

DAEN-CWH-Y

3 July 1984

SUBJECT: Memorandum of Understanding (Operating Agreement) Among the Corps of Engineers, US Army, Tennessee Valley Authority, and Southeastern Power Administration, Department of Energy, with Respect to Operation of the Cumberland System Projects

Commander, Ohio River Division
ATTN: ORDDE

*7/11/84
CENTRAL/DOE
July 84*

The Acting Assistant Secretary of the Army (Civil Works) has authorized you to sign the subject MOU as the Corps representative.

FOR THE COMMANDER:

VERNON K. HAGEN
Chief, Hydraulics and Hydrology Division
Directorate of Civil Works

*7/17
Letter confirming telecon with Col. Gish on 6/26/84.
By*

DIVISION FILE COPY

MEMORANDUM OF UNDERSTANDING (OPERATING AGREEMENT) BETWEEN
CORPS OF ENGINEERS, U.S. ARMY, TENNESSEE VALLEY AUTHORITY,
AND SOUTHEASTERN POWER ADMINISTRATION, DEPARTMENT
OF ENERGY, WITH RESPECT TO OPERATIONS OF THE
CUMBERLAND SYSTEM PROJECTS

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1. General: This memorandum of understanding is agreed to as of 1 July 1984, between the Corps of Engineers (hereinafter referred to as Corps) and the Tennessee Valley Authority (hereinafter referred to as TVA) and Southeastern Power Administration (hereinafter referred to as SEPA) for disposal of electric power and energy generated at the Cumberland System Projects. The Cumberland System is comprised of the following Corps projects in the Cumberland River Basin, in Tennessee and Kentucky: Barkley, Cheatham, Old Hickory, Cordell Hull, and Wolf Creek Projects on the Cumberland River, J. Percy Priest Project on the Stones River, Center Hill Project on the Caney Fork River, and Dale Hollow Project on the Obey River.

2. Term: This memorandum shall become effective as of the first date mentioned above and shall remain in effect, unless otherwise modified by mutual agreement of the parties, for the term of the agreement (hereinafter called "marketing agreement") between SEPA and TVA dated 27 June 1984, and any renewal or replacement thereof. If the marketing agreement or any renewal or replacement thereof is terminated for any reason whatsoever, any party hereto may terminate this memorandum upon reasonable notice, effective as of the date of termination of said marketing agreement; provided, however, that in the event of any such termination of this memorandum the provisions shall remain in effect for flood control, navigation, recreation, and secondary purposes until other mutually satisfactory alternative arrangements are made. This memorandum supersedes those memorandums of understanding (operating agreements) relative to the operations of the Cumberland Basin Projects as set forth in Exhibit 1.

3. Objectives: The Cumberland System Projects will be operated for authorized and secondary purposes in accordance with applicable statutory responsibilities. Accordingly, it is intended that the operating requirements hereinafter provided

shall constitute a framework for operations designed to accomplish this objective. It is recognized that the responsibility for the overall water management of the Cumberland Basin rest with the Corps. TVA and SEPA's primary interest in the Cumberland Basin is the marketing of hydropower excess to the needs of the projects. The Corps, SEPA, and TVA will from time to time review and revise the operating criteria under this memorandum to accommodate changed conditions and possible future legal requirements while striving to optimize total project benefits.

4. Project Guide Curves: The Corps has specified certain elevations at each project as the power pool and either the flood control or surcharge pool. The project guide curves for the Cumberland Basin Projects are shown on Plates 1 through 8. The Corps reserves the right to release water over and above the discharge of the turbines in order to prevent reservoir levels from rising or remaining above full power pool elevations. The Corps may also reduce the release of water from any project below the rate that would be required to produce the power requested by TVA and SEPA to prevent reservoir levels from falling below the designated minimum pool elevation.

5. Flood Control:

a. Five of the projects, in addition to the hydropower facilities, have flood control as a primary purpose. During a flood control operation, available energy and capacity at any of these projects may be reduced or curtailed. The Corps will have the sole responsibility of determining when and to what extent flood control operations will impact power generation. The Corps will give TVA and SEPA as much advance notice as possible of expected flood control operations. However, it is recognized that the flood control measures will often have to be initiated on short notice and during off duty hours. Flood

control instructions that affect power will be relayed to project operating personnel from the Corps through the TVA load coordinator.

b. Barkley Reservoir may be drawn down as low as elevation 346.0 msl at the dam while maintaining a minimum equivalent level storage of elevation 354.0 if necessary to preserve the storage capacity of the reservoir prior to a flood crest on the lower Ohio and Mississippi Rivers.

6. Navigation:

a. Rates of change in discharges and minimum releases for navigation have been established as guidance to maintain adequate operating conditions in the rivers and at downstream terminals. This guidance is outlined below:

(1) Barkley - Change in discharge per hour is limited to discharge equivalent to one generating unit operating at full capacity

(2) Barkley - Minimum continuous release of 6000 cfs

(3) Center Hill - Change in discharge per hour is limited to discharge equivalent to two generating units operating at full capacity

(4) Cheatham - Change in discharge per hour is limited to discharge equivalent to one generating unit operating at full capacity

(5) Cordell Hull - Change in discharge per hour is limited to discharge equivalent to two generating units operating at full capacity

(6) Dale Hollow - Change in discharge per hour is limited to discharge equivalent to two generating units operating at full capacity

(7) J. Percy Priest - none

(8) Old Hickory - Change in discharge per hour is limited to discharge equivalent to one generating unit operating at full capacity plus quarter day limits as outlined in Table 1.

(9) Wolf Creek - Change in discharge per hour is limited to discharge equivalent to three generating units operating at full capacity. The above listed rates of change may be modified at the discretion of the Corps in the event of power system emergencies.

b. It is recognized that the Corps provides a nine-foot channel depth in the Cumberland River below Barkley Dam, which is based on a minimum pool elevation of 302. Release of water from Barkley which would otherwise be stored may be needed to prevent the tailwater level from falling below elevation 302.

c. The authorized range for Cheatham is between elevations 385 and 382. However, in order to maintain adequate depths for navigation, headwater levels at Cheatham Dam will not be lowered below elevation 383 except during high flow periods when generation has been suspended due to low net head. Also, the tailwater level at Old Hickory Dam must be maintained at elevation 385 or above. Therefore the amount by which the headwater level at Cheatham may be lowered below elevation 385 is governed by a corresponding release from Old Hickory. When Old Hickory's releases are cut to zero for a period of more than two or three hours, a negative surge is generated below the dam. This amounts to about one-half foot with a zero discharge period of six hours with Cheatham headwater at elevation 385. It is necessary to compensate for this surge by making intermittent releases from Old Hickory. During low flow periods, such releases during off peak hours reduce the capability of the project to generate power during the high demand hours, and thus are highly undesirable from the standpoint of power. For this reason, a tolerance of up to one-half foot above elevation 385 is permitted in the Cheatham headwater level during low flow periods. In summary, the Cheatham headwater will normally be maintained between elevation 385.5 and 383 and the Old Hickory tailwater will be maintained at elevation 385 or above.

d. The operation of the Old Hickory and Cheatham plants will be synchronized so that the drawdown at Nashville below elevation 385.0 that would result from operating Cheatham below that level will be offset to the extent practicable by the rise at Nashville that will result from releases at Old Hickory and/or J. Percy Priest.

e. Barkley and Kentucky Reservoirs shall be operated so as to limit water velocities in the canal connecting these reservoirs to rates tolerable to navigation using the canal. To accomplish this, the differential in water levels between the two reservoirs at the Dams shall be limited to about one foot under normal operating conditions.

