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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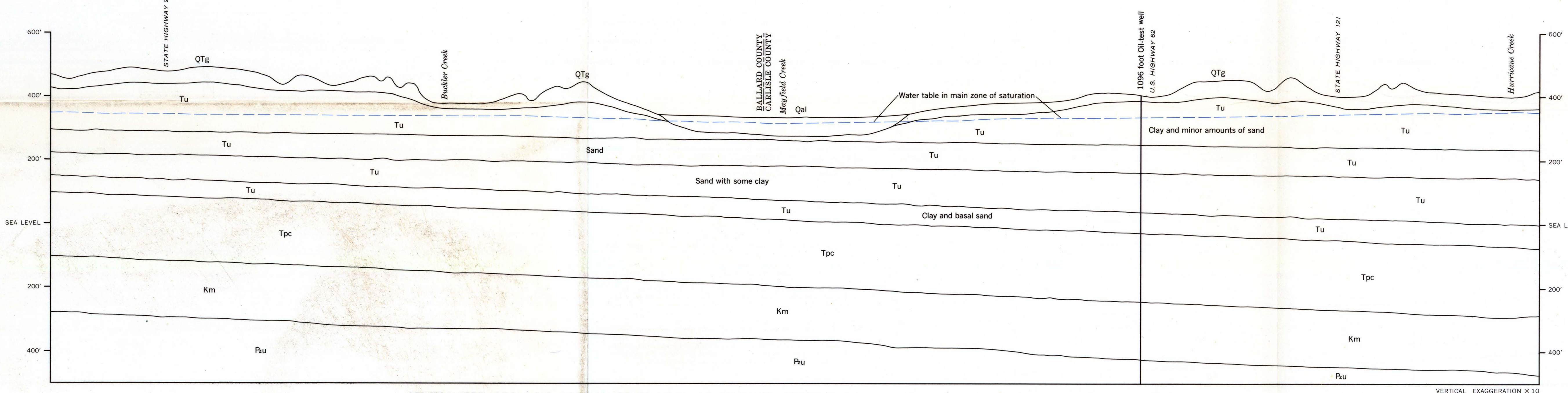
GENERALIZED COLUMNAR SECTION AND WATER-BEARING CHARACTER OF GEOLOGIC FORMATIONS

