



DEPARTMENT OF THE ARMY
WATERWAYS EXPERIMENT STATION, CORPS OF ENGINEERS
3909 HALLS FERRY ROAD
VICKSBURG, MISSISSIPPI 39180-6199

dy
Frank Jones
6/12

REPLY TO
ATTENTION OF

CEWES-EP-L (70-1r)

14 April 1993

MEMORANDUM FOR Commander, U. S. Army Engineer District, Louisville,
ATTN: Planning Division (Ms. Jan Hemberger),
P.O. Box 59, Louisville, KY 40201-0059

SUBJECT: NRTS Request for Assistance

1. Enclosed is a Memorandum for Record (MFR) in response to your request for assistance in assessing site conditions and providing recommendations concerning protection measures for a number of cultural resource sites located along the shoreline of Cave Run Lake. This response was developed by Dr. Paul Nickens of the Environmental Laboratory.
2. We appreciate your interest in the NRTS Program, and if you have any questions, please contact Dr. Nickens at 601-634-2380.

FOR THE DIRECTOR, ENVIRONMENTAL LABORATORY:

J. L. DECELL
Manager, Environmental Resources
Research and Assistance Programs

Encl

CF:
P. Nickens, EN-R

31 Mar 93

MEMORANDUM FOR RECORD

SUBJECT: Field Visit to Cave Run Lake, Morehead, KY, U.S. Army Engineer District, Louisville

1. At the request of the U.S. Army Engineer District, Louisville, I visited the Cave Run Lake project during the week of 15 Feb 1993. The request was initiated as a Natural Resources Technical Support (NRTS) response.
2. Cave Run Lake, located near Morehead, KY, is operated by the Corps of Engineers, but the perimeter of the lake is on the U.S. Forest Service Daniel Boone National Forest. The Forest Service, through its Morehead District Ranger Office, manages the land adjacent to the shoreline, including the existing recreation and camping areas.
3. Several known cultural resource sites are found along the shoreline of the lake. One in particular is a large concentration of artifacts and features that occurs on a peninsula of land on the west side of the lake. The Zilpo Recreation Area is also found at this locale.
4. Due to inclement weather at the time of the field visit, limited time was spent in the field assessing the current condition of this resource. However, extended discussions were conducted with both Corps and Forest Service personnel concerning the ongoing impacts due to erosion of the shoreline and fluctuating water levels and the need for mitigation of adverse effects to the archeological resource.
5. The archeological site area exposed in the drawdown zone of the lake consists of a broad mud flat that is covered by very shallow water during full pool. During the winter months, operational drawdown exposes this mud flat, on which scattered and concentrated artifacts occur. Last December, an artifact collector was apprehended in this area with illegally collected artifacts in his pocket. In addition to the problem of exposure creating opportunities for illicit artifact collecting, various physical impacts are occurring, such as damage from wave action and deflation of the sediments containing the cultural materials.
6. Field and office discussions during the visit centered on how to protect and preserve this important cultural site, particularly the undisturbed portions that occur above or behind the eroded shoreline scarp.
7. While the materials that remain above the shoreline are

undisturbed, the overall condition of the remains in the drawdown zone itself has not been determined. Based on the field reconnaissance, it appears likely that significant damage and loss has already taken place in the drawdown zone. Exposed tree stumps and their roots indicate loss of a large amount of sediment. Many artifacts exposed on the surface today probably result from this deflation process.

8. The site protection considerations focused on biotechnical strategies, particularly the possibility for establishing a wetland area on the mud flat and in front of the eroding shoreline. Creation of a wetland would certainly serve to protect the undisturbed portions of the cultural property, and would be aesthetically pleasing given the proximity to the recreation area. At this time, there are no wetland areas on the lake's perimeter.

9. I discussed both the shoreline stabilization work that Mr. Hollis Allen has been involved in here at WES as well as the Wetlands Research Program (Following my return to WES, I also discussed this situation with Mr. Allen and Dr. Russell Theriot, Program Manager for the WRP).

10. My verbal recommendations to the District and the Forest Service focused on the desirability to gain a better understanding of the actual distribution and significance of the cultural resource property. This should include fairly detailed mapping of the exposed remains, both on the mud flat and along the eroding shoreline. Moreover, the ongoing impacts need to be better defined. Since the site was initially recorded a number of years ago, it is necessary to have better information on its condition and the duration and intensity of the impacts. It is critical, for example, to have information on the condition of the exposed materials in the drawdown zone. If they are merely the result of deflation of the sediments, simple mapping of the concentrations, along with some collection of specimens, may suffice. If, however, there are intact subsurface deposits in this zone, they will have to be dealt with prior to creation of a wetland. Some subsurface data recovery may be necessary to prevent further loss of important intact data.

11. In any event, fairly detailed information on the cultural resource situation as a whole will be required before a protective strategy can be put into place. This should also include subsurface testing of the site area above the shoreline so that the precise boundaries are known. This testing should be limited to only that which is necessary to more exactly define the spatial and vertical limits of the site.

12. Based on my observations, the physical setting seems ideal for creation of a wetland area. Further discussion of this possibility will probably take place next fall when the lake is once again drawn down.

13. Two WES technical publications are particularly pertinent in this situation. The first is WES Technical Report EL-88-8, "Guidelines for the Organization of Archeological Site Stabilization Projects." Figure 2 from that report is attached (Atch 1). This figure illustrates a sequence for planning and implementing a site protection effort. Also, a copy of a recently published WRP Technical Note is attached (Atch 2) that discusses the design sequence for wetlands establishment.

2 Atchs

Paul R. Nickens

Paul R. Nickens, PhD
Research Archeologist

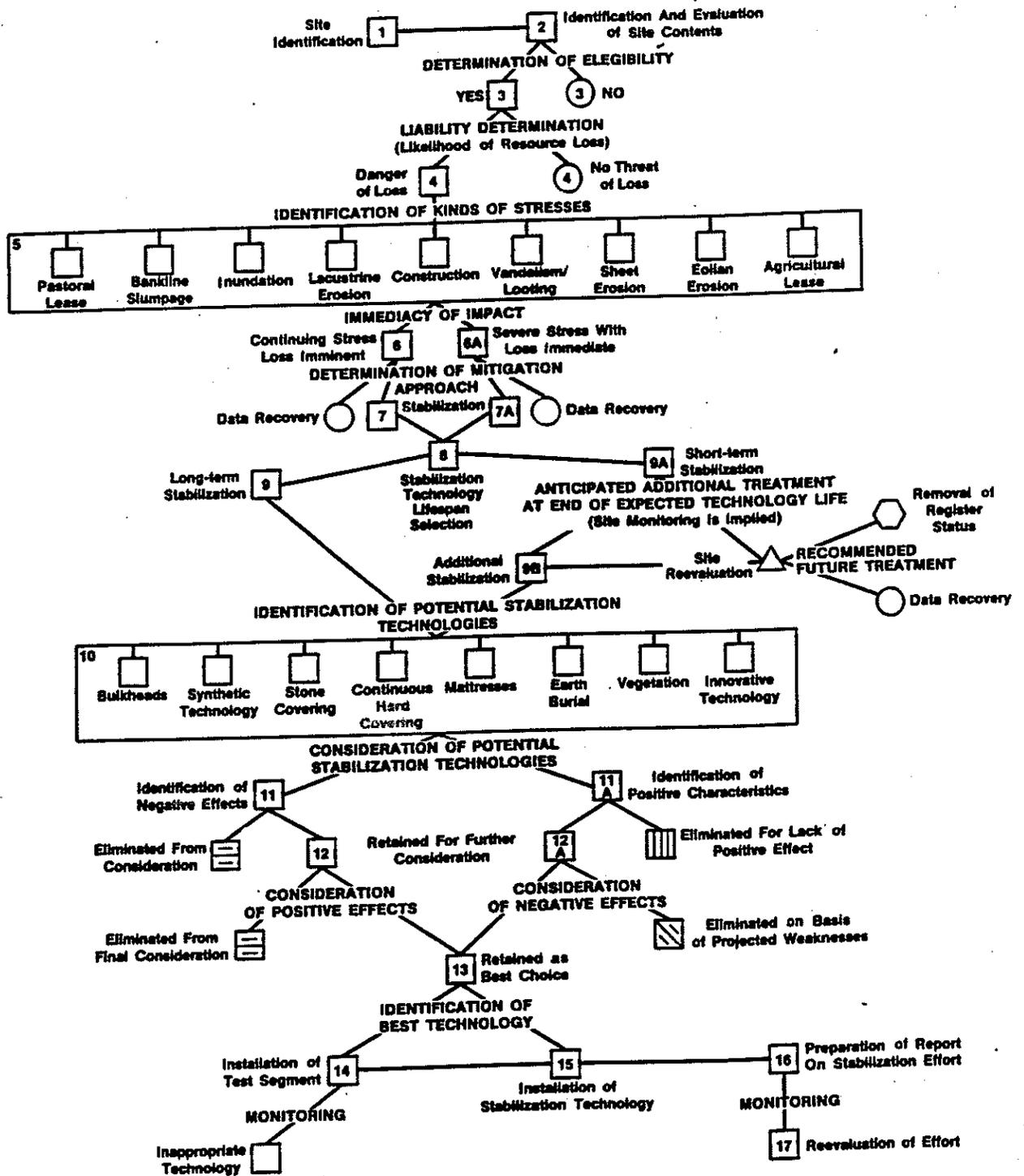


Figure 2. Schematic of proposed steps in archeological site stabilization projects



Wetlands Engineering: Design Sequence for Wetlands Restoration and Establishment

PURPOSE: This technical note describes a sequence of activities for design and selection of construction techniques for wetlands restoration and establishment. The design sequence includes consideration of wetlands needs, site characteristics, and design criteria; fill or excavation equipment and techniques for wetlands soils; water and erosion control structures for wetlands hydrology; and techniques and materials for establishing wetlands vegetation. Duplicative and unnecessary design evaluations can be avoided by following the guidance in this technical note (TN).

BACKGROUND: Guidelines pertaining to various aspects of wetlands design are available [Environmental Laboratory (1978), Federal Highway Administration (1990), Soil Conservation Service (in preparation)], and additional guidance is being developed as a part of the WRP Restoration and Establishment Task Area. This TN supplements the currently available guidance by describing a design sequence for wetlands establishment and restoration projects.

DESIGN SEQUENCE: The flowchart shown in Figure 1 illustrates the design activities for a wetlands restoration and establishment project and the sequence in which the activities should be considered. The overall sequence is based on the concept that design activities associated with establishing wetland substrate soils and hydrology should precede those associated with establishing wetland vegetation.

The numbered blocks in the flowchart in Figure 1 are referenced to the following brief descriptions of the activities:

- (1) Conduct an initial evaluation of wetlands needs for the area under consideration for the restoration/establishment project.
- (2) Select a desired set of wetlands functions and values for the project.
- (3) Perform a baseline site survey in the project area to determine initial topographic, hydrologic, soils, and vegetative conditions.
- (4) Prioritize and select specific sites for restoration and establishment within the project area.
- (5) Determine design criteria for soils, hydrology, and vegetation based on desired functions and values and site characteristics as determined in Step 2.
- (6) Determine if existing substrate soils and hydrology meet the design criteria. If substrate soils and criteria are adequate, proceed to Step 22 to evaluate wetlands vegetation requirements.
- (7) Determine if substrate fill or excavation will be required. If existing substrate elevation and grading are adequate, proceed to Step 17 to evaluate water and erosion control measures.
- (8) If fill or excavation will be required, determine substrate elevation and grading requirements to meet the design criteria (i.e. design the new substrate topography).
- (9) Select borrow material sources for fill requirements and placement sites for any excavated material (preferably within the restoration/establishment site).

DESIGN SEQUENCE
 FOR WETLANDS
 RESTORATION/ESTABLISHMENT

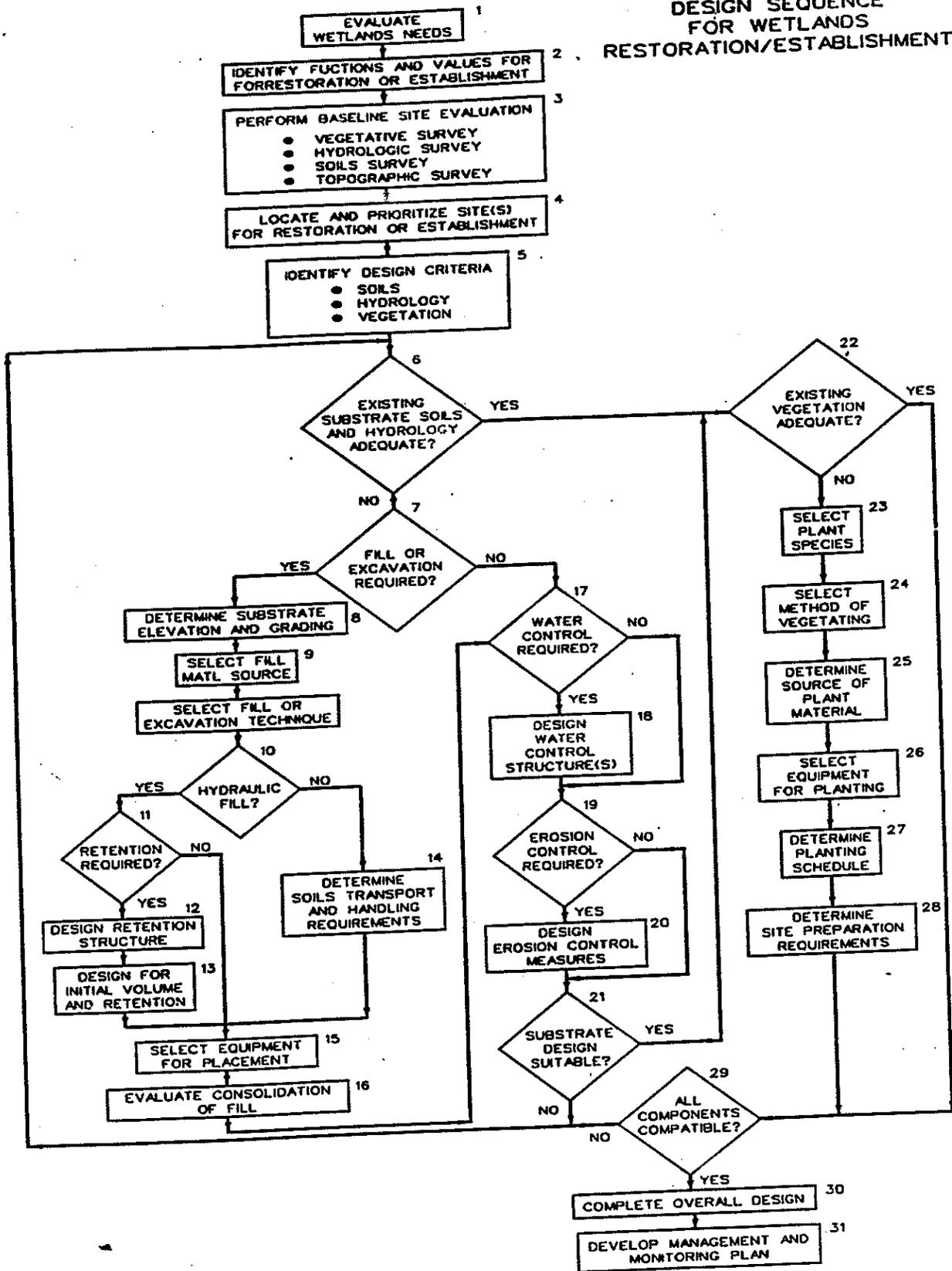


Figure 1. Flowchart illustrating design sequence for wetlands restoration and establishment projects

- (10) Determine the most desirable fill or excavation process (i.e. hydraulic fill or conventional soils handling). If a conventional soils handling process is chosen, proceed to Step 14 to select soils handling requirements.
- (11) If hydraulic fill is the desirable approach, determine if retention of the material will be required. If not, proceed to Step 15 to select the appropriate hydraulic dredging equipment.
- (12) If retention of hydraulic fill is required, design the retention dike or structure.
- (13) Design the retention area for initial volume of material to be placed hydraulically and for retention of suspended solids during placement.
- (14) If conventional soils handling is the desirable approach, determine soils handling requirements.
- (15) Select equipment for hydraulic placement or placement using conventional soils handling techniques.
- (16) Predict consolidation of fill and account for consolidation in fill elevation and grading.
- (17) Evaluate requirements for water control. If water control structures are not required, proceed to Step 19 to evaluate erosion control requirements.
- (18) Design any required water control structure(s).
- (19) Evaluate requirements for erosion control. If erosion control measures are not required, proceed to Step 21 to evaluate overall suitability of the substrate design.
- (20) Design necessary measures for erosion control.
- (21) Evaluate compatibility of all design components pertaining to substrate soils and hydrology. If compatible, proceed to Step 22 to evaluate vegetation requirements. If not, return to Step 6 to reevaluate requirements or designs associated with substrate soils and hydrology.
- (22) Determine if adjacent vegetation is adequate and will colonize the restoration/establishment site in an appropriate time frame without active planting. If adequate, proceed to Step 29 to evaluate overall compatibility of design components.
- (23) If active planting is required, select species for planting.
- (24) Select method of vegetating (e.g. seeds, propagules, etc.)
- (25) Determine source(s) of plant materials.
- (26) Select equipment for planting.
- (27) Determine planting schedule.
- (28) Determine site preparation requirements.
- (29) Evaluate overall compatibility of all components of design (soils, hydrology, vegetation). If not compatible, return to Step 6 to reevaluate requirements or designs.
- (30) Complete overall design.
- (31) Develop management and monitoring plan to include appropriate remedial actions.

Future TN's in the WRP series will provide more detailed information on the various activities included in this design sequence.

CONCLUSION: By following an efficient sequence of activities for design, unnecessary evaluations can be avoided and a fully integrated design will result.

REFERENCES:

Environmental Laboratory. 1978. Wetland habitat development with dredged material: Engineering and plant propagation. Technical Report DS-78-16. Vicksburg, MS: U.S. Army Engineer Waterways Experiment Station.

Federal Highway Administration. 1990. A guide to wetland functional design. Report No. FHWA-IP-90-010. Office of Implementation, Research, Development, and Technology. McLean, VA: Federal Highway Administration.

Soil Conservation Service. In preparation. Wetland restoration, enhancement, or creation. Chapter 13, Engineering Field Handbook. Washington, D.C. Soil Conservation Service.

POINT OF CONTACT FOR ADDITIONAL INFORMATION: Dr. Michael R. Palermo, USAE Waterways Experiment Station, ATTN: CEWES-EE-P, 3909 Halls Ferry Road, Vicksburg, MS 39180-6199, Phone: (601) 634-3753.

[1] From: Jan M Hemberger 8/31/95 7:58AM (1698 bytes: 29 ln)
To: CEORL-ORR-CVR
Subject: Re: WES Recommendations for Zilpo Archeological Sites
----- Message Contents -----

Mark,

Since you and I spoke I have been searching through boxes as we once again try to fit everything into a place where it can be relocated. I was going to call you today to let you know that I finally located the documentation from WES concerning the sites at Cave Run Lake. I will be putting two copies in the mail to you today (One for your files and one for U.S.F.S.).

I apologize for the long delay. I thought that this had been sent some time ago to U.S.F.S., but instead it must have become mixed in with documents packed for one of the many moves here in the District Office. This was in part possible due to the report's size - about 8-9 pages.

Please relay to the Forest Service my apologies. Also let them know that if they have questions or want to discuss the report to give me a call at (502) 582-6015. You might also relay to U.S.F.S. that we have a copy of "The Archaeological Sites Protection and Preservation Notebook" prepared by WES. If they don't have a copy I would be willing to send a copy to them (I have it within reach). Just provide me with a name and address.

If you need anything else just call or drop a note via cc:mail.

Jan Marie

PD

ORDPD-R (17 Nov 77) 1st Ind
SUBJECT: Supplemental Facilities Report No. 3, Design Memorandum
No. 12, Cave Run Lake, Kentucky

DA, Ohio River Division, Corps of Engineers, P.O. Box 1159, Cincinnati,
OH 45201 5 December 1977

TO: District Engineer, Louisville, ATTN: ORLED-R

1. The recommendations contained in the subject supplement are approved.
2. The comfort station for the High Bank Picnic Area should be included in the industrialized building program.

FOR THE DIVISION ENGINEER:

1 Encl
as

Frank P. Guehr
for HAROLD W. BEEMER
Acting Chief, Planning Division



DEPARTMENT OF THE ARMY
LOUISVILLE DISTRICT CORPS OF ENGINEERS
P. O. BOX 59
LOUISVILLE, KENTUCKY 40201

17 NOV 1977

ORLPD-R

SUBJECT: Supplemental Facilities Report No. 3, Design Memorandum No.
12, Cave Run Lake, Kentucky

Division Engineer, Ohio River
ATTN: ORDPD-R

1. Reference: ORLPD-R letter dated 9 June 77, subject as above, and ORDPD-R 1st Indorsement thereto dated 2 August 1977, copy inclosed.
2. The High Bank Picnic Area is one of a system of similar sites which are designed to help satisfy the critical need for day use recreation and shoreline fishing along the Kentucky Highway 801 shoreline. If not developed at the proposed location, a similar site would still need to be developed along Kentucky Highway 801. However, no site exists which offers as much potential for off-road parking, day use development, and fisherman access to the shoreline. Development of the land along the right abutment, southeast of the project office is infeasible due to the highway cut created by construction of Kentucky Highway 826 which crosses the dam.
3. It should be noted that year-round use is being made of the High Bank area by the visiting public. The old abandoned road (S.R. 801) has been blocked and a rough parking lot provided at the entrance. This was done to try to concentrate the parking off the highway as the scattered vehicles were becoming a hazard in the general area. It is felt that there would be much resentment from the public if this day use area were closed.
4. For the above reasons, it is recommended that High Bank Picnic Area be developed as proposed.
5. It is further recommended that the comfort facility at High Bank Picnic Area be developed as a flush facility rather than a chemical toilet

17 NOV 1977

ORLPD-R

SUBJECT: Supplemental Facilities Report No. 3, Design Memorandum No.
12, Cave Run Lake, Kentucky

as previously proposed and approved. Although a flush facility would cost approximately \$30,000.00 as compared to \$5,100.00 for a chemical toilet, a reevaluation of the public use expected at this site indicates that a flush facility would be more practical in handling the sanitation load.

FOR THE DISTRICT ENGINEER:

1 Incl
as


NEAL E. JENKINS
Chief, Planning Division



US Army Corps
of Engineers
Louisville District

--010

CAVE RUN LAKE
Licking River, Kentucky

MASTER PLAN
Design Memorandum No. 13

1984

CAVE RUN LAKE, KENTUCKY
LICKING RIVER

DESIGN MEMORANDUM NO. 13
MASTER PLAN

TABLE OF CONTENTS

Section	Paragraph	Title	Page
I		INTRODUCTION	
	1-01	Project Authorization	1
	1-02	Project Purpose	1
	1-03	Purpose and Scope of Master Plan	1
	1-04	Prior Design Memoranda	1
	1-05	Other Pertinent Publications	2
	1-06	Status of Project	2
II		PROJECT DESCRIPTION	
	2-01	Project Location	3
	2-02	Accessibility	3
	2-03	Project Operation	3
	2-04	Project Structures	3
	2-05	Land Resources	4
	2-06	Shoreline Length & Character	4
	2-07	Basin Hydrology	5
III		RECREATION AND ENVIRONMENTAL RESOURCES OF THE PROJECT AREA	
	3-01	History	5
	3-02	Archaeology	5
	3-03	Topography	5
	3-04	Geology and Soils	6
	3-05	Mineral Resources	6
	3-06	Climate	6
	3-07	Biology	7
	3-08	Vegetation	7
IV		FACTORS INFLUENCING AND CONSTRAINING RESOURCE DEVELOPMENT AND MANAGEMENT	
	4-01	Demography	7
	4-02	Area of Influence	8
	4-03	Visitation	9
		a. Previous Estimates	9
		b. Visitation Patterns	9
		c. Recreation Use Patterns	10
	4-04	Water Quality	11
		a. Preimpoundment Quality	11
		b. Postimpoundment Quality	11
	4-05	Relocations	12

TABLE OF CONTENTS (CONT.)

