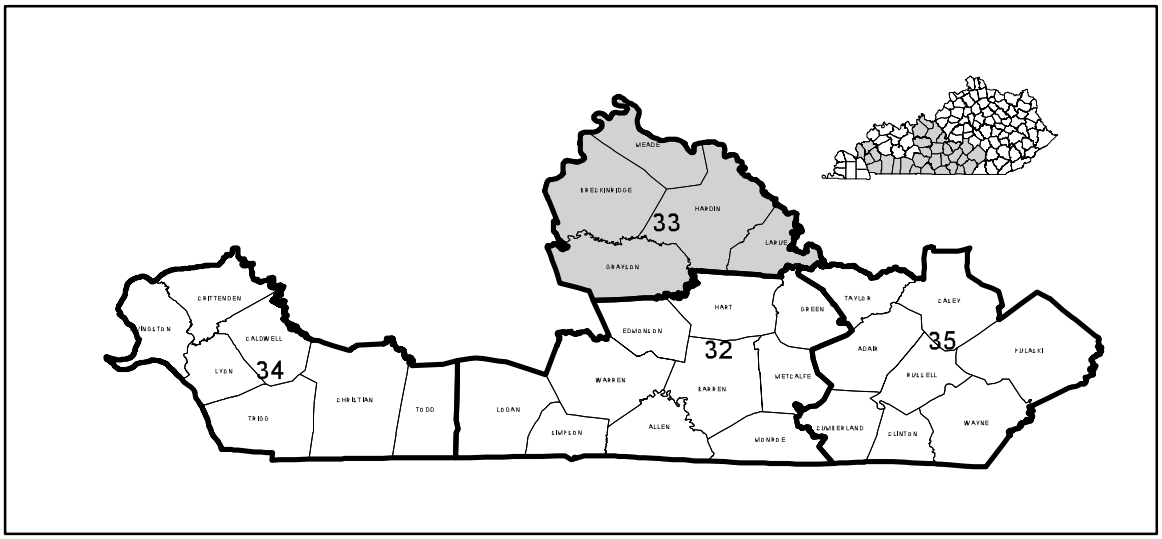
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

PREPARED IN COOPERATION WITH
THE COMMONWEALTH OF KENTUCKY
AND THE KENTUCKY GEOLOGICAL SURVEY
UNIVERSITY OF KENTUCKY

AVAILABILITY OF GROUND WATER IN BRECKINRIDGE, GRAYSON, HARDIN, LARUE, AND MEADE COUNTIES, KENTUCKY

By
R.F. Brown and T.W. Lambert

HYDROLOGIC INVESTIGATIONS
ATLAS HA-33



INDEX MAP OF THE MISSISSIPPIAN PLATEAU REGION, KENTUCKY, SHOWING COUNTY GROUPS AND AREA OF THIS ATLAS

This is 1 of 4 atlases (HA-32 to HA-35) showing geology and availability of ground water in the Mississippian Plateau region, Kentucky U.S. Geological Survey Water-Supply Paper 1603 contains a text description and illustrations providing further information on the occurrence and quality of ground water in the Mississippian Plateau region.

