

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

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## Acknowledgments

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## Slope Variability

There is a noticeable difference in topography north of the Cumberland River compared to south of the river. North of the river, slopes tend to be steeper near channels in rock types (limestone and sandstone) paralleling stream channels, whereas hillslopes are generally broad and flat. In contrast, the topography south of the Cumberland River is much more rugged.

## 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 out 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.

## For Planning 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 [kgmap.uky.edu/web/latkyuplan/viewer.htm](http://kgmap.uky.edu/web/latkyuplan/viewer.htm).

## EXPLANATION

- School
- Urban service boundary
- Watershed divide
- Wetlands > 1 acre (U.S. Fish & Wildlife Service, 2003)
- Water
- Wildlife management area
- Quarry
- Artificial fill
- Sinkholes
- Concealed faults
- Faults
- Secondary faults
- Water Wells
  - Domestic
  - Heat pump
  - Industrial
  - Irrigation
  - Livestock
  - Monitoring
  - Public
  - Unknown
- 20-foot contour interval

## Geologic Hazards

Many concealed and exposed faults are located throughout Livingston County. Currently, there is no evidence that these faults are active. Because Livingston County is near the New Madrid Seismic Zone, however, strong earthquake activity is a possibility.

Soil creep, slumps, and landslides along steep slopes may occur from erosion or ground motion associated with a strong earthquake. Areas associated with alluvium (unit 1) are subject to liquefaction during a strong earthquake. These areas are also subject to flooding. Soils derived from alluvium deposits have a moderate to high shrink-swell capacity, which may affect structural foundations and roads. Flood information is available from the Kentucky Division of Water, Flood Plain Management Branch, [www.water.ky.gov/flood/](http://www.water.ky.gov/flood/).

## Earthquake Hazard Information

Peak ground acceleration at the top of rock that will probably occur in the next 500 years in Kentucky



## Sinkholes



Sinkholes are common karst features throughout Livingston County. Sinkholes commonly form in row crop fields as small openings, 1 to 2 feet in diameter, as seen above. Without proper management, these sinkholes can form depressions that are tens of feet in diameter. Photo by Glynn Beck, Kentucky Geological Survey.



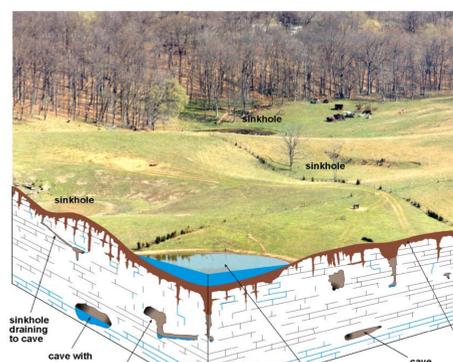
Sinkholes are natural drainage points for groundwater and should never be used as trash dumps. One way to protect sinkholes is by using geosynthetic materials and rip-rap, which help to control further soil erosion. Pictured above is a sinkhole that has been protected on the T.L. Maddux Farm in Livingston County. This sinkhole protection was funded by the Kentucky Soil Erosion and Water Quality Cost Share Program through the Livingston County Conservation District. Photo by Glynn Beck, Kentucky Geological Survey.

## Karst

The term "karst" refers to a landscape characterized by sinkholes, springs, sinking streams (streams that disappear underground), and underground drainage through solution-enlarged conduits or caves. Karst landscapes form when slightly acidic water from rain and snow-melt seeps through soil cover into fractured and soluble bedrock (usually limestone, dolomite, or gypsum).

Sinkholes are depressions on the land surface where water drains underground. Usually circular and often funnel-shaped, they range in size from a few feet to hundreds of feet in diameter. Springs occur when water emerges from underground to become surface water. Caves are solution-enlarged fractures or conduits that are large enough for a person to enter.

## Environmental Protection



Never use sinkholes as dumps. All waste, but especially pesticides, paints, household chemicals, automobile batteries, and used motor oil, should be taken to an appropriate recycling center or landfill.

Make sure runoff from parking lots, streets, and other urban areas is routed through a detention basin and sediment trap to filter it before it flows into a sinkhole.

Make sure your home septic system is working properly and that it's not discharging sewage into a crevice or sinkhole.

Keep cattle and other livestock out of sinkholes and sinking streams. There are other methods of providing water to livestock.

See to it that sinkholes near or in crop fields are bordered with trees, shrubs, or grass buffer strips. This will filter runoff flowing into sinkholes and also keep tilled areas away from sinkholes.

Construct waste-holding lagoons in karst areas carefully, to prevent the bottom of the lagoon from collapsing, which would result in a catastrophic emptying of waste into the groundwater.

If required, develop a groundwater protection plan (410KARS:037) or an agricultural water-quality plan (KRS224.71) for your land use.

