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SURFACE WATER SECTION
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UNIVERSITY OF ILLINOIS

ENR

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Energy and Natural Resources

SWS Contract Report 291

SEDIMENTATION SURVEYS OF PARADISE LAKE AND LAKE MATTOON, MATTOON, ILLINOIS

by

William C. Bogner

Prepared in cooperation with
the Illinois Department of Transportation, Division of Water Resources,
and the Water Resources Center at the University of Illinois

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SEDIMENTATION SURVEYS
OF PARADISE LAKE AND LAKE MATTOON,
MATTOON, ILLINOIS

by William C. Bogner

Introduction

The Illinois State Water Survey (SWS) in cooperation with the Illinois Department of Transportation, Division of Water Resources (DOWR) has performed sedimentation surveys of Paradise Lake and Lake Mattoon, the two water supply lakes for Mattoon, Illinois. The results of the 1979 and 1980 surveys are presented in this report.

Field data for the surveys were collected by a DOWR survey crew using SWS sediment surveying equipment. Grain size analyses of sediment samples as well as other chemical analyses were made by the University of Illinois Department of Agronomy for Lake Paradise and by the SWS Sediment Laboratory for Lake Mattoon. Calculations of water and sediment volumes and sedimentation rates were performed by SWS personnel.

This work was accomplished as part of the regular work of the Illinois State Water Survey under the administrative guidance of Stanley A. Changnon, Jr., Chief, and Michael L. Terstriep, Head of the Surface Water Section.

Figures for the report were prepared by William Motherway and Linda Riggin under the supervision of John Brother. The report was edited by Gail Taylor, and Pamela Lovett and Kathy Brown prepared the camera-ready copy.

Reservoir Locations

Paradise Lake and Lake Mattoon are located on the main stem of the Little Wabash River.

The dam for Paradise Lake is about 4 miles southwest of the City of Mattoon in Section 8, Township 11N., Range 7E., Coles County. The lake lies entirely in Coles County.

The dam for Lake Mattoon is about 12 miles southwest of the City of Mattoon in Section 1, Township 10N., Range 6E., Shelby County. The lake lies in Shelby, Cumberland, and Coles Counties.

Watershed

The watershed of Paradise Lake lies in Coles and Moultrie Counties and is a sub-basin of the Lake Mattoon watershed. The Lake Mattoon watershed consists of portions of Shelby, Cumberland, Coles, and Moultrie Counties. The principal land use in both watersheds is agriculture. The topography of the area is dominated by low slopes with deeply incised, well developed waterways. A map showing both watersheds is given in figure 1.

Geologically, there is a striking difference in the history of the two watersheds. The Lake Mattoon watershed is bisected approximately east to west by the end moraine of the first advance of the Wisconsin glacier. As a result, the northern half of the watershed, including the watershed of Paradise Lake, is composed primarily of glacial till materials, while the southern portion is composed primarily of glacial outwash and loess materials.

Historical Background

In the early 1900's, Mattoon, Illinois served as the terminal center for the "Big Four" Railroads. In 1908, the demands of the railroads for a reliable, high quality source of water forced private interests from

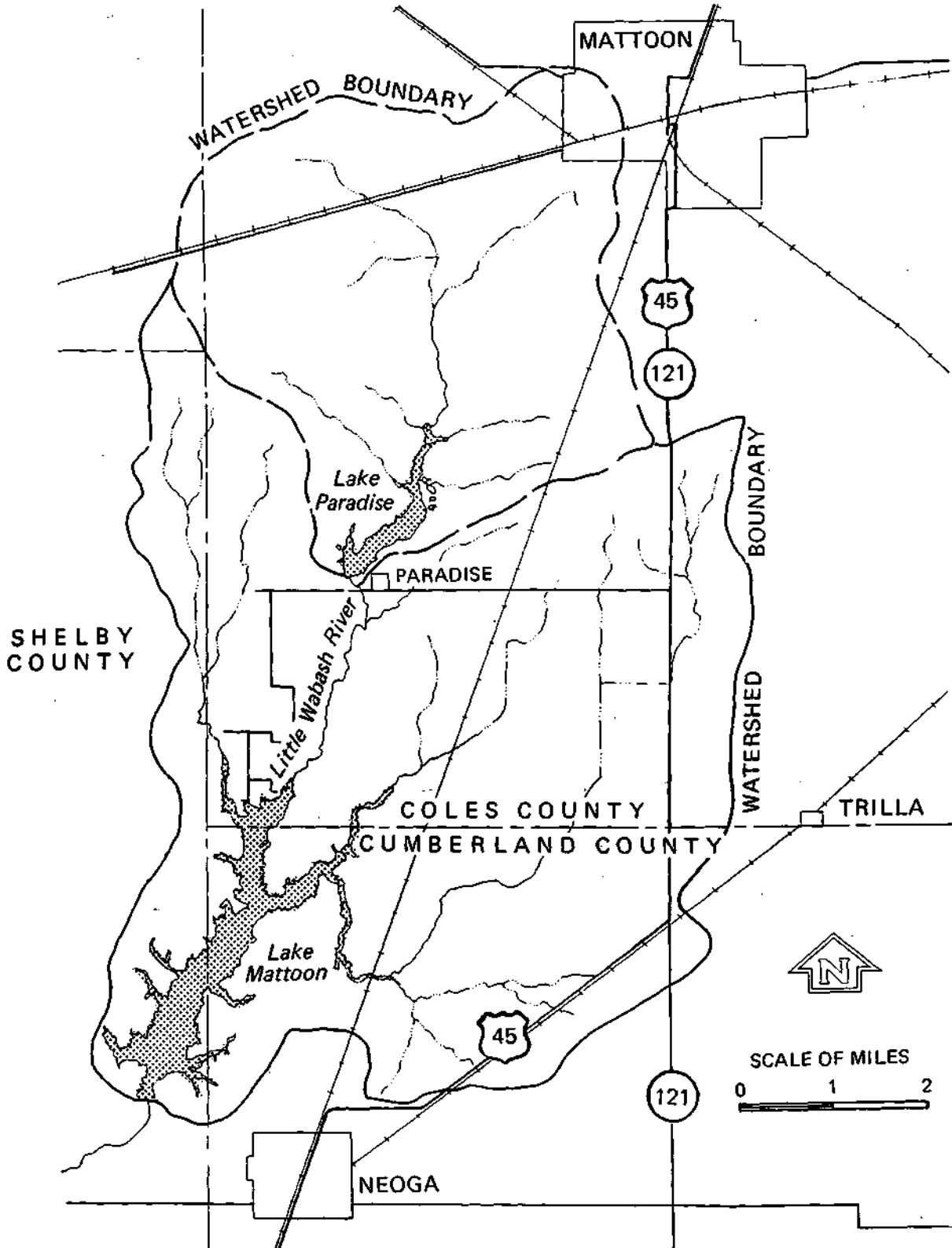


Figure 1. Watershed and location map of Paradise Lake and Lake Mattoon

the city to construct a small reservoir southwest of town. The dam for this reservoir was located just north of the current dam and spillway for Paradise Lake. The spillway of this reservoir was raised 2.5 feet in 1914 and 2.0 feet in 1922.

In 1931, the current dam and spillway were built with the spillway crest at an elevation of 684.1 feet above mean sea level. This spillway elevation resulted in a near total inundation of the original dam, the remnants of which can still be seen in Segment 3 of the lake (figure 2). Prior to the construction of the present Lake Mattoon, Paradise Lake was known as Lake Mattoon.

The City of Mattoon bought Paradise Lake in the mid-1930's. In order to guarantee itself a reliable water source through the twentieth century, the city constructed Lake Mattoon in 1958 to serve as a backup supply during periods of drought. Initially, the operating plan was to use Paradise Lake water for the city's water supply and to use Lake Mattoon to maintain the level of Paradise Lake. However, facilities now exist for pumping Lake Mattoon water directly to the treatment plant. The spillway elevation of Lake Mattoon is 632.0 feet above mean sea level.

Sediment Surveys

Sounding data were collected from 13 cross sections of Paradise Lake in 1979 and from 25 cross sections of Lake Mattoon in 1980. Figure 2 is a map of Paradise Lake showing the locations of the cross sections. Similarly, the Lake Mattoon survey layout is shown in figure 3a, b, and c. The range ends were monumented by installing concrete posts with railroad spikes imbedded in the tops.

