Chapter 3 - Environment

ENVIRONMENT

A. Steep Slopes

A slope is considered to be steep when it has a slope of 25% or greater with respect to a horizontal plane. The steep slopes of Berks County are depicted on the Steep Slopes map (Figure 03). Steep slopes are scattered throughout the county, with the greatest concentrations being found in the extreme northern portion associated with the Blue Mountain along the Kittatinny Ridge, the southern portions comprised of the rolling hills of the Lowlands, and the eastern portions of the Reading Prong. Most of the steep slopes are heavily-wooded, and are a prominent element of the landscape. These forested slopes, hills and mountain ridgelines help define our scenic views, and are an essential source of the county's drinking water, wildlife habitat and recreational opportunities. The Kittatinny Ridge is a world-renown migration flyway used by raptors and other birds, and is home to Hawk Mountain Sanctuary, an international center for raptor conservation, education, observation and research.

View of the Blue Mountain in Upper Tulpehocken Township

Problems associated with steep slopes are numerous and need special consideration. It is important that steep slopes be protected from erosion, pollution, and development. The most common problem associated with steep slopes is the hazard of erosion, particularly if the slope is disturbed. In the most severe cases, slopes will erode so rapidly that they form destructive landslides. When steep slopes are disturbed, they can produce heavy soil erosion and sediment loading in streams. This, in turn can trigger a cycle of erosion and deposition all the way down to the stream mouth. When rain strikes a steep slope, it runs off rapidly. Excessive erosion and sedimentation has indirect impacts as it can damage aquatic habitats in streams and lakes and it can dramatically reduce reservoir storage capacity. Since steep slopes serve as the headwaters for our streams, they play an important role in the quality of our drinking water supply.

The hazard of erosion can be natural but much of the time it is caused by human influence. Construction on a steep slope requires extensive grading and therefore, the disturbance of the soil and vegetative cover protecting the slope increases the erosion hazard. Development also results in the alteration of natural drainage patterns and the formation of impervious surfaces. Impervious surfaces greatly magnify surface runoff. Topographic constraints often result in roads that are steep, winding, and narrow. These types of roads can pose safety problems with blind curves and steep driveways creating accessibility issues for visitors, residents, and emergency service vehicles. Septic systems for on-lot sewage disposal are impractical on steep slopes due to the rapid downhill flow of improperly treated effluent. Therefore, construction on steep slopes is often difficult, costly, and not a sound planning practice.

The topographic and geological qualities of steep slope areas often create a variety of unique vegetative communities and wildlife habitats. For these ecological reasons steep slope areas require protection in order to preserve biodiversity. Undisturbed steep slopes and their ridgelines have general aesthetic values to many communities due to their visibility. They create a sense of spatial enclosure, contribute to a community's sense of identity, and provide recreational opportunities.

Moderate slopes, between 15% and 25%, can also yield heavy soil erosion and sediment loading of streams. Therefore, many of the same concerns outlined for steep slopes apply to moderate slopes. Moderate slopes are unsuitable for intensive development, and require special design restrictions for the construction of structures, roads, stormwater management facilities, and sewage disposal systems.

B. Woodlands

The Forested Areas map (Figure 04) identifies those areas of forest cover which are of significant size. One of the most prominent, contiguous areas of forest cover in the county is the Blue Mountain Region, which is found along the northern boundary of the county, and includes a portion of the Weiser State Forest. Deciduous trees are the most prevalent types found in this area and in the rest of Berks County. The most common deciduous species in Berks County are the Maple, Beech, Oak and Hickory. Coniferous species in the county, an example being the Hemlock, often favor stream valleys in

mountainous and hilly areas. Another prominent area of forest land is the Hopewell Big Woods (HBW). HBW is in the vicinity of French Creek State Park, which is located in the southeastern portion of the county. Forested land in District, Pike and Rockland Townships, commonly referred to as the Oley Hills is also a large forested area that is home to five pristine watersheds. However, the wooded areas in these two regions have been fragmented by low density development and agricultural activities.

Among the many uses and functions of a forest, perhaps its greatest benefits, are its ability to filter pollution, purify, and cool the air in the summer. Woodlands also help stabilize slopes, reduce erosion, provide riparian buffers, muffle noise, absorb odors, and serve as land use buffers. Forests are also extremely important areas for native vegetation, bird and wildlife habitats, and provide recreational opportunities. There are also the economic benefits of forests associated with commercial timbering, provided proper forest management principles are implemented.

