DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
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PREPARED IN COOPERATION WITH
THE COMMONWEALTH OF KENTUCKY, UNIVERSITY OF KENTUCKY
KENTUCKY GEOLOGICAL SURVEY
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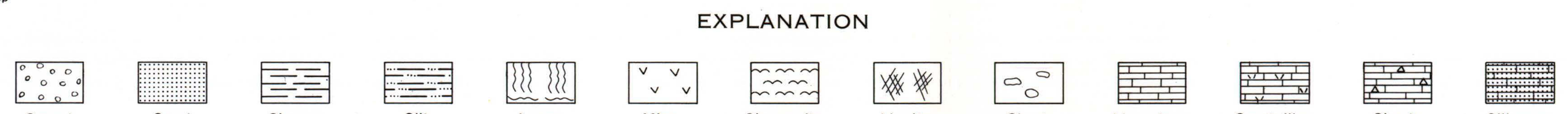
HYDROLOGIC INVESTIGATIONS
ATLAS HA-169

GENERALIZED COLUMNAR SECTION AND WATER-BEARING CHARACTER OF GEOLOGIC FORMATIONS

SYSTEM	SERIES	GROUP	FORMATION	SECTION	THICKNESS, IN FEET	LITHOLOGY	TOPOGRAPHY AND GEOLOGIC SETTING	HYDROLOGY
QUATERNARY	Pleistocene and Recent		Alluvium		0-40±	Clay or silt near the surface, grading downward into clayey sand or silt with clayey gravel and (or) clean gravel (about 5 to 10 feet thick in large creeks) near the base.	Present in the larger stream valleys and their tributaries. As thick as 30 to 40 feet in the valleys of West Fork Mayfield Creek and Little Creek; about 5 to 25 feet thick in smaller stream valleys.	Water bearing in much of the quadrangle. Will furnish a sufficient supply for domestic use in most of the valleys of West Fork Mayfield Creek and Little Creek. Presently appears to be unused, either because of poor chemical quality (possibly high iron content and high hardness) or of concern about possible contamination existing in such a shallow aquifer.
	Pleistocene		Loess		0-12	Tan to gray unstratified silt or clay.	Covers all upland areas and the gently sloping sides of stream valleys.	Not an aquifer. When saturated by rainfall transmits water to lower aquifers.
	Pliocene(?)		Gravel[1]		0-50±	Tan, red, or brown chert gravel, commonly sandy, grading upward to gravelly sand, sand with chert pebbles, sand, or clay.	Overlies Eocene sediments in most of the quadrangle. Most exposures are gravel; the finer grained sediments in the upland areas are concealed by loess.	The water table is below the base of the Pliocene(?) gravel in the entire quadrangle: therefore the gravel is not an aquifer. Cemented zones at the base of the gravel may perch water locally, but no wells are known that tap such a perched zone; however, a small spring from such a perched zone near the northeast corner of the quadrangle is reported to flow all year.
TERTIARY	Eocene		Sand and clay		100-170 (450-600 total)	Red, tan, to white fine- to coarse-grained sand, with stringers of white to gray clay.	Underlies Pliocene(?) gravel and Quaternary alluvium in all the area. Sand and clay exposures are common in the deeper highway and railroad cuts and along creek banks of streams that have cut through the surficial material.	An excellent aquifer in the entire quadrangle. Most wells tap the upper part of the Eocene sands, but a few wells probably tap sand in the middle part. No wells are known that penetrate deeply to the lower part. During a pumping test, public-supply wells at Fancy Farm yielded 100 gpm (gallons per minute) with a reported specific capacity of 0.8 gpm per foot of drawdown. A slightly deeper well, also at Fancy Farm, is reported to yield 59 gpm with a specific capacity of 9.3 gpm per foot. Wells tapping the lower Eocene aquifers should be capable of yielding 1000 gpm, or more, throughout the quadrangle. The water is soft, contains less than 0.3 ppm (parts per million) of iron, and is slightly acidic.
					90±	White to gray clay; fine- to medium-grained sand; interlayered sand and clay; appears to become more sandy in the southern part of the quadrangle. Because well data are insufficient, the unit is not traceable across the quadrangle.		
					150±	Brown to white coarse- to fine-grained sand.		
					100±	Gray to black clay, probably lignitic, and fine-grained sand; grades downward to coarse-grained sand near the base.	Not exposed, but probably underlies the entire quadrangle.	No wells in this quadrangle tap this unit. The sand near the base may be capable of supplying water for domestic use, but probably will not supply large yields because of its thinness.
	Paleocene	Midway	Porters Creek Clay		160-200	Light- to dark-gray or black, slightly to very micaceous clay with fine- to medium-grained, commonly glauconitic sand beds in the upper part. Black clay and glauconitic sand or glauconitic clay at the base.	Not exposed, but underlies Eocene sediments throughout the quadrangle.	Generally not an aquifer. The clay is the base of the zone of ground-water circulation in the overlying Eocene sediments and confines ground water in the underlying McNairy Formation. Penetrated in the Fancy Farm quadrangle only by the 1090-foot oil-test hole 2 miles southeast of Fancy Farm.
CRETACEOUS	Upper Cretaceous		McNairy Formation[2]		300	Dark-gray to black clay interlaminated with fine- to medium-grained sand; mica and lignitic material common. Clay is the most common material in the upper part of the formation. Sand and clay are interbedded in the lower part; sand beds of varying thicknesses are generally present at the base.	Not exposed, but underlies Porters Creek Clay throughout the quadrangle.	The water-bearing character of the formations below the Porters Creek Clay has not been tested in the Fancy Farm quadrangle. The sand in the McNairy Formation probably could yield a large amount of water of fair to good quality, but because of the large amount of water available from the shallower Eocene aquifer, the McNairy has not been tapped for a source of ground water. The casing of the 1090-foot oil-test hole near Fancy Farm is reported to have been perforated near the base of the McNairy. The water level in this well was measured, but other data on the water are unavailable.
			Tuscaloosa Formation		?	Rounded chert gravel in a clay matrix.	Not exposed. Discontinuous farther north and east below the McNairy Formation and above Paleozoic rocks. May be thin or absent in Fancy Farm quadrangle.	Water bearing, but generally not an aquifer because of poor sorting and high clay content.
DEVONIAN			Sedimentary rocks, undivided		0-300±	All rocks below the Cretaceous are of Paleozoic age and are the "bedrock" of well drillers. Coarsely crystalline dolomitic limestone and chert.	Not exposed. Underlies Cretaceous rocks in most of the quadrangle.	Not penetrated by wells in the Fancy Farm quadrangle. Probably water bearing, but quality and quantity of water are unknown.
SILURIAN			Sedimentary rocks, undivided		300±	Limestone, siliceous; red color prominent in the lower part.	Not exposed. Underlies Devonian rocks in most of the quadrangle.	Not penetrated by wells in the Fancy Farm quadrangle. Probably water bearing, but quality and quantity of water are unknown.