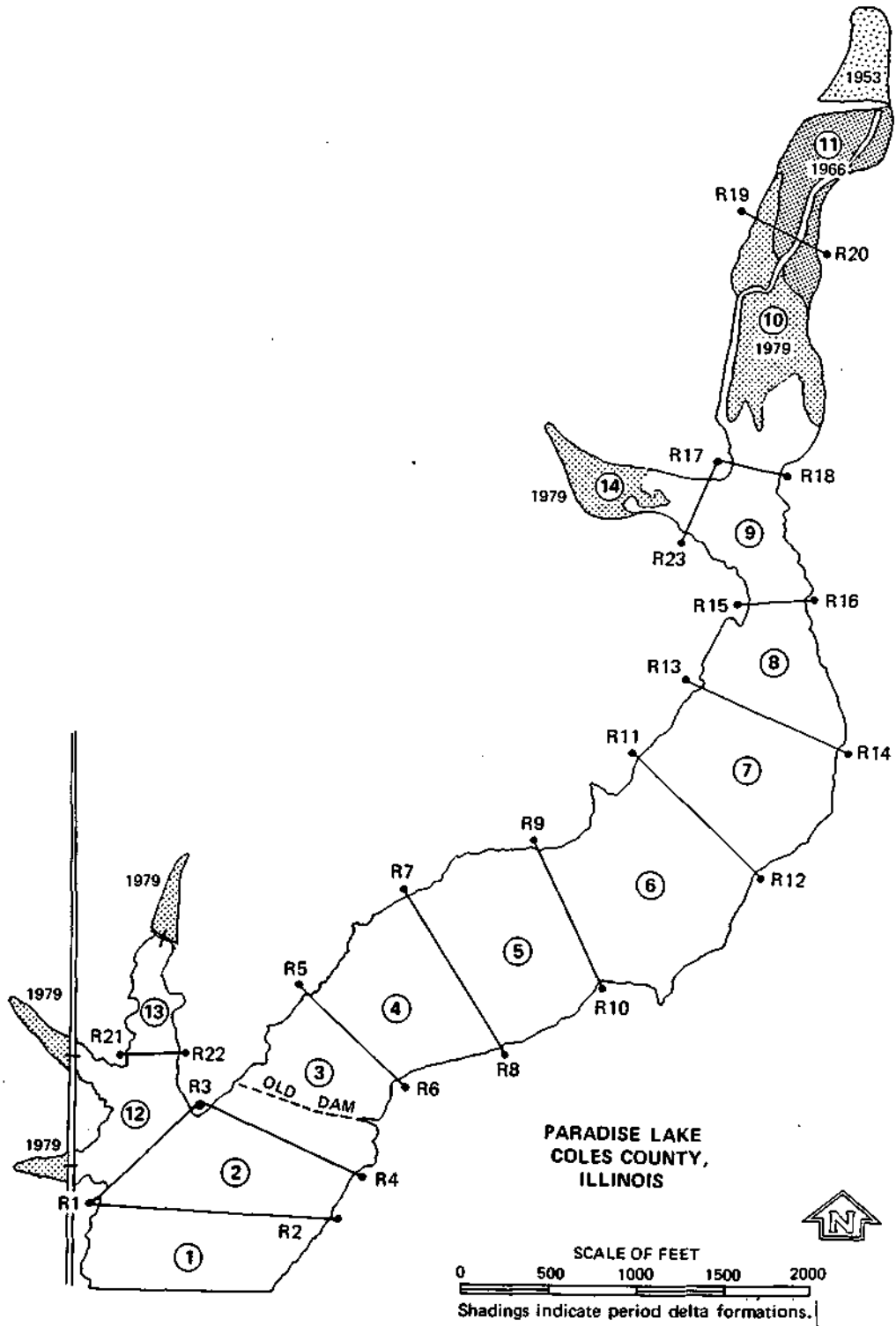


Figure 2. Paradise Lake and cross section locations

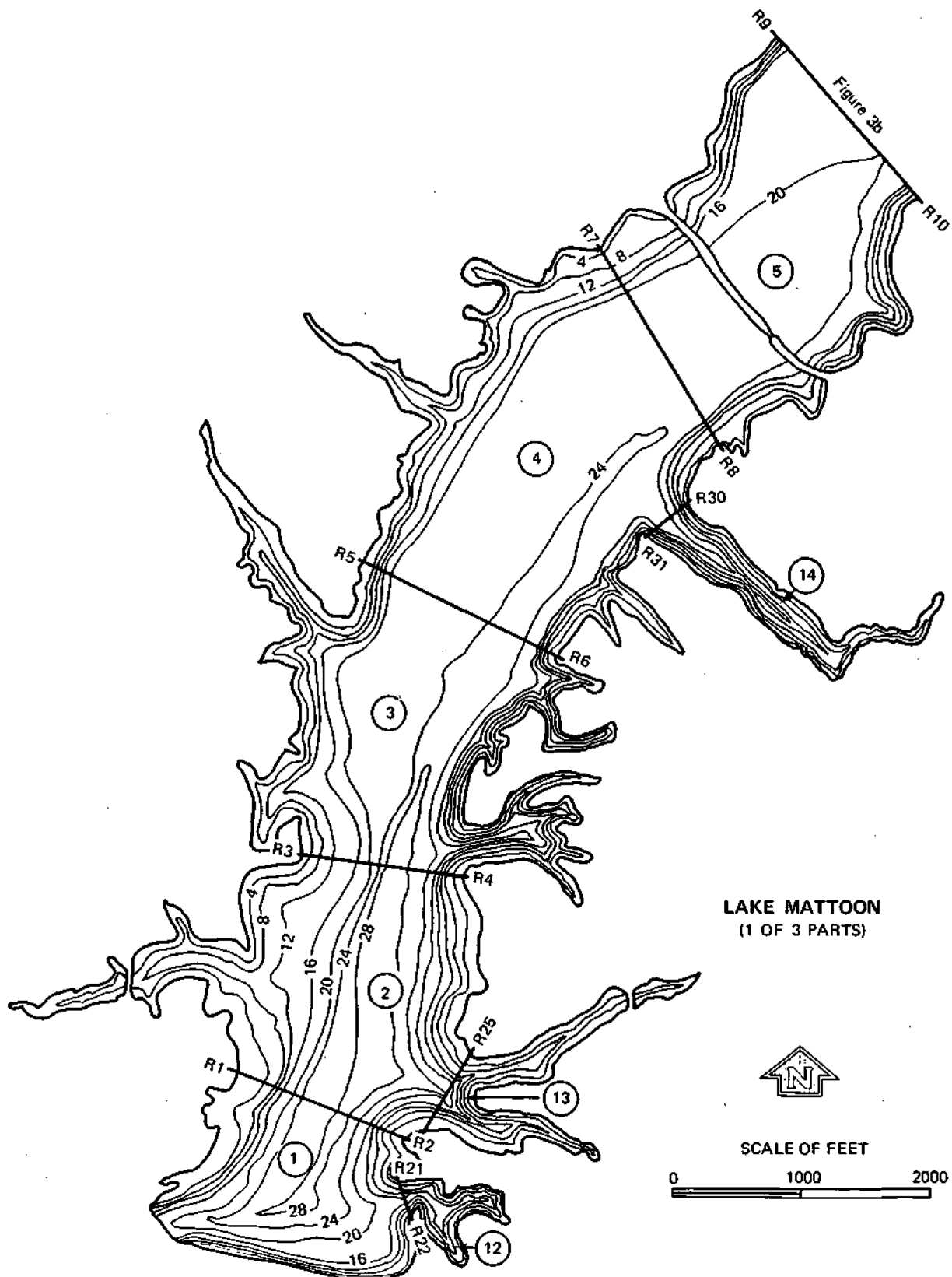


Figure 3a. Lake Mattoon and cross section locations

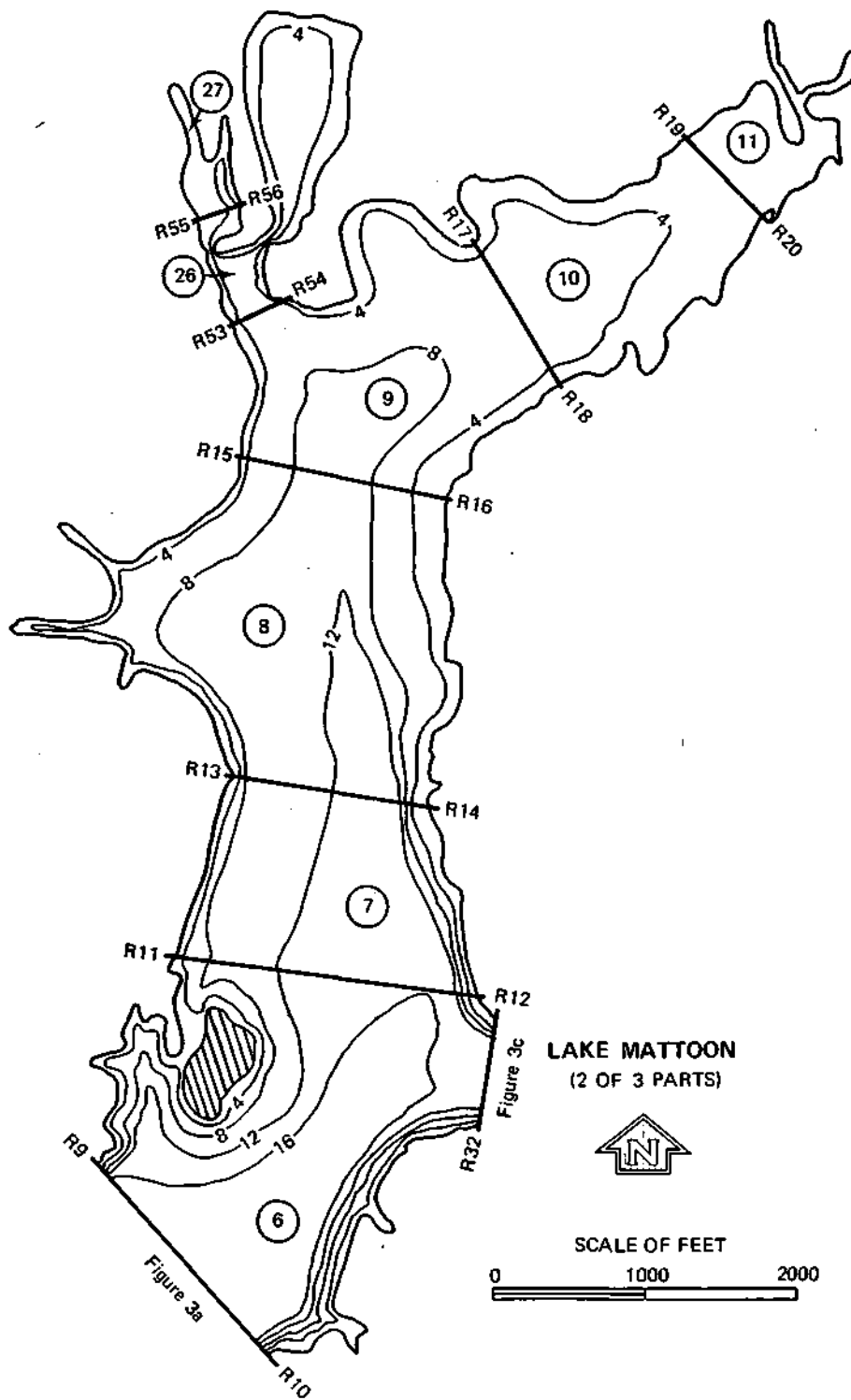


Figure 3b. Continued

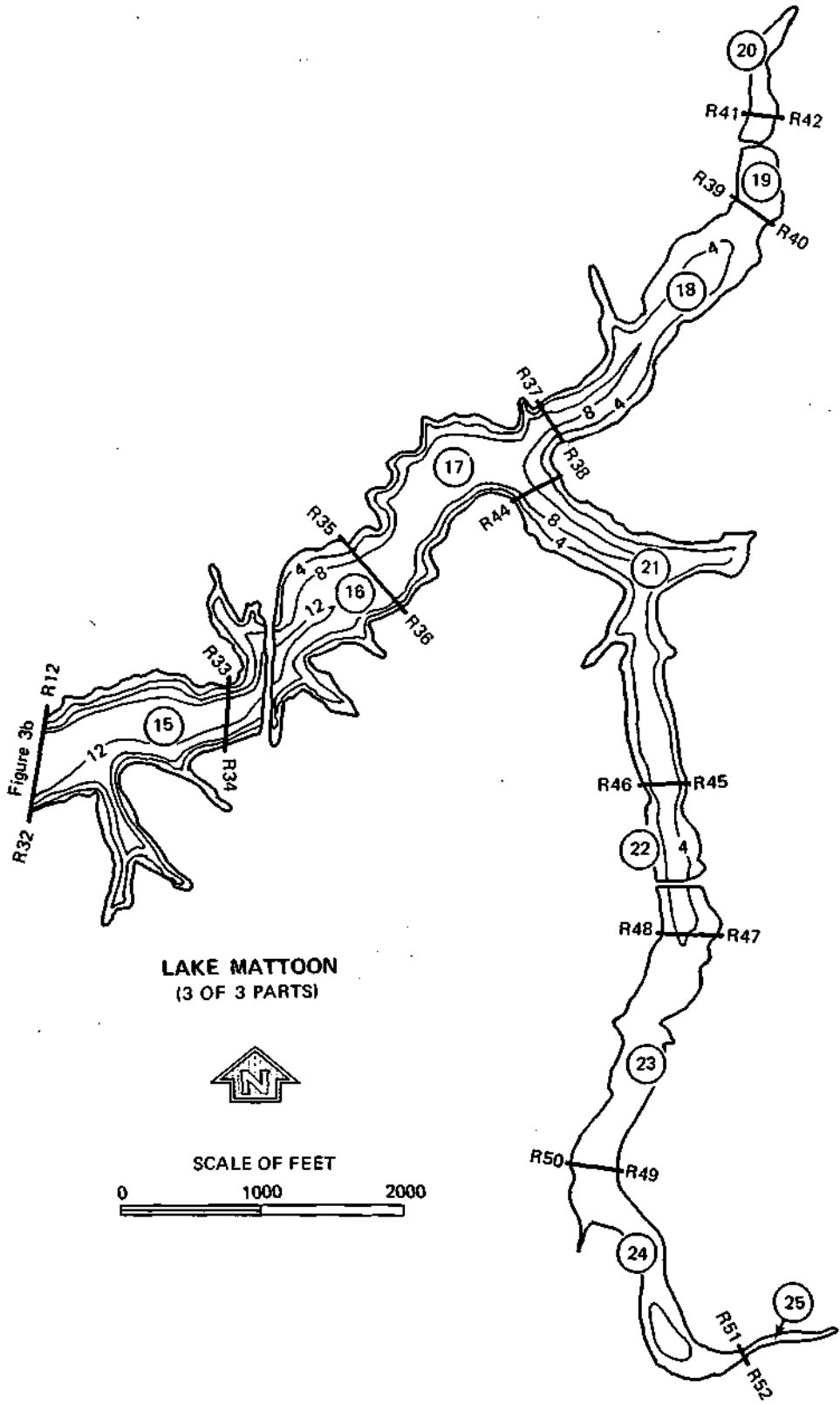


Figure 3c. Concluded

In the surveys, sounding data were collected at 25-foot intervals on each cross section to measure both the original and current depths of water in the lakes at the current spillway elevations. All depth measurements were made with a 2-inch diameter aluminum pole marked in tenths of feet. The pole was first lowered until it touched the current lake bottom and a depth measurement was made. The pole was then pushed through the accumulated sediment until it hit the solid original lake bed where another depth measurement was made. Horizontal control on each cross section was maintained with a marked plastic cable.

Samples of the accumulated sediment were collected during the surveys for determining grain size, unit weight, and chemical constituents of the sediments. The locations of these samples are summarized in table 1 for Paradise Lake and in table 2 for Lake Mattoon. Detailed results are included in appendices A and B.

