

# Generalized Geologic Map for Land-Use Planning: Marshall County, Kentucky

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**Acknowledgments**  
Thanks to Lincoln Martin (Cooperative Extension Service Agricultural and Natural Resource Agent) for help with obtaining photos. Thanks to Rick Huffines (Clarks River National Wildlife Refuge Manager) for granting access to the refuge.

## For Planning Use Only

This map is not intended to be used for selecting individual sites. Its purpose is to inform land-use planners, government officials, and the public in a general way about geologic bedrock conditions that affect the selection of sites for various purposes. The properties of thick soils may supercede those of the underlying bedrock and should be considered on a site-to-site basis. At any site, it is important to understand both the soils and the underlying bedrock. For further assistance, contact the Kentucky Geological Survey, Western Kentucky Office, 1401 Corporate Court, Henderson, KY 42420, phone 270.827.3414 or 270.827.3404. For more information, and to make custom maps of your local area, visit our Land-Use Planning Internet Mapping Web Site at [kgsmap.uky.edu/webste/kyplanviewer.htm](http://kgsmap.uky.edu/webste/kyplanviewer.htm).

## Geologic Hazards

The most prominent geologic hazard for Marshall County is flooding. Areas underlain by alluvium, unit 1 on the map, are subject to regular flooding. Urban development often increases flooding, and therefore potential flooding should always be considered in urban development plans. Areas of steep-walled drainage are conducive to flash flooding, especially in developed areas. Flood prone areas are usually available from the Federal Emergency Management Agency and the United States Geological Survey. Flood information is available from the Kentucky Division of Water, Flood Plain Management Branch, [www.water.ky.gov/floods/](http://www.water.ky.gov/floods/).

None of the faults in Marshall County are considered to be active; the proximity of the New Madrid Seismic Zone, however, calls for precautions to be taken for earthquake damage mitigation. The presence of thick alluvium, which normally has a high water table, should also be treated with special concern, because of the possibility of augmented shaking and liquefaction during a strong earthquake. In addition, alluvium often contains high amounts of clay minerals, which can give soil a high shrink/swell capacity, affecting structural foundations and roads.

Steep slopes, especially along streams, are present throughout the county. Steep slopes can develop soil creep and landslides if not properly treated during development. Proper engineering techniques should be followed when developing on hillsides, and care should be taken not to affect property above and below a development site on a hillside.

Soil piping, which may occur in various soil types, but particularly in alluvium and loess, produces small to large holes if left untreated. The only way to treat soil piping is to fill the holes with rock and soil to keep the holes from enlarging and to divert drainage from the area.

## Earthquake Hazard Information

Peak ground acceleration at the top of rock that will probably occur in the next 500 years in Kentucky



Although we do not know when and where the next major earthquake will occur, we do know that an earthquake will cause damage. Severity depends on many factors, such as earthquake magnitude, the distance from the epicenter, and local geology. Information on earthquake effects is obtained by monitoring earthquakes and performing research. Such information is vital for earthquake hazard mitigation and risk reduction.

The most important information for seismic-hazard mitigation and risk reduction is ground-motion hazard. One way ground-motion hazard is by determining the peak ground acceleration (PGA) that may occur in a particular timeframe. The map above shows the PGA at the top of bedrock that will likely occur within the next 500 years in Kentucky (Street and others, 1996). It shows, as expected, that PGA would be greatest in far western Kentucky near the New Madrid Seismic Zone. Ground-motion hazard maps for the central United States and other areas are available from the U.S. Geological Survey. These maps are used to set general policies on mitigating damage. For example, maps produced by the USGS in 1996 were used to determine seismic design in building codes. For additional information pertaining to earthquake hazards, visit the Kentucky Geological Survey Web site at [www.uky.edu/KGS/geologic\\_hazards/geologic\\_hazards.html](http://www.uky.edu/KGS/geologic_hazards/geologic_hazards.html).



Surficial materials in Marshall County are unconsolidated and generally saturated with water, which can make them prone to collapse during excavation. Shallow excavation through these surficial materials is needed in order to construct water and sewer lines. Photo by Glynn Beck, Kentucky Geological Survey.

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## Water Resources



The 60-year-old Kentucky Dam, constructed by the Tennessee Valley Authority on the Tennessee River, is 206 feet high and 8,422 feet long. Kentucky Dam forms Kentucky Lake, and provides flood protection to millions of acres on the lower Ohio and Mississippi Rivers. Kentucky Dam also produces hydroelectric power, and has a generating capacity of 184,000 kilowatts. Photo by Glynn Beck, Kentucky Geological Survey.



