LMVED-HH (27 Feb 81) 1st Ind
SUBJECT: Carlyle Lake, Kaskaskia River, Illinois, Report of Sedimentation 1976 Resurvey

DA, Lower Mississippi Valley Division, Corps of Engineers, Vicksburg, MS 39180

10 JUN 82

TO: Commander, St. Louis District, ATTN: LMSED-HD

Forwarded to note approval.

FOR THE COMMANDER:

R. H. RESTA, P.E.
Chief, Engineering Division

DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 TUCKER BOULEVARD, N. 19TH
ST. LOUIS, MISSOURI 63101

REPLY TO
ATTENTION OF

LMSED-HD

27 February 1981

SUBJECT: Carlyle Lake, Kaskaskia River, Illinois, Report of Sedimentation, 1976 Resurvey

Division Engineer, Lower Mississippi Valley
ATTN: LMVED-W

1. An analysis of Carlyle Lake resurvey data was conducted in 1980 in order to evaluate and determine the accuracy between the computed volume of sediment deposited from the initial sediment survey (1971) and the sediment resurvey (1976). The results of the analysis are complete and are submitted, in accordance with EM 1110-2-4000, for your review and approval.

2. In June 1980, sedimentation data were obtained for the upstream sedimentation ranges 1A, 2A, and 3A only due to a lack of time and funding. However, it is anticipated that the remaining upstream sediment ranges and the downstream retrogression ranges will be completed in FY 82. A separate sedimentation report will be presented relative to the 1981-82 resurvey data.

FOR THE DISTRICT ENGINEER:

1 Incl (5 cys)
as

JACK R. NIEMI
Chief, Engineering Division

LMVED-WH (SLD 27 Feb 81) 1st Ind
SUBJECT: Carlyle Lake, Kaskaskia River, Illinois, Report of Sedimentation, 1976 Resurvey

DA, Lower Mississippi Valley Division, Corps of Engineers, Vicksburg, Miss. 39180 , 1 APR 81

TO: HQDA (DAEN-CWE-HY) WASH DC 20314

1. Recommend approval of the inclosed report subject to resolution of the following comments.

2. Para 1, p 1.

a. One of the primary purposes of the report is "to determine the distribution of sediment depletion of storage in the reservoir." Therefore, the report should include a discussion of the distribution of sediment deposition in the various elevation intervals (Plate 28, Item 43), percent of volume reduction in the various pools, and the areal distribution with respect to the location of the dam (Plate 28, Item 44).

b. The date of initial operation of the reservoir does not agree with that shown on Plate 27, Item 15. This should be corrected.

3. Para 12, p 3. The third subparagraph should be rewritten to describe the "Average Depth Method" rather than the "Average End Method."

4. Para 13, p 4.

a. The rate of sediment deposition for the second resurvey (1967-1976) should be shown as 1,798 acre-ft per year based on deposition of about 16,000 acre-ft over the 8.9-year period.

b. The previous "Report of Sedimentation, 1971 Resurvey" stated that during the 4.3-year period (1967-1971), about 10 percent of the inactive storage was filled as compared to the statement in this report that 26 percent was filled. The previous report also stated that the rate of sediment deposition was 1,186 acre-ft per year as compared to 2,960 acre-ft/year as stated in this report. The reason for these differences should be explained in the report.

5. Para 14, p 4.

a. This paragraph should include a discussion of what data were used and how the trap efficiency was estimated.

b. The capacity-inflow ratio should be shown on Plate 27, Item 33.

6. Para 16, p 5.

a. The original rate of deposition is stated to have been 820 acre-ft per year. However, para 20 of DM No. 1 (Revised Mar 58) states that the inactive storage volume of 50,000 acre-ft would be sufficient for 67 years

of silt accumulation. This is equal to a rate of deposition of 746 acre-ft per year. This discrepancy should be resolved.

b. In explaining the reason for the differences in the present observed rates of deposition and the original predicted rate, a brief discussion of the basis for the original predicted rate should be included.

7. Table 5. A note should be included to define the term "UNILATERAL AREA - A'."

8. Tables 8 and 9. The percent of "Inactive Storage Pool" filled is based on the following two assumptions:

a. All deposition is occurring in the Inactive Storage Pool which is below elevation 429.5.

b. The original storage in that pool was 50,000 acre-ft.

The first assumption is in error as can be seen by examining the cross sections of the retrogression ranges shown on Plates 18 through 26. These cross sections show significant deposition at elevations above 429.5. The second assumption does not agree with the 1966 capacity curve shown on Plate 4. These tables should be revised to correct these errors.

9. Plate 4.

a. The curve labeled "VOLUME 1966" is apparently the original storage curve; however, it shows significantly less storage below elevation 430 and above elevation 460 than shown in Table 11 of Appendix B to the Master Reservoir Regulation Manual, revised 1977. This discrepancy should be resolved.

b. The storage curves adjusted for sediment deposition should be based on the original storage curve less the deposition which has occurred between various elevations. The 1971 and 1976 elevation-storage data shown in Tables 3 and 4, and the 1976 curve shown on this plate, should be based on this type analysis, and revised if in error.

10. Plate 17. The original tailwater rating curve should be shown on the plate.

11. Plates 27 and 28. These plates should be corrected using the revised March 1966 instructions for completion of Form 1787. The form in the report is incomplete, some data are inconsistent with data presented in this report and others, and data from the previous version of the same form, such as Items 34, 35, 36, 37, 45, and 46 have been changed for no apparent reason.

1 APR 81

LMVED-EH (SLD 27 Feb 81) 1st Ind
SUBJECT: Carlyle Lake, Kaskaskia River, Illinois, Report of Sedimentation, 1976 Resurvey

12. The Water Supply Contract for Carlyle Lake contains a section entitled "Sediment Surveys." A paragraph should be added to the report addressing how the results of the resurvey affect the existing Water Supply Contract.

FOR THE DIVISION ENGINEER:

R. H. RESTA
Chief, Engineering Division

1 Incl (dupe)
wd 3 cy

DAEN-CWE-PY (LMSMD-HD, 27 Feb 81) 2nd Ind
SUBJECT: Carlyle Lake, Kaskaskia River, Illinois, Report of Sedimentation, 1976 Resurvey

DA, Office of the Chief of Engineers, Washington, DC 20314 20 April 1981

TO: Division Engineer, Lower Mississippi Valley
Attn: LMVED-WH

1. The subject resurvey report is approved, subject to the Division comments 2 through 11 and the comments furnished below.

2. Para 9, Page 2. This report should include another table showing the tabulation of original reservoir area and capacity.

3. Para 13, Page 4. The time of depletion of 20 and 48 years as described in the last two sentences are in error. They should be corrected.

4. Para 15, Page 5. In the last two sentences "Plates 17 through 25" should be changed to "Plates 18 through 26" and "Plate 26" should be changed to "Plate 17".

5. Table 2. The rainfall and therefore also runoff data for Year 1966-1977 has been revised from Table 2 of the "Report of Sedimentation 1971 Resurvey." Basic data like the "rainfall" should not be changed. This matter should be clarified.

6. Table 3 & 4.

a. The 1971 and 1976 reservoir areas should be shown here rather than original areas.

b. Footnote indicates that the reservoir capacity presented is based on using average-end method (including item 46 of Plate 28), however, the capacity shown on item 37 of Plate 27 are taken from column (A) (result obtained using Prismoidal method) of Table 7. This discrepancy in presenting the data should be avoided and resolved.

7. Plate 4. This plate should be replotted to show all three years involved, i.e., original, 1971 and 1976. The capacity curves shown are also in error.

8. Plate 6-14, 16, 18-26. The 1971 data should also be shown.

9. Plate 27 and 28. This reservoir sedimentation data summary sheet contains several errors and should be revised. For example,

a. The original capacity below EL 462.5 is shown as 982,900 A-F under item 14, whereas under item 32 the capacity is shown as 974,890 A-F.

b. The capacity lost shown under item 37a during the period of time mentioned apparently is not obtained from the figures given under item 32. [illegible] Item 46

c. The data shown should be from the latest 1976 resurvey results.

FOR THE CHIEF OF ENGINEERS:

wd incl (dupe)

LLOYD A. DUSCHA, P.E.
Chief, Engineering Division
Directorate of Civil Works

LMVED-WH (SLD 27 Feb 81) 3rd Ind
SUBJECT: Carlyle Lake, Kaskaskia River, Illinois, Report of Sedimentation, 1976 Survey

DA, Lower Mississippi Valley Division, Corps of Engineers, Vicksburg, Miss. 39180 6 MAY 81

TO: District Engineer, St. Louis, ATTN: LMSED-HD

1. Referred for necessary action.

2. Telecon with OCE revealed that paragraph 9c of the 2d Ind should be rewritten as follows: "The data shown under item 46 should be from the latest 1976 resurvey results."

FOR THE DIVISION ENGINEER:

Robert J. Kaufman
for R. H. RESTA
Chief, Engineering Division

LMSED-HD (SLD 27 Feb 81) 4th Ind
SUBJECT: Carlyle Lake, Kaskaskia River, Illinois, Report of Sedimentation, 1976 Survey

DA, St. Louis District, Corps of Engineers, 210 Tucker Blvd., North, St. Louis, MO 63101 10 March 1982

TO: Commander, Lower Mississippi Valley Division
ATTN: LMVED-WH

1. The following information is submitted regarding comments on 1st, 2nd and 3rd Indorsements to basic letter.

2. First Indorsement.

a. Para 1, p 1. A discussion of the distribution of sediment deposition in the various elevation intervals (Plate 28, Item 43), percent of volume reduction in the various pools, and the aerial distribution with respect to the location of the dam has been included.

b. Para 1, p 1. The date of initial operation of the reservoir has been corrected to agree with Plate 27, Item 15.

c. Para 12, p 3. The third subpara was rewritten to describe the "Average Depth Method."

d. Para 13, p 4. The rate of sediment deposition for the second resurvey (1967-1976) was corrected to 1,798 acre-ft. per year.

e. Para 13, p 4. An attempt was made to verify the data and results of the previous "Report of Sedimentation, 1971 Resurvey," however, no back-up material was available concerning the report and calculations using the 1971 Resurvey Data produced results different than those presented in the previous report. Therefore, all data concerning the 1971 Resurvey have been reevaluated and presented in the subject report.

f. Para 14, p 4. A discussion of what data was used and how the trap efficiency was estimated has been included.

g. Para 14, p 4. The capacity-inflow ratio has been included on Plate 27, Item 33.

h. Para 16, p 5. The original rate of deposition has been changed to 746 acre-ft. per year.

i. Para 16, p 5. A brief discussion of the basis for the original predicted rate has been included.

j. Table 5. The term "Unilateral Area - A'" has been defined.

k. Tables 8 and 9. Both tables have been revised to correct the errors.

l. Plate 4. The plate has been revised to compare with Table 11 of Appendix B to the Master Reservoir Regulation Manual, revised 1977.

m. Plate 4. The 1971 and 1976 elevation-storage data have been revised to compare with Tables 3 and 4.

n. Plate 17. The original tailwater rating curve has been added.

o. Plates 27 and 28. These plates have been corrected using the revised March 1966 instructions. See para e above for explanation of inconsistent data.

p. A paragraph has been included addressing how the results of the resurvey affect the existing water supply contract.

3. Second Indorsement.

a. Para 9, p 2. Table 3 has been revised to show original reservoir area and capacity.

b. Para 13, p 4. The times of depletion have been corrected.

c. Para 15, p 5. The sentence containing "Plates 17 through 25" has been changed to "Plates 18 through 26," and "Plate 26" has been changed to "Plate 17."

d. Table 2 . See para 2e above.

e. Tables 3 and 4. The 1971 and 1976 reservoir areas have been shown instead of the original areas.

f. Tables 3 and 4. The footnote has been changed to indicate that the capacities are based on the prismoidal method.

g. Plate 4. The plate has been replotted and corrected to show all three years involved.

h. Plates 6-14, 16, 18-26. The 1971 data have been included.

i. Plates 27 and 28. The errors have been corrected and the plates revised according to the revised March 1966 instructions.

FOR THE COMMANDER:

Arthur L. Larson
for JACK R. NIEMI, P.E.
Chief, Engineering Division

1 Incl
Added 1 incl
2. Report of Sedimentation (4 cys)

LMVED-WR (SLD 27 Feb 81) 5th Ind
SUBJECT: Carlyle Lake, Kaskaskia River, Illinois, Report of Sedimentation, 1976 Resurvey

DA, Lower Mississippi Valley Division, Corps of Engineers, Vicksburg, MS 39180

08 APR 82
TO: CDR USACE (DAEN-CWE-HY) WASH DC 20314

1. The inclosed revised report is considered satisfactory subject to resolution of the following comments.

2. Table 3. The areas for 1971 should be identical to the 1966 areas, as shown in red, from elevation 450 and above, since the change in volume between each 5-ft interval is the same for 1971 and 1966. The 1971 area data shows a greater lake area for 1971 than 1966 above elevation 445. This is not reasonable considering that there is less volume in 1971. The areas for 1971, shown in red, below elevation 450 are based on adjusting the 1966 area data to conform to the 1971 volume data.

3. Table 4. The 1976 area data should be identical to the 1966 area, as shown in red, from elevation 455 and above, since the change in volume between each 5-ft interval is the same for 1976 and 1966. The areas for 1976, shown in red, below elevation 455 are based on adjusting the 1966 area data to conform to the 1976 volume data.

4. Plate 9. The 1971 survey should be shown.

5. Plate 27. The inflows in items 35a, 35c, 36a, and 36b for the period August 1971 through March 1976 are not consistent. For example: The 4.6-year period total inflow is shown as 10,125,991 acre-ft, which results in a mean annual inflow of 2,201,302 acre-ft which does not agree with item 35a. These items should be corrected.

6. Corrections are shown in red on pp iv, 2, 3, 4, 5, Tables 3 and 4, and Plates 27 and 28.

FOR THE COMMANDER:

for Robert J. Kaufman
R. H. RESTA
Chief, Engineering Division

1 Incl (quad)
wd 2 cy

CF wo incl:
LMSED-HD

DAEN-CWE-CY (27 Feb 81) 6th Ind
SUBJECT: Carlyle Lake, Kaskaskia River, Illinois, Report of Sedimentation, 1976 Resurvey

HQ, U.S. Army Corps of Engineers, Washington, D.C. 20314 28 April 1982

TO: Commander, Lower Mississippi Valley Division
ATTN: LMVED-WH

1. The subject revised resurvey report is approved, subject to the Division comments and the comments furnished below.

2. Paragraph 14, page 4. In the second sentence, capacity-inflow ratio of 0.77 should be changed to 0.90.

3. Paragraph 18, page 5. Based on the 1976 resurvey results, the average annual sedimentation rate has dropped from 1.928 to 0.462 A-F/sq. mi. If the FY 82 resurvey indicates this reduced rate is continuing and will continue, we strongly recommend the scheduled resurvey intervals of 10 to 15 years rather than 5 to 10 years as stated.

4. Plate 27. The C/I ratios in item 33 should be corrected to show 0.91, 0.90 and 0.90.

FOR THE COMMANDER:

Vernon R. Hagen

wd all incl

for LLOYD A. DUSCHA, P.E.
Chief, Engineering Division
Directorate of Civil Works

LMVED-WH (27 Feb 81) 7th Ind
SUBJECT: Carlyle Lake, Kaskaskia River, Illinois, Report of Sedimentation, 1976 Resurvey

DA, Lower Mississippi Valley Division, Corps of Engineers, Vicksburg, MS 39180

04 MAY 82

TO: Commander, St. Louis District, ATTN: LMSED-HD

Referred for necessary action.

FOR THE COMMANDER:

Robert J. Kaufman, P.E.
for R. H. RESTA, P.E.
Chief, Engineering Division

LMVED-WH (SLD 27 Feb 82) 8th Ind
SUBJECT: Carlyle Lake, Kaskaskia River, Illinois, Report of Sedimentation, 1976 Survey

DA, St. Louis District, Corps of Engineers, 210 Tucker Blvd., North, St. Louis, MO 63101 17 May 1982

TO: Commander, Lower Mississippi Valley Division
ATTN: LMVED-WH

1. The following information is submitted regarding comments on 5th and 6th Indorsements.

2. Fifth Indorsement.

a. Table 3. Concur. The 1971 areas have been corrected.

b. Table 4. Concur. The 1976 areas have been corrected.

c. Plate 9. The 1971 data for range 4A were incomplete, and, therefore, not plotted. A note is provided on the plate to indicate this.

d. Plate 27. Items 35a, 35c, 36a and 36b have been corrected.

e. Corrections to pp iv, 2, 3, 4, 5, Tables 3 and 4, and Plates 27 and 28 have been made.

3. Sixth Indorsement.

a. Para 14, p 4. In the second sentence, capacity inflow ratio of 0.77 has been changed to 0.90.

b. Para 18, p 5. Concur. If the FY82 resurvey indicates this reduced rate is continuing, it will be recommended to schedule resurveys at intervals of 10 to 15 years.

c. Plate 27. The C/I ratios in Item 33 have been corrected.

FOR THE COMMANDER:

JACK R. NIEMI, P.E.
Chief, Engineering Division

1 Incl
Added 1 incl
3. Report of Sedimentation (4 cys)

LMVED-WH (SLD 27 Feb 81) 9th Ind
SUBJECT: Carlyle Lake, Kaskaskia River, Illinois, Report of Sedimentation, 1976 Resurvey

DA, Lower Mississippi Valley Division, Corps of Engineers, Vicksburg, MS 39180

25 MAY '82

TO: CDR USACE (DAEN-CWE-HY) WASH DC 20314

The subject report has been revised to comply with previous comments.

FOR THE COMMANDER:

for Robert J Kaufman, P.E.
R. H. RESTA, P.E.
Chief, Engineering Division

1 Incl (quad)
wd 2 cy

CF wo incl:
LMSED-HD

DAEN-CWE-HY (LMSED-HD, 27 Feb 82) 10th Ind
SUBJECT: Carlyle Lake, Kaskaskia River, Illinois, Report of Sedimentation 1976 Resurvey

HQ, U.S. Army Corps of Engineers, Washington, D.C. 20314 7 June 1982

TO: Commander, Lower Mississippi Valley Division
Attn: LMVED-WH

The subject report is approved.

FOR THE COMMANDER:

wd all incl

LLOYD A. DUSCHA, P.E.
Chief, Engineering Division
Directorate of Civil Works

CARLYLE LAKE
UPPER MISSISSIPPI RIVER BASIN

KASKASKIA RIVER, ILLINOIS

REPORT OF SEDIMENTATION

1976 RESURVEY

U.S. ARMY ENGINEER DISTRICT, ST. LOUIS
CORPS OF ENGINEERS
ST. LOUIS, MISSOURI

REPORT ON RESURVEY OF SEDIMENTATION
CARLYLE RESERVOIR
KASKASKIA RIVER, ILLINOIS
1976

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PERTINENT DATA SUMMARY
CARLYLE LAKE

Item	Unit	
DRAINAGE AREA	sq. mi.	2,680
INACTIVE STORAGE POOL		
Elevation	n.g.v.d.	429.5
Area	acres	6,672
Storage	acre-feet	50,368
Storage (runoff)	inches	0.35
JOINT-USE POOL		
Elevation	n.g.v.d.	429.5 - 445.0
Area	acres	24,580
Storage	acre-feet	230,227
Storage (runoff)	inches	1.63
Regulated Outflow (min.)	c.f.s.	50
Regulated Outflow (max.)	c.f.s.	4,000
FLOOD CONTROL POOL		
Elevation	n.g.v.d.	445.0 - 462.5
Area	acres	58,440
Storage	acre-feet	694,050
Storage (runoff)	inches	4.89
Regulated Outflow (min.)	c.f.s.	50
Regulated Outflow (max.)	c.f.s.	10,000
INDUCED SURCHARGE		
Elevation	n.g.v.d.	462.5 - 465.5
Area	acres	65,000
Storage	acre-feet	184,000
Storage (runoff)	inches	1.29
Outflow (max.)	c.f.s.	149,000
SURCHARGE POOL (TOTAL)		
Elevation	n.g.v.d.	462.5 - 467.2
Area	acres	69,400
Storage	acre-feet	304,000
Storage (runoff)	inches	2.13
Outflow (max.)	c.f.s.	160,000

PERTINENT DATA SUMMARY (Continued)

Item	Unit	
FREEBOARD		
Elevation	n.g.v.d.	467.2 - 472.0
Area	acres	111,600
Storage	acre-feet	409,000
Storage (runoff)	inches	2.71
Height	feet	4.8
STANDARD PROJECT FLOOD		
Peak Inflow	c.f.s.	104,550
Peak Outflow	c.f.s.	7,000
Design Storm	inches	11.54
Runoff (includes base flow)	acre-feet	1,157,321
Runoff (includes base flow)	inches	8.10
DAM		
Elevation, Top of Dam	n.g.v.d.	472.00
Height above Streambed	feet	67
Length of Crest	feet	6,610
SPILLWAY		
Width		
Gross	feet	179
Net	feet	152
Elevation of Crest	n.v.g.d.	425
Tainter Gates		
Number	each	4
Size	feet	38 ft. W. x 39 ft. H.
Top Elevation, Closed	n.g.v.d.	463.5
OUTLET STRUCTURE		
Number of Sluices	each	1
Size	inches	30-in. and 24-in. diameter conduits joined by a Venturi tube and a regulating valve
Intake Invert Elevation	n.g.v.d.	417.0
Outlet Invert Elevation	n.g.v.d.	404.0

CONVERSION FACTORS, U.S. CUSTOMARY TO METRIC (SI) UNITS OF MEASUREMENT

U.S. customary units of measurement used in this report can be converted to metric (SI) units as follows:

Multiply	By	To Obtain
inches	25.4	millimetres
feet	0.3048	metres
miles (U.S. statute)	1.609344	kilometres
square miles	2.589988	square kilometres
cubic yards	0.7645549	cubic metres
acre-feet	1233.482	cubic metres
feet per second	0.3048	metres pre second
cubic feet per second	0.2831685	cubic meters per second

REPORT ON RESURVEY OF SEDIMENTATION
CARLYLE RESERVOIR
KASKASKIA RIVER, ILLINOIS

1. INTRODUCTION.

This report is prepared according to instructions in EM 1110-2-4000, dated 15 November 1961 and represents the results of the 1971 and 1976 resurvey of Carlyle Reservoir sedimentation ranges and downstream retrogression ranges on the Kaskaskia River. The purpose of the investigation was to analyze the 1971 and 1976 resurvey data to determine the distribution of sediment depletion of storage in the reservoir, and trap efficiency of the reservoir. Initial operation of the reservoir began on 1 April 1967.