Section	Paragraph	Title	Page
	4-06	Related Recreational/Historical Areas	12
	a.	Recreation Areas	12
	b.	Historical Areas	13
V		COORDINATION WITH OTHER AGENCIES	
	5-01	General Coordination	14
	5-02	Coordination with Federal Agencies	14
	5-03	Coordination with State Agencies	14
	5-04	Coordination with Local Agencies	14
IV		RECREATION DEVELOPMENT	
	6-01	Original Development	15
	6-02	Amended Recreational Development Responsibilities	16
	a.	Completion of Initial Forest Service Facilities	16
	b.	Completion of Initial Corps of Engineers Recreation Facilities	16
	6-03	Site Description	16
	a.	Tailwater Area	16
	b.	Shop and Office Area	17
	c.	Stony Cave	17
	d.	Highbank	17
	e.	Caney	17
	f.	Twin Knobs Recreation Area	17
	g.	Alfrey Boat Ramp	21
	h.	Warix Run Boat Ramp	22
	i.	Zilpo Recreation Area	22
	j.	Clay Lick Boat Ramp	23
	k.	Bangor Boat Ramp	23
	l.	Poppin Rock Boat Ramp	23
	m.	Longbow Marina and Boat Ramp	24
	n.	Twenty-six Boat Ramp	24
	o.	Scott Creek Marina and Boat Ramp	24
	p.	Leatherwood Boat Ramp	25
	q.	Clear Creek Recreation Area	25
	r.	Highway 801 Recreation Area	26
	s.	Buckskin Trail	28
	t.	Sheltowee	29
	6-04	Future Recreational Facility Development	29
	a.	Future Forest Service Recreational Facility	29
	b.	Future Corps of Engineers Recreational Facilities	30

TABLE OF CONTENTS (CONT.)

Section	Paragraph	Title	Page
VII		CONCLUSIONS	
	7-01	Conclusions	31

EXHIBITS

Exhibit Number	Title
A	Pertinent Correspondence with Daniel Boone National Forest
B	Memorandum of Understanding dated October 21, 1968
C	Amendment to the Memorandum of Understanding December 4, 1975

CAVE RUN LAKE, KENTUCKY

LICKING RIVER BASIN

DESIGN MEMORANDUM NO. 13

MASTER PLAN

Prepared By
U.S. Army Engineer District, Louisville
Corps of Engineers
Louisville, Kentucky

I. INTRODUCTION

1-01. Project Authorization. The Cave Run Project was authorized by the Flood Control Act of 22 June 1936 (Public Law No. 738, 74th Congress, 1st Session), and the Flood Control Act 28 June 1938 (Public Law 761, 75th Congress, 3rd Session).

1-02. Project Purpose. Cave Run Lake is a unit included in the comprehensive development plan for the Ohio River Basin, furnishing flood protection for the lower Licking River and lowering flood stages on the Ohio River. The lake is also operated for water quality control, recreation and fish and wildlife activities.

1-03. Purpose and Scope of Master Plan. The purpose of this Master Plan is to guide recreational development of land and water resources within the project area. This plan includes site development plans designed from the preparation of final site plans and specifications for initial recreation use, and will provide a context for future site developments. Certain existing recreation facilities, and those scheduled prior to the draft of this plan, are incorporated.

1-04. Prior Design Memoranda. Design Memoranda Number 5a, prepared by the U.S. Army Corps of Engineers, Louisville District, and Number 12, prepared by the U.S. Forest Service, Daniel Boone National Forest, serve as pertinent references to this Master Plan as they formed the basis for the present day policy of resource development at Cave Run Lake. A complete list of previous Design Memoranda is located below.

- DM #1 Reservoir & Spillway Capacities, Flood Control, Water Quality Control, Seasonal Regulation, and Hydroelectric Power - Dec 1963
- DM #2 General Design Memorandum & Supplement #1 - December 63
- DM #3 Dam and Spillway - August 1964
- DM #4 Outlet Works - October 1964
- DM #5a Preliminary Master Plan - March 1965
- DM #6 Concrete Aggregates and Riprap Sources - May 1965
- DM #7 Real Estate Required for Construction Area - September 1964
- DM #8 Relocation of State, County, and Forest Service Roads August 1965
- DM #9
thru
DM #9f Real Estate Required
- DM #10 Relocation of Utilities - 1966

- DM #11 Reservoir Clearing - January 1972
- DM #12 Cave Run Composite Recreation Plan - June 1968 (published by U.S. Forest Service) & Supplemental Facilities Reports No. 1 through No. 4 of Appendix A - Project Resources Treatment Plan - May 1979
- 1-05. Other Pertinent Publications.

Report of Impact on Daniel Boone National Forest Resulting from Proposed Cave Run Reservoir, Licking River, Kentucky. Prepared by Forest Service, U.S. Department of Agriculture, Winchester, Kentucky, November, 1966.

Real Estate Planning Report - Interchange of Lands Between the Department of the Army and Department of Agriculture - January 1969 and April 1971.

Final Environmental Impact Statement, Cave Run Lake, Kentucky, April 1975.

Addendum to Final Environmental Impact Statement, Cave Run Lake Project, Kentucky, June 1974.

Alternatives for the Alleviation of Flooded Timber Problems, November, 1978.

1-06. Status of Project. Construction of Cave Run Lake begin in June 1965 and is 89.2 percent complete. The project was placed in operation in 1974. Total costs projected through Fiscal Yea 1983 are \$79,811,000. This total is distributed as follows:

TABLE 1

DISTRIBUTION OF CONSTRUCTION COSTS

CAVE RUN LAKE
(in Thousands)

Lands & Damages	12,271.0
Relocations	20,890.8
Lake	1,136.3
Dam	13,060.8
Roads	1,827.8
Recreation Facilities	19,326.4
Buildings, Grounds & Utilities	469.7
Permanent Operating Equipment	316.2
Engineering & Design	5,255.0

Supervision & Administration

5,257.0

79,811.0

II. PROJECT DESCRIPTION

2-01. Project Location. The project area is located in the Licking River Basin of east-central Kentucky, 84 air miles from Cincinnati and 118 air miles from Louisville. The damsite is on the Licking River 1.9 miles upstream from U.S. Highway 60 and 173.6 miles above the junction of the Licking and Ohio Rivers. The seasonal pool (El. 730) lies in Morgan, Menifee, Rowan and Bath Counties, and extends to 11 miles below West Liberty, Kentucky. At spillway crest (El. 765), the lake extends approximately 64 miles above the damsite

2-02. Accessibility. Access to the north lake shore is excellent while access to the south shore is generally lacking. The main access to the project area is U.S. 60 via Interstate 64. County road 801 provides excellent access to a large portion of the north shore of the lake, while the dam and tailwater areas are made accessible by county road 826. County road 1274 bisects the project area, running north-south near the Morgan-Menifee county line and provides access to the North Fork and Beaver Creek embayments. County roads 519, 203, 36, 211, and State highway 460 provide access to the southern and eastern portions of the project area. A ridge road passing through the Pioneer Weapons hunting area and connecting county road 211 to the Zilpo recreation area, has also been developed.

2-03. Project Operation. The Cave Run Lake project has been in operation since 1974. It is operated for the purpose of flood control, water quality control, general recreation, and fish and wildlife recreation. The plan of operation calls for water impoundment within three designated limits:

<u>Pool</u>	<u>Elevation</u>	<u>Area (Acres)</u>	<u>Backwater Main Stream (Miles)</u>
Water Quality	724 ms1	7,390	44.9
Seasonal Recreation	730 ms1	8,270	48.1
Flood Control	765 ms1	14,870	66.2

Maximum release of water into the Licking River is 6,000 cfs. Minimum release required to maintain water quality is 50 cfs during normal operation except up to 150 cfs may be required to satisfy downstream water quality control objectives. Minimum release when pool is above rule curve is 150 cfs.

2-04. Project Structures. The existing project structures are a spillway, dam, and outlet works. The basic characteristics of these structures are as follows:

Embankment - located 2 miles south of Farmers, Kentucky

Maximum height of dam	148 ft
Type of dam	Earth and rock fill
Length of dam	2,700 ft
Maximum fill	136 ft
Top elevation	788 msl
Top width of dam	30 ft

Spillway - located at left abutment end of dam

Type	Uncontrolled open cut
Width of cut	280'-650'
Crest elevation	765 msl

Outlet Works - location at station 15+80 of the dam

Intake structures	Two 6.75' x 15.0 vertical slide gates
-------------------	--

Two 24" low flow by pass
pipes with multiple-level
inlets.

Diameter of concrete conduit	15'
---------------------------------	-----

2-05. Land Resources. Federal property acquired within the Cave Run Lake project area, comprised of both Corps owned and Forest Service owned land, amounts to 27,200 acres with reserved-use permits extending to 31,502 acres. The U.S. Army Corps of Engineers owns easement rights to 3,806 acres. (At the time of this draft's preparation, the Corps has jurisdiction over fee lands totaling 6,121.5 acres 5,768.07 of these acres are planned for transfer to the U.S. Forest Service.)

2-06. Shoreline Length and Character. At the flood control pool level (765 msl), Cave Run Lake has a surface area of 14,870 acres and extends 66.2 miles upstream from the dam. At seasonal pool level (730 msl), the lake covers an area of 8,270 surface acres and extends 48.1 miles upstream. The water quality pool (724 msl) covers 7,390 surface acres and extends 44.9 miles above the dam.

Cave Run Lake is formed primarily from the Licking River and two of its main tributaries--Beaver Creek and North Fork Licking River. The nature of the terrain, together with the large number of branches and tributaries, has provided a shoreline with many coves and embayments. The terrain is generally characterized by steep slopes to the shoreline with moderately rolling terrain at the top. These steep shorelines provide varying degrees of difficulty to lake access and generally become higher and steeper as one moves further upstream from the dam.

The lower lake also offers numerous scenic vistas which are readily viewable from the shore. Stands of flooded timber near the shorelines characterize the upper reaches of the impoundment (see "Alternatives for the Alleviation of Flooded Timber Problems, November 1978").

2-07. Basin Hydrology. Cave Run Lake is located at mile 173.6 of the Licking River which flows north-northwest into the Ohio River near Cincinnati, Ohio. Both rugged and steep, the upper watershed has narrow ridgetops running from 300 to 1,000 feet apart. Principal tributaries of the Licking River in the project area include Licking River North Fork, Elk Fork Creek, Beaver Creek, and Caney Creek.

Peak waterflows may be experienced in any month, however, they generally occur in March and April. Minimum flows usually occur in late summer. Snowfall is rarely so significant as to influence streamflow.

III. RECREATION AND ENVIRONMENTAL RESOURCES OF THE PROJECT AREA

3-01. History. The Licking River valley was first discovered in 1750 and the river was named for the abundance of natural salt licks in the area. The region was settled in the late 1700's despite fierce Indian resistance. One occurrence of notable interest, the last Indian massacre in Kentucky took place at Murder Branch Creek in southern Menifee County.

Local timber and iron industries, which supplied Cincinnati and other Ohio River settlements flourished in the 1800's. Clear Creek Furnace, in Bath County, 5 miles south of Salt Lick, remains a monument to the iron mining days. It was built for the smelting of pig iron in 1839 and was active until 1857. During this period, countless tons of pig iron were produced and used primarily for the manufacture of railroad car wheels. Other iron furnaces in the Cave Run Lake area were located on Caney Creek and Beaver Creek. A narrow gauge railroad tunnel still exists at the Poppin Rock recreation area.

3-02. Archaeology. A total of 64 aboriginal sites have been examined in the area. One significant bottomland site, located in a borrow area, was extensively excavated and two additional sites were examined by the University of Kentucky Department of Anthropology. Conclusions reached concerning the area show a settlement system of Late Archaic and Early Woodland people who inhabited upland rock shelters for part of the year while seasonally moving to the river terraces. The sites examined are believed to have been seasonally occupied. No archaeological sites in the project have been placed on the National Register of Historic Places.

3-03. Topography. The topography of the Licking River Basin is steep and rugged. Relief ranges between 300 and 400 feet from valley bottoms to ridge tops. The slopes range from 1-5 percent in the valleys to

45-50 percent at the valley walls. The lake's flood plain measures 3,500 feet in width in the lower half of the valley and narrows to 1,000 feet wide at the upper portions.

3-04 Geology and Soils. Formations representing four major geologic ages are found in the Cave Run project area: Pennsylvanian, Mississippian, Devonian and Silurian. There are also three soil associations found within the area: Cranston-Berks, Berks-Cranston-Wharton, and Tilson-Wharton-Johnsbury.

The Cranston-Berks and Berks-Cranston-Wharton series are formed from limestone. These soils are generally found on sideslopes and broad ridgetops. The Tilson-Wharton-Johnsbury soils consist of old alluvium from siltstone and shales and are found in nearly level to broad sloping ridge tops and high terraces. All of these soils are well drained, high in natural acidity, and low in natural fertility.

3-05. Mineral Resources. There are four exploited mineral resources within the Licking River Basin -- coal, oil, limestone, and fire clay. The area contains an estimated one billion short tons of extractable coal, most of which is concentrated in the upper basin in Magoffin and southern Morgan Counties. To date, over 3,000 acres have been stripped and reclaimed although incidence of acid drainage has been recorded in the Elk Fork Creek area. Mining within the basin is expected to continue. Because of the location of future mining sites, little short-term sedimentation is expected to occur in the lake, however some long-term sedimentation and general water degradation can be expected to occur.

Production of crude oil, mainly occurring in Magoffin County, has taken place in the basin area since 1901. Salt brine used to force oil to the surface of these wells is becoming an increasing problem as it leaks into the Licking River watershed. In 1982, significant water quality problems were created in Salyersville and West Liberty when salt brine contaminated the source of drinking water for these communities. As of 1973, however, all active and non-active wells in the Cave Run area were plugged. Fire clay, used to make high temperature resistant clay products, is also found in the basin area. A strip site within the area of acquisition was formerly in operation. Another site adjacent to Federally owned lands has recently been opened.

Also found in the area, concentrated in Morgan and Menifee Counties, are deposits of high quality limestone used for road surfacing, concrete aggregate, and agricultural limes. There are three limestone quarries at the head of Ramey Creek.

3-06. Climate. The project area has a temperate climate. Summers are warm and humid with extended periods of sultry weather. Winters are cool while spring and fall weather is mild. Temperatures extremes range from -20° F. to 100° F. Average yearly rainfall is 46.65 inches. High intensity thunderstorms are frequent in summer while moderate and low intensity rainstorms and snow occur in winter. Snow often stays on the ground one month out of the year, and the average freeze depth ranges from 6 to 8 inches, occasionally ranging from 12 to 18 inches.

3-07. Biology. The Licking River has a high habitat value for game fish species. The effect of water impoundment is generally beneficial to most species of fish. Game fish species found in the area include smallmouth bass, rock bass, largemouth bass, spotted bass, crappie and muskellunge. Roughfish such as catfish, freshwater drum, carp and sucker are also found.

The area immediately surrounding the lake is classified as lowland and consists of large clear pastures interspersed with small sections of hardwood vegetation. Sideslopes and ridges in the area are covered by communities of mixed climax hardwoods. Habitat conditions for these areas are classified as low to medium for wildlife species such as rabbit, deer, squirrel, quail, dove, grouse, raccoon, and turkey. Relocations resulting from the flooding of the lake area caused an initial increase in the surrounding areas wildlife populations, which have since stabilized.

3-08. Vegetation. The project lies on the western edge of an area classified as a mixed mesophytic forest characterized by mixed climax communities of yellow poplar, beech, sugar maple, white oak, white basswood, yellow buckeye, red oak, and hemlock. Other associations include white ash, red maple, cucumber tree, shagbark and butternut hickories, black gum, black cherry, black walnut, and sweet birch. Also noted within the area are pin-oak, oak-hickory, and tuliptree-oak communities.

Vegetative regeneration in this area is unsettled due to disease, fire, and past land use practices such as logging operations. Stress is occurring in some species near the lake shoreline due to water fluctuations. Species diversity and distribution are also decreasing. As a result, dead and dying trees and shrubs are found along the shoreline. Water-tolerant plants have occupied the zone of fluctuation to force new communities.

IV. FACTORS INFLUENCING AND CONSTRAINING

RESOURCE DEVELOPMENT AND MANAGEMENT

4-01. Demography. The Cave Run Lake project area is located within the four-county area of Bath, Rowan, Menifee and Morgan Counties. The area has seen a significant change in its economic base in the last 25 years. Once primarily agricultural the area has witnessed the growth of manufacturing and services. One agricultural trend within the area consistent with national trends is the consolidation of farm units, evidenced by a decreased number of units and an increase in average size.

Of the four counties most directly affected by recreation development at Cave Run Lake, three are heavily agricultural in nature and rural in character - Bath, Menifee, and Morgan. In contrast, a wide range of manufacturing and service industries are concentrated in Rowan County, primarily in the Morehead area, the region's dominating urban influence.

4-02. Area of Influence. Because of its proximity to U.S. Interstate 64 (I-64), the project is affected by several large metropolitan areas: Cincinnati, Ohio (135 miles away); Louisville, Kentucky (120 miles away); Huntington, West Virginia (75 miles away); and Lexington, Kentucky (55 miles away). The Lexington-Fayette, Kentucky SMSA is located west of Cave Run Lake and had a 1980 population of 204,165. It is one of the fastest growing areas in the United States and is expected to continue to provide a large portion of visitation to the project area. Ashland, Kentucky, located along I-64 about 70 miles east of the project, had a population of 27,064 in 1980. Though Ashland's population has been slowly decreasing over the past decade, that area still ranks as an important source of visitors to Cave Run Lake project.

Population density within the project's vicinity is low except in Morehead and surrounding Rowan County. Morehead, located 10 miles to the northeast of the lake, had an increasing population of 7,789 in 1980 and is the largest urban area near the project. The cities of Owingsville (pop. 1,419) and West Liberty (pop. 1,381) are the only other significant population influences within the immediate project area. Generally speaking, the population of the region surrounding the project area is expected to remain stable to slightly increasing. The following table presents projected population figures for the Cave Run Lake region through 2000:

TABLE 2
COUNTY POPULATION PROJECTIONS
CAVE RUN LAKE REGION

County	Populations*		Projected Populations**		
	1970	1980	1985	1990	2000
Bath	92,350,025	10,078	10,125	10,137	
Carter	19,850,060	27,287	29,588	34,341	
Elliott	5,933	6,908	7,214	7,523	7,971
Fleming	11,366	12,323	12,620	12,902	13,369
Menifee	4,050	5,117	5,548	5,979	6,886
Montgomery	15,364	20,046	21,695	23,374	26,898

Morgan	10,010,103	12,683	13,314	14,521
Rowan	17,010,049	19,460	20,171	21,158

* Actual census figures presented for comparison

** Source: Preliminary 1981 Population Projections Update,
Urban Studies Center
Universit of Louisville
December 1981

4-03. Visitation.

a. Previous Estimates. Visitation to Cave Run Lake was first addressed by estimates in the General Design Memorandum (DM No. 5A, U.S. Army Corps of Engineers, Louisville District. 1965) in cooperation with the Bureau of Outdoor Recreation. Annual visitation was estimated at 400,000 initially with an increment increases until a total of 980,000 ultimate visitation was reached. These figures were based upon the 1960 population of 736,200 within a 50-mile zone of influence around Cave Run Lake.

In 1968, the U.S. Forest Service published the Cave Run Composite Recreation Plan. In this publication, the annual visitation estimate for the initial development period was revised upward to 1,370,000 with ultimate visitation estimated at 2,950,000.

b. Visitation Patterns. Actual visitation to Cave Run Lake project has been recorded since impoundment (1974) and is approaching the visitation pattern which was projected by the more recent planning documents.

TABLE 3

CAVE RUN LAKE PROJECT VISITATION (IN THOUSANDS)

Year	Corps of Engineer's Visitation*	Forest Service Visitation**	Total Visitation
1974	170.0	109.0	279.0
1975	154.0	263.4	417.4
1976	114.6	336.9	451.5
1977	570.0	1,091.1	1,661.1
1978	395.3	1,229.3	1,624.6
1979	315.6	1,548.7	1,864.3
1980	363.9	2,054.0	2,417.9
1981	761.9	2,227.6	2,989.5
1982	726.0	1,090.8	1,816.8

* Visitation recorded in "recreation days" as measured at project lands under jurisdiction of the Corps of Engineers. A recreation day is a standard unit of use consisting of a visit by one individual to a recreation development or area for recreation purposes during any reasonable portion or all of a 24-hour day.

** Visitation recorded in "visits" as measured at project lands under jurisdiction of the Forest Service. A visit is the entry of any person upon a National Forest site or area of land or water generally recognized as an element in the recreation population.

c Recreation Use Patterns. Existing uses within the project area include both water and land-based activities. Most of the recreational activities are seasonal and are reflected in facility demand during the recreation season. Water-related activities include power boating, canoeing, sailing, swimming, diving, water skiing, and fishing. Land-related recreational activities include hunting, hiking, camping, picnicking, and horseback riding.

Since the time Cave Run Lake began operation, visitor use has been heavier than anticipated. Day-use activities has been especially popular. Bank fishing is notable for the unusually turnout This has resulted in the planned additional development of several day-use facilities along Highway 801.

Another heavily used day-use area has been the Twin Knobs beach, which accommodates campers in the area a well as day visitors. The additional beach facility under construction at the Zilpo recreation area is expected to relieve pressure on the Twin Knobs beach and result in better visitor distribution.

Tent and trailer camping is receiving heavy usage at the Twin Knobs recreation area. During the peak summer months, the area is experiencing capacity usage on the weekends and is operating at near capacity during the week. According to the U.S. Forest Service, an estimated 5 percent of the camping visitation to the Red River Gorge area results from "spill over" visitation from Cave Run Lake. The Zilpo camping area will help accommodate visitor use during peak times.

Because of its location and size, the Caney recreation area's future development will have an appreciable impact upon the public use patterns of the project area and the type and number of visitors coming to Cave Run Lake. These effects will be studied in depth by both the U.S. Forest Service and the U.S. Army Corps of Engineers before development of this area begins.

4-04. Water Quality.

a. Preimpoundment Quality. The water in the Licking River basin has low hardness and a moderate capacity to produce aquatic organisms. It meets all Commonwealth of Kentucky water quality requirements. Conditions tested include hardness, dissolved solids, conductivity, alkalinity, iron, manganese, pH, temperature, dissolved oxygen, chlorine, and phosphate.

b. Postimpoundment Quality. Cave Run Lake is thermally stratified from late spring to early fall. The only major water quality problem associated with the project is the oxygen-deficient hypolimnion which contains high concentrations of iron and manganese. To counteract this influence, a multi-level, selective withdrawal system has been placed to augment low flow conditions. Impoundment is also causing an increase in the productivity of the water while creating a sediment trap for waterborne particles.

In the lake itself, river dwelling aquatic fauna and flora are being replaced by lake dwelling species. No significant change is expected upstream from the pool with the exception of some migrating species of fish. Generally, the stream environment below the dam benefits from the stabilized water discharge. Occasional release of hypolimnion water. This water, which is 20° F. cooler than the channel water and contains concentrations of iron and manganese has had some effect on the stream environs immediately downstream from the dam. Accumulation of these elements is not expected in the lake itself because of the seasonal periodic flushing action and the location of the outtake source at the bottom of the lake.

c. Developed Water Uses. There are no sources of water intake in Cave Run Lake. The city of Morehead maintains an intake facility on the Licking River just downstream from the project--between the dam and U.S. Highway 60. This system currently provides water to the Twin Knobs Recreation Area. Waterlines have been laid across the lake to eventually service the Zilpo Recreation Area.

