Kentucky Geological Survey
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MAP AND CHART 110
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Generalized Geologic Map for Land-Use Planning: Muhlenberg County, Kentucky

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Acknowledgments

Geology adapted from Ashcraft and Hosey (2003), Conley (2005), Crawford (2005), Johnson (2005), Mullins (2005), Mullins and Thompson (2002), Nelson (2005a, b), Smith (2003, 2005a, b), Solis (2005), Toth (2002a, b, 2005), and Tyra and Crawford (2003). Coal data from the Kentucky Mine Mapping Information System (2005).

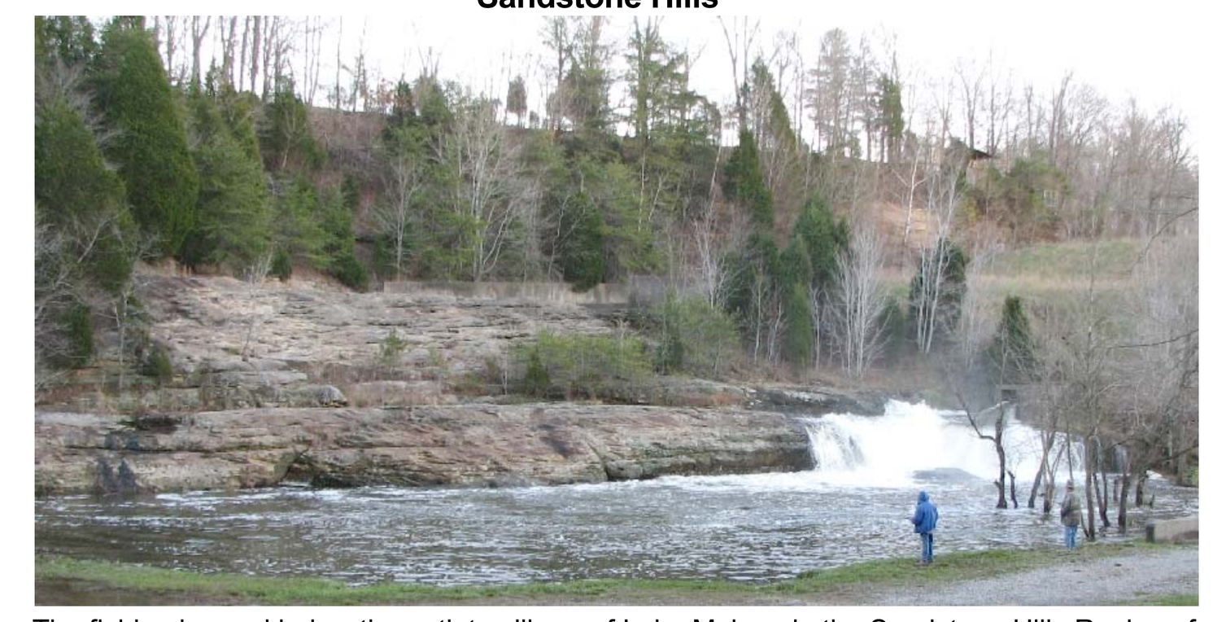
Energy Resources

Coal mining continues to be a vital part of the Muhlenberg County economy. Surface and underground mines in the county have produced over 750 million tons of coal since 1820. With nearly 1,000 wells, oil and gas production also provides an important resource to the county. Photo by Glynn Beck, Kentucky Geological Survey.

Power Generation

The Tennessee Valley Authority Paradise Plant, located on the Green River, is one of 22 coal-fired electric generating plants in Kentucky. Photo by Glynn Beck, Kentucky Geological Survey.

Sandstone Hills



The fishing is good below the outlet spillway of Lake Malone in the Sandstone Hills Region of Muhlenberg County. The lake is surrounded by 50-foot Caseyville Formation sandstone bluffs and hardwood forests with hiking trails. Photo by Dan Carey, Kentucky Geological Survey.