2. LOCATION OF RESERVOIR.

Carlyle Reservoir is located in Clinton County, Illinois, on the Kaskaskia River. The dam is approximately 100 miles* above the confluence of the Kaskaskia River and the Mississippi River, and approximately 1 mile upstream of the town of Carlyle, Illinois. The watershed for the reservoir is 2,680 square miles, or about 46 percent of the total Kaskaskia River Basin. The basin is shown on Plate 1.

3. PURPOSE OF RESERVOIR.

Carlyle Reservoir is part of the Kaskaskia River Basin development plan. This plan provides flood control, water supply, storage for navigation releases, recreation, and fish and wildlife conservation. The reservoir is operated jointly with the other projects in the Kaskaskia River Basin.

4. RESERVOIR PERTINENT DATA - DAM AND APPURTENANT STRUCTURES.

The Pertinent Data Summary, shown on page iv, contains pertinent data concerning the dam, outlet, and spillway structures and the elevations, areas, and capacities of the inactive, joint-use, flood control, and surcharge pools.

5. WATERSHED CHARACTERISTICS.

The watershed has a total area of 2,680 square miles. The reservoir occupies approximately 90 square miles of this area at flood control pool (elevation 462.5**). The watershed has a median length of about 120 miles, an extreme width of 57 miles, and an average width of about ~~30~~ 22.3 miles. The course of the river is generally tortuous with many bends. The topography of

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*A table of factors for converting U.S. customary units of measurement to metric (SI) units is presented on page vi.

**All elevations (el) cited herein are in feet referred to National Geodetic Vertical Datum.

the basin is flat to gently rolling terrain. The principal occupation in the watershed is agricultural with approximately 86 percent of the watershed being cultivated annually.

6. CLIMATE.

The climate in the area is relatively moderate. The summers are usually mild with occasional temperatures of 100°F or higher. The winters are generally short and moderate, although temperatures below zero are not uncommon. The minimum and maximum temperatures of record are -34°F during the winter and 115°F during the summer. The average annual temperature is about 55°F. The average monthly temperature ranges from a maximum of 78°F during July, to a minimum of 30°F during January. Summaries of the monthly and annual precipitation and runoff for the watershed are given in Tables 1 and 2.

7. RESERVOIR OPERATION.

Carlyle Reservoir was designed to operate jointly with Shelbyville Reservoir in a way that their design-flood outflows can be safely and economically handled by authorized levees downstream. The reservoir outflows are regulated during the normal December through April flood season to reduce flood peaks downstream, to affect maximum flood control benefits, and to empty the flood control pool during the normal May through November low-water season. Usually, normal operational outflow does not exceed 4,000 cfs. The monthly reservoir pool hydrograph for the period 1967 through 1976 is shown on Plate 2.

8. RESERVOIR INFLOW.

Summaries of the monthly and annual precipitation and runoff data for the watershed are given in Tables 1 and 2. One inch of runoff equals 142,933 acre-feet. Average annual precipitation and inflow for the sediment survey period are tabulated in Items 34 and 35 of Plate 27, a data summary of reservoir sediment, ENG. Form 1787. The average monthly inflow hydrograph for the period 1966 through 1976 is shown on Plate 3.

9. ORIGINAL RESERVOIR SURVEY.

Reservoir area and volume were determined from U.S. Geological Survey quandrangle sheets and River and Lakes Commission topographic survey sheets of 1908. The area and volume curves were checked from 1956 topographic reservoir survey sheets. A tabulation of the reservoir area and storage for 5-foot intervals are shown as Tables 3 and 4 for the 1971 and 1976 surveys, respectively. Area and capacity curves are shown on Plate 4.

10. TYPE AND SCOPE OF THE INITIAL SEDIMENT SURVEY.

There were nine sediment ranges established and surveyed by direct leveling during the period of July 1965 - January 1967 for the purpose of observing sediment distribution and the approximate rate of reservoir storage depletion. Plate 5 shows the locations of the pool sediment ranges. The

cross-sections of the ranges, original, and 1976, are shown on Plates 6 through 14.

11. TYPE AND SCOPE OF SEDIMENT RESURVEY.

Detailed sediment resurveys of the nine sediment ranges by direct leveling and by a Ratheon Recording Depth Sounder, Model EE-119 were made during 1971 and 1976. The 1971 sediment resurvey was conducted from May to August 1971. The average elevation of the reservoir pool during the measurements was about 443.0. The 1976 sediment resurvey was conducted from January to March 1976. The average elevation of the reservoir pool during the measurements was about 440.5.

12. METHODS OF SEDIMENT COMPUTATIONS.

Several methods have been developed for computing the amount of sediment deposited in a reservoir. The area-depth method, end area-length method and the modified-prismoidal method were used in this report to analyze and compute the volume of sediment deposited. In the analysis, water surface areas were determined for ranges 1-A, 2-A, 3-A, and 4-A using a pool elevation of 445.0. An elevation of 462.0 was used for the upper ranges of 7-A, 9-A, 5-B, 6-B, and 8-B. Cross-sectional range data is tabulated in Tables 5 and 6. The three methods used to compute the volume of sediment for the periods of 1966-1971 and 1966-1976 are defined as:

Prismoidal Method - The prismoidal formula used to compute the volume of sediment deposited during the 1971 and 1976 resurveys was derived by the Soil Conservation Service and published as USDA Technical Bulletin No. 524, "Silting of Reservoirs, " dated August 1939. For method of computations see pages 158-161.

Average Depth Method - The surface area between two adjacent ranges was multiplied by the average depth of the two ranges to determine the capacity of the segment of reservoir bounded by the two ranges. The average depth of a range equals the cross-sectional area divided by the horizontal length of the range. The equation is expressed as:

$$V = A_{1-2} \times \frac{\left[\frac{E_1}{W_1} + \frac{E_2}{W_2}\right]}{2} \qquad (1)$$

Average End Method - The average cross-sectional area of sediment between two adjacent ranges was multiplied by the length of the segment (L) to determine the net change in volume of sediment bounded by the two ranges. The equation is expressed as:

$$V = \frac{(E_1 + E_2)}{2} \times \frac{L}{43,560} \qquad (2)$$

Symbols used in the above equations are defined as:

V = change in sediment volume between ranges for a survey period in acre-feet

A = surface area between ranges of the segment in acres.

E = net change in cross-sectional area between ranges for a survey period in square feet.

W = horizontal length of the range at crest elevation in feet.

L = length of segment in feet.

Results of the analysis using the above equations are presented in Table 7.

13. SEDIMENT QUANTITIES AND RESERVOIR LIFE.

A summary of the area changes of each sediment range along with the volume of sediment deposited between each range in the entire reservoir for the periods 1966-1971 and 1966-1976 are presented in Tables 8 and 9, respectively. Calculations of the initial 1971 sedimentation resurvey data indicate that about 8.5% of the inactive storage and 3.3% of the joint use storage at the reservoir has been filled between the dates of initial operation in April 1967 and the first hydrographic resurvey of the reservoir in 1971. The results of the 1976 sedimentation resurvey indicate that about 8.7% of the inactive storage and 3.9% of the joint use storage has been filled between initial operation in April 1967 and the second hydrographic resurvey in 1976. The computed rate of initial sediment deposition for the 4.3-year period (1967-1971) was 2,960 acre-feet per year. The rate of sediment deposition for the second resurvey (1967-1976) was 1,797 acre-feet per year. As expected, the long term rate of sedimentation was lower than the initial rate indicating that the time of filling the inactive storage pool will probably be longer than that based on the present average rate of 1,797 acre-feet per year. The results also indicate that since the 1971 resurvey the computed rate of deposition is about 709 acre-feet per year which is less than one-half of the rate for the period 1967-1976. Based on the results of the 1976 resurvey, the rate of deposition in the inactive pool is 491 acre-feet per year, while the rate in the joint use pool is 1,020 acre-feet per year. Therefore, in 33 years 50,000 acre-feet of storage would be depleted. (16,200 acre-feet of inactive storage and 33,660 acre-feet of joint-use storage.) However, using the rates obtained between the 1971 and 1976 resurveys, it would take about 153 years before 50,000 acre-feet of storage was depleted. It should be noted that the above life-spans are based upon the first year being 1967. Based upon the results of both resurveys, the areal distribution of the sediment deposited was fairly uniform, with the greatest amount being deposited between Ranges 3A and 4A, which are approximately 5 and 10 miles upstream of the dam, respectively.

14. TRAP EFFICIENCY OF THE RESERVOIR

For the period of operation, Carlyle Lake has a trap efficiency of 100%. This computation was based on the method of Gunnar M. Brune, using a capacity-inflow ratio of 0.90 (Item 33 of Plate 27), presented in a transaction of the American Geophysical Union, Volume 34, Number 3, June 1953, pages 407-417.

15. DOWNSTREAM CHANNEL AND RESERVOIR OPERATION.

A series of nine retrogression ranges cover from the U.S. 50 highway bridge (mile 105.7) to mile 102.75 (See Plate 15). The initial survey of the retrogression ranges showed no significant scouring of the bed downstream. A thalweg profile, including the 1966 and 1976 surveys, is shown on Plate 16. Cross-sections of the downstream ranges are shown on Plates 18 through 26. The tailwater rating curve has not changed significantly during the operation of the dam. Both the original and latest curves are shown as Plate 17.

16. EFFECT ON WATER SUPPLY CONTRACT.

The joint-use pool originally had 230,227 acre-feet of storage, of which 32,692 acre-feet was allocated for water supply. Of the total joint-use storage, only 9,080 acre-feet had been depleted by 1976, a reduction of about 3.9%. Due to the small amount of storage depleted, the existing Water Supply Contract should not be changed. In the future, as the amount of joint-use storage decreases due to sedimentation, modifications to the contract might be necessary.

17. SUMMARY.

The rate of sediment deposition computed (1,797 acre-feet per year) is much higher than the predicted rate of 746 acre-feet per year, which was the expected yearly sedimentation rate computed before the operation of the project. This predicted rate was obtained from the suspended sediment and bed load capacity of the river at the nearest sedimentation station to Carlyle Dam, located at Shelbyville, Illinois, and based upon information furnished by the U.S. Department of Agriculture, Soil Conservation Service, in a letter, dated 28 February 1954. The results indicated, as expected, that the rate of sediment has decreased from the initial 1971 survey. It is anticipated that the rate of sediment deposition has stabilized since the 1971 survey at about 709 acre-feet per year. No significant degradation has occurred downstream as a result of reservoir operation. A summary of reservoir sedimentation is shown on ENG. Form 1787 (Plate 27 and 28).

18. RECOMMENDATION.

In June 1980, sedimentation data was obtained for the upstream sedimention ranges 1A, 2A, and 3A. However, this survey was not completed due to a lack of time and funding. It is therefore, recommended that the remaining upstream sediment ranges and the downstream retrogression ranges be scheduled and completed in FY 82. A separate sedimentation report will be presented relative to the 1982 survey data. It is also recommended that the present plan of resurveys at intervals of 5 to 10 years be continued in order to substantiate the prediction that the future sediment rate will only slightly be reduced as compared to the present.

TABLE 1

MONTHLY PRECIPITATION AND RUNOFF
FOR DRAINAGE AREA ABOVE CARLYLE GAGE
(1966-1976)

MONTH	MAXIMUM RAINFALL	MINIMUM RAINFALL	AVERAGE RAINFALL	AVERAGE RUNOFF (Inches)	(Percent)
January	5.04	0.55	2.19	1.43	65.3
February	3.58	0.87	1.86	1.89	101.6
March	7.41	1.52	3.23	1.61	49.8
April	7.73	0.96	3.98	1.68	42.2
May	7.07	1.59	3.97	1.10	27.7
June	8.56	0.48	4.21	1.10	26.1
July	6.38	0.57	3.66	0.58	15.8
August	5.25	0.52	2.88	0.40	13.9
September	6.54	2.16	3.82	0.31	8.1
October	4.71	0.77	2.51	0.49	19.5
November	7.27	0.33	3.07	0.47	15.3
December	8.65	0.42	3.68	1.41	38.3

TABLE 2

ANNUAL PRECIPITATION AND RUNOFF
FOR DRAINAGE AREA ABOVE CARLYLE GAGE
(1966-1976)

YEAR	RAINFALL (Inches)	RUNOFF (Inches)	RUNOFF (Percent)	AVERAGE DAILY RUNOFF (cfs)
1966	31.78	14.9	46.7	2942.3
1967	45.81	14.0	30.6	2771.5
1968	34.73	9.0	25.9	1776.8
1969	44.01	12.6	28.6	2482.1
1970	37.98	10.4	27.4	2052.3
1971	35.88	5.8	16.2	1137.7
1972	39.13	9.6	24.5	1898.5
1973	47.92	19.4	40.5	3840.9
1974	44.17	21.3	48.2	4211.0
1975	42.25	14.3	33.8	2829.6
1976	25.65	4.1	16.0	805.1
MAXIMUM	47.92	21.3	48.2	4211.0
MINIMUM	25.65	4.1	16.0	805.1
AVERAGE	39.04	12.3	30.7	2431.6

TABLE 3

TABULATION OF AREA AND CAPACITY
FOR CARLYLE RESERVOIR
(1971)

ELEVATION	1966 AREA (Acres)	1971 AREA (Acres)	1966 CAPACITY (Acre - Feet)	1971 CAPACITY (Acre- Feet)*
415	1,146	1,120	5,156	5,041
420	2,181	2,066	13,088	12,608
425	3,851	3,513	27,762	26,138
430	7,109	6,200	53,739	49,206
435	12, 115	11,288	101,133	96,097
440	17,990	17,127	175,297	166,424
445	24,583	24,174	280,595	268,644
450	32,397	32,397	421,388	408,657
455	41,548	41,548	605,212	592,481
460	52,398	52,398	837,421	824,690
465	65,113	65,113	1,127,534	1,114,803
470	84,360	84,360	1,489,630	1,476,899

*NOTE: Based on prismoidal method.

TABLE 4

TABULATION OF AREA AND CAPACITY
FOR CARLYLE RESERVOIR
(1976)

ELEVATION	1976 AREA (Acres)	1976 CAPACITY (Acre - Feet) *
415	1,120	5,040
420	2,061	12,595
425	3,507	26,097
430	6,164	49,066
435	11,198	95,211
440	16,939	165,227
445	23,852	267,140
450	32,367	406,281
455	41,548	589,220
460	52,398	821,429
465	65,113	1,111,542
470	84,360	1,473,638

* Based on prismoidal method.

NOTE: For original areas & capacities see TABLE 3.

TABLE 5

RANGE DATA - CARLYLE LAKE

SECTION	WATER-SURFACE ELEVATION (FEET, NGVD)	DISTANCE BETWEEN RANGES (FEET)	UNILATERAL AREA-A'* (ACRES)	ACTUAL SURFACE AREA-A (ACRES)
DAM-1-A	445.0	5600	-	949.5
1-A - 2-A	445.0	10400	2753.3	3164.8
2-A - 3-A	445.0	9700	3229.9	3133.3
3-A - 4-A	445.0	27700	9831.7	10448.5
4-A - 7-A	462.0	27400	8582.3	9500.3
7-A - 9-A	462.0	27000	8623.5	8871.3
5-B	462.0	21000	1125.3	1699.5
6-B	462.0	24500	870.9	1463.9
8-B	462.0	13500	1006.2	1213.5
9-A-END	462.0	11000	2860.0	3083.6

*Area formed by connecting the points of intersection of the ranges with the crest elevation. Used with prismoidal method.

TABLE 6

CROSS-SECTION RANGE DATA - CARLYLE LAKE

@ El. 445

	1965-1971		1965-1976	
SECTION	CHANGE IN AREA (Sq. Ft.)	WIDTH (Feet)	CHANGE IN AREA (Sq. Ft.)	WIDTH (Feet)
1-A	4546	11730	4044	11760
2-A	4895	12800	5721	13000
3-A	7895	17500	10842	17700
4-A	9749	16500	12609	16700
7-A	226	11300	2716	11300
9-A	2384	8800	71	8800
5-B	456	3390	25	3390
6-B	-415	3180	112	3180
8-B	-562	4110	-574	4120

TABLE 7

TABULATION OF COMPUTATION OF RESERVOIR SEDIMENT DEPOSITED IN ACRE-FEET

	1966 - 1971				1966 - 1976			
SECTION	(A)	(B)	(C)	Average	(A)	(B)	(C)	Average
DAM - 1-A	351	368	584	434	312	327	520	386
1-A - 2-A	1166	1218	1127	1170	1188	1241	1121	1183
2-A - 3-A	1324	1306	1424	1351	1681	1650	1844	1725
3-A - 4-A	5328	5444	5610	5461	7000	7145	7456	7200
4-A - 7-A	2867	2902	3137	2969	4732	4728	4820	4760
7-A - 9-A	1234	1290	810	1111	1132	1102	864	1032
5-B	127	114	110	117	7	6	6	6
6-B	-102	-96	-117	-105	27	26	31	28
8-B	-101	-83	-87	-90	-103	-85	-89	-92
9-A END	537	418	301	419	16	13	9	13
TOTAL	12731	12881	12900	12837	15992	16153	16582	16241

NOTE: (A) Prismoidal Method
(B) Average - Depth Method
(C) Average - End Method

TABLE 8

TABULATION OF RANGE AREA AND VOLUME CHANGES
IN CARLYLE RESERVOIR
(1967-1971)

RANGE CROSS SECTION	AREA CHANGE (Square Feet)	VOLUME SEDIMENT DEPOSITED (Acre - Feet) METHOD A	AVG. METHOD A, B, C
DAM	--	351	434
1-A	4546	1166	1170
2-A	4895	1324	1351
3-A	7895	5328	5461
4-A	9749	2867	2969
7-A	226	1234	1111
9-A	2384	537	419
TOP OF RESERVOIR			
5-B	456	127	117
6-B	-415	-102	-105
8-B	-562	-101	-90
TOTAL		12731	12837

Percent of Storage Lost

METHOD (A) $\frac{12,731}{974,645} \times 100 = 1.3\%$

METHODS (A,B,C) $\frac{12,837}{974,645} \times 100 = 1.3\%$

TABLE 9

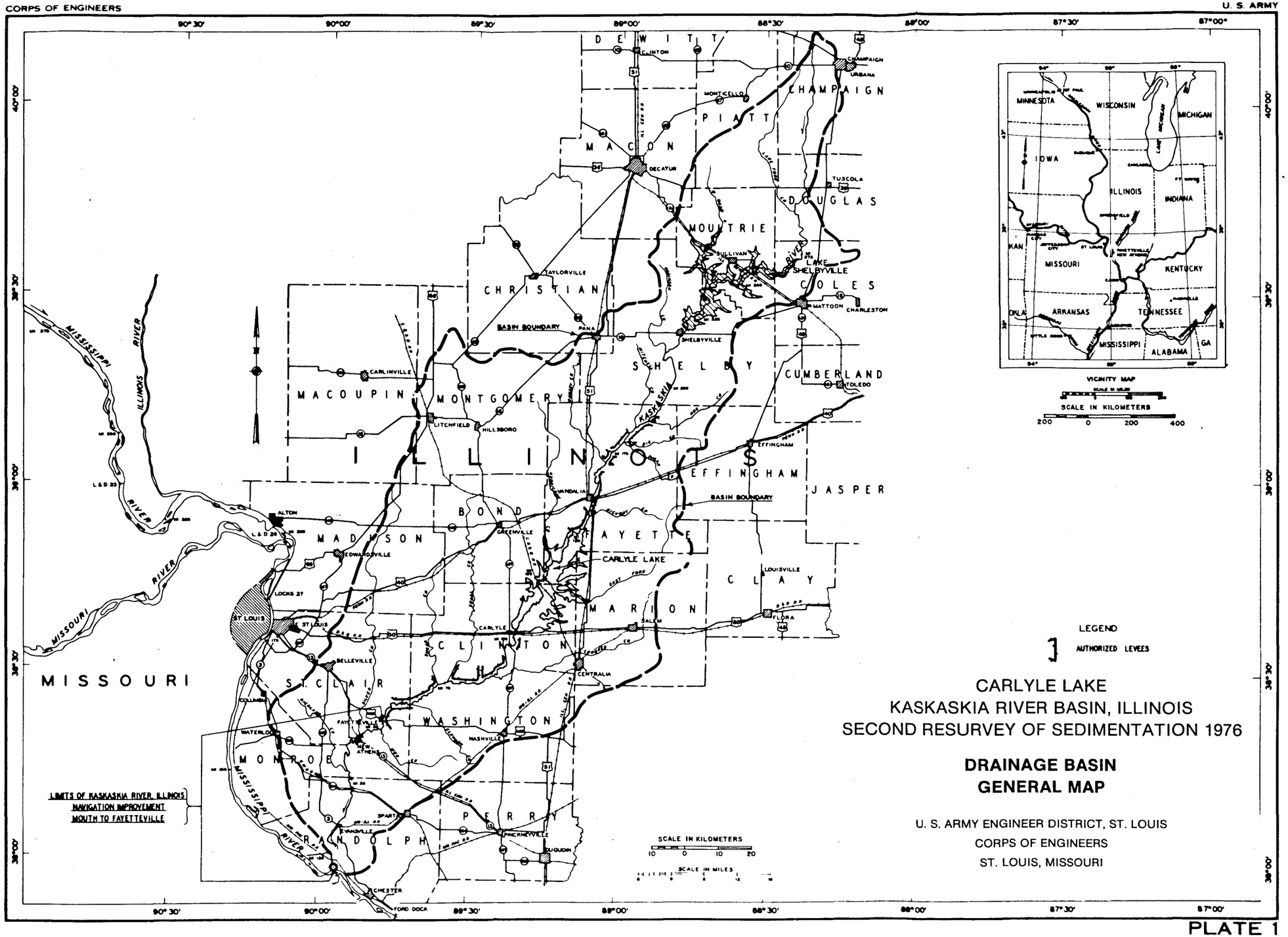
TABULATION OF RANGE AREA AND VOLUME CHANGES IN CARLYLE RESERVOIR (1967-1976)

