south of Wister in LeFlore County, Oklahoma.	
DRAINAGE AREA:	993 square miles above the dam.	
DAM:	Type:	Earthfill
	Length:	5,700 feet
	Top of Dam:	527.5 feet, NGVD
	Maximum Height:	99 feet above streambed
	Crest Width:	25 feet
SPILLWAY:	Location:	Near right abutment
	Type:	Concrete chute
	Crest Elevation:	502.5 feet, NGVD
	Width:	600 feet
	Control:	Uncontrolled
OUTLET WORKS:	Location:	Near right abutment in concrete gate tower
	Type and size:	Twin elliptical conduits 14' x 15.8'
	Intake invert:	450.0 feet, NGVD
	Control:	Six 7' x 12' vertical lift gates
LOW FLOW:	Location:	With outlet works
	Type and size:	One 30-inch diameter pipe
	Intake invert:	450.0 feet, NGVD
	Control:	One gate valve and one butterfly valve
LAND ACQUISITION:	Taking line:	Blocked perimeter which includes all land below elevation 510.9 feet, NGVD or to the limits of the backwater envelope curve whichever is higher.

ELEVATIONS, AREAS, AND STORAGES

Feature	Elevation (ft, NGVD)	Area (acres)	Storage	
			acre-ft (1)	inches (2)
Top of Dam	527.5	--	--	--
Maximum Pool	522.0	38,630	966,400	18.25
Top of Flood Control Pool	502.5	23,366	427,400	8.07
Top of Conservation Pool	478.0	7,386	61,400	1.16
Inactive Pool	468.8	2,340	14,900	0.28
Streambed at Dam	428.5	--	--	--
Flood Control Storage	478.0-502.5	--	366,000	6.91
Conservation Storage	468.8-478.0	--	46,500	0.89
Water Supply Storage (3)	468.8-478.0	--	13,488	0.25

(1) Based on 1985 Survey

(2) Runoff from drainage area of 993 square miles

(3) Pending ongoing reallocation, water supply allocation 14,000 AF, with 13,488 AF under contract.

WISTER LAKE
POTEAU RIVER, OKLAHOMA

WATER CONTROL MANUAL
APPENDIX J

TO
WATER CONTROL MASTER MANUAL
ARKANSAS RIVER BASIN

TABLE OF CONTENTS

TABLE OF CONTENTS (CONT)

TABLE OF CONTENTS (CONT)

VI - HYDROLOGIC FORECASTS

VII - WATER CONTROL PLAN

TABLE OF CONTENTS (CONT)

VIII - EFFECT OF WATER CONTROL PLAN

TABLE OF CONTENTS (CONT)

IX - WATER CONTROL MANAGEMENT

TABLE INDEX

TABLE INDEX, Cont'd

EXHIBIT INDEX

PLATE INDEX

PLATE INDEX, Cont'd

WISTER LAKE
POTEAU RIVER, OKLAHOMA

APPENDIX J
TO
WATER CONTROL MASTER MANUAL
ARKANSAS RIVER BASIN

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 (ER 1110-2-8156 and ETL 1110-2-241).

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

1-03. Related Manuals. This manual is Appendix J to the Arkansas River Water Control Master Manual. Other related manuals are:

Appendix S	Part II	- W.D. Mayo Lock and Dam (Aug 99)
	Part III	- Robert S. Kerr Lock and Dam (Dec 98)
	Part IV	- Webbers Falls Lock and Dam (Nov 97)
Appendix G	Tenkiller Ferry Lake (Jul 76)	
Appendix N	Eufaula Lake (Jan 94)	
Appendix DCP-3	Drought Contingency Plan for Wister, Tenkiller, and Fort Gibson Lakes (Jan 90)	

The locations of existing, under construction, and authorized projects in the Tulsa District are shown on Plate 1-1.

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

1-05. Operating Agency. The Corps of Engineers is the operating agency for Wister Lake. The Project Manager under direction of the Operations Division, Tulsa District is responsible for the operation of the project. The project is placed under 24-hour surveillance when the lake level is above elevation 500.0. The project is placed under daily surveillance when the lake level is between elevation 495.0 and 500.0. Below elevation 495.0 the project is manned as necessary under normal operating procedures. However, when the project is in flood control operations, project personnel will closely monitor the project and the downstream river reaches. The project office is furnished a list of Hydrology and Hydraulics Branch personnel to contact when necessary (page i). The Project Manager will furnish the Water Management Section with a current list of project personnel to contact during non-duty hours for emergency operations.

1-06. Regulating Agencies. The Corps of Engineers is the regulatory agency for Wister Lake. The Water Management Section of the Hydrology and Hydraulics Branch, Tulsa District is responsible for regulating the lake according to the water control plan.

II - DESCRIPTION OF PROJECT

2-01. Location. Wister Lake is located at river mile 60.9 on the Poteau River about 2 miles south of Wister, Oklahoma. The dam and reservoir are located entirely in LeFlore County. A location and vicinity map of the project is shown on Plate 2-1.

2-02. Purpose. Wister Lake is a multiple purpose project authorized for flood control, water supply, and navigation. The project is also operated to benefit recreation and fish and wildlife. The project was designed to provide maximum flood protection on the Poteau River from the dam to the confluence with the Arkansas River. The project also provides flood control benefits on the Arkansas River below the confluence of the Poteau River when operated in conjunction with the other flood control projects in the Arkansas River Basin.

2-03. Physical Components.

a. Embankment. The embankment is a rolled earth-fill structure consisting of impervious material. The crest of the embankment is at elevation 527.5 with a maximum height of 99 feet above the streambed. The embankment is 25 feet wide at the crest, which includes 21 feet of roadway paving. The embankment section has a crest length of 5,700 feet not including the spillway section. The upstream slopes of the embankment are protected with 2 feet of dumped riprap above elevation 485 and the downstream face is covered with grass. A major dam safety modification was made to the embankment during 1989-1991 to correct seepage problems through and under the earth-fill. The modifications included adding a plastic concrete slurry wall cutoff on the upstream side and a downstream sand filter blanket and toe drain. A general plan and a section of the embankment are shown on Plate 2-2.

b. Dike. The rolled impervious earth-fill dike extends southward from the right abutment. The dike has a crest length of 2,400 feet and a maximum height of 40 feet. The crest is 25 feet wide and carries a paved roadway. The reservoir side of the dike is protected with riprap and the downstream face is covered with grass. Lake waters stand on the dike for short durations during flood control operations.

c. Spillway. The spillway is located through the right abutment between the main embankment and the dike. The spillway is a concrete chute with a modified, broad crested weir that is 600 feet wide and has a crest elevation of 502.5 feet. The concrete chute extends 120 feet into an earthen and rock bottom channel with concrete side slopes that discharges into the river channel about 1,800 feet below the dam axis. A section through the spillway is shown on Plate 2-2.

d. Outlet Works. The outlet works consist of two semi-elliptical conduits 14 feet wide by 15.8 feet high located near the right abutment. The conduits are controlled by six, 7- by 12-foot, tractor-type, vertical lift gates located in a concrete gate tower. Each conduit accepts releases from three of the tractor gates through an upper transition section. The two conduits discharge through a lower transition section into a concrete stilling basin in the outlet channel. The outlet channel joins with the spillway channel about 2,000 feet below the stilling basin. Low flow regulation is provided by means of a 30-inch diameter pipe located next to the outlet works. The low flow pipe is controlled by means of a motor operated butterfly valve and a manually operated gate valve located in the gate tower. A longitudinal plan and section of the outlet works are shown on Plate 2-3.

e. Sedimentation and Degradation Ranges. Sediment deposition in the lake has been determined based on periodic resurveys of 41 sediment ranges, which were established in and above the lake. The ends of each range are marked by permanent monuments, which have known vertical and horizontal

positions. The original sediment survey was completed in 1948 and resurveys have been completed in 1972 and 1985. Five degradation ranges were established across the Poteau River flood plain in order to provide information on the river channel below the dam. The furthest downstream range is located at approximately river mile 51, about 10 river miles above the city of Poteau, Oklahoma. The locations of the sedimentation and degradation ranges are shown on Plate 2-4. Future sedimentation surveys will be done using contour hydrographic methods.

f. Water Supply Facilities. Two 8-inch water supply pipes are provided for municipal water supply connections at the dam. The two pipes are connected to a single 12-inch diameter intake with an invert elevation of 459.5 feet located in the gate tower. Currently, these two pipes are not being used. The current water supply users at Wister Lake have separate water supply intake structures in the lake or are withdrawing water from the river below the dam.

2-04. Related Control Facilities. There are no related control facilities at Wister Lake.

2-05. Real Estate Acquisition. The fee taking line is a blocked perimeter including all lands below the elevation of the backwater envelope curve to the limits of the backwater effects. The limits of the backwater effects and the backwater envelope curve were developed using the flood of 1935 as representative of the 50-year flood event. The elevation of the backwater envelope curve extends from elevation 510.9 in the lake area to elevation 524.0 in the upper reaches of the Poteau River and to elevation 520.0 in the upper reaches of the Fourche Maline River. The total land purchased by the Government was 39,169 acres. The fee taking line is shown on Plate 2-5. The backwater envelope curves are included as Plates 2-6 and 2-7.

2-06. Public Facilities. There are nine public use areas at Wister Lake, including the damsite and overlook. The Corps of Engineers maintains five of the areas, two of which have developed facilities including boat ramps. The State of Oklahoma maintains and operates the other four areas, which have been developed with a number of facilities, which include boat ramps, picnic areas, camping areas, drinking water, restrooms, showers, and concession services. Approximately 33,400 acres of project lands have been made available to the Oklahoma Department of Wildlife Conservation for wildlife management purposes. Two thousand acres of this land have been designated as a State waterfowl refuge, while the remaining lands are managed for upland game and whitetail deer and are open for public hunting. A map of the public use areas is shown on Plate 2-5.

III - HISTORY OF PROJECT

3-01. Authorization. Wister Lake was authorized for construction by the Flood Control Act of June 28, 1938 (Public Law 761, 75th Congress, 3rd Session) in accordance with the general comprehensive plan set forth in Flood Control Committee Document No. 1, 75th Congress, 1st Session.

3-02. Planning and Design. Wister Lake was included as a practical plan for flood control on the Poteau River in the comprehensive report "Arkansas River and Tributaries", published as House Document No. 308, 74th Congress, 1st Session. The Definite Project Report, Wister Dam and Reservoir, Poteau River, Oklahoma, published in June 1940 and revised in December 1940 and June 1943, recommended the construction of the Wister Dam and Reservoir project with 400,000 acre-feet of flood control storage and an uncontrolled spillway. The option of hydropower generation was determined to be not feasible.

3-03. Construction Activities. A summary of construction activities for Wister Lake is presented in Table 3-1.

TABLE 3-1
SUMMARY OF CONSTRUCTION ACTIVITIES

Activity	Date
Construction Began	April 1946
Date of Diversion	June 1948
Construction Completed	May 1949
Final Storage Began	October 1949
Conservation Pool Filled	December 1949

3-04. Related Projects. Wister Lake is a component of the Arkansas River Basin flood control and navigation system. Included in this system are 30 completed flood control projects in the Arkansas, Verdigris, Grand, Canadian, Illinois, and Poteau River Basins. Also included are the five navigation locks and dams located on the navigation system above Van Buren, Arkansas.

3-05. Modification to Regulations. Deviations from the top of conservation pool in support of lake level manipulation plans (seasonal pools) have been implemented over the years to benefit fish and wildlife in the lake. The Water Resource Development Act of 1996 changed the top of conservation pool from 474.6 to 478.

3-06. Principal Regulation Problems. The principal regulating problem for Wister Lake is the channel capacity restriction below the dam. The small channel capacity limits the ability to evacuate floodwaters between consecutive rainfall events. Another regulating problem is the stream bank erosion that occurs during and after periods of high flows in the Poteau River below the dam. To attempt to minimize the effect of releases on stream bank erosion, releases are decreased as slowly as possible in order to slow the rate of fall in the downstream river stage. Much of the stream bank erosion has been attributed to the long periods of bank full flow and the fast rate of fall from regulated flows.

IV - WATERSHED CHARACTERISTICS

4-01. General Characteristics. The Poteau River basin above Wister Lake is divided into a T-shape with two main tributaries, the Fourche Maline to the west and the main stem of the Poteau River to the east. The watershed is approximately 70 miles long east to west and 14 miles wide north and south with a total drainage area of 993 square miles. The source of the Fourche Maline is in the hill region about eight miles north of Wilburton, Oklahoma. From there it flows in an easterly direction through a wide valley that drains the Sans Bois Mountains on the north and the Winding Stair Mountains to the south. The Fourche Maline has a river length of approximately 64 miles and drains an area of about 400 square miles before it joins the Poteau River at Wister Lake. The main stem of the Poteau River flows in a westerly direction from its source in the mountain region about 13 miles east of Waldron, Arkansas. The river flows about 70 miles through a valley that drains the Poteau Mountains to the north and the Black Fork and Winding Stair Mountains to the south before it joins the Fourche Maline at Wister Lake. The Black Fork River with a drainage area of about 195 square miles is the main tributary of the upper part of the Poteau River. A stream profile of the Poteau River downstream of Wister Dam is shown on Plate 4-1.

4-02. Topography. The Poteau River basin is generally mountainous rising from an elevation of about 460 feet in the valley floor at the dam to about 2,250 feet on the highest peaks. The valley slopes are steep and rocky and most of the area is covered with a heavy growth of timber and underbrush. The average fall of the Poteau River from its source in Arkansas to the Oklahoma State line is about 6 feet per mile and from that point to the lake the average slope is about 3 feet per mile. Below the dam the Poteau River is not as steep with an average fall between 0.5 feet and 1 foot per mile between Wister and Panama. The Poteau River valley averages about one-half mile in width and the Fourche Maline valley averages about one mile in width. The channel of the two rivers varies between about 175 and 250 feet in width with banks averaging 20 feet in height.

4-03. Geology and Soils. The topography of the region has resulted from the differential erosion of severely folded and faulted hard sandstones and softer shales of the Ouachita Mountains. The Ouachita Mountains were formed by intense folding and faulting, and as a result the rocks have been deformed into generally east-west trending anticlines and synclines. Long parallel hogbacks and rounded ridges mark the outcrops of the sandstone beds that alternate with broad valleys underlain by shale. Wister Dam is located on the northern flank of the Heavener Anticline, where the formations have a northward dip averaging about 25 degrees. The rocks of the region are sediments of the lower Pennsylvanian age and include, from older to younger, the Atoka formation, the Hartshorne sandstone, and the McAlester shale. These formations have a combined thickness of more than 9,000 feet. The Atoka formation, generally sandy shale containing some rather prominent sandstone beds, underlies the entire floodplain area at and near the dam, and outcrops on both sides of the valley. The Hartshorne sandstone, overlying the Atoka, outcrops on the north side of the valley along the low ridge that forms the common abutment for the main and left wing dams. The Hartshorne is a resistant formation that forms hogbacks wherever exposed. The McAlester shale, overlying the Hartshorne, is exposed on the north side of the river valley. The overburden in the flood plain is an alluvial deposit composed in general of impervious silty clay and clayey silt containing thin lenses of fine sand. The average depth of the flood plain alluvium near the embankment is 30 feet.

4-04. Sediment. The lake inflow carries some sediment from the Poteau and Fourche Maline Rivers. Erosion from streambanks and cultivated lands are the primary sources of the sediment that is carried primarily during high flows.

Since the original survey in 1948, two sediment resurveys were completed in 1972 and 1985. The results of the resurveys have shown that over 17 percent of the original conservation storage has been filled in with sediment, while very little change has taken place in the original flood storage. The results indicate that very little sedimentation occurred between the 1972 and 1985 resurveys. Additional resurveys will be done periodically to monitor the continued rate of sedimentation.

4-05. Climate. The watershed above Wister Lake lies in a region characterized by short winters and comparatively long summers of relatively high temperatures. The average annual temperature in the basin is approximately 62 degrees F and the mean annual precipitation in the basin is approximately 44.2 inches. Climatic characteristics for the basin are shown in the following tabulation. The average monthly and annual rainfall and runoff data are shown in Table 4-1.

TABLE 4-1

AVERAGE MONTHLY AND ANNUAL RAINFALL AND RUNOFF
UPSTREAM OF WISTER DAM

Month	(1) Basin average rainfall (inches)	Percent average annual rainfall	Average Runoff (2) (acre-feet)	(3) (inches)	Percent average annual runoff
January	2.70	6.1	78,960	1.49	9.2
February	2.97	6.7	104,480	1.97	12.1
March	3.72	8.4	126,890	2.40	14.7
April	4.36	9.9	122,050	2.31	14.1
May	5.72	12.9	141,870	2.68	16.4
June	4.00	9.0	59,620	1.13	6.9
July	3.41	7.7	18,430	0.35	2.2
August	3.09	7.0	7,880	0.15	0.9
September	3.96	8.9	17,390	0.33	2.1
October	3.55	8.0	31,460	0.59	3.6
November	3.72	8.4	67,400	1.27	7.8
December	3.00	7.0	86,480	1.63	10.0
Total	44.20	100.0	862,910	16.30	100.0

(1) Period of record: 1930-2002.
(2) Period of record: 1939-2002.
(3) Contributing drainage area above Wister Dam = 993 square miles.

a. Temperature. (at Wilburton, OK)

Mean annual (1971-2000)	61.0	degrees F
Maximum (30 July 1986)	111	degrees F
Minimum (2 February 1951)	-16	degrees F

b. Precipitation. (at Wilburton, OK)

Mean annual (1971-2000)	50.42	inches
Maximum annual (1990)	78.28	inches
Minimum annual (1963)	20.72	inches
Percent during growing season (April-September)	53.8	percent

c. Snowfall. The mean annual snowfall in the Poteau River basin is approximately 4 inches.

d. Evaporation. The average monthly pan evaporation at Wister Dam is shown in Table 4-2.

e. Wind. The prevailing wind during most times of the year is from a southerly direction with the highest winds occurring during the spring months.

TABLE 4-2

AVERAGE MONTHLY PAN EVAPORATION
WISTER DAM

Evaporation (inches) (1)

Month	Average (2)	Maximum Recorded
January	1.92	3.58
February	2.32	3.37
March	3.85	5.64
April	5.12	6.29
May	5.82	7.50
June	6.70	8.13
July	7.90	10.78
August	7.35	10.28
September	5.38	7.16
October	3.69	4.77
November	2.31	3.53
December	1.81	2.42
Annual	54.17	73.45

(1) National Weather Service Class "A" Pan
(2) Period of Record 1980-2002

4-06. Storms and Floods. Most of the flood-producing storms in the Poteau River Basin have a duration of 2 to 8 days. The longer duration storms usually consist of two or three periods of intense precipitation with moderate periods of intervening precipitation, resulting in high percentages of runoff. The heaviest rainfall is generally in April and May with a noticeable decrease in rainfall during the latter part of June and the month of July. On the average the winter months have low rainfall totals and few major runoff-producing storms. The largest flood of record on the Poteau River above and below Wister Dam occurred in June 1935, before the dam was built. Since the dam was completed the two largest storms and floods of record occurred in May 1960 with a basin average rainfall of 9.56 inches and in May 1990 with a basin average rainfall of 8.77 inches. Storms with a basin average precipitation of 4 inches or more above Wister Lake are shown in Table 4-3. The average rainfall amounts were computed from records of stations in the watershed area and do not necessarily record the rainfall amounts at the center of the most intense storms. Major floods at gages above and below Wister Dam are presented in Table 4-4.

TABLE 4-3

MAJOR STORMS
JANUARY 1935 THROUGH DECEMBER 2002
WISTER LAKE

Inclusive Dates	Average Basin Rainfall (inches)	Inclusive Dates	Average Basin Rainfall (inches)
13-21 Jun 1935	10.58	15-21 Oct 1971	5.46
20-25 Jan 1938	4.06	29 Oct-02 Nov 1972	5.99
12-22 Feb 1938	8.09	15-24 Apr 1973	6.87
15-17 Apr 1939	5.52	01-05 Jun 1973	4.82
01-11 Oct 1941	5.14	04-08 Sep 1973	4.10
09-11 May 1943	7.10	04-09 Jun 1974	8.04
10-22 Feb 1945	5.33	27-28 Mar 1977	5.38
25 Feb-02 Mar 1945	4.11	13-17 Nov 1978	5.15
29 Mar-05 Apr 1945	5.69	20-22 May 1979	5.48
09-16 May 1945	7.38	12-18 Oct 1981	5.54
04-18 Jun 1945	8.19	12-15 May 1982	5.41
24 Sep-05 Oct 1945	8.15	01-04 Dec 1982	4.33
01-11 Nov 1946	9.84	13-19 May 1983	4.71
09-13 Dec 1946	5.32	18-26 Oct 1984	8.74
21-30 Jan 1949	7.72	14-20 Nov 1985	5.30
04-15 Jun 1949	5.03	22-29 May 1987	6.23
14-23 Jul 1950	6.08	23-27 Dec 1987	4.85
11-17 Sep 1950	6.03	12-18 Feb 1989	4.51
13-16 Feb 1951	4.70	15-23 May 1989	5.59
02-16 Jun 1951	6.29	16-20 Jan 1990	6.16
04-10 Sep 1951	4.16	15-21 Apr 1990	4.40
27 Oct-02 Nov 1951	4.12	01-04 May 1990	8.77
22-26 Nov 1952	4.00	16-21 May 1990	4.23
10-17 May 1953	4.60	16-22 Sep 1990	5.32
20-25 Jul 1953	5.34	24-29 Oct 1991	9.25
28 Apr-03 May 1954	4.34	18-22 Sep 1992	5.15
19-27 Apr 1957	6.53	13-17 Dec 1992	4.13
21-25 May 1957	5.02	08-13 May 1993	4.42
11-18 Aug 1957	5.84	28 Apr-03 May 1994	4.28
21-23 Sep 1957	4.13	03-06 Nov 1994	6.91
29 Apr-05 May 1958	4.44	20-30 Nov 1996	5.58
18-27 Jul 1959	4.11	04-09 Jan 1998	5.16
29 Sep-06 Oct 1959	4.56	13-18 Sep 1998	4.83
18-20 May 1960	9.56	18-22 May 2001	4.11
21-26 Jul 1960	6.40	16-18 Dec 2001	4.99
05-11 Dec 1960	5.18		
12-17 Jul 1961	5.18		
15-20 Nov 1964	4.92		
20-23 Sep 1965	4.54		
09-10 Feb 1966	4.59		
23 Apr-02 May 1966	6.48		
10-13 Apr 1967	4.42		
30 Oct-03 Nov 1967	5.12		
19-21 Mar 1968	4.66		
08-14 May 1968	7.91		

4-07. Runoff Characteristics. The Poteau River watershed above Wister Dam includes two major drainage basins, the Poteau and Fourche Maline Rivers that join at Wister Lake. The Fourche Maline arm contributes approximately 400 square miles that is about 40 percent of the total drainage area above the dam. Its major tributaries include Holston Creek, Long Creek, and Red Oak Creek. The Poteau River arm contributes the remaining 60 percent of the drainage area, about 593 square miles. Its major tributary is Black Fork Creek that drains 195 square miles. The two rivers run east and west along wide valleys that are bordered by hills and mountains on the north and south sides. Runoff travels quickly off of the steep valley slopes into the main tributaries and rivers where it slows down as the streams become wider and flatter. It takes about 1.5 to 2 days for runoff in the upper Poteau and Fourche Maline watersheds to reach Wister Lake, while travel time for runoff in the creeks near the lake is less than 1 day. Estimated monthly and annual flows past the dam are shown in Table 4-5 and the inflow volume frequencies for each month are shown in Table 4-6. Plate 4-2 shows the flow duration curve for inflow and outflow to the reservoir.

TABLE 4-6

INFLOW VOLUME FREQUENCY
(1939-1995)

Exceedance Frequency (percent)	Monthly Inflows in Thousands of Acre-Feet												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
2	537	615	627	550	835	527	203	96	274	500	540	754	2120
5	329	410	420	350	534	299	87	47	119	224	345	435	1730
10	213	286	294	257	359	170	50	25	57	98	227	300	1450
20	126	170	191	160	222	86	23	11	33	36	130	200	1170
50	46	63	83	70	89	23	5	2.6	6	7	48	85	[illegible]

4-08. Water Quality. The quality of water in Wister Lake is considered poor to fair, requiring at least conventional treatment to be suitable for domestic and industrial use.

4-09. Channel and Floodway Characteristics. The regulating channel capacity below Wister Dam is currently 7,800 c.f.s., which corresponds to a 20 foot stage at the Poteau gage 21 miles downstream. The regulating channel capacity increases to approximately 10,800 c.f.s., at the Panama gage located 34 river miles below the dam. Travel time for releases from the dam to the Poteau gage is approximately 8 hours. Travel time from the Poteau gage to the Panama gage is about another 8 hours. Pertinent data for stream gaging stations above and below the dam are presented in Table 4-7 and the discharge rating curves for the Panama and Poteau stations are on Plates 4-3 and 4-4. Plate 4-5 shows the crest travel times between gaging stations along the Poteau and Arkansas Rivers.

4-10. Upstream Structures. There are no structures upstream of Wister Dam.

4-11. Downstream Structures. Operational structures downstream of Wister Dam include the Arkansas River Navigation System below Lock and Dam 14 (W.D. Mayo). The Port of Fort Smith is located in the Poteau River channel upstream of the confluence with the Arkansas River.

TABLE 4-7

PERTINENT DATA FOR STREAM GAGING STATIONS

Stream and Station	Miles Above Mouth	Drainage Area (sq.mi)	Gage Datum (ft NGVD)	Flood Stage (ft)	Bank Full Capacity (cfs)	Maximum Flood of Record Date	Stage (ft)	Discharge (cfs)
Blackfork River								
Page, OK	24.6	74	684.00	(1)	(1)	8 Apr 02	21.05	23,650
Fourche Maline River								
Red Oak, OK	41.2	122	540.80	15	2,600	Jun 35	25.4	(2)
Poteau River								
Cauthron, AR	109.0	203	569.53	17	9,900	Jun 35	27.37	(2)
Loving, OK	93.6	269	507.76	(1)	(1)	8 Apr 02	27.92	12,500
Wister, OK	60.8	993	445.43(3)	8	7,800	Jun 35	43.0	(2)
Poteau, OK	39.6	1240	409.40	20	7,200	18 Jun 35	39.0	100,000
Panama, OK	26.8	1767	387.96(4)	29	11,500	18 Jun 35	44.6	95,000

Stream and Station	2nd Largest Flood of Record Date	Stage (ft)	Discharge (cfs)	3rd Largest Flood of Record Date	Stage (ft)	Discharge (cfs)	Period of Record
Blackfork River							
Page, OK	4 Jan 93	18.45	25,800	5 Jan 98	17.25	17,100	Mar 92 - Feb 04
Fourche Maline River							
Red Oak, OK	19 May 60	24.79	41,500	25 Apr 42	22.34	26,300	Apr 39 - Feb 04
Poteau River							
Cauthron, AR	20 May 60	23.76	32,200	3 May 90	22.17	24,000	Feb 39 - Feb 04
Loving, OK	16 Dec 92	27.18	8,400	9 May 95	26.84	8,200	Apr 92 - Feb 04
Wister, OK	16 May 45	37.16	78,600	17 Apr 39	37.05	77,800	May 38 - Feb 04
Poteau, OK	11 May 34	37.0	58,100	16 May 45	36.42	66,300	Jan 29 - Feb 04
Panama, OK	3 May 90	46.59	74,600	14 May 68	41.4	(2)	Oct 50 - Feb 04

(1) Flood stage and bankfull flow not determined.
(2) High water mark, flow data not available.
(3) Datum of gage raised 0.7 ft in Jan 1939 and 12.41 ft in Jun 1953
(4) Datum of gage lowered 5.0 ft in April 1992.

4-12. Economic Data.

a. Population. Four counties, two in Oklahoma, Le Flore and Latimer counties, and two in Arkansas, Scott and Sebastian counties comprise the Poteau River basin. Le Flore and Sebastian counties are below Wister Lake, while Latimer and Scott counties are in the basin above Wister. Scott and Latimer counties are rural and have mainly agriculture and forest related industries. The largest city in the region is Fort Smith, Arkansas, which has considerable manufacturing activities. Le Flore county and the city of Poteau, the county seat, have the next largest population, but contain mainly agricultural and service related industries. Table 4-8 shows the principal counties and cities within the Poteau River basin.

TABLE 4-8
POPULATION OF COUNTIES AND CITIES
POTEAU RIVER BASIN 1980-2000

County or City	1980	1990	2000	%Change 1990-2000
Oklahoma				
Latimer County	9,840	10,333	10,692	3
Wilburton	2,996	3,092	2,972	-4
Le Flore County	40,698	43,270	48,109	11
Poteau	7,089	7,210	7,939	10
Arkansas				
Scott County	9,685	10,205	10,996	8
Waldron	2,642	2,785	3,508	26
Sebastian County	95,172	99,590	115,071	16
Fort Smith	71,626	72,798	80,268	10
Total, Counties	**155,395**	**163,398**	**184,868**	**13**

Source:) U.S. Department of Commerce, Bureau of the Census, 2000

b. Agriculture. The chief industry within the basin is agriculture with 1,744 farms in Le Flore County in 1997. The average size of farms in Le Flore County is about 234 acres. Most of these farms raise livestock with some production of feed crops, cash crops, and vegetables. Le Flore County had 407,359 acres in farms in 1997, a 7 percent increase from 1992 to 1997. In Sebastian County, Arkansas, about 114,950 acres were in farms in 1997, less than a 1 percent decrease from 1992 to 1997. Table 4-9 shows the annual value of crops in the flood plain below Wister Lake to the Arkansas River.

TABLE 4-9
ANNUAL PRODUCTION AND VALUE OF CROPS
BELOW WISTER DAM
(2002 Current Normalized Prices)

Crops	Acres	Value
Oats	2,604	$379,200
Corn	2,820	$778,300
Soybeans	6,305	$1,071,350
Wheat	8,381	$751,800
Pasture		
Improved	14,735	$3,913,300
Open	2,106	$239,700
Woods	5,150	$293,100
Total	**42,101**	**$7,426,750**

*Source: United States Department of Agriculture, Economic Research Service. $Value calculated by taking price*yield*acre.*

c. Manufacturing. In 1997, 32 manufacturing establishments were in Le Flore County. Manufacturing activities in Le Flore County produce such items as refrigerator parts, instrument panels, crackers, and cattle feed. Earnings by the service-related industry, such as retail trade, finance, insurance, real estate, and other services, comprise about 33 percent of total earnings in 2000, followed by government with 26 percent of total earnings, and manufacturing with 17 percent of total earnings. Sebastian County in Arkansas, with 233 manufacturing establishments in 1997, has about 31 percent of total earnings in manufacturing and 53 percent in services.

d. Flood Damages. Periodic flooding of varying magnitudes has occurred in the Poteau River flood plain below Wister Lake. Major floods occur on average of about once every 5 years, less severe floods on an average of once every 2 years, and some overflow occurs 2 or 3 times annually. Major floods occurred in June 1935, April 1939, May 1943, May 1945, January 1949, April and May 1957, May 1960, June 1986, May 1990, and October 1991. In April 1957 about 32,000 acres of agricultural land were inundated. Cumulative flood damages prevented by Wister Lake since it became operational are $185,695,000 through FY 2003. Table 4-10 shows the estimated average annual residual flood damages from Wister Lake downstream to the confluence of the Poteau River with the Arkansas River. Structural loss and area curves are shown on Plates 4-6 through 4-8.

Table 4-10
AVERAGE ANNUAL RESIDUAL FLOOD DAMAGES
(2003 price levels and 2002 CNP)

Category	Residual Damages
Residential Structures	$448,200
Commercial Structures	$24,800
Agriculture	$276,400
TOTAL	**$749,400**

Source: Wister Lake Reconnaissance Report, Tulsa District, 1993.

V - DATA COLLECTION AND COMMUNICATION NETWORKS

5-01. Hydro-meteorological Stations.

a. Facilities. The Hydrology-Hydraulics Branch, Tulsa District Office; 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 for Wister Lake are shown on Plate 5-1.

The important stream-gaging stations on the Poteau River have automated gages with Data Collection Platforms (DCP). The DCPs record and transmit the data to the Hydrology-Hydraulics Branch computer through a system of satellites and downlinks. The stream gages used in forecasting inflows into Wister Lake are located on the Poteau River near Cauthron and Loving, on the Fourche Maline River near Red Oak, and on the Blackfork River near Page. The stream gages used to regulate flows downstream of the dam are located on the Poteau River near Poteau and Panama. The USGS maintains all of the automated stream gages along the Poteau and Fourche Maline Rivers and takes stream flow measurements periodically to develop accurate rating curves.

Automated precipitation gages are located at all automated stream-gaging stations in the Poteau River Basin. These gages are connected to a DCP that records and transmits the precipitation data along with the stage data. Wister Dam also has an automated precipitation gage and DCP located on the dam. The NWS maintains a network of local rainfall observers throughout the Poteau and Arkansas River Basins who report precipitation to the NWS on a daily basis. Weather stations located at the Wister Lake office have equipment for monitoring precipitation, evaporation, wind speed, wind direction, and air temperature.

Pool elevations at Wister Lake are monitored by a float well gage and a recording chart located in the gate tower on the dam. A DCP is connected to the gage to record and transmit the pool elevation and precipitation data to satellite. A wire weight gage and a staff gage located at the dam can be used to verify the elevations recorded at the automated float gage.

b. Reporting. The NWS maintains a network of rainfall and river stage observers in the Poteau River Basin that report directly to the NWS on a daily basis. Observer reports are put into the Automated Field Observing Station (AFOS) computer network by the NWS. All AFOS data is directly accessed by the Hydrology-Hydraulics Branch computer network, which is located at the District office. Precipitation, stream, and pool gage readings from the automated gaging stations are transmitted by the DOMSAT satellite and are received by a downlink directly into the computer network at the District office. This data is automatically put into the database on the computer network in the Hydrology-Hydraulics Branch. The reporting criteria for the pertinent precipitation and stream gaging stations are shown in Table 5-1.

Hydrometeorological data and conditions are collected and recorded by the project personnel at the Wister Lake office. This data, which includes precipitation, evaporation, wind speed and direction, and sky conditions is reported on a daily basis to the Hydrology-Hydraulics Branch, Tulsa District Office (telephone 918-669-7097 or VHF-FM radio, call signal WUI-3). Detailed instructions on project reporting criteria are presented in paragraph 2. (page B-1) of Exhibit B, "Standing Instructions to Project Manager."