4-05. Relocation. Relocation of existing facilities affected by the impoundment of water included portions of eight state highways, eight county roads, certain affected utilities, gas transmission lines, and approximately 1,950 graves. Extensive relocation work immediately adjacent to the project area has been conducted on Highways 801, 821, and 1274. Construction of an additional access road through the Pioneer Weapons Hunting Area to the Zilpo recreation site and connecting to Highway 36 has been completed.

4-06. Related Recreational/Historical Areas.

a. Recreational Areas. The major portion of the project area lies within the proclamation boundary of Daniel Boone National Forest, administered by the U.S. Forest Service. The 7,500-acre primitive weapons hunting area lies adjacent to the lake. Other sites which attract visitors are the Minor E. Clark fish hatchery (located below the tailwater of the dam), Murder Creek cave, and the Clear Creek Furnace site. Other recreation areas within a 50-mile radius of the project are as follows:

<u>Area</u>	<u>Location</u>	<u>Activities</u>
Blue Licks State Park	10 miles south of Mt. Olivet	Picnicking, camping, swimming
Boonesboro State Park	Boonesboro	Camping, swimming, picnicking
Broke Leg Falls Roadside	11 miles east of Frenchburg	Picnicking
Buckhorn Lake and Buckhorn State Park	Buckhorn	Cabins, boating, swimming, picnicking, camping
Carter Caves State Park	8 miles north of Olive Hill	Boating, fishing, picnicking, camping, cabins, golf, horse-back riding
Kincaid Lake State Park	5 miles east of Falmouth	Boating, fishing, swimming, camping, picnicking
Greenbo State Park	13 miles south of Greenup	Boating, fishing, swimming, camping, picnicking
Jennie Wiley State Park	5 miles east of Prestonburg	Boating, fishing, golf, cabins, camping, picnicking, swimming

Natural Bridge State Park 2 miles south of Slade Boating, swimming, camping, picnicking, cabins, horseback riding

b. Historical Areas. There are a number of sites of historical interest in proximity to the project area. A list of historical sites within the four-county area of Morgan, Menifee, Rowan, and Bath includes:

Bath County

Bourbon Iron Works
Byron House (Owingsville)
Chesapeake & Ohio Railroad Depot (Preston)
Knob Licks (east of Owingsville)
Lee House (Owingsville)
Olympian Springs Health Spa Sit (KY 36)
Owings, Thomas Dye, House (Owingsville)
Presbyterian Church (near Sharpsburg)
Clear Creek furnace (off KY 211 near Salt Lick)

Menifee County

Beaver Dam Furnace (on Beaver Creek east of Frenchburg)
Grants Arch (off KY 163 at Indian Creek, south of Frenchburg)

Morgan County

Henry Cabin (US 460, Index, near West Liberty)
Hotel Delancey (Cannel City)
Morgan County Courthouse (Main Street, West Liberty)
Old Caney Cemetery (off Hwy 191, east of Caney)
Paint Creek School (Paint Creek, northeast of West Liberty)

Rowan County

Morehead Stat University (Rowan)
Mt. Pisgah Church (Sharkey)

V. COORDINATION WITH OTHER AGENCIES

5-01. General Coordination. In accordance with the requirements in ER 1120-2-400, coordination has been maintained with the appropriate Federal, State, and local government agencies, planning bodies, and local interest groups, individuals, and institutions.

5-02. Coordination with Federal Agencies. The greatest portion of the coordination activities have been between the Daniel Boone National Forest, U.S. Forest Service, and the Louisville District of the U.S. Army Corps of Engineers. This close coordination between the two agencies, from inception of Cave Run Lake to the present, is as per the Memorandum of Understanding. Other Federal agencies coordinated with the development of the Master Plan and/or the development of the Cave Run Lake Project are:

- U. S. Department of Interior
- U. S. Soil Conservation Service, USDA
- U. S. Fish and Wildlife Service
- U. S. Environmental Protection Agency
- U. S. Department of Transportation
- U. S. Department of Health, Education & Welfare,
Environmental Health Services

5-03. Coordination with State Agencies. Coordination with various State agencies of the Commonwealth of Kentucky has also been maintained during the preparation of this master plan and/or during the development of the Cave Run Project. Close coordination has been especially maintained with the Department of Fish and Wildlife Resources, which has developed and currently operates the Minor E. Clark Fish Hatchery. Other cooperating State agencies are:

- Office of the Governor
- Office of the Lt. Governor
- Ky. Department of Parks
- Ky. Department of Forestry
- Ky. Historical Society
- Ky. Department of Transportation
- Ky H.E.W., Bureau of Health Services
- Ky Department for Environmental Protection and
Natural Resources

5-04. Coordination with Local Agencies. The following contains a list of local private and governmental agencies, and private individuals/-groups with whom coordination has been maintained during the development of the Master Plan and/or the Cave Run Project:

- University of Kentucky, Department of Anthropology
- Kentucky Heritage Commission
- Former Senator Marlow W. Cook
- League of Kentucky Sportsmen, Inc.

Frenchburg City Council
Menifee Fiscal Court
Salt Lick Lodge No. 682
Mt Sterling City Council
Salt Lick Chapter No. 563, Order of Eastern Star
Mt. Sterling Chamber of Commerce
Bath County Fiscal Court
Salt Lick City Council
Salt Lick Volunteer Fire Department
Owingsville Women's Club
Robert and Lola Robinson
A. J. and Mary Louise Denton
Owingsville Lion's Club
Bath County Memorial Library Board
Owingsville Elementary School PTA
Owingsville Chamber of Commerce
Nicholas County Fiscal Court
Carlisle City Council
Morgan County Historical Society
National Rifle Association
Kentucky Silver Muskie Club
League of Kentucky Sportsmen
Cave Run Sailing Association
Cave Run Development Association
Gateway Development District

VI. RECREATIONAL DEVELOPMENT

6-01 Original Development. In 1964 the Secretaries of the Department of Agriculture and Army established a policy to implement development and management of lake projects where both the U.S. Forest Service and U.S. Army Corps of Engineer are involved. The policy as stated in the 1964 Memorandum of Agreement requires that early in the planning process the administrative responsibilities of the agencies be established in accordance with the interagency agreement through a Memorandum of Understanding.

Since a major part of the lands of the Cave Run project are located within the proclamation boundary of the Daniel Boone National Forest the basic responsibility for development and management of recreation facilities was determined to be the responsibility of the Forest Service. Since the Corps of Engineers was to operate the lake for flood control the dam, spillway, tailwater and near by land would be retained by the Corps to perform its functions and develop any required public use facilities on these lands that might be required. These responsibilities were articulated in the Memorandum of Understanding of 1968. Subsequently, project lands acquired by the Corps were transferred to the Forest Service and rights over Forest Service lands were transmitted to the Corps for project operation.

6-02. Amended Recreational Development Responsibilities. As the Forest Service developed the recreation areas located throughout the project area it became evident by 1975 that many more facilities would be required than originally planned. In order to complete the amount of construction required funds were requested through the Corps of Engineers to enable the Corps to assist the Forest Service in an timely completion of the expanded initial program. This new relationship between the agencies was set forth in the amended Memorandum of Understanding of 1975. The amendment directed the Corps to "assume, subject to the availability of funds, financial responsibility for planning, design, and construction of initial recreation facilities." It further stated that the Forest Service would retain responsibilities for "... future development and construction of recreation facilities."

a. Completion of Initial Forest Service Facilities. Since the establishment of the Amendment, the Corps and the Forest Service have cooperated toward completion of those initial recreational facilities which will be managed by the Forest Service at Cave Run Lake. The construction contracts completed by the Corps were accomplished with private contractors, while the Forest Service used both private contractors and their own force account work crews. The portion of the work accomplished by each agency is detailed in the site description in paragraph 6-3.

b. Completion of Initial Corps of Engineers Recreation Facilities. While having the financial responsibility for completion of all initial facilities developed at Cave Run Lake since December 1975, the Corps has also had full development and management responsibility for providing initial public access to the dam and tailwater area. The work planned and agreed to is finished. No additional funds for continuing development are forthcoming.

6-03. Site Description. Following is a site by site listing of facilities developed during both the original and initial construction periods. Other than the four Corps' sites (Tailwater, Dam/Office, Stony Cave and Highland), the Forest Service was responsible, for original under the terms of the Memorandum of Understanding of 1968. The work indicated as the initial work was a cooperative effort of both the Corps and Forest Service under the Memorandum of 1975 and its various ancillary agreements, except again the Corps was solely responsible for the three sites under its jurisdiction.

a. Tailwater Area. Under the terms of both of the Memorandum of Understanding, recreation facilities in the tailwater area were to be constructed and operated by the Corps as part of the operation of the flood control facilities.

Graveled roads, graveled parking for approximately 40 cars and a concrete walk leading to the mouth of the stilling basin were provided for tailwater fishermen during the "original" construction period. Facilities subsequently developed at this site during the "initial"

phase include paved roads; concrete walks, a concrete fishing platform along each bank of the riprapped retreat channel; an additional concrete fishing platform on the north bank terminus of the retreat channel; a one-lane boat ramp, boat ramp parking for 9 cars (includes one space for handicapped) and 13 car/trailers (includes one space for handicapped) a picnic shelter; a comfort station with oil recirculating toilets; 5 water fountains; 2 horseshoe pits; a children's playground which includes swings and a play sculpture, parking for 31 cars, two bulletin boards; and landscaping.

b. Shop and Office Area. Original development in this area consisted of Corps' shop/office complex, a sewage treatment facility, and two residences for operations personnel. To complete initial facility development in the shop and office area, one of the residences was removed; the sewage treatment plant was doubled in size to accommodate development of flush sanitary facilities at High Bank and Fern Bluff recreation sites (however, due to funding considerations, these areas will be serviced by chemical toilets until funds become available in the future); interpretive facilities were developed in the office/visitor reception area; an overlook was constructed immediately in front of the office, and Barrel Springs Interpretive Trail was developed on the wooded ridge just west of the Corps' office.

c. Stony Cave. This small Corps operated day-use area on the left abutment was developed as part of the initial facilities. It consists of 3 double and 2 single picnic units and two paved parking area with space for 42 vehicles.

d. Highbank. The third site operated by the Corps under the MOU is the Highbank site. Utilizing abandoned Ky Hwy 801, a small day use area was developed along the right abutment of the dam. The site is a wooded bluff about 10 acres in size and offers an excellent view of the dam, control tower, and lake. Graveled parking for 15 cars; 8 single and 2 double picnic sites with tables and fire rings; and foot access to the shoreline were provided in the first phase of development. In addition to the original recreational development at this site, initial facilities which have been constructed include paving and enlarging the parking area to accommodate 17 cars and 3 car/trailers; (includes one handicapped space) upgrading the original picnic sites and adding 6 single and 2 double picnic sites; 1,400 feet of graveled foot trail; chemical toilets; and paved road access. A typical picnic unit consists of a graveled impact pad, a table, and a grill (see Plate 10).

e. Caney. This 950-acre site, located in Bath County, is scheduled for development by the Forest Service as a major recreation area. Details of these plans are in paragraph 6-04.

f. Twin Knobs Recreation Area. Twin Knobs Recreation Area is located in a unique hatched-shaped peninsular site, measuring some 900 acres in area above seasonal pool. It is characterized by two knob hills in the middle of the peninsula, sloping on the south and west in a

relatively gently slope to the water's edge. Its importance in the Cave Run recreation plan is twofold--it offers excellent vehicular access (from Highway 801), and offers the visitor to Cave Run Lake a variety of recreational experiences, both in size and scope.

(1) Original Forest Service Development.

Swimming Beach. The beach site is located on the western edge of a gently sloping south-pointing peninsula. The sand beach consists of a shoreline of some 2,400 feet in length. A large grassy area adjacent to the sand beach is used extensively for sunbathing. Other site facilities included in the beach development are 403 parking spaces which include 376 spaces for cars, 10 spaces for handicapped, and 17 spaces for buses/car trailers; concrete walkways; and a beach bathhouse which includes heated showers and flush toilets. The beach is most noted for the many amenities mentioned above and its open, extensive views of the lake.

Family Camping. Development for family tent and trailer camping is located on an undulating site to the south and west of the furthest hill on the peninsula. The vegetative character of the site is that of a mixture of succession forest and old field communities. Five camping areas, or loops, were originally developed offering 82 campsites (63 single; 19 double). Each loop is accessible by a single lane paved access road and individual campsite spurs, which serve as parking for each camp site. Each loop is connected to the main road (FS 1017) leading to the entrance station and Highway 801. Four of these original loops (D, E, upper F, and I) are located on the lake side of the main road with C loop located above the road at the base of the hill.

Both single and double occupancy campsites are available. Each campsite is furnished with the following facilities; gravel tent pad(s), gravel cooking and eating (impact) pad, picnic table(s), grill/fireplace, paved back in parking spur, and metal lantern posts. Plate No. 7 presents a detail of a typical camping unit.

Sanitary and Water. Five comfort stations which offer hot showers, flush toilets, and wash basins were provided in camping loops C, D, E, and upper F and I. Twenty-one water hydrants were dispersed throughout these loops. Water and sewer service was also provided to the beach bathhouse.

Boat Launch Facility. The Twin Knobs boat ramp, located on a small embayment on the northwestern tip of the Twin Knobs site, was provided for campground use. It offers two launching lanes, a chemical toilet, a bulletin board, two security lights, and parking for 80 car/trailers. Access to the ramp was originally provided via the gravel service road (FS 1018) which connects the ramp area to the main access road just west of the entrance station.

Sewage Treatment Plant (STP). Original development of the Twin Knobs site included the construction of a sewage treatment plant which serviced the campground comfort stations, the swimming beach bathhouse,

the sanitary dump station, and the Scott Creek marina. The original STP included a laboratory/air compressor building; 60,000 gallon and 10,000 gallon secondary treatment tanks; two storage lagoons; and a chlorine contact basin. The plant is located along the western edge of the site adjacent to loop D.

Roads. Original roads developed at Twin Knobs were graveled and included the main access road, loop roads and campsite spurs, boat ramp parking area and a service road, the beach parking area and access road (seal coated); and the group use area access road and parking.

Landscaping. Original landscape work at the Twin Knobs site was limited to grass seeding at the beach area and tree planting of three camping loops.

(2) Initial Phase Additional Development by Forest Service.

Both the Forest Service and the Corps of Engineers are engaged in completing initial facility development at this site. Beginning in 1977 with Ancillary Operating Agreement #4, the Forest Service began completion of initial facilities at Twin Knobs Recreation Area under the provisions of the Amendment to the Memorandum of Understanding. As authorized by ancillary operating agreements #4, #5, #6, #7, #8, and #9, the following initial facilities have been developed by the Forest Service at this site.

134 Campsites. 92 single; 42 double sites including tables, grill/fireplaces, lantern posts, and identification posts.

Beach. Parking area, sidewalks, buoys, depth markers, kiosk, signing, trash containers, benches, bathhouse railing, and landscaping of the parking area.

Administration. Site Administrator's trailer set-up with access panel.

Trails. 2,695' graveled Interpretive Trail, 6,000' graveled beach to knob trail, graveled shoreline trail, paved and graveled connector trails.

Groups Use Areas. (See Plate 5) - In response to the demand for day use and/or overnight areas which are designed for use by groups, the Forest Service has provided four "group-use" areas within the Twin Knobs site:

The west area is designed for a capacity of 180 persons. It offers a picnic shelter with large Bar-B-Que grill, picnic tables, softball field, volleyball court with poles and net; horseshoe pit, comfort station (no showers, cold water only), 34 car parking spaces, 2 handi-capped parking spaces, bus parking (two maximum).

The east area is designed for a capacity of 100 persons. This site offers a picnic shelter with large Bar-B-Que grill; shaded picnic tables; horseshoe pit, courtesy boat dock; comfort station (solar heated showers); 16 car parking spaces; one handicapped parking space; and bus parking.

The tent camping area is designed for a capacity of 60 persons. It offers five individual walk-in graveled tent pads (each pad is shaded and has two picnic tables, one firering, one pedestal grill, group campfire circle, horseshoe pit); fishing point; group cooking area with picnic tables and double pedestal grill; two portable comfort stations; no water; 16 car parking spaces; one handicapped parking space; and bus parking.

The trailer camping area is designed for a capacity of 30 persons. The site offers six separate back-in car/trailer parking spurs (not shaded); no tents or individual camping areas; shaded group cooking area with picnic tables and pedestal grills (2); two portable comfort stations; and no water.

-- The Forest Service developed additional facilities at Twin Knobs under the provisions of Ancillary Operating Agreement #11. These facilities include picnic tables and dumpsters for a new camping loop, Loop J.

-- A Fitness Trail which is located between the beach and the Group Use Areas.

-- The entrance control station.

-- The Knob Overlook structure.

-- The Trailer Camping Group Use Area.

(3) Corps of Engineers Development.

In addition to the facilities that have been constructed at this site by the Forest Service through their own funding and through ancillary operating agreements, the Corps has also developed initial facilities here under separate contract. Work accomplished at this site by the Corps includes:

-- Construction of an operational and maintenance building located on service road 1018.

-- Upgrading and paving of existing campsite spurs.

-- Correction and repairs to area drainage systems.

-- Addition of 100,000 gallon secondary treatment tank to existing sewage treatment plant. This was accomplished to accommodate Zilpo Recreation Area and Highway 801 recreation

areas sanitary service. (Included laying a six-inch force main across the lake between Twin Knobs and Zilpo recreation areas.)

- Construction of access road 1017 extension which connects the campground to the Twin Knobs Boat Ramp.
- Construction of five control gates: Two in camping loops, two on the maintenance building service road, and one on the beach access road.
- Construction of four garbage unit enclosures and pads.
- Upgrading and paving of Trailer Dump Station.
- Upgrading and paving of access road to site Administrator's residence
- Upgrading and paving of Group Use Areas access road and parking.
- Upgrading and paving of the Beach parking and access road.
- Paving of Twin Knobs Boat Ramp parking and access road.
- Upgrading and paving of roads and spurs in Camping Loops A, B, C, D, E, F, G, H, and I.
- Installation of sanitary sewers, water service, and electrical service to comfort stations in Loop A.
- Installation of individual electric hookups to campsites in Loop C.
- Construction of one comfort station each in Loops B, lower F, G, H, J, East Group Use area and West Group Use Area; construction of two comfort stations in Loop A. Each of the comfort stations offers three stalls for women (or two stalls and a urinal for men) solar heated water, two lavatories, showers, and an electric hand dryer (the comfort station in the West Group Use Area has only cold water and no showers).

g. Alfrey Boat Ramp - The Alfrey boat launching facility is located on the southeastern shore of the Twin Knobs peninsula. Access is provided by the main road (FS 1017) which connects Twin Knobs Recreation Area to Hwy 801. Original development of the Alfrey site included a two-lane launching ramp, graveled parking for 86 vehicles, chemical toilets, two ramp lights, and a bulletin board. After the original Forest Service construction, and subsequent installation of a floating courtesy dock, final paving was accomplished by the Corps under the Amendment to the Memorandum of Understanding completing initial development of this site.

h. Warix Run Boat Ramp - The Warix Run boat launching site is located along Hwy 801 at the upper end of the Warix Run embayment. Situated on a gentle slope, original development of the site included a two-lane launching ramp, a chemical toilet, graveled parking for 64 vehicles, two ramp lights, and a bulletin board. After the original Forest Service construction final paving was accomplished under the Amendment to the Memorandum of Understanding and completes initial development of this site.

i. Zilpo Recreation Area - Zilpo Recreation Area is the second largest development in the Cave Run Lake project measuring some 700 acres in area. It is located on a wooded peninsular site adjacent to the Pioneer Weapons hunting area on the south shoreline of the lake. The character of the site is one of a bisected ridgetop with steep slopes plunging to the lake on the southeast and sloping more gradually on the northwest. The site is partially forested and outstanding views of the surrounding lake environment are offered from the site's higher elevations. Original Forest Service construction at this site was minimal. No access was provided to the site and only a two-lane concrete boat launching ramp and a rough graded 450 ft. swimming beach (with sand stockpiled) were constructed. These limited facilities were constructed prior to the impoundment of the lake and were too limited to enable public use of the site. Through recent cooperative efforts by the Forest Service and the Corps, however, initial development of this site is being completed.

(1) Initial Phase Forest Service Development. The following initial facilities has been completed at Zilpo Recreation Area by the Forest Service through ancillary operating agreements #8, #9, and #11 with the Corps.

- Construction of approximately 28 000 feet of gravel trail.
- Construction of 167 tent/trailer campsites (147 singles and 20 doubles). A typical camping unit offers a tent or trailer pad, and impact area, or picnic table, lantern posts, and a grill fireplace (see Plate 7).
- Construction of 2,500 feet of gravel connector trails.
- Construction of entrance station.
- Installation of ten pairs (one men's, one women's) of chemical toilet units.

(2) Corps of Engineers Development. In addition to initial facility development being completed by the Forest Service at Zilpo Recreation Area, the Corps is accomplishing the following work at Zilpo under separate contract.

- Finish grading of 95 camping spurs.
- Construction of boat ramp parking and access road.

- Construction of beach (end wall, concrete walk, handicapped ramp into water, placement of sand).
- Paving of spurs of 100 camping units; 40 spurs to be graveled.
- Development of water and sanitary facilities (six lift stations; sewer lines; 125,000 gallon water storage tank; access road to water tank.
- Provision of electrical power to site.

j. Claylick Boat Ramp - Claylick Boat Ramp is located along the eastern shore of the lake at the mouth and embayment of Claylick Branch. The ramp is located 1-3/4 miles from Hwy 1274 with access provided by a gravel road.

(1) Original Development of the site included a two-lane launching ramp, a chemical toilet, a graveled parking area for 80 vehicles, and a bulletin board. Development of this site was completed prior to the Amendment to the Memorandum of Understanding.