RANGE CROSS SECTION	AREA CHANGE (Square Feet)	VOLUME SEDIMENT DEPOSITED (Acre - Feet) METHOD A	AVG. METHOD A, B, C
DAM	—	312	386
1-A	4044	1188	1183
2-A	5721	1681	1725
3-A	10842	7000	7200
4-A	12609	4732	4760
7-A	2716	1132	1032
9-A	71	16	13
Top of Reservoir			
5-B	25	7	6
6-B	112	27	28
8-B	-574	-103	-92
TOTAL		15992	16241

Percent of Storage Lost

METHOD (A) $\frac{15,992}{974,645} \times 100 = 1.6\%$

METHODS (A,B,C) $\frac{16,241}{974,645} \times 100 = 1.7\%$



CARLYLE LAKE
KASKASKIA RIVER BASIN, ILLINOIS
SECOND RESURVEY OF SEDIMENTATION 1976

DRAINAGE BASIN
GENERAL MAP

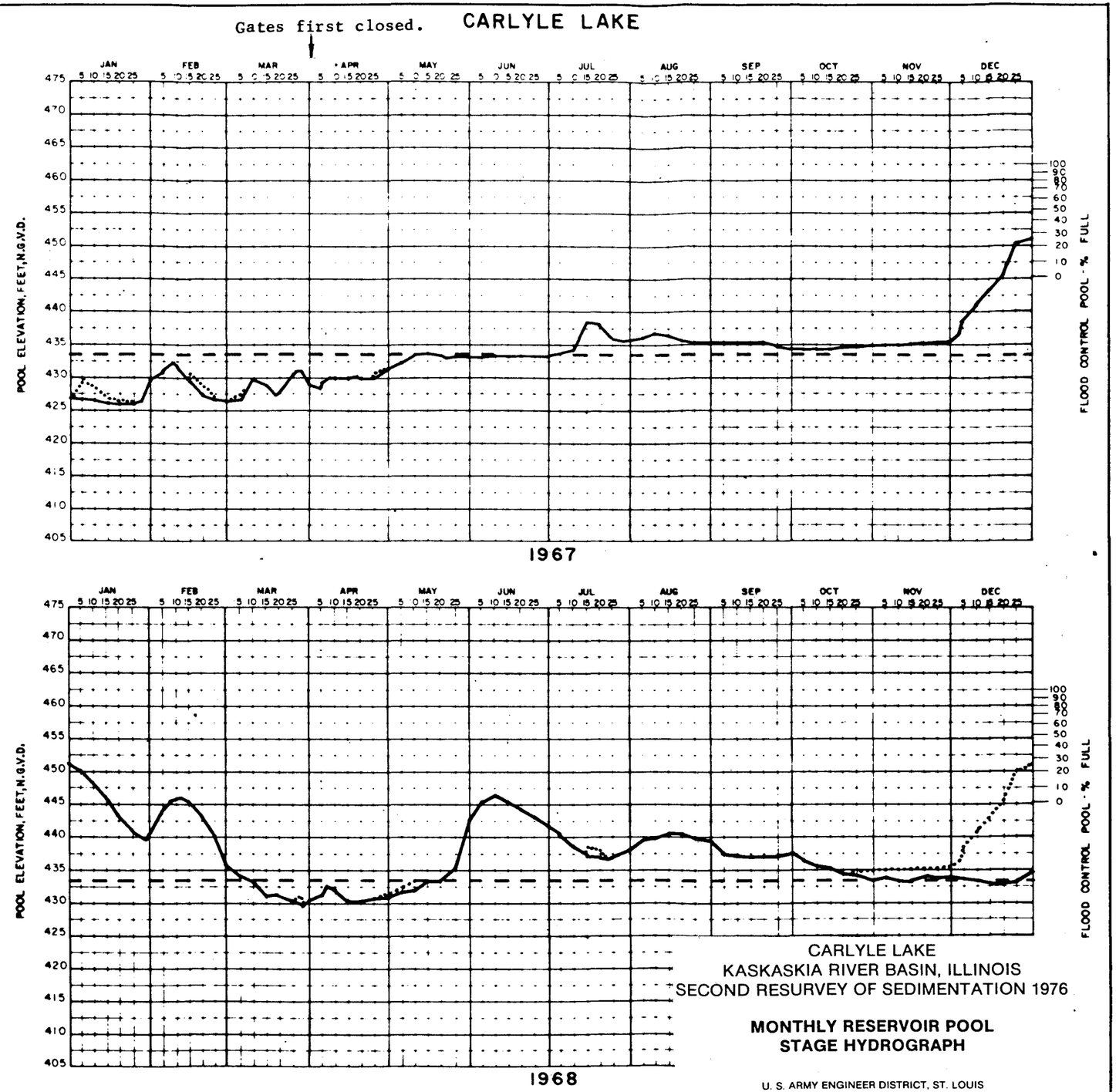
U. S. ARMY ENGINEER DISTRICT, ST. LOUIS
CORPS OF ENGINEERS
ST. LOUIS, MISSOURI

Nominclature

····· Max. Pool of Record

—— Pool Elevation

- - - Rule Curve



CARLYLE LAKE
KASKASKIA RIVER BASIN, ILLINOIS
SECOND RESURVEY OF SEDIMENTATION 1976

MONTHLY RESERVOIR POOL STAGE HYDROGRAPH

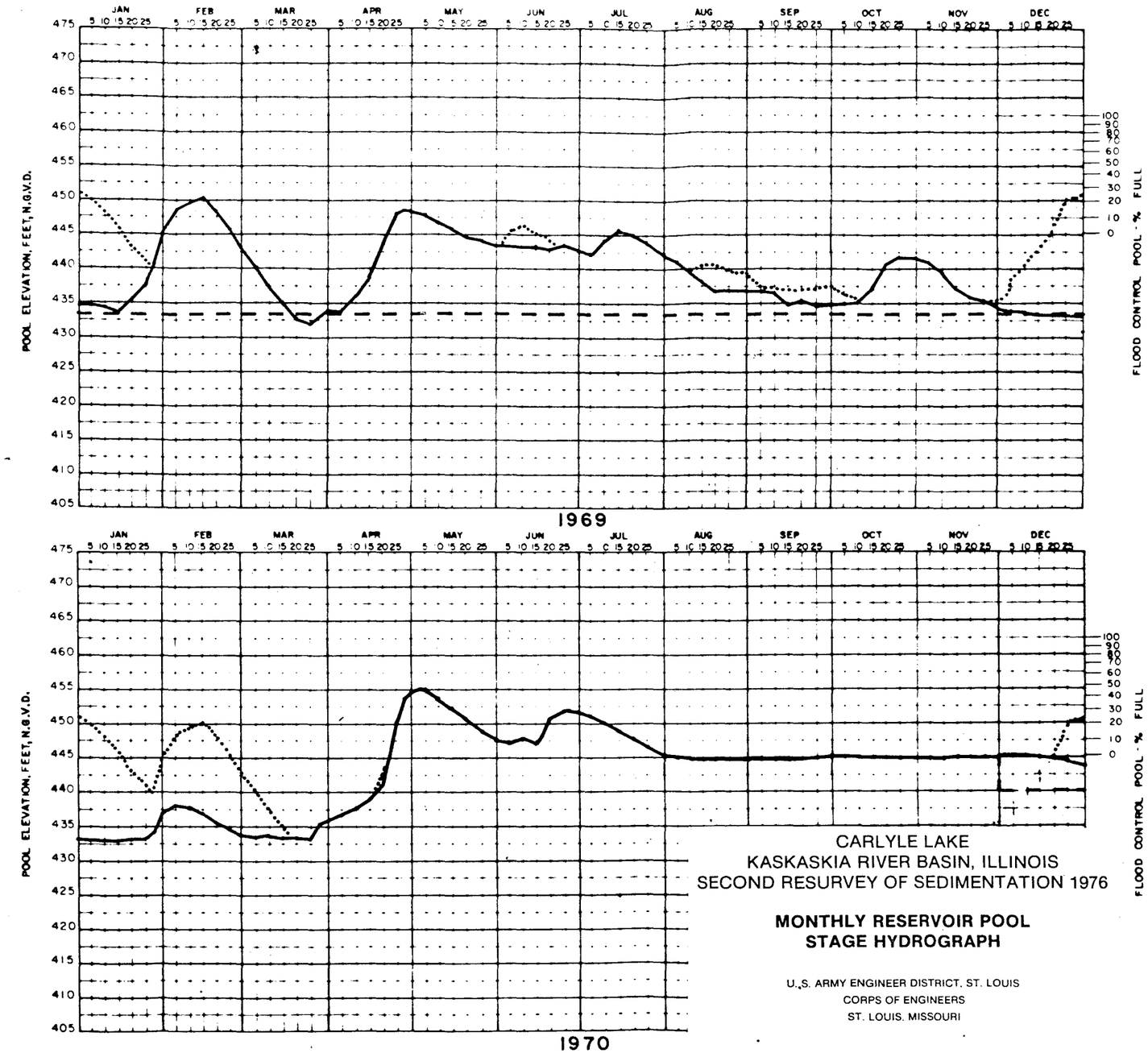
U. S. ARMY ENGINEER DISTRICT, ST. LOUIS
CORPS OF ENGINEERS
ST. LOUIS, MISSOURI

PLATE 2A

CARLYLE LAKE

Nominclature

····· Max. Pool of Record
—— Pool Elevation
– – – Rule Curve



CARLYLE LAKE
KASKASKIA RIVER BASIN, ILLINOIS
SECOND RESURVEY OF SEDIMENTATION 1976

MONTHLY RESERVOIR POOL STAGE HYDROGRAPH

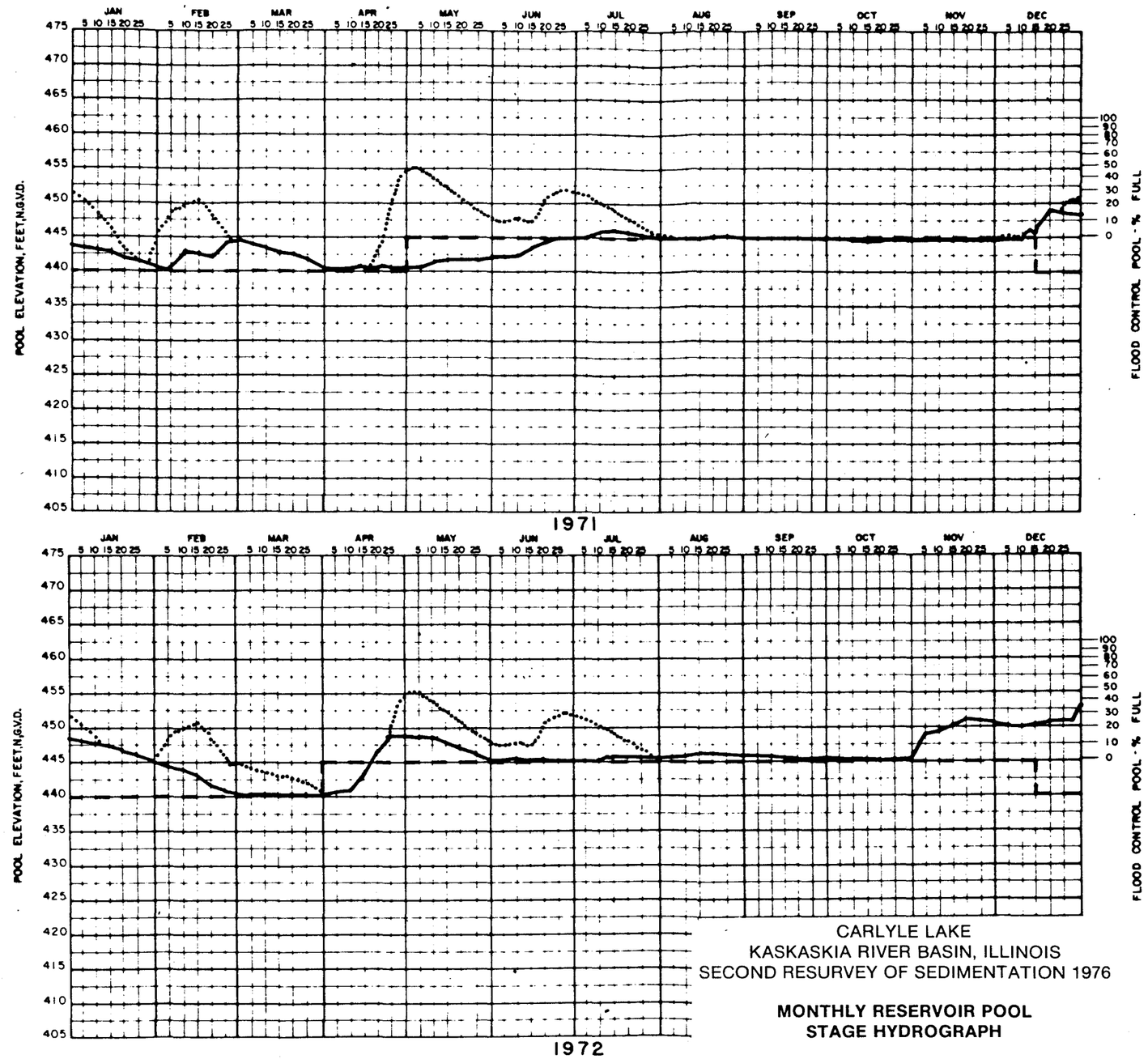
U.S. ARMY ENGINEER DISTRICT, ST. LOUIS
CORPS OF ENGINEERS
ST. LOUIS, MISSOURI

PLATE 2B

CARLYLE LAKE

Nominclature

····· Max. Pool of Record
—— Pool Elevation
– – – Rule Curve



CARLYLE LAKE
KASKASKIA RIVER BASIN, ILLINOIS
SECOND RESURVEY OF SEDIMENTATION 1976

MONTHLY RESERVOIR POOL STAGE HYDROGRAPH

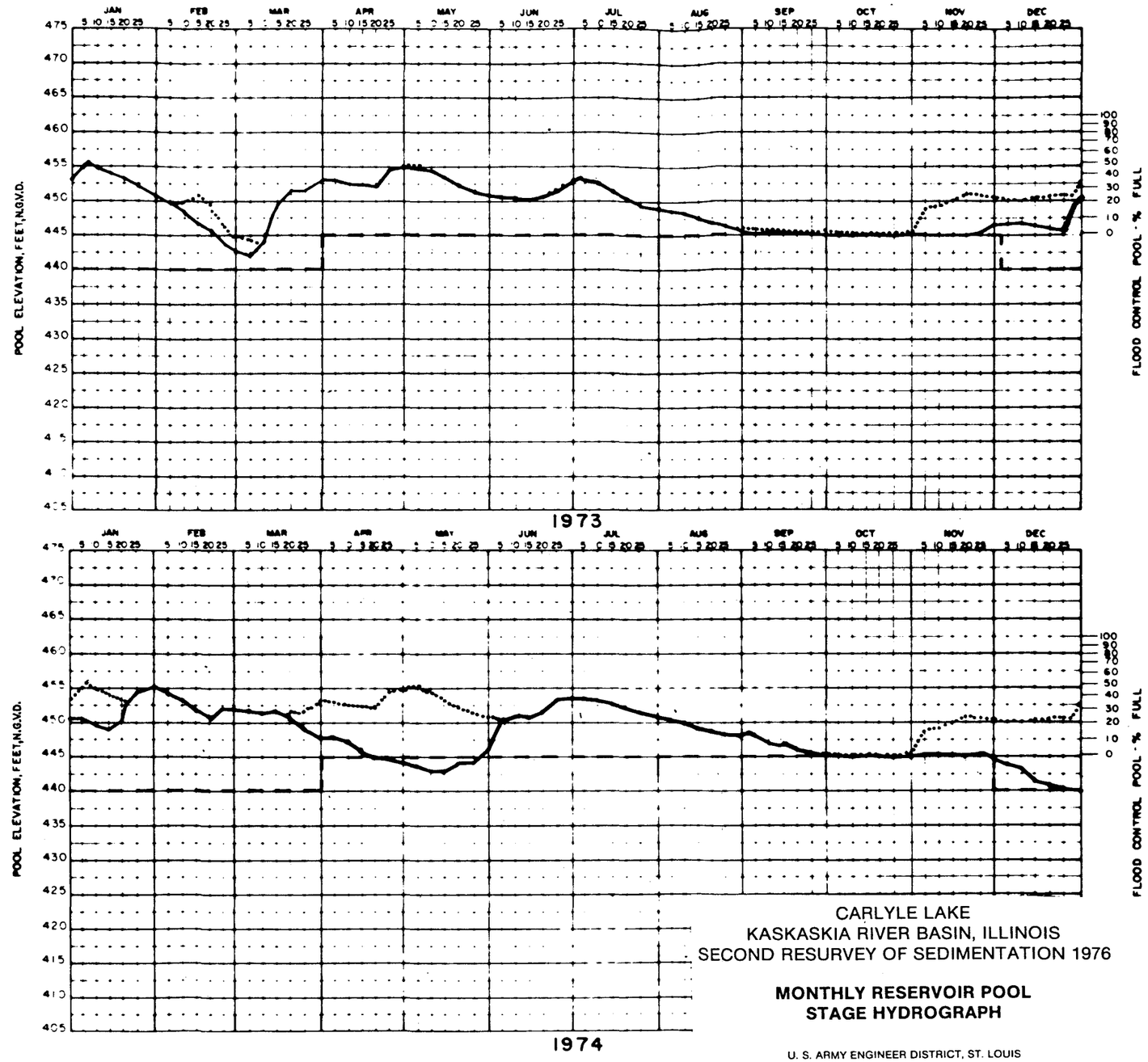
U. S. ARMY ENGINEER DISTRICT, ST. LOUIS
CORPS OF ENGINEERS
ST. LOUIS, MISSOURI

PLATE 2C

CARLYLE LAKE

Nominclature

····· Max. Pool of Record
—— Pool Elevation