TABLE 5-1

REPORTING CRITERIA FOR PERTINENT STATIONS

Station	Report to	Times of Report
Rainfall Stations		
Airport Stations	National Weather Service	6-hour rainfall as of 6 a.m., 12 noon, 6 p.m., and 12 midnight
Corps of Engineers Dams	Corps of Engineers	Reporting criteria as listed in paragraph 5-07.d. (1-4)
Automated Gages	Data Collection Platform	Hourly or as needed
Observer Stations	National Weather Service	At 7:00 a.m. and additionally every 6 hours as directed by the NWS
Stream Gaging Stations		
Poteau River		
Cauthorn, AR	Data Collection Platform	Hourly or as needed
Loving, OK	Data Collection Platform	"
Fourche Maline River		
Red Oak, OK	Data Collection Platform	Hourly or as needed
Blackfork River		
Page, OK	Data Collection Platform	Hourly or as needed

c. Maintenance. The maintenance and repair of the automated stream and precipitation stations in the Poteau River Basin is the responsibility of both the Corps of Engineers and the USGS. Both the Corps of Engineers and the USGS have stream-gaging equipment and the Corps has contracted with the USGS for maintenance of the Corps owned stream and precipitation gaging equipment in the Poteau River Basin. The maintenance and repair of the observer weather stations is the responsibility of the NWS.

d. Automation. The reporting of data from lake, stream and precipitation gaging stations has been automated through the use of Data Collection Platforms (DCP). The DCPs transmit hourly and random data to the GOES satellite, which is then received by a downlink to a central computer operated by the National Oceanic and Atmospheric Administration (NOAA). The data is then retransmitted to a DOMSAT satellite and is received by a downlink directly into the computer network located in the Hydrology-Hydraulics Branch at the Tulsa District Office. The DCP data is then processed by the Hydrology-Hydraulics Branch computers and put into a database to be used for regulation of the district reservoir systems. Observer rainfall data is currently received automatically from the AFOS network through a dedicated line from the Hydrology-Hydraulics Branch computer to the Tulsa River Forecast Center. This data is automatically encoded into the Hydrology-Hydraulics computer database for use in forecasting river flows and reservoir inflows. Weather forecasts, river forecasts, radar depictions, and other weather information are also received automatically from the AFOS network.

5-02. Water Quality Stations.

a. Facilities. Water quality stations for the Wister Lake drainage area are listed in Table 5-2. Water quality samples from the lake were taken from four sites selected by the Environmental Analysis Section, Tulsa District during the summers of 1989 and 1990. The data is contained in a report written by Environmental Analysis Section entitled "Wister Lake Oklahoma Water Quality Study, February 1994."

TABLE 5-2

PERTINENT REPORTING WATER QUALITY STATIONS

Station and Stream	Station ID Number	Period of Record
Holson Creek		
Summerfield, OK	07247800	Dec 1991 to Present
Fourche Maline River		
LeFlore, OK	07247650	Dec 1991 to Present
Red Oak, OK	07247500	Water Years 1952, 1954, 1956-60, 1978-79, 1991-96 (discontinued)
Blackfork River		
Hodgen, OK	07247345	Dec 1991 to Present
Page, OK	07247250	Dec 1991 to Present
Poteau River		
Loving, OK	07247015	Dec 1991 to Present
Cauthorn, AR	07247000	WY 1945-61, 1975-79, 1991-96 (discontinued)
Waldron, AR	07246950	Nov 1983 to July 1996
Waldron, AR	07246940	Nov 1983 to July 1996
Jones Creek		
Hon, AR	07246980	Feb 1993 to June 1993 July 1994 to July 1996

* All stations were sampled for specific conductance, pH, water temperature, alkalinity, dissolved oxygen and chemical, biological and sediment parameters on a six-week schedule by the USGS.

b. Reporting. The reporting procedures for water quality stations are made in cooperation with the USGS. Water quality samples are taken by the USGS at periodic intervals to determine the chemical, biological, and sediment quantities contained in the stream water. The Corps of Engineers is sent copies of the published data entitled "Water Resources Data Oklahoma, Volume 1." Water quality samples taken by Corps of Engineers personnel will be reported directly to the Tulsa District Office.

c. Maintenance. Maintenance of the gages is the responsibility of the USGS. The Corps of Engineers shares in the expense. The Hydrology and Hydraulics Section, Hydrology-Hydraulics Branch, Tulsa District, is responsible for any gaging equipment owned by the Corps of Engineers.

5-03. Sediment Stations.

a. Facilities. There are 41 sedimentation ranges upstream of Wister Dam, which are used for sedimentation measurements (paragraph 2-03.e.). The sedimentation ranges were established in 1948 for the original sediment survey and both ends of each range are identified with permanent markers of known vertical and horizontal positions. Sedimentation ranges are surveyed periodically for the purpose of computing sediment deposition in the lake and determining the current area and capacity data. The latest sediment resurvey was completed in 1985. Sedimentation in the lake is discussed in paragraph 4-04.

b. Reporting. Sediment resurveys are documented and published by the Hydrology-Hydraulics Branch, Tulsa District Corps of Engineers. Since the original survey in 1949, two sediment resurveys have been completed at Wister Lake in 1972 and 1985.

c. Maintenance. Maintenance of the sediment and degradation ranges is the responsibility of the Corps of Engineers.

5-04. Recording Hydrologic Data. Hydrologic information is recorded on a computer database when received by the Water Management Section, Hydrology-Hydraulics Branch, as follows:

a. Stage, Flow, Elevation and Storage. Hourly river stage and pool elevation data is received automatically through a satellite downlink into the computer network in the Hydrology-Hydraulics Branch. The computer decodes the transmissions and puts the data in a database to be used in various Water Management programs for regulating the Tulsa District reservoirs. The computer converts river stage to river flow at each gage using a stage-flow rating curve. Lake storage is computed with elevation-capacity tables. All the hourly data from river and lake gages is stored on the network database and archived on tape for permanent storage. Lake elevations, discharges, gate settings and changes, and hydropower information are reported on a daily basis by the projects to the Water Management Section. Water Management Section personnel enter the project data and computed daily inflows into the network computer database every morning.

b. Precipitation. Precipitation data from the DCP stations and the projects are combined with NWS observer precipitation data and stored in the network rainfall database. This data can then be accessed by computer, for plotting rainfall distribution, determining basin average rainfall, and forecasting runoff (see Chapter VI). Radar estimated rainfall can also be plotted with observed rainfall to calibrate areas where there are no precipitation gage reports.

c. Water Quality Data. Environmental Analysis Branch and Operations Division, Tulsa District take water quality samples in the lake at random times as needed. Water quality data at selected stream gages is recorded by

the USGS and received at the Tulsa District Office in the form of an annual report entitled "Water Resources Data Oklahoma."

d. Radar and Satellite Reports. Currently, radar and satellite images are received by the Hydrology-Hydraulics Branch to view real time weather images. Radar summaries, quantitative precipitation forecasts, and weather forecasts are received through a direct connection to the NWS AFOS network. Radar estimated rainfall data is also received from the NWS on a real time basis for comparison with data from precipitation stations.

5-05. Communication Network. Wire facilities at Wister Lake include local and long distance telephone service. Radio communication is by a VHF-FM fixed station (call signal WUI-318) capable of reaching local mobile stations, the Tulsa District Office, and other stations in the District via repeater relay. Maintenance of the telephone lines is the responsibility of the company leasing the lines to the Government. Radio equipment is tested periodically in transmitting and receiving the hydrologic data and civil works activities. The 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, a warning horn is located at the spillway.

5-06. Communication With Project.

a. Between Regulating Office and 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 Chapter VII of this manual. This communication will normally be made by long distance 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 at the Tulsa District Office. Should communication between the project and the district offices be disrupted, the Project Manager will, on his own initiative, direct regulation of the lake in accordance with the emergency regulations as required in Chapter VII and Exhibit B of this manual. An organization chart for Flood Control Regulation at Wister Lake is shown on Plate 5-2.

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

5-07. Project Reporting Instructions. Daily lake data from Wister Lake (see Plate 5-3) will be submitted to the Water Management Section, Hydrology-Hydraulics Branch, Tulsa District Office, (telephone 918-669-7097 or VHF-FM radio, call signal WUI-3). The Water Management Section office is manned from 6:30 a.m. to 4:30 p.m. daily and various hours on weekends and holidays as required. Lake elevation data for weekends and holidays shall be read from the recorder chart and submitted the following workday. Should unusual conditions arise during nonworking hours, one of the persons listed on page i of this manual should be contacted. The following data should be included in the daily report.

a. As of 8 a.m. Pool elevations at 12 noon, 4 p.m., and 12 midnight of the previous day and the current 8 a.m. pool elevation; the current gate setting and any gate changes during the previous 24 hours; the current tailwater elevation; precipitation in inches for the preceding 24 hours (7 a.m. to 7 a.m.); wind velocity and direction, and sky conditions at 8 a.m.

b. Each Gate Operation. Date and time of operation, number and height of gates open before and after operation and lake elevation shall be logged following completion of each gate operation. Confirmation of gate changes

shall be made to the Water Management Section immediately after completion of the change. Complaints about pool elevations or releases, operating machinery failure, and out-of-service times for maintenance shall be reported to the Water Management Section as they occur.

c. During Flood Periods. In addition to reports referenced in subparagraphs a. and b. above, additional reports of lake elevations may be requested by the Water Management Section personnel during flood periods.

d. Rainfall Reports. Rainfall reports shall be made as follows:

(1) At 8 a.m. all precipitation that occurred during the preceding 24 hours (7 a.m. to 7 a.m.) as shown on the Lake Data Report Form (Plate 5-3).

(2) At 1 p.m. when 0.50 inches or more of precipitation has occurred since 7 a.m. or if it has continued to rain since the 8 a.m. report.

(3) At 7 p.m. when 0.50 inches or more of precipitation has occurred since the 7 a.m. report and no 1 p.m. report was made, or if it has continued to rain since reporting at 1 p.m.

(4) Report at once the occurrence of 2.00 inches or more of precipitation that occurs during a period of 6 hours or less. During nonworking hours, the report should be made to one of the persons listed on page i of this manual. If no contact with Water Management Section personnel can be made, rainfall reports should be made to the National Weather Service in Tulsa, Oklahoma, telephone 1-918-832-4109.

5-08. Warnings. It is the responsibility of the Project Manager to maintain a list of the current status of residents and property owners who would be endangered or inconvenienced by large or prolonged releases. If damaging releases are expected to occur, notification will be made by telephone or in person warning by Corps employees. Notification will be made in accordance with the Tulsa District supplements to ER 500-1-1. This would include radio, television, telephone, citizen band radio, use of law enforcement and civil defense agencies and their communication systems, National Guard and Reserve Units, supplemented by oral warning from Corps employees. Studies have been made to determine the possible downstream flood conditions, which 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 showing the results of these studies are kept at the Wister Lake Office. In every case when a gate change is made a horn is blown to give warning to people immediately downstream of the dam.

5-09. 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.

VI - HYDROLOGIC FORECASTS

6-01. General. Hydrologic forecasts are necessary in predicting stream-flow upstream and downstream of Wister Lake to regulate releases from the dam.

a. Role of Corps of Engineers. Hydrologic forecasts are made by the Tulsa District, Hydrology-Hydraulics Branch for use in regulation of lakes for flood control and other authorized purposes and for the benefit of Corps of Engineers construction projects and flood fighting activities. As distinguished from the National Weather Service (NWS), which furnishes weather and flood forecasts to the public, the Corps furnishes current information on lake levels, weather, stream-flow, or any other available information on observed conditions, along with technical advice. Current lake levels and discharges are available to the public on a recorded message that can be reached at telephone number 918-669-7521 which is listed in the Tulsa, Oklahoma telephone directory. Further information on Water Management operations is available by speaking directly with Water Management Section personnel. General news releases are made by the Public Affairs Office, which is kept fully informed of the hydrologic situation as appropriate.

b. Role of Other Agencies. The National Weather Service (NWS) is the official agency making flood forecasts available to the public. This information is distributed to subscribing government agencies and the news media. Through a direct line to the NWS-AFOS network, the Tulsa District, Hydrology-Hydraulics Branch receives weather and flood forecasts as well as radar depictions, flood and storm warnings, weather summaries and statements, and observed precipitation. The NWS issues routine scheduled reports including the following information:

(1) Daily and extended weather forecasts.

(2) Weather summaries and statements of current conditions.

(3) Quantitative Precipitation Forecasts (QPF) for the next 6, 12, 24, and 48 hours.

(4) 5-day precipitation outlooks.

(5) 3-day river stage forecasts.

(6) Rainfall that would produce bank full stages (weekly).

(7) Urgent priority messages such as severe weather warnings, watches, forecasts, and statements and instructions from Civil Defense during emergency conditions are transmitted immediately. The following reports are sent as time permits.

(a) Damage reports.
(b) Road information and winter weather conditions.
(c) River and flood warning bulletins, forecasts, and statements.
(d) 30-day forecast.

6-02. Flood Condition Forecasts.

a. Requirements. Flood condition forecasts are necessary whenever substantial rainfall has fallen in the Poteau River Basin above or below Wister Lake in order to regulate the releases from the dam. The Tulsa District, Hydrology-Hydraulics Branch makes forecasts for inflow into Wister Lake and for regulated flow below Wister Lake using the basin subdivisions shown on Plate 6-1.

b. Methods. The Hydrology-Hydraulics Branch currently uses the HEC-1 forecasting program to make flood condition forecasts. In this program, runoff hydrographs are developed for each sub-basin depending on the amount of rainfall. These hydrographs are then routed in the river channels to control points where the estimated flow is compared to data from the gaging stations. The resulting volume of runoff in the river is then routed to the reservoir to determine the amount of flood control storage that will be used. Releases are determined by routing the trial releases to the downstream control points, combining the flow with the runoff from rainfall below the dam. Regulated flows in the rivers are not to exceed the bank full flow at any control point downstream of the dam.

(1) Forecasting of River Stages. The official forecasts of river stages are made by the National Weather Service (NWS). Release schedules from all the Tulsa District reservoirs are communicated to the NWS for putting into their official river stage forecasts. While NWS forecasts are helpful in regulating reservoir flood operations, forecasts made by the Hydrology-Hydraulics Branch are used for forecasting reservoir inflow volumes and for determining release rates from the dams.

(2) Forecasting of Flows and Pool Elevations. A single HEC-1 forecast model is currently being used for forecasting the river flows upstream and downstream of Wister Lake. The upstream forecast is used for determining the inflow rate and volume to the reservoir and for developing a pool elevation forecast. The downstream forecast is used for determining release rates from Wister Lake and the regulated flows at the Poteau and Panama gages. Example input and output from the Wister HEC-1 model are shown in Tables 6-1 and 6-2 on pages T6-1 through T6-9. Forecasted inflows are compared to actual inflows, which are computed from known pool elevations and discharges. A sample discharge and inflow computation is shown on Plate 6-2.

6-03. Conservation Purpose Forecasts.

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

b. Methods. Forecasts for conservation purposes during non-flood periods would depend largely on statistical interpretation of historical data. The flow duration curve on Plate 4-2 and the inflow volume frequency data in Table 4-6 would be considered in conjunction with NWS forecasts in making conservation forecasts during non-flood periods.

6-04. Long-Range Forecasts.

a. Requirements. Long-range forecasts are required for the evacuation of floodwater stored in the reservoir, for sustaining yield during low flow periods, and for maintaining constant conservation pool levels. These forecasts are made with a known volume of water in the reservoir and an estimated volume and rate of inflow to the reservoir.

b. Methods. Floodwater evacuation forecasts are determined from a known storage volume, allowable discharge rates, and an estimate of future inflows. Releases from the projects in the Arkansas River Flood Control System, which includes Wister Lake, are determined using an operational computer program that routes flows to the control point on the Arkansas River at Van Buren, Arkansas. Regulated flows in the Arkansas River are maintained while balancing the percentage of flood control storage in the lakes. Estimates of long-range inflows for low flow purposes can be made using historical records of stream-flows on the Poteau and Fourche Maline Rivers and the current groundwater conditions. Reliable methods for long-range inflow forecasts are not presently available. Long-range yield and conservation

forecast methods also depend on the inflow forecast. The NWS publishes an "Average Monthly Weather Outlook" semi-monthly, which is an estimate of the trend of the weather, but may not be reliable for forecasting long-range reservoir inflows. The NWS forecasts described in paragraph 6-01.b. are only useful for short-range forecasts.

VII - WATER CONTROL PLAN

7-01. General Objectives. The primary objectives of Wister Lake are flood control, water supply, and providing benefits to recreation, fish and wildlife, and navigation. Wister Lake is the primary flood control project for the Poteau River below the dam. Regulated releases from the reservoir will be made in accordance with the predicted runoff from the uncontrolled area downstream, the allowable stages for the downstream control points, and the predicted volume of inflow into the lake (Method A, paragraph 3-3c(2)(b) of EM 1110-2-3600, 30 Nov 87).

7-02. Major Constraints. The major constraint to flood control operations at Wister Lake is the channel capacity of the Poteau River downstream of the dam. The non-damaging channel capacity immediately below Wister Dam is currently 7,800 c.f.s., which corresponds to the regulating stage of 20.0 feet at the gage near Poteau, Oklahoma. The regulating stage at the gage near Panama, Oklahoma is also limiting because of the large uncontrolled drainage area below the dam. The current regulating stage for the gage near Panama is 29.0 feet with a corresponding flow of 10,800 c.f.s. The total uncontrolled drainage area between the dam and the Panama gage is 774 square miles. The regulating stages and corresponding discharges for the control points below Wister Lake are shown in Table 7-1.

TABLE 7-1

REGULATING STAGES AND DISCHARGES

Station	River	Regulating lakes	Regulating stage (feet)	Discharge (c.f.s.)
Poteau	Poteau	Wister	20.0	7,800
Panama	Poteau	Wister	29.0	10,800
Van Buren	Arkansas	Wister and System	22.0	135,000

7-03. Overall Plan for Water Control.

a. General. Wister Lake is regulated as a unit in a multi-purpose system for the benefit of water resources in the Arkansas River Basin as discussed in the Arkansas River Basin Master Manual.

b. System Regulation. Wister Lake is operated as a unit of the Arkansas River Basin System for the reduction of floods on the Arkansas River. Regulated releases from Wister will be coordinated with the other projects in the Arkansas River Basin to provide optimum flood reduction on the Arkansas River downstream of the mouth of the Poteau River. When floodwaters are being accumulated in the Arkansas River Basin, each lake in the system shall be regulated to retain equivalent flood control capabilities, as much as possible. Priority for releases will be given to the lake with the least amount of flood storage available considering present and forecasted inflows into the lake and downstream conditions. The priority lake levels used for balancing flood control storage in the Arkansas River Basin are shown on Plate 7-54 of the Arkansas River Basin Water Control Master Manual.

7-04. Standing Instructions to Project Manager. During flood periods, the 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 floodwater will be

issued by the Water Management Section, Hydrology-Hydraulics Branch, Tulsa District Office. If communication with the Tulsa District Office is disrupted, the lake regulation will become the responsibility of the Project Manager and will be in accordance with subparagraph 7-05.b. and Exhibit B of this manual. In addition, the Project Manager will immediately make every effort to re-establish communication with the Tulsa District Office. The Project Manager will make daily observations of the weather station and pool level data and report those observations as directed in paragraph 5-07 and Exhibit B. Should an emergency situation occur in which communication is not lost, such as inoperable gates, drowning accident, excessive trash in gates, broken buoy line, or power outage, the Water Control Section will be notified immediately.

7-05. Flood Control.

a. Normal Flood Control Regulations. Wister Lake will be regulated for maximum flood reductions on the Poteau River from the dam to the confluence with the Arkansas River. Releases will also be coordinated with the flood control operations of the Arkansas River System to provide maximum flood control benefits on the Arkansas River from the mouth of the Poteau River to Van Buren, Arkansas. Under normal flood control operations, releases will not exceed the maximum rate permissible, which is the release that when combined with local flows will not exceed the channel capacity on the Poteau River below the dam. Releases may exceed the maximum rate permissible only when the reservoir is above or is forecasted to rise above the top of the flood control pool, elevation 502.5, in which cases releases will be made to reduce the peak outflow and maximize flood control benefits downstream. The following regulations included in Table 7-2 will govern releases under normal flood control operations.

TABLE 7-2

NORMAL FLOOD CONTROL REGULATION SCHEDULE

Pool Elevation and Condition	Regulation
a. Below Top of Conservation Pool and Rising	When the pool level is at or below the top of the conservation pool and no flooding is forecasted, releases will be made equal to the downstream water requirement. If the lake is forecasted to rise above the conservation pool, releases may be made to crest the pool at or near the top of the conservation pool. Releases will not exceed the maximum rate permissible.
b. Above Top of Conservation Pool and Rising	When the pool is above the top of the conservation pool and rising, regulated releases through the conduit gates will be made at the maximum rate permissible. When the pool is forecasted to crest within 5 feet of the conservation pool, regulated releases may be made at less than the maximum rate permissible, provided that the rate of release is enough to empty the flood control storage in approximately one week or less.
c. Above Elevation 502.5 and Rising	When the lake is above the crest of the uncontrolled spillway, elevation 502.5, the conduit gates will be operated so that the combined releases from the conduits and uncontrolled spillway will not exceed the maximum rate permissible. If the lake level is forecasted to rise above the elevation when the uncontrolled spillway

discharge exceeds the maximum rate permissible, regulated releases greater than the maximum rate permissible may be made in order to reduce the peak discharge and maximize benefits downstream.

d. Above Elevation 510.0 and Rising

When the lake level rises to elevation 510.0, the conduit gates shall be gradually opened in amounts not to exceed 2,000 c.f.s. every 6 hours in order to keep the lake from rising above elevation 510.5 or until the conduit gates are fully open.

e. Above Elevation 502.5 and Falling

When the lake level is above elevation 502.5 and begins to fall, the maximum conduit gate setting attained during rising conditions will be maintained until the pool recedes to elevation 502.5, at which point releases will be made equal to inflow or the maximum rate permissible, whichever is greater. If, while the lake is falling, the combined releases from the conduits and uncontrolled spillway become less than the maximum rate permissible, the conduits will be operated to maintain a discharge equal to the maximum rate permissible.

f. Below Elevation 502.5 and Falling

When the lake level is below the 502.5 and falling the regulated release will be made equal to the maximum rate permissible. When the lake level recedes to within 5 feet of the top of the conservation pool, releases may be made less than the maximum rate permissible, provided that the rate of release is enough to empty the flood control storage in approximately one week or less.

b. Emergency Flood Control Regulations. When communication with the Tulsa District Office is disrupted, the Project Manager will, on his own initiative, direct flood control operation of the lake in accordance with Table 7-3 until communications are restored. In addition, the Project Manager will make every effort to re-establish communications with the Tulsa District Office and will send information to the Tulsa District Office by any means possible. In the event that communications are disrupted, releases shall not be changed until 12 hours has elapsed or until the pool rises to elevation 502.5, at which time releases through the conduits will be started immediately in accordance with Table 7-3. At no time during emergency flood control operations shall releases be decreased if the pool is rising, however, conduit releases should be closely monitored in case large spillway flows/backwater are causing problems. The following regulations included in Table 7-3 will govern releases during emergency flood control operations.

TABLE 7-3

EMERGENCY FLOOD CONTROL REGULATION SCHEDULE

Pool Elevation and Condition	Regulation
a. Below Top of Conservation Pool and Rising	Maintain current releases until communication is restored.
b. Above Top of Conservation Pool and Rising	Maintain current releases until communication is restored, the pool rises to elevation 502.5, or 12 hours has elapsed. If communication is not restored after 12 hours and the releases are less than 1,000 c.f.s., increase releases to 1,000 c.f.s. immediately.
c. Above Elevation 502.5 and Rising	Releases will be gradually increased by opening the conduit gates an amount not to exceed 2,000 c.f.s. every 6 hours, so that outflow equals inflow as long as possible. Conduit releases should be closely monitored in case large spillway flows/backwater are causing problems.
d. Above Elevation 502.5 and Falling	The maximum gate setting attained during rising conditions shall be maintained until the lake level recedes to elevation 502.5.
e. Below Elevation 502.5 and Falling	If the maximum release rate attained during rising conditions was less than 3,500 c.f.s., through the conduits, then the maximum release rate should be maintained until the pool level nears the top of the conservation pool. If the maximum release rate attained was greater than 3,500 c.f.s., then releases shall be made equal to the previous 2-hour inflow (see Plate 6-2) or 3,500 c.f.s., whichever is greater, until the lake level nears the top of the conservation pool. When the lake level nears the top of the conservation pool, releases shall be gradually reduced by an amount not to exceed 2,000 c.f.s. every 6 hours so that releases are equal to inflow when the lake level recedes to the top of the conservation pool.

7-06. Recreation. Although recreation is an authorized project purpose, no storage is provided specifically for that purpose and no special regulations are made for recreational activities.

7-07. Water Quality. Although water quality control is not an authorized project purpose, when possible, releases will be made to improve water quality in the river below the dam. Requests for releases for water quality control from Federal, State, and local interests will be considered on a case-by-case basis. Low flow releases made to satisfy existing water rights downstream from the dam are usually enough to satisfy water quality needs.

7-08. Fish and Wildlife. One of the major benefits of the raised conservation pool at Wister Lake is the increase in habitat for fish and waterfowl. Management of the fish and wildlife resources at the reservoir is under the direction of the Oklahoma Department of Wildlife Conservation (ODWC). Approximately 33,428 acres of project lands have been made available to the ODWC for wildlife management purposes. Two thousand of those acres have been set aside as a State waterfowl refuge, and the remainder is managed for upland game and whitetail deer, and are open for public hunting.

7-09. Water Supply.

a. General. The availability of dependable water supply storage is an authorized purpose of Wister Lake. The lake has a total of 14,000 acre-feet of conservation storage allocated to water supply. The current yield study indicates that this storage will yield approximately 20 million gallons per day (mgd). Contracts for storage in Wister Lake, listed in Table 7-4, total 13,653 acre-feet, which is nearly all of the available water supply storage. There is approximately 23,500 acre-feet of conservation storage that could be reallocated if there are future requests for additional water supply storage.

TABLE 7-4

CONTRACTS FOR STORAGE IN WISTER LAKE

User	Storage allocated (ac-ft)	Yield (mgd)	Lowest inlet Elevation (feet,NGVD)
Heavener Utility Authority	1,600	2.28	465.75
Poteau Valley Improvement Authority	4,800	6.85	466.78
Applied Energy Services, Shady Point	7,253	10.36	downstream
Total	13,653	19.49	

b. Accounting Procedures. An accounting procedure for conservation storage in multiple purpose reservoirs has been developed by the Tulsa District and approved by the Southwestern Division to regulate the withdrawal of water from lakes by water supply users during critical periods. Losses are charged to each user in proportion to their average remaining storage. Inflows, after deductions for downstream water rights, are credited to the storage account of the user in proportion to its contracted storage. When a user has 50 percent or less of contracted storage remaining, the contracting officer will be notified in order to 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. Storage accounting generally will not be necessary for inflows above the conservation pool level.

7-10. Water Rights.

a. General. Water rights on the Poteau River upstream and downstream of Wister Dam, are issued by the Oklahoma Water Resources Board, (OWRB). The active water right holders along the Poteau River below the dam and authorized amounts are listed in Table 7-5. The OWRB should be contacted for updated water rights holders.

b. Regulation Procedure for Water Rights. Releases from inflow to satisfy downstream water rights will be made at the request of the OWRB. When the lake level is below the conservation pool level, releases will be made equal to inflow, up to a maximum of 12 c.f.s., to satisfy the water rights applied for by the towns of Poteau, Panama, and Wister. All excess inflows will be stored unless notice has been received from the OWRB that additional releases are necessary to satisfy water rights applied for by private property owners along the Poteau River. When additional releases are necessary, releases will be made equal to inflow up to a maximum of 30 c.f.s.

TABLE 7-5

Active Water Rights Holders

Water User	Location (LeFlore County)			Use	Amount (ac-ft/yr)
City of Poteau	SE4	SEC19	T07N R26E	Municipal	1.0
Zimmerman, Inc.		SEC05	T06N R26E	Irrigation	53.0
	SE4	SEC07	T06N R26E		
	W2NW4	SEC08	T06N R26E		
	W2SW4	SEC08	T06N R26E		
Zimmerman, Inc.	S2SE4	SEC11	T06N R25E	Irrigation	160.0
Mobley, Wm. D.	NW4NE4	SEC14	T06N R25E	Irrigation	112.0
	E2SE4NE4	SEC14	T06N R25E		
Poteau R. Frms Inc.	E2SW4	SEC14	T06N R25E	Irrigation	112.0
Young III R.A.	SE4NW4NE4	SEC09	T10N R27E	Irrigation	270.0
	SE4SE4SW4	SEC16	T10N R27E		
	NW4SE4SW4	SEC03	T10N R27E		
Young III R.A.	NE4NE4NE4	SEC09	T10N R27E	Irrigation	150.0
	NW4NE4NW4	SEC03	T10N R27E		
Hoffman Wm. D.	NE4SE4NW4	SEC36	T08N R25E	Irrigation	190.0
	NE4NE4SE4	SEC36	T08N R25E		
Neff Tommy G.	NW4SE4SE4	SEC15	T06N R25E	Irrigation	317.0
Burgess D. & M.	NE4NE4SE4	SEC14	T09N R26E	Irrigation	264.0
Paw Paw D & D Inc.	SW4SW4NE4	SEC29	T10N R27E	Rec,Fish,Wildlife	8.0
	NW4SW4SE4	SEC29	T10N R27E		
Smith Cogeneration Oklahoma	SE4NW4SW4	SEC33	T10N R27E	Power	19300.0
WW Farmlands LLC	NW4SE4NW4	SEC05	T09N R27E	Irrigation	695.0

7-11. Hydroelectric Power. Hydroelectric power is not a project purpose and there is no storage allocated to it. At the present time there are no provisions or plans to generate hydroelectric power at Wister Dam.

7-12. Navigation. Navigation is a project purpose, however there is no storage allocated for it. Flood control releases from Wister Lake are coordinated with releases from the other reservoirs in the Arkansas River system. After periods of high flows, flood control releases are regulated on the Arkansas River to provide a tapered recession of flows along the navigation channel. The coordinated regulation of the reservoir is discussed in Chapter 7 of the Arkansas River Basin Water Control Master Manual.

7-13. Drought Contingency Plans. A drought contingency plan for Wister, Tenkiller, and Fort Gibson Lakes was approved in January 1990 as Appendix DCP-3 to the Arkansas River Basin Water Control Master Manual. This plan identifies water uses and needs within the Poteau River basin and outlines the steps and coordination to be taken during drought conditions. Copies of this plan are kept in the Hydrology-Hydraulics Branch, Tulsa District Office.

7-14. Flood Emergency Action Plans. A flood emergency action plan is outlined in the Operation and Maintenance Manual, Volume II, for Wister Lake, approved November 1983 (revised September 1992). The manual specifies the procedures to follow in order to protect the public from possible damage or loss of life as a result of uncontrolled releases of water due to failure or severe damage to the dam or to its appurtenant works. The manual includes dam-breach and maximum spillway discharge water surface profiles and potential flooded area maps. Copies of this manual are kept at the project, district, and division offices.

7-15. Deviation From Normal Regulation. The District Commander is occasionally requested to deviate from normal regulation of the lake. Prior approval for a deviation is obtained from the Southwestern Division Office except as noted in subparagraph a. below. Deviation requests usually fall into the following categories:

a. Emergencies. Some emergencies that can be expected are: drowning and other accidents, failure of operation facilities, and flushing of pollution where water quality is not a project purpose. Necessary action under emergency conditions is taken immediately unless such action would create equal or worse conditions. The Southwestern Division is informed as soon as is practicable. A written confirmation showing the deviation and conditions will be furnished to CESWD-RBT as soon as possible.

b. Unplanned Minor Deviations. There are unplanned instances that create a temporary need for minor deviations from the normal regulation of the lake, although they are not considered emergencies. Construction accounts for the major portion of the incidents and includes utility stream crossing, bridgework, 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 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 for the authorized purposes. Approval for these minor deviations will normally be obtained from the Southwestern Division Office by telephone. A written confirmation showing the deviation and conditions will be furnished to CESWD-RBT as soon as possible.

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, condition of the lake, and alternative measures that can be taken. Approval for these major deviations normally will be obtained from the Division office by telephone. Written confirmation explaining the deviation and its cause will be furnished to the Division water control manager.

d. Planned Deviations. Other instances include anticipated or planned deviations. Each condition should be analyzed on its own merits. Sufficient data on flood potential, lake and watershed conditions, possible alternative measures, benefits to be expected, and probable effects on other authorized and useful purposes will be presented by letter, telephone, facsimile or email to Southwestern Division along with Tulsa District recommendations for review and approval.

7-16. Rate of Release Change. The increase and decrease in releases from the reservoir shall be accomplished in a manner which minimizes bank erosion and danger to human and animal lives, whenever possible. Releases should be increased and decreased in increments of 1,000 c.f.s., or less, with a minimum of 3 hours between changes. Situations will arise which will not allow an orderly increase or decrease in releases. Examples of these situations are shutting off releases to minimize downstream flooding, drowning, and other downstream emergencies.

7-17. Operational Curves. The conduit rating curve for partial and full gate openings for six gates is shown on Plate 7-1. The low-flow rating curve is shown on Plate 7-2. The tailwater rating curve for the gage below the outlet works is shown on Plate 7-3. The rating curve for the uncontrolled spillway is given on Plate 7-4. A tailwater rating curve for higher discharges is also included on Plate 7-4. Evaporation curves relating daily pan evaporation to the average daily evaporation rate in cubic feet per second (c.f.s.) are shown on Plate 7-5. Curves relating elevation to reservoir area and capacity are shown on Plate 7-6. Area and capacity data are also presented in Table 7-6.

VIII - EFFECT OF WATER CONTROL PLAN

8-01. General. The effects of flood control regulations on the spillway design flood, standard project flood, and on three major floods, May 1957, October-November 1984, and May 1990 are presented in the following paragraphs. The floods were selected to show the effects of the emergency flood control regulations for Wister Lake.

8-02. Flood Control.

a. Spillway Design Flood. The spillway design flood was developed using probable maximum precipitation from Hydro-meteorological Report No. 33. The resulting inflow hydrograph was used as the maximum flood for evaluation of the effects of emergency flood control regulations. The spillway design flood has a total runoff volume of 1,260,000 acre-feet with a peak inflow of 360,000 c.f.s. The flood was routed through Wister Lake on full and empty flood control pools using the emergency flood control regulations outlined in Table 7-3. The full pool regulation resulted in a peak outflow of 170,000 c.f.s., and a maximum pool elevation of 522.0. The operational hydrographs resulting from the emergency regulations of the spillway design flood on a full and empty flood control pool are shown on Plate 8-1.

b. Standard Project Flood. The standard project flood for Wister Lake is equal to one-half of the spillway design flood hydrograph. The resulting flood has a total runoff volume of 637,000 acre-feet with a peak inflow of 180,000 c.f.s. The flood was routed through Wister Lake on full and empty flood control pools using the emergency flood control regulations outlined in Table 7-3. The full pool regulation resulted in a peak outflow of 82,400 c.f.s. and a maximum pool elevation of 513.7. The operational hydrographs resulting from the emergency regulations of the standard project flood on a full and empty flood control pool are shown on Plate 8-2.

c. Flood of May 1957. The flood of late May 1957 resulted in the second highest pool of record at Wister Lake. The flood was caused by a series of heavy rainfall periods throughout April and May that filled the flood control storage at the lake. On May 27, during the last of these storms, the lake was filled to elevation 505.7 with a peak discharge from the dam of nearly 11,000 c.f.s. A portion of the flood from May 21 to May 30 with a volume of approximately 194,000 acre-feet was routed through Wister Lake using the emergency flood control regulations outlined in Table 7-3. The emergency regulation resulted in a peak outflow of 19,400 c.f.s., and a maximum pool elevation of 504.2. The operational hydrographs resulting from the emergency regulations of the May 1957 flood compared to the actual operation are shown on Plate 8-3.

d. Flood of Oct-Nov 1984. The flood of October-November 1984 resulted in the third highest lake elevation at Wister Lake. The flood was caused by a series of storms beginning in the middle of October and ending in early November. The peak inflow for the flood was 64,000 c.f.s., on October 20 and the lake crested at an elevation of 504.94 on November 3 with a peak discharge of 7,400 c.f.s. A portion of the flood from October 23 to November 8 was routed through the reservoir using the emergency flood control regulations outlined in Table 7-3. The emergency regulations resulted in a peak outflow of 17,500 c.f.s., and a maximum pool elevation of 503.8. The operational hydrographs comparing the emergency regulation of the October-November 1984 flood with the actual regulation are shown on Plate 8-4.

e. Flood of May 1990. The flood of May 1990 was the largest flood at Wister Lake since the project was completed for full flood control operation. The total inflow volume of the flood from May 1 to May 11 was 461,500 acre-feet with a peak inflow of 103,000 c.f.s., on May 3. On May 4 the lake filled

to a record maximum pool elevation of 508.22 with a peak outflow of about 25,000 c.f.s. A portion of the flood from May 2 to May 12 was routed through the reservoir using the emergency flood control regulations outlined in Table 7-3. The emergency regulations resulted in a peak outflow of 34,000 c.f.s., and a maximum pool elevation of 507.5. The operational hydrographs comparing the emergency regulations of the May 1990 flood with the actual operation are shown on Plate 8-5.