C. Geology

The geology of Berks is both unique and fairly complex. This is visible on the Geology Map (Figure 05). Underlying Berks County are formations that developed millions of years ago and in various geological time periods. The chronology includes the Precambrian Era and the Cambrian, Ordovician, Silurian, Triassic, and Jurassic Periods. The Cambrian, Ordovician, and Silurian Periods are from the Paleozoic Era, while the Triassic and Jurassic Periods are from the Mesozoic Era. Formations in the Jurassic Period are those which developed most recently while formations in the Precambrian Era developed earlier in Earth's history.

The oldest formations in Berks County derive from the Precambrian Era. Formations from the Precambrian are comprised of various types of Gneiss and occur throughout the eastern central portion of the county, with a smaller area found in the western central region, south of Robesonia and Wernersville Boroughs. Formations in the Precambrian are fairly poor aquifers due to the dependency of secondary openings in the parent material.

Formations from the Cambrian Period are found in a band traversing Berks County from the central west border to the central northeast border. This band is thin in the central western portion and thicker in the central eastern portion of Berks County. They are also found sporadically throughout the eastern central region of the county and along the extreme southern border. Formations in the Cambrian Period comprise the majority of the limestone areas of the county. The majority of the formations are composed of various gray limestone and dolomites. A few formations are mainly composed of quartzite. These are some of the best groundwater yielding areas in Berks County, especially the Allentown Formation which is one of the best water yielding limestone in the area.

The most distinguishing characteristic of the formations in the Cambrian Period is the abundance of surface depressions and solution cavities. Due to the relative purity of the limestone that comprises the formations, and the fact that this limestone is soluble in water, it is susceptible to being dissolved by the action of percolating water. Once water enters the soil and reaches the limestone, the calcium carbonate in the limestone will be dissolved. This dissolving of calcium carbonate rock creates a sinkhole. Caves can also occur when large amounts of rock are dissolved.

Berks County has many caves around the northeast portion of the county. Some of the more famous caves of the county are Crystal Cave, Onyx Cave, Schofer's Cave, Temple Cave, Hobo Cave, Dragon Cave, Dreibelbis Cave, and Pinnacle Cave. Some of these caves such as Dragon Cave have a rich background of folk and Indian lore. Most of the caves listed above have been closed due to safety issues. However, Crystal Cave is still commercially open. Onyx Cave is privately owned and is accessible for educationally oriented visits.

The most abundant formations in Berks County are found in the Ordovician Period. These formations comprise the majority of the northern portion and extend into the northern central portion of the county. Sporadic areas are found in the south central and eastern central portions of the county. They are mainly composed of shales and limestones, with some sandstone present. The materials are mostly gray in color, with some appearing almost black. Formations from the Ordovician Period, such as the Martinsburg Formation, are considered to be moderate suppliers of groundwater. The Beekmantown Group and Hershey and Myerstown Formations, made up of limestone and dolomite, can produce large amounts of groundwater if a channel or fracture in the rock is found.

Formations from the Silurian Period occupy the extreme northern border of Berks County. These formations underlie and give rise to the Blue Mountains-Kittatinny Ridge. Formations from this period are composed predominantly of sandstones and shales. These rocks are gray and tan in appearance and are often exposed on the surface.

Formations from the Triassic Period are found predominantly in the southern portion of Berks County. Additional areas exist along the extreme eastern boundary of the county which includes portions of Colebrookdale Township through Hereford Township. Formations from this time period are comprised predominantly of quartz conglomerate, sandstones, mudstones, limestones, and shale. A few of the formations found in the Triassic Period include the Brunswick Formation, Hammer Creek Formation and conglomerate, and Stockton Formation. These materials often appear red and gray in color, explaining the reddish hue to the soils found in these areas. The formations from the Triassic generally yield relatively good amounts of groundwater.

The Jurassic Period for Berks County includes two formations. The two formations found are Diabase and Sedimentary strata at Jacksonwald and Aspers. The main geologic composition for this period is diabase and sandstone. The Jurassic Period formations are found in various small, scattered bands throughout the Triassic Period.

