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

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Kentucky Geological Survey James C. Cobb, State Geologist and Director UNIVERSITY OF KENTUCKY, LEXINGTON

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

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> Joseph D. Buckles University of Kentucky

Acknowledgments Geology adapted from Conley (2002a, b, 2005), Crawford (2002a-d), Harbin (2002a, b), Hawkins (2002a, b), Solis (2002a, b), Solis and Venard (2002), Toth (2002a-d), and Toth and Crawford (2002). Mapped sinkhole data provided by Paylor and others (2004).

## EXPLANATION

	School								
*	Gas well								
*	Oil well								
*	Enhanced recovery well								
Water v	vells								
	Domestic								
-	Monitoring								
	Public								
	Industrial								
•	Agricultural								
	Severely eroded area								
SALE	Wet area								
$\bigotimes$	Mine or quarry								
0~	Spring								
<u> </u>	County line								
	Watershed boundary								
	Railroad								
	Geologic fault								
	Concealed geologic fault								
	Designated flood zone* (FEMA, 2005)								
	Wetlands > 1 acre (U.S. Fish and Wildlife Service, 2003)								
	Incorporated city boundaries								
	Source-water protection area, zone 1								
	Wildlife management area								

Mapped sinkhole Quarry 40-foot contour interval

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

Tar-Sands in Western Kentucky



sloped uplands. The eastern edge of the county is on the karst limestone plain that extends from the Ohio River generally south to the Tennessee line. Sinkholes, streamless valleys, and underground drainage systems characterize the area. Photo by Dan Kotter, Kentucky Geological Survey.

A plateau west of the sinkhole plain is marked by a conspicuous escarpment that rises 200 to 250 feet above the plain. The plateau, which is generally higher in the east than in the west, is moderately to deeply dissected. Large flat-topped ridges are present in several parts of the county. These flat areas, developed on resistant rock formations, give these regions a tableland appearance. Locally, isolated hills or ridges rise 80 to 100 feet above the plateau surface.

The greatest local relief is in the vicinity of the Ohio River. In the northeastern corner of the county, the difference in elevation from one hilltop to the Ohio River floodplain is 500 feet over a distance of about 3/4 mile. Locally, precipitous cliffs are present along some of the streams.

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.

For more information information on tar-sands, go to

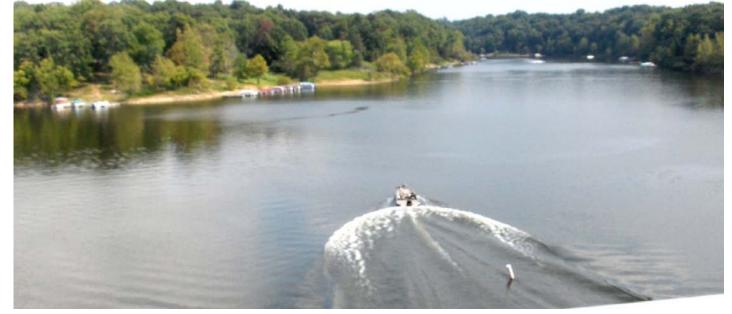
igations by the Kentucky Geological Survey have confirmed that major tar-sand resources are present in western Kentucky (Noger, 1999). In-place resources are calculated to be in excess of 3 billion barrels. The principal formations that contain tar-sand deposits (also referred to as asphaltic sandstones, heavy-oil deposits, or bitumenpregnated sandstones) are the Kyrock, Bee Springs, Tar Springs, Hardinsburg, and Big Clifty Sandstones. Some of these may occur n Logan, Warren, Butler, Edmonson, Hart, Grayson, Breckinridge, and Hardin counties. In Breckinridge County, tar-sands may be present unit 3. Photo by Randy Bruner.

kgsweb.uky.edu/PubsSearching/PubsSimpleSearch.asp, keyword= tar sands.