– – – Rule Curve



CARLYLE LAKE
KASKASKIA RIVER BASIN, ILLINOIS
SECOND RESURVEY OF SEDIMENTATION 1976

MONTHLY RESERVOIR POOL STAGE HYDROGRAPH

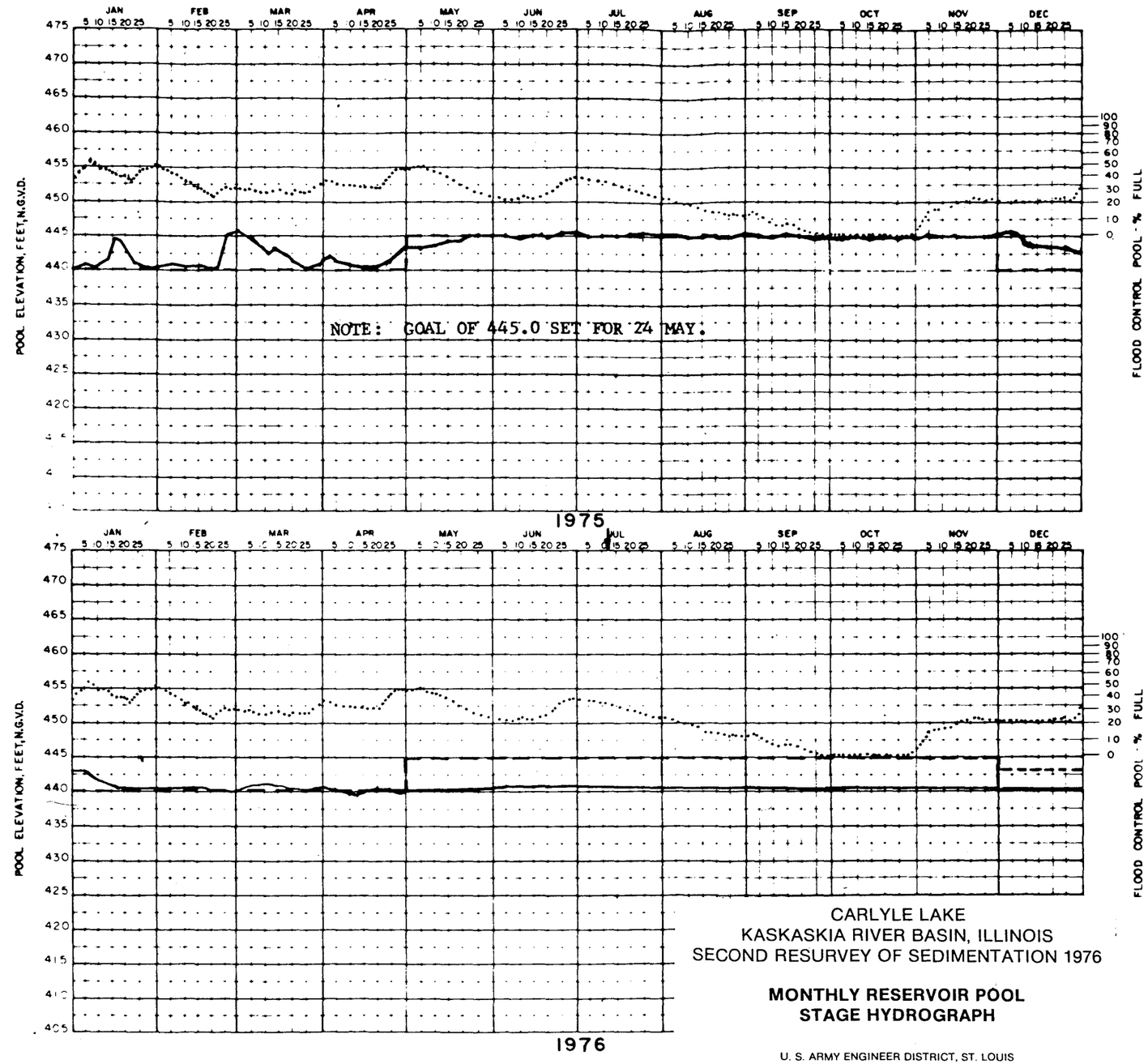
U. S. ARMY ENGINEER DISTRICT, ST. LOUIS
CORPS OF ENGINEERS
ST. LOUIS, MISSOURI

PLATE 2D

CARLYLE LAKE

Nominclature

....Max. Pool of Record
____Pool Elevation
– – – Rule Curve

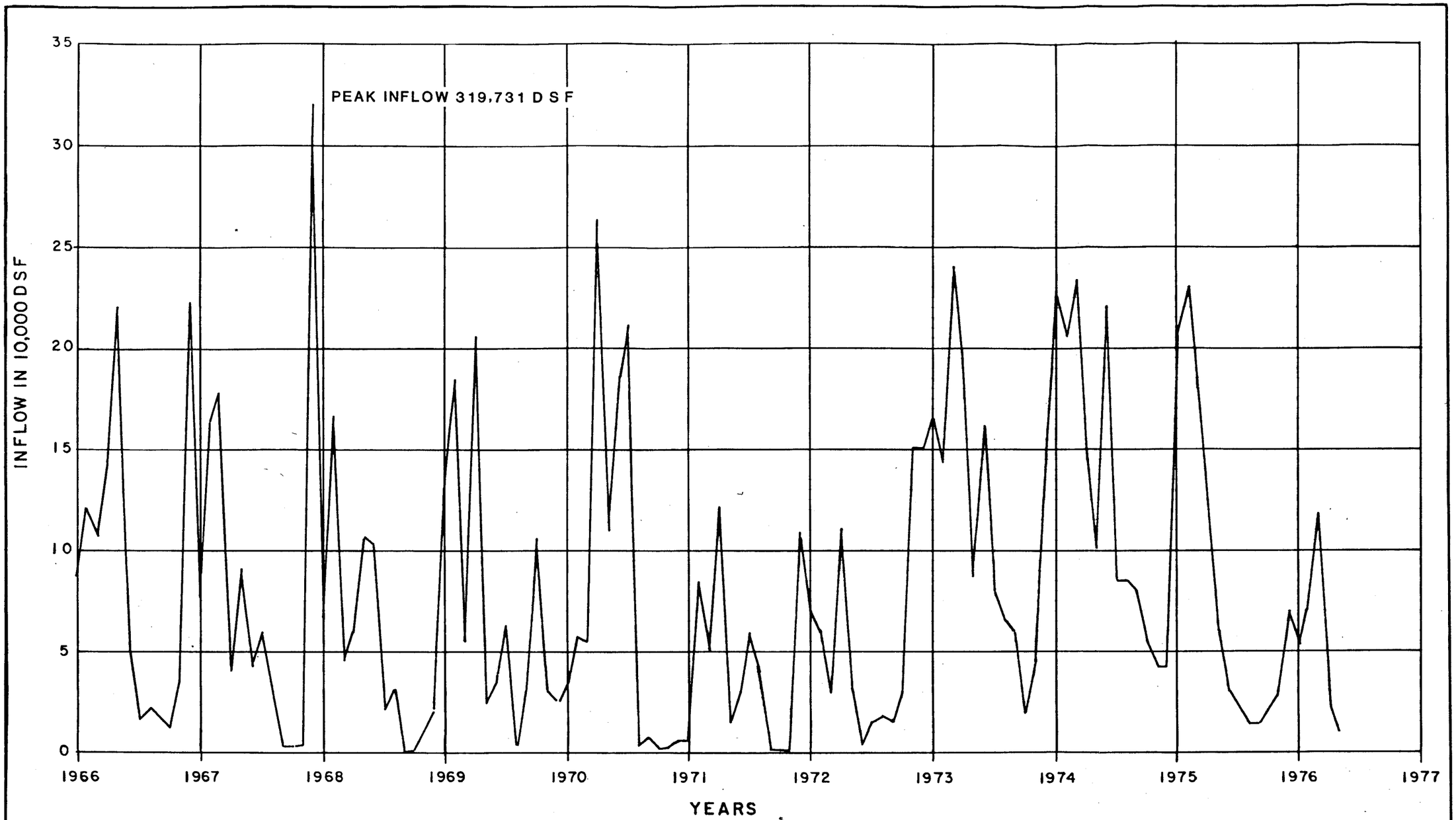


CARLYLE LAKE
KASKASKIA RIVER BASIN, ILLINOIS
SECOND RESURVEY OF SEDIMENTATION 1976

MONTHLY RESERVOIR POOL STAGE HYDROGRAPH

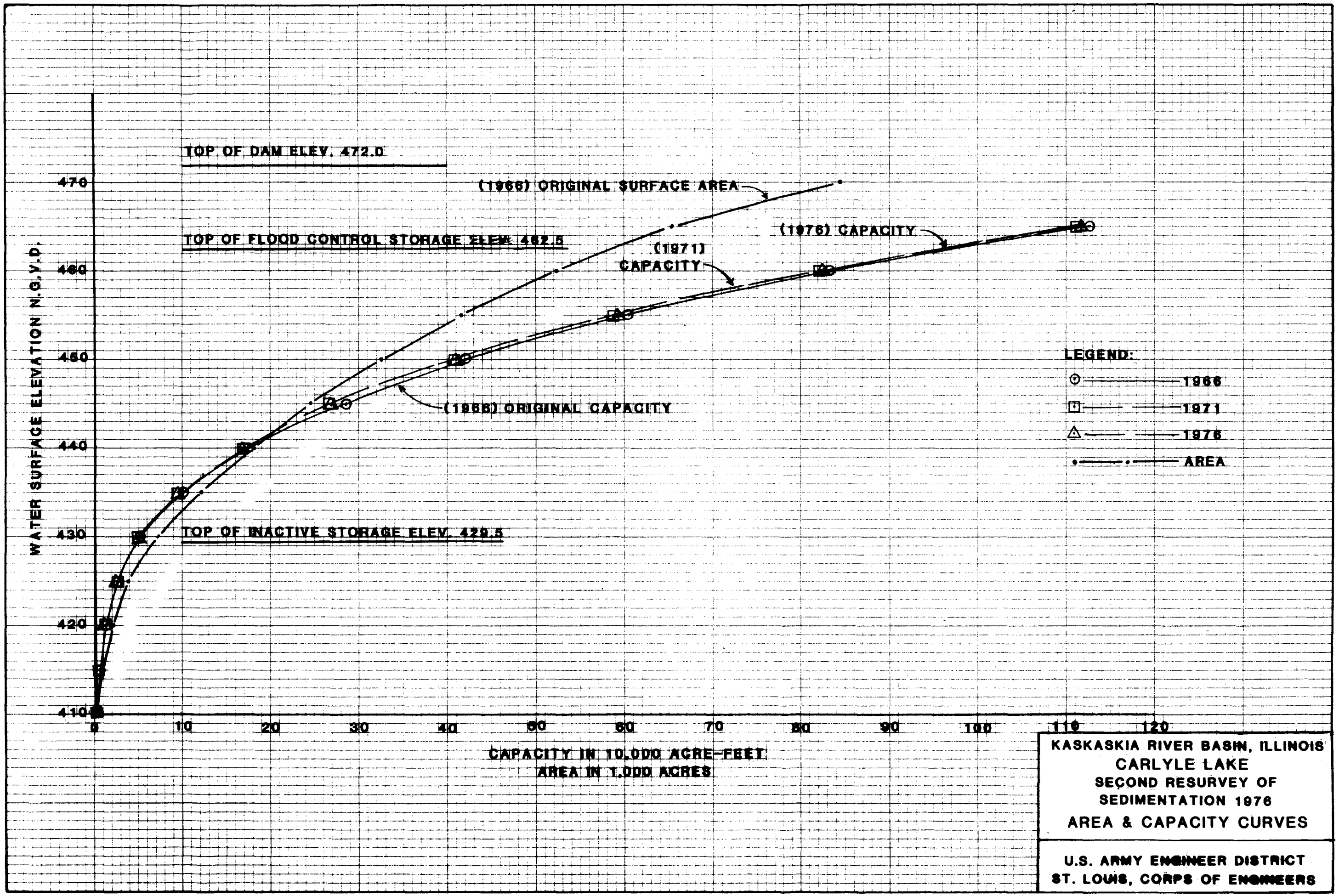
U. S. ARMY ENGINEER DISTRICT, ST. LOUIS
CORPS OF ENGINEERS
ST. LOUIS, MISSOURI

PLATE 2E



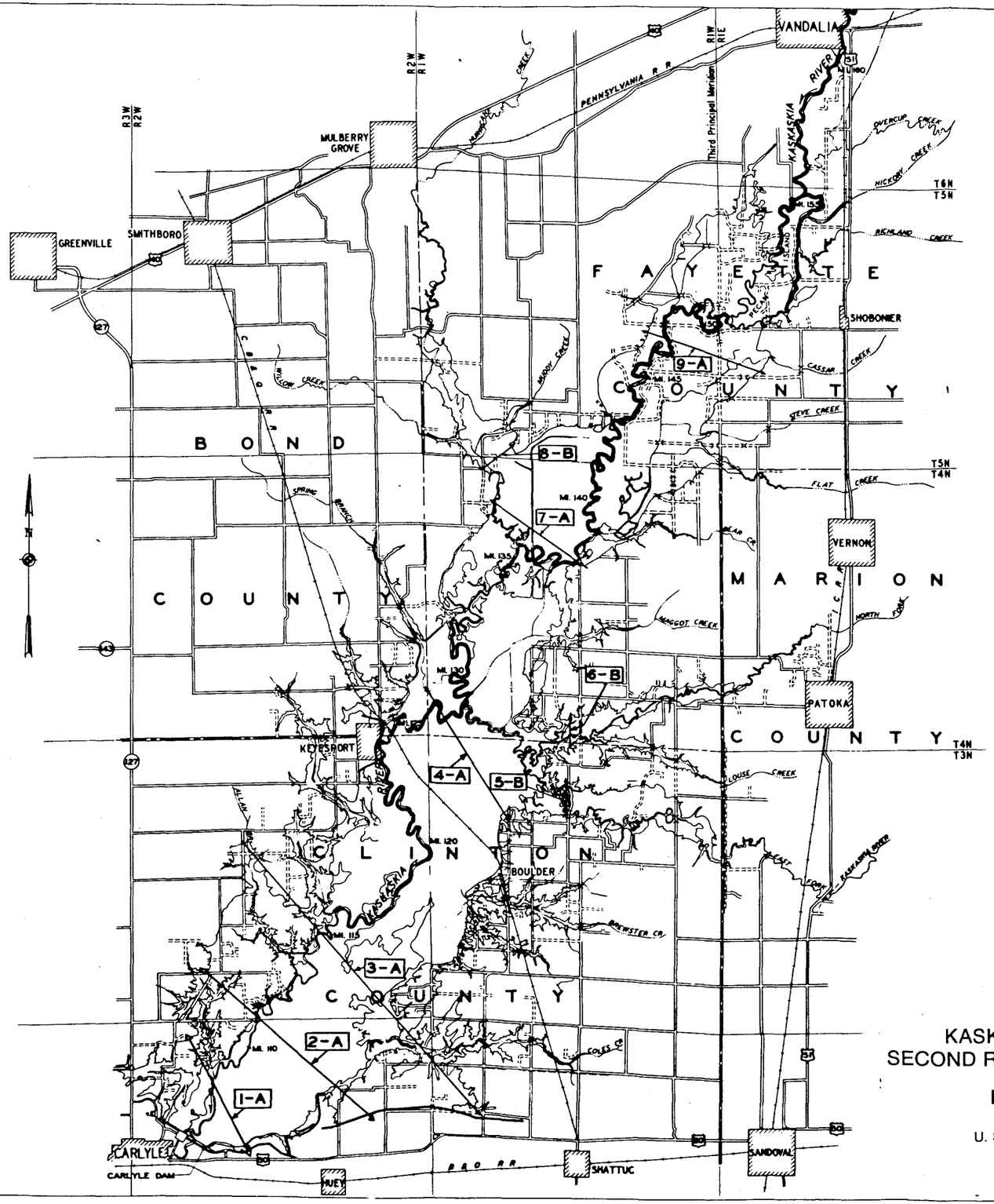
CARLYLE LAKE
KASKASKIA RIVER BASIN, ILLINOIS
RESURVEY OF SEDIMENTATION
AVERAGE MONTHLY
INFLOW HYDROGRAPH (1966-1976)

U. S. ARMY ENGINEER DISTRICT, ST. LOUIS
CORPS OF ENGINEERS
ST. LOUIS, MISSOURI



KASKASKIA RIVER BASIN, ILLINOIS
CARLYLE LAKE
SECOND RESURVEY OF
SEDIMENTATION 1976
AREA & CAPACITY CURVES

U.S. ARMY ENGINEER DISTRICT
ST. LOUIS, CORPS OF ENGINEERS



CARLYLE LAKE
KASKASKIA RIVER BASIN, ILLINOIS
SECOND RESURVEY OF SEDIMENTATION 1976

POOL SEDIMENT RANGES

U. S. ARMY ENGINEER DISTRICT, ST. LOUIS
CORPS OF ENGINEERS
ST. LOUIS, MISSOURI

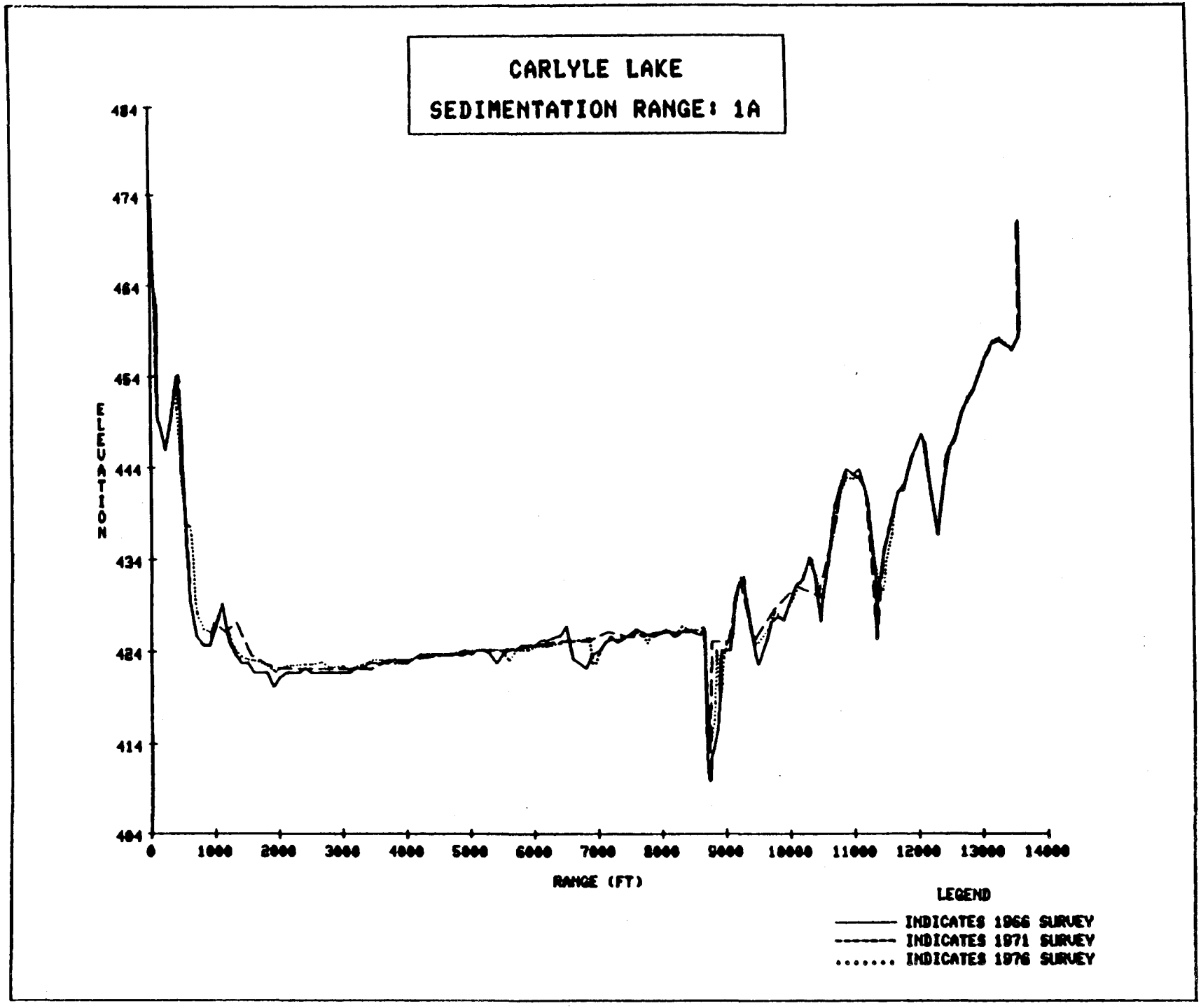

CARLYLE LAKE
SEDIMENTATION RANGE: 1A
ELEVATION
484
474
464
454
444
434
424
414
404
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
11000
12000
13000
14000
RANGE (FT)
LEGEND
INDICATES 1966 SURVEY
INDICATES 1971 SURVEY
INDICATES 1976 SURVEY

PLATE 6

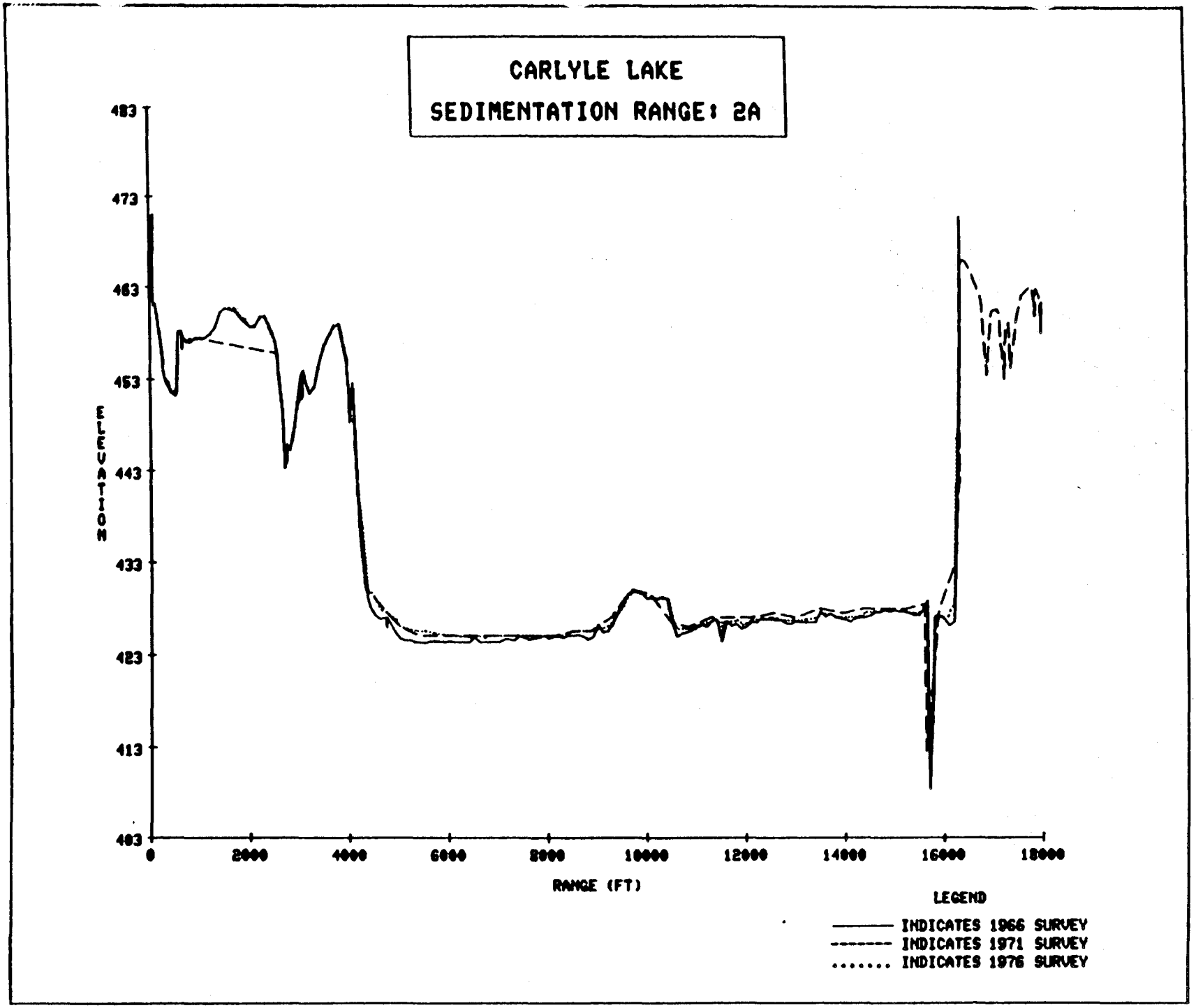

CARLYLE LAKE
SEDIMENTATION RANGE: 2A
ELEVATION
483
473
463
453
443
433
423
413
403
0
2000
4000
6000
8000
10000
12000
14000
16000
18000
RANGE (FT)
LEGEND
INDICATES 1966 SURVEY
INDICATES 1971 SURVEY
INDICATES 1976 SURVEY

