THE WATER SUPPLY NEAR SELBY
WALWORTH COUNTY, SO. DAK.

BY

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K. Y. Lee

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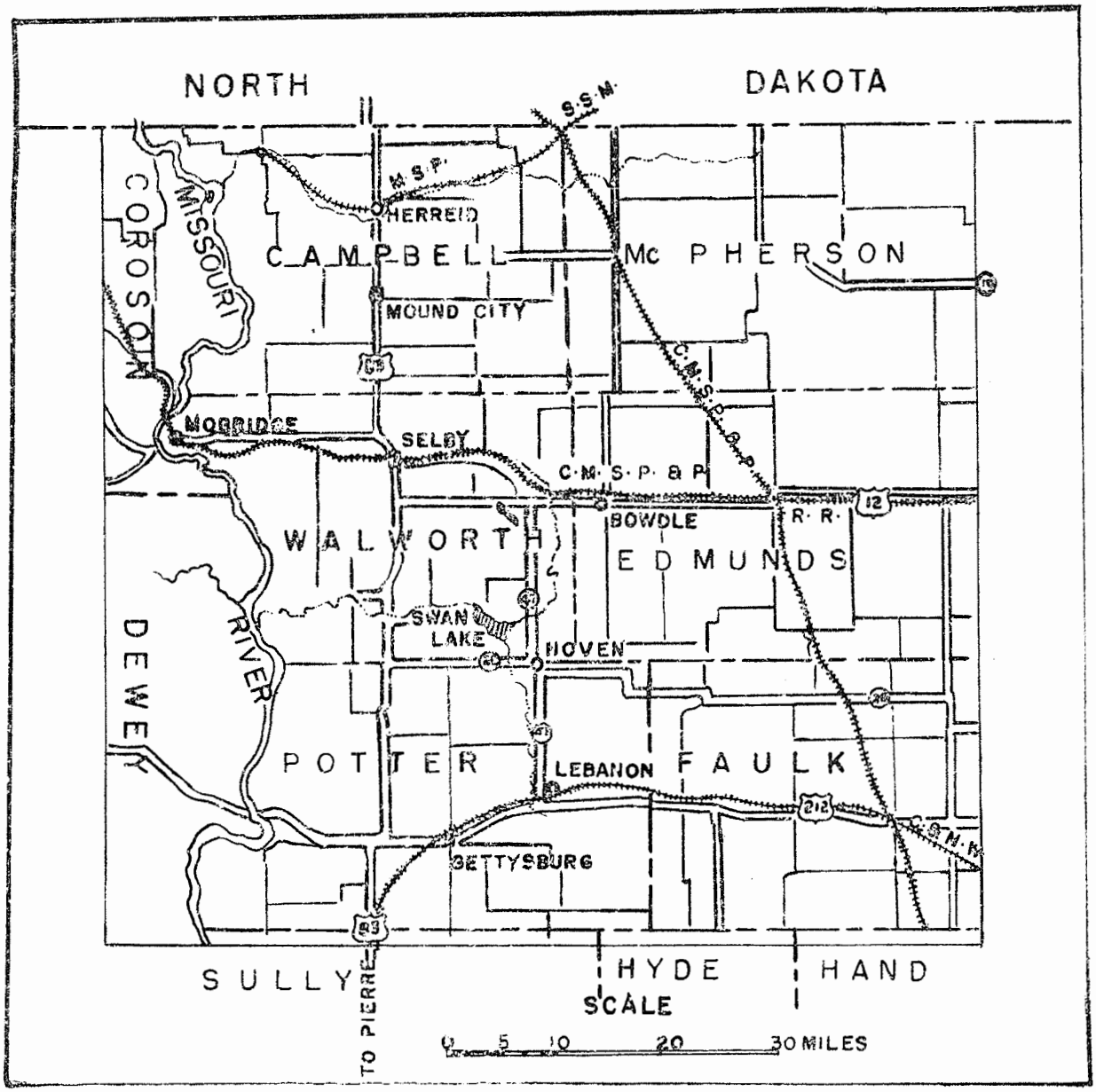

FIG. 1 INDEX MAP

THE SHALLOW WATER SUPPLY NEAR SELBY, WALWORTH COUNTY SOUTH DAKOTA

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INTRODUCTION

Frequent dry seasons have caused repeated shortage in Selby's city water supply and has raised questions concerning the condition, quantity, movement and availability of shallow water in this area. At the request of city officials, a systematic investigation was undertaken by the State Geological Survey during the summer season of 1956.

Selby (Fig. 1, Index Map) is the county seat of Walworth county. It has a population of about seven hundred and is situated in the northern-central part of the county. It lies ninety-one miles from the State Capitol, Pierre, and twenty-two miles east of Mobridge. U. S. Highways 83 and 12 pass through the western portion of the city.

The area under investigation extends east-west about three miles and a half, and north and south more than one mile. The city of Selby is located nearly at the center of its northern part.

During the progress of the investigation, a topographic and geologic map was made by plane table surveying on a scale of one inch to a thousand feet, using a contour interval of five feet. In addition a Carl A. Bays and Associates Earth Resistivity Instrument ER-7 (1953 Model) was used to measure the apparent resistances of subsurface sediments, on the basis of which the thickness of the outwash gravels determined. Simultaneously the locations and elevations of domestic water wells and resistivity stations were plotted. A hand auger was used to determine the thickness of overburden as well as the boundary of the outwash.

Textural study on the outwash sediments was made at the laboratory of the State Geological Survey.

GEOGRAPHY

A drainage basin with an integrated drainage pattern is well-developed in this region. This basin is elongate in shape, and trends nearly due east and west. The maximum relief is 121 feet. The highest elevation is 1966 feet and is located at the southern corner in Section 3, T123N., R76W., while the lowest relief occurs in the eastern part of Section 6, T123N, R76W, with an elevation

OF 1845 FEET.