7. Recreation: Recreation benefits are obtained by operation of the projects in accordance with the attached project guide curves and other provisions of this memorandum.

8. Fish Propagation: The states of Tennessee and Kentucky have requested that lake levels be stabilized as much as possible during the fish spawning season. This usually starts in the spring and may extend over a period of from two to three weeks. The Corps in cooperation with the appropriate agencies of the respective states will determine dates of and allowable water level fluctuation for the stabilization period. Every reasonable effort consistent with authorized project purposes will be made to stabilize reservoir levels during the spawning season.

9. Environmental Consideration: The Corps may through modification of power generation schedules take into account water quality conditions downstream of all Cumberland Basin Projects.

10. Special Operations: The Corps will be responsible for coordinating all special operations. Special operations which affect power will be coordinated with both TVA and SEPA. If an emergency does not exist, TVA and SEPA will be consulted on possible alternatives.

11. Power:

a. It is desirable to maximize the benefits of the projects for the authorized purposes of navigation, flood control, power, recreation, and secondary purposes. Scheduling of power generation will take into consideration the effects, as determined by the Corps, on authorized purposes and secondary purposes in accordance with applicable requirements. Generation schedules may be modified by the Corps to meet emergencies. The Corps agrees to give TVA and SEPA as much advance notice as possible of any such actions to be taken or rescheduling of power generation required. The Corps will endeavor to time its actions so as to cause the minimum disadvantage to the system.

b. The Corps will continue to maintain existing switchyard and terminal facilities at the project, as well as such additional equipment as SEPA may provide or cause to be provided including the metering, communication, supervisory control and telemetering equipment required for coordinating the operations of the projects with the TVA system. TVA will continue to provide and maintain, or cause to be provided and maintained, the existing transmission line capacity beyond the take-off structures in the switchyards.

c. TVA will deliver to the Corps such amounts of power and energy as may be required for the operation of the projects to the extent that the generation at any project is insufficient at any time, which is also recognized in the marketing agreement between SEPA and TVA..

d. The Corps or TVA may cause the available generating units at the Cumberland Projects to be operated as condensers or for spinning reserve if such operation does not unreasonably interfere with the delivery of capacity and energy and is not contrary to good operating practice. Such operations, subject to the preceding limitations, shall be in accordance with procedures and schedules developed and agreed upon from time to time by the operating representatives of the parties hereto. All energy required for such condensing or motorizing operations requested by TVA shall be logged and accounted for on each individual project operating log and such energy will be added to the actual deliveries to TVA for energy accounting and billing purposes. All energy required for such condensing or motorizing operations requested by the Corps shall be logged and accounted for on each individual project operating log and will be deducted from the actual deliveries to TVA for energy accounting and billing purposes.

e. SEPA has established a zone of hydropower operation for Wolf Creek, Dale Hollow, and Center Hill as shown on plates 1, 2, and 3 respectively which falls within the project guide curves established by the Corps. SEPA may permit TVA to cause these projects to be operated above or below that SEPA zone of operation consistent with the Corps' Project Guide Curves. Efforts will be made during hydropower operations to provide uniform withdrawals of stored energy on a proportionate basis from the three major storage projects.

f. Based upon declarations made by SEPA, TVA will request power from the Cumberland Projects to provide capacity and energy desired by SEPA and by TVA. During the reservoir filling months of March through May, the Corps in conjunction with SEPA, shall determine whether and to what extent TVA shall be allowed to withdraw additional energy in excess of declarations.

g. TVA shall take capacity and energy from the Cumberland Projects at such power factor as will best serve TVA's system from time to time; provided, that TVA shall not impose a power factor of less than .85 lagging on the Corps facilities which requires operation contrary to good operating practice or results in overload or impairment of such facilities.

h. The Corps will endeavor to control the voltage of the generators and the ratio of the transformers at the Cumberland Projects so that capacity and energy will be delivered to TVA at TVA's nominal voltage with such changes above or below nominal voltage as may from time to time or at any time be requested by TVA; provided, that such changes are within the limits of good operating practice and do not jeopardize the facilities at the Cumberland Projects.

i. Subject to the provisions of the other paragraphs in this memorandum, the Corps will release water through the turbines, impound storable water, and operate the power facilities in such a manner and with such loadings as may be required to deliver power in accordance with requests from TVA. Such operation of power facilities by the Corps shall also include switching operations and operation of the generating units for reserve capacity or as synchronous condensers, for system voltage regulation, and for the coordination of load frequency control. The requests shall be made in the form of schedules which TVA shall furnish the Corps as far in advance as practicable, subject to change by TVA.

j. Meters for measuring power generation installed at the Cumberland Projects are owned by the Corps and shall be tested at least annually to ascertain meter accuracy. Such tests, adjustments, repairs or replacement of the meters shall be performed by the Corps with TVA and SEPA being afforded the

opportunity to witness such tests, adjustments, repairs or replacement. Either TVA or SEPA may make a special request for a test on any Corps meter used for determining billing and if defective, corrective measures will be made by the Corps. The requesting agency shall reimburse the Corps for the cost of any such special test unless it shows the meter to be inaccurate. TVA shall have the right to install or cause to be installed, at its own expense, check meters subject to the provisions of Paragraph 13 below.

k. When the capacity requirement does not exceed the available nameplate capacity of the plant, the individual units will be operated within their nameplate rating capacities as shown on Table 2 under the "Nameplate Rating MW" column.

l. When additional capacity is requested by TVA above the available nameplate MW capacity of the plant or plants the generating units will be operated in accordance with the megawatt limits shown on Table 2 under the "115% Nameplate Rating MW" Column.

m. At times when water is being or is about to be wasted through the spillways or during system emergencies such as frequency, voltage, or other disturbances, the generating units may be operated at up to full gate opening for reasonable periods of time.

n. Total system capacity quantities shown on Table 2 are subject to reduction when determined necessary by the Corps for (1) emergency and/or routine maintenance, (2) contingencies such as floods, droughts, failure of facilities, storms, war, riots, etc., (3) maximum temperature limitations, (4) excessive vibration, cavitation limits, and (5) protection of equipment from

known deficiencies such as magnetic unbalance caused by stator coils being electrically removed.

o. Temperature limits for stators are 100°C total, 60°C rise, and 95°C total for main transformers. Current and temperature limitations for the excitation systems as indicated by the nameplates shall not be exceeded. Lower cavitation limits at all plants will be observed. Cable tunnel temperature limits will be observed. Current and temperature limits may be modified, at the Corps' discretion, during power system emergencies.

