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

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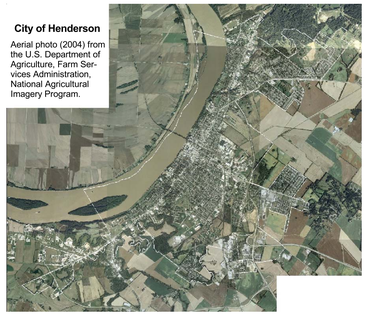
For Planning Use Only

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 Drive, Henderson, KY 42420, phone 270.827.3414 or 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.

City of Henderson



Aerial photo (2004) from the U.S. Department of Agriculture, Farm Services Administration, National Agricultural Imagery Program.

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Acknowledgments

Bedrock mapping adapted from Solis, M.P., and Terry, J. (2000a-h), Solis, M.P., and Venard, E. (2000a-d), Terry, J., and Solis, M.P. (2000), and Tyra, M.A., and Terry, J. (2000). Thanks to the Henderson County Historical Society for providing historic flood photographs.

Groundwater Availability

The alluvium along the Ohio River is the best source of groundwater in the county. In northern Henderson County nearly all drilled wells from depths of less than 150 feet in the alluvium of the Ohio River Valley are adequate for domestic use; most wells yield more than 50 gallons per minute, and some wells as much as 1,000 gallons per minute. In the southern and central parts of Henderson County, most wells that penetrate sandstones at depths less than 300 feet are adequate for a domestic supply. In the highlands of the eastern part of the county, and in western Henderson County in the area around Smith Mills, only a few wells yield enough water for a domestic supply. Generally, groundwater is hard to very hard, and iron and salt may be present in objectionable amounts. Often, groundwater becomes saltier with depth. For more information on groundwater resources in the county, see Carey and Stickney (2001).

Flooding

Flooding in low-lying areas was widespread during the heavy rains of March, 2008.

Kentucky Geological Survey

The Western Kentucky Office of the Kentucky Geological Survey is located at 1401 Corporate Court, Henderson, KY 42420, tel. 270.8278.3414. Office hours are 8 a.m. to 5 p.m., Monday through Friday.

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Transportation

Ohio River and CSX Railroad Bridge

The Ohio River and the CSX railroad system are two major modes of transportation used by industry in Henderson County. This photo was taken just south of the boat ramp in downtown Henderson. Photo by Glynn Beck, Kentucky Geological Survey.

The late afternoon sun creates a shadow CSX bridge across the river at Henderson. Aerial photo (2004) by the U.S. Department of Agriculture, Farm Services Administration, National Agricultural Imagery Program.

Flooding

Flood at Beals Station and Railroad Crossing on January 30, 1937. Photo courtesy of the Henderson County Historical Society.

Same location on February 11, 1937. The white building in the background was Edgar Simmons's store. This building is still in use today as Cagey's store in Beals. Photo courtesy of the Henderson County Historical Society.

Flat Lowlands and Rolling Uplands

Flat lowlands and rolling uplands are the two dominant physiographic features in Henderson County. This photo illustrates the physiographic changes that are common in Henderson County. Flat lowlands, on the right side of the photo, are associated with Ohio River flood deposits. The lowlands are used extensively for cropland. Because of seasonal flooding, land use on these lowlands may be restricted. Rolling uplands, on the left side of the photo, are associated with eroded loess deposits and are used for cropland, pastureland, and residential and commercial development. Photo by Glynn Beck, Kentucky Geological Survey.

Cypress Swamp

This cypress swamp, located just north of the John James Audubon State Park, is an example of how varied the ecology is in Henderson County. The swamp lies within the Wabash-Ohio Bottomlands, which covers northern Henderson County along the Ohio River (Woods and others, 2002). Photo by Glynn Beck, Kentucky Geological Survey.

Henderson County Courthouse

Henderson County, an area of 440 square miles, was formed in the Western Coalfield Region in 1799. The lowest elevation in the county is at the normal pool of the Ohio River, 331 feet. The highest elevation, 588 feet, is in Wolf Hills, northeast of Henderson. The 2005 population of 45,470 was 5.6 percent greater than in 1990. Photo by Glynn Beck, Kentucky Geological Survey.

Soil Piping

"Soil piping" is a term used to describe the removal of soil by subsurface water. When the soil is removed, small to large holes form, which may occur along linear paths, as seen in the above photo. Photo by Glynn Beck, Kentucky Geological Survey.

Energy Resources

This pump jack is located in the Ohio River floodplain and is constructed on stilts to avoid flooding, which is common during the spring months. Approximately 3,000 producing oil and gas wells have been completed in Henderson County. Photo by Glynn Beck, Kentucky Geological Survey.

EXPLANATION

- School
- Urban services boundary
- Watershed divide
- Chert gravel
- Water
- Abandoned underground mines
- Abandoned surface mine areas
- Concealed faults

Oil and Gas Wells

- Gas well
- Oil and gas well
- Oil well
- Enhanced recovery well
- Mine shaft

Water Wells

- Domestic
- Industrial
- Monitoring
- Public

10-foot elevation contour interval

Surface-Water Drainage

Because of the large percentage of flat to gently sloping areas associated with the Ohio and Green Rivers, development, such as subdivisions, can cause flooding if proper drainage designs are not implemented as part of the planning and development process. Watersheds can also be impaired from improper sewage treatment and urban and industrial runoff.