THE INTERMITTENT MAIN STREAM FLOWS FROM THE EAST TO THE WEST, WITH AN AVERAGE GRADIENT OF ABOUT 16 FEET PER MILE. ITS OUTLET IS LOCATED IN THE NORTHWESTERN PORTION OF THIS REGION. THREE DISTINCT TRIBUTARIES ENTER IT FROM THE SOUTHEAST AND FACILITATE THE WATER FLOWS TO THE MAIN INTERMITTENT STREAM. THE GRADIENTS OF THESE TRIBUTARIES ARE IN THE RANGE OF 35 TO 40 FEET PER MILE, HOWEVER THE PROFILES OF THE TRIBUTARIES BECOMES FLATTER AS THE MAIN INTERMITTENT STREAM IS REACHED, AND AT THE JUNCTION THEY ARE ABOUT ON A LEVEL.

IN THIS REGION A TYPICAL CONTINENTAL CLIMATE IS MARKED BY THE RAPID FLUCTUATION OF TEMPERATURES WHICH TYPICALLY MAKES HOT SUMMERS AND COLD WINTERS. DURING THE PERIOD FROM 1930 TO 1955 (TABLE 1) THE COLDEST WINTER WAS RECORDED AS HAVING A MEAN ANNUAL TEMPERATURE OF 39.70 F^{O} BY THE U. S. WEATHER BUREAU IN 1950. LIKE THE TEMPERATURES, THE ANNUAL PRECIPITATION HAD BEEN QUITE VARIABLE; IN THE PAST TWENTY-SIX YEARS, THE ANNUAL AVERAGE PRECIPITATION WAS 16.146 INCHES. THE DRYEST YEARS OCCURRED FROM 1933 TO 1937, AND THE LOWEST ANNUAL PRECIPITATION, 6.15 INCHES, WAS RECORDED IN 1934. SINCE 1937, HOWEVER, THE ANNUAL PRECIPITATION REACHED A RECORD OF 25.78 INCHES IN 1946. ON THE BASIS OF MONTHLY AVERAGE PRECIPITATION, MAY, JUNE, JULY AND AUGUST ARE THE WET MONTHS, WHILE NOVEMBER, DECEMBER AND JANUARY ARE THE DRY MONTHS.

GEOLOGY

THE REGIONAL GEOLOGY (PLATES 1 & 2, & FIG. 2) IS MADE UP CHIEFLY OF IOWAN DRIFT OF THE WISCONSIN AGE. THIS DRIFT CONSISTS OF TILL WITH INCLUSIONS OF STRATIFIED DRIFT AND OUTWASH. SCATTERED RECENT ALLUVIAL DEPOSITS OCCUR ALONG THE BANKS OF THE INTERMITTENT MAIN STREAM AND ITS TRIBUTARIES.

IOWAN GROUP: IOWAN DRIFT IS WIDELY SPREAD OVER A PRE-GLACIAL EROSION SURFACE OF PIERRE SHALE, AND TENTATIVELY SUBDIVIDED INTO TILL AND OUTWASH RESPECTIVELY.

TILL: TILL, POPULARLY KNOWN AS BOULDER-CLAY, IS MADE UP OF ABUNDANT PEBBLES AND SOME BOULDERS IN A SILT-RICH CLAY MATRIX; MEDIUM GRAY OR DUST YELLOW IN COLOR, WHEN IT IS DRY; GRAYISH BUFF TO GREENISH-GRAY WHEN IT IS MOIST. AS DETERMINED BY SAMPLING WITH A HAND AUGER, A LEACHED ZONE, AVERAGING ONE FOOT THICK, IS USUALLY PRESENT ON TOP OF THE TILLS. THE TOP SOIL IS GENERALLY DARKISH BROWN, SILTY TO SANDY, AND GRADES DOWNWARD INTO MEDIUM GRAY TO GRAYISH BUFF, SOMEWHAT GREENISH-GRAY PEBBLE-CLAY OR BOULDER-CLAY. THIS TILL COMMONLY CARRIES STRATIFIED SAND AND GRAVEL IN ITS BASAL PART, WHICH HAD BEEN ENCOUNTERED BY DOMESTIC WELLS IN THIS REGION.

TABLE I

ANNUAL AND MONTHLY AVERAGE PRECIPITATIONS AND MEAN TEMPERATURES
1930-1955

(DATA BASED ON THE RECORDS ISSUED BY THE U. S. WEATHER BUREAU)*

YEAR	ANNUAL MEAN TEMPERATURE (F°)	ANNUAL PRECIPITATION (INCHES)
1930	45.10	20.31
1931	49.40	13.82
1932	44.40	19.50
1933	48.10	9.20
1934	49.80	6.15
1935	46.00	14.07
1936	44.90	7.21
1937	44.60	13.70
1938	48.00	13.80
1939	48.40	12.47
1940	45.40	13.39
1941	46.60	19.41
1942	44.10	23.36
1943	43.20	18.66
1944	43.70	21.88
1945	42.70	14.64
1946	45.20	25.78
1947	44.30	14.92
1948	44.30	15.06
1949	43.80	17.77
1950	39.70	16.90
1951	40.60	18.66
1952	44.40	10.29
1953	46.00	24.34
1954	45.80	15.54
1955	44.20	15.04

MONTHLY AVERAGE PRECIPITATION 1930-1955	
MONTH	PRECIPITATION (INCHES)
JANUARY	0.425
FEBRUARY	0.550
MARCH	0.916
APRIL	1.324
MAY	2.270
JUNE	3.500
JULY	2.099
AUGUST	1.939
SEPTEMBER	1.129
OCTOBER	1.264
NOVEMBER	0.425
DECEMBER	0.305
TOTAL	16.146

* STATION AT MOBRIDGE, WALWORTH COUNTY, SOUTH DAKOTA

THE ROUNDED ROCK FRAGMENTS WHICH ARE SCATTERED THROUGH THE MASS OF TILL, CONSIST CHIEFLY OF IGNEOUS AND METAMORPHIC ROCK TYPES, PLUS PALEOZOIC LIMESTONES AND DOLOMITES, AND CRETACEOUS PIERRE SHALE. IRONSTONE CONCRETIONS AND CHERT ARE PRESENT IN SUBORDINATE AMOUNTS.

