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WILLIAM C. ACKERMANN, CHIEF

SEDIMENT DEPOSITION OF LAKE CHAUTAUQUA

HAVANA, ILLINOIS

Ming T. Lee, P.E.
Associate Engineer

ILLINOIS STATE WATER SURVEY

Urbana, Illinois

April, 1976

... sediment survey was made in 1950 ...
... an effort to appraise the amount of sedimentation
... that has occurred in the past 25 years, a survey of the water
... depth of Lake Chautauqua was made by the Illinois Natural History
... Survey on February 1976 through the ice.
... It is worthwhile to note that a new cross-dike was built
... in the lake in about 1970. Hence, the lake was divided into upper
... and lower pools. A higher water level is maintained in the upper
... pool (northern part of the lake). The water level in the lower
... pool (southern part of the lake) rises and falls directly with
... the Illinois River.
...
... The Results of 1976 Survey
... The locations of the cross-sections taken in the 1976 survey
... are the same as the 1950 survey shown in Figure 1. The
... 1976 lake bed elevations were plotted on Figures 2 to 5. Based on
... these cross-sections, the lake capacity was calculated for 1925,
... 1950 and 1976 based on the data shown in Table 1. The
... results indicated that, during the 1950-1976 period, the sediment
... deposition pattern was relatively uniform in all the segments.
... However, during the 1950-1976 period, the segments A and H which
... are located at the southern and northern ends of the lake, have
... the highest capacity losses. Those segments near the new cross-dike
... (segment E on Figure 1) have less sediment deposition.
... The results are summarized in Table 2. The significant
... findings are:

Sediment Deposition of Lake Chautauqua, Havana, Illinois

Background

The previous sediment survey was made in 1950 by Stall and Melsted [1]. In an effort to appraise the amount of sedimentation that has occurred in the past 25 years, a survey of the water depth of Lake Chautauqua was made by the Illinois Natural History Survey on February 9-11, 1976. The survey was made through the ice.

It is worthwhile to note here that a new cross-dike was built in the lake in about 1970. Hence, the lake was divided into upper and lower pools. A higher water level is maintained in the upper pool (northern part of the lake). The water level in the lower pool (southern part of the lake) rises and falls directly with the Illinois River.

The Results of 1976 Survey

The locations of the cross-sections taken in the 1976 survey are the same as the 1950 survey [1] as shown in Figure 1. The 1976 lake bed elevations were plotted on Figures 2 to 8. Based on these cross-sections, the lake capacity was calculated for 1926, 1950 and 1976 based on eight segments as shown in Table 1. The results indicated that, during the 1926-1950 period, the sediment deposition pattern was relatively uniform in all the segments. However, during the 1950-1976 period, the segments A and H which are located at the southern and northern ends of the lake, have the highest capacity losses. Those segments near the new cross-dike at segment E on Figure 1) have less sediment deposition.