p. During all power operations, the Corps will give due consideration to the safety of equipment.

q. The Corps reserves the right to stop generation at a plant without prior notice to perform emergency rescue operations or due to other emergency conditions. Notice will be given to TVA and SEPA as soon as possible regarding such operations. When requests for special releases are received to facilitate recovery of bodies or other special operations, they will be coordinated with TVA and SEPA. Maximum consideration will be given to granting such requests.

r. The parties hereto shall so far as practicable coordinate their scheduled outages of facilities for maintenance to the end that the highest degree of continuity and reliability of generation from the Cumberland Projects pursuant to this agreement will be maintained. Removal of equipment from service at the power plants for routine and emergency maintenance shall be scheduled by the Corps as much in advance as practicable. Consideration will be given by the Corps to adjusting both routine and emergency maintenance outages to optimize TVA and SEPA operations while still enabling the Corps to perform its maintenance in a reasonable, timely, and efficient manner. In scheduling

routine maintenance, maximum regard will be given to the availability of capacity, to making use of excess flows, and to variations in the needs for capacity on the integrated power system.

12. Cooperation of Parties:

a. The Corps and TVA each grant to the other such rights of ingress and egress over the properties in its charge as may be desirable to permit the other party to fulfill adequately its obligations and exercise its rights hereunder. The rights of ingress and egress hereby granted to TVA include rights of access to be exercised by or for any of TVA's customers which, under arrangements with TVA, provides or owns power transmission and/or communication facilities located on property in the custody of the Corps. All access to Corps facilities will be in accordance with Corps Security Procedures and all work performed on Corps property will comply with Corps Safety Rules and Procedures. The parties will exchange such information as may be mutually beneficial in achieving the purposes of this memorandum, including without limitation, information required in scheduling the operation of the Cumberland Projects, operating records relating to the project powerplants, plans and specifications of equipment, other project data, and hydrologic reports and forecasts.

b. If in the operation and maintenance of their respective facilities and the utilization thereof for the purposes of this memorandum, either the Corps or TVA, because of any emergency or extraordinary condition or for any other valid reason, requests the other party to furnish personnel, material, tools or equipment, the other party shall cooperate and render such assistance as it may determine to be available. The agency making the request will notify the other party of the amount of funds available for performance of the work. The party receiving assistance, upon receipt of properly itemized bills from the other

party, shall promptly reimburse the other party for all costs reasonably incurred by the other party in providing such assistance, including rental value of equipment and the usual allowance for administrative and general expense.

c. The operating representatives of the Corps, SEPA and TVA shall keep each other regularly informed as to water releases, reservoir elevations, rainfall, load patterns, and other operating conditions pertinent to this agreement.

13. Facilities on Corps Property: It is recognized during the term of this memorandum, TVA (and any of TVA's customers as described in Paragraph 12a above) will need to use property under the jurisdiction of the Corps at or in the vicinity of the Cumberland Projects for the modification, construction and operation of electric power transmission lines, and appurtenances which may be necessary in connection with the marketing of power from the Cumberland System. In connection with any such proposed action, TVA shall submit the plans to the Corps for approval as to compatibility of design and availability of space.

14. Notices: Any notice or request, except such exchanges as may ordinarily be required between the authorized representatives of the parties hereto to accomplish the objectives of this agreement shall be sent to the Manager of Power and Engineering, TVA, Chattanooga, Tennessee, on behalf of TVA; or to the District Engineer, Corps of Engineers, U.S. Army, Nashville, Tennessee, on behalf of the Corps; or to the Administrator, Southeastern Power Administration, Elberton, Georgia, on behalf of SEPA. The designation of the person to be notified, or of his address, may be changed by any party by similar notice.

15. Uncontrollable Forces: No party shall be considered in default with respect to any obligation hereunder if it is unable to fulfill such obligation because of circumstances reasonably beyond said party's control, including,

without limitation, failure of facilities, flood, drought, earthquake, storm, lightning, fire, epidemic, war, riot, civil disturbance, labor disturbance, materials or equipment shortages, fuel curtailment or shortage, or restraint by court or public authority which by exercise of reasonable diligence and foresight could not have been avoided. Any party rendered unable to fulfill any obligation by reason of an uncontrollable force shall remove such inability with all reasonable dispatch.

16. Waivers: Any waiver of rights hereunder at any time by any party shall not be considered a waiver of any subsequent rights.

17. Officials Not to Benefit: No member of or Delegate to Congress or Resident Commissioner, or any official, employee, special Government employee, or agent of TVA or the Department of Energy or the Department of Defense shall be admitted to any share or part of this agreement or to any benefit that may arise herefrom, but this provision shall not be construed to extend to a corporation or unit of Government contracting for its or for the public's general benefit.

In witness whereof, the parties hereto have caused this memorandum of understanding (operating agreement) to be executed as of the date first above written by their duly authorized representatives,

U.S. ARMY CORPS OF ENGINEERS,
OHIO RIVER DIVISION

By 

R. S. KEM, Major General, US Army

Title Division Engineer

TENNESSEE VALLEY AUTHORITY
Knoxville, Tennessee 37902

By 

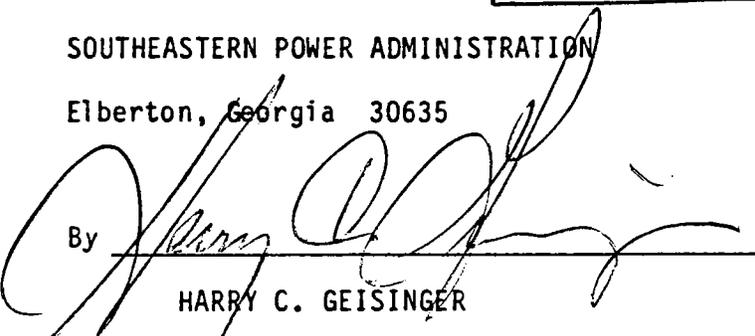
W. F. WILLIS

Title General Manager

EHW
OGC

Approved by TVA Board of Directors JUN 26 1984 <i>EHW</i> ASSISTANT SECRETARY

SOUTHEASTERN POWER ADMINISTRATION
Elberton, Georgia 30635

By 

HARRY C. GEISINGER

Title Administrator

TABLE 1

Old Hickory Project
 Quarter Day Limits on Generations

Average Generation during: Preceding Quarter-Day-mw:	Allowable Average Generation in Following Quarter-Day-mw			
	: 2nd or 3rd Quarter-days		: 1st or 4th Quarter-Days	
	: Maximum	Minimum	: Maximum	Minimum
0-50	100	0	75	0
50-75	Capacity	0	100	50mw less than preceding quarter-day
75-100	Capacity	25	Capacity	25mw less than preceding quarter-day
100-Capacity	Capacity	75	Capacity	25mw less than preceding quarter-day

*Generation may be limited by the one-unit per hour restriction on changes.

