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		0–150'	Clay or silt near the surface, grading downward into gravel and (or) sand. Includes glacial outwash near base at mouth of Tennessee River.	Thickest deposit occurs in the Black Bottom of Illinois and in Livingston County of Kentucky. The alluvial deposits of Clarks River thin upstream.	Water bearing in most of the two quadrangles. Will furnish sufficient supply for domestic use and locally for industrial and public needs. Water levels in the alluvial deposits of the Ohio River and its tributaries fluctuate with the stages of the Ohio and Tennessee Rivers; they rise as much as 20 feet or more during floods, but return to former levels as the river returns to pool stage of 302 feet above sea level. During floods the alluvial valleys below 335 feet altitude are flooded. Locally perched water occurs above alluvial clay and silt in the Woodlawn area and is tapped by many shallow bored or dug wells. The water in the alluvium is generally hard and contains more than 0.3 ppm (part per million) of iron. Many local owners have reported that the water from their wells is contaminated.
			Lake deposits		0–31'	Clayey silt with lenses of clayey sandy gravel near the base. Sandy gravel bars with concordant crests along the shoreline of an ancient Pleistocene lake.	Gravel bars are common along the Cairo Road at an altitude of 355 feet. Lake silt blankets the Pliocene(?) gravel to an altitude of 330 feet. Remnants are present along the west valley wall of Clarks River.	Lake silt is not water bearing, but transmits water to the underlying Pliocene(?) deposits when saturated. Gravel near base may supply some water to bored wells. Gravel bars along Cairo Road yield sufficient water for domestic use to large-diameter bored wells. Owing to the shallow water table and the looseness of the surficial material, contamination is likely to be a problem.
	Pleistocene		Loess		0–13'	Tan to gray unstratified silty clay.	Covers all upland and the gently sloping sides of stream valleys.	Not an aquifer. When saturated by rainfall, transmits water to lower aquifers.
			Silt		0–38'			
TERTIARY	Pliocene(?)		Gravel, sand, and silt[1]		0–50'	Reddish-brown sandy chert gravel, sand, and silt; locally indurated with iron oxide. Brown clayey silt and sand north of U.S. Highway 60 west of Paducah rests on gravel and is about 50 feet thick (see geologic section from Friendship Church Road to Ohio River). South of Highway 60 the silt and sand is less than 5 feet thick.	Continental terrace deposits lying on two irregular surfaces cut into sediments of Eocene, Paleocene, and Cretaceous age. The pre-Pliocene surface consists of channels and terraces cut by an intricate drainage system. Above 400 feet altitude, the Pliocene rests mainly on rocks of Eocene age.	North of U.S. Highway 60 west of Paducah, the Pliocene(?) gravel will yield large amounts of water for domestic use and sufficient water in selected areas for industrial and public needs. Several shallow large-diameter bored wells south of Black Branch that are completed above a purple-gray clay in the Pliocene(?) gravel may fail during extended droughts. Wells that are completed in the gravel below the clay may locally yield sufficient water for irrigation. In the upland (above 400 feet altitude) the yields of most wells are likely to be inadequate; some are adequate except during droughts. Water in the Pliocene(?) gravel in the upland is perched above the Porters Creek Clay or clays within the lower part of the Eocene. Water for domestic use may be obtained from the Porters Creek Clay or the lower part of the Eocene where sands are available; elsewhere, water must be obtained from the underlying McNairy Formation or Mississippian bedrock.
	Eocene, undifferentiated		Sand and clay		0–40' +	Reddish-brown to tan well-sorted fine to coarse sand. Lenses of light-gray clay.	Crops out in creeks and road cuts below the Pliocene(?) gravel in the upland between the East and Middle Forks of Massac Creek.	May yield sufficient water for domestic use southeast of Massac, but may not be adequate for both domestic and stock uses. The water level will be above 430 feet altitude. Analyses of water and reports by owners show an objectionable amount of iron, probably due to the reaction between the acidic ground water and the steel well casing and pump apparatus.
					0–136' + (0–196' +)	Light-gray to black silty clay, lignitic in places. Locally non-silty. Lenses of reddish-brown to white well-sorted medium to coarse sand. Thickness of individual lenses ranges from a few inches to several feet.	Crops out in creeks and road cuts south and southwest of Paducah.	May yield sufficient water for domestic use to some (large-diameter bored wells and locally to drilled wells. Clayey nature of unit may cause problems in well completion.
					0–20' +	Reddish-brown medium to coarse sand. Varying thickness appears to be caused by pre-Eocene erosion.	Basal sand crops out in creeks and in a few road cuts, chiefly on the east side of the Tennessee Valley Divide.	Wells as deep as 200 feet may yield more than 100 gpm where sufficient saturated thickness of sand is present. Large withdrawals from well fields could reduce or deplete the supplies available from the Eocene. Because the basal sand was deposited on an irregular surface, this aquifer may not be present or may be too thin to yield an adequate supply. Large-diameter bored wells may obtain sufficient water where the basal sand is thin. If a shallow aquifer is not available drilled wells must tap either the Cretaceous or the Mississippian aquifers.