Many manufacturing companies have located in the Calvert City Industrial Complex because of the excellent transportation routes (Ohio and Tennessee Rivers and railroad and Interstate highway access) and the inexpensive hydroelectric power produced by Kentucky Dam. Photo by Glynn Beck, Kentucky Geological Survey.



Clarks River National Wildlife Refuge comprises over 7,000 acres and is the only National Wildlife Refuge solely located within the state of Kentucky. The refuge begins just southeast of Benton and extends nearly to Paducah, but the majority of the refuge is within Marshall County. Photo by Glynn Beck, Kentucky Geological Survey.

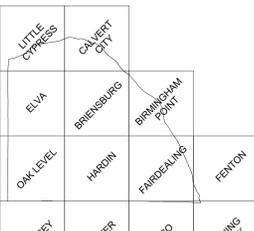


Parts of Marshall County are prone to flooding, as seen in this photo of a bridge crossing Cypress Creek, in the northern part of the county. Photo by Glynn Beck, Kentucky Geological Survey.

## Groundwater

Groundwater resources in Marshall County are abundant and have fair to good water quality. All areas of the county can produce water from drilled wells at reasonable depths in quantities sufficient for domestic use. Multiple zones of production are common throughout the county. The depth to uppermost production is between 30 and 150 feet. A few wells may intersect shallow perched water from gravel or alluvial deposits, but these zones often will not yield sufficient water for an adequate domestic supply during periods of low rainfall, which is typical in late summer and fall. Water from alluvium and limestone in this county is generally hard to very hard, with moderate to high levels of dissolved solids. Some limestone wells in the eastern part of the county contain minor amounts of hydrogen sulfide. Water from the unconsolidated sand or gravel aquifers is considered soft and slightly acidic, with low dissolved solids. Water quality generally is good except in areas where downward percolation of surface water and fluids from domestic sewage-disposal systems and other sources of domestic or industrial pollution have contaminated the aquifer. In a few wells, harmful amounts of nitrate have been detected. Groundwater sometimes contains naturally occurring iron and manganese in objectionable amounts from the deeper zones. In some formations with slightly acidic groundwater, a chemical reaction between the acidic groundwater, steel well casing, and pump equipment will produce a high iron content. For more information about groundwater in the county, see Carey and Stickney (2001).