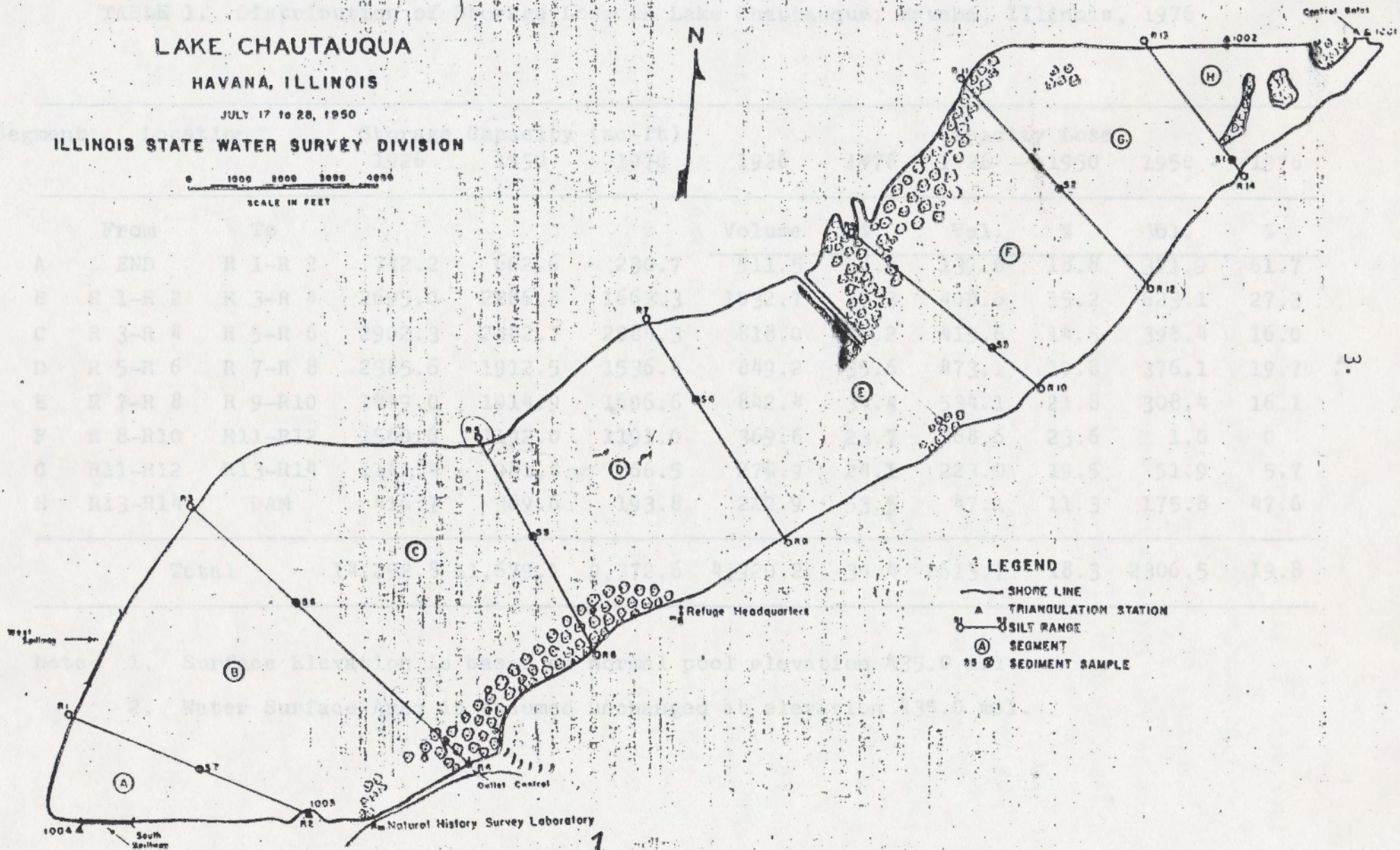
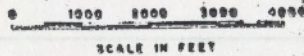
The results are summarized in Table 2. The significant findings are:

LAKE CHAUTAUQUA

HAVANA, ILLINOIS

JULY 17 to 28, 1950

ILLINOIS STATE WATER SURVEY DIVISION



- LEGEND**
- SHORE LINE
 - ▲ TRIANGULATION STATION
 - ▨ SILT RANGE
 - ⊙ SEGMENT
 - SS ⊙ SEDIMENT SAMPLE

Figure 3. Base Map of Lake Chautauqua

TABLE 1. Distribution of Storage Loss in Lake Chautauque, Havana, Illinois, 1976

Segment	Location		Storage Capacity (ac-ft)			Capacity Loss					
			1926	1950	1976	1926 - 1976		1926 - 1950		1950 - 1976	
	From	To				Volume	%	Vol.	%	Vol.	%
A	END	R 1-R 2	742.2	602.6	230.7	511.5	68.9	139.6	18.8	371.9	61.7
B	R 1-R 2	R 3-R 4	2695.0	2286.4	1663.3	1032.7	38.3	408.6	15.2	623.1	27.3
C	R 3-R 4	R 5-R 6	2902.3	2482.7	2084.3	818.0	28.2	419.6	14.5	398.4	16.0
D	R 5-R 6	R 7-R 8	2385.6	1912.5	1536.4	849.2	35.6	473.1	19.8	376.1	19.7
E	R 7-R 8	R 9-R10	2449.0	1914.9	1606.6	842.4	34.4	534.1	21.8	308.4	16.1
F	R 8-R10	R11-R12	1560.6	1192.0	1191.0	369.6	23.7	368.6	23.6	1.0	0
G	R11-R12	R13-R14	1141.4	981.4	866.5	274.9	24.1	223.0	19.5	51.9	5.7
H	R13-R14	DAM	416.7	369.6	193.8	222.9	53.5	47.1	11.3	175.8	47.6
Total			14,292.8	11,679.1	9,372.6	4,920.2	34.4	2613.7	18.3	2306.5	19.8