The various formations discussed all represent the composition of the county below the soil surface which is visible on the land surface. For instance, the northern edge of the County is made up of the Blue Mountains that are underlain by formations from the Silurian Period. Conversely, many of the rich agricultural valleys, such as those in the eastern portions of the county, are underlain by limestone, which gives the soil its agriculturally productive characteristics.

The highest point (1690 ft.) in Berks County is located in Bethel Township, in the extreme northwest portion of the county, and is part of the Blue Mountain-Kittatinny Ridge. This peak is just to the west of where SR 183 crosses the Blue Mountain. The most prominent geologic feature in the county is known as the Pinnacle, located along the Kittatinny Ridge in Albany Township. The elevation at the top of this sandstone ridge is 1,615 feet above sea level and is a scenic overlook. The Appalachian National Scenic Trail passes closely by both of these high points, as it traverses 29 miles along the spine of the Kittatinny Ridge in Berks County. Another geologic feature found in the vicinity of the Pinnacle is the Blue Rocks. These are large sandstone boulders that have moved down the sides of the mountains above, forming a glacier of rock.

Due to the complexities of the geologic formations of Berks County, it is difficult to predict what the potential groundwater yield is on a site specific basis. However, each type of geology has an average potential groundwater yield, measured in gallons per minute (gpm) associated with it.

Essentially, all of the rocks within the county have openings that contain and transmit water. However, few have primary openings (i.e. voids as a result of original deposition) that are great enough to store and transmit large quantities of water. Secondary openings, (joints, bedding planes, fault planes or zones, schistosity) especially those which have been subsequently enlarged by erosion, which have occurred after the rock was deposited, will account for most of the high yield wells in the county. The more secondary structures transgressed by a well, the better opportunity for large quantities of water.

D. Soils

Soil is the unconsolidated mineral material on the earth's surface, which has been subjected to physical and chemical action over time. Soils are mostly derived from the parent material that underlies them. This parent material gives the soil its specific characteristics. These characteristics may, for example, consist of deep well-drained limestone based soils, or thin poorly drained soils produced from gneiss.

A soil may have moved from its original place of formation through various forces. A soil that has been deposited by the flow of a river or stream is called an alluvial soil. These soils often consist of silt and gravel and will accumulate in depth over time as the river or stream continually deposits material. The force of gravity can also cause a soil to move. Soils that have moved down the sides of hills or mountains in this manner are called colluvial soils. As the material on the higher and steeper slopes of a hill or mountain becomes weathered into soil, it will accumulate and slowly (or occasionally quite rapidly) move toward the base of the mountain. Another force that can move soil is wind. This is particularly evident in very dry regions. This soil, called loess, consists of very fine particles that become airborne due to dry, windy conditions and lack of vegetative cover.

Soils with similar characteristics are grouped into a soil series. There are 44 soil series within Berks County that are described in the *Soil Survey of Berks County, Pennsylvania* which is completed by the National Resources Conservation Service and the National Cooperative Soil Survey, in coordination with the Berks County Conservation District. Soils are also broken down by class. There are eight classes in all, beginning with I and ending with VIII. Class I soils have few limitations that restrict their uses while Class VIII soils are limited in their uses to such things as recreation, wildlife habitat and aesthetic purposes due to hazards such as steep slopes and erodibility. There are no Class V soils in Berks County.

Berks County has both good and poor soils. A large portion of the County consists of agriculturally productive soils, Class I through IV, as evident on the Agricultural Soils map (Figure 06). The limestone belt found across Berks and the area of limestone concentrated in the eastern central portion of the county, primarily in Oley Township, yield the greatest amounts of Class I soil. The Oley Valley is one of the most productive agricultural areas in the county. The soils of the Oley Valley are derived from the underlying limestone. The reason these soils are so productive is due partly to the geologic characteristics of limestone. Limestone allows soil to percolate water rather rapidly, preventing flooding and excessively high water tables.

Limestone soils are generally deep and the limestone rock allows a soil derived from it to maintain a fairly neutral pH level. This is due to limestone's basic composition of calcium carbonate. Calcium carbonate tends to neutralize acids which provide the soils derived from it a natural buffer against acidic infiltration. Another benefit of a good soil is its ability to filter percolating water, and provide clean, sub-surface aquifers. This process of recharging groundwater supplies is best achieved on Class I and II soils.