(From Currens, 2001)

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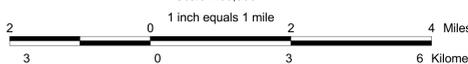
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## Additional Planning Resources

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

- [www.livingstonco.ky.gov/](http://www.livingstonco.ky.gov/)—Livingston County
- [ces.ca.uky.edu/livingston/](http://ces.ca.uky.edu/livingston/)—University of Kentucky Cooperative Extension Service
- [www.peadd.org/](http://www.peadd.org/)—Pennyrite Area Development District
- [www.thinkkentucky.com/edis/cmm/cw/119/](http://www.thinkkentucky.com/edis/cmm/cw/119/)—Kentucky Economic Development Information System
- [www.uky.edu/ky/kentuckyAtlas211336.html](http://www.uky.edu/ky/kentuckyAtlas211336.html)—Kentucky Atlas and Gazetteer
- [quickfacts.census.gov/datasets/12/1139.html](http://quickfacts.census.gov/datasets/12/1139.html)—U.S. Census data
- [kgswb.uky.edu/download/kgspstates.htm](http://kgswb.uky.edu/download/kgspstates.htm)—Planning information from the Kentucky Geological Survey

Scale 1:63,360



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859.257.3896 or  
877.778.7827 (toll free)

View the KGS World Wide Web site at:  
[www.uky.edu/kgss](http://www.uky.edu/kgss)

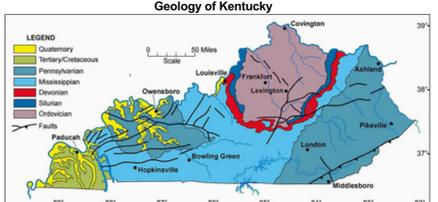
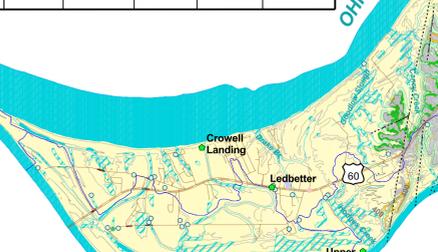
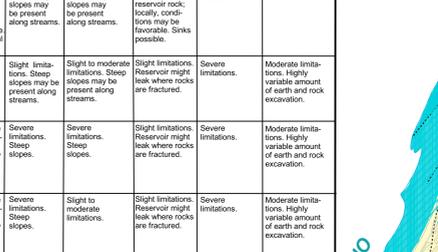
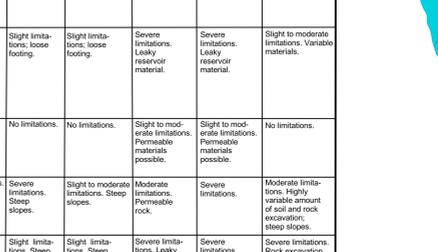
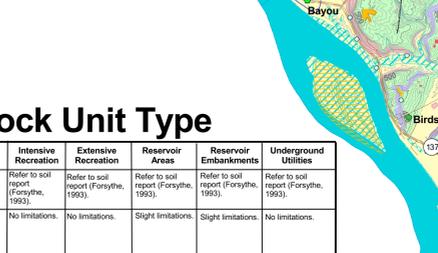
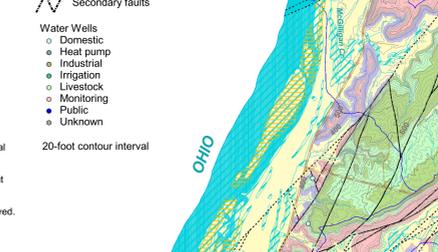
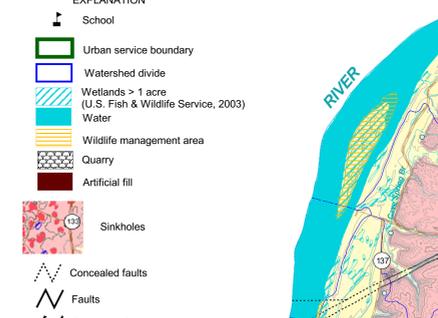


As seen in this photo, low-lying areas along the Ohio, Cumberland, and Tennessee Rivers in Livingston County are prone to flooding. During the 1997 flood, Ohio River floodwater was 3.5 feet deep in this house. Photo courtesy of Sheena Thomas-Brown, Livingston County 4-H/Youth Development Agent.



The 40-year-old Barkley Dam, constructed by the U.S. Army Corps of Engineers, provides flood protection along the Cumberland River and produces hydroelectric power. Barkley Dam has a generating capacity of 148 megawatts. Photo by Glynn Beck, Kentucky Geological Survey.

## Geology of Kentucky



## Industrial Minerals

Limestone is an abundant rock in Livingston County. Currently, there are two active limestone quarries in Livingston County: Vulcan Materials Reed Quarry (pictured above) and Marlin Marietta Aggregates' Three Rivers Quarry. Combined, these companies employ approximately 350 people and produce approximately 13 million tons of crushed stone per year. Photo by Glynn Beck, Kentucky Geological Survey.

## Groundwater

Wells in the Ohio River alluvium yield several hundred gallons per minute; compound horizontal wells have a potential yield as high as 5,000 gallons per minute. In most of Livingston County, drilled wells in the uplands are adequate for a domestic supply.

Yields as high as 50 gallons per minute have been reported from wells penetrating large solution channels or fault zones. In the low-lying areas along the Cumberland and Tennessee Rivers and tributaries to the Ohio River, most wells are inadequate for domestic use, unless the well intercepts a major solution opening in the limestone, and then the yield could be very large. In the uplands of the southern section of the county, between the Tennessee and Cumberland Rivers, most wells in gravel do not yield enough water for a domestic supply. Springs with flows ranging from a few gallons per minute to 177 gallons per minute are found in the county. Minimum flow generally occurs in early fall; maximum flows in late winter. For more information on groundwater in the county, see Carey and Stickney (2001).



Limestone springs, such as Gum Spring pictured above, are located throughout Livingston County. Most of these springs flow year around and are used as drinking-water sources. Photo by Glynn Beck, Kentucky Geological Survey.

Learn more about Kentucky geology at [www.uky.edu/KGS/geoly/](http://www.uky.edu/KGS/geoly/)