

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

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Morgan County, 381 square miles in the Eastern Kentucky Coal Field, was formed in 1823. The highest elevation, 1,409 feet, is on a ridge at the headwaters of Lunce Branch and Stone Coal Fork about 1.5 miles southwest of Cannel City. The lowest elevation is the pool level of Paintsville Lake, about 700 feet. Principal areas of flat land are along large streams and, to a lesser extent, on narrow ridges in the northwest. The 2006 population of 14,306 was 2.6 percent greater than that of 2000. The courthouse celebrated its 100th birthday in 2007. Photo by Dan Carey, Kentucky Geological Survey.

EXPLANATION

- School
- Water wells
- Agricultural
- Domestic
- Monitoring
- Public
- Spring
- Wet area
- Gas well
- Oil well
- Railroad
- County line
- Watershed boundary
- Geologic fault
- Concealed geologic fault
- Designated flood zone* (FEMA, 2005)
- Source-water protection area, zone 1
- Wetlands > 1 acre (U.S. Fish and Wildlife Service, 2003)
- Incorporated city boundaries
- Surface- or auger-mined area
- Underground-mined area
- Quarry
- 100-foot contour interval
- Photo location

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 www.water.ky.gov/wpp.htm.

*Flood information is available from the Kentucky Division of Water, Flood Plain Management Branch, www.water.ky.gov/floods/.

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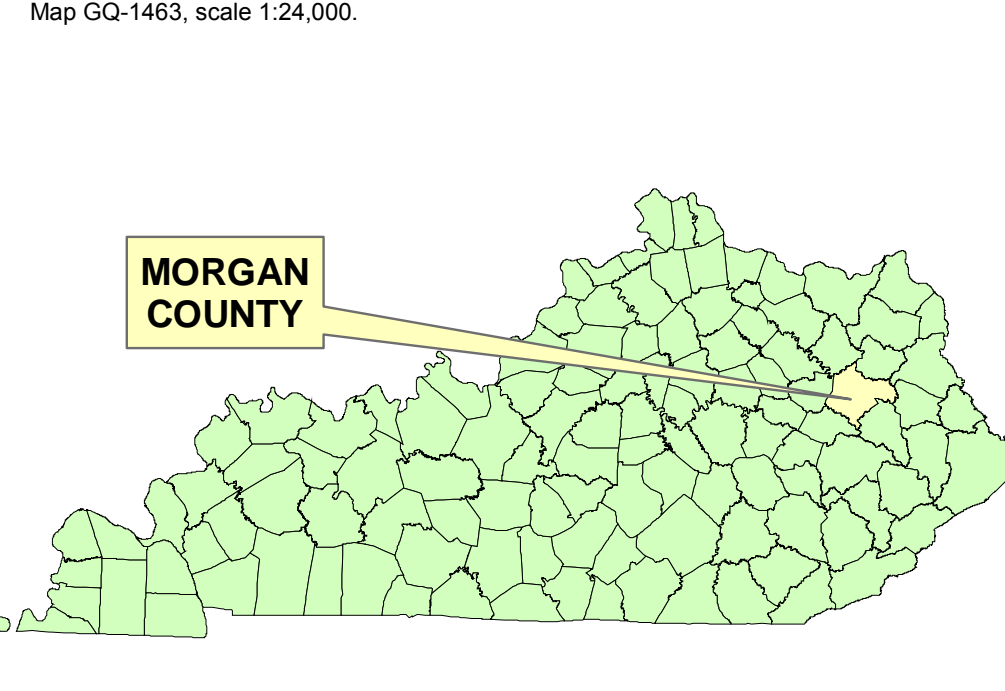
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Mapped Surface Faults