## 7.5-Minute Quadrangle Maps

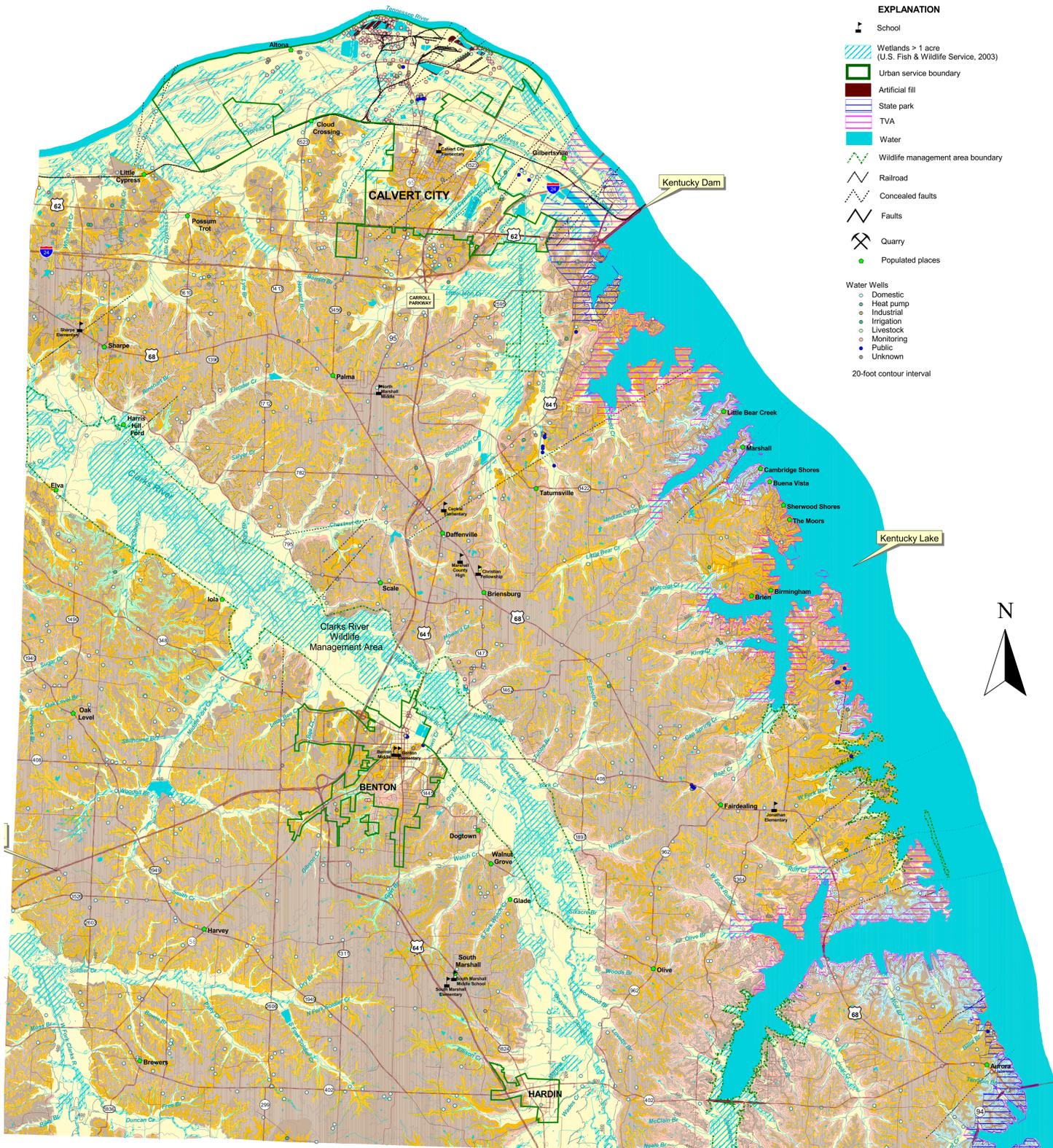


## PLANNING TABLE DEFINITIONS

**FOUNDATION AND EXCAVATION**  
The terms "earth" and "rock" excavation are used in the engineering sense; earth can be excavated by hand tools, whereas rock requires heavy equipment or blasting to remove.

**LIMITATIONS**  
Slight—A slight limitation is one that commonly requires some corrective measure but can be overcome without a great deal of difficulty or expense.  
Moderate—A moderate limitation is one that can normally be overcome but the difficulty and expense are great enough that completing the project is commonly a question of feasibility.  
Severe—A severe limitation is one that is difficult to overcome and commonly is not feasible because of the expense involved.

**LAND USES**  
Septic tank disposal system—A septic tank disposal system consists of a septic tank and a filter field. The filter field is a subsurface life system laid in such a way that effluent from the septic tank is distributed with reasonable uniformity into the natural soil.  
Residences—Ratings are made for residences with and without basements because the degree of limitation is dependent upon ease and required depth of excavation. For example, excavation in limestone has greater limitation than excavation in shale for a house with a basement.  
Highways and streets—Refers to paved roads in which cuts and fills are made in hilly topography, and considerable work is done preparing subgrades and bases before the surface is applied.  
Access roads—These are low-cost roads, driveways, etc., usually surfaced with crushed stone or a thin layer of blacktop. A minimum of cuts and fills are made; little work is done preparing a subgrade, and generally only a thin base is used. The degree of limitation is based on year-around use and would be less severe if not used during the winter and early spring. Some types of recreation areas would not be used during these seasons.  
Light industry and malls—Ratings are based on developments having structures or equivalent load limit requirements of the industries or malls, and large paved areas for parking lots. Structures with greater load limit requirements would normally need footings in solid rock, and the rock would need to be core drilled to determine presence of caverns, cracks, etc.  
Intensive recreation—Athletic fields, stadiums, etc.  
Extensive recreation—Camp sites, picnic areas, parks, etc.  
Reservoir areas—The floor of the area where the water is impounded. Ratings are based on the permeability of the rock.  
Reservoir embankments—The rocks are rated on limitations for embankment material.  
Underground utilities—Included in this group are sanitary sewers, storm sewers, water mains, and other pipes that require fairly deep trenches.