	Paleocene	Midway	Porters Creek Clay		110–220'	Dark-gray slightly to very micaceous clay. Fine-grained clayey sand, commonly glauconitic, in upper part. Glauconitic sand and clay at the base.	Crops out in the tributaries of Clarks River and Perkins and Massac Creeks. Underlies the Eocene deposits southwest of Paducah.	Sand beds in upper part may furnish sufficient water for domestic use west of Avondale Heights. Sand beds are not known to yield water to wells except at shallow depth. Clay retards the movement of water between the overlying aquifers and the Cretaceous sand. Quality of the water is good to very poor.
CRETACEOUS	Upper Cretaceous		McNairy Formation[2]		30–280'	Dark-gray to black clay interbedded with fine to very fine sand; mica and lignitic material are common. A sand bed in upper part occurs at Reidland and is tapped downdip by some drilled wells. Clay is the most common lithology in the upper part; clay and sand alternate throughout the middle and lower parts. Sand of varying thickness generally present at base. Thin gravel lenses are present in the basal McNairy to the east and north of this area.	Crops out in valleys below the Porters Creek Clay and the Pliocene(?) gravel at Reidland. Occurs at a shallow depth below the Pleistocene lake and Pliocene(?) deposits north of Cairo Road. Top of the McNairy Formation—occurs about 70 feet above sea level at Massac.	Yields a plentiful supply of water for domestic use, but probably will not yield more than 250 gpm for public and industrial needs. Largest yielding wells are at Reidland, Ky., and Brookport, Ill. The specific capacities of wells in the McNairy are in the range of 1 to 2 gpm per foot of drawdown. A discontinuous basal silty fine to medium sand is tapped by many wells.
			Tuscaloosa Formation		0–10'	White rounded pebbles and cobbles in tripolitic matrix.	May occur in remnants of channels in the eroded surface of the Paleozoic rocks.	Water-bearing character is unknown. Generally this unit is a poor aquifer, owing to the tripolitic matrix.
CARBONIFEROUS MISSISSIPPIAN	Chester		Chester rocks undifferentiated		200–600'	The rocks that underlie the Cretaceous beds are of Paleozoic age and are called bedrock by drillers. The upper surface of the bedrock locally may be deeply weathered, forming a chert rubble. This rubble consists of angular to subangular chert fragments in a matrix of tripolitic clay. Alternating beds of sandstone, shale, and limestone. Commonly gray fine- to medium-grained, partly calcareous sandstone; dark-gray silty and sandy shale; and light- to dark-gray dense to crystalline cherty limestone, in part argillaceous and fossiliferous.	Test holes drilled for the Tennessee Valley Authority in Illinois indicate that rocks of Chester age may be found beneath the Cretaceous sediments in Kentucky. Rocks of Chester age are in downdropped fault blocks.	Probably will yield little or no water. Sandstone may yield minor amounts of water.
	Meramec		Ste. Genevieve Limestone		200'	White to gray crystalline oolitic cherty limestone. Very fine-grained sandstone near the top.	Not known to be present beneath the Cretaceous sediments; however, may occur in downdropped fault blocks below the Chester rocks.	Probably will yield little or no water.
			St. Louis and Warsaw Limestones[3]		500–600'	Gray, very fine grained in upper part to partly oolitic in middle part, cherty, argillaceous limestone. Lower part is coarsely crystalline gray limestone.	Present beneath the Cretaceous sediments.	Probably will yield large amounts of water from gravellike chert rubble and from crevices in limestone. Most wells tap only the upper few feet of the bedrock and the thickness of chert rubble is unknown. About 100 feet of chert rubble is present in an oil-test hole near Hendron. Some wells are known to tap crevices in limestone. Wells tapping the bedrock range in depth from 310 to 535 feet. The potential yield of the bedrock is unknown. A well at Reidland and a well near Cecil yield more than 100 gpm from the limestone. Another well near Metropolis, Ill., which was pumped at 1,084 gpm, has a specific capacity of 360 gpm per foot of drawdown. The water from the bedrock is hard to very hard and may contain an objectionable amount of iron. Hydrogen sulfide may be present in minor amounts; water from the well at Reidland contains 0.7 ppm of hydrogen sulfide.
	Osage		Fort Payne Formation[4]		400–600'	Dark-gray fine-grained argillaceous limestone interbedded with dark-gray to black chert. Black, brown, or grayish-green shale. May be glauconitic.		
DEVONIAN	Upper Devonian		Chattanooga Shale		0–220'	Black carbonaceous fissile shale.	Present at depth throughout the area. Underlies the Fort Payne Formation.	Yields little or no water. Formation confines water in the underlying rocks and retards the movement of water between the Fort Payne and the underlying Devonian limestone.
	Middle Devonian		Devonian rocks undifferentiated		0–700'	White to brown cherty limestone and chert. Limestone may be finely to coarsely crystalline and may contain silty or siliceous zones. Thin to thick beds of chert are common. The upper surface may have been weathered before the deposition of the Chattanooga Shale.	Present at great depth throughout the area.	Two wells yield water from the Devonian limestone in the adjacent Heath and Little Cypress quadrangles. Data from several oil-test holes indicate that the Devonian limestone is likely to yield little or no water except in areas of pre-Chattanooga weathering and areas adjacent to faults. The Devonian limestone probably will yield water where the Chattanooga Shale has been removed by pre-Cretaceous weathering; the Devonian limestone may be beneath Cretaceous deposits southwest of Massac. Water, if found, may be hard to very hard and may contain an objectionable amount of iron. Hydrogen sulfide may be present in minor amounts.