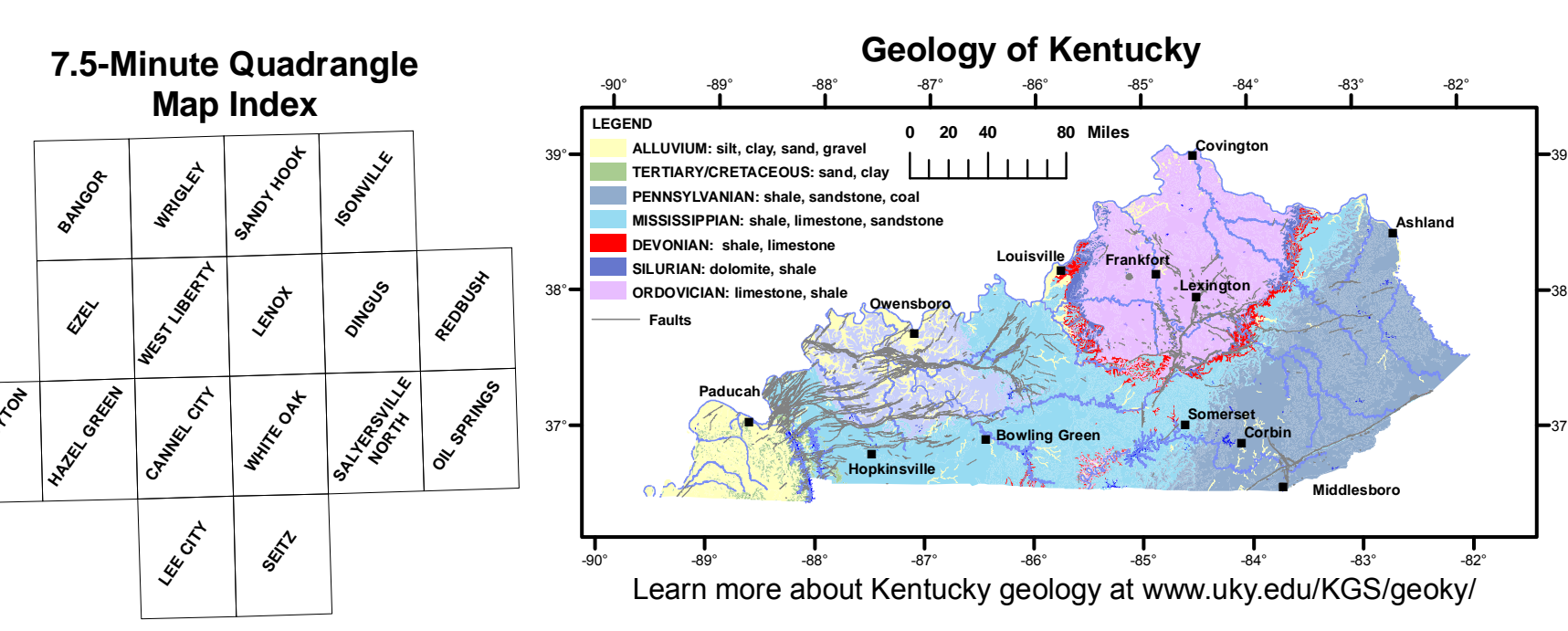
Faults are common geologic structures across Kentucky, and have been mapped in many of the commonwealth's counties. The faults shown on this map represent seismic activity that occurred several million years ago at the latest. There has been no activity along these faults in recorded history. Seismic risk associated with these faults is very low. Faults may be associated with increased fracturing of bedrock in the immediately adjacent areas. This fracturing may influence slope stability and groundwater flow in these limited areas.

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



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Shale, Siltstone, Sandstone, Thin Coal (Unit 3)



The terrain in the northeast underlain by unit 3, with shale more predominant, is less rugged and is amenable to limited agriculture. Photo by Dan Carey, Kentucky Geological Survey.

Sandstone, Siltstone, Shale, Coal (Units 5 and 7)



Sandstone-capped hills are characteristic of the rugged terrain dominated by units 5 and 7 in the east and south. Photo by Dan Carey, Kentucky Geological Survey.

Sandstone (Unit 9)