SYSTEM	SERIES	GROUP	FORMATION	SECTION	THICKNESS, IN FEET	LITHOLOGY	TOPOGRAPHY AND GEOLOGIC SETTING	HYDROLOGY
QUATERNARY	Pleistocene and Recent		Alluvium		0–45; 0–10	Medium brown to medium gray clayey silt with sand and gravel, as much as 10 feet thick in the valley of Mayfield Creek, at the base.	Present in the valleys of the larger streams and their tributaries. One auger hole indicated thickness of 40 feet in the valley of Mayfield Creek. Thin, or absent, in smaller stream valleys.	No wells are known to tap the alluvium although a few of the wells along the gently sloping south side of Mayfield Creek valley may derive some water from the basal gravel. In the tributary valleys, the alluvium is above the zone of saturation and is not an aquifer. In the larger valleys, alluvium may furnish enough water for domestic or stock use. Wells in the alluvium may be susceptible to contamination from storm-water runoff or sewage effluent. This hazard should be considered in constructing wells for human use.
	Pleistocene		Loess		0–20±	Tan to medium gray silty clay or clayey silt.	Windblown deposits covering all upland, draping down slopes as colluvium, and merging with alluvium along edges of gently sloping valleys.	Above the zone of saturation. When saturated by rainfall, transmits water to underlying aquifers.
TERTIARY	Pliocene(?)		Sand and gravel[1]		0–40±	Brown to red sandy chert gravel, in matrix of sandy clay.	Continental deposits overlying Eocene strata in upland. Drapes down slopes as colluvium, commonly mixed with loess.	Usually above the zone of saturation. Locally, water may be perched above clay of Eocene age or cemented zones at the base of the gravel. Along the edges of major valleys, Pliocene deposits may be in the zone of saturation and may yield enough water for domestic use. The water is moderately hard and contains about 240 ppm (parts per million) of dissolved solids. Two water samples have nitrate concentrations of 46 and 30 ppm, indicating that the water may be subject to contamination. Water with more than 45 ppm of nitrate may cause methemoglobinemia ("blue baby" disease), sometimes fatal, in infants and should not be used in their formulas.
	Eocene, undifferentiated		Sand, silt, and clay (325–550)		0–100	Yellow to gray sandy clay, clayey silt, and very fine sand; occasionally, layers of fine to medium sand.	Coastal-plain sediments underlying either continental deposits or alluvium in the entire quadrangle. Crops out along the north valley wall of Mayfield Creek and along Stovall and Buckler Creeks.	Southwest of West Fork, wells may be completed in this unit at an altitude of about 250 feet above mean sea level. At Bardwell, southwest of this quadrangle, the specific capacity of a municipal well withdrawing water from the upper Eocene is about 7 gpm (gallons per minute) per foot of drawdown, when pumped at about 200 gpm. The water is soft and contains about 90 ppm of dissolved solids.
					100–125	White to gray lignitic clay; some discontinuous layers of fine to medium sand.		In the uplands north of Mayfield Creek and east of West Fork, several drilled wells tap this unit. Along the edge of the larger valleys, many wells have been bored into this unit; most are adequate for domestic use. The water is soft to moderately hard and generally contains between 110 and 150 ppm of dissolved solids. Waters from two bored wells (analysis numbers 10 and 14) have a nitrate content high enough to suggest contamination. The iron content commonly exceeds 0.3 ppm; more than 0.3 ppm of iron imparts a bitter taste to water and stains fabrics and fixtures.
					50–100	Brown to white coarse sand; some layers of fine to medium sand.		Wells may be completed in this unit at about 300 feet altitude at the northeast corner of the map down to about 100 feet at the southwest corner. The unit is the best potential aquifer in the quadrangle; it is capable of yielding as much as 500 gpm to properly constructed wells. The water is soft and generally contains between 60 and 80 ppm of dissolved solids. The specific capacity of the town well at Barlow, northwest of this map, is about 10 gpm per foot, when pumped at about 275 gpm.
					125–150	Mostly clay in the upper one-third; the lower part is predominantly sand, with some layers of clay.		The sand of this unit probably will yield enough water to supply domestic wells throughout the quadrangle. Only one well taps this unit at present. Based on one sample, the water is soft and contains about 50 ppm of dissolved solids.
					50–75	Gray lignitic clay with some layers of sand; a basal sand, up to 25 feet thick.		The basal Eocene sand may be an adequate aquifer for many uses; however, it may never be utilized because shallower aquifers are capable of yielding enough water for the foreseeable future.
	Paleocene	Midway	Porters Creek Clay		200±	Dark-gray clay, slightly to very micaceous. Upper and basal parts are glauconitic clayey very fine-grained sand.	Marine sediments underlying Eocene sediments in the entire quadrangle.	Not an aquifer. Retards ground-water movement between the Eocene sediments and the underlying McNairy Formation.
CRETACEOUS	Upper Cretaceous		McNairy Formation[2]		150–200	Light- to dark-gray micaceous clay, interlaminated with silt or very fine-grained sand. The upper part is predominantly clay. The lower part is interbedded clay and micaceous very fine- to fine-grained sand.	Deltaic deposits underlying the Porters Creek Clay in the entire quadrangle.	The sand in this formation may yield enough water for domestic use. However, it may never be tapped because the overlying Eocene aquifers will meet foreseeable demands.
			Paleozoic rocks, undifferentiated		275+	White or gray coarsely crystalline dolomitic limestone, often siliceous, interbedded with chert.	Underlies the Cretaceous sediments in the entire area.	Wells may obtain water from fractures and solution openings.