[1]Age undetermined. Estimates of age range from Pliocene or older to Pleistocene.
[2]May contain beds of Clayton age at top.
[3]Lower part of St. Louis Limestone includes the Salem Limestone.
[4]Basal part of the Fort Payne Formation may include the New Providence Shale.

AVAILABILITY OF GROUND WATER IN THE PADUCAH WEST AND EAST QUADRANGLES ILLINOIS AND JACKSON PURCHASE REGION, KENTUCKY

Water is one of man's most important natural resources. Since early time, man has used water from rivers and lakes. In contrast, sources of underground water are largely undeveloped because they are hidden from view and little is known about them. The people of the Paducah area are fortunate to have large supplies of water readily available to them, both on the surface and under the ground. Although surface water is the most used water resource in this area, because of its abundance and ready availability, ground water is a valuable unused resource which can be developed to a much greater extent in the future. This report, one of a series that includes the entire Jackson Purchase region, provides detailed information concerning the ground water in the Paducah West and East quadrangles.

The occurrence of ground water in the Paducah area is indicated on a water-availability map, which is a graphic representation of the shallowest aquifer that may yield water in adequate amounts for domestic use. The availability of ground water at a particular site can be determined from the pattern on the map and from a study of data on wells near the site. The chemical quality of the water is shown by circular diagrams.

The Paducah area is a land of many rivers. At Paducah two large rivers, the Ohio and the Tennessee, join and a few miles upstream from Paducah the Cumberland River joins the Ohio River. The waters of these combined rivers meet the Mississippi River 46 miles downstream from Paducah. The Ohio near Metropolis, Ill., 9 miles downstream from Paducah, drains an area of some 200,000 square miles. The average and minimum discharge of the Ohio River at Metropolis is 260,000 and 20,600 cfs (cubic feet per second), respectively. One cfs is about 450 gpm (gallons per minute). The flows of the Tennessee and Cumberland Rivers are regulated by a series of dams upstream from Paducah. To some extent, the Ohio River also is regulated by a series of dams in order that a 9-foot navigable channel can be maintained throughout the year. Paducah obtains water for public supply from an intake in the Ohio River north of Owens Island and uses about 4.7 mgd (million gallons per day). Industrial plants use about 60 percent of this amount.

The water temperature of the Ohio River at Metropolis ranged from freezing to 88°F during the period 1954-62. The temperature of ground water in the Paducah area ranges from about 58° to 62°F. Thus, ground water is more useful than surface water as a coolant in the summer.