PLATE 7

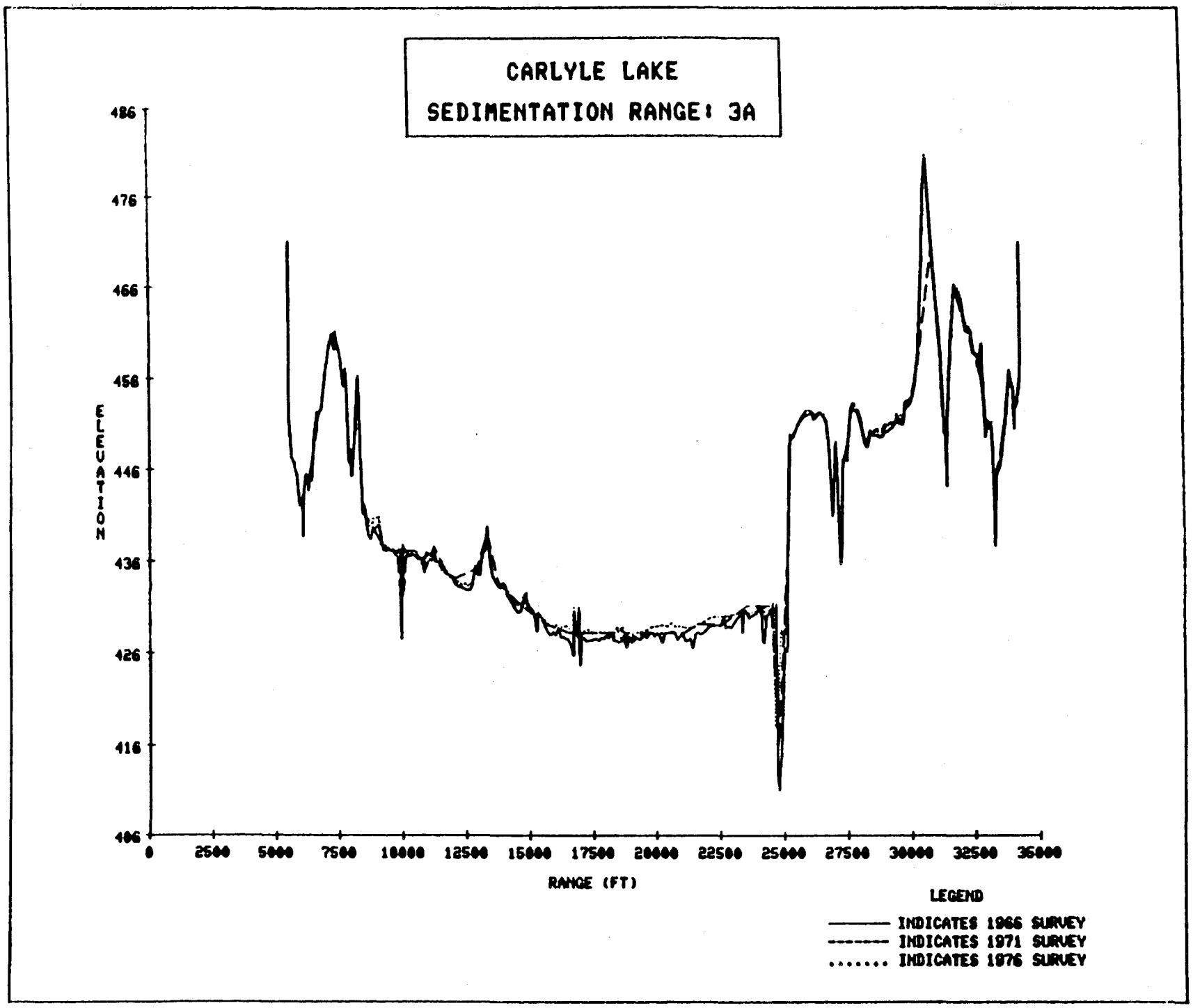
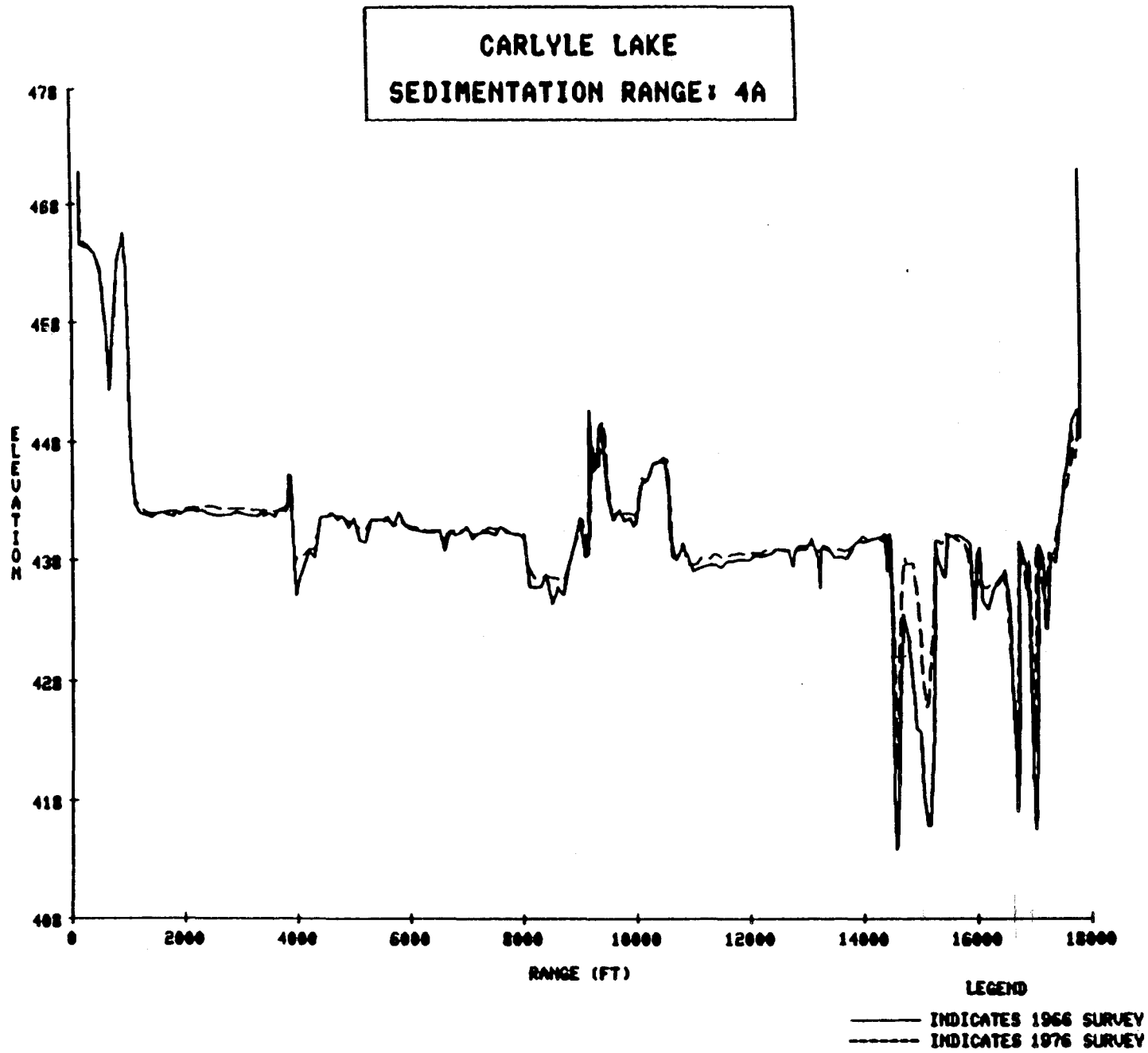
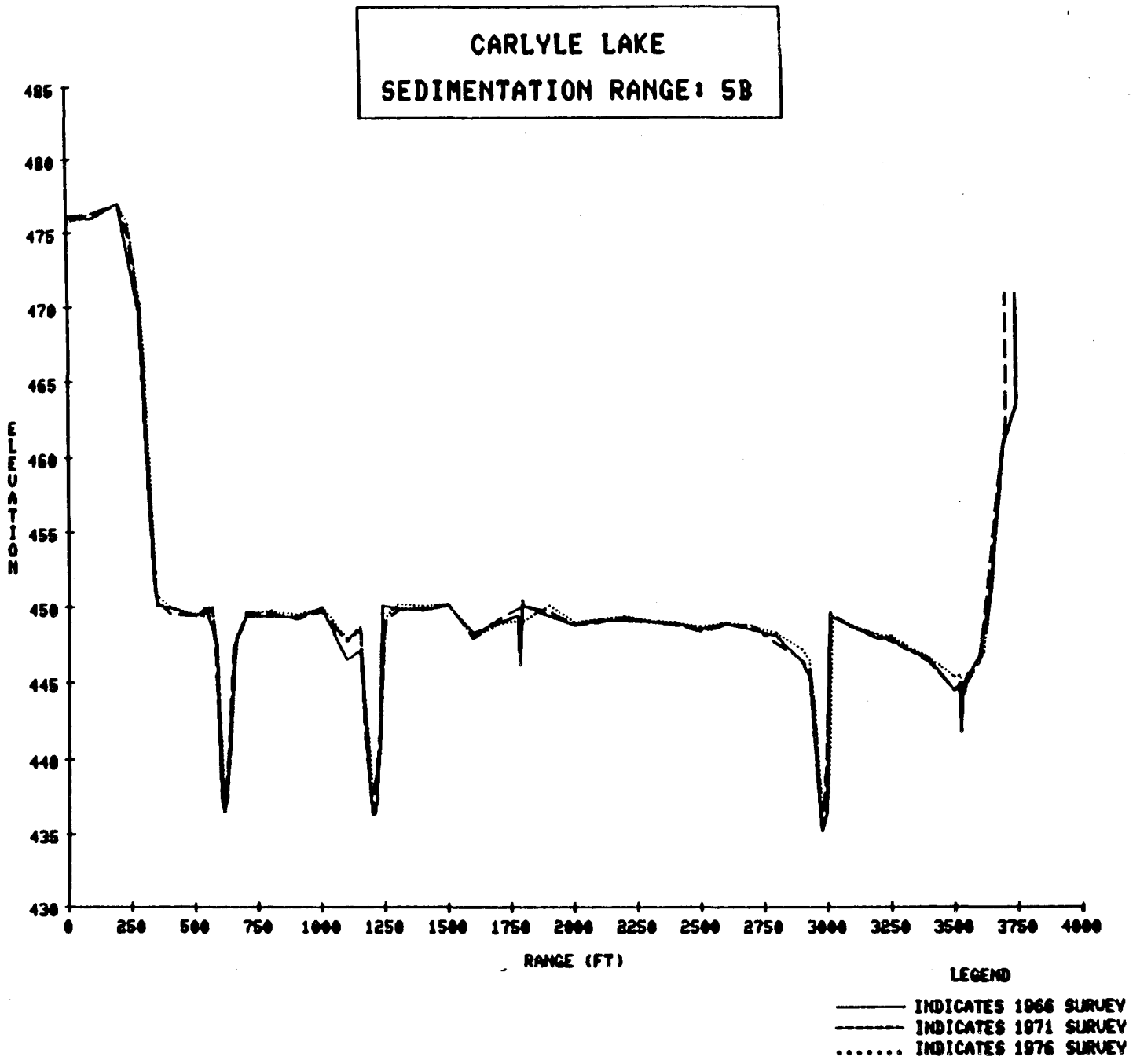
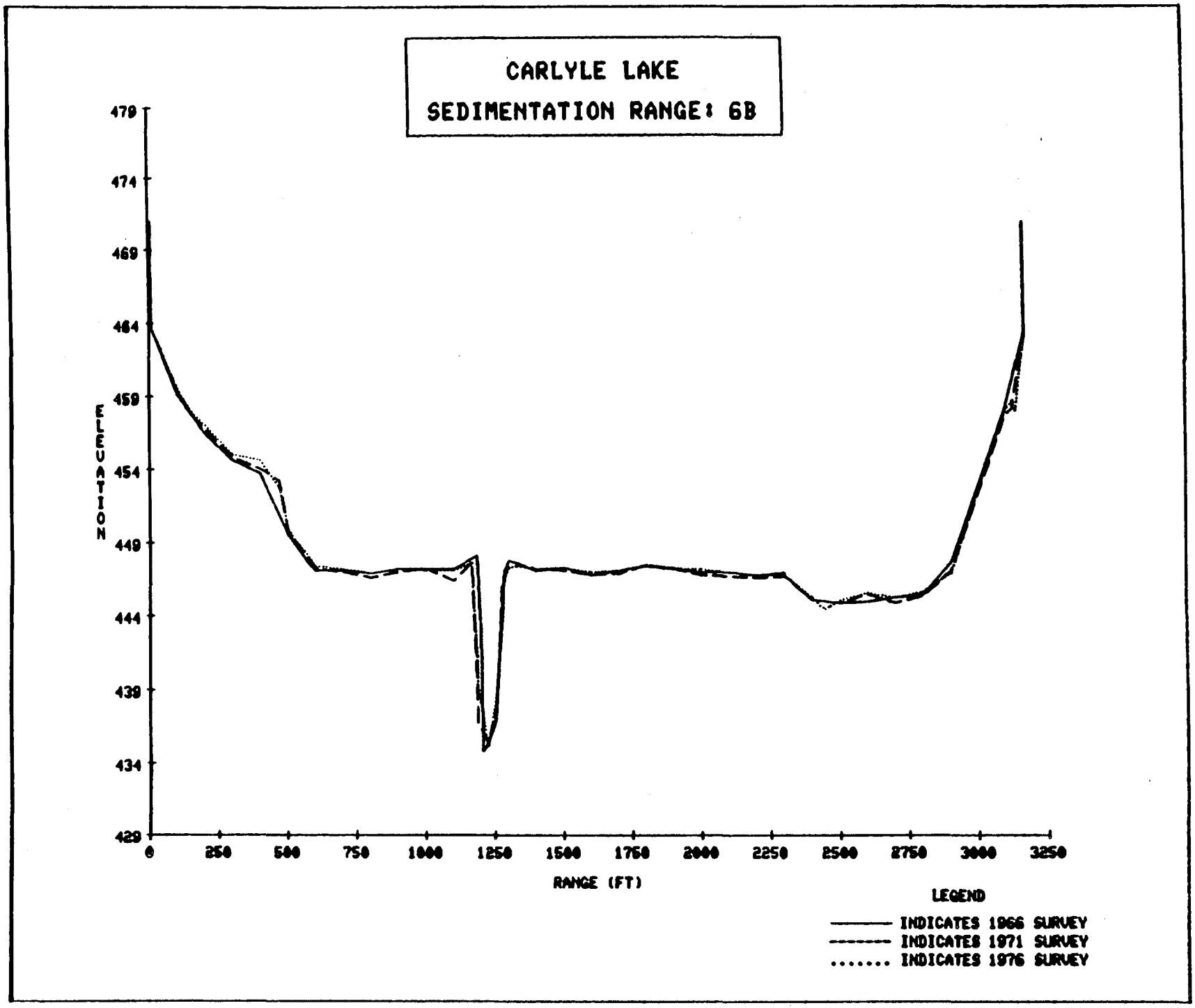

CARLYLE LAKE
SEDIMENTATION RANGE: 3A
ELEVATION
486
476
466
456
446
436
426
416
406
0
2500
5000
7500
10000
12500
15000
17500
20000
22500
25000
27500
30000
32500
35000
RANGE (FT)
LEGEND
INDICATES 1966 SURVEY
INDICATES 1971 SURVEY
INDICATES 1976 SURVEY

PLATE 8



Note: 1971 data was incomplete. Not shown.


CARLYLE LAKE
SEDIMENTATION RANGE: 5B
ELEVATION
485
480
475
470
465
460
455
450
445
440
435
430
0
250
500
750
1000
1250
1500
1750
2000
2250
2500
2750
3000
3250
3500
3750
4000
RANGE (FT)
LEGEND
INDICATES 1966 SURVEY
INDICATES 1971 SURVEY
INDICATES 1976 SURVEY


CARLYLE LAKE
SEDIMENTATION RANGE: 6B
479
474
469
464
459
454
449
444
439
434
429
ELEVATION
0
250
500
750
1000
1250
1500
1750
2000
2250
2500
2750
3000
3250
RANGE (FT)
LEGEND
INDICATES 1966 SURVEY
INDICATES 1971 SURVEY
INDICATES 1976 SURVEY