Even though a soil may be considered as Class I, it may still have problems that limit its use. The limestone soils, while being one of the most productive agriculturally, can be very hazardous if used inappropriately.

There is a band of sinkhole-prone areas traversing the county that overlies the limestone band. There is also an area of sinkhole-prone soils in and around Oley Township. A sinkhole is the common name given to a depression in a limestone soil surface. These depressions can vary in size and may open in the bottom exposing cavities in the bedrock below. A sinkhole develops when underground channels and cavities, formed by water percolating through the soluble limestone bedrock, collapse allowing the soil lying above to fall into them. The development of a sinkhole is usually gradual but can be fairly rapid. A heavy rain may expose an underground cavity in a matter of hours, causing soil to occupy the void and leave a depression or sinkhole.

A sinkhole can be a problem for on-lot septic systems. Since a sinkhole allows for very rapid percolation of water and functions as a direct link to underground water supplies, a sinkhole located in the vicinity of a septic system may allow for the flow of untreated wastes into an underground water supply. Any material (garbage, chemicals, etc.) when deposited in or near a sinkhole may eventually find its way to groundwater supplies.

Another problem with soils in Berks County is the infiltration and percolation of water. Soils that are wet, shallow, or on steep slopes need to be studied carefully before being used. Unfortunately, development on unsuitable soils occurs and the results can be disastrous. A housing development started on a soil, which at first seems to be appropriate, could, due to the soil association and class (as described above), become inundated with excess runoff. This scenario could be avoided by better knowledge of soil characteristics.

E. Mineral Resources

Historically, iron-ore, which occurs as magnetite, limonite (brown hematite), and red hematite, is the most important of the county's abundant mineral resources. Magnetite, averaging 50% iron, was mined throughout the eastern portion of the county, and was used extensively by the many early iron furnaces. Considerable resources still exist in the vicinity of Boyertown, where the State's first iron furnace was established in 1720. The Bethlehem Steel Company had large-scale magnetite mining operations near the southern tip of the county around the Morgantown area. Limonite, which is more abundant than magnetite, was mined in numerous locations. Red hematite has also been found in scattered locations, but none in mineable quantity.

Trap rock and limestone are quarried extensively and crushed for use as concrete aggregate and railroad ballast. The

principal trap rock quarry is near Douglassville, while limestone is quarried near Kutztown, Temple, Leesport, Oley, and Evansville. Stone from the latter two locations is used for manufacturing Portland cement at Evansville. Quarry locations are depicted on the Quarries map (Figure 07).

Mining of materials has proven itself vital to Berks County. In the future, it is likely that this industry will continue to be a very valuable part of the county. The table below illustrates the annual yield of surface mined materials for 2015.

Municipality	Site Name	Tonnage	Mineral	Permitted Acres
Alsace	Highway Materials Temple Quarry	157,592	Sandstone	190
Colebrookdale	Martin Stone Bechtelsville Quarry	1,488,631	Sandstone	349
District	Rolling Rock Building Stone Quarry	7,033,823	Limestone	427
Douglass	Haines and Kibblehouse Douglassville Quarry	676,745	Diabase, Hornfels	244
Lower Heidelberg	Glen-Gery Lower Heidelberg Quarry	548	Shale	181.6
Maidencreek	Lehigh Cement Evansville Pit and Quarry	828,730	Limestone, Other Sedimentary	329.9
Maxatawny	Berks Products Kutztown Quarry	600	Limestone	38
Maxatawny	Eastern Industries Kutztown E Quarry	731,400	Limestone, Shale	47
Maxatawny	Eastern Industries Kutztown Quarry	15,000	Limestone	205
Oley	Lehigh Cement Oley 1 Quarry	735	Limestone	91.1
Oley	Lehigh Cement Oley 2 Quarry	735	Limestone, Other Sedimentary	180.2
Oley	Lehigh Cement Oley West Quarry	686	Limestone, Other Sedimentary	160.8
Oley	Eastern Industries Oley Quarry	32,900	Limestone	675
Ontelaunee	Berks Products Ontelaunee Quarry	774,226	Limestone, Topsoil	351
Perry	Shoemakersville 1 Quarry	74,381	Shale	115
Perry	Shoemakersville 2 Quarry	62,589	Shale	225
Perry	Shoemakersville 3 Quarry	507	Clay, Shale	184
Richmond	Lehigh Cement 5 Quarry	1,416	Limestone	202.1
Robeson	Dyer Quarry	527,577	Diabase, Subsoil, Topsoil	323
Robeson	Haines and Kibblehouse Birdsboro Quarry	1,571,386	Diabase, Sandstone, Shale, Topsoil	289.6
Washington	Martin Stone Gabel Quarry	82,480	Gneiss, Other Sedimentary, Topsoil	96

Source: PA Department of Environmental Protection

F. Water Resources/Features

Berks County has numerous water resources within its borders. This resource has been very important in the county's past and will continue to be important in the county's future. This invaluable resource has many benefits for the whole of Berks County.

Surface water is comprised of rivers, streams, ponds, and lakes. These waterways and surface impoundments provide for water withdrawals which are used for domestic, industrial and agricultural purposes. Surface water also provides habitat for aquatic plant and animal life; attracts migratory waterfowl; provides recreation in the forms of boating, fishing, swimming and aesthetic appreciation of nature; and the absorption of treated waste water effluent. Surface water occupies 6,467 acres or approximately 1% of the county's total land area.

Berks County is divided into thirteen Act 167 state-designated watershed drainage basins as shown on Water Resources map (Figure 08). A drainage basin is an area that surrounds a particular stream or river and delivers its surface water runoff and groundwater flow to that stream or river. The Schuylkill River drains the majority of the county and eventually empties into the Delaware River and Delaware Bay. Other streams in northwestern and southwestern Berks County drain into the Susquehanna River and Chesapeake Bay.

The county is drained by a network of streams, the majority of which empty into the Schuylkill River and eventually drain to the Delaware River. In addition to the Schuylkill River Watershed, two and one-half percent of the county land area also drains to the Delaware River, but via the Little Lehigh Watershed and Lehigh River. The Delaware River Basin Commission (DRBC) manages the water resources within these two sub-watersheds. DRBC programs include water quality protection, water supply allocation, regulatory review, water conservation initiatives, watershed planning, drought management, flood loss reduction, and recreation. Approximately 10% of the county land area drains into the Susquehanna River, and eventually the Chesapeake Bay, through the Swatara, Conestoga and Cocalico Watersheds. The Susquehanna River Basin Commission manages the water resources in these watersheds much like DRBC.

The major watercourse in the county is the Schuylkill River. The Schuylkill River enters Berks County through the Blue Mountain Gap near Hamburg Borough and traverses centrally through the county in a south and southeasterly direction before exiting the county near Douglassville.

Two major tributaries to the Schuylkill River, the Tulpehocken Creek and the Maiden Creek, are dammed and used as public water supplies. The Tulpehocken Creek Watershed drains over 140,000 acres and has 19 named streams which contribute water flow to the Schuylkill River.

The Maiden Creek Watershed drains over 138,000 acres and also has numerous named streams which contribute water flow to the Schuylkill River. Other major tributaries to the Schuylkill River include the Allegheny, Hay, Antietam, Irish and Monocacy Creeks.

G. Important County Water Bodies

Blue Marsh Lake from State Hill overlook

Berks County contains two lakes of significant size. Lake Ontelaunee, formed by a dam on the Maiden Creek, is found in the northern central portion of the county, lying in Ontelaunee and Maidencreek Townships. Lake Ontelaunee is a 1,082 acre man-made lake. This reservoir was developed in 1926 by the City of Reading for water supply, but is also a popular venue for fishing, hiking and other passive recreational activities.

Blue Marsh Lake, formed by a dam on the Tulpehocken Creek, is located in the central western portion of the county. Completed in 1979, Blue Marsh is a 1,150 acre lake built and maintained by the U.S. Army Corps of Engineers. The dam was authorized by Congress for flood control, water supply, water quality and recreation. Blue Marsh Lake is the major water supply for the suburbs located west of the City of Reading. The reservoirs' water control practices benefit downstream communities including Reading, Birdsboro, Pottstown and Philadelphia.