Ground water in the Paducah area is a relatively untapped resource having a large potential; only minor amounts are now withdrawn for domestic, farm, industrial, and municipal uses. Several aquifers are available for development though only two underlie the entire area. The most important aquifers are the cherts and limestones of Mississippian age, the sands of Late Cretaceous and early Eocene ages, the sandy gravel of Pliocene(?) age, and the sand and gravel of Pleistocene age. Less important aquifers are the perched zones found in the Upper Cretaceous, Eocene, Pliocene(?) and Pleistocene sediments. It is estimated that less than 1 mgd of ground water is withdrawn from the aquifers in the Paducah area.

The geologic formations underlying the Paducah area are shown in the geologic and columnar sections. They are discussed here according to their relative ages, the oldest first.

The Mississippian bedrock, an important aquifer throughout the Paducah area, is the largest potential source of ground water adequate for industrial demands. It ranges in depth below the land surface from about 130 feet to more than 500 feet. The small-scale map of the buried topography of the Mississippian bedrock shows the shape of the bedrock surface beneath the area. Depth to the bedrock can be computed by subtracting the bedrock altitude from the altitude of the land surface at that point. The amount of weathered bedrock consisting mostly of chert rubble on top of the solid limestone surface is unknown in most of the area, but where known it is as much as 95 feet thick. In a few places, Cretaceous sediments rest directly on unweathered limestone that is cavernous at depth. A well in such a limestone at a fish hatchery near Cecil is pumped at 140 gpm; a similar well at Reidland Water District is pumped at 240 gpm. Other wells tapping either the chert rubble or limestone are used for domestic supplies. Near Metropolis, one well producing from limestone openings was test pumped at 1,084 gpm and its water level was drawn down about 3 feet, indicating a specific capacity of 360 gpm per foot of drawdown. Two other wells producing from limestone at the same plant site have specific capacities of 108 and 13 gpm per foot. There have been no known attempts in the Paducah area to obtain large yields of water from the bedrock. All wells drilled into the Paleozoic rocks in the Jackson Purchase region are known to yield sufficient water for domestic use.

The Tuscaloosa Formation is of slight importance as an aquifer in the Paducah area. It occurs as thin remnants in irregular channels on the Mississippian bedrock floor, consists of gravel mixed with a tripolitic clay matrix, and has a low permeability.

The McNairy Formation is an important aquifer throughout the Paducah area. It supplies water to many shallow dug and bored wells in the outcrop area at Reidland and to many drilled wells throughout the area. Most drilled wells tap the basal McNairy sand; a few drilled wells tap irregular sand lenses in the upper and middle parts of the formation. The McNairy ranges in thickness from about 30 feet in the northern part of the Paducah area to more than 280 feet downdip toward the south and west. A basal sand ranges from a few inches to 25 feet in thickness. Owing to lithologic variations of the McNairy sediments at places, the basal sand may be missing, too thin, or too silty to have a well completed in it. Drilled wells must then tap the Mississippian bedrock. There are only three large users of water from the McNairy Formation in the Paducah area; one well at Brookport, Ill., yields 250 gpm, and wells at Reidland Water District and at Concord School yield about 100 gpm. Other wells tapping the McNairy Formation yield small amounts for domestic and commercial uses. The potential yield of the McNairy is unknown, but yields to individual wells may not be more than about 300 gpm.

The Porters Creek Clay of Paleocene age is normally not an aquifer, but in an area west of Avondale Heights, a few large-diameter bored wells tap an upper sand in the formation. Most wells are reported to yield sufficient water for domestic use, although in some cases dry sand has been encountered. The quality of water from the sand in the Porters Creek ranges from good to very poor. It has a reported pH as low as 4.9, which causes pipes to corrode badly. The Porters Creek Clay is a barrier to the movement of ground water between younger and older aquifers.

The sands of the Eocene deposits are important aquifers, supplying many homes and several subdivisions southwest of Paducah. Two sand zones are present, separated by clay and sandy clay. The upper sand crops out in the creeks and road cuts southeast of Massac and south of Lone Oak. The basal sand, which occurs on top of an irregular surface cut into the Porters Creek Clay, crops out in an arch from southeast of Champion Creek to Bleich Road and in the upland south of Concord School. The saturated thickness of the upper sand is probably less than 10 feet, and that of the basal sand ranges from a few inches to 20 feet or more. Where insufficient yields are obtained from the upper sand, the basal sand can be tapped.