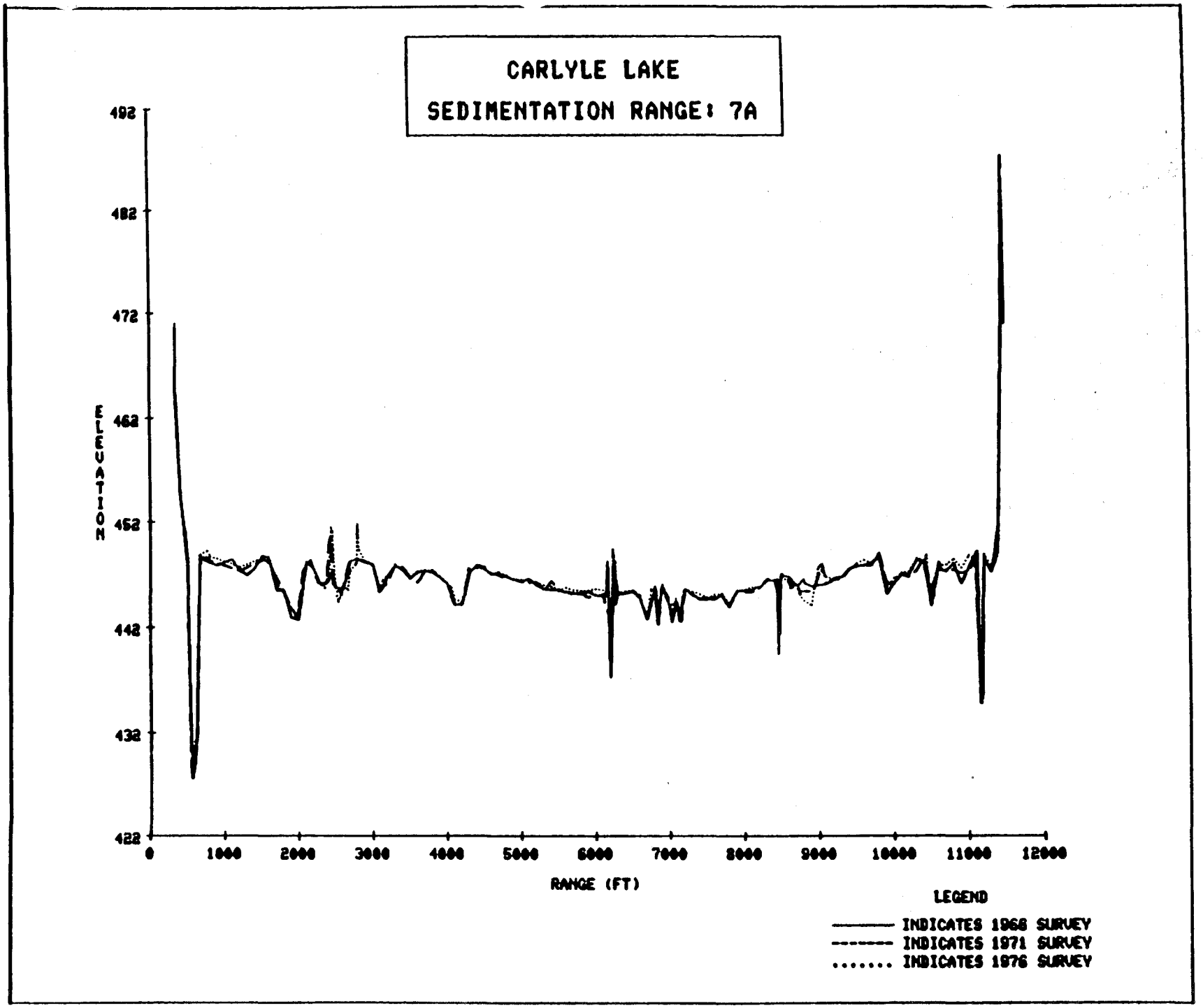
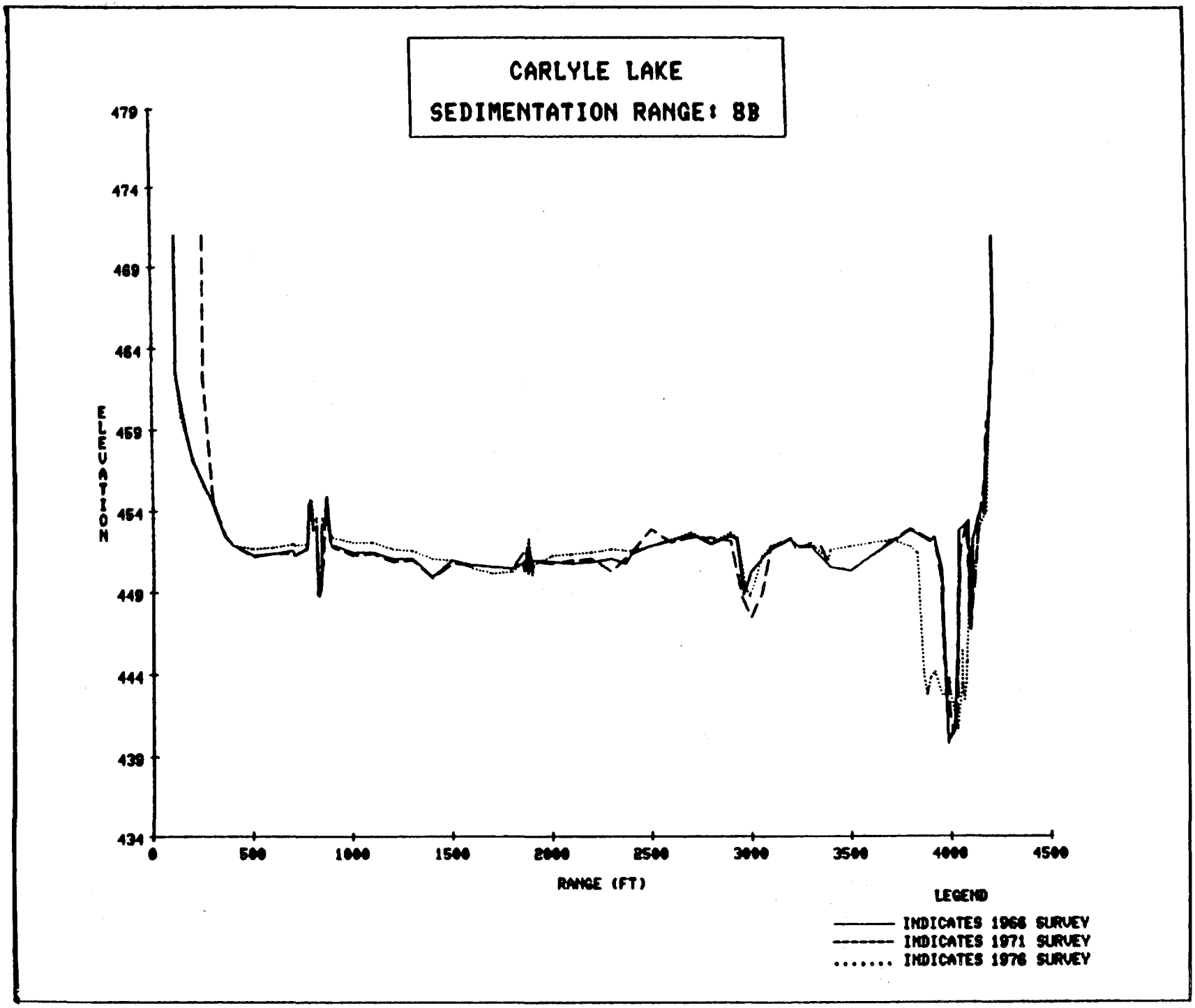

CARLYLE LAKE
SEDIMENTATION RANGE: 7A
ELEVATION
492
482
472
462
452
442
432
422
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
11000
12000
RANGE (FT)
LEGEND
INDICATES 1968 SURVEY
INDICATES 1971 SURVEY
INDICATES 1976 SURVEY

PLATE 12


CARLYLE LAKE
SEDIMENTATION RANGE: 8B
479
474
469
464
459
454
449
444
439
434
ELEVATION
0
500
1000
1500
2000
2500
3000
3500
4000
4500
RANGE (FT)
LEGEND
INDICATES 1968 SURVEY
INDICATES 1971 SURVEY
INDICATES 1976 SURVEY

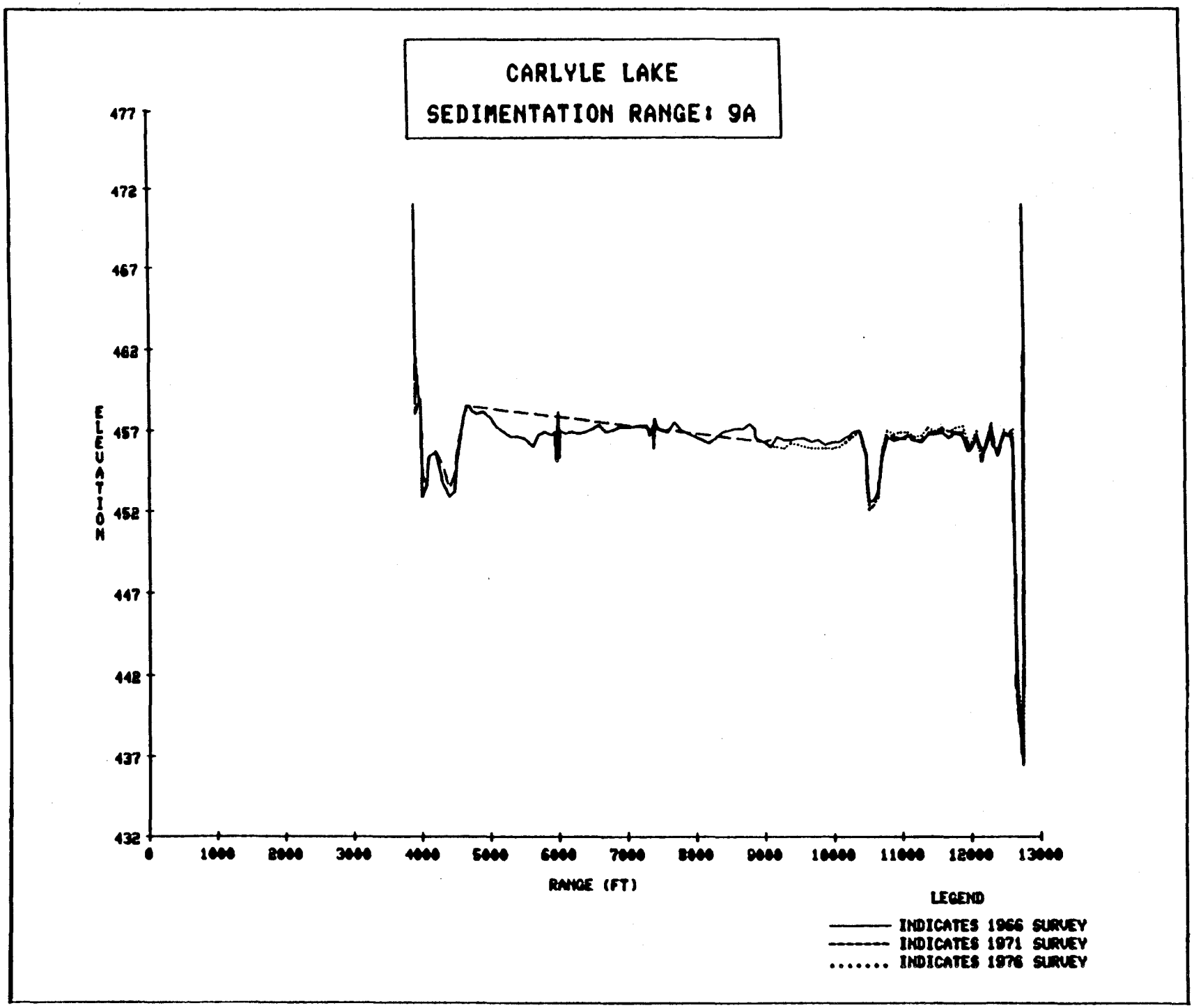
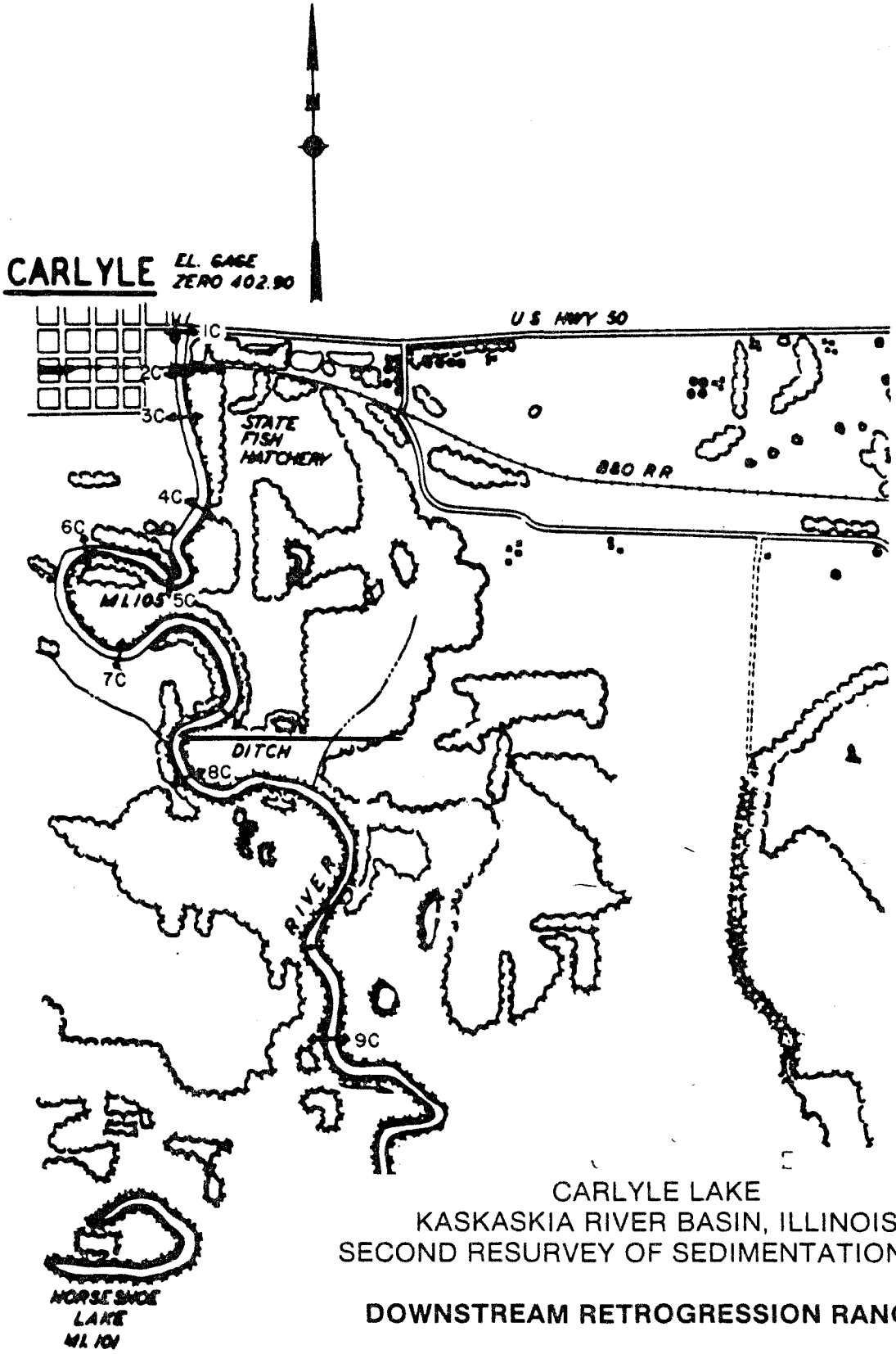

CARLYLE LAKE
SEDIMENTATION RANGE: 9A
ELEVATION
477
472
467
462
457
452
447
442
437
432
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
11000
12000
13000
RANGE (FT)
LEGEND
INDICATES 1966 SURVEY
INDICATES 1971 SURVEY
INDICATES 1976 SURVEY

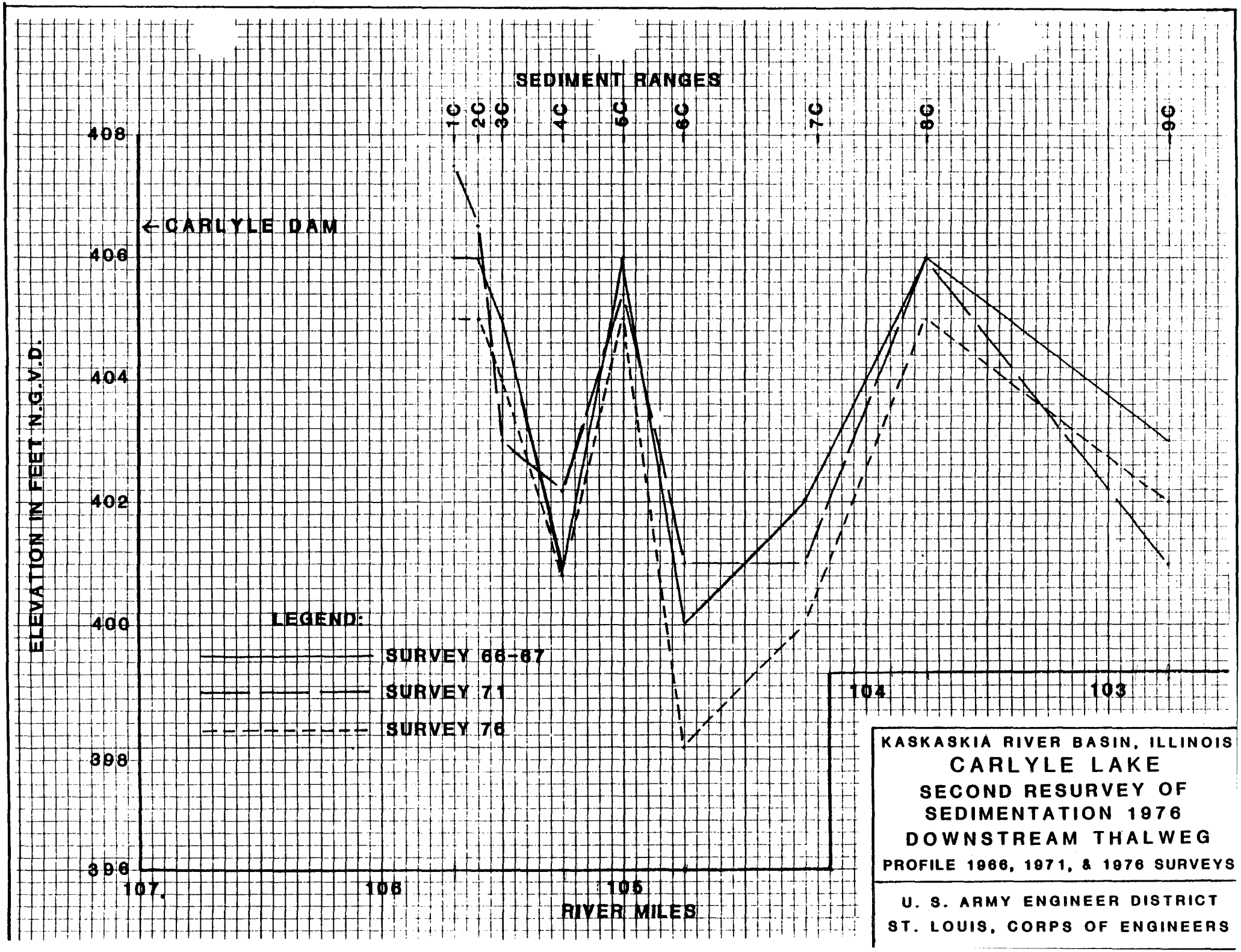
PLATE 14

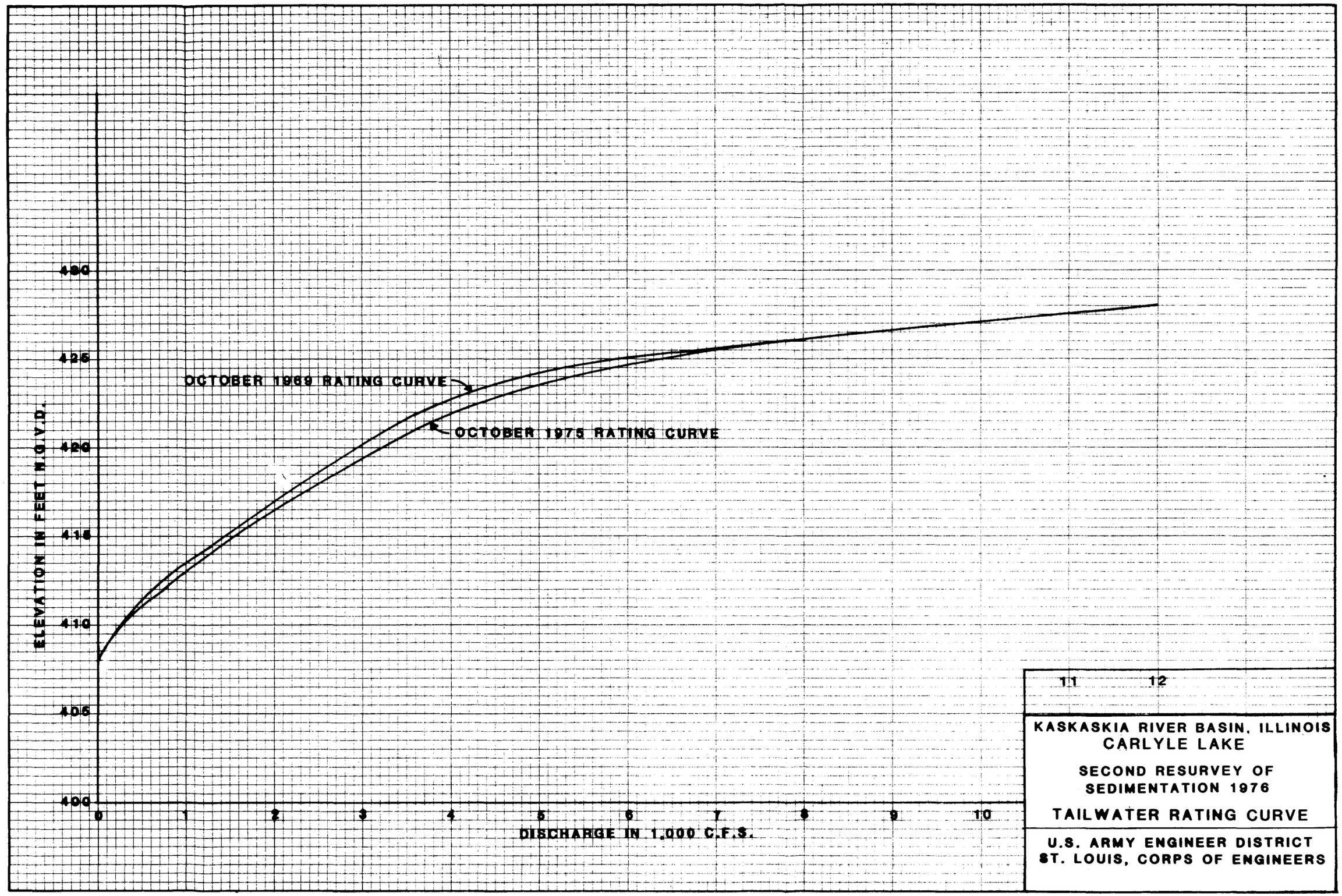


CARLYLE LAKE
KASKASKIA RIVER BASIN, ILLINOIS
SECOND RESURVEY OF SEDIMENTATION 1976

DOWNSTREAM RETROGRESSION RANGES

U. S. ARMY ENGINEER DISTRICT, ST. LOUIS
CORPS OF ENGINEERS
ST. LOUIS, MISSOURI


SEDIMENT RANGES
1C
2C
3C
4C
5C
6C
7C
8C
9C
408
406
404
402
400
398
396
← CARLYLE DAM
ELEVATION IN FEET N.G.V.D.
LEGEND:
SURVEY 66-67
SURVEY 71
SURVEY 76
107
106
105
104
103
RIVER MILES
KASKASKIA RIVER BASIN, ILLINOIS
CARLYLE LAKE
SECOND RESURVEY OF
SEDIMENTATION 1976
DOWNSTREAM THALWEG
PROFILE 1966, 1971, & 1976 SURVEYS
U. S. ARMY ENGINEER DISTRICT
ST. LOUIS, CORPS OF ENGINEERS