8-03. Recreation. Nine public use areas are located at Wister Lake. The State of Oklahoma maintains and operates four of these areas with developed facilities including boat ramps, camping and picnic areas, sanitary facilities, a swimming pool and concession services. High lake elevations affect many of the public use areas and facilities.

8-04. Water Quality. The quality of water in Wister Lake is considered fair to poor, requiring at least conventional treatment to be suitable for domestic and industrial use.

8-05. Fish and Wildlife. Wister Lake provides benefits over the natural river to fish and wildlife. While some wildlife habitat was inundated due to impoundment of the reservoir, wildlife management of lake perimeter lands has helped to replace these losses. The State of Oklahoma manages much of the lake area on the Fourche Maline arm including the State Waterfowl Refuge for the benefit of fish and wildlife resources.

8-06. Water Supply. Currently all of the water supply storage in Wister Lake is under contract. Additional conservation storage is available for reallocation to water supply storage if and when it is required. A reallocation study is currently ongoing for Wister Lake. Withdrawals for water supply storage have not had a major effect on the operation of the reservoir.

8-07. Hydroelectric Power. At the present time there are no facilities or plans for generating hydroelectric power at Wister Lake. The generation of hydroelectric power at other lakes in the Arkansas River Basin System has no effect on the operation of Wister Lake.

8-08. Navigation. Flood control releases from Wister Lake are coordinated with releases from all the projects in the Arkansas River Basin to benefit the Arkansas River navigation system, whenever possible. The coordinated regulation of the reservoir is discussed in Chapter 7 of the Arkansas River Basin Water Control Master Manual. Releases are not made from conservation storage for the benefit of navigation.

8-09. Drought Contingency Plans. The Drought Contingency Plan for Wister, Tenkiller, and Fort Gibson Lakes addresses the problems encountered during drought conditions at the reservoirs. The plan outlines the actions necessary for conservation of water supply storage depending on the severity of the drought and the reservoir level. This plan enables the Hydrology-Hydraulics Branch to effectively coordinate with the public and other District elements during drought conditions.

8-10. Flood Emergency Action Plans. The Flood Emergency Plan for Wister Lake is contained in the Operation and Maintenance Manual, Volume II, Contingency Plan for Emergencies. This manual specifies the procedure to be used for protecting the public during flood emergencies by means of coordination

between the Water Management Section and other District elements and communication with local governments and media.

8-11. Frequencies.

a. Peak Inflow Probability. Annual peak inflows for Wister Lake were obtained for the period 1938 to 2003 from historical gage data (1938-1949), monthly charts (1950-1979), daily computations (1980-1989), and computer records (1990-2003). The annual peak inflows were used in computing a peak inflow probability curve in accordance with the methods described in Bulletin 17B, Guidelines for Determining Flood Flow Frequency, September 1981. The peak daily inflow probability curve is shown on Plate 8-6. The peak inflow in May 1990 of 103,000 c.f.s has approximately a 20-year recurrence probability. The peak inflow in October 1984 of 64,000 c.f.s has approximately a 6-year recurrence probability. The peak inflow for the standard project flood, of 180,000 c.f.s., has approximately a 170-year recurrence probability. The spillway design flood is beyond the limits of the calculated probability curve.

b. Pool Elevation Duration and Frequency. Pool elevation duration and frequency data, for the period 1940-2000 at Wister Lake, were calculated by "SUPER" model, runs A03X10 and A04X03. The "SUPER" model routes period of record flows through the Arkansas River System using existing regulations and actual conditions. The minimum and maximum pool elevation probabilities are shown on Plate 8-7. The data shows that the top of the flood control pool elevation of 502.5 has an average recurrence interval of approximately 8 years and that the top of conservation pool elevation 478.0 is exceeded approximately 65 percent of the time. The pool elevation duration relationship is shown on Plate 8-8.

c. Key Control Points. Discharge rating curves for the stream gages used in the regulation of outflow from Wister Lake are shown on Plates 4-3 and 4-4. These key control points include the gages on the Poteau River near Poteau and Panama. Table 7-1 shows the current regulating stage and flow for the key control points.

8-12. Other Studies.

a. Improvements in Forecasting. Studies have been made to improve the forecasting techniques presented in Section VI of this manual. Computer models have been developed to forecast reservoir inflows and pool elevations and flows at downstream control points. Revision of the models continues to be done to take advantage of improved rainfall distribution data and improved computer capabilities.

IX - WATER MANAGEMENT MANAGEMENT

9-01. Responsibilities and Organizations.

a. Corps of Engineers. Wister Lake is owned by the U.S. Government and the Corps of Engineers; Tulsa District is the operating agency. The operations and maintenance of Wister Lake is the responsibility of the Project Manager under supervision of the Operations Division, Tulsa District Office. Project reporting instructions and an organization chart are presented in Chapter V. Project regulating instructions are presented in Chapter VII of this manual.

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

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

(b) Investigation and refinement of regulation procedures.

1. Analyses of past floods.

2. Reconnaissance to determine channel capacities.

3. Improvement of forecasting techniques.

4. The planning and coordination of the hydrologic reporting network with the National Weather Service (NWS) and the U.S. Geological Survey (USGS).

(c) Training of personnel in flood control duties.

1. Periodic visits to projects by personnel of the section to familiarize themselves with regulation facilities, to become acquainted with the operating personnel, to discuss emergency regulation procedures with operating personnel, to provide background information for improving facilities and methods, and to receive feedback from project personnel.

2. Instructing personnel of the Hydrology-Hydraulics Branch in flood control procedures to supplement the Water Management Section during flood emergencies, when necessary.

(d) Preparation of reports on lake regulation.

1. Recurring reports.

2. Water Management manuals.

3. Postflood 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 and meteorologic data.

(b) Presentation of storm and flood analyses to the District Commander and other interested District personnel.

(c) When necessary, furnishing personnel to assist project operating personnel in flood regulations.

(d) Regulation of lakes and navigation pools in accordance with flood control regulation schedules.

(e) Furnishing information to higher authority.

1. Initial reports to the Southwestern Division.

2. Provide hydrologic data for situation reports.

(f) Furnishing information to the Reservoir Information Control Center. The duties of the project operating personnel under the flood conditions are set forth in Chapter 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, lake regulation is accomplished by the Water Management Section. However, during flood periods, assistance of other personnel may be required to maintain effective regulation of the reservoir. Plate 5-2 shows the organization of flood control regulation for Wister Lake. The area and magnitude of the flood will determine the number of people engaged in each activity.

(4) Provision for 24-Hour Alert. The National Weather Service and project personnel are provided with a list of names, addresses, and telephone numbers of key personnel of the Engineering and Construction Division with instructions to provide warning if unusual conditions occur. Responsible personnel are on duty at the Tulsa District Office 24 hours a day whenever basin 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 Project Manager. The Project Manager will regulate the reservoir according to instructions issued by personnel of the Water Management Section. These instructions follow the "Normal Regulations for Flood Control" included in Chapter VII and in paragraph II-2 of Exhibit B. If the Project Manager loses communication with the District Office, he will immediately make every effort to re-establish communication with the District Office while initiating emergency regulations for flood control as included in Chapter VII and paragraph II-3 of Exhibit B. The Project Manager will make daily observations as directed in paragraph 5-07.

b. Other Federal Agencies. The National Weather Service and the U.S. Geological Service cooperate together and with the Hydrology-Hydraulics Branch, Tulsa District, to accumulate rainfall and streamflow data.

c. State Agencies. Management of fish and wildlife resources at Wister Lake is coordinated by the Oklahoma Department of Wildlife Conservation. The Oklahoma Water Resources Board manages water rights on the Poteau River below the dam and requests releases from inflow as necessary.

d. Private Organizations. Presently, there are no private organizations with regulatory responsibilities at Wister Lake.

9-02. Interagency Coordination.

a. Local Press and Corps Bulletins. The Corps of Engineers, the National Weather Service (NWS), and the U.S. Geological Survey (USGS) coordinate in forecasting flood stages, stream-flow, and pool elevations. Local press will be provided with information of flood forecasts as furnished by the NWS, which is officially responsible for issuing flood warnings. This

information will be supplemented by Corps of Engineers bulletins on reservoir conditions and with technical advice to enable local interests, within the limits of their capabilities, to obtain optimum flood protection and to perform rescue and relief functions. The Corps of Engineers further assists in flood fighting through the Office of Emergency Management, who furnishes sandbags and other necessary equipment based on equipment on hand and need.

b. National Weather Service. The Tulsa District Office and the National Weather Service, River Forecast Center exchange hydro-meteorological data and reports in order to prevent duplication of effort in obtaining and disseminating data. This exchange of data is discussed in greater detail in Chapter VI of this manual.

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. Operation of Wister Lake does not include hydroelectric power generation.

e. Other Federal, State, or Local Agencies. The Tulsa District Office exchanges information with state and local government officials, the State Highway Department, the State Highway Patrol, and others during flood emergencies. The Tulsa District also coordinates with federal and state fish and wildlife agencies throughout normal operation.

9-03. Interagency Agreements. There are no known Interagency Agreements for the regulation of Wister Lake.

9-04. Commissions, River Authorities, Compacts, and Committees. Arkansas River Basin compacts have been established between the states of Arkansas and Oklahoma. The purposes of these compacts are:

a. To provide interstate comity between Arkansas and Oklahoma.

b. To provide for an equitable apportionment of the waters of the Arkansas River between Arkansas 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 cooperation of the water administration agencies of Arkansas 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 resource development within the Arkansas River Basin. The committee meets when conditions warrant to discuss the previous year's activities and to exchange information and ideas to better serve specific project purposes.

9-05. Reports.

a. Morning Report. In accordance with TDR 1130-2-12, the Water

Management Section prepares daily Morning Reports to cover a period of 24 hours, except on Saturday, Sunday, and holidays. The report provides data for use by personnel whose work requires information pertaining to the regulation of reservoirs, field investigations, stream gaging, construction of flood control projects affected by releases from reservoirs, the answering of public inquiries, and the preparation of public press releases. The report includes a summary of hydrologic conditions as of 8 a.m. of that date and lake data for the previous and present days. The report is completed and dispatched from the Hydrology-Hydraulics Branch by 10 a.m. daily under normal conditions.

b. Monthly Lake Reports. The Water Management Section prepares monthly lake reports in accordance with paragraph 6-04 of EM 1110-2-3600 and paragraph 13(d) of ER 1110-2-240. These reports are records of daily hydrologic data for all flood control, navigation, and multiple-purpose storage lakes under supervision of or of direct interest to the Tulsa District Office. Supplemental information on the regulation of the reservoirs such as explanations of deviations from approved schedules is added as a note or as an attachment to the reports. 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.

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

d. Post Flood Reports. This report is prepared in accordance with ER 500-1-1 and OM 500-1-6 as soon as 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 to be essential for flood control and flood plain studies or in the review of possible claims against the United States for damages. The report should be completed within approximately 3 months of the time of flooding.

e. Annual Reports. This report is prepared by the Water Management Section, in accordance with ER 1110-2-1400 and OM 500-1-6. Each report contains a summation of the District Water Management activities including project visitations, special operations, water quality, sedimentation, navigation, hydropower production, lake attendance, water supply, and flood damages prevented, as well as hydrologic conditions of the Arkansas and Red River basins and the individual projects in the District for the preceding fiscal year. The report is forwarded to the Southwestern Division Water Management Staff for inclusion in the Annual Report.

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

TABLE 9-1

SUMMARY OF REPORTS

Name of report	When required	Form number	Regulation requiring reporting
Morning Report	Daily, except Saturday, Sunday, and holidays	SWT Forms 56 and 57	TDR 1130-2-12
Monthly Lake Report	Monthly	—	EM 1110-2-3600 ER 1110-2-240
Flood Situation Reports	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 Reports	Annually	—	ER 1110-2-1400 OM 500-1-6

TABLES

TABLE 4-4

FLOOD OF RECORD AT PERTINENT GAGES

TABLE 4-4

MAJOR FLOODS FOR PERIOD OF RECORD
WISTER LAKE (1935-2002)

Fourche Maline River at Red Oak Flood Stage = 15 ft			Poteau River at Cauthron Flood Stage = 17 ft			Poteau River at Wister (1) Flood Stage = 8 ft		
Date	Stage (ft)	Flow (cfs)	Date	Stage (ft)	Flow (cfs)	Date	Stage (ft)	Flow (cfs) (2)
Jun 35	25.36	(1)	Jun 35	27.37	(1)	Jun 35	43.0	(3)
11 Apr 40	17.47	5,850	16 Apr 39	22.50	24,400	26 Feb 39	25.35	(3)
31 Aug 41	17.94	7,130	31 Oct 41	18.87	10,500	07 Apr 39	25.95	(3)
25 Apr 42	22.34	26,300	11 May 43	21.74	19,000	17 Apr 39	37.05	77,800
27 Dec 42	21.34	21,600	20 May 43	19.43	11,800	02 Nov 41	27.69	15,400
10 May 43	21.14	20,900	21 Feb 45	21.03	16,600	09 Apr 42	31.03	21,800
28 Feb 44	17.80	6,790	27 Feb 45	19.07	10,800	26 Apr 42	29.82	18,700
02 May 44	17.52	5,850	29 Mar 45	22.11	22,000	28 Dec 42	30.64	20,600
21 Feb 45	21.01	17,600	15 May 45	22.39	23,800	11 May 43	37.05	77,000
03 Mar 45	17.60	5,990	11 Jun 45	18.56	9,850	22 May 43	26.08	13,400
19 Mar 45	19.17	11,000	13 Feb 46	18.30	9,350	29 Feb 44	28.75	17,000
20 Mar 45	17.99	7,130	10 Dec 46	21.18	17,400	20 Mar 44	25.20	12,400
13 Feb 46	17.32	5,190	01 Jan 48	21.08	17,000	03 May 44	31.06	22,100
06 Nov 46	17.68	6,270	24 Jan 49	23.34	31,000	22 Feb 45	34.31	42,800
10 Dec 46	19.34	11,300	13 Jan 50	19.81	13,200	28 Feb 45	32.66	30,100
12 Dec 46	18.43	8,340	12 Feb 50	22.78	27,800	20 Mar 45	33.08	32,900
11 Apr 47	17.70	6,270	08 May 50	18.28	9,500	31 Mar 45	34.23	41,900
11 May 50	17.49	5,720	12 Apr 52	18.86	10,700	16 May 45	37.16	78,600
29 Jul 50	20.72	16,400	22 Apr 52	18.69	10,900	12 Jun 45	35.00	49,400
16 Sep 50	20.60	16,100	25 Nov 52	20.44	15,600	29 Sep 45	26.64	14,000
18 Feb 51	17.60	5,990	18 Mar 53	20.28	15,200	10 Jan 46	27.51	14,800
12 Apr 52	17.36	5,450	29 Apr 53	18.90	10,700	14 Feb 46	30.00	18,400
18 Mar 53	18.46	8,970	13 May 53	20.46	16,000	25 Apr 46	27.15	14,400
24 Apr 53	19.47	12,800	02 May 54	19.86	13,600	26 May 46	30.20	18,800
12 May 53	17.96	8,030	04 Apr 57	18.37	9,680	01 Jun 46	32.24	26,800
21 Mar 55	17.28	5,190	27 Apr 57	18.15	9,320	07 Nov 46	27.90	15,300
03 Apr 57	18.86	13,400	12 Aug 57	18.38	9,320	09 Nov 46	28.72	16,400
26 Apr 57	19.02	14,300	18 Nov 57	18.63	10,100	12 Dec 46	34.66	46,400
26 May 57	17.76	7,520	02 May 58	18.91	11,200	11 Apr 47	26.29	13,800
02 May 58	18.19	8,200	20 May 60	23.76	32,200	30 Apr 47	23.56	11,500
11 May 59	18.58	8,950	09 Feb 65	20.23	14,400	14 May 47	25.10	12,700
06 May 60	19.86	14,000	22 Sep 65	18.00	8,600	02 Jan 48	32.71	24,500
19 May 60	24.79	41,500	10 Feb 66	20.42	15,200	27 Feb 48	29.50	17,500
24 Jul 60	19.89	14,000	30 Oct 67	18.93	10,300	02 Mar 48	26.03	12,200
22 Nov 61	18.50	8,710	21 Mar 68	20.63	16,400	12 May 48	25.12	11,300
23 Apr 62	17.96	7,170	04 Apr 68	19.21	10,900	27 Jan 49	29.12	14,600
15 Aug 64	17.72	6,320	14 May 68	21.75	22,000	15 Feb 49	24.98	10,000
27 May 65	17.68	6,320	28 Dec 68	20.00	13,600	27 Apr 52	24.03	9,700
09 Feb 66	17.86	7,240	30 Jan 69	19.99	13,600	27 May 57	14.41	11,300
24 Apr 66	18.27	8,530	26 Jul 69	23.24	29,400	04 May 90	(4)	25,000
20 Mar 68	17.64	6,370	10 Dec 71	21.82	22,300			
14 May 68	17.63	6,370	07 Jun 74	21.24	19,400			
28 Dec 68	17.15	5,350	28 Mar 75	18.39	9,280			
10 Dec 71	17.64	6,210	28 Mar 77	19.20	11,400			
23 Apr 73	17.69	6,470	03 Dec 82	20.12	14,100			
24 Nov 73	20.55	17,800	21 Oct 84	20.24	14,500			
30 Jan 82	17.35	5,440	27 Nov 85	19.67	15,300			
20 Oct 84	17.42	5,550	18 Mar 87	18.21	9,050			
19 Nov 85	17.28	5,250	15 Feb 89	18.42	9,510			
03 May 90	19.03	10,100	03 May 90	22.17	24,000			
10 May 93	16.11	3,350	01 Nov 96	20.74	16,600			
07 May 94	15.90	3,300	05 Jan 98	19.51	13,300			
			17 Dec 01	20.42	15,500			

(1) No flow data available

(1) Regulated by Wister Lake since Oct 1949
(2) Datum of gage raised 12.41 ft in Jun 1953
(3) No flow data available
(4) No recorded stage available

Fourche Maline River at Red Oak Flood Stage = 15 ft				
Date	Stage (ft)	Flow (cfs)		
15 Nov 94	15.39	2,850		
07 Nov 96	17.65	6,000		
05 Jan 98	17.25	4,900		
17 Dec 01	16.52	3,800		
(1) No flow data available				

TABLE 4-4 (CONT)

MAJOR FLOODS FOR PERIOD OF RECORD
WISTER LAKE (1923-2002)

Poteau River at Poteau Flood Stage = 20 ft			Poteau River at Panama Flood Stage = 29 ft(1)		
Date	Stage (ft)	Flow (cfs)	Date	Stage (ft)	Flow (cfs)
Sep 23	29.00	21,000	18 Jun 35	44.6	95,000
Sep 26	32.50	40,000	Apr 39	40.1	(2)
15 Apr 27	34.00	51,000	11 Mar 52	29.0	(2)
20 May 29	28.70	21,000	13 Apr 52	29.0	(2)
12 May 30	31.80	37,000	18 Mar 53	32.05	(2)
25 Jan 32	29.20	(1)	25 Apr 53	33.0	(2)
18 Feb 32	31.20	32,000	13 May 53	31.9	(2)
02 Jul 32	27.90	(1)	22 May 55	31.31	(2)
06 May 35	35.25	(1)	04 Apr 57	34.56	(2)
18 Jun 35	39.00	100,000	03 May 58	31.60	(2)
16 Jan 37	27.50	(1)	07 May 60	31.90	(2)
25 Jan 38	31.92	37,000	21 May 60	35.84	(2)
19 Feb 38	36.30	73,000	24 Jul 60	30.14	(2)
30 May 38	27.96	16,500	19 May 61	31.63	(2)
17 Apr 39	36.20	68,200	16 Jul 61	28.45	(2)
03 Nov 41	27.77	11,800	23 Nov 61	30.98	(2)
10 Apr 42	29.63	22,700	28 May 65	28.76	(2)
27 Apr 42	28.56	18,500	25 Apr 66	28.58	(2)
29 Dec 42	29.13	20,900	22 Dec 67	27.13	(2)
11 May 43	37.00	58,100	14 May 68	41.40	(2)
01 Mar 44	28.27	15,400	28 Nov 68	27.66	(2)
04 May 44	29.51	20,300	28 Dec 68	32.81	(2)
22 Feb 45	32.89	39,200	22 Feb 69	29.35	(2)
01 Mar 45	31.02	27,300	18 Apr 70	29.58	(2)
20 Mar 45	31.55	30,700	25 Oct 70	29.06	(2)
31 Mar 45	32.38	35,800	11 Dec 71	39.16	(2)
16 May 45	36.42	66,300	07 Nov 72	29.14	(2)
12 Jun 45	35.10	55,900	11 Mar 73	30.63	(2)
30 Sep 45	27.89	13,800	26 Mar 73	30.52	(2)
11 Nov 46	28.28	(1)	16 Apr 73	27.29	(2)
13 Dec 46	33.50	(1)	24 Apr 73	35.90	(2)
02 Jan 48	27.83	(1)	04 Jun 73	27.51	(2)
28 Feb 48	28.20	(1)	01 May 74	29.17	(2)
25 Jan 49	30.50	(1)	08 Jun 74	28.54	(2)
14 Mar 53	27.86	(1)	11 Nov 74	28.27	(2)
04 Apr 57	29.25	(1)	23 Feb 75	27.83	(2)
20 May 60	29.38	(1)	29 Mar 75	28.01	(2)
18 May 61	28.71	(1)	18 Jun 75	29.38	(2)
20 Mar 68	28.10	(1)	07 Jun 81	28.74	(2)
14 May 68	32.55	(1)	19 Oct 81	28.6	(2)
28 Dec 68	27.85	(1)	15 May 82	31.31	(2)
10 Dec 71	32.20	(1)	05 Jun 82	28.13	(2)
23 Apr 73	29.84	(1)	16 May 83	27.2	(2)
21 Oct 84	28.32	15,700	21 Oct 84	33.71	26,300

Poteau River at Poteau
Flood Stage = 20 ft

Date	Stage (ft)	Flow (cfs)
02 Nov 84	27.72	13,700
23 Feb 85	27.97	14,400
03 May 90	30.59	25,000
29 Oct 91	29.15	18,700
10 May 93	27.25	12,900
14 Jan 95	28.57	16,400
29 Oct 91	29.20	18,700
10 May 93	27.25	12,900
03 May 94	21.58	8,000
15 Nov 94	25.00	9,900
07 Nov 96	26.60	11,800

(1) No flow data available

Poteau River at Panama
Flood Stage = 29 ft(1)

Date	Stage (ft)	Flow (cfs)
24 Feb 85	33.22	25,000
27 Dec 87	32.84	24,100
03 May 90	41.59	74,600
16 Dec 92	37.60	23,500
15 Apr 93	32.05	14,600
30 Apr 93	32.29	15,000
11 May 93	34.23	18,400
15 Jan 95	38.44	28,200
09 May 95	35.14	20,100
23 Apr 96	38.47	28,400
11 May 93	34.22	18,500
04 May 94	32.23	14,900
15 Nov 94	35.00	19,800
20 Nov 96	40.30	32,000
06 Jan 98	41.45	48,300
18 Dec 01	36.56	23,300

(1) Datum of gage lowered 5.0 ft in Apr 1992
(2) No flow data available

TABLE 4-5

ESTIMATED MONTHLY AND ANNUAL FLOWS IN ACRE FEET

WISTER LAKE

TABLE 4-5

ESTIMATED MONTHLY AND ANNUAL FLOWS IN ACRE-FEET
WISTER LAKE

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	ANNUAL
1939	8320	149000	41160	386000	23190	15200	4290	1800	50	150	790	1810	631760
1940	2120	13440	6890	100800	29680	11220	6560	14880	2810	290	19060	59910	267660
1941	102500	135100	46230	125600	52090	23470	3150	1750	8330	76680	111000	65150	751050
1942	50400	81020	96480	258100	82700	28850	14970	3620	9430	1390	48310	121800	797070
1943	18030	8600	68900	67880	385600	38680	2420	60	80	10690	5220	17410	623570
1944	60740	181800	200200	95200	170800	71780	2000	3640	2360	760	3890	34580	827750
1945	21100	339400	613200	200000	351400	388600	44610	17860	90050	82290	13300	7700	2169510
1946	162300	184300	30480	119300	312800	115800	13390	1550	18	72	247000	321000	1508010
1947	29120	7440	38110	195800	199700	25390	950	9200	22780	3970	8680	85180	626320
1948	148400	176400	153200	61360	75760	4670	4050	14160	950	1850	4680	19480	664960
1949	443400	198200	116500	63160	104800	93220	470	5750	4290	17490	4710	28880	1080870
1950	295700	261100	31430	20210	166800	18380	236200	63180	109800	6200	2000	1900	1212900
1951	18020	244100	45090	57470	31560	92190	44680	4420	14850	36690	127200	57650	773920
1952	49880	31870	145600	296600	33650	14180	403	34	264	17	55430	37590	665518
1953	42010	46210	269700	363500	179100	2650	65650	1340	156	551	195	2860	973922
1954	101100	30010	6680	62070	106600	1230	285	0	0	10210	3460	54110	375755
1955	39680	83270	232100	51480	24630	3730	106	873	3940	1460	79	78	441426
1956	330	96660	18030	9180	18430	3650	331	646	0	0	4060	22350	173667
1957	75180	121300	144100	509700	311500	134600	1130	81110	97230	6100	137200	32900	1652050
1958	72670	42840	201400	109100	264100	86060	31030	27070	7710	2710	34140	11840	890670
1959	20320	20800	118300	81900	55890	3600	37680	2560	1670	59700	25600	124100	552120
1960	115200	77140	85640	18170	515300	5620	111500	19990	2290	2610	1830	110900	1066190
1961	45020	77410	129000	67890	131100	21230	70550	12760	14860	19150	139000	122200	850170
1962	113800	90940	87620	104400	11080	6200	11310	1740	7040	38810	38070	24070	535080
1963	17130	4510	60120	37410	17120	1940	90	4	9	0	0	0	138333
1964	165	3860	74300	71660	46540	700	12	20880	66410	7410	103000	21220	416157
1965	53240	142600	137400	38730	108100	87530	3280	1470	33560	3470	1400	3370	614150
1966	15080	124200	19950	161100	73150	1400	5470	6650	4340	400	680	140	412560
1967	910	2380	6410	166100	149200	33790	26460	2540	34230	94340	32680	165800	714840
1968	109100	62570	365100	171600	342200	23850	15470	1630	6540	5070	174100	248000	1525230
1969	125700	164700	91600	104900	167800	99920	52740	6910	1860	12910	11710	59850	900600
1970	45740	33140	127800	250100	47930	20700	2200	540	43750	166444	36996	16447	791787
1971	67266	67228	49682	99241	26172	7641	7087	19474	7991	69948	19967	466963	908660
1972	32665	20912	21600	77277	17992	53	9621	475	899	9391	235288	47823	473996
1973	118751	98222	378786	105602	107609	165099	10704	1781	23881	31505	204020	160104	1406064
1974	31288	25237	122453	111605	122326	281962	3436	2127	92998	43706	245341	74386	1156865
1975	53915	209909	232849	103720	147045	177331	1566	6142	5448	13	7240	39831	985009
1976	15863	11926	64899	109819	39457	11375	1020	266	10349	13657	10376	30056	319063
1977	56174	46803	273065	31473	7129	2403	1744	2051	6175	980	10680	6160	444837
1978	13620	55090	158270	28300	41350	17580	350	1010	610	340	19570	24330	360420
1979	85760	183330	226060	257220	414300	182700	28330	14220	5040	4260	8200	56830	1466250
1980	21010	36930	29510	58000	130750	28790	640	60	740	19170	8230	42030	375860
1981	5000	34660	71310	29360	139130	199840	42960	17940	4960	119940	40410	21060	726570
1982	127200	167280	82570	19340	251040	139710	9970	5410	120	2840	17690	272630	1095800

TABLE 4-5, CONT'D

ESTIMATED MONTHLY AND ANNUAL FLOWS IN ACRE-FEET
WISTER LAKE

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	ANNUAL
1983	33540	72590	76760	107500	313190	26910	33580	3640	310	1050	12130	28560	709760
1984	17790	96790	224330	60790	232760	4960	4630	2580	7540	477020	269160	200330	1598680
1985	73030	212230	160460	176130	47110	15870	2780	730	2580	16560	333120	58120	1098720
1986	11500	142020	42250	20390	149550	219770	3970	3630	2100	5750	13410	20920	635260
1987	51670	57120	15173	26380	79340	24500	3270	4960	5260	1943	53404	350876	673896
1988	67537	61943	102188	150614	5395	902	3371	11633	5276	297	45024	42505	496685
1989	108317	295983	180565	30446	211616	114624	44142	4919	16204	950	525	1725	1010016
1990	127447	248618	260231	278392	632628	16195	12733	9808	31319	31795	29652	75580	1754398
1991	166115	18535	87471	252842	63530	13725	4224	1775	6297	174981	135004	255371	1179870
1992	70550	37790	57260	64190	73330	180950	36420	29120	167500	4070	88680	232580	1042440
1993	172030	115500	71010	185020	268200	21480	1270	6400	9820	44620	67680	174840	1137870
1994	117920	113260	188030	96200	164830	5870	4680	3770	4220	3640	299677	148277	1150374
1995	251706	11961	55717	99175	220169	53039	2251	139	2420	4760	496	13686	715519
1996	55935	7636	50678	185457	48397	26678	32589	13637	37439	27154	501925	67538	1055063
1997	28850	298993	142108	75026	11147	63482	4800	2450	694	14142	15511	179289	836492
1998	355265	119665	218790	33918	45601	9927	179	397	38053	141146	27511	104570	1095022
1999	47654	66646	172565	141771	203110	75680	45283	69	1121	565	942	56520	811926
2000	13656	23157	29653	54993	51928	159969	2579	0	2430	1091	124633	86183	550272
2001	130713	335212	85092	40761	136068	24933	605	1924	21263	44877	5256	228598	1055302
MEAN	78288	103643	122859	119642	142738	59587	18638	7987	17662	31461	67400	86485	856389
MAXIMUM	443400	339400	613200	509700	632628	388600	236200	81110	167500	477020	501925	466963	2169510
MINIMUM	165	2380	6410	9180	5395	53	12	0	0	0	0	0	138333

TABLE 6-1

HEC-1 INPUT FOR FORECAST MODEL

WISTER LAKE

TABLE 6-1
WISTER LAKE
FORECAST MODEL

HEC-1 INPUT PAGE 1

```
1    ID  WISTER LAKE
2    ID  NEW HEC1 MODEL , GOODWIN , OCT,93
3    ID  14 SUBAREAS
4    ID  MODIFIED FOR DRAG AND DROP AND MESONET JAN 95  CTA
5    IT   120 20APR96   0800    100
6    IO    5
7    VS    IN  RELESE    OUT    OUT
8    VV   2.11   2.11   7.11   2.11
9    VS  MALINE  MALINE  POTEAU  POTEAU  BLK-FK
10   VV   5.11   2.11   5.11   2.11
11   VS  RELES  POTEAU  BRAZIL  PANAMA
12   VV   2.11   2.11   2.11   2.11

13   KK  REDOAK FOURCHE MALINE AT RED OAK GAGE
14   BA   122
15   LU   0.9   0.13
16   BF   100   1200   1.01
17   PB    0
18   ZR  =PI  A=WISTER LAKE B=REDOAK C=PRECIP-INC F=ADJUST
19   US    16   .56
20   ZW  A=FOURCHE MALINE B=REDO C=FLOW F=CALC

21   KK  RLONG  ROUTE RED OAK TO MALINE CNF WITH LONG CR , 16MI
22   RM    1    8    .3

23   KK  LONGCR FOURCHE MALINE(LONG CR LOCAL)
24   BA  141.3
25   LU  0.20   0.02
26   BF   50   -.20   1.02
27   PB    0
28   ZR  =PI  A=WISTER LAKE B=LONGCR C=PRECIP-INC F=ADJUST
29   US    12   .66

30   KK  MALINE TOTAL Q FROM FOURCHE MALINE RIVER BLW LONG CR
31   HC    2

32   KK  RHOLS  ROUTE LONG CR TO MALINE CNF WITH HOLSTON CR , 10MI
33   RM    1    5    .3

34   KK  HOLSTN FOURCHE MALINE(HOLSTON CR LOCAL)
35   BA   117
36   PB    0
37   ZR  =PI  A=WISTER LAKE B=LONGCR C=PRECIP-INC F=ADJUST
38   US    10   .66

39   KK  FMALIN TOTAL Q FROM FOURCHE MALINE RIVER
```

TABLE 6-1 (CONT)

HEC-1 INPUT PAGE 2

```
40    HC    2

41    KK LAGMAL  LAG FROM MALINE TO DAM
42    RM    1    2   0.2

43    KK BFPAGE BLACK FORK CR NR PAGE
44    BA   74.4
45    LU   0.9   0.06
46    BF   100   1000   1.02
47    PB    0
48    ZR  =PI  A=WISTER LAKE B=BFPAGE C=PRECIP-INC F=ADJUST
49    US   9.5   .75
50    ZW  A=POTEAU B=PAGE C=FLOW F=CALC
51    KK RPOTRV   ROUTE 24 MILES TO POTEAU RIVER
52    RM    1    12   .3

53    KK BLK-FK BLACK FORK CR LOCAL
54    BA  116.8
55    LU  0.20   0.02
56    BF   50   -.20   1.02
57    PB    0
58    ZR  =PI  A=WISTER LAKE B=BLK-FK C=PRECIP-INC F=ADJUST
59    US   15   .66

60    KK BLFORK TOTAL Q FROM BLACK FORK CREEK
61    HC    2

62    KK CATHRN POTEAU RIVER AT CAUTHRON GAGE
63    BA   203
64    LU   0.2   0.03
65    BF   250   1000   1.02
66    PB    0
67    ZR  =PI  A=WISTER LAKE B=CATHRN C=PRECIP-INC F=ADJUST
68    US  16.0   .85
69    ZW  A=POTEAU B=CAUT C=FLOW F=CALC

70    KK  RLOVI  ROUTE TO LOVING GAGE, 15.4 MI
71    RM    2    4   0.30

72    KK LOVING  LOVING GAGE LOCAL AREA
73    BA   69
74    LU  0.20   0.03
75    BF    0   -.20   1.02
76    PB    0
77    ZR  =PI  A=WISTER LAKE B=LOVING C=PRECIP-INC F=ADJUST
78    US   6.0   .67

79    KK   LOVI  TOTAL Q AT LOVING GAGE
```