Large-diameter bored wells, having large storage capacity, may be better suited for obtaining water from the upper sand than drilled wells. Both drilled and bored wells tap the basal sand. Yields may be as much as 100 gpm. In the areas adjacent to availability area 7 and in the upland west of Paducah between U.S. Highways 60 and 62, large-diameter bored wells tapping the basal sand may yield sufficient water if adequate storage is provided in the well. The saturated thickness may be only a few feet or a few inches. In availability areas 5 and 6, some wells have found no basal sand above the Porters Creek Clay and were drilled to a deeper aquifer.

Between the upper and basal Eocene sands is a clayey silt with lenses of coarse sand and lignitic clay. Some large-diameter bored wells and a few drilled wells, which tap thin sand bodies, as much as 4 feet thick, yield sufficient water for domestic use. Large-diameter bored wells cannot penetrate easily through the clayey silt when the silt is saturated.

It is doubtful that any sand of Eocene age in the Paducah area will yield adequate water supplies to meet industrial demands. These aquifers should be reserved for commercial, domestic, and stock supplies.

The Pliocene(?) gravel is the chief aquifer for many domestic wells. The capacity of this aquifer to supply industries has not been investigated; north of U.S. Highway 60 it may yield sufficient water for industrial needs. Yields from the gravel aquifer in nearby areas may be 400 gpm or more. The location and saturated thickness of the terrace deposits commonly determine the potential yield. In the area north of U.S. Highway 60 in Paducah West quadrangle (see geologic section), large yields can be expected from wells on the lower terrace, but in the upland areas to the south, small yields can be expected from wells on the upper terraces. Most wells tapping the Pliocene(?) gravel in the upland areas obtain their supplies from perched water bodies above the Porters Creek Clay or above clays in the Eocene deposits.

In an area westward from Paducah to Oscar and northward to the Ohio River, the Pliocene(?) gravel is an important source of water for small industrial needs. The saturated thickness of the gravel in the Paducah area ranges from a few feet to 50 feet or more. Small yields are expected where the gravel is thin or is clayey. West of Paducah, in areas where the saturated gravel is thick, specific capacities of properly constructed wells are more than 100 gpm per foot of drawdown. Similar specific capacity may be obtained in the Paducah area. The geologic section from Friendship Church Road along Olivet Church Road shows the details of a gravel channel cut into the Porters Creek Clay on the north side of U.S. Highway 60. Other similar channels probably are present, but few data exist on their location and direction in relation to a master stream. In some areas adjacent to the former valley wall, the gravels are drained and yields are inadequate for domestic use. Such areas are near Emma Morgan School southward to Schneidman Road Church and near Concord School south of U.S. Highway 60.

In the Reidland area, the water in the Pliocene(?) gravel is perched above either the clay of the McNairy Formation or the Porters Creek Clay. Saturated thicknesses range from 0 to 28 feet or more. The exact boundary between water availability areas 3 and 8 is unknown. At places in area 3 the Pliocene(?) gravel contains little or no water; in area 8 some wells may obtain water from the Pliocene(?) gravel.

The alluvium of Quaternary age is also a potential aquifer of major industrial importance for the Paducah area. The saturated thickness of the alluvium, based on test holes by the U.S. Geological Survey and the Tennessee Valley Authority, ranges from a few feet to 70 feet or more in the Woodlawn area east of Paducah, in the Black Bottoms of Illinois, and in Livingston County, Ky. Estimated yields of 1,000 gpm or more may be obtained in favorable places. At present only domestic and commercial wells tap the alluvial deposits. Many dug wells tap a perched water zone in the alluvium east of Paducah, but few wells are presently used. Water levels in the perched zone are about 15 feet higher than those in the main zone of saturation.

Development of ground-water supplies in areas along the alluvial valley faces two problems. One of these problems is the annual flooding of the valley each spring to altitudes of about 335 feet; the other is the high iron content of the water from the alluvium which may limit the use of the water unless it is treated for removal of the iron.

According to measurements made in the early 1950's and again in 1964, at selected wells, there were negligible changes in the ground-water levels and in the amount of ground water in storage for the period. Both sets of measurements were made during periods of droughts. Many owners of shallow wells complained of insufficient water for domestic use during these dry periods. Except in areas near the outcrop of the Porters Creek Clay, the problem of insufficient water commonly was caused by improper well construction. Wells that had been dug by hand were not deep enough to insure an adequate supply when water levels declined.