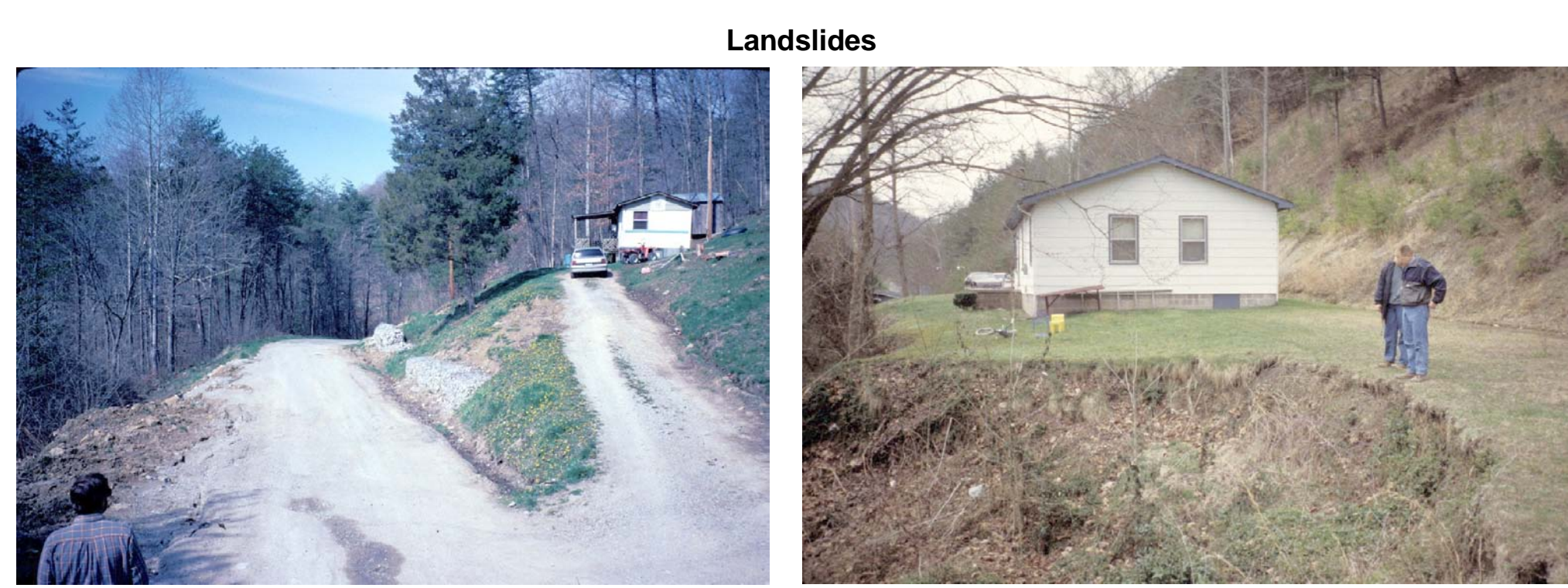
Massive sandstone (unit 9) towers above a flotta of geese on Cave Run Lake. Photo by Dan Carey, Kentucky Geological Survey.

Terrace Deposits

Terrace deposits underlie the shale in the Pikeville Formation provide level land for agriculture and homes (right). Photo by Dan Carey, Kentucky Geological Survey.



Terrace deposits underlie the shale in the Pikeville Formation provide level land for agriculture and homes (right). Photo by Dan Carey, Kentucky Geological Survey.



Hillside construction can cause earth movement if not properly planned. Photos by Paul Howell, U.S. Department of Agriculture, Natural Resources Conservation Service.

Landslides

Virtually all units containing shale on slopes are subject to landslides. Shales will break down and weather rapidly when exposed to air and water. Gravity is the main driving force, but water nearly always plays a critical role by adding weight and lubricating the shale. Cutting into or overloading a slope with structures and fill can also be major contributing factors. The failure of the slope may be rapid, but more commonly is a slow, almost imperceptible movement, called creep, of a few inches per year. Whether rapid or slow, the end results and damage are similar and costly: broken plumbing, cracked walls and foundations, cracked streets and sidewalks, and commonly total loss of the structures.

Precautions include taking care of all surface-water runoff by making certain that all runoff from roofs, gutters, patios, sidewalks, and driveways is carried well away from and not toward the house; diverting drainage from areas sloping toward the house; cutting into natural slopes as little as possible and avoiding the use of fill; and trying to place the foundation of the structure on undisturbed bedrock. When in doubt, consult an engineering geologist or a geotechnical engineer.

What Are the Factors That Cause Landslides?

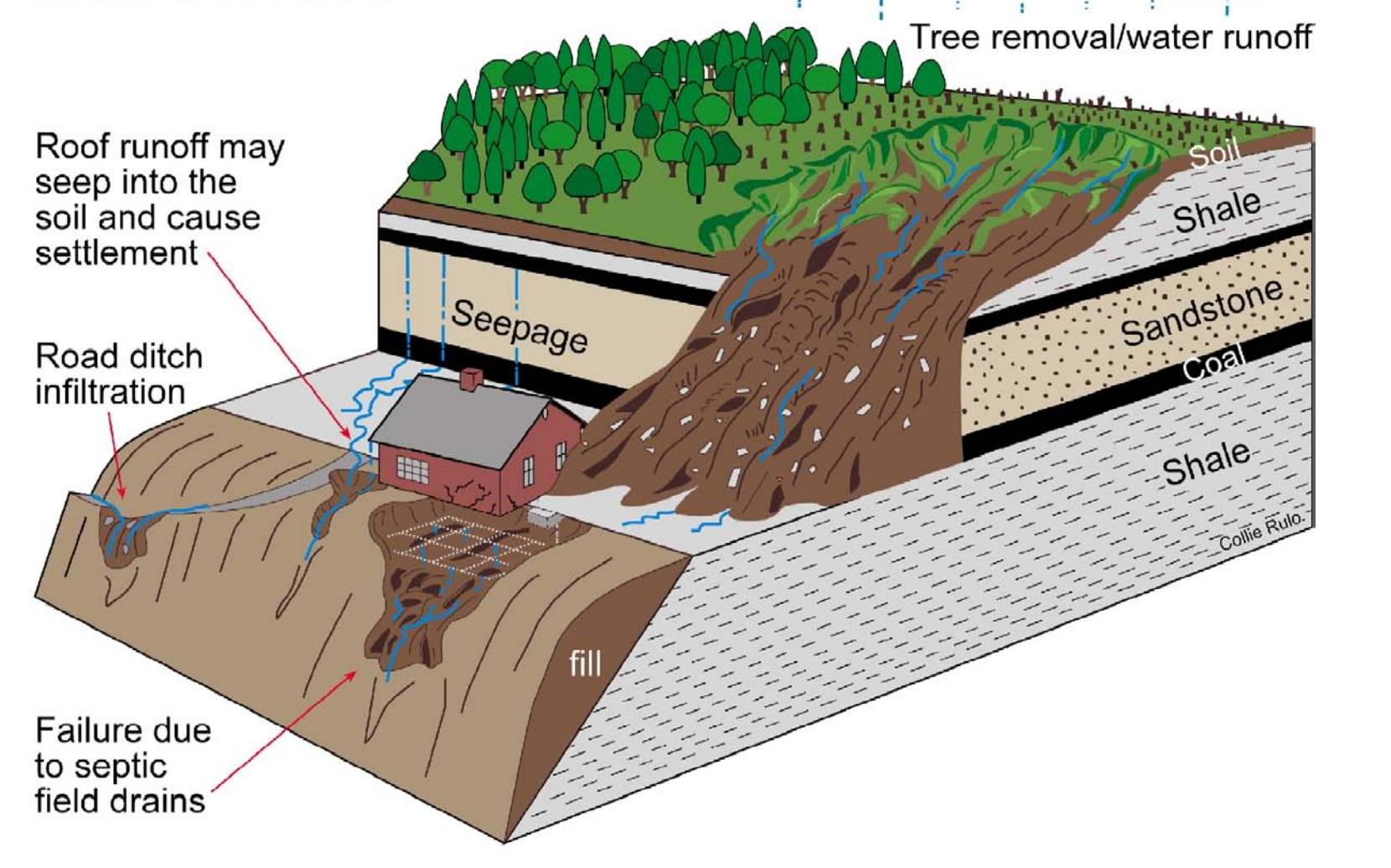
- Many factors contribute to landslides. The most common in eastern Kentucky are listed below:
1. Steep slopes: Avoid when choosing a building site.
 2. Water: Slope stability decreases as water moves into the soil. Springs, seeps, roof runoff, gutter downspouts, septic systems, and site grading that cause ponding or runoff are sources of water that often contribute to landslides.
 3. Changing the natural slope by creating a level area where none previously existed.
 4. Poor site selection for roads and driveways.
 5. Improper placement of fill material.
 6. Removal of trees and other vegetation: Site construction often results in the elimination of trees and other vegetation. Plants, especially trees, help remove water and stabilize the soil with their extensive root systems.

What Are Some Ways to Prevent Landslides?

1. Seek professional assistance prior to construction.
2. Proper site selection: Some sloping areas are naturally prone to landslides. Inspect the site for springs, seeps, and other wet areas that might indicate water problems. Take note of unusual cracks or bulges at the soil surface. These are typical signs of soil movement that may lead to slope failure. Also be aware of geologically sensitive areas where landslides are more likely to occur.
3. Alter the natural slope of the building site as little as possible during construction. Never remove soil from the toe or bottom of the slope or add soil to the top of the slope. Landslides are less likely to occur on sites where disturbance has been minimized. Seek professional assistance before earth-moving begins.
4. Remove as few trees and other vegetation as possible. Trees develop extensive root systems that are very useful in slope stabilization. Trees also remove large amounts of groundwater. Trees and other permanent vegetative covers should be established as rapidly as possible and maintained to reduce soil erosion and landslide potential.
5. Household water disposal system: Seek professional assistance in selecting the appropriate type and location of your septic system. Septic systems located in fill material can saturate soil and contribute to landslides.
6. Proper water disposal: Allowing surface waters to saturate the sloping soil is the most common cause of landslides in eastern Kentucky. Properly located diversion channels are helpful in redirecting runoff away from areas disturbed during construction. Runoff should be channeled and water from roofs and downspouts piped to stable areas at the bottom of the slope.

(From U.S. Department of Agriculture, Natural Resources Conservation Service, no date)

Water Can Cause Landslides



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

- ces.ca.uky.edu/Morgan/: University of Kentucky Cooperative Extension Service
- www.gwaodi.org/: Big Sandy Area Development District
- www.thrkenky.com/eds/cmty/cw/cw050/: Kentucky Economic Development Information System
- www.uky.edu/KentuckyAtlas21175.html: Kentucky Atlas and Gazetteer, Morgan County
- quickfacts.census.gov/qd/states/21/21175.html: U.S. Census data
- kgsweb.uky.edu/download/kgsplanning.htm: Planning information from the Kentucky Geological Survey

Additional Resources

Acknowledgments

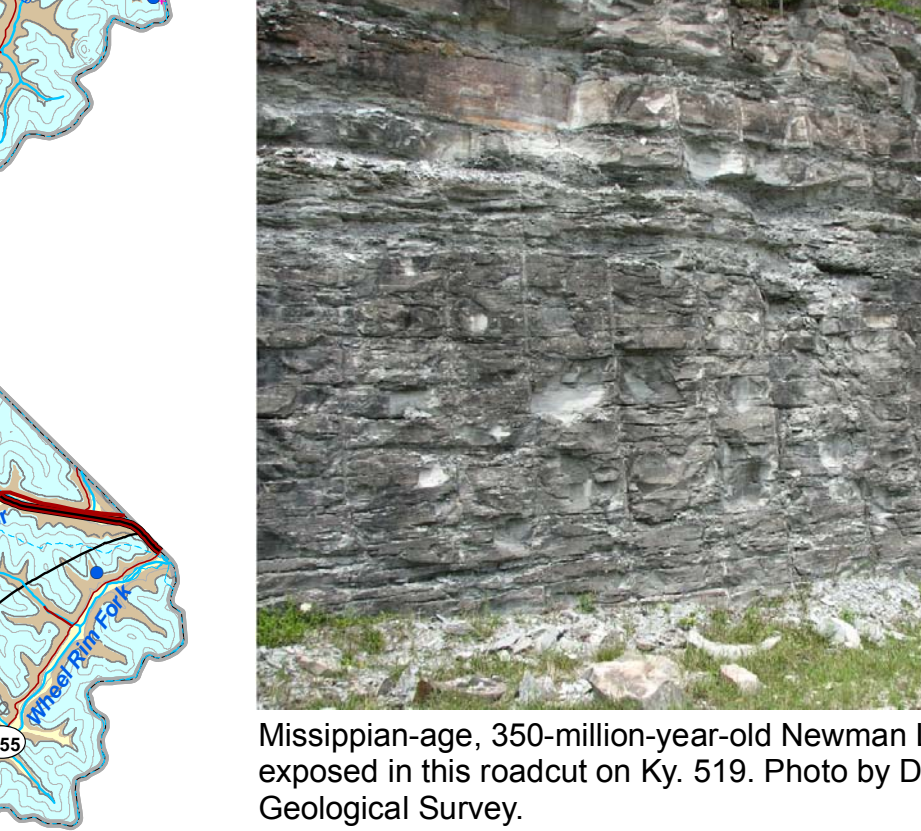
Geology adapted from Ciszak and Lambert (2005), Ciszak and Lambert (2005a-c), Murphy (2005a-e), and others (2005a, b), Nelson and Lambert (2005), Paingreen and Petersen (2005), Sparks and others (2005), Sparks and Lambert (2005), Sullivan and others (2005), and Zhang and others (2005). Thanks to Steve Webb and Bart Davidson, Kentucky Geological Survey, for photo assistance. Thanks to Kim and Kent Ames, Kentucky Division of Geographic Information, for base-map data.

Sandstone, Siltstone, Shale, Coal (Units 5 and 7)



Alternating bands of sandstones and siltstones (light color) and shales and coals (dark color) of units 5 and 7 are exposed at this massive roadcut on Ky. 7. Photo by Dan Carey, Kentucky Geological Survey.

Limestone (Unit 4)



Missippian-age, 350-million-year-old Newman Limestone (unit 4) is exposed in this roadcut on Ky. 519. Photo by Dan Carey, Kentucky Geological Survey.

LAND-USE 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 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 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 backstop. 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 are adequate for 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 the characteristics of both the soils and the underlying rock. For further assistance, contact the Kentucky Geological Survey, 859.257.5500. For more information, visit the KGS Community Development Planning Web Site at kgsweb.uky.edu/download/kgsplanning.htm.

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 the characteristics of both the soils and the underlying rock. For further assistance, contact the Kentucky Geological Survey, 859.257.5500. For more information, visit the KGS Community Development Planning Web Site at kgsweb.uky.edu/download/kgsplanning.htm.

Rock Unit	Foundation and Excavation	Septic System	Residence with Basement	Highways and Streets	Access Roads	Light Industry and Malls	Intensive Recreation	Extensive Recreation	Reservoir Areas	Reservoir Embankments	Underground Utilities
1. Clay, silt, sand, and gravel (alluvium)	Fair foundation material; easy to excavate. Seasonal high water table. Subject to flooding. Refer to soil report (McIntosh, 2002).	Severe limitations. Seasonal high water table. Subject to flooding. Refer to soil report (McIntosh, 2002).	Severe limitations. Seasonal high water table. Subject to flooding. Refer to soil report (McIntosh, 2002).	Severe limitations. Seasonal high water table. Subject to flooding. Refer to soil report (McIntosh, 2002).	Severe limitations. Seasonal high water table. Subject to flooding. Refer to soil report (McIntosh, 2002).	Severe limitations. Seasonal high water table. Subject to flooding. Refer to soil report (McIntosh, 2002).	Slight to severe limitations, depending on type of activity and topography. Subject to flooding. Refer to soil report (McIntosh, 2002).	Slight to severe limitations, depending on type of activity and topography. Subject to flooding. Refer to soil report (McIntosh, 2002).	Previous material. Seasonal high water table. Subject to flooding. Refer to soil report (McIntosh, 2002).	Severe limitations. Fair compaction characteristics. Piping hazard. Refer to soil report (McIntosh, 2002).	Seasonal high water table. Subject to flooding. Refer to soil report (McIntosh, 2002).
2. Sand, silt, clay, and gravel (terrace deposits)	Fair foundation material; easy to excavate.	Severe to slight limitations, depending on amount of soil cover.	Moderate to slight limitations, depending on slope.	Slight limitations.	Slight limitations, depending on slope.	Slight limitations, depending on slope.	Moderate to severe limitations, depending on activity and topography.	Moderate to severe limitations, depending on activity and topography.	Previous material. Not recommended.	Severe to slight limitations. Unstable steep slopes.	Slight limitations.
3. Shale, siltstone, sandstone, thin coal, underclay	Fair to good foundation material; difficult to excavate. Possible low strength associated with shales, sparse coals, and underclays.	Severe limitations. This soils and impermeable rock associated with shales.	Severe to moderate limitations. Rock excavation may be required. Possible steep slopes.	Moderate to severe limitations. Rock excavation may be required. Possible steep slopes.	Moderate to severe limitations. Rock excavation may be required. Possible steep slopes.	Moderate to severe limitations. Rock excavation may be required. Possible steep slopes.	Moderate to severe limitations, depending on topography. Rock excavation may be required. Possible steep slopes.	Moderate to severe limitations, depending on topography. Rock excavation may be required. Possible steep slopes.	Slight to severe limitations. Reservoir may leak where rocks are fractured.	Severe limitations. Reservoir may leak where rocks are fractured.	Severe to moderate limitations. This soils. Possible rock excavation.
4. Limestone	Good to excellent foundation material; difficult to excavate.	Moderate to severe limitations. Impermeable rock. Locally fat clays and shales. Dangerous of groundwater contamination.	Severe to moderate limitations. Rock excavation may be required. Possible steep slopes.	Slight to moderate limitations. Rock excavation may be required. Possible steep slopes.	Slight to moderate limitations, depending on topography. Rock excavation may be required. Possible steep slopes.	Slight to moderate limitations, depending on topography. Rock excavation may be required. Possible steep slopes.	Slight to moderate limitations, depending on topography. Rock excavation may be required. Possible steep slopes.	Slight to moderate limitations, depending on topography. Rock excavation may be required. Possible steep slopes.	Slight to moderate limitations. Reservoir may leak where rocks are fractured.	Severe limitations. Leaky rock.	Severe limitations. Rock excavation.
5. Sandstone, siltstone, shale, coal, underclay	Fair to good foundation material; difficult to excavate. Possible low strength associated with shales, sparse coals, and underclays. Possible bit of underground coal mine voids.	Severe limitations. This soils and impermeable rock associated with shales.	Severe to moderate limitations. Rock excavation may be required.	Moderate to severe limitations. Rock excavation may be required. Possible steep slopes.	Moderate to severe limitations. Rock excavation may be required. Possible steep slopes.	Moderate to severe limitations. Rock excavation may be required. Possible steep slopes.	Moderate to severe limitations, depending on topography. Rock excavation may be required. Possible steep slopes.	Moderate to severe limitations, depending on topography. Rock excavation may be required. Possible steep slopes.	Moderate to severe limitations. Reservoir may leak where rocks are fractured.	Severe limitations. Reservoir may leak where rocks are fractured.	Severe to moderate limitations. This soils. Possible rock excavation.
6. Shale and limestone	Fair to good foundation material; difficult to excavate. Avoid steep slopes.	Slight to severe limitations, depending on amount of soil cover and depth to impermeable rock.	Severe to moderate limitations. Rock excavation may be required. Possible steep slopes.	Severe to moderate limitations. Rock excavation may be required. Possible steep slopes.	Severe to moderate limitations. Rock excavation may be required. Possible steep slopes.	Severe to moderate limitations. Rock excavation may be required. Possible steep slopes.	Severe to moderate limitations, depending on activity and topography. Rock excavation may be required. Possible steep slopes.	Slight to moderate limitations, depending on activity and topography. Rock excavation may be required. Possible steep slopes.	Moderate to slight limitations. Reservoir may leak where rocks are fractured.	Slight to moderate limitations. Reservoir may leak where rocks are fractured.	Moderate to severe limitations. Reservoir may leak where rocks are fractured.
7. Siltstone, shale, coal, underclay	Good to excellent foundation material; difficult to excavate.	Severe limitations. This soils.	Severe limitations. Rock excavation. Steep slopes.	Severe limitations. Rock excavation. Steep slopes.	Severe limitations. Rock excavation. Steep slopes.	Severe limitations. Rock excavation. Steep slopes.	Moderate to severe limitations, depending on activity and slope.	Moderate to severe limitations, depending on activity and slope.	Slight to moderate limitations. Reservoir may leak where rocks are fractured.	Slight to moderate limitations. Reservoir may leak where rocks are fractured.	Severe limitations. Rock excavation.
8. Siltstone and shale	Good to excellent foundation material; difficult to excavate.	Severe limitations. This soils.	Severe limitations. Rock excavation. Steep slopes.	Severe limitations. Rock excavation. Steep slopes.	Severe limitations. Rock excavation. Steep slopes.	Moderate to severe limitations. Rock excavation. Steep slopes.	Moderate to severe limitations, depending on activity and slope.	Moderate to severe limitations, depending on activity and slope.	Slight to moderate limitations. Reservoir may leak where rocks are fractured.	Slight to moderate limitations. Reservoir may leak where rocks are fractured.	Severe limitations. Rock excavation.
9. Sandstone	Excellent foundation material; difficult to excavate.	Severe limitations. This soils.	Severe to moderate limitations. Rock excavation. Steep slopes.	Severe to moderate limitations. Rock excavation. Steep slopes.	Severe to moderate limitations. Rock excavation. Steep slopes.	Moderate to severe limitations. Rock excavation. Steep slopes.	Moderate to severe limitations, depending on activity and slope.	Slight to severe limitations, depending on activity and topography. Rock excavation may be required. Possible steep slopes.	Slight to moderate limitations. Reservoir may leak where rocks are fractured.	Slight to moderate limitations. Reservoir may leak where rocks are fractured.	Severe limitations. Rock excavation.

*Shales and clays in these units may shrink during dry periods and swell during wet periods and cause cracking of foundations. On hillsides, especially where seeps and springs are present, they can also be susceptible to landslides.