Geologic Hazards

The most prominent geologic hazard for Henderson County is flooding. Areas underlain by alluvium, unit 1 on the map, are regularly subjected to flooding. Urban development often exacerbates flooding; therefore potential flooding should always be considered in urban development plans. Areas of steep-walled drainage, such as that formed in terrain underlain by units 3 and 4, are conducive to flash flooding, especially in developed areas. Flood information is available from the Kentucky Division of Water, Flood Plain Management Branch, www.water.ky.gov/floods/.

None of the faults in Henderson County are considered to be active. The proximity of active seismic zones, such as the New Madrid, Wabash, and East Tennessee, however, means precautions should be taken to mitigate earthquake damage. 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 a soil a high shrink-swell capacity.

Steep slopes, especially along streams, are present in areas underlain by units 3 and 4. 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.

Several underground coal mines are in Henderson County. The locations of known mine workings and shafts are shown on this map. Precautions need to be taken when developing over old mined areas because of the possibility of subsidence. Mine subsidence insurance is available in Kentucky.

Surface coal mine areas are prone to settling after reclamation, which may affect structural foundations and roads. Surface mine areas also lack soil structure, which inhibits the growth of vegetation during summer months. Abandoned deep and surface mine boundaries shown on the map are approximate and do not represent all the mining that has occurred in the county.

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 or soil to keep the holes from enlarging, and to divert drainage from the area.

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 (Converse and Cox, 1967).	Refer to soil report (Converse and Cox, 1967).	Refer to soil report (Converse and Cox, 1967).	Refer to soil report (Converse and Cox, 1967).	Refer to soil report (Converse and Cox, 1967).	Refer to soil report (Converse and Cox, 1967).	Refer to soil report (Converse and Cox, 1967).	Refer to soil report (Converse and Cox, 1967).	Refer to soil report (Converse and Cox, 1967).	Refer to soil report (Converse and Cox, 1967).
2. Loess	Fair to good foundation material. Easily excavated.	Slight to moderate limitations. Variable thickness and permeability.	Slight limitations.	No limitations.	No limitations.	No limitations.	No limitations.	No limitations.	Slight limitations.	Slight limitations.	No limitations.
3. Sandstone, shale, limestone, coal, and underclay	Fair to good foundation material. Difficult excavation.	Severe limitations. Thin soils and impermeable rock.	Severe to moderate limitations. Rock excavation; locally, upper few feet may be rippable. Steep slopes.	Severe limitations. Rock excavation; locally, upper few feet may be rippable. Underclay susceptible to slumping; steep slopes.	Moderate limitations. Rock excavation. Steep slopes.	Severe limitations. Rock excavation; locally, upper few feet may be rippable. Steep slopes.	Severe limitations. Steep slopes.	Slight to moderate limitations.	Slight limitations. Reservoir might leak where rocks are fractured.	Severe limitations.	Moderate limitations. Highly variable amount of rock and earth excavation.
4. Siltstone, sandstone, shale, and coal	Fair to good foundation material. Difficult excavation.	Severe limitations. Thin soils and impermeable rock.	Severe to moderate limitations. Rock excavation; locally, upper few feet may be rippable. Steep slopes.	Severe limitations. Rock excavation; locally, upper few feet may be rippable. Steep slopes.	Moderate limitations. Rock excavation. Steep slopes.	Severe limitations. Rock excavation; locally, upper few feet may be rippable. Steep slopes.	Severe limitations. Steep slopes.	Slight to moderate limitations.	Slight limitations. Reservoir might leak where rocks are fractured.	Severe limitations.	Moderate limitations. Highly variable amount of rock and earth excavation.

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. The term "rippable" means excavation with a ripper attachment on a bulldozer.

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.

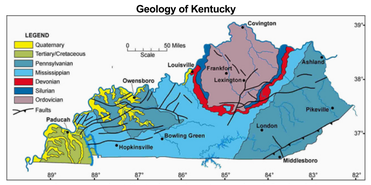
Extensive recreation–Camp sites, picnic areas, parks, etc.

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.

Geology of Kentucky



Learn more about Kentucky geology at www.uky.edu/kgs/geoky/

7.5-Minute Quadrangles

Additional Planning Resources

Listed below are Web sites for several agencies and organizations that may be of assistance with landuse planning issues in Henderson County:

www.hendersonky.com/—Henderson-Henderson County Chamber of Commerce
www.hendersonky.org/—Henderson County Tourist Commission
ces.ca.uky.edu/henderson/—University of Kentucky Cooperative Extension Service
www.gradd.org/—Green River Area Development District
www.thinkkentucky.com/edis/cmnty/cw031/—Kentucky Economic Development Information System
www.uky.edu/KentuckyAtlas/21101.html—Kentucky Atlas and Gazetteer
quickfacts.census.gov/qfd/states/21/21101.html—U.S. Census data
kgsweb.uky.edu/download/kgsplanning.htm—Planning information from the Kentucky Geological Survey

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