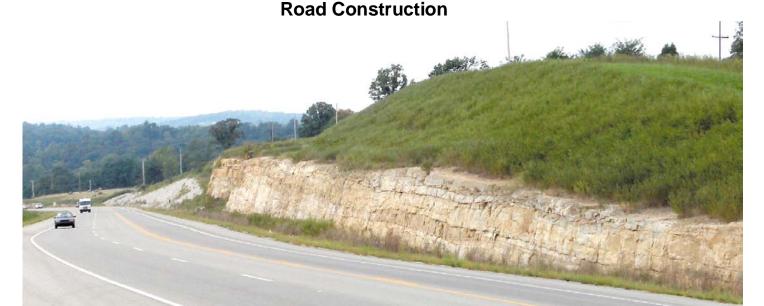
Agriculture



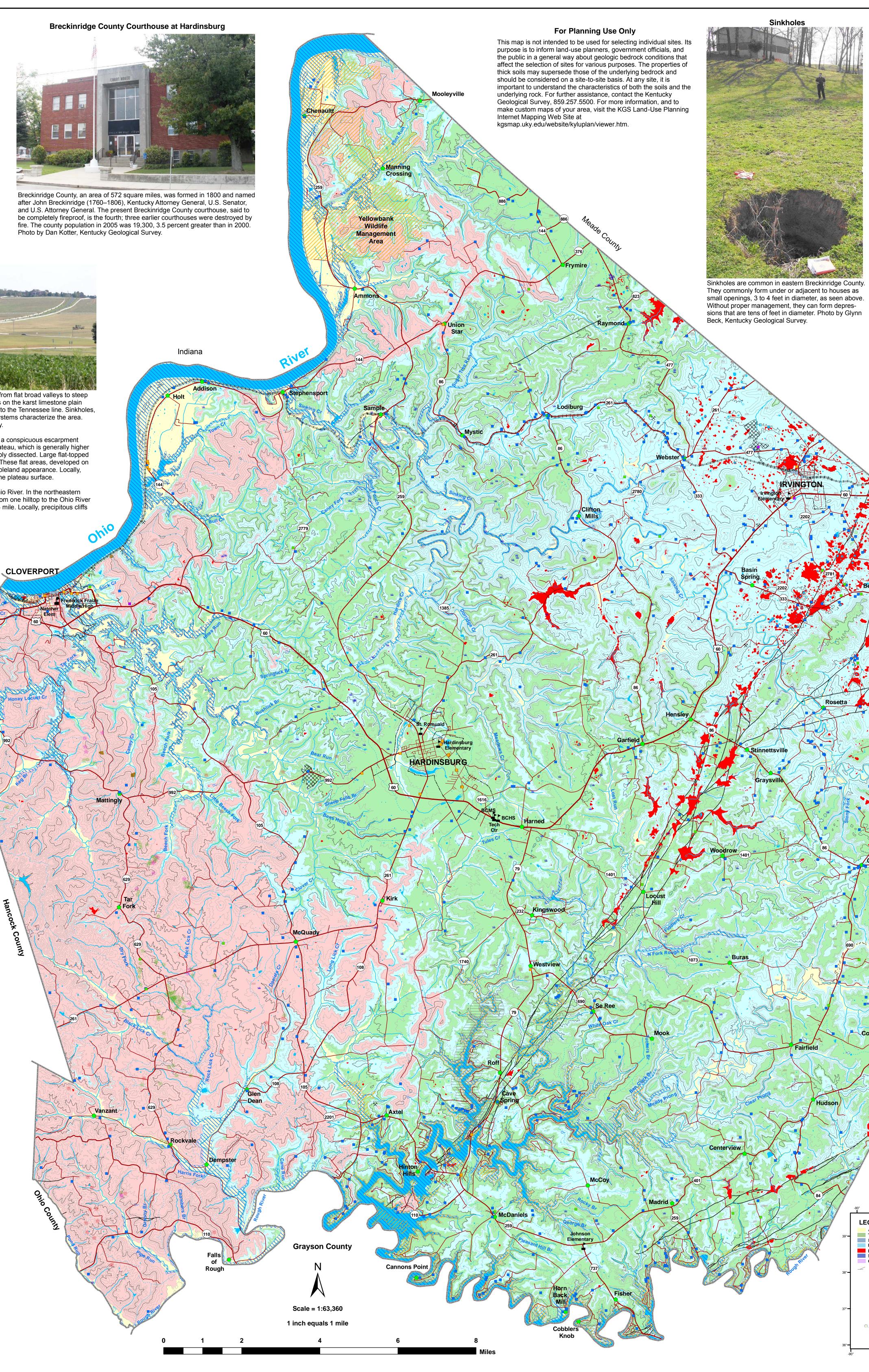
Agricultural Statistics Service (2004-2005) reported that 31,400 acres (8 percent) of the 374,720 acres available were planted in corn, soybeans and tobacco. Photo by Dan Kotter, Kentucky Geological Survey.