The water surface in all aquifers slopes toward the Ohio and Tennessee Rivers, except in an area south of Lone Oak where Mayfield Creek intersects the water table. A change in the stage of the Ohio and Tennessee Rivers may affect this slope temporarily. The water level in the McNairy Formation and possibly in the Mississippian bedrock show an effect characteristic of loading of an artesian aquifer. Near the river, the ground-water level in the deeper aquifers normally is only a few feet above pool stage at dam 52. If the Ohio and Tennessee Rivers rise about 30 feet above normal pool stage, the flood plain is inundated and the alluvial aquifer becomes full of water. This additional weight of water on the flood plain and in the alluvial aquifer causes a pressure-transmitting effect that raises the water level in the McNairy Formation about 18 feet. Similar effects may be noticeable in wells more than 10 miles from the river. At Lone Oak, the water level rises about 5 feet.

Along the west edge of the valley of Clarks River, the water table in the alluvium is higher than the piezometric surface of the McNairy Formation and the Mississippian bedrock (see geologic section). Eastward from Island Creek where the Porters Creek Clay thins out, the piezometric surface in the McNairy and Mississippian aquifers may be a few feet higher than the water level in the Quaternary alluvium.

The chemical quality of ground water is generally good except that the concentration of iron in the water from some aquifers is more than 0.3 ppm (part per million). More than 0.3 ppm of iron may cause staining of textiles and porcelain, imparts a disagreeable taste, and limits the use of untreated water for some industrial uses. The water from all aquifers except the Pliocene(?) gravel and the Eocene sands may contain an objectionable amount of iron. However, no water samples were collected from steel-cased wells in the Pliocene(?) gravel to determine if there is a reaction between the water and the steel casing.

The high iron in water sampled from the Eocene aquifers is a special problem. It is believed that the high iron content is not typical of the natural water from the Eocene aquifer, but that it results from corrosion of the steel well casings by the slightly acidic water. Most of the water sampled from 2- to 3-inch jetted wells equipped with steel casing and sucker rod or jet pumps contains large amounts of iron. Water samples from the Eocene aquifer collected from plastic-cased wells elsewhere in the Jackson Purchase are noted to have a much lower iron content than those from steel-cased wells.

The water from the Mississippian, Cretaceous, and alluvial aquifers is hard to very hard; that from the Eocene aquifer is soft. The water from the Pliocene(?) gravel ranges from soft to very hard, and increases in hardness toward the Ohio River in Paducah West quadrangle. Hydrogen sulfide may be present in minor amounts in water obtained from the Mississippian bedrock. Water from a well in bedrock at Reidland contains 0.7 ppm of hydrogen sulfide. Several analyses of water, generally from dug wells, show a nitrate content in excess of 45 ppm. 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. Nitrate concentration appreciably higher than the local average would suggest pollution.

Urbanization in the Paducah area may cause pollution of the shallow aquifers, and many homeowners may need to drill wells into deeper aquifers to obtain safe water. Such water may be supplied more economically to the area of urban growth by water districts obtaining water from the Paducah water system or from new well fields than by individual wells. Great care should be exercised in new water districts to prevent well owners from using old wells as seepage pits for domestic sewage. Direct discharge of sewage into wells causes pollution of the valuable ground-water resource. Adequate sanitary sewer systems are essential in all water districts to prevent pollution of wells.

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

Analysis number	1	2	3	4	5	6	7	8	9	10
Iron content	0.11	0.02	0.73	0.45	1.3	0.16	0.28	[a]3.1	0.21	[b]0.09
pH	7.7	7.6	—	—	7.1	6.1	5.8	7.4	7.0	—

Analysis number	11	12	13	14	15	16	16A	17	18	19
Iron content	2.3	0.21	0.16	0.21	0.14	[a]1.2	[b]0.06	[b]0.14	0.36	1.1
pH	7.4	—	5.7	—	—	7.1	—	—	7.4	7.6

Analysis number	20	21	22	23	24	25	26	27	28	28A
Iron content	0.97	0.00	[b]0.07	0.24	0.39	1.1	2.3	[a]4	0.83	0.08
pH	5.5	7.0	—	—	—	7.3	7.2	7.4	6.0	7.4

Analysis number	29	30	31	32	33	34	35	36	37	38
Iron content	[b]0.10	0.27	0.15	0.10	[b]0.14	2.2	0.03	3.7	[b]0.06	0.25
pH	—	6.9	6.2	8.0	—	7.8	6.2	—	—	—