(2) Claylick Boat Access Camping (see Plate 24) - One of the most popular overnight recreational facilities at a recently impounded southeastern Kentucky Lake (Laurel Lake) being managed by the Forest Service is a boat-in camping site. Weekend occupancy during the recreation season at that lake is estimated to be 95 to 100 percent by overnight and/or day-users. In response to public demand for a similar facility at Cave Run Lake, the Claylick Boat Access Camping site was included in initial plans for development. The site is located along a sparsely vegetated shoreline just west of the Claylick Boat Ramp. Service access is provided by an abandoned road which extends from the boat ramp to the camping area. Facilities developed at the site include 20 camp sites; chemical toilets; garbage collectors; and 8,600 feet of paved trail. Amenities offered by each campsite are a tent pad, table, 2 lantern posts and a grill/fireplace.

k. Bangor Boat Ramp - The Bangor boat launching site is located on the north shore of the North Fork Licking portion of the lake about 1/2 mile upstream from its confluence with the main Licking River pool. The ramp is situated at the terminus of a steep, narrow gravel road which connects with Hwy 1274, 1/2 mile from the site. Original development of the site included a one-lane launching ramp, a chemical toilet, graveled parking for 40 vehicles and a bulletin board. Development of this site was completed prior to the Amendment to the Memorandum of Understanding.

l. Poppin Rock Boat Ramp - Located along Hwy 519 at the confluence of the Lower Lick Fork and North Fork Licking tributaries, the Poppin Rock boat launching site offers good lake and highway access. Historic Poppin Rock tunnel is located only 1/2 mile away. Original development of this boat ramp site included only a two-lane launching ramp, graveled parking for 80 vehicles, a chemical toilet and a bulletin board. Original

development of this site was limited to construction of the boat ramp without the access road or parking area. Completion of initial development was then begun in 1975 when the Forest Service funded construction of the access road and parking area. This construction was completed in 1976.

m. Longbow Marina and Boat Ramp - Located in Menifee County where Hwy 1274 crosses the Beaver Creek embayment, the Longbow Marina was opened in 1977. It has been developed with private funding as a concessionaire facility through a special use permit with the Forest Service. Original development includes a floating dock and office/concessions building; a gas livery; vault toilets; 42 covered slips for runabout-sized boats; 10 uncovered slips for houseboats; 8 uncovered slips for pontoon boats; and 20 vehicle parking. The ramp is located adjacent to the Longbow Marina. Development of the boat ramp site includes a two-lane launching ramp, graveled 76 vehicle parking, a chemical toilet, and a bulletin board. Initial Development of this site was completed prior to the Amendment to the Memorandum of Understanding.

n. Twenty-six Boat Ramp - The Twenty-six boat launching site is located in Morgan County on the main fork of the Licking River 6 miles below the town of West Liberty, Kentucky. Situated immediately downstream from the Hwy 772 bridge, original development of this boat access site included a two-lane launching ramp and graveled parking for 66 vehicles. Development of this site was completed prior to the Amendment to the Memorandum of Understanding.

o. Scott Creek Marina and Boat Ramp. Scott Creek Marina is located on the Scott Creek embayment on the north shore of Cave Run Lake. Accessible from Hwy 801 and adjacent to Scott Creek boat ramp, this area serves as the most popular boat launching/marina site on the lake. Similar to Longbow Marina, Scott Creek Marina was developed with private funds as a concessionaire facility through a special use permit with the Forest Service. Opened to the public in 1976, original development of this site include a manager's residence, a floating dock and concessions/office building, a gas livery, 90 covered slips for runabout sized boats, 60 uncovered slips for houseboats, 46 uncovered slips for pontoon boats and sailboats, paved parking for 179 vehicles, and waterborne toilets. After the initial construction was completed in 1976 under concessionaire agreement, the only additional development at this marina has been the provision of offshore mooring for approximately 65 boats. To complete "initial" facilities, the construction of a floating breakwater is scheduled in the near future by the concessionaire. The boat launching site is located just downstream and adjacent to the Scott Creek Marina. Its original development include a two-lane launching ramp, a chemical toilet, graveled parking for 80 vehicles, two ramp lights, and a bulletin board. After the original Forest Service construction, and subsequent installation of a floating courtesy dock, final paving was accomplished under the Amendment to the Memorandum of Understanding completing initial development of this site.

p. Leatherwood Boat Ramp - Leatherwood boat ramp is located at the head of Leatherwood Creek embayment along the west shore of Cave Run Lake. Access is provided by Forest Service road FS 129 which also serves as the access for Clear Creek Recreation Area. Original facilities developed at the site included a two-lane boat launching ramp, a graveled 78 vehicle parking area, a chemical toilet and a bulletin board. Development of this site was completed prior to the Amendment to the Memorandum of Understanding.

q. Clear Creek Recreation Area - Clear Creek Recreation Area is located at the site of an iron furnace ruin just southwest and adjacent to the Pioneer Weapons Hunting Area. Situated along the banks of Clear Creek, the site is largely characterized as a heavily wooded creek bottom set among rugged hardwood covered ridges. Access to this site is provided by FS 129. Access roads and spurs within the site are gravel. Original site development included:

(1) Family Camping. Twenty-one family camping units were arranged in two camping loops. Each unit included an unimproved tent pad, table, fireplace, and metal lantern posts.

(2) Picnicking. Located near the campground and adjacent to the furnace site is a picnic area consisting of twelve picnic units with each offering a table and a grill.

(3) Sanitary and Water. Two single vault toilets were originally constructed in both the camping area and the picnic area. Two non-chlorinated hand waterpumps were provided in the campground with on pump available in the picnic ground.

As part of the completion of initial facility development, the Forest Service constructed a rifle range to complement the facilities originally developed at Clear Creek Recreation Area. The range was developed in response to the need for a safe, effective "sighting-in" area for the many hunters who use the Pioneer Weapons Hunting Area and other forest lands on the southwest side of Cave Run Lake. The site offers a graveled parking area for 10 cars; a firing line; and target stations at 25 yards, 50 yards, 100 yards, and 200 yards.

Another facility which has been developed in conjunction with this site since original site construction is a 40-acre lake. Users of this lake are served by a single-lane boat ramp, chemical toilets, a bulletin board, landscaping, and a dirt tread foottrail which is 1-1/4 miles long and connects the subject lake area to the picnic area. Only electric motors are allowed on the lake.

Subsequent to original development, a five vehicle parking area and trailhead has been developed in the campground. Also, loop roads and spurs have been upgraded; campsites have been realigned and reconstructed; and four chemical toilets have replaced the original vault toilets.

Both original development and completion of initial facilities at this site have been totally funded by the Forest Service.

r. Highway 801 Recreation Areas - Although day-use development adjacent to the Twin Knobs site was recommended by DM 12, initial recreation planning by the U.S. Forest Service and the Corps of Engineers did not accommodate significant public use of the relatively narrow strip of land between Kentucky Highway 801 and the Cave Run Lake shoreline. The area under consideration generally extends from the damsite to Warix Run Boat Ramp, a distance of approximately 6-1/2 miles and comprises about 600 acres of mostly wooded shoreline. Topography within the area is steep to moderately sloping with occasional areas of relatively flat creek bottoms.

Immediately following impoundment of the lake, public use of the subject area rapidly increased to a level which was characterized by overuse, unsafe parking conditions along Kentucky Highway 801, and a growing sanitation and litter problem along the shoreline.

In order to gain an understanding of the recreational use patterns which were occurring along the shoreline, a field study was conducted which revealed the following:

- Shoreline fishing is the predominant recreational activity.
- Picnicking is a popular activity
- Passive uses of the shoreline, i.e., walking for pleasure, sightseeing, sunbathing, and "socializing" are also popular.
- Actual field counts revealed that approximately 265 cars were parked along the shoulders of Highway 801 at one time on a summer day.

These study findings resulted in planning criteria which stated that (1) recreational use of the "801" shoreline public use areas would be restricted to day use activities, (2) bank fishing would be the major planning and design consideration, (3) no area would be developed unless adequate off-highway parking could be provided, and (4) public use facilities would be designed to accommodate high use and in such a way as to lower long-term maintenance costs.

Although the development of public use areas along Highway 801 accommodates bank fishing in particular, a minimum of car/trailer parking has been provided for those users who are towing a boat but elect to picnic and/or fish from the bank in this vicinity.

Using the above stated planning criteria, "Supplemental Facilities Report No. 3" to Cave Run Lake Project Design Memorandum No. 12 proposed nine Forest Service sites for development as initial facilities. An additional recommendation was made to upgrade the Corps' existing facilities at the High Bank day-use area along Highway 801. This report was

approved in 1977, construction began in 1981, and the sites were opened to use during the 1982 recreation season. Following is a site by site description of the Kentucky Highway 801 recreational facilities which have been constructed by Corps contract:

(1) Fern Bluff (see Plate 10) - Located on a wooded bluff adjacent to the Corps' managed High Bank picnic area, this site offers an excellent view of the dam and control tower. The site derives its name from its unusually dense ground cover of ferns.

This site is to be the primary visitor information facility for the Forest Service at the Cave Run Lake project and was originally planned to be an initial facility which would offer parking, a staffed and/or unmanned visitor center with multi-media interpretive exhibits, an interpretive trail, and flush sanitary facilities. Due to funding limitations at time of construction, however, the only facilities developed were paved parking for 14 cars (one space for handicapped), 10 pull-through car/trailer spaces (one space for handicapped), sewage lines, and water lines. Eventual treatment of wastes from the flush sanitary facilities at this site will be accomplished at the Corps' existing sewage treatment plant located at the shop and office area.

Sheltowee Trace passes through this site, through the High Bank site, and then across the dam. It is expected that Fern Bluff will serve as an undesignated trailhead for this National Recreation Trail.

(2) Billy Branch (see Plate 11) - This wooded site slopes gently to the lake and offers ample opportunities for picnicking and bank fishing. Initial development includes 23 picnic sites (17 single and 3 double); 1,800 linear feet of graveled trails; paved parking for 29 cars (one space for handicapped) and 10 car/trailers; sewage lines; water lines; and a chemical toilet. A comfort station with flush sanitary facilities was planned for initial construction but funding limitations at time of construction have changed this facility to a future item.

(3) Oak Ridge (See Plate 12) - Located adjacent to and south-east of the Scott Creek marina, Oak Ridge is characterized by wooded ridges which slope gently to the lake. Developed primarily for shoreline fishing and hiking, this site offers 1,500 feet of graveled trails; 1,700 feet of paved trails and 2 trailside benches. Parking which was allocated for this site was ultimately constructed at the adjacent Boat Gunnel Branch site (an unscheduled picnic shelter which was constructed at Boat Gunnel Branch by the Frenchburg Job Corps Center in 1982 necessitated this additional parking).

(4) Boat Gunnel Branch (see Plate 13) - This moderately sloping wooded site lies immediately east of the Oak Ridge site and offers excellent opportunities for picnicking and shoreline fishing. Facilities developed include 28 single and 7 double picnic sites; a picnic shelter; paved roads and parking for 50 cars (3 spaces for handicapped) and 5 car/trailers (1 space for handicapped); 10 trailside benches; chemical toilets; water lines; sewage lines; 3,800 feet of paved trails; and 1,400 feet of graveled trails.

(5) Shallow Flats (see Plate 14) - Originally used as a borrow area for construction of Kentucky Highway 801, this relatively flat, sparsely vegetated site has been regarded and developed as a viewing area for waterfowl. Developments include paved roads and parking for 25 cars (2 spaces for handicapped); 700 feet of paved trails; chemical toilets; an interpretive station; 3,500 feet of predator fence; two 1-acre waterfowl ponds within a 1.7 acre goose inclosure; and Shallow Flats Wildlife Habitat Interpretive Trail (ninetenths of a mile long with unimproved tread). Although this site's primary use is for waterfowl viewing, it is also a popular area for shoreline fishing below the Scott Creek culvert.

(6) Muskie Bend (see Plate 15) - This site is located at a fill area which was formed during construction of relocated Kentucky Highway 801. Being relatively flat but well-drained and providing a good view of the lake, this site has become one of the most popular areas along the "801 shoreline." The most frequent uses include lake viewing, socializing, and sunbathing. Facility development at this site includes paved roads and parking for 24 cars (1 space for handicapped); 10 car/trailers (2 spaces for handicapped); a chemical toilet; 920 feet of paved trails; 800 feet of gravel trails; and 1 trailside bench.

(7) Lakeview (see Plate 15) - Of all the public use areas along Highway 801, the widest view of the lake is afforded from this site. Formed by a flat narrow fill area created during construction of Highway 801, adequate space is available only for paved roads and parking for 25 cars and chemical toilets. The area is used for shoreline fishing and offers 1,400 feet of graveled trails.

(8) Ramey Creek (see Plate 16) - This site is located at the Ramey Creek embayment which is formed by the relocated Kentucky Highway 801 causeway where it crosses the Ramey Creek tributary. This embayment provides a recreational experience much the same as a small lake and is a very popular area for these users who enjoy more passive wateroriented recreation. This site offers 2,700 feet of gravel trails; paved parking for 12 cars; 5 single and 2 double picnic sites; and chemical toilets. Bank fishing is the primary public use activity.

(9) Windy Bay (see Plate 17) - Due to the short distance from parking to the shoreline and the noted fishing success, this site has become a popular area for bank fishermen. The area is moderately steep and semiwooded and offers the following facilities: paved parking for 20 vehicles; a chemical toilet; and 2,600 feet of gravel trails.

s. Buckskin Trail (see Plate 31) - When Cave Run Lake was impounded, the trail system within the Pioneer Weapons Hunting Area (PWA) was permanently disjointed by rising waters. Four of the trails dead-ended at the water's edge. To restore the continuity of the trail system, Buckskin Trail was constructed. This trail re-connected the trails within the PWA and was further extended to connect Zilpo Recreation Area to the proposed Caney Recreation Area site. Opened in

1981 and available for use by horseback riders as well as hikers, the Buckskin Trail is 10-1/2 miles long and offers a trailhead near Zilpo Recreation Area. This trail and trailhead was totally developed by the Forest Service.

t. Sheltowee Trace (See Plate 31). In 1979, the Forest Service completed construction of the Sheltowee Trace. This National Recreation Trail was developed as part of the Federal effort to address the growing demand for extended hiking and trail use opportunities. Beginning at Kentucky Highway 377 in Rowan County, the Trace extends mostly within the Daniel Boone National Forest, 254 miles southward to its termination at Pickett State Park, Tennessee. As shown on Plate 31, the trail passes through the Cave Run Lake project area near the dam. Although sections of the trail which traverse Corps of Engineers' lands are open to foot travel only, other portions of the trail on the DBNF in the project area allow multiple use which means horses and ORV's are welcome also.

6-04. Future Recreational Facility Development. Most of the recreational development planned at Cave Run Lake project was scheduled to be completed during the initial phase of facility construction. This development plan resulted from the Forest Service's early commitment to accommodate the basic initial recreational demand and provide adequate dispersal of public use impact. Extensive initial development of recreational facilities was also given impetus when the Corps of Engineers became an active development partner under provisions of the Amendment of the Memorandum of Understanding.

a. Future Forest Service Recreational Facilities. The only significant future recreational developments planned for Cave Run Lake are (a) Caney Recreational Area, and (b) miscellaneous improvements to the Highway 801 day use areas and Zilpo Recreational Area. Work proposed for these areas is discussed below:

(1) Caney Recreation Area - Development of a resort on Cave Run Lake has been included as part of overall recreation development plan since 1971 when the recreation composite plan was approved. The Caney area was selected as the most feasible site for an extensive development. This 950-acre site, located in Bath County, is adjacent to the dam and spillway and has two distinct site characteristics: The larger western section is steep and has severe soil limitations which make it unsuitable for high use types of development. The central part of the site was used for borrow to complete the dam. It was left relatively flat with slopes from 0% to 10%. The southern edge of the site is well suited for development.

An early economic feasibility report, prepared by Spindletop Inc., found the area to have a reasonably strong market for resort development. This was further documented in a July 1980 report developed by Midwest Research Institute to update the economic feasibility of a resort development. It is estimated that by 1985 about 71.8 million out-of-state visitors will be traveling in Kentucky; of these 36 million will be

destined to Kentucky recreation facilities. It is notable that Cave Run Lake account for 40% of all visits to developed recreation facilities on the Daniel Boone National Forest.

As planned, the Caney report development includes:

1. A two-hundred unit rental lodge.
2. Convention facilities (Six hundred seat capacity).
3. Tennis courts.
4. Multipurpose courts.
5. A two-hundred seat capacity restaurant.
6. Swimming pool.

Estimated construction costs are seven/nine million dollars.

A draft prospectus for issuing a thirty-year Forest Services Special Use Permit for up to eighty acres of the site has been developed within that agency and is undergoing review at the writing of this report.

The first draft of the prospectus was submitted to the Forest Service's regional office in October 1980 while the most recent draft was submitted in November 1982. The Regional Office in Atlanta, Georgia has reviewed this most recent draft prospectus and after agreeing with the Daniel Boone National Forest on some needed changes, sent it for review to the Washington Office in December 1982.

(2) Miscellaneous Improvements - Other than development of Caney Recreation Area, future Forest Service recreation facility construction will be limited to provision of comfort stations at both Zilpo Recreation Area and some of the day use sites along Ky-Highway 801; construction of the Cave Run Visitor Information Station and possible administrative offices located at the Fern Bluff site; an entrance station and electrical power at Zilpo Recreation Area; and final paving of Zilpo roads and camping spurs. Signing and trails will also be added at these recreation areas.

b. Future Corps of Engineers Recreational Facilities. As mentioned previously, the Corp's responsibility for managing public use lands at Cave Run Lake is limited to the dam, tailwater, office area, and two small sites at either end of the dam. For the most part, development of these areas will be accomplished during the initial stage of project construction.

A limited number of facilities, however, have been proposed for development in the future. As funds become available, as many as six individual picnic units would be developed in the tailwater in the grassy

area between the existing picnic shelter and the riprapped bank of the retreat channel. These facilities would be provided in response to a demand for picnic facilities which are in visual contact with family or friends who might be fishing down along the water's edge. Each of these picnic units would offer a graveled impact area, a picnic table, and a grill.

Also planned for future consideration is the provision of twelve boat-access campsites located along Licking River at the north-western corner of the tailwater site. These campsites would provide an overnight basecamp for the river users such as muskie fishermen, duck hunters, and canoeists who presently must use the river without the availability of overnight facilities. Each of these campsites would offer amenities which include a graveled tent pad, a picnic table, a lantern pole, and a fire ring.

Development of both the future picnic sites and boat-access campsites will be relatively inexpensive since they will be constructed by project personnel.

VII. CONCLUSIONS AND RECOMMENDATIONS

7-01. Conclusions. a. Since funds for initial construction are expended and no additional funds are expected to be forthcoming, the initial development period is concluded.

b. Since 5,768.07 acres of the 6,121.5 acres in Corps ownership are to be transferred to the Forest Service, this Master Plan should be regarded as a record of facilities developed by both the Forest Service and Corps of Engineers.

c. Since additional facilities planned at the Corps-operated dam and tailwater areas are relatively minor, no construction monies will be requested and implementation will be by operating funds, as available, over a period of time.

DEC 15 1982

ORLPD

Mr. Dick Wengert
Forest Supervisor
Daniel Boone National Forest
Winchester, KY 40391

Dear Mr. Wengert:

As you know we have been constructing recreation facilities at Cave Run Lake pursuant to the December 1975 amendment to the 1968 Memorandum of Understanding between the Chief of Engineers and the Chief of the Forest Service. Planned recreation construction items not yet under contract are listed on the inclosure.

During April 1982 I was advised by the Director of Civil Works of the Office of the Chief of Engineers that no construction contracts at new sites will be programmed beyond Fiscal Year 1982 for recreation facilities unless nonfederal interests agree to provide 50% financing for their share of separable recreation construction costs and to bear 100% of recreation O&M costs. Essentially, this policy will preclude all future recreation construction by this office unless a nonfederal sponsoring agency is both willing and able to pay (up front) one-half of such costs and to bear all operation and maintenance costs.

Subsequent correspondence considered the applicability of such a policy to Corps lakes within National Forest proclamation boundaries and resulted in a conclusion that due to the substantial costs to be borne by the Federal government during a period of constrained funding, construction of the remaining recreation facilities at Cave Run Lake should not be scheduled. This leaves us in a position of having a partially completed site at Zilpo and without sufficient funding to proceed with the visitor center which had been approved for construction by separate correspondence.

In view of the substantial investments that have been made at Zilpo and my understanding of its state of completion, it would appear proper to take those actions preparatory to opening at least a portion of the Zilpo site for selected limited use this coming recreation season. I understand that the boat ramp, beach, parking lots, internal roads and camping spurs are basically complete and could be used. I also understand that some picnic tables and fire rings are on site. With the addition of minimal sanitation facilities the site could be operated as a limited facility day-use area this summer and perhaps some of the camping loops could be opened for primitive camping. In order

FC-7c

ORLPD

Mr. Dick Wengert

to facilitate such use, chemical toilets would be required and the existing water and sewage facilities protected from vandalism. It appears that limited funds may be available this fiscal year to accomplish such tasks.

I understand that Mr. Neal Jenkins, Chief of my Planning Division, discussed this matter with you by telephone on 3 December and you may be willing to consider a program of this nature. Should that be the case, I would be pleased to have members of my staff to meet with the appropriate Forest Service personnel to define specifically those minimal work items required to open Zilpo as a limited facility site during the spring of 1983. I would be pleased to hear your views with regard to this matter.

Sincerely,

1 Incl
As stated

C. E. EASTBURN
Colonel, Corps of Engineers
District Engineer

AG

DEC 15 1982

ORLPD

Mr. Dick Wengert
Forest Supervisor
Daniel Boone National Forest
Winchester, KY 40391

Dear Mr. Wengert:

As you know we have been constructing recreation facilities at Cave Run Lake pursuant to the December 1975 amendment to the 1968 Memorandum of Understanding between the Chief of Engineers and the Chief of the Forest Service. Planned recreation construction items not yet under contract are listed on the inclosure.

During April 1982 I was advised by the Director of Civil Works of the Office of the Chief of Engineers that no construction contracts at new sites will be programmed beyond Fiscal Year 1982 for recreation facilities unless nonfederal interests agree to provide 50% financing for their share of separable recreation construction costs and to bear 100% of recreation O&M costs. Essentially, this policy will preclude all future recreation construction by this office unless a nonfederal sponsoring agency is both willing and able to pay (up front) one-half of such costs and to bear all operation and maintenance costs.

Subsequent correspondence considered the applicability of such a policy to Corps lakes within National Forest proclamation boundaries and resulted in a conclusion that due to the substantial costs to be borne by the Federal government during a period of constrained funding, construction of the remaining recreation facilities at Cave Run Lake should not be scheduled. This leaves us in a position of having a partially completed site at Zilpo and without sufficient funding to proceed with the visitor center which had been approved for construction by separate correspondence.

In view of the substantial investments that have been made at Zilpo and my understanding of its state of completion, it would appear proper to take those actions preparatory to opening at least a portion of the Zilpo site for selected limited use this coming recreation season. I understand that the boat ramp, beach, parking lots, internal roads and camping spurs are basically complete and could be used. I also understand that some picnic tables and fire rings are on site. With the addition of minimal sanitation facilities the site could be operated as a limited facility day-use area this summer and perhaps some of the camping loops could be opened for primitive camping. In order

FB-70

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

Morehead, KY 40351

1 July 1980
2330



Tom Sweet, Recreation Planner
U.S. Army Corps of Engineers
P.O. Box 59
Louisville, KY 40201

Dear Tom,

Here is a list of proposed or potential recreation development sites on the Morehead Ranger District for use in your master planning work.

<u>Name</u>	<u>Location</u>
Zilpo-Caney Multi-Recreation Trail	South Shoreline of Cave Run Lake
"Quarry" Boat Ramp	Main Licking River
"Bluff" Picnic Area	Main Licking River
Primitive Campsites By Reservation (const. May 1980)	Clear Creek General Forest Area
Shallow Flats Wildlife Habitat Interpretive Trail (future const.)	Scotts Creek Bay
Fitness Trail (Completed by late summer)	Twin Knobs Beach Area
Courtesy Boat Docks	East Group Use Area, Twin Knobs Scotts Creek Boat Ramp Alfrey Boat Ramp

The accompanying maps should help locate these facilities.

The Daily Visitation Report figures summarize recreational use at Twin Knobs Campground for the period April 20 through May 28, 1980. Please note that the beach was open only the last five days during that period. The \$1.00 beach passes are for three or less persons per vehicle and \$2.00 passes for four or more per vehicle. Our group use areas are

reserved on a daily basis for large gatherings or overnight use (a one day reservation runs 24 hours from 9 AM until 9 AM). Sightseers were issued a special pass to allow them 30 minutes to tour the recreation area without charge.

The information shows several trends. Over 90 percent of our campers come from Kentucky, Ohio, and West Virginia. Less than one percent come from any other individual state. Our Kentucky figures are broken down by county. Most of the campers come from Rowan, Bath, Boyd, Campbell, Clark, Fayette, Greenup, Jefferson, Kenton, Montgomery, and Pike counties. These counties include Louisville, Sexington and Ashland. Our records also show that our visitation comes from Kentucky counties and areas in West Virginia adjacent to the Interstate 64 connector. Most of our Ohio visitors are from the Portsmouth and greater Cincinnati metropolitan areas.

We have not ascertained where our beach visitors are from, however the beach figures do not include campers who use the beach. Our beach use has continued to steadily increase since May 28 and Sunday, June 22 we had over 2100 persons check in to go to the beach, not counting campers who swam. The campground is also experiencing near 100 percent occupancy on weekends.

Our group use areas are used by groups from Kentucky and Ohio. The groups have included a graduating nursing school class from Morehead State University, a sailing association, family reunions, Boy Scout Troops, and company picnics.

The sightseers come predominately from Rowan and Fayette counties in Kentucky. Unlike our Ohio campers who mostly come from the Cincinnati area, the sightseers from Ohio come from areas more widely spread around the state.

The attachments give more detailed information and we would have all the daily visitation reports from which the summaries were compiled available for any use you may desire.

I hope this information can help you with your planning efforts. We appreciated your visit on May 23, 1980.