Rough River Dam Resort Park has a 5,000-acre lake located in both Breckinridge and Grayson Counties. The dam, completed in 1961, provides reduction of flood stages downstream and public recreation on the impounded Rough River Lake. Photo by Dan Kotter, Kentucky Geological Survey.

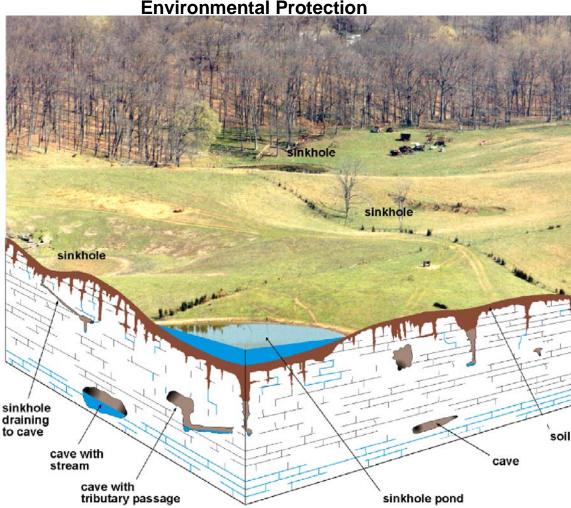


Because of thin soil cover in certain areas of the county, rock excavation is required during road and other types of construction. An example is this roadcut on U.S. 60 just west of Hardinsburg. Photo by Dan Kotter, Kentucky Geological Survey.