Analysis number	39	40	41	42	43	44	45	46	47	48
Iron content	0.44	12	0.10	0.97	0.62	0.43	0.07	0.16	[a]14	0.45
pH	—	—	6.3	5.5	—	7.1	—	7.2	7.9	5.9

Analysis number	49	50	51	52	53	54	55	56	57	58
Iron content	3.3	0.12	[b]0.07	0.26	0.66	0.54	0.06	0.05	0.15	0.05
pH	—	6.9	—	6.1	6.5	6.0	7.3	—	6.3	7.7

Analysis number	59	60	61	62	63	64	65	66
Iron content	1.1	0.09	0.94	0.43	0.62	14	2.1	0.27
pH	6.8	—	7.8	7.6	6.6	—	6.6	6.1

[a]In solution and sediment
[b]In solution at time of analysis

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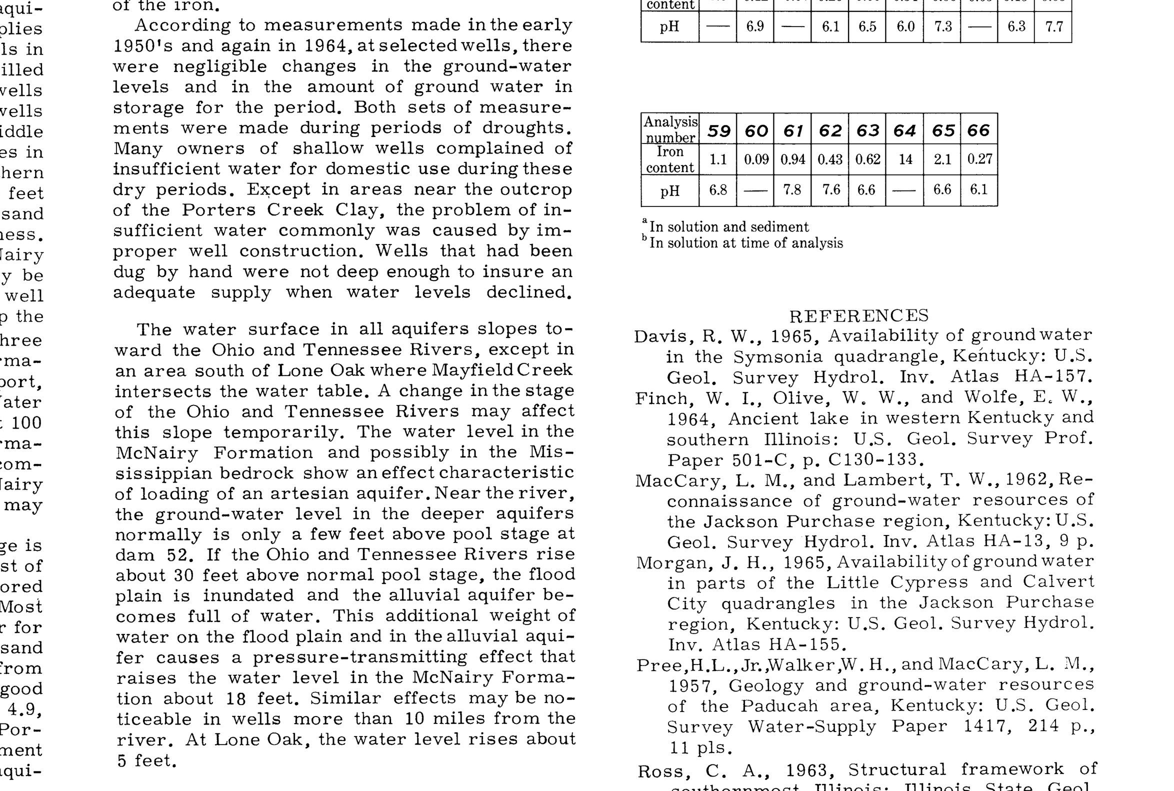

BURIED TOPOGRAPHY OF TOP OF MISSISSIPPIAN BEDROCK

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AVAILABILITY OF GROUND WATER IN THE PADUCAH WEST AND EAST QUADRANGLES, ILLINOIS AND JACKSON PURCHASE REGION, KENTUCKY

By
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1967

HYDROLOGIC INVESTIGATIONS
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