

Ground Water Situation at Eureka

MINERAL RESOURCE
RECORDS DIVISION

WORKMAN, L. E.

Ms 15-copy 1

ILLINOIS STATE

August 27, 1930 GEOLOGICAL SURVEY

Memorandum to Dr. Leighton

Accompanying herewith for your reference are (1) a Report on the "Geology of the Ground Water Resources of Eureka, Illinois", and (2) the Mackinaw quadrangle showing the proposed reservoir site and collecting area.

My conclusions after the investigation of the ground water resources at Eureka are that (1) thus far no adequate water-bearing sand and gravel deposit in the glacial drift has been discovered; (2) the geologic situation does not strongly suggest that further prospecting will disclose such a deposit; and (3) that it is not advisable to drill a well into bed rock because of the high mineral content of the waters it contains.

Possible sources of underground water in the glacial drift are as follows:

(1) A widespread sand deposit at a depth of 280 to 375 feet lying west of a line running northwest-southeast through Goodfield, the nearest point to Eureka being the middle of section 22, T. 6 N., R. 2 W., 3 1/3 miles southwest of the village. This sand lies on bed rock and is reported as being 3 to 20 or more feet thick with the size of grain as fine as the beach sand at Lake Michigan. It yields abundant supplies of water for farm wells but is perhaps too far distant and too fine grained to be a suitable source of water for the village.

(2) A thin sand at 111 to 127 feet below the general upland at the contact of the pre-Illinoian ~~outcrop~~ and Illinoian tills. This has been found to be only 6 inches thick in village test wells but contains water. It may be thicker at the location of the Swisher well 1 mile west of the village where drillers state that they obtained the best well of their drilling to that horizon. The prospects for a thick enough deposit are not encouraging.

(3) Shallow terrace deposits in which the last well for the village was developed are too small for an adequate supply of water to be obtained from them and are too near the surface to prevent pollution.

2/27/30

State Geological Survey Division
Urbana, Illinois

Geology of the ground water resources of Eureka, Illinois

Introduction

Over a period of several years the village of Eureka has been faced with a water shortage which has been a serious handicap even during times of average rainfall and normal water consumption. At the request of Mayor Charles Williams and Water Commissioner C. E. Kesler an investigation of the geological conditions which govern the available supplies of underground water was undertaken by the State Geological Survey in the fall of 1929. The results of this investigation are set forth in this report, which attempts to point out the possible water-bearing formations in the vicinity of Eureka and to evaluate each one in the light of its geological situation.

The method of study consisted of (1) the collection of well data from the various well drillers who have done work in the village and the surrounding territory; (2) an examination of previous reports by engineers on their investigations of the water supply possibilities; and (3) a survey of the geological formations outcropping in the valleys of Walnut Creek and its tributaries. The writer wishes to acknowledge his especial indebtedness to the well drillers Messrs. Mike Ebert, Forrest Ebert, E. H. Johnson, E. W. Johnson, and H. W. Packard, all of whom have done work in the community and who very willingly contributed the knowledge gained by their experience.

The two major types of rock materials underlying Eureka, the bedrock and the glacial drift, will be considered separately because of their distinctly different characteristics. The bedrock consists of beds or strata of limestone, shale, and sandstone, so widespread that the characteristics of these rocks which would be encountered in drilling a deep well at Eureka are fairly well known from the study of drillers logs of wells several miles away. For this purpose records of wells at Peoria, Minonk, and Chenoa are available. The glacial drift, however, varies greatly in short distances so that its water-bearing possibilities are entirely a local problem.

Bedrock

The following geologic section has been compiled from the study of deep bedrock wells at Peoria, Minonk, and Chenoa, and shows the approximate thicknesses and depths of the various formations which might be encountered in drilling such a well at the location of the present pumping station at Eureka.