TABLE 2

PLANT CAPABILITIES

<u>PLANT</u>	<u>NAMEPLATE</u>		<u>115% NAMEPLATE</u>	
	<u>UNIT</u>	<u>PLANT</u>	<u>UNIT</u>	<u>PLANT</u>
Wolf Creek	45	270	52	312
Center Hill	45	135	52	156
Dale Hollow	18	54	20.7*	62
Cordell Hull	33.3	99.9	38	114
Old Hickory	25	100	29	112**
J. P. Priest	28	28	30	30***
Cheatham	12	36	13.8	41
Barkley	32.5	130	37	148
TOTAL		852.9		975

*Reflects maximum turbine capacity.

**Unit No. 1 limited to 25 MW.

***Unit to be operated at 30 MW only.

NOTE: Total supplied reflects 114.3% of rated nameplate MW.

EXHIBIT 1

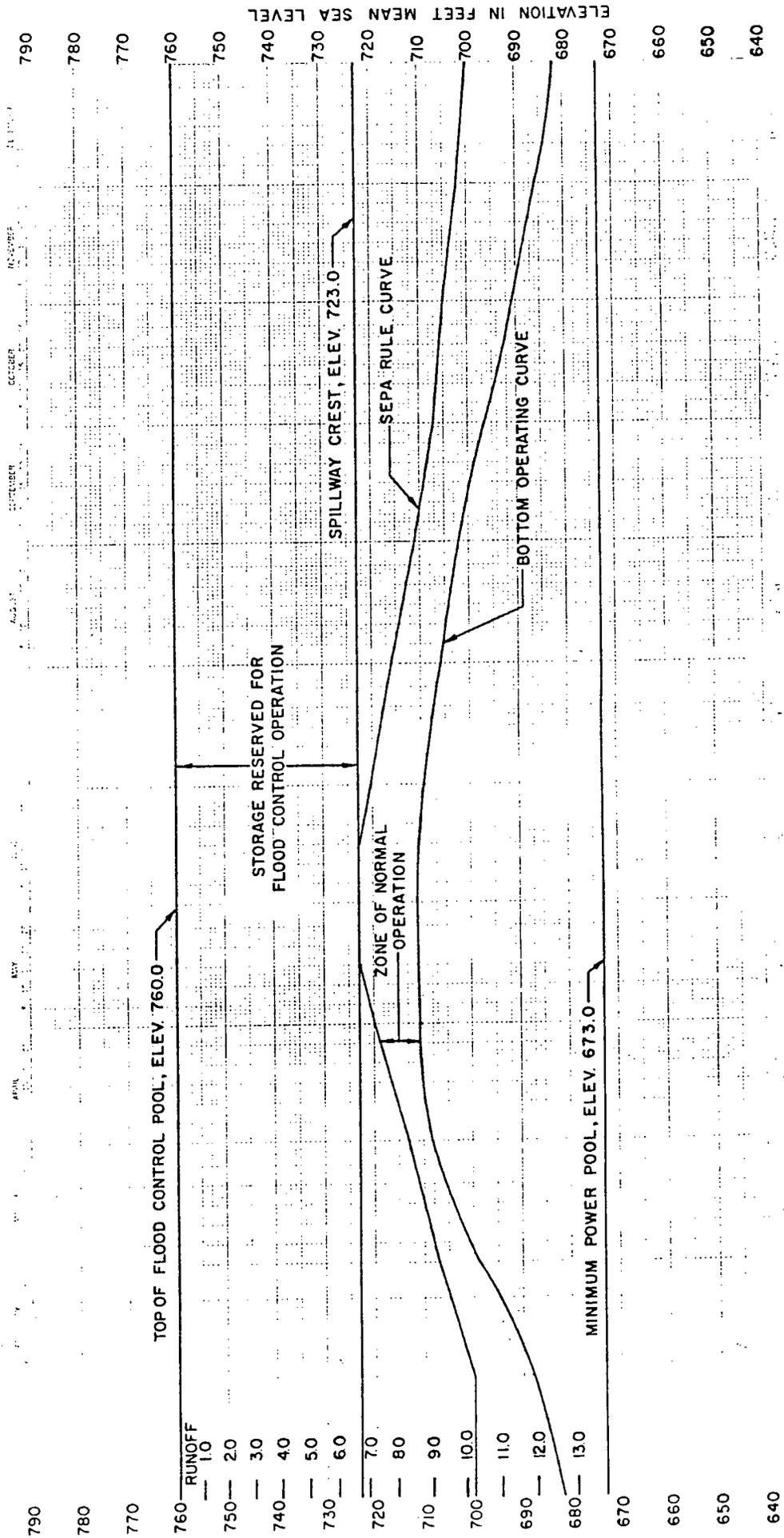
Memorandums of Understanding (Operating Agreements)
Superseded by this Memorandum

1. MEMORANDUM OF UNDERSTANDING (Operating Agreement) WITH TENNESSEE VALLEY AUTHORITY ON OPERATION OF WOLF CREEK, CENTER HILL AND DALE HOLLOW HYDRO POWER PROJECTS, Dated 9 December 1948.
2. MEMORANDUM OF UNDERSTANDING (Operating Agreement) BETWEEN CORPS OF ENGINEERS, U.S. ARMY, AND TENNESSEE VALLEY AUTHORITY WITH RESPECT TO OPERATIONS AT OLD HICKORY AND CHEATHAM PROJECTS, Dated 27 February 1957.
3. MEMORANDUM OF UNDERSTANDING (Operating Agreement) BETWEEN CORPS OF ENGINEERS, U.S. ARMY, THE TENNESSEE VALLEY AUTHORITY, AND SOUTHEASTERN POWER ADMINISTRATION (U.S. DEPT. OF INTERIOR) WITH RESPECT TO OPERATIONS AT THE BARKLEY HYDRO-POWER PROJECTS, Dated January 1, 1966.
4. MEMORANDUM OF UNDERSTANDING (Operating agreement) BETWEEN CORPS OF ENGINEERS, U.S. ARMY, THE TENNESSEE VALLEY AUTHORITY, AND SOUTHEASTERN POWER ADMINISTRATION (U.S. DEPARTMENT OF THE INTERIOR) WITH RESPECT TO THE OPERATIONS AT J. PERCY PRIEST PROJECT Dated, December 23, 1970.
5. MEMORANDUM OF UNDERSTANDING (Operating Agreement) BETWEEN CORPS OF ENGINEERS, U.S. ARMY, THE TENNESSEE VALLEY AUTHORITY, AND SOUTHEASTERN POWER ADMINISTRATION (U.S. DEPARTMENT OF THE INTERIOR) WITH RESPECT TO OPERATIONS AT CORDELL HULL PROJECT, Dated June 18, 1973.