[1] Age undetermined. Estimates of age range from Pliocene or older to Pleistocene
[2] May contain beds of Clayton age at the top

EXPLANATION



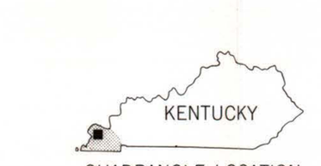
MAP SHOWING AVAILABILITY OF GROUND WATER, LOCATION OF WELLS AND SPRINGS, AND QUALITY OF THE WATER

Base by Tennessee Valley Authority and U.S. Geological Survey, 1955
The Carter Coordinate System letters and numbers used to designate five-minute divisions of latitude and longitude are shown along the margins; tick marks indicate one-minute divisions

APPROXIMATE MEAN DECLINATION, 1966

SCALE 1:24 000

CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL



Hydrology by R. W. Davis, 1964

EXPLANATION

The water-availability areas on this map show the occurrence and availability of ground water in the shallowest aquifer that will yield adequate amounts of water for domestic use in each area. As considered in this report, an adequate domestic supply will deliver approximately 500 gallons per day from a well equipped with a power pump and pressure-distribution system. The shallowest aquifer is underlain by deeper aquifers whose water-bearing properties are described in the generalized columnar section

Qal

AREA 1
Water in Quaternary alluvium

The alluvium will yield sufficient supplies of water for domestic use in the valleys of West Fork Mayfield Creek and Little Creek. In other parts of the quadrangle, ground water may be perched in the alluvium above cemented beds or clay bodies. At present, wells in Area 1 appear to obtain water from the underlying Eocene sand, probably because the water quality is better and there is a possibility of contamination from the shallower alluvial sources

Tu

AREA 2
Water in Eocene sand
Diagonal ruling shows areas where the water level in wells is more than 100 feet below land surface

Furnishes adequate domestic supplies in all of the quadrangle. Properly constructed wells tapping the lower part of the Eocene sand in the entire area should be capable of yielding 1000 or more gallons per minute. Drilled wells are most common where the depth to water is more than 100 feet. Both drilled and bored wells are used where the depth to water is less than 100 feet

