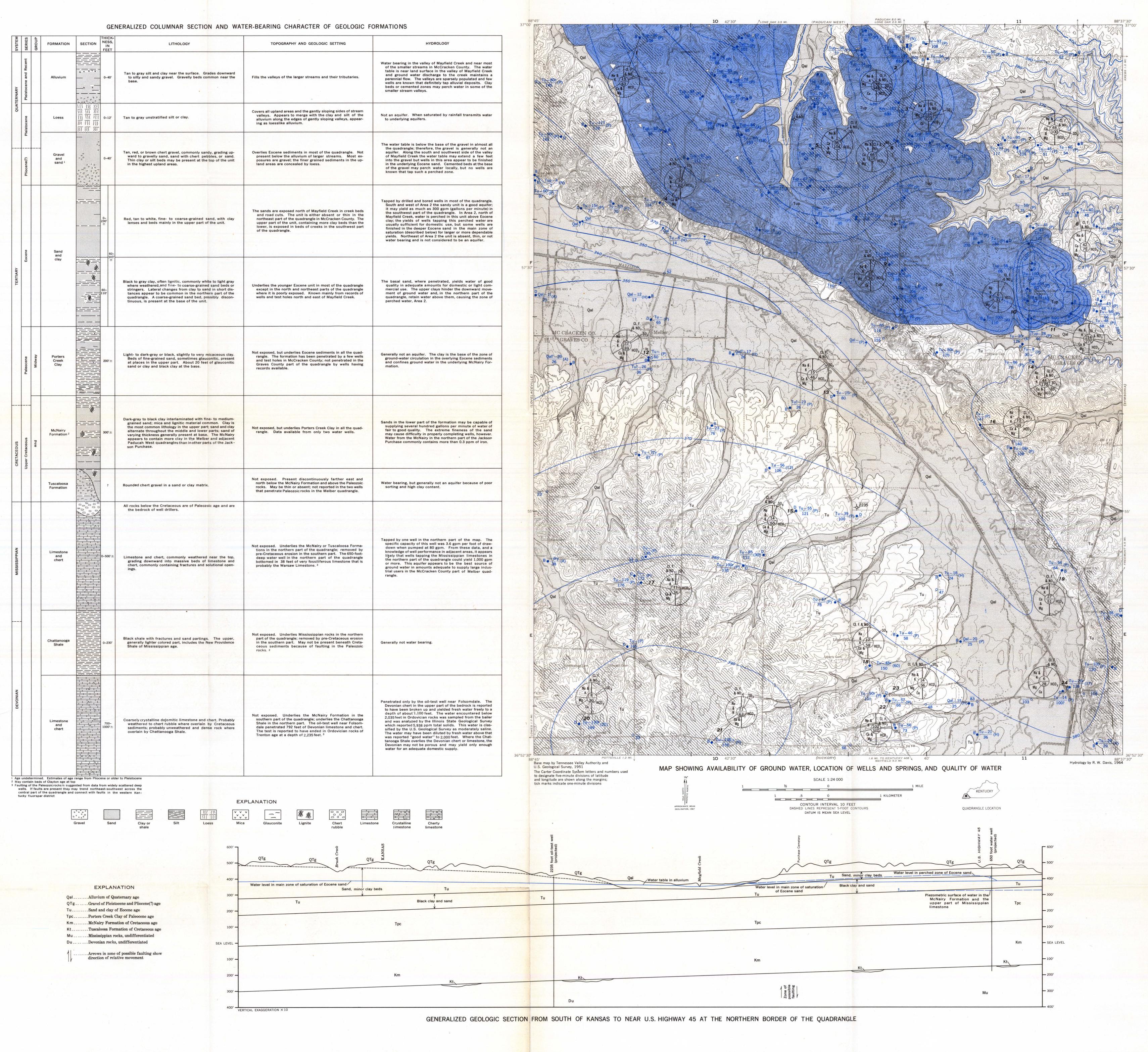
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The water-availability areas on this map show the occurrence and availability of ground water in the shallowest aquifer that may yield adequate amounts of water for domestic use in each area. As considered in this report an adequate domestic supply will deliver

sidered 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.

AREA 1
Water in Quaternary alluvium
The alluvium will yield sufficient supplies of water for domestic use in the valleys of Mayfield Creek and possibly Blizzard Pond Drainage Canal and the unnamed tributary south of Houser Cemetery. In other parts of Area 1 ground water may be perched in the alluvium above cemented beds or clay bodies as is probably present in Massac Creek valley.

valley.