WOLF CREEK RESERVOIR
CUMBERLAND RIVER, KENTUCKY

CORPS OF ENGINEERS

U.S. ARMY



DALE HOLLOW RESERVOIR
 OBEY RIVER, KENTUCKY & TENNESSEE

CORPS OF ENGINEERS

U. S. ARMY

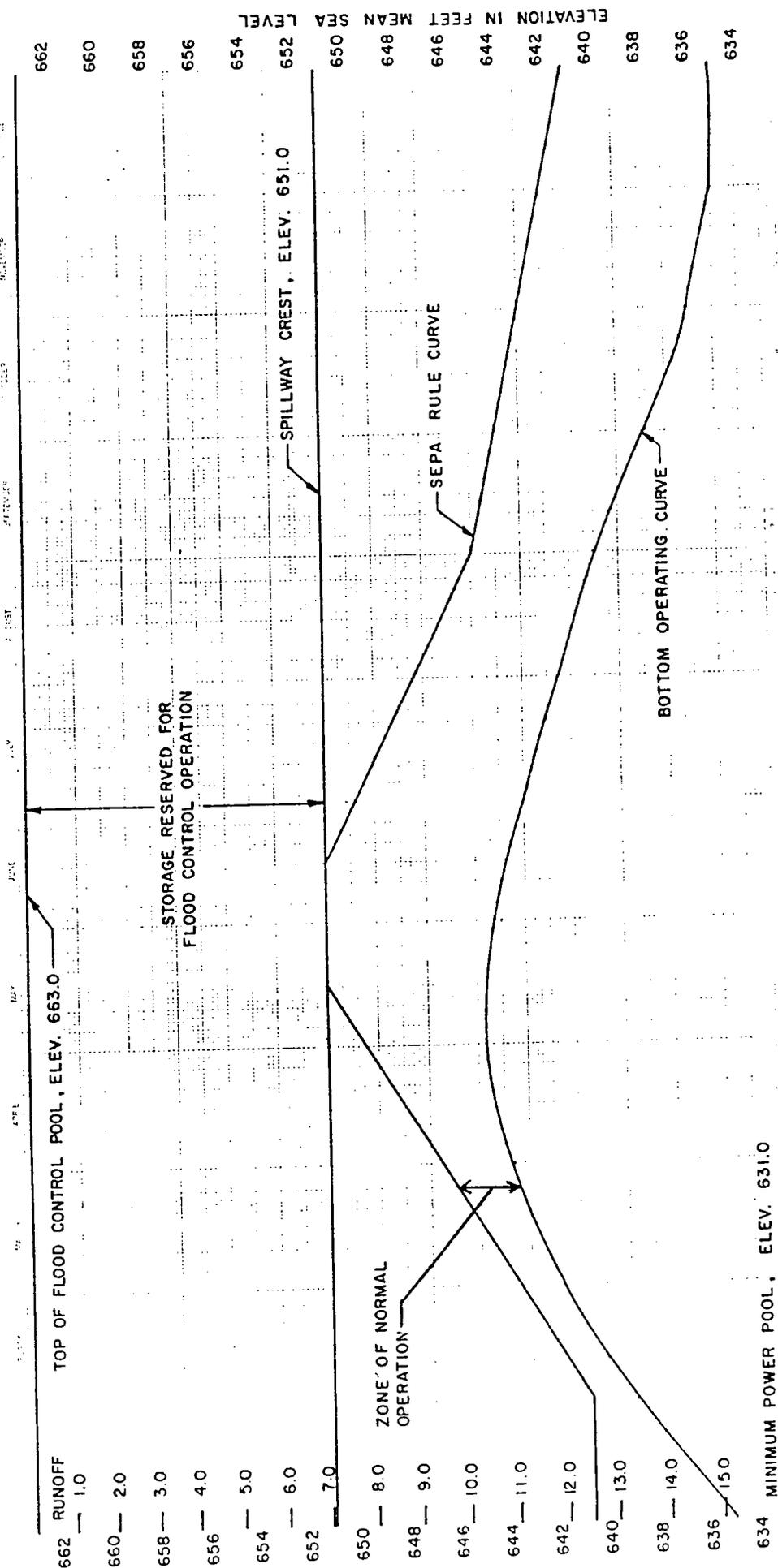
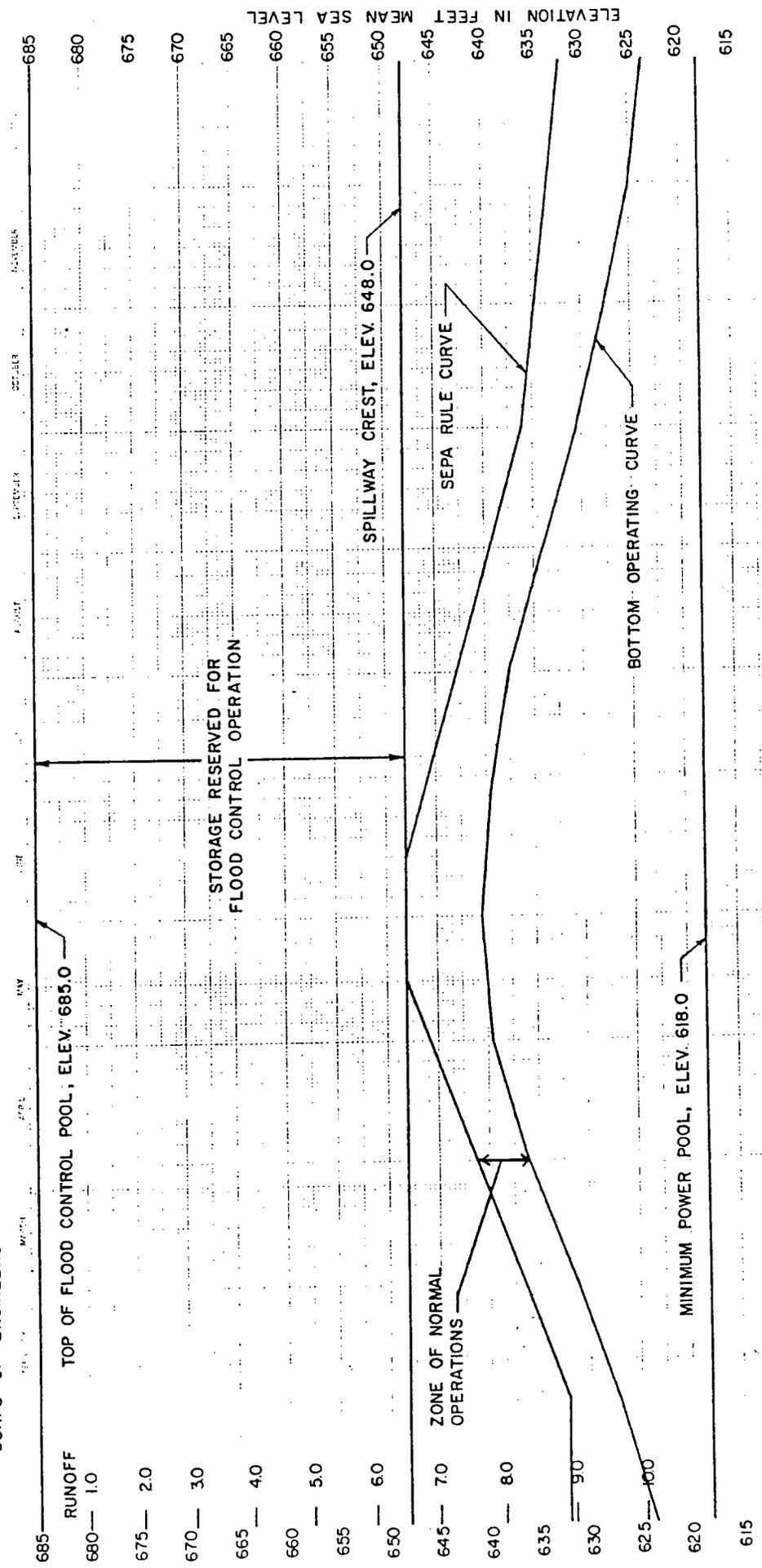