Water Resources

Constructed in the late 1950's, Lake Malone covers an area of approximately 825 acres in Muhlenberg, Logan, and Todd Counties. The lake was made possible by the local game and fishing clubs and is currently the only major water recreational site in the three-county area. Photo by Glynn Beck, Kentucky Geological Survey.

Residential Construction

Residential homes are an important land use in Muhlenberg County. Siting of homes and infrastructure requires an understanding of soils and geology. Photo by Glynn Beck, Kentucky Geological Survey.

Geologic Hazards

The most prominent geologic hazard for Muhlenberg County is flooding. Areas underlain by alluvium, unit 1 on the map, are often subject to flooding. Urban development can exacerbate flooding, and 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, 4, and 5, 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/.

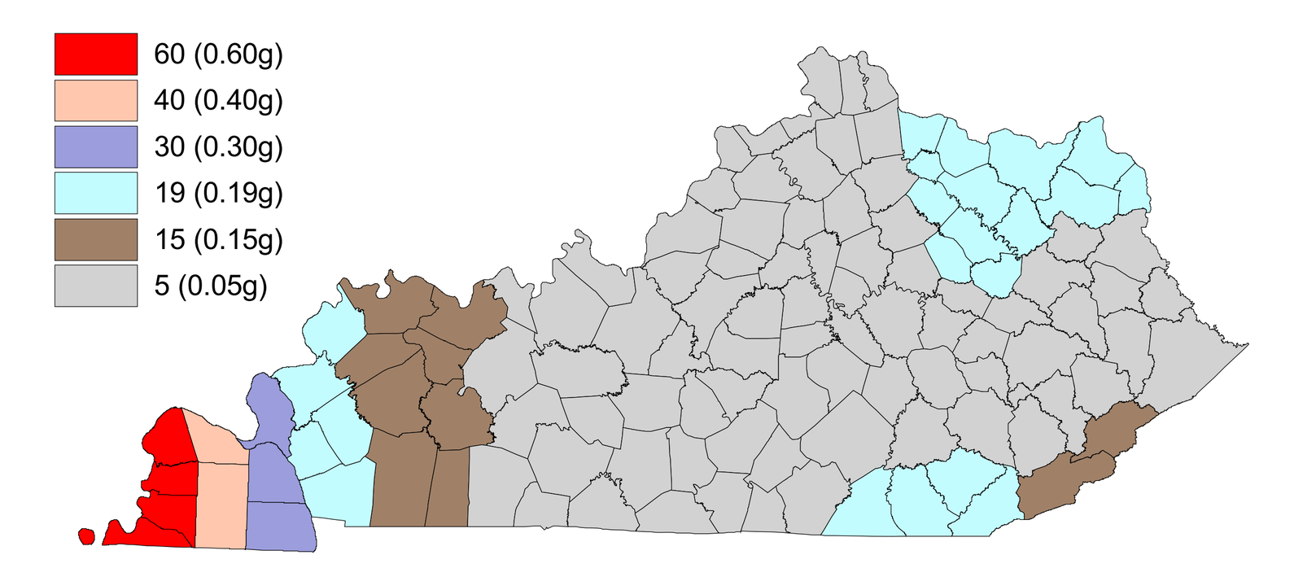
None of the faults in Muhlenberg County are considered to be active. The proximity of active seismic zones such as the New Madrid and Wabash, however, does call for precautions to be taken for earthquake damage mitigation. The presence of thick alluvium, which normally has a high groundwater table, should 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 that can give a soil a high shrink/swell capacity.

Steep slopes are present, especially along streams in areas underlain by units 3, 4, and 5 in the southern part of 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.

There are underground coal mines in Muhlenberg County and mine subsidence has been a problem. The locations of known mine workings and shafts are shown on the map. Precautions need to be taken when developing over old mined areas because of the possibility of mine subsidence. 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 dry periods. 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.

