BLACK WARRIOR-TOMBIGBEE RIVER BASIN

RESERVOIR REGULATION MANUAL

APPENDIX B

HOLT RESERVOIR

BLACK WARRIOR RIVER, ALABAMA

DECEMBER 1967

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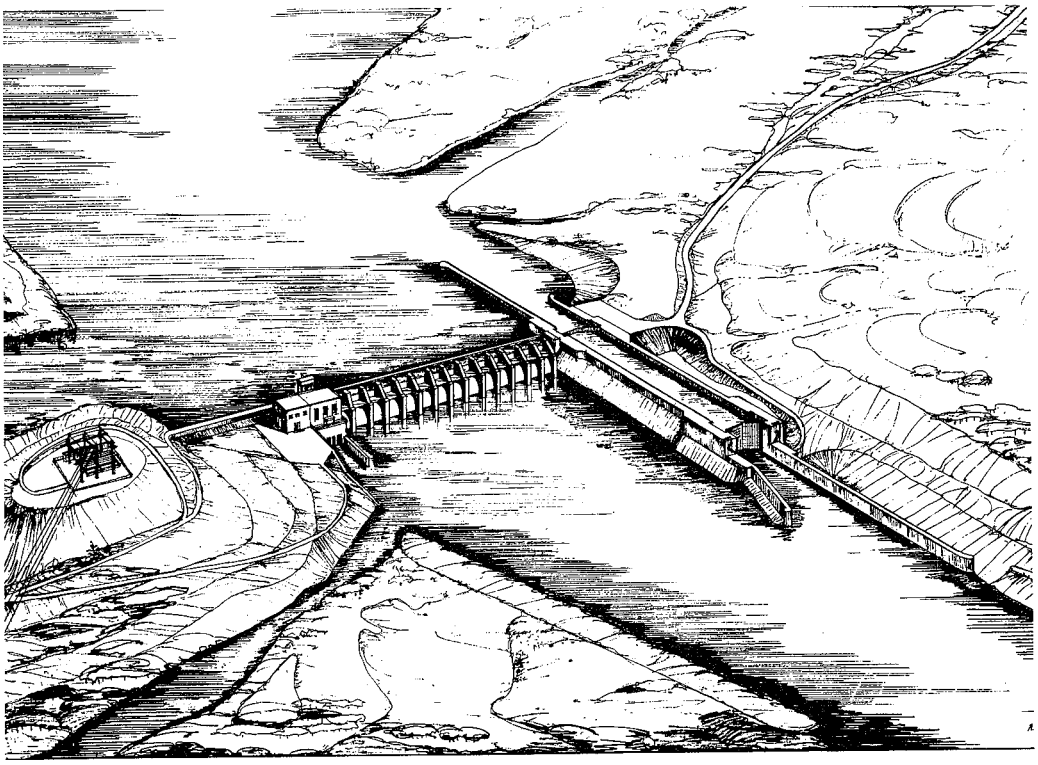

HOLT LOCK AND DAM

BLACK WARRIOR - TOMBIGBEE RIVER BASIN

RESERVOIR REGULATION MANUAL

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BLACK WARRIOR RIVER, ALABAMA

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PERTINENT DATA

STREAM FLOW

Drainage area at dam site - square miles	4,232
Estimated minimum discharge (23 October 1953) - cfs	37*
Minimum mean monthly flow (Sept. 1954) - cfs	139*
Average annual flow (1894-1902, 1928-1964) - cfs	7,719*
Discharge at bankfull stage - cfs	30,000
Maximum mean monthly flow (March 1929) - cfs	49,600*
Maximum estimated discharge (21 Feb. 1961) - cfs	224,000*

SPILLWAY DESIGN FLOOD

Total rainfall - inches	22.1
Initial loss - inches	0
Average infiltration rate - inches per hour	0.05
Total storm runoff - inches	19.2
Total volume of storm runoff - acre-feet	4,546,830
Peak rates of flow	
Natural flow at dam site - cfs	650,500**
Inflow to full reservoir - cfs	650,000**
Reservoir outflow - cfs	639,500
Duration of flood - days	11

RESERVOIR

Pool elevation - feet msl	
Maximum pool spillway design flood (initial pool, elevation 187.0)	206.4
Maximum operating pool	187.0
Minimum pool	186.0
Storage volumes - acre-feet	
Total volume to elevation 187.0	117,990
Volume between elevations 186.0 and 187.0	3,270
Total volume to elevation 186.0	114,720
Reservoir area - acres	
Maximum operating pool, elevation 187.0	3,296
At maximum drawdown, elevation 186.0	3,252
Area to be acquired - acres	2,250
Length of shoreline, elevation 187.0 - miles	85
Length of reservoir - river miles	18.5

* Based on records on Black Warrior River at Tuscaloosa, Alabama.
** Assuming all gates clear at Bankhead Lock and Dam.

PERTINENT DATA (Cont'd)

DAM AND SPILLWAY

Type, main dam	Reinforced concrete
Length of non-overflow section & powerhouse - feet	412
Spillway section	
Total spillway length - feet	680
Overflow crest length - feet	560
Elevation of crest - feet msl	152.5
Number of tainter gates	14
Height of gates - feet	35
Length of gates - feet	40
Elevation of top of gates - feet msl	187.5
Service bridge elevation - feet msl	209.0
Total spillway capacity (pool elev. 206.4) - cfs	639,500
Total spillway capacity (pool elev. 187.0) - cfs	393,000

LOCK

Maximum lift - feet	64.1
Chamber width - feet	110
Nominal chamber length - feet	600
Distance, center to center of pintles - feet	670
Freeboard on lower approach when locks become inoperative - feet	1
Percent of time lock will be inoperative	0.1
Height of upper miter gate - feet	40.5
Height of lower miter gate - feet	83.6
Culvert size - feet	12.5 x 12.5
Elevations - feet msl	
Upper stop log sill	171.5 167.5
Upper miter sill	153.0
Lower miter sill	109.9
Chamber floor	109.0
Top of lock wall	193.5
Top of upper guide wall	193.5
Top of lower guide wall	153.0
Total time required to fill lock chamber, starting with valves closed - minutes	11.1
Total time required to empty lock chamber, starting with valves closed - minutes	12.6

POWER PLANT

Size of building	
Length - feet	130
Width - feet	77
Height - feet	51
Type	Indoor, reinforced concrete and structural steel

PERTINENT DATA (Cont'd)

POWER PLANT (Cont'd)

Elevations - feet, msl	
Bottom of substructure (approximate)	62.0
Low point of draft tube	72.0
Centerline distributor	127.0
Generating units	
Number	1
Speed - rpm	100
Turbines	
Type	Fixed-blade propellor, vertical shaft
Rotation	Counter clockwise
Guaranteed capacity of fullgate, 58-foot net head - hp each	55,600
Generators	
Rated capacity, continuous - kva each	45,000
Rated capacity, continuous - kw each	40,000
Rated power factor	0.889
Rated voltage	13,800

HISTORY OF PROJECT

1. The original project for the improvement of the Black Warrior and Tombigbee Rivers was initiated in 1887, as a result of Congressional approval of the River and Harbor Act of 5 July 1884. This authority, which was modified by subsequent Congressional action, provided essentially for an all-year channel 9 feet deep and 200 feet wide, where practicable, from the mouth of the Chickasaw Creek, 3.2 miles above Mobile, Alabama, to mile 447.6 on the Sipsey Fork, mile 444.6 on the Mulberry Fork and mile 420.6 on the Locust Fork. The channel was originally obtained by dredging and snagging and by the construction of 17 dams and 18 locks.

2. A report contained in House Document No. 56, Seventy-Third Congress, first session, was submitted to Congress by the Secretary of War on 27 October 1932. It presented the results of studies for the development of the water resources of the Black Warrior and Tombigbee Rivers and tributaries in Alabama and Mississippi in accordance with House Document No. 308, Sixty-Ninth Congress, first session, which was enacted into law with modifications in the River and Harbor Act of 21 January 1927. General plans were developed to improve the existing navigation project by the replacement of old structures, raising the crest of dams by adding concrete caps or gates, and headwater impounding dams. The Chief of Engineers proposed a general plan for the most effective improvement of the Black Warrior and Tombigbee Rivers, but found the execution of the plan was not justified at that time. Modernization of the waterway was later found to be economically justified and between 1940 and 1960 twelve of the old locks and dams were replaced by 4 modern structures with higher dams and larger locks.

3. The Holt Lock and Dam was recommended in the "Project Report on the Modernization of Black Warrior River between Tuscaloosa and John Hollis Bankhead Lock and Dam" submitted by the District Engineer on 14 March 1958 and indorsed by the Division Engineer. It was approved by the Board of Rivers and Harbors at its meeting in September 1958, and authorized by the Secretary of the Army on 29 December 1958. The plan as authorized consisted of a gated overflow dam with an upper pool normally at elevation 186.5, a single-lift lock 110 feet wide and 600 feet long with a maximum lift of 63.6 feet, which would replace four of the original locks and dams. The Holt project completes the modernization of the entire Black Warrior and Tombigbee Waterway except for Bankhead Lock and Dam where modification of the spillway and design of a new lock is under way. The authorized plan for Holt provided for future installation of a power plant by either the Federal Government or private interest.

4. The Alabama Power Company, which had indicated its firm intention of obtaining a Federal Power Commission license to develop the hydro power facilities at Holt Dam as soon as permitted, filed an application dated 5 November 1959, with supplements on 17 April 1961, 19 June 1961 and 10 December 1964, for a license for the construction of proposed water power project No. 2203. The powerhouse would contain one

55,200 - horsepower turbine connected to a 40,000 - kilowatt generator. On 7 October 1965 the Federal Power Commission issued a 50-year license to the Alabama Power Company, with an effective date of 1 September 1965, for the construction, operation and maintenance of the water power project at Holt Lock and Dam. Power plant construction was initiated on 19 July 1966, with completion and full operation scheduled for June 1968. Design Memorandum No. 1, "Basic Hydrology" was submitted on 3 June 1960 and 13 additional Design Memoranda have been submitted and approved by the Chief of Engineers since that date.

5. A contract for diversion excavation was awarded to Ferrel Construction Company on 18 March 1962 and construction of the first stage cofferdam began in June 1962 under a contract awarded to Hardaway Contracting Company. The contract for the construction of the lock and dam was awarded on 22 May 1963 to three firms, Arundel Corporation, L. E. Dixon Company and Hunkin-Conkey Construction Company, who undertook the work as a joint venture under the name of the Holt Construction Company. The lock was placed in operation in June 1966, as the first stage of construction was completed and the pool raised to interim elevation 163. The pool will be held as near elevation 163 as practicable until final completion of over-all project which is scheduled for June 1968. The estimated total cost to the Government is $28,400,000.

6. Location. The Holt Lock and Dam is located on the Black Warrior River about 6 miles northeast of Tuscaloosa, Alabama, and about 8.8 miles above the William Bacon Oliver Lock and Dam. The dam and reservoir are located entirely in Tuscaloosa County, Alabama. The total drainage area above the dam is 4,232 square miles, including 944 square miles of controlled drainage area above the Alabama Power Company's Lewis M. Smith Dam on Sipsey Fork. The drainage area between the John Hollis Bankhead Lock and Dam, located 18.5 miles upstream, and the Holt project is 242 square miles. The location of the project, at 355.1 miles above Mobile, Alabama, and at mile 135.1 on the Black Warrior River, is indicated on chart 2.

7. Purpose. Holt is a multiple-purpose project with principal purposes of navigation and power. It replaces four obsolete locks and dams and provides a 9-foot navigation channel to John Hollis Bankhead Lock and Dam, 18.5 miles upstream. The Alabama Power Company constructed and operates the hydro-electric power plant under Federal Power Commission License No. 2203. It will normally be operated as a peaking plant to help meet load demands on the Alabama Power Company's system. Other benefits include public recreation and fish and wildlife conservation. There are no provisions for flood control, with the only change in normal flow being due to power operations and navigation lockages.

8. General features. The project consists of a gated spillway, a navigation lock with lock control station, a concrete non-overflow section, a 40,000 kw power plant and appurtenances and a reservoir extending 18.5 miles up the Black Warrior River to Bankhead Lock and Dam. Principal features of the project are described in detail in subsequent paragraphs and plans and sections are shown on chart 1.

9. Lock. The lock, located along the left bank, has a chamber 110 feet wide with a usable length of 600 feet, with the upper and lower guide walls having usable lengths approximately equal to the length of the chamber. Maximum lift is 64.1 feet, from the minimum lower pool, elevation 122.9 to the maximum normal upper pool, elevation 187. The top of the lock walls is at elevation 193.5, with the top of lower guide wall at elevation 153. The top of the lower miter sill is at elevation 109.9 which is 13 feet below the minimum lower pool. The upper miter sill is designed to support the upper stop-logs as well as to provide a seal for the upper miter gate. The top of the miter sill at the gate seal is at elevation 153 and the stop-log sill is at elevation 171.5 providing a depth of 14.5 feet below elevation 186, the lower limit of drawdown of the upper pool. The lock filling and emptying system consists of two intake ports in the riverside face of the riverside lock wall upstream of the upper gate, a 12.5 foot square culvert in each lock wall, and two discharge ports in the river just upstream of the lower gate. The culverts are connected to the lock chamber by five bottom laterals from each lock wall. The filling and emptying system is controlled by reverse tainter valves located in the culverts.

10. Lock-control station. The lock-control station is a two-story, reinforced-concrete building located on the river wall of the lock just downstream of the upper miter gate. It is 40 feet and 8 inches long and the maximum width is 32 feet. The control station has a basement built into the lock wall with the floor at the same level as the lock gallery, elevation 178.5. The first floor is at elevation 194, or 6 inches above the top of the lock walls. The building houses a stand-by generator, a switchboard for the lock and gated spillway, a remote control panel for the spillway gates and other miscellaneous equipment. All lock and gated spillway operating equipment which would be damaged by floods is located on the second floor, elevation 209, which is the same level as the spillway access bridge.

11. Gated spillway. The gated spillway is located in the river channel between the lock and powerhouse. The spillway is a concrete gravity structure, 680 feet long with crest at elevation 152.5. Flow over the crest is regulated by 14 tainter gates 40 feet long and 35 feet high, which provides a clear spillway length of 560 feet. There are 15 piers, each 8 feet wide, which support an access bridge across the top of the spillway. The gates are operated by individual electric hoists located on the top of the piers immediately under the access bridge. They may also be operated from the remote control station board in the lock-control station. A gate operating schedule and spillway discharge values are shown on charts 7 through 11.

12. Powerhouse. The powerhouse and intake structure, located near the right bank of the river as shown in chart 1, constitute part of the dam. The powerhouse, owned and operated by the Alabama Power Company, is a reinforced concrete structure with over-all dimensions of 130 by 77 feet. The power installation consists of one generator unit rated at 40,000 kw. A section through the powerhouse is shown on chart 1 and turbine rating curves are shown on chart 6.

13. Non-overflow section. The concrete non-overflow section is 130 feet long and ties the powerhouse section into high ground at the right abutment. The top of the non-overflow section is at elevation 207.

14. Reservoir. The reservoir at maximum operating level, elevation 187, covers an area of 3,296 acres and has a storage of 117,990 acre-feet. It extends up the Black Warrior River 18.5 miles to the John Hollis Bankhead Lock and Dam and has a total shore line length of 85 miles. Area and capacity curves are shown on chart 4 and selected area and capacity values are tabulated on chart 5.

15. Recreational development. The areas retained for public use and operation comprise approximately 1,489 acres. This includes two areas at the damsite and eight areas distributed around the reservoir. These areas are shown on chart 3. The four larger areas, ranging in size from 172 to 348 acres, are planned to provide a variety of recreational

activities including boating, fishing, picnicking and sightseeing. Two areas, Rock Quarry Landing and Old Lock 15, are planned so that a portion of these areas can be leased by the Corps to private concessionaires to provide facilities and services associated with a marina type operation including overnight and vacation cabins, lodges, restaurants, sales-service buildings for boating and fishing accessories, boat and motor servicing and repair and sales of fuels and oil. The Corps will construct access roads and a total of 8 launching ramps, with boat-trailer parking areas. The Corps will develop the dam site areas which will provide a public overlook as well as picnic areas and boat launching facilities. The overlook will be located on the left bank or south side of the dam and will provide shelter, observation parking, a public toilet and information sign. Visitors will be able to observe boats locking through the dam from the overlook structure.

REGULATION PLAN

16. General. The major objectives in the regulation of Holt Reservoir are providing navigation through the lock and reservoir and the generation of hydro-electric power. This operation will be affected by variations in natural inflow, by the operation of upstream developments, and by water requirements for navigation downstream. Other factors which are important, but not necessarily controlling in the regulation of the reservoir, include mosquito control, aquatic plant control, drift removal, recreational features and fish propagation. There is no flood control in the project. During floods the reservoir will be held at maximum operating pool, elevation 187, by passing the inflow through the spillway gates and/or the power plant until the full discharge capacity of the spillway is reached. When the full capacity of the spillway is reached free overflow with all gates fully opened will prevail until the reservoir peaks and recedes to elevation 187.

17. Normal regulation. Limiting elevations for reservoir operation are a maximum of 187 and a minimum of 186, and the reservoir will normally be maintained between these levels. Because of navigation requirements, based on channel depths in the upper end of the reservoir, the pool must not be drawn down below elevation 186. The upper limit of 187 will not be exceeded, except during floods when inflows exceed the full discharge capacity of the project, unless otherwise directed by the Reservoir Regulation Section.

18. Reservoir operation for power. The power plant is owned and operated by the Alabama Power Company to help meet load demands on its system throughout Alabama. It will normally be operated as a peaking plant utilizing the one foot of pondage between elevations 186 and 187 to reregulate the power discharges from the plant at Bankhead Lock and Dam plus the local inflow between Bankhead and Holt. Power operations shall be scheduled so that the pool will be at or below elevation 187 at all times when flooding is not occurring, and so that a minimum elevation of 186 may be maintained at all times. In most cases the power plant will utilize all available flow up to capacity of the turbines. When the pool is at elevation 186 no power releases in excess of the inflow will be permitted.

19. Reservoir operation for navigation. The reservoir will be operated to provide 9-foot depths in the navigation channel which extends 18.5 miles upstream to Bankhead Lock and Dam. It is expected that very little maintenance dredging will be required and in general the 9-foot depth will be provided by controlling the reservoir level at or above elevation 186, the lower limit of drawdown.

20. A tailwater elevation of 121.9 or higher at Holt Dam is required to provide the 9-foot depth for navigation in the upper reaches of the William Bacon Oliver pool. Since Oliver will normally be operated at or above elevation 122.9, the crest elevation of the free-overflow spillway, few if any problems are anticipated in maintaining navigable depths between Holt and Oliver Dams. Should the pool

elevation at Oliver drop to elevation 121.9 water will be released from Holt, to the extent that it is available above elevation 186, to maintain the Oliver pool at minimum elevation of 121.9 and as near elevation 122.9 as practicable. Consideration must also be given during low-flow periods to the release of water to help maintain navigable depths in the basin below Oliver Dam. Such releases for low-flow regulation are discussed further in paragraph 28.

21. Limitations on lock operation. The maximum discharge rate from the lock during emptying is estimated at 11,500 cfs. Normal emptying time is approximately 13 minutes. A coincidence of lock emptying with the loading of the powerhouse unit would cause velocities and turbulence in the downstream approach area considerably in excess of those normally resulting from either of these operations alone. Such operation will be closely observed and if the velocities and turbulence are found to be hazardous to navigation, lock emptying will be delayed when necessary to avoid this condition. Since a powerhouse unit is normally loaded in approximately 5 minutes, such delays will be of short duration.