TABLE 6-1 (CONT)

HEC-1 INPUT PAGE 3

```
80    HC    2
81    ZW  A=POTEAU B=LOVI C=FLOW F=CALC

82    KK  RBLKFK  ROUTE TO BLACK FORK, 10 MI
83    RM    1    5    .3

84    KK  BLWLOV POTEAU RIVER ABOVE BLACK FORK,BELOW LOVING GAGE
85    BA  48.6
86    LU  0.20  0.02
87    BF    0  -.20  1.02
88    PB    0
89    ZR =PI  A=WISTER LAKE B=BLWLOV C=PRECIP-INC F=ADJUST
90    US  6.0   .67

91    KK  POTRIV  TOTAL Q FROM POTEAU RIVER,ABV BLACK FORK
92    HC    2

93    KK  POTERV  TOTAL Q FROM POTEAU RIVER,BLW BLACK FORK
94    HC    2

95    KK   RPOT  ROUTE POTEAU RIV TO WISTER LAKE, 4MI
96    RM    1    2    .2



97    KK  WISLOC  LAKE LOCAL AREA
98    BA  92.4
99    LU  0.0  0.02
100   PB    0
101   ZR =PI  A=WISTER LAKE B=WISLOC C=PRECIP-INC F=ADJUST
102   US  8.0   .67

103   KK  WISLAK  LAKE AREA
104   BA  11.5
105   PB    0
106   ZR =PI  A=WISTER LAKE B=WISLAK C=PRECIP-INC F=ADJUST
107   LU    0    0
108   UI  3710

109   KK    IN  COMBINE ALL HYDROGRAPHS FOR LAKE INFLOW
110   HC    4
111   ZW  A=POTEAU B=WIST C=FLOW-RES IN F=CALC

112   KK  RELESERELEASES FROM WISTER LAKE
113   BA    1
114   ZR =-QI  A=POSITIVE B=WIST C=FLOW-RES OUT F=OBS

115   KK   NETIN  DIFFERENCE BETWEEN INFLOW AND RELEASE
116   HC    2
```

TABLE 6-1 (CONT)

HEC-1 INPUT PAGE 4

```
117     KK   OUT  NET INFLOW ROUTED THRU LAKE
118     RS    1  ELEV  476.5
119     SV    0   734  4235  7808  10760  15090  21110  28690  37930  49020
120     SV  62360  78210  96480 117000 152400 193400 274700 372500 487900 950400
121     SE   438   450   460   464   466   468   470   472   474   476
122     SE   478   480   482   484   487   490   495   500   505   520
123     SQ    0     0  1500  4500  12500  23500  51500  87500 130000 170000
124     SE   438 502.5   503   504   506   508   512   516   520 523.4
125     ZW  A=POTEAU B=WIST C=ELEV F=CALC

126     KK  RELES  WISTER DAM RELEASES  (BA=993 SQ MI)
127     BA    1
128     ZR  =QI  A=POSITIVE B=WIST C=FLOW-RES OUT F=OBS

129     KK  SPILL  WISTER DAM RELEASES & SPILL
130     HC    2

131     KK  POTEU  ROUTE WISTER RELEASES TO POTEAU
132     RS    5  FLOW    0
133     SV    0  4597  9497  14968  20201  28520  36329  45214  54868  69116
134     SV  92892 118286 148433 180867 211221
135     SQ    0  5000  10000  15000  20000  30000  40000  50000  60000  75000
136     SQ 100000 125000 150000 175000 200000

137     KK POTLOC  POTEAU GAGE LOCAL RUNOFF
138     BA   247
139     BF   100   9000   1.02
140     LU  0.20  0.02
141     PB    0
142     ZR  =PI  A=WISTER LAKE B=POTLOC C=PRECIP-INC F=ADJUST
143     US   20    .8

144     KK  POTEAU  GAGE
145     HC    2
146     ZW   A=POTEAU B=POTE C=FLOW F=CALC

147     KK  PANMA  ROUTE TO PANAMA GAGE
148     RM   20   40   0.2

149     KK  BRAZIL  CREEK RUNOFF
150     BA   234
151     PB    0
152     BF  3000  2000  1.02
153     LU  0.00  0.02
154     ZR  =PI  A=WISTER LAKE B=BRAZIL C=PRECIP-INC F=ADJUST
155     US   40    .8
```

TABLE 6-1 (CONT)

HEC-1 INPUT PAGE 5

```
156     KK JAMESC EAST SIDE LOCAL RUNOFF (JAMES CR)
157     BA   293
158     PB     0
159     BF     0
160     ZR =PI  A=WISTER LAKE B=JAMESC C=PRECIP-INC F=ADJUST
161     US    24    .8

162     KK PANAMA GAGE
163     KO     3
164     HC     3
165     ZW     A=POTEAU B=PANA C=FLOW F=CALC

166     KK   MOUT ROUTE TO CONFLUENCE OF POTEAU & ARKANSAS RIVERS
167     RS    10   FLOW    -1
168     SV     0  6562  13052  24154  38446  66177  85473 102390 116416 137273
169     SV 169877 198517 224898 249911 273195
170     SQ     0  5000  10000  15000  20000  30000  40000  50000  60000  75000
171     SQ 100000 125000 150000 175000 200000

172     KK BLWPAN  BELOW PANAMA
173     BA   121
174     PB     0
175     BF     0
176     ZR =PI  A=WISTER LAKE B=BLWPAN C=PRECIP-INC F=ADJUST
177     US    10    .8

178     KK  MOUTH  OF POTEAU RIVER
179     KO     3
180     HC     2
181     ZW      A=POTEAU B=CONF C=FLOW F=CALC
182     ZZ
```

TABLE 6-2

SAMPLE OUTPUT FOR FORECAST MODEL

WISTER LAKE

TABLE 6-2

WISTER LAKE
FORECAST MODEL
SAMPLE SUMMARY OUTPUT

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD			BASIN AREA	MAXIMUM STAGE
				6-HOUR	24-HOUR	72-HOUR		
HYDROGRAPH AT	REDOAK	5314.	62.00	5181.	4142.	2275.	122.00	
ROUTED TO	RLONG	4662.	68.00	4588.	3900.	2253.	122.00	
HYDROGRAPH AT	LONGCR	12094.	58.00	11821.	9097.	4429.	141.30	
2 COMBINED AT	MALINE	14907.	62.00	14697.	12206.	6601.	263.30	
ROUTED TO	RHOLS	14237.	66.00	14023.	11848.	6569.	263.30	
HYDROGRAPH AT	HOLSTN	11338.	56.00	11032.	8090.	3848.	117.00	
2 COMBINED AT	FMALIN	22380.	62.00	21986.	18627.	10325.	380.30	
ROUTED TO	LAGMAL	22148.	64.00	21781.	18495.	10309.	380.30	
HYDROGRAPH AT	BFPAGE	1165.	60.00	1081.	906.	620.	74.40	
ROUTED TO	RPOTRV	843.	74.00	840.	799.	605.	74.40	
HYDROGRAPH AT	BLK-FK	4580.	64.00	4452.	3403.	1685.	116.80	
2 COMBINED AT	BLFORK	5246.	64.00	5084.	3998.	2249.	191.20	
HYDROGRAPH AT	CATHRN	7231.	62.00	7097.	5553.	2560.	203.00	
ROUTED TO	RLOVI	7113.	66.00	6972.	5496.	2554.	203.00	
HYDROGRAPH AT	LOVING	3172.	52.00	2928.	1770.	881.	69.00	
2 COMBINED AT	LOVI	8254.	66.00	8051.	6755.	3424.	272.00	
ROUTED TO	RBLKFK	7943.	70.00	7786.	6558.	3412.	272.00	
HYDROGRAPH AT	BLWLOV	3478.	54.00	3211.	1789.	866.	48.60	

TABLE 6-2 (CONT)

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD			BASIN AREA	MAXIMUM STAGE
				6-HOUR	24-HOUR	72-HOUR		
2 COMBINED AT	POTRIV	8569.	70.00	8400.	7649.	4254.	320.60	
2 COMBINED AT	POTERV	13055.	68.00	12917.	11633.	6492.	511.80	
ROUTED TO	RPOT	12967.	70.00	12850.	11552.	6481.	511.80	
HYDROGRAPH AT	WISLOC	6475.	56.00	6149.	4127.	1952.	92.40	
HYDROGRAPH AT	WISLAK	1547.	46.00	1343.	707.	392.	11.50	
4 COMBINED AT	IN	38202.	64.00	37890.	33446.	18996.	996.00	
HYDROGRAPH AT	RELESE	0.	52.00	0.	0.	0.	1.00	
2 COMBINED AT	NET	38202.	64.00	37890.	33446.	18910.	997.00	
ROUTED TO	OUT	0.	2.00	0.	0.	0.	997.00	487.71
HYDROGRAPH AT	RELES	6000.	156.00	6000.	6000.	4767.	1.00	
2 COMBINED AT	SPILL	6000.	156.00	6000.	6000.	4767.	998.00	
ROUTED TO	POTEU	6000.	198.00	6000.	5982.	3895.	998.00	
HYDROGRAPH AT	POTLOC	13590.	66.00	13392.	11352.	7637.	247.00	
2 COMBINED AT	POTEAU	14337.	64.00	14150.	12363.	8247.	1245.00	
ROUTED TO	PANMA	12544.	104.00	12428.	11391.	8129.	1245.00	
HYDROGRAPH AT	BRAZIL	11690.	84.00	11641.	11067.	7589.	234.00	
HYDROGRAPH AT	JAMESC	13330.	70.00	13202.	11474.	6012.	293.00	
3 COMBINED AT	PANAMA	25981.	72.00	25836.	24769.	20365.	1772.00	
ROUTED TO	MOUT	23879.	116.00	23851.	23479.	19855.	1772.00	
HYDROGRAPH AT	BLWPAN	17717.	54.00	16791.	10518.	3696.	121.00	
2 COMBINED AT	MOUTH	23879.	116.00	23851.	23479.	19859.	1893.00	

TABLE 6-2 (CONT)

1TABLE 1 STATION				IN FLOW	RELESE FLOW	OUT STAGE	OUT FLOW
PER	DAY	MON	HRMN				
21	22	APR	0000	379.22	-3100.00	475.05	.00
22	22	APR	0200	778.02	-3100.00	474.97	.00
23	22	APR	0400	1937.25	-3100.00	474.92	.00
24	22	APR	0600	3813.30	-3100.00	474.92	.00
25	22	APR	0800	6796.70	-3100.00	474.98	.00
26	22	APR	1000	11587.90	-1550.00	475.19	.00
27	22	APR	1200	17891.88	.00	475.60	.00
28	22	APR	1400	24532.98	.00	476.19	.00
29	22	APR	1600	30356.12	.00	476.87	.00
30	22	APR	1800	34581.26	.00	477.68	.00
31	22	APR	2000	37107.01	.00	478.48	.00
32	22	APR	2200	38180.13	.00	479.26	.00
33	23	APR	0000	38202.08	.00	480.05	.00
34	23	APR	0200	37466.39	.00	480.74	.00
35	23	APR	0400	36210.22	.00	481.40	.00
36	23	APR	0600	34448.89	.00	482.04	.00
37	23	APR	0800	32427.42	.00	482.58	.00
38	23	APR	1000	30277.96	.00	483.08	.00
39	23	APR	1200	27453.16	.00	483.55	.00
40	23	APR	1400	24738.61	.00	483.97	.00
41	23	APR	1600	22270.07	.00	484.30	.00
42	23	APR	1800	19932.41	.00	484.60	.00
43	23	APR	2000	17769.50	.00	484.86	.00
44	23	APR	2200	15892.61	.00	485.10	.00
45	24	APR	0000	14336.90	.00	485.31	.00
46	24	APR	0200	13065.54	.00	485.50	.00
47	24	APR	0400	12000.51	.00	485.67	.00
48	24	APR	0600	11112.19	.00	485.84	.00
49	24	APR	0800	10367.23	.00	485.99	.00
50	24	APR	1000	9733.66	.00	486.13	.00
51	24	APR	1200	9190.61	.00	486.26	.00
52	24	APR	1400	8719.64	.00	486.39	.00
53	24	APR	1600	8305.18	.00	486.51	.00
54	24	APR	1800	7934.83	.00	486.62	.00
55	24	APR	2000	7599.07	.00	486.73	.00
56	24	APR	2200	7290.74	.00	486.83	.00
57	25	APR	0000	7004.53	.00	486.93	.00
58	25	APR	0200	6736.51	.00	487.02	.00
59	25	APR	0400	6483.77	.00	487.10	.00
60	25	APR	0600	6244.16	.00	487.18	.00
61	25	APR	0800	6016.06	.00	487.26	.00
62	25	APR	1000	5798.25	-600.00	487.32	.00
63	25	APR	1200	5589.78	-1200.00	487.38	.00
64	25	APR	1400	5389.92	-1200.00	487.43	.00
65	25	APR	1600	5198.06	-1800.00	487.48	.00

TABLE 6-2 (CONT)

1TABLE 1 STATION				IN FLOW	RELESE FLOW	OUT STAGE	OUT FLOW
PER	DAY	MON	HRMN				
66	25	APR	1800	5013.72	-2400.00	487.52	.00
67	25	APR	2000	4836.47	-2400.00	487.55	.00
68	25	APR	2200	4665.95	-2400.00	487.57	.00
69	26	APR	0000	4501.85	-2400.00	487.60	.00
70	26	APR	0200	4343.89	-2400.00	487.63	.00
71	26	APR	0400	4191.79	-2400.00	487.65	.00
72	26	APR	0600	4045.31	-2400.00	487.67	.00
73	26	APR	0800	3904.23	-2400.00	487.69	.00
74	26	APR	1000	3768.34	-3000.00	487.70	.00
75	26	APR	1200	3637.43	-3600.00	487.71	.00
76	26	APR	1400	3511.30	-4200.00	487.70	.00
77	26	APR	1600	3389.79	-4800.00	487.69	.00
78	26	APR	1800	3272.70	-5400.00	487.67	.00
79	26	APR	2000	3159.88	-6000.00	487.64	.00
80	26	APR	2200	3051.16	-6000.00	487.60	.00
81	27	APR	0000	2946.39	-6000.00	487.57	.00
82	27	APR	0200	2845.42	-6000.00	487.53	.00
83	27	APR	0400	2748.10	-6000.00	487.49	.00
84	27	APR	0600	2654.31	-6000.00	487.45	.00
85	27	APR	0800	2563.90	-6000.00	487.41	.00
86	27	APR	1000	2476.75	-6000.00	487.37	.00
87	27	APR	1200	2392.75	-6000.00	487.32	.00
88	27	APR	1400	2311.76	-6000.00	487.28	.00
89	27	APR	1600	2233.69	-6000.00	487.24	.00
90	27	APR	1800	2158.41	-6000.00	487.19	.00
91	27	APR	2000	2085.84	-6000.00	487.14	.00
92	27	APR	2200	2015.86	-6000.00	487.09	.00
93	28	APR	0000	1948.38	-6000.00	487.05	.00
94	28	APR	0200	1883.31	-6000.00	487.00	.00
95	28	APR	0400	1820.55	-6000.00	486.94	.00
96	28	APR	0600	1760.03	-6000.00	486.88	.00
97	28	APR	0800	1701.66	-6000.00	486.82	.00
98	28	APR	1000	1645.36	-6000.00	486.76	.00
99	28	APR	1200	1591.05	-6000.00	486.70	.00
100	28	APR	1400	1538.66	-6000.00	486.64	.00
		MAX		38202.08	.00	487.71	.00
		MIN		379.22	-6000.00	474.92	.00
		AVE		8317.99	-2560.50	483.04	.00

TABLE 7-6

ELEVATION - AREA - CAPACITY

TABLE 7-6
ELEVATION VERSUS AREA AND CAPACITY DATA

WISTER LAKE, OKLAHOMA
09 DECEMBER 2003 - BASED ON 1985 SEDIMENTATION RESURVEY

AREA IN 1000'S OF AC

ELEV	0	1	2	3	4	5	6	7	8	9
430	.000	.000	.000	.000	.000	.000	.004	.006	.010	.018
440	.021	.023	.025	.026	.028	.029	.030	.037	.047	.054
450	.068	.103	.190	.228	.252	.321	.410	.445	.451	.494
460	.564	.721	.879	1.073	1.163	1.280	1.399	1.757	1.978	2.431
470	3.086	3.758	4.382	5.108	5.514	5.922	6.478	6.923	7.386	7.949
480	8.523	8.906	9.474	9.969	10.502	11.414	11.924	12.430	12.963	13.636
490	14.452	15.401	16.209	16.780	17.195	17.988	18.630	19.569	20.405	21.037
500	21.535	22.296	22.985	23.747	24.647	25.580	26.196	26.879	27.530	28.224
510	28.765									

CAPACITY IN 1000'S OF ACRE-FEET

ELEV	0	1	2	3	4	5	6	7	8	9
430	.000	.000	.000	.000	.000	.000	.002	.007	.015	.029
440	.049	.071	.095	.120	.147	.176	.205	.239	.281	.331
450	.392	.478	.624	.833	1.073	1.360	1.725	2.153	2.601	3.073
460	3.602	4.245	5.045	6.021	7.139	8.360	9.700	11.278	13.145	15.350
470	18.108	21.530	25.600	30.345	35.656	41.374	47.574	54.275	61.429	69.097
480	77.333	86.047	95.237	104.959	115.194	126.152	137.821	149.998	162.695	175.994
490	190.038	204.965	220.770	237.264	254.252	271.843	290.152	309.252	329.239	349.960
500	371.246	393.161	415.802	439.168	463.365	488.478	514.366	540.904	568.108	595.985
510	624.480									

TABLE 7-6, CONT'D
ELEVATION VERSUS AREA AND CAPACITY DATA

WISTER LAKE, OKLAHOMA
09 DECEMBER 2003 - BASED ON 1985 RESURVEY

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
430.0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
431.0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
432.0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
433.0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
434.0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
435.0	.000	.000	.000	.000	.000	.001	.001	.001	.001	.002
	.000	.001	.001	.001	.002	.002	.003	.003	.003	.004
436.0	.002	.003	.003	.003	.004	.004	.005	.005	.006	.007
	.004	.004	.004	.005	.005	.005	.005	.005	.006	.006
437.0	.007	.008	.008	.009	.010	.011	.011	.012	.013	.014
	.006	.007	.007	.007	.008	.008	.009	.009	.009	.010
438.0	.015	.016	.017	.018	.020	.021	.023	.024	.026	.027
	.010	.011	.012	.013	.013	.014	.015	.016	.016	.017
439.0	.029	.031	.033	.035	.037	.038	.040	.042	.044	.047
	.018	.018	.019	.019	.019	.020	.020	.020	.021	.021

TABLE 7-6, CONT'D
ELEVATION VERSUS AREA AND CAPACITY DATA

WISTER LAKE, OKLAHOMA
09 DECEMBER 2003 - BASED ON 1985 RESURVEY

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
440.0	.049	.051	.053	.055	.057	.059	.062	.064	.066	.068
	.021	.021	.022	.022	.022	.022	.022	.023	.023	.023
441.0	.071	.073	.075	.078	.080	.082	.085	.087	.090	.092
	.023	.023	.023	.024	.024	.024	.024	.024	.025	.025
442.0	.095	.097	.100	.102	.105	.107	.110	.112	.115	.118
	.025	.025	.025	.025	.025	.026	.026	.026	.026	.026
443.0	.120	.123	.125	.128	.131	.133	.136	.139	.142	.144
	.026	.026	.026	.027	.027	.027	.027	.027	.028	.028
444.0	.147	.150	.153	.156	.158	.161	.164	.167	.170	.173
	.028	.028	.028	.028	.029	.029	.029	.029	.029	.029
445.0	.176	.179	.181	.184	.187	.190	.193	.196	.199	.202
	.029	.029	.029	.029	.030	.030	.030	.030	.030	.030
446.0	.205	.208	.211	.214	.218	.221	.224	.228	.231	.235
	.030	.031	.032	.032	.033	.034	.034	.035	.036	.036
447.0	.239	.242	.246	.250	.254	.258	.263	.267	.271	.276
	.037	.038	.039	.040	.041	.042	.043	.044	.045	.046
448.0	.281	.285	.290	.295	.300	.305	.310	.315	.320	.326
	.047	.048	.049	.049	.050	.051	.051	.052	.053	.053
449.0	.331	.337	.342	.348	.354	.360	.366	.372	.379	.385
	.054	.056	.057	.058	.060	.061	.063	.064	.065	.067

TABLE 7-6, CONT'D
ELEVATION VERSUS AREA AND CAPACITY DATA

WISTER LAKE, OKLAHOMA
09 DECEMBER 2003 - BASED ON 1985 RESURVEY

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
450.0	.392	.399	.406	.414	.422	.430	.439	.448	.458	.467
	.068	.072	.075	.079	.082	.086	.089	.093	.096	.100
451.0	.478	.488	.500	.512	.526	.540	.555	.571	.588	.606
	.103	.112	.120	.129	.138	.147	.155	.164	.173	.181
452.0	.624	.643	.663	.683	.703	.724	.745	.766	.788	.810
	.190	.194	.198	.201	.205	.209	.213	.217	.221	.224
453.0	.833	.856	.879	.903	.926	.950	.974	.999	1.023	1.048
	.228	.230	.233	.235	.238	.240	.243	.245	.247	.250
454.0	1.073	1.099	1.125	1.152	1.179	1.208	1.237	1.266	1.297	1.328
	.252	.259	.266	.273	.280	.287	.294	.300	.307	.314
455.0	1.360	1.392	1.426	1.460	1.495	1.531	1.568	1.606	1.645	1.685
	.321	.330	.339	.348	.357	.366	.375	.383	.392	.401
456.0	1.725	1.766	1.808	1.850	1.892	1.934	1.977	2.021	2.064	2.108
	.410	.414	.417	.421	.424	.428	.431	.435	.438	.442
457.0	2.153	2.197	2.242	2.286	2.331	2.376	2.421	2.466	2.511	2.556
	.445	.446	.446	.447	.447	.448	.449	.449	.450	.451
458.0	2.601	2.646	2.692	2.738	2.784	2.831	2.879	2.927	2.975	3.024
	.451	.455	.460	.464	.468	.473	.477	.481	.486	.490
459.0	3.073	3.123	3.173	3.224	3.276	3.329	3.382	3.436	3.491	3.546
	.494	.501	.508	.515	.522	.529	.536	.543	.550	.557

TABLE 7-6, CONT'D
ELEVATION VERSUS AREA AND CAPACITY DATA

WISTER LAKE, OKLAHOMA
09 DECEMBER 2003 - BASED ON 1985 RESURVEY

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
460.0	3.602	3.659	3.718	3.778	3.840	3.904	3.969	4.035	4.104	4.173
	.564	.580	.595	.611	.627	.643	.658	.674	.690	.705
461.0	4.245	4.317	4.392	4.468	4.546	4.625	4.706	4.788	4.872	4.957
	.721	.737	.753	.769	.784	.800	.816	.832	.848	.863
462.0	5.045	5.133	5.224	5.317	5.412	5.508	5.607	5.707	5.810	5.914
	.879	.899	.918	.937	.957	.976	.996	1.015	1.034	1.054
463.0	6.021	6.128	6.237	6.347	6.457	6.568	6.681	6.794	6.908	7.023
	1.073	1.082	1.091	1.100	1.109	1.118	1.127	1.136	1.145	1.154
464.0	7.139	7.255	7.374	7.493	7.613	7.735	7.857	7.981	8.106	8.233
	1.163	1.175	1.186	1.198	1.210	1.222	1.233	1.245	1.257	1.268
465.0	8.360	8.489	8.618	8.749	8.882	9.015	9.150	9.285	9.422	9.560
	1.280	1.292	1.304	1.316	1.328	1.340	1.352	1.363	1.375	1.387
466.0	9.700	9.841	9.987	10.135	10.288	10.444	10.603	10.767	10.933	11.104
	1.399	1.435	1.471	1.507	1.542	1.578	1.614	1.650	1.686	1.721
467.0	11.278	11.454	11.633	11.815	11.998	12.184	12.372	12.562	12.754	12.948
	1.757	1.779	1.801	1.823	1.845	1.868	1.890	1.912	1.934	1.956
468.0	13.145	13.345	13.550	13.759	13.973	14.191	14.413	14.641	14.872	15.109
	1.978	2.023	2.069	2.114	2.159	2.205	2.250	2.295	2.341	2.386
469.0	15.350	15.596	15.849	16.108	16.374	16.647	16.926	17.212	17.504	17.803
	2.431	2.497	2.562	2.628	2.693	2.759	2.824	2.890	2.955	3.021

TABLE 7-6, CONT'D
ELEVATION VERSUS AREA AND CAPACITY DATA

WISTER LAKE, OKLAHOMA
09 DECEMBER 2003 - BASED ON 1985 RESURVEY

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
470.0	18.108	18.420	18.739	19.064	19.396	19.735	20.081	20.433	20.792	21.158
	3.086	3.153	3.220	3.288	3.355	3.422	3.489	3.556	3.624	3.691
471.0	21.530	21.909	22.294	22.686	23.083	23.487	23.897	24.314	24.736	25.165
	3.758	3.820	3.883	3.945	4.008	4.070	4.133	4.195	4.257	4.320
472.0	25.600	26.042	26.491	26.947	27.411	27.882	28.360	28.845	29.338	29.838
	4.382	4.455	4.527	4.600	4.673	4.745	4.818	4.890	4.963	5.036
473.0	30.345	30.858	31.375	31.896	32.421	32.950	33.483	34.020	34.561	35.107
	5.108	5.149	5.189	5.230	5.271	5.311	5.352	5.392	5.433	5.474
474.0	35.656	36.210	36.767	37.329	37.894	38.464	39.038	39.616	40.198	40.784
	5.514	5.555	5.596	5.636	5.677	5.718	5.759	5.800	5.840	5.881
475.0	41.374	41.969	42.570	43.176	43.787	44.405	45.027	45.656	46.290	46.929
	5.922	5.978	6.033	6.089	6.144	6.200	6.256	6.311	6.367	6.423
476.0	47.574	48.224	48.879	49.538	50.201	50.869	51.541	52.218	52.899	53.585
	6.478	6.523	6.567	6.612	6.656	6.701	6.745	6.790	6.834	6.879
477.0	54.275	54.969	55.668	56.372	57.081	57.794	58.512	59.234	59.961	60.693
	6.923	6.969	7.016	7.062	7.108	7.155	7.201	7.247	7.293	7.340
478.0	61.429	62.171	62.918	63.670	64.429	65.192	65.962	66.737	67.518	68.305
	7.386	7.442	7.499	7.555	7.611	7.668	7.724	7.780	7.837	7.893
479.0	69.097	69.894	70.698	71.507	72.322	73.143	73.969	74.802	75.639	76.483
	7.949	8.007	8.064	8.121	8.179	8.236	8.293	8.351	8.408	8.466

TABLE 7-6, CONT'D
ELEVATION VERSUS AREA AND CAPACITY DATA

WISTER LAKE, OKLAHOMA
09 DECEMBER 2003 - BASED ON 1985 RESURVEY

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
480.0	77.333	78.187	79.045	79.907	80.772	81.642	82.515	83.393	84.274	85.158
	8.523	8.561	8.600	8.638	8.676	8.715	8.753	8.791	8.830	8.868
481.0	86.047	86.941	87.840	88.744	89.655	90.571	91.493	92.420	93.354	94.293
	8.906	8.963	9.020	9.076	9.133	9.190	9.247	9.304	9.361	9.417
482.0	95.237	96.187	97.142	98.102	99.066	100.036	101.011	101.990	102.975	103.964
	9.474	9.524	9.573	9.623	9.672	9.722	9.771	9.821	9.870	9.920
483.0	104.959	105.958	106.963	107.973	108.989	110.010	111.036	112.067	113.104	114.147
	9.969	10.022	10.076	10.129	10.182	10.236	10.289	10.342	10.396	10.449
484.0	115.194	116.249	117.313	118.386	119.468	120.559	121.659	122.769	123.888	125.015
	10.502	10.593	10.684	10.776	10.867	10.958	11.049	11.141	11.232	11.323
485.0	126.152	127.296	128.445	129.599	130.758	131.923	133.092	134.267	135.447	136.631
	11.414	11.465	11.516	11.567	11.618	11.669	11.720	11.771	11.822	11.873
486.0	137.821	139.016	140.216	141.421	142.631	143.846	145.067	146.292	147.522	148.758
	11.924	11.975	12.025	12.076	12.127	12.177	12.228	12.278	12.329	12.380
487.0	149.998	151.244	152.495	153.751	155.013	156.280	157.552	158.830	160.113	161.401
	12.430	12.483	12.537	12.590	12.643	12.697	12.750	12.803	12.856	12.910
488.0	162.695	163.994	165.301	166.614	167.934	169.260	170.594	171.934	173.280	174.634
	12.963	13.030	13.098	13.165	13.232	13.300	13.367	13.434	13.502	13.569
489.0	175.994	177.362	178.738	180.122	181.514	182.914	184.323	185.739	187.164	188.597
	13.636	13.718	13.799	13.881	13.962	14.044	14.126	14.207	14.289	14.370

TABLE 7-6, CONT'D
ELEVATION VERSUS AREA AND CAPACITY DATA

WISTER LAKE, OKLAHOMA
09 DECEMBER 2003 - BASED ON 1985 RESURVEY

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
490.0	190.038	191.488	192.947	194.416	195.895	197.383	198.880	200.387	201.903	203.429
	14.452	14.547	14.642	14.737	14.832	14.927	15.021	15.116	15.211	15.306
491.0	204.965	206.509	208.061	209.621	211.190	212.766	214.351	215.943	217.544	219.153
	15.401	15.482	15.563	15.644	15.724	15.805	15.886	15.967	16.048	16.128
492.0	220.770	222.393	224.023	225.658	227.299	228.945	230.598	232.256	233.920	235.589
	16.209	16.266	16.323	16.380	16.438	16.495	16.552	16.609	16.666	16.723
493.0	237.264	238.944	240.628	242.317	244.009	245.706	247.407	249.112	250.821	252.534
	16.780	16.822	16.863	16.905	16.946	16.988	17.029	17.071	17.112	17.154
494.0	254.252	255.975	257.706	259.446	261.193	262.948	264.711	266.482	268.261	270.048
	17.195	17.274	17.354	17.433	17.512	17.592	17.671	17.750	17.830	17.909
495.0	271.843	273.645	275.454	277.268	279.090	280.917	282.751	284.592	286.439	288.292
	17.988	18.052	18.117	18.181	18.245	18.309	18.373	18.438	18.502	18.566
496.0	290.152	292.020	293.897	295.783	297.679	299.584	301.499	303.423	305.357	307.299
	18.630	18.724	18.818	18.912	19.006	19.100	19.194	19.287	19.381	19.475
497.0	309.252	311.213	313.182	315.160	317.146	319.141	321.143	323.155	325.174	327.202
	19.569	19.653	19.736	19.820	19.903	19.987	20.071	20.154	20.238	20.322
498.0	329.239	331.282	333.332	335.389	337.451	339.520	341.595	343.677	345.765	347.859
	20.405	20.468	20.531	20.595	20.658	20.721	20.784	20.847	20.911	20.974
499.0	349.960	352.066	354.177	356.293	358.414	360.540	362.671	364.807	366.949	369.095
	21.037	21.087	21.137	21.187	21.236	21.286	21.336	21.386	21.435	21.485

TABLE 7-6, CONT'D
ELEVATION VERSUS AREA AND CAPACITY DATA

WISTER LAKE, OKLAHOMA
09 DECEMBER 2003 - BASED ON 1985 RESURVEY

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
500.0	371.246	373.403	375.568	377.740	379.920	382.108	384.304	386.507	388.717	390.935
	21.535	21.611	21.687	21.763	21.840	21.916	21.992	22.068	22.144	22.220
501.0	393.161	395.394	397.634	399.881	402.135	404.395	406.663	408.937	411.218	413.507
	22.296	22.365	22.434	22.503	22.572	22.641	22.709	22.778	22.847	22.916
502.0	415.802	418.104	420.414	422.731	425.057	427.389	429.730	432.078	434.433	436.797
	22.985	23.061	23.138	23.214	23.290	23.366	23.442	23.518	23.595	23.671
503.0	439.168	441.547	443.935	446.332	448.738	451.154	453.578	456.011	458.453	460.904
	23.747	23.837	23.927	24.017	24.107	24.197	24.287	24.377	24.467	24.557
504.0	463.365	465.834	468.313	470.801	473.298	475.805	478.321	480.846	483.381	485.925
	24.647	24.740	24.834	24.927	25.020	25.114	25.207	25.300	25.393	25.487
505.0	488.478	491.039	493.606	496.180	498.759	501.345	503.937	506.535	509.139	511.750
	25.580	25.642	25.703	25.765	25.826	25.888	25.950	26.011	26.073	26.135
506.0	514.366	516.989	519.619	522.256	524.899	527.549	530.207	532.871	535.542	538.219
	26.196	26.264	26.333	26.401	26.469	26.538	26.606	26.674	26.743	26.811
507.0	540.904	543.595	546.292	548.997	551.707	554.424	557.148	559.878	562.615	565.358
	26.879	26.944	27.009	27.074	27.139	27.205	27.270	27.335	27.400	27.465
508.0	568.108	570.865	573.628	576.398	579.176	581.960	584.751	587.549	590.354	593.166
	27.530	27.600	27.669	27.738	27.808	27.877	27.947	28.016	28.085	28.155

TABLE 7-6, CONT'D
ELEVATION VERSUS AREA AND CAPACITY DATA

WISTER LAKE, OKLAHOMA
09 DECEMBER 2003 - BASED ON 1985 RESURVEY

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
509.0	595.985	598.810	601.641	604.477	607.318	610.165	613.017	615.874	618.737	621.606
	28.224	28.278	28.332	28.386	28.441	28.495	28.549	28.603	28.657	28.711

EXHIBITS

EXHIBIT A

SUPPLEMENTARY PERTINENT DATA

EXHIBIT A

SUPPLEMENTARY PERTINENT DATA

WISTER LAKE

TABLE OF CONTENTS

1. GENERAL INFORMATION

Other names for project	Wister Dam and Reservoir
Location	Poteau River at river mile 60.9, about 2 miles south of Wister in LeFlore County, Oklahoma
Type of project	Dam and lake
Objectives of regulation	Multipurpose - Flood control, water supply, fish and wildlife, recreation, and navigation
Project owner	U. S. Government
Operating agency	U. S. Army Corps of Engineers. The working hours of operation for weekdays and normal conditions are 7:45 a.m. to 4:30 p.m.; working hours for weekends, holidays, and nights vary; working hours during flood emergency conditions are 24 hours a day.
Regulating agency	U. S. Army Corps of Engineers

		Amount
Water supply contracts	User	(acre-feet)
	Heavener Utility Authority	1,600
	Poteau Valley Improvement Authority	4,800
	Applied Energy Services, Shady Point	7,253
Water Rights	(See Table 7-5)	
Project cost	$10,501,000	
Closure date	The embankment was closed in June 1948, and the project was completed for full flood control operation in October 1949. The top of conservation pool was changed from elevation 474.6 to 478.0 in May 1996.	