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. 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.

Source-Water Protection Areas

Source-water protection areas are those in which activities are likely to affect the quality of the drinking-water source. For more information, see kgsweb.uky.edu/download/water/swapp/swapp.htm.

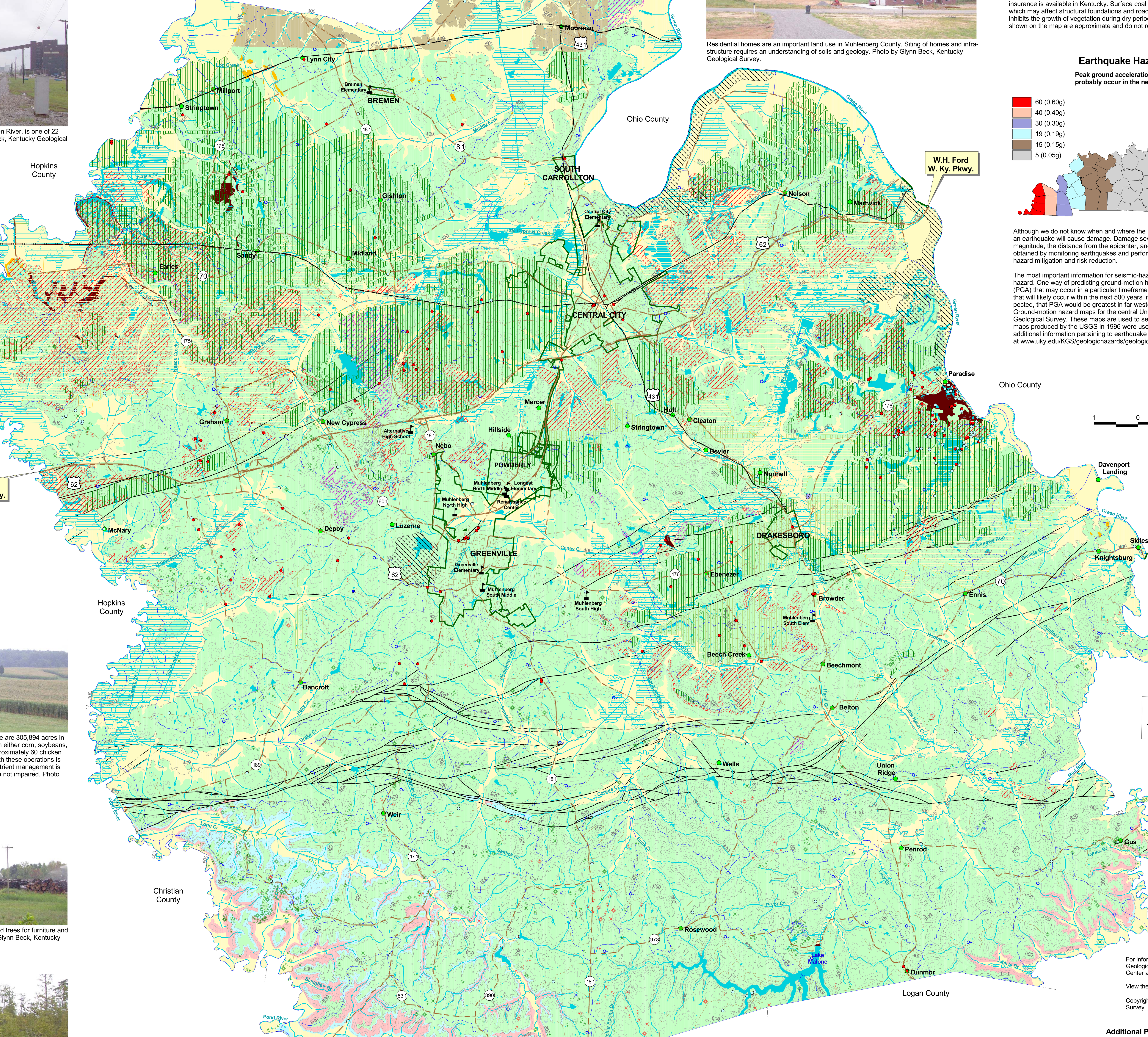
EXPLANATION

- School
- Urban service boundary
- Watershed divide
- Wetlands > 1 acre (U.S. Fish and Wildlife Service, 2003)
- Wildlife management area
- Source-water protection area, zone 1
- Surface mining
- Auger mining