There are a vast number of streams and springs that traverse Berks County in a "branching pattern". The Schuylkill River provides the major source of drainage in the area. The various streams drain small areas of the county but most eventually empty into the Schuylkill, contributing to its overall flow.

Of the various other water features in Berks, the Maiden Creek and Tulpehocken Creek are two of the most prominent. Both creeks provide important sources of drainage in the county, and provide sources of recreation and species habitat. The majority of the Berks County Parks System lies along the Tulpehocken Creek. The Tulpehocken is a widely recognized trout stream, supporting a variety of these and other fresh water species.

The Commonwealth of Pennsylvania has classified all surface waters according to water uses and water quality criteria which need to be maintained to prevent water quality degradation as defined by federal regulations. This classification system is known as Pennsylvania's Water Quality Standards and is implemented through the Pennsylvania Code, Chapter 93 and Chapter 95. Streams with excellent water quality have been designated by the state as High Quality waters (HQ) or Exceptional Value waters (EV). These streams or watersheds require special water quality protection. Berks County

is fortunate to have numerous HQ and EV streams, and the list continues to grow. While HQ and EV streams are found throughout Berks County, higher concentrations are found in the Oley Hills, South Mountain, Hopewell Big Woods, and Kittatinny Ridge regions due to the abundance of undeveloped wooded areas. An up-to-date list of the classified streams for Berks County can be found on the Department of Environmental protections eMapPa system at: **http://www.depgis.state.pa.us/emappa/**

H. Floodplains

A floodplain is a relatively flat or low land area which is subject to partial or complete inundation from an adjoining or nearby stream, or watercourse: and/or any area subject to the unusual and rapid accumulation of surface waters from any source. This land consists primarily of alluvial soils. These soils may be wet a portion of the year, but can still be extremely productive for the growth of vegetation. This vegetation can help filter sediment from surface runoff, stabilize streambanks, reduce soil erosion, and protect water quality. Floodplains provide a natural barrier that protects the stream or river's flow. They can absorb and store large amounts of water and provide aquifer recharge. They also provide excellent areas for species habitat and diversity.

Flooding at Dreibelbis Mill, Perry Township, in 2011
Photo courtesy of Melissa Rozetar

The floodplains of Berks County are indicated on the Water Resources map (Figure 08). The most prominent floodplain in the county is that of the Schuylkill River. It traverses Berks in a north-to-south direction and is joined by many other streams in its journey. Other fairly prominent floodplain regions of the county include those associated with the Maiden Creek, Manatawny Creek, Saucony Creek, and the Tulpehocken Creek.

Regulation of floodplains can help minimize the threat to human life and property due to flooding. Restricting certain types of land uses within a floodplain is an important step in assuring its protection. All municipalities are required by the Federal Emergency Management Agency (FEMA) and the Commonwealth to have ordinances that deal with the use of land within a floodplain. The types of floodplains identified are the 1- and 0.2-percent-annual-chance floodplains. A 1-percent-annual-chance floodplain is an area that is expected to be covered by water once in every 100 years. The 0.2-percent-annual-chance floodplain is an area that is expected to be covered by water once every 500 years. Further discussion on goals and policies regarding floodplains and environmental hazard areas can be found in Chapter 8 Landuse.

I. Wetlands

A wetland is an area that exists as a swamp-like region at some point due to poor soils and underlying geology. Wetlands are usually found in lowland areas where the underlying water tables are closer to the soil surface. The area may be quite large in scale or be only a few feet across. A wetland is often associated with a lake, stream or spring, but may exist in a fairly isolated region away from these water features. Many wetlands follow the path of streams and rivers.

Wetland areas are unique environments that perform a variety of biological and physical functions. They can be extremely rich areas for plant growth and animal habitat. Wetlands often serve as breeding places for many organisms and are consequently rich in species diversity. However, a wetland does more than simply provide a home and a source of food for organisms. Wetlands protect water sources and can actually help to keep these sources of water clean. They act as natural filters in removing pollutants such as bacteria and sediment from water. This is achieved because the plants growing in and around a wetland will help to trap these pollutants, which are then consumed as food by organisms living in the wetland. The soils found in a wetland are often acidic, and consequently, the plants growing in a wetland are predominantly acid tolerant species. This allows a wetland to receive acidic infiltrations and remain relatively unaffected. Wetlands also retain stormwater runoff and floodwaters, and can facilitate groundwater recharge.