2. LAKE INFORMATION

ELEVATIONS, AREAS, AND STORAGES

Feature	Elevation (ft, NGVD)	Area (acres)	Storage	
			acre-ft (1)	inches (2)
Top of Dam	527.5	--	--	--
Maximum Pool	522.0	38,630	966,400	18.25
Top of Flood Control Pool	502.5	23,366	427,400	8.07
Top of Conservation Pool	478.0	7,386	61,400	1.16
Inactive Pool	468.8	2,340	14,900	0.28
Streambed at Dam	428.5	--	--	--
Flood Control Storage	478.0 - 502.5	--	366,000	6.91
Conservation Storage	468.8 - 478.0	--	46,500	0.89
Water Supply Storage	468.8 - 472.6	--	13,488	0.25

(1) Based on 1985 Survey

(2) Runoff from drainage area of 993 square miles

Real estate taking line	Blocked perimeter, which includes all land below elevation 510.9 or the elevation of the limits of the backwater envelope curve, whichever is higher.
Range of clearing	Minimal Clearing
Pool elevation at which downstream channel capacity can be achieved	Channel capacity at Poteau, approximately 20 river miles below the dam, is 7,800 c.f.s. This discharge can be achieved through the conduits at a lake elevation of 471.5 and over the uncontrolled spillway at a lake elevation of 505.0.

Reservoir length at top of conservation pool	6 miles
Shoreline length at top of conservation pool	115 miles
Safety aspects possibly requiring warning	Starting at elevation 485.4 some of the public use area roads, boat ramps, and facilities require barricades, signs or closing.
Emergency drawdown	Minimum required time to empty from spillway crest elevation 502.5 to top of conservation pool elevation 478.0 with a maximum release of 7,800 c.f.s. is 24 days. Minimum time required to empty the pool from elevation 478.0 to the inlet invert of the conduits elevation 450.0 is approximately 7 days.

3. HYDROLOGY

Drainage area	993 square miles

Spillway Design Flood - Full Pool

Maximum water surface elevation	522.0 feet, NGVD
Peak inflow	360,000 c.f.s.
Total runoff	23.8 inches
Volume	1,260,000 acre-feet
Maximum outflow	170,000 c.f.s.
Flood duration	9 days

Standard Project Flood - Full Pool

Maximum water surface elevation	513.7 feet, NGVD
Peak inflow	180,000 c.f.s.
Total runoff	12.0 inches
Volume	637,000 acre-feet
Maximum outflow	82,400 c.f.s.
Flood duration	9 days

MAJOR FLOODS PAST THE DAM SITE

Date	Peak Flow (c.f.s.)	Volume (Acre-feet)	Runoff (inches) (1)
15-27 June 1935	81,000	397,000	7.48
16-21 April 1939	77,800	324,000	6.12
10-22 May 1945	78,600	365,800	6.92
02-07 April 1957	48,500	156,000	2.95
18-22 May 1960	100,000	394,700	7.44
03-16 May 1968	66,500	231,500	4.37
04-12 Jun 1974	47,800	292,000	5.51
18-26 Oct 1984	64,000	345,400	6.52
01-06 May 1990	103,000	426,600	8.06
25-31 Oct 1991	50,600	174,800	3.30
04-16 Nov 1994	35,000	261,200	4.93
04-09 Jan 1998	49,700	287,100	5.42
07-09 Apr 2002	65,300	186,400	3.52

(1) Runoff from uncontrolled drainage basin area of 993 square miles

(2) Estimated

Climate	Moderate
One inch runoff	52,960 acre-feet
Storm types	Primarily thunderstorms
Flood season	Primary flood periods March through June and September through October; however, floods are possible in any month of the year.

Low flow season	Primarily November-February and July-September; however, low flow can occur at any time of year.
Minimum daily flow	0 c.f.s. (at various times)
Minimum monthly flow	0 acre-feet (Sep-Oct 1956 and Oct-Dec 1963)
Minimum annual flow	138,300 acre-feet (1963)
Average annual flow	856,390 acre-feet (1939 - 2001)
Maximum daily flow	92,300 c.f.s. (3 May 1990)
Maximum instantaneous flow	103,000 c.f.s. (3 May 1990)
Maximum monthly flow	632,630 acre-feet (May 1990)
Maximum annual flow	2,169,510 acre-feet (1945)
Maximum flood volume	420,100 acre-feet (01-06 May 1990)

Name and location of key streamflow stations	Fourche Maline River: Red Oak (river mile 41.2) Blackfork River: Page (river mile 24.6) Poteau River: Cauthron (river mile 109.0) Loving (river mile 93.6) Poteau (river mile 39.6) Panama (river mile 26.8)
Type of data recorded at the dam site	Lake and tailwater elevations, rainfall, pan evaporation, wind speed and direction, lake clarity, and weather conditions
Number of precipitation stations used in hydrologic forecasting of Wister Lake	17 DCP recording, 4 AFOS observer
Number of sediment ranges	41
Number of degradation ranges	5

4. EMBANKMENT

Location	Poteau River at river mile 60.9
Purpose	Multipurpose - Flood control, water supply, fish and wildlife, recreation, and navigation
Type	Non-overflow embankment
Type of fill	Earth-fill
Slope protection	Riprap upstream and grass cover downstream
Height	99 feet above streambed
Length	5,700 feet
Top elevation	527.5 feet, NGVD
Design flood	Spillway design flood
Freeboard	5.5 feet above maximum pool elevation
Used for roadway	U.S. Highway 270
Elevation of streambed	428.5 feet, NGVD

5. SPILLWAY

Location	Near right abutment
Type	Concrete chute
Crest elevation	502.5 feet, NGVD
Net overflow width	600 feet
Control	Uncontrolled
Maximum discharge capacity	225,000 c.f.s. (527.5 feet, NGVD) 153,000 c.f.s. (522.0 feet, NGVD)
Type energy dissipator	None
Spillway activation	Uncontrolled above elevation 502.5 feet, NGVD

6. OUTLET FACILITIES

Location	Near right abutment in concrete gate tower
Purpose	Flood releases
Type of outlet	Two elliptical conduits 14′ x 15.8′
Type of gates	Six 7′ x 12′ vertical lift gates
Entrance invert elevation	450.0 feet, NGVD
Discharge at pertinent elevations	Bottom of Conservation (468.8): 6,600 c.f.s. Top of Conservation (478.0): 9,700 c.f.s. Top of Flood Pool (502.5): 14,700 c.f.s. Maximum Pool (522.0): 17,400 c.f.s.
Minimum pool elevation when inoperative	450.0 feet, NGVD
Minimum time required to open or close gates	37 seconds/foot
Type energy dissipator	Stilling basin

7. CONTROL POINTS

a. Poteau River at Poteau

Location	On left bank at downstream side of county road bridge, located 0.5 miles east of Poteau at river mile 39.6.
Purpose	Provide stage and precipitation data and serve as a control point for flood releases
Channel description	The channel is well defined and fairly straight in the vicinity of the gage. The banks are fairly high and lightly wooded. The streambed is composed of sand, silt, and rock and is clean and stable.
Drainage Area	1,240 square miles
Uncontrolled drainage area	247 square miles
Bank full stage and flow	20.0 feet, 7,800 c.f.s.
Time of water travel	Wister Dam to Poteau gage, 8 hours, approximate

Monitoring provisions	Stage and precipitation data are recorded by a Sutron Data Collection Platform (DCP)
Zero of gage	409.40 feet, NGVD
Maximum stage of record	39.0 feet (18 June 1935)
Maximum flow of record	100,000 c.f.s. (18 June 1935)
Channel usage	Water supply, fish spawning, fishing

b. Poteau River at Panama

Location	On downstream side of county highway bridge 1 mile east of Panama at river mile 26.4.
Purpose	Provide stage and precipitation data and serve as a control point for flood releases
Channel description	The channel is well defined and fairly straight in the vicinity of the gage. The banks are lightly wooded and subject to overflow. The streambed consists of gravel, shale, and silt and some shifting is expected during periods of prolonged high flows.

Drainage Area	1,767 square miles
Uncontrolled drainage area	774 square miles
Bank full stage and flow	29.0 feet, 11,500 c.f.s
Time of water travel	Wister Dam to Panama gage, 24 hours, approximate
Monitoring provisions	Stage and precipitation data is recorded on a Sutron Data Collection Platform (DCP)
Zero of gage	387.96 feet, NGVD
Maximum stage of record	44.6 feet (18 June 1935)
Maximum flow of record	95,000 c.f.s. (18 June 1935)
Channel usage	Water supply, fish spawning, fishing

EXHIBIT B

STANDING INSTRUCTIONS TO PROJECT MANAGER

EXHIBIT B

STANDING INSTRUCTIONS TO PROJECT MANAGER

WISTER LAKE

POTEAU RIVER, OKLAHOMA

TABLE OF CONTENTS

TABLE INDEX

I - GENERAL INSTRUCTIONS

1. Operation. During flood periods, the lake will be regulated in accordance with the normal flood control regulations as directed in Chapter VII of this manual or paragraph 2 of Section II 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 Office are disrupted, the lake will be regulated in accordance with the schedule of emergency flood control regulations as directed in Chapter VII of this manual or paragraphs 3 and 5 of Section II of this Exhibit. In addition, the Project Manager will immediately make every effort to re-establish communications with the Tulsa District Office.

2. Data Reporting Instructions. Daily lake data from Wister Lake will be submitted to the Water Management Section, Hydrology-Hydraulics Branch, Tulsa District Office (telephone 918-669-7097 or VHF-FM radio, call signal WUI-3). The Water Management Section office is manned from 7:00 a.m. to 4:30 p.m. daily and various hours on weekends and holidays. Data for nonworking days shall be read from the recorder chart and submitted the following workday. Should unusual conditions arise during nonworking hours, one of the persons listed on page i of this manual should be contacted. The following data should be included in the daily report.

a. As of 8 a.m. Pool elevations at 12 noon, 4 p.m., and 12 midnight of the previous day and the current day 8 a.m. pool elevation; number, type, and height of gate openings; tailwater elevation at 8 a.m.; precipitation in inches for the preceding 24 hours (7 a.m. to 7 a.m.); and the 8 a.m. wind velocity and direction.

b. Each gate operation. Date and time of operation, number and heights of gates open before and after operation, and the lake elevation. Confirmation of gate changes shall be made immediately after completion of the change. Complaints about pool elevations or releases, operating machinery failure, and out of service times for maintenance shall be reported to the Water Management Section as they occur.

c. During Flood Periods. In addition to paragraphs a and b above, additional reports may be required by the Water Management Section.

d. Rainfall Reports. Rainfall reports shall be made as follows:

(1) At 8 a.m. all precipitation that occurred during the preceding 24 hours, 7 a.m. to 7 a.m. (covered by routine report on work days).

(2) At 1 p.m. when 0.50 inch or more of precipitation has occurred since 7 a.m. or if it has continued to rain since the 8 a.m. report.

(3) At 7 p.m. when 0.50 inch or more of precipitation has occurred since the 7 a.m. report and no 1 p.m. report was made, or if it has continued to rain since reporting at 1 p.m.

(4) Report at once the occurrence of 2.00 inches or more of precipitation that occurs during a period of 6 hours or less. During nonworking hours, the reports should be made to one of the persons listed on page i of this manual. If no contact with Water Management Section personnel can be made, rainfall reports should be made to the National Weather Service, Tulsa, Oklahoma telephone 1-918-832-4109.

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 a 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 indication 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 Project Manager to maintain a list in current status of residents and property owners who would be endangered or inconvenienced by large 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 radio, television, telephone, Citizen Band radio, use of law enforcement and Civil Defense agencies and their communication systems, National Guard and Reserve Units, supplemented by oral warning from Corps employees in Government vehicles. Approximate water surface profiles and flooded area maps that would result from maximum spillway releases or dam failure are found in the Wister Lake, Operation and Maintenance Manual, Volume II, Flood Emergency Plan. A warning horn will be blown when gate changes are made to give warning to people immediately downstream who are within hearing distance of the horn blast.

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 downstream of Wister Dam is not to be exceeded insofar as practicable. The current regulating stage below the Dam at Poteau is 20.0 feet (approximately 7,800 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. 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, and status of crops in low-lying farmlands.

2. Normal Flood Control Regulations. Under normal procedures, instructions for the storage and release of water for conservation and flood control will be issued by the Water Management Section, Hydrology-Hydraulics Branch. Gate changes and other instructions are to be confirmed back to the Water Management Section as soon as the required action is completed. Instructions originating from any other source should not be processed. Wister Lake will be operated for maximum flood reductions on the Poteau River from the dam to the confluence with the Arkansas River. Releases will also be coordinated with the flood control operations at the other projects in the Arkansas Basin to provide maximum flood control benefits on the Arkansas River.

3. Emergency Flood Control Regulations. When communication with the Tulsa District Office is disrupted, the Project Manager will, on his own initiative, direct flood control operation of the reservoir in accordance with Table B-1 until communications are restored. In addition, the Project Manager will make every effort to re-establish communications with the Tulsa District Office and will send information to the Tulsa District Office by any means possible. In the event that communications are disrupted, releases shall not be changed until 12 hours has elapsed or until the pool rises to elevation 502.5, at which time releases will be made in accordance with Table B-1. At no time during emergency flood control operations shall releases be decreased if the pool is rising.

TABLE B-1

EMERGENCY FLOOD CONTROL REGULATION SCHEDULE

Pool Elevation and Condition	Regulation
a. Below Top of Conservation Pool and Rising	Maintain current releases until communication is restored.
b. Above Top of Conservation Pool and Rising	Maintain current releases until either communication is restored, the pool rises to elevation 502.5, or 12 hours has elapsed. If communication is not restored after 12 hours and the releases are less than 1,000 c.f.s., increase releases to 1,000 c.f.s. immediately.
c. Above Elevation 502.5 and Rising	Releases will be gradually increased by opening the conduit gates an amount not to exceed 2,000 c.f.s. every 6 hours so that outflow equals inflow as long as possible.
d. Above Elevation 502.5 and Falling	The maximum gate setting attained during rising conditions shall be maintained until the lake level recedes to elevation 502.5.
e. Below Elevation 502.5 and Falling	If the maximum release rate attained during rising conditions was less than 3,500 c.f.s. through the conduits, then the maximum release rate should be maintained until the pool level nears the top of the conservation pool. If the maximum release rate attained was greater than 3,500 c.f.s., then releases shall be made equal to the previous 2-hour inflow or 3,500 c.f.s., whichever is greater, until the lake level nears the top of conservation pool. When the lake level nears the top of the conservation pool, releases shall be gradually reduced by an amount not to exceed 2,000 c.f.s. every 6 hours so that releases are equal to inflow when the lake level recedes to the top of the conservation pool.

4. Rate of Release Change. The increase and decrease in releases from the reservoir shall be accomplished in a manner which minimizes bank erosion and danger to human and animal lives whenever possible. Releases should be increased and decreased in increments of 1,000 c.f.s. or less with a minimum of 3 hours between changes. Situations will arise which will not allow an orderly increase or decrease in releases. Examples of these situations are shutting off releases to minimize downstream flooding, drownings, and other downstream emergencies.

5. During Emergency Events. The Project 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 the dam or to avoid serious hazards to life. Such actions shall be immediately reported by the fastest means of communication available and shall be confirmed in writing the same day to the Water Management Section with justification for the action. Continuation of the deviation will require the express approval of the Water Management Section.

PLATES

U.S. REPRESENTATIVE		U.S. SENATOR
KANSAS		
1	Jerry Moran	Sam Brownback
2	Jim Ryun	Pat Roberts
4	Todd Tiahrt	
OKLAHOMA		
1	John Sullivan	James Inhofe
2	Brad Carson	Don Nickles
3	Frank Lucas	
4	Tom Cole	
5	Ernest J. Istook	
TEXAS		
1	Max Sandlin	Kay Bailey Hutchison
4	Ralph M. Hall	John Cornyn
13	William Thornberry	
19	Larry Combest	

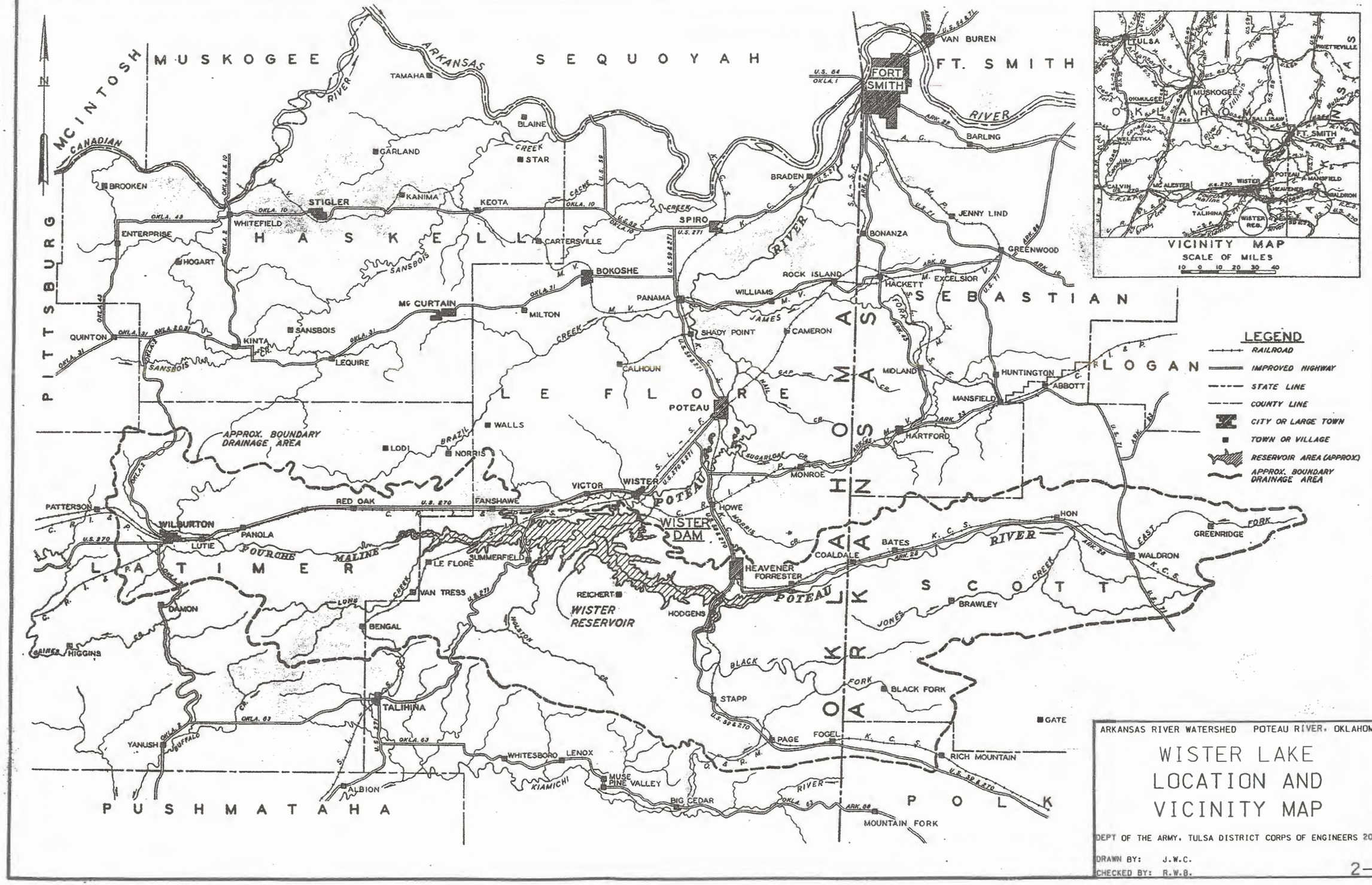
US Army Corps of Engineers®
Tulsa District

N

Wabaunsee
Morris
Council Grove
Ellsworth
Greeley
Wichita
Scott
Lane
Ness
Rush
Barton
Rice
McPherson
Marion
Marion
Chase
Lyon
John Redmond
Coffey
Anderson
Hamilton
Kearny
Finney
Hodgeman
Pawnee
Stafford
Reno
Harvey
El Dorado
Butler
Greenwood
Woodson
Allen
Bourbon
Toronto
Edwards
Cheney
Gray
Ford
1
Pratt
Sedgwick
Fall River
2
Stanton
Grant
Haskell
Kiowa
Kingman
4
Wilson
Neosho
Crawford
Elk
Pearson-Skubitz
Big Hill
Elk City
Morton
Stevens
Seward
Meade
Clark
Comanche
Barber
Harper
Sumner
Cowley
Chautauqua
Montgomery
Labette
Cherokee
Hulah
Coffeyville
Cimarron
Texas
Optima
Beaver
Harper
Woods
Great Salt Plains
Grant
Kay
Kaw
Osage
Nowata
Craig
Ottawa
Grand Lake
o the Cherokees
Alfalaa
Fort Supply
Woodward
Birch
Skiatook
Washington
Oologah
Dallam
Sherman
Hansford
Ochiltree
Lipscomb
Ellis
Major
Garfield
Vance AFB
Noble
Pawnee
Keystone
Delaware
Rogers
Mayes
Hudson
Tulsa
1
Canton
Dewey
3
Payne
Heyburn
Creek
Wagoner
Fort Gibson
Cherokee
Adair
Hartley
Moore
Hutchinson
Roberts
Hemphill
Blaine
Kingfisher
Logan
Meredith
Foss
Roger Mills
Custer
Arcadia
Lincoln
Okmulgee
Muskogee
Tenkiller
Oklahoma
Canadian
Okfuskee
Sequoyah
Oldham
Potter
Carson
Gray
Wheeler
Tinker AFB
Cleveland
Pottawatomie
5
Seminole
Eufaula
Haskell
Robert S. Ker
Beckham
Washita
Fort Cobb
Caddo
Thunderbird
Hughes
Wister
Deaf Smith
Randall
Armstrong
Donley
Collingsworth
Greer
Altus Reservoir
Kiowa
Grady
McClain
Pittsburg
Latimer
13
McAlester AAP
Le Flore
Harmon
Altus AFB
Jackson
Tom Steed
Fort Sill
Comanche
4
Garvin
Pontotoc
Coal
2
Sardis
Parmer
Castro
Swisher
Briscoe
Hall
Childress
Stephens
Murray
Arbuckle
Pushmataha
Broken Bow
Tillman
Waurika
Johnston
Atoka
McGee Creek
Hardeman
Cotton
Carter
Jefferson
Marshall
Hugo
McCurtain
Pine Creek
19
Hale
Floyd
Motley
Cottle
Wilbarger
Wichita
Foard
Sheppard AFB
Love
Bryan
Texoma
Choctaw
Lake Kemp
Clay
Pat Mayse
Lamar
Dickens
Truscott
Montague
Lubbock
Crosby
King
Knox
Baylor
Archer
Cooke
Grayson
4
Fannin
1
Red River
Bowie
Reese AFB

Lakes
Military Installations
Tulsa District Civil Works Boundary
Political Boundaries

POLITICAL SUBDIVISIONS
DECEMBER 2002
1-1



ARKANSAS RIVER WATERSHED POTEAU RIVER, OKLAHOMA

WISTER LAKE LOCATION AND VICINITY MAP

DEPT OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2004

DRAWN BY: J.W.C.

CHECKED BY: R.W.B.

2-1

(b) (7)(F)

ARKANSAS RIVER WATERSHED POTEAU RIVER, OKLAHOMA

WISTER LAKE

GENERAL PLAN
AND SECTIONS

DEPARTMENT OF THE ARMY, TULSA DISTRICT, CORPS OF ENGINEERS 2004
DRAWN BY: J.W.C.
CHECKED BY: R.W.B.

2-2

(b) (7)(F)

ARKANSAS RIVER WATERSHED POTEAU RIVER, OKLAHOMA

WISTER LAKE

OUTLET WORKS

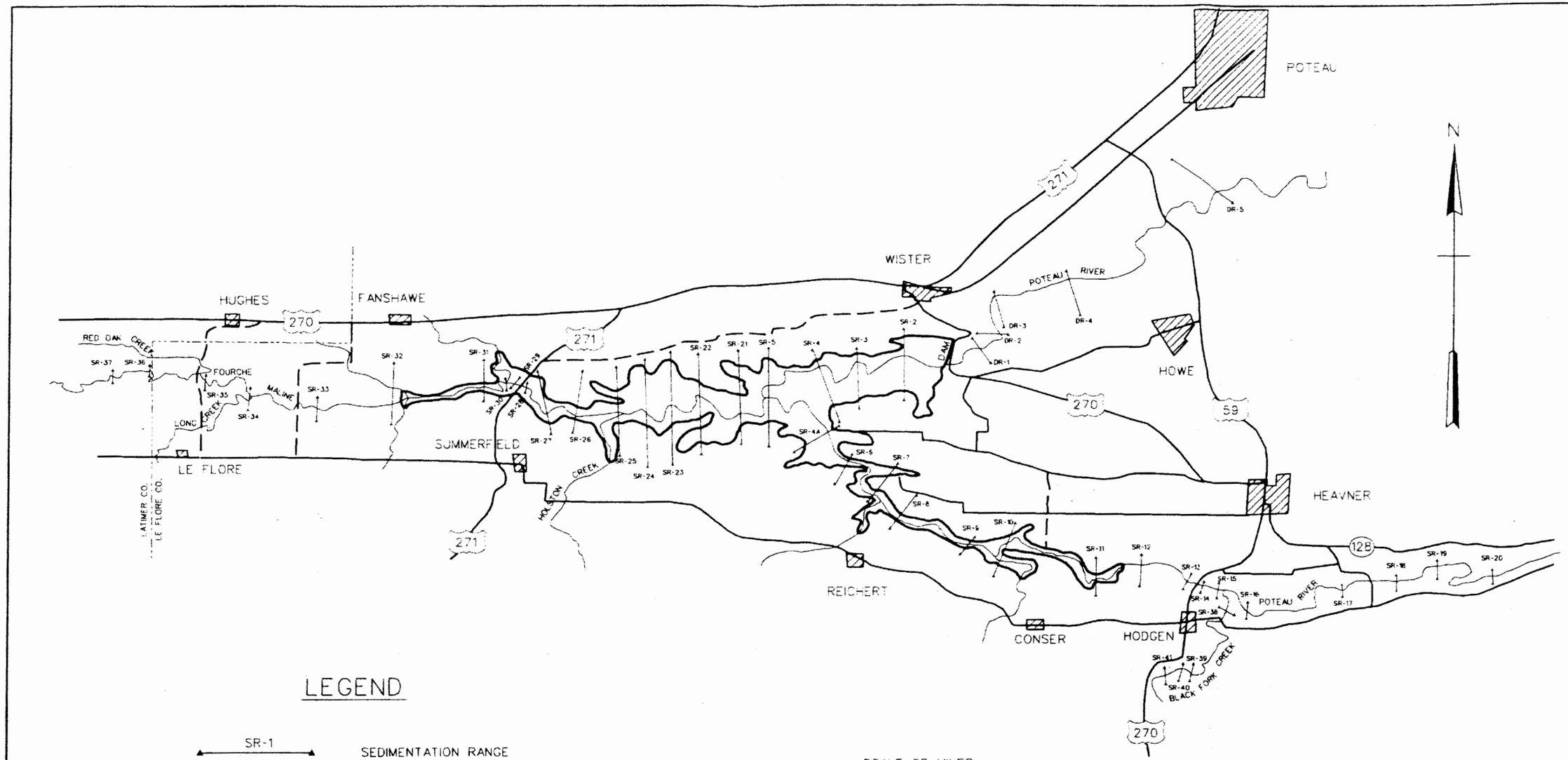
PLAN AND LONGITUDINAL SECTION

DEPT OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2004

DRAWN BY: J.W.C.
CHECKED BY: R.W.B.

2-3

ADDED AUG 1974



LEGEND

SR-1 — SEDIMENTATION RANGE

DR-1 — DEGRADATION RANGE

SCALE OF MILES

1 0 1 2

ARKANSAS RIVER WATERSHED POTEAU RIVER, OKLAHOMA

WISTER LAKE

SEDIMENTATION AND DEGRADATION RANGES

DEPT OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2004

DRAWN BY: J.W.C.
CHECKED BY: R.W.B.

2-4

HUGHES

FANSHAWE

GAME MANAGEMENT AREA

CONSERVATION POOL EL. 471.6

MALINE RIVER

POTEAU

LATIMER COUNTY
LE FLORE COUNTY

MATCH LINE

LE FLORE

R 22 E

R 23 E

SUMMERFIELD

INSERT-1

R 26 E

MATCH LINE

INSERT-2

VICINITY MAP
SCALE OF MILES

WISTER LAKE

POTEAU

OKLAHOMA

LEGEND

PROJECT OPERATIONS

RECREATION - HIGH DENSITY USE

RECREATION - LOW DENSITY USE

WILDLIFE MANAGEMENT

PUBLIC USE AREAS

2 DAMSITE
3 QUARRY ISLE (STATE PARK)
4 WISTER
5 VICTOR
6 CONSER CROSSING

GAME MANAGEMENT AREA

STATE WATERFOWL REFUGE

OVERLOOK

HOWE

R 25 E

T 5 N

HEAVENER

LE FLORE COUNTY

OUACHITA NATIONAL FOREST

R 24 E

REICHERT

CONSER

HODGENS

GOVERNMENT PROPERTY LINE

MATCH LINE (INSERT 2)

LEGEND

RESERVOIR DATA

CONSERVATION POOL ELEVATION 471.6

FLOOD CONTROL POOL ELEVATION 502.5

11.5 MILES OF SHORE LINE AT ELEVATION 471.6

SYMBOLS

PAVED ROADS

IMPROVED ROADS

DIRT ROADS

ARKANSAS RIVER WATERSHED POTEAU RIVER, OKLAHOMA

WISTER LAKE

PUBLIC USE AREAS

DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2004

DRAWN BY: J.W.C.

CHECKED BY: R.W.B.

2-5

LEGEND

NATURAL PROFILES

PROFILES WITH DAM IN PLACE

ENVELOPE OF BACKWATER EFFECTS

NOTE: FOR VARIATIONS IN DISCHARGE SEE ACCOMPANYING MEMORANDUM

PEAK INFLOW (17,000 C.F.S.)ON POOL AT ELEVATION 508.8 AT DAM SITE

17,000 C.F.S

STREAM BED PROFILE

ELEVATION IN FEET ABOVE M.S.L.

HYDRAULIC SECTION LOCATIONS

BLACK FORK RIVER MILES

INFLOW WHEN POOL IS AT STAGE 510.0 M.S.L. VARIES FROM 40,000 C.F.S. AT MOUTH OF FOURCHE MALINE RIVER TO 20,000 C.F.S. AT RIVER MILE 93.

INFLOW AT TIME OF PEAK POOL STAGE (510.9 M.S.L.) VARIES FROM 25,000 C.F.S. AT MOUTH OF FOURCHE MALINE RIVER TO 13,500 C.F.S. AT RIVER MILE 93.

LIMIT OF BACK-WATER EFFECTS.

INFLOW WHEN POOL IS AT STAGE 510.3 M.S.L. VARIES FROM 8,250 C.F.S. AT MOUTH OF FOURCHE MALINE RIVER TO 4,500 C.F.S. AT RIVER MILE 93.

PEAK INFLOW ON POOL AT STAGE 508.8 M.S.L. VARIES FROM 34,000 C.F.S. AT MOUTH OF FOURCHE MALINE RIVER TO 32,500 C.F.S. AT RIVER MILE 93.

VARIES FROM 54,000 C.F.S. AT MOUTH OF FOURCHE MALINE RIVER TO 32,500 C.F.S. AT RIVER MILE 93.

VARIES FROM 40,000 C.F.S. AT MOUTH OF FOURCHE MALINE RIVER TO 20,000 C.F.S. AT RIVER MILE 93.

VARIES FROM 25,000 C.F.S. AT MOUTH OF FOURCHE MALINE RIVER TO 13,500 C.F.S. AT RIVER MILE 93.

VARIES FROM 8,250 C.F.S. AT MOUTH OF FOURCHE MALINE RIVER TO 4,500 C.F.S. AT RIVER MILE 93.

STREAM BED PROFILE

MOUTH OF BLACK FORK RIVER.

MOUTH OF FOURCHE MALINE RIVER

WISTER DAM - POTEAU RIVER MILE 91.33

HYDRAULIC SECTION LOCATIONS

POTEAU RIVER MILES

ARKANSAS RIVER WATERSHED — POTEAU RIVER, OKLAHOMA

WISTER LAKE

ENVELOPE CURVE OF BACKWATER EFFECTS PROFILES ON POTEAU & BLACKFORK RIVERS

1935 FLOOD ON FLOOD CONTROL POOL

DEPARTMENT OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2004

DRAWN BY: J.W.C.

CHECKED BY: R.W.B.

2-6

LEGEND

NATURAL PROFILES

PROFILES WITH DAM IN PLACE

ENVELOPE OF BACKWATER EFFECTS

NOTE: FOR VARIATIONS IN DISCHARGE SEE ACCOMPANYING MEMORANDUM.

INFLOW WHEN POOL IS AT STAGE 510.0 M.S.L. VARIES FROM 23,500 C.F.S. AT RIVER MILE 4 TO 6,000 C.F.S. AT RIVER MILE 29.

INFLOW AT TIME OF PEAK POOL STAGE (510.9 M.S.L.) VARIES FROM 10,000 C.F.S. AT RIVER MILE 4 TO 3,000 C.F.S. AT RIVER MILE 29.

PEAK INFLOW ON POOL AT STAGE 507.1 M.S.L. VARIES FROM 34,000 C.F.S. AT RIVER MILE 4 TO 15,500 C.F.S. AT RIVER MILE 29.

LIMIT OF BACK-WATER EFFECTS.

VARIES FROM 34,000 C.F.S. AT RIVER MILE 4 TO 15,500 C.F.S. AT RIVER MILE 29.

VARIES FROM 23,500 C.F.S. AT RIVER MILE 4 TO 6,000 C.F.S. AT RIVER MILE 29.

VARIES FROM 10,000 C.F.S. AT RIVER MILE 4 TO 3,000 C.F.S. AT RIVER MILE 29.

ELEVATION IN FEET ABOVE M.S.L.