- Underground mining
- Mining
- Artificial fill
- Concealed fault
- Fault
- Projected fault

Water Wells
- Domestic
- Industrial
- Monitoring
- Public
- Spring

Oil and Gas Wells
- Gas well
- Oil and gas well
- Oil well
- Class II injection well

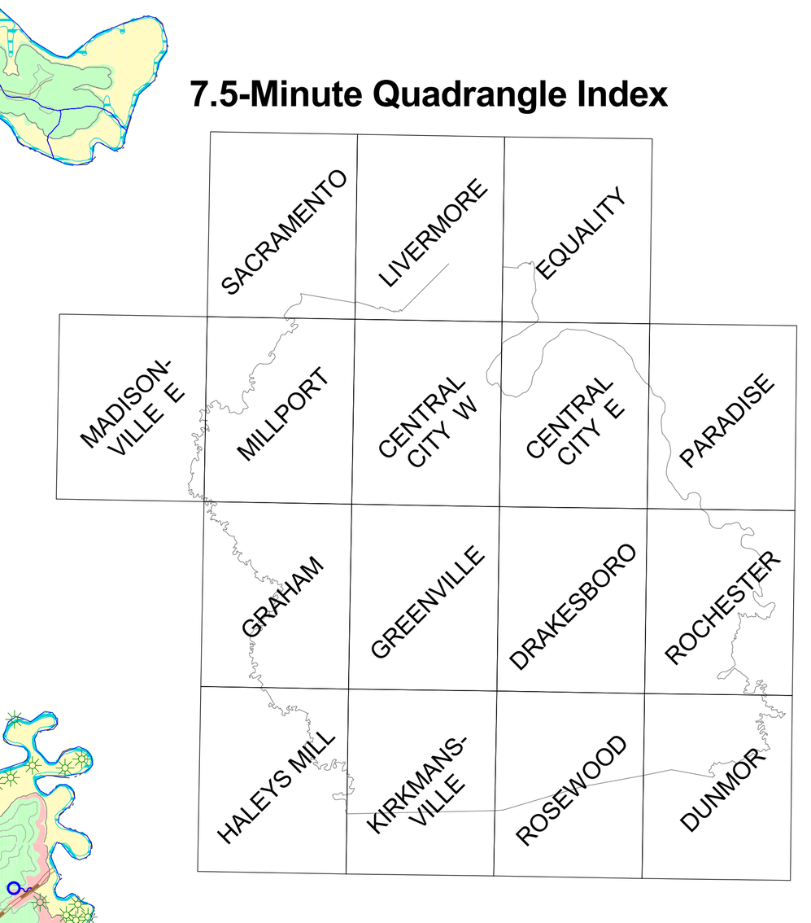
20-foot contour interval



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 supersede 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 rock. For further assistance, contact the Kentucky Geological Survey, Western Regional Office, 1401 Corporate Court, Henderson, KY 42420, phone 270.827.3414 or 270.827.3404