Plate 2

CORPS OF ENGINEERS
 CENTER HILL RESERVOIR
 CANEY FORK RIVER, TENNESSEE

U. S. ARMY



J. PERCY PRIEST RESERVOIR STONES RIVER, TENNESSEE

U.S. ARMY

CORPS OF ENGINEERS

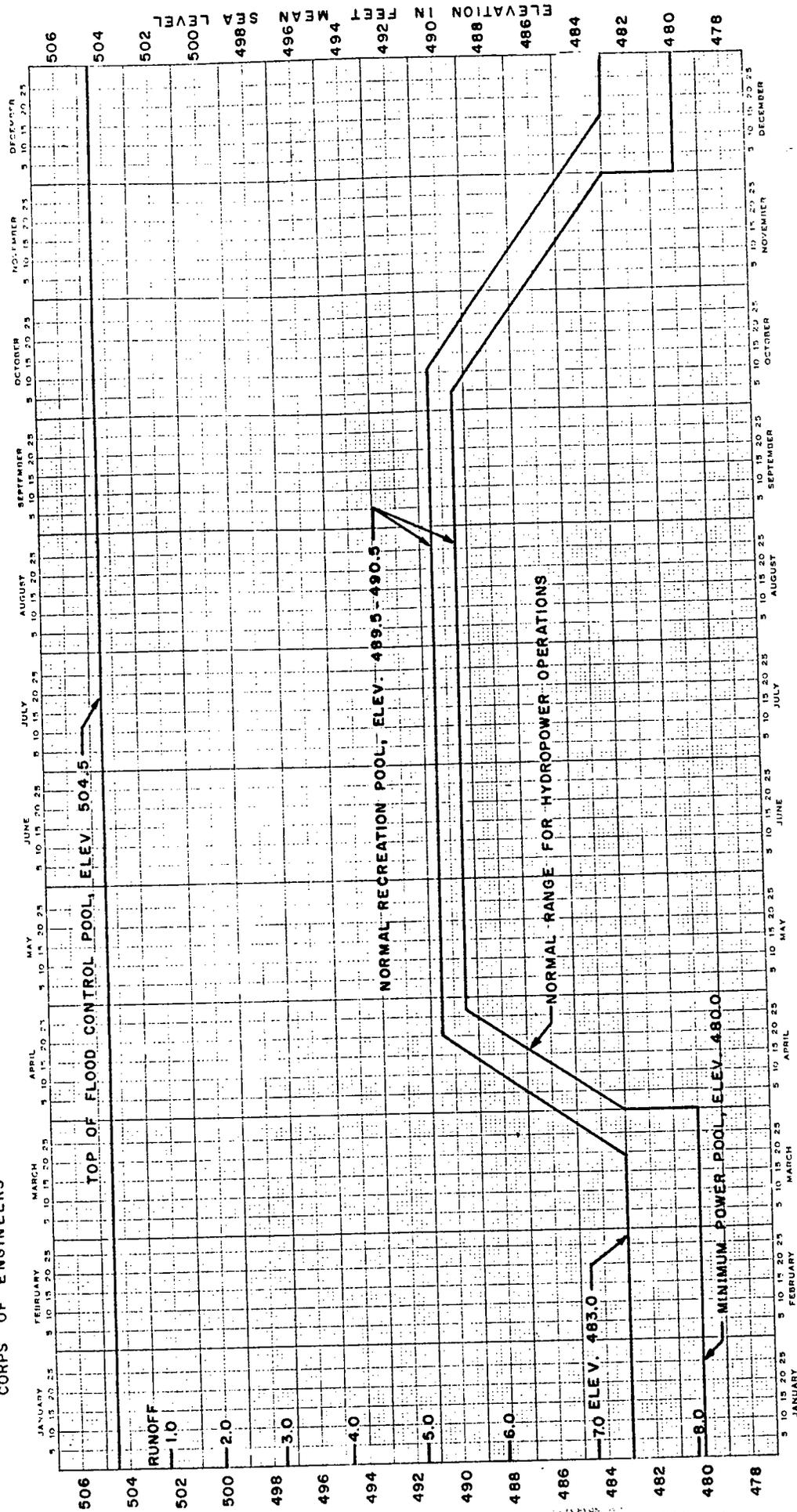


