Kentucky Geological Survey
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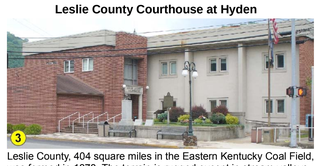
UNIVERSITY OF KENTUCKY, LEXINGTON

MAP AND CHART 174
Series XII, 2007

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

Daniel I. Carey, Steven E. Webb, and Bart Davidson

Leslie County Courthouse at Hyden



Leslie County, 404 square miles in the Eastern Kentucky Coal Field, was formed in 1878. The terrain is rugged except in stream valleys. Ridgetop elevations are 1,400 to 1,660 feet in the north and 2,000 to 2,200 feet in the south. The highest elevation, 2,600 feet, is on Peters Knob on the Harlan County line. The lowest elevation, 757 feet, is the normal pool of Buckhorn Lake. The 2006 population of 11,828 was 4.6 percent smaller than that of 2000. Photo by Bart Davidson, Kentucky Geological Survey.

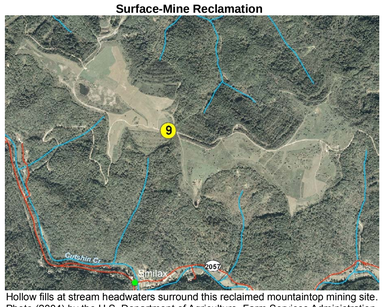
Kudzu

The kudzu plant, named after the area where it originated in southern Japan, has expanded rapidly across much of the South, including eastern Kentucky. This stand of kudzu is on Ky. 257 near Dryhill (near the overpass of the Hal Rogers Parkway). It can grow as much as 60 feet per season, or 12 inches per day, and vines may extend to over 100 feet in length. The nonwoody parts are edible. Kudzu also serves to prevent erosion of hillsides, although it can kill plants to which it attaches by blocking vital sunlight. Photo by Bart Davidson, Kentucky Geological Survey.

Coal

Coal mining continues to be the principal driver behind the economy of Leslie County. This coal tipple (above) is located on U.S. 421 south of Mozelle. In 2004, the latest year for which statistics are available, Leslie County produced 2.7 million tons of coal from underground mines and 1.8 million tons from surface mines. Photo by Bart Davidson, Kentucky Geological Survey.

Surface-Mine Reclamation



Hollow fills at stream headwaters surround this reclaimed mountaintop mining site. Photo (2004) by the U.S. Department of Agriculture, Farm Services Administration, National Aerial Imagery Program.

Groundwater

About 8,000 people in Leslie County rely on private domestic water supplies: 7,400 use wells and 600 use other sources. Problems with private wells in Leslie County are various and scattered throughout the county. In some areas there is not enough water, while in other areas the water has high concentrations of salt and various other minerals and metals. Most wells drilled in valley bottoms are adequate for a domestic supply. In the northwestern half of the county, fewer than half of the wells on hillsides and only some of the wells on hilltops are adequate for a domestic supply. In the southeastern half of the county, about three-quarters of the wells drilled on hillsides are adequate for a domestic supply, and some wells on hilltops or ridges may be. Also in the southeastern half of the county, wells deeper than 200 feet in valleys may yield enough water for a small municipal or industrial supply. A few springs supply enough water for domestic use. Almost all groundwater obtained from drilled wells in this area is moderately to extremely hard and contains noticeable amounts of iron. Salty water may be found in wells drilled less than 100 feet below the level of the principal valley bottoms, except in the southeastern half of the county, where salty water probably will not be found less than 200 feet. Springs yield less than 5 gallons per minute. For more information on groundwater in the county, see Carey and Stickney (2005).

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Sandstone, Siltstone, Shale, Thin Coal (Unit 4)

This small coal seam, at the intersection of Ky. 80 and U.S. 421, is typical of unit 4 coals. Sandstone lies above and shale below. Photo by Bart Davidson, Kentucky Geological Survey.

Acknowledgments

Geology adapted from Mullins and Murphy (2003), Sparks (2003a, b), Sparks and Murphy (2003), Andrews and others (2005), Morris and others (2005a-e), and Sparks and others (2005a-d). Thanks to Meg Smath, Kentucky Geological Survey, for editorial improvements. Thanks to Kim and Kent Anness, Kentucky Division of Geographic Information, for base-map data.

EXPLANATION

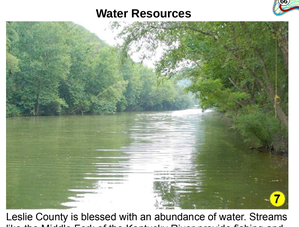
- School
- Water wells
  - Industrial
  - Domestic
  - Monitoring
  - Public
  - Livestock
- Spring
- Gas well
- Oil well
- Enhanced recovery injection well
- Watershed boundary
- Mapped mined areas (does not include all mining)
- Designated flood zone* (FEMA, 2005)
- Source-water protection area, zone 1
- Wetlands > 1 acre (U.S. Fish and Wildlife Service, 2003)
- Public lands
- Incorporated city boundaries
- Artificial fill
- 200-foot contour interval
- Photo location

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

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.

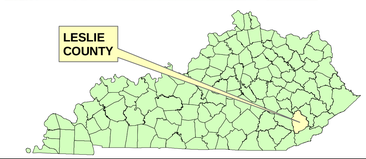
Water Resources



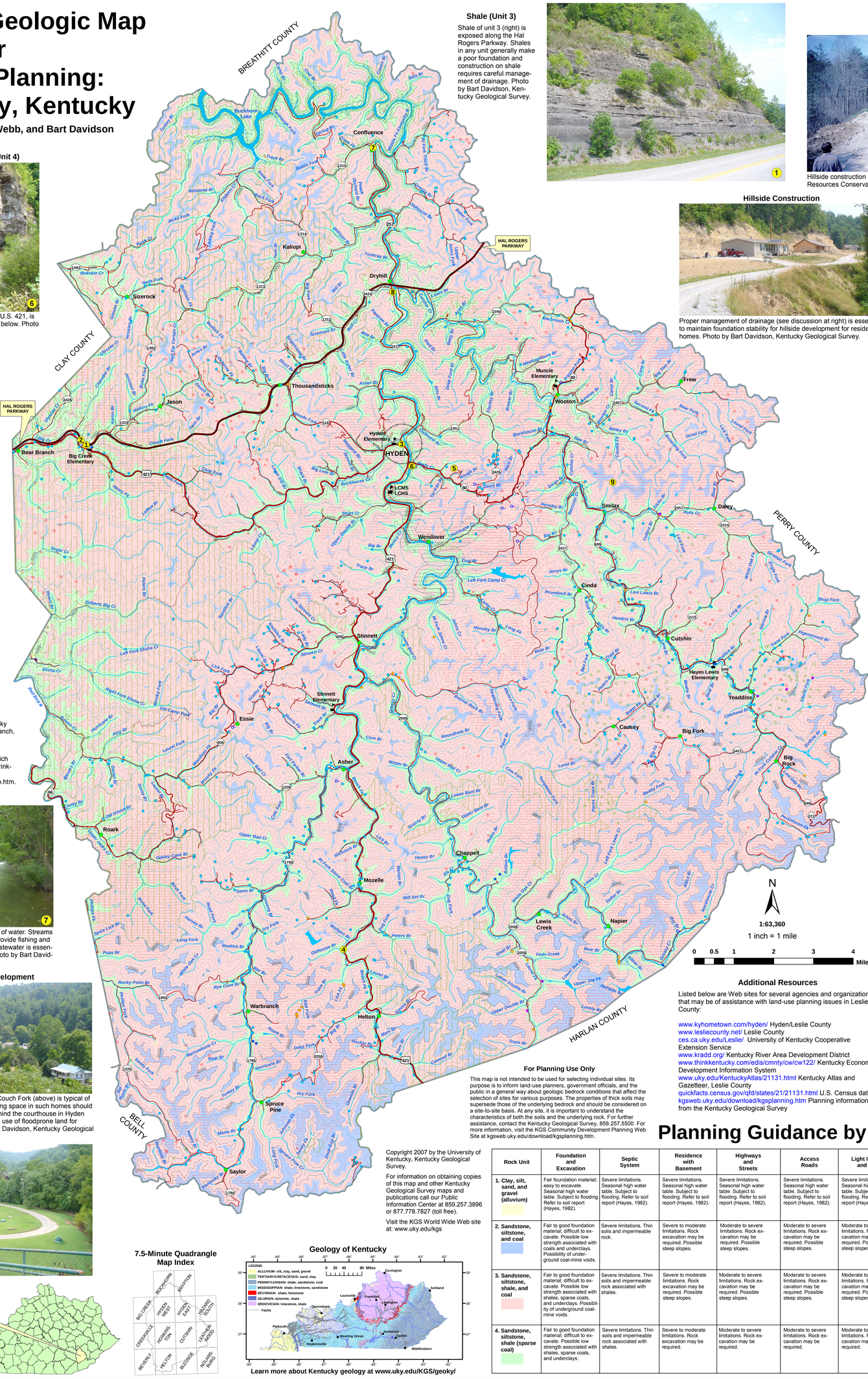
Leslie County is blessed with an abundance of water. Streams like the Middle Fork of the Kentucky River provide fishing and recreation. Proper treatment of domestic wastewater is essential to maintain the health of the streams. Photo by Bart Davidson, Kentucky Geological Survey.

Floodplain Development

Development along the floodplain of Couch Fork (above) is typical of much of Leslie County. The lowest living space in such homes should lie above flood level. The city park behind the courthouse in Hyden (below) is an excellent example of the use of floodprone land for recreational purposes. Photos by Bart Davidson, Kentucky Geological Survey.