Sincerely,


LEONARD J. McNEAL
District Ranger

Enclosures: Maps
Visitation Reports

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
100 Vaught Road
Winchester, Kentucky 40391

2330
December 5, 1979



Col. Thomas P. Nack, District Engineer
Corps of Engineers - Louisville District
600 Federal Place
P.O. Box 59
Louisville, Kentucky 40201

Dear Colonel Nack:

Please reference your 15 October 1979 letter and our 16 November 1979 letter on Recreation facility construction at Cave Run Lake.

We have completed our review and concur that items covered in the Chart "Initial Recreation Development, Cave Run Lake" date October, 1979 contains those facilities that comprise the initial recreation development program.

I appreciate the opportunity to comment on this.

Sincerely,


RICHARD H. WENGERT
Forest Supervisor

A-6

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
100 Vaught Road
Winchester, KY 40391

2330

November 16, 1979



Colonel Thomas P. Nack
C.O.E. - Louisville District
P.O. Box 59
Louisville, KY 40201

Dear Colonel Nack:

This reply is to coordinate with the October 30 telephone conversation between Mr. Mike Tanner and Mr. Tom Sweet, which concerned the topic of the initial recreation facility development on Cave Run Lake.

For the following list, refer to the development chart dated October, 1979.

1. Item 9: Is trail-head parking for the Knob Trail included in this figure?
2. Item 10: This electrical service may have been figured into Item 21.
3. Item 14: This refers to the 801 projects, in place of Twin Knobs.
4. Item 21: Ancil. #9, should be written to include the following:
 - a. 2,000 lin. ft. of concrete sidewalks.
 - b. 3 bulletin boards.
 - c. 9 trash containers.
 - d. 44 camping units.
 - e. Miscellaneous sidewalk sections at beach.
 - f. Relocation of 1 water hydrant.
 - g. 150 camping units at Zilpo.
 - h. Equipment rental (trucks).
5. Item 22: Ancil. #10, should read as electrical service to Twin Knobs.
6. Item 23: Ancil. #11, should be written as electrical service to Zilpo.

A-7

-2-

7. Ancil. #12 should be written to include the following:
- a. 2500 lin. ft. of paved connector trails at Zilpo.
 - b. Landscaping beach and miscellaneous areas at Zilpo.
 - c. 2 boat docks at Zilpo.
 - d. 87 camping units at Zilpo.
 - e. Interpretive signs at Twin Knobs.
 - f. 9 benches at Twin Knobs.
 - g. 8695 lin. ft. of trail at Twin Knobs.
 - h. Signs at Twin Knobs.

Sincerely,

Robert C. Joslin
FOR RICHARD H. MENGERT
Forest Supervisor

A-8.

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
100 Vaught Road
Winchester, Kentucky 40391

2330

January 3, 1978

Colonel Thomas P. Nack, District Engineer
U.S. Army Corps of Engineers
Louisville District
P.O. Box 59
Louisville, Kentucky 40201



Dear Colonel Nack:

With the termination of fiscal year 1977, we have several force account projects that have not been completed. We have \$85,423.15 in account 881-77-219-312-01-15. We propose to complete the remaining projects that were part of the Ancillary Operating Agreement Number 4 to the Memorandum of Understanding dated October 21, 1968. These projects are listed below:

1. Complete hiking trail.
2. Complete bulletin boards.
3. Complete connector trails.
4. Landscape camping area.
5. Landscape entrance station.

These projects will be completed by April 1, 1978 and all monies apportioned for force account construction will be expended.

The projects outlined below are force account projects we wish to accomplish between January 1, 1978 and September 30, 1978.

I. Twin Knob Recreation Area

- A. 54 camping units - Camping Area A.
- B. Launch dock at ramps (two).
- C. Furbish fishing points and provide fish attractors.
- D. Construct remaining shoreline trail (from Camping Area I to boat ramp).
- E. Construct additional connector trails.

A-9

- F. Provide electric power to units on Camping Areas B, C, and H.
- G. Resident trailer set-up and entrance road to trailer.
- H. Knob overlook.
- I. Benches for trails and bathhouse.
- J. Telephone system - optional item if cost is feasible.

II. Shallow Flats*

- A. Fence
- B. Tree planting
- C. Grading
- D. Seeding

III. Claylick Boat-In Camping Area*

- A. 20 camping units
- B. Water well
- C. Toilets
- D. Trail
- E. Signs
- F. Bulletin board
- G. Service road

*Supplemental Facilities Report No. 3, Cave Run Lake.

At your request we have included a number of projects that must be accomplished before we terminate construction at Twin Knobs Recreation Area.

- I. Beach
 - A. Buoys and supports
 - B. Depth markers
 - C. Bulletin board

- D. Signs
- E. Garbage containers
- F. Landscaping

II. Trails

- A. Pave Knob Trail
- B. Bikeway along 1017 and 1019
- C. Additional connector trails
- D. Signs
- E. Trail from knob to beach
- F. Interpretive trail
- G. Trailhead parking to knob
- H. Benches

III. Boat Ramps

- A. Fish cleaning station (Boat Ramp No. 2; campground)
- B. Flush toilet (Boat Ramp No. 2; campground)
- C. Holding tank (Boat Ramp No. 1; Alfre)

IV. Group Use Area

- A. Walks, units and accessories
- B. Shelters
- C. Toilets
- D. Landscaping
- E. Open play area

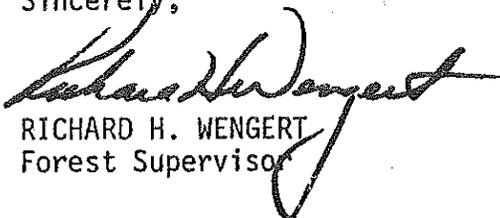
V. Campground

- A. Camping Area J
 - 1. Road, spurs, units and accessories
 - 2. Toilet buildings

3. Hydrants
 4. Garbage
 - B. Camping Area A
 1. Toilet buildings
 2. Garbage
 3. Hydrants
 - C. Signs
 - D. Sidewalks at toilet building in Loops H,G,B, & F
 - E. Floating docks for campers along shoreline
 - F. Group camp (existing camping Loop H available for reservation by groups)
 1. Group shelter
 2. Fire ring
 - G. Unit modification for handicapped
- VI. Operational Maintenance
- A. Work storage area
 - B. Removal of old storage building
 - C. Treatment plant expansion
- VII. Paving of All Roads
- A. Amphitheater
 - B. Final landscaping

We request your comments and concurrence on the proposed force account projects. Further breakdown concerning cost of materials and labor will be sent at a later date with a proposed ancillary operating agreement.

Sincerely,



RICHARD H. WENGERT
Forest Supervisor

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

100 Vaught Road
Winchester, Kentucky 40391

2340

September 8, 1977



Colonel Thomas P. Nack, District Engineer
Corps of Engineers - Louisville District
600 Federal Place
Louisville, Kentucky 40201

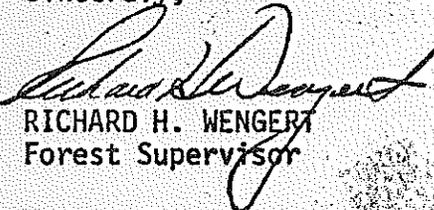
Dear Colonel Nack:

Reference is made to the Memorandum of Understanding between the Chief of Engineers, Corps of Engineers and Chief of the Forest Service, Department of Agriculture pertaining to PLANNING, DEVELOPMENT, AND MANAGEMENT OF RECREATION AND OTHER RELATED LAND MANAGEMENT ACTIVITIES ASSOCIATED WITH THE CAVE RUN RESERVOIR PROJECT AND THE DANIEL BOONE NATIONAL FOREST, KENTUCKY signed October 21, 1968 by William Cassidy, Chief of Engineers, Corps of Engineers, United States Army and Edward P. Cliff, Chief of the Forest Service, Department of Agriculture.

Recent investigation by the Forest Service has revealed a significant interest for the types of facilities and services that could be provided by a commercial resort development at Cave Run Lake. The Caney Recreation Area originally proposed for future development is an ideal site for this type of development and planning is now to be considered a component of the initial development. It is requested that the U.S. Army Corps of Engineers prepare a revised report on the Master Plan (concept) and a Feasibility Report for the Caney Recreation Area, based on the assumption the site will be leased by private interests for commercial resort development, as a requirement of the referenced Memorandum of Understanding.

Please feel free to contact me for additional information on this subject.

Sincerely,


RICHARD H. WENGERT
Forest Supervisor

A-13

DISPOSITION FORM

For use of this form, see AR 340-15; the proponent agency is The Adjutant General's Office.

REFERENCE OR OFFICE SYMBOL

SUBJECT

ORLPD-R

Meeting with U.S.F.S. on 6 Feb 76 at Winchester, Ky.
to Discuss Funding Priorities For Additional Recreation
Development at Cave Run Lake

TO

FILES

FROM

Thomas Sweet

DATE

25 Feb 76

CNT 1

Participants:

Dick Wengert, Supr. DBNF
Bob Strosnider, DBNF
Mike Tanner - DBNF
Dave French - ORLPD-R
Tom Sweet - ORLPD-R
Allan Worms - U of K
Clayton Perkins - Cave Run Develop. Assoc.
Dave Wagner - DBNF

1. The main focus of discussion and product of this meeting was the drafting of a priority list of initial recreation facilities to be developed at Cave Run Lake, Kentucky. Appropriate cost estimates were assigned and the proposed work was put into fiscal year format in order to develop a tentative schedule of funding needs (See inclosed schedule).
2. DBNF related that they would like to utilize their force account to construct proposed camping area at Twin Knobs (except where contract is needed, to accomplish clearing for spurs, spur modifications, buildings, sewer lines, power and paving). Unofficial agreement was expressed by Corps representatives and official comment will be forthcoming.
3. Strosnider expressed that they (FS) will probably not be able to get funding for doing in-house planning for Cave Run and asked if Corps funds might be made available.
4. FS and Corps both agreed that, if possible, the initial contract for construction of Zilpo Road should include construction of that segment which extends into the Zilpo recreation site, and terminates at Zilpo boat ramp, with ramp parking area also to be constructed under this initial contract. (Assuming contractor does quality work).
5. The FS related that they were still interested in providing some type of interpretive facility. Their current thought as to location seems to favor a facility at the Corps' construction overlook site. They also would like to provide some type of information booth along Hwy 801 as soon as possible to help solve some of the congestion that "information seekers" cause at the Twin Knobs control station.
6. If available, the FS requested use of current aerial photo and survey mapping of the Caney Creek site.
7. The FS expressed a strong interest in obtaining more information about the "industrial building" type comfort stations that the Corps has recently used. They are particularly interested in the flexibility of these buildings to be decreased in size. PD-R will arrange meeting to show Brookville facility to DBNF representatives.

ORLPD-R

25 February 1976

SUBJECT: Meeting with U.S.F.S on 6 Feb 76 at Winchester, Ky. to Discuss
Funding Priorities for Additional Recreation Development at
Cave Run Lake

8. The FS already has plans and specifications for total development of Zilpo site; however, these will likely require careful review and supplementation by FD.

9. Plans and specs are being completed for the Scott Creek Marina and the marina is scheduled to be in service by June 76.

10. The FS expressed their intentions to, as soon as possible, designate several more boat-in camping areas at Cave Run Lake.

11. The FS expressed their strong interest in developing Hwy 801 as soon as possible. The Corps responded by agreeing with the unanticipated need for such but cautioned that a strong push for developing unapproved sites initially may jeopardize the needed funding for approved priority areas.

12. After lunch, Allan J. Worms (U of K) and Clayton M. Perkins (Cave Run Development Association) met with the Corps and FS to gather information which could be used in a letter which the Development Association was sending to Congressmen from Kentucky encouraging them to be responsive to the total needs of the project area. This letter would point out some of the socio-economic problems in the project area, point out how development of Cave Run Lake will help alleviate some of these problems, and present a list of construction priorities and funding requirements.

1 Inc
as

CF:
DE
ED
PB

SWEET

Sweet

PRIORITIES AND ESTIMATED COSTS FOR INITIAL RECREATION DEVELOPMENT AT CAVE RUN LAKE, KENTUCKY

PLANNING

CONSTRUCTION

FY 77
 FY 78
 FY 79
 FY 80
 FY 81

- Develop P&S for following:
- Twin Knobs - 80 camping units related facilities, landscaping and paving of existing roads
 - Scott Creek and Warix Run - paving parking area and roads
 - Cave Run Boat Access Camping - 20 camping units, related facilities and access road

Work listed above under PLANNING

\$ 100,000

\$ 2,000,000

100,000

\$ 2,200,000

- Supplement M.P. for facilities along 801
- Develop P&S for remainder of Twin Knobs
- Develop P&S for Zilpo Road extension and parking at ramp plus camping roads
- Develop P&S for facilities along 801
- Supplement M.P. for Caney Creek
- Develop P&S for remainder initial work at Zilpo
- Develop P&S for information and interpretive station
- Develop P&S for initial work at Caney Creek

TOTAL FY77

- Construct remainder of Twin Knobs (57 units)

- Construct Zilpo extension, parking, camp roads
- Construct facilities along 801

- Construct additional facilities at Zilpo
- Construct information and interpretive station
- Construct roads at Caney Creek

TOTAL FY77 & FY78

\$ 4,000,000

TOTAL ESTIMATE

\$ 6,200,000

6 FEB 76
8-16

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

Daniel Boone NF

REPLY TO: 2330 Development Sites in Public Sector

December 15, 1975

SUBJECT: Cave Run Lake Recreation Development



TO: The Record

On December 4, 1975, representatives from the Corps of Engineers, Louisville District, and the Daniel Boone National Forest met to discuss the Cave Run Lake Project.

Representing the respective organizations were:

U.S. Army Corps of Engineers--

- Rachel Doane - Landscape Architect
- John Sirles - Civil Engineer
- Tom Sweet - Recreation Planner

U.S. Forest Service--

- Richard H. Wengert - Forest Supervisor
- John Korb - Deputy Forest Supervisor
- Robert Strosnider - Recreation Staff Officer
- Glen Bonar - Forest Engineer
- Michael Tanner - Landscape Architect

The purpose of the meeting was to discuss priorities and existing plans that are available which could be applied to the development of recreation facilities on Cave Run Lake as called for in the Memorandum of Agreement between the COE and the FS. The following is an outline of items discussed.

1. The COE could not add any additional information concerning the agreement between the two agencies. Their instructions were to gather data and plans available that could be utilized when funds are appropriated.
2. The COE stated that if plans are not available which could be utilized not much construction could be started in FY 76.
3. The question was asked if a new Master Plan would have to be done before appropriated funds could be used in a construction contract. The COE did not know at this time.
4. The COE questioned the number of boat ramp lanes available on the lake as being insufficient. It was stated that there were twenty-one (21) lanes existing with nine (9) proposed if needed and that the lake was planned this way to control overuse.

5. The status of Caney Recreation Area was discussed and it was brought out that this area needed to be replanned and is not in the Forest Service initial program for development.
6. The Forest Service stated that the assumed \$2,000,000 to be appropriated should be spent at Twin Knobs Recreation Area. (See letter to Honorable Walter D. Huddleston, March 21, 1975.)
7. A site plan of Twin Knobs Recreation Area (see enclosure 1) was reviewed which showed 1) the areas which are complete with the exception of paving, 2) the roads under a existing paving contract, and 3) the Forest Service priority areas for the next construction contract.
8. FS involvement in the construction phase was discussed with the possibility of utilizing the Morehead District crews. This would eliminate detail construction drawings and would be a cost savings to the Government because of past experience and available equipment. Camping units and water distribution lines were jobs mentioned for possible FS involvement. The Forest is to decide if it has the capacity to undertake this portion of the project and inform the COE.
9. The existing paving contract could be altered and additional roads could be added to the contract.
10. The plans were given to the COE to look over before another meeting would be held. The plans consisted of the following:
 - a. Twin Knobs Recreation Area - 1" = 400'
 - b. Twin Knobs Recreation Area - 1" = 50'
 - c. Comfort station plans and specifications
 - d. Paving contract plans and specifications
 - e. Forest Service standard road specifications

Utility plans of existing lines (power, water, sewer) are to be sent to the COE when we complete them.

Michael A. Tanner

MICHAEL A. TANNER
Landscape Architect

MATANNER:jem

A-18

EXHIBIT B

MEMORANDUM OF UNDERSTANDING

CHIEF OF ENGINEERS
CORPS OF ENGINEERS
U. S. ARMY

Between
and
Pertaining
to

CHIEF OF THE FOREST SERVICE
DEPARTMENT OF AGRICULTURE

PLANNING, DEVELOPMENT AND MANAGEMENT OF RECREATION,
AND OTHER RELATED LAND MANAGEMENT ACTIVITIES
ASSOCIATED WITH THE CAVE RUN RESERVOIR PROJECT
AND THE DANIEL BOONE NATIONAL FOREST, KENTUCKY

THIS MEMORANDUM OF UNDERSTANDING is entered into pursuant to paragraph 9 of Memorandum of Agreement, dated August 13, 1964, between the Secretaries of the Army and Agriculture relating to this subject for the purpose of establishing and recording agreed-upon policies and principles governing the planning, establishing, and the managing of water, land, and recreational resources which will develop from the Cave Run Reservoir project which is being constructed by the Corps of Engineers on the Licking River in Bath, Rowan, Menifee, and Morgan Counties, Kentucky, primarily within the boundary of the Daniel Boone National Forest.

ARTICLE I. The Corps of Engineers will:

a. Subject to availability of funds, acquire all privately-owned lands, with appurtenant rights needed for the Cave Run Reservoir project in accordance with the joint policies of the Departments of the Interior and of the Army relating to the acquisition of land for water resource projects published in the Federal Register, dated February 22, 1962, Vol. 27, Page 1734, and implemented by Engineer Regulation 405-2-150, dated March 9, 1962.

b. Pursuant to Public Law 804, 84th Congress (16 U.S.C. 505a, b), recommend the transfer of all land, with appurtenant rights, acquired by the Corps under Article Ia, within or adjacent to exterior boundaries of the Daniel Boone National Forest, to the Department of Agriculture for the development, management, and administration by the Forest Service of the Cave Run Reservoir project provisions for public recreation and Federal responsibilities for fish and wildlife, in conjunction with the management and administration of related Forest Service programs for the Daniel Boone National Forest. The Corps reserves, however, the right to use all of these lands which are necessary to the construction, operation, and maintenance of the Cave Run Reservoir project for its intended purposes, other than recreation and fish and wildlife, as presently authorized, or as may be

1518-01

Exhibit B-1

2

authorized in the future; including, but not limited to, the right to perform timber clearing, flooding of the area, to construct and maintain transmission lines, utilities, access roads, and to make improvements in the aid of navigation.

c. Remove debris during construction and for six months after initial impoundment to elevation 730 feet. Stabilize and revegetate lands disturbed by construction or maintenance activities of the Corps.

d. Establish and permanently mark exterior boundary lines on private lands acquired by the Corps which will be transferred to the Department of Agriculture, to the extent that such exterior boundaries will abut private lands after completion of the land transfers contemplated herein.

e. Construct, operate, and maintain facilities for accommodation of visitors to the dam, unless otherwise agreed upon, and provided for in the coordinated Reservoir Project Master Plan.

ARTICLE II. The Forest Service will:

a. Take necessary action to secure extension of the boundary of the Daniel Boone National Forest to include proposed Corps recreation sites 9 and 10, and all project lands west of site 10.

b. Pursuant to Public Law 804, 84th Congress (16 U.S.C. 505a, b) recommend transfer to the Secretary of the Army, full custody and control of all National Forest lands and land rights, the limits of which shall be defined by the Corps in a manner calculated to provide for the construction, operation, and maintenance of the dam, spillway, and interment sites. The Forest Service reserves the right of access and use necessary to provide for required other uses of National Forest lands, including the sale of timber therefrom prior to clearing activities of the Corps and access for National Forest purposes.

c. Grant to the Secretary of the Army for the use of the Corps, rights to enter upon all other National Forest lands lying within the Cave Run Reservoir project area, together with rights of ingress and egress for the purpose of constructing, operating, and maintaining said project for its intended purposes, other than recreation and Federal responsibilities for fish and wildlife as presently authorized, or as may be authorized in the future, including, but not limited to, the right to clear timber, the performance of initial construction work relating to the project, and to flood the area as may be necessary for the operation of the project, all of which shall be coordinated with the Forest Supervisor.

1518-01

d. Assume, subject to the availability of funds, the financial responsibilities for development of all public use areas and facilities in accordance with plans which shall be prepared on a coordinated basis by the Forest Service and the Corps, except those outlined in Article Ie.

e. Initiate and prepare, on a coordinated basis with the Corps, comprehensive plans for the development and realization of the full recreation and associated water and land management potentials of the reservoir. These plans will constitute a joint Master Plan of the Forest Service and the Corps of Engineers for public recreation use of the reservoir project.

f. Accept responsibilities for care and protective custody of all lands as they are made available by interchange by the Corps and for the conduct of all reservoir management activities on lands other than those under full custody and control of the Corps as provided in Article IIb, except those activities which will be performed by the Corps as outlined in Article I above, including, but not limited to custody and control of all public use facilities established along the shore of the reservoir and shoreline maintenance.

g. Assume the responsibility for the establishment of water-related, commercial facilities programmed under the jointly-approved Master Plan. In the event the establishment of proposed commercial facilities may depart from those programmed under the Master Plan, all plans, specifications, and contract or lease documents pertaining thereto shall be coordinated with the Corps.

h. Accept the responsibility for debris removal following the period provided for in Article Ic, and for aquatic weed and vector control.

ARTICLE III. The relocation of public roads and other public service facilities, such as power, telephone, water, and gas lines resulting from the construction of the Cave Run Reservoir project may involve National Forest lands outside the normal project boundaries. It is agreed that the owners of said roads and facilities will be granted rights-of-way on National Forest lands (if this is the feasible location) equivalent to those held on the original location subject to the requirements for protection of lands and resources of the National Forest within the authorities available to the Secretary of Agriculture.

ARTICLE IV. The Corps and the Forest Service will jointly prepare rules and regulations governing the use of the reservoir

1518-01

B-3

4

and use and occupancy for peripheral project land by the general public. The Forest Service will issue any permits or easements on project lands under Forest Service jurisdiction and, except for the types of permitted activity as may be provided for in the jointly approved Master Plan, will issue such permits or easements only after concurrence by the Forest Supervisor and the District Engineer in the need for, and acceptability of, such outgrants in each individual case.

ARTICLE V. The Forest Service will, in collaboration with the Corps of Engineers, prepare fire prevention and control plans for the project which will include provisions for fire prevention and fire control clauses in all Forest Service and Corps contracts.

ARTICLE VI. Pursuant to the authority contained in the Act of July 26, 1956 (16 U.S.C. 505a, b), the Forest Service and the Corps will prepare and have executed appropriate land interchange orders to accomplish an exchange of lands and land rights in order to fulfill the terms and conditions set forth in Articles I and II above.

ARTICLE VII. Ancillary operating agreements will be needed in implementing this Memorandum of Understanding. It is agreed that the District Engineer and the Forest Supervisor will, from time to time, discuss the various phases of the construction and management programs and will, when appropriate, insofar as they are capable of doing so under the authorities of their offices, incorporate the mutual understanding, responsibilities and obligations in written operating agreements.

IN WITNESS WHEREOF, we have hereunto subscribed our names for and on behalf of our respective Departments this 21 day of October, 1968.