Name	Description	Thickness Feet	Depth Feet
Pleistocene system:	glacial till, sand and gravel, includes an old soil	190	190
Pennsylvanian system:	thin beds of shale, sandstone, limestone, and coal; salt water, gas and oil showings.....	510	700
Burlington formation:	white limestone; salt water, artesian at Peoria...	175	875
Kinderhook series:	blue and brown shales...	225	1100
Devonian-Silurian systems:	gray limestone; salt and sulphur waters, artesian at Peoria.....	275	1375
Maquoketa formation:	gray and brown shales with thin limestones.....	200	1575
Galena-Platteville formations:	brown and gray limestones, artesian water at top at Peoria, high mineral content.....	325	1900
St. Peter formation:	white sandstone, water with high mineral content...	200	2100

It will be noted that all waters in the bedrock are highly mineralized. Flowing wells are obtained at Peoria only along the lowland close to the river, the artesian head being about 560 feet above sea-level in the St. Peter sandstone. As the elevation at the pumping station at Eureka is about 760 feet above sea-level this would mean that the head of water in the St. Peter at Eureka may be about 200 feet below the surface.

Glacial Drift

"Glacial drift" is an all-inclusive term given to all materials now found above the surface of the bedrock, with the exception of the alluvium which has been deposited in the valleys during recent times. The drift is composed of roughly stratified beds of pebbly clay known as "till", in which and between which are layers and lenses of sand and gravel, beds of wind-blown silt known as loess, and at least one old soil. In the vicinity of Eureka and westward to Peoria the known thickness of the drift ranges from 149 to 375 feet, owing not only to irregularities in the present topography but to similar irregularities in the preglacial surface of the bedrock. It is evident that at least two and possibly three great continental glaciers spread southward over this region carrying soil and rock debris which had been derived from areas farther north and which was deposited as till or stream-sorted sand and gravel when the glaciers melted. In the long intervals between glacial epochs the wind-blown loess was deposited and the soil was formed.

A general section of the glacial drift in the vicinity of Eureka is as follows:

Formation	Name	Thickness Feet
Soil, silty, dark brown (post-Wisconsin).....		1
Loess, yellow-brown (Wisconsin).....		3 1/2
Till, pebbly, pink and gray (Wisconsin).....		25-54
Loess, yellow-gray, fossiliferous (Peorian).....		3-6

Soil, loessial, brown, peaty (Sangamon).....	1
Loess, brown to gray (Sangamon).....	7
Till, pebbly, bluish-gray (Illinoian).....	30-50
Sand and gravel, water-bearing (Illinoian)....	0-1/2
Till, pebbly, bluish gray and brown, very tough (pre-Illinoian?).....	60-100

In this paper the materials in the glacial drift will be considered from the lower deposits to the upper in the order of their deposition rather than from the top down as they are met in drilling.

Southwest of a line roughly extending from Metamora to Goodfield a deposit of sand is encountered under the pre-Illinoian (?) till. Drillers state that this sand is encountered generally at depths of 280 to 375 feet throughout almost the entire region as far west as Peoria. The sand is said to be fine, similar to the sand now found along the shores of Lake Michigan. It varies from 3 to 20 or more feet in thickness and yields abundant supplies of water for farm wells. The known occurrence of this sand closest to Eureka is in the 280-foot Swartzenthroat well, about 3 1/3 miles west of the court house. A study of the sea-level elevations of the sand in numerous wells discloses the fact that it occupies a broad depression in the bedrock surface which lies from 20 to 100 feet lower than the bedrock surface at Eureka. It is therefore hardly possible that the deposit is available at Eureka for supplying the village with underground water. However, there is a sand and gravel deposit at Eureka, probably lying on the surface of the bedrock and under the pre-Illinoian (?) till, which now supplies water to the 187-foot village well and the 179-foot Dickinson Canning Co. well and was possibly encountered in the 170-foot coal-shaft well. The bed of sand is practically horizontal with a variation of ten feet in the elevation of the base in the 187-foot and 179-foot wells and of four feet in the 187-foot and 170-foot wells. Although this sand now yields water to the village and Dickinson Canning Co. wells, it seems of

such limited extent that it is probably unable to yield a sufficient quantity of water for both wells. It is reported that pumping either well reduces the available supply in the other well and that the Dickinson well is in a more favorable location because of the slope of the bottom of the sand towards that well.

The fact that there is a pre-Illinoian till in ^{the} region of Eureka is indicated by several factors: 1. Drillers report that a blue and brown till encountered in the lower part of deeper wells is considerably more compact than the blue till above, a condition which may be due to the greater age of the lower till and to being overridden by an ice sheet additional to the ones which compacted the Illinoian till above it. 2. The contact of the tills is found in test borings Nos. 1, 2, and 17 respectively, at depths 91 1/2, 78, and 86 feet, or at about 630 feet above sea-level, indicating that the possible pre-Illinoian surface was relatively even. However, there is a possibility that test borings Nos. 11 and 13, drilled close together in the western part of the village, encountered the contact at 656 and 648 feet respectively. 3. A very thin deposit of water-bearing sand and gravel was encountered on the surface of the hard till in each of the five test holes here mentioned and also at an elevation of about 630 feet above sea-level in several wells within an area extending 2 to 3 miles westward and southward from the court house. (No sand and gravel lenses are reported in the pre-Illinoian till itself).