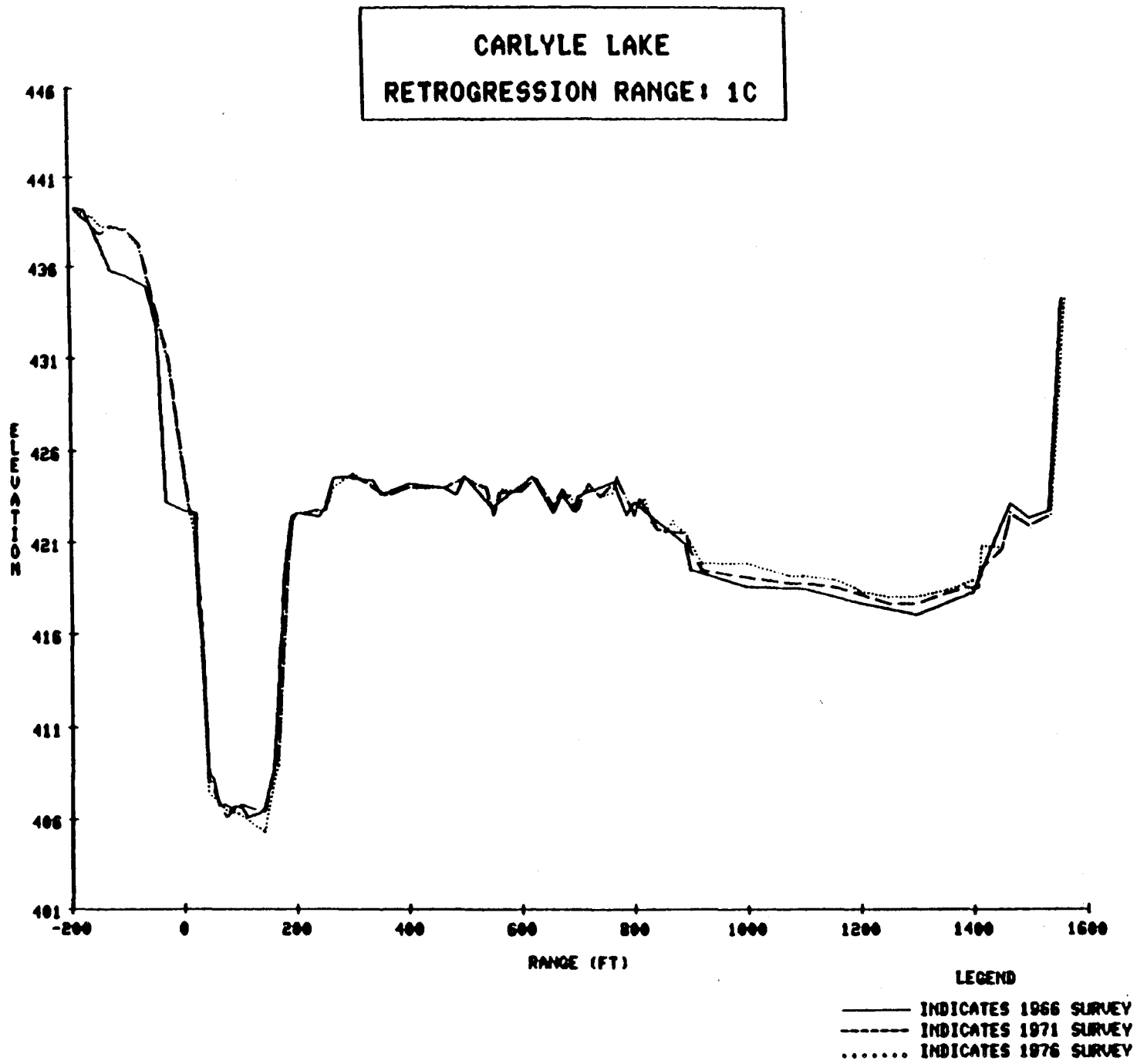


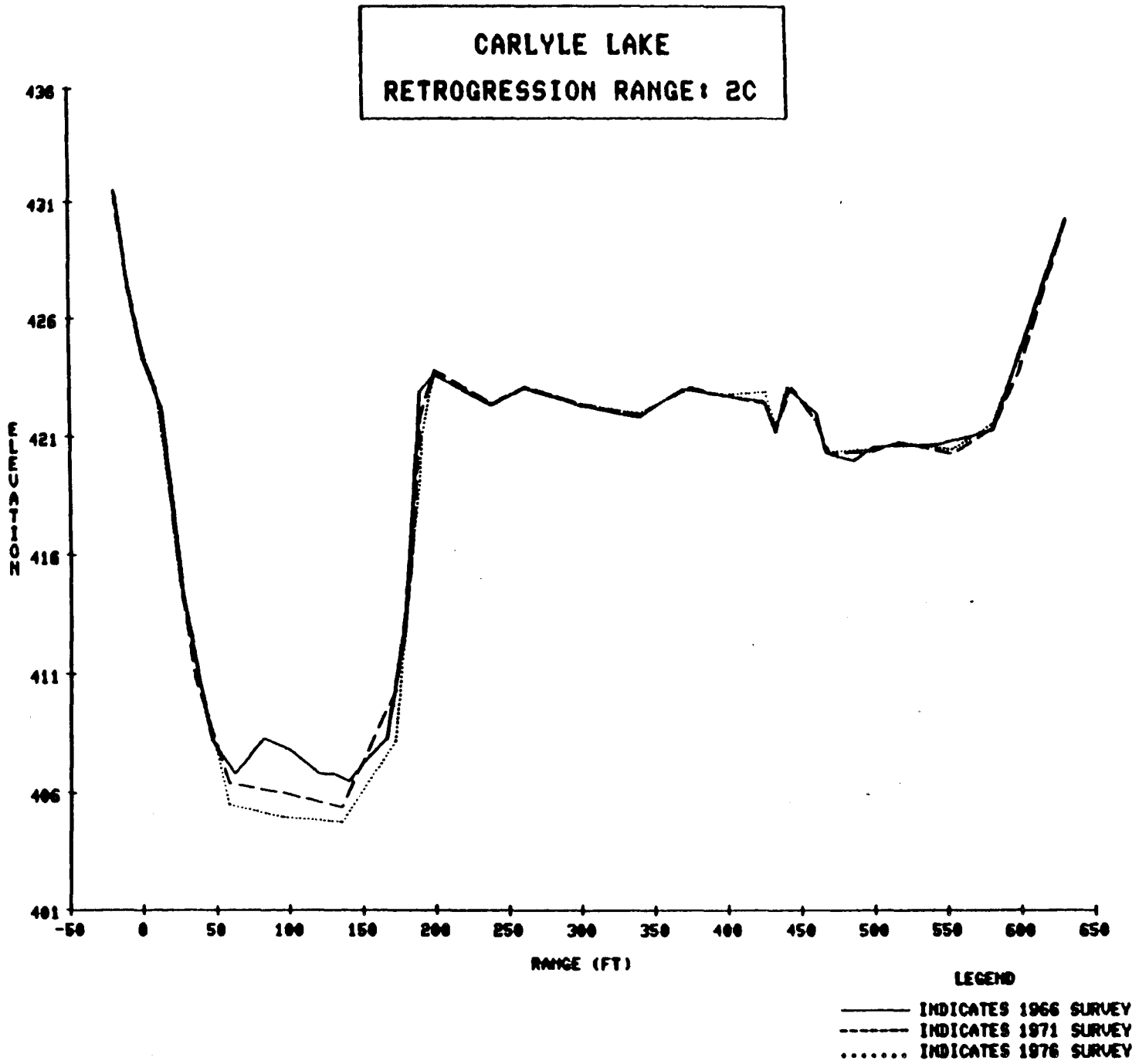
KASKASKIA RIVER BASIN, ILLINOIS
CARLYLE LAKE

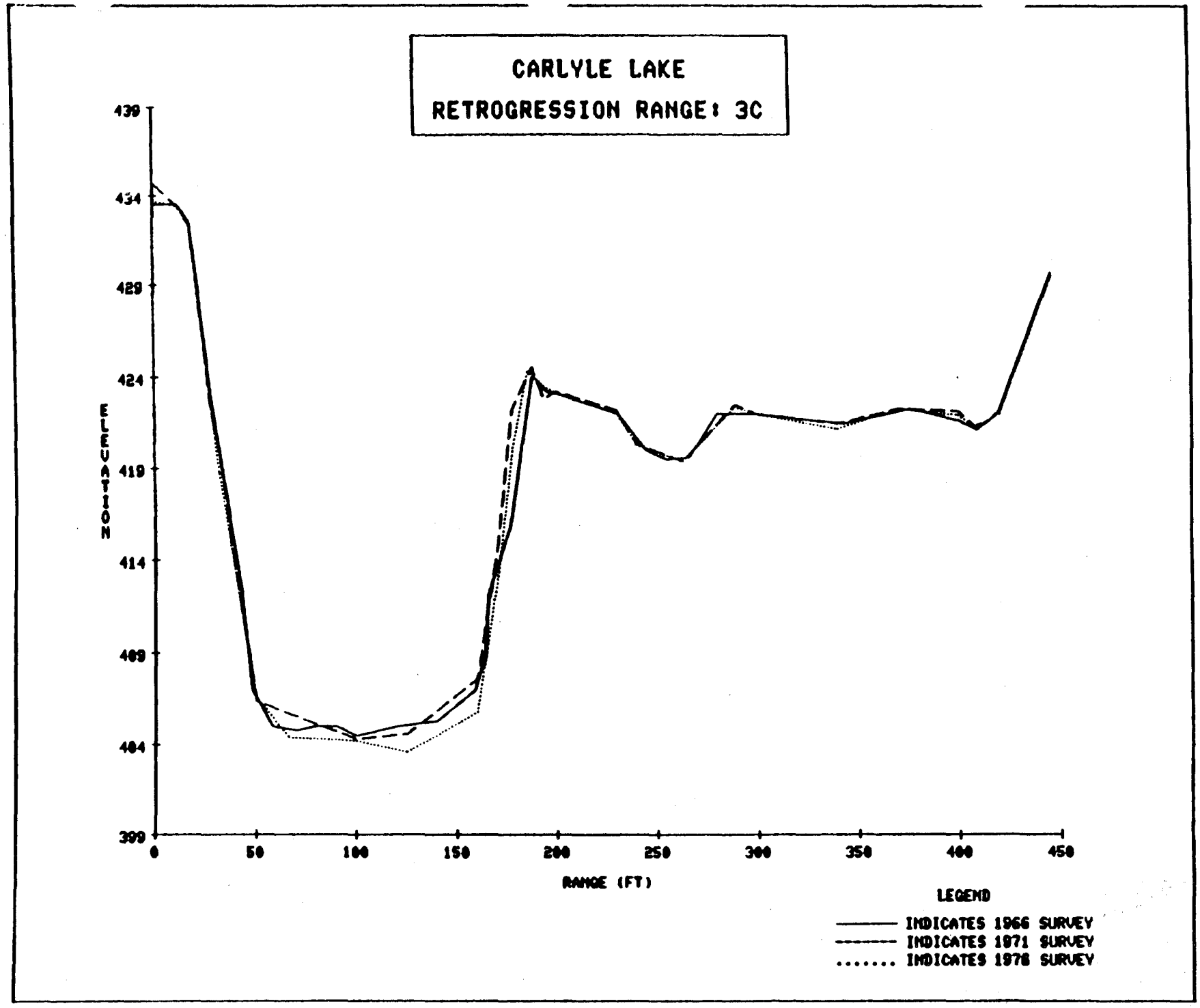
SECOND RESURVEY OF
SEDIMENTATION 1976

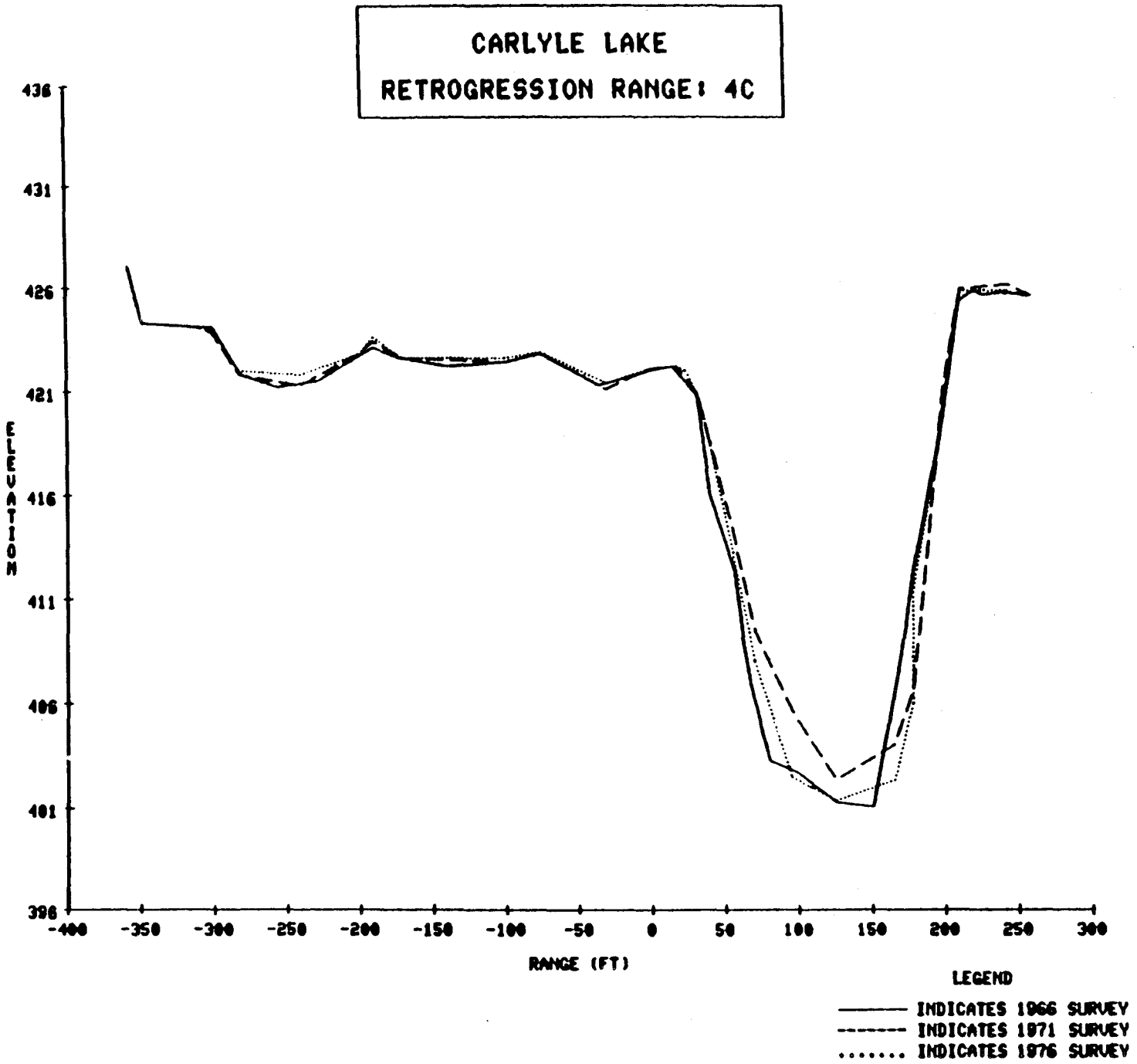
TAILWATER RATING CURVE

U.S. ARMY ENGINEER DISTRICT
ST. LOUIS, CORPS OF ENGINEERS


CARLYLE LAKE
RETROGRESSION RANGE: 1C
ELEVATION
446
441
436
431
426
421
416
411
406
401
-200
0
200
400
600
800
1000
1200
1400
1600
RANGE (FT)
LEGEND
INDICATES 1966 SURVEY
INDICATES 1971 SURVEY
INDICATES 1976 SURVEY


CARLYLE LAKE
RETROGRESSION RANGE: 2C
ELEVATION
436
431
426
421
416
411
406
401
-50
0
50
100
150
200
250
300
350
400
450
500
550
600
650
RANGE (FT)
LEGEND
INDICATES 1966 SURVEY
INDICATES 1971 SURVEY
INDICATES 1976 SURVEY


CARLYLE LAKE
RETROGRESSION RANGE: 3C
ELEVATION
439
434
429
424
419
414
409
404
399
0
50
100
150
200
250
300
350
400
450
RANGE (FT)
LEGEND
INDICATES 1966 SURVEY
INDICATES 1971 SURVEY
INDICATES 1978 SURVEY


CARLYLE LAKE
RETROGRESSION RANGE: 4C
ELEVATION
436
431
426
421
416
411
406
401
396
-400
-350
-300
-250
-200
-150
-100
-50
0
50
100
150
200
250
300
RANGE (FT)
LEGEND
INDICATES 1966 SURVEY
INDICATES 1971 SURVEY
INDICATES 1976 SURVEY