22. Operation of the lock will be discontinued during flood periods when the tailwater exceeds elevation 152, which is one foot below the top of the lower approach wall. The estimated discharge for this tailwater elevation is 166,000 cfs. This discharge will be equaled or exceeded only about 0.1 percent of the time.

23. Regulation during floods. During floods the reservoir will be operated to keep it from exceeding elevation 187 by passing the inflow through the spillway gates and/or the power plant until the full discharge capacity of the spillway is reached. The gated spillway will discharge up to 393,000 cfs at elevation 187, and the proper manipulation of the gates will maintain the pool at that level for all inflows up to 393,000 cfs. Discharges above about 326,000 cfs will cause the power plant to be non-productive because of the high tailwater, so that for the higher flows all outflow will be through the gated spillway. When the inflow exceeds 393,000 cfs all gates will be fully opened and there will be no control over the outflow: the pool will rise as long as the inflow exceeds spillway discharge capacity. The gates will remain in the fully open position until the pool peaks and recedes to elevation 187, at which time they will be operated as necessary to maintain elevation 187. Reservoir regulation procedures for floods occurring on various conditions of pool elevation are described in the following two paragraphs, and gate operating instructions are given in paragraphs 26 and 27. Any departures from this operation will be made only if and as directed by the Reservoir Regulation Section.

24. When inflows in excess of operating requirements occur, with the pool at less than maximum operating pool elevation, all inflow in excess of generation and lockage requirements will be stored. If the pool is at elevation 186 at the beginning of this period, the excess inflow volume required for such filling will be 3,270 acre-feet. This

segment of storage will normally be filled well before inflows have increased to the point where excessively large increases in outflow would be required to keep the pool from continuing to rise when it reaches maximum operating level, elevation 187.

25. When flood inflows cause the pool to rise to maximum operating level, elevation 187, or when a flood occurs with the reservoir at maximum operating pool, elevation 187, the power plant and/or spillway will be used to pass all inflow up to spillway capacity. Close liaison will be maintained between the Lockmaster and the Alabama Power Company's operating personnel, and the Company will be given the option of passing any part or all of the inflow through the power plant up to full turbine capacity. Any part of the inflow not passed through the turbines will be discharged through the spillway gates.

26. Operation of spillway gates. The spillway gates will be operated as directed by the Lockmaster in order to maintain the reservoir between elevations 186 and 187 except during floods with inflows in excess of spillway capacity. During floods the Lockmaster will maintain contact with both the Reservoir Regulation Section and Bankhead Lock and Dam for the exchange of hydrologic data which may be helpful in anticipating gate operating requirements. He will also keep informed as to changes in power generating schedules which would require a change in spillway discharge.

27. When inflow and pool conditions require operation of the spillway, the gates will be opened in the order and increments of openings shown on charts 7 through 11. The 14 spillway gates are numbered in sequence beginning at the left bank or east end of the spillway, adjacent to the lock. Gate adjustments will be made as necessary and as specified by the above mentioned charts to maintain the pool between the limiting elevations, 186 and 187. For inflows in excess of spillway capacity the gates will be left in the fully open position until the pool has peaked and recedes to elevation 187. When this elevation is reached the operator will begin closing gates to pass the inflow, in excess of power plant and lock operation discharge, necessary to keep the pool within the established limits.

28. Regulation to meet minimum downstream requirements. Continuous releases are not required at the Holt project for the purpose of downstream flow regulation, and no minimum daily or weekly release volumes are specified. However, downstream water requirements for navigation will be carefully considered in scheduling total releases from the project particularly during low flow periods. Any special releases which may be required, except in emergencies, will be coordinated with the Reservoir Regulation Section. Emergency releases for navigation or to meet the head limitation requirement discussed in the next paragraph will be reported by the Lockmaster to the Reservoir Regulation Section as soon as practicable. Such special releases will be made through the power plant and/or spillway, in cooperation with the Alabama Power Company.

29. Head limitation. The headwater - tailwater differential at Holt Dam must not exceed 64.6 feet at any time. This limitation will require particular attention during low flow periods when the Oliver pool is lower than elevation 122.9. Releases required to maintain the necessary tailwater elevation will be met by power and/or spillway releases. The Lockmaster will coordinate all such releases with the Alabama Power Company.

30. Mosquito-control operations. Holt Reservoir is primarily a navigation project and controlled fluctuation of the pool in excess of the one-foot power pondage is undesirable. Therefore water-level management is not considered as part of the mosquito-control program. Mosquito-control operations will consist primarily of clearing the reservoir of undesirable debris and vegetation, periodic inspections for adult mosquitos and larva, the application of larvicides as necessary, aquatic plant control and drift removal operations.

31. Water quality control operations. Water quality control is not an authorized function of Holt Reservoir and no provisions have been made for any special operations or releases in this connection. However, the Federal Power Commission has recognized that power operations may have some effect on water quality and has included in the project license a requirement for a 5-year evaluation study to be made by the Alabama Power Company. Depending on the results of this study it may be necessary to modify the regulation plan to include operation for water quality control.

32. Examples of flood regulation. The effect of reservoir regulation on the flood of record, April 1900, is shown on chart 23. Regulation of the standard project flood is shown on chart 24 and the spillway design flood on chart 25. The initial pool in all cases was assumed to be maximum operating pool, elevation 187.

COMMUNICATION AND REPORTING NETWORK

33. Communications. Communication between the District Office and Holt Lock and Dam is by telephone or two-way voice radio. The radio installation at the dam is part of the Mobile District Radio communications network. For local communication within the Black Warrior and Tombigbee system there is a VHF radio network of fixed stations at the Tuscaloosa Area Office and at each of the locks within the system. Emergency communication between the Mobile District Office and the Alabama Power Company is available through a radio link from the Reservoir Regulation Section of the District Office to the Company's control center in Mobile, which maintains communication with their System Load Dispatcher at Magella. Reports from the U. S. Weather Bureau are transmitted to the Reservoir Regulation Section either by teletype or telephone. The observers at all reporting rainfall and river stage stations have access to a teletype and/or a telegraph office.

34. Rainfall reporting network. Rainfall reports are received in the Mobile District Office for 19 stations in or adjacent to the Black Warrior River basin between Lewis Smith Dam and Tuscaloosa, Alabama. These stations are listed in table 1 and their locations are shown on chart 15. The stations at Lewis Smith Dam, Gorgas and Magella are operated by the Alabama Power Company. The stations at Birmingham Airport and Tuscaloosa are U. S. Weather Bureau Airways Stations and the stations at Bankhead, Holt and Oliver Locks and Dams are operated by the Corps of Engineers. All others are operated by the U. S. Weather Bureau under the cooperative agreement between that agency and the Corps of Engineers.

35. The stations at Lewis Smith Dam and Gorgas report directly to the Power Company's Load Dispatching Office at Magella. These reports, along with the report of rainfall from the station at Magella are relayed by the dispatcher to the Mobile District Office by telephone or over the emergency radio facilities described in paragraph 33. Reports from the stations at Bankhead, Holt and Oliver Locks and Dams are relayed by lock operating personnel to the Mobile District Office by means of the voice radio or by telephone. Reports from the airways stations are received by the Reservoir Regulation Section over one of their regular teletype circuits. The observers at all other stations report by telephone or telegraph to the U. S. Weather Bureau and these messages are also relayed to the District Office by telephone or teletype.

36. The airways stations at Birmingham and Tuscaloosa report every 6 hours; Lewis Smith Dam, Gorgas, Magella, Bankhead Lock and Dam, Holt Lock and Dam and Oliver Lock and Dam report once daily except during periods of heavy rainfall when more frequent reports are made as requested by the Reservoir Regulation Section. All stations report in accordance with standard Weather Bureau Reporting Instructions, WB Form 612-20, shown on chart 17. These instructions call for an initial report at 7:00 a.m., 1:00 p.m. or 7:00 p.m. whenever rain since last

measurement totals 0.50 inch or more and thereafter at 7:00 a.m., 1:00 p.m. and 7:00 p.m. until the rain stops.

37. Rainfall reports are gathered daily and tabulated by the Reservoir Regulation Section on the form shown in chart 18 which is a portion of a larger form listing all stations in the Black Warrior-Tombigbee basin. Special reports received during periods of heavy rainfall from the Corps of Engineer and Alabama Power Company stations are tabulated on the form shown on chart 19.

38. River-stage reporting network. There are 5 river-stage reporting stations in the Black Warrior basin above Oliver Lock and Dam and below Lewis Smith Dam. The stations at Lewis Smith Dam and Cordova report directly to the Alabama Power Company's Load Dispatching Office at Magella and the reports are relayed to the Mobile District Office. The stations at Bankhead, Holt and Oliver Locks and Dams are operated by the Corps of Engineers and report to the District Office by radio or telephone.

39. Normally the river stage at approximately 7:00 a.m. at each of the reporting stations is reported to the District Office each morning except Sunday. Sunday readings are generally reported with the Monday readings. Readings at Lewis Smith Dam are reported automatically each hour to the Alabama Power Company and these readings are available to the District Office at any time upon request. The Cordova gage, installed and maintained by the Corps of Engineers in connection with the flood control operation of Lewis Smith Dam, is equipped with a telemark and an unattended station relay to permit interrogation by telephone at any time by either the Alabama Power Company or the Corps of Engineers. Additional reports can be received from all other reporting stations by contacting the Lockmasters at the individual projects by means of the District radio network or by telephone. During periods of unusually high stages reports from the 5 reporting stations are obtained as frequently as necessary and are recorded on the form shown on chart 19.

40. Pertinent data concerning all river stations in the Black Warrior basin between Oliver Lock and Dam and Lewis Smith Dam including the reporting stations, are shown in table 2. The locations of the reporting stations are shown on chart 15, and the locations of all river stations in the Black Warrior basin between Oliver Lock and Dam and Smith Dam are shown on chart 16. Discharge rating curves for the stations at Cordova, and the tailwater at Bankhead and Holt Locks and Dams are shown on charts 20 through 22. All stations which are shown on table 2 as being operated by the U. S. Geological Survey or the Corps of Engineers are included in the cooperative stream gaging program between the two agencies.

Table 1

Rainfall reporting stations
Black Warrior River basin above Oliver Lock and Dam

Drainage	Station	Latitude	Longitude	Elevation ft., msl	Type	Observer
Sipsey Fork	Lewis M. Smith Dam	33° 56'	87° 06'	(1)	Non-rec.	Ala. Power Co.
Mulberry Fork	Falkville 1N	34° 22'	86° 54'	630	Non-rec.	Edgbert M. Hardin
Mulberry Fork	Garden City	34° 01'	86° 45'	500	Recording	Mrs. G. McKenzie
Mulberry Fork	Cordova	33° 46'	87° 11'	334	Non-rec.	Mrs. C. Gresham
Mulberry Fork	Gorgas	33° 39'	87° 13'	300	Non-rec.	Ala. Power Co.
Blackwater Creek	Haleyville	34° 14'	87° 37'	910	Recording	Radio Station WJBB
Lost Creek	Carbon Hill	33° 54'	87° 32'	430	Non-rec.	Floyd J. Garrison
Locust Fork	Boaz	34° 13'	86° 10'	1070	Recording	David A. Burns
Locust Fork	Oneonta	33° 57'	86° 29'	875	Non-rec.	Lonnie R. Norris
Locust Fork	Trafford	33° 49'	86° 44'	470	Recording	William P. Doss
Locust Fork	Sayre (Dora)	33° 43'	86° 58'	304	Non-rec.	Mrs. M. W. Pridmore
Village Creek	Birmingham Apt.	33° 34'	86° 45'	610	Recording	U. S. Weather Bureau
Black Warrior River	John Hollis Bankhead L&D	33° 29'	87° 20'	280	Non-rec.	Corps of Engrs.
Black Warrior River	Wm. Bacon Oliver L&D	33° 13'	87° 35'	152	Recording	Corps of Engrs.
Black Warrior River	Tuscaloosa Apt.	33° 14'	87° 37'	170	Non-rec.	Fed. Aviation Agency
Valley Creek	Magella	33° 30'	86° 51'	654	Non-rec.	Ala. Power Co.
Valley Creek	Bessemer 4SW	33° 22'	87° 01'	533	Non-rec.	James E. McCravy
Black Warrior River	Holt Lock and Dam	33° 19'	87° 27'	(1)	Recording	Corps of Engrs.

(1) Not yet determined

Table 2

River-stage reporting network and other river stations
Black Warrior River basin above Oliver Lock and Dam

Stream	Station (1)	River miles above mouth	Drainage area (sq.mi.)	Gage zero elev. (ft.msl)	Flood stage (reporting stations, feet)	Type gage (3)	Operated by (4)
Sipsey Fork	LEWIS M. SMITH DAM (5)	13.8	944	0	(2)	R	APC
Sipsey Fork	Jasper	11.2	971	253.8		R	USGS
Mulberry Fork	Garden City	79.2	368	380.5		R	USGS
Mulberry Fork	CORDOVA	30.8	1,927	243.6	16	R	CofE
Mulberry Fork	Gorgas Steam Plant	12.5	2,000	0		S	APC
Dorsey Creek	Arkadelphia	8.0	13	(2)		R	USGS
Blackwater Creek	Manchester	20.0	188	401.0		R	USGS
Lost Creek	Oakman	(2)	130	-		R	USGS
Locust Fork	Cleveland	96.2	309	536.9		R	USGS
Locust Fork	Trafford	67.4	625	309.1		R	USGS
Locust Fork	Sayre	33.9	887	258.6		R	USGS
Locust Fork	Port Birmingham	11.4	1,155	242.5		S	CofE
Turkey Creek	Morris	4.0	81.5	345.2		S	USGS
Black Warrior River	JOHN HOLLIS BANKHEAD L&D (5)	153.6	3,990	173.5	(2)	R	CofE
Black Warrior River	John Hollis Bankhead L&D (5)	153.6	3,990	0		R	APC
Black Warrior River	HOLT LOCK AND DAM (5)	155.0	4,232	0	(2)	R	CofE
Black Warrior River	Holt Lock and Dam (5)	155.0	4,232	0		R	APC
Davis Creek	Abernant	(2)	45.2	(2)		R	USGS
Black Warrior River	OLIVER LOCK AND DAM (5)	338.1	4,830	82.3	47.0	R	CofE

(1) Reporting stations indicated by capital letters
(2) Not yet determined
(3) R-Recording; S-Staff
(4) APC - Alabama Power Co.; USGS - United States Geological Survey; CofE - Corps of Engineers
(5) Both headwater and tailwater gages at these locations

FORECASTING

41. Forecasts of reservoir inflow. The regulation plan for the Holt project does not require a knowledge of expected inflow therefore no inflow forecasting procedure has been developed. However, since there is little local inflow between Bankhead and Holt, the expected inflow to Holt Reservoir can be estimated by lagging the hydrograph of expected releases from Bankhead 6 hours.

42. Responsibility for issuing stage forecasts to public. The issuing to the general public of stage forecasts is the legal responsibility of the U. S. Weather Bureau. For the Black Warrior basin forecasts are prepared by the Weather Bureau's River Forecast Center in Atlanta, Georgia, and issued through their Mobile, Alabama, office. The Reservoir Regulation Section maintains close liaison with the River Forecast Center and the Mobile Weather Bureau at all times, and particularly during floods, with mutual exchange of information and agreement on expected stages at Weather Bureau river stations which may be affected by operations at Corps of Engineers' projects.

CONTINUING STUDIES AND SURVEYS

43. Sedimentation and retrogression surveys. Plans have been formulated for sedimentation studies of the Holt Reservoir and retrogression studies of the channel below the dam. In accordance with these plans sedimentation and retrogression ranges will be established and original range profiles obtained. The proposed locations of the ranges are shown on chart 2.

44. The first complete sedimentation and retrogression survey will be made about 5 years after the dam is closed unless the results of annual check surveys indicate an earlier need for a complete sedimentation and retrogression study.

45. Water quality evaluation. In accordance with article 43 of the license issued by the Federal Power Commission, shown in Attachment I, the Alabama Power Company will conduct a 5-year study to evaluate the effect of the power plant operations on water quality.

46. Studies in progress or planned. In addition to the studies mentioned above, studies will be continually in progress for possible improvements in the regulation plan or operating technique that would result in additional project benefits without violating any authorized project functions.

MISCELLANEOUS

47. Temperature. The average annual temperature in the basin above Holt Lock and Dam is about 62 degrees. This figure is based on records at five long-term stations. These stations, Albertville, Birmingham, Cordova, St. Bernard and Tuscaloosa-Oliver Dam, are considered representative of the area. Birmingham, with an annual normal of 64.1 degrees, has the longest period of record dating back to 1896. Cordova has the shortest period of record, 35 years, and a normal annual temperature of 62.4 degrees. The normal monthly temperature ranges from about 46 degrees in January to about 82 degrees in July. A minimum of -17 degrees and a maximum of 110 degrees have been recorded in the basin. The normal frost-free period of seven months lasts from April to October.

48. Precipitation. The Black Warrior River and its tributaries lies in a region of heavy annual rainfall which is fairly well distributed throughout the year. There is some seasonal variation with about 41 percent occurring during the 4-month wet period (January through April), while only about 18 percent occurs during the 3-month dry period, September through November. The normal monthly and annual precipitation for the basin above Holt Lock and Dam is shown in table 3. The amounts shown are the arithmetic means of the normals of the 8 stations in and adjacent to the basin. These stations: Albertville, Birmingham, Cordova, Fayette, Haleyville, Oneonta, St. Bernard and Tuscaloosa-Oliver Dam; are shown on chart 16. The maximum, minimum and normal annual precipitation for these stations are shown on table 4. Moderate snowfall occurs in the basin during the months October through April, but seldom covers the ground for more than a few days at a time and has not been an important contributing factor in any major flood recorded in the basin.

49. Flood-producing storms may occur over the Black Warrior basin at anytime during the year but are much more frequent in the winter and early spring. Major storms in the winter are usually of the frontal type and the summer storms of the hurricane type.

50. Stream flow at Holt damsite. Stream flow has been measured in the vicinity of Holt Lock and Dam site since 1894 at Tuscaloosa, Alabama, about 8 miles below thedam site. Records for the station are published by the U. S. Geological Survey. Hydrographs of average daily flows at Tuscaloosa for the period 1928-1964 are shown on charts 12 through 14. Broken records for the period 1894 to 1928 are available in publications of U. S. Geological Survey.