Farm wells west and southwest of Eureka which draw their supplies from the sand on the surface of the pre-Illinoian till are as follows:

Swisher, NE cor. Sec. 14, 111 feet deep
Wm. Nafsinger, NW cor. Sec. 15, 127 feet
Chris Good, SE cor. SW 1/4 Sec. 9, 120 feet
John Reeser, NW cor. Sec. 23, 111 feet
John Bradle, SE 1/4 Sec. 23, 127 feet

It is very possible that this is the same sand encountered at about 84 feet in the main pumping-plant wells of the village, at about 80 feet in the Dickinson well, and somewhere above 90 feet in the coal-shaft well. The best well into the sand was reported by drillers to be the old Swisher well, one mile west of the court house. At Cruger no sand was found, the drill passing at 120 feet from the softer blue clay to "shale" that is probably the hard pre-Illinoian till.

The Wisconsin drift in the vicinity of Eureka consists of a pebbly pink and blue till, the surface of which rises in two broad northwest-southeast ridges known as the Bloomington terminal moraine to the southwest and the Normal terminal moraine to the northeast. Eureka is situated on the western side of the Normal terminal moraine. These terminal moraines represent positions held by the front of the Wisconsin glacier while its southwestward advance just kept pace with the rate of melting so that new materials were constantly being brought forward to be deposited at the edge of the glacier. The conditions indicate that while the Normal moraine was being formed a stream from the melting edge of the ice flowed out into the present position of Walnut Creek and not only cut a valley in the soft till but left sand and gravel deposits in the valley. Remnants of such deposits are now exposed in the terrace gravels on both sides of Walnut Creek in the SE. 1/4 Sec. 13, in the southwestern part of the village. It is believed that the sand and gravel encountered in the well which was developed at the location of test boring No. 2 in the western part of the village is a part of this deposit that has been completely covered up by subsequent alluvium, slope-wash, and surface-creep of the ground.

Water Possibilities

A consideration of each of the known water-bearing deposits does not give assurance that an adequate supply of underground water is available for use by the village of Eureka but gives some suggestions which, if they are followed up, may prove of value. Each of the deposits will be considered in the order of their deposition.

1. Waters from the bedrock are probably all so highly mineralized that they would be very unsatisfactory supplies, although they could be utilized if there is no other source available. For data on the chemical characters and possible yields of waters from the various bedrock formations consult the State Water Survey, Urbana.

2. The fine water-bearing sand at 280 to 375 feet depth in a depression in the top of the bedrock west of Eureka is probably too far away from the village to be an economical supply unless there is no other source available closer to the village. The closest known occurrence of this sand in farm wells is $3 \frac{1}{3}$ miles west of the court house. It is possible, too, that the sand may be too fine to permit a large yield from a single well.

3. The water-bearing sand and gravel in the base of the glacial drift which now supplies the 187-foot village well and the 179-foot Dickinson Canning Co. well is of such limited extent that it is now unable to supply both wells adequately and is therefore not worthy of further prospecting.

4. The most favorable water-bearing deposit seems to be the sand at the base of the Illinoian till at an average depth of 120 feet west of Eureka. However, it is by no means certain that it will furnish an adequate supply to the village. Although farm wells drilled to this horizon are reported as very good, the quantity of water required for a village supply is so much greater than the quantity needed for a farm that it is impossible to estimate the capacity of this deposit. The