At present, most wells in Area 1 obtain water from the underlying Eocene sand probably because the water in the Eocene is of better quality and because of the possibility of contamination from the shallow alluvial sources; especially along the parts of Mayfield Creek valley that are flooded frequently by heavy rainfall



Water in Eocene sand perched above Eocene clay
Diagonal ruling shows areas where water level in wells tapping the
underlying main zone of saturation is more than 100 feet below land

Furnishes sufficient water for domestic use to most large diameter bored wells and some drilled wells in Area 2. Near the eastern and northern border of this area wells may have to be deepened to the underlying main zone of saturation because of an inadequate thickness of saturated sand in the perched zone. Throughout Area 2 wells may be finished in the underlying Eocene sand in the main zone of saturation for larger and more dependable yields; however, the Eocene sand in the main zone of saturation may be thin, and possibly absent locally. Wells that require larger-than-normal domestic yields in Area 2 may have to be drilled to the McNairy Formation or the Paleozoic bedrock.

The southern boundary of Area 2 is defined arbitrarily as approximately the 380-foot water-level contour of the perched zone. Beyond this line the water level in the perched zone appears to merge with the water level in the main zone of saturation, apparently because of discharge of ground water into Mayfield Creek

AREA 3

Water in the main zone of saturation in Eocene sand
Diagonal ruling shows area where water level in wells is more than
100 feet below land surface

Furnishes sufficient water for an adequate domestic supply throughout
the quadrangle. Properly constructed wells in the southwest part of
the quadrangle should be capable of yielding from 100 to probably not
more than 300 gallons per minute. Elsewhere, large yielding wells
probably will have to be finished in the lower part of the McNairy For-

mation or in the Paleozoic bedrock

Area boundary

440

Oil-test well

Figure below line is depth of test well

Figure below line is depth of test hole

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 or brick casing, open

Spring

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

| Alluvium of Quaternary age | Perched water in sand of Eocene age | Water in main zone of saturation in sand of Eocene age | McNairy Formation of Cretaceous age | Limestone of Mississippian age

Abandoned or destroyed

YIELD OR ADEQUACY

----Gallons per minute where known

----Well reported adequate for power pump for domestic and(or) stock supply

----Well reported adequate for bailer or hand pump

Well reported inadequate

No yield data available

Water-level contour, autumn 1964, in the main zone of saturation, dotted where covered by the perched zone (Area 2)

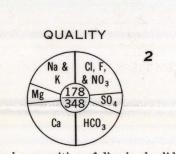
Shows the altitude of water level in the main zone of saturation of the Quaternary alluvium and Eocene sand. Contour interval 10 feet; datum is mean sea level. The approximate depth to water can be calculated by subtracting the altitude of the water level (as shown by the water-level contours) from the altitude of the land surface. In Area 2, thick beds of clay are present that do not yield water and the calculated depth to water in the main zone of saturation may be considered the minimum depth of a well

Water-level contour, autumn 1964, in the zone of perched water

Shows the altitude of water level in the zone of perched water in the

Eocene sand. Contour interval 10 feet, datum is mean sea level. The

approximate depth to water can be calculated as described above



Chemical composition of dissolved solids Figure between circular diagram and well location refers to analysis number at end of text. Figure above line at center of circular diagram is carbonate hardness (calcium magnesium hardness, as CaCO3) in 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

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

Sufficient supplies of ground water for domestic and other uses are available throughout the Melber quadrangle. Large supplies for industrial use or public supply also are available, but generally at depths greater than most existing wells. This atlas, one of a series being prepared to describe in detail the ground-water conditions in the Jackson Purchase, presents in nontechnical language information about ground water in an area of suburban expansion south of Paducah for use by well drillers, landowners, and other well users.

In general, supplies of ground water for domestic use are available at moderate depths in all the quadrangle. Most wells are less than 200 feet deep and obtain water from sand of Eocene age. Properly constructed wells should yield as much as 100 to 300 gpm (gallons per minute) in most of the Graves County part of the quadrangle. The occurrence and availability of shallow ground water in the McCracken County part of the quadrangle are more complex than in Graves County because ground water can be obtained from two separate aquifers in the Eocene deposits: (1) from a zone of water perched above clay beds and (2) from the main zone of saturation below clay beds.

The water-availability map presents information on the occurrence of the shallowest ground water that may yield an adequate supply of water for domestic use. Three water-availability areas are shown in the Melber quadrangle and are described below. The generalized geologic section shows the occurrence of ground water and its relation to the geology in each area. Availability of ground water at a particular location may be determined by the area pattern on the map. The map explanation and columnar section

briefly describe the water-yielding properties of the formation. Chemical analyses of water from wells are represented on the map by circular diagrams.

Area 1 is along the flood plains of the major streams and their tributaries. Water is available at shallow depths from the alluvial sand and gravel deposits that fill the valleys, but most wells in this area are deeper and obtain water from the underlying Eocene sands.