IN THIS REGION EXPOSURES OF THE BASE OF THE TILL COULD NOT BE FOUND, HOWEVER TEST HOLES DRILLED IN SECTION 4, T123N., R76W., IN THE PAST DECADES SHOW THAT THE TOTAL THICKNESS OF THIS DRIFT IS ABOUT 85 FEET.

OUTWASH: THE OUTWASH IS WELL-CONFINED TO THE BOTTOM OF THE DRAINAGE BASIN IN SECTIONS 3 AND 4, T123N., R76W. IT IS COMPOSED OF THE CLASTIC DETRITUS, SAND AND GRAVEL. THE OUTWASH SEDIMENTS WERE CARRIED INTO THE MAIN DRAINAGE BY THE IOWAN MELT WATER FLOWING DOWN SEVERAL SMALL, PRE-GLACIAL RAVINES, WHICH WERE LEADING AWAY FROM AN ICE FRONT LYING SOUTHEAST OF THE DRAINAGE BASIN. THESE STREAMS JOINED THE MAIN VALLEY IN THE NORTHERN PART OF SECTIONS 3 AND 4, T123N., R76W. IN CONSEQUENCE THE OUTWASH PLAIN WAS FORMED AS A SERIES OF SMALL COALESCENT FANS WITH A RATHER EVEN PLAIN SURFACE. THE SANDS AND GRAVELS WERE THEN CARRIED FURTHER WESTWARD ALONG THE OLD CHANNEL OF THE PRESENT MAIN INTERMITTENT STREAM. AS A RESULT OF THIS TYPE OF FILLING, A VALLEY TRAIN WAS FORMED.

THE OUTWASH PLAIN IS LOCATED IN THE NORTHWESTERN PART OF SEC. 3, T123N., R76W., AND EASTERN ONE-FOURTH OF SEC. 4, T123N., R76W., WHILE THE VALLEY TRAIN OCCURS ONLY ALONG THE BANK OF THE PRESENT INTERMITTENT STREAM. THICKNESS OF THE OUTWASH WAS DETERMINED BY THE ELECTRIC SOUNDINGS AND AVERAGES 13.23 FEET IN THICKNESS (TABLE 2).

THE GROSS COMPOSITION OF THE OUTWASH IS A TYPICAL MECHANICAL MIXTURE OF PEBBLES AND COBBLES ASSOCIATED WITH FINE- TO COARSE-GRAINED SAND, AND SOME SILT AND CLAY. THEREFORE THE COMPOSITION WILL BE DISCUSSED UNDER TWO HEADS: 1. THE FINE TO COARSE DETRITUS, AND 2. THE VERY COARSE DETRITUS. THE FINE TO COARSE DETRITUS INCLUDES CLAY, SILT AND FINE- TO COARSE-GRAINED SAND. IT WAS SEPARATED UPON SCREENING INTO 18.17 PERCENT OF SAND, AND 1.78 PERCENT OF SILT AND CLAY. BY WEIGHT PERCENTAGE IT CONSISTS MAINLY OF ROUNDED TO SUBANGULAR QUARTZ GRAINS, WITH SOME ACCESSORY MINERALS AND SCATTERED ROCK FRAGMENTS.

THE VERY COARSE DETRITUS CONSISTS OF GRANULES AND SMALL TO VERY LARGE PEBBLES WHICH ARE CLASSIFIED ACCORDING TO THE WENTWORTH'S GRADE LIMIT: 2-4 MM AS GRANULE AND 4-64 MM AS SMALL TO VERY LARGE PEBBLES. THIS FRACTION IS DIVIDED INTO 13.16 PERCENT GRANULES, AND 56.83 PERCENT SMALL TO VERY LARGE PEBBLES BY WEIGHT PERCENTAGE. THE MAIN CONSTITUENTS OF THE VERY COARSE

TABLE 2

RESISTIVITY DATA ON THE THICKNESS
OF
SAND AND GRAVEL

Station No.	Location	Elevation Datum: Sea Level (feet)			Thickness (feet)	
		Surface	Sand and Gravel		Sand & Gravel	Mantle
			Top	Bottom		
1	Sec. 3, T123N, R76W	1891.333	1889.333	1886.333	3.00	2.00
2	Sec. 3, T123N, R76W	1894.883	1889.883	1886.883	3.00	5.00
4	Sec. 4, T123N, R76W	1887.233	--------	--------	----	----
6	Sec. 3, T123N, R76W	1890.330	1887.330	1882.330	5.00	3.00
7	Sec. 4, T123N, R76W	1889.433	1884.433	1854.433	30.00	5.00
8	Sec. 4, T123N, R76W	1887.630	1884.530	1881.000	3.53	3.10
9	Sec. 4, T123N, R76W	1888.333	1884.133	1848.833	35.30	4.20
10	Sec. 4, T123N, R76W	1895.600	1889.100	1810.600	18.50	6.50
12	Sec. 3, T123N, R76W	1895.233	1889.233	1875.233	14.00	6.00
13	Sec. 3, T123N, R76W	1902.630	1895.380	1876.130	19.25	7.25
14	Sec. 3, T123N, R76W	1908.433	1905.433	1884.183	21.25	3.00
15	Sec. 4, T123N, R76W	1885.033	--------	--------	-----	----
16	Sec. 4, T123N, R76W	1876.533	1874.533	1873.533	1.00	2.00
17	Sec. 5, T123N, R76W	1877.530	--------	--------	----	----
18	Sec. 5, T123N, R76W	1873.633	1869.633	1864.633	5.00	4.00
		Average Thickness-----			13.23	4.25