7.5-Minute Quadrangle Index



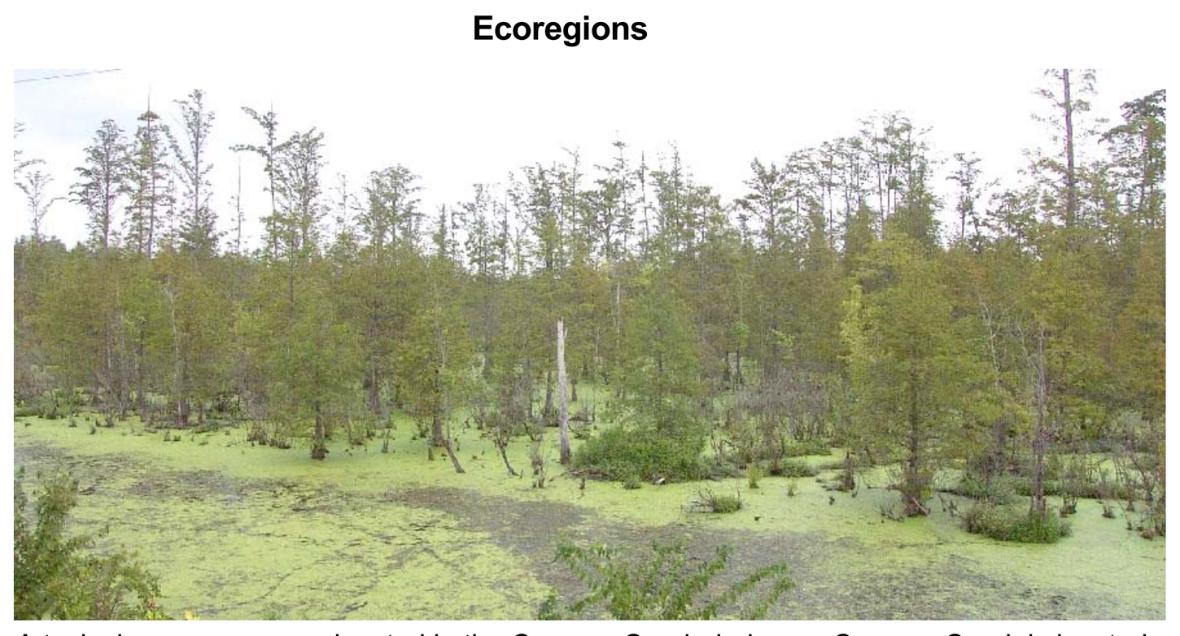
Agriculture

Agriculture is a major part of the Muhlenberg County economy. There are 305,894 acres in the county, and 32,022 of those acres (10 percent) were planted with either corn, soybeans, or tobacco in 2002 (Kentucky Agriculture Statistics 2002-2003). Approximately 60 chicken houses (background) are in the county. Chicken litter associated with these operations is used as a substitute for synthetic fertilizers on row crops. Proper nutrient management is extremely important to ensure that local soil and water resources are not impaired. Photo by Glynn Beck, Kentucky Geological Survey.

Timber Harvesting

Along with row crop agriculture and coal mining, harvesting hardwood trees for furniture and pulp is a sustained land use in Muhlenberg County. Photograph by Glynn Beck, Kentucky Geological Survey.

Ecoregions



A typical cypress swamp located in the Cypress Creek drainage. Cypress Creek is located in the Green River–Southern Wabash Lowlands ecoregion, which is characterized by meandering, low-gradient streams and rivers with wide floodplains and soft substrates (Woods and others, 2002). Photo by Glynn Beck, Kentucky Geological Survey.

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; poor on hillsides. Easily excavated.	Refer to soil report (Cox, 1980).	Refer to soil report (Cox, 1980).	Refer to soil report (Cox, 1980).	Refer to soil report (Cox, 1980).	Refer to soil report (Cox, 1980).	Refer to soil report (Cox, 1980).	Refer to soil report (Cox, 1980).	Refer to soil report (Cox, 1980).	Refer to soil report (Cox, 1980).	Refer to soil report (Cox, 1980).
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. Shale, siltstone, sandstone, limestone, coal, underclay	Fair to good foundation material. Moderately 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 earth and rock excavation.
4. Sandstone, siltstone, shale, and thin limestone	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 earth and rock excavation.
5. Limestone, shale, siltstone, thin sandstone	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 soil and rock excavation.
6. Gravel	Fair to good foundation material. Moderately difficult excavation.	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.	Severe limitations. Leaky reservoir material.	Severe limitations. Leaky reservoir material.	Slight to moderate limitations. Variable materials.