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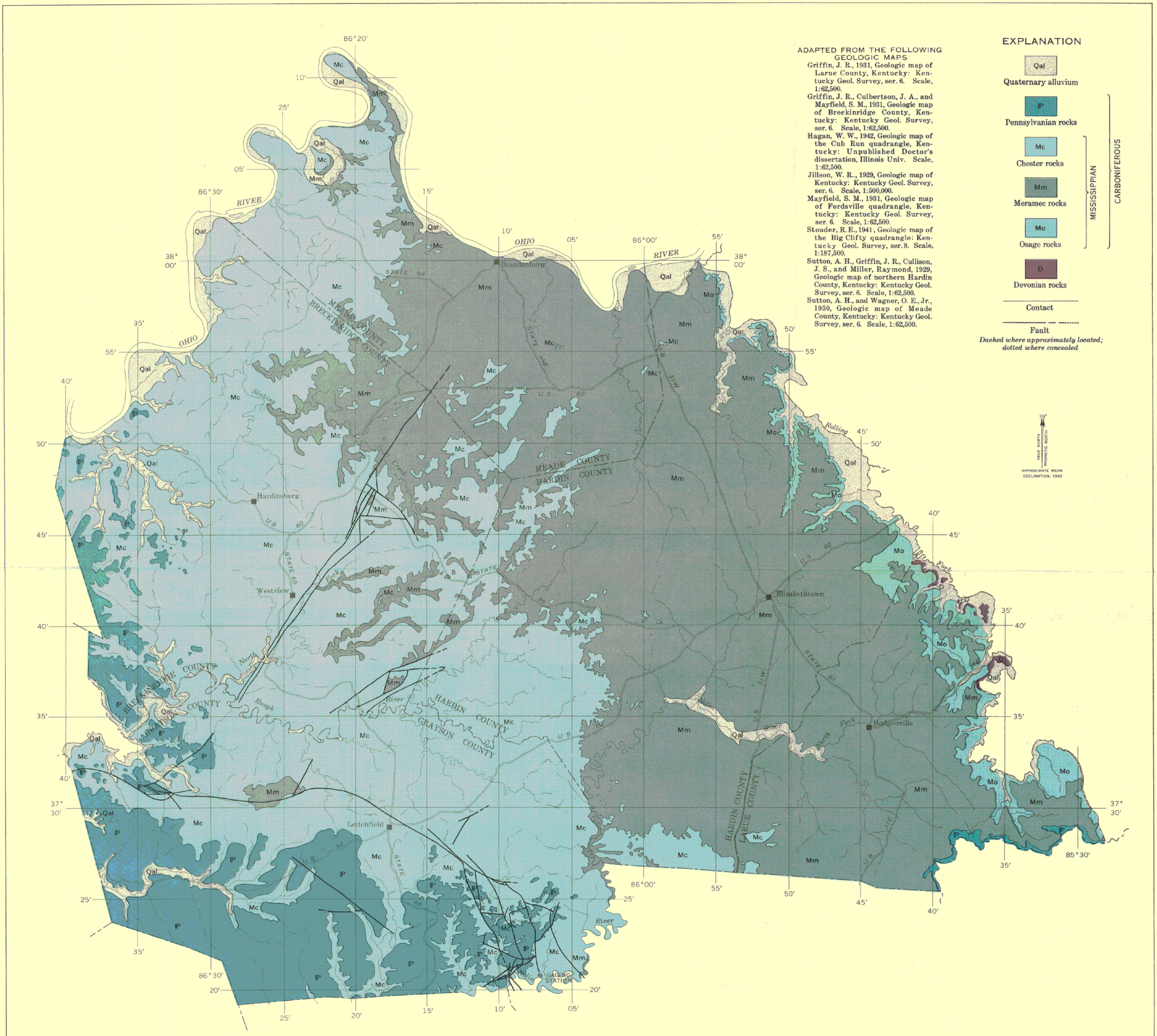

ADAPTED FROM THE FOLLOWING GEOLOGIC MAPS

Griffin, J. R., 1931, Geologic map of Larue County, Kentucky: Kentucky Geol. Survey, ser. 6. Scale, 1:62,500.

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EXPLANATION

- Qal — Quaternary alluvium
- IP — Pennsylvanian rocks
- Mc — Chester rocks
- Mm — Meramec rocks
- Mo — Osage rocks
- D — Devonian rocks

MISSISSIPPIAN; CARBONIFEROUS

Contact

Fault

Dashed where approximately located; dotted where concealed

Base maps are county highway maps and adjacent county groups may not match

INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D. C.—10415

GEOLOGIC MAP OF BRECKINRIDGE, GRAYSON, HARDIN, LARUE, AND MEADE COUNTIES, KENTUCKY

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SCALE 1:250 000

4 0 4 8 12 MILES

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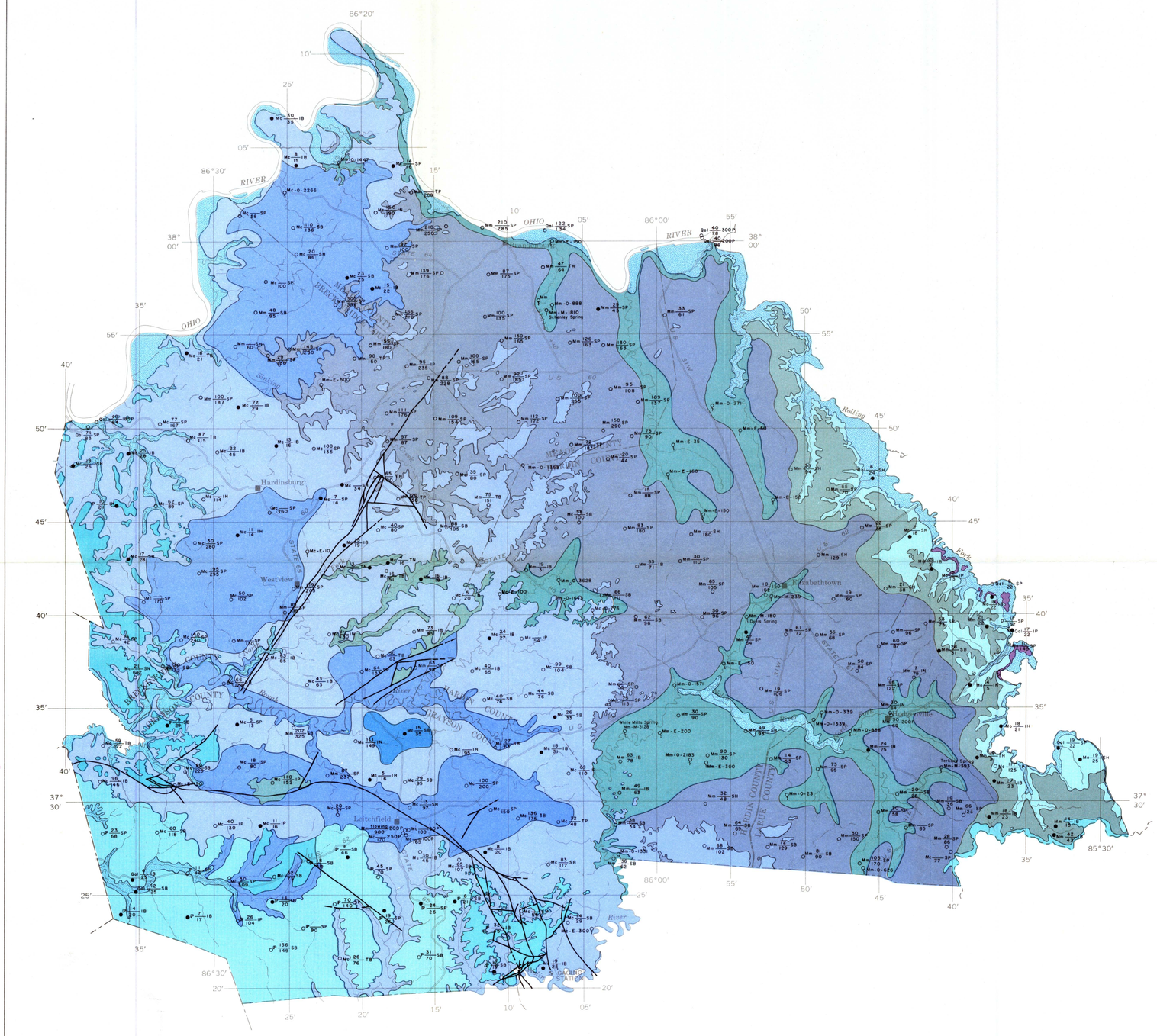

WATER-BEARING FORMATION

Qal	Quaternary alluvium	
P	Pennsylvanian	CARBONIFEROUS
Mc	Chester age	MISSISSIPPIAN
Mm	Meramec age	MISSISSIPPIAN
Mo	Osage age	MISSISSIPPIAN
D	Devonian	

Contact

Fault
Dashed where approximately located; dotted where concealed

Water in Recent and Pleistocene alluvium
Drilled wells in alluvium in the Ohio River valley may yield several hundred gpm (gallons per minute). Compound horizontal wells may yield as much as 5,000 gpm. Nearly all wells yield more than 500 gpd (gallons per day) and are adequate for domestic use. Alluvium in stream valleys tributary to the Ohio River is fine grained and thin; most drilled wells are inadequate for bailer or bucket (less than 100 gpd), whereas dug wells will generally yield enough for a bailer or bucket (more than 100 gpd).

Water in rocks of Pennsylvanian age
Nearly all drilled wells in the upland are inadequate for power pumps. About half the wells do not yield enough water for a domestic supply with bailer or bucket (less than 100 gpd). Drilled wells in lowland areas bordering streams generally yield enough water for a domestic supply with bailer or bucket (more than 100 gpd).
Dug wells in lowland areas bordering streams yield enough water for a domestic supply with bailer or bucket (more than 100 gpd) if adequate storage is provided for peak needs. Very few dug wells are adequate for a domestic supply with power pump (more than 500 gpd).

Water in rocks of Pennsylvanian age
Less than half the drilled wells in this area yield enough water for a domestic supply with power pump (more than 500 gpd), but most are adequate for a domestic supply with bailer or bucket (more than 100 gpd). Drilled wells in lowland areas bordering streams will generally yield enough water for a domestic supply with bailer or bucket (more than 100 gpd).
Dug wells in lowland areas bordering streams yield enough water for a domestic supply with bailer or bucket (more than 100 gpd) if adequate storage is provided for peak needs. Very few dug wells are adequate for a domestic supply with power pump (more than 500 gpd).

Water in Mississippian rocks of Chester age
Most drilled wells are adequate for a domestic supply with power pump (more than 500 gpd). Adequate wells range from about 100 to 300 feet in depth. Yields of as much as 100 gpm are obtained from wells penetrating fault zones. Shallow drilled wells are adequate only where water levels are close to perennial stream levels.
Most dug wells are inadequate for a domestic supply (less than 100 gpd). An adequate domestic supply with bucket or bailer (more than 100 gpd) may be obtained from dug wells in some places close to streams. Most wells in the Leitchfield formation are inadequate for domestic use.

EXPLANATION

Water in Mississippian rocks of Chester age
About half the drilled wells are adequate for a domestic supply with bucket or bailer (more than 100 gpd). A few wells yield enough for a domestic supply with power pump (more than 500 gpd), but mostly from depths of about 150 feet or more. Shallow drilled wells (less than 100 feet deep) generally are inadequate for a domestic supply (less than 100 gpd).
Most dug wells are inadequate for a domestic supply (less than 100 gpd). An adequate domestic supply with bucket or bailer (more than 100 gpd) may be obtained in some places close to streams if perched water bodies in sandstone formations are intercepted. Most wells in the Leitchfield and Buffalo Wallow formations are inadequate for domestic use.
A minor spring horizon is present at the base of the Big Clifty sandstone. Flows range up to about 50 gpm. Seepage springs occur at other horizons, but most are seasonal. A few large springs occur near the Chester-Meramec contact. The lower Chester limestone is lithologically similar to the Meramec, and solution openings are well formed in places. Flows are as much as 1,000 gpm.

Water in Mississippian rocks of Meramec age
More than three-fourths of the drilled wells in this area yield enough water for a domestic supply with a power pump (more than 500 gpd). Very few wells are inadequate for domestic use with bailer or bucket (less than 100 gpd). Wells that penetrate large solution channels yield more than 5 gpm, and some yield more than 50 gpm.
Dug wells are inadequate for a domestic supply with bucket or bailer (less than 100 gpd) except where water levels are close to perennial stream levels.
Springs are present in a few areas where there are minor surface streams. Flows are as much as 500 gpm. Many of the springs are of the depression type and yield more than 100 gpm when pumped.

Water in Mississippian rocks of Meramec age
Springs with low flows ranging from less than 10 gpm to about 1,500 gpm occur at or near stream level. Maximum flows range from less than 100 gpm to more than 100,000 gpm. Minimum flows generally occur in early fall, maximum flows in late winter. A few drilled wells in this area that intercept openings leading to springs may yield as much as the flow of the springs, but most wells are inadequate for domestic use with bailer or bucket (less than 100 gpd).
Dug wells are inadequate for a domestic supply except in lowland areas bordering streams.

Water in Mississippian rocks of Meramec age
More than half the drilled wells in this area are inadequate for a domestic supply with bailer or bucket (less than 100 gpd). Very few wells yield enough water for a domestic supply with power pump.
Nearly all dug wells are inadequate for a domestic supply with bailer or bucket (less than 100 gpd).

Water in Mississippian rocks of Osage age
Yields of about half the drilled wells are adequate for a domestic supply with bailer or bucket (more than 100 gpd). A few wells in lowland areas bordering streams yield enough for a domestic supply with power pump (more than 500 gpd). Most wells penetrate perched or semiperched water bodies of small areal extent between layers of shale and limestone. In some wells, water from the perched water bodies migrates below any openings in the well during rainless periods. These wells are then dry until rainfall reestablishes a perched water body.
Most dug wells obtain water from the contact of mantle and bedrock or from shallow perched water bodies in the bedrock. These wells usually go dry during extended dry periods in late summer and fall.

Water in rocks of Mississippian-Devonian age
Nearly all drilled and dug wells are inadequate for domestic use with bailer or bucket (less than 100 gpd) from the Chattanooga shale.
Seepage springs are present along much of the area in which the Chattanooga shale crops out. Flows are generally less than 1 gpm, and most springs dry up during late summer and fall.
Yields from fault zones generally are greater than shown by the availability pattern; however, some wells yield much less than is shown by the pattern.

Drilled well

Dug well

Qal 40/84 185 P
- Depth to water below land surface, in feet
- Type of lift
- Yield of well
- Depth of well below land surface, in feet
- Water-bearing formation

TYPE OF LIFT

B	Bailer or bucket
H	Hand force pump
P	Power pump
N	No pump, bucket, or bailer

YIELD

185	Gallons per minute, where known
S	Satisfactory supply for domestic use
I	Inadequate supply for domestic use
T	Yield not determined
SB SH	Minimum yield of well reported 100 gallons per day
SP	Minimum yield of well reported 500 gallons per day
IB IH IP	Will not yield a minimum supply with type of lift installed

Spring

Mm-E-300
- Formation
- Yield
- Method used to determine yield figure

METHOD USED TO DETERMINE YIELD

E	Estimated on basis of one observation
M	Measured with pygmy meter or flume more than one time. Minimum measured flow shown
O	Measured with pygmy meter or flume one time. Observed measured flow shown

YIELD

300 Gallons of flow per minute

Base maps are county highway maps and adjacent county groups may not match

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SYSTEM	SERIES	FORMATION OR GROUP	THICKNESS (IN FEET)	SECTION	LITHOLOGY	TOPOGRAPHY	WATER-BEARING CHARACTER
QUATERNARY	Recent and Pleistocene	Alluvium	0–120		Silt, clay, sand, and gravel in Ohio River valley. Silt, clay, and minor amounts of sand and gravel in tributary valleys.	Terraces and floodplains. Valley-train deposits in terraces occur along the Ohio River.	Yields several hundred gallons per minute to drilled wells in alluvium in the Ohio River valley. Yields as much as 5,000 gpm (gallons per minute) to compound horizontal wells. Nearly all wells furnish more than 500 gpd (gallons per day), enough water for a domestic supply with a power pump. Alluvium in stream valleys tributary to the Ohio River is fine grained and thin; most wells do not furnish enough for a bailer or bucket (less than 100 gpd).
CARBONIFEROUS — PENNSYLVANIAN		Caseyville sandstone	0–100		Sandstone, yellowish-brown, medium-grained, crossbedded, and poorly cemented lenticular conglomerate. Massive in places.	Underlies dissected uplands and ridgetops in western part of area. Caps isolated hilltops.	Yields enough water for a domestic supply with a power pump (more than 500 gpd) to wells in lowland areas bordering streams. Wells in upland generally are inadequate (yields less than 100 gpd).
		Leitchfield[1] / Buffalo Wallow; Tar Springs sandstone	0–125		Variegated shale with thin-bedded sandstone and limestone. Thickness varies greatly owing to pre-Pennsylvanian erosion.	Gently rolling uplands and fairly steep slopes adjacent to stream valleys. Sandstone lenses, some massive, form small benches.	Yield little or no water to wells.
					Sandstone, gray, fine-grained, locally bituminous, and dark-gray shale. Lithology varies greatly within short distances.		
	Chester	Glen Dean limestone	50–70		Limestone, dark- to bluish-gray, fine- to medium-grained, very fossiliferous; black to gray shale near top.	Gently rolling uplands, dissected on perimeter of Dripping Springs escarpment.	Sandstone formations yield enough water for a domestic supply with bailer or bucket (more than 100 gpd) in lowland areas bordering streams and in broad upland areas where there is a substantial saturated thickness in perched water bodies. Deep wells that tap the sandstone formations near perennial stream level furnish enough for a domestic supply with a power pump (more than 500 gpd). Close to outcrop areas, particularly near major escarpments, yields from perched water bodies generally are low and not dependable. Minor spring horizons occur near the base of most of the sandstones on discontinuous layers of shale. The most prominent springs are those which discharge from the base of the Big Clifty sandstone. These are the "dripping springs" of the Dripping Springs escarpment. Many of these springs go dry during the late fall and summer, and very few are adequate for a domestic supply with a power pump.
		Hardinsburg sandstone	30		Sandstone, gray, fine- to medium-grained, massive to thin-bedded; contains red or green shale.	Underlies dissected uplands and ridgetops. Forms small benches on hillsides.	
		Haney limestone[2]	35		Limestone, gray, fine-to medium-grained, medium crystalline to oolitic in places, very distinctive light-gray block, chert, and variegated shales.	Gently rolling to fairly flat uplands; moderate bluffs near the heads of valleys.	
		Big Clifty sandstone[2]	75		Sandstone, gray, fine- to coarse-grained, massive, crossbedded; contains green fissile shale.	Forms a major escarpment (Dripping Springs escarpment) of several hundred feet of relief. Underlies gently rolling uplands.	
		Beech Creek ls.[2]	10		Limestone, gray, finely to coarsely crystalline, oolitic to coarsely crinoidal.	Form lower part of Dripping Springs escarpment. Have numerous large sinks into which overlying sandstone has collapsed. Underlie gently rolling upland.	Limestone formations yield small to adequate supplies from solution openings. In lowland areas bordering streams some wells furnish enough for a domestic supply with a power pump (more than 500 gpd). Most in upland areas are inadequate for a domestic supply with a bailer or bucket (less than 100 gpd). Deep wells that encounter solution openings in limestone may produce more than 5 gpm, but most deep wells are inadequate for a domestic supply with bailer or bucket (less than 100 gpd). Where karst is formed on the Paoli limestone, some wells yield more than 5 gpm from solution openings in the Paoli and the underlying Ste. Genevieve limestone. Close to outcrop areas, particularly near major escarpments, yields from perched water bodies generally are inadequate during dry periods. Springs occur at the base of many of the limestones where they crop out on escarpments and hillsides. Adjacent to large upland areas, flows are as much as 1,000 gpm and low flows are more than 5 gpm from some springs.
		Elwren sandstone[2]	30		Shale, soft, gray or green.		
		Reelsville limestone[2]	10		Limestone, white to light-gray, fine- to medium-grained, oolitic to coarsely crinoidal.		
		Sample sandstone[2]	30		Sandstone, gray, medium-grained, with black and gray shale.	Forms a small bench or "double step" in the Dripping Springs escarpment in Meade and Breckinridge Counties. Underlies dissected uplands and ridgetops.	
		Beaver Bend limestone[2]	20		Limestone, light- to dark-gray, fine- to medium-grained, oolitic in places.	Forms small benches on hillsides. Underlies gently rolling upland. Sinkholes are present in upland areas.	
			15		Sandstone or black clayey shale.		
		Mooretown sandstone[2]	40		Limestone, light- to dark-gray, fine- to medium-grained, argillaceous to oolitic in places.	Forms small benches where sandstone is locally massive. Underlies relatively flat upland. Shows collapse structure into sinkholes in underlying Paoli limestone.	
		Paoli limestone[2]				Underlies rolling karst areas. Forms lower part of the Dripping Springs escarpment in most areas. Contains numerous sinkholes into which the overlying sandstone has collapsed.	
MISSISSIPPIAN	Meramec	Ste. Genevieve limestone	150–200		Limestone, light-gray to white, oolitic, crossbedded, fine-grained in places; contains a minor amount of chert. Limestone breccia is usually present at the top of the formation.	Underlies rolling karst areas. Greatly dissected in places. Forms steep bluffs along the Ohio River.	Yields more than 50 gpm to wells from large solution openings in karst areas. Most wells encounter solution openings, but in areas high above perennial streams these solution openings are dry in late summer and fall and many wells are inadequate. Contains major caverns of Mammoth Cave area which have large, connected, subsurface streams. Springs having low flows ranging from less than 10 to about 1,500 gpm occur at or near stream level. Smaller springs discharge from perched water bodies in upland areas but many go dry during late summer and fall.
		St. Louis limestone	300		Limestone, gray to tan, fine-grained, coarsely crystalline, dolomitic, argillaceous, cherty. Gypsum present locally.	Underlies rolling karst areas. Has less relief than karst on Ste. Genevieve limestone, but sinkholes are steeper. Forms steep bluffs along the Ohio River.	Yields more than 50 gpm to wells from large solution openings in karst areas. Most wells penetrate solution openings and are inadequate for a domestic supply with a power pump. Major spring horizon; many springs have low flows of several hundred to several thousands of gallons per minute. Many springs are used for public and industrial water supplies.
		Spergen[3] and Warsaw *limestones*	70		Limestone, brown to gray, very crystalline, dolomitic, argillaceous, fossiliferous; contains chert and some shale.	Underlie gently rolling uplands. Karst in upper part. Form cap of Muldraugh escarpment in Hardin and Larue Counties. Form steep bluffs above exposures of Borden group.	Yields enough water for a domestic supply with a power pump where solution openings are encountered close to perennial stream level. Minor spring horizon in upper part.
					Limestone, gray, granular to fine-grained, argillaceous, crinoidal, crossbedded, with small gypsum geodes and chert. Siltstone near base.		Yields enough water for a domestic supply with bailer or bucket (100 gpd). Wells that encounter large solution openings produce more than 5 gpm. Minor spring horizon near base at contact zone of limestone and underlying siltstone.
	Osage	Borden group[4] — Muldraugh[5]	50		Limestone, gray to yellow, granular to fine-grained, siliceous, crinoidal, silty, geodiferous; contains chert beds. Gray calcareous geodiferous siltstone. Unit grades laterally from one lithology to another.	Underlies rolling dissected uplands. Forms steep bluffs near the Muldraugh escarpment. Small valleys are steep and V-shaped.	Yields enough water for a domestic supply with bailer or bucket (more than 100 gpd). Wells in lowland areas close to streams produce more than 5 gpm from solution openings. Most wells obtain water from perched water bodies supported by discontinuous shale layers, and many are dry during late summer and fall. Minor spring horizons occur throughout the formation. Flows are as much as 30 gpm, but most are seasonal. Where the formation consists predominantly of siltstone, most wells are inadequate for domestic use (less than 100 gpd).
		Floyd Knob[4]	10		Limestone, yellow to brown, impure, siliceous, crinoidal, with chert, and greenish-black glauconitic siltstone.		
		Brodhead[5]	100		Limestone, white to gray, siliceous, crinoidal, and a few small geodes. Gray locally calcareous and locally massive siltstone; contains chert beds. Gray to green silty siliceous locally fossiliferous shale; contains calcium carbonate concretions. Unit grades laterally from one lithology to another.		
		New Providence shale[4]	150		Shale, green to gray, clayey; contains iron oxide concretions and small phosphatic nodules at base.	Forms lower part of "knobs" near base of Muldraugh escarpment.	Yields little or no water to wells.
DEVONIAN		New Albany shale	40		Shale, black, fissile.	Forms lower part of "knobs" near base of Muldraugh escarpment. Caps small round hills away from the base of the escarpment.	Yields little or no water to wells. Seepage springs are present at numerous horizons, but most of them go dry during late summer and fall.

See list of references in Water-Supply Paper 1603.

1 As used by Weller (1927).
2 As used by McFarlan, Swann, Walker, and Nosow (1955).
3 As used by Stockdale (1939)=Salem limestone of Cummings (1901)=Somerset shale member of Warsaw limestone.
4 As used by Stockdale (1939).
5 Of Stockdale (1939).

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