7.5-Minute Quadrangle Map Index



Shale (Unit 3)

Shale of unit 3 (right) is exposed along the Hal Rogers Parkway. Shales in any unit generally make a poor foundation and construction on shale requires careful management of drainage. Photo by Bart Davidson, Kentucky Geological Survey.

Hillside Construction

Proper management of drainage (see discussion at right) is essential to maintain foundation stability for hillside development for residential homes. Photo by Bart Davidson, Kentucky Geological Survey.

Landslides

Hillside construction can cause earth movements 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.

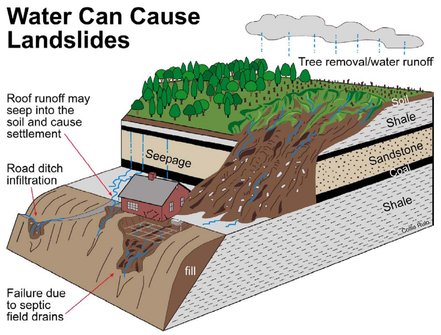
Precautions include taking care of all surface-water runoff by making certain that all runoff from roofs, gutters, patios, sidewalks, and driveways is carried well away from and not toward the house; diverting drainage from areas sloping toward the house; cutting into natural slopes as little as possible 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.

Water Can Cause Landslides



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)

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 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 the 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.

Additional Resources

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

www.kyhometown.com/hyden/ Hyden/Leslie County
www.lesliecounty.net/ Leslie County
ces.ca.uky.edu/Leslie/ University of Kentucky Cooperative Extension Service
www.kradd.org/ Kentucky River Area Development District
www.thinkkentucky.com/edis/cmnty/cw/cw122/ Kentucky Economic Development Information System
www.uky.edu/KentuckyAtlas/21131.html Kentucky Atlas and Gazetteer, Leslie County
quickfacts.census.gov/qfd/states/21/21131.html U.S. Census data
kgsweb.uky.edu/download/kgsplanning.htm Planning information from the Kentucky Geological Survey

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.

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

Geology of Kentucky

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

Planning Guidance by Rock Unit Type

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 (Hayes, 1982).	Severe limitations. Seasonal high water table. Subject to flooding. Refer to soil report (Hayes, 1982).	Severe limitations. Seasonal high water table. Subject to flooding. Refer to soil report (Hayes, 1982).	Severe limitations. Seasonal high water table. Subject to flooding. Refer to soil report (Hayes, 1982).	Severe limitations. Seasonal high water table. Subject to flooding. Refer to soil report (Hayes, 1982).	Severe limitations. Seasonal high water table. Subject to flooding. Refer to soil report (Hayes, 1982).	Slight to severe limitations, depending on type of activity and topography. Subject to flooding. Refer to soil report (Hayes, 1982).	Slight to severe limitations, depending on type of activity and topography. Subject to flooding. Refer to soil report (Hayes, 1982).	Pervious material. Seasonal high water table. Subject to flooding. Refer to soil report (Hayes, 1982).	Fair stability. Fair compaction characteristics. Piping hazard. Refer to soil report (Hayes, 1982).	Slight limitations, in general, except for seasonal high water table. Subject to flooding. Refer to soil report (Hayes, 1982).
2. Sandstone, siltstone, and coal	Fair to good foundation material; difficult to excavate. Possible low strength associated with coals and underclays. Possibility of underground coal-mine voids.	Severe limitations. Thin soils and impermeable rock.	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. Rock excavation may be required.	Slight to severe limitations, depending on activity and topography. Possible steep wooded slopes. Slight limitations for forest or nature preserve.	Slight limitations. Reservoir may leak where rocks, including coal, are jointed or fractured.	Severe limitations. Reservoir may leak where rocks are fractured.	Severe to moderate limitations. Thin soils. Possible rock excavation.
3. Sandstone, siltstone, shale, and coal	Fair to good foundation material; difficult to excavate. Possible low strength associated with shales, sparse coals, and underclays. Possibility of underground coal-mine voids.	Severe limitations. Thin 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. Rock excavation may be required.	Slight to severe limitations, depending on activity and topography. Possible steep wooded slopes. Slight limitations for forest or nature preserve.	Slight limitations. Reservoir may leak where rocks, including coal, are jointed or fractured.	Severe limitations. Reservoir may leak where rocks are fractured.	Severe to moderate limitations. Thin soils. Possible rock excavation.
4. Sandstone, siltstone, shale (sparse coal)	Fair to good foundation material; difficult to excavate. Possible low strength associated with shales, sparse coals, and underclays.	Severe limitations. Thin 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.	Moderate to severe limitations. Rock excavation may be required.	Moderate to severe limitations. Rock excavation may be required.	Moderate to severe limitations. Rock excavation may be required.	Slight to severe limitations, depending on activity and topography. Possible steep wooded slopes. Slight limitations for forest or nature preserve.	Slight limitations. Reservoir may leak where rocks, including coal, are jointed or fractured.	Severe limitations. Reservoir may leak where rocks are fractured.	Severe to moderate limitations. Thin soils. Possible rock excavation.