## Planning Guidance by Rock Unit Type

Rock Unit	Foundation and Excavation	Septic Tank Disposal System	Residence with Basement	Highways and Streets	Access Roads	Light Industry and Malls	Intensive Recreation	Extensive Recreation	Reservoir Areas	Reservoir Embankments	Underground Utilities
1. Alluvium	Fair to good foundation material. Easily excavated.	Refer to soil report (Humphrey and others, 1973).	Refer to soil report (Humphrey and others, 1973).	Refer to soil report (Humphrey and others, 1973).	Refer to soil report (Humphrey and others, 1973).	Refer to soil report (Humphrey and others, 1973).	Refer to soil report (Humphrey and others, 1973).	Refer to soil report (Humphrey and others, 1973).	Refer to soil report (Humphrey and others, 1973).	Refer to soil report (Humphrey and others, 1973).	Refer to soil report (Humphrey and others, 1973).
2. Loess	Fair to good foundation material. Easily excavated.	Slight to moderate limitations. Variable thickness and permeability.	Severe limitations.	No limitations.	No limitations.	No limitations.	No limitations.	No limitations.	Slight limitations.	Slight limitations.	No limitations.
3. Gravel	Fair to good foundation material. Moderate to difficult excavation.	Slight to moderate limitations. Variable thickness. Low permeability zones.	Severe to moderate limitations. Shallow water table may be present.	No limitations.	No limitations.	No limitations.	No limitations.	No limitations.	Severe limitations. Leaky reservoir material.	Severe limitations. Leaky reservoir material.	Slight to moderate limitations. Variable materials.
4. Sand, clay, and silt	Fair to good foundation material.	Slight to moderate limitations. Variable thickness. Low permeability zones.	Slight limitations. Shallow water table may be present.	No limitations.	No limitations.	No limitations.	No limitations.	No limitations.	Slight to moderate limitations. Permeable materials possible.	Slight to moderate limitations. Permeable materials possible.	No limitations.
5. Clay and sand	Moderate limitations. Difficult excavation.	Severe limitations. Impermeable material.	Severe limitations. High moisture content.	Moderate limitations. Expanding clay minerals possible when wet.	Minor limitations. Expanding clay minerals possible; may be slippery when wet.	Minor limitations. Expanding clay minerals possible; drainage required.	No limitations.	No limitations.	No limitations.	No limitations.	No limitations.
6. Limestone	Excellent foundation material. Difficult to excavate.	Severe limitations. Impermeable material. Locally fast drainage through fractures. Danger of groundwater contamination.	Severe to moderate limitations. Rock excavation locally, upper few feet may be ripable. Sinks possible; drainage required.	Slight to moderate limitations. Rock excavation locally, upper few feet may be ripable. Sinks possible; drainage required.	Slight limitations. Local drainage problems from seeps or springs.	Slight to moderate limitations. Rock excavation locally, upper few feet may be ripable. Sinks possible; drainage required.	No limitations.	No limitations.	Severe limitations. Leaky reservoir rock locally, conditions may be favorable. Sinks possible.	Severe limitations. Leaky reservoir material.	Severe limitations. Rock excavation.
7. Shale	Fair foundation material; some restrictions for excavation.	Severe limitations. Impermeable rock. Locally fast drainage through fractures. Danger of groundwater contamination.	Slight to moderate limitations. Rock excavation locally, upper few feet may be ripable. Drainage required.	Slight to moderate limitations. Rock excavation locally, upper few feet may be ripable. Drainage required.	Slight limitations. Local drainage problems from seeps or springs.	Slight to moderate limitations. Local drainage problems from seeps or springs.	No limitations.	No limitations.	No limitations.	No limitations.	No limitations.
8. Sandstone	Fair to good foundation material. Difficult excavation.	Severe limitations. Thin soils.	Severe to moderate limitations. Rock excavation locally, upper few feet may be ripable. Steep slopes.	Moderate limitations. Rock excavation locally, upper few feet may be ripable. Steep slopes.	Moderate limitations. Rock excavation locally, upper few feet may be ripable. Steep slopes.	Moderate limitations. Rock excavation locally, upper few feet may be ripable. Steep slopes.	Severe limitations. Steep slopes.	Slight to moderate limitations.	Moderate limitations. Permeable rock.	Severe limitations.	Moderate limitations. Highly variable amount of soil and rock excavation. Steep slopes.

## Additional Planning Resources

Listed below are Web sites for several agencies and organizations that may be of assistance with land-use planning issues in Marshall County:

[ces.ca.uky.edu/marshall/](http://ces.ca.uky.edu/marshall/)—University of Kentucky Cooperative Extension Service  
[www.purchaseread.org/](http://www.purchaseread.org/)—Purchase Area Development District  
[www.thinkkentucky.com/eds/cmty/cw097/](http://www.thinkkentucky.com/eds/cmty/cw097/)—Kentucky Economic Development Information System  
[www.uky.edu/KentuckyAtlas/21157.html](http://www.uky.edu/KentuckyAtlas/21157.html)—Kentucky Atlas and Gazetteer  
[quickfacts.census.gov/qf/states/21/21157.html](http://quickfacts.census.gov/qf/states/21/21157.html)—U.S. Census data  
[kgsweb.uky.edu/download/kgsplanning.htm](http://kgsweb.uky.edu/download/kgsplanning.htm)—Planning information, Kentucky Geological Survey

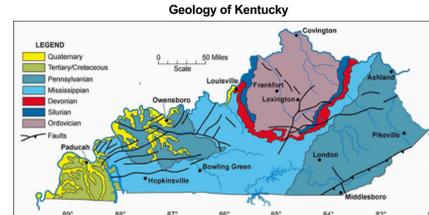
## MARSHALL COUNTY



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