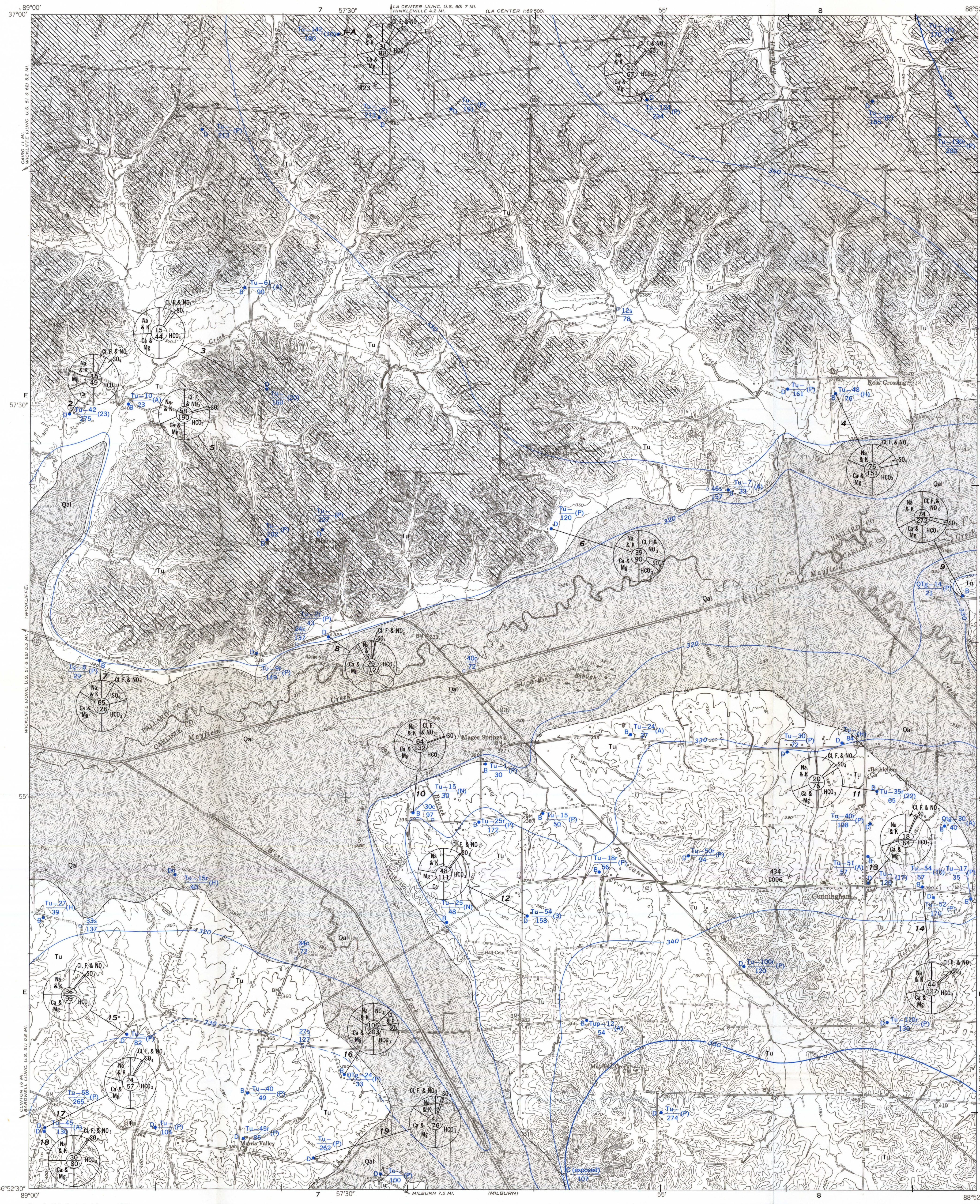
[1] Age undetermined. Estimates of age range from Pliocene or older to Pleistocene
[2] Upper part may be of Clayton age

EXPLANATION

Gravel · Sand · Silt · Loess · Clay · Mica · Glauconite · Lignite · Cherty limestone · Dolomite



GENERALIZED GEOLOGIC SECTION FROM HEAD OF BUCKLER CREEK THROUGH CUNNINGHAM TO HEAD OF HURRICANE CREEK



Base by U.S. Geological Survey, 1951
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, 1968

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

SCALE 1:24 000

CONTOUR INTERVAL 10 FEET
DOTTED LINES REPRESENT HALF-INTERVAL CONTOURS
DATUM IS MEAN SEA LEVEL

Hydrology by Arnold J. Hansen Jr., 1966

KENTUCKY
QUADRANGLE LOCATION

EXPLANATION

Qal .... Alluvium of Quaternary age
QTg .... Gravel of Pliocene(?) and Pleistocene age
Tu .... Sand and clay of Eocene age, undifferentiated
Tpc .... Porters Creek Clay of Paleocene age
Km .... McNairy Formation of Cretaceous age
Pzu .... Rocks of Paleozoic age, undifferentiated

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 aquifer will yield at least 500 gallons per day to a well equipped with a power pump and pressure-distribution system. The shallowest aquifer is underlain by other aquifers which are described in the generalized columnar section