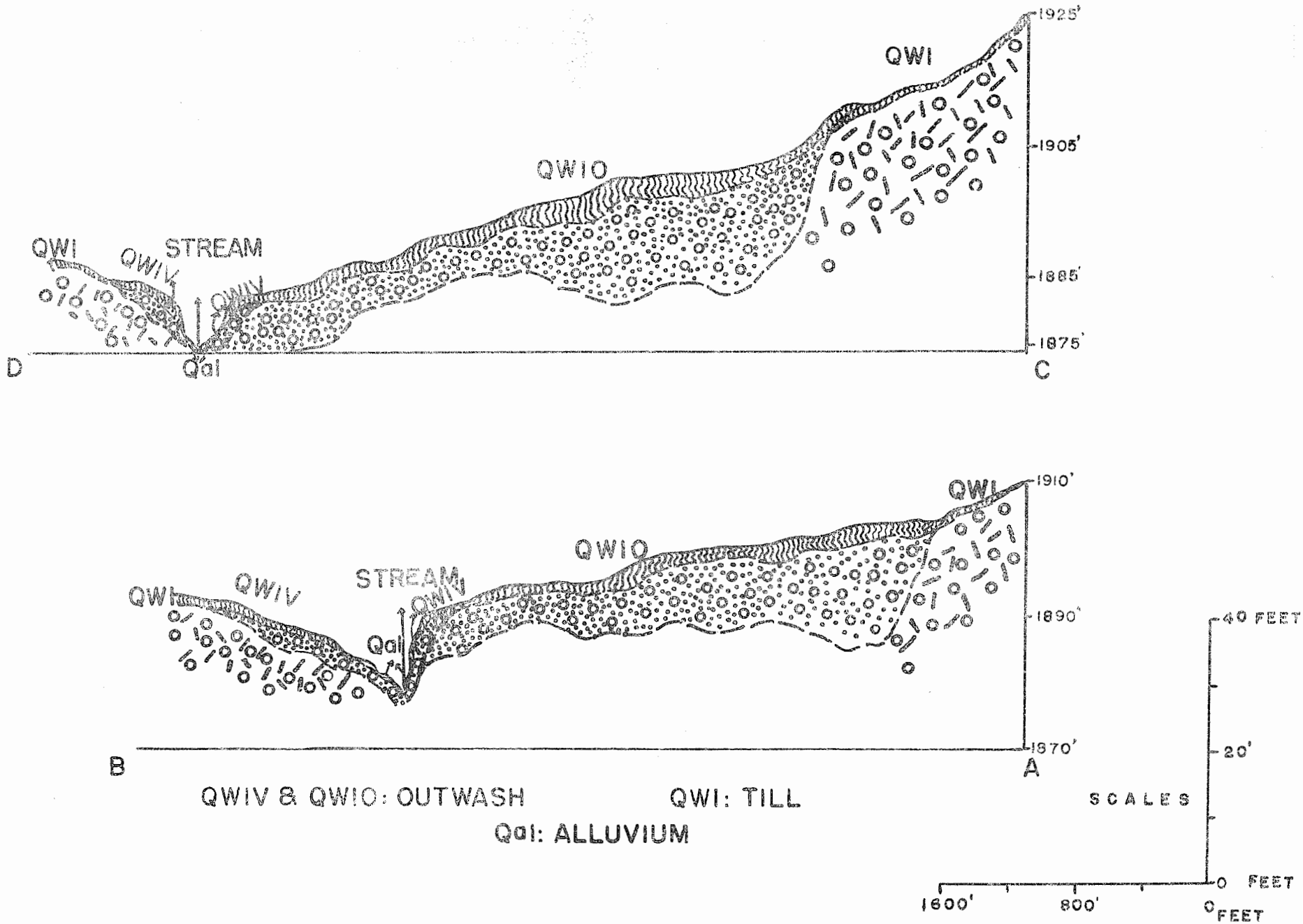


FIG. 2 CROSS SECTIONS SHOWING THE STRATIGRAPHIC RELATIONSHIP OF THE IOWAN DRIFT

DETRITUS ARE MADE UP OF 33 PERCENT OF PALEOZOIC LIMESTONES AND DOLOMITES AND 31.70 PERCENT OF IGNEOUS AND METAMORPHIC ROCK TYPES PLUS 29.03 PERCENT OF PIERRE SHALE, CLAY IRONSTONES AND SOME SANDSTONE AND 5 PERCENT OF CHERT.

TWO BASIC PARAMETERS, MEDIAN AND SORTING COEFFICIENT, ON TEXTURAL STUDY ARE GRAPHICALLY DETERMINED ON THE BASIS OF THE FOREGOING WEIGHT PERCENTAGES, MADE ACCORDING TO THE WENTWORTH GRADE SCALE. THE VALUE OF THE MEDIAN AVERAGES 5.2 MM, WHILE THE SORTING COEFFICIENT HAS THE VALUE OF ABOUT 3.162. THESE FIGURES INDICATE THAT THE TRANSPORTING AGENT WAS A RATHER TURBULENT CURRENT DURING MOST OF THE TIME OF DEPOSITION, AND CARRIED THE SAND AND GRAVEL AT LEAST ONE MILE DOWN THE MAIN VALLEY FROM ITS POINT OF ENTRANCE.

ON THE TOP OF THE OUTWASH A SANDY CLAY LAYER, "HARD PAN", IS USUALLY PRESENT. THIS LAYER HAS A VARIABLE THICKNESS AND GENERALLY CONSISTS OF MEDIUM GRAY SANDY CLAY WITH PATCHES OF LIGHT GRAY BENTONITIC MATERIALS. APPARENTLY IT WAS FORMED IN THE LAST STAGE OF OUTWASH DEPOSITION. AT THAT TIME THE TRANSPORTING CURRENT HAD A LOWER VELOCITY AND THE SUSPENDED CLAY AND SILT HAD ENOUGH TIME TO SETTLE THROUGH THE SLUGGISH CURRENT.

RECENT

ALLUVIUM

THE ALLUVIUM OCCURS ALONG BOTH SIDES OF THE MAIN INTERMITTENT STREAM AND ITS TRIBUTARIES. IT CONSISTS CHIEFLY OF CLAY AND SOME SILT WITH VERY FINE LAMINATION. SCATTERED WHITE TO LIGHT GRAY PATCHES OF BENTONITIC CLAY ARE OCCASIONALLY PRESENT.

SHALLOW WATER

IN THIS REGION THE AMOUNT, CAPACITY AND MOVEMENT OF SHALLOW WATER MAINLY DEPEND ON THE PHYSICAL CHARACTER OF THE IOWAN DRIFT, THE MEAN VALUE OF ANNUAL PRECIPITATION AND THE TOPOGRAPHY NEAR SELBY.