Sedimentation Calculations

The sounding data from the surveys were used to calculate the original storage capacities of the lakes (1908 for Paradise Lake and 1958 for Lake Mattoon) at the current spillway levels, and the corresponding capacity at the time of the surveys. The difference between these storage capacities is the lake volume that has been lost to sedimentation since construction of the reservoir.

The volume calculations were made for both lakes using the Dobson prismoidal formula as described in the National Engineering Handbook of the Soil Conservation Service, Section 3 (SCS, 1968). The volumes for Lake Mattoon were calculated using the contour method calculation as described in the same handbook.

Table 1. Locations and Sampling Depths of Sediment Samples for Paradise Lake

<u>Sample #</u>	<u>Location*</u>	<u>Sample depth below present bed (ft)</u>
1	R1-R2 mdpt	surface
2	R1-R2 mdpt	0.4-0.8
3	R1-R2 mdpt	1.1-1.3
4	R1-R2 W. 1/4 pt.	surface
5	R1-R2 E. 1/4 pt.	surface
6	R21-R22 mdpt	surface
7	R5-R6 mdpt	surface
8	R5-R6 W. 1/4 pt.	surface
9	R5-R6 E. 1/4 pt.	surface
10	R9-R10 mdpt	surface
11	R9-R10 mdpt	0.4-0.8
12	R9-R10 mdpt	1.1-1.6
13	R9-R10 W. 1/4 pt.	surface
14	R9-R10 E. 1/4 pt.	surface
15	R13-R14 mdpt	surface
16	R13-R14 W. 1/4 pt.	surface
17	R13-R14 E. 1/4 pt.	surface
18	R19-R20 E. channel	surface
19	R19-R20 W. 1/4 pt.	surface
20	R19-R20 mdpt	surface
21	R19-R20 mdpt	0.6-0.9
22	R19-R20 mdpt	1.1-1.4
23	R17-R18	0.0-0.3

*Mdpt: midpoint of cross section; see figure 2 for cross section locations.

W. 1/4 pt.: West 1/4 point of cross section

E. 1/4 pt.: East 1/4 point of cross section

Table 2. Locations and Sampling Depths of Sediment Samples for Lake Mattoon

<u>Sample #</u>	<u>Location*</u>	<u>Sample depth below present bed (ft)</u>
1	R1-R2 mdpt	surface
2	R5-R6 mdpt	surface
3	R9-R10 mdpt	surface
5	R13-R14 mdpt	surface
6	R17-R18 mdpt	surface
7	R19-R20 mdpt	surface
8	R33-R34 mdpt	surface
9	R33-R34 mdpt	1.2-1.4
10	R39-R40 mdpt	surface
11	R45-R46 mdpt	surface
12	R7-R8	surface

*Mdpt: midpoint of cross section; see figure 3 for cross section locations

The changes in spillway elevation of Paradise Lake, and the consequent changes in surface area and volume, considerably complicated the calculation of the sedimentation rate of the lake.

Increasing the capacity of a lake improves the efficiency of the lake as a sediment trap because the given inflow into the lake will be held longer, allowing more of the sediments to settle out of suspension. This increase in the trap efficiency of the lake varies considerably depending on the original and new volumes of the lake.

The most widely used method for determining trap efficiency is the graph developed by Brune (1953), shown in figure 4. In this curve, trap efficiency is shown as a function of the Capacity/Inflow (C/I) ratio where capacity and annual inflow are in acre-feet.

For Lake Paradise, the variation in capacity has been from 460 acre-feet in 1908 to 2040 acre-feet in 1931. Average annual discharges in the Little Wabash River Basin range from 10.6 to 13.15 inches (USGS,

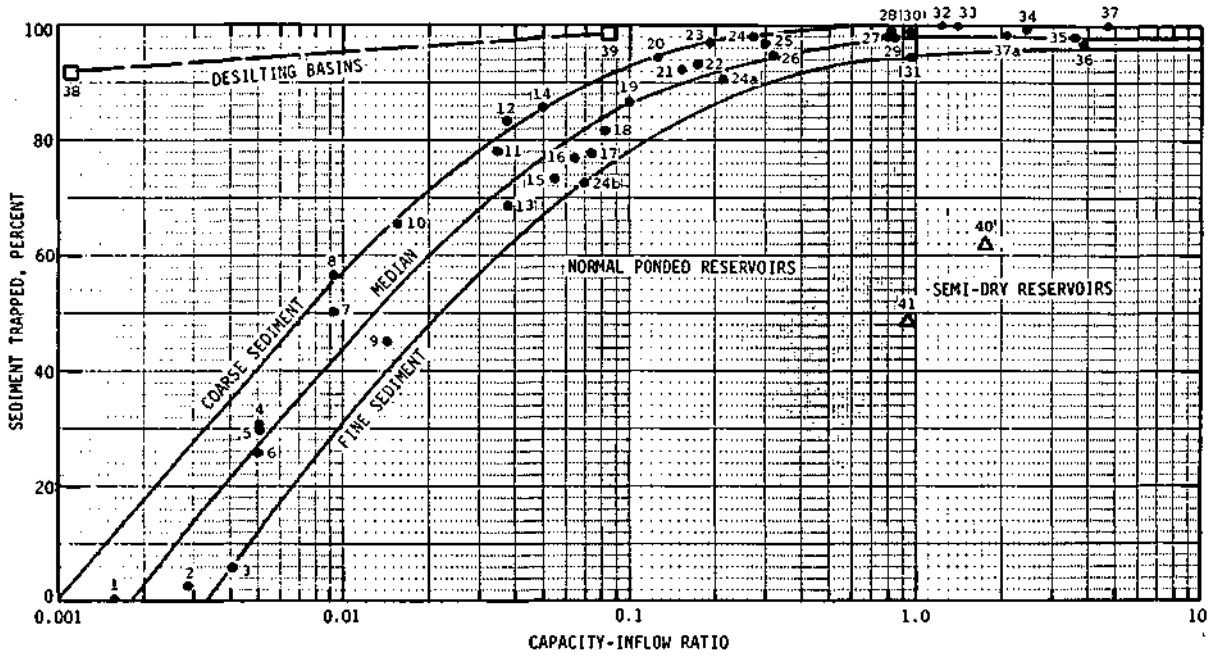


Figure 4. Trap efficiency of a man-made lake (after Brune, 1953)

1979). Assuming 12 inches of annual runoff from the 11,400 acre watershed of Lake Paradise, the inflow becomes 11,400 acre-feet/year and the C/I ratio would be 0.04 for 1908 and 0.18 for 1931. For these C/I ratios, the trap efficiencies are 69% for 1908 and 87% for 1931, based on the graph in figure 4. This analysis indicates that the trap efficiency of the lake was increased approximately 25% from 1908 to 1931, when the new dam was constructed.

To reduce the effects of these variations in the trap efficiency on calculations of the sedimentation rate of the lake, the sedimentation rate of Lake Paradise was determined by adjusting the calculated results to a 1931 to 1979 sedimentation period.

The volumes determined by the sedimentation survey were the 1979 water volume contained in the reservoir and the volume of sediment contained in the reservoir in 1979. The sum of these values is the potential water volume of the reservoir if the 1931 dam and spillway had been constructed in 1908.

However, in 1931 when the dam and spillway were constructed, a portion of this volume had already been filled by sediment resulting from the existence of the original dam and spillway.

To develop a sedimentation rate for Paradise Lake for the 1931 to 1979 sedimentation period, it was necessary to estimate the volume losses due to sedimentation from 1908 to 1931. This was accomplished by prorating the sediment accumulations in segments 3 to 9 between the periods 1908-1931 and 1931-1979.

The 1931 water volume in each segment was determined by using the formula:

$$\text{Water volume (1931)} = \text{water volume (1908)} - \text{sediment volume (1908-1931)}$$

By this method, the lake volume at the 1931 spillway elevation was reduced 6.7% due to sedimentation during the period 1908-1931. This is an approximate adjustment and cannot be used to determine a sedimentation rate during the period 1908-1931.

Results and Analyses

Paradise Lake. Table 3 is a summary of the results of the 1979 survey of Paradise Lake. It shows that the lake has lost 31.1% of its 1908 potential capacity as a result of sedimentation between 1908 and 1979. About 24.4% of this loss has occurred since 1931. This gives a sedimentation rate of 0.51% per year since 1931.

If this rate of sedimentation continues, the volume of Paradise Lake will be approximately half of the potential 1908 volume in the year 2016 and will be completely filled by sediment in the year 2114. However, because of the decreasing volume of the lake, the trap efficiency of the lake will tend to decrease with age and this will very likely extend the life of the lake considerably.

Table 4 shows the variation in sediment accumulation in Paradise Lake by segments. Locations of these segments are shown in figure 2. In the computation of the weight of total sediment shown in table 4, the unit weights of samples of the deposited sediments were used. The average unit weight of the deposited sediment was 40.2 pounds per cubic foot based on the samples collected in 1979.

Table 3. Summary of Sedimentation Data
for Paradise Lake

<u>Age</u>	Years		
1908-1931	23		
1931-1979	48		
1908-1979	71		
<u>Watershed</u>	Sq mi	Acres	
Total area	18.1	11585	
Area excluding lake	17.8	11389	
<u>Reservoir</u>			
Primary spillway elevation 684 ft above msl			
Surface area at spillway level	Acres		
1931	196		
1979	166		
Storage capacity at spillway level .	Acre-feet	Mil gal	
1908	2042	665	
1931*	1905	621	
1979	1407	458	
Capacity per square mile of drainage area**	Acre-feet		
1908	113		
1931	105		
1979	78		
Sedimentation	Acre-feet	Mil gal	
1908-1979	635	207	
1931-1979	498	162	
<u>Average annual accumulation (1931-1979)+</u>			
From entire watershed	10.4	acre-feet	
Per square mile	0.58	acre-feet	
Per acre	39.7	cubic feet	
Tons per acre	0.80	tons	
<u>Loss of capacity</u>			
Total (1908-1979)	31.1%		
1931-1979	24.4%		
Per year (1931-1979)	0.51%	per year	

* Adjusted for sedimentation, 1908-1931

** Includes area of lake

+ Excludes area of lake

Table 4. Summary of Sedimentation Data for Paradise Lake by Segments
(For segment locations, see figure 2)

Segment	(1) 1908 volume (ac-ft)	(2) 1931 volume (ac-ft)	(3) 1979 volume (ac-ft)	(4) Capacity loss 1908-79 (%)	(5) Capacity loss 1931-79 (%)	(6) Average annual Capacity loss 1931-79 (%/year)	(7) Weight of sediment (tons)
1	233	233	195		16.3	0.34	24,800
2	244	244	201		17.6	0.37	28,200
3	228	215	187	18.0	12.3	0.26	26,900
4	216	193	146	32.4	21.8	0.45	49,200
5	245	218	162	33.9	22.9	0.48	58,400
6	308	271	195	36.7	24.7	0.51	91,800
7	177	159	120	32.2	22.0	0.46	46,300
8	87	77	57	34.5	23.0	0.48	32,100
9	52	43	23	55.8	38.5	0.80	31,000
10 & 11	84	84	10		88.1	1.84	98,600
12	105	105	79		24.8	0.52	29,600
13	34	34	24		29.4	0.61	11,400
14	29	29	8				28,000
Total	2042	1905	1407				556,000

Average unit weight = 40.2 #/cu ft
Annual rate of capacity loss, 1908-1979 = 0.44%

- (1) Potential 1908 volume of segment in acre-feet at 1931 spillway elevation of 684.1 ft msl (no sedimentation)
- (2) 1931 volume of segment in acre-feet after adjusting for previous sedimentation (1908-1931); segments 1, 2, 10, 11, 12, 13, and 14 were not adjusted
- (3) 1979 volume of segment in acre-feet as surveyed in September of 1979
- (4) Percent of 1908 capacity loss from 1908 to 1979 [(Col 1)-(Col 3) / (Col 1)]
- (5) Percent of 1908 capacity loss from 1931 to 1979 [(Col 2)-(Col 3) / (Col 1)]
- (6) Annual volume loss from 1931 to 1979 in percent per year
- (7) Tonnage of deposited sediment in each segment from 1908 to 1979

Analyses of aerial photographic records for Paradise Lake indicate that a considerable portion (30 acres out of 200 acres or 15% of the original area) of the lake has been completely filled by sediment.

