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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HYDROLOGIC INVESTIGATIONS
ATLAS HA-160

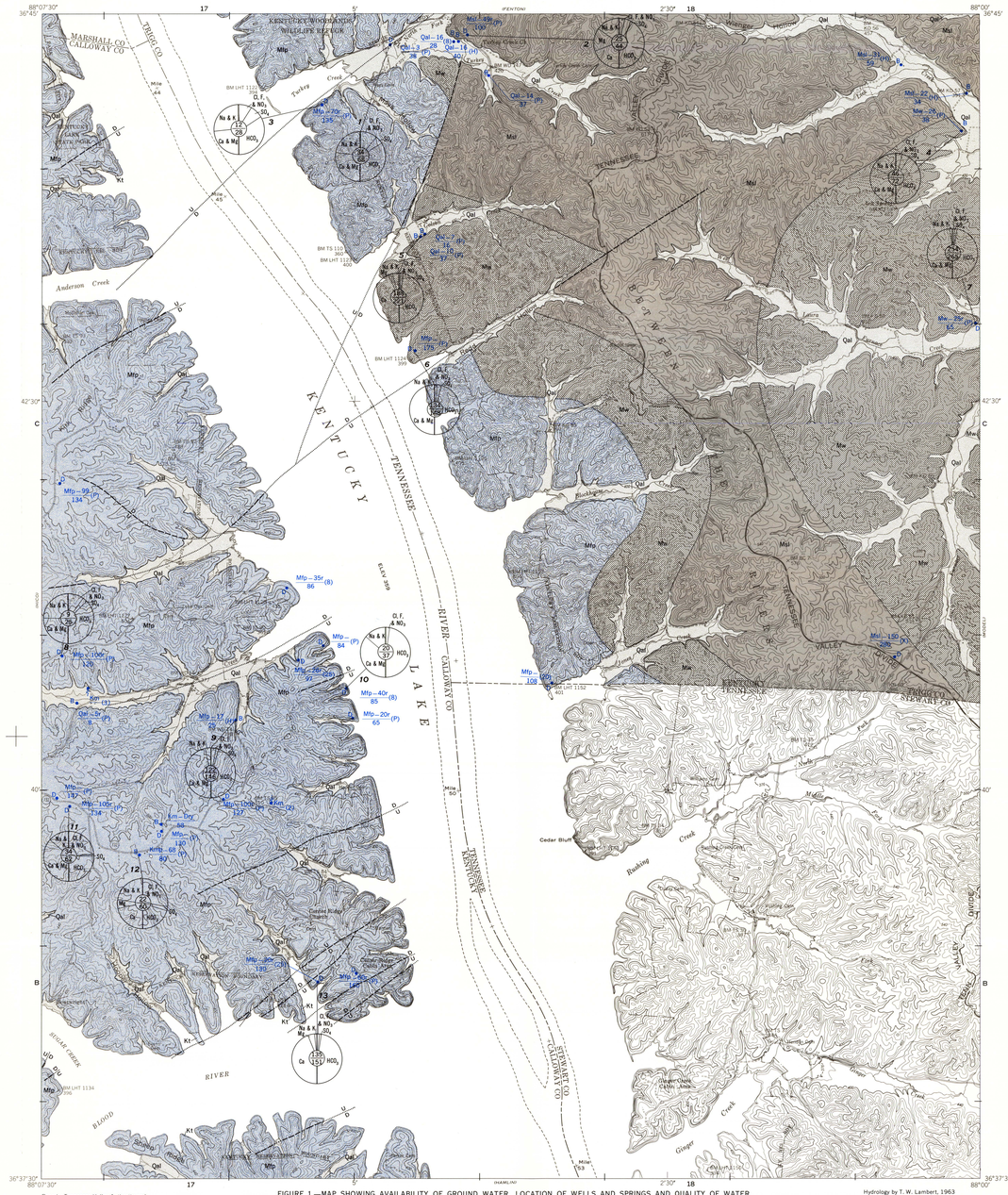
| System | Series | Group | Formation | Thickness, in feet | Lithology | Topography and geologic setting | Hydrology |
|---|---|---|---|---|---|---|---|
| QUATERNARY | Pleistocene and Recent | | Alluvium | 0-125' | Silt, clay, sand, and gravel. | Flood-plain and terrace deposits fill the valleys of the Tennessee and Cumberland Rivers and their tributaries. Thickness of alluvium beneath Kentucky Lake is about 125 feet, and as much as 40 feet in the valleys of major tributaries to Kentucky Lake; it is thinner in the smaller tributaries. | Yields sufficient water for domestic use to large-diameter bored or dug wells in the major tributaries. One flowing drilled well occurs in the alluvial valley of Turkey Creek. Water found above the main zone of saturation in the small tributaries is perched and may be inadequate for domestic use. One water sample from a drilled well has an iron content of 8.4 ppm (parts per million). Another water sample from a bored well has an iron content of 0.94 ppm. An iron content in excess of 0.3 ppm may cause staining of textiles and porcelain, and imparts a disagreeable taste to the water. |
| QUATERNARY | Pleistocene | | Loess | 0-5' | Silt and clay, unstratified. | Windblown deposits cap the upland and slopes. | Not an aquifer. When saturated, transmits water to the underlying units. |
| QUATERNARY / TERTIARY | Pleistocene / Pliocene(?) | | Gravel and sand[1] | 0-30' | Brown pebbles, cobbles, and boulders and very fine to very coarse sand. | Terrace deposits of an old drainage system cap the upland and are present on lower terraces down to the level of the present drainage system. | Not an aquifer because of thinness of the unit and the lithology of underlying units. Locally, some perched water may be found above cemented beds, but it may be inadequate for domestic use. |
| TERTIARY | Pliocene(?) | | McNairy Formation | 0-100' | Very fine to fine clayey to well-sorted micaceous sand with scattered clay lenses. Subrounded white chert pebbles and cobbles in sand matrix are commonly present near base of formation. | Present beneath the Pliocene(?) gravel; crops out along the hillsides in the upland. Present in concealed channels in the eroded surface of the Paleozoic rocks. | Not an aquifer because of thinness of the unit and the lithology of underlying units. Locally, water may be perched above the main zone of saturation and may be adequate for domestic use. One bored well at the head of Snipe Creek yields sufficient water, but a nearby well in the same valley is dry. In general, the main zone of saturation below the base of the unit flow less than 2 gpm (gallons per minute). Where the main zone of saturation intersects the unit in concealed channels or depressions, the McNairy may yield more than 5 gpm. |
| CRETACEOUS | Upper Cretaceous | | Tuscaloosa Formation | 0-150'+ | White rounded pebbles and cobbles in tripolitic matrix. Lenses of tripolitic clay. | Crops out chiefly in the "Between the Rivers" area and mantles the Paleozoic rocks. May be present in concealed channels and depressions in Paleozoic rocks. | Generally a poor aquifer. Large-diameter bored wells may obtain sufficient amounts of water for domestic use where formation extends below the level of Kentucky Lake. Lenses of tripolitic clay may perch some water and form a spring horizon around the edge of the clay body. May locally yield sufficient water to drilled wells. Without rock cuttings from the wells, it is difficult to know whether the aquifer is the Tuscaloosa or the chert rubble of the weathered Mississippian rocks. Well drillers normally refer to chert rubble as a gravel. |
| CARBONIFEROUS MISSISSIPPIAN | Meramec | | St. Louis Limestone[2] | 150'+ | All rocks below the Cretaceous are of Paleozoic age and are the bedrock of drillers. The upper surface of the Mississippian limestones is deeply weathered, forming a chert rubble which consists chiefly of angular or subrounded chert blocks in a matrix of tripolitic clay. Gray, medium-grained limestone interbedded with fine-grained silty, cherty limestone. Lower part is gray thin- to thick-bedded cherty limestone interbedded with medium- to coarse-grained, fossiliferous limestone and light-gray thick-bedded oolitic limestone. | Probably will yield large quantities of ground water for domestic and public supplies from gravelike chert rubble and a lesser amount from solution openings in limestone. The chert rubble, derived from pre-Cretaceous weathering and by solution along faults, may yield sufficient water for domestic and small public supplies. Yields in excess of 100 gpm are known. The yields will vary with the thickness of the rubble, the position and thickness of the main zone of saturation, the character and structure of the underlying limestone and the amount of fine-grained material in the interstices of the chert rubble. The chert rubble has hydrologic characteristics resembling unconsolidated gravel. Water in the rubble drains from areas of pinnacles of limestone toward collapse structures (areas of thick deposits of chert rubble formed by solutional collapse along former drainage channels and fracture zones). |