THE PHYSICAL CHARACTER OF THE IOWAN DRIFT: AS MENTIONED BEFORE THE IOWAN DRIFT CONSISTS OF TILL AND OUTWASH. TILL IS AN UNASSORTED MIXTURE AND CONTAINS PARTICLES OF GREAT VARIETY IN SIZE; IT HAS A VERY LOW POROSITY. THE OUTWASH IS MADE UP OF SAND AND GRAVEL, AND HAS A SORTING COEFFICIENT OF 3.162. IN OTHER WORDS, THE MODERATELY SORTED SEDIMENTS OF THE OUTWASH HAVE A HIGHER PERCENTAGE OF POROSITY THAN THE TILL.

PORE SPACE IS A STORAGE PLACE FOR WATER. IT IS A FUNCTION OF THE UNIFORMITY OF PARTICLE SIZE, AND SHAPE AND OF THE STATE OF

PACKING OF THE PARTICLES. AS A RULE, POORLY SORTED SEDIMENTS ARE LESS POROUS THAN WELL SORTED SEDIMENTS. THE FLOWAGE OF SHALLOW WATER IS CONTROLLED BY THE PERMEABILITY OF THE SEDIMENTS IN WHICH IT OCCURS, AND IS DETERMINED BY THE SIZE, SHAPE AND ARRANGEMENT OF THE OPENINGS. COARSE GRAVEL HAS LARGE OPENINGS AMONG THE PEBBLES OR BOULDERS, AFFORDING EASY PASSAGE FOR FLUIDS. AS THE PARTICLES BECOME SMALLER, THE PORES ALSO BECOME SMALLER, AND IT REQUIRES A GREAT LENGTH OF TIME TO LET THE FLUIDS PASS THROUGH.

ON THE BASIS OF THE SORTING COEFFICIENT OF THE OUTWASH, THE STORAGE CAPACITY OF THIS RESERVOIR IS TENTATIVELY DEDUCED SINCE THE SORTING COEFFICIENT OF A SEDIMENT DIRECTLY INFLUENCES THE POROSITY. POROSITY OF THE OUTWASH SEDIMENTS IS ASSUMED AS 25 PERCENT IN SECTION 4, T123N., R76W. THE ESTIMATED RESERVE OF SAND AND GRAVEL IN THIS AREA IS 102,557,664 CUBIC FEET. THE WATER STORAGE CAPACITY, THEREFORE, WOULD BE 7, 639,416 CUBIC FEET. THE ASSUMED VALUE OF POROSITY IS 30 PERCENT IN SECTION 4, T123 N., R76W. THE ESTIMATED VOLUME OF SAND AND GRAVEL IS 115,279,760 CUBIC FEET. THE STORAGE CAPACITY HERE IS COMPUTED TO BE 34,583,928 CUBIC FEET. THE TOTAL WATER STORAGE CAPACITY IN THIS RESERVOIR, THEREFORE, IS 42,223,344 CUBIC FEET.

THE MEAN VALUE OF ANNUAL PRECIPITATION: SHALLOW WATER IS FURNISHED ALMOST ENTIRELY FROM PRECIPITATION IN THE FORM OF RAIN OR SNOW IN THIS REGION. FROM 1930 TO 1955 THE MEAN VALUE OF ANNUAL PRECIPITATION IS 16.146 INCHES (TABLE 1). IF ONE INCH OF RAINFALL ON ONE SQUARE MILE OF LAND SURFACE IS EQUIVALENT TO 2,323,000 CUBIC FEET OF WATER OR MORE THAN 50 ACRE-FEET; THEN THE 16.146 INCHES OF PRECIPITATION WOULD BE MORE THAN 807 ACRE-FEET ON ONE SQUARE MILE. HOWEVER THE ESTIMATED STORAGE CAPACITY OF THE RESERVOIR NEAR SELBY IS 42,223,344 CUBIC FEET OR 971 ACRE-FEET.

IN THE SUMMER OF 1950 THE AVERAGE DEPTH OF WATER IN THE OUTWASH SEDIMENTS WAS 7 FEET. THIS IS COMPUTED FROM THE DOMESTIC WELL (TABLE 3). IF POROSITY OF THE OUTWASH SEDIMENTS AVERAGES 27 PERCENT, A VERTICAL COLUMN OF A SQUARE FOOT IN AREA WOULD CONTAIN ABOUT 1.89 CUBIC FEET. THE MASS OF SAND AND GRAVEL COVERS APPROXIMATELY 365 ACRES OR 12,614,400 SQUARE FEET. IF THE VERTICAL COLUMN OF 12,614,400 SQUARE FEET IS FILLED WITH 7 FEET OF WATER, THE VOLUME OF WATER STORED WOULD BE 23,841,216 CUBIC FEET OR ABOUT 548 ACRE-FEET. THIS FIGURE, HOWEVER, IS OVER HALF OF THE TOTAL WATER STORAGE CAPACITY OF THE RESERVOIR.

THE TOPOGRAPHY NEAR SELBY: THE REGIONAL TOPOGRAPHY IS REPRESENTED BY A DRAINAGE BASIN WITH THE INTERGATED DRAINAGE. THE MAXIMUM RELIEF IS 122 FEET. THE AVERAGE GRADIENT OF THE MAIN INTERMITTENT STREAM AND ITS TRIBUTARIES HAS THE VALUE OF 26 FEET PER MILE. THIS GRADIENT FACILITATES THE RUN-OFF OF SURFACE PRECIPITA-