HYDRAULIC SECTION LOCATIONS

FOURCHE MALINE RIVER MILES

POTEAU RIVER 5.3 MILES

ARKANSAS RIVER WATERSHED — POTEAU RIVER, OKLAHOMA

WISTER LAKE

ENVELOPE CURVE OF BACKWATER EFFECTS PROFILES ON FOURCHE MALINE RIVER

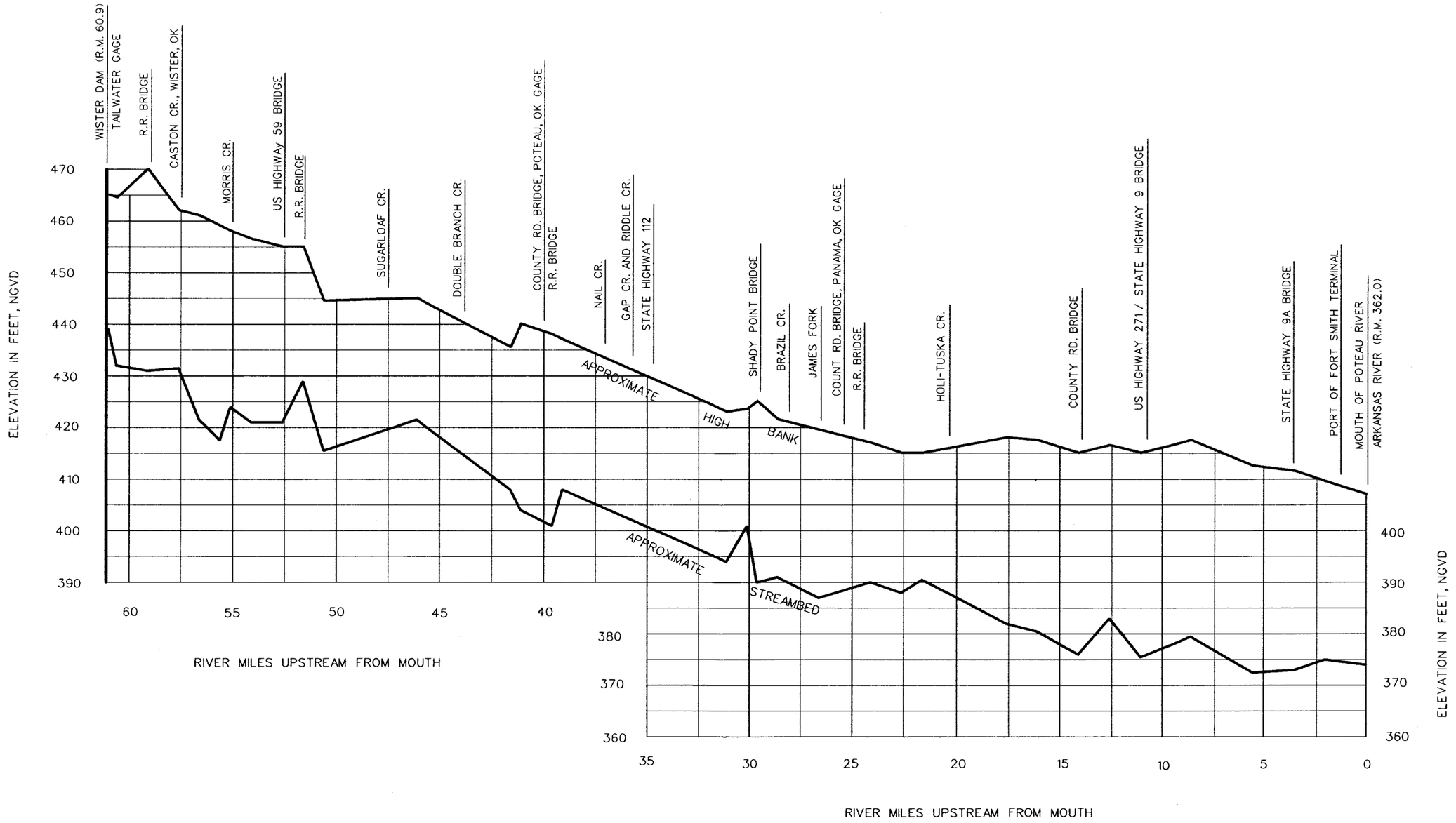
1935 FLOOD ON FLOOD CONTROL POOL

DEPARTMENT OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2004

DRAWN BY: J.W.C.

CHECKED BY: R.W.B.

2-7



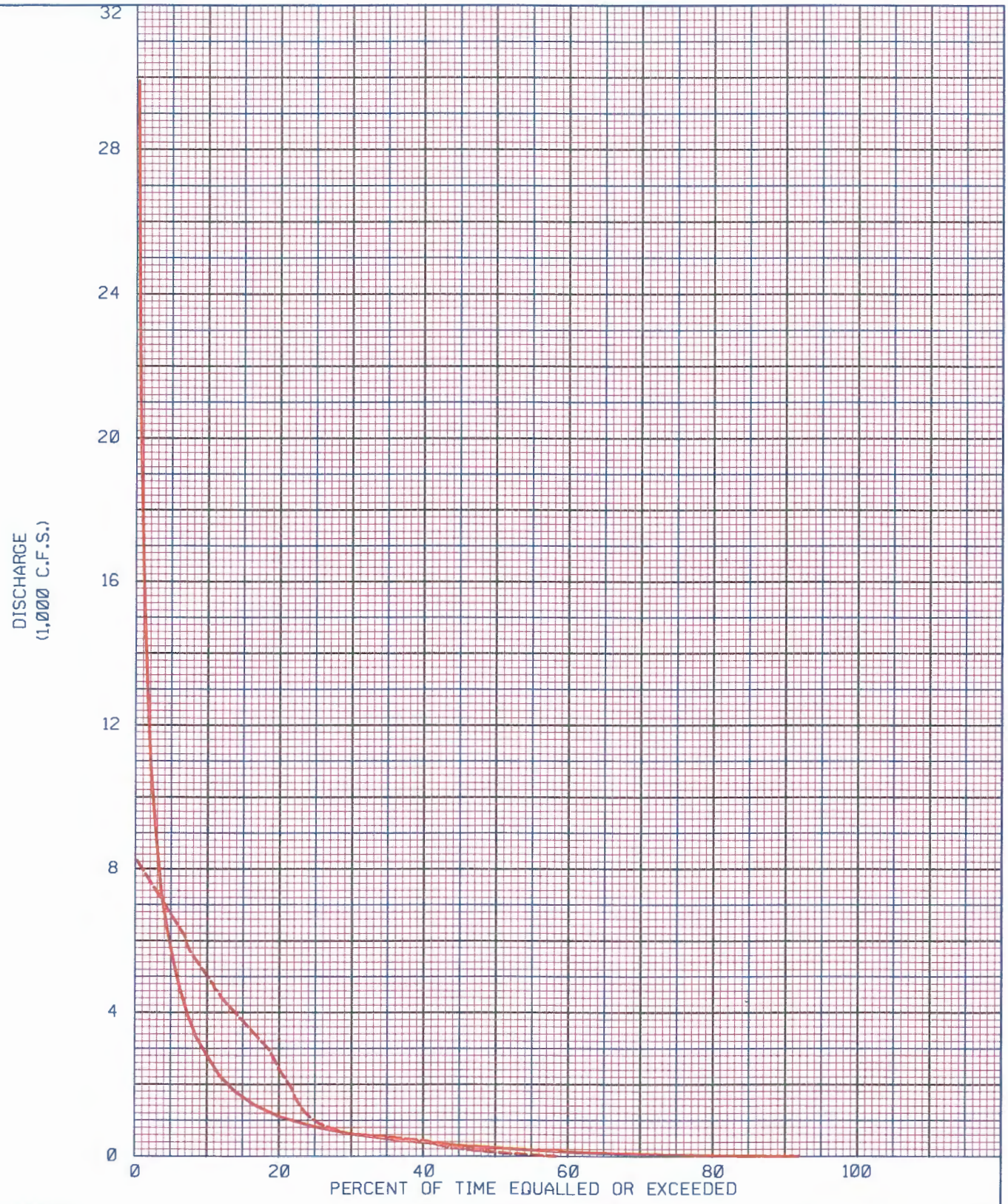
ARKANSAS RIVER BASIN — POTEAU RIVER, OKLAHOMA

WISTER LAKE

POTEAU RIVER PROFILE

DEPARTMENT OF THE ARMY, TULSA DISTRICT, CORPS OF ENGINEERS 2004
DRAWN BY: J.W.C.
CHECKED BY: R.W.B.

4-1



LEGEND:

_____ INFLOW

_ _ _ OUTFLOW

NOTE:

1. APPROACHES ZERO AT 30,000 C.F.S.
2. BASED ON PERIOD OF RECORD JAN. 1940 THRU DEC. 2000

ARKANSAS RIVER WATERSHED — POTEAU RIVER, OKLAHOMA

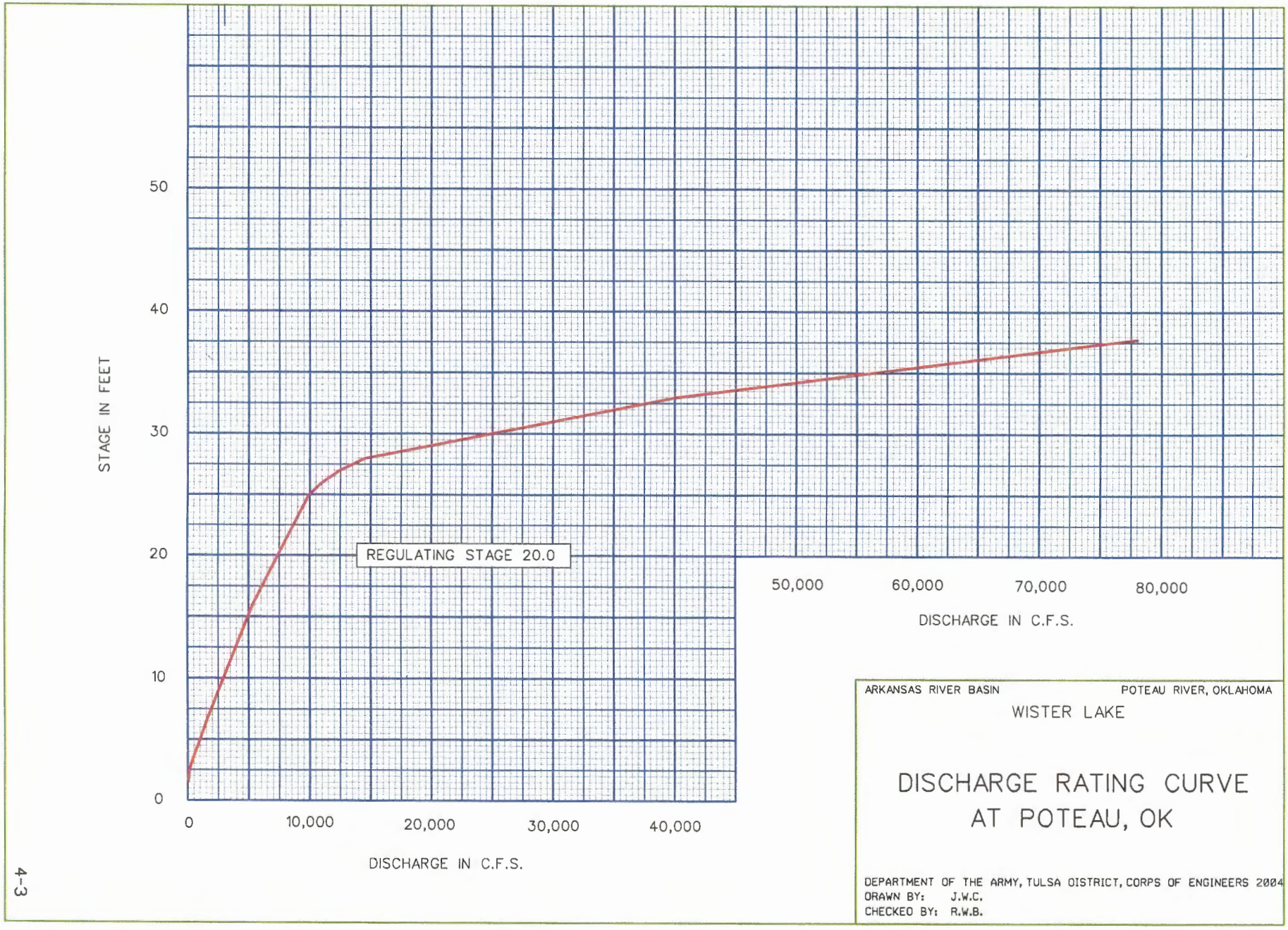
WISTER LAKE

FLOW DURATION CURVE

DEPARTMENT OF THE ARMY, TULSA DISTRICT, CORPS OF ENGINEERS 2000

DRAWN BY: J.W.C.

CHECKED BY: R.W.B.

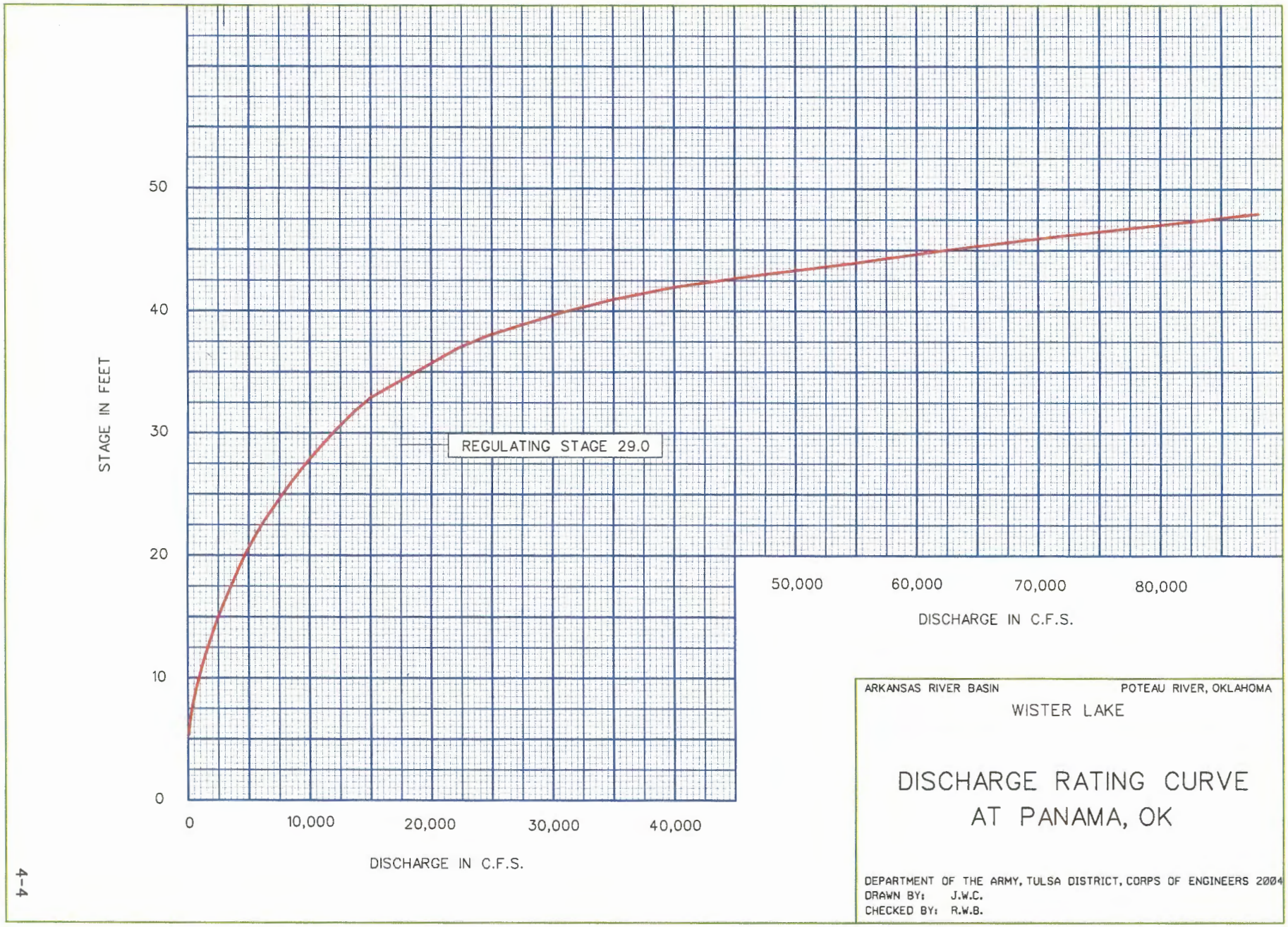


ARKANSAS RIVER BASIN — POTEAU RIVER, OKLAHOMA

WISTER LAKE

DISCHARGE RATING CURVE AT POTEAU, OK

DEPARTMENT OF THE ARMY, TULSA DISTRICT, CORPS OF ENGINEERS 2004
DRAWN BY: J.W.C.
CHECKED BY: R.W.B.

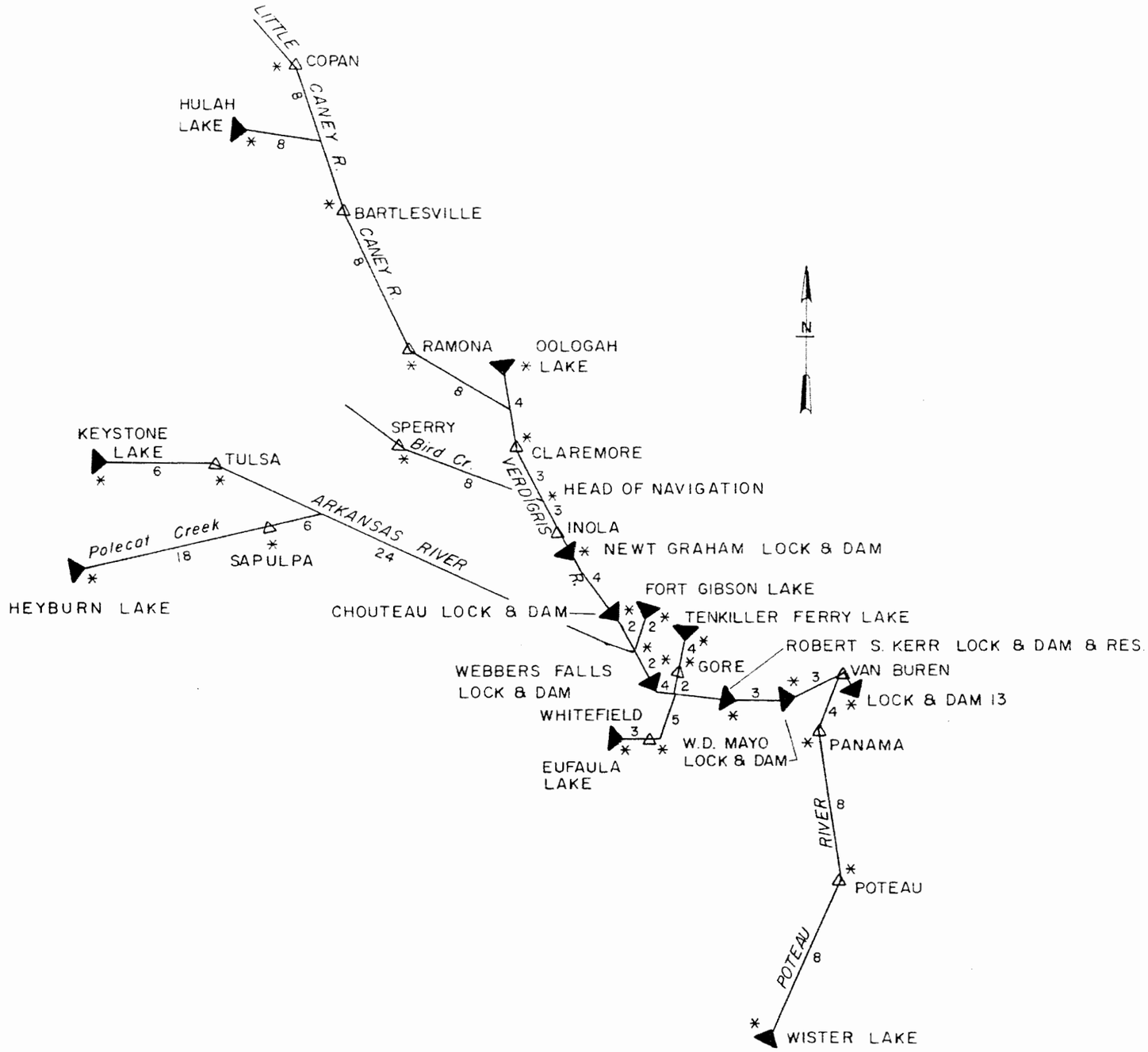


ARKANSAS RIVER BASIN — POTEAU RIVER, OKLAHOMA

WISTER LAKE

DISCHARGE RATING CURVE AT PANAMA, OK

DEPARTMENT OF THE ARMY, TULSA DISTRICT, CORPS OF ENGINEERS 2004
DRAWN BY: J.W.C.
CHECKED BY: R.W.B.



NOTE:
EFFECTIVE TRAVEL TIME FOR
IN-CHANNEL FLOW IN HOURS IS SHOWN

* 6 *

▲ LAKE AND/OR LOCK AND DAM

△ STREAM GAGING STATION

ARKANSAS RIVER WATERSHED POTEAU RIVER, OKLAHOMA

WISTER LAKE
TRAVEL TIME

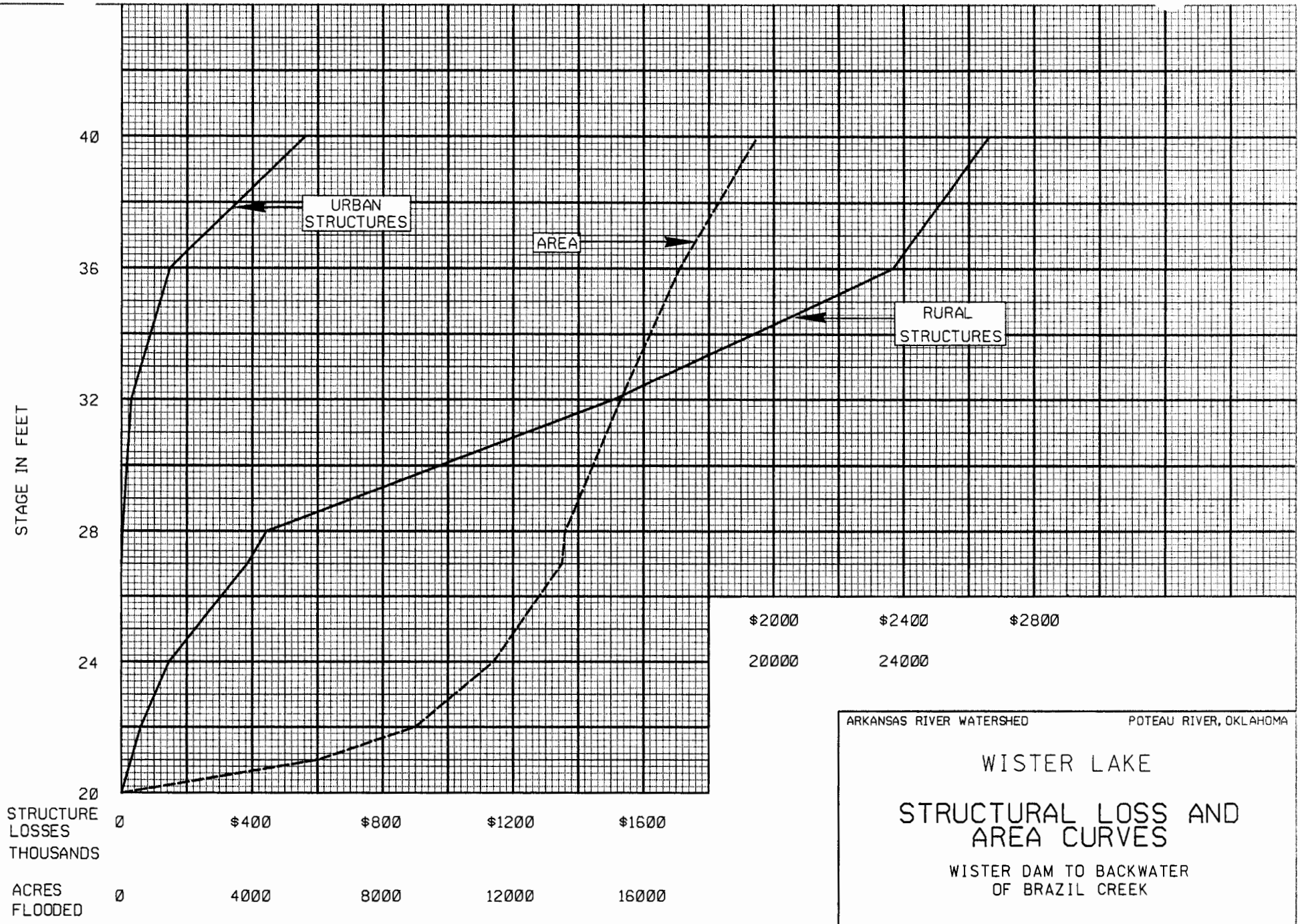
DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2004

DRAWN BY: J.W.C.

CHECKED BY: R.W.B.

4-5

REVISED AUG 1974



ARKANSAS RIVER WATERSHED — POTEAU RIVER, OKLAHOMA

WISTER LAKE

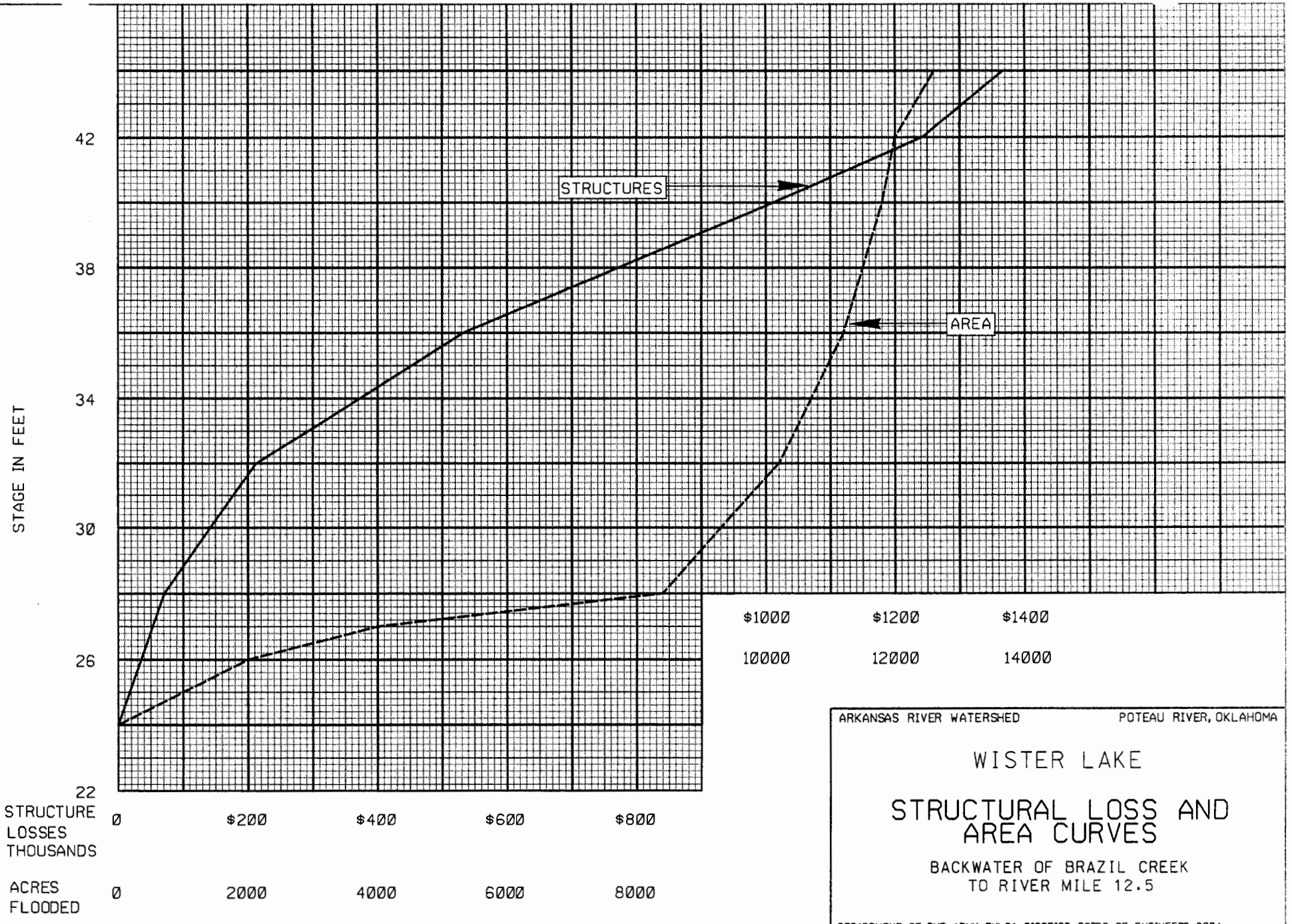
STRUCTURAL LOSS AND AREA CURVES

WISTER DAM TO BACKWATER OF BRAZIL CREEK

DEPARTMENT OF THE ARMY, TULSA DISTRICT, CORPS OF ENGINEERS 2004

DRAWN BY: J.W.C.

CHECKED BY: R.W.B.



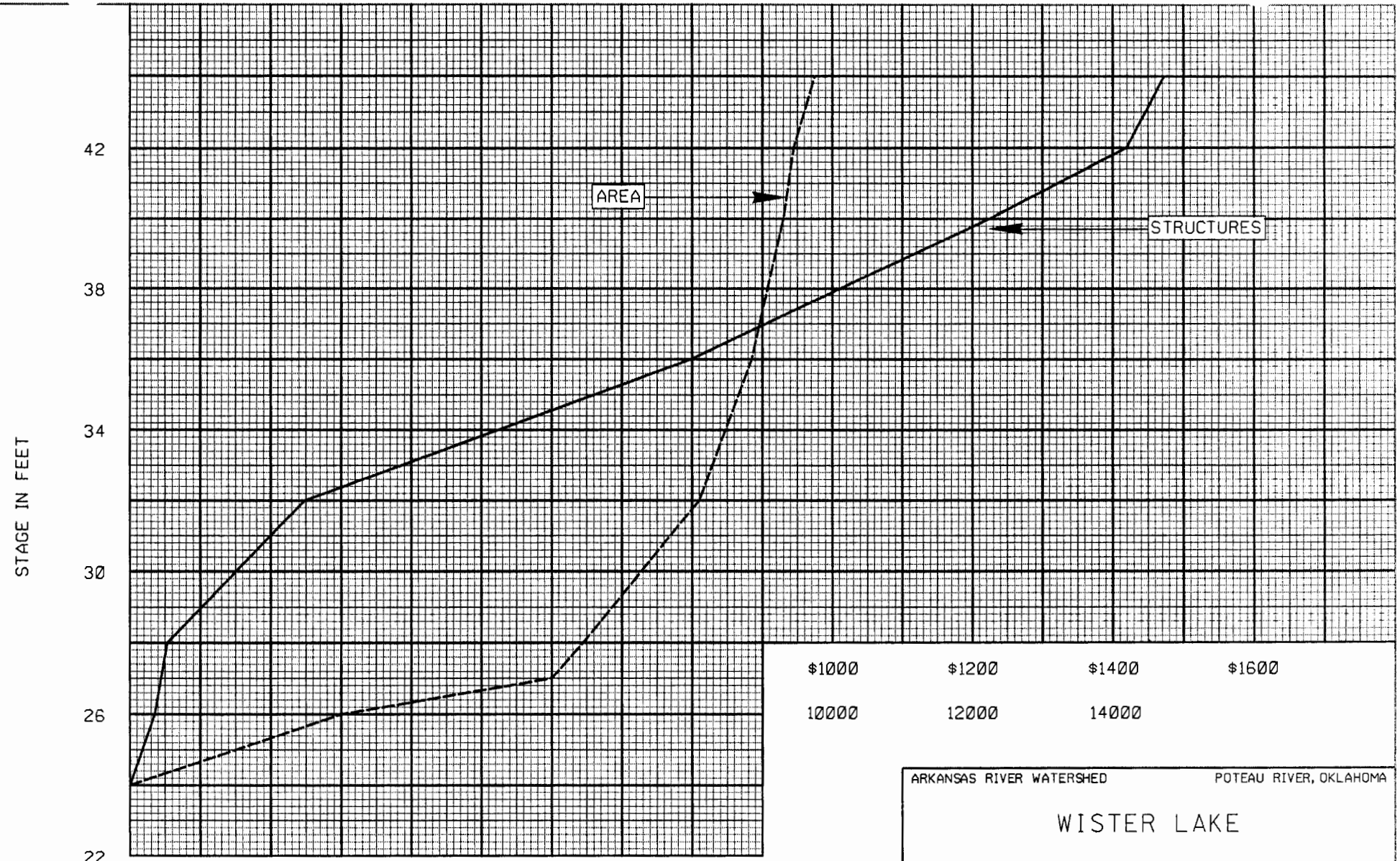
ARKANSAS RIVER WATERSHED — POTEAU RIVER, OKLAHOMA

WISTER LAKE

STRUCTURAL LOSS AND AREA CURVES

BACKWATER OF BRAZIL CREEK
TO RIVER MILE 12.5

DEPARTMENT OF THE ARMY, TULSA DISTRICT, CORPS OF ENGINEERS 2004
DRAWN BY: J.W.C.
CHECKED BY: R.W.B.



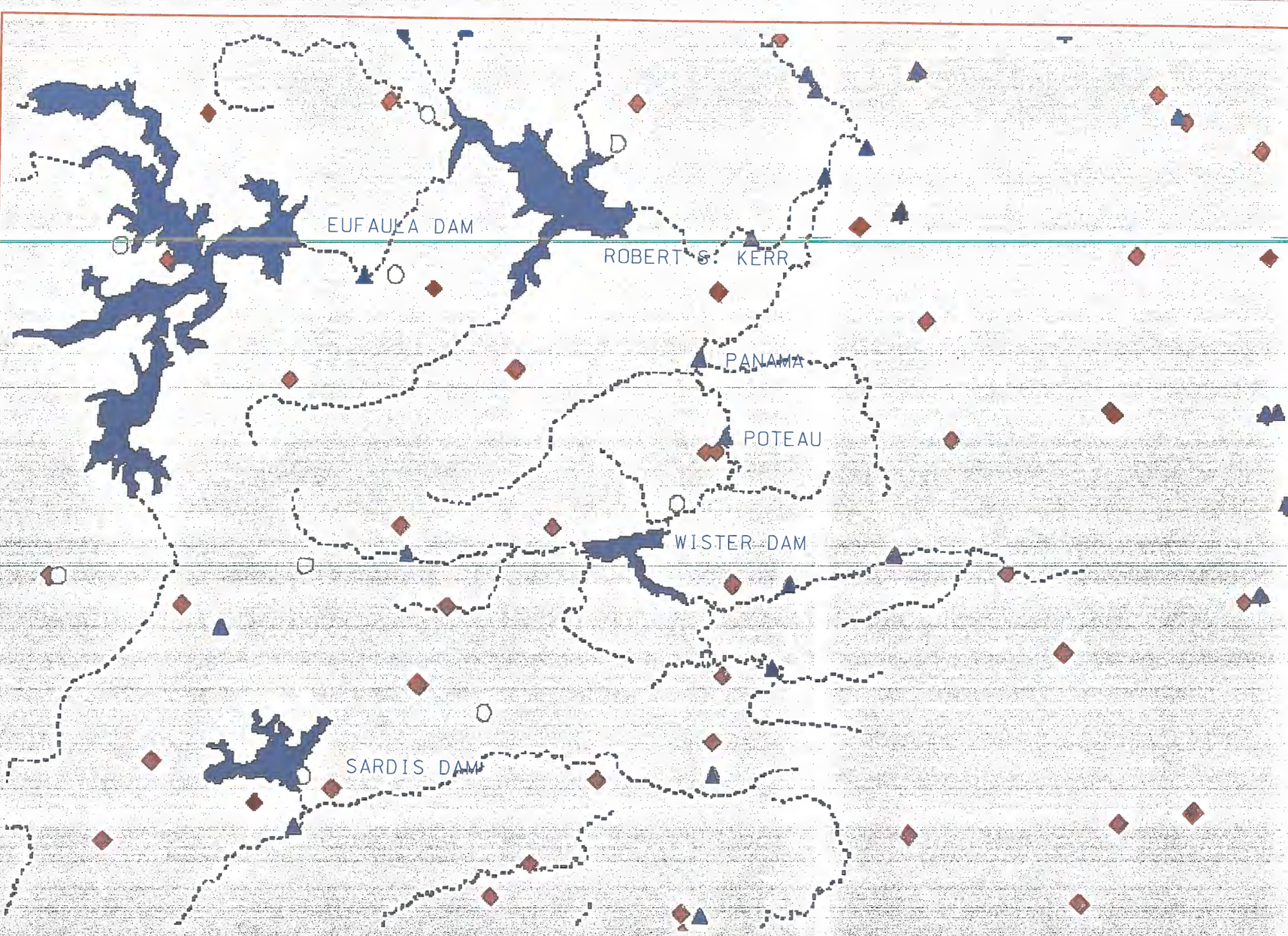
ARKANSAS RIVER WATERSHED — POTEAU RIVER, OKLAHOMA

WISTER LAKE

STRUCTURAL LOSS AND AREA CURVES

RIVER MILE 12.5
TO THE MOUTH

DEPARTMENT OF THE ARMY, TULSA DISTRICT, CORPS OF ENGINEERS 2004
DRAWN BY: J.W.C.
CHECKED BY: R.W.B.