William J. Cassin

CHIEF OF ENGINEERS
Corps of Engineers
United States Army

Edward P. Quinn

CHIEF OF THE FOREST SERVICE
Department of Agriculture

B-4

EXHIBIT C

AMENDMENT TO:

MEMORANDUM OF UNDERSTANDING

CHIEF OF ENGINEERS
CORPS OF ENGINEERS
U.S. ARMY

Between
and
Pertaining
to

CHIEF OF THE FOREST SERVICE
DEPARTMENT OF AGRICULTURE

PLANNING, DEVELOPMENT AND MANAGEMENT OF RECREATION
AND OTHER RELATED LAND MANAGEMENT ACTIVITIES
ASSOCIATED WITH THE CAVE RUN RESERVOIR PROJECT
AND THE DANIEL BOONE NATIONAL FOREST, KENTUCKY

Signed the 21st day of October 1968

by: William Cassidy, Chief of Engineers
Corps of Engineers, United States Army

Edward P. Cliff, Chief of the Forest Service
Department of Agriculture

TO FACILITATE INITIAL RECREATION DEVELOPMENT ON THE CAVE RUN RESERVOIR
PROJECT, WITHIN THE DANIEL BOONE NATIONAL FOREST, KENTUCKY,
ARTICLE I. *f.* IS ADDED TO PAGE 2 OF THIS AGREEMENT AS FOLLOWS:
(*Italicized words are added.*)

(ARTICLE I. The Corps of Engineers will:)

- f. Assume, subject to the availability of funds, financial responsibility for planning, design, and construction of initial recreation facilities. The planning, design, and construction inspection will be a coordinated effort, leading to general concurrence on each sequential increment, between the Corps and the Forest Service. (The Forest Service will retain responsibility for the operation, maintenance, and replacement of such facilities, and, subject to the availability of funds, for the future development and construction of recreation facilities.)*

Exhibit C-1

AND ARTICLE II. d. IS AMENDED AS FOLLOWS:

(ARTICLE II. The Forest Service will:)

- d. Assume, subject to the availability of funds, the financial responsibilities for development of all public use areas and facilities in accordance with plans which shall be prepared on a coordinated basis by the Forest Service and the Corps, except those outlined in Articles I. e. and I. f.

Signed the 4th day of December 1975



Lt. Gen., Chief of Engineers,
Corps of Engineers, Department of the Army



Chief of the Forest Service
Department of Agriculture



**US Army Corps
of Engineers**
Louisville District

Report of Sedimentation

Design Memorandum No. I3

Cave Run Lake, Kentucky

PARK MANAGER
U.S. ARMY CORPS OF ENGINEERS
CAVE RUN LAKE
150 KENTUCKY 826
MOREHEAD, KENTUCKY 40351-9211

September 1990

**REPORT OF SEDIMENTATION
IN CAVE RUN LAKE, KENTUCKY
TABLE OF CONTENTS**

<u>Part</u>	<u>Subject</u>	<u>Paragraph</u>	<u>Page</u>
	Authority	1	1
	Purpose	2	1
	Scope	3	1
I	Abstract	4	2
II	Introduction	5	3
III	General Information		
	Location of Dam	6	4
	Location of Lake	7	4
	Ownership and Operation	8	4
	Purpose Served	9	4
	Description of Dam	10	4
	Date of Completion of Dam	11	4
	Description of Lake	12	5
	Operation of Lake	13	5
	Lake Storage and Drawdown	14	5
	Area of Drainage Basin		
	Above Dam	15	6
	General Character		
	of Drainage Basin	16	6
	Precipitation	17	6
	Streamflow Records	18	6
IV	Methods of Survey		
	Initial Sedimentation Survey	19	7
	First Sedimentation Survey	20	7
	Calculation Methods	21	7
	Calculation Procedures	22	7
	Accuracy	23	7
V	Sediment Deposits		
	Volume of Sediment	24	8
	Rate of Sedimentation	25	8
	Distribution of Sediment	26	8
	Storage Reduction	27	8
	Character of Sediment	28	8
VI	Conclusions		
	Conclusions	29	9
	Summary of Data	30	9
VII	Projected Survey		
	Projected Survey	31	10

**REPORT OF SEDIMENTATION
IN CAVE RUN LAKE, KENTUCKY**

TABLES

<u>Number</u>	<u>Title</u>	<u>Page</u>
1	Changes in Lake Capacities	11
2	Changes in Lake Areas	12
3	Sediment Distribution	13

PLATES

1	Louisville District Multi-Purpose Lake Projects	14
2,3	Sedimentation Survey Range Layout	15,17
4	Sedimentation Survey Revised Area/ Capacity Curves	19

Exhibits

1	Reservoir Sediment Data Summary "Cave Run Lake"	21
---	--	----

APPENDICES

A	Profiles of Sedimentation Ranges
B	Pertinent Data - Cave Run Reservoir

SEDIMENTATION
IN
CAVE RUN LAKE, KENTUCKY

AUTHORITY

1. This report on sedimentation in Cave Run Lake, Licking River Basin, Kentucky, is submitted in compliance with ER 1110-2-240 dated 12 November 1981 and EM 1110-2-4000, dated 15 December 1989, subject: "Reservoir Sedimentation Investigations Program".

PURPOSE AND SCOPE

2. Purpose. The purpose of this investigation is to obtain information about the amount and distribution of sediment at Cave Run Lake below flood pool, to estimate the rate of sedimentation and to present data, results, and analyses of the 1985 sedimentation survey. This information is utilized in connection with the effective operation and management of the project and may also be used in studies of projects on other streams with similar physical and hydrologic characteristics.

3. Scope. This report presents the results of the first sedimentation resurvey of Cave Run Lake. It contains determinations of distribution and volume of sediment accumulation in the lake since the initial sediment survey in January of 1975, to the time of the first resurvey in September of 1985. The scope and arrangement of this report are as follows:

<u>Section</u>	<u>Subject</u>
I	Abstract
II	Introduction
III	General Information
IV	Methods of Survey
V	Sediment Deposits
VI	Conclusions
VII	Projected Survey

I. ABSTRACT

This report addresses sedimentation in Cave Run Lake from the time of the initial sedimentation survey, January 1975, to completion of the first sedimentation resurvey, September 1985. It contains a summary of the sedimentation survey findings and forms a basis for recommendations with respect to future surveys.

The total sediment accumulation in the lake below elevation 730 (seasonal pool), for the period of January 1975 to September 1985, is 6797 acre-feet by volume.

II. INTRODUCTION

Impoundment of Cave Run Lake began in January 1974 and, like other Corps' multipurpose projects, the reservoir includes in its storage allocations a reserve for sedimentation. Based on the nature of the drainage area, a siltation rate of 0.5 acre-foot/square mile/year was used to estimate a 100 year life. This survey revealed an actual siltation rate of 0.64 acre-foot/square mile/year. Available silt storage will be depleted in about 83 years if this rate remains steady.

This report summarizes the accumulation and distribution of sediment in Cave Run Lake.

III. GENERAL INFORMATION

6. Location of Dam. Cave Run Damsite is located on Licking River, 173.6 miles above its junction with the Ohio River, and 4 miles upstream from Farmers, Kentucky.

7. Location of Lake. Cave Run Lake is located in East Central Kentucky about 84 air miles southeast from Cincinnati, Ohio, and about 118 air miles east from Louisville, Kentucky. The reservoir area lies in Bath, Rowan, Menifee, and Morgan Counties.

8. Ownership and Operation. Cave Run Lake is owned by the Federal Government and operated by the U.S. Army Engineer District, Louisville, Kentucky.

9. Purposes Served. The lake is part of the overall development plan for flood control, recreation, and water quality improvement in the Licking River Basin.

a. Flood Control. The project has flood control capability to contain 9.95 inches of runoff from the 826 square mile drainage area, affording reductions in flood stages at all stations downstream from the dam. The 9.95 inches of runoff equal a storage volume of 438,500 acre-feet. The project will effect considerable reduction in damaging stages in the Licking River, with some reduction in stages in the Ohio River.

b. Recreation. For seasonal recreational periods (May through September) the lake elevation is raised from 724 (top of water quality pool) to 730. This additional storage provides a lake surface area of 8,270 acres for boating, fishing, swimming, and other water-oriented recreational activities.

c. Water Quality. For water quality needs, an impoundment between elevations 720 and 724 provides 28,300 acre-feet of storage to be used for maintaining firm monthly flows at Catawba, Kentucky to assimilate organic wastes entering the river.

10. Description of Dam. The dam is an earth and rockfill structure, 2700 feet long with a maximum height of 140 feet, reaching an elevation of 788 feet mean sea level. An open cut spillway is located near the left abutment with a crest elevation of 765 feet mean sea level. The outlet works consist of a circular concrete conduit 15 feet in diameter with a stilling basin located on the downstream end. Two 24-inch bypass outlets are provided for low discharges.

11. Date of Completion of Dam. Construction of the dam and spillway was completed in December 1973. The reservoir was placed in operation for flood control purposes in January 1974.

12. Description of Lake.

a. Original lake storage capacity allocation, acre-feet

seasonal pool storage (below elevation 730)	222,581
flood control storage (between elevation 730 & 765)	391,491
total storage below spillway crest (full elevation 765)	614,072

b. Original size of lake, acres - 1974

seasonal pool - elevation 730	8,270
flood pool - elevation 765	14,870

13. Operation of the Lake. The reservoir primarily operates as a unit of the reservoir plan for the Ohio River Basin to effect reduction in flood stages at all points downstream from the dam.

14. Lake Storage and Drawdown. Lake storages and drawdowns, since the reservoir was placed in complete operation, have resulted in monthly maximum and minimum lake pool levels as follows:

<u>Month</u>	<u>Maximum Water Surface</u>		<u>Minimum Water Surface</u>	
	<u>Elevation</u>	<u>Year</u>	<u>Elevation</u>	<u>Year</u>
January	745.8	1979	705.2	1974
February	750.0	1979	708.8	1974
March	753.9	1979	713.0	1974
April	741.2	1975	715.1	1974
May	747.8	1984	722.9	1974
June	741.2	1983	727.2	1974
July	738.8	1981	727.2	1974
August	733.5	1979	727.2	1974
September	734.1	1974	726.0	1974
October	731.2	1976	721.0	1974
November	732.5	1975	717.8	1974
December	755.0	1978	713.1	1974

15. Area of Drainage Basin. The drainage area of Cave Run Lake at the damsite is 826 square miles, while the drainage area at the mouth of Licking River covers 3,707 square miles.

16. General Character of Drainage Basin. The lake is located in a predominately rural area, the major land uses being agriculture and forestry. A large percentage of the drainage area is part of the Daniel Boone National Forest. The basin is long and narrow, having a width-length ratio of about 0.4. The topography of the area above the damsite is in sharp relief with narrow ridge tops reaching 1500 feet above m.s.l. and slopes averaging 40 percent or more.

17. Precipitation. Based on records for nearby stations, the mean annual precipitation for Cave Run basin is 45 inches. The maximum monthly precipitation recorded was 15.51 inches and the minimum is less than 0.1 inches.

18. Streamflow Records. The U.S. Geological Survey and Corps of Engineers are the principal agencies operating stream gaging stations in the Licking River Basin. Discharge records for gaging stations in Kentucky at Catawba, McKinneysburg, Farmers, and Salyersville, are collected and published by the U.S. Geological Survey, under the Cooperative Stream Gaging Program with the Corps of Engineers.

IV. METHODS OF SURVEY

19. Initial Sedimentation Survey. Index ranges were established during fiscal year 1968. The initial survey was completed in January 1975.

20. First Sedimentation Resurvey. The first sedimentation resurvey was performed in September 1985. Twelve ranges above the dam and three ranges below the dam were resurveyed.

21. Calculation Methods. Computations were made by the method used in Corps of Engineers, Tulsa District, Report of Sedimentation Survey, Dennison Dam and Reservoir (Lake Texoma), Red River Basin, June 1950.

22. Calculation Procedure. Sediment range profiles were established for the 1975 and 1985 surveys. Common profile features were used to align the cross sections, and the incremental end areas of the sediment ranges were computed for each survey. The 1985 incremental capacity was calculated using the following equation:

$$\frac{\text{Sum of 1975 inc. segment end areas}}{\text{Sum of 1985 inc. segment end areas}} = \frac{\text{1975 inc. segment capacity}}{\text{1985 inc. segment capacity}}$$

From these two surveys, area/capacity tables were generated and compared to determine the amount of sediment accumulation. A ratio was then established at each elevation to represent the change in capacity. This ratio was then applied to the existing area/capacity table to ascertain a new area/capacity table. By subtracting the new values from the old, the volume of sediment accumulation was determined for each elevation. A factor of 1.093 was applied to the volume of sediment calculated to include sediment deposited between impoundment in January 1974 and the first range survey in January 1975. The same method was applied to each segment.

23. Accuracy. Horizontal adjustments were applied to each sediment range individually. The profiles of the original and resurveyed ranges were overlaid and, in cases where there was horizontal misalignment of profile features, a correction was made. The resurveyed range profile was held constant and a scale factor was applied to the horizontal distance of the original survey to align the prominent features. Sediment calculations were performed using the adjusted profiles.

V. SEDIMENT DEPOSITS

24. Volume of Sediment. The total sediment accumulation in the lake below Summer Pool, El. 730, for the period from January 1974 to September 1985 (12.75 years) is 6797 acre-feet.

25. Rate of Sedimentation. The annual rate of sedimentation for the Cave Run Lake watershed is 0.64 acre-foot/square mile/year. This rate is somewhat in excess of the originally designed 100 year project life rate of 0.5 acre-foot/square mile/year.

26. Distribution of Sediment. Table 3 shows longitudinal and vertical sediment distribution throughout the lake. Plates in Appendix A show profiles of the sedimentation ranges. Item 43 on ENG Form 1787 (Exhibit 1) displays the percent of total sediment located within reach designations in the lake.

27. Storage Reduction. The usual amount of storage provided for siltation reserve is equivalent to about 1" of runoff from the reservoir drainage area. For Cave Run Lake this is 44,053 acre-feet. With the sedimentation rate of 0.64 acre-foot/square mile/year, the silt storage reserve would be depleted in approximately 83 years. Silt storage is estimated to be at 15.4% of capacity.

28. Character of Sediment. Sediment samples were obtained from the main body of the lake and from two selected sites in the headwaters. Sample locations are shown on Plate 2. The sediment deposits found in the main body of the lake, station CRR20001, are classified as a brown with black and gray silty clay with some fine sand and having a unit dry weight of 28.9 lbs/cu.ft. The sediment deposits found at station CRR20198 are classified as a brown with gray silty clay having a unit dry weight of 37.7 lbs/cu.ft. The sediment deposits found at station CRR20003 are classified as a brown with gray, very sandy silt with traces of clay and having a unit dry weight of 64.5 lbs/cu.ft. The average dry weight of all three samples is 43.7 lbs/cu.ft.

VI. CONCLUSIONS

29. Conclusions. The rate of siltation is higher than the original design estimate, however the total volume of sediment accumulated does not appear to be significantly impacting the lake. A reconnaissance survey is scheduled for 1995. Since there are only twelve cross sections, it is recommended that a full resurvey be done.

30. Summary of Data for Cave Run Lake.

- a. Age at mean date of resurvey 12.75 years
- b. Drainage area 826 square miles
- c. Storage capacities at flood pool El. 765

Original (1974)	614,072 acre-feet
Resurvey (1985)	607,275 acre-feet
- d. Capacity per square mile

Original (1974)	743.4 acre-feet
Resurvey (1985)	735.2 acre-feet
- e. Total volume of storage lost to sedimentation; 1974-1985

	<u>Storage Lost</u>	<u>% Original Storage</u>
Below El. 730	6797	3.1%
Below El. 720	5178	3.5%
- f. Average weight of sediment (lbs per cubic foot):

At time of first resurvey (3 samples)	43.7
---------------------------------------	------
- g. Average annual accumulation per square mile of drainage area for period of first resurvey (acre-feet):

.64

VII. PROJECTED SURVEY

31. A reconnaissance survey of Cave Run Lake is currently scheduled for 1995. A full resurvey is not presently scheduled.

TABLE 1
CHANGES IN LAKE CAPACITIES
(ACRE-FEET)

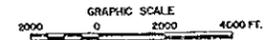
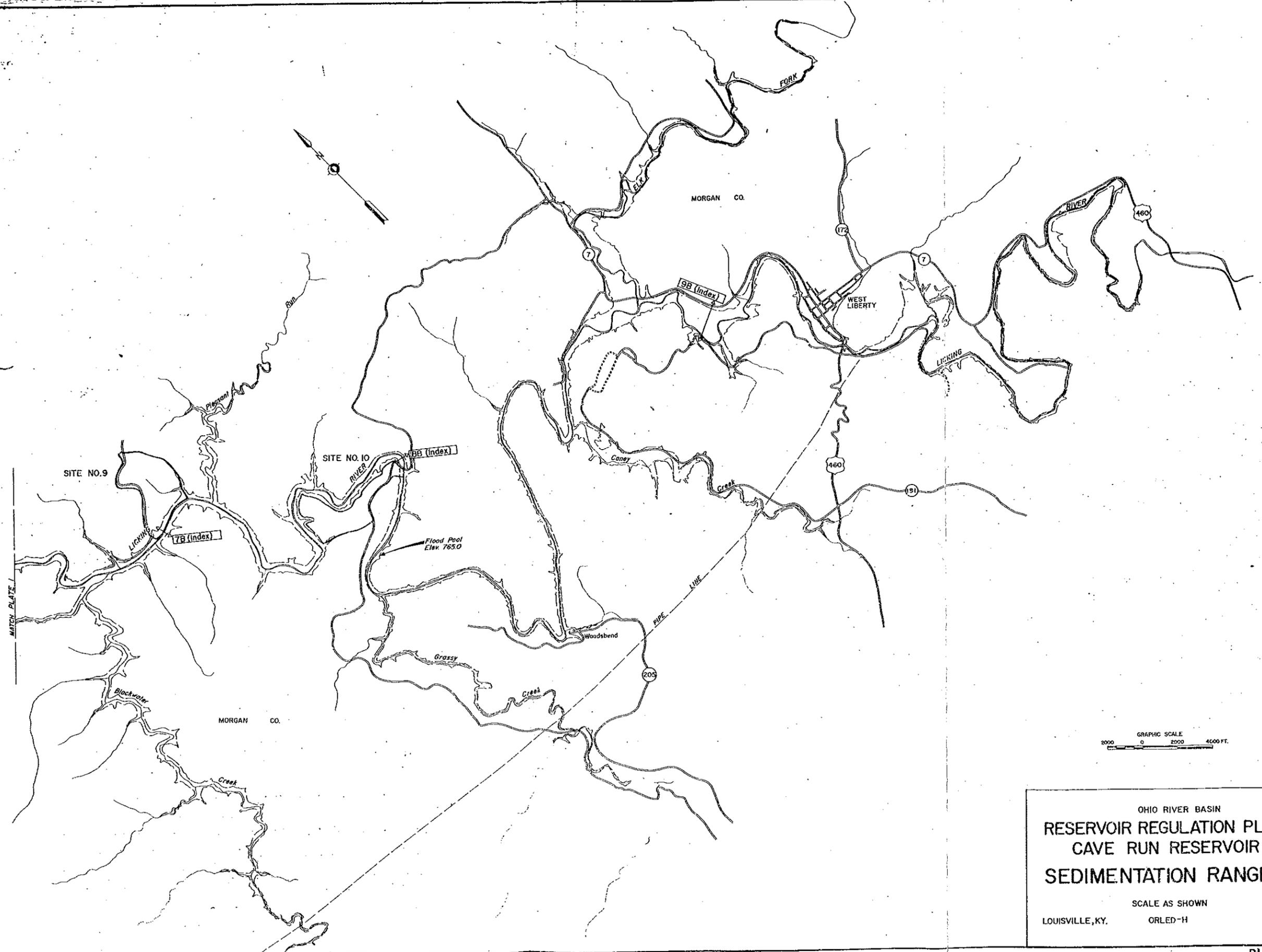
<u>ELEVATION</u>	<u>1974 STORAGE</u>	<u>VOLUME CHANGE X 1.093</u>	<u>1986 STORAGE</u>
730	222581		215784
	39426	602	38824
725	183155		176960
	35895	1017	34878
720	147260		142082
	31966	1013	30953
715	115294		111129
	28127	607	27520
710	87167		83609
	23790	824	22966
705	63377		60643
	19651	908	18743
700	43726		41900
	15130	336	14794
695	28596		27106
	11550	224	11326
690	17046		15780
	8175	275	7900
685	8871		7880
	5221	304	4917
680	3650		2963
	2431	520	1911
675	1219		1052
	834	164	670
670	385		382
	267	0	267
665	118		115
	98	0	98
660	20		17
	20	3	17
656	0		0

TABLE 2
CHANGES IN LAKE AREAS
(ACRES)

<u>ELEVATION</u>	<u>1975 AREA</u>	<u>CHANGE IN AREA</u>	<u>1986 AREA</u>
730	8270	76	8194
725	7535	180	7355
720	6790	211	6579
715	6013	132	5881
710	5200	89	5111
705	4350	206	4144
700	3462	101	3361
695	2650	40	2610
690	1960	66	1894
685	1335	56	1279
680	736	109	627
675	285	64	221
660	79	0	79
665	33	0	33
660	10	0	10
656	0	0	0

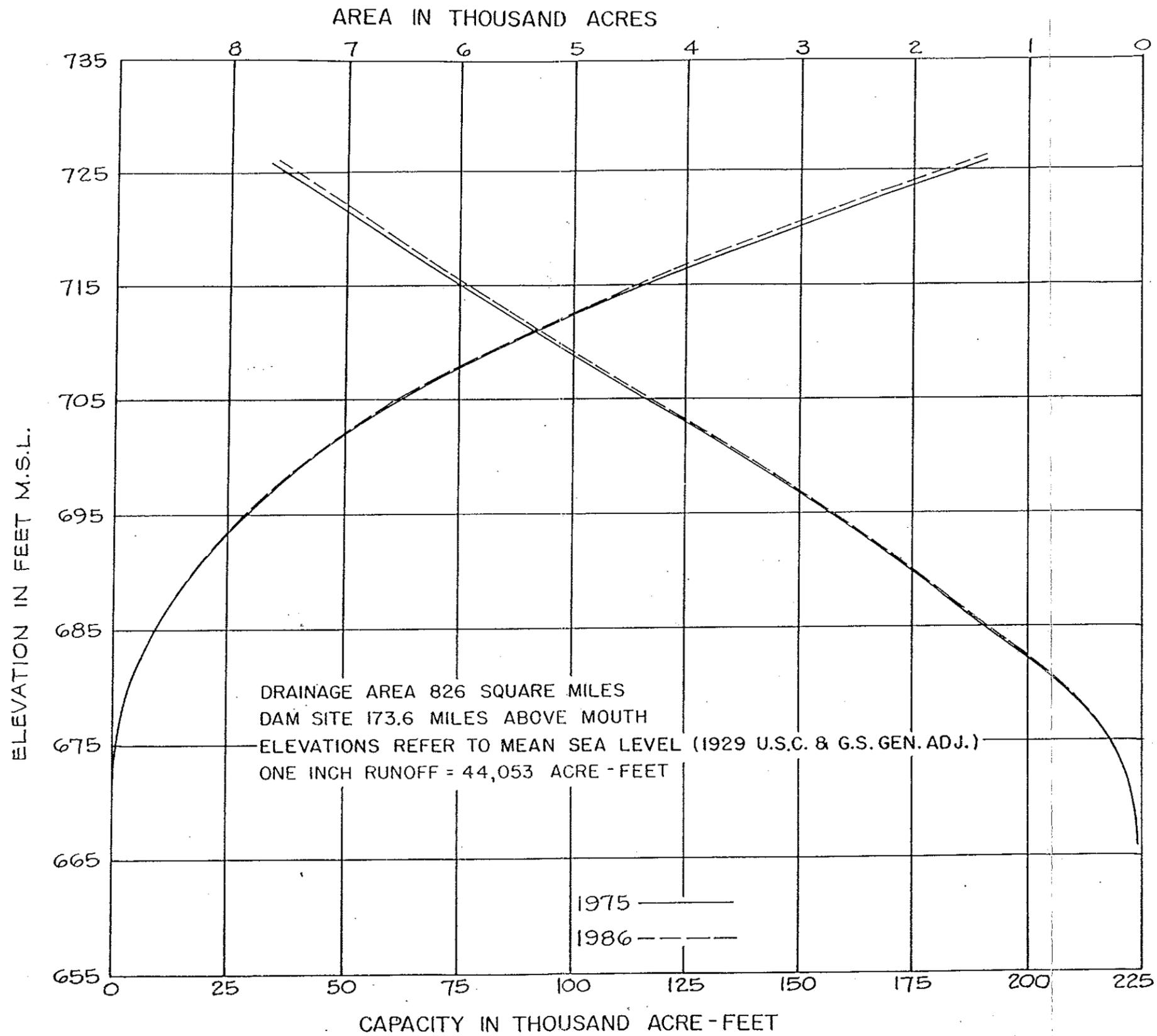
MODIFIED SEDIMENT DISTRIBUTION
(ACRE-FEET)