TABLE 3

WELL RECORDS
AUGUST, 1956

No. on Map	Location	Owner or Tenant	Type of Well	Depth of Well (feet)	Diameter of Well (inches)	Type & Amount of Casing	Height Above Sea Level (feet)
1	Sec. 4, T123N, R76W	Selby City	Du	32	18	Cement 4' down, steel down to 24', screen 8' at bottom	1881.333
2	Sec. 14, T123N, R76W	Selby City	Du	30.5	78	14x4' cement platform, then tile & cement all the way to the bottom	1883.833
3	Sec. 4, T123N, R76W	Selby City	D	32	8	Steel to 22' then 10' of screen to the bottom	1881.433
4	Sec. 32, T124N, R76W	Mrs. D. Smith	Du	20	18	Wood	1872.133
5	Sec. 3, T123N, R76W	John Fiedler	Du	32	16	Wood	1920.933
6	Sec. 2, T123N, R76W	John Fiedler	Du	30	16	Wood	1916.433
7	Sec. 4, T123N, R76W	John Flemmer	Du	33	18	Wood	1897.73
8	Sec. 4, T123N, R76W	John Flemmer	Du	33	18	Wood	1893.73
9	Sec. 4, T123N, R76W	W. J. Schmidt-gall	Du	22	24	Wood	1875.230
10	Sec. 34, T124N, R76W	R. Himrich	D	105	4	Steel	1899.733

TABLE 3 (CONTINUED)

WELL RECORDS
AUGUST, 1956

HEIGHT OF CASING ABOVE GROUND LEVEL (INCHES)	PRINCIPAL WATER BEARING BEDS		METHOD OF LIFT	USE OF WATER	DATE DRILLED OR DUG	DEPTH OF WATER (AUGUST, 1956) (FEET)
	CHARACTER OF MATERIAL	GEOLOGIC SOURCE				
14	SAND AND GRAVEL	OUTWASH	JE	D	1951	8
36	SAND AND GRAVEL	OUTWASH	JE	D	1947	9.5
24	SAND AND GRAVEL	OUTWASH	JE	D	1956	11
18	SAND AND GRAVEL & TILL	OUTWASH IOWAN	WP	SD	1890 (?)	4
12	TILL AND STRATIFIED DRIFT	IOWAN	WP	S	1936	17
24	TILL AND STRATIFIED DRIFT	IOWAN	WP	S	1906	12
10	SAND AND GRAVEL	OUTWASH	EP	SD	1948	7
18	SAND AND GRAVEL	OUTWASH	EP	SD	1906	3
12	SAND AND GRAVEL & TILL	OUTWASH & IOWAN	HP	D	1955	6
12	TILL AND STRATIFIED DRIFT	IOWAN	EP	DS	1948	3

TABLE 3 (CONTINUED)

WELL RECORDS
AUGUST, 1956

NO. ON MAP	LOCATION	OWNER OR TENANT	TYPE OF WELL	DEPTH OF WELL (FEET)	DIAMETER OF WELL (INCHES)	TYPE & AMOUNT OF CASING	HEIGHT ABOVE SEA LEVEL (FEET)
11	SEC. 34, T124N, R76W	R. HIMRICH	DU	14	36x36	WOOD	1893.000
12	SEC. 34, T104N, R76W	R. HIMRICH	DU	90	24	CEMENT 1' DOWN THEN WOOD, DOWN TO THE BOTTOM	1892.233

TABLE 3 (CONTINUED)

WELL RECORDS
AUGUST, 1956

HEIGHT OF CASING ABOVE GROUND LEVEL (INCHES)	PRINCIPAL WATER BEARING BEDS		METHOD OF LIFT	USE OF WATER	DATE DRILLED OR DUG	DEPTH OF WATER (AUGUST, 1956) (FEET)
	CHARACTER OF MATERIAL	GEOLOGIC SOURCE				
36	TILL AND STRATIFIED DRIFT	IOWAN	WEP	S	1941	1
6	TILL AND STRATIFIED DRIFT	IOWAN	WP	S	1926	70

DU: DUG
D: DRILLED
W: WINDMILL

J: JET PUMP
P: PITCHER PUMP

E: ELECTRIC
H: HAND

S: STOCK
D: DOMESTIC

TION INTO THE RESERVOIR AND ALSO CAUSES A RAPID DISCHARGE OF WATER FROM THE RESERVOIR. ALTHOUGH THE IRREGULARITIES OF THE WATER TABLE AND NATURE OF MOVEMENT OF SHALLOW WATER ARE CONTROLLED BY THE DIFFERENCES IN PERMEABILITY OR THICKNESS OF THE WATER-BEARING MATERIALS, AND UNEQUAL ADDITION TO OR WITHDRAWALS FROM THE SHALLOW WATER RESERVOIR AT DIFFERENT PLACES, NEVERTHELESS, THE TOPOGRAPHIC FACTOR IN THIS REGION PLAYS A MAJOR ROLE IN CONROLLING THE SHAPE AND SLOPE OF THE WATER TABLE AND THE VELOCITY OF THE SHALLOW WATER MOVEMENT.

ON THE BASIS OF ELECTRIC SOUNDINGS, THE SURFACE OF THE BOTTOM OF THE RESERVOIR APPEARS MORE RUGGED THAN THAT OF THE OUTWASH PLAIN, AND THEREFORE IT CAUSES STEEPER GRADIENTS IN THOSE SMALL PREGLACIAL RAVINES. OBVIOUSLY THIS SUBSURFACE CONFIGURATION DIRECTLY INCREASES THE VELOCITY OF THE SHALLOW WATER MOVEMENT, BECAUSE THE VELOCITY OF SHALLOW WATER DEPENDS ON THE HYDRAULIC GRADIENT OR THE SLOPE OF THE WATER TABLE AND THE PERMEABILITY.

ACCORDING TO THE TEXTURAL STUDY OF THE OUTWASH SEDIMENTS, THE VALUE OF MEDIAN AVERAGES 5.2 MM; THIS FIGURE INDICATES THE SHALLOW WATER-BEARING MATERIAL CONSISTS CHIEFLY OF PEBBLE DETRITUS, AND HAS A CONSIDERABLY HIGHER VALUE OF PERMEABILITY. THE WATER-BEARING MATERIAL, THEREFORE, WILL READILY YIELD LARGE QUANTITIES OF WATER TO A WELL WITH A MINIMUM DRAWDOWN. THIS EVIDENCE HAD BEEN PROVED BY THE SELBY CITY WELL NO. 3 IN SECTION 4, T123N, R76W. SINCE THE OPERATION STARTED, THIS WELL IS REPORTED TO HAVE HAD A RAPID RECOVERY, AND RATHER SMALL DRAWDOWN.

