

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	0-33'	0-33'	Brown to gray silty clay, clay, and clayey silt with gravel, as much as 7 feet thick, at base.	Recent flood-plain deposits in the valleys of the larger streams and their tributaries. Maximum known thickness, 33 feet, is in the valley of Little Cypress Creek. Probably thicker in the valleys of Obion Creek and Bayou du Chien. Thin, or absent, in smaller stream valleys.	No wells are known to tap the alluvium in the quadrangle. In the tributary valleys, the alluvium is above the main zone of saturation; if water is present locally, it is perched above clay. In the larger valleys, yields from bored wells may be adequate for domestic use. Yields will be small where the gravel is thin; larger yields are available from the underlying Eocene sand. The stream channels of Obion Creek and Bayou du Chien, and of Brush Creek and Cane Creek, downstream from the 330-foot water-level contour, intersect the water table and the streams flow throughout the year.	
			Pleistocene	Loess	0-40'	0-40'	Brown unstratified silty clay.	Wind-blown deposits covering all upland areas. Drapes down slopes as colluvial deposits; merges with alluvium on gentle slopes.	Above the main zone of saturation. When saturated by precipitation, transmits water to underlying aquifers.
			Pleistocene(?)	Gravel and sand	0-30'	0-30'	Brown clayey to sandy gravel and sand with clay matrix. Along the eastern part of State Highway 58, cemented zones near base.	Continental deposits overlying Eocene strata in uplands. Drapes down slopes as thin colluvial deposits, commonly mixed with loess.	Above the main zone of saturation. Near the intersection of State Highway 58 and the east edge of the map, water is perched above silty clay and clayey silt of Eocene age. The perched water may provide an adequate domestic supply; however, in adjacent Dublin quadrangle, a few wells are reported to go dry during dry years. Based on one sample, the perched water is soft, has about 145 ppm (parts per million) of dissolved solids, and about 25 ppm of nitrate.
TERTIARY	Eocene, undifferentiated			100-175'	100-175'	White to light-gray clay with some white to yellow silt and fine- to medium-grained sand.		Yields of all wells in the main zone of saturation are adequate for domestic use. All domestic wells, generally between 100 and 175 feet deep, are completed in this unit; yields may exceed 50 gpm (gallons per minute). The water generally is soft, acidic, and has less than 0.3 ppm of iron.	
				75-100'	75-100'	Brown to white very fine- to fine-grained sand and silt with some medium- to coarse-grained sand near base.		Municipal wells at Clinton, about 300 feet deep, are completed in this unit. Yields range from 350 to 600 gpm. The depth to the basal sand ranges from about 250 feet in the northeast corner of the quadrangle to about 400 feet south of State Highway 58 and in the upland between Brush Creek and Cane Creek.	
				100-125'	100-125'	Gray to brown clay with some brown to white silt and fine- to medium-grained sand.		No wells tap this unit.	
				150-200'	150-200'	Brown to white fine- to medium-grained sand with some coarse-grained sand near base.		Industrial and municipal wells may be completed in this unit at depths as shallow as 500 feet in the northeast corner of the quadrangle. At least one well, completed in this unit, yields more than 1,000 gpm. The water is soft and has about 170 feet southwest of Brush Creek yields may exceed 1,000 gpm.	
				125-150'	125-150'	Brown to gray lignitic clay with a basal fine- to medium-grained sand.		No wells tap the lowest unit.	
Paleozoic	McNairy	Porters Creek Clay		300'	300'	Dark-gray micaceous silty clay, often micaceous and silty. Upper and basal parts are micaceous glauconitic clayey very fine-grained sand.	Marine sediments underlying Eocene strata in the entire quadrangle. Thickness variable owing to pre-Eocene and Paleozoic rocks because these strata lie at considerable depth below the land surface. Partly because of this depth, the water from them may be hard and contain excessive iron and dissolved solids.	Not an aquifer. Retards ground-water movement between the Eocene sediments and the underlying formations.	



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

Ground water for domestic and industrial use is abundant in the Clinton quadrangle. This atlas, one of a series for the entire Jackson Purchase region in western Kentucky, presents, in non-technical language, information about ground water in central Hickman County.

The availability map shows the occurrence and quality of ground water in the shallowest aquifer that may yield enough water for domestic use. Ground-water availability at any site is shown by the map pattern and the data for nearby wells. Chemical quality of water is shown by circular diagrams.

The principal aquifers are the sands of Eocene age. Limited data suggest that the Eocene strata are from 600 to 850 feet thick and dip southwestward about 25 feet per mile. Three water-yielding sands are recognized - an upper sand and two lower sands. Yields from 4-inch domestic wells, generally between 100 and 175 feet deep, in the upper sand, may exceed 50 gpm (gallons per minute). Properly constructed wells in the deeper Eocene sands may yield more than 1,000 gpm. A municipal supply well at Clinton yields 600 gpm. Municipal supply wells at nearby Fulton and Mayfield are pumped at 1,200 gpm and 1,700 gpm, respectively. Lenses of clay in the Eocene strata in the main zone of saturation may require that some wells be drilled deeper than others nearby in order to obtain the same yield.

The water level in the main zone of saturation slopes westward from about 360 feet above sea level near the intersection of State Highway 58 and the east edge of the map to about 305 feet where Bayou du Chien flows out of the quadrangle. Thus, part of the upper sand unit may be above the zone of saturation in some areas. The annual range of water-level fluctuation in the upland is about 3 feet.