Photographs were available from four different years: 1938, 1953, and 1966 (from the University of Illinois Map Library) and 1979 (from the DOWR). The changes in the surface area of the lake are indicated in figure 2. The delta formations shown indicate that with periodic dry dredging it might be feasible to use the area upstream of R17-R18 as a sediment basin, as a sedimentation reduction measure in Paradise Lake.

Lake Mattoon. Table 5 is a summary of the results of the 1980 survey of Lake Mattoon. It shows that the lake has lost 11.4% of its 1958 capacity as a result of sedimentation between 1958 and 1980. This gives a sedimentation rate of 0.52% per year since 1958.

If this rate of sedimentation continues, the volume of Lake Mattoon will be approximately half of the 1958 capacity by 2054 and will be completely filled by sediment in the year 2150. As with Paradise Lake, as the lake volume decreases the sedimentation rate will also decrease, thus extending the life of the lake.

Table 6 shows the variation of sedimentation accumulations in Lake Mattoon by segments. Locations of these segments are shown in figure 3a-c. In the computation of the weight of sediment shown in table 6, the unit weights of samples of the deposited sediments were used. The average unit weight of the deposited sediment was 36.8 pounds per cubic foot based on the samples collected in 1980.

The volume calculations for Lake Mattoon were made on the basis of two methods of calculation, the range and contour methods described in the

Table 5. Summary of Sedimentation Data
for Lake Mattoon

<u>Age</u>		Years	
Built June 1958			
Surveyed May 1980		22	
<u>Watershed</u>		Sq mi	Acres
Total area		56.0	35,840
Area excluding lake		54.4	34,812
Paradise Lake Watershed		18.1	11,585
<u>Reservoir</u>			
Surface area at spillway level		Sq mi	Acres
		1.61	1028
Storage capacity at spillway level		Acre-feet	Mil gal
1958		13,160	4288
1980		11,660	3799
Capacity per square mile of drainage area**		Acre-feet	
1958		235	
1980		208	
Sedimentation		Acre-feet	
1958-1980		1505	
<u>Average annual accumulation of sediment**</u>			
		Acres	Acres
1958-1980		68.4	
		Acres	Acres
1958-1980		1.26	
		Cubic feet	per acre
1958-1980		85.6	
		Tons	per acre
1958-1980		1.57	
<u>Depletion of original storage</u>		Percent of	Percent
		original storage	per year
1958-1980		11.4	0.52

* Includes area of lake

** Excludes area of lake

Table 6. Summary of Sedimentation Data
for Lake Mattoon by Segments

Segment*	Volume (ac-ft)		Loss of original capacity		Weight of sediment (tons)
	1958	1981	% of total	%/yr	
1	898	829	7.68	0.35	45,521
2	1,458	1,352	7.27	0.33	67,807
3	1,874	1,744	6.94	0.32	83,800
4	2,293	2,153	6.11	0.28	87,140
5	1,739	1,593	8.40	0.38	99,003
6	1,385	1,205	13.0	0.59	132,649
7	568	494	13.0	0.59	52,977
8	782	672	14.1	0.64	104,827
9	375	303	19.2	0.87	68,382
10	161	116	28.0	1.27	42,780
11	16.2	7.3	55.0	2.50	8,180
12	30.0	26.7	11.0	0.50	1,969
13	109	98.9	9.27	0.42	6,027
14	127	115	9.45	0.43	7,161
15	316	266	15.8	0.72	46,718
16	228	184	19.3	0.88	41,112
17	217	160	26.3	1.19	53,259
18	123	74.7	39.3	1.78	56,108
19	11.3	4.6	59.3	2.70	7,448
20	2.5	0.7	72.0	3.27	1,799
21	167	120	28.1	1.28	44,734
22	58.9	36.4	38.2	1.74	21,415
23	65.8	29.4	55.3	2.51	34,645
24	39.0	11.3	71.0	3.23	26,364
25	1.58	0.83	47.5	2.16	714
26	97.3	57.6	40.8	1.85	44,242
27	<u>21.5</u>	<u>4.6</u>	78.6	3.57	<u>19,172</u>
Total	13,164	11,659			1,206,000
Percentages of total			11.4	0.52	

*Refer to figure 3 for locations of segments

SCS Engineering Handbook (SCS, 1968). The results of these calculations were within 1% of each other. Tables 5 and 6 were prepared using the results of the range calculations, while the depth contours in figure 3a-c and the stage-volume-area graphs shown in figure 5 were developed on the basis of the contour method of calculation.

Comparison of Results. The sedimentation rates of 0.51% per year for Paradise Lake and 0.52% per year for Lake Mattoon are very close to the general sedimentation rates for other Illinois reservoirs determined in the SWS lake sedimentation program. However, when the results of the two surveys are compared more closely, it is seen that the sedimentation rate at Lake Mattoon is higher than would be expected if a direct extrapolation were made from the Paradise Lake results.

In general, it is expected that the sedimentation rates from similar watersheds are inversely related to the capacity per square mile of drainage area (C/W ratio; see tables 3 and 5). If the Lake Mattoon watershed were exactly similar to the Paradise Lake watershed, the sedimentation rate for Lake Mattoon would be expected to be approximately $(113 / 235) \times 0.51 = 0.25\%$. However, the sedimentation rate calculated for Lake Mattoon is approximately double this value. There is obviously some major dissimilarity in the two watersheds.

The only obvious difference in the two watersheds is their geologic histories. As stated in the description of the watersheds, the geology of the Paradise Lake watershed is primarily morainal deposits from the Wisconsinan glacier while the geology of the southern half of the Lake Mattoon watershed is primarily glacial outwash and loess deposits resulting from the Wisconsinan glacier. It is quite likely that these

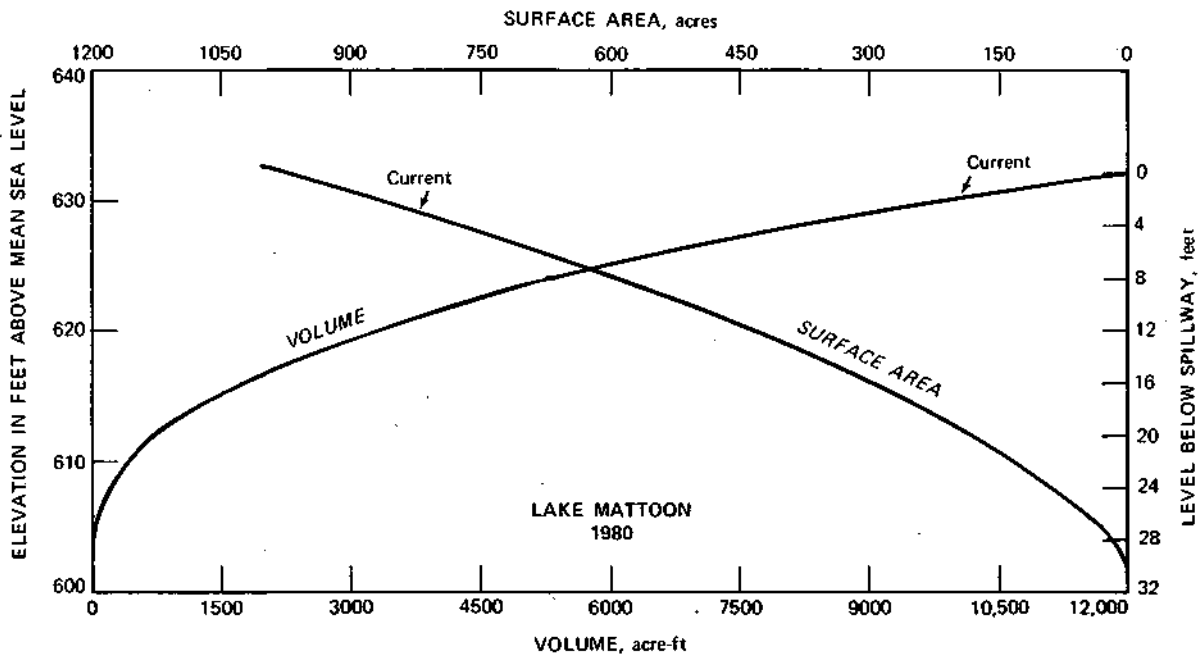


Figure 5. Stage-volume-area curve, Lake Mattoon, 1980

geological differences are the cause of the unexpectedly high sedimentation rate in Lake Mattoon.

This difference in the geological history of the watersheds is also reflected in the sediment yields in tons per acre of 0.80 for Paradise Lake and 1.57 for Lake Mattoon, as shown in tables 3 and 5.

Summary and Conclusions

Sedimentation surveys have been conducted for Paradise Lake and Lake Mattoon. The results of these surveys show that the sedimentation rate in both lakes is about 0.5% per year. This sedimentation rate, though not extremely high for Illinois, is already causing local concern about the future of Paradise Lake because of its greater age and smaller volume.

Preliminary observations about the sedimentation rate in Lake Mattoon based on the sedimentation rate of Paradise Lake and the geometry of the two watersheds proved inadequate. The variation can be attributed to differences in the surface geology of the watersheds.

Analyses of aerial photographic records indicate that 15% of the original surface area of Paradise Lake has been lost to delta formation.

References

- Brune, G.M. 1953. *Trap Efficiency of Reservoirs*. Transactions, American Geophysical Union, v. 34:407-418.
- Soil Conservation Service, *National Engineering Handbook, Section 3, Sedimentation, Chapters 1, 2, and 7*, March 1968.
- U.S. Geological Survey. 1979. *Water Resources Data for Illinois*. Water-Data Report IL-79-1.

APPENDIX A

University of Illinois at Urbana-Champaign

COLLEGE OF AGRICULTURE • DEPARTMENT OF AGRONOMY • N214 TURNER HALL • URBANA, ILLINOIS 61801

February 4, 1980

TO: Glenn Stout

FROM: J. B. Fehrenbacher

SUBJECT: Lake Paradise Sediments - Agricultural Value

We have completed particle size, exchangeable cations, cation exchange capacity, pH, CaCO₃ equivalent, organic carbon, P1, P2, and K analyses on the 23 sediment samples taken from Lake Paradise in Coles County in the fall of 1979.

The samples were labeled 1 through 23. The sand content, in general, is low (max. of 12.7% in sample 18) and can be ignored. The clay content varies from a high of 68.8% to a low of 18.6%. Presumably the samples with the higher clay contents came from the deeper water near the dam of the lake. Silt content varies, more or less, inversely with clay content. A quick check on clay mineralogy of a few samples indicates that Illite is the dominate clay mineral. Cation exchange capacity is moderate to high and correlates well with clay content. Exchangeable cations are generally high and the clays are 100% base saturated. Reaction is neutral to mildly alkaline and most samples, except those lower in clay, have small amounts of carbonates. Upon drying pH will probably be somewhat lower. Organic carbon is moderate to high compared to natural surface soils. Multiplying % organic carbon by the factor 1.724 gives the % of organic matter which ranges from about 2.6 to 6.2 percent. The P1 (available) and P2 (reserve) and K (available) soil test values are high. The P1 values have to be discounted some (perhaps reduced about 1/3) since the samples from the bottom of the lake are in a reduced state and upon oxidation some of the P1 will be fixed by iron oxides. Upon drying, P2 values will probably stay about the same but K values may be reduced about one-half.

In general, these sediments are moderate to moderately high in plant nutrients needed for agricultural production. Also pH is favorable. The greatest drawback would be the high clay content of some samples. Generally, as the clay content increase above about 40% their desirability as a surface soil replacement becomes less and less. The sediments containing more than 40% clay would be most useful on sandy soils, mixed or chiseled in the upper 6 to 12 inches of the sandy soil surface. As there are few if any sandy soils in the immediate area, those sediments high in clay should very definitely be mixed in the surface or upper layer of any soil to which they are applied. In fact, all of the sediments probably should be mixed in the upper 6 to 12 inches of any soil to which they are applied in order to break any sharp contrast in texture at their interface.

One of the problems with those sediments quite high in clay may be their high retention of water. In other words, dewatering the sediments may be a problem if they were stockpiled in thick layers, or were applied to soil in layers more than 1-2 feet thick.