SUMMARY

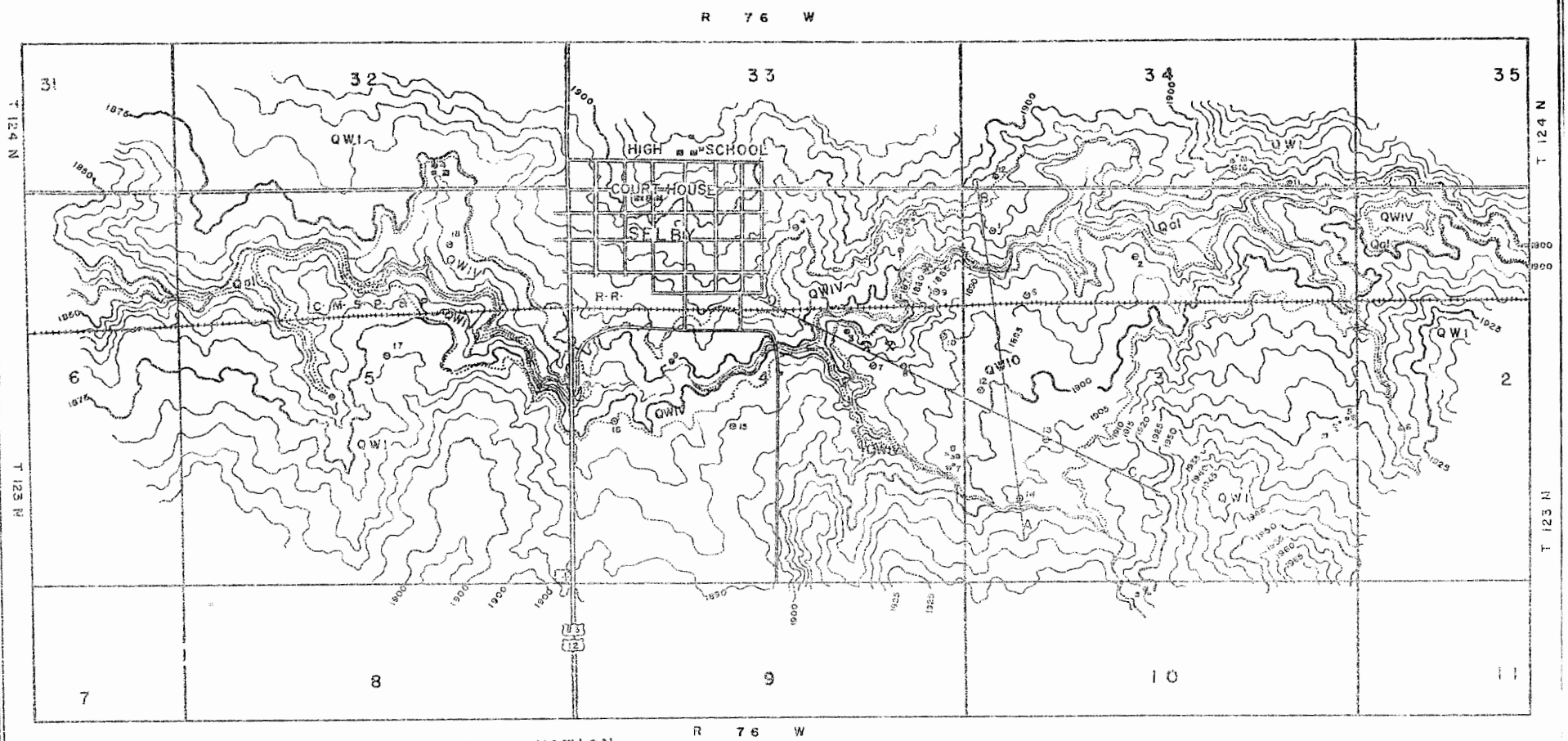
THE IOWAN DRIFT PLAYS A MAJOR ROLE IN THE WATER SUPPLY NEAR SELBY. THE ESTIMATED VOLUME OF THE OUTWASH PORTION IS 8,067,312 CUBIC YARDS. THE GROSS COMPOSITION OF THE SHALLOW WATER-BEARING MATERIAL IS MADE UP OF TYPICAL MECHANICAL MIXTURES OF PEBBLE FRACTIONS IN ASSOCIATION WITH FINE- TO COARSE-GRAINED SAND, AND SOME SILT AND CLAY DETRITUS. THE MAIN CONSTITUENTS OF THE ROCK FRAGMENTS ARE COMPOSED OF 33 PERCENT OF PALEOZOIC LIMESTONES AND DOLOMITES, AND 31.70 PERCENT OF IGNEOUS AND METAMORPHIC ROCK TYPES PLUS 29.03 PERCENT OF PIERRE SHALE, CLAY IRONSTONE AND SOME SANDSTONE AND 5 PERCENT OF CHERT.

THE MAIN BODIES OF SHALLOW WATER FLOW ALONG SEVERAL PREGLACIAL RAVINE CHANNELS WITH HIGHER HYDRAULIC GRADIENTS FROM THE SOUTHEAST TOWARD THE NORTHWEST. THE WATER-BEARING MATERIAL HAS A HIGHER VALUE OF PERMEABILITY AND IT FACILITATES THE PROCESSES OF RAPID RECOVERY OF DOMESTIC WELLS IN THIS REGION.

WATER STORAGE CAPACITY IS COMPUTED AS 42,223,334 CUBIC FEET OR 971 ACRE-FEET WITHIN 365 ACRES ON THE BASIS OF POROSITY OF SAND

AND GRAVEL, WHICH IS REGIONALLY ASSUMED. IN THE SUMMER OF 1956, THE AMOUNT OF WATER IN THE RESERVOIR, HOWEVER, IS ESTIMATED AS 23,841,216 CUBIC FEET OR 548 ACRE-FEET. THIS FIGURE IS OVER HALF OF THE TOTAL WATER STORAGE CAPACITY OF THE RESERVOIR, IT SHOULD THEREFORE FURNISH ENOUGH WATER TO SUPPLY THE CITY OF SELBY.