Area 2 is in McCracken County north of Mayfield Creek. Beds of clay at shallow depths hinder most of the downward movement of ground water in this area forming a large zone of shallow perched water in the Eocene deposits. The water is perched above the main zone of saturation in the Eocene deposits—that part of the earth completely saturated with water. The southern boundary of the perched zone, Area 2, is arbitrarily defined as near the 380-foot water—

level contour of water in the perched zone. Most domestic wells in Area 2 obtain water at shallow depths from sand in the perched zone. Where sufficient saturated sand is penetrated by wells, this perched zone yields an adequate and dependable supply of water for domestic use. However, in parts of Area 2 the obtaining of a ependable supply at shallow depths is a problem because the saturated sand in the perched zone may either be too thin or contain too much clay to yield an adequate supply of water. Where such a situation is encountered, wells can be drilled to the underlying Eocene sand in the main zone of saturation or deeper to obtain a dependable supply. When drilling wells in Area 2, drilling should progress carefully in the Eocene interval so as not to pass by a water-bearing sand before entering the Porters Creek Clay. If no sand capable of supplying the well is found above the Porters Creek Clay, wells may have to be deepened to the underlying sand of the Mc-Nairy Formation or to the Paleozoic bedrock. If sand is found above the Porters Creek Clay but the adequacy of its yield is questionable, it is probably good practice to develop and pump a trial well at this horizon before drilling deeper. Deeper drilling to the lower McNairy and bedrock aguifers is expensive and the water is of poorer quality. Large-diameter bored wells, because of their large storage capacity, sometimes produce adequate amounts of water from sand in the perched zone where small-diameter wells of similar depths have been unsuccessful. Two wells are known that penetrate deeply into the earth in Area 2; one tapping water in sand in the McNairy Formation, the other tapping water in limestone in the Paleozoic bedrock.

Area 3, the third availability area in the quadrangle, is the main zone of saturation in the Eocene sand. Wells tapping the Eocene sand in the southern part of this area can obtain from 100 to 300 gpm at moderate depths. In the north and northeast, wells tapping the Eocene sand yield adequate water for domestic uses, but larger yields can be obtained from the deeper McNairy Formation or the Paleozoic bedrock. In Area 3, the clays that perch water in Area 2 are: (1) at the surface or are near the surface but covered by dry sediments, (2) overlain by insufficient saturated sand to complete an adequate yielding well, (3) missing because they have changed laterally to sand, or (4) at considerable depth below the water table of the main zone of saturation. Conditions 1, 2, and 3 occur in the north and east parts of the quadrangle. The fourth condition exists south of the 380-foot water-level contour of water in the perched zone and comprises most of the map.

Present withdrawals of ground water from the Eocene sands in the quadrangle are insignificant compared to the large amount of water in storage. The water table on each side of Mayfield Creek slopes toward the creek and excess ground water drains from the Eocene aquifers continuously, maintaining perennial flow in Mayfield Creek and in numerous springs in the valley on the north side of the creek. Because of the large amount of water in storage, the Eocene sands should be capable of supplying all foreseeable public and domestic needs, and many industrial needs in Graves County, However, in the part of McCracken County in the Melber quadrangle the Eocene sands may not be capable of supplying both domestic and large industrial withdrawals. In planning ground-water developments in this part of McCracken County the shallow Eocene sands should be reserved for domestic and possibly small public supply uses. Large yields from multiple well fields for industrial use could deplete or seriously reduce the shallow groundwater supplies from the Eocene. Wells that supply large industrial needs in this part of Mc-Cracken County, and also in Graves County, may tap deeper aquifers and the withdrawals of water from the deeper aquifer should have no effect on the water stored in the shallower Eocene

The quality of water from the Eocene sands is good. The water is soft, generally containing less than 100 ppm (parts per million) dissolved solids, is slightly acidic, and may contain more than 0.3 ppm of iron. An iron content of more than 0.3 ppm imparts a disagreeable taste to water and may cause staining of clothing and utensils. The higher iron concentrations are from wells that have iron casings; however, samples of water from several wells having plastic or concrete casing also show an iron content greater than 0.3 ppm. The temperature of the ground water from the Eocene sands is about 59°F.

The quality of water from the McNairy Formation and the Paleozoic bedrock is good, but the water contains a higher concentration of dissolved solids than the water from the Eocene aquifers. The water is hard, contains from about 200 to 400 ppm dissolved solids, is slightly alkaline, and contains more than 0.3 ppm of iron. The temperature of the ground water from the McNairy Formation and the Paleozoic bedrock is about 60°F.

The following table shows the iron content in parts per million and the hydrogen-ion concentration, expressed as pH, of the water analyses 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.

No.	1	2	3	4	5	6	7	8	9	10
Iron ontent	0.03	2.7ª	1.1	0.88	0.10	0.06	0.05	0.59	1.4	0.14
pН	6.3	6.8ª	7.5	6.6	6.7	6.1	6.9	6.0	6.1	5.7
nalysis No.	11	12	13	14	15	16	17	18	19	20
Iron ontent	0.99	6.3	0.13	0.47	0.46	1.4	0.62	1.5	0.16	0.08
"U	61		60	0.5	69	57	61	60	E0	50

pH | 6.6 | — | 5.8 | 6.0

^aAn earlier analysis showed an iron content of 1.8 and pH of 7.3 ^bIn suspension and solution

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