Table 3

Normal monthly and annual precipitation
Black Warrior River basin above Holt Lock and Dam

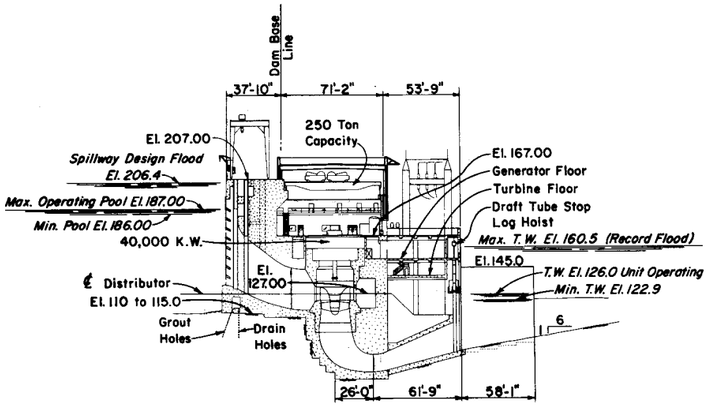
Month	Normal precipitation	
	Inches	Percent of normal annual
January	5.49	10.07
February	5.51	10.11
March	6.09	11.17
April	4.75	8.72
May	3.91	7.17
June	4.10	7.52
July	5.30	9.72
August	4.36	8.00
September	3.06	5.61
October	2.90	5.32
November	3.78	6.92
December	5.28	9.67
Annual	54.51	100.00

Table 4

Maximum, minimum and normal annual precipitation for selected stations in Black Warrior basin above Holt Lock and Dam

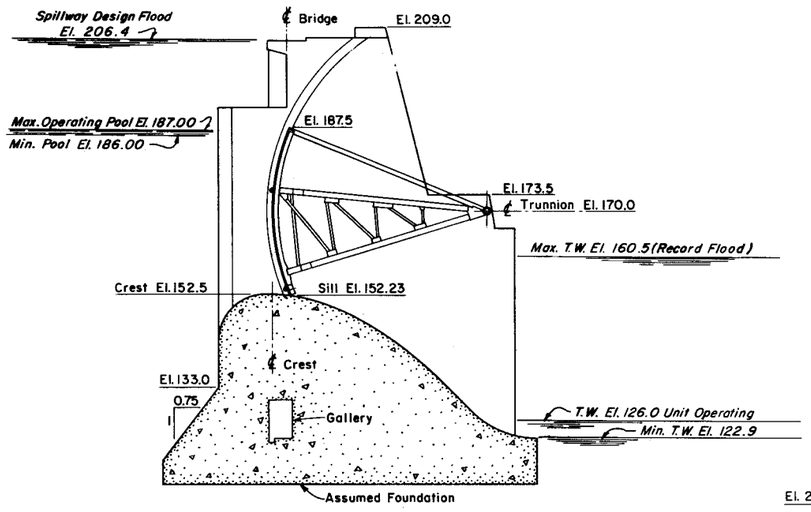
Station	Period of record (years)	Normal annual precipitation (inches)	Maximum annual precipitation		Minimum annual precipitation	
			inches	year	inches	year
Albertville	39	53.21	78.58	1946	39.04	1958
Birmingham	66	53.05	81.82	1929	34.32	1904
Cordova	62	53.44	76.40	1964	36.61	1933
Fayette	39	54.92	75.76	1923	31.12	1954
Haleyville	28	58.01	77.69	1964	39.96	1952
Oneonta	63	56.91	88.85	1900	40.70	1943
St. Bernard	58	54.08	72.78	1946	35.02	1943
Tuscaloosa-Oliver Dam	38	52.46	73.17	1932	32.87	1954

CHARTS



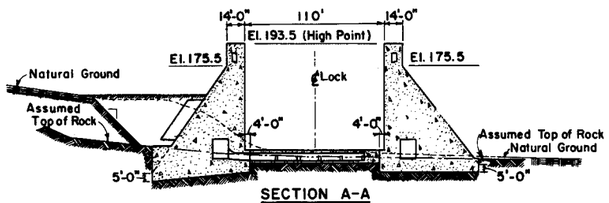
TYPICAL POWERHOUSE SECTION

10 0 20 40 60
SCALE IN FEET



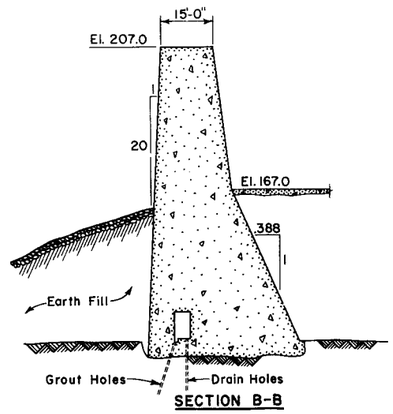
SECTION C-C
GATED SPILLWAY

SCALE: 1/16" = 1'-0"
16' 8' 0 16FT



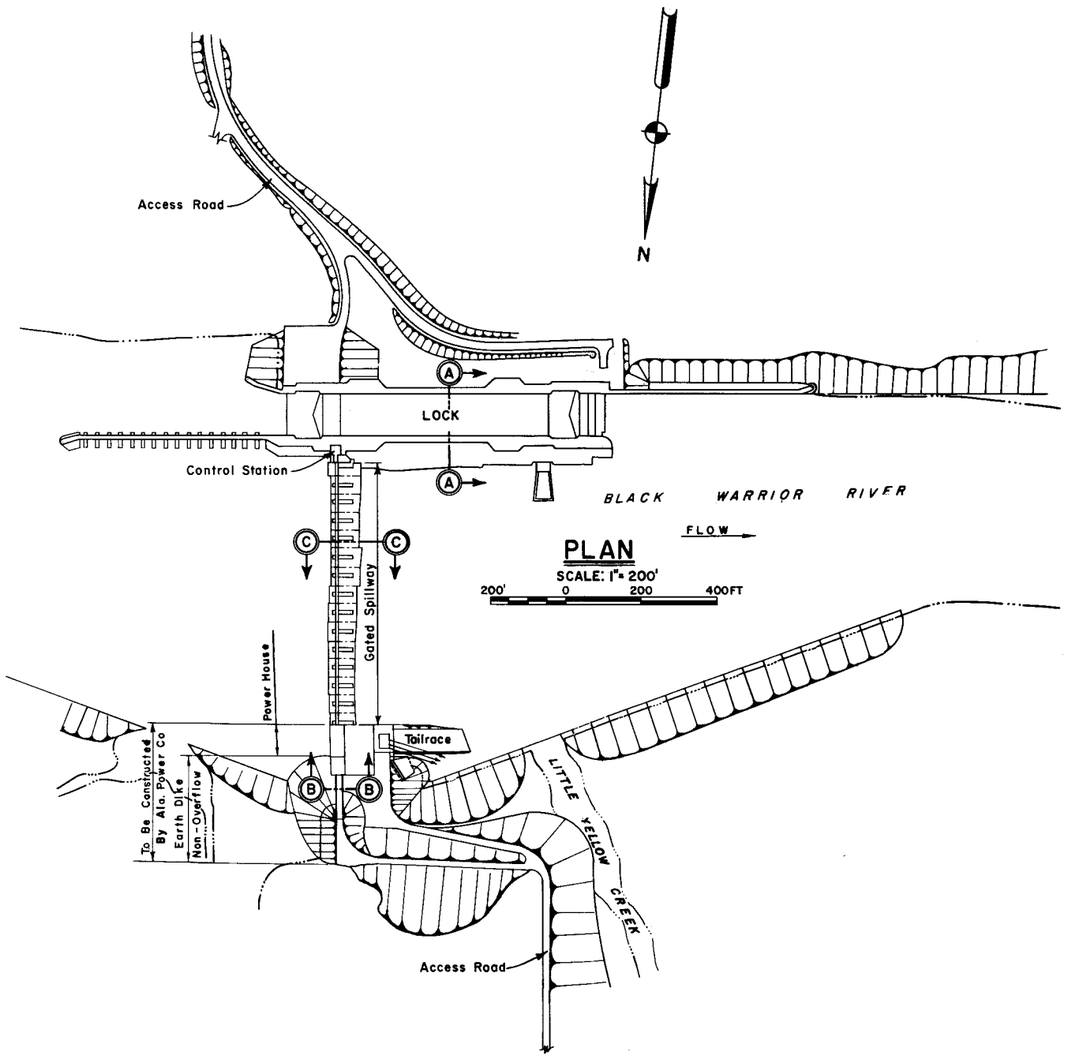
SECTION A-A
TYPICAL LOCK SECTION

SCALE: 1" = 60'
60' 0 60 120 FT.



SECTION B-B
NON-OVERFLOW DAM

10 0 10 20 30 40
SCALE IN FEET



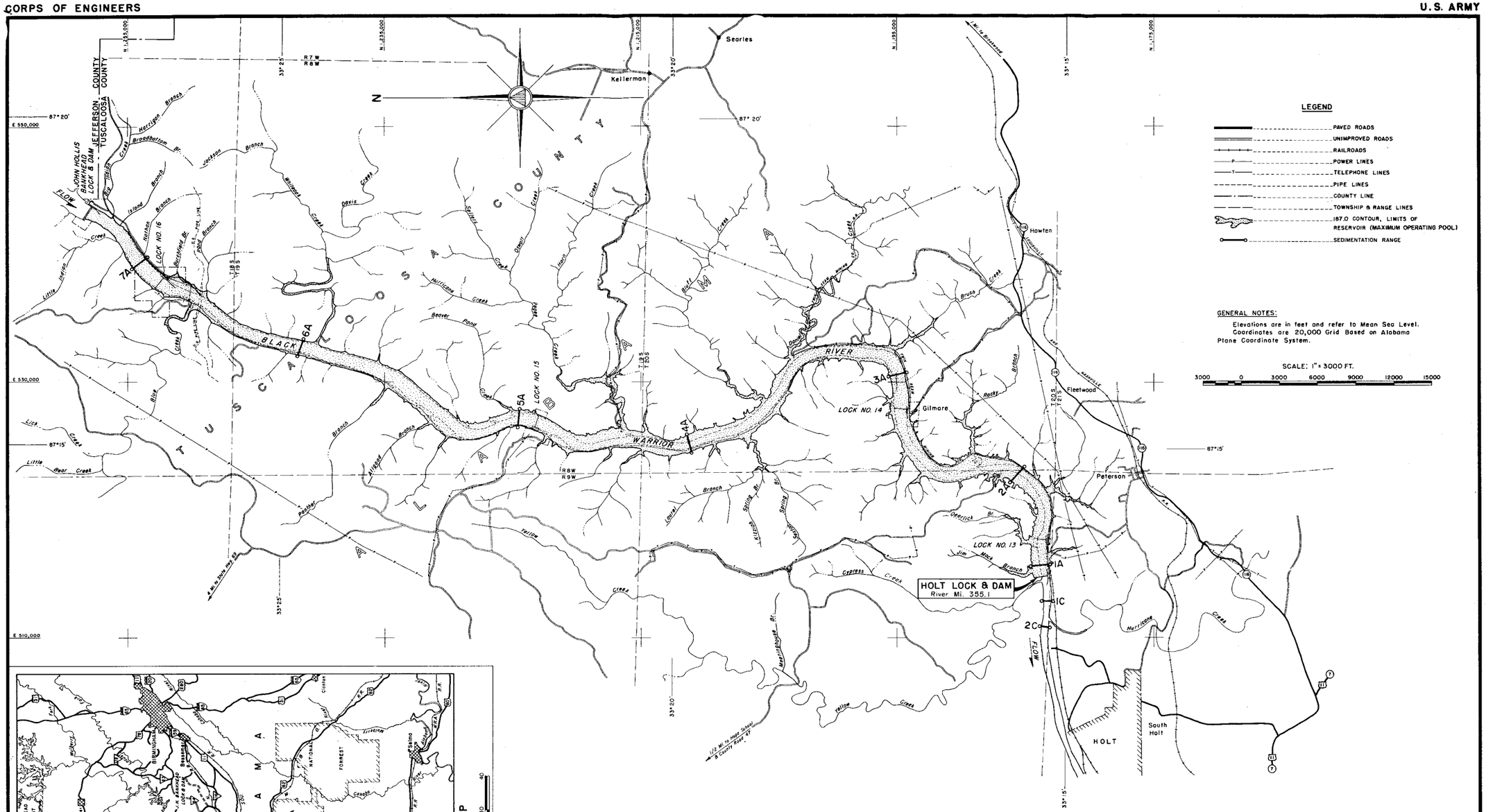
PLAN
SCALE: 1"= 200'
200' 0 200 400FT

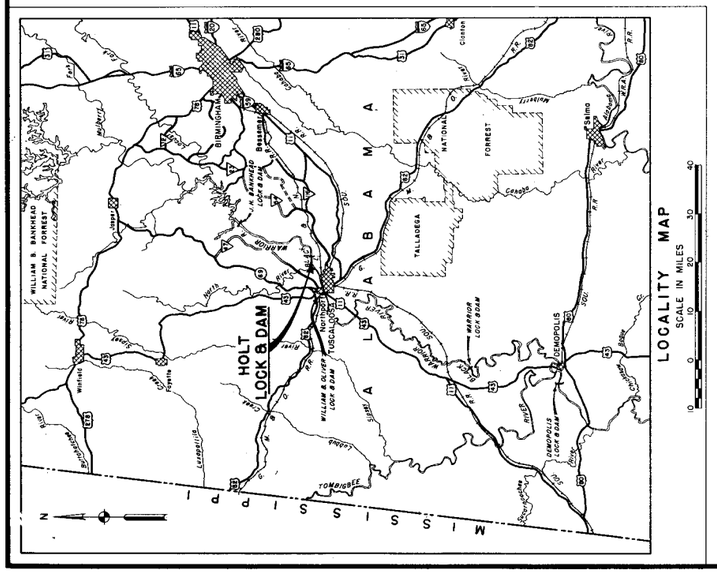
BLACK WARRIOR-TOMBIGBEE RIVER BASIN
RESERVOIR REGULATION MANUAL
HOLT RESERVOIR
BLACK WARRIOR RIVER, ALABAMA

PLAN AND SECTION OF DAM POWERHOUSE AND LOCK

CORPS OF ENGINEERS

U.S. ARMY





BLACK WARRIOR TOMBIGBEE RIVER BASIN
RESERVOIR REGULATION MANUAL

HOLT RESERVOIR

BLACK WARRIOR RIVER, ALABAMA

RESERVOIR MAP

SEDIMENTATION RANGES

APPENDIX B CHART NO. 2

CORPS OF ENGINEERS

U.S. ARMY

BIG INDIAN CREEK PUBLIC USE AREA

15 ACRES ABOVE NORMAL POOL
HEAVILY WOODED
TERRAIN HILLY TO MOUNTAINOUS
ELEV. OF LAND 186.5 to 390
SEC. 22 & 27, T18S, R8W

OLD LOCK 16 PUBLIC USE AREA

348 ACRES ABOVE NORMAL POOL
HEAVILY WOODED
TERRAIN HILLY TO MOUNTAINOUS
ELEV. OF LAND 186.5 to 390
SEC. 28 & 33, T18S, R8W

DANIEL CREEK PUBLIC USE AREA

48 ACRES ABOVE NORMAL POOL
HEAVILY WOODED
TERRAIN HILLY TO MOUNTAINOUS
ELEV. OF LAND 186.5 to 300
SEC. 16 & 17, T20S, R8W

ROCKY BRANCH PUBLIC USE AREA

341 ACRES ABOVE NORMAL POOL
HEAVILY WOODED
TERRAIN HILLY TO MOUNTAINOUS
ELEV. OF LAND 186.5 to 457
SEC. 30, T20S, R8W

ROCK QUARRY LANDING

76 ACRES ABOVE NORMAL POOL
HEAVILY WOODED
TERRAIN HILLY TO MOUNTAINOUS
ELEV. OF LAND 186.5 to 369
SEC. 36, T20S, R9W
SEC. 1, T20S, R9W

BLUE CREEK PUBLIC USE AREA

172 ACRES ABOVE NORMAL POOL
HEAVILY WOODED
TERRAIN HILLY TO MOUNTAINOUS
ELEV. OF LAND 186.5 to 457
SEC. 28 & 33, T18S, R8W

OLD LOCK 15 PUBLIC USE AREA

99 ACRES ABOVE NORMAL POOL
HEAVILY WOODED
TERRAIN HILLY TO MOUNTAINOUS
ELEV. OF LAND 186.5 to 440
SEC. 30, T19S, R8W

DEERLICK CREEK PUBLIC USE AREA

300 ACRES ABOVE NORMAL POOL
HEAVILY WOODED
TERRAIN HILLY TO MOUNTAINOUS
ELEV. OF LAND 186.5 to 382
SEC. 36, T20S, R9W

DAMSITE - LEFT BANK

(CONSTRUCTION)
30 ACRES ABOVE NORMAL POOL
HEAVILY WOODED
TERRAIN HILLY TO MOUNTAINOUS
ELEV. OF LAND 186.5 to 345
SEC. 1 & 2, T21S, R9W
(SEE GENERAL NOTES)

DAMSITE - RIGHT BANK

(CONSTRUCTION)
40 ACRES ABOVE NORMAL POOL
HEAVILY WOODED
TERRAIN HILLY TO MOUNTAINOUS
ELEV. OF LAND 186.5 to 300
SEC. 34 & 35, T20S, R9W
(SEE GENERAL NOTES)

LOCALITY MAP
SCALE IN MILES

LEGEND

- ROAD RIGHT-OF-WAY (ROW)
- PAVED ROADS
- IMPROVED ROADS
- RAILROADS
- POWER LINES
- TELEPHONE LINES
- PIPE LINES
- COUNTY LINE
- TOWNSHIP & RANGE LINES
- 186.5 CONTOUR, LIMITS OF RESERVOIR (NORMAL POOL)
- PROPOSED PUBLIC USE AREAS
- CONSTRUCTION AREAS

GENERAL NOTES:

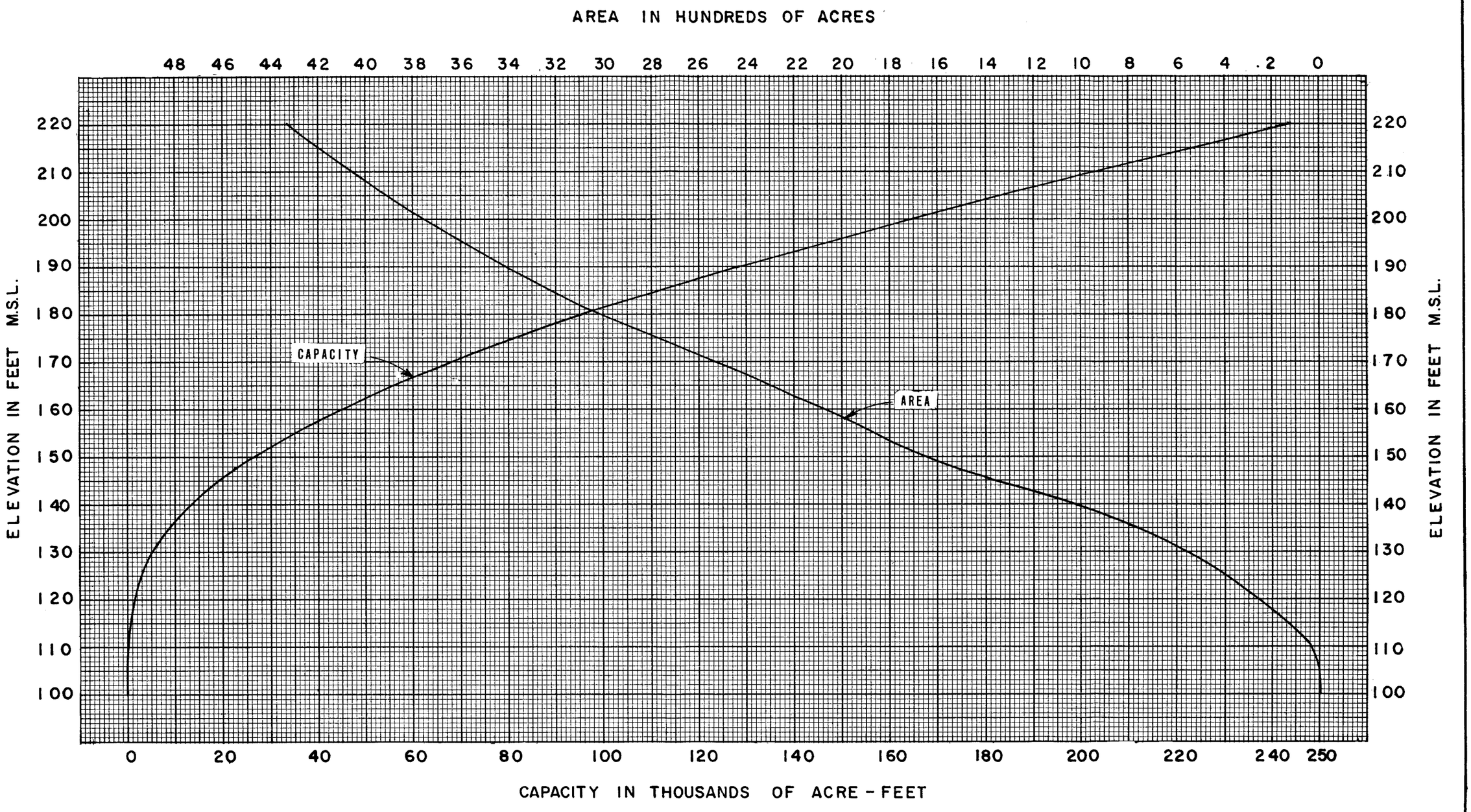
Elevations are in feet and refer to Mean Sea Level.
Coordinates are 20,000 Grid Based on Alabama Plane Coordinate System.
Areas at the Damsite which are suitable for Development will be used for PUBLIC USE AND ACCESS.