Qal

AREA 1
Water in Quaternary alluvium

Yields from driven or bored wells may be adequate for domestic use; yields will be small where the basal gravel is thin or absent. Wells can be drilled into the sands in the underlying Eocene strata to obtain larger yields. Wells intended for human use should be constructed carefully to protect against contamination

Tu

AREA 2
Water in Eocene sand
Diagonal ruling indicates where the static water level is deeper than 100 feet (not shown in Carlisle County)

Yields of almost all wells in the Eocene sediments are adequate for domestic use. However, between West Fork and Hurricane Creek, some bored wells are reported to be inadequate. Most domestic wells penetrate a deep sand at altitudes varying from about 275 feet near Gage to about 100 feet near Morris Valley Church. Southwest of West Fork, wells may tap an upper sand at an altitude of about 250 feet. Properly constructed wells completed in the deeper sand may yield as much as 500 gpm (gallons per minute)

Along the larger valleys, several bored wells derive adequate domestic water supplies from gravel of Pliocene(?) or Pleistocene age. East of West Fork, a bored well taps water perched in Eocene sand, probably above Eocene clay. Such perched water is only of local significance; even where present, it may not constitute an adequate supply

Area boundary

EXPLANATION

Test hole
40c / 72
- Depth to top of Eocene strata, in feet below land surface
- Lithology of upper Eocene layer; c clay, s sand
- Depth of test hole

Oil-test well
434 / 1096
- Depth to base of Eocene strata, in feet below land surface
- Depth of well (November 1966)

Water well
D, *Drilled well, generally 4-inch plastic or smaller steel casing with well screen*
B, *Bored or dug well, generally 24-inch concrete tile, open at the bottom*
Dn, *Driven well, generally 1¼-inch pipe with well point*

Tu–42 (23) / 275
- Aquifer (see below)
- Water level in well, in feet below land surface; r, if reported
- Yield, in gpm; or adequacy (see below)
- Depth of well, in feet below land surface

AQUIFER SYMBOLS

QTg .... Gravel of Pliocene(?) and Pleistocene age
Tup .... Perched water in sand of Eocene age
Tu .... Sand of Eocene age

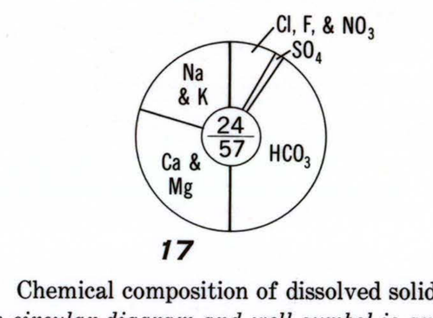
YIELD OR ADEQUACY

(22) .... Gallons per minute
(P) .... Reported adequate for power pump for domestic and/or stock supply
(H) .... Reported adequate for bailer or hand pump
(N) .... Inadequate
(A) .... Abandoned or destroyed

— 350 —
Water-level contour
Shows altitude of water level in the zone of saturation. The depth to water is the difference between the land-surface altitude and the water-level contour. Water levels measured in September 1965. Contour interval, 10 feet; datum is mean sea level. North of Mayfield Creek, contours interpreted from sparse, predominantly reported, data

— — 330 — —
Water-level contour
Shows altitude of water level in the upper sand southwest of West Fork

QUALITY



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Chemical composition of dissolved solids
Figure between circular diagram and well symbol is 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 parts per million. The U.S. Geological Survey classifies hardness as follows: 0-60 ppm, soft; 61-120 ppm, moderately hard; 121-180 ppm, hard; and 181 ppm or more, very hard. Figure below line is dissolved solids in ppm; in partial analyses, it is computed from specific conductance and is only approximate. Each segment in the circle is proportional to the ion dissolved in the water; percentages are computed from equivalents per million of the ions. Calcium and magnesium are shown together as one segment in partial analyses. Nitrate shown separately if greater than 45 ppm

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

Ground water for domestic, agricultural, or industrial use is abundant in the Blandville quadrangle. This atlas, one of a series describing the ground water of the entire Jackson Purchase region in western Kentucky, presents a nontechnical description of the ground water in the quadrangle between Bardwell and La Center, Kentucky.

