

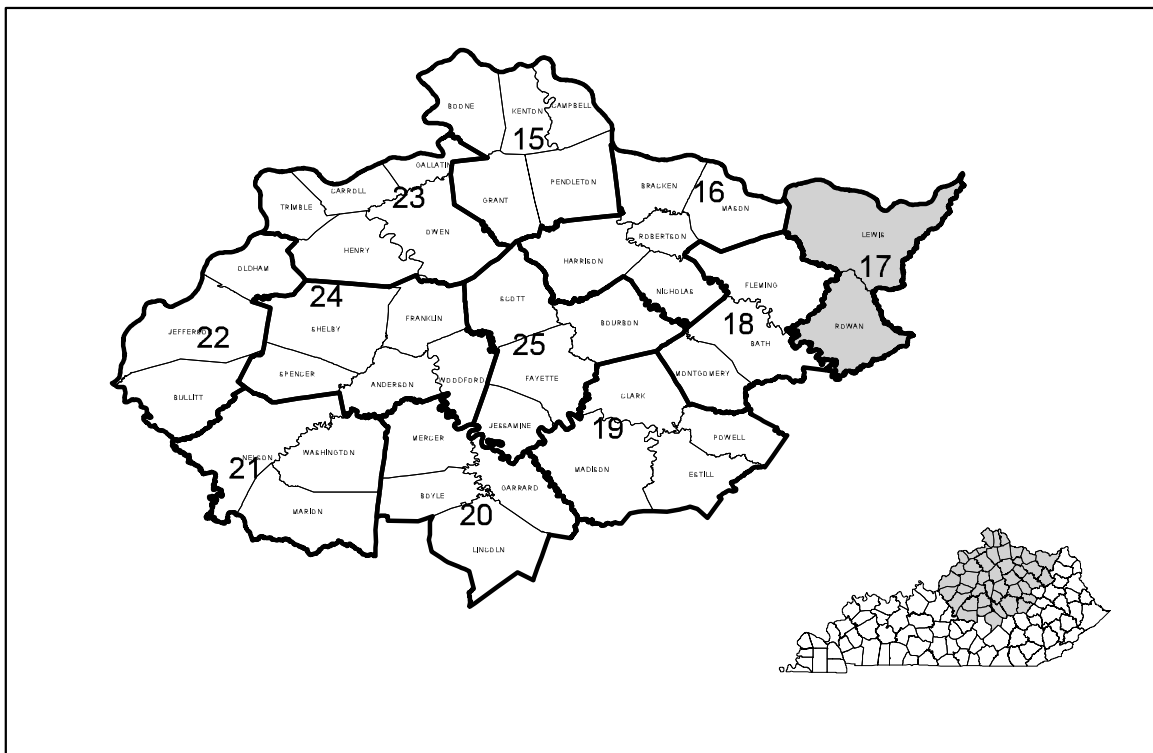
DEPARTMENT OF THE INTERIOR  
UNITED STATES GEOLOGICAL SURVEY

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

AVAILABILITY OF GROUND WATER IN LEWIS  
AND ROWAN COUNTIES, KENTUCKY

By  
W.N. Palmquist, Jr., and F.R. Hall

HYDROLOGIC INVESTIGATIONS  
ATLAS HA-17



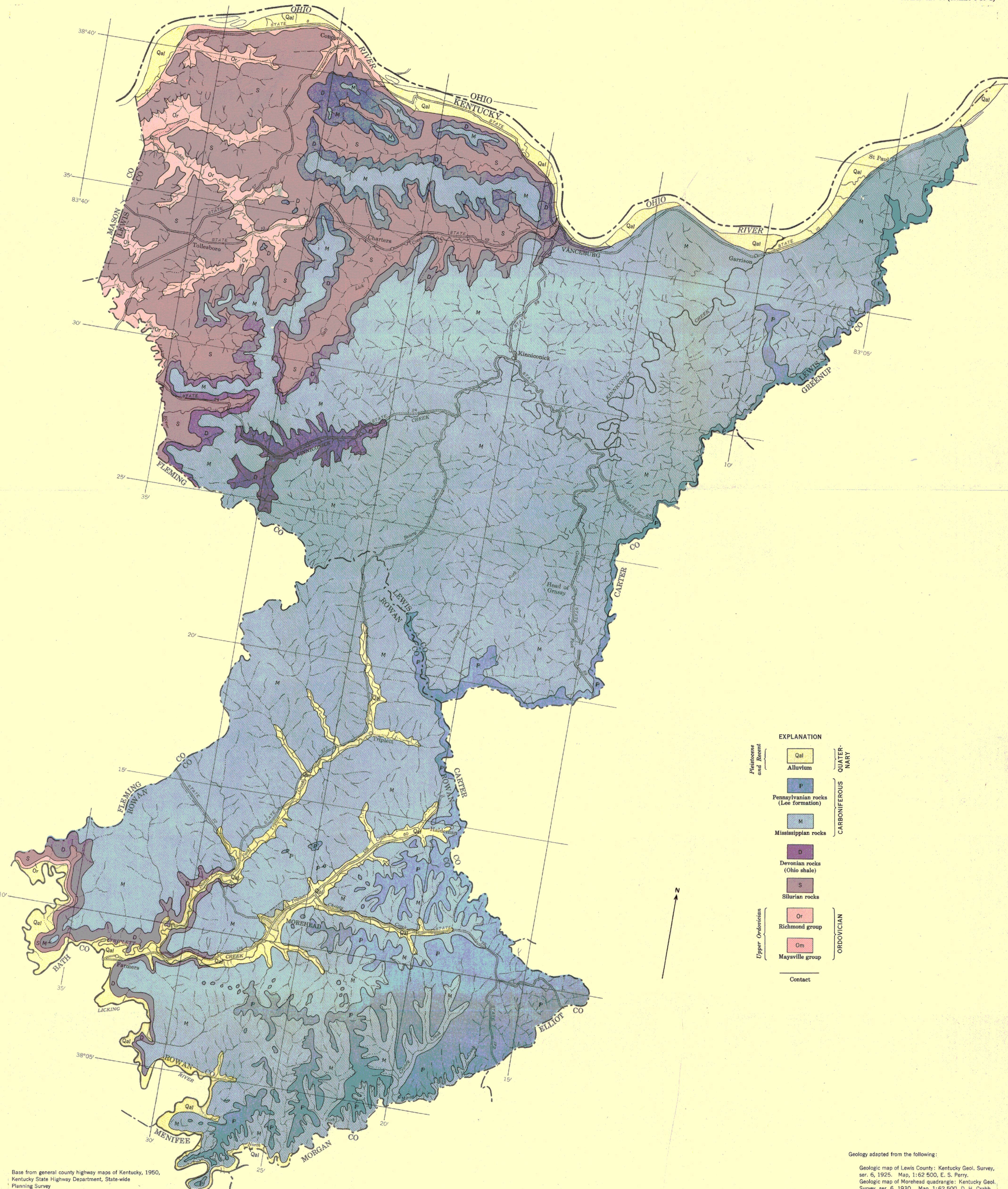
INDEX MAP OF THE BLUE GRASS REGION, KENTUCKY, SHOWING COUNTY  
GROUPS AND AREA OF THIS ATLAS

This is 1 of 11 atlases (HA-15 to HA-25) showing geology and availability of ground water in the Blue Grass region, Kentucky U.S. Geological Survey Water-Supply Paper 1533 contains a text description and illustrations providing further information on the occurrence and quality of ground water in the Blue Grass region.

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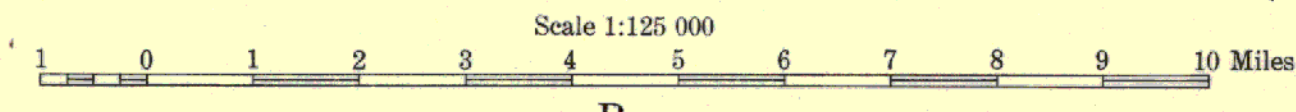
1960



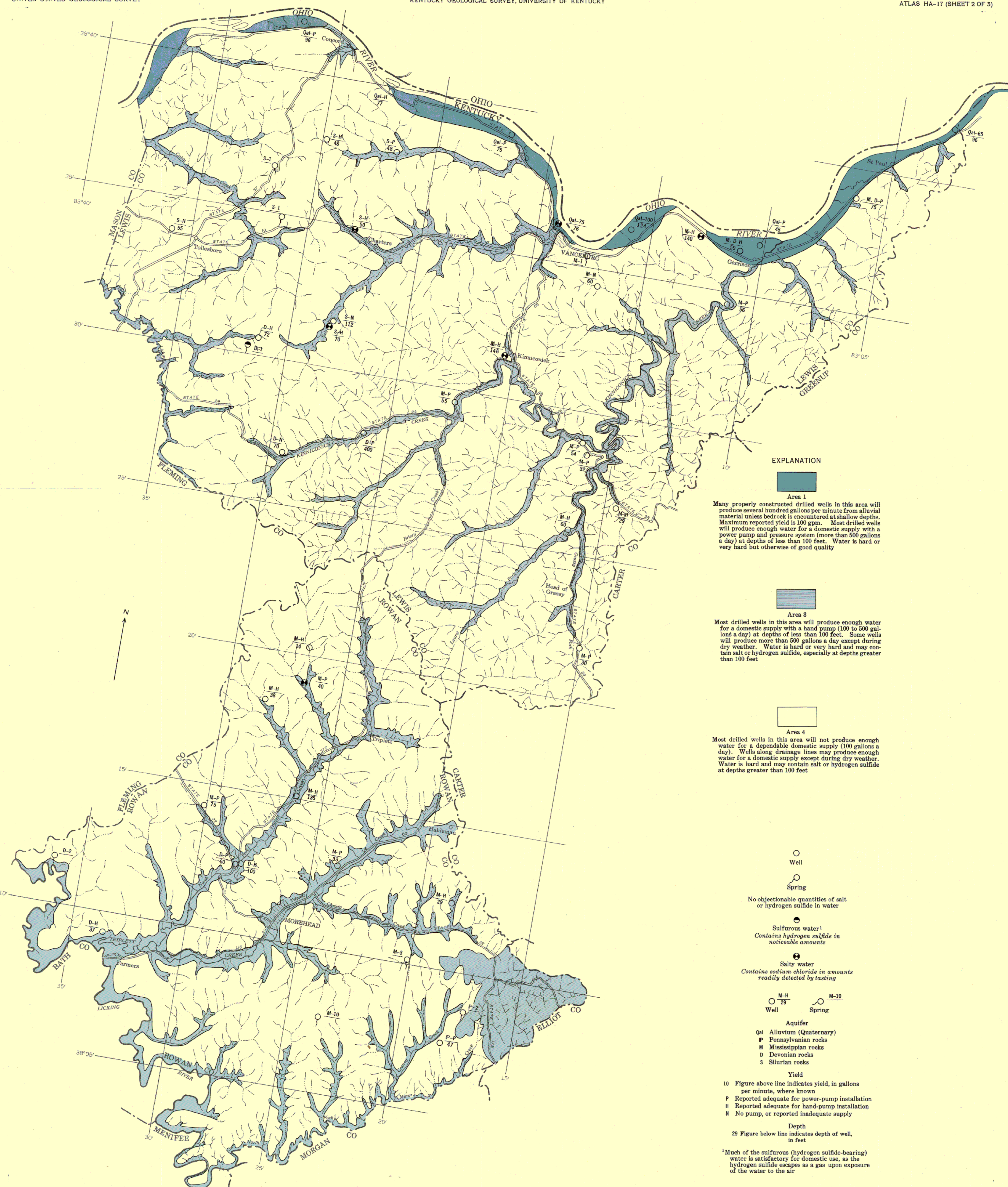
Base from general county highway maps of Kentucky, 1950, Kentucky State Highway Department, State-wide Planning Survey

Geology adapted from the following:  
 Geologic map of Lewis County: Kentucky Geol. Survey, ser. 6, 1925. Map, 1:62 500, E. S. Perry.  
 Geologic map of Morehead quadrangle: Kentucky Geol. Survey, ser. 6, 1930. Map, 1:62 500, D. H. Crabb  
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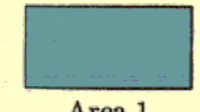
**GEOLOGIC MAP OF LEWIS AND ROWAN COUNTIES, KENTUCKY (COUNTY GROUP 17)**



By  
 W. N. Palmquist, Jr., and F. R. Hall  
 1960



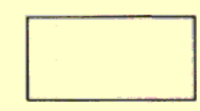
EXPLANATION



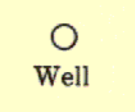
**Area 1**  
Many properly constructed drilled wells in this area will produce several hundred gallons per minute from alluvial material unless bedrock is encountered at shallow depths. Maximum reported yield is 100 gpm. Most drilled wells will produce enough water for a domestic supply with a power pump and pressure system (more than 500 gallons a day) at depths of less than 100 feet. Water is hard or very hard but otherwise of good quality



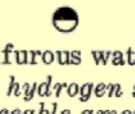
**Area 3**  
Most drilled wells in this area will produce enough water for a domestic supply with a hand pump (100 to 500 gallons a day) at depths of less than 100 feet. Some wells will produce more than 500 gallons a day except during dry weather. Water is hard or very hard and may contain salt or hydrogen sulfide, especially at depths greater than 100 feet



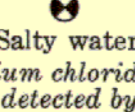
**Area 4**  
Most drilled wells in this area will not produce enough water for a dependable domestic supply (100 gallons a day). Wells along drainage lines may produce enough water for a domestic supply except during dry weather. Water is hard and may contain salt or hydrogen sulfide at depths greater than 100 feet



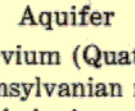
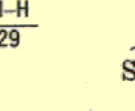
No objectionable quantities of salt or hydrogen sulfide in water



Sulfurous water<sup>1</sup>  
Contains hydrogen sulfide in noticeable amounts



Salty water  
Contains sodium chloride in amounts readily detected by tasting



M-H  
29 Well  
M-10  
Spring

**Aquifer**

Qal Alluvium (Quaternary)

P Pennsylvanian rocks

M Mississippian rocks

D Devonian rocks

S Silurian rocks

**Yield**

10 Figure above line indicates yield, in gallons per minute, where known

P Reported adequate for power-pump installation

H Reported adequate for hand-pump installation

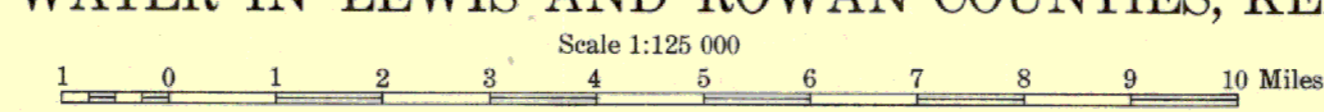
N No pump, or reported inadequate supply

**Depth**

29 Figure below line indicates depth of well, in feet

<sup>1</sup>Much of the sulfurous (hydrogen sulfide-bearing) water is satisfactory for domestic use, as the hydrogen sulfide escapes as a gas upon exposure of the water to the air

AVAILABILITY OF GROUND WATER IN LEWIS AND ROWAN COUNTIES, KENTUCKY (COUNTY GROUP 17)



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1960

SYSTEM	SERIES	GROUP	FORMATION	THICKNESS, IN FEET	SECTION	LITHOLOGY	TOPOGRAPHY	HYDROLOGY			
QUATERNARY	PLEISTOCENE AND RECENT		ALLUVIUM	0-100		Silt, clay, and some sand in upper part, and lenses and layers of silt, sand, and gravel in lower part in the Ohio River Valley; fine-grained sand, silt, and clay in tributaries.	Valley flats, terraces, and flood plains in the rather narrow Ohio River valley where terraces are long, narrow, and discontinuous. Thin in tributary streams but may form flood plains and small terraces along broad valleys.	Yields moderate to large quantities of water to drilled wells in the Ohio River valley according to thickness and texture; yields as much as 100 gpm (gallons per minute), probably more where sand and gravel are thick. Too thin and fine grained in tributary valleys to yield large quantities of water.			
PENNSYLVANIAN	UPPER MISSISSIPPIAN	BORDER	LEE FORMATION	200		Massive and crossbedded white to brown, mostly medium- to coarse-grained sandstone; well-rounded pebbles scattered throughout; interlayered with beds and lenses of sandy conglomerate and conglomeratic sandstone and a few thin seams of coal; thin bed of fire clay in many places at the base.	Ridgetops in eastern Lewis County and southern Rowan County; somewhat dissected upland in southeastern Rowan County. Upper part erodes easily and forms broad, flat ridges. Lower part is more conglomeratic and resistant and caps knobs and narrow ridges in Rowan County; in many places forms steep walls high on the sides of ridges. Underlies valleys only in southeastern Rowan County.	Yields 100 to 500 gpd (gallons per day) to drilled wells along streams and more than 500 gpd in broad valleys; yields 100 to 500 gpd on some wide ridges where water may be semiperched in sandstone on top of fire clay that impedes downward percolation of water. Sandstone beds yield water to small springs. Water is soft and has a low dissolved-solids content.			
			UNDIFFERENTIATED LIMESTONE AND SHALE	50		Medium- to thick-bedded bluish-gray coarse-grained limestone with some thin shale partings at top; massive layers of yellow oolitic limestone, argillaceous shelly limestone, shaly limestone, and shale in middle part; and oolitic limestone at base.	Ridges in eastern Lewis County and Knobs and ridges in Rowan County. Limestone beds are resistant and form cliffs high on the sides of ridges. Some deep erosion channels are filled with clastic rocks of Pottsville age.	May yield 100 to 500 gpd to drilled wells in valley bottoms in the few places in southeastern Rowan County where it occurs below stream level; elsewhere, yields water primarily to springs, which flow from the limestone at the heads of streams high up on the sides of ridges. Many springs yield almost no water and in summer commonly go dry. Little water is available from these rocks where overlain by Pennsylvanian rocks. Water is generally hard but of good quality.			
			MULDRAUGH FORMATION <sup>2</sup>	50		Argillaceous limestone with shaly partings in upper part, and clayey shale in lower part.	Upper slopes and tops of some of the knobs. Limestone beds project as ledges in ravines and on hillsides. Erodes easily, undermining overlying limestone beds and causing them to fall in large blocks.	Limestone forms ledges on slopes and in ravines.			
			FLOYDS KNOB FORMATION <sup>3</sup>	1		Greenish-black glauconitic silt and silty limestone with glauconitic streaks in some places.					
			BRODHEAD FORMATION <sup>2</sup>	195-270		Silty shale with limestone lenses and laminated siltstone in upper part; bedded siltstone with shale partings and limestone lenses in middle part; and massive siltstone in lower part.	Main part of Mississippian escarpment and many knobs. Shale forms dissected slopes and massive siltstone forms cliffs. Limestone lenses form ledges and benches on slopes underlain by shale.	Yields 100 to 500 gpd to wells in valley bottoms throughout its extensive outcrop area; yields more than 500 gpd from fractures in sandy beds near streams; yields almost no water to wells in shale or on hills; yields small amounts of water to springs and seeps. Water from many wells drilled below stream level contains objectionable amounts of salt and sulfate. Water from dug wells and springs is generally soft and has a low dissolved-solids content. These rather soft and sandy rocks are well suited to dug wells, many of which yield more than 500 gpd. In valley bottoms the water table is at a shallow depth, and most drilled wells are less than 50 feet deep. Water of poor quality is found at shallow depth in many places. Most wells that penetrate the underlying Ohio shale yield water of poor quality.			
			NEW PROVIDENCE FORMATION <sup>1</sup>	275-300		Smooth evenly bedded siltstone with interbedded shale in west and north-central Lewis County; massive shaly siltstone, argillaceous to silty shale with siltstone layers, evenly bedded siltstone with shale partings, and argillaceous shale, from top to bottom, in southwestern Lewis County and in Rowan County.	Flat, broad valleys and steep, dissected lower hillsides. Resistant siltstone in lower part forms cliffs along valley edges.				
			SUNBURY SHALE	16		Black highly fissile carbonaceous shale which is like the Ohio shale.	Steep walls and bluffs of the Ohio River and tributary valleys.		Similar to the Ohio shale.		
			BEREA SANDSTONE	? 95		Thick-bedded gray fine-grained poorly cemented soft sandstone, much of which is iron stained; contains ripple marks throughout; present in Lewis County along the Ohio River but thins rapidly southward and is hard to distinguish in Rowan County.	Steep walls and bluffs along the Ohio River and tributaries in Lewis County.		Yields small amounts of water to springs. May yield 100 to 500 gpd to wells where it occurs at and below stream level. Water is soft.		
			DEVONIAN	UPPER DEVONIAN		OHIO SHALE	185-300		Black highly fissile carbonaceous shale, locally containing green shale layers; thin sandstone and calcareous layers in upper part. Shale contains small amounts of fine quartz grains, pyrite, and other minerals, and black organic material. Large limestone concretions in lower 30 feet at Vanceburg, Lewis County. The thickness of 300 feet in Lewis County is the maximum known in Kentucky. Thins to 185 feet, or less, in Rowan County.	Steep hillsides and broad, flat valley bottoms.	Yields 100 to 500 gpd to drilled wells in valley bottoms or on low hillsides; yields some water to almost any dug well; yields small amounts of water to springs and seeps. Water quality ranges from good to poor; iron, salt, sulfate, and hydrogen sulfide are the main objectionable constituents. Acid water with high sulfate content is found in places. Shale has small, poorly connected openings, and ground-water circulation is slow; however, the shale is commonly fractured to a depth of at least 40 feet, and fractures form main reservoir for water in this formation.
						BEDFORD SHALE	20-25		Laminated bluish-gray silty clay shale with thin beds of greenish fine-grained sandstone; thins southward from Lewis County.	Steep walls and bluffs of the Ohio River and tributary valleys.	Yields little water to wells
SILURIAN	CRAB ORCHARD <sup>3</sup>		BISHER FORMATION <sup>3</sup>	? 20		Yellowish-brown fine-grained granular dolomite which weathers to a sandy-appearing surface; crops out along the Ohio River and thins southward.	Prominent ledges along hillsides in Lewis County.	Yields 100 to 500 gpd to wells in the few places where it occurs below stream level; yields water to small perennial springs where it crops out on hillsides. Water is hard.			
			BRASSFIELD LIMESTONE	20		Fossiliferous medium-crystalline to coarsely crystalline dolomitic limestone, gray to pink on fresh surfaces and sandy brown on weathered surfaces.	Steep, dissected slopes, flat valley bottoms, and upland surfaces.	Yields 100 to 500 gpd to wells in valley bottoms or along major streams on upland, but almost no water to wells on hills; yields water to small seeps and springs. Water from wells and springs may contain large amounts of calcium and magnesium sulfate dissolved from epsom salt and selenite in the shale.			
ORDOVICIAN	UPPER ORDOVICIAN	RICHMOND	INCLUDES ELKHORN, WHITE-WATER, LIBERTY, WAYNESVILLE, AND ARNHEIM FORMATIONS	200-300		From top to bottom: Shale with interlayered thin beds of limestone, alternating beds of limestone and shale, dolomitic limestone with interlayered thin beds of calcareous shale, alternating beds of argillaceous limestone and calcareous shale, fossiliferous rubbly limestone, dolomitic claystone, and interbedded argillaceous shale.	Steep, dissected hillsides beneath the upland underlain by shale beds of Foerste's Crab Orchard group in western Lewis County.	Yields 100 to 500 gpd to drilled wells in broad valley bottoms and along major streams on upland but almost no water to drilled wells on hills; yields small quantities of water to dug wells on ridgetops; yields water to small springs. Water is hard and may contain salt or hydrogen sulfide in valley bottoms.			
			MAYSVILLE	30 EXP.		Thin- to medium-bedded argillaceous limestone, rubbly in places, interbedded with lumpy blue-gray calcareous shale.	Valley bottoms in extreme western part of Lewis County.	Yields 100 to 500 gpd to wells drilled in broad valley bottoms.			

<sup>1</sup>As used by Stockdale (1939). <sup>2</sup>Of Stockdale (1939). <sup>3</sup>As used by Foerste (1935).

GENERALIZED COLUMNAR SECTION AND WATER BEARING CHARACTER OF THE ROCKS IN LEWIS AND ROWAN COUNTIES, KENTUCKY (COUNTY GROUP 17)

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