BLACK WARRIOR TOMBIGBEE RIVER BASIN
RESERVOIR REGULATION MANUAL
HOLT RESERVOIR
BLACK WARRIOR RIVER, ALABAMA

RECEATIONAL FACILITIES

APPENDIX B CHART NO. 3

CORPS OF ENGINEERS U.S. ARMY



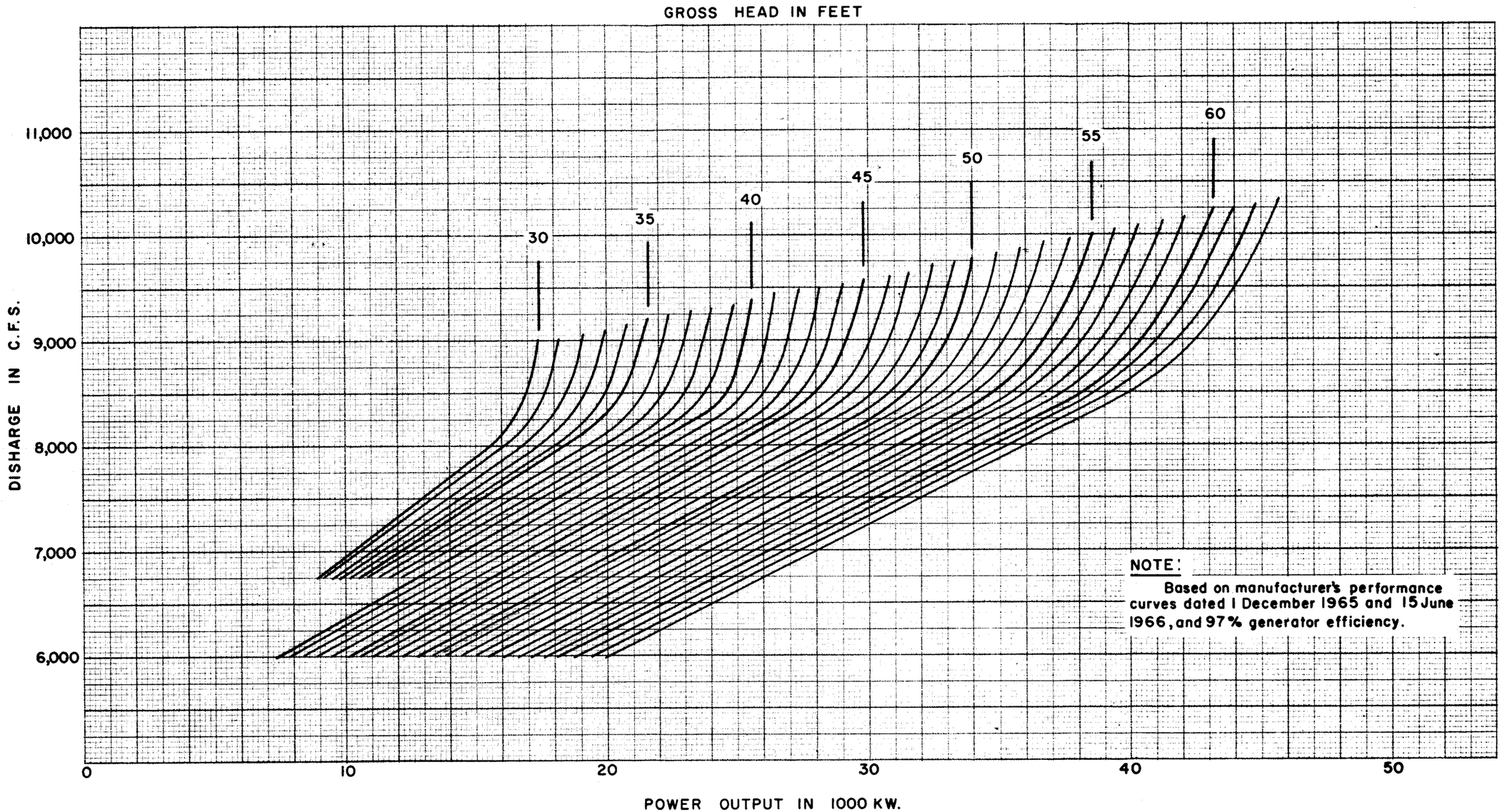
BLACK WARRIOR-TOMBIGBEE RIVER BASIN
RESERVOIR REGULATION MANUAL
HOLT RESERVOIR
BLACK WARRIOR RIVER, ALABAMA
AREA AND CAPACITY CURVES

APPENDIX B CHART NO. 4

HOLT LOCK AND DAM
Area and capacity

Pool Elevation (msl)	Total area (acres)	Total Storage (ac. - ft.)
100	0	0
110	30	90
120	251	1,470
130	559	5,380
140	1,018	13,150
150	1,658	26,470
*152.5	1,759	30,735
160	2,084	45,140
170	2,541	68,280
180	2,995	95,960
181	3,038	98,980
182	3,083	102,040
183	3,128	105,150
184	3,172	108,300
185	3,212	111,490
**186	3,252	114,720
***187	3,296	117,990
188	3,333	121,300
189	3,373	124,660
190	3,411	128,060
191	3,446	131,490
192	3,484	134,950
193	3,519	138,450
194	3,557	141,990
195	3,592	145,570
200	3,759	163,945
210	4,052	203,004
220	4,327	244,916

* Crest of gated spillway
** Minimum pool
*** Maximum operating pool



BLACK WARRIOR-TOMBIGBEE RIVER BASIN
RESERVOIR REGULATION MANUAL
HOLT RESERVOIR
BLACK WARRIOR RIVER, ALABAMA
PERFORMANCE CURVES
TURBOGENERATOR UNIT
APPENDIX B CHART NO. 6

R	GATE OPENING IN FEET														SPILLWAY DISCHARGE IN C.F.S.						
	GATE NUMBER														POOL ELEVATION						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	185.5	186.0	186.5	187.0	187.5	188.0	188.5
	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	580	580	590	590	600		
	0.5	0.5	0	0	0	0	0	0	0	0	0	0	0	0	1160	1170	1170	1180	1190		
	0.5	0.5	0.5	0	0	0	0	0	0	0	0	0	0	0	1730	1750	1760	1770	1790		
	0.5	0.5	0.5	0.5	0	0	0	0	0	0	0	0	0	0	2310	2330	2350	2360	2380		
	0.5	0.5	0.5	0.5	0.5	0	0	0	0	0	0	0	0	0	2890	2910	2930	2960	2980		
	0.5	0.5	0.5	0.5	0.5	0.5	0	0	0	0	0	0	0	0	3470	3500	3520	3550	3570		
	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0	0	0	0	0	0	0	4050	4080	4110	4140	4170		
	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0	0	0	0	0	0	4630	4660	4700	4730	4760		
	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0	0	0	0	0	5200	5240	5280	5320	5360		
	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0	0	0	0	5780	5830	5870	5910	5960		
	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0	0	0	6360	6410	6460	6500	6550		
	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0	0	6940	6990	7040	7090	7150		
	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0	7520	7570	7630	7690	7740		
	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	8100	8160	8220	8280	8340		
	1.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	8680	8740	8810	8870	8930	9000	
	1.0	1.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	9260	9330	9400	9460	9530	9600	
	1.0	1.0	1.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	9840	9910	9980	10060	10130	10200	
	1.0	1.0	1.0	1.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	10420	10500	10570	10650	10730	10810	
	1.0	1.0	1.0	1.0	1.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	11000	11080	11160	11240	11330	11410	
	1.0	1.0	1.0	1.0	1.0	1.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	11580	11660	11750	11840	11920	12010	
	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	12160	12250	12340	12430	12520	12610	
	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.5	0.5	0.5	0.5	0.5	0.5	12740	12830	12930	13030	13120	13210	
	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.5	0.5	0.5	0.5	0.5	13320	13420	13520	13620	13720	13820	
	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.5	0.5	0.5	0.5	13900	14000	14110	14210	14320	14420	
	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.5	0.5	0.5	14480	14590	14700	14810	14910	15020	
	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.5	0.5	15060	15170	15290	15400	15510	15620	
	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.5	15640	15760	15880	15990	16110	16220	
	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	16220	16340	16460	16590	16710	16830	
	1.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	16800	16930	17050	17180	17300	17430	17550
	1.5	1.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	17380	17510	17640	17770	17900	18030	18160
	1.5	1.5	1.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	17960	18090	18230	18370	18500	18630	18760
	1.5	1.5	1.5	1.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	18540	18680	18820	18960	19100	19230	19370
	1.5	1.5	1.5	1.5	1.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	19120	19260	19410	19550	19690	19840	19980
	1.5	1.5	1.5	1.5	1.5	1.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	19700	19850	20000	20140	20290	20440	20580
	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	20280	20430	20590	20740	20890	21040	21190
	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.0	1.0	1.0	1.0	1.0	1.0	20860	21020	21170	21330	21490	21640	21800
	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.0	1.0	1.0	1.0	1.0	21440	21600	21760	21920	22080	22240	22400
	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.0	1.0	1.0	1.0	22020	22180	22350	22520	22680	22850	23010
	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.0	1.0	1.0	22600	22770	22940	23110	23280	23450	23610
	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.0	1.0	23180	23350	23530	23700	23880	24050	24220
	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.0	23750	23940	24120	24300	24480	24650	24830
	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	24330	24520	24710	24890	25070	25250	25430
	2	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	24910	25100	25290	25480	25670	25850	26040
	2	2	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	25490	25690	25880	26070	26270	26460	26640
	2	2	2	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	26070	26270	26470	26670	26860	27060	27250

BLACK WARRIOR-TOMBIGBEE RIVER BASIN
RESERVOIR REGULATION MANUAL
HOLT RESERVOIR
BLACK WARRIOR RIVER, ALABAMA
GATE OPERATING SCHEDULE
AND SPILLWAY DISCHARGE

P ER	GATE OPENING IN FEET														SPILLWAY DISCHARGE IN C.F.S.						
	GATE NUMBER														POOL ELEVATION						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	185.5	186.0	186.5	187.0	187.5	188.0	188.5
3	2	2	2	2	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	26650	26850	27060	27260	27460	27660	27850
7	2	2	2	2	2	1.5	1.5	1.5	1 5	1.5	1.5	1.5	1.5	1.5	27230	27440	27640	27850	28050	28260	28460
3	2	2	2	2	2	2	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	27800	28020	28230	28440	28650	28860	29060
9	2	2	2	2	2	2	2	1.5	1.5	1.5	1.5	1.5	1.5	1.5	28380	28600	28820	29030	29250	29460	29670
0	2	2	2	2	2	2	2	2	1.5	1.5	1.5	1.5	1.5	1.5	28960	29180	29400	29620	29840	30060	30270
1	2	2	2	2	2	2	2	2	2	1.5	1.5	1.5	1.5	1.5	29540	29770	29990	30220	30440	30660	30880
2	2	2	2	2	2	2	2	2	2	2	1.5	1.5	1.5	1.5	30120	30350	30580	30810	31040	31260	31490
3	2	2	2	2	2	2	2	2	2	2	2	1.5	1.5	1.5	30690	30930	31170	31400	31630	31860	32090
4	2	2	2	2	2	2	2	2	2	2	2	2	1.5	1.5	31270	31510	31750	31990	32230	32460	32700
5	2	2	2	2	2	2	2	2	2	2	2	2	2	1.5	31850	32100	32340	32580	32820	33060	33300
6	2	2	2	2	2	2	2	2	2	2	2	2	2	2	32430	32680	32930	33180	33420	33660	33910
7	3	2	2	2	2	2	2	2	2	2	2	2	2	2	33580	33840	34100	34360	34610	34860	35110
8	3	3	2	2	2	2	2	2	2	2	2	2	2	2	34740	35010	35270	35540	35800	36060	36320
9	3	3	3	2	2	2	2	2	2	2	2	2	2	2	35890	36170	36440	36720	36990	37260	37530
0	3	3	3	3	2	2	2	2	2	2	2	2	2	2	37040	37330	37620	37900	38180	38460	38740
1	3	3	3	3	3	2	2	2	2	2	2	2	2	2	38200	38490	38790	39080	39370	39660	39950
2	3	3	3	3	3	3	2	2	2	2	2	2	2	2	39350	39660	39960	40260	40560	40860	41160
3	3	3	3	3	3	3	3	2	2	2	2	2	2	2	40500	40820	41130	41440	41750	42060	42360
4	3	3	3	3	3	3	3	3	2	2	2	2	2	2	41660	41980	42300	42630	42940	43260	43570
5	3	3	3	3	3	3	3	3	3	2	2	2	2	2	42810	43140	43480	43810	44130	44460	44780
6	3	3	3	3	3	3	3	3	3	3	2	2	2	2	43960	44310	44650	44990	45320	45660	45990
7	3	3	3	3	3	3	3	3	3	3	3	2	2	2	45120	45470	45820	46170	46510	46860	47200
8	3	3	3	3	3	3	3	3	3	3	3	3	2	2	46270	46630	46990	47350	47710	48060	48410
9	3	3	3	3	3	3	3	3	3	3	3	3	3	2	47420	47800	48160	48530	48900	49260	49620
0	3	3	3	3	3	3	3	3	3	3	3	3	3	3	48580	48960	49340	49710	50090	50460	50820
1	4	3	3	3	3	3	3	3	3	3	3	3	3	3	49730	50120	50500	50890	51270	51650	52030
2	4	4	3	3	3	3	3	3	3	3	3	3	3	3	50870	51270	51670	52070	52460	52850	53230
3	4	4	4	3	3	3	3	3	3	3	3	3	3	3	52020	52430	52840	53240	53650	54040	54440
4	4	4	4	4	3	3	3	3	3	3	3	3	3	3	53170	53590	54010	54420	54830	55240	55640
5	4	4	4	4	4	3	3	3	3	3	3	3	3	3	54320	54750	55180	55600	56020	56440	56850
6	4	4	4	4	4	4	3	3	3	3	3	3	3	3	55470	55910	56340	56780	57210	57630	58050
7	4	4	4	4	4	4	4	3	3	3	3	3	3	3	56620	57070	57510	57950	58390	58830	59260
8	4	4	4	4	4	4	4	4	3	3	3	3	3	3	57770	58220	58680	59130	59580	60020	60460
9	4	4	4	4	4	4	4	4	4	3	3	3	3	3	58910	59380	59850	60310	60770	61220	61670
0	4	4	4	4	4	4	4	4	4	4	3	3	3	3	60060	60540	61010	61480	61950	62420	62880
1	4	4	4	4	4	4	4	4	4	4	4	3	3	3	61210	61700	62180	62660	63140	63610	64080
2	4	4	4	4	4	4	4	4	4	4	4	4	3	3	62360	62860	63350	63840	64320	64810	65290
3	4	4	4	4	4	4	4	4	4	4	4	4	4	3	63510	64010	64520	65020	65510	66000	66490
4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	64660	65170	65690	66190	66700	67200	67700
5	5	4	4	4	4	4	4	4	4	4	4	4	4	4	55810	66330	66850	67370	67890	68400	68900
6	5	5	4	4	4	4	4	4	4	4	4	4	4	4	66960	67490	68020	68550	69080	69600	70110
7	5	5	5	4	4	4	4	4	4	4	4	4	4	4	68110	68650	69190	69730	70260	70790	71320
8	5	5	5	5	4	4	4	4	4	4	4	4	4	4	69250	69810	70360	70910	71450	71990	72530
9	5	5	5	5	5	4	4	4	4	4	4	4	4	4	70400	70970	71530	72090	72640	73190	73740
0	5	5	5	5	5	5	4	4	4	4	4	4	4	4	71550	72130	72700	73270	73830	74390	74940

BLACK WARRIOR-TOMBIGBEE RIVER BASIN
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HOLT RESERVOIR
BLACK WARRIOR RIVER, ALABAMA
GATE OPERATING SCHEDULE
AND SPILLWAY DISCHARGE
SHEET 2 OF 5 SHEETS