Our recommendation for some trials with corn and/or soybeans would be to apply about 6 inches of sediments on an eroded slope and when the sediments and underlying soil are dry enough to cultivate, chisel (and thus mix) to about 12 inches depth. Then apply another 6 inches of sediments and again chiseling and mixing to a depth of about 12 inches or more, depending on ease of chiseling with common farm chisel plows and tractors. On a trial bases 12, 18, and 24 inches of total thickness of sediments might be built up in 6 inches increments as described above and compared for crop production. If only one thickness was used, it should be in the 12-18 inch range.

JBF/brs

Enclosure

Soil Type Lake Paradise Sediment Samples Sampling Date 9/27/79

Location Coles County, T 11N R 7W, Sec. 4, 5, & 160, 40, 10, 2 1/2
8 in part

Sampled by Ill. State Water Survey Collector(s) Bogner, Wm. C.

Slope _____ Drainage Class _____ Classification _____

Lab. No.	Depth in.	Horizon	% of entire sample > 2 mm.	Particle Size Distribution of < 2 mm. (in mm.) (%)						Bulk density	Pores		Hydraulic conductivity in./hr.
				Sand	Silt		Clay		Capillary %		Non-capillary %		
					Total 2-.050	Coarse .050-.020	Fine .020-.002	Total .050-.002				Coarse .002-.0002	
1				0.4			30.8			68.8			
2				0.2			40.1			59.7			
3				0.4			35.4			64.2			
4				0.4			32.2			67.4			
5				0.6			36.7			62.7			
6				1.1			60.1			38.8			
7				0.5			40.2			59.3			
8				0.5			42.0			57.5			
9				0.5			45.1			54.4			
10				0.4			46.4			53.2			
11				0.5			41.7			57.8			
12				0.3			51.1			48.6			
13				0.4			44.0			55.6			
14				0.5			48.3			51.2			
15				0.2			53.9			45.9			
16				0.3			53.3			46.4			

Lab. No.	Exch. Cations me./100g. Soil					Exch. Ca Exch. Mg.	Cation exch. cap. me./100g.	Base saturation %	pH 1:1 ratio	CaCO ₃ equiv. %	Organic carbon %	Bray		
	Ca	Mg	K	Na	H							P ₁	P ₂	K
1	51.5	11.4	.8	.3		50.3	100+	7.0	3.2	2.93	46	120	580	
2	37.4	9.8	.7	.3		48.0	100+	6.7	1.1	2.28	45	164	480	
3	42.7	10.7	.7	.3		48.7	100+	7.1	2.4	2.70	38	176	440	
4	46.5	10.9	.8	.3		49.0	100+	7.3	3.4	3.00	46	126	580	
5	45.1	11.4	.8	.3		46.9	100+	7.3	3.8	3.08	51	120	540	
6	34.2	7.7	.5	.2		34.2	100+	7.5	3.2	2.04	45	103	360	
7	41.1	10.7	.7	.2		43.4	100+	7.4	3.2	2.87	45	82	520	
8	44.9	11.2	.7	.2		45.2	100+	7.8	3.8	2.85	51	107	520	
9	43.7	11.9	.8	.3		46.9	100+	7.4	3.2	2.92	53	126	540	
10	42.6	10.9	.7	.3		44.0	100+	7.5	3.4	2.85	57	146	520	
11	44.2	10.7	.7	.4		44.9	100+	7.3	3.0	2.74	41	126	560	
12	41.3	9.6	.6	.3		35.2	100+	7.3	2.5	2.11	36	138	400	
13	44.4	10.7	.7	.2		41.4	100+	7.4	3.0	2.77	49	120	520	
14	43.9	10.8	.7	.2		38.4	100+	7.5	3.5	2.70	59	138	500	
15	40.0	9.9	.5	.2		35.0	100+	7.2	3.3	2.58	66	215	440	
16	41.2	9.6	.7	.3		34.4	100+	7.5	3.5	2.43	62	164	440	

Appendix B



GILSON SCREEN/SIEVE TEST REPORT



		RETAINED					PASSING			NOTES	
WEIGHTS in: g kg lbs		PERCENT			SCREEN/SIEVE	WEIGHT	PERCENT				
Sample + Retain	-- Screen	= Sample	Cumulative	Incremental	Cumulative	Spec	SIZE OR RANGE	Cumulative	Cumulative		Spec
							.062	99.45			1
							.031	95.65			2
							.016	82.84			3
							.008	67.43			4
							.004	57.24			5
							.002	50.43			6
											7
											8
											9
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											19
											20

NOTES:

Sample ID: LAKO MATTOON #1

Lab# B-89

Date: 8/26/89

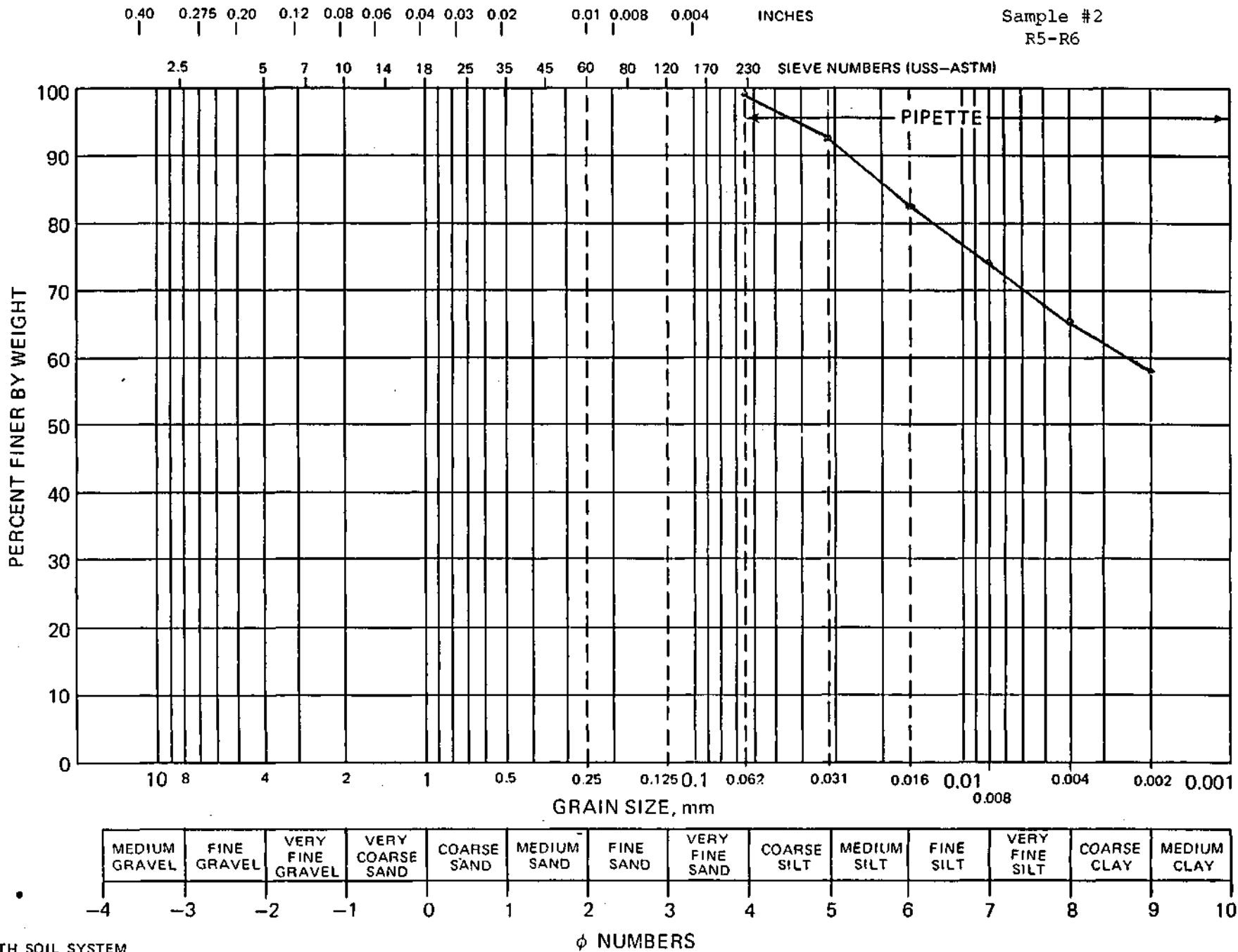
R1-R7

Book #:

Page #:

ILLINOIS STATE WATER SURVEY
 SEDIMENT LABORATORY

Sample #2
 R5-R6



9

GILSON SCREEN/SIEVE TEST REPORT

9

WEIGHTS in: g kg lbs				RETAINED			SCREEN/SIEVE	PASSING			NOTES
Sample + Screen	- Screen	= Sample	= Cumulative	PERCENT		SIZE OR RANGE	WEIGHT		PERCENT		
				Incremental	Cumulative		Spec	Cumulative	Cumulative	Spec	
							.062	99.60			1
							.031	92.78			2
							.016	83.31			3
							.008	74.41			4
							.004	66.63			5
							.002	57.96			6
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											8
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NOTES:

Sample ID: L.V. Patton # 2-

Lab # PS-90
R5-R6

Date: 8/26/81

Book #:

Page #:

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GILSON SCREEN/SIEVE TEST REPORT



RETAINED							PASSING			NOTES	
WEIGHTS in: g kg lbs			PERCENT				SCREEN/SIEVE SIZE OR RANGE	WEIGHT			PERCENT
+ Sample - Screen	+ Sample	- Screen	Cumulative	Incremental	Cumulative	Spec		Cumulative	Cumulative		Spec
							.062	99.61		1	
							.031	93.26		2	
							.016	88.79		3	
							.008	81.78		4	
							.004	71.60		5	
							.002	59.70		6	
										7	
										8	
										9	
										10	
										11	
										12	
										13	
										14	
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										20	

NOTES:

Sample ID: LAKE MATLON #3

Lab # PS-91

Date: 8/26/81

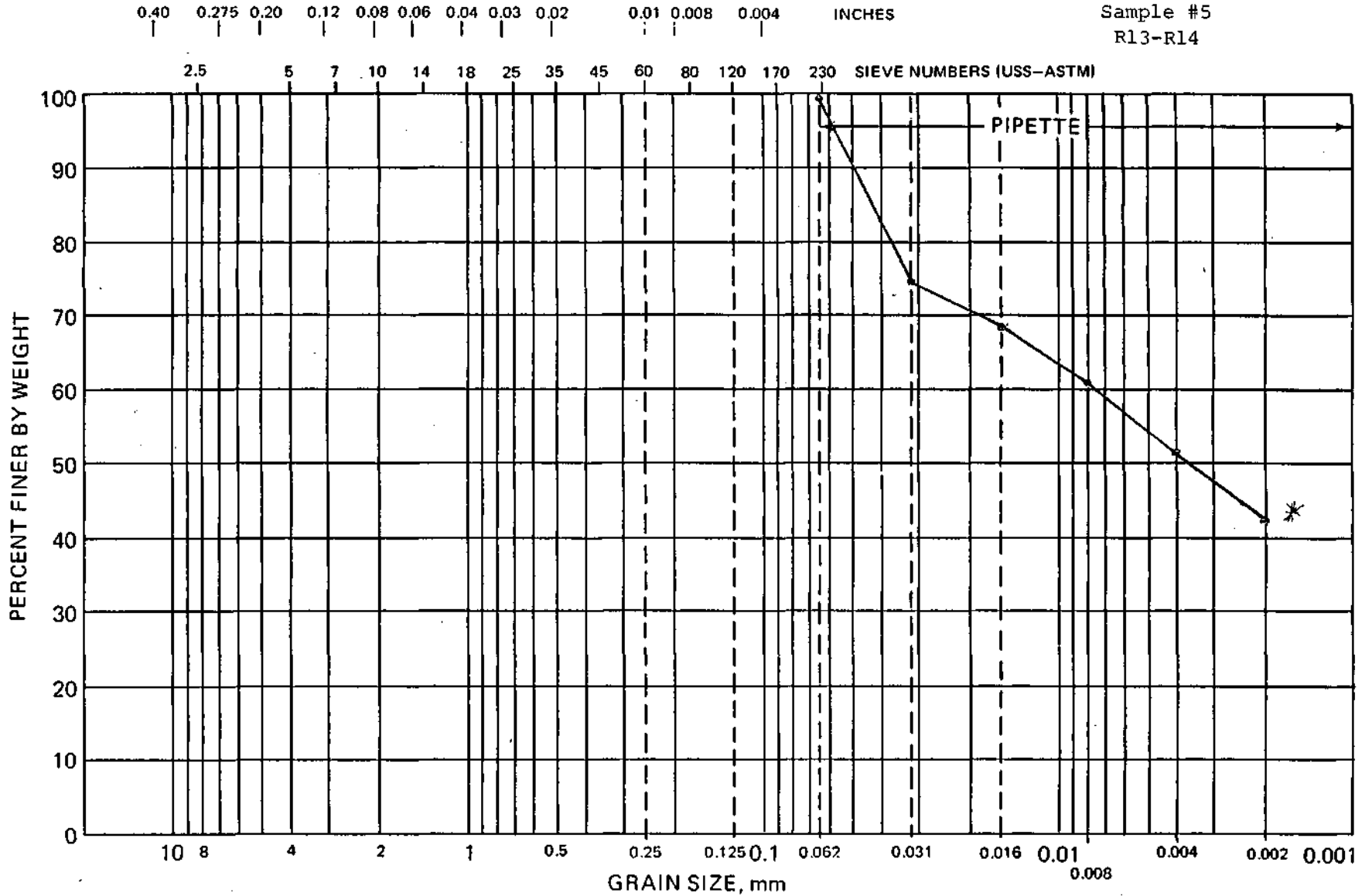
RA-210

Book #:

Page #:

ILLINOIS STATE WATER SURVEY
 SEDIMENT LABORATORY

Sample #5
 R13-R14



MEDIUM GRAVEL	FINE GRAVEL	VERY FINE GRAVEL	VERY COARSE SAND	COARSE SAND	MEDIUM SAND	FINE SAND	VERY FINE SAND	COARSE SILT	MEDIUM SILT	FINE SILT	VERY FINE SILT	COARSE CLAY	MEDIUM CLAY	
-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10
φ NUMBERS														

WENTWORTH SOIL SYSTEM

* See Note on reverse.

9

GILSON SCREEN/SIEVE TEST REPORT

9

RETAINED							PASSING			NOTES	
WEIGHTS in: g kg lbs			PERCENT				SCREEN/SIEVE SIZE OR RANGE	WEIGHT			PERCENT
Sample + Screen	- Screen	= Sample	Cumulative	Incremental	Cumulative	Spec		Cumulative	Cumulative		Spec
							.062	99.27			1
							.031	74.60			2
							.016	68.11			3
							.008	60.29			4
							.004	51.85			5
							.002	42.64			6
											7
											8
											9
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NOTES: The oven dry weights of this sample appear to be too high. The sample had been subjected to high moisture before this test was run so could not be done over. If the weights are too low then the percentages are too low.

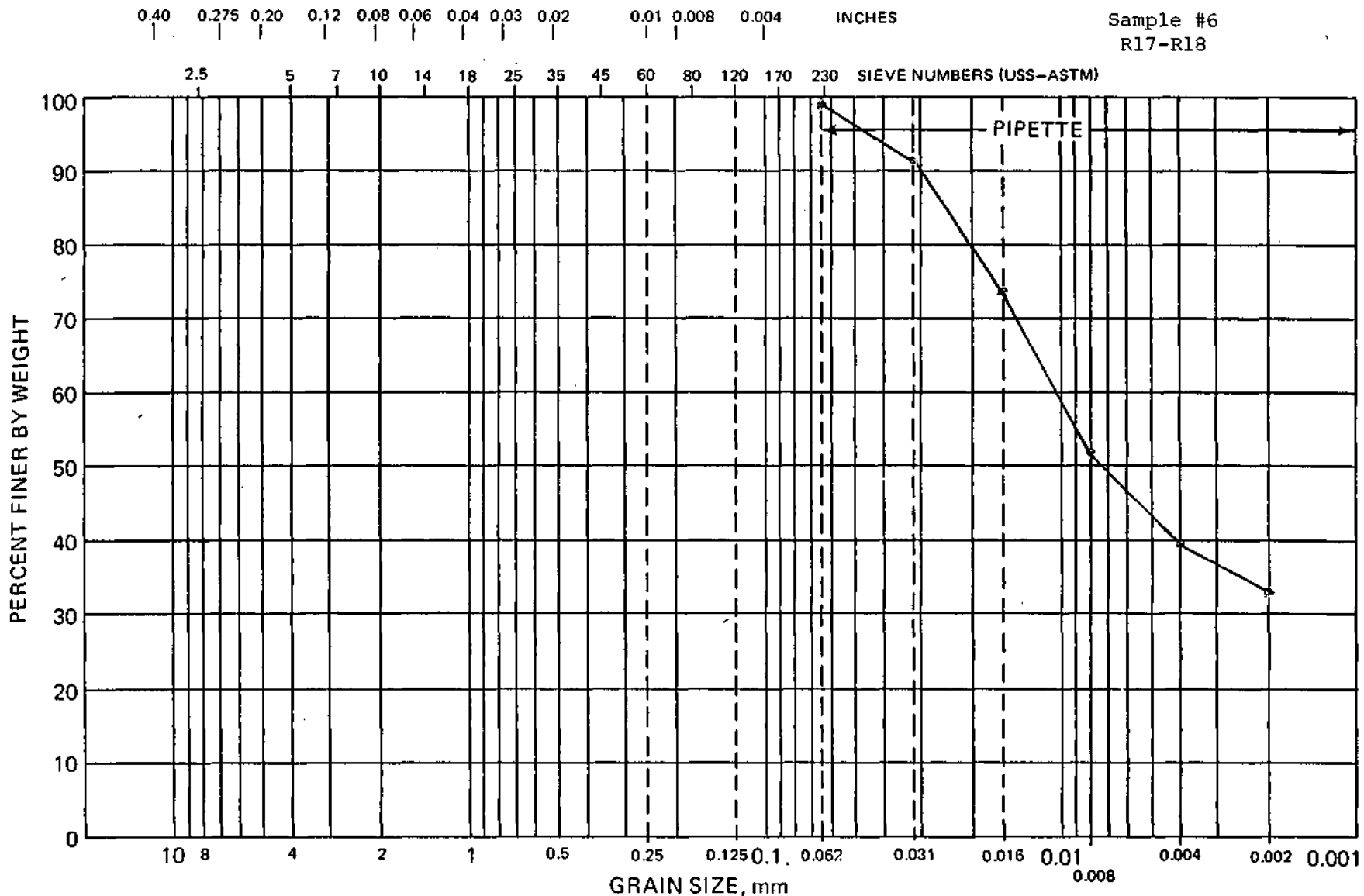
Sample ID: LAKE MATHOON #5 Lab # PS-92 Date: 8/26/81

R13-R14

Book #: Page #:

ILLINOIS STATE WATER SURVEY
 SEDIMENT LABORATORY

Sample #6
 R17-R18



MEDIUM GRAVEL	FINE GRAVEL	VERY FINE GRAVEL	VERY COARSE SAND	COARSE SAND	MEDIUM SAND	FINE SAND	VERY FINE SAND	COARSE SILT	MEDIUM SILT	FINE SILT	VERY FINE SILT	COARSE CLAY	MEDIUM CLAY	
-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10
φ NUMBERS														

WENTWORTH SOIL SYSTEM



GILSON SCREEN/SIEVE TEST REPORT



RETAINED							PASSING			NOTES	
WEIGHTS in. g kg lbs				PERCENT			SCREEN/SIEVE SIZE OR RANGE	WEIGHT Cumulative	PERCENT		
Sample + Blank	- Screen	= Sample	Cumulative	Incremental	Cumulative	Spec			Cumulative		Spec
							062	99.08		1	
							031	91.35		2	
							015	73.96		3	
							008	57.81		4	
							004	39.39		5	
							002	32.72		6	
										7	
										8	
										9	
										10	
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										19	
										20	

NOTES:

Sample ID: LAKE MATHEON #6 Lab # PS-93 Date: 8/26/81

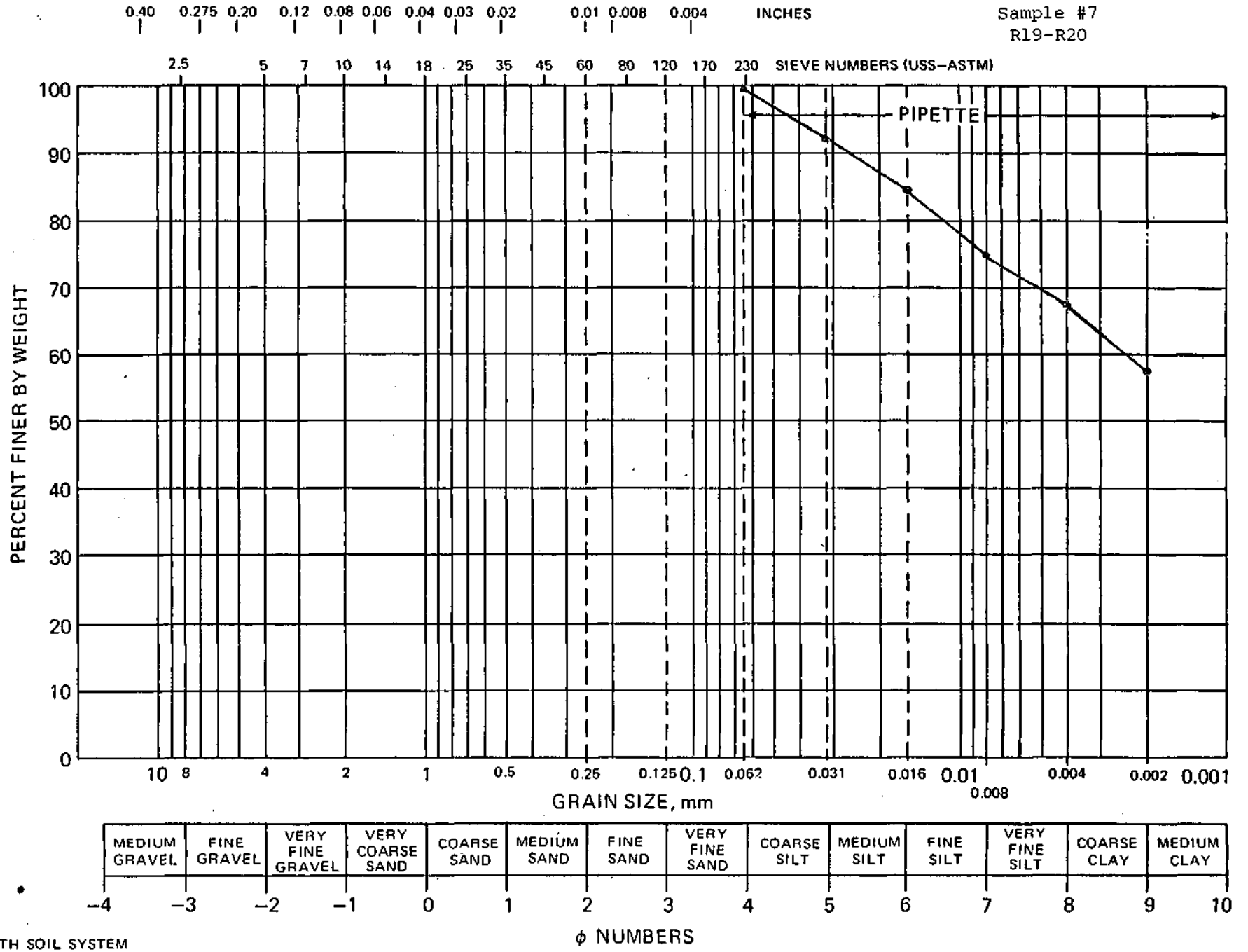
REV. 1.5

Book #: Page #:

07

ILLINOIS STATE WATER SURVEY
 SEDIMENT LABORATORY

Sample #7
 R19-R20



MEDIUM GRAVEL	FINE GRAVEL	VERY FINE GRAVEL	VERY COARSE SAND	COARSE SAND	MEDIUM SAND	FINE SAND	VERY FINE SAND	COARSE SILT	MEDIUM SILT	FINE SILT	VERY FINE SILT	COARSE CLAY	MEDIUM CLAY
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WENTWORTH SOIL SYSTEM

9

GILSON SCREEN/SIEVE TEST REPORT

9

RETAINED							PASSING			NOTES	
WEIGHTS in. g kg lbs			PERCENT				SCREEN/SIEVE SIZE OR RANGE	WEIGHT	PERCENT		
Sample + Solids	- Screen	= Sample	Cumulative	Incremental	Cumulative	Spec		Cumulative	Cumulative		Spec
							.062	99.64			1
							.031	92.70			2
							.016	85.44			3
							.008	75.95			4
							.004	67.55			5
							.002	57.18			6
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NOTES:

Sample ID: LAKE HUTCHON # 7 Lab # PS-94 Date: 8/26/81

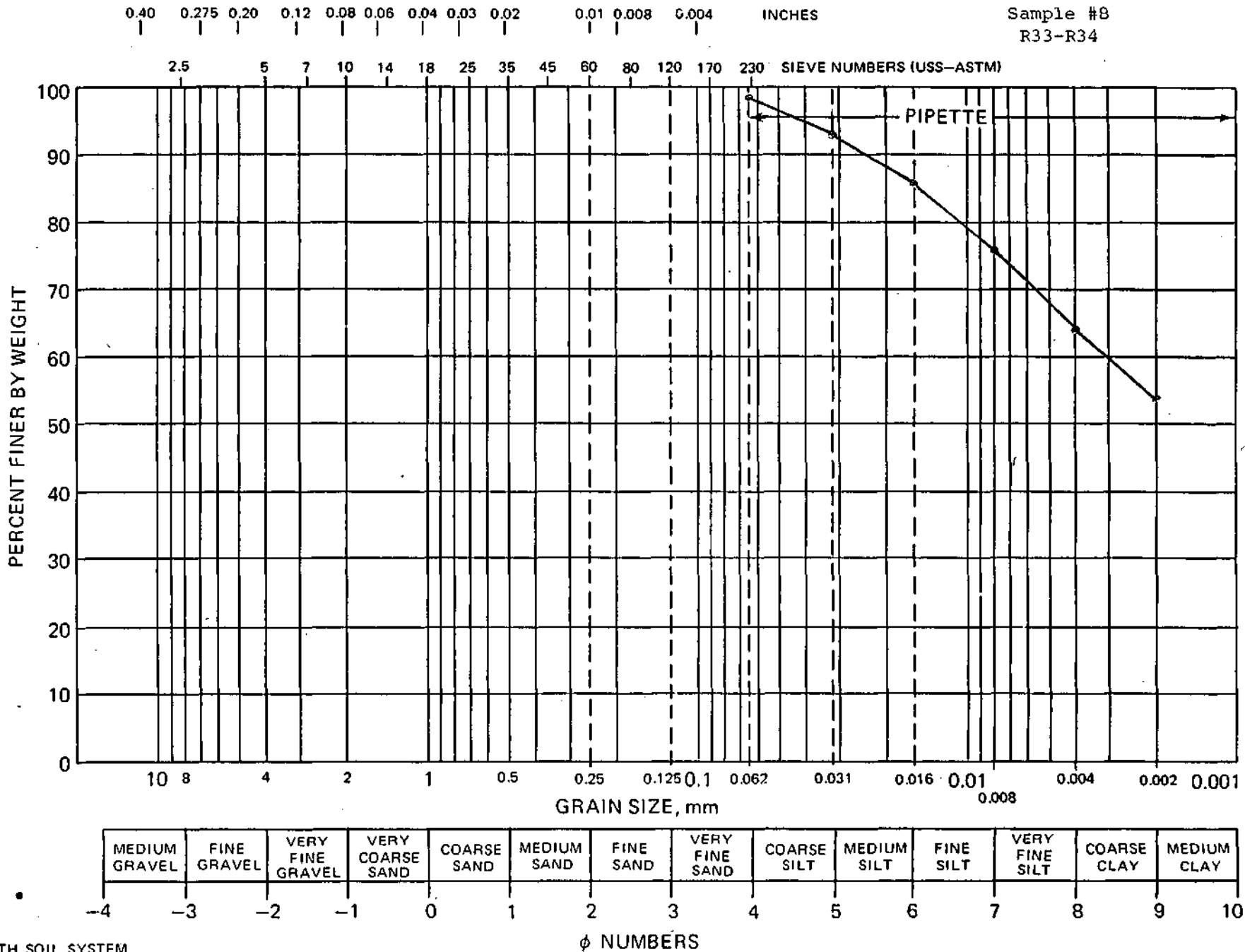
R19-R20

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ILLINOIS STATE WATER SURVEY
 SEDIMENT LABORATORY

Sample #8
 R33-R34



GILSON SCREEN/SIEVE TEST REPORT

RETAINED							PASSING			NOTES	
WEIGHTS in: g kg lbs			PERCENT				SCREEN/SIEVE	WEIGHT	PERCENT		
Sample + Screen	- Screen	= Sample	Cumulative	Incremental	Cumulative	Spec	SIZE OR RANGE	Cumulative	Cumulative		Spec
							<i>mm</i>				
							.062	98.07			1
							.031	92.67			2
							.016	85.97			3
							.008	75.68			4
							.004	64.38			5
							.002	54.00			6
											7
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NOTES:

Sample ID: LAKO Pailoon # B

Lab # PS-95

Date: 8/26/81

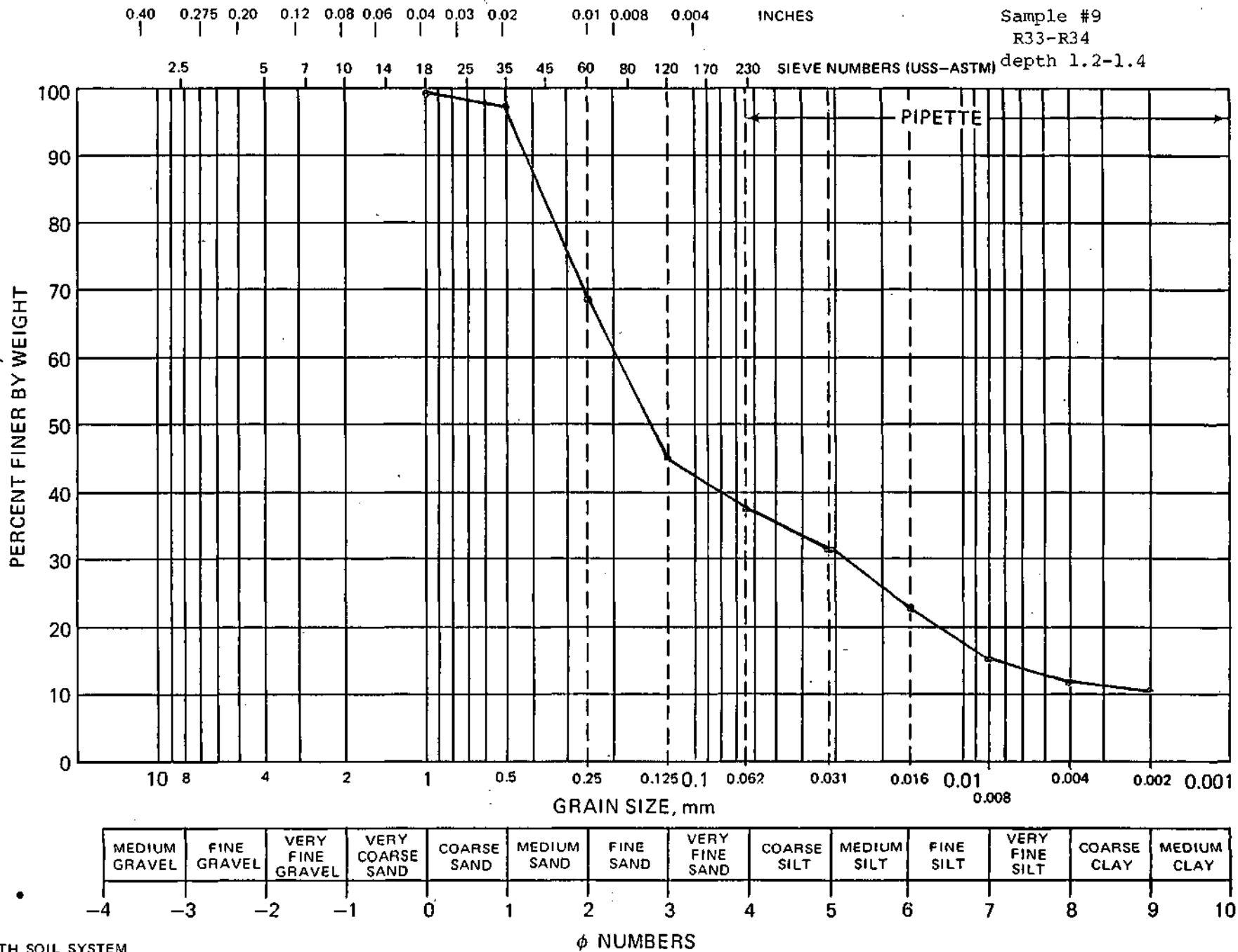
R33-134

Book #:

Page #:

ILLINOIS STATE WATER SURVEY
 SEDIMENT LABORATORY

Sample #9
 R33-R34
 depth 1.2-1.4





GILSON SCREEN/SIEVE TEST REPORT



WEIGHTS in: g kg lbs		RETAINED					PASSING			NOTES	
		PERCENT		SCREEN/SIEVE			WEIGHT		PERCENT		
Sample + Screen	- Screen	= Sample	Cumulative	Incremental	Cumulative	Spec	SIZE OR RANGE	Cumulative	Cumulative	Spec	
							100		99.82		1
							.500		97.54		2
							.250		68.69		3
							.125		44.23		4
							.062		37.48		5
							.031		30.95		6
							.016		22.71		7
							.008		15.82		8
							.004		11.56		9
							.002		10.10		10
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											19
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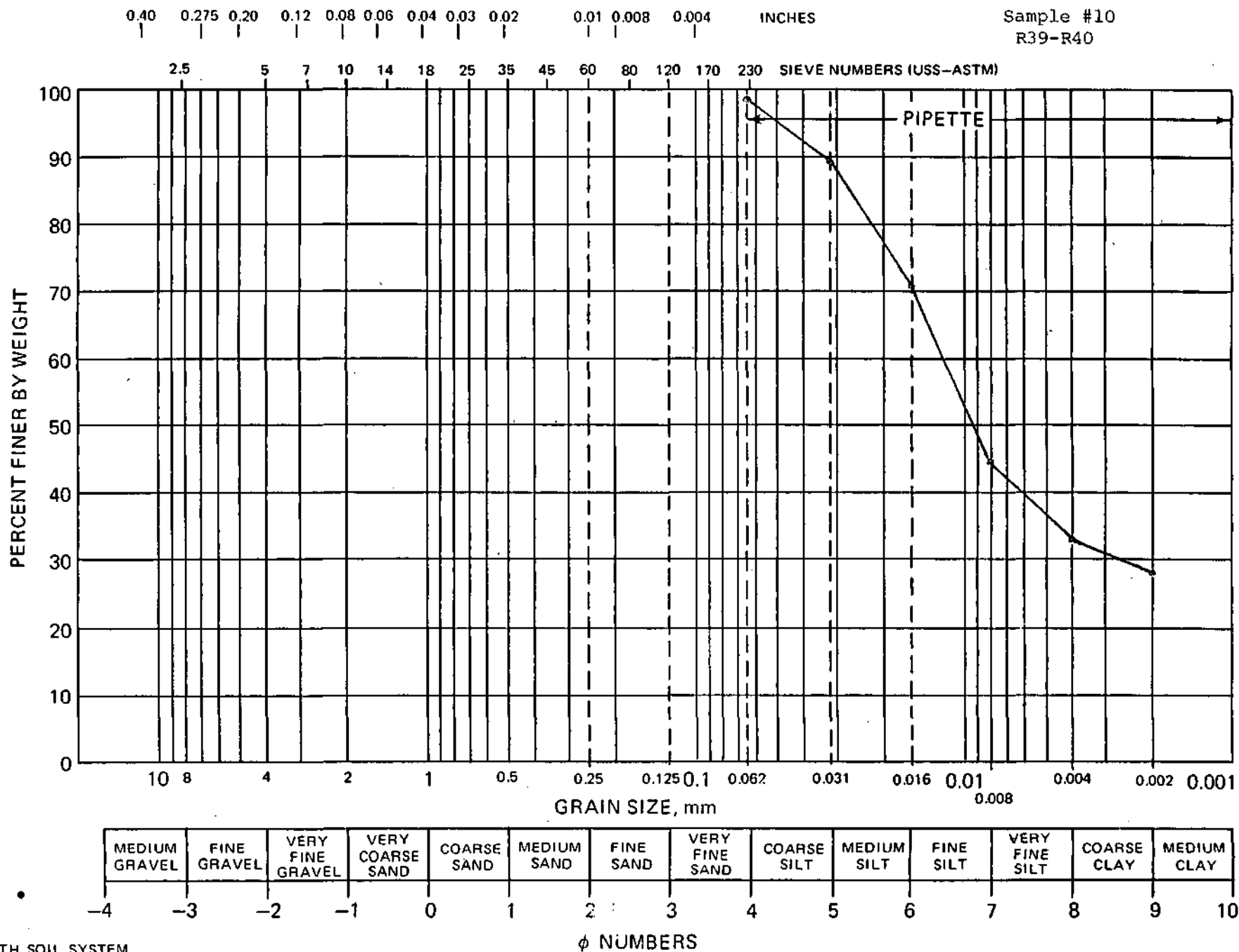
NOTES:

Sample ID: LAKE MALTOON #9 Lab # PS-96 Date: 8/26/21

R33-R34 14-14 Book #: Page #:

ILLINOIS STATE WATER SURVEY
 SEDIMENT LABORATORY

Sample #10
 R39-R40



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GILSON SCREEN/SIEVE TEST REPORT

9

RETAINED							PASSING			NOTES		
WEIGHTS in: g kg Etc			PERCENT				SCREEN/SIEVE SIZE OR RANGE	WEIGHT	PERCENT			
Sample Specimen	- Screen	= Sample	Cumulative	Incremental	Cumulative	Spec		Cumulative	Cumulative			Spec
							.062	98.32			1	
							.031	89.42			2	
							.016	70.78			3	
							.008	45.38			4	
							.004	33.18			5	
							.002	27.79			6	
											7	
											8	
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NOTES:

Sample ID: LAKE (MADISON) # 10

Lab# PS-97

Date: 8/26/81

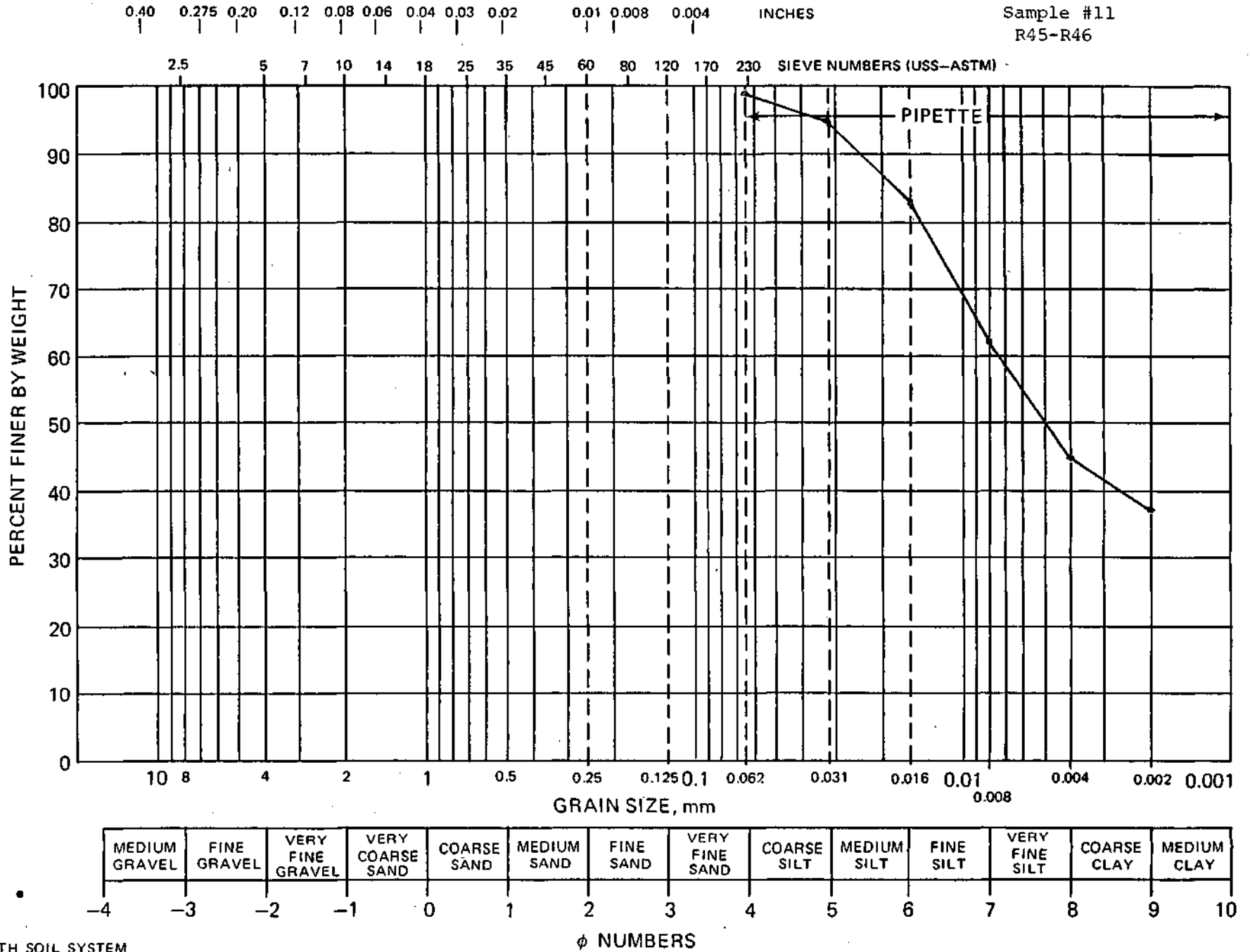
R39-R40

Book #:

Page #:

ILLINOIS STATE WATER SURVEY
 SEDIMENT LABORATORY

Sample #11
 R45-R46



WENTWORTH SOIL SYSTEM

GILSON SCREEN/SIEVE TEST REPORT

RETAINED							PASSING			NOTES		
WEIGHTS in. g kg lbs			PERCENT				SCREEN/SIEVE SIZE OR RANGE	WEIGHT			PERCENT	
Sample - Screen	= Sample	Cumulative	Incremental	Cumulative	Spec	Cumulative		Cumulative	Spec			
mm												
						.0625	99.04		1			
						.031	95.77		2			
						.016	82.49		3			
						.008	61.28		4			
						.004	45.80		5			
						.002	37.04		6			
									7			
									8			
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NOTES:

Sample ID: LAKE MATTOON # 11

LAB # PS-98

Date: 8/26/81

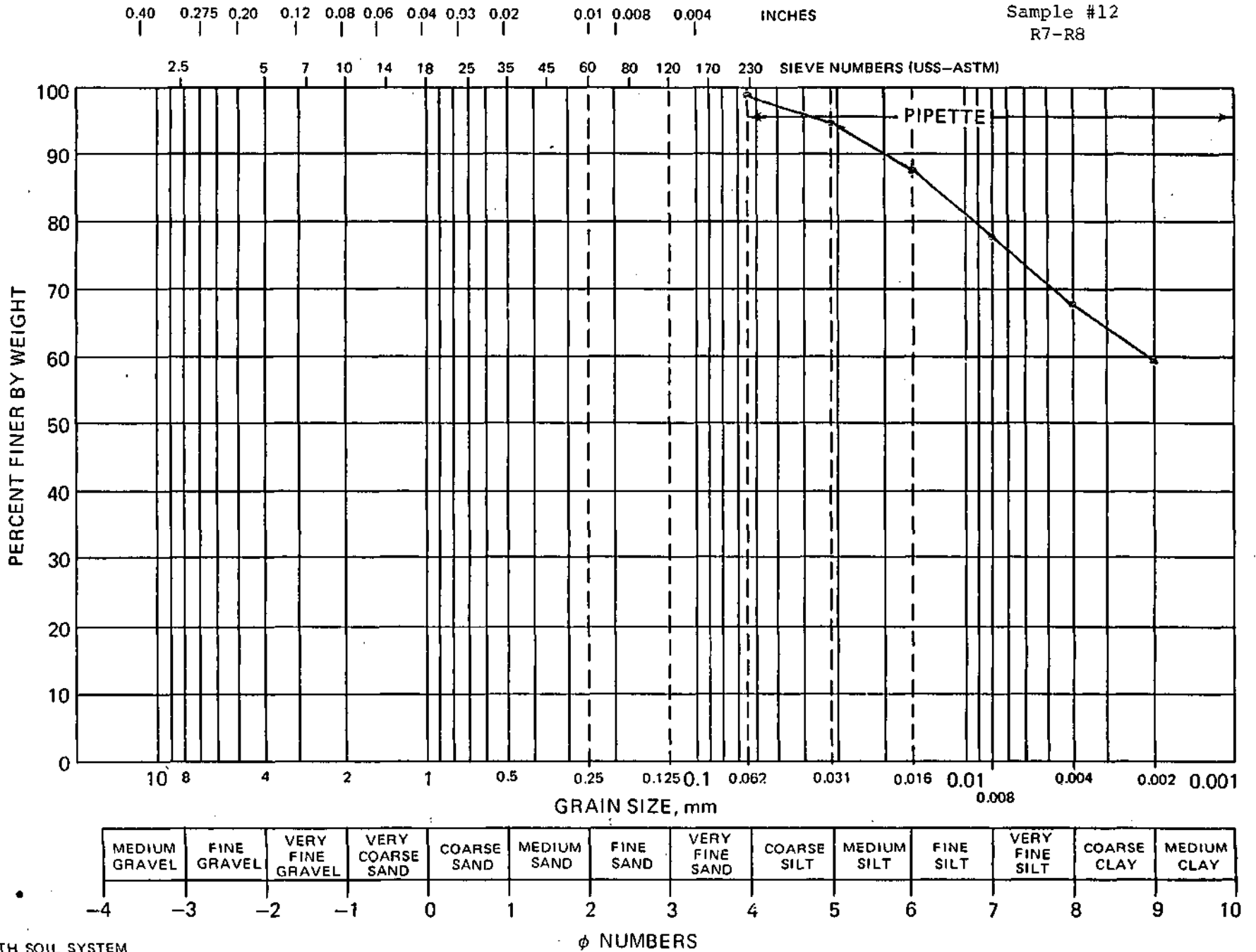
R45-R46

Book #:

Page #:

ILLINOIS STATE WATER SURVEY
 SEDIMENT LABORATORY

Sample #12
 R7-R8



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WENTWORTH SOIL SYSTEM

φ NUMBERS

GILSON SCREEN/SIEVE TEST REPORT

RETAINED							PASSING			NOTES	
WEIGHTS in: g kg Etc			PERCENT				SCREEN/SIEVE SIZE OR RANGE	WEIGHT	PERCENT		
- Screen	= Sample	+ Retained	Cumulative	Incremental	Cumulative	Spec		Cumulative	Cumulative		Spec
+ Retained	- Screen	= Sample	Cumulative	Incremental	Cumulative	Spec	Cumulative	Cumulative	Spec		
							.0525	99.18		1	
							.031	95.33		2	
							.016	87.29		3	
							.0075	77.21		4	
							.004	67.93		5	
							.002	59.38		6	
										7	
										8	
										9	
										10	
										11	
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NOTES:

Sample ID: LAKE MATHEON # 12

Lab # PS-99

Date: 8/25/81

RT-RF

Book #:

Page #: