

CHAPTER 7 ENVIRONMENTAL

INTRODUCTION

Barren County is located in the south central part of the State of Kentucky. The total land area of Barren County is approximately 500 square miles or 320,083 acres. Barren County contains 308,499 land acres and 11,584 water acres. The topography of Barren County ranges from 1,068 feet above sea level, along Love Knob Road, to 470 feet above sea level, along the Barren River in the western part of the County, (see Map 7.1: Barren County General Geology and Relief Map). Prewitt's Knob, at 1,055 feet above sea level, is commonly mistaken for the highest point in Barren County because of its unusual location and geology.

Barren County lies in the eastern and western Pennyroyal physiographic regions of Kentucky, part of the Mississippian Plateau. The topography of the County is predominantly that of a dissected plateau, particularly in the central and southern parts, and varies greatly. The central and southern areas are composed of deep, narrow valleys that have moderately steep to steep side walls and of moderately broad to narrow ridges. The northern part of the County is rolling and has karst topography. The County is traversed from the northeast to the southwest by Beaver Creek and its tributaries and from the southwestern boundary by the Barren River and its reservoir.

With the exception of Beaver Creek and the Barren River, the principal streams in the County are deeply entrenched and flow in relatively narrow valleys. A rolling section of considerable acreage extends across the northern part of the County. Broad, gently sloping inter-stream areas are common between sinkholes and depressions. Surface drainage is predominant in approximately 60 percent of the County. Subterranean drainage is predominant in areas of karst topography.

GENERAL PHYSIOGRAPHIC FEATURES

Barren County is underlain by sedimentary rocks of the Mississippian and Devonian periods, but the

rocks are predominantly of Mississippian age. In the most deeply entrenched channels, minor exposures of Chattanooga shale of the Devonian period occur, but these exposures have had little or no influence of the parent material of the soils. Map 7.1 shows the general geology of Barren County.

Resting upon the Chattanooga shale is the Fort Payne formation of the Mississippian age. This formation consists of cherty limestone, siltstone, shale, and sandstone. It ranges from about 100 to 200 feet in thickness. Limestone, thinly bedded siltstone, and shale of the Salem and Warsaw formations are above the Fort Payne formation. These formations are 150 feet thick in places. They normally occur together, either inter-fingered or mixed, but the Salem formation is absent in some areas.

Cherty limestone of the St. Louis formation is on the higher ridgetops and is most extensive in the northern part of the County. The thickness of this formation ranges from about 60 feet in the south to 290 feet in the north. St. Genevieve limestone is above the St. Louis formation in the vicinity of Park City and is approximately 180 feet thick. Argillaceous limestone of the Girkin formation is immediately above the St. Genevieve limestone at the base of the Knobs and is 100 feet thick in places. Resting on the Girkin formation in the vicinity of Mammoth Cave is the Big Clifty sandstone, which is approximately 85 feet thick. A mantle of wind-deposited silt, or loess, that range from practically zero up to 30 inches in thickness, covers many of the gently rolling to level ridgetops throughout the County.

KARST TOPOGRAPHY

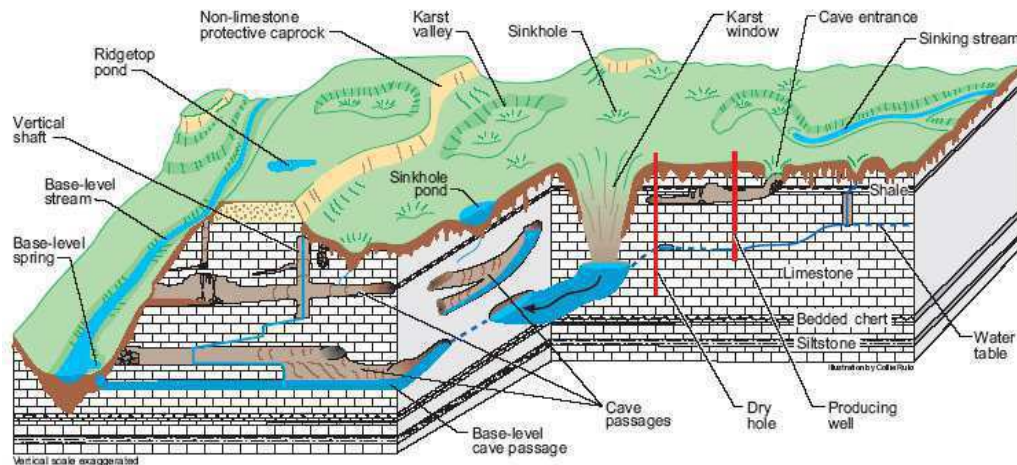
Karst occurs where limestone or other soluble bedrock is near the earth's surface, and fractures in the rock become enlarged when the rock dissolves. Sinkholes and sinking streams are two surface features that indicate karst development. In karst areas most rainfall sinks underground, resulting in fewer streams flowing on the surface than in non-karst settings. Instead of flowing on the surface, the water flows underground through caves, sometimes reemerging at karst windows, then sinks again to eventually discharge at a base-level spring along a

major stream or at the top of an impermeable strata. The development of karst features is influenced by the type of soluble rock and how it has been broken or folded by geologic forces. There are four major karst regions in Kentucky: the Inner Bluegrass, Western Pennyroyal, Eastern Pennyroyal, and Pine Mountain. Figure 7.1 depicts the Western Pennyroyal karst of which Barren County is a part of.

Many of the conditions needed for long cave systems occur in the Western Pennyroyal. These include a

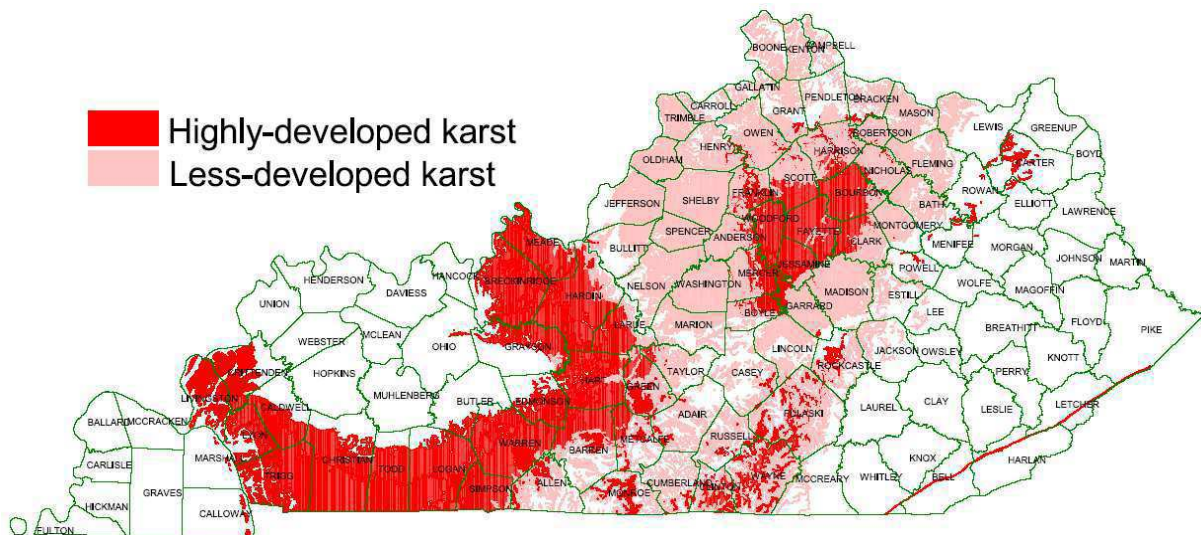
thick block of pure limestone, a high rainfall rate, higher elevation areas draining toward a major stream, rocks dipping toward the stream, and large areas of the limestone protected from erosion at the surface by overlying insoluble rocks. In the Mammoth Cave area, all of these conditions are found together, which resulted in Mammoth Cave, the longest known cave system in the world at 350 miles mapped to date.

Figure 7.1:
Generalized Block Diagram of the Western Pennyroyal Karst



Source: Kentucky Geological Survey

Figure 7.2:
Karst Areas of Kentucky



Source: Kentucky Geological Survey

As erosion on the surface continues over geologic time, the major stream draining a karst terrain cuts its channel deeper. In response, deeper conduits increase their flow to the major stream and new springs develop at lower elevations along the stream's banks. Older, higher flow routes are left as dry cave passages, some of which become sediment filled. To produce significant amounts of water, wells drilled into karst aquifers must intersect a set of enlarged fractures, a dissolution conduit, or a cave passage with an underground stream. Figure 7.2 shows the karst areas of Kentucky.

SOILS ANALYSIS

The Soil Survey of Barren County is shown on Map 9.14, General Soils Map. This information was produced from the Soil Survey Geographic (SSURGO) Database provided by the Natural Resources Conservation Service (NRCS) of the U.S. Department of Agriculture and shows the extent and location of the various soil types in Barren County. This information delineates favorable and unfavorable characteristics of each soil type.

GENERAL SOILS CHARACTERISTICS

A soil association is a landscape that has distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soil or soils. The soils in one association may occur in another, but in a different pattern. Barren County is classified by five soil associations: (1) Weikert-Caneyville-Wellston-Zanesville, (2) Cumberland-Pembroke, (3) Dickson-Melvin-Crider, (4) Baxter-Talbott-Dickson, (5) Clarksville-Bodine-Mountview.

Weikert-Caneyville-Wellston-Zanesville Association

Shallow and moderately deep, well to somewhat excessively drained, sloping to steep, rocky or stony soils on hillsides and deep, well drained to moderately well drained, gently sloping to sloping loamy soils on ridgetops. This association is in the northwestern corner of the County, a part known as the Mammoth Cave area. It has steep side slopes, moderately broad to narrow ridgetops, and sink-dotted valleys. Underground streams drain the area and the elevation range is from about 630 to about 970 feet.

Steep slopes, stones, and rocks are the chief limitations of soils in this association. Approximately 1,336 acres of the association lie within the Mammoth Cave National Park. More than 60% of the association is in woods of low commercial value. Most of the farms average about 100 acres in size; a few are considerably larger. Ordinarily, only a small part of each farm is suitable for cultivation, and the total value of farm products is rather low. Most of this association has low potential for crops and pasture.

Cumberland-Pembroke Association

Deep, well drained, gently sloping to strongly sloping clayey or loamy soils of the lime-stone uplands. This association occurs in the northern part of the County. It is a karst area having moderately broad to narrow ridges and intervening bowl-shaped sinks and depressions. Drainage is mostly through underground streams. More than 90% of this association is used for corn, alfalfa, tobacco, small grain, hay, and pasture. Eroded soils and chert are limitations to farming. There are a few one to ten acre hardwood stands in this area. They occur mostly on knobs and around large sinks. Most of the farms average about 100 acres in size; a few are much larger. Most of the acreage of gently sloping to strongly sloping soils is suitable for cultivation when managed properly. This association surpasses the other four associations in the total value of farm products. The association is suited to the production of all crops that are grown locally.

Dickson-Melvin-Crider Association

Dominantly, moderately deep, moderately well drained, gently sloping silty soils of the uplands and poorly drained, nearly level silty soils on floodplains. This association occurs in narrow strips from Merry Oaks to the vicinity of Goodnight and along the Metcalfe County boundary line east of Hiseville. It is commonly referred to as the slash area. It consists of moderately broad to narrow ridges and depressed areas. Several intermittent streams begin in this association.

More than 60% of this association is used for corn, tobacco, small grain, alfalfa, hay and pasture. The poorly drained areas, some of which are 40 acres or more in size, are mostly wooded. Most of the farms average about 90 acres in size, a few considerably larger. The total value of farm products sold is moderate. The association is suited to the production of timber and pasture.

Baxter-Talbott-Dickson Association

Deep, well drained, gently sloping to moderately steep, dominantly cherty soils with clayey subsoil, on uplands and moderately deep, moderately well drained, gently sloping silty soils on ridgetops. This association extends from the Warren County boundary line in the west, near Railton, to the Metcalfe County line in the east, and along narrow ridges at Eighty Eight, Temple Hill, Lucas, Roseville, Austin and Tracy. It is made up of broad and narrow ridges and predominantly short side slopes. In some places karsts topography is dominant. Several permanent streams pass through the area. Along these are strips of alluvial soils ranging from about 300 to 1,300 feet in width.

Erosion and chertiness are the dominant limitations of this association for farming. About 85% of the association is used for corn, tobacco, small grain, hay and pasture. The steep soils on short side slopes area dominantly in hardwood trees. A few acres are in unimproved pasture. The farms average about 85 acres in size. The total value of farm products is high. The association is suited for crops, pasture and timber.

Clarksville-Bodine-Mountview Association

Dominantly deep, well drained to excessively drained, sloping to steep, cherty and very cherty silty soils on hillsides; and deep, well-drained, gently sloping to sloping silty soils on ridgetops. This association extends from the Barren River and Allen County in the west to Monroe County in the southeast and Metcalfe County in the east. It has the most deeply dissected topography in the County. It is made up predominantly of hillsides and moderately wide to narrow ridgetops. Most large tributaries of the Barren River drain this area. Floodplains in the association range from about 100 to 2,600 feet in width. Soils on bottoms along the Barren River are part of this association, but they are mostly covered by water from the Barren Reservoir area and are not available for farming.

Chertiness, droughtiness, and erosion are the dominant soil limitations in this association. More than 75% of the association is used for corn, small grain, tobacco, alfalfa, hay and pasture. About 20% is wooded, and some of the larger trees are marketed, mainly for lumber. The alluvial soils in the association are important to farming, and nearly all are cultivated. Most of the farms in this association average about 85 acres in size; a few are considerably

larger. The total value of farm products sold in this association is low to moderate in comparison with the value of farm products sold in most of the other associations in the County. The potential of this association for timber production is fair to good.

PRIME FARMLAND

According to the Department of Agriculture, prime farmland has “the soil quality, growing season, and moisture supply needed to produce economically sustained high yields of crops when treated and managed according to acceptable farming methods, including water management. These lands have an adequate and dependable water supply from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, acceptable salt and sodium content, and few to no rocks. They are permeable to water and air, are not excessively erodible or saturated with water for a long period of time, and they either do not flood frequently or are protected from flooding.”

Areas with soil characteristics recognized as prime farmland and farmland of statewide importance have been identified using the SSURGO database information. A large quantity of prime farmland and farmland of statewide importance are located throughout Barren County, see Map 9.11: Barren County Soil Farmland Characteristics. Maps showing soil associations and characteristics are very useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for certain kind of farming or for other land uses.

ENVIRONMENTALLY SENSITIVE AREAS

A combination of many of the foregoing described characteristics may result in the identification of areas considered environmentally sensitive. For example, lands which are underlain by geologically fragile formations and covered by somewhat unstable soil conditions are likely environmentally sensitive and caution should be applied when they are being considered for development purposes. Areas that are subject to periodic flooding are considered environmentally sensitive. Land areas characterized by steep slope conditions, unstable soil characteristics, etc. could also easily be classified as environmentally sensitive.

FLOODPLAINS

Flooding has caused the deaths of more than 10,000 people since 1900. Property damage from flooding now totals over \$1 billion each year in the United States as reported by the Federal Emergency Management Agency (FEMA). When planning for the future land development of Barren County “flood prone areas” should be of major concern. In these areas, no new development should be permitted and heavy restrictions should regulate limited development. When development is permitted, adequate protection systems and flood-proofing measures should be required.

Flooding can produce widespread impacts in both rural and urban areas. Any type of agricultural, commercial, or residential development located in a floodplain is vulnerable to flooding. Increasing urbanization in some areas enhances the threat of flooding where drainage systems cannot cope with the increased input of storm water runoff. Flooding is a recurrent hazard. While it may be difficult to predict when it will happen, it is possible to predict where it is likely to happen. Indeed, some lands may not be suited for development because of the threat of flooding. It is the responsibility of local governments through development regulations to pursue good planning practices. FEMA offers a checklist of flood mitigation actions targeted to public works, utilities, residences, and businesses. They include recommendations such as elevating vital electrical equipment and infrastructure above floodwater levels, elevating buildings or moving them outside the floodplain, and elevating or relocating any hazardous materials stored in buildings.

The most hazardous flood danger conditions in Barren County are prevalent immediately adjacent to major water bodies and streams. Primary areas of concern are: (1) the major permanent flowing water bodies; (2) areas identified by the Federal Emergency Management Administration (FEMA) as subject to a 100 Year Flood; and (3) other land subject to periodic flooding. Map 7.2 identifies the flood hazard areas for Barren County. This information was established from FEMA Digital Q3 Flood Data and shows the existing Flood Insurance Rate Map (FIRM) thematic overlay of flood risk.

National Flood Insurance Program

In 1968, Congress created the National Flood Insurance Program (NFIP) in response to the rising

cost of taxpayer-funded disaster relief for flood victims and the increasing amount of damage caused by floods.

The NFIP makes federally backed flood insurance available in communities that agree to adopt and enforce floodplain management ordinances to reduce future flood damage. The Federal Emergency Management Agency’s (FEMA) Federal Insurance Administration and Mitigation Directorate manage the NFIP. The Federal Insurance Administration manages the insurance component of the NFIP, and works closely with FEMA’s Mitigation Directorate, which oversees the floodplain management aspect of the program. The City of Park City, the City of Cave City, the City of Glasgow and the Barren County Fiscal Court have adopted ordinances relating to flood damage prevention and participation in the NFIP. All classified Cities within Barren County, as well as the Barren County Fiscal Court entered the NFIP program in the year of 2009. Barren County received an ISO rating of 9 on a 1 to 10 scale with 1 being the most savings on required insurance premiums for citizens living in Barren County. Many variables are factored into the CRS rating for a community, such as: amount of fire departments for coverage area, coverage time in response to a disaster, number of vehicles and firefighters each district has and training hours all individuals have, whether a community has a safe-room for shelter, etc. The City of Glasgow has received an ISO rating of 3.

State and Regional Assistance

The National Resources and Environmental Protection Cabinet, Division of Water, has major responsibility among state agencies for floodplain management in Kentucky. Within the Division of Water, the Water Resources Branch, Floodplain Management Section is responsible for the following:

- Analyze and issue permits for proposed construction within the 100-year floodplain.
- Issue permits for construction, reconstruction, and repair of dams.
- Provide liaison for the National Flood Insurance Program.
- Administer the state-owned Dam Repair Program.

- Coordinate and provide technical assistance for floodplain management activities within the Commonwealth.

Construction in a floodplain without a permit violates KRS 151 and becomes the responsibility of the Dam Safety and Floodplain Compliance Section of the Division of Water.

WETLANDS

Wetlands are defined in the Army Corps of Engineer's (ACE) regulations [33 CFR, 328.3(b)] as "areas inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions."

Section 404 of the Clean Water Act established a program to regulate the discharge of dredged and fill material into waters of the United States, including wetlands. Activities in waters of the United States that are regulated under this program include fills for development, water resource projects, infrastructure development, and conversion of wetland to uplands for farming and forestry.

For the purpose of Section 404 of the Clean Water Act, the identification and delineation of wetlands is accomplished in accordance with the 1987 Army Corps of Engineers Wetland Delineation Manual. The Army Corps of Engineers has the responsibility, subject to oversight by the Environmental Protection Agency (EPA), for the delineation of all wetlands within the United States. In addition the U.S. Fish and Wildlife Service, the National Marine Fisheries Service, and State resource agencies have important advisory roles.

While wetland protection and mitigation is done under federal laws through permitting, it is important in this Plan Update to recognize that the characteristics associated with wetlands may be important to Barren County with its relationship to the Barren River Reservoir and its many streams. Map 7.2 shows wetland areas identified by the Kentucky Natural Resources and Environmental Protection Cabinet. This map also identifies soil sensitive areas. The SSURGO Database was used to identify the soil sensitive areas based on poorly drained soil characteristics associated with hydric soils.

Although recognition for preserving wetland habitat is growing within the region, it is important to understand that wetland areas should first be avoided for development. If that is not possible, then the impact on these areas should be mitigated. There are several ways the EPA regulates compensation and mitigation for use of wetlands: (1) preservation or conservation easements, which result in the purchase of a valuable wetland with provision for long-term protection and management; (2) the exchange of the damaged wetland with one of higher value which is placed under long-term protection; and (3) the repair of a somewhat degraded wetland to restore its lost function. Some private or public entities may also choose to participate in mitigation banking. This process involves the enhancement, restoration, or creation of a new wetland area in order to get "credits" that can be applied at a later time when wetland impacts are unavoidable elsewhere. Again, it is important to note that the EPA regulates the development of wetlands, however, local government and citizen input is important to the process in Barren County.

VEGETATION, ENDANGERED SPECIES, AND WILDLIFE HABITATS

When the first Europeans came upon this region of Kentucky, they discovered an area quite different from the rugged hills and thick forests encountered farther east. Early documentation of south-central and western Kentucky describes it as vast plains of grasslands, with trees being widely scattered or absent. Today we call these areas "prairies", but in those days, these explorers were not familiar with this French word. They called these grasslands the "barrens" because they thought the soil was too poor to support trees.

These "barren" areas were prime hunting grounds for the Native Americans and early settlers who called this region home. Through elimination of the extensive animal herds, suppression of fire, and the conversion of the land to crops and pastures, the "barrens" rapidly disappeared, and today only small fragments of this unique ecosystem remain in Kentucky.

Vegetation

The United States Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS) has divided the vegetation of Barren County into six major groups: grains and seed crops, domestic grasses and legumes, wild herbaceous

plants, hardwoods, coniferous plants, and wetland plants. The major crops of the grain and seed category include corn, wheat, soybeans, and hay. Tobacco is also a major crop.

Domestic grasses and legumes present in Barren County consist of perennial grasses and herbaceous legumes which are established by planting and which provide food and shelter to wildlife. Some examples are fescue, timothy, orchard grass, clover, and lespedeza.

Wild herbaceous plants are native or introduced perennial grasses and weeds. Indiangrass, little bluestem, big bluestem, quackgrass, goldenrod, wild carrot, nightshade, and dandelion are the major types of wild herbaceous plants found in Barren County.

Hardwood trees are non-coniferous trees, shrubs, and wood vines which bear fruit, nuts, buds, catkins, twigs, or foliage that is edible by wildlife and are usually naturally established. Hardwoods present in Barren County include oak, cottonwood, cherry, maple, poplar, apple, dogwood, hawthorn, sweetgum, hickory, sassafras, persimmon, black walnut, and sumac. Other hardwoods present are bayberry, blueberry, huckleberry, blackshaw, viburnum, grape, and briars. This category also includes several fruit-bearing shrubs raised commercially.

Coniferous plants are cone-bearing evergreens, including both trees and shrubs. Among the species in this category are Norway spruce, Virginia pine, loblolly pine, shortleaf pine, white pine, Scotch pine, and red cedar. All these woody plants, trees and shrubs are used as cover by wildlife and provide some nourishment. Map 9.8, Barren County Existing Land Use, shows identified woodlands for the County.

The wetland plants category consists of wild, herbaceous, annual, and perennial plants which grow in moist areas but are not submerged or aquatic. Among the wetland plants in Barren County are smartweed, wild millet, pondweed, duckweed, duckmillet, sedges, barnyard grass, bulrush, arrow-
arum, pickerelweed, phragmites or common reed, water willow wetland grasses, wildrice, cattails, water lilies, and sweet flags. These plants produce food and cover for wildlife.

Other Habitats

Shallow water areas, usually not over five feet in depth, provide cover and food for wetland wildlife.

These areas may be natural or created such as when marshes and streams are subjected to dams, levees, and water-control devices. They include areas such as beaver ponds, muskrat ponds, wildlife ponds, waterfowl feeding areas, and wildlife water developments.

Endangered Species

The U.S. Fish and Wildlife Service has compiled a list of threatened and endangered species within Kentucky, see Table 7.1.

Table 7.1:
Threatened and Endangered Species in Kentucky

| Species | Common Name | Status |
|--|-------------------------|--------|
| Mammals | | |
| Myotis Grisescens | Gray Bay | E |
| Myotis Sodalis | Indiana Bat | E |
| Corynorhinus Townsendii Virginianus | Virginia Big Eared Bat | E |
| Myotis Septentrionalis | Northern Long-Eared Bat | T |
| Birds | | |
| Callidris Canutus Rufa | Rufa Red Knot | T |
| Charadrius Melodus | Piping Plover | T |
| Grus Americana | Whooping Crane | XN |
| Sterna Antillarum | Least Tern | E |
| Fish | | |
| Crystallaria Cincotta | Diamond Darter | E |
| Etheostoma Chienense | Relict Darter | E |
| Etheostoma Percnorum | Duskytail Darter | E |
| Etheostoma Spilotum | Kentucky Arrow Darter | T |
| Etheostoma Susanae | Cumberland Darter | E |
| Notropis Albizonatus | Palezone Shiner | E |
| Chrosomus Cumberlandensis | Blackside Dace | T |
| Scaphirhynchus Albus | Pallid Sturgeon | E |
| Scaphirhynchus Platyrhynchus | Shovelnose Sturgeon | T |
| Crustaceans | | |
| Cambarus Callainus | Big Sandy Crayfish | T |
| Palaemonias Ganteri | Kentucky Cave Shrimp | E |
| Mussels | | |
| Alasmidonta Atropurpurea | Cumberland Elktoe | E |
| Epioblasma Triquetra | Snuffbox Mussel | E |
| Hemistena Lata | Cracking Pearlymussel | E |
| Dromus Dromas | Dromedary Pearlymussel | E |
| Pegias Fabula | Littlewing Pearlymussel | E |
| Pleuonaia Dolabelloides | Slabside Pearlymussel | E |
| Pleurobema Plenum | Rough Pigtoe | E |
| Plethobasus Cooperianus | Orangefoot Pimpleback | E |
| Plethobasus Cicatricosus | White Wartyback | E |
| Potamilus Capax | Fat Pocketbook | E |
| Cumberlandia Monodonta | Spectaclecase | E |
| Quadrula Cylindric | Rabbitsfoot | T |
| Epioblasma Torulosa Rangiana | Northern Riffleshell | E |

| | | |
|--------------------------------|-------------------------|---|
| Epioblasma Florentina Walkeri | Tan Riffleshell | E |
| Obovaria Retusa | Ring Pink | E |
| Cyprogenia Stegaria | Fanshell | E |
| Epioblasma Brevidens | Cumberland Combshell | E |
| Epioblasma Capsaeformis | Oyster Mussel | E |
| Epioblasma Oblaquata Obliquata | Purple Catpaw | E |
| Lampsilus Abrupta | Pink Mucket | E |
| Leptodea Leptodon | Scaleshell | E |
| Plethobasus Cyphus | Sheepnose | E |
| Pleurobema Clava | Clubshell | E |
| Ptychobranhus Subtentum | Fluted Kidneyshell | E |
| Quadrula Fragosa | Winged Mapleleaf | E |
| Villosa Trabilis | Cumberland Bean | E |
| Insects | | |
| Bombus Affinis | Rusty Patched Bumblebee | T |
| Nicrophorus Americanus | American Burying Beetle | E |
| Plants | | |
| Trifolium Stoloniferum | Running Buffalo Clover | E |
| Solidago Shortii | Short's Goldenrod | E |
| Solidago Albopilosa | White-Haired Goldenrod | T |
| Apios Priceana | Price's Potato Bean | T |
| Arabis Perstellata | Bruan's Rockcress | E |
| Arenaria Cumberlandensis | Cumberland Sandwort | E |
| Conradina Verticillata | Cumberland Rosemary | T |
| Spiraea Virginiana | Virginia Spiraea | T |
| Leavenworthia Exigua | Kentucky Glade Grass | T |
| Platanthera Integrilabia | White Fringeless Orchid | T |
| Physaria Globosa | Short's Bladderpod | E |
| Schwalbea Americana | American Chaffseed | E |

Source: Threatened and Endangered Species System (TESS), 2019

Great emphasis should be placed on the protection of plant and animal species that are considered threatened and endangered by the Federal Government. The term, Federally Endangered, refers to those species in danger of extinction throughout all or a significant portion of their range. The Planning Commission should consider the impacts of new development on species that are considered threatened and endangered.

Wildlife

The USDA NRCS classifies three types of wildlife in Barren County: open land wildlife, woodland wildlife, and wetland wildlife. Open land wildlife consists of birds and mammals that typically exist in fields, pastures, lawns, or meadows within grasses and shrubs. These animals include quail, field sparrows, doves, rabbits, foxes, and woodchucks. Woodland wildlife consists of birds and mammals that normally exist within wooded areas with hardwood trees. The different species include killdeer, foxes, raccoons, and squirrels. Wetland wildlife consists of birds or animals that exist in wet

areas such as ponds, marshes, or swamps. Wetland wildlife include: ducks, geese, shore birds, herons, muskrats, and beavers.

WATER QUALITY

The water in rivers, creeks, lakes, and circulating ground water in Barren County, together with the water in the atmosphere, are a hydrologic system that can, in part, be developed and managed to provide maximum benefit to the community. As the urban population of Barren County increases, a multiplication of water problems can develop. In order to prevent unnecessary problems, the public officials of our community need to be concerned with protecting existing water supplies in the streams and in the ground from pollution, and also making sure adequate water supplies exist.

Threats to the Groundwater

The Federal Safe Drinking Water Act of 1974 and its amendments regulate the nation's public drinking water to ensure it is safe for consumption. An estimated 3,516,272 Kentuckians (87 percent) now have access to public drinking water provided by 656 public drinking water systems. But access to public drinking water varies greatly by county. Estimates in 2008 indicated that 99 percent of residents within Barren County were served by a public water system.

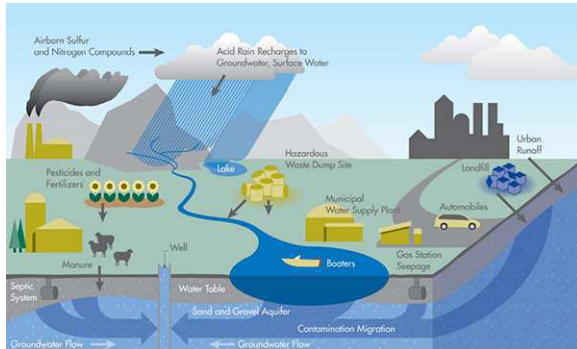
About 90 percent of the water offered for drinking in Kentucky is supplied by streams, lakes, and reservoirs, with the remainder coming from groundwater sources. The Barren River Reservoir, Beaver Creek, Green River and Rio Verde Spring supply water to the public water systems that service Barren County.

Pollutants can enter raw drinking water sources in a number of ways and come from a variety of sources. In Kentucky, polluted runoff from farmlands, coal mines and discharges from wastewater treatment plants are the greatest sources of water pollution. Other pollution sources include failing septic systems, sewage straight pipes, waste sites, urban runoff, combined sewer overflows, and toxic spills.

Threats to the groundwater in Barren County include 219 unplugged wells, a minimum of 7,348 septic tanks, 159 underground storage tanks, 15 potential hazardous waste sites, and 2 underground injection wells (State of Kentucky's Environment, Kentucky

Environmental Quality Commission). Other threats include old landfills and surface runoff.

Figure 7.3:
Groundwater Pollution Threats



Source: American Groundwater Trust

Septic tank systems are the most frequent source of bacterial contamination in groundwater. According to the Kentucky Department of Health Services, about half of the private drinking wells in Kentucky are contaminated with bacteria due to sewage. On-site sewage disposal systems, many of which were installed prior to 1985 under conditions that would now be prohibited, are potential sources of groundwater contamination in Barren County.

The Kentucky Department of Mines and Minerals estimates that there are some 120,000 unplugged oil and gas wells in the state of Kentucky, but there is no way to know for certain since records were previously not required. Industrial contaminants, municipal wastewater, pollutants from farm and mine sites, and other pollutants can find their way directly into the underground water system through unplugged oil and gas wells.

The U.S. Environmental Protection Agency (EPA) has estimated that approximately 25% of the underground storage tanks in Kentucky are leaking contaminants. Since 1988, the state has been making efforts to detect underground petroleum storage tank leakage, and many have been replaced throughout the state. However, underground farm fuel tanks and heating oil storage tanks are exempt from the detection and replacement program.

NPDES Phase II

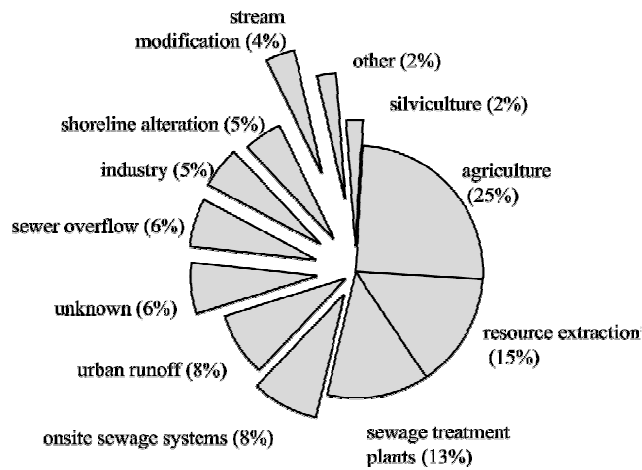
Based on total population and population density, Glasgow has been designated as being required to comply with the National Pollution Discharge Elimination System (NPDES) Phase II Storm Water Management Program. Therefore, a storm water management entity must design a local program to reduce the discharge of pollutants, protect water quality, and satisfy the appropriate water quality requirements of the Clean Water Act. This local program must have: a comprehensive plan for regulating storm water discharges within their watershed; educate and involve the public in its administration; and produce evidence that storm water discharges are meeting the standards of the Clean Water Act. The local storm water management entity has developed, and refined its program. Requirements of the second five-year cycle have not yet been specified.

Watersheds (Rivers, Streams, and Lakes)

Kentuckians enjoy the benefits of an estimated 89,431 miles of rivers and streams. The quality of these waterways varies from severely degraded to clean enough for swimming, fishing or use as a drinking water source. The Kentucky Division of Water maintains a network of ambient water quality stations throughout the state to monitor water quality. Based on monitoring data, agricultural activities were the leading source of water pollution in waterways. Contaminated runoff containing agricultural nutrients and chemicals has impacted 25 percent of the monitored impaired stream miles. Resource extraction (coal mining and petroleum activities), followed impacting 15 percent of the miles impaired, while sewage treatment plants impaired 13 percent of the monitored waterways, see Figure 7.4 below.

Disease-carrying pathogens, often associated with untreated or poorly treated animal and human waste, remain the principal pollutant, impairing 31 percent of the stream miles monitored. In 1999, the state declared that 234 miles of Kentucky's rivers and streams were too polluted for swimming because of high levels of fecal coliform bacteria.

Figure 7.4:
Sources of Stream and River Pollution
in Kentucky (1997 – 1999)



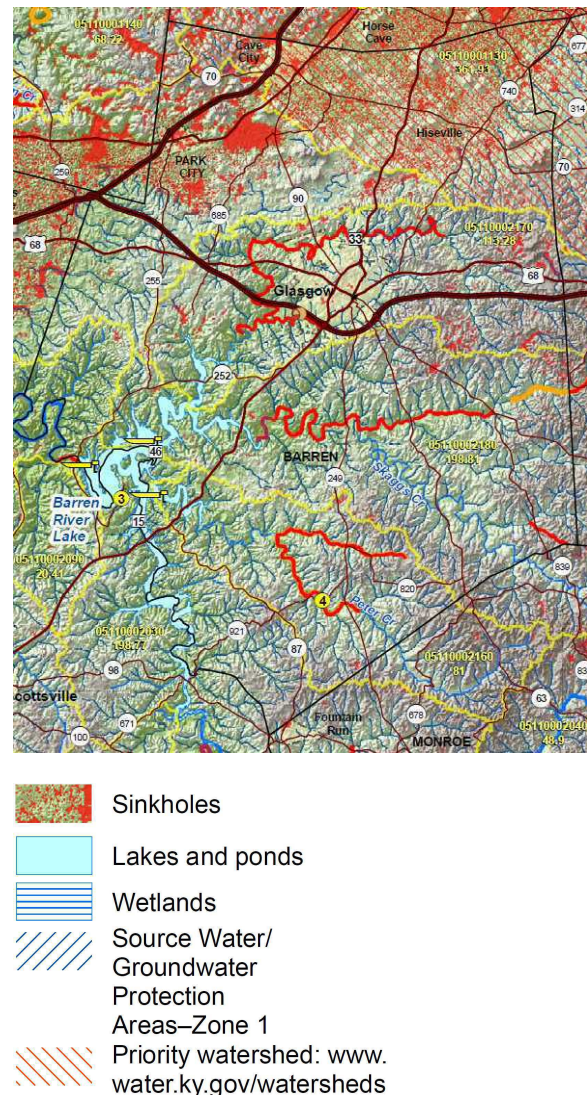
Source: State of Kentucky's Environment Report 2001

Barren County is located in the Barren River watershed, largest in the Green River Basin, which drains approximately 2,262 square miles. Much of this watershed has ill-defined surface drainage with some surface streams becoming subterranean at points. The Barren River itself is not free flowing. Most of it is controlled by the Barren River Reservoir, one of the 4 multi-purpose dams in the River Basin. The Green River Basin contains 9,230 square miles, including 410 in Tennessee. On average, about 7,160 million gallons per day (mgd) flow out of the Green River Basin. Figure 7.5 illustrates the section of Barren County located within the Green River Basin. Map 7.3 shows the major individual watersheds within Barren County.

AIR QUALITY

There are numerous sources of air pollution, including point (smokestack), mobile (automobile and off-highway vehicle exhaust), and area sources (small paint shops, gas stations, open burning). The Federal Clean Air Act (CAA) of 1970, along with modifications in 1977 and amendments in 1990, has significantly improved the quality of air Kentuckians breathe. The CAA specifies controls for six criteria pollutants that can cause serious threats to human health and ecosystems and consequently are the primary focus of federal and state air pollution programs.

Figure 7.5:
Green River Basin in Barren County

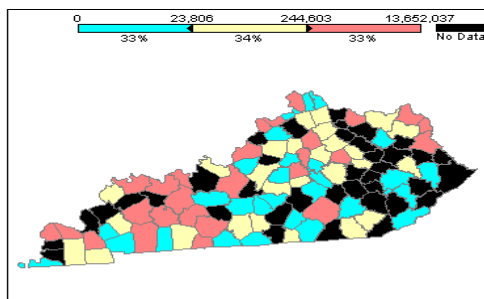


Source: University of Kentucky Geological Survey, Map and Chart 189, Series XII, 2009

The Kentucky Division for Air Quality (DAQ) operates a network of 98 air monitoring stations in 34 counties. These stations provide data used by the Environmental Quality Commission to track yearly average concentrations of air pollutants, such as sulfur dioxide, nitrogen, ozone, fluorides, hydrogen sulfide, and particulates, in Kentucky. As of 2018, Barren County is in compliance with air quality standards. Mammoth Cave National Park also operates an air monitoring station within the park and data results can be obtained in real time from their website at: <http://www.nps.gov/macai/index.htm>.

In 2012 more than 78 million pounds of air toxins were released into the air by 431 reporting Kentucky industries. Approximately 24,471,833 pounds of the 1990 state total were highly toxic chemicals. The 13 highly toxic chemicals range from Benzene to Xylenes. Figure 7.6 indicates industrial toxic chemical releases to land, air, and water within Kentucky. Further information may be obtained from the *State of Kentucky's Environment 2001: A Report on Environmental Trends and Conditions*.

Figure 7.6:
Industrial Toxic Releases to Land, Air, and Water in Kentucky



Source: Kentucky Department for Environmental Protection, Toxic Chemical Release Inventory Data, 2006

Radon Gas is another air quality issue that many Kentuckians are vulnerable to. Radon is a colorless, odorless gas that occurs naturally in the environment in rocks and soils. Radon gas becomes an indoor air pollutant when it enters buildings through cracks in foundations and basements and becomes trapped. It is also found in building materials and well water, and is most acute in areas with poor ventilation.

From 1998 to 2008 the Kentucky Radon Program conducted and collected Radon test and samples across the state. Radon gas levels were measured in 425 randomly chosen homes in Barren County. Radon levels of greater than 4.0 pCi/L (Pico Curies per Liter of air) indicates dangerous levels of Radon gas. The results showed that on average Barren County had an average 6.23 pCi/L, with 44% exceeding the standard threshold of 4.0 pCi/L, see Figure 7.7. Various regions have differing radon levels due to the area's geological characteristics which are associated with naturally occurring radium and uranium.

Figure 7.7:
Radon Gas Levels by Regions

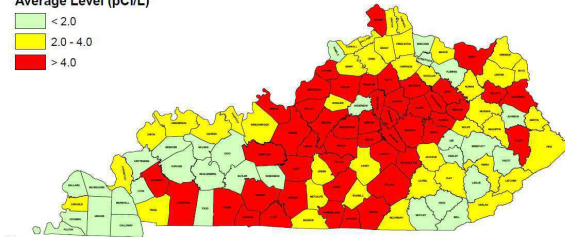
Kentucky Radon Map

Average Radon Levels by County

Legend

Average Level (pCi/L)

- < 2.0
- 2.0 - 4.0
- > 4.0



Notes:
The amount of radon in the air is measured in "picoCuries per liter of air" or "pCi/L".
The risk of contracting lung cancer from radon depends on how much radon is in your home, the amount of time you spend in your home, and whether you are a smoker or have ever smoked.
The EPA recommends to take action to reduce radon in your home if the level is 4 pCi/L or higher. Even radon levels below 4 pCi/L pose some risk because there is no safe level of radon.
Source: EPA, "A Citizen's Guide to Radon", January 2009

pCi/L stands for Pico Curies per liter of air. This measurement is used to determine radioactive levels. Source: WKU Department of Environment, 2019.

CLIMATE

The climate of Barren County is generally temperate, with a wide range of temperature between winters and summers. Although August is the driest month, on the average, precipitation is generally well distributed throughout the year. Temperature, rainfall, and humidity remain within the levels suited for various plant and animal types. The average annual temperature is 56.3 degrees Fahrenheit (°F) according to the Kentucky Mesonet website. The nighttime temperature drops to freezing (32°F) or below on average 96 days of the year. Since the mercury rises to above freezing on all but about 12 of these days normally, a daily freeze-thaw cycle is expected. A temperature of zero or below occurs, on an average, 1 day per winter. See Table 7.2 for monthly historical (1895-2019) temperature averages versus 2018 averages. In Barren County, the average length of the growing season (from the last freezing temperature in the spring to the first of fall) is roughly 180 days in any given year as critical temperatures differ between different crops.

Table 7.2:
Monthly Temperature Average:
Historical (1895-2018) vs. 2018

| Month | Historical Avg. (°F) | 2018 Avg. (°F) |
|-----------|----------------------|----------------|
| January | 34.2 | 30.3 |
| February | 38.2 | 45.3 |
| March | 46.7 | 45.1 |
| April | 56.2 | 51.4 |
| May | 64.8 | 72.3 |
| June | 73.1 | 76.3 |
| July | 76.6 | 77.1 |
| August | 75.6 | 76.4 |
| September | 68.5 | 73.1 |
| October | 57.4 | 59.2 |
| November | 47.3 | 42.4 |
| December | 37.1 | 41.4 |

Source: Kentucky Mesonet Site

Barren County averages 49.73 inches of rainfall per year. Measurable precipitation occurs about 120 days during the average year. In some years precipitation can be either inadequate or excessive. Thunderstorms occur, on an average, 50 days per year. They are most frequent during spring or summer, but may occur in any month. Thunderstorms will cause most of the high-intensity rainfall of short duration that is likely to occur during summer. In almost every year the greatest 1 hour rainfall total will be 1.2 inches on average. There is a 30% chance that such a rainfall will occur in July of any year and a chance of less than 1% that such a rainfall will occur from December through February. Table 7.3 shows the comparison between monthly historical precipitation averages and 2018. Lower intensity rainfall that lasts several days occasionally occurs during late spring and may delay soil tillage. Long periods of mild, sunny weather are typical in fall when they are needed to permit completion of harvesting, see Table 7.4.

Barren County averages 11 inches of snowfall per year historically. However, the mean snowfall over the last thirty years has been 6.3 inches which is a more likely indicator of what can be expected on any given year. On average, 11 days during year have a snowfall of 1 inch or more. Snowfall is significantly variable year to year and some winters have little to

no accumulation. Snowstorms are recognized more for the disruptions they create than for the damage they cause as they can bring local and regional economies to a standstill, cutting off surface and air transportation and by downing communication and power lines.

Table 7.3:
Monthly Precipitation Average:
Historical (1895-2018) vs. 2018

| Month | Historical Avg. (inches) | 2018 Avg. (inches) |
|-----------|--------------------------|--------------------|
| January | 3.68 | 2.39 |
| February | 3.94 | 9.52 |
| March | 4.40 | 5.66 |
| April | 4.22 | 4.14 |
| May | 5.55 | 4.24 |
| June | 4.21 | 6.78 |
| July | 4.45 | 3.55 |
| August | 3.49 | 5.01 |
| September | 3.59 | 7.42 |
| October | 3.51 | 3.44 |
| November | 4.07 | 6.41 |
| December | 4.63 | 5.31 |

Source: Kentucky Mesonet Site

Table 7.4:
Historical Climate Data
Precipitation by Climate

| Climates | High (in.) | Year | Low (in.) | Year |
|----------|------------|------|-----------|------|
| Annual | 68.96 | 1979 | 34.27 | 1963 |
| Winter | 25.96 | 1979 | 5.42 | 1963 |
| Spring | 24.48 | 1983 | 8.07 | 1987 |
| Summer | 21.79 | 1971 | 6.81 | 1980 |
| Fall | 19.20 | 1975 | 3.29 | 1953 |

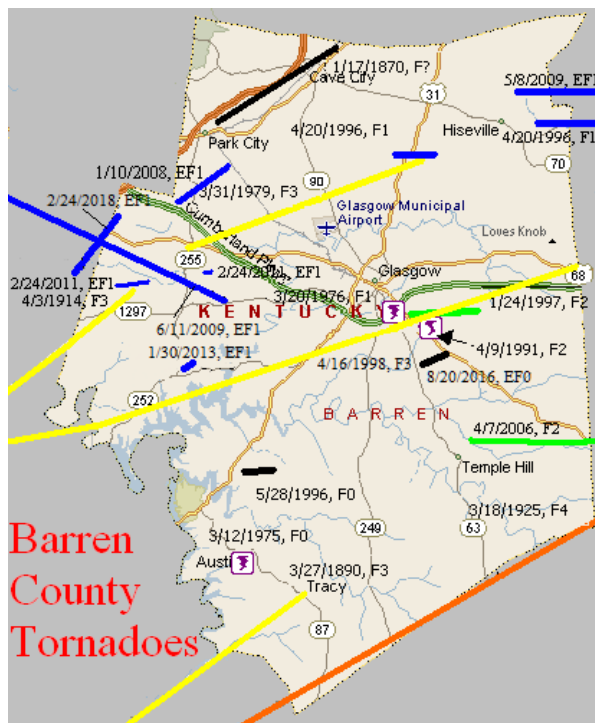
Source: Kentucky Climate Center

Winds blow primarily out of the south to southwest. Wind speed is lowest in the months of June through October, averaging monthly from 6 to 8 mile per hour (m.p.h.). Wind speed is highest from November to May, averaging monthly from 9 to 11 m.p.h.

Damaging winds are classified as those of 50 knots (58 miles per hour) or stronger. The most active year for storms producing damaging winds was in 2000 when reports of high winds were documented on 15 days. According to the Kentucky Climate Center, from 1955 to 2000, Barren County has had 37 days of damaging winds with 50 knots or better. Rises and falls of relative humidity are opposite to those of temperature during the typical day, the highest humidity normally occurring with the lowest temperature of the day and the lowest humidity with the highest temperature of the day.

Tornadoes, however infrequent, do occur occasionally throughout Barren and surrounding counties. According to the National Oceanic and Atmospheric Administration's (NOAA) National Weather Service, from 1870 to 2018, 16 tornadoes have occurred in Barren County. In Figure 7.8, tornado paths of Barren County have been identified. These paths are generally in the direction of the south to northeast. Injuries and fatalities have occurred with these tornadoes, as a result there have been 233 injuries and 55 fatalities due to these storm events according to the National Oceanic and Atmospheric Administration (NOAA).

Figure 7.8:
Recorded Tornado Paths



Source: www.noaa.gov, 2019

HAZARD MITIGATION PLANNING

According to the Federal Emergency Management Agency (FEMA) the definition of hazard mitigation planning is “the process of determining how to reduce or eliminate the loss of life and property damage resulting from natural and human-caused hazards.” In the past the reaction to disasters has always been one of response and recovery. With dwindling state and federal resources and ever increasing insurance premiums, the ability to fund these efforts is becoming more difficult. FEMA has begun to change its approach from being reactive to more proactive.

Hazard mitigation planning efforts are now being required of local communities, as a condition to receive funding for recoveries should a disaster occur. Through planning the impact of disasters, both in the loss of life and the cost of property replacement or repair can be reduced. The hazard mitigation planning effort will identify risks and set objectives to help minimize the impact of those risks. While some efforts might require funding, such as the relocation of families out of floodplains or the construction of tornado shelters, many efforts would only require policy changes on the part of local government. For instance, not allowing construction in floodways or near sinkholes to reduce damage from flooding or subsidence, examining building code requirements that would improve the public safety and welfare in the event of high winds or earthquakes, and better education and information could be disseminated to help homeowners prepare for disasters. In addition, various potential hazard areas could be identified and mapped by the use of local Geographic Information System (GIS) data.

The Barren River Area Development District (BRADD) has assisted with the development of a Hazard Mitigation Plan for Barren County. The BRADD will support the efforts of the community to develop a plan that will identify potential natural hazards, examine deficiencies and current policies, and develop mitigation goals and objectives. The Mitigation Plan will need to be constantly examined and updated and expanded to include human caused hazards, especially terrorism. Some of the mitigation objectives are tied directly to the physical development of the community requiring close communication between emergency management agencies, local building code officials, and the planning commission.