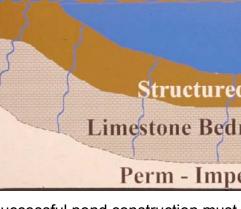
Rock Unit	Foundation and Excavation	Septic System	Residence with Basement	Highways and Streets	Access Roads	Light Industry and Malls	Intensive Recreation	Extensive Recreation	Reservoir Areas	Reservoir Embankments	Underground Utilities
1. Clay, silt, sand, loess, and gravel	Fair foundation material; easy to excavate.	Severe limitations. Failed septic systems can contaminate groundwater. Refer to soil report (Haagen, 2001).	Water in alluvium may be in direct contact with basements. Refer to soil report (Haagen, 2001).	Slight limitations. Refer to soil report (Haagen, 2001).	Slight to moderate limitations. Refer to soil report (Haagen, 2001).	Slight to moderate limitations. Avoid construction in flood- plain. Refer to soil report (Haagen, 2001).	Refer to soil report (Haagen, 2001).	Refer to soil report (Haagen, 2001).	Refer to soil report (Haagen, 2001).	Not recommended. Refer to soil report (Haagen, 2001).	Not recommended. Refer to soil report (Haagen, 2001).
2. Limestone	Excellent foundation material; difficult to excavate.	Severe limitations. Impermeable rock; locally fast drainage through fractures and danger of groundwater contamination.	Severe to moderate limita- tions. Rock excavation; locally upper few feet may be rippable. Sinks common; drainage required.	Slight to moderate limita- tions. Rock excavation; locally, upper few feet may be rippable. Sinks common. Local drainage problems.	Slight limitations. Local drainage problems from seeps or springs; sinks common and caves possible.	Slight to moderate limita- tions, depending on topog- raphy. Rock excavation; locally, upper few feet may be rippable. Sinks common. Local drainage required.	Moderate to severe limitations, depending on activity and topog- raphy.	Slight limitations, depending on activity and facilities.	Severe limitations. Leaky reservoir. Locally, condi- tions may be favorable. Sinks possible.	Severe limitations. Possible leaky reservoir rock.	Severe limitations. Rock excavation.
3. Sandstone	Fair to good founda- tion material; difficult to excavate.	Severe limitations. Thin soils.	excavation may be required; locally, upper few feet may	Severe to moderate limitations. Rock excavation may be required; locally, upper few feet may be rippable.	Moderate limitations. Rock excavation possible. Possible steep slopes.	Moderate limitations. Rock excavation possible. Possible steep slopes.	Moderate to severe limitations, depending on activity and topog- raphy.	Slight to moderate limitations, depending on activity and topography.	Slight limitations. Reservoir may leak where rocks are fractured.	Severe limitations. Leaky rock.	Moderate limitations. Highly variable amount of rock and earth excava tion.
4. Sandstone, shale, siltstone, limestone	Fair to good founda- tion material; difficult to excavate.	Severe limitations. Impermeable rock. Thin soils.	limitations. Rock excavation may be	Severe limitations. Rock excavation; locally, upper few feet may be rippable. Possible steep slopes.	Moderate limitations. Rock excavation; locally, upper few feet may be rippable. Possible steep slopes.	Severe limitations. Rock excavation; locally, upper few feet may be rippable. Possible steep slopes.	Moderate to severe limitations, depending on activity and topog- raphy.	Moderate to slight limitations, depending on activity and topog- raphy.	Slight limitations. Reservoir may leak where rocks are fractured.	Severe limitations. Leaky rock.	Moderate limitations. Highly variable amount of rock and earth excava tion.
5. Shale	Fair to good foundation material; difficult to exca- vate. Unstable slopes.	Moderate to severe limitations. Impermeable rock.	Moderate to slight limitations. Rock excavation possible. Poor drainage.	Slight to moderate limitations. Possible rock excavation. Slopes tend to be unstable when wet.	Slight limitations. Slopes tend to be unstable when wet.	Slight limitations. Rock generally rippable in shallow cuts.	No limitations.	No limitations.	No limitations. Impermeable rock.	Slight to moderate limitations. Slopes may be unstable when wet.	Moderate limitations. Highly variable amount of rock and earth excava tion.

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 snowmelt seeps through soil cover into fractured and soluble bedrock (usually limestone, dolomite, or gypsum). Sinkholes are depressions on the land surface into which water drains underground. Usually circular and often funnelsolution-enlarged fractures or conduits large enough for a person to enter.



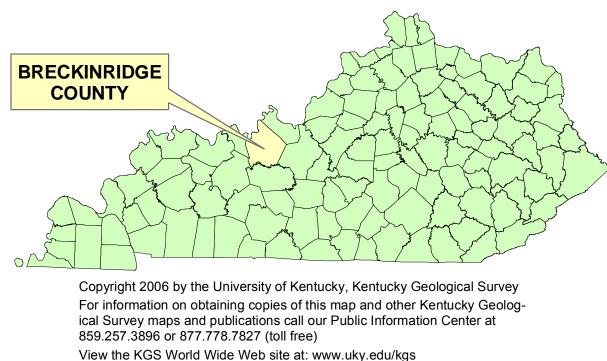
- should be taken to an appropriate recycling center or landfill.
- flows into a sinkhole.
- discharging sewage into a crevice or sinkhole. Keep cattle and other livestock out of sinkholes and sinking streams.
- There are other methods of providing water to livestock.
- and also keep tilled areas away from sinkholes.
- emptying of waste into the groundwater.
- agricultural water-quality plan (KRS224.71) for your land use (From Currens, 2001)