EP ER	GATE OPENING IN FEET — GATE NUMBER 1	2	3	4	5	6	7	8	9	10	11	12	13	14	SPILLWAY DISCHARGE IN C.F.S. — POOL ELEVATION 185.5	186.0	186.5	187.0	187.5	188.0	188.5
91	5	5	5	5	5	5	5	4	4	4	4	4	4	4	72700	73290	73870	74450	75020	75590	76150
92	5	5	5	5	5	5	5	5	4	4	4	4	4	4	73850	74450	75040	75630	76210	76790	77360
93	5	5	5	5	5	5	5	5	5	4	4	4	4	4	75000	75610	76210	76810	77400	77980	78570
94	5	5	5	5	5	5	5	5	5	5	4	4	4	4	76150	76770	77380	77980	78590	79180	79780
95	5	5	5	5	5	5	5	5	5	5	5	4	4	4	77300	77930	78550	79160	79770	80380	80980
96	5	5	5	5	5	5	5	5	5	5	5	5	4	4	78450	79090	79720	80340	80960	81580	82190
97	5	5	5	5	5	5	5	5	5	5	5	5	5	4	79600	80250	80890	81520	82150	82780	83400
98	5	5	5	5	5	5	5	5	5	5	5	5	5	5	80750	81410	82060	82700	83340	83980	84610
99	6	5	5	5	5	5	5	5	5	5	5	5	5	5	81880	82550	83210	83860	84510	85160	85800
00	6	6	5	5	5	5	5	5	5	5	5	5	5	5	83020	83690	84360	85030	85690	86340	86990
01	6	6	6	5	5	5	5	5	5	5	5	5	5	5	84150	84840	85520	86190	86860	87530	88190
02	6	6	6	6	5	5	5	5	5	5	5	5	5	5	85280	85980	86670	87360	88040	88710	89380
03	6	6	6	6	6	5	5	5	5	5	5	5	5	5	86420	87120	87820	88520	89210	89890	90570
04	6	6	6	6	6	6	5	5	5	5	5	5	5	5	87550	88270	88980	89680	90380	91080	91770
05	6	6	6	6	6	6	6	5	5	5	5	5	5	5	88680	89410	90130	90850	91560	92260	92960
06	6	6	6	6	6	6	6	6	5	5	5	5	5	5	89820	90550	91290	92010	92730	93440	94150
07	6	6	6	6	6	6	6	6	6	5	5	5	5	5	90950	91700	92440	93170	93900	94630	95350
08	6	6	6	6	6	6	6	6	6	6	5	5	5	5	92080	92840	93590	94340	95080	95810	96540
09	6	6	6	6	6	6	6	6	6	6	6	5	5	5	93220	93990	94750	95500	96250	96990	97730
10	6	6	6	6	6	6	6	6	6	6	6	6	5	5	94350	95130	95900	96670	97420	98180	98920
11	6	6	6	6	6	6	6	6	6	6	6	6	6	5	95490	96270	97050	97830	98600	99360	100120
12	6	6	6	6	6	6	6	6	6	6	6	6	6	6	96620	97420	98210	98990	99770	100540	101310
13	8	6	6	6	6	6	6	6	6	6	6	6	6	6	98880	99700	100510	101310	102110	102910	103690
14	8	8	6	6	6	6	6	6	6	6	6	6	6	6	101140	101980	102810	103640	104460	105270	106080
15	8	8	8	6	6	6	6	6	6	6	6	6	6	6	103400	104260	105110	105960	106800	107630	108460
16	8	8	8	8	6	6	6	6	6	6	6	6	6	6	105650	106540	107410	108280	109140	110000	110850
17	8	8	8	8	8	6	6	6	6	6	6	6	6	6	107910	108820	109710	110600	111490	112360	113230
18	8	8	8	8	8	8	6	6	6	6	6	6	6	6	110170	111100	112020	112930	113830	114720	115610
19	8	8	8	8	8	8	8	6	6	6	6	6	6	6	112430	113380	114320	115250	116170	117090	118000
20	8	8	8	8	8	8	8	8	6	6	6	6	6	6	114690	115660	116620	117570	118510	119450	120380
21	8	8	8	8	8	8	8	8	8	6	6	6	6	6	116950	117940	118920	119890	120860	121820	122760
22	8	8	8	8	8	8	8	8	8	8	6	6	6	6	119210	120220	121220	122220	123200	124180	125150
23	8	8	8	8	8	8	8	8	8	8	8	6	6	6	121470	122500	123520	124540	125540	126540	127530
24	8	8	8	8	8	8	8	8	8	8	8	8	6	6	123730	124780	125820	126860	127890	128910	129920
25	8	8	8	8	8	8	8	8	8	8	8	8	8	6	125990	127060	128130	129180	130230	131270	132300
26	8	8	8	8	8	8	8	8	8	8	8	8	8	8	128250	129340	130430	131500	132570	133630	134680
27	10	8	8	8	8	8	8	8	8	8	8	8	8	8	130440	131560	132670	133770	134860	135940	137010
28	10	10	8	8	8	8	8	8	8	8	8	8	8	8	132640	133780	134910	136030	137150	138250	139340
29	10	10	10	8	8	8	8	8	8	8	8	8	8	8	134840	136000	137160	138300	139430	140560	141670
30	10	10	10	10	8	8	8	8	8	8	8	8	8	8	137040	138230	139400	140560	141720	142870	144000
31	10	10	10	10	10	8	8	8	8	8	8	8	8	8	139240	140450	141640	142830	144010	145170	146330
32	10	10	10	10	10	10	8	8	8	8	8	8	8	8	141440	142670	143890	145100	146290	147480	148660
33	10	10	10	10	10	10	10	8	8	8	8	8	8	8	143640	144890	146130	147360	148580	149790	150990
34	10	10	10	10	10	10	10	10	8	8	8	8	8	8	145840	147110	148370	149630	150870	152100	153320
35	10	10	10	10	10	10	10	10	10	8	8	8	8	8	148040	149330	150620	151890	153150	154410	155650

BLACK WARRIOR-TOMBIGBEE RIVER BASIN
RESERVOIR REGULATION MANUAL
HOLT RESERVOIR
BLACK WARRIOR RIVER, ALABAMA
GATE OPERATING SCHEDULE
AND SPILLWAY DISCHARGE

SHEET 3 OF 5 SHEETS

APPENDIX B CHART NO. 9

EP BER	GATE OPENING IN FEET — GATE NUMBER														SPILLWAY DISCHARGE IN C.F.S. — POOL ELEVATION						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	185.5	186.0	186.5	187.0	187.5	188.0	188.5
46	10	10	10	10	10	10	10	10	10	10	8	8	8	8	150240	151550	152860	154160	155440	156710	157980
47	10	10	10	10	10	10	10	10	10	10	10	8	8	8	152440	153780	155100	156420	157730	159020	160310
48	10	10	10	10	10	10	10	10	10	10	10	10	8	8	154630	156000	157350	158690	160010	161330	162640
49	10	10	10	10	10	10	10	10	10	10	10	10	10	8	156830	158220	159590	160950	162300	163640	164970
50	10	10	10	10	10	10	10	10	10	10	10	10	10	10	159030	160440	161830	163220	164590	165950	167300
51	12	10	10	10	10	10	10	10	10	10	10	10	10	10	161190	162620	164040	165450	166840	168220	169590
52	12	12	10	10	10	10	10	10	10	10	10	10	10	10	163350	164810	166250	167680	169090	170500	171890
53	12	12	12	10	10	10	10	10	10	10	10	10	10	10	165510	166990	168450	169900	171340	172770	174190
54	12	12	12	12	10	10	10	10	10	10	10	10	10	10	167670	169170	170660	172130	173600	175050	176480
55	12	12	12	12	12	10	10	10	10	10	10	10	10	10	169830	171360	172870	174360	175850	177320	178780
56	12	12	12	12	12	12	10	10	10	10	10	10	10	10	171990	173540	175070	176590	178100	179600	181080
57	12	12	12	12	12	12	12	10	10	10	10	10	10	10	174150	175720	177280	178820	180350	181870	183380
58	12	12	12	12	12	12	12	12	10	10	10	10	10	10	176310	177910	179490	181050	182610	184150	185670
59	12	12	12	12	12	12	12	12	12	10	10	10	10	10	178470	180090	181690	183280	184860	186420	187970
60	12	12	12	12	12	12	12	12	12	12	10	10	10	10	180630	182270	183900	185510	187110	188700	190270
61	12	12	12	12	12	12	12	12	12	12	12	10	10	10	182790	184450	186110	187740	189360	190970	192560
62	12	12	12	12	12	12	12	12	12	12	12	12	10	10	184950	186640	188310	189970	191610	193240	194860
63	12	12	12	12	12	12	12	12	12	12	12	12	12	10	187110	188820	190520	192200	193870	195520	197160
64	12	12	12	12	12	12	12	12	12	12	12	12	12	12	189270	191000	192720	194430	196120	197790	199460
65	16	12	12	12	12	12	12	12	12	12	12	12	12	12	193450	195240	197010	198760	200500	202230	203940
66	16	16	12	12	12	12	12	12	12	12	12	12	12	12	197630	199470	201290	203100	204880	206660	208420
67	16	16	16	12	12	12	12	12	12	12	12	12	12	12	201810	203700	205570	207430	209270	210930	212290
68	16	16	16	16	12	12	12	12	12	12	12	12	12	12	205990	207930	209860	211450	212910	214350	215790
69	16	16	16	16	16	12	12	12	12	12	12	12	12	12	210170	211790	213340	214880	216420	217950	219470
70	16	16	16	16	16	16	12	12	12	12	12	12	12	12	213570	215220	216850	218480	220110	221720	223320
71	16	16	16	16	16	16	16	12	12	12	12	12	12	12	217090	218830	220550	222270	223980	225680	227290
72	16	16	16	16	16	16	16	16	12	12	12	12	12	12	220800	222630	224450	226260	227820	229230	230640
73	16	16	16	16	16	16	16	16	16	12	12	12	12	12	224700	226630	228160	229620	231060	232500	233940
74	16	16	16	16	16	16	16	16	16	16	12	12	12	12	228320	229810	231300	232780	234260	235730	237190
75	16	16	16	16	16	16	16	16	16	16	16	12	12	12	231350	232870	234390	235900	237400	238910	240400
76	16	16	16	16	16	16	16	16	16	16	16	16	12	12	234340	235890	237440	238980	240510	242040	243560
77	16	16	16	16	16	16	16	16	16	16	16	16	16	12	237290	238860	240440	242010	243570	245120	246670
78	16	16	16	16	16	16	16	16	16	16	16	16	16	16	240190	241790	243390	244990	246580	248160	249730
79	20	16	16	16	16	16	16	16	16	16	16	16	16	16	243100	244770	246400	248020	249640	251250	252850
80	20	20	16	16	16	16	16	16	16	16	16	16	16	16	246040	247710	249360	251010	252650	254290	255930
71	20	20	20	16	16	16	16	16	16	16	16	16	16	16	248900	250590	252270	253950	255620	257300	258960
72	20	20	20	20	16	16	16	16	16	16	16	16	16	16	251710	253430	255140	256850	258560	260260	261960
73	20	20	20	20	20	16	16	16	16	16	16	16	16	16	254470	256220	257970	259710	261450	263190	264920
74	20	20	20	20	20	20	16	16	15	16	16	16	16	16	257200	258990	260770	262540	264310	266070	267840
75	20	20	20	20	20	20	20	16	16	16	16	16	16	16	259900	261710	263520	265330	267130	268920	270710
76	20	20	20	20	20	20	20	20	16	16	16	16	16	16	262550	264400	266240	268080	269910	271730	273550
77	20	20	20	20	20	20	20	20	20	16	16	16	16	16	265170	267050	268920	270790	272650	274500	276350
78	20	20	20	20	20	20	20	20	20	20	16	16	16	16	267760	269660	271560	273460	275350	277230	279110
79	20	20	20	20	20	20	20	20	20	20	20	16	16	16	270300	272240	274170	276090	278010	279930	281840
80	20	20	20	20	20	20	20	20	20	20	20	20	16	16	272810	274780	276740	278690	280640	282580	284520

BLACK WARRIOR-TOMBIGBEE RIVER BASIN
RESERVOIR REGULATION MANUAL
HOLT RESERVOIR
BLACK WARRIOR RIVER, ALABAMA
GATE OPERATING SCHEDULE
AND SPILLWAY DISCHARGE
SHEET 4 OF 5 SHEETS

APPENDIX B CHART NO. 10

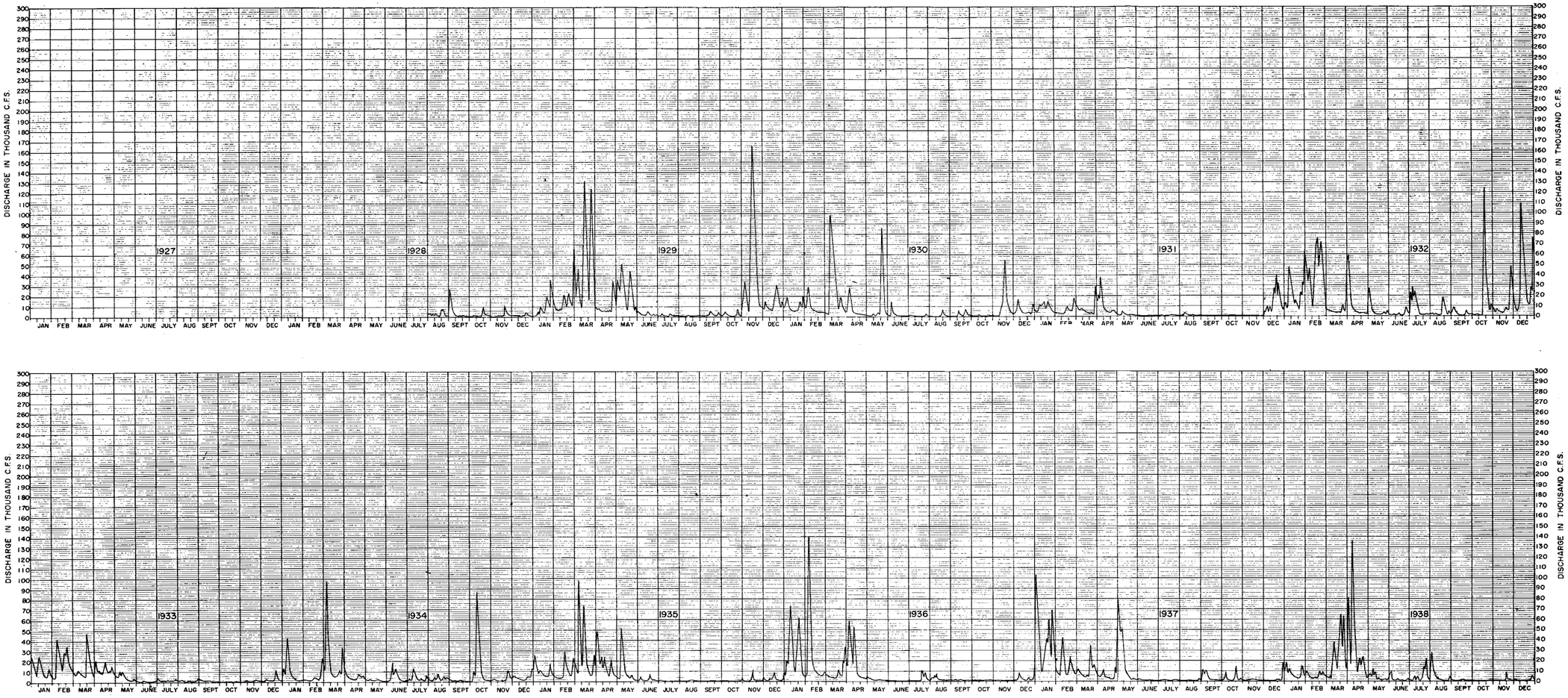
STEP NUMBER	GATE OPENING IN FEET — GATE NUMBER 1	2	3	4	5	6	7	8	9	10	11	12	13	14	SPILLWAY DISCHARGE IN C.F.S. — POOL ELEVATION 185.5	186.0	186.5	187.0	187.5	188.0	188.5
181	20	20	20	20	20	20	20	20	20	20	20	20	20	16	275290	277280	279270	281250	283230	285200	287160
182	20	20	20	20	20	20	20	20	20	20	20	20	20	20	277730	279750	281770	283780	285780	287780	289770
183	FULL	20	20	20	20	20	20	20	20	20	20	20	20	20	282040	284350	286700	289100	291400	293810	296120
184	FULL	FULL	20	20	20	20	20	20	20	20	20	20	20	20	286620	289220	291920	294730	297330	300170	302830
185	FULL	FULL	FULL	20	20	20	20	20	20	20	20	20	20	20	291470	294390	297450	300690	303600	306910	309930
186	FULL	FULL	FULL	FULL	20	20	20	20	20	20	20	20	20	20	296620	299870	303320	307010	310270	314050	317460
187	FULL	FULL	FULL	FULL	FULL	20	20	20	20	20	20	20	20	20	302090	305690	309550	313720	317330	321610	325410
188	FULL	FULL	FULL	FULL	FULL	FULL	20	20	20	20	20	20	20	20	307910	311880	316160	320830	324800	329600	333820
189	FULL	FULL	FULL	FULL	FULL	FULL	FULL	20	20	20	20	20	20	20	314110	318460	323180	328370	332720	338070	342720
190	FULL	FULL	FULL	FULL	FULL	FULL	FULL	FULL	20	20	20	20	20	20	320720	325470	330660	336400	341160	347070	352160
191	FULL	FULL	FULL	FULL	FULL	FULL	FULL	FULL	FULL	20	20	20	20	20	327780	332950	338630	344940	350090	356570	362100
192	FULL	FULL	FULL	FULL	FULL	FULL	FULL	FULL	FULL	FULL	20	20	20	20	335320	340920	347100	353960	359530	366570	372530
193	FULL	FULL	FULL	FULL	FULL	FULL	FULL	FULL	FULL	FULL	FULL	20	20	20	343360	349420	356090	363490	369450	377080	383510
194	FULL	FULL	FULL	FULL	FULL	FULL	FULL	FULL	FULL	FULL	FULL	FULL	20	20	351940	358390	365540	373540	379910	387960	394630
195	FULL	FULL	FULL	FULL	FULL	FULL	FULL	FULL	FULL	FULL	FULL	FULL	FULL	20	360970	367870	375430	383690	390240	398480	405350
196	FULL	FULL	FULL	FULL	FULL	FULL	FULL	FULL	FULL	FULL	FULL	FULL	FULL	FULL	370000	377000	385000	393000	400000	408000	415000

BLACK WARRIOR-TOMBIGBEE RIVER BASIN
RESERVOIR REGULATION MANUAL
HOLT RESERVOIR
BLACK WARRIOR RIVER, ALABAMA

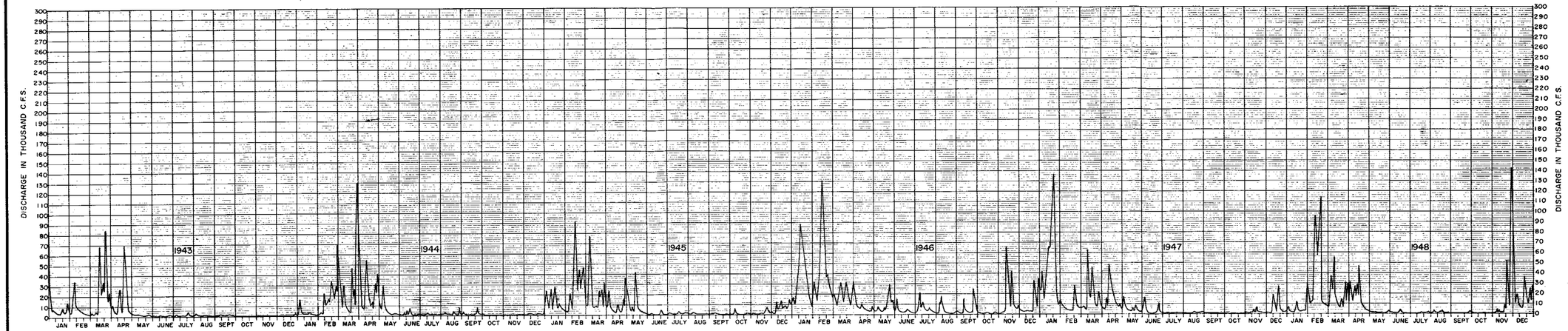
GATE OPERATING SCHEDULE
AND SPILLWAY DISCHARGE