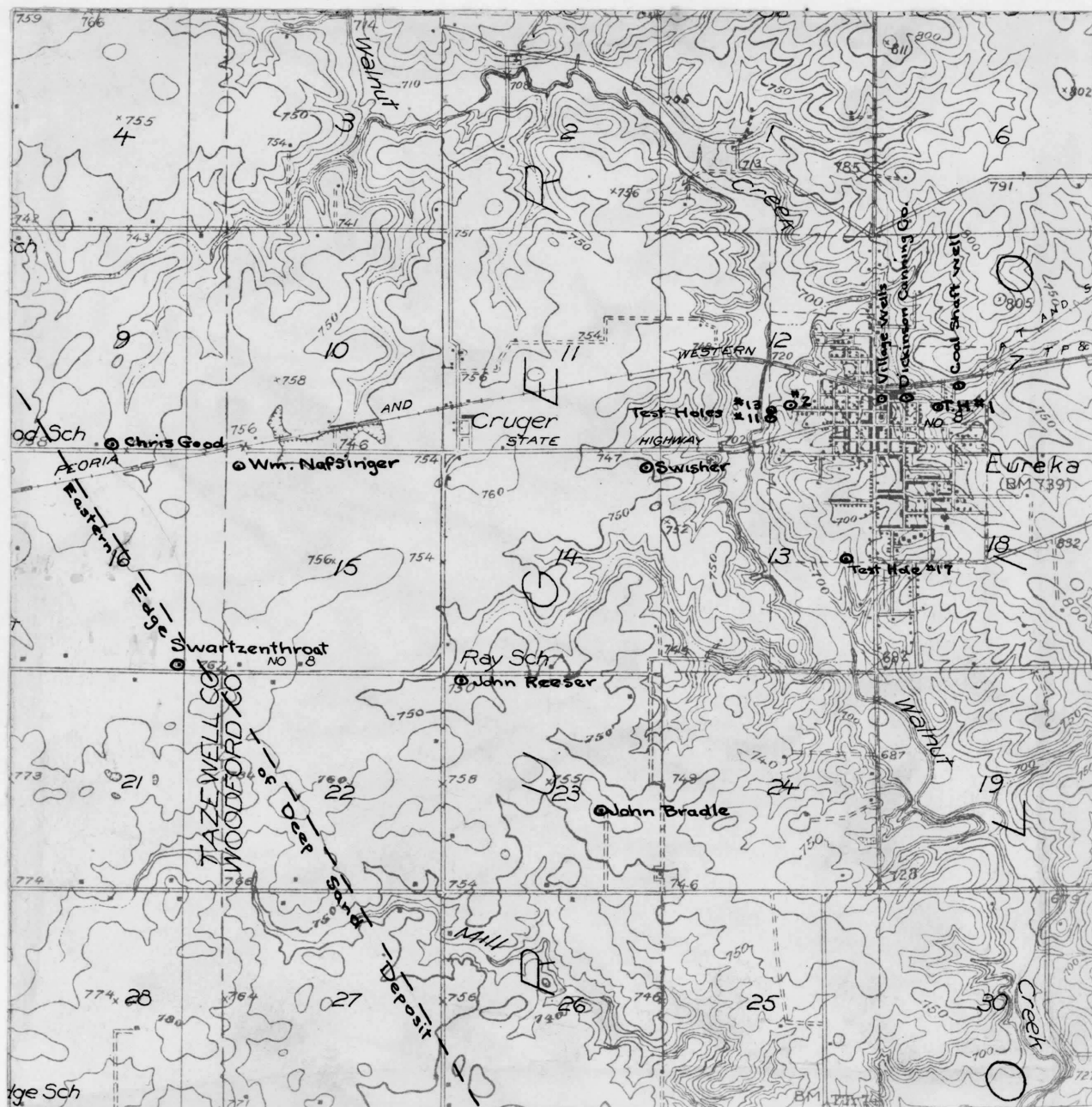
discovery of the sand in almost every test hole which was drilled deep enough and its occurrence in the several farm wells west of Eureka indicate that the deposit is widespread and thus collects the water seeping downward through the till over a large area. If at any place this sand can be found to be perhaps five or more feet thick and of satisfactory porosity, it is likely that it would meet the water requirements of the village of Eureka. The greatest thickness found in test holes was 6 inches. Inasmuch as the best well to this horizon seems to be the old Swisher well, one mile west of the court house, a test boring about 111 feet deep near the Swisher well should prove of value to the village. If the hypothesis that this is an outwash deposit is correct, it is possible that coarser and thicker material will be found to the north nearer to where the stream from which it was deposited flowed out from the edge of the glacier. Such a possibility should be tested by one or two test holes if the results of the first test hole are favorable. A satisfactory deposit of this type has recently been discovered by the city of Mattoon after several years' prospecting. It was suggested by one driller that if this sand deposit is developed by digging a well of large diameter in the vicinity of the Swisher well, the village requirements will be fully met.