* Coal beds and underclays should not be used for foundations or reservoir embankments because of the presence of expanding pyrite in coal and underclays and the weakness of underclay when it becomes wet.

PLANNING GUIDANCE 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 soil.

Residences--Ratings are made for residences with basements because the degree of limitation depends on the 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.

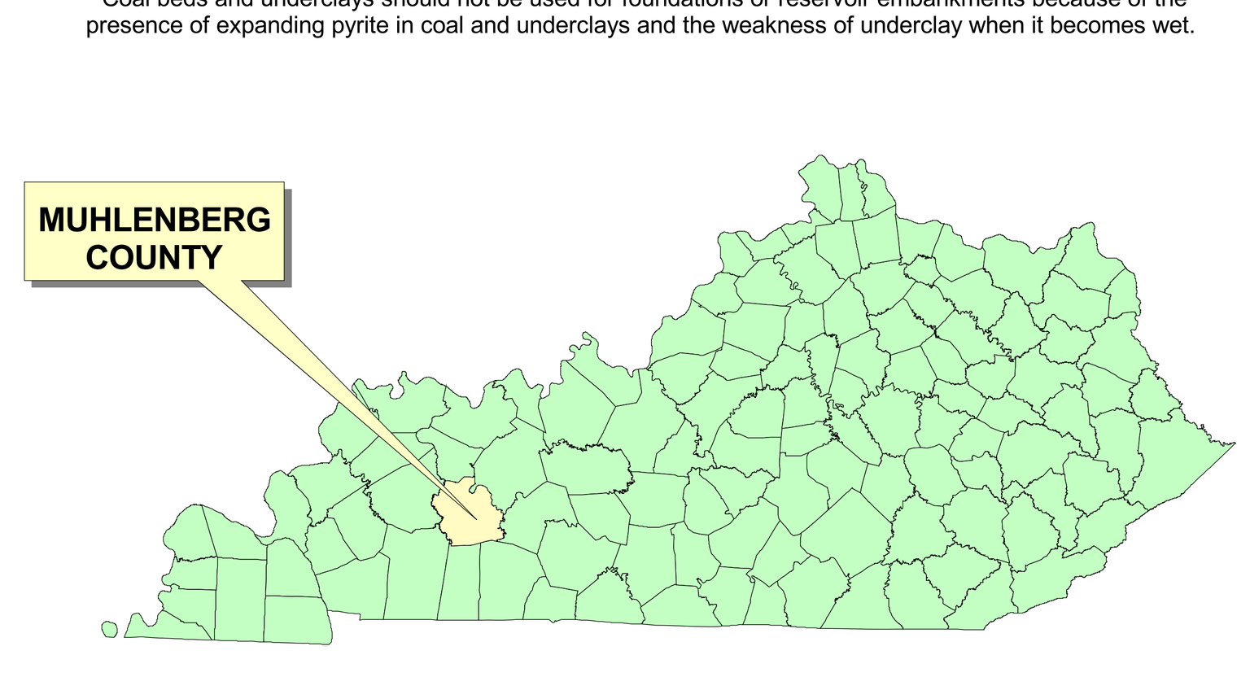
Intensive recreation--Athletic fields, stadiums, etc.