PLATE 4

**CORDELL HULL PROJECT
CUMBERLAND RIVER, KENTUCKY & TENNESSEE**

CORPS OF ENGINEERS

U.S. ARMY

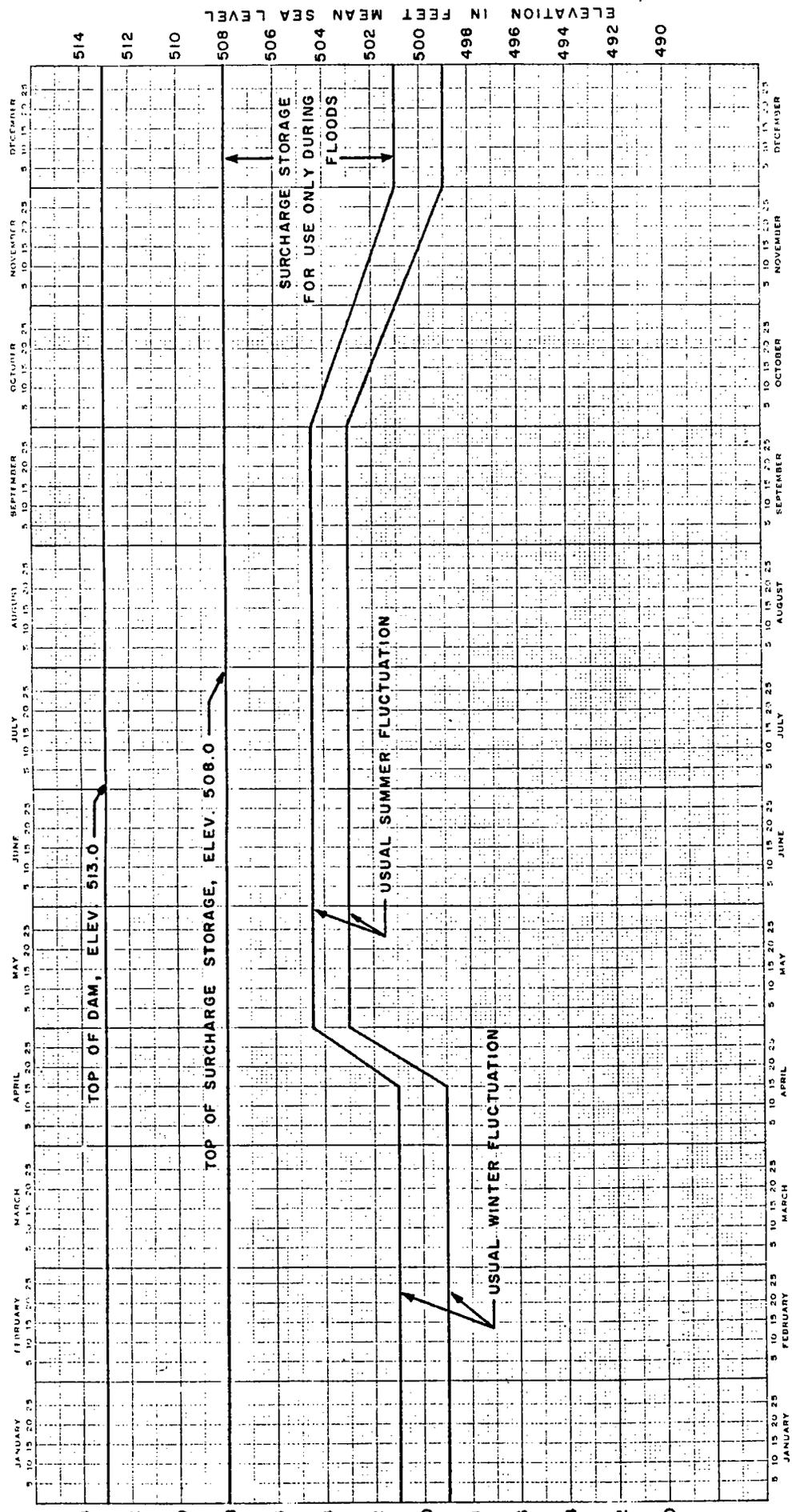
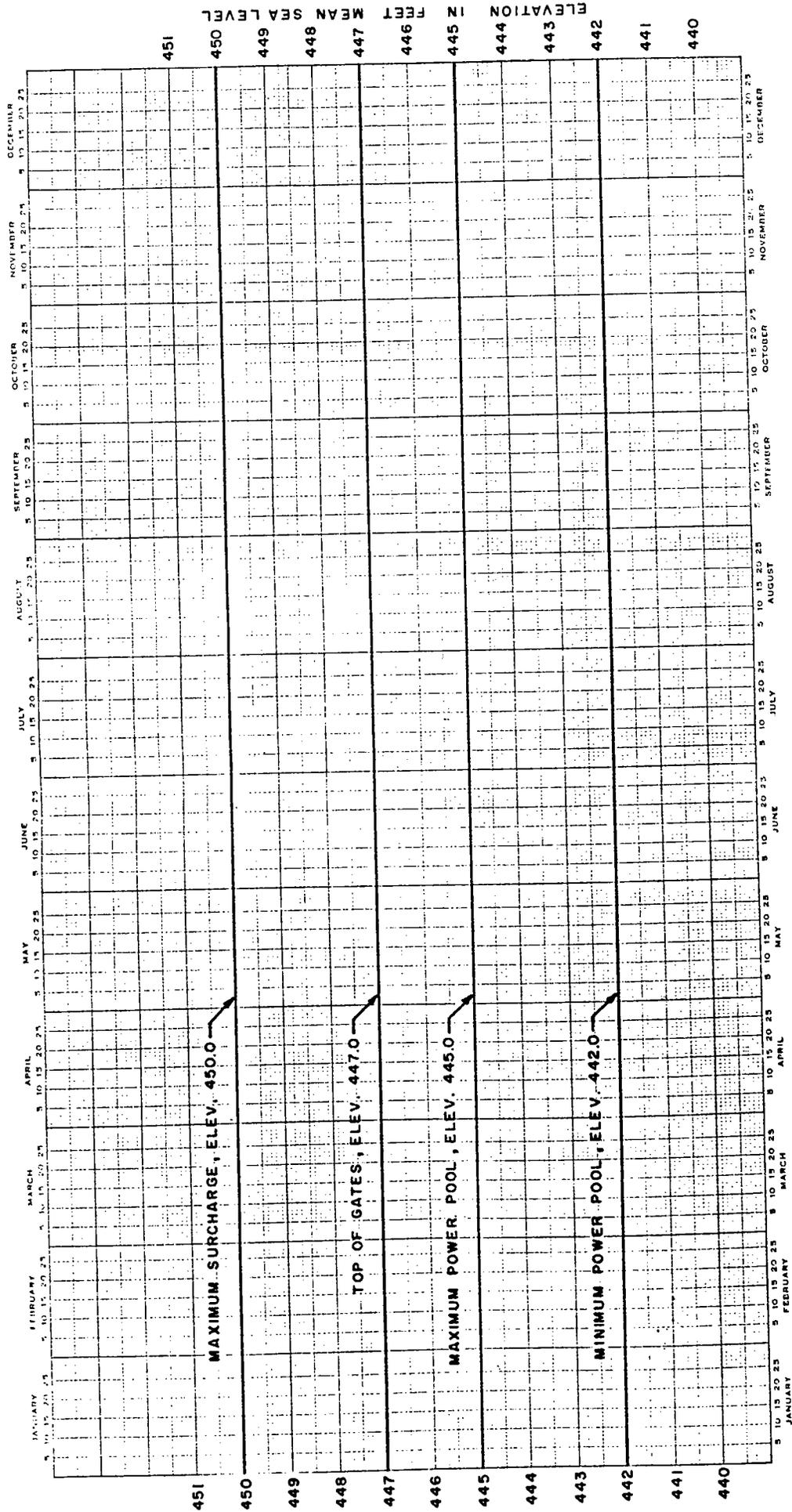