LEGEND:

- OBSERVER STATION
- DCP STATION
- MESONET STATION

ARKANSAS RIVER WATERSHED POTEAU RIVER, OKLAHOMA

WISTER LAKE

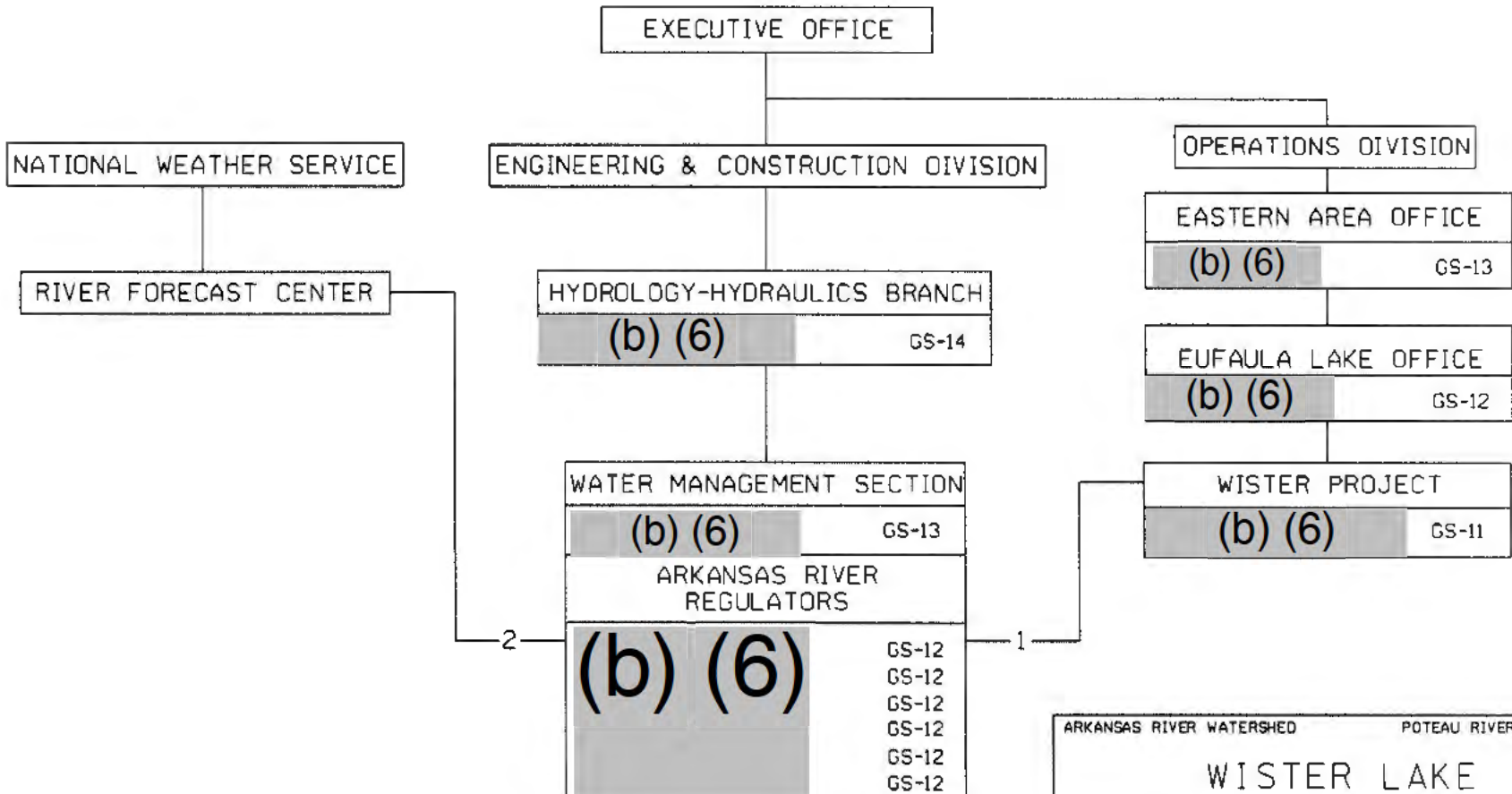
REPORTING RAINFALL AND STREAM GAGING STATIONS

DEPT OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2004

DRAWN BY: J.W.C.
CHECKED BY: R.W.B.

5-1

ORGANIZATION OF FLOOD CONTROL REGULATION
WISTER LAKE
TULSA DISTRICT
(FEBRUARY 2004)



1. DIRECT COMMUNICATIONS ARE MAINTAINED BETWEEN THE LAKES AND THE WATER MANAGEMENT SECTION FOR TRANSMISSION OF LAKE DATA AND INSTRUCTIONS.
2. PRECIPITATION AND STREAM GAGE DATA ARE FURNISHED BY THE NATIONAL WEATHER SERVICE, RIVER FORECAST CENTER.

ARKANSAS RIVER WATERSHED — POTEAU RIVER, OKLAHOMA

WISTER LAKE

ORGANIZATIONAL CHART

OF FLOOD CONTROL REGULATION
WISTER DAM

DEPARTMENT OF THE ARMY, TULSA DISTRICT, CORPS OF ENGINEERS 2004
DRAWN BY: J.W.C.
CHECKED BY: R.W.B.

5-2

PROJECT: WISTER LAKE 081

LAKE DATA

DATE: JUNE 20XX

LINE #	ITEM	TIME	1	2	3	4	5	6	7
1	POOL ELEVATION	12N	478.27						
2	POOL ELEVATION	4PM	478.27						
3	POOL ELEVATION	12M	478.27						
4	POOL ELEVATION	8AM	478.26						
5	TAILWATER ELEVATION	8AM	1.09						
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	M / CL	/	/	/	/	/	/
14	TOTAL PRECEDING 6 HOUR PRECIPITATION ENDING AT	1PM							
		7PM							
		1AM							
		7AM							
15	TOTAL 24 HOUR PRECIPITATION	7AM	0						
16	COMMENTS ON PRECIP DIST								
17	EVAPORATION 24 HOURS	8AM	.05						
18/19	WIND DIRECTION AND VELOCITY	8AM	C / B-0	B-	/ B-	/ B-	B-	/ B-	B-
20	WATER SUPPLY								
21	GATE SETTINGS NO., TYPE, AND OPENING	8AM	1 F100%						
22	GATE CHANGES / DATE / TIME		1 12 0920						
23	POOL ELEVATION		478 27						
24	FROM / GATE SETTING		ALL CLSD						
25	TO / GATE SETTING		LF100%						
26	GATE CHANGES / DATE / TIME								
27	POOL ELEVATION								
28	FROM / GATE SETTING								
29	TO / GATE SETTING								
30	GATE CHANGES / DATE / TIME								
31	POOL ELEVATION								
32	FROM / GATE SETTING								
33	TO / GATE SETTING								

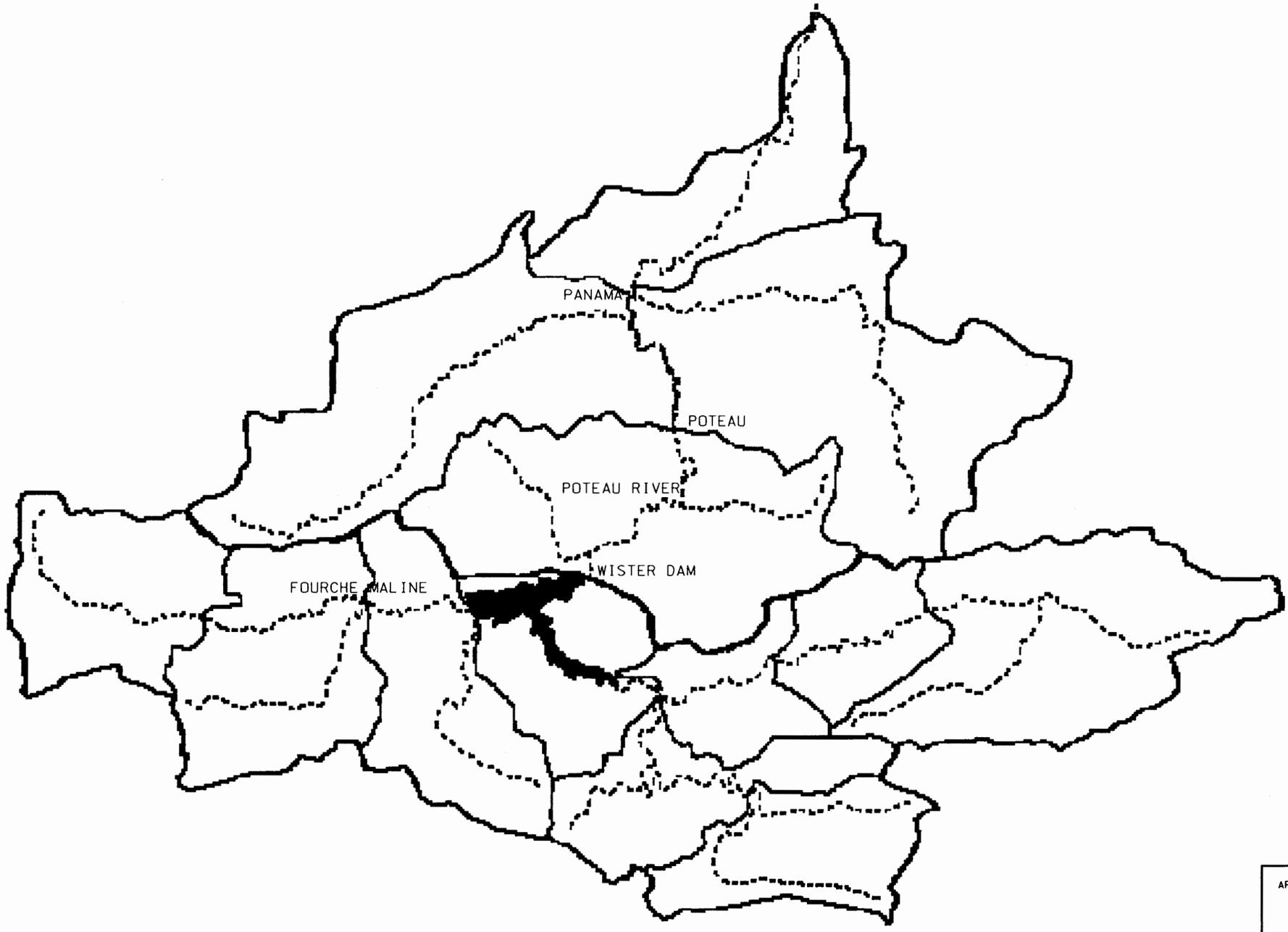
ARKANSAS RIVER WATERSHED POTEAU RIVER, OKLAHOMA

WISTER LAKE

LAKE DATA

DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2004

DRAWN BY: J.W.C.
CHECKED BY: R.W.B.



ARKANSAS RIVER WATERSHED POTEAU RIVER, OKLAHOMA

WISTER LAKE

FORECAST REACHES

DEPT OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2004

DRAWN BY: J.W.C.
CHECKED BY: R.W.B.

6-1

WISTER RESERVOIR
DISCHARGE AND INFLOW COMPUTATION

Computed by JWC Date 2-XX Checked By Date

Date	Time	Pool Elevation	1000 Acre Feet	Change in Storage		Gates Operating		Discharge in c.f.s.							Inflow
								Instantaneous			Average				
				1000 Acre Feet	c.f.s.	No. & Type	Opening	Flood Control	Power	Total	Flood Control	Power	Evap	Total	
26	0800	478.94	7208			6CG	2	3100		3100					
	1010	478.91	6978			2CG	2								
						4CG	1	2100		2100					
	1200	478.90	6901	4/-307	4/-928			2100		2100	2642	0	0	2642	4/ 1714
	1600	478.84	6441												
	2400	478.70	5368	8/-1073	8/-1622			2100		2100	2100	0	0	2100	. 8/ 478
27	0800	478.61	4677	8/-691	8/-1045			2100		2100	2100	0	0	2100	8/ 1055
	1200	478.54	4141												
	1315	478.53	4064			4CG	1	1050		1050					
	1600	478.52	3987	4/-154	4/-465			1050		1050	1378	0	0	1378	4/ 913
	2400	478.48	3681												
28	0800	478.45	3451	8/-230	8/-347			1050		1050	1050	0	0	1050	8/ 703

NOTE: COMPUTE INFLOW AS FOLLOWS --
SUBTRACT BEGINNING AF FROM ENDING AF.
MULTIPLY 12.1 X DELTA AF/HOURS TO GET
CFS FOR THE PERIOD. THEN ADD THIS
VALUE TO THE AVERAGE DISCHARGE
FOR THE PERIOD TO GET INFLOW IN CFS.

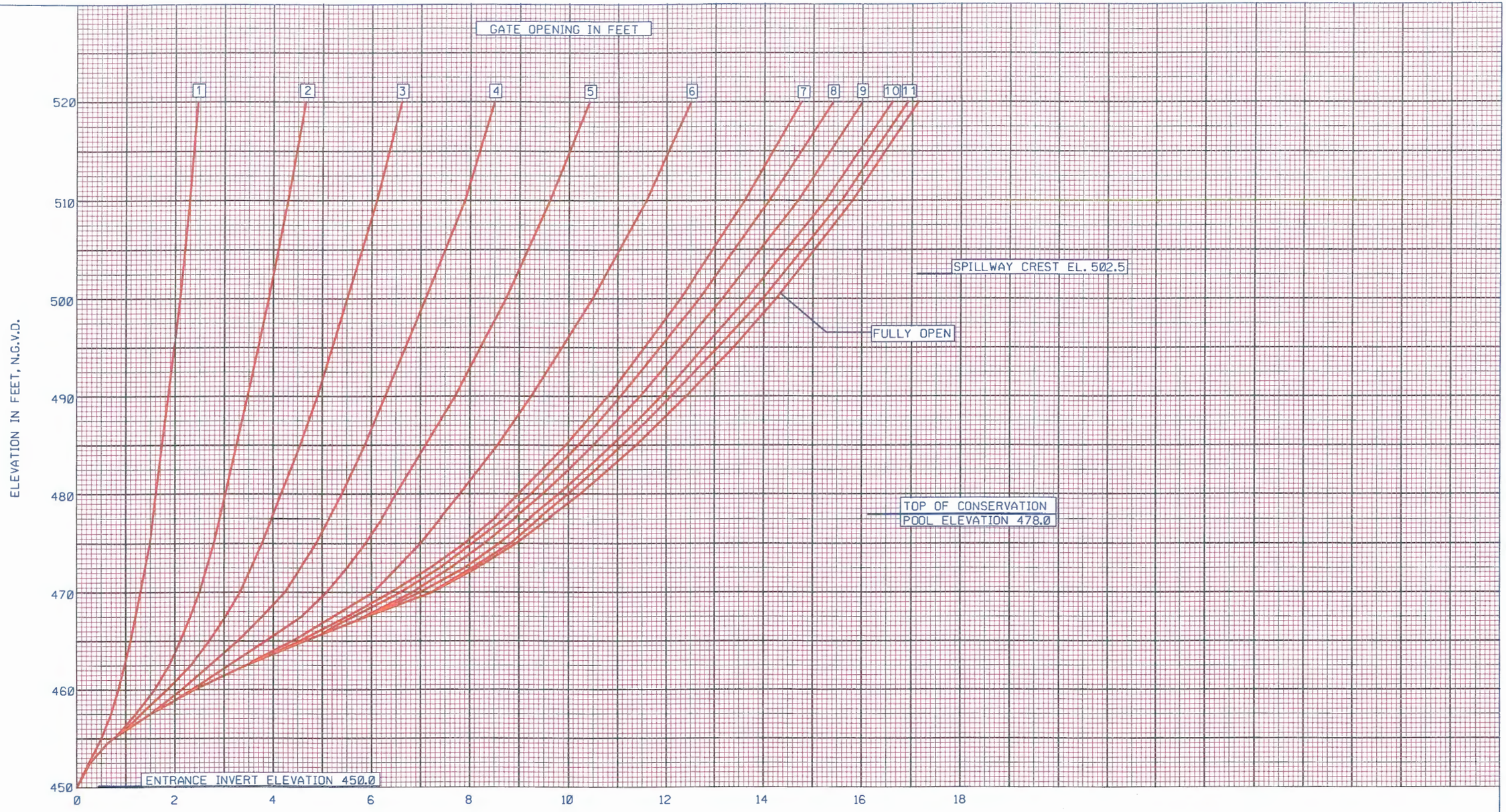
ARKANSAS RIVER WATERSHED POTEAU RIVER, OKLAHOMA

WISTER LAKE

SAMPLE DISCHARGE AND INFLOW COMPUTATIONS

DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2004

DRAWN BY: J.W.C.
CHECKED BY: R.W.B.



ARKANSAS RIVER WATERSHED — POTEAU RIVER, OKLAHOMA

WISTER LAKE

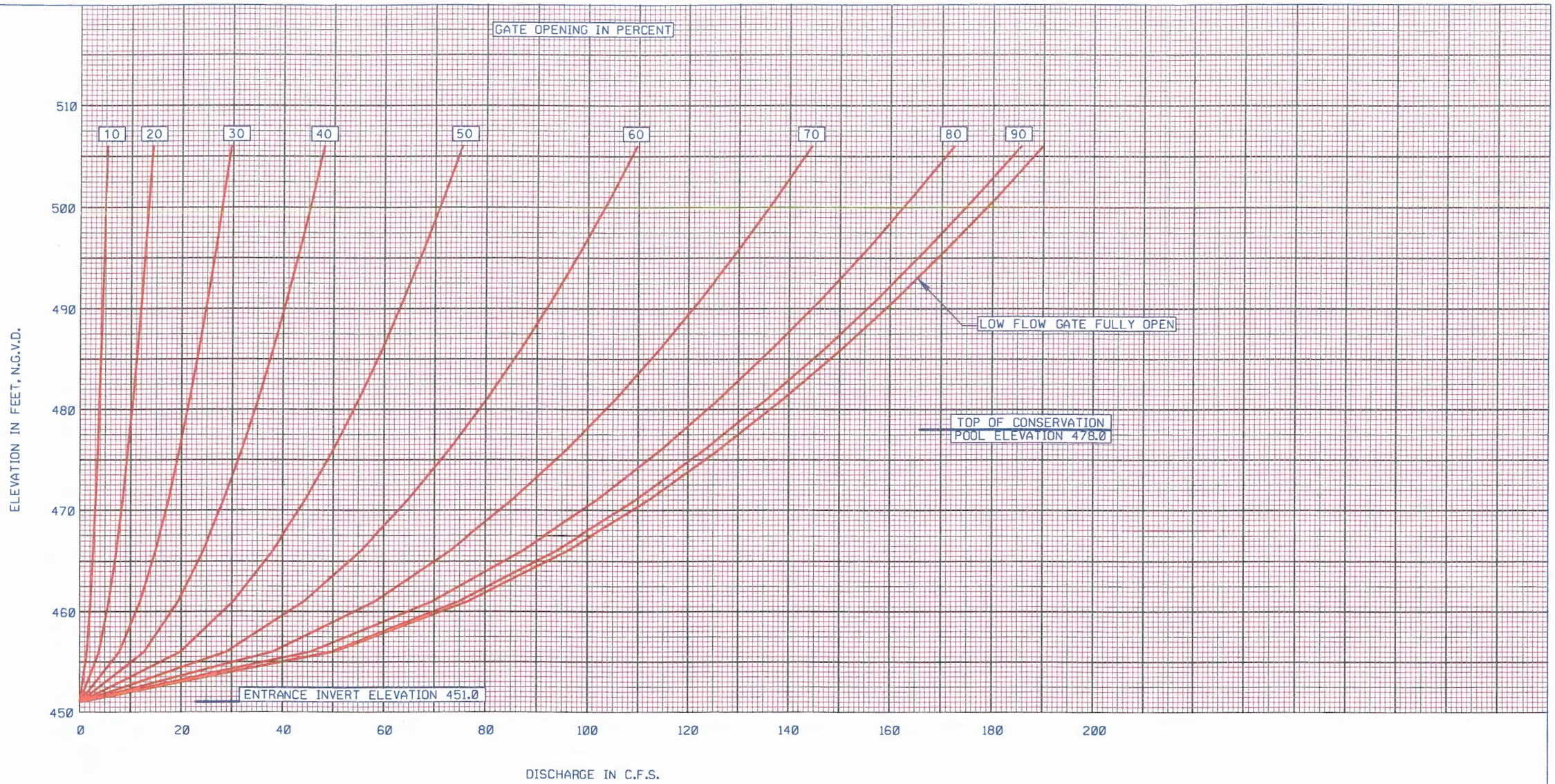
(SIX GATES - TWO CONDUITS)

CONDUIT RATING CURVE

(FOR PARTIAL AND FULL GATE OPENINGS)

DEPARTMENT OF THE ARMY, TULSA DISTRICT, CORPS OF ENGINEERS 2004
DRAWN BY: J.W.C.
CHECKED BY: R.W.B.

7-1



ARKANSAS RIVER WATERSHED — POTEAU RIVER, OKLAHOMA

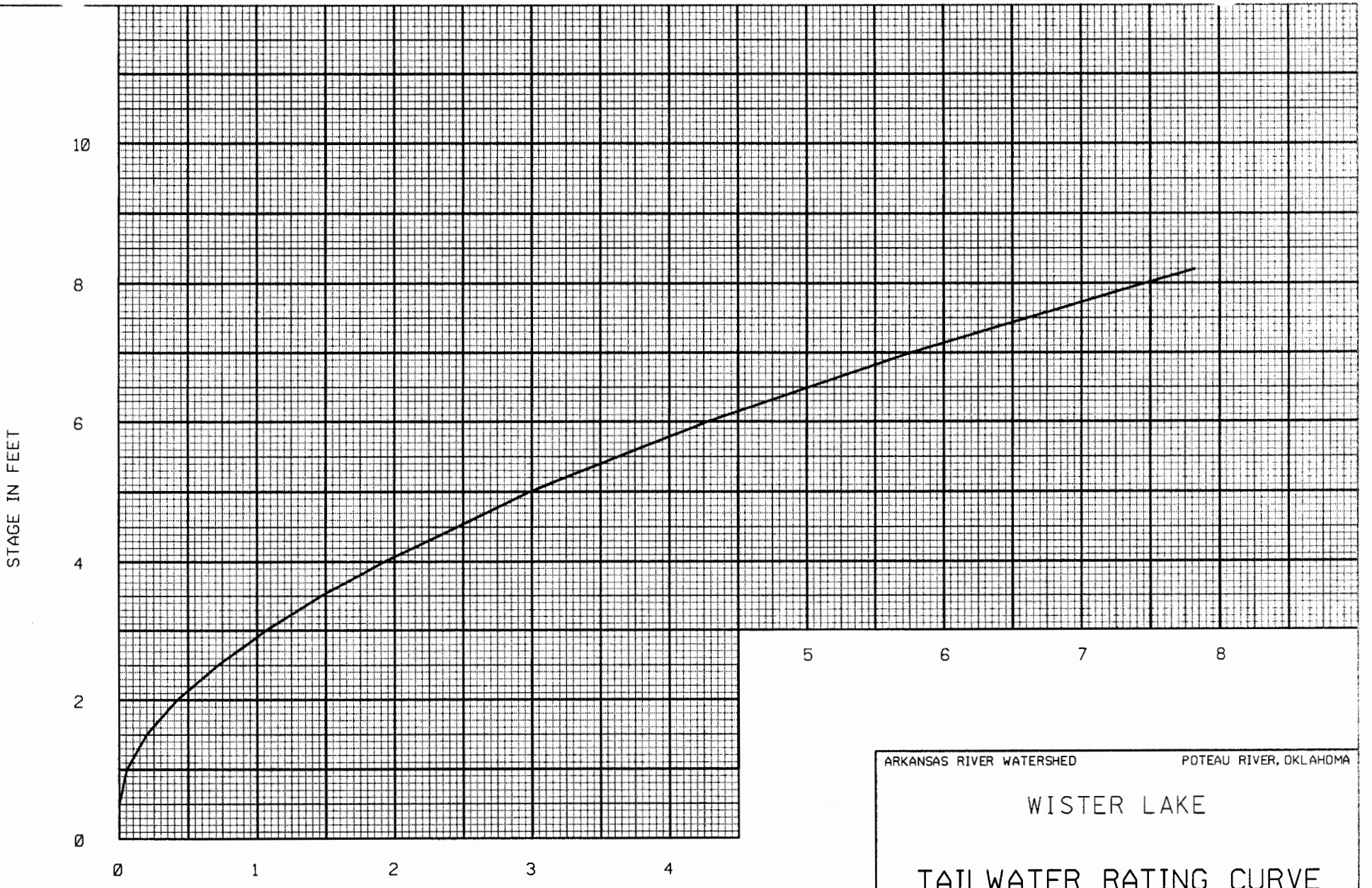
WISTER LAKE

DISCHARGE RATING CURVE

30 INCH LOW FLOW PIPE

DEPARTMENT OF THE ARMY, TULSA DISTRICT, CORPS OF ENGINEERS 2004
DRAWN BY: J.W.C.
CHECKED BY: R.W.B.

7-2



ARKANSAS RIVER WATERSHED — POTEAU RIVER, OKLAHOMA

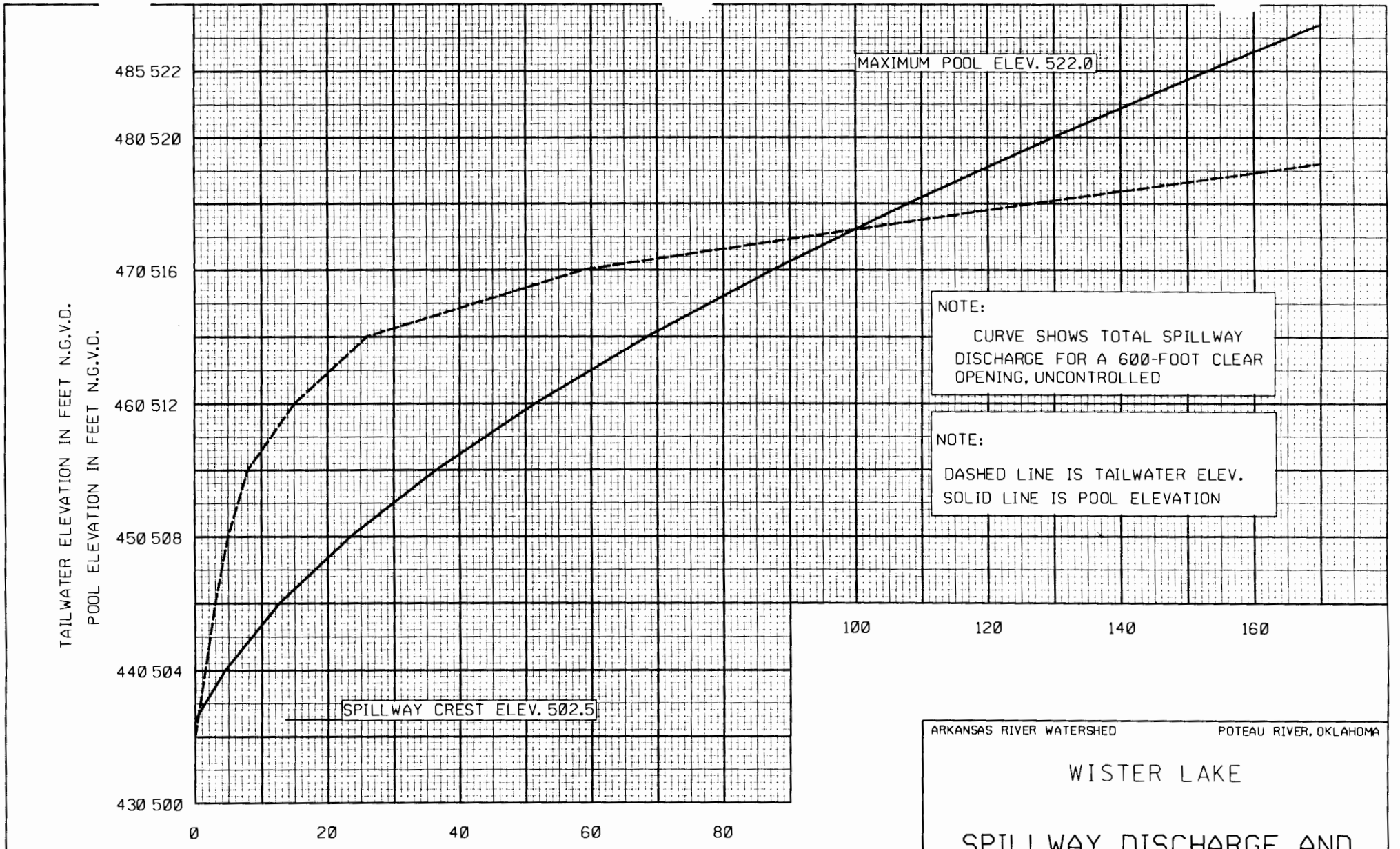
WISTER LAKE

TAILWATER RATING CURVE

DEPARTMENT OF THE ARMY, TULSA DISTRICT, CORPS OF ENGINEERS 2004

DRAWN BY: J.W.C.

CHECKED BY: R.W.B.



ARKANSAS RIVER WATERSHED — POTEAU RIVER, OKLAHOMA

WISTER LAKE

SPILLWAY DISCHARGE AND TAILWATER CURVES

DEPARTMENT OF THE ARMY, TULSA DISTRICT, CORPS OF ENGINEERS 2004
DRAWN BY: J.W.C.
CHECKED BY: R.W.B.

INCHES OF EVAPORATION

0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0

ELEVATION IN FEET, N.G.V.D.

502
498
494
490
486
482
478
474
470

0 400 80 120 160 200 240 280 320 360 400

EVAPORATION IN C.F.S.

440 480 520 560

NOTES:

CURVES COMPUTED FOR 70 PERCENT OF PAN EVAPORATION
NOTATION ABOVE EACH CURVE DENOTES ACTUAL PAN EVAPORATION
FOR INTERMEDIATE RATES, INTERPOLATE BETWEEN APPROPRIATE LIMITS.

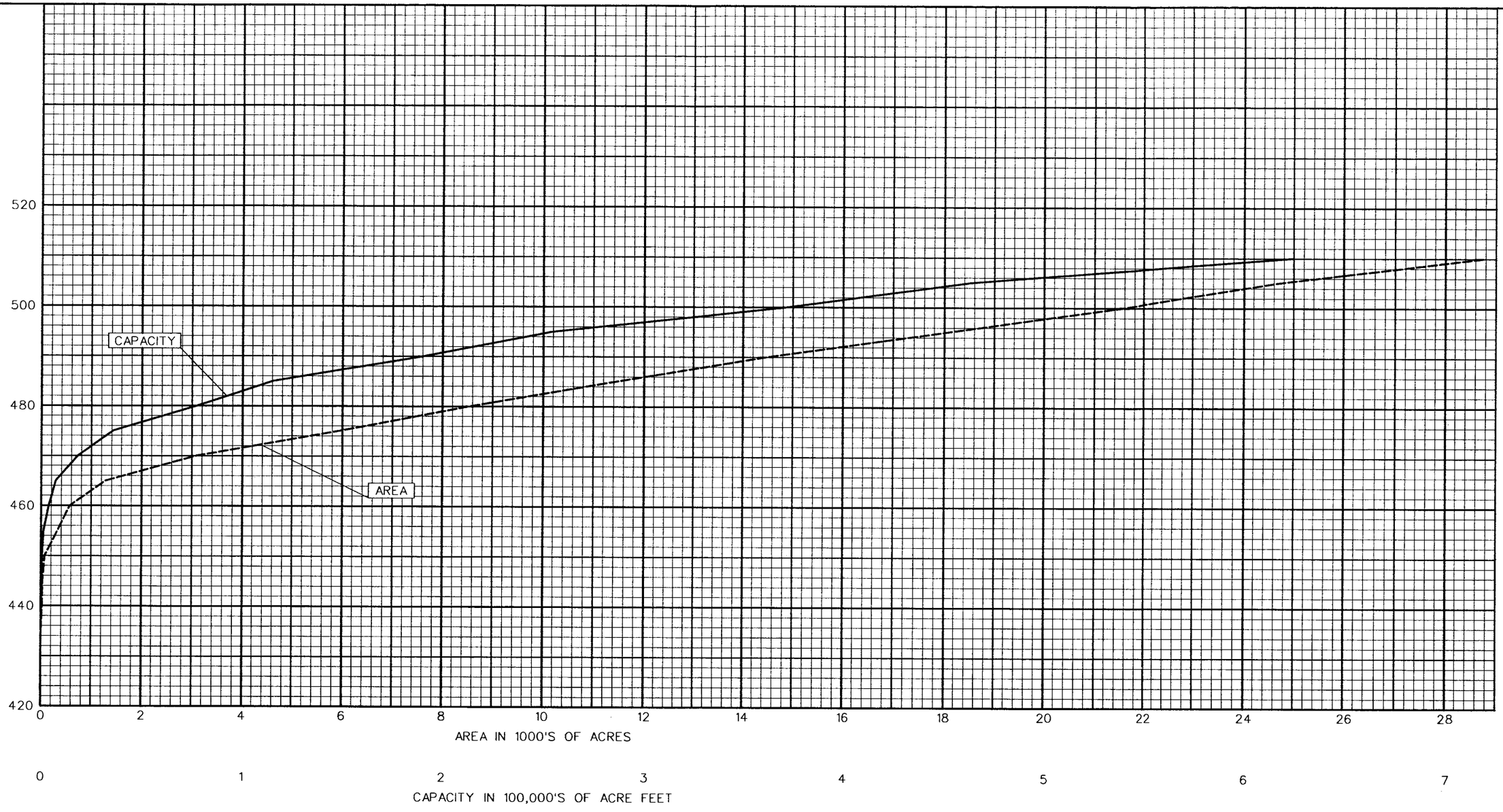
ARKANSAS RIVER WATERSHED POTEAU RIVER, OKLAHOMA

WISTER LAKE

EVAPORATION CURVES

DEPARTMENT OF THE ARMY, TULSA DISTRICT, CORPS OF ENGINEERS 2004
DRAWN BY: J.W.C.
CHECKED BY: R.W.B.