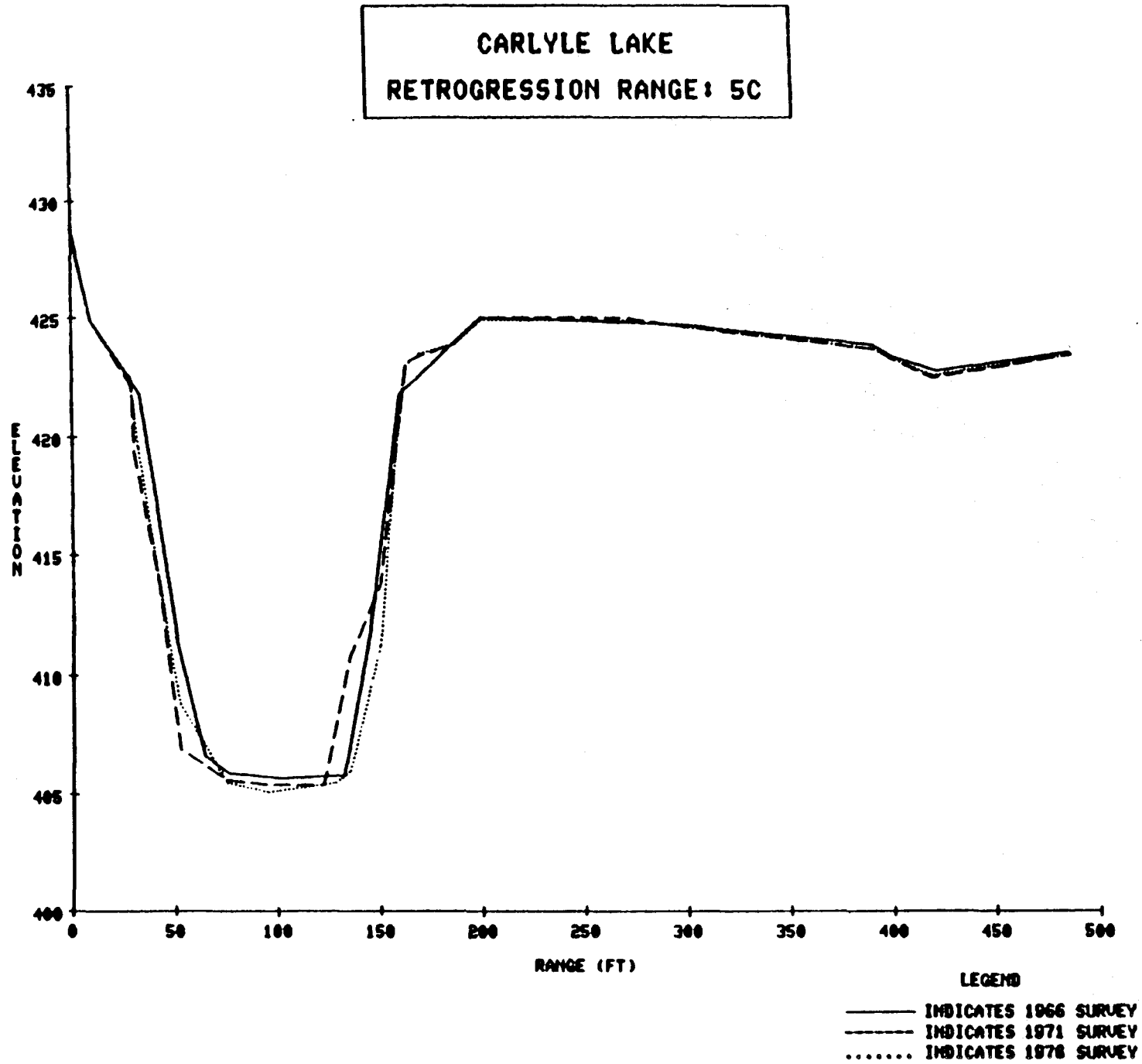
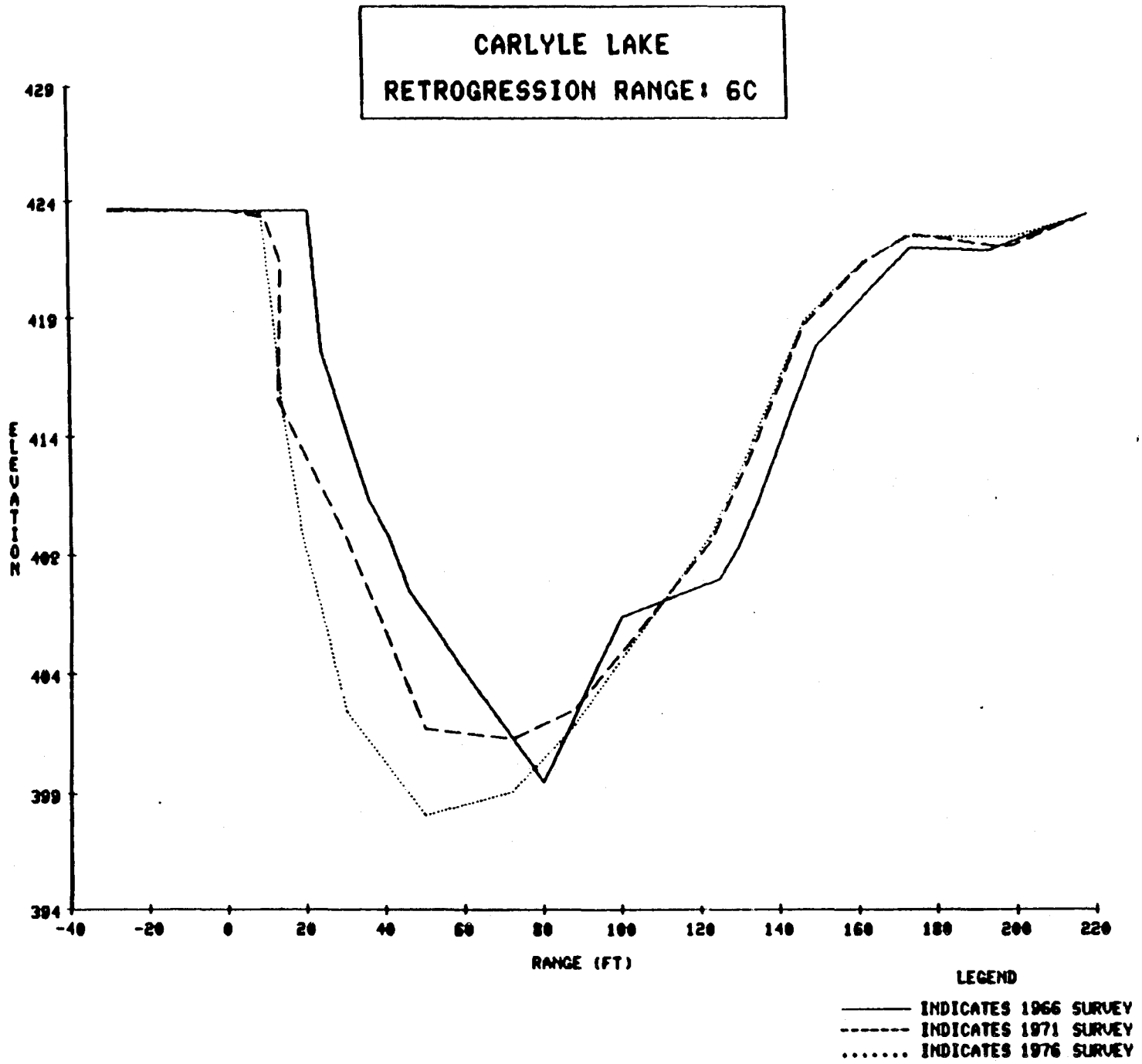
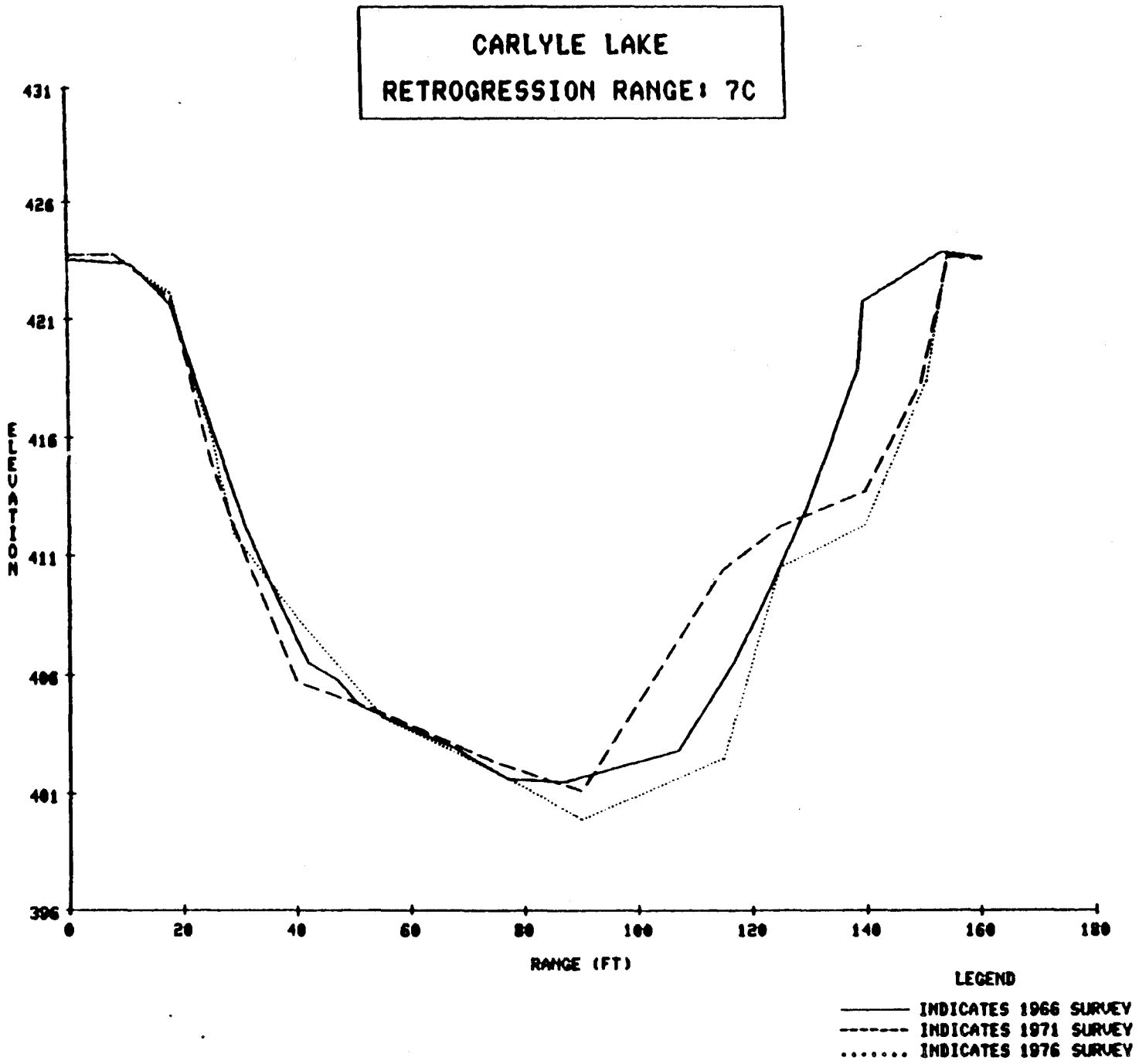
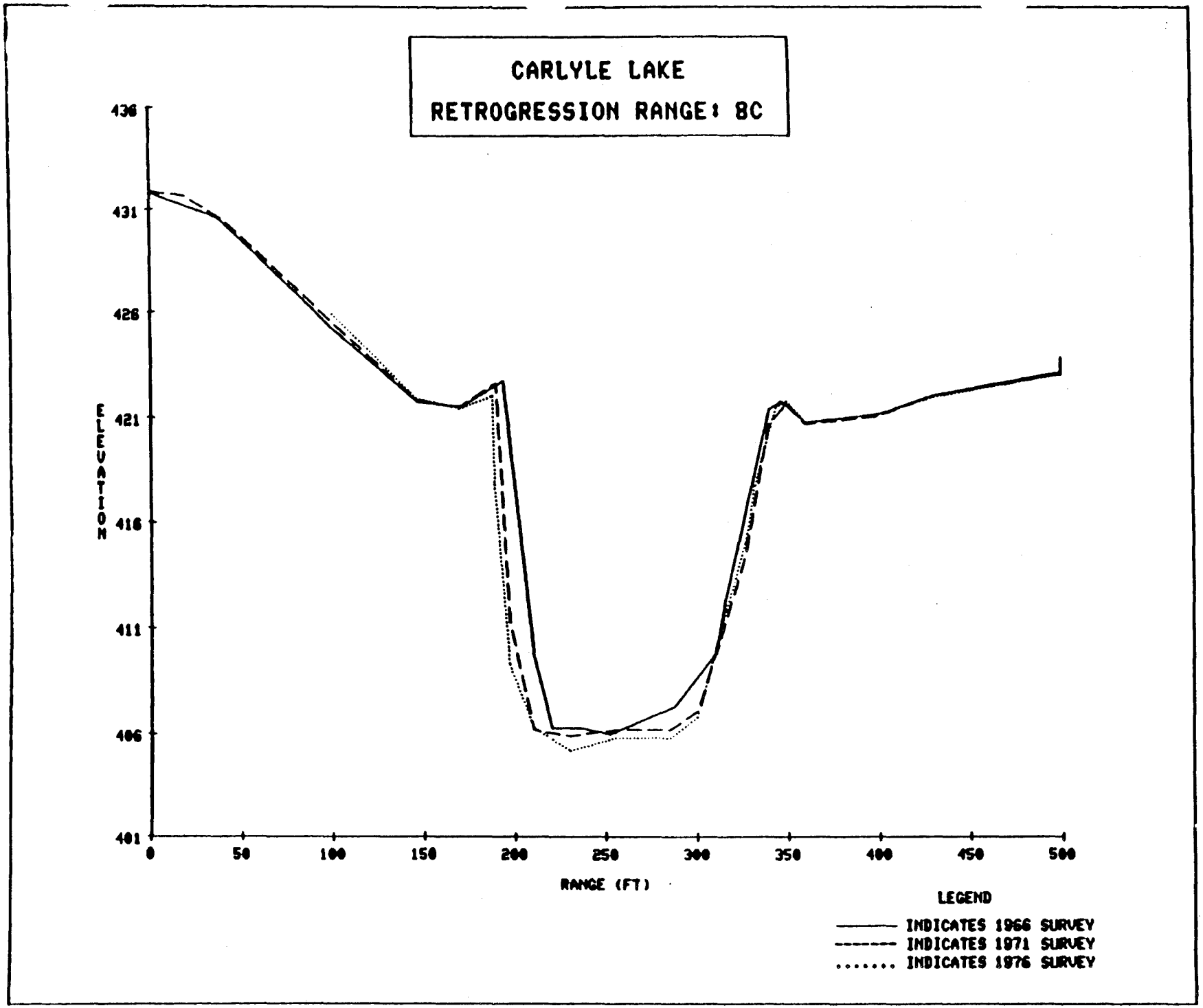
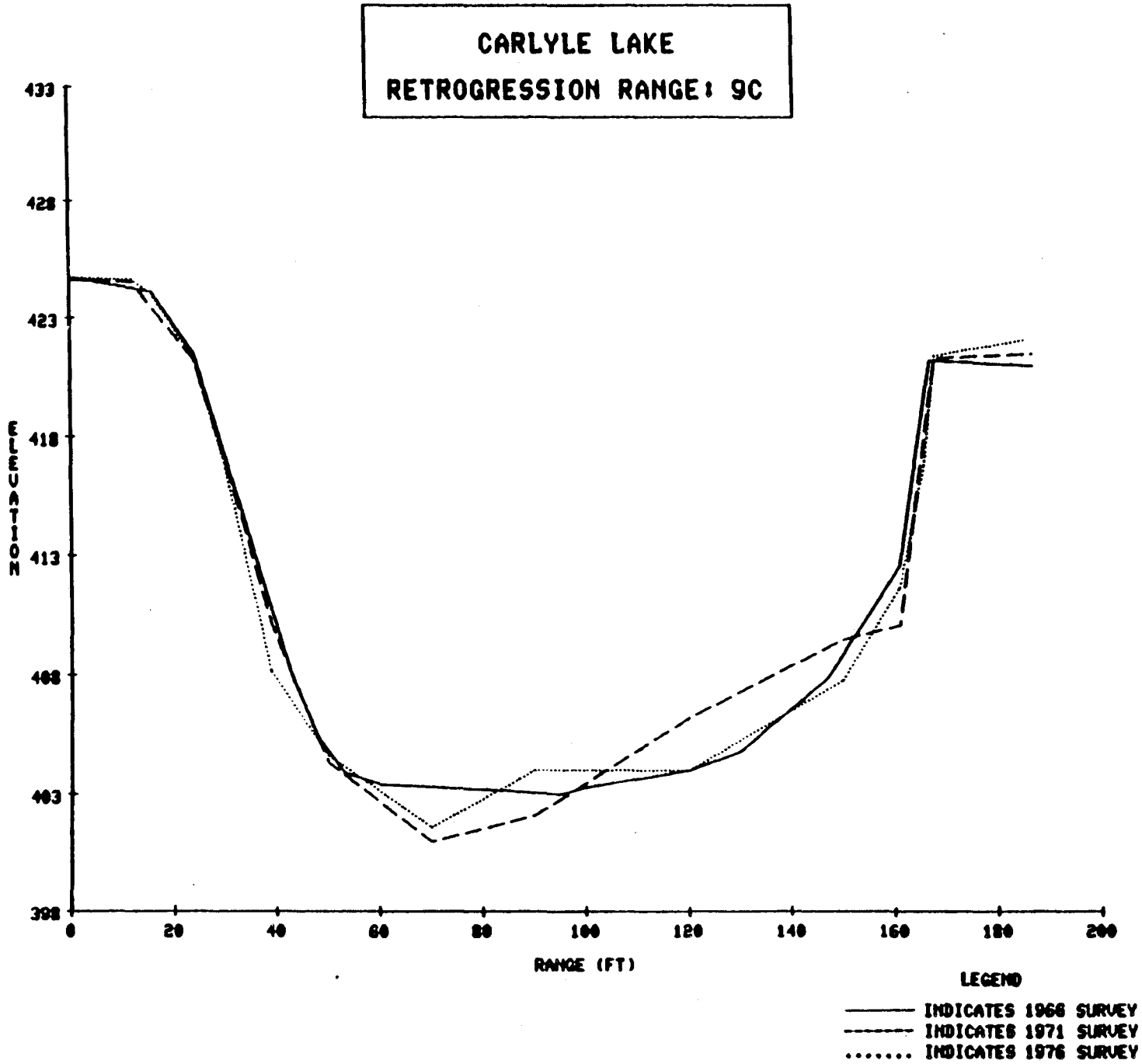

CARLYLE LAKE
RETROGRESSION RANGE: 5C
ELEVATION
435
430
425
420
415
410
405
400
0
50
100
150
200
250
300
350
400
450
500
RANGE (FT)
LEGEND
INDICATES 1966 SURVEY
INDICATES 1971 SURVEY
INDICATES 1978 SURVEY

PLATE 22


CARLYLE LAKE
RETROGRESSION RANGE: 6C
ELEVATION
429
424
419
414
409
404
399
394
-40
-20
0
20
40
60
80
100
120
140
160
180
200
220
RANGE (FT)
LEGEND
INDICATES 1966 SURVEY
INDICATES 1971 SURVEY
INDICATES 1976 SURVEY


CARLYLE LAKE
RETROGRESSION RANGE: 7C
ELEVATION
431
426
421
416
411
406
401
396
0
20
40
60
80
100
120
140
160
180
RANGE (FT)
LEGEND
INDICATES 1966 SURVEY
INDICATES 1971 SURVEY
INDICATES 1976 SURVEY


CARLYLE LAKE
RETROGRESSION RANGE: 8C
436
431
426
421
416
411
406
401
ELEVATION
0
50
100
150
200
250
300
350
400
450
500
RANGE (FT)
LEGEND
INDICATES 1966 SURVEY
INDICATES 1971 SURVEY
INDICATES 1976 SURVEY


CARLYLE LAKE
RETROGRESSION RANGE: 9C
ELEVATION
433
428
423
418
413
408
403
398
0
20
40
60
80
100
120
140
160
180
200
RANGE (FT)
LEGEND
INDICATES 1966 SURVEY
INDICATES 1971 SURVEY
INDICATES 1976 SURVEY

RESERVOIR SEDIMENT
DATA SUMMARY

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS

CARLYLE LAKE
NAME OF RESERVOIR

DATA SHEET NO.

DAM

1. OWNER DA, CORPS OF ENGRS.	2. STREAM KASKASKIA RIVER	3. STATE ILLINOIS
4. SEC. 17-18 TWP. 2N RANGE 2W	5. NEAREST P O CARLYLE, IL	6. COUNTY CLINTON
7. LAT ° ' " LONG. ° ' "	8. TOP OF DAM ELEVATION 472.0	9. SPILLWAY CREST ELEV. 463.5 1/

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	462.5	58,447	694,050	974,645	1 Apr. 1967
b. MULTIPLE USE	445.0	24,583	230,227 2/	280,595	
c. POWER					16. DATE NORMAL OPER. BEGAN
d. WATER SUPPLY					
e. IRRIGATION					
f. CONSERVATION					1 Aug. 1970
g. INACTIVE	429.5	6,672	50,368	50,368	

17. LENGTH OF RESERVOIR JOINT USE POOL 15.1 MILES; AV. WIDTH OF RESERVOIR 2.5 MILES

WATERSHED

18. TOTAL DRAINAGE AREA 2,680 SQ. MI.	22. MEAN ANNUAL PRECIPITATION 39.04 (11) INCHES
19. NET SEDIMENT CONTRIBUTING AREA 1,535 SQ. MI.	23. MEAN ANNUAL RUNOFF 12.3 (11) INCHES
20. LENGTH 120 MILES; AV. WIDTH 22.3 MILES	24. MEAN ANNUAL RUNOFF 1,757,970 (11) AC.-FT.
21. MAX. ELEV. 725; MIN. ELEV. 405	25. ANNUAL TEMP. MEAN 55° RANGE -34° to +115°

SURVEY DATA

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.
April 1967			RANGE(D)	9(R)	58,447	974,645	(2) 0.91 3/
	4.3	4.3					
August 1971			RANGE(D)	9(R)	58,447	961,914	0.90 3/
	4.6	8.9					
March 1976			RANGE(D)	9(R)	58,447	958,653	0.90 3/

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
April 1967	38.9	1,475,723	1,796,562	6,345,607	1,475,723	6,345,607
August 1971	39.0	2,201,302	3,179,291	10,125,991	1,850,741	16,471,598
March 1976						

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
April 1967	12,731	2,960	1.928	12,731	2,960	1.928
August 1971	3,261	709	.462	15,992	1,797	1.171
March 1976						

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, PCT.	
		a. PERIOD	b. TOTAL TO DATE	a. AV. ANN.	b. TOT. TO DATE	a. PERIOD	b. TOT. TO DATE
April 1967	4/	4/	4/	0.30	1.31	4/	4/
August 1971	4/	4/	4/	0.18	1.64	4/	4/
March 1976							

ENG FORM 1787 NOV 66 PREVIOUS EDITIONS ARE OBSOLETE.

26. DATE OF SURVEY	43. DEPTH DESIGNATION RANGE IN FEET BELOW, AND ABOVE, CREST ELEVATION											
	55-50	50-45	45-40	40-35	35-30	30-25	25-20	20-15	15-10	10-5	5-Crest	
	PERCENT OF TOTAL SEDIMENT LOCATED WITHIN DEPTH DESIGNATION											
April 1967												
Aug. 1971	0.0	0.9	2.9	9.0	22.8	4.0	30.2	24.1	6.1	0.0	0.0	
March 1976	0.0	0.0	0.4	0.9	3.0	22.9	9.6	9.4	26.7	27.1	0.0	

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														
April 1967															
Aug. 1971	9.0	12.1	17.5	18.8	18.3	9.9	3.9	3.5	3.5	3.5					
March 1976	6.9	11.6	18.1	19.4	21.3	12.7	4.4	2.7	2.6	0.3					

45. RANGE IN RESERVOIR OPERATION

WATER YEAR	MAX. ELEV.	MIN. ELEV.	INFLOW, AC.-FT.	WATER YEAR	MAX. ELEV	MIN. ELEV.	INFLOW, AC.-FT.
1967	435.9	425.2	2,005,901	1975	446.4	439.9	2,090,527
1968	451.2	429.8	1,342,311	1976	455.4	439.7	802.991
1969	450.2	429.6	1,796,562				
1970	455.0	433.1	1,485,455				
1971	446.1	440.3	821,865				
1972	448.9	440.0	927,602				
1973	455.5	442.2	3,021,705				
1974	455.1	442.7	3,179,291				

46. ELEVATION-AREA-CAPACITY DATA

ELEVATION	AREA	CAPACITY	ELEVATION	AREA	CAPACITY	ELEVATION	AREA	CAPACITY
5/								
415	1,120	5,040	450	32,367	406,281			
420	2,061	12,595	455	41,548	589,220			
425	3,507	26,097	460	52,398	821,429			
430	6,164	49,066	465	65,113	1,111,542			
435	11,198	95,211	470	84,360	1,473,638			
440	16,939	165,227						
445	23,852	267,140						

47. REMARKS AND REFERENCES

1/ Top of moveable gates in closed position, includes 1 ft. freeboard. Flood control pool(el. 462.5), used for items 19,31,32,33,41,43.
2/ Includes 32,692 acre-feet for water supply, remainder for navigation.
3/ Lake Shelbyville controls 39% of watershed. C/I ratio adjusted to reflect this.
4/ No sediment samples taken.
5/ 1976 data based on prismoidal method.
Land use in watershed: 86 percent farmland.

48. AGENCY MAKING SURVEY

49. AGENCY SUPPLYING DATA U.S. Corps of Engrs., St. Louis Dist 50. DATE 3 December 1980