PLATE 5

OLD HICKORY RESERVOIR
CUMBERLAND RIVER, ILLINOIS

U.S. ARMY

CORPS OF ENGINEERS



CHEATHAM RESERVOIR
CUMBERLAND RIVER, TENNESSEE

U.S. ARMY

CORPS OF ENGINEERS

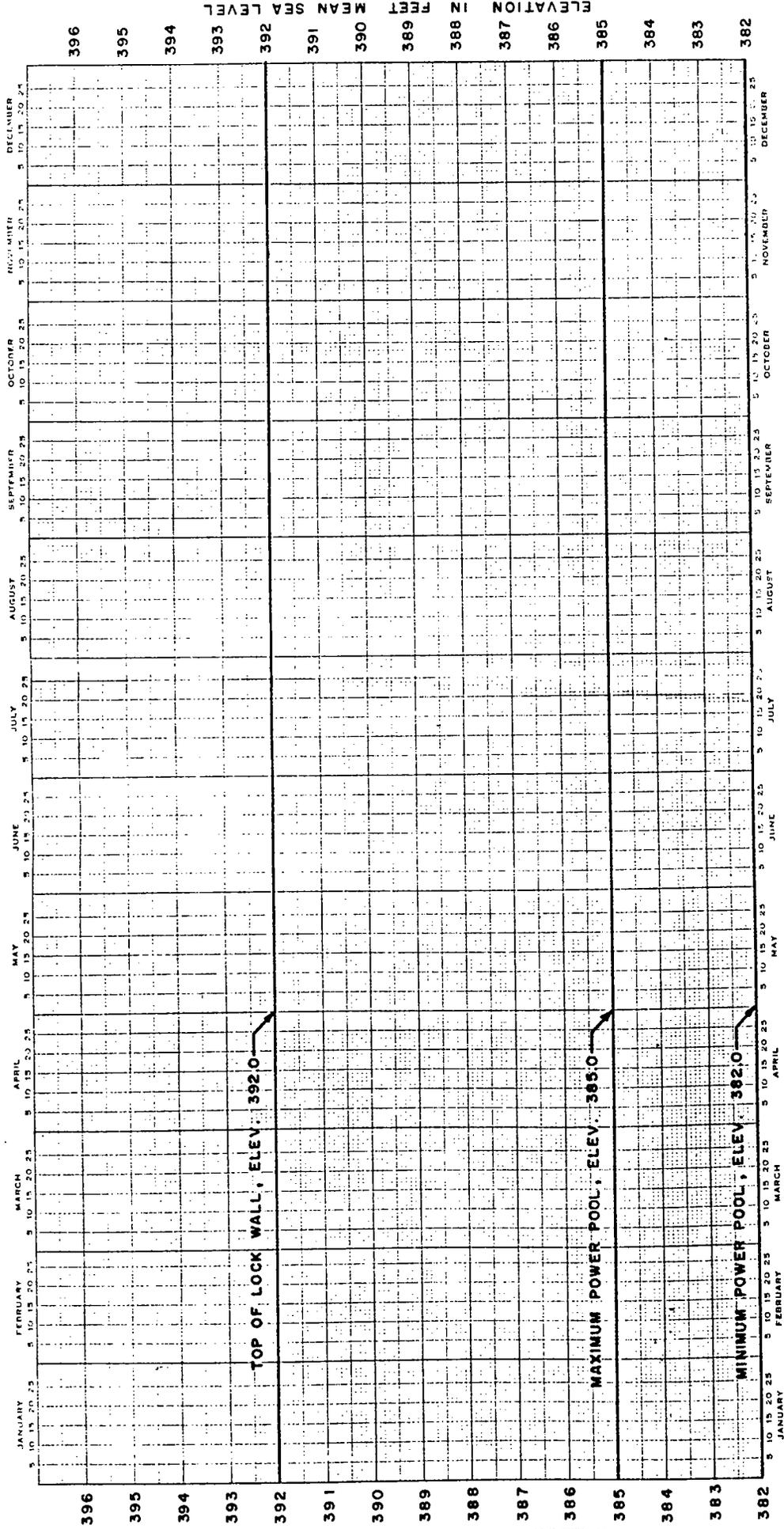


PLATE 7

BARKLEY DAM PROJECT
CUMBERLAND RIVER, KENTUCKY & TENNESSEE

U.S. ARMY

CORPS OF ENGINEERS

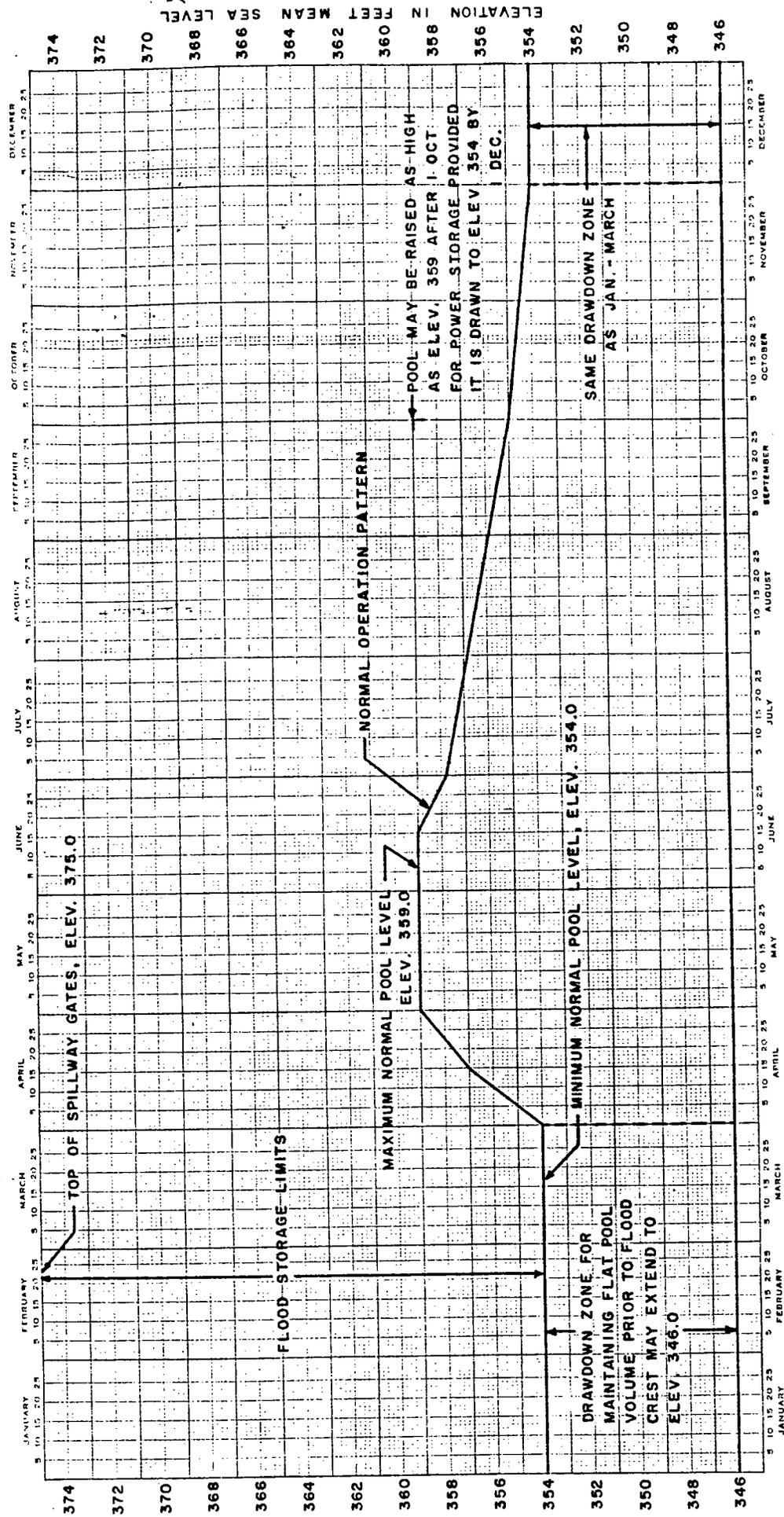


PLATE 8