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

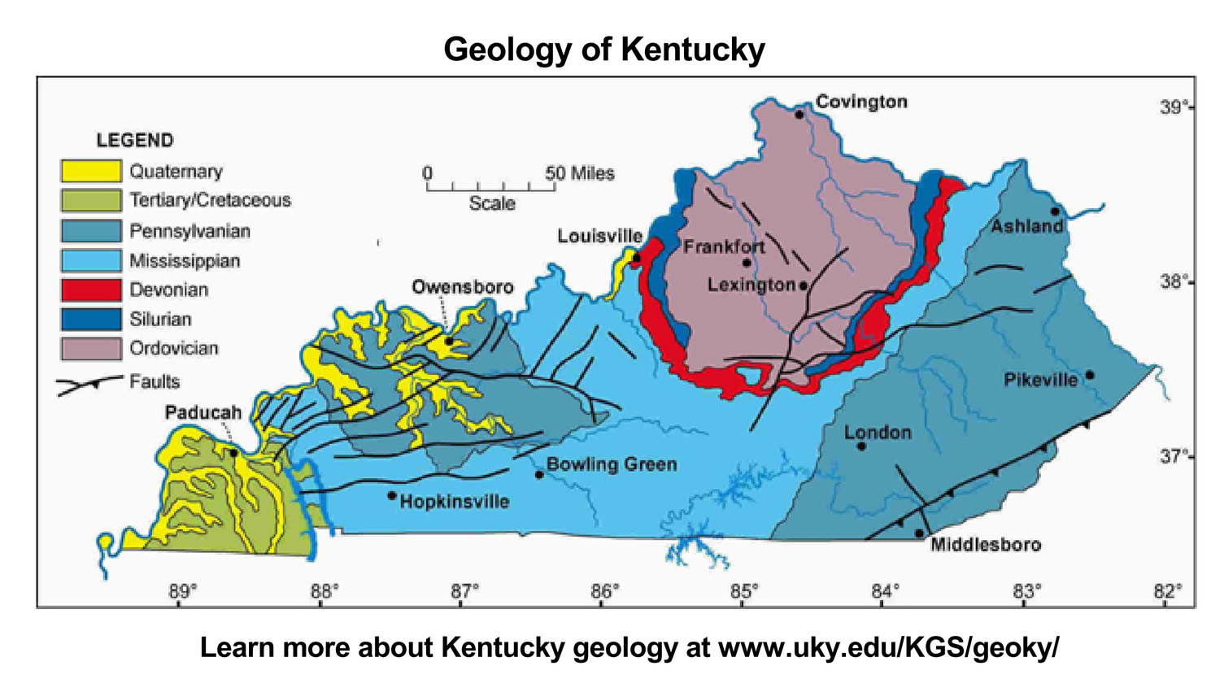
Reservoir areas--The floor of the area where the water is impounded. Ratings are based on the permeability of the rock.

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/

Groundwater

Throughout 90 percent of Muhlenberg County, most wells less than 300 feet deep provide an adequate domestic supply. Wells located in the Green River floodplain can produce as much as 100 gallons of hard water per minute. Most wells obtain water from thick sandstone layers and will yield as much as 60 gallons per minute. In the southwestern corner of the county, only a few wells yield enough water for a domestic supply. In a small localized area north of Earles, most wells produce less than 100 gallons per day, which is far less than is needed for a domestic supply.

Generally, groundwater is hard to very hard, and iron and salt may be present in objectionable amounts. Groundwater often becomes saltier with depth. In the northern and eastern part of the county, moderately mineralized water may be obtained locally from deep sandstone formations at depths of 1,200 feet.

For more information on groundwater in the county, see Carey and Stickney (2004).

Additional Planning Resources

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

ces.ca.uky.edu/muhlenberg/—University of Kentucky Cooperative Extension Service
www.peadd.org/—Pennyrile Area Development District
www.thinkkentucky.com/edis/cmnty/cw009/—Kentucky Economic Development Information System
www.uky.edu/KentuckyAtlas/21177.html—Kentucky Atlas and Gazetteer
quickfacts.census.gov/qfd/states/21/21177.html—U.S. Census data
kgsweb.uky.edu/download/kgsplanning.htm—Planning information from the Kentucky Geological Survey

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