Given the uses and functions of wetlands, it is important that they be preserved in their natural state and protected from destruction. The knowledge of wetland characteristics is important to allow even the most unnoticeable wetland areas to be identified. Most municipalities enact various land use regulations; federal and state regulations also apply to protect the local wetlands. These regulations include buffering the wetlands so that the proper function of the wetland is preserved.

J. Threats to County Water Resources

Many individuals see air and water pollution as being the most harmful influences to the natural world. These factors have certainly been felt in Berks County but they are only a small part of the pollution problem. Pollution exists in many forms: air, water, noise, and thermal. The misuse and excessive development of land can even be considered pollution. When one considers pollution in its broadest sense, the problems become increasingly obvious. Berks County has its share of these problems. Pollution can be divided into two basic categories: point sources and non-point sources. Point sources are those which have easily identifiable origins, such as the discharges from a specific industry. Non-point sources exist on a much broader scale and often cannot be pinpointed, such as increased sedimentation in a river or stream. Some pollutants are difficult to classify as to whether they are point or non-point in origin.

The sources that are blamed for the majority of the Earth's pollution are point sources. In Berks County, as elsewhere, one of the most common types of point source pollution is industry. Industries are not necessarily heavy manufacturing plants. They can consist of a variety of different types of industries from very light manufacturing or processing to very large steel mills. Most industries, commercial buildings and businesses generate some type of identifiable waste. However, some of these generate waste that needs to be discharged either into neighboring water bodies (streams, rivers) or into the air. To discharge wastes in these manners requires that a permit(s) be obtained, typically from the Pennsylvania Department of Environmental Protection (DEP).

Agricultural operations can sometimes affect water quality. The use of Best Management Practices including riparian buffers, Conservation Plans, and Nutrient Management Plans can help to control these affects.

Another type of pollution source in Berks County is septic effluent. When sewage is disposed of improperly due to poor soils and underlying geology, it may reach groundwater or surface water supplies and become a pollution source.

Septic effluent can be considered both a point and non-point source of pollution. Sewage treatment plants discharge effluent into streams or rivers often. In this way, the effluent has an identifiable source. However, it is more difficult to determine whether the homes in a development, or even if one house, is polluting water supplies with septic wastes. A stream that flows near a home or development may be high in bacteria such as coliform, which is associated with septic effluent but it may be very difficult to determine which home, if any, is the actual source of pollution.

Other non-point pollution sources in Berks County are attributed to homeowner landscaping applications carried away by stormwater. Homeowner and landscaping applications of herbicides, pesticides and nutrients are normally applied in excess of the needs of soil and plant conditions. Appropriate testing should occur prior to application. Once soil erodes from an area, surface water, groundwater or wind will carry it away. This soil, once it enters a stream, will become sediment and have detrimental effects on the stream's ecosystem. Generally, the precise source of sediment in a stream will be identifiable. Even though sediment is a natural material that is usually found in a stream, the abuse of the surrounding soils will often cause undesirable levels to accumulate to the point of it becoming a pollutant. It is important that riparian buffers are created and maintained to protect and reclaim waterways as they reduce the impact of stormwater runoff.

K. Water Quantity and Quality Problems in Berks County

Water is evaluated by quality and quantity. While quantity problems can be severe, rarely do we hear of instances in Berks County where water is totally unavailable for an area. Quality problems however, can cause entire water systems to shut down and affect the health of all individuals who rely on the system. The Pennsylvania Department of Environmental Protection has established guidelines for potable water. Public water systems that fail to meet these guidelines face fines and penalties. Formal penalties, however, are of little comfort to residents who justly expect to receive uncontaminated water.

When a water quality problem affects public water systems, certain steps are taken. First, a clean source of water is obtained for customers. Second, the cause of the problem is determined. Finally, the necessary measures are taken to correct the problem.

Pollution of on-lot water wells can occur in a variety of ways. Septic tank malfunction is the most common, particularly in areas with poor soils. In Berks County, septic tanks in limestone soils can malfunction, allowing untreated wastewater to enter underground aquifers. Extremely wet or dry soils can also cause on-lot sewage systems to malfunction thus polluting groundwater. Industrial pollution and intensive agricultural activity can also cause groundwater pollution. Commercial agriculture production may impact both the quality and quantity of water supply sources. Lawful activities such as extraction of minerals impact water supply sources and such activities are governed by statutes regulating mineral extraction that specify replacement and restoration of water supplies affected by such activities. Although providing public water service is generally not as costly as providing public sewer service, correcting groundwater pollution is extremely difficult and expensive.