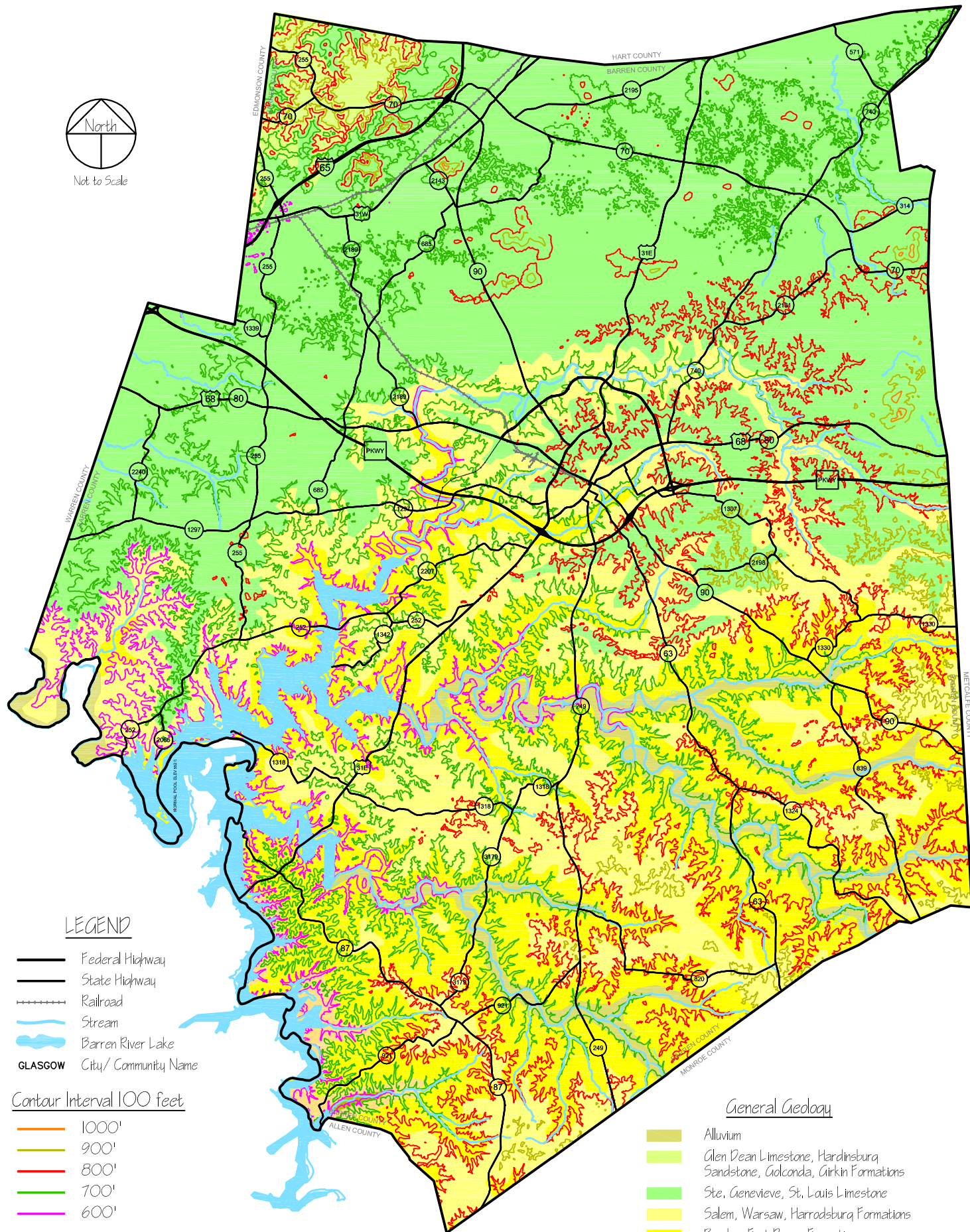
RECOMMENDATIONS

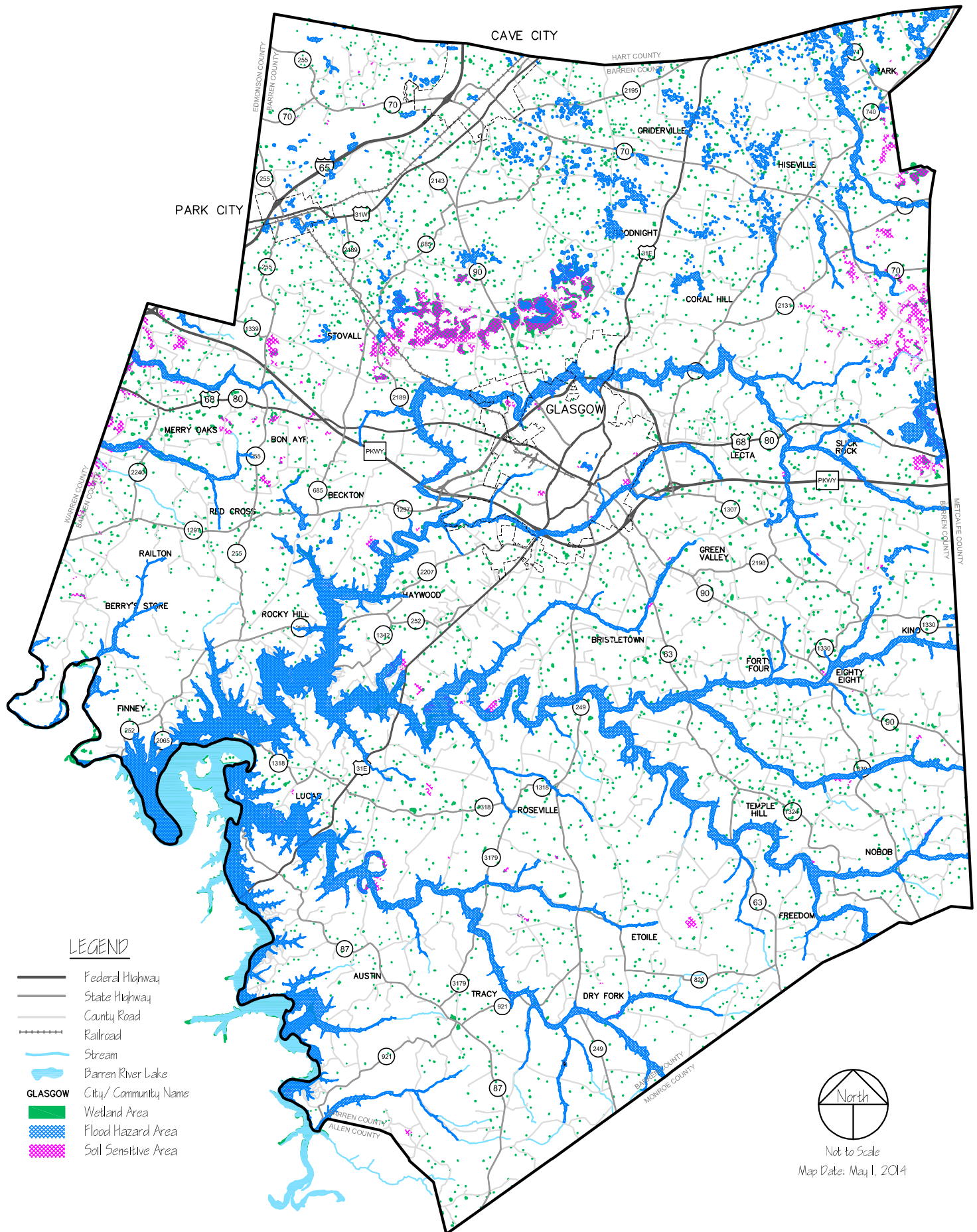
- ❖ All new development must consider and minimize any possible adverse impacts on the natural environment and on other activities in the community.
- ❖ Commercial and industrial development should consider its effects on ambient air quality in the vicinity of the development and take appropriate steps to mitigate negative impacts on air quality.
- ❖ Barren County must reduce the volume of material disposed of in the land fill. This could be greatly enabled by the encouragement of the eco-industrial park concept where waste products of one industry would become the raw materials of another industry.
- ❖ Local governments should actively support the Mammoth Cave Area International Biosphere Reserve Program.
- ❖ Each individual jurisdiction should be encouraged to adopt flood prevention/storm water management and water quality ordinances for their jurisdiction.
- ❖ Prepare a Floodplain Management Program for all jurisdictions through their combined effort.
- ❖ Review new building construction in accordance with locally adopted building code regulations in an effort to protect the public health, safety, and welfare and adopt the International Building Code to help in the reduction of the ISO rating.
- ❖ Adopt the policy of requiring all new residential, commercial and industrial construction to be at two feet (2') above the base flood elevation when within the identified flood hazard areas from the FEMA Flood Hazard Maps.
- ❖ Review the strategy of having a county wide Fly-Over using GIS Topographic LIDAR technology in an effort to have precise two foot (2') contours for the entire County and all Cities.
- ❖ Re-evaluate regulations to stop permanent construction within designated flood hazard areas, within wetland areas, on slopes over 15% grades, and within areas directly adjacent to creeks and streams.
- ❖ Support the continuation of the county-wide solid waste collection and disposal plan with an eco-friendly disposal.
- ❖ Support, encourage and assist farmers, loggers and developers to adopt erosion and sediment control measures to address water quality issues.
- ❖ Preserve soils within prime agricultural areas.
- ❖ Develop Karst-sensitive Best Management Practices (BMPs) that strive to strike a balance between the need for minimized impairment of water quality and the economic and cultural needs of residents.
- ❖ Better educate and inform individuals of the importance of leaving streams in their natural state avoiding the temptation to channelize them, clear their vegetation, straighten them out, dig up their gravel bars and control their flows.
- ❖ Advocate a strong, regional recycling program.
- ❖ Test residential groundwater at least once a year.
- ❖ Ensure features of Barren County are preserved as development occurs, such as: rolling hills/woodlands/wildlife, well-defined urban areas bound by rural landscapes, significant environmental features, and natural look along roadways.
- ❖ Aggressively provide means to identify and protect areas of endangered species in Barren County.
- ❖ Actively seek to preserve and enhance scenic and natural features in development review.
- ❖ Identify roads and areas that serve as valuable scenic assets to the County.
- ❖ Coordinate planning efforts and evaluate environmental conditions with the Barren County Conservation District, Barren County Health Department, other state and federal agencies, local governmental agencies, local public and private organizations, and the general public.
- ❖ Environmental assessments shall include locating floodplains, unique environmental areas, air flow patterns, steep slopes, sensitive soils, air quality, and potential solar access.

ENVIRONMENTAL STRATEGIES

Strategy 1: Develop a Community Environmental Plan to identify environmentally sensitive lands and habitats, green space areas, wetlands, prime scenic areas, marsh lands, and floodplains. This plan should incorporate ways to develop sustainable communities and also identify short and long term environmental issues which will affect Barren County as it develops.

Strategy 2: Develop a local Floodplain and Stormwater Education Plan that would identify community risks from potential hazards, examine deficiencies of current local policies, and prepare a plan of action for future disasters and more transparent understanding of what each plan entails.





Sources: FEMA Digital Q3 Flood Data
Barren County Soil SSURGO Database
Kentucky Natural Resources & Environmental Protection Cabinet

2019 Comprehensive Plan

Map 7.2: Barren County Environmental Sensitive Areas