5. Further prospecting in the Wisconsin drift to depths of 25 to 50 feet is thought to be useless. The terrace gravels along Walnut Creek such as outcrop in the southwestern part of the village, are probably too close to the ground-water table and of too limited extent to provide continuously the desired amount of water.

February 6, 1930

L. E. Workmen
Associate Geologist
Section of Subsurface Data

Approved: Wm. H. Light Chief



SOME WELLS IN THE VICINITY OF EUREKA

FACTS CONCERNING PROPOSED WATER SUPPLY FOR EUREKA

A lake is to be made by building an earth dam across the valley of a creek flowing into Walnut Creek south of Eureka. The dam is to have a concrete core wall and a concrete spillway for passing surplus storm water.

Size of lake - 22 acres.

Maximum depth of water 15 ft.

Shore line - $1 \frac{5}{8}$ miles.

Quantity of water in lake 43,000,000 gallons.

The present rate of consumption is about 20 million gallons per year and the new lake will hold sufficient for 2 years.

Watershed draining into the lake 1600 acres.

The run off from this area in a year of average rainfall will fill the lake 6 to 8 times.

Dam will be 10 ft. wide at the top and 105 ft. wide at the bottom.

The water is to be filtered and softened in a modern plant located near the dam and then pumped to a new elevated steel tank in the city.

Plant will have a capacity of 300,000 gallons per day.

Present consumption is about 60,000 gallons per day.

This elevated tank will hold 100,000 gallons, providing adequate storage for fire protection and enough for one and one half days of normal consumption.

Duplicate pumps will be provided at the plant.

Water will be as soft as cistern water and
much cleaner.

Pipe line to city to be 8 inch cast iron.

Estimated cost of operation of new plant \$250.00
per month.

~~Building the project will require a large amount
of local labor and materials.~~

MINERAL RESOURCE
RECORDS DIVISION
Workman, E.F.
Aug 15
ILLINOIS STATE
GEOLOGICAL SURVEY



Advance sheet
Subject to correction

644-N-IV-W/2
STATE OF ILLINOIS
DEPARTMENT OF REGISTRATION AND EDUCATION
A. M. SHELTON, DIRECTOR
GEOLOGICAL SURVEY DIVISION, M. M. LEIGHTON, CHIEF, URBANA, ILLINOIS
(Metamore)

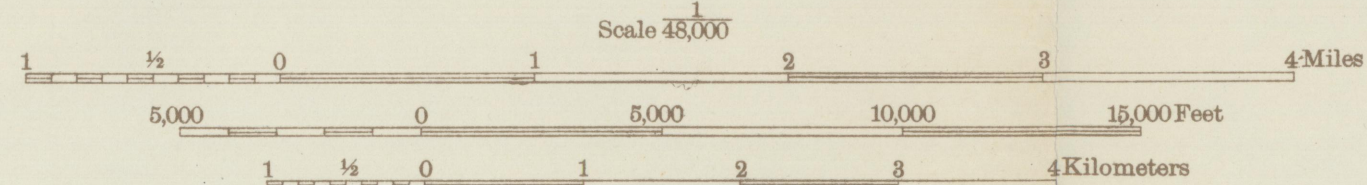
ILLINOIS
MACKINAW QUADRANGLE
T. 26 N.
R. 2 W.

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T. 24 N.

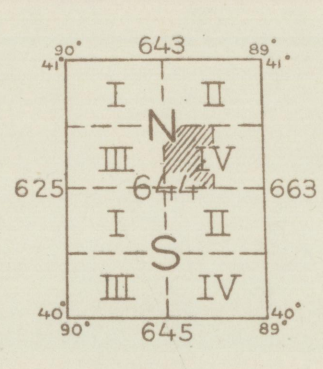
W. H. Herron, Division Engineer
Topography by F. A. Danforth, W. R. Chenoweth,
S. B. O'Hara, H. S. Milsted and A. T. Munson
Control by U. S. Geological Survey
Surveyed in 1927-1928

Metamore	644
Chert	645
Shale	646
Quartzite	647

TRUE NORTH
MAGNETIC NORTH
APPROXIMATE MEAN
DECLINATION, 1927



Contour interval 10 feet
Datum is mean sea level



MACKINAW, ILL.