Area boundary

Oil-test well

61

Test hole
Figure below line is depth of test hole

D

Water well
D, *Drilled or jetted well, generally steel or plastic casing with well screen on the lower end*
B, *Bored or dug well, generally 24-inch concrete tile casing or 6-inch vitrified clay pipe, open at the bottom*

Spring

Tu–60r (P) / 197
- Aquifer (see below)
- Water level in well, in feet below land surface; r if reported
- Yield in gallons per minute, or adequacy (see below)
- Depth of well, in feet below land surface

AQUIFER SYMBOLS

QTg........Gravel of Pliocene(?) age
Tu........Sand of Eocene age
Km........McNairy Formation of Cretaceous age

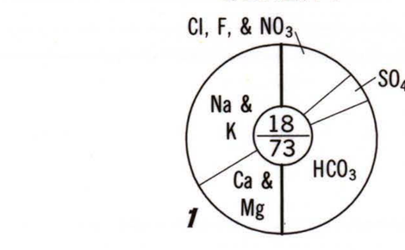
YIELD OR ADEQUACY

(150)........Gallons per minute, where known
(P)........Well reported adequate for power pump for domestic and (or) stock supply
(H)........Well reported adequate for hand pump or bailer
(X)........No yield information available

—350—

Water-level contour
Shows altitude of water level in the saturated zone of Quaternary alluvium and Eocene sand. Contour interval 10 feet; datum is mean sea level. Water-level measurements made in July 1964

QUALITY



Chemical composition of dissolved solids

Figure between circular diagram and well symbol refers to analysis number in table at end of text. Figure above line at center of circle is carbonate hardness (calcium magnesium hardness, as $CaCO_3$) in ppm (parts per million); figure below line is dissolved solids in parts per million. Hardness of water is classified by the U.S. Geological Survey as follows: 0-60 ppm, soft; 61-120 ppm, moderately hard; 121-180 ppm, hard; and 181 ppm or more, very hard. Dissolved solids in partial analyses are computed from specific conductances and are only approximate values. Areas of the segments of each circle are proportional to the mineral components in the dissolved solids in the water. Percentages are computed from equivalents per million of the anions and cations. Calcium and magnesium are shown as one segment in partial analyses. All wells sampled contained less than 45 ppm of nitrate. Water containing more than 45 ppm of nitrate may cause a type of methemoglobinemia in infants ("blue baby" disease), sometimes fatal, and should not be used in infants' formulas

EXPLANATION

Qal........Alluvium of Quaternary age
QTg........Gravel and sand of Pliocene(?) and Pleistocene ages
Tu........Sand and clay of Eocene age, undifferentiated
Tpc........Porters Creek Clay of Paleocene age
Km........McNairy Formation of Cretaceous age
Kt........Tuscaloosa Formation of Cretaceous age
Du........Devonian rocks, undifferentiated
Su........Silurian rocks, undifferentiated

AVAILABILITY OF GROUND WATER IN THE FANCY FARM QUADRANGLE, JACKSON PURCHASE REGION, KENTUCKY

Sufficient supplies of ground water for domestic and most public and industrial needs are available in the area of the Fancy Farm quadrangle, Kentucky. This atlas, one of a series being prepared to describe in detail the ground-water conditions in the Jackson Purchase region in western Kentucky, presents nontechnical information about ground water in an area near Fancy Farm for use by well drillers, landowners, and other well users.

Most wells in the quadrangle are less than 200 feet deep and obtain ground water from sand of Eocene age. A few bored or dug wells in the bottom-land areas may obtain some ground water from alluvial deposits.

The water-availability map presents information on the occurrence of the shallowest aquifer that will yield an adequate supply of water for domestic use. The map explanation and the columnar section briefly describe the water-yielding properties of the formation, and the availability of ground water at a particular location may be determined by the area pattern on the map. The approximate depth to water can be calculated by subtracting the altitude of the water level (as shown by the water-level contours) from the altitude of the land surface. Chemical composition of water from wells is represented on the map by circular diagrams.

The Eocene sands contain an abundance of good-quality ground water. Wells at Fancy Farm presently yield about 250 gpm (gallons per minute) for public supply and commercial use. A well northeast of Wheel yields 105 gpm. Although present use of ground water in the Fancy Farm quadrangle is not large, potential yields throughout the area may be as great as 1000 gpm, or more, from wells tapping the deeper sands. The specific capacities of wells tapping the deeper sands should be greater than those of any wells now in use in the quadrangle—probably in the range of 25 to 30 gpm per foot of drawdown in properly constructed wells.