ACKNOWLEDGMENTS: THE WRITER IS INDEBTED TO MESSRS. D. DONOVAN, D. VALANDRY AND F. KROGMAN FOR THEIR HELP TO CARRY OUT THE ELECTRIC SOUNDING MEASUREMENTS. SPECIAL THANKS ARE DUE THE RESIDENTS OF SELBY AND PROFESSOR T. H. BEDWELL, SOUTHERN STATE TEACHERS COLLEGE, FOR THEIR VALUABLE HELP DURING THE INVESTIGATION.



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EXPLANATION

RECENT

PLEISTOCENE

WISCONSIN

IOWAN

- qal — ALLUVIUM
- QWIV — VALLEY TRAIN (SAND AND GRAVEL)
- QWIO — OUTWASH (SAND AND GRAVEL)
- QWI — TILL & STRATIFIED DRIFT

- GEOLOGIC BOUNDARY
- INTERMITTENT STREAM & BRIDGE
- CONTOURS
- BUILDING & STREETS
- WATER WELL

- XBM 1904-3 — BENCH MARK
- GRAVEL PIT
- RAILWAY
- CEMETERY
- RESISTIVITY STATION

- A B / C D — SECTIONS
- ROADS

SURFACE GEOLOGY NEAR SELBY, WALWORTH CO. SOUTH DAKOTA

SCALE

0 500 1000 2000 3000 FEET

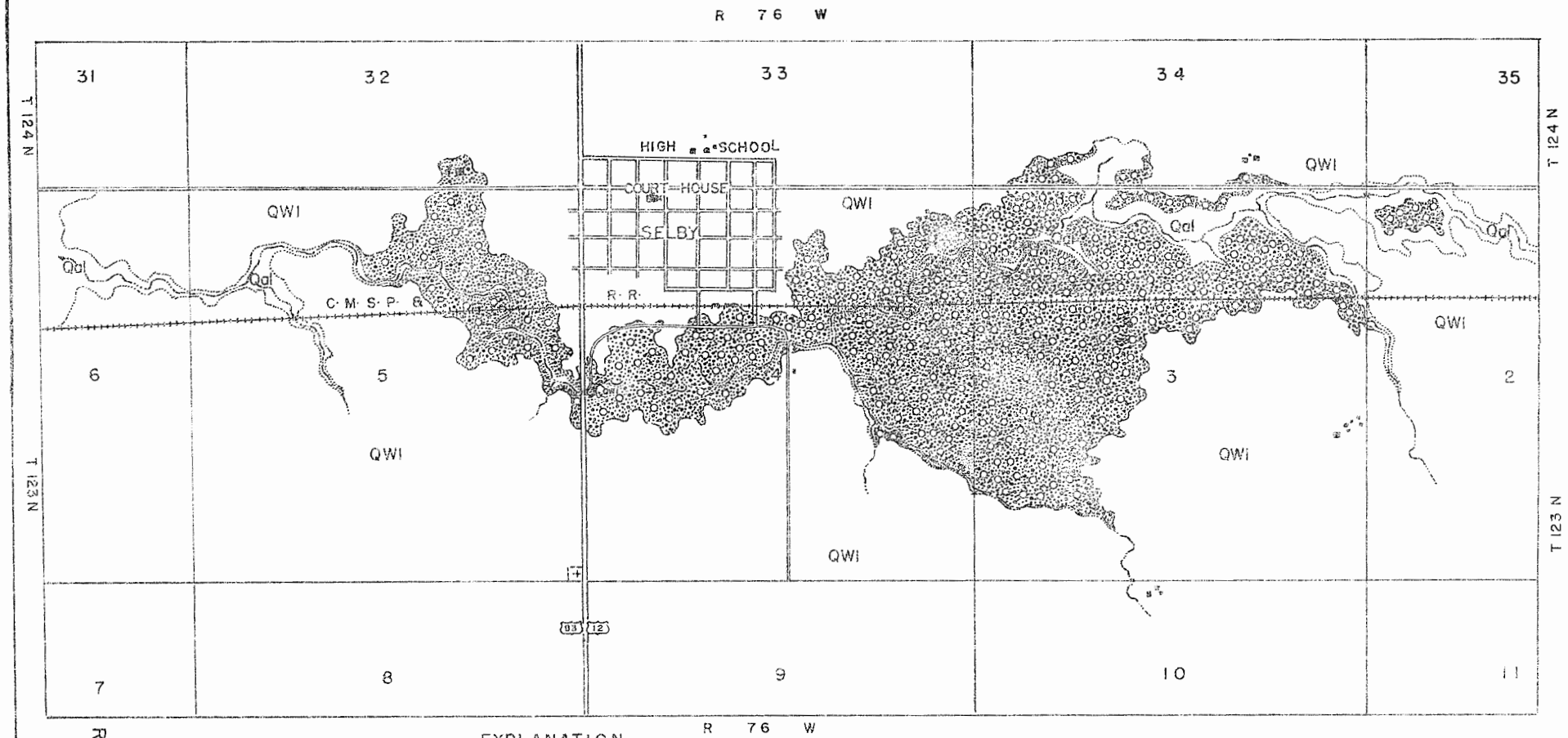
COUNTER INTERVAL

5 FEET

1956

GEOLOGY & TOPOGRAPHY: K. Y. LEE; assisted by D. DONOVAN, D. VALANDRY & F. KROGMAN

GEOPHYSICS: T. H. BEDWELL; assisted by D. DONOVAN, F. KROGMAN & D. VALANDRY



EXPLANATION

RECENT PLEISTOCENE

WISCONSIN — IOWAN

- Qal — ALLUVIUM
- QWI — TILL
- OUTWASH (SAND & GRAVEL)
- GEOLOGIC BOUNDARY
- INTERMITTENT STREAM & BRIDGE
- BUILDING & STREETS
- BENCH MARK
- RAILWAY
- CEMETERY
- ROADS

SHOLLOW WATER RESERVOIR NEAR SELBY, WALWORTH CO· SOUTH DAKOTA

SCALE

0 500 1000 2000 3000 FEET

1956

PREPARED BY K·Y· LEE