| CARBONIFEROUS MISSISSIPPIAN | Meramec | | Warsaw Limestone | 50-210' | Gray, medium- to coarse-grained, stylolitic, cross-bedded limestone and gray, fine- to medium-grained cherty, thick-bedded limestone. | The Paleozoic rocks are consolidated marine deposits. The surface of the Paleozoic rock has been reduced to a chert rubble by pre-Cretaceous weathering of the limestone. Pinnacles of limestone project up through the rubble. The rocks underlie the entire quadrangle and crop out locally in stream valleys. | Ground water in the Paleozoic rocks is controlled primarily by three factors: geologic structure, weathering, and degree of solution in the limestone. Openings along joints and bedding planes in dense limestone have been enlarged by the downward movement of ground water to form conduits for the movement of water toward Kentucky Lake and Cumberland River. Some openings may be hydraulically connected with the lake. In general, the solution openings in the Warsaw and St. Louis Limestones are better developed than those in the siliceous limestone of the Fort Payne Formation. The solution openings in the limestone often are filled with fine-grained material which may be partly cemented by calcite. In the Fort Payne the bedding plane openings are less likely to be developed and may not yield sufficient water for domestic wells. However, some deep wells tapping rectilinear deposits of limestone in the Fort Payne in adjacent quadrangles yield more than 30 gpm.<br>In faulted areas, joints in limestone tend to be spaced more closely and are better developed, and the chert rubble is thicker than in unfaulted areas. Thus, larger yields probably can be obtained close to faults. In a nearby quadrangle, a water well that penetrated 291 feet of chert rubble in the Warsaw Limestone in a fault zone has a reported capacity of 22 gpm per foot of drawdown. The amount of water that can be obtained from a faulted area depends on the amount of cementation of the fault gouge and the surrounding rock, the amount of fine-grained material in the chert rubble, and the position of the water table. In downdropped fault blocks, the joints and bedding planes in the limestone will be less subjected to enlargement by solution.<br>Water from the chert rubble is soft and low in dissolved solids, while that from the limestone is hard and has a high mineral content. In general, water from the limestone below the local stream base may be quite hard and contain hydrogen sulfide. Iron which may occur in objectionable amounts probably is derived from the iron-rich clay that fills the voids and the solution openings in the chert rubble and the limestone. Some wells are equipped with water softeners and iron-removal units. |
| CARBONIFEROUS MISSISSIPPIAN | Chester | | Fort Payne Formation[3] | 600' | Dark-gray fine-grained argillaceous limestone interbedded with dark-gray to black dense chert. Lenses of medium- to light-gray coarse-grained limestone composed of fossil fragments. | | |
| | | | | | Black, brown, or grayish-green shale or siltstone and thin-bedded limestone. | | |
| DEVONIAN | Upper Devonian | | Chattanooga Shale | 0-110' | Black micaceous carbonaceous fissile shale. | Present at great depth throughout the quadrangle, increasing in depth from west to east. | Yields little or no water. Formation confines water in the underlying rocks and retards the movement of water between the Mississippian and the Devonian limestones. |
| DEVONIAN | Lower and Middle Devonian | | Devonian rocks undifferentiated | 0-100'+ | 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. | Present at great depth throughout the quadrangle. Overlain by the Chattanooga Shale. | Depth to the Devonian limestones is too great for most water wells. Water might be found in the Devonian limestones along the west edge of the quadrangle. Wells in other quadrangles tapping rocks of Devonian age have reported water suitable for domestic use. The water may be hard and contains 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] Lower part of the formation includes the Salem Limestone
[3] Basal part of Fort Payne Formation includes the New Providence Shale