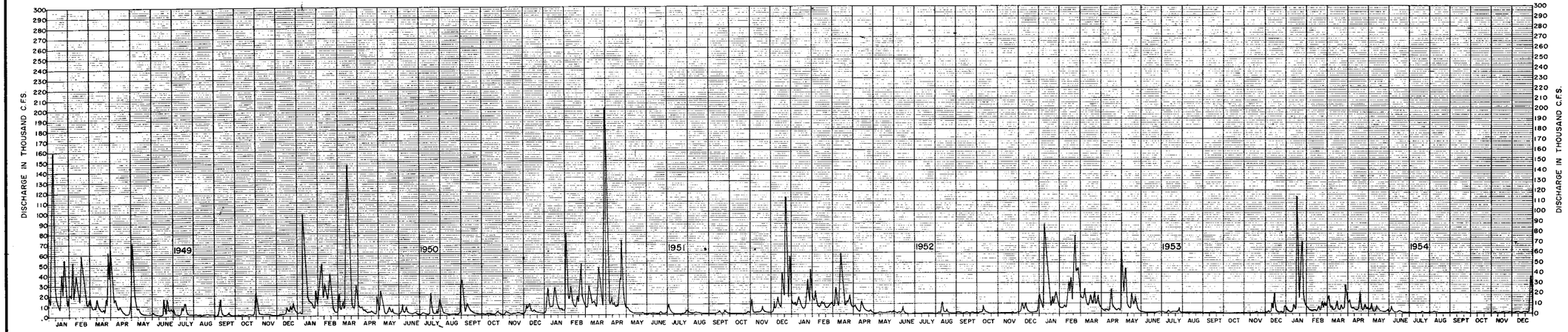
SHEET 5 OF 5 SHEETS

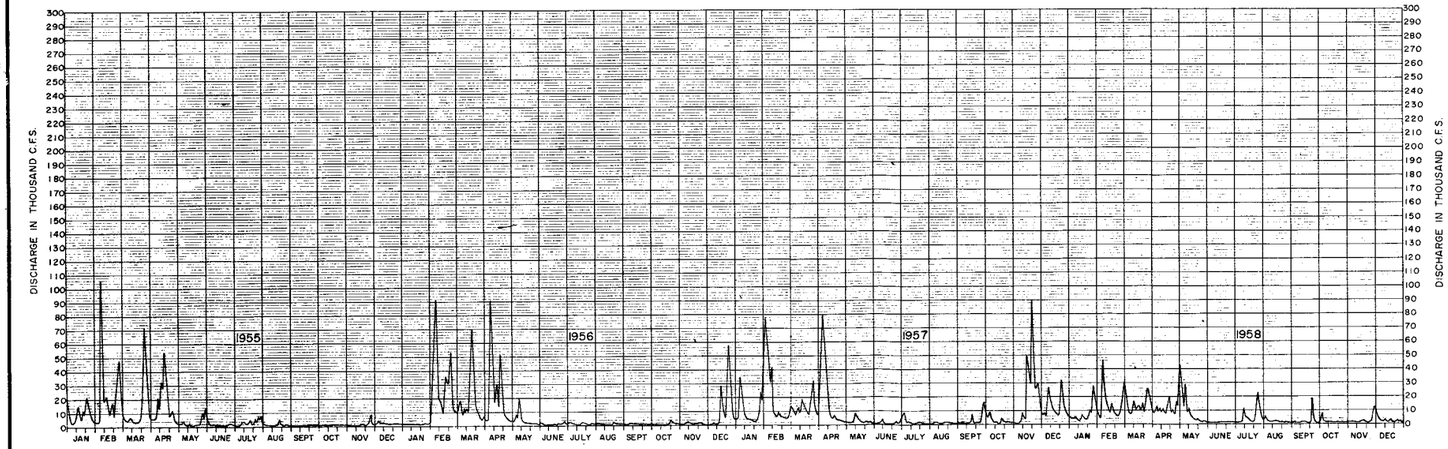
APPENDIX B CHART NO. 11



BLACK WARRIOR TOMBIGBEE RIVER BASIN
RESERVOIR REGULATION MANUAL
HOLT RESERVOIR
BLACK WARRIOR RIVER, ALABAMA
HYDROGRAPHS
AVERAGE DAILY DISCHARGE AT DAMSITE







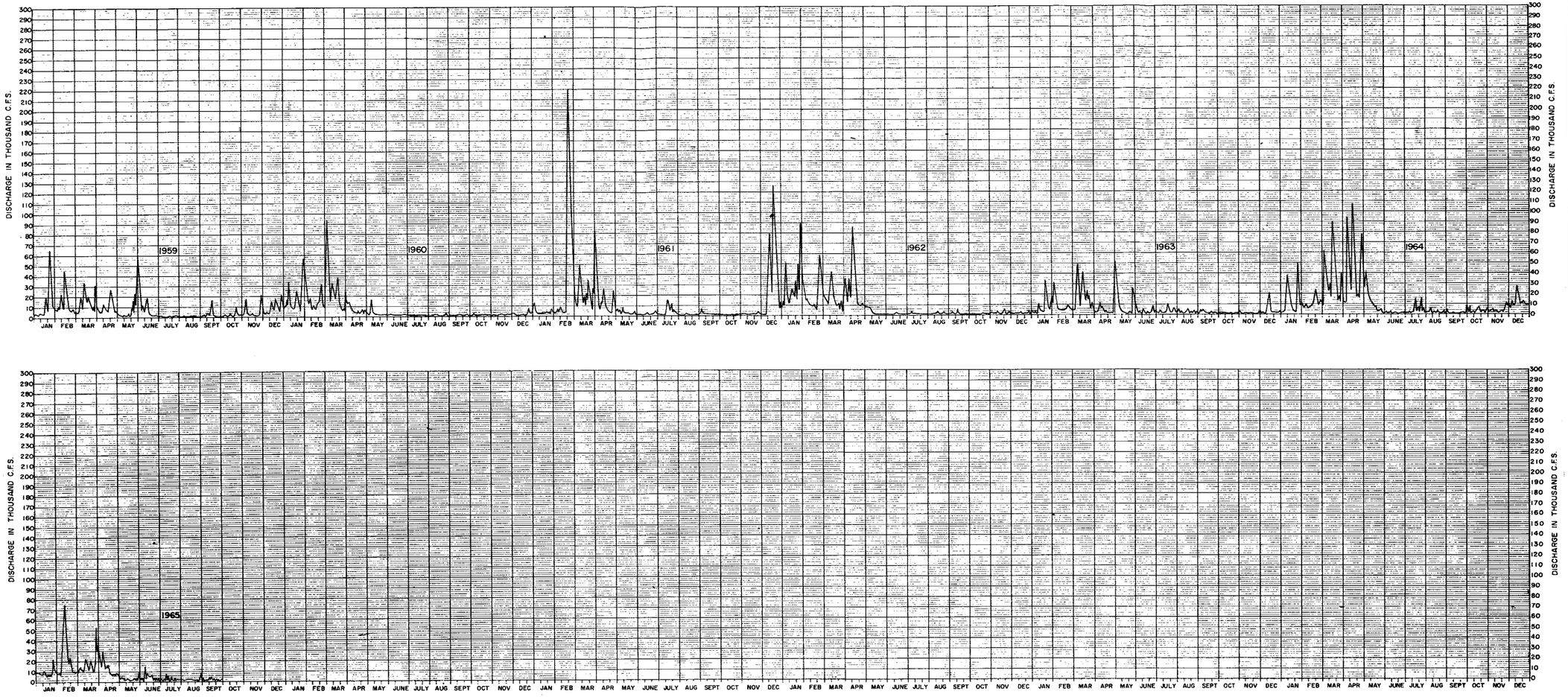
BLACK WARRIOR TOMBIGBEE RIVER BASIN
RESERVOIR REGULATION MANUAL

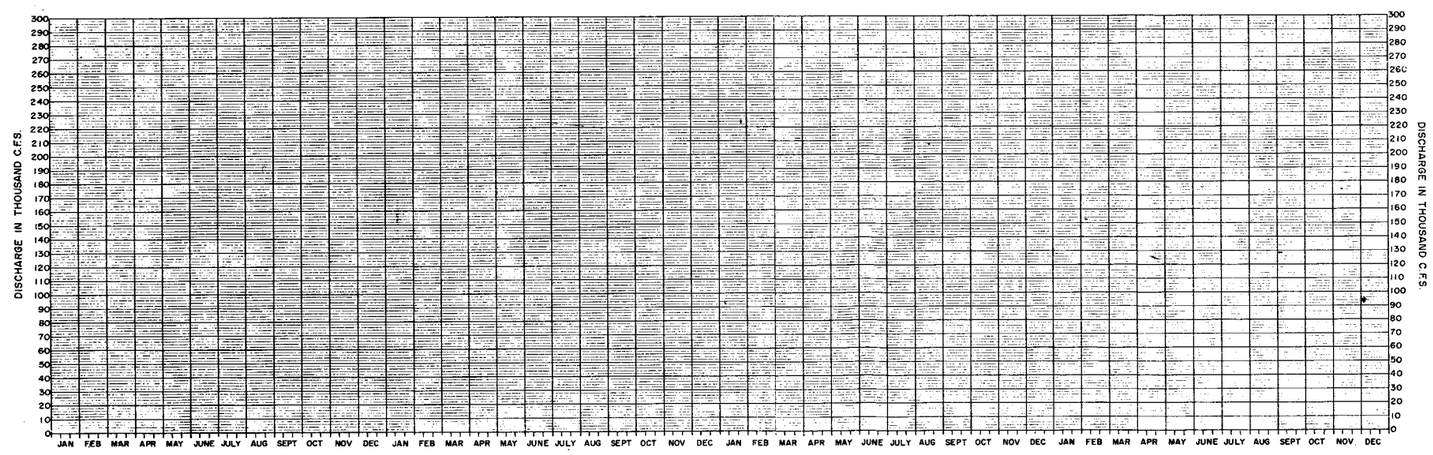
HOLT RESERVOIR

BLACK WARRIOR RIVER, ALABAMA

HYDROGRAPHS

AVERAGE DAILY DISCHARGE AT DAMSITE





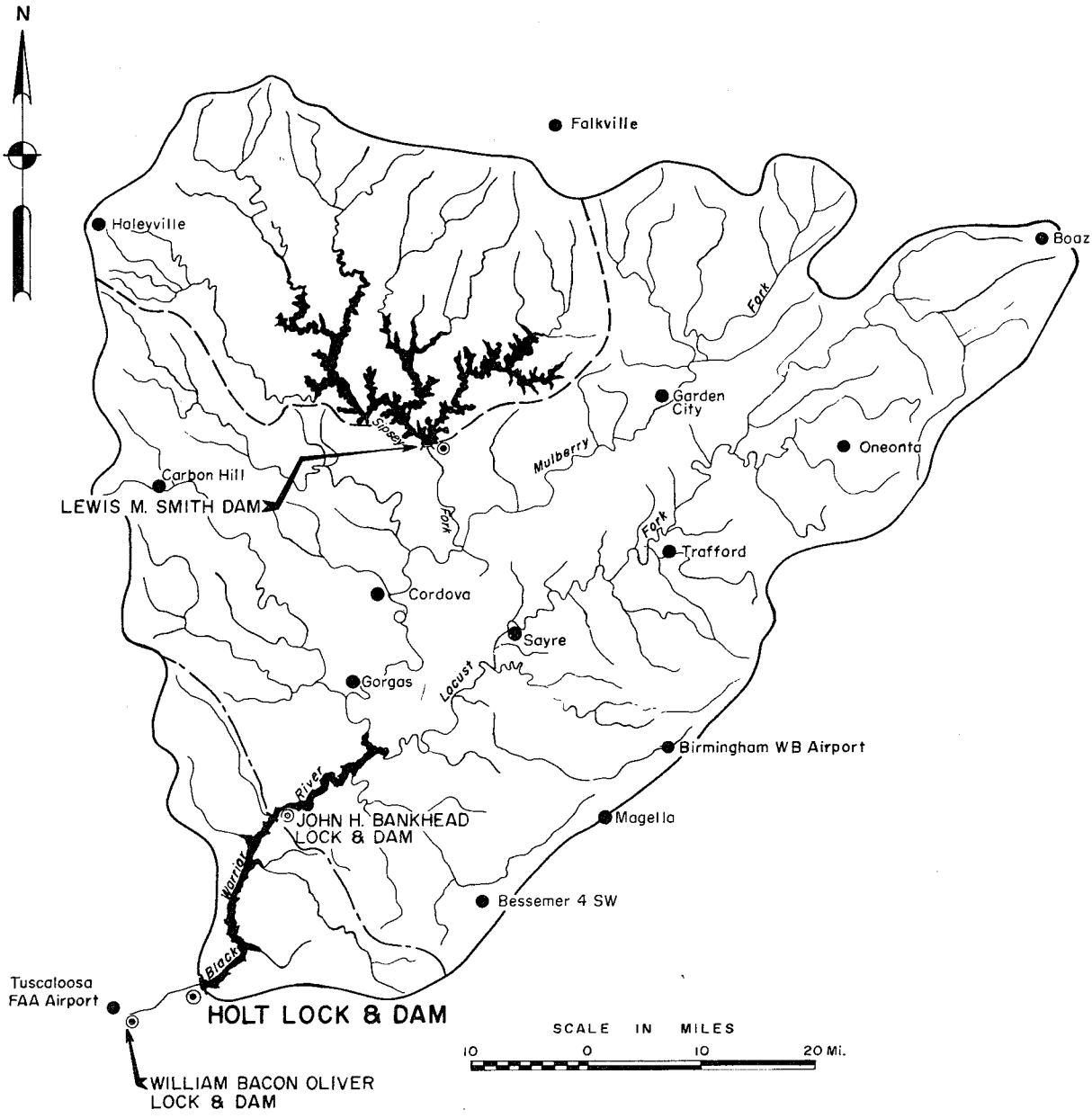
BLACK WARRIOR TOMBIGBEE RIVER BASIN
RESERVOIR REGULATION MANUAL

HOLT RESERVOIR

BLACK WARRIOR RIVER, ALABAMA

HYDROGRAPHS

AVERAGE DAILY DISCHARGE AT DAMSITE



LEGEND

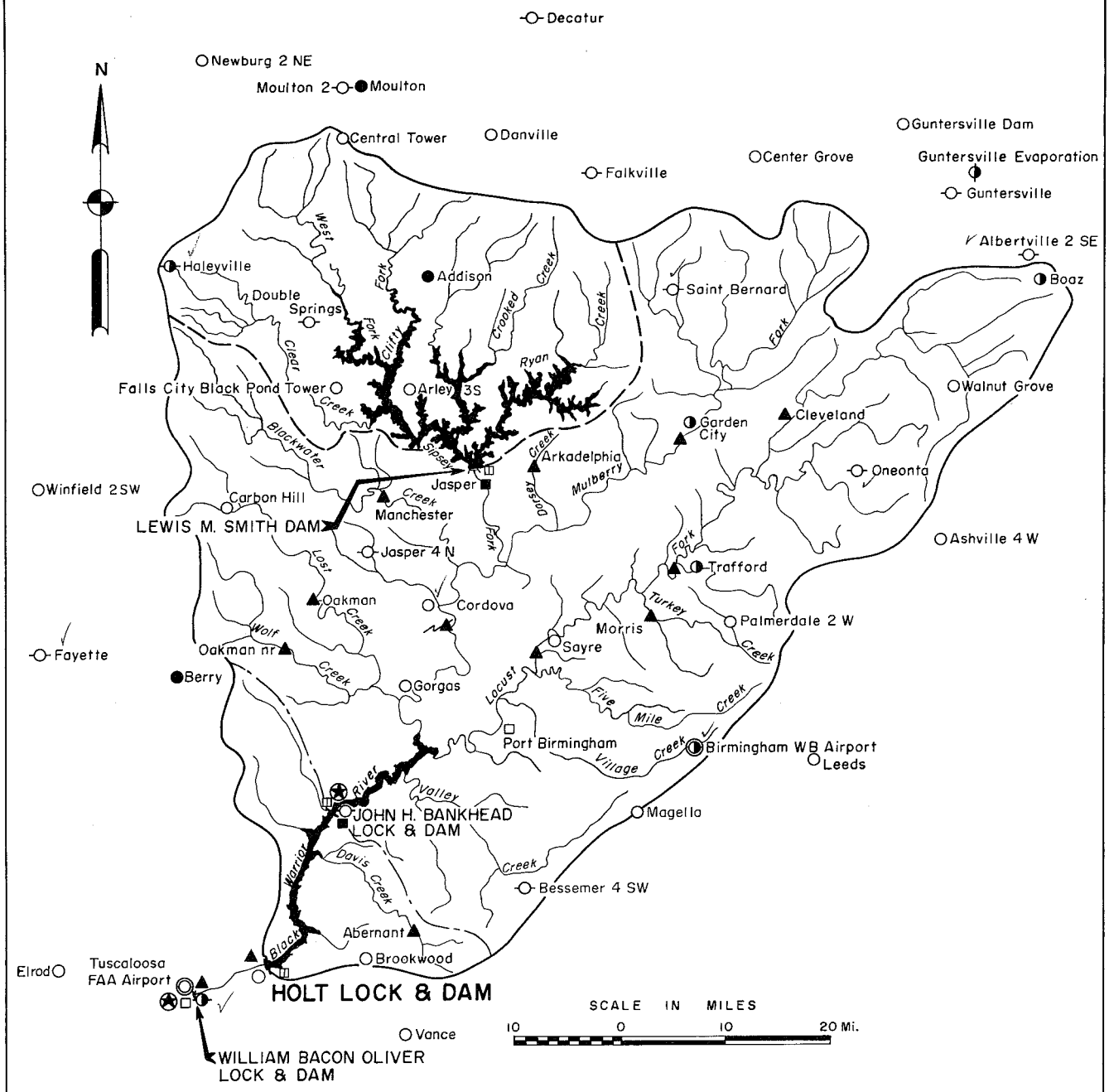
- ● RAINFALL STATION
- ◉ RAINFALL AND RIVER STAGE STATIONS
- ○ RIVER STAGE STATION

BLACK WARRIOR TOMBIGBEE RIVER BASIN
RESERVOIR REGULATION MANUAL

HOLT RESERVOIR

BLACK WARRIOR RIVER, ALA.

RAINFALL AND RIVER STAGE REPORTING NETWORK



LEGEND

RECORDING	NON-RECORDING	
●	○	PRECIPITATION STATION
●	-○-	PRECIPITATION AND TEMPERATURE
●	-○-	PRECIPITATION AND EVAPORATION
◉	◎	COMPLETE METEOROLOGICAL STATION
▲	△	RIVER GAGE, RATED
■	□	RIVER GAGE, STAGE ONLY
◧	◫	RESERVOIR OR LAKE GAGE
★		STATIONS FOR WHICH WEATHER BUREAU ISSUES STAGE FORECASTS
◑		INDICATES RECORDING AND NON-RECORDING GAGES AT SAME LOCATION
⟋		WHEN USED IN COMBINATION WITH OTHER SYMBOLS INDICATES REMOTE TELEPHONIC REPORTING GAGE
—— —— ——		DRAINAGE BASIN ABOVE LEWIS M. SMITH DAM
——·——		DRAINAGE BASIN ABOVE BANKHEAD L. & D.

BLACK WARRIOR TOMBIGBEE RIVER BASIN
RESERVOIR REGULATION MANUAL
HOLT RESERVOIR
BLACK WARRIOR RIVER, ALABAMA

GENERAL HYDROLOGIC MAP

WB Form 612-20
(Formerly 1087[b])

(656)

U. S. Department of Commerce—Weather Bureau

REPORTING INSTRUCTIONS

RAINFALL STATION

TIMES OF OBSERVATION

1. Your regular daily observation of precipitation should be taken at 7 a. m. each day. (EMPTY NON-RECORDING RAIN GAGE AFTER EACH 7 A. M. OBSERVATION.)

2. Special observations when made should be taken at 1 p. m., and 7 p. m. These special observations should be taken ONLY when a report is required in accordance with instructions (see below).

WHEN TO REPORT

1. Make an initial report at 7 a. m., 1 p. m., or 7 p. m., whenever 0.50 or more of precipitation has accumulated in the rain gage.
2. After the first report has been made CONTINUE REPORTING at each observation time (1 p. m., 7 p. m., 7 a. m.) as long as any additional precipitation has occurred since your previous report.
3. If you have made a final report, but it begins to rain again in less than 24 hours start reporting again, just as though you had not stopped. That is, you should not consider the storm to be over until there has been no precipitation for 24 hours.

WHAT TO REPORT

Your report should include the following information in the order listed (Numbers refer to WB Form 1089):

(1) Time of observation (hour).

(2) Amount of precipitation in gage at time of observation, in figures (inches and hundredths).

(3) Character of precipitation as it fell (rain, snow, sleet, etc.).

(4) Amount of precipitation measured at PREVIOUS 7 A. M. OBSERVATION, in figures (inches and hundredths). This information should be sent ONLY in your first report of a series of reports. The amount, when sent, should always be preceded by "Previous 7 a. m." In subsequent reports omit this section entirely.

(5) Weather at time of observation (clear, cloudy, raining, snowing, etc.).

(6) Depth of snow or ice on ground, in figures (nearest inch). The figure showing depth should always be followed by the word "Inch" or "Inches." If there is no snow on the ground omit this section entirely.

(12) Remarks. Any general comments which you feel would be of real value to the forecaster, such as: If snow is melting state whether slowly or rapidly. If thunderstorm or unusually heavy shower occurred within short period of time, give time of beginning and ending, etc. If instructed, include temperature readings.

(13) Last name of observer.

PREPARATION OF REPORT

1. The special River Rainfall Report card (WB Form 1089) furnished will assist you in arranging your report in the proper order. This form has numbered blocks for each of the items to be reported by river and rainfall observers.
2. You should enter the designated information in blocks 1 through 6, 12, and 13. Each report must be complete. Your report will then be ready for transmission in message form as follows (Indicate on card whether report has been telephoned or telegraphed).

Sample messages:

(First of a series)—"7 A. M. 0.75 SNOW PREVIOUS 7 A. M. 0.25 CLOUDY 6 INCHES MELTING RAPIDLY JONES"

(Subsequent reports)

"1 P. M. 0.30 RAIN CLOUDY 4 INCHES MELTING RAPIDLY JONES"

"7 P. M. 1.20 SHOWERS CLEAR THUNDERSTORM 4 P. M. JONES"

SENDING THE REPORT

1. If you report by telegram, address message to_____
_____
2. If you report by telephone, call_____
_____
3. All messages should be sent COLLECT.
4. If you customarily report by telegram, use telephone when telegraph office is closed.
5. If you customarily report by telephone and the lines are out of order, report by telegram, if possible.
6. In an emergency, when all land lines of communication are out, contact your local or state police who may be able to transmit your report by police radio.

NOTES

1. Promptly after each observation, mail the River Rainfall Report card which you have filled out, to_____
_____
2. When additional supplies are needed, notify_____
_____
_____
3. SPECIAL INSTRUCTIONS: _____
_____
_____

WB Form 612-20

FLOOD REPORTS

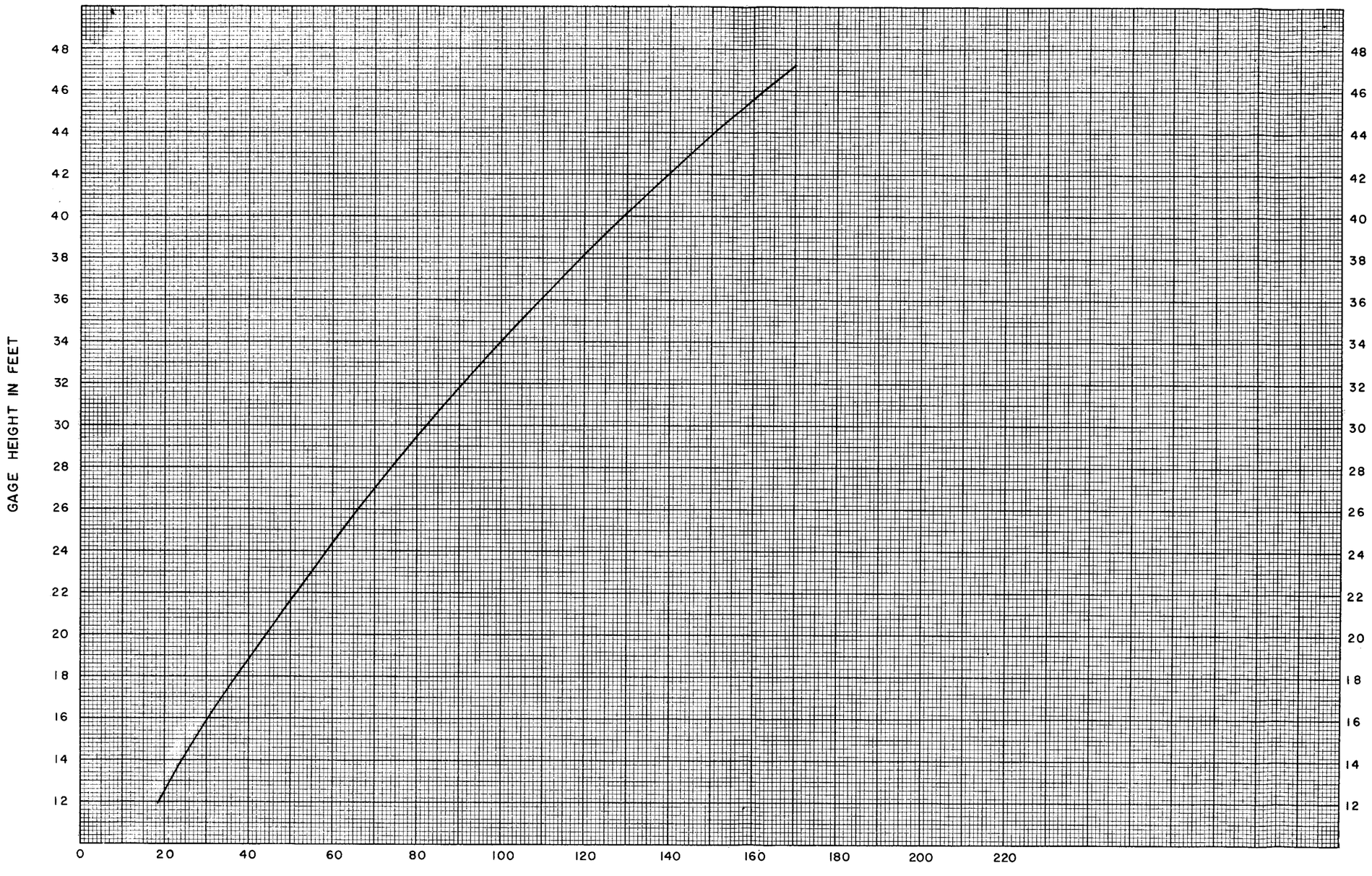
	DRAINAGE	CODE	STATION		24-HOUR RAINFALL ENDING AT 7:30 AM (APPROX)							STORM TOTAL
BLACK WARRIOR RIVER	Sipsey Fork		Faulkville	Ala.								
	Sipsey Fork		Haleyville	Ala.								
	Sipsey Fork		Arley	Ala.								
	Sipsey Fork		Smith Dam	Ala.								
	Mulberry Fork		Garden City	Ala.								
	Mulberry Fork		Cordova	Ala.								
	Mulberry Fork		Gorgas	Ala.								
	Mulberry Fork		Carbon Hill	Ala.								
	Locust Fork		Boaz	Ala.								
	Locust Fork		Oneonta	Ala.								
	Locust Fork		Trafford	Ala.								
	Locust Fork		Sayre (Dora)	Ala.								
	Village Cr	BHM	Birmingham Apt	Ala.								
	Valley Cr		Magella	Ala.								
	Valley Cr		Bessemer	Ala.								
	-		Bankhead APC	Ala.								
	-	BLAL	Bankhead L & D	Ala.								
	-		Holt L & D	Ala.								
	-	TCL	Oliver L & D	Ala.								
	-	TCL	Tuscaloosa Apt	Ala.								
	-	WAAL	Warrior L & D	Ala.								
	-	DEAL	Demopolis L & D	Ala.								

SPECIAL RAINFALL AND RIVER STAGE REPORTS
UPPER BLACK WARRIOR BASIN
FLOOD REPORTS

DATE TIME	CORDOVA	BANKHEAD L & D				HOLT L & D			OLIVER L & D			RAINFALL		
	STAGE	UPPER	LOWER	GATES	RAIN-FALL	UPPER	LOWER	RAIN-FALL	UPPER	LOWER	RAIN-FALL	LEWIS SMITH	GORGAS	MAGELLA
7 A														
8														
9														
10														
11														
NOON														
1 P														
2														
3														
4														
5														
6														
7														
8														
9														
10														
11														
MDN														
1 A														
2														
3														
4														
5														
6														
7 A														

NOTE RAINFALL IS BASED ON READINGS SINCE 7 AM.

APPENDIX B CHART NO. 19

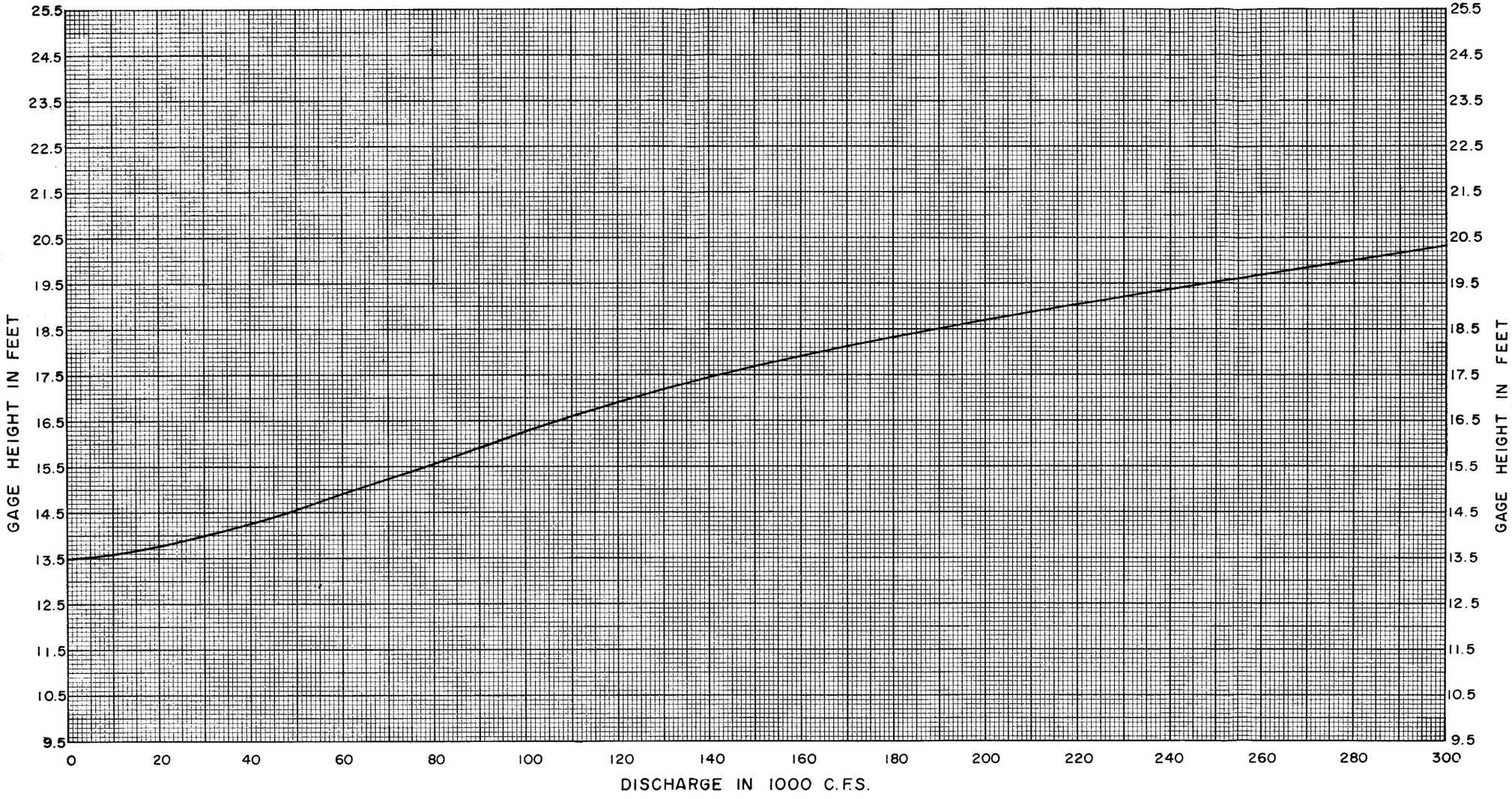


NOTE:
ELEVATION OF GAGE ZERO IS 243.6 FEET M.S.L.

BLACK WARRIOR TOMBIGBEE RIVER BASIN
RESERVOIR REGULATION MANUAL

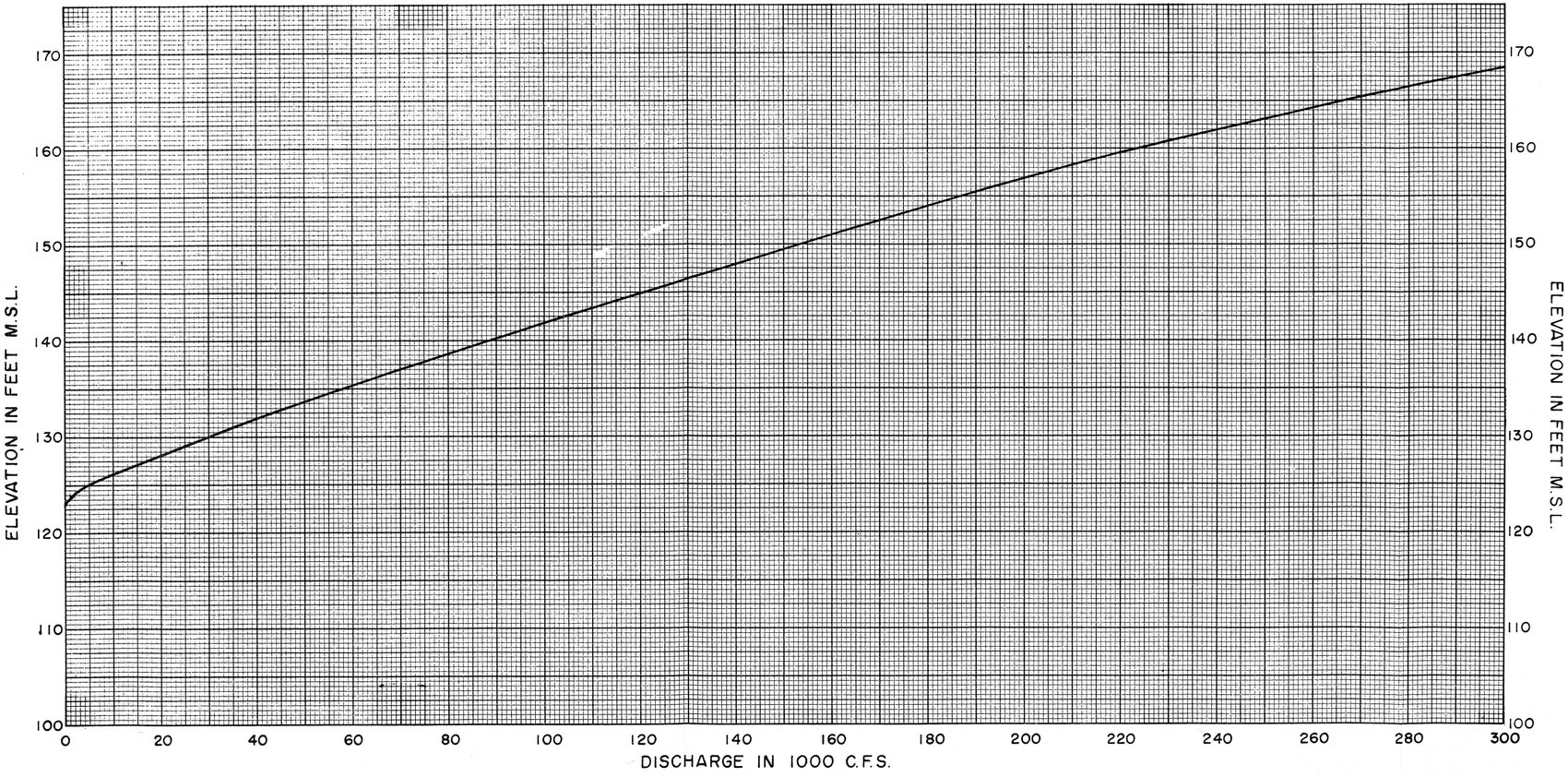
HOLT RESERVOIR
BLACK WARRIOR RIVER, ALA.

RATING CURVE FOR
MULBERRY FORK AT CORDOVA, ALA
DRAINAGE AREA = 1,927 SQUARE MILES



NOTES:
DISCHARGE BASED ON POOL ELEVATION OF 187.0 AT HOLT LOCK AND DAM.
ELEVATION OF GAGE ZERO IS 173.5 FEET M.S.L.

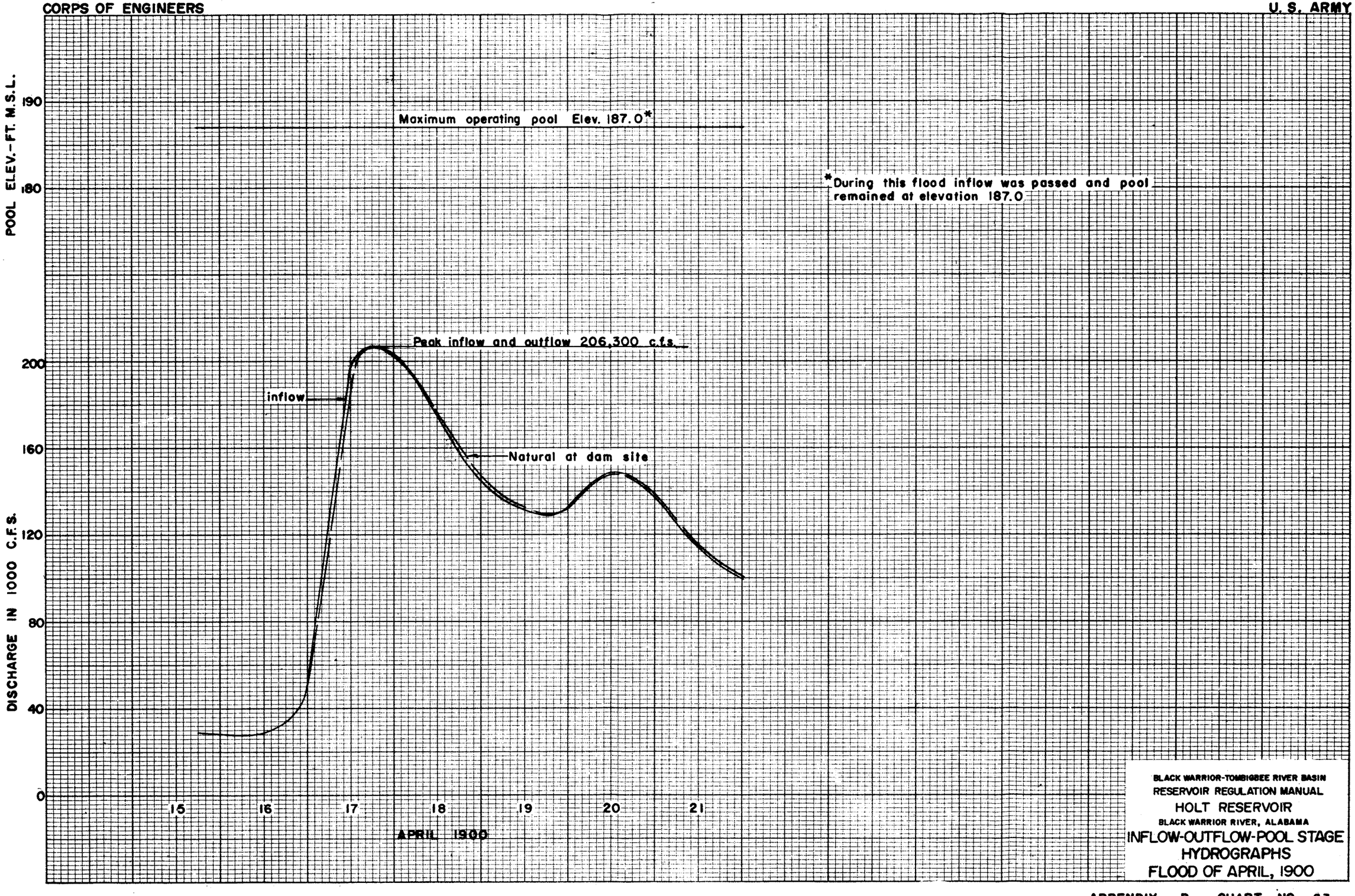
BLACK WARRIOR-TOMBIGBEE RIVER BASIN
RESERVOIR REGULATION MANUAL
HOLT RESERVOIR
BLACK WARRIOR RIVER, ALABAMA
TAILWATER RATING CURVE
FOR BANKHEAD LOCK & DAM



BLACK WARRIOR TOMBIGBEE RIVER BASIN
RESERVOIR REGULATION MANUAL
HOLT RESERVOIR
BLACK WARRIOR RIVER, ALA.