Clay and silt in the Eocene strata above the main zone of saturation retard downward movement of water to perch water in the overlying material. Along the eastern part of State Highway 58, the water is perched in the Pleistocene(?) and Pleistocene gravel, above silty clay and clayey silt of Eocene age. The perched water may yield enough water for domestic use to large-diameter bored wells; however, in the adjacent Dublin quadrangle, a few wells in the perched water are reported to go dry occasionally.

The Porters Creek Clay underlies the Eocene strata and is not an aquifer; instead, it retards ground-water movement between the Eocene beds and the underlying Cretaceous sediments. The clay is about 300 feet thick, its upper surface probably slopes southwestward from about 275 feet below sea level at the northeast corner of the quadrangle to about 550 feet below sea level at the southwest corner.

The McNairy Formation is below the Porters Creek Clay and is about 300 feet thick. The McNairy sediments were deposited on limestone and chert of Paleozoic age. The Paleozoic bedrock surface probably slopes southwestward from about 900 feet below sea level at the northeast corner of the quadrangle to about 1,200 feet below sea level in the southwest. No wells in the quadrangle tap either the McNairy Formation or the Paleozoic rocks because these strata lie at considerable depth below the land surface. Partly because of this depth, the water from them may be hard and contain excessive iron and dissolved solids.

The quality of water in the main zone of saturation is satisfactory for most uses. Generally, the water is soft and contains between 50 and 115 ppm (parts per million) of dissolved solids. The water has a pH generally between 6.0 and 6.6 and may be corrosive. It generally contains less than 9 ppm of nitrate; the temperature ranges from 59° to 62°F.

The water that is pumped from most of the drilled wells with 2 1/2-inch or smaller steel casings and "sucker rod" pumps contains large amounts of iron. Most of this iron is derived from the corrosion of the well casing and pump apparatus by the acidic ground water. To obtain water more representative of the actual iron content of the ground water, 10 of the 12 samples from drilled wells were collected from wells with 4-inch plastic casings. In the table at the end of the text, only analyses 8 and 16 are from wells with steel casings. In 4 of the other 15 samples, the iron content exceeds 0.3 ppm; generally, it is between 0.05 and 0.5 ppm. Apparently, plastic casing can alleviate the problem of corrosion and high iron content in most cases. However, in some areas, as near New Cypress, the ground water contains more than 0.3 ppm of iron even though plastic casing is used.

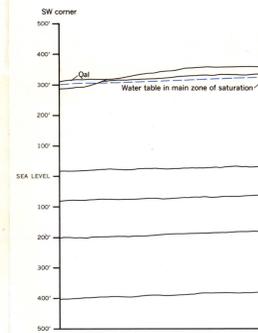
The quality of the perched water depends upon local factors, and the chemical character of the one sample available may not be representative of the perched water in the quadrangle. Based on this one sample, the perched water is soft,

has about 165 ppm of dissolved solids, and contains about 25 ppm of nitrate.

The following table lists the iron content, in ppm, and the hydrogen-ion concentration, as pH, of the water analyses shown by circular diagrams on the availability map. A pH of 7.0 indicates neutrality. Values higher than 7.0 denote alkalinity; lower values indicate acidity. Below 7.0, corrosiveness generally increases as pH decreases.

Analysis number	1	2	3	4	5	6	7	8	9	10
Iron content	1.40	0.09	0.34	0.00	0.00	0.51	0.06	7.8	0.05	0.06
pH	6.0	6.2	6.1	6.6	6.3	7.0	6.3	6.6	6.0	6.1

Analysis number	11	12	13	14	15	16	17
Iron content	0.11	0.03	0.04	0.06	0.20	0.26	0.10
pH	6.5	6.6	6.5	6.6	7.4	-	6.2

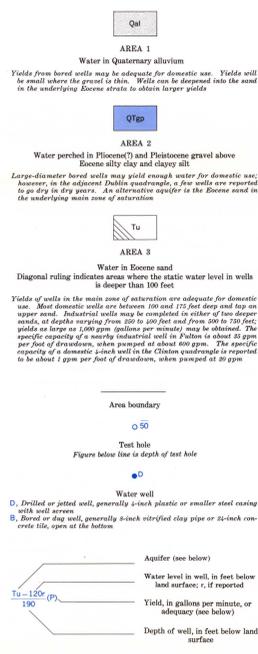


MAP SHOWING AVAILABILITY OF GROUND WATER, LOCATION OF WELLS, AND QUALITY OF WATER

GENERALIZED GEOLOGIC SECTION FROM THE SOUTHWEST CORNER OF THE QUADRANGLE THROUGH STATE HIGHWAYS 58 AND 288 TO THE NORTHEAST CORNER OF THE QUADRANGLE

EXPLANATION

Each availability area on this map shows the occurrence and availability of ground water in the shallowest aquifer that may yield enough water for domestic use. This report considers that an adequate domestic supply will yield about 500 gallons per day to a well equipped with a power pump and pressure-distribution system. The shallowest aquifer is indicated by other symbols whose water-bearing properties are described in the generalized columnar section.



Chemical composition of dissolved solids
Figures between circular diagrams and well symbols is analysis number in table at end of text. Figures show that at center of circle is carbonate hardness (calcium magnesium hardness, as CaCO₃) in parts per million. Hardness is classified by the TDS Geological Survey as follows: 0-50 ppm, soft; 51-100 ppm, moderately hard; 101-150 ppm, hard; and 151 ppm or more, very hard. Figures below line in diamond are in parts per million; in partial analyses, they are computed from specific conductance and are only approximate. Each segment in the circle is proportional to the mineral component dissolved in the water; percentages are computed from equivalent per million of the anions and cations. Calcium and magnesium are shown together as one segment in partial analyses.