Note: 1. Surface Elevation is based on normal pool elevation 435.0 msl.

2. Water Surface Area is assumed unchanged at elevation 435.0 msl.

(1) The average annual sediment accumulation is 110 acre-feet or 0.77% per year for the 1926-1950 period, and 88.7 acre-feet or 0.62% per year for the 1950-1976 period. This result indicates that the sedimentation rate of the past 26 years (1950-1976) is about 80% of that of 1926-1950 period.

(2) The average rate of rise of the lake bed is defined as the ratio of the annual sediment deposition volume to the lake surface area; it is expressed in terms of inches per year. The average rate of rise of the lake bed on Lake Chautauqua is about 0.37 inches per year in the 1926-1950 period and 0.30 inches per year in the 1950-1976 period. This rate is smaller than those of Lake Meredosia (0.41 inches per year) and Lake DePue (0.59 inches per year) [2, 3].

1926-1950	11.3	Percent
1950-1976	10.2	Percent
1926-1976	10.5	Percent
1926-1950	0.77	Percent per year
1950-1976	0.62	"
1926-1976	0.69	"
1926-1950	0.37	Inches per year
1950-1976	0.30	Inches per year
1926-1976	0.33	Inches per year
Average Depth (1976)	2.63	Feet
Expected Life ^{*1}	96	Years

Note: ^{*1} Expected life is defined as the ratio of average depth and annual rate of rise of lake bed.

TABLE 2. Summary of Sediment Data on Lake Chautauqua, Havana, Illinois, 1976

Reservoir	Quantity	Unit
(1) Area	3,562	Acres
(2) Storage Capacity		
Original	14,293	Acre-feet
1950	11,679	"
1976	9,373	"
(3) Sedimentation		
1926-1950 (23.75 yrs.)	2,614	Acre-feet
1950-1976 (26 yrs.)	2,307	"
1926-1976 (49.75 yrs.)	4,921	"
(4) Average Annual Accumulation		
1926-1950	110.1	Ac-ft per year
1950-1976	88.7	"
1926-1976	98.9	"
(5) Depletion of storage		
Loss of Original Capacity		
1926-1950	18.3	Percent
1950-1976	16.2	Percent
1926-1976	34.5	Percent
(6) Annual Rate of Loss of Original Capacity		
1926-1950	0.77	Percent per year
1950-1976	0.62	"
1926-1976	0.69	"
(7) Annual Rate of rise of Lake Bottom		
1926-1950	0.37	Inches per year
1950-1976	0.30	Inches per year
1926-1976	0.33	Inches per year
(8) Average Depth (1976)	2.63	Feet
(9) Expected Life ^{*1}	96	Years

Note: ^{*1} Expected life is defined as the ratio of average depth and annual rate of rise of lake bed.

References

- [1] Stall, J. B. and S. W. Melsted, "The Silting of Lake Chautauqua, Havana, Illinois", Report of Investigation No. 8, Illinois State Water Survey, Urbana, Illinois, 1951.
- [2] Ming T. Lee and John B. Stall, "The 1975 Sediment Survey of Lake Meredosia, Meredosia, Illinois", Report prepared for Division of Water Resources, Illinois State Water Survey, Urbana, Illinois, 1976.
- [3] Ming T. Lee and John B. Stall, "Sediment Deposition in Lake DePue, DePue, Illinois and Its Implications for Future Lake Management", Report prepared for Department of Conservation and Village of DePue, Illinois State Water Survey, Urbana, Illinois, March, 1976.

Note Figs. 2 to 8 can be found in lake-x-section file.

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