7-5



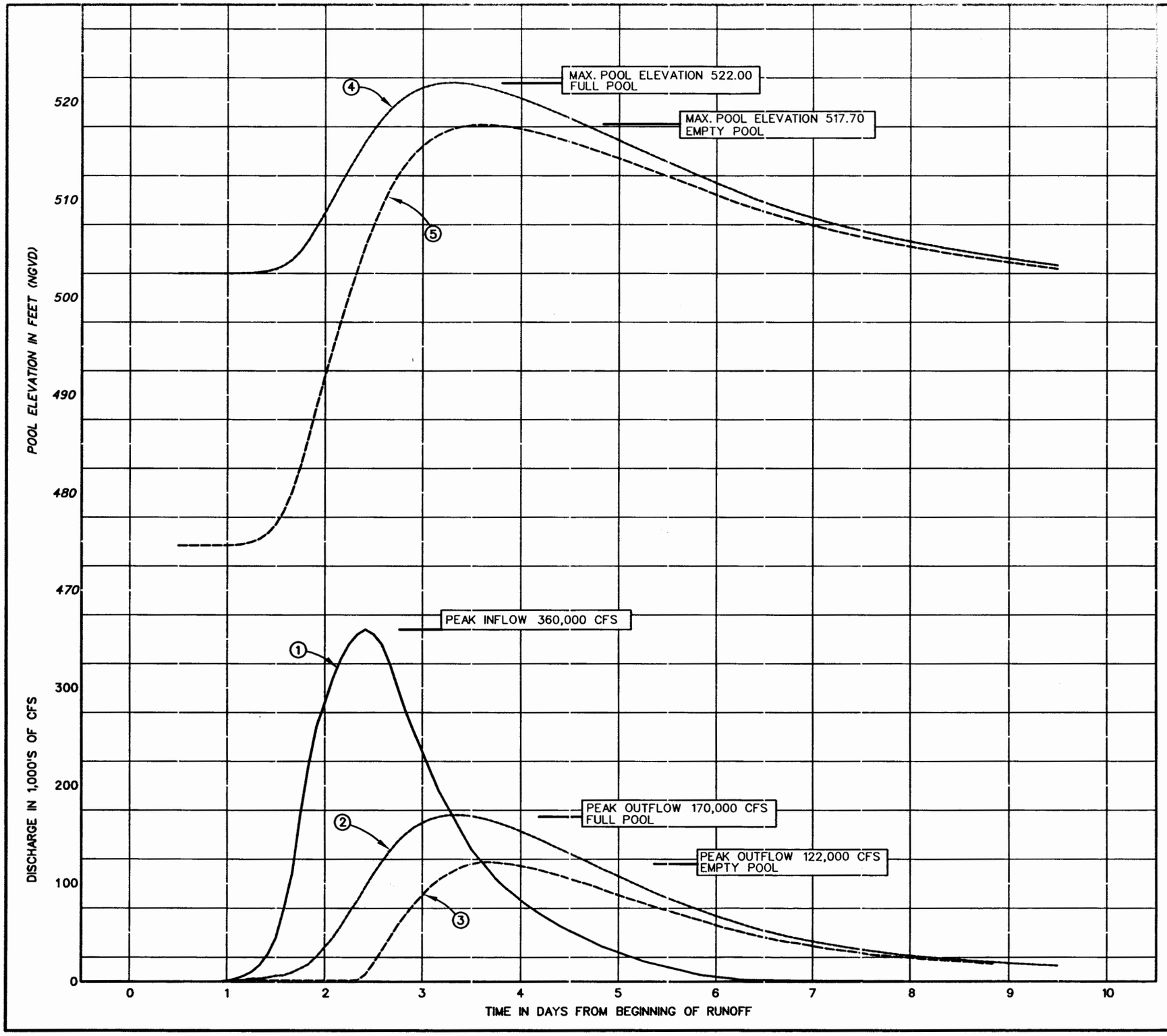
ARKANSAS RIVER WATERSHED POTEAU RIVER, OKLAHOMA

WISTER LAKE

AREA AND CAPACITY CURVES

DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2004
DRAWN: J.W.C.
CHECKED: R.W.B.

7-6



NOTES: EMERGENCY REGULATIONS

1. INFLOW HYDROGRAPH
2. OUTFLOW - FULL POOL
3. OUTFLOW - EMPTY POOL
4. POOL ELEVATION - FULL POOL
5. POOL ELEVATION - EMPTY POOL

ARKANSAS RIVER BASIN — POTEAU RIVER, OKLAHOMA

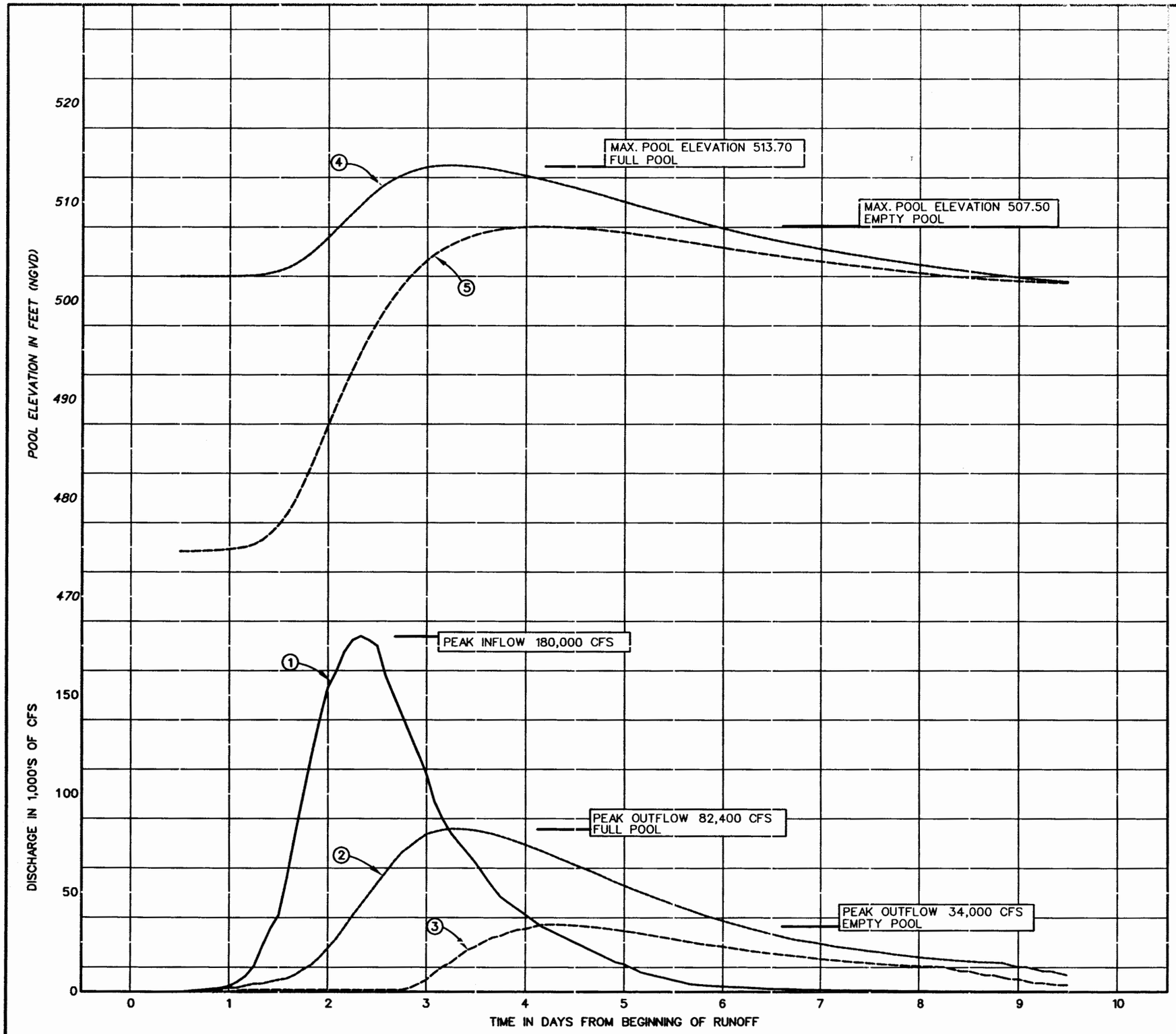
WISTER LAKE

OPERATIONAL HYDROGRAPHS

SPILLWAY DESIGN FLOOD

DEPARTMENT OF THE ARMY, TULSA DISTRICT, CORPS OF ENGINEERS 2004
DRAWN BY: J.W.C.
CHECKED BY: R.W.B.

8-1



NOTES: EMERGENCY REGULATIONS

1. INFLOW HYDROGRAPH
2. OUTFLOW - FULL POOL
3. OUTFLOW - EMPTY POOL
4. POOL ELEVATION - FULL POOL
5. POOL ELEVATION - EMPTY POOL

ARKANSAS RIVER BASIN — POTEAU RIVER, OKLAHOMA

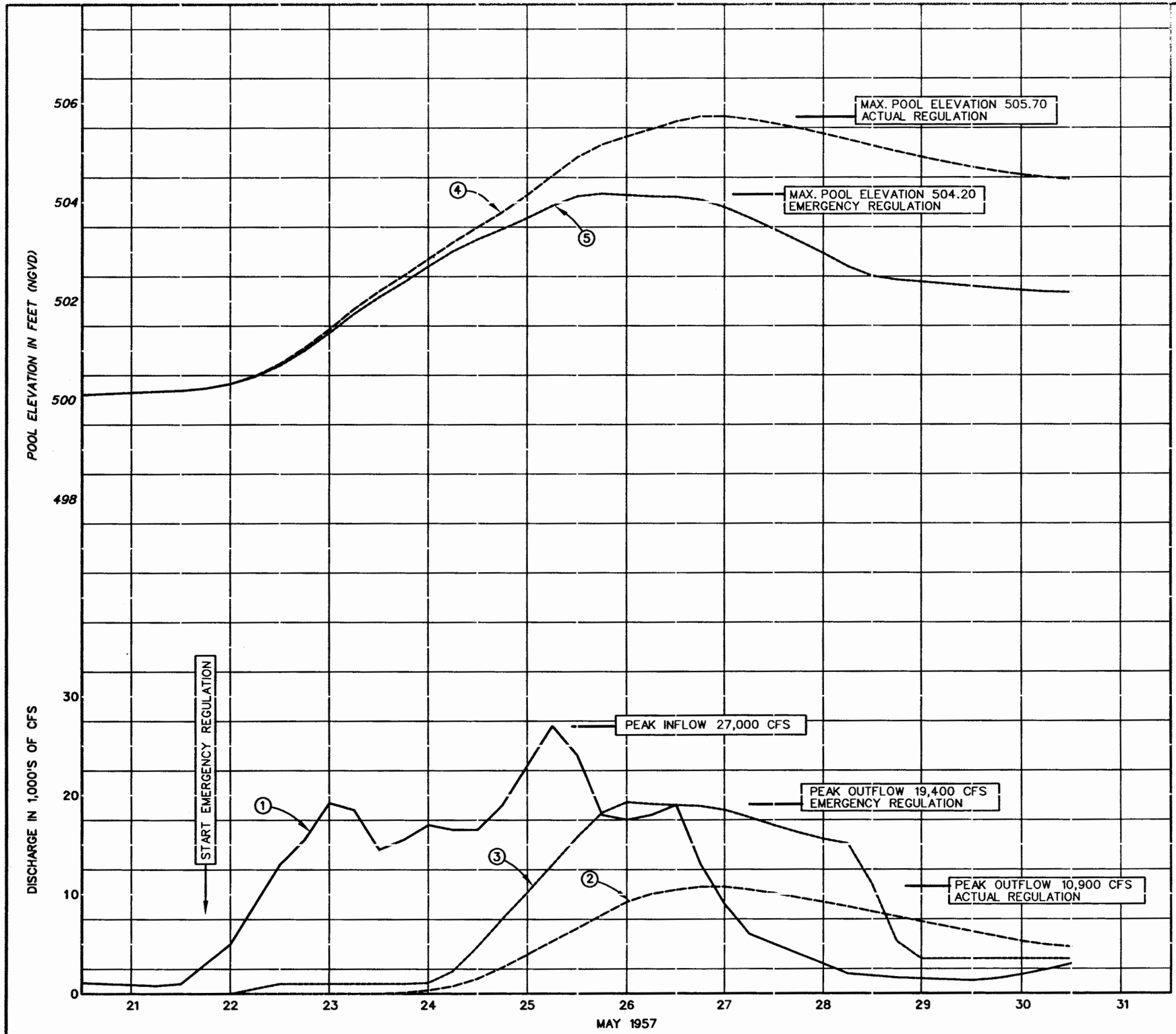
WISTER LAKE

OPERATIONAL HYDROGRAPHS

STANDARD PROJECT FLOOD

DEPARTMENT OF THE ARMY, TULSA DISTRICT, CORPS OF ENGINEERS 2004
DRAWN BY: J.W.C.
CHECKED BY: R.W.B.

8-2



NOTES: EMERGENCY REGULATIONS

1. INFLOW HYDROGRAPH
2. OUTFLOW - ACTUAL REGULATION
3. OUTFLOW - EMERGENCY REGULATION
4. POOL ELEVATION - ACTUAL REGULATION
5. POOL ELEVATION - EMERGENCY REGULATION

ARKANSAS RIVER BASIN — POTEAU RIVER, OKLAHOMA

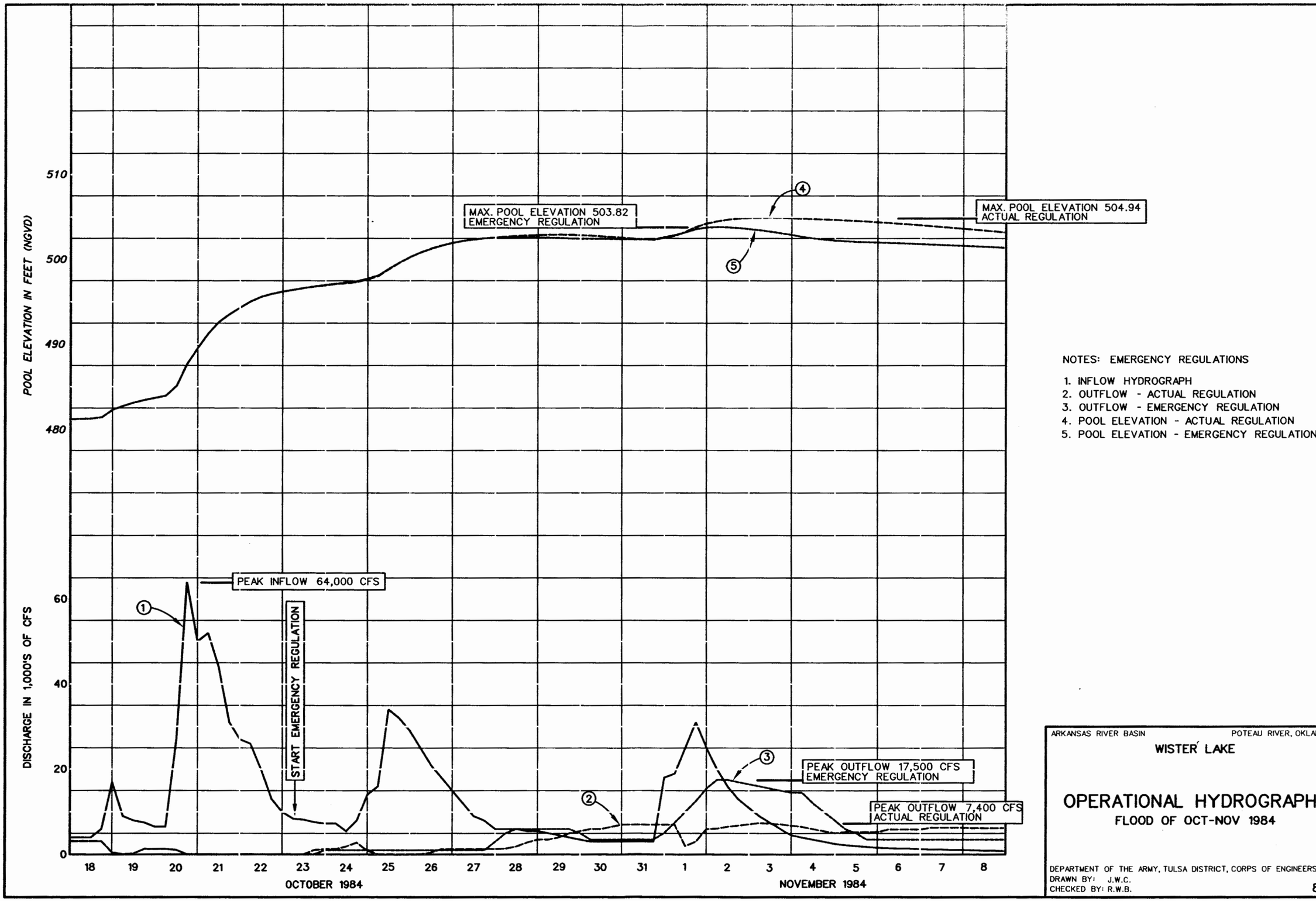
WISTER LAKE

OPERATIONAL HYDROGRAPHS

FLOOD OF MAY 1957

DEPARTMENT OF THE ARMY, TULSA DISTRICT, CORPS OF ENGINEERS 2004
DRAWN BY: J.W.C.
CHECKED BY: R.W.B.

8-3



NOTES: EMERGENCY REGULATIONS

1. INFLOW HYDROGRAPH
2. OUTFLOW - ACTUAL REGULATION
3. OUTFLOW - EMERGENCY REGULATION
4. POOL ELEVATION - ACTUAL REGULATION
5. POOL ELEVATION - EMERGENCY REGULATION

ARKANSAS RIVER BASIN — POTEAU RIVER, OKLAHOMA

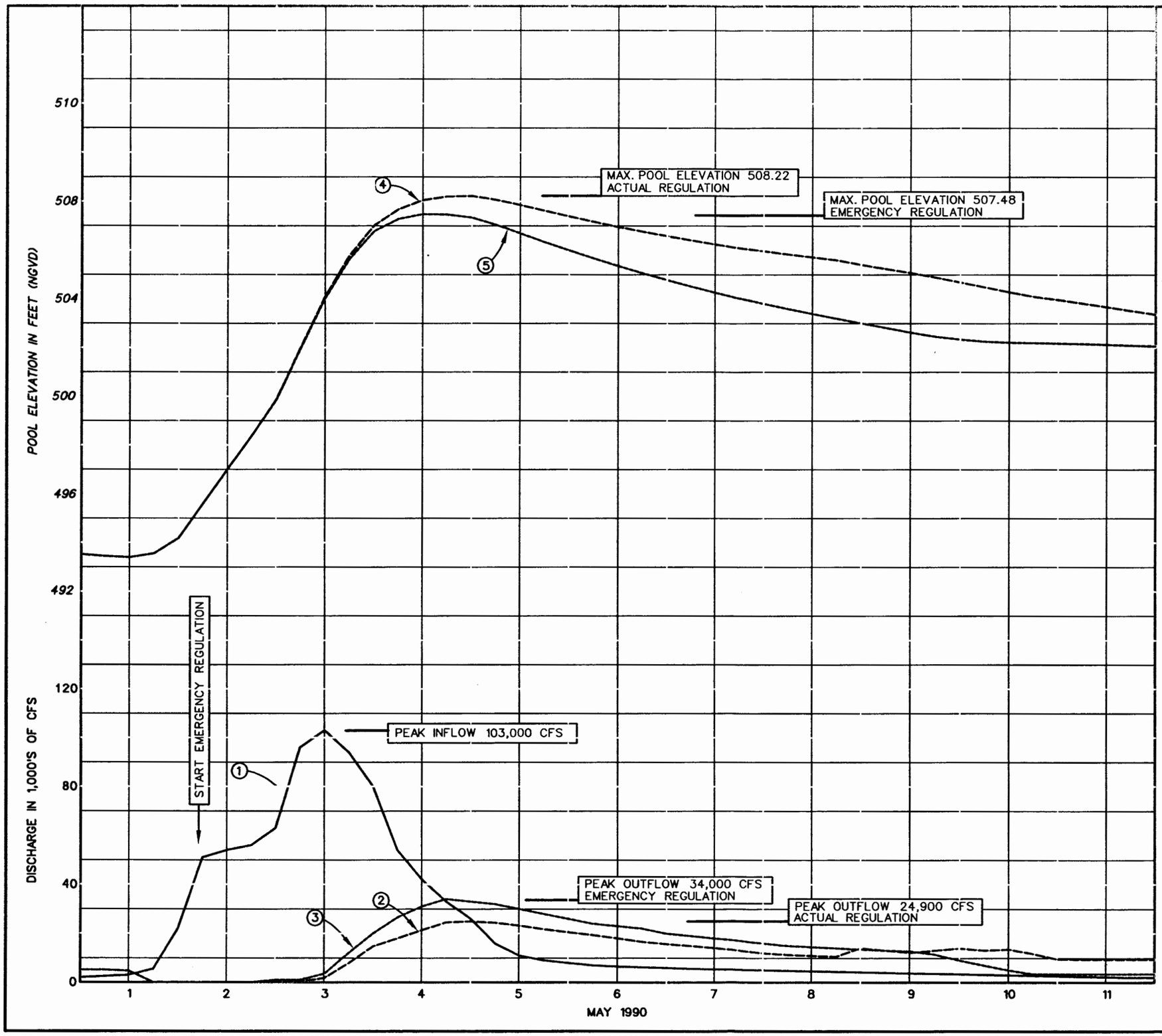
WISTER LAKE

OPERATIONAL HYDROGRAPHS

FLOOD OF OCT-NOV 1984

DEPARTMENT OF THE ARMY, TULSA DISTRICT, CORPS OF ENGINEERS 2004
DRAWN BY: J.W.C.
CHECKED BY: R.W.B.

8-4



NOTES: EMERGENCY REGULATIONS

1. INFLOW HYDROGRAPH
2. OUTFLOW - ACTUAL REGULATION
3. OUTFLOW - EMERGENCY REGULATION
4. POOL ELEVATION - ACTUAL REGULATION
5. POOL ELEVATION - EMERGENCY REGULATION

ARKANSAS RIVER BASIN — POTEAU RIVER, OKLAHOMA

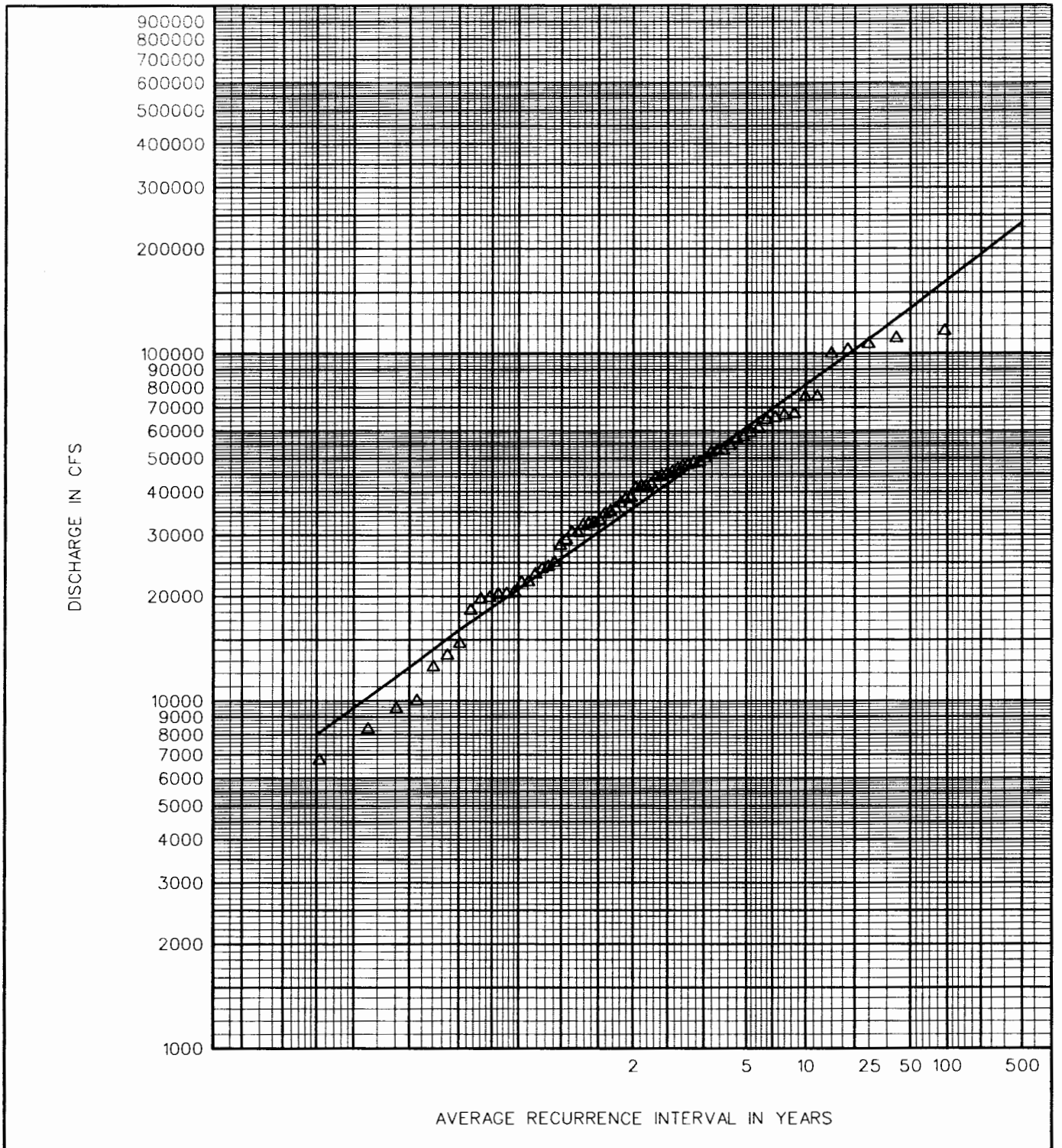
WISTER LAKE

OPERATIONAL HYDROGRAPHS

FLOOD OF MAY 1990

DEPARTMENT OF THE ARMY, TULSA DISTRICT, CORPS OF ENGINEERS 2004
DRAWN BY: J.W.C.
CHECKED BY: R.W.B.

8-5



——— COMPUTED PEAK INFLOW PROBABILITY
△ HISTORICAL EVENTS

NOTE:

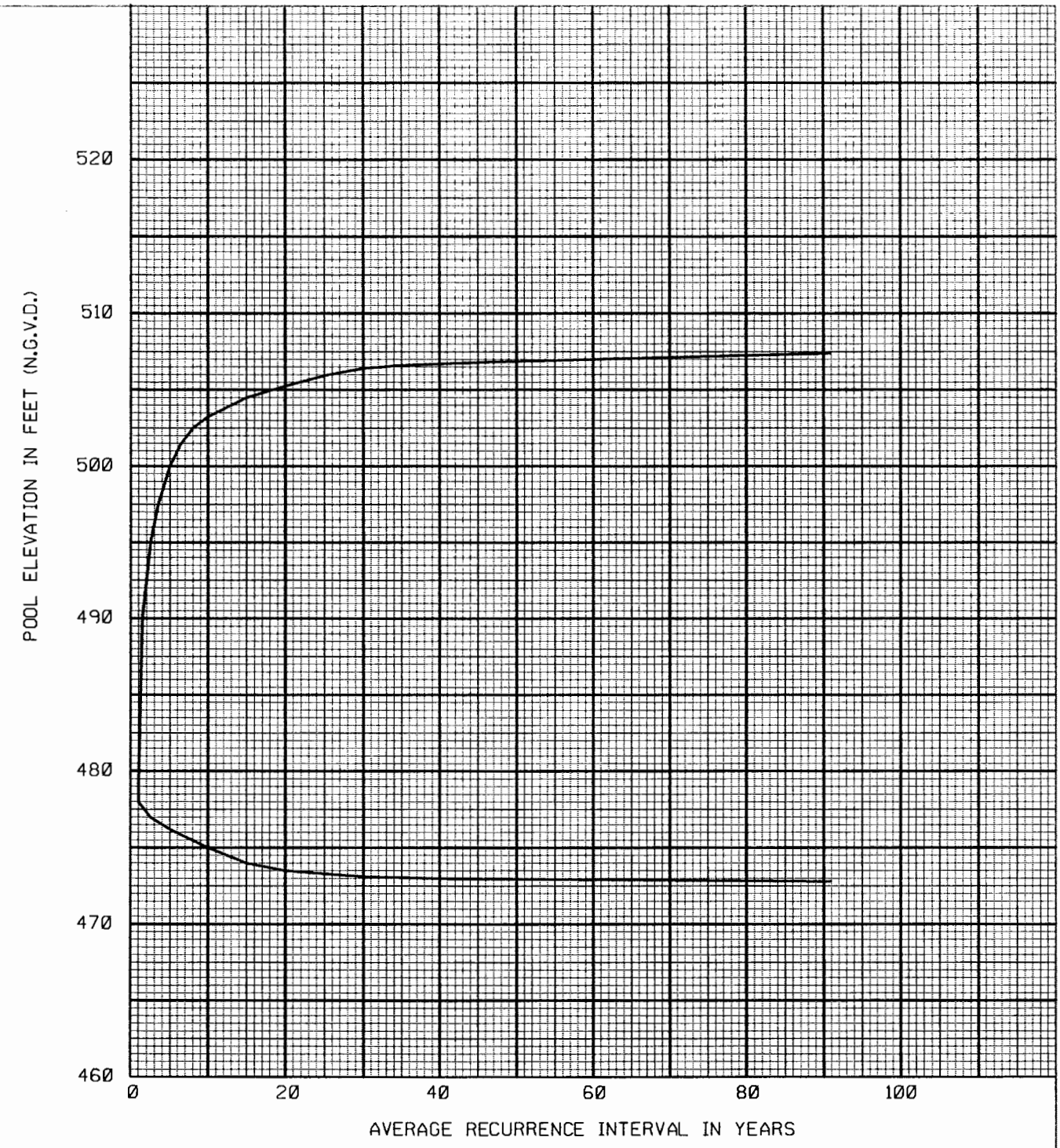
BASED ON PERIOD OF RECORD
1938 TO 2003.

ARKANSAS RIVER WATERSHED POTEAU RIVER, OKLAHOMA

WISTER LAKE

PEAK INFLOW PROBABILITY CURVE

DEPT. OF THE ARMY, TULSA DISTRICT CORPS OF ENGINEERS 2004
DRAWN: J.W.C.
CHECKED: R.W.B.



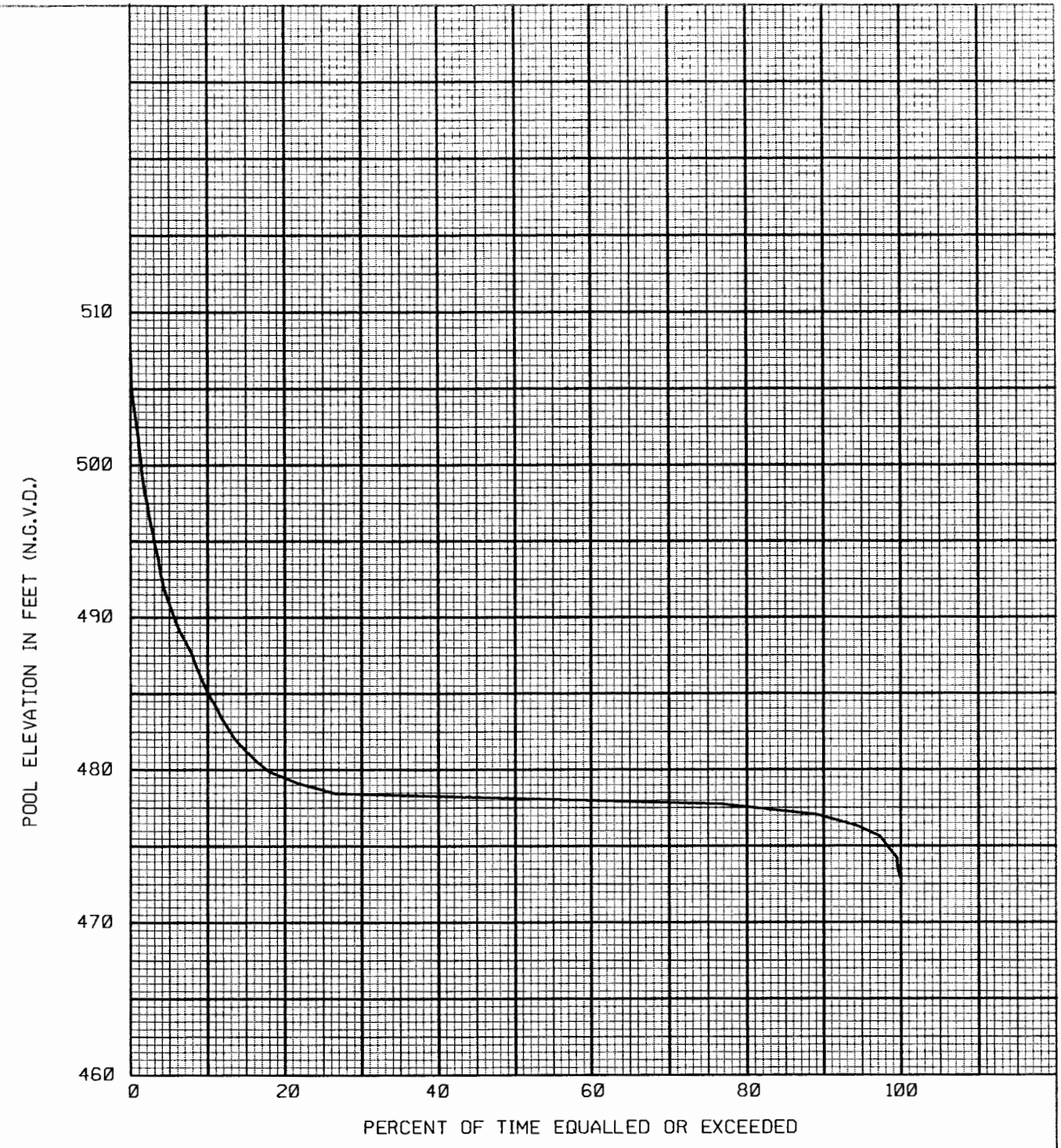
DAM OPERATED FROM 1940 - 2000

ARKANSAS RIVER WATERSHED — POTEAU RIVER, OKLAHOMA

WISTER LAKE

POOL ELEVATION PROBABILITY CURVE

DEPARTMENT OF THE ARMY, TULSA DISTRICT, CORPS OF ENGINEERS 2004
DRAWN BY: J.W.C.
CHECKED BY: R.W.B.



DAM OPERATED FROM 1940 - 2000

ARKANSAS RIVER WATERSHED — POTEAU RIVER, OKLAHOMA

WISTER LAKE

POOL ELEVATION DURATION CURVE

DEPARTMENT OF THE ARMY, TULSA DISTRICT, CORPS OF ENGINEERS 2004
DRAWN BY: J.W.C.
CHECKED BY: R.W.B.