EXPLANATION

Gravel, Sand, Clay or shale, Loess, Mica, Glauconite, Carbonaceous material, Chert rubble, Limestone, Cherty limestone, Oolitic limestone, Cross-bedded limestone

FIGURE 2.—GENERALIZED COLUMNAR SECTION AND WATER-BEARING CHARACTER OF THE GEOLOGIC FORMATIONS


KENTUCKY
TENNESSEE
RIVER
LAKE
Kentucky Woodlands Wildlife Refuge
Marshall Co.
Calloway Co.
Trigg Co.
Stewart Co.
Henry Co.
Tennessee Valley Authority
Cedar Bluff Church
Rushing Creek
Turkey Creek
Anderson Creek
Sugar Creek
Blood River
Clayton Cemetery
Hazel
Aurora
Kentucky Dam Village State Park
Kentucky Dam
Kentucky Reservoir
Tennessee Reservoir
Qal
Mw
Msl
Mfp
Kt
Km
Mmp
Mfp-35r (8) 86
Mfp-54 (P)
Mfp-40r (8) 85
Mfp-20r (P) 65
Mfp-17 (P) 60
Mfp-108
Mfp-99 (P) 134
Mfp-100r (P) 134
Mfp-120
Mfp-60r (P) 120
Mfp-60r (P) 120
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