The availability map shows the occurrence and quality of ground water in the shallowest aquifer that may yield an adequate domestic water supply. Ground-water availability at any site is shown by the map pattern and the data for nearby wells. Chemical quality is shown by circular diagrams on the map and a table in this text.

The principal aquifers are the sands of Eocene age. Data from an oil-test well near Cunningham and other records suggest that the Eocene strata are from 300 to 500 feet thick and dip southwestward about 20 feet per mile.

Five water-bearing units in the Eocene are recognizable. In descending order of depth they are: An upper sand southwest of West Fork, sporadic sand layers within a predominantly clay section, a moderately thick sand which may yield large quantities of water, a section of sand with some clay layers, and a basal sand.

Wells may be completed in the upper sand southwest of West Fork at an altitude of about 250 feet above mean sea level; yields to individual wells may be as much as 200 gpm (gallons per minute).

Wells completed in one of the sporadic sand layers within the sequence of clays may be adequate for domestic use. Bored wells in these sands may have small yields or may pump sand; drilled wells may have small specific capacities. More dependable wells can be obtained by drilling deeper into the underlying sand unit. Most of the sands in the clay section are discontinuous; therefore, some wells must be drilled deeper than others nearby in order to penetrate water-yielding sand beds.

Wells may tap the moderately thick sand of the third unit at altitudes varying from about 300 feet above mean sea level at the northeast corner of the quadrangle to about 100 feet in the southwest corner. Properly constructed wells may yield as much as 500 gpm. Municipal wells in this unit in nearby towns yield more than 250 gpm.

Very little data are available for the lower two units, the sand with clay layers and the basal sand. Only one well taps the upper of the two units. Probably both will yield sufficient supplies for domestic use, but neither may be utilized in the near future because adequate supplies can be obtained in upper units.

The water level in the saturated zone slopes westward from about 350 feet above mean sea level in the northeast and southeast corners of the quadrangle to about 315 feet where Mayfield Creek flows out of the quadrangle. Based on continuous water-level records in the Jackson Purchase, the seasonal range of water-level fluctuation in upland wells is about 3 feet. Southwest of West Fork, the water level in the upper sand slopes northwestward from about 335 feet along the south edge of the quadrangle to about 320 feet where the sand and the alluvium are in contact south of West Fork.

The Porters Creek Clay of Paleocene age, which underlies the Eocene strata, is not an aquifer; instead, it retards ground-water movement between the Eocene beds and the underlying Cretaceous sediments. The clay is about 200 feet thick, its upper surface probably sloping southwestward from about 100 feet above mean sea level at the northeast corner of the quadrangle to about 200 feet below mean sea level at the southwest corner.

The McNairy Formation of Cretaceous age, below the Porters Creek Clay, is about 175 feet thick and lies on the limestone and chert bedrock of Paleozoic age. The surface of the Paleozoic bedrock probably slopes southwestward about 25 feet per mile and is about 400 feet below mean sea level in the center of the quadrangle. The altitude of the bedrock at Cunningham is 419 feet below mean sea level. Although water is present, no wells in this quadrangle tap formations deeper than the Eocene strata. The water below the Porters Creek Clay may be hard and contain excessive iron and dissolved solids.

The quality of water in the Eocene strata is satisfactory for most uses. The water generally is soft or moderately hard and contains 65 to 130 ppm (parts per million) of dissolved solids. The water has a pH generally between 6.1 and 6.6. The temperature generally ranges from 59°F to 61°F. The nitrate content of the water is extremely variable and has little correlation with the aquifer from which the water is obtained. Analysis numbers 5, 6, 9, 10, 14, and 16 contain a nitrate content high enough to suggest local contamination; two of these wells are known to be subjected to contamination from surface runoff. The iron content generally is between 0.1 and 4.0 ppm.

The following table lists the iron content, in parts per million, 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	1-A	2	3	4	5	6	7	8	9
Iron content	7.0	--	1.7	3.0	0.31	0.03	0.06	0.38	15	0.00
pH	6.4	6.3	5.8	6.1	6.7	6.6	6.0	6.4	6.6	6.5

Analysis number	10	11	12	13	14	15	16	17	18	19
Iron content	0.12	--	0.10	0.19	0.15	0.05	0.12	0.00	0.07	4.1
pH	6.4	5.8	6.3	6.3	6.7	--	7.6	6.1	6.3	6.3

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

By
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1968

For sale by U.S. Geological Survey, price 75 cents