SEGMENT NUMBER	650		660		670		680		690		700		710		720		TOTALS	TOTALS *1.093
	TO	660	TO	670	TO	680	TO	690	TO	700	TO	710	TO	720	TO	730		
S01	0.33	0.00	54.82	13.98	6.80	20.47	-3.84	0.18	92.75	101.37								
S02	3.38	0.00	549.14	196.45	29.79	107.12	-50.38	23.42	858.92	938.80								
S03	-0.72	0.00	-28.79	9.95	138.75	540.45	923.32	-22.68	1560.29	1705.40								
S04	0.00	0.00	46.77	187.30	17.16	500.36	389.18	1234.89	2375.65	2596.59								
S05	0.00	0.00	0.00	54.17	94.22	28.17	8.68	8.15	193.39	211.37								
S06	0.00	0.00	4.05	10.14	21.16	46.82	32.85	26.51	141.52	154.68								
S07	0.00	0.00	0.00	58.01	130.01	127.66	90.48	32.18	438.33	479.09								
S08	0.00	0.00	0.00	0.00	18.66	86.30	28.53	61.07	194.57	212.67								
S09	0.00	0.00	0.00	0.00	55.46	90.49	11.23	71.40	228.58	249.84								
S10	0.00	0.00	0.00	0.00	0.00	37.16	28.85	12.30	78.31	85.59								
S11	0.00	0.00	0.00	0.00	0.00	0.00	23.11	33.59	56.70	61.97								
S12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00								
TOTALS	3.00	0.00	626.00	530.00	512.00	1585.00	1482.00	1481.00	6219.00	6797.37								
TOTALS *1.093	3.28	0.00	684.22	579.29	559.62	1732.40	1619.83	1618.73										



OHIO RIVER BASIN
 RESERVOIR REGULATION PLAN
 CAVE RUN RESERVOIR
 SEDIMENTATION RANGES

SCALE AS SHOWN
 LOUISVILLE, KY. ORLED-H



RESERVOIR SEDIMENT
DATA SUMMARY

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS

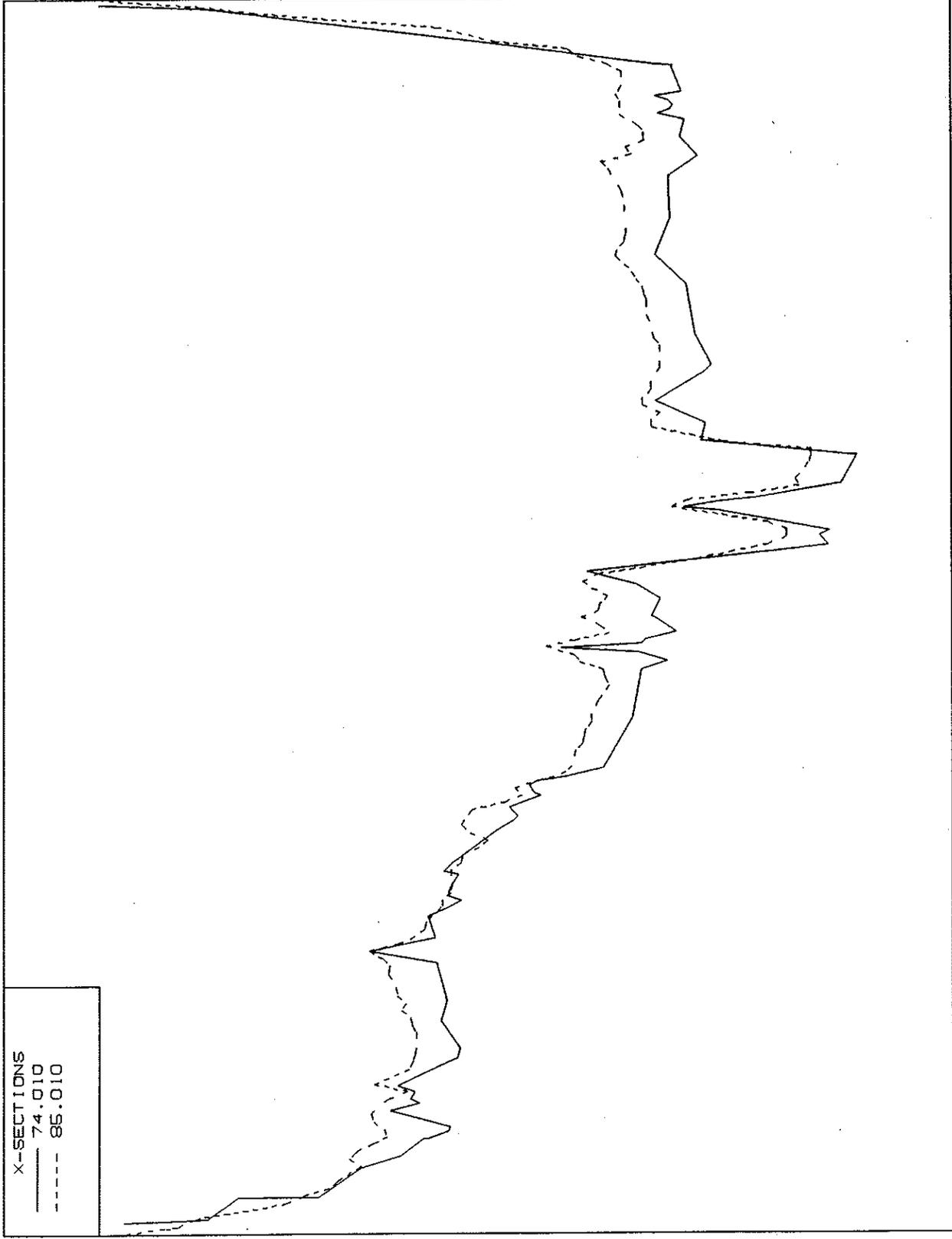
CAVE RUN LAKE
NAME OF RESERVOIR

DATA SHEET NO.

DAM	1. OWNER US Army Corps of Engrs			2. STREAM Licking River			3. STATE Kentucky								
	4. SEC. TWP. RANGE		5. NEAREST P. O. Farmers, KY			6. COUNTY Bath, Rowan									
	7. LAT. 38° 06' 55" LONG. 83° 32' 00"			8. TOP OF DAM ELEVATION 788			9. SPILLWAY CREST ELEV. 765								
RESERVOIR	10. STORAGE ALLOCATION		11. ELEVATION TOP OF POOL'		12. ORIGINAL SURFACE AREA, ACRES		13. ORIGINAL CAPACITY, ACRE-FEET		14. GROSS STORAGE, ACRE-FEET		15. DATE STORAGE BEGAN				
	a. FLOOD CONTROL		765		14870		391491		614072		JAN 74				
	b. MULTIPLE USE		730		8270		46961		222581						
	c. POWER														
	d. WATER SUPPLY										16. DATE NORMAL OPER. BEGAN				
	e. IRRIGATION										FEB 74				
	f. CONSERVATION		724		7390		175620		175620						
	g. INACTIVE														
17. LENGTH OF RESERVOIR 48 MILES					AV. WIDTH OF RESERVOIR 0.27 MILES										
WATERSHED	18. TOTAL DRAINAGE AREA 827 SQ. MI.				22. MEAN ANNUAL PRECIPITATION 45 INCHES										
	19. NET SEDIMENT CONTRIBUTING AREA 826 SQ. MI.				23. MEAN ANNUAL RUNOFF 1/ 16.70 INCHES										
	20. LENGTH 57 MILES		AV. WIDTH 14.5 MILES		24. MEAN ANNUAL RUNOFF 1/ 736710 AC.-FT.										
	21. MAX. ELEV. 1500		MIN. ELEV. 650		25. ANNUAL TEMP.: MEAN 55 RANGE -34 to 110°F										
	26. DATE OF SURVEY		27. PERIOD YEARS		28. ACCL. YEARS		29. TYPE OF SURVEY		30. NO. OF RANGES OR CONTOUR INT.		31. SURFACE AREA, ACRES		32. CAPACITY, ACRE-FEET		33. C/I. RATIO, AC.-FT. PER AC.-FT.
JAN 1975		11.75		12.75		RANGE		12		14,870		614072		0.83	
SEPT 1986						RANGE		12		14,870		607275		0.82	
26. DATE OF SURVEY		34. PERIOD ANNUAL PRECIPITATION		35. PERIOD WATER INFLOW, ACRE-FEET				36. WATER INFL. TO DATE, AC.-FT.							
				a. MEAN ANNUAL		b. MAX. ANNUAL		c. PERIOD TOTAL		a. MEAN ANNUAL		b. TOTAL TO DATE			
SEPT 1986		45.8		374152		567804		4115672		351960		4223516			
		1/		1/		1/		1/		1/		1/			
26. DATE OF SURVEY		37. PERIOD CAPACITY LOSS, ACRE-FEET						38. TOTAL SED. DEPOSITS TO DATE, ACRE-FEET							
		a. PERIOD TOTAL		b. AV. ANNUAL		c. PER SQ. MI.-YEAR		a. TOTAL TO DATE		b. AV. ANNUAL		c. PER SQ. MI.-YEAR			
SEPT 1986		6797		533		.64		6797		533		.64			
26. DATE OF SURVEY		39. AV. DRY WGT., LBS. PER CU. FT.		40. SED. DEP., TONS PER SQ. MI.-YR.				41. STORAGE LOSS, PCT.		42. SED. INFLOW, PPM					
				a. PERIOD		b. TOTAL TO DATE		a. AV. ANN.		b. TOT. TO DATE		a. PERIOD		b. TOT. TO DATE	
SEPT 1986		43.7		609		609		.09		1.11		1057		1127	

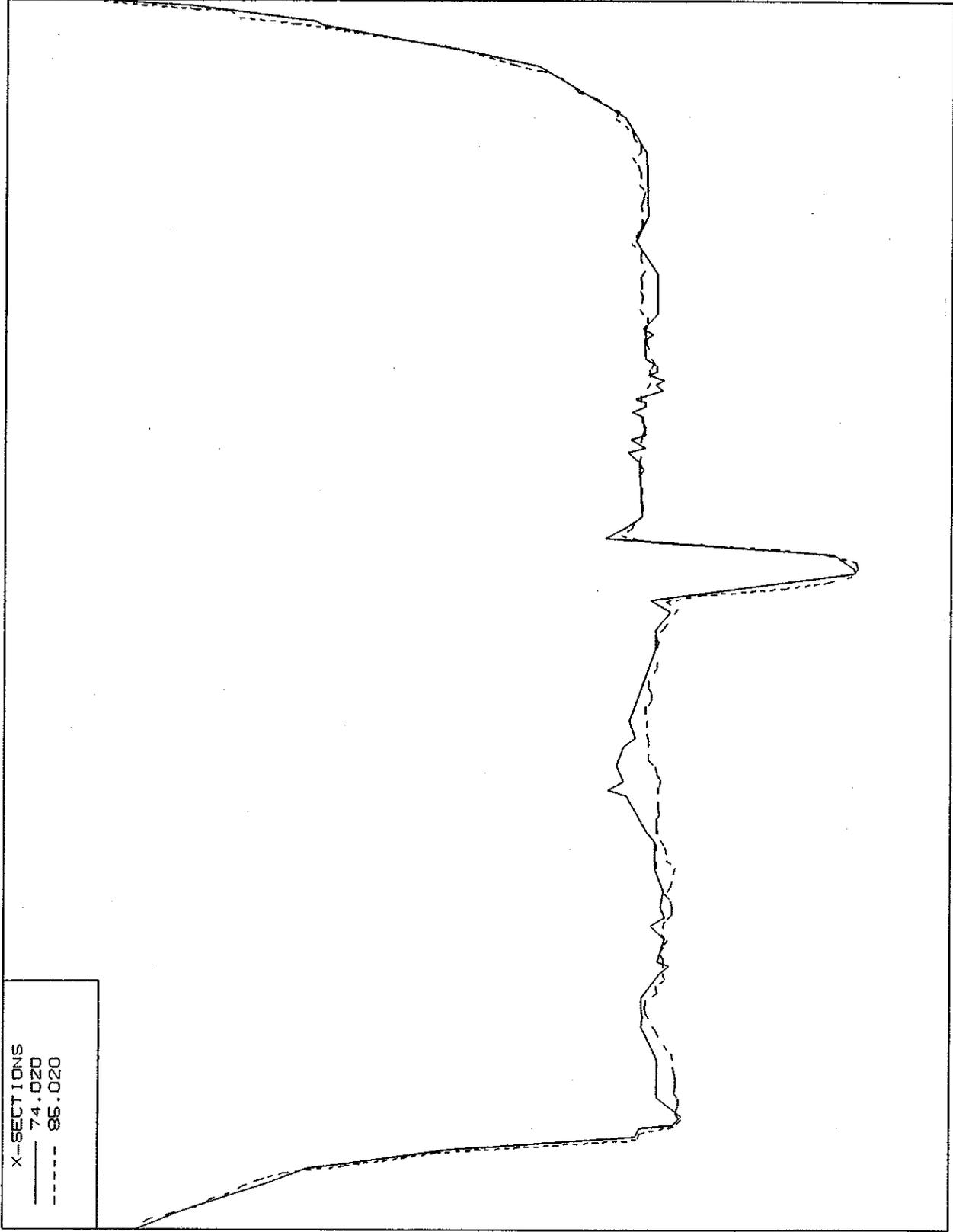
26. DATE OF SURVEY	43. DEPTH DESIGNATION RANGE IN FEET BELOW, AND ABOVE, CREST ELEVATION														
	115	105	95-85	85-75	75-65	65-55	55-45	45-0							
	-105 -95 PERCENT OF TOTAL SEDIMENT LOCATED WITHIN DEPTH DESIGNATION														
SEPT 1986	0	0	.10	.09	.08	.25	.24	.24							
26. DATE OF SURVEY	44. REACH DESIGNATION PERCENT OF TOTAL ORIGINAL LENGTH OF RESERVOIR														
	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100	-105	-110	-115	-120	-125
	PERCENT OF TOTAL SEDIMENT LOCATED WITHIN REACH DESIGNATION														
SEPT 1986	.32	.47	.05	.07	.03	.04	.01	.01							
45. RANGE IN RESERVOIR OPERATION															
WATER YEAR	MAX. ELEV.	MIN. ELEV.	INFLOW, AC.-FT.	WATER YEAR	MAX. ELEV.	MIN. ELEV.	INFLOW, AC.-FT.								
1975	734.1	713.2	1126239												
1976	741.2	718.5	617603												
1977	731.9	725.7	493312												
1978	733.4	724.5	830539												
1979	737.3	727.8	1102479												
1980	755.0	726.3	762370												
1981	736.5	725.0	558802												
1982	738.8	724.7	610027												
1983	735.2	724.7	672407												
1984	744.8	724.9	682699												
1985	747.8	724.5	706957												
46. ELEVATION-AREA-CAPACITY DATA															
ELEVATION	AREA	CAPACITY	ELEVATION	AREA	CAPACITY	ELEVATION	AREA	CAPACITY							
656	0	0	695	2610	27106										
660	10	17	700	3361	41900										
665	33	115	705	4144	60643										
670	79	382	710	5111	83609										
675	221	1052	715	5881	111129										
680	627	2963	720	6579	142082										
685	1279	7880	725	7355	176960										
690	1894	15780	730	8194	215784										
47. REMARKS AND REFERENCES															
1/ USGS Water Resources Data - Licking River at Farmers, KY															
48. AGENCY MAKING SURVEY				US Army Corps of Engineers				50. DATE	9 August 1990						
49. AGENCY SUPPLYING DATA				Louisville District											

