Kentucky Geological Survey
UNIVERSITY OF KENTUCKY
James C. Cobb, State Geologist and Director

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

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Acknowledgments

Bedrock mapping was adapted from Martin (2003a-c), Melton (2003), and Solis (2003a-b). Thanks to Todd Templeton, Carlisle County District Conservationist; Melvin Samples, Samples Poultry Farm; Roger Hobbs, Hobbs Farms; and Walt Redmon, Kentucky Department of Fish and Wildlife Resources, for photo assistance.

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 the characteristics of both the soils and the underlying rock. 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/website/kyluplan/viewer.htm.

Geologic Hazards

The most prominent geologic hazard for Carlisle 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 maps 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/.

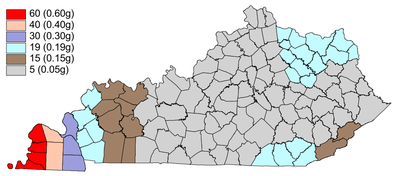
None of the faults in Carlisle County are considered to be active; the proximity of the New Madrid Seismic Zone, however, calls for precautions to be taken for earthquake damage mitigation. The presence of thick alluvium, which normally has a high water table, should also be treated with special concern, 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 of predicting 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/geologichazards/geologichazards.html.

An abandoned hog lagoon is being pumped to utilize the nutrient-rich waste water on nearby row crop fields. To control runoff of the wastewater, the lagoon can only be pumped during certain times of the year. Photo by Glynn Beck, Kentucky Geological Survey.

Agriculture is a major part of the Carlisle County economy. There are 122,112 acres in Carlisle County, and 49,300 of them were planted with either corn or soybeans in 2002 (Kentucky Agriculture Statistics, 2002-2003). Photo courtesy of Jerry McIntosh, USDA Natural Resources Conservation Service.

Approximately 40 chicken houses are in Carlisle County. Each house holds about 27,000 birds. Chicken litter associated with these operations is used as a substitute for synthetic fertilizers on row crop fields. Photo by Glynn Beck, Kentucky Geological Survey.

MeadWestvaco has a fine-grade paper mill in Ballard County, which uses the bottomlands in Carlisle County to grow cottonwoods and sycamores for paper production. MeadWestvaco owns approximately 3,500 acres in Carlisle County. Photo by Glynn Beck, Kentucky Geological Survey.

The new Burkley boat ramp will make the Mississippi River more accessible to residents of Carlisle County. Ramp construction is a cooperative effort between the U.S. Army Corps of Engineers, Kentucky Department of Fish and Wildlife, and Carlisle County. Photo by Glynn Beck, Kentucky Geological Survey.

Groundwater

Abundant groundwater is available for domestic, irrigation, and industrial uses in Carlisle County from depths of a few feet down to 600 feet. Generally, depth to groundwater is less than 100 feet, except in the uplands of Carlisle County, where sufficient groundwater is obtained at depths greater than 100 feet. Yields in some of the deeper wells are greater than 1,000 gallons per minute, which is sufficient for a community or industrial supply.

Water from the thick Mississippi River alluvium is generally hard to very hard. Water from the non-alluvium 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. Groundwater from the deeper zones sometimes contains iron and manganese naturally in objectionable amounts. 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 in the water, which is not naturally occurring. See Carey and Stickney (2001).

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 tile 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 three stories or less, 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.

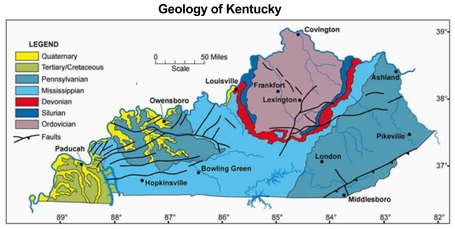
Reservoir embankments--The rocks are rated on limitations for embankment material.

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

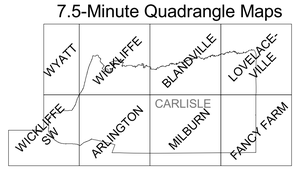
Rock Unit	Foundation and Excavation	Septic Tank Disposal System	Residence with Basement	Highways and Streets	Access Roads	Light Industry and Malls	Intensive Recreation	Extensive Recreation	Reservoir Areas	Reservoir Embankments	Underground Utilities
1. Alluvium	Fair to good foundation material. Easily excavated.	Refer to soil report (Forsythe, 1997).	Refer to soil report (Forsythe, 1997).	Refer to soil report (Forsythe, 1997).	Refer to soil report (Forsythe, 1997).	Refer to soil report (Forsythe, 1997).	Refer to soil report (Forsythe, 1997).	Refer to soil report (Forsythe, 1997).	Refer to soil report (Forsythe, 1997).	Refer to soil report (Forsythe, 1997).	Refer to soil report (Forsythe, 1997).
2. Loess	Fair to good foundation material. Easily excavated.	Slight to moderate limitations. Variable thickness and permeability.	Severe limitations. Shallow water table may be present.	No limitations.	No limitations.	No limitations.	No limitations.	No limitations.	Slight limitations.	Slight limitations.	No limitations.
3. Gravel	Fair to good foundation material. Moderately difficult excavation.	Slight to moderate limitations. Variable thickness and permeability.	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 materials. Low-permeability zones possible.	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.

Geology of Kentucky



Learn more about the geology of Kentucky at www.uky.edu/KGS/geoky/

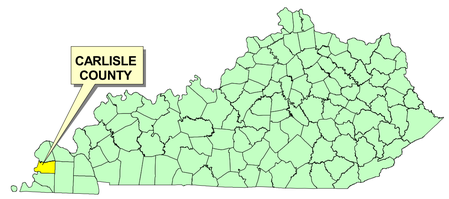
7.5-Minute Quadrangle Maps



Addtional Planning Resources

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

ces.ca.uky.edu/carlisle/—University of Kentucky Cooperative Extension Service
www.purchaseadd.org/—Purchase Area Development District
www.thinkkentucky.com/edis/cmnty/cw083/—Detailed county statistics
www.uky.edu/KentuckyAtlas/21039.html—Kentucky Atlas and Gazetteer
quickfacts.census.gov/qfd/states/21/21039.html—U.S. Census data
kgsweb.uky.edu/download/kgsplanning.htm—Planning information, Kentucky Geological Survey



For information on obtaining copies of this map and other Kentucky Geological Survey maps and publications call our Public Information Center at 859.257.3896 or 877.778.7827 (toll free).

View the KGS World Wide Web site at: www.uky.edu/kgs

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