Present withdrawals of ground water from the Eocene sands in the area are insignificant compared to the large amount of water in storage. These sands should therefore be capable of supplying all foreseeable public and domestic needs, and most industrial needs. Excess ground water drains continuously from the Eocene aquifers and maintains perennial flows in the lower reaches of West Fork Mayfield Creek and Little Creek.

The quality of water from the Eocene sands is good. The water is soft, slightly acidic, and commonly contains less than 50 ppm (parts per million) dissolved solids. The iron content is generally less than 0.3 ppm. An iron content of more than 0.3 ppm imparts a disagreeable taste to water and may cause staining of clothing and utensils.

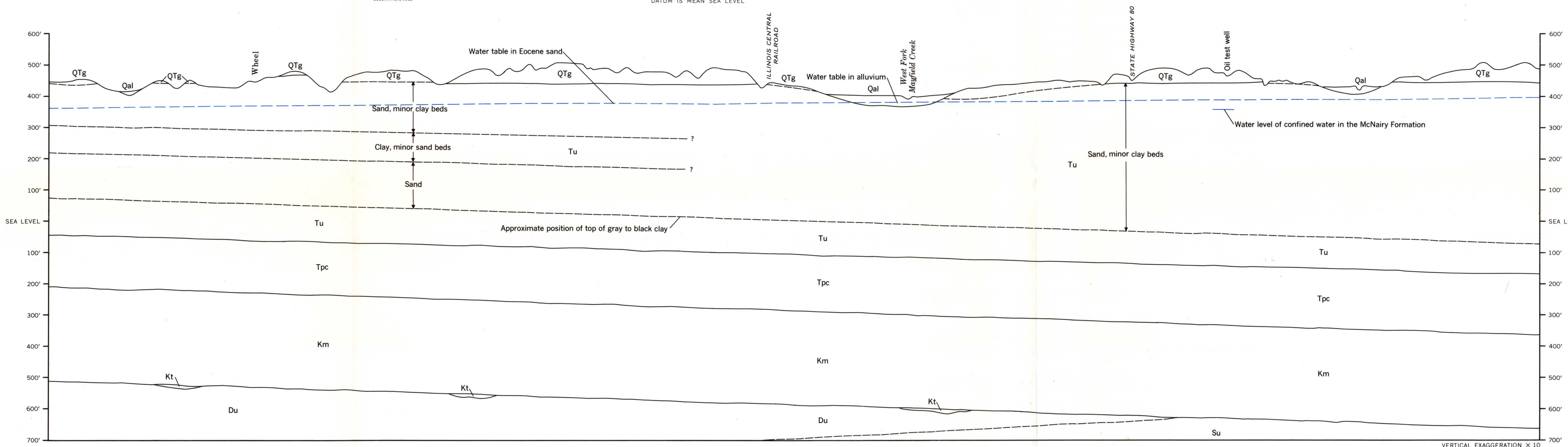
Excessive iron in the water (see table below) is a common cause for complaint by many well owners in the area. It probably is due to the corrosive action of the slightly acidic ground water on the 2-inch-diameter steel and galvanized-iron well casings and the cylinder pumps (locally called "sucker rod" pumps) used in the area. Most wells sampled were of this construction. In wells where plastic casing is used the iron content is usually within an acceptable range, as shown in analysis 11 which is normal for water from Eocene sand.

The temperature of ground water from the Eocene sand is about 59°F.

The following table shows the iron content, in parts per million, and the hydrogen-ion concentration, expressed as pH, of the water analyzed and shown by circular diagrams on the map. A pH of 7.0 indicates neutrality of a solution. Values higher than 7.0 denote alkalinity; values lower than 7.0 indicate acidity. Corrosiveness of water generally increases as pH decreases.

Analysis number	1	2	3	4	5	6	7	8	9	10	11
Iron content	3.2	0.24	0.21	3.2	1.6	0.54	0.12	2.1	1.01[a]	0.38	0.07
pH	6.2	4.7	6.0	6.0	5.8	6.4	—	5.8	6.0	6.4	5.7

[a] In sediment and solution when analyzed



GENERALIZED GEOLOGIC SECTION ALONG A NORTH-NORTHWEST LINE FROM THE SOUTHEAST CORNER OF THE MAP TO ABOUT 1 MILE NORTH OF WHEEL

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AVAILABILITY OF GROUND WATER IN THE FANCY FARM QUADRANGLE, JACKSON PURCHASE REGION, KENTUCKY

By
R. W. Davis
1966

For sale by U.S. Geological Survey, price 50 cents