Anti-Leakage Strategy water access to permeable materials and/or alter materials to an impermeable condition Top of Dame



Successful pond construction must prevent water from seeping through structured soils into limestone solution channels below. A compacted clay liner or artificial liner may prevent pond failure. Getting the basin filled with water as soon as possible after construction prevents drying and cracking, and possible leakage, of the clayey soil liner. Ponds constructed in dry weather are more apt to leak than ponds constructed in wet weather. A geotechnical engineer or geologist should be consulted regarding the requirements of a specific site. Other leakage prevention measures include synthetic liners, bentonite, and asphaltic emulsions. The U.S. Department of Agriculture–Natural Resources Conservation Service can provide guidance on the application of these liners to new construction, and for treatment of existing leaking ponds.

Dams should be constructed of compacted clayey soils at slopes flatter than 3 units horizontal to 1 unit vertical. Ponds with dam heights exceeding 25 feet, or pond volumes exceeding 50 acre-feet, require permits. Contact the Kentucky Division of Water, 14 Reilly Rd., Frankfort, KY 40601, telephone: 502.564.3410. Illustration by Paul Howell, U.S. Department of Agriculture–Natural Resources Conservation Service.



# Groundwater

7.5-Minute Quadrangle

Map Index

wells in the Ohio River alluvium are adequate for domestic use; many wells yield several hundred gallons per minute. Compound horizontal wells set in the alluvium may yield 5,000 gallons per minute, enough for a community or industrial supply. In the northern third of the county (the central highlands and southeastern edge of Breckinridge County), most drilled wells are adequate for a domestic supply. Yields as high as 100 gallons per minute have been reported from wells penetrating fault zones. Depths of adequate wells range from 100 to 300 feet. In the remaining areas of the county, only a few wells yield enough water for a domestic supply, except that in the lowland areas bordering streams, some wells may be adequate. For more information on groundwater in the county, see Carey and Stickney (2005).

ALLUVIUM: silt, clay, sand, gravel TERTIARY/CRETACEOUS: sand, clay PENNSYLVANIAN: shale, sandstone, coal **MISSISSIPPIAN:** shale, limestone, sandstone **ORDOVICIAN:** limestone, shal Faults

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

In the northwestern edge of Breckinridge County, nearly all drilled

Geology of Kentucky

LEGEND DEVONIAN: shale, limestone SILURIAN: dolomite, shale



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# Planning Guidance by Rock Unit Type

# Karst Geology

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

Never use sinkholes as dumps. All waste, but especially pesticides, paints, household chemicals, automobile batteries, and used motor oil 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

Make sure your home septic system is working properly and that it's not

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

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

If required, develop a groundwater protection plan (410KAR5:037) or an

# Pond Construction

tured Clav S Limestone Bedrock with Plumbing

## Perm - Imperm Boundary

## 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.

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

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.

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### Additional Resources Listed below are Web sites for several agencies and organizations that may be of assistance with land-use planning

ces.ca.uky.edu/breckinridge/ University of Kentucky Cooperative Extension Service

issues in Breckinridge County:

www.ltadd.org/ Lincoln Trail Area Development District www.thinkkentucky.com/edis/cmnty/cw/cw006/ Kentucky Economic Development Information System

kgsweb.uky.edu/download/kgsplanning.htm County planning data from the Kentucky Geological Survey www.uky.edu/KentuckyAtlas/21027.html Kentucky Atlas and Gazetteer

quickfacts.census.gov/qfd/states/21/21027.html U.S. Census data

www.breckinridgecounty.net/ Local government site www.breckinridgeco.com Breckinridge County Chamber of Commerce