TAILWATER RATING CURVE

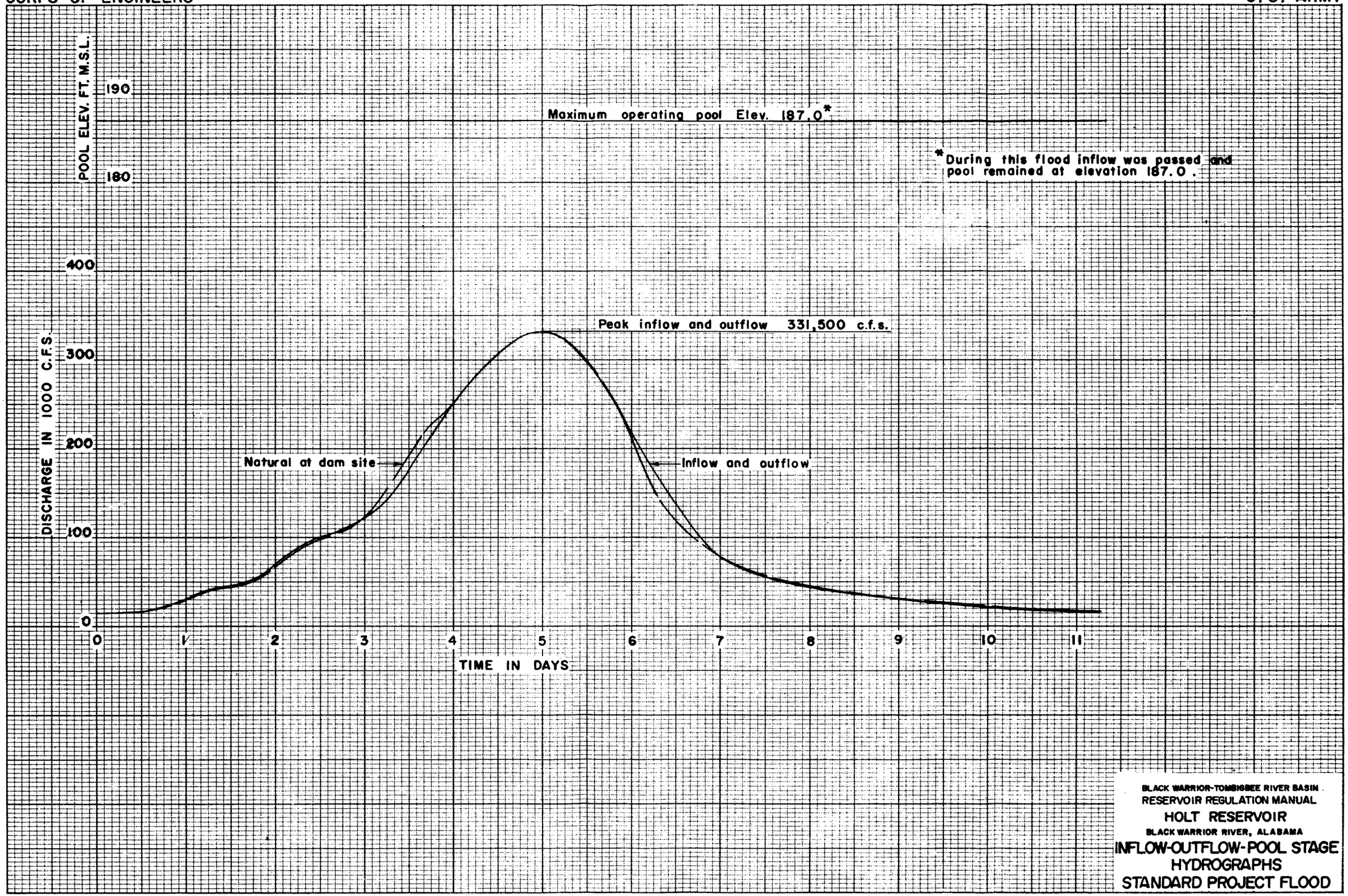
CORPS OF ENGINEERS U. S. ARMY



BLACK WARRIOR-TOMBIGBEE RIVER BASIN
RESERVOIR REGULATION MANUAL
HOLT RESERVOIR
BLACK WARRIOR RIVER, ALABAMA
INFLOW-OUTFLOW-POOL STAGE HYDROGRAPHS
FLOOD OF APRIL, 1900

APPENDIX B CHART NO. 23

CORPS OF ENGINEERS U. S. ARMY

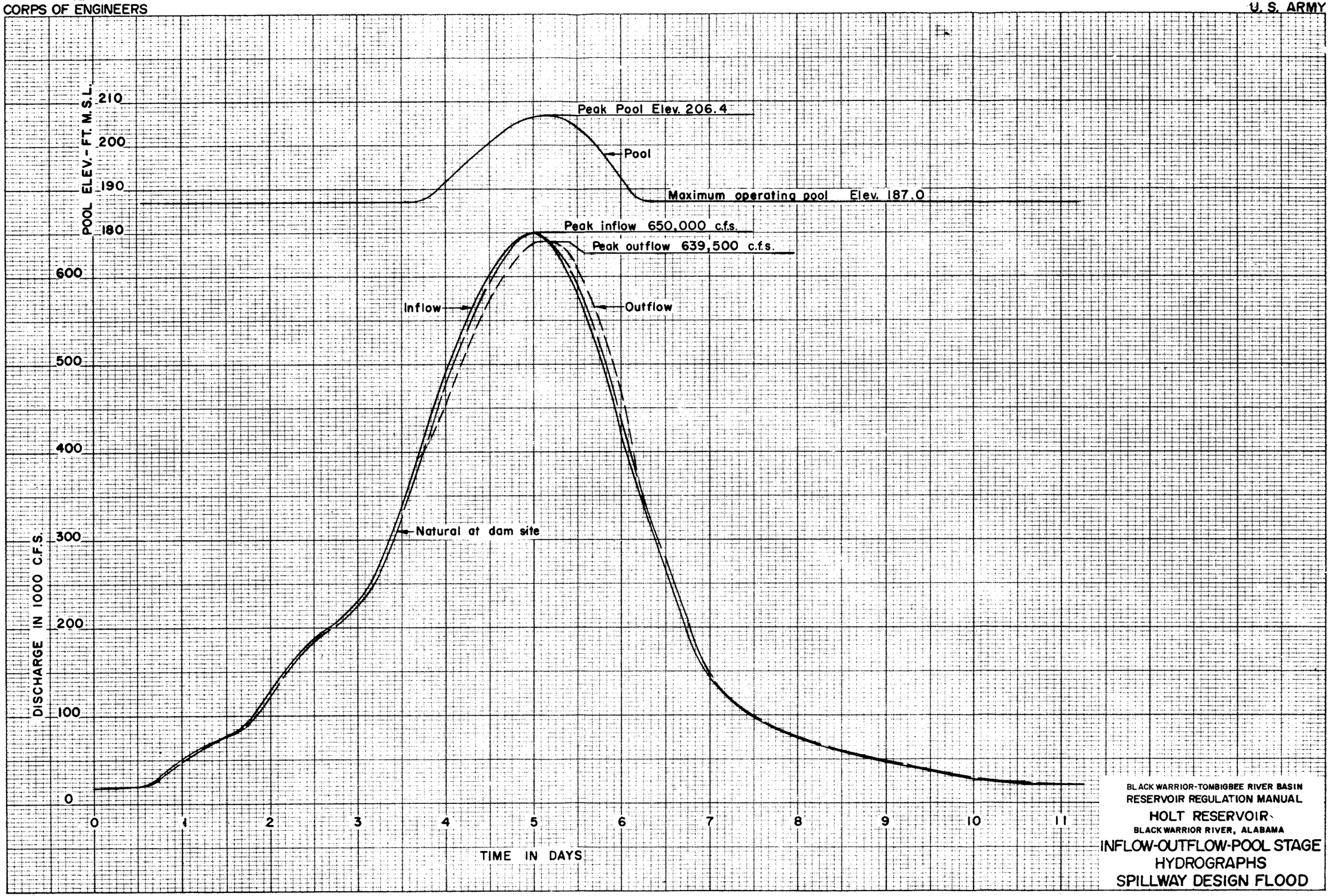


BLACK WARRIOR-TOMBIGBEE RIVER BASIN
RESERVOIR REGULATION MANUAL
HOLT RESERVOIR
BLACK WARRIOR RIVER, ALABAMA
INFLOW-OUTFLOW-POOL STAGE HYDROGRAPHS
STANDARD PROJECT FLOOD

APPENDIX B CHART NO. 24

CORPS OF ENGINEERS

U. S. ARMY



BLACK WARRIOR-TOMBIGBEE RIVER BASIN
RESERVOIR REGULATION MANUAL
HOLT RESERVOIR
BLACK WARRIOR RIVER, ALABAMA
INFLOW-OUTFLOW-POOL STAGE HYDROGRAPHS
SPILLWAY DESIGN FLOOD

APPENDIX B CHART NO. 25

ATTACHMENT I

EXTRACTS FROM FEDERAL

POWER COMMISSION LICENSE

FOR PROJECT NO. 2203

EXTRACTS FROM PROJECT LICENSE

Federal Power Commission License for major project No. 2203, issued October 7, 1965, authorizes construction by Alabama Power Company of the intake structure and powerhouse with an installation of 40,000 kw at the Holt Lock and Dam. Extracts from the project license especially pertinent to navigation, water use and reservoir regulation are quoted for guidance and reference purposes.

"Article 5. Insofar as any material is dredged or excavated in the prosecution of any work authorized under the license, or in the maintenance of the project, such material shall be removed and deposited so it will not interfere with navigation, and will be to the satisfaction of the District Engineer, Department of the Army, in charge of the locality.

Article 6. The United States specifically retains and safeguards the right to use water in such amount, to be determined by the Secretary of the Army, as may be necessary for the purposes of navigation on the navigable waterway affected; and the operations of the Licensee, so far as they affect the use, storage and discharge from storage of waters affected by the license, shall at all times be controlled by such reasonable rules and regulations as the Secretary of the Army may prescribe in the interest of navigation, and as the Commission may prescribe for the protection of life, health, and property, and in the interest of the fullest practicable conservation and utilization of such waters for power purposes and for other beneficial public uses, including recreational purposes; and the Licensee shall release water from the project reservoir at such rate in cubic feet per second, or such volume in acre-feet per specified period of time, as the Secretary of the Army may prescribe in the interest of navigation, or as the Commission may prescribe for the other purposes hereinbefore mentioned.

Article 7. Whenever the United States shall desire to construct, complete, or improve navigation facilities in connection with the project, the Licensee shall convey to the United States, free of cost, such of its lands and its rights-of-way and such right of passage through its dams or other structures, and permit such control of pools as may be required to complete and maintain such navigation facilities.

Article 8. The Licensee shall furnish free of cost to the United States power for the operation and maintenance of navigation facilities at the voltage and frequency required by such facilities and at a point adjacent thereto whether said facilities are constructed by the Licensee or by the United States.

Article 9. The operation of any navigation facilities which may be constructed as a part of or in connection with any dam or diversion structure constituting a part of the project works

shall at all times be controlled by such reasonable rules and regulations in the interest of navigation, including the control of the level of the pool caused by such dam or diversion structure, as may be made from time to time by the Secretary of the Army.

Article 10. The Licensee shall for the protection of navigation, construct, maintain and operate at its own expense such lights and other signals on fixed structures in or over navigable waters of the United States as may be directed by the Secretary of the Department in which the Coast Guard is operating.

*****

Article 14. The Licensee shall, after notice and opportunity for hearing, coordinate the operation of the project, electrically and hydraulically, with such other power systems and in such manner as the Commission may direct in the interest of power and other beneficial public uses of water resources, and on such conditions concerning the equitable sharing of benefits by the Licensee as the Commission may order.

Article 15. The Licensee shall, for the conservation, and development of fish and wildlife resources, construct, maintain, and operate, or arrange for the construction, maintenance and operation of such facilities and comply with such reasonable modifications of the project structures and operation as may be ordered by the Commission upon its own motion or upon the recommendation of the Secretary of the Interior or the fish and wildlife agency or agencies of any State in which the project or a part thereof is located, after notice and opportunity for hearing and upon findings based on substantial evidence that such facilities and modifications are necessary and desirable, reasonably consistent with the primary purpose of the project, and consistent with the provisions of the Act.

Article 16. Whenever the United States shall desire, in connection with the project, to construct fish and wildlife facilities or to improve the existing fish and wildlife facilities at its own expense, the Licensee shall permit the United States or its designated agency to use, free of cost, such of Licensee's lands and interest in lands, reservoirs, waterways and project works as may be reasonably required to complete such facilities or such improvements thereof. In addition, after notice and opportunity for hearing, the Licensee shall modify the project operation as may be prescribed by the Commission, reasonably consistent with the primary purpose of the project, in order to permit the maintenance and operation of the fish and wildlife facilities constructed or improved by the United States under the provisions of this article. This article

shall not be interpreted to place any obligation on the United States to construct or improve fish and wildlife facilities or to relieve the Licensee of any obligation under this license.

Article 17. The Licensee shall construct, maintain and operate or shall arrange for the construction, maintenance and operation of such recreational facilities including modifications thereto, such as access roads, wharves, launching ramps, beaches, picnic and camping areas, sanitary facilities and utilities, as may be prescribed hereafter by the Commission during the term of this license upon its own motion or upon the recommendation of the Secretary of the Interior or other interested Federal and State agencies, after notice and opportunity for hearing and upon findings based upon substantial evidence that such facilities are necessary and desirable, and reasonably consistent with the primary purpose of the project.

Article 18. Sofar as is consistent with proper operation of the project, the Licensee shall allow the public free access, to a reasonable extent, to project waters and adjacent project lands owned by the Licensee for the purpose of full public utilization of such lands and waters for navigation and recreational purposes, including fish and hunting, and shall allow to a reasonable extent for such purposes the construction of access roads, wharves, landings, and other facilities on its lands the occupancy of which may be appropriate circumstances be subject to payment of rent to the Licensee in a reasonable amount: Provided, that the Licensee may reserve from public access, such portions of the project waters, adjacent lands, and project facilities as may be necessary for the protection of life, health, and property and Provided further, that the Licensee's consent to the construction of access roads, wharves, landings, and other facilities shall not, without its express agreement, place upon the Licensee any obligation to construct or maintain such facilities. These facilities are in addition to the facilities that the Licensee may construct and maintain as required by the license.

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Article 33. For the purpose of determining the stage and flow of the stream or streams from which water is diverted for the operation of the project works, the amount of water held in and withdrawn from storage, and the effective head on the turbines, the Licensee shall install and thereafter maintain such gages and stream gaging stations as the Commission may deem necessary and best adapted to the requirements; and shall provide for the required readings of such gages and for the adequate rating of such stations. The Licensee shall also install and maintain standard meters adequate for the determination of the amount of

electric energy generated by said project works. The number, character, and location of gages, meters, or other measuring devices, and the method of operation thereof, shall at all times be satisfactory to the Commission and may be altered from time to time if necessary to secure adequate determinations, but such alteration shall not be made except with the approval of the Commission or upon the specific direction of the Commission. The installation of gages, the ratings of said stream or streams, and the determination of the flow thereof, shall be under the supervision of, or in cooperation with, the District Engineer of the United States Geological Survey having charge of stream-gaging operations in the region of said project, and the Licensee shall advance to the United States Geological Survey the amount of funds estimated to be necessary for such supervision or co-operation for such periods as may be mutually agreed upon. The Licensee shall keep accurate and sufficient record of the foregoing determinations to the satisfaction of the Commission, and shall make return of such records annually at such time and in such form as the Commission may prescribe.

Article 34. On the application of any person, association, corporation, Federal agency, State or municipality, the Licensee shall, after notice and opportunity for hearing, permit such reasonable use of its reservoirs or other project works or parts thereof as may be ordered by the Commission in the interest of comprehensive development of the waterway or waterways involved and the conservation and utilization of water resources of the region for water supply for steam-electric, irrigation, industrial, municipal or similar purposes consistent with the primary objective of the project. The Licensee shall receive such reasonable compensation as may be appropriate for use of its reservoirs or other project works or parts thereof for such purposes, any such compensation to be fixed either by Commission approval of an agreement between the Licensee and the party or parties benefiting or by the Commission in the event the parties are unable to agree. Applications shall contain information in sufficient detail to afford a full understanding of the proposed use, including satisfactory evidence that the applicant possesses necessary water rights pursuant to applicable State law, or a showing of cause why such evidence cannot be submitted, and a statement as to the relationship of the proposed use to any State or municipal plans or orders which may have been adopted with respect to the use of such waters.

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Article 40. The construction, operation, and maintenance of the project and any work incident to additions or alterations shall be subject to the inspection and supervision of the District Engineer, U. S. Army Engineer District, Mobile, Alabama,

or of such other officer or agent as the Commission may designate, who shall be the authorized representative of the Commission for such purposes. The Licensee shall furnish detail plans and specifications to said representative and construction of the project works or any feature thereof shall not be initiated until such plans and specifications have been approved by said representative. The Licensee shall cooperate fully with said representative and shall furnish him a detailed program of inspection by the Licensee that will provide for an adequate and qualified inspection force for construction of the project. Construction of the project works or any feature thereof shall not be initiated until the program of inspection for the project works or any such feature thereof has been approved by said representative. The Licensee shall also furnish to said representative such further information as he may require concerning the construction, operation, maintenance of the project, and of any alteration thereof, and shall notify him of the date upon which work will begin, and as far in advance thereof as said representative may reasonably specify, and shall notify him promptly in writing of any suspension of work for a period of more than one week, and of its resumption and completion. The Licensee shall allow him and other officers or employees of the United States, showing proper credentials, free and unrestricted access to, through, and across the project lands and project works in the performance of their official duties.

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Article 43. The Licensee shall, in cooperation with the Alabama Water Improvement Commission and the U. S. Public Health Service, conduct an evaluation study for a period of five years to determine the dissolved oxygen content of the water just downstream from the Bankhead Dam and powerhouse and the Holt Dam and powerhouse. An annual progress report of the evaluation study shall be filed with the Commission. The Licensee shall modify the project operation or project structures as may be prescribed by the Commission, after notice and opportunity for hearing, in the event the operation of Holt powerhouse has a deleterious effect on the quality of the water.

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Article 49. Licensee shall construct facilities or take other corrective measures to eliminate adverse affects on navigation caused by discharge from the power plant, as may be ordered by the Commission upon its own motion or upon the recommendation of the Chief of Engineers, Department of the Army, after notice and opportunity for hearing and upon findings based on substantial evidence that the construction of such

facilities or the taking of other corrective measures are necessary and desirable to eliminate adverse affects on navigation and are otherwise consistent with the provisions of the Act.