APPENDIX A: Sediment Range Profiles



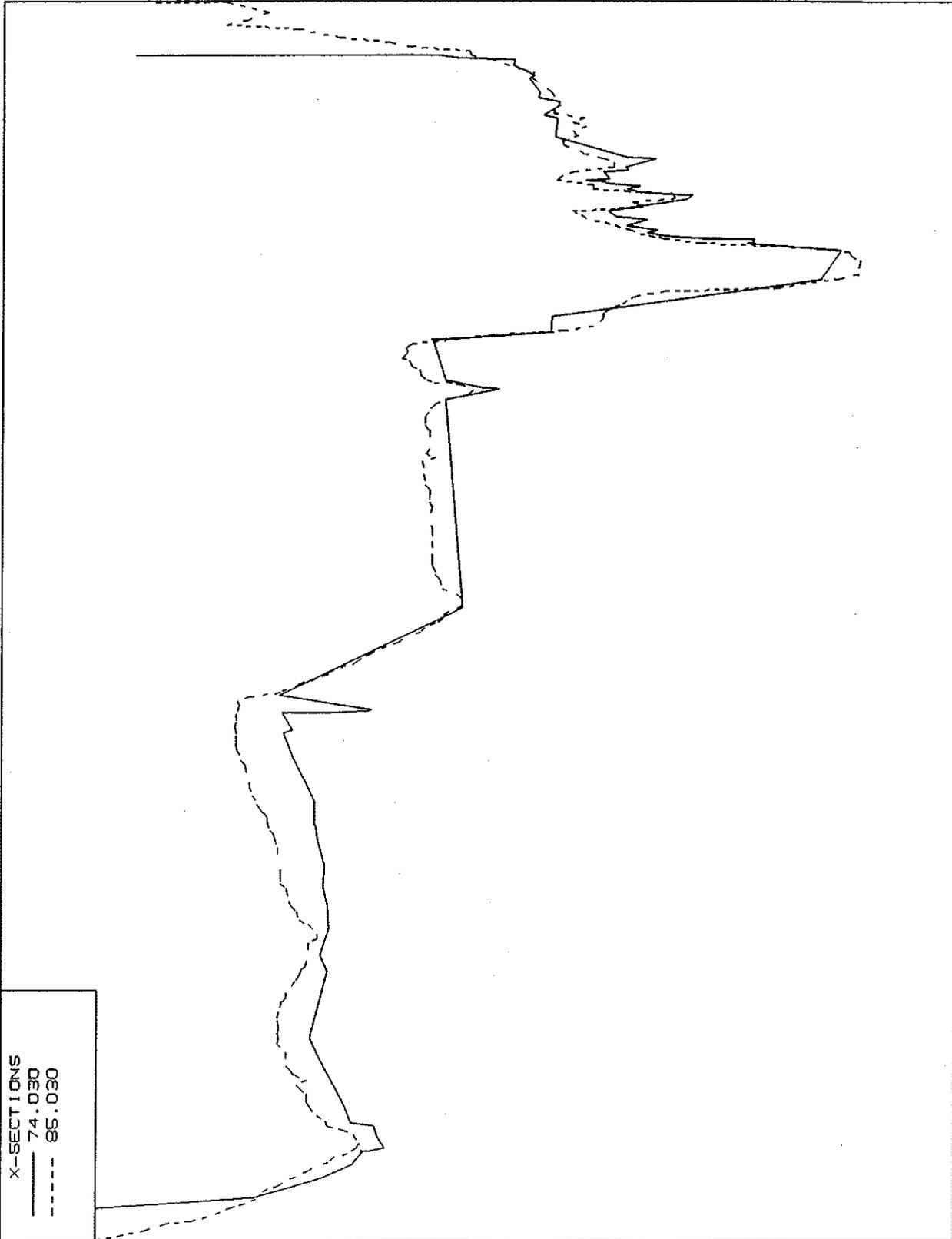
X-SECTIONS
—— 74.010
----- 85.010

X-SECTIONS
—— 74.020
----- 86.020



0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8
1.9
2.0

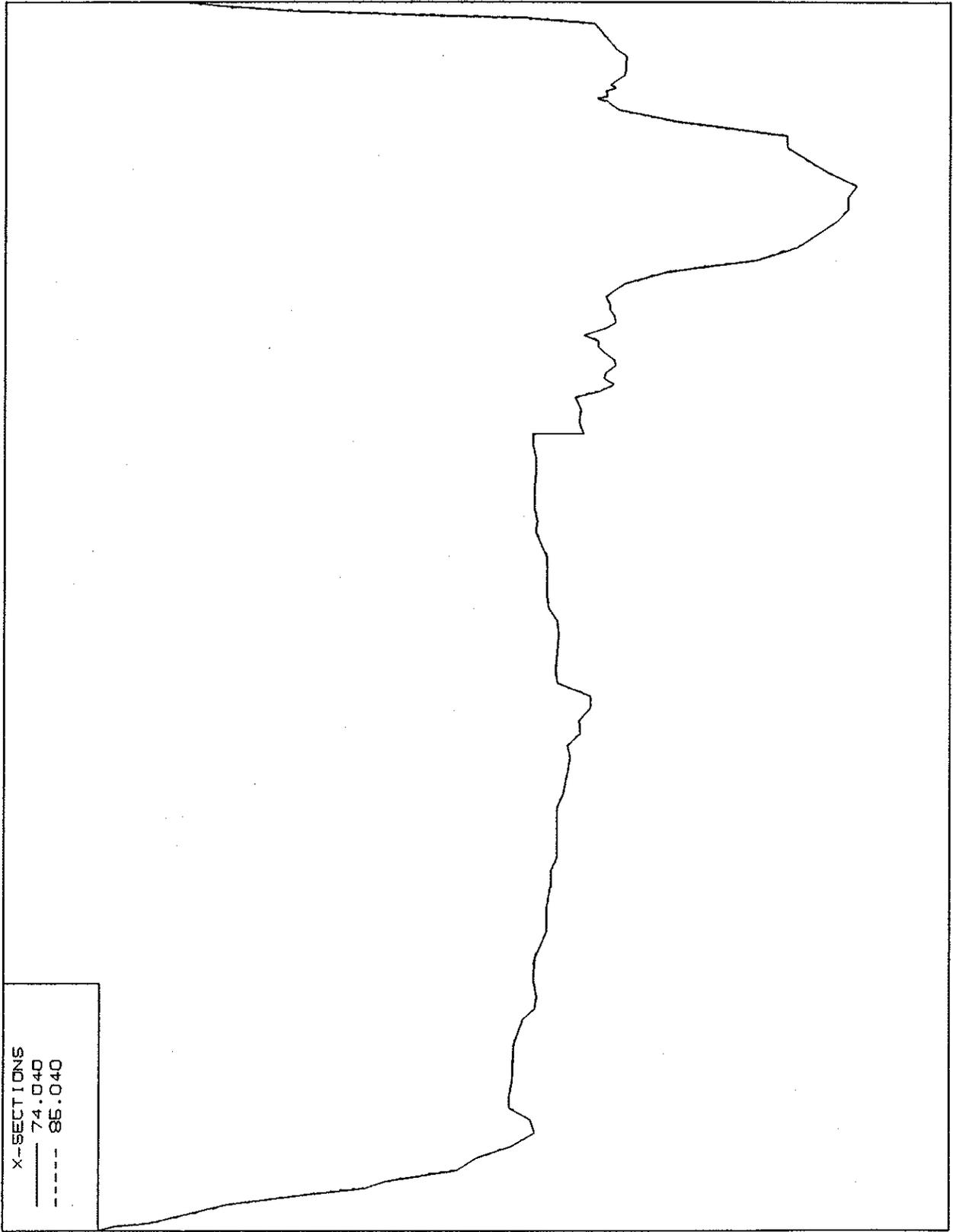
X-SECTIONS
—— 74.030
----- 85.030



X-SECTIONS

— 74.040

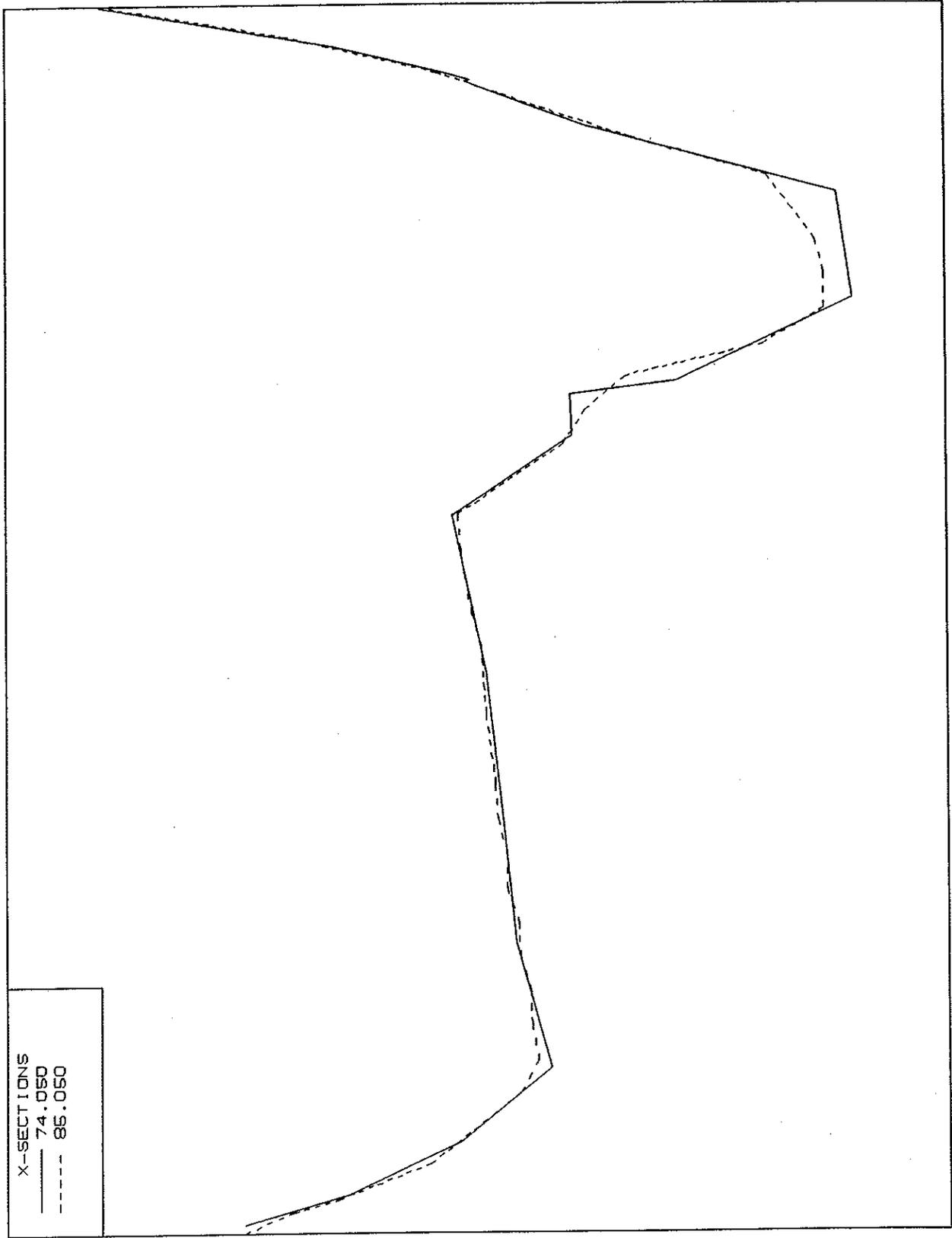
- - - - - 85.040

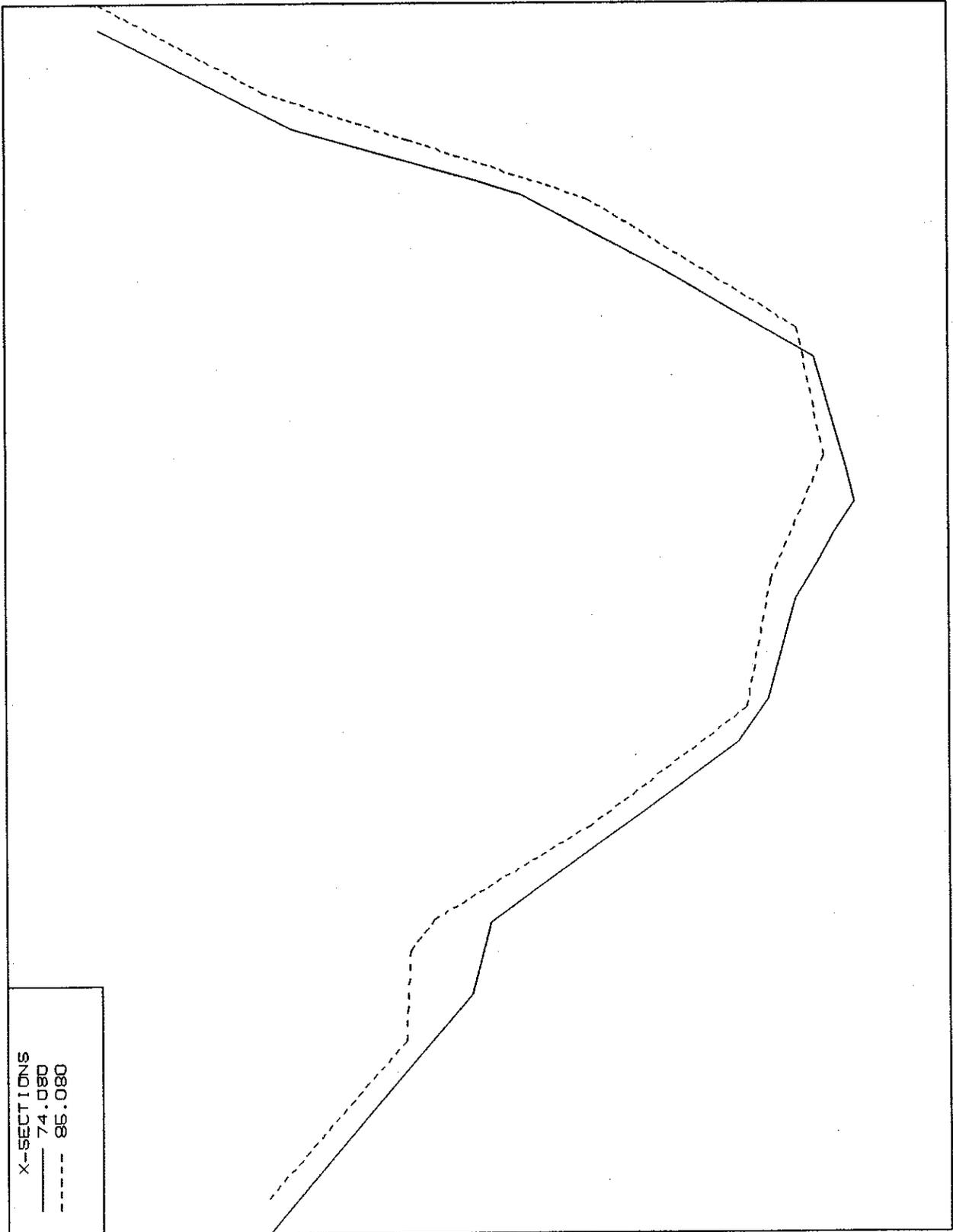


X-SECTIONS

— 74.050

- - - 85.050



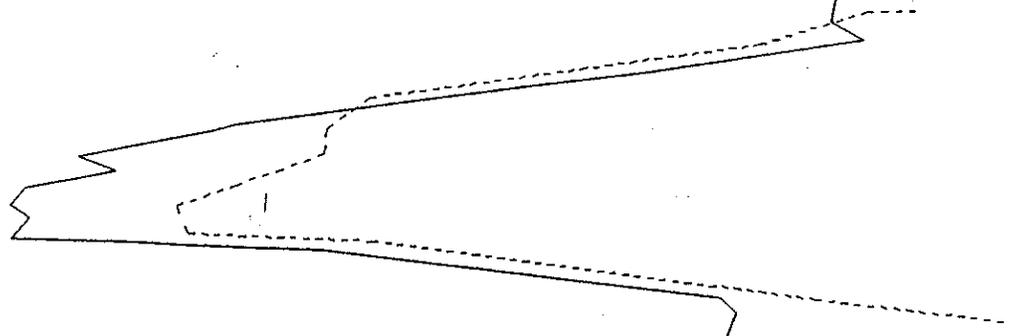


X-SECTIONS

—— 74.080

----- 85.080

X-SECTIONS
—— 74.100
----- 85.100

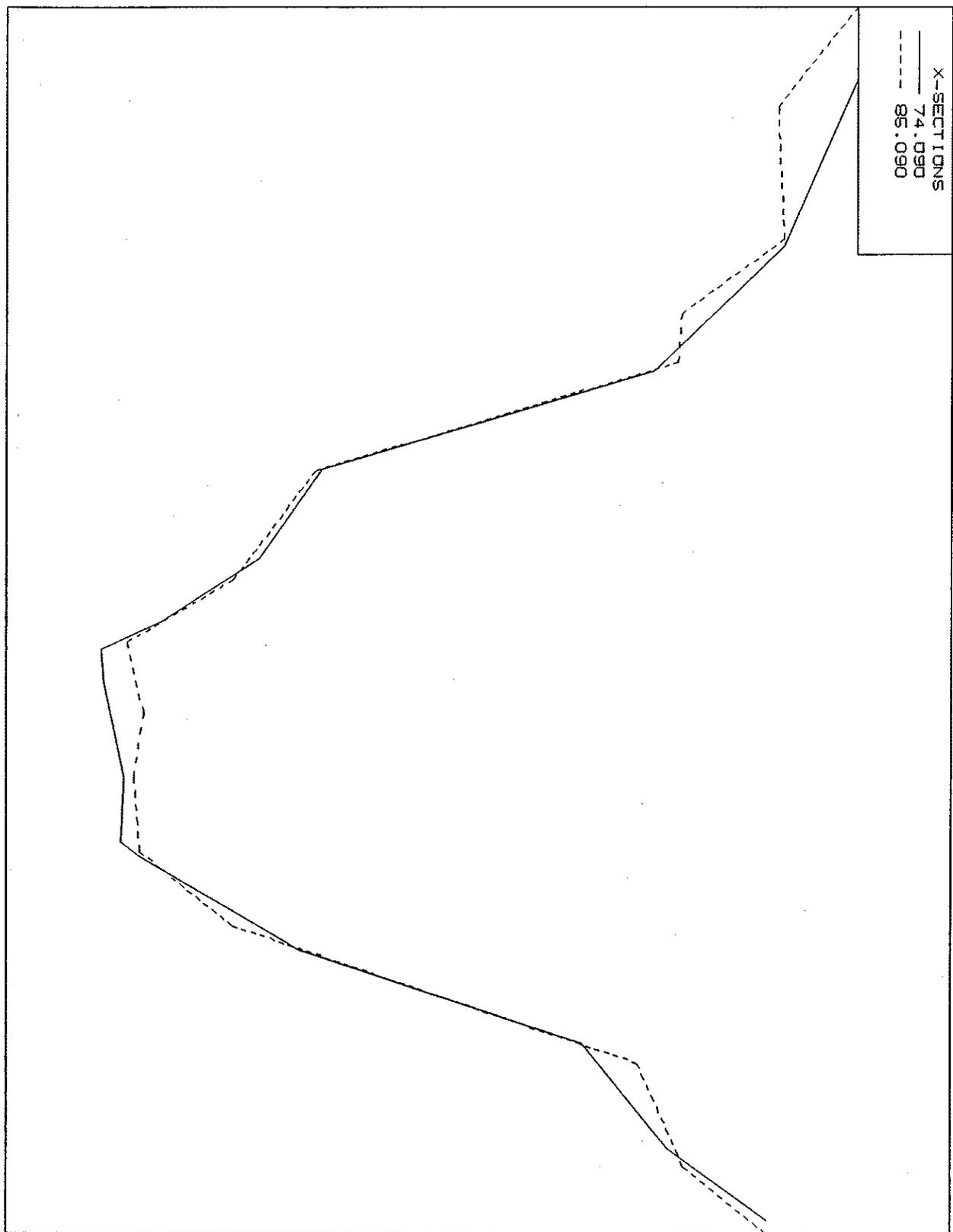


Handwritten mark resembling a stylized 'E' or '3'.

Handwritten mark resembling a stylized 'E' or '3'.

Handwritten mark resembling a stylized 'E' or '3'.

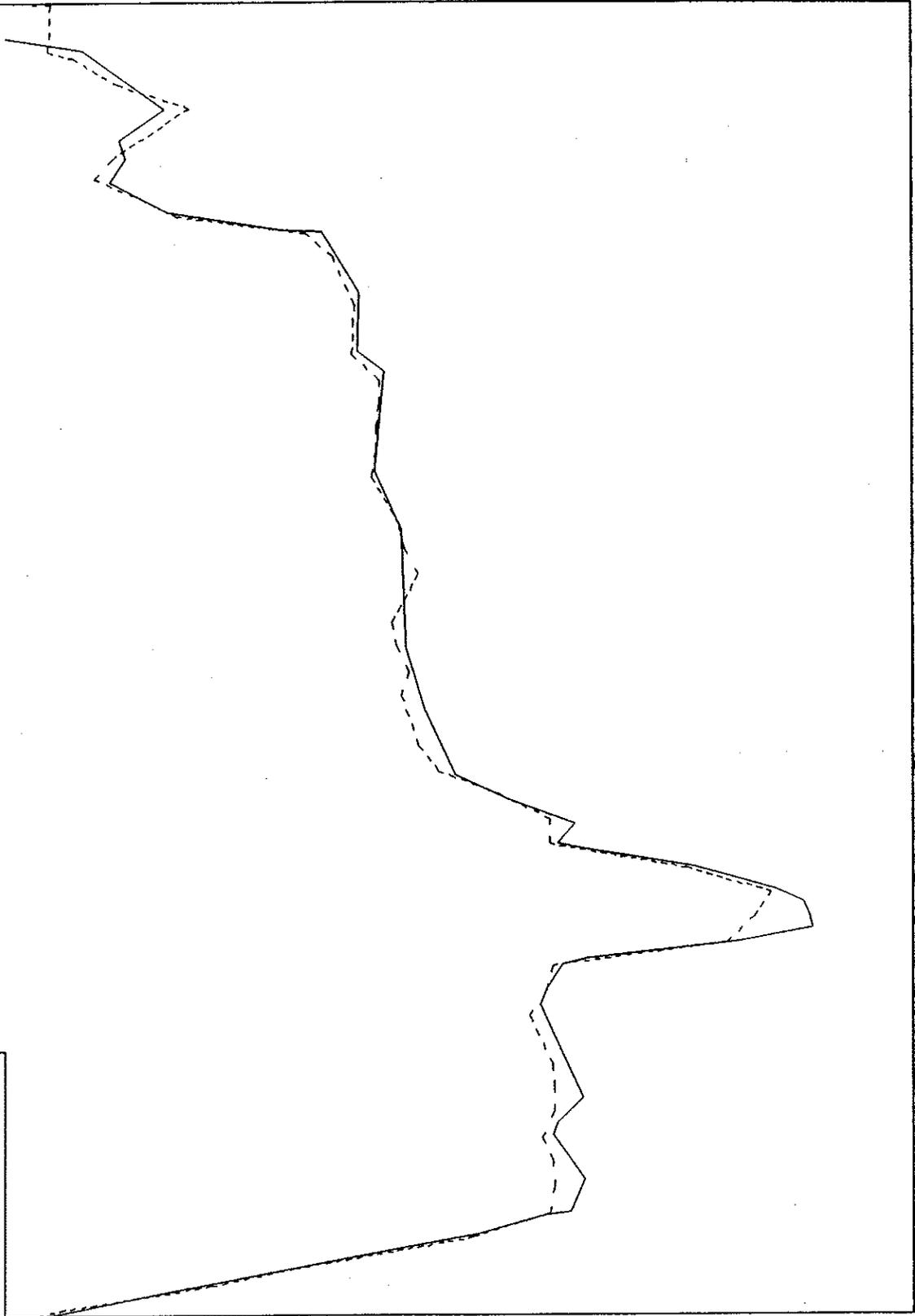
X-SECTIONS
—— 74.090
---- 85.090



X-SECTIONS

— 74.110

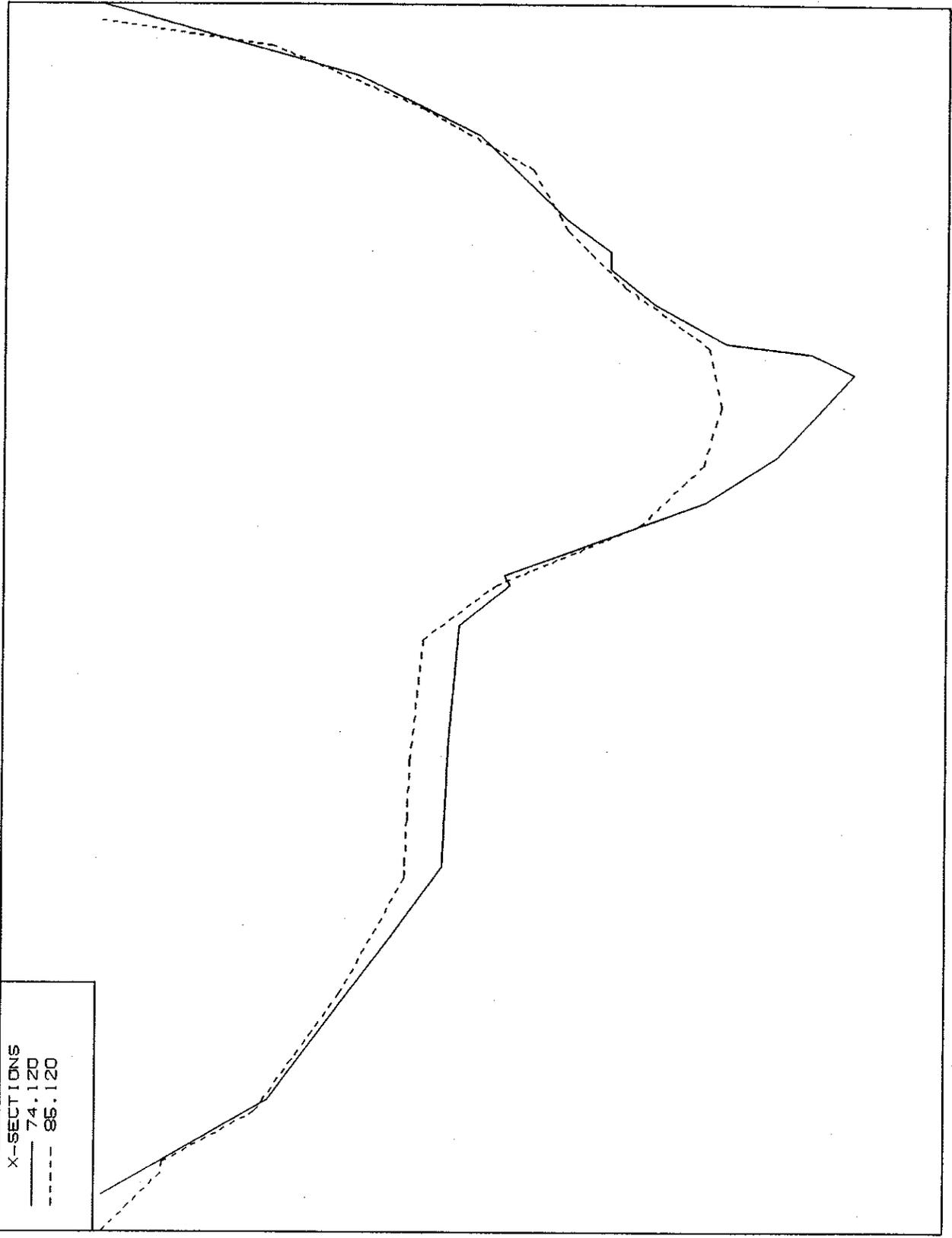
- - - 85.110



X-SECTIONS

— 74.120

- - - 85.120



APPENDIX B: Pertinent Data

UPPER KENTUCKY RIVER BASIN

KENTUCKY

RESERVOIR REGULATION PLAN

CAVE RUN - BUCKHORN - CARR FORK

RESERVOIRS

Pertinent Data - Cave Run Reservoir

1. Authority for Project. Flood Control Act of 22 June 1936; Public Law No. 738, 74th Congress, 1st Session and Flood Control Act of 28 June 1938, Public Law No. 761, 75th Congress, 3rd Session.

2. Authority for Water Quality Control. Federal Water Pollution Control Act Amendments of 1961.

3. Location of Project. The project is located in east central Kentucky, approximately 84 air miles east from Louisville, Kentucky. The damsite is on Licking River, 173.6 miles above its junction with the Ohio River and four miles upstream from Farmers, Kentucky.

4. Area Protected. The reservoir operates as a unit of the reservoir plan for the Ohio River Basin to effect reduction in flood stages at all points downstream from the reservoir.

5. Drainage Area.

Damsite	826 square miles
Farmers Gage	827 square miles
Mouth of Licking River	3707 square miles

6. Reservoir Pools.

	Elevation (feet) m.s.l.	Area (acres)	Storage	
			(acre- feet)	(inches- runoff)
Minimum Pool	720	6790	147300	3.34
Water Quality Pool	724	7390	175600	3.99
Seasonal Pool	730	8270	222600	5.05
Flood Pool	765	14870	614100	13.94
Allocated to Flood Storage	724-765		438500	9.95
Allocated to Water Quality Pool	720-724		28300	0.65
Available for Seasonal Flow Control	724-730		47000	1.06

7. Dam.

a. Embankment

Type	Earth and Rockfill
Top Elevation, feet m.s.l.	788
Maximum Height, feet	140
Length, feet	2700
Crown Width, feet	30

b. Spillway

Type	Open Cut through ridge near left abutment
Crest Elevation, feet m.s.l.	765
Bottom Width of cut, feet	650

c. Outlet Works

Type	Circular
Size, Diameter	15-foot
Control Gates - Number	2 service 2 emergency
Control Gates - Size in Feet	6.75 H x 15.0 V
Inlet Invert Elevation	656.0
Discharge Capacities (cfs)	
Minimum Pool Level (720)	7500
Water Quality Pool Level (724)	7800
Seasonal Pool Level (730)	8200
Flood Pool Level (765)	10300

c. Outlet Works, continued

Bypasses, Number	2
Diameter, Inches	24
Inlet Invert Elevation, feet m.s.l.	690.0
Multi-level inlet controls on each bypass permits withdrawal of water from pool elevations 690, 705, and 720	
Discharge Capacity, c.f.s. (one bypass)	
Minimum Pool Level (720)	156
Water Quality Pool Level (724)	164
Seasonal Pool Level (730)	175
Flood Pool Level (765)	228

8. Spillway Design.

a. Design Flood (All-season)

Total precipitation in 48 hours, in	25.28
Peak Flow into full reservoir, c.f.s.	510,000
Total Volume of hydrographs, acre-feet	909,300

b. Results of Spillway Design Flood Routing.

Elevation of pool at start of flood feet, m.s.l.	765
Release to spillway crest elevation, cfs	150
Maximum discharge, cfs	168,500 *
Maximum water surface elevation, feet, m.s.l.	785
Available freeboard, feet	3.0

* Conduit discharge 10500 cfs, spillway discharge 158000 cfs

The usual amount of storage provided for siltation reserve is equivalent to about one inch of runoff from the reservoir drainage area. This would be approximately 44,100 acre-feet for Cave Run Lake, which is about 30% of the capacity of minimum pool. Index ranges were established during fiscal year 1968.

The topography of the Cave Run drainage area is rugged. The area is basically wooded with some small upland flat areas in agriculture. Based on the nature of the drainage area, it is expected that a siltation rate of about 0.3 acre-foot per square mile per year will occur. Using this rate, the sedimentation storage would be depleted in about 178 years. A rate as high as 0.5 acre-foot per square mile of drainage area per year would deplete available storage in about 100 years.