A decline in the amount of available groundwater accounts for most problems regarding on-lot water wells. Groundwater supplies fluctuate with weather conditions, increased withdrawals, and decreases in re-charge. It is rare that a single residential well will deplete an underground aquifer. However, large developments where each individual lot owner has his own well can burden underground water supplies and cause quantity problems. It is imperative that municipalities enforce stormwater management and water quality regulations.

L. Stormwater Management

When it rains in urban and suburban areas, rainwater washes pollutants such as nutrients, chemicals, and heavy metals off impervious surfaces, lawns, or bare soils into storm drains that lead to streams and rivers. With increased amounts of impervious surfaces, larger quantities of rainwater reach the streams quickly causing flash flooding, stream bank scouring, and sedimentation of streambeds. Because of stream damage, litter, and pollution, stormwater has become a major concern in Pennsylvania impairing 4,170 miles of streams and accounting for one third of the problems facing our waterways.

The development of land, without adequate stormwater regulations, can create excess stormwater runoff, inadequate stormwater drainage, and reduced water quality.

Oil residue being carried into the stormdrain system by falling rain.

Under the 1987 Clean Water Act Amendments, the U.S. EPA developed new stormwater regulations to address stormwater that might impact water quality. These new regulations were set up in two Phases depending upon population. Phase I affected Allentown and Philadelphia and the Phase II portion of the regulation applied to about 1,000 municipalities in Pennsylvania. Those municipalities that are located within an “urbanized area” as defined by the 1990 Census and the 2000 Census were required to apply for a National Pollutant Discharge Elimination System (NPDES) permit to discharge stormwater from their municipal separate storm sewer system (MS4s).

Municipalities that are designated MS4 communities (Municipal Separate Storm Sewer Systems) by the EPA and DEP are required to control stormwater runoff through six minimum control measures. An MS4 is defined as: A state, city, town, borough, county, parish, district, association, or other public body which has a drainage system which conveys only stormwater (i.e. curbs, gutters, basins, storm pipes, ditches, swales, municipal streets).

The MS4 does not include pipes that convey sanitary sewage nor does it include the stormwater entering the system that receives treatment prior to entering local waterways.

The six minimum control measures (MCMs) are: 1. Public Education, 2. Public Participation, 3. Illicit Discharge Detection and Elimination, 4. Construction Site Storm Water Runoff Control, 5. Post-Construction Storm Water Management in New Development and Redevelopment, and 6. Pollution Prevention/Good Housekeeping for Municipal Operations Maintenance.

In addition to the six minimum control measures, permittees must have an Act 167 Stormwater Management Ordinance as well as Pollution Reduction Plan (PRP) or Total Maximum Daily Load Plan (TMDL) for impaired streams.

M. Loss of Sensitive Flora and Fauna

The most environmentally significant areas often support populations of extremely sensitive flora and fauna. Unfortunately, these areas due to their natural beauty and unique features attract development as well.

In Berks County environmentally sensitive regions exist in a number of forms accounting for the majority of the non-agricultural open land remaining in the County. Bogs, swamps, marshes, meadows, grasslands, open fields, deciduous and evergreen forests, mountains, streams, lakes and even caverns are all environmentally sensitive areas within Berks County. These areas are environmentally significant because they provide habitat for threatened or endangered plants or animals. These species and the environmentally significant areas are found in the Berks County Natural Heritage Inventory. The inventory was compiled by the Pennsylvania Natural Heritage Program, Western Pennsylvania Conservancy. The most recent update was in 2014. The inventory can be viewed at http://www.naturalheritage.state.pa.us/CNHI.aspx .

Developers of environmentally significant land are required to do an environmental review of their site prior to construction. The review provides conservation information on biological diversity, protected lands, streams and other natural resources for planning purposes and also allows developers to screen a project area for potential impacts to threatened, endangered, and special concern species. Conservation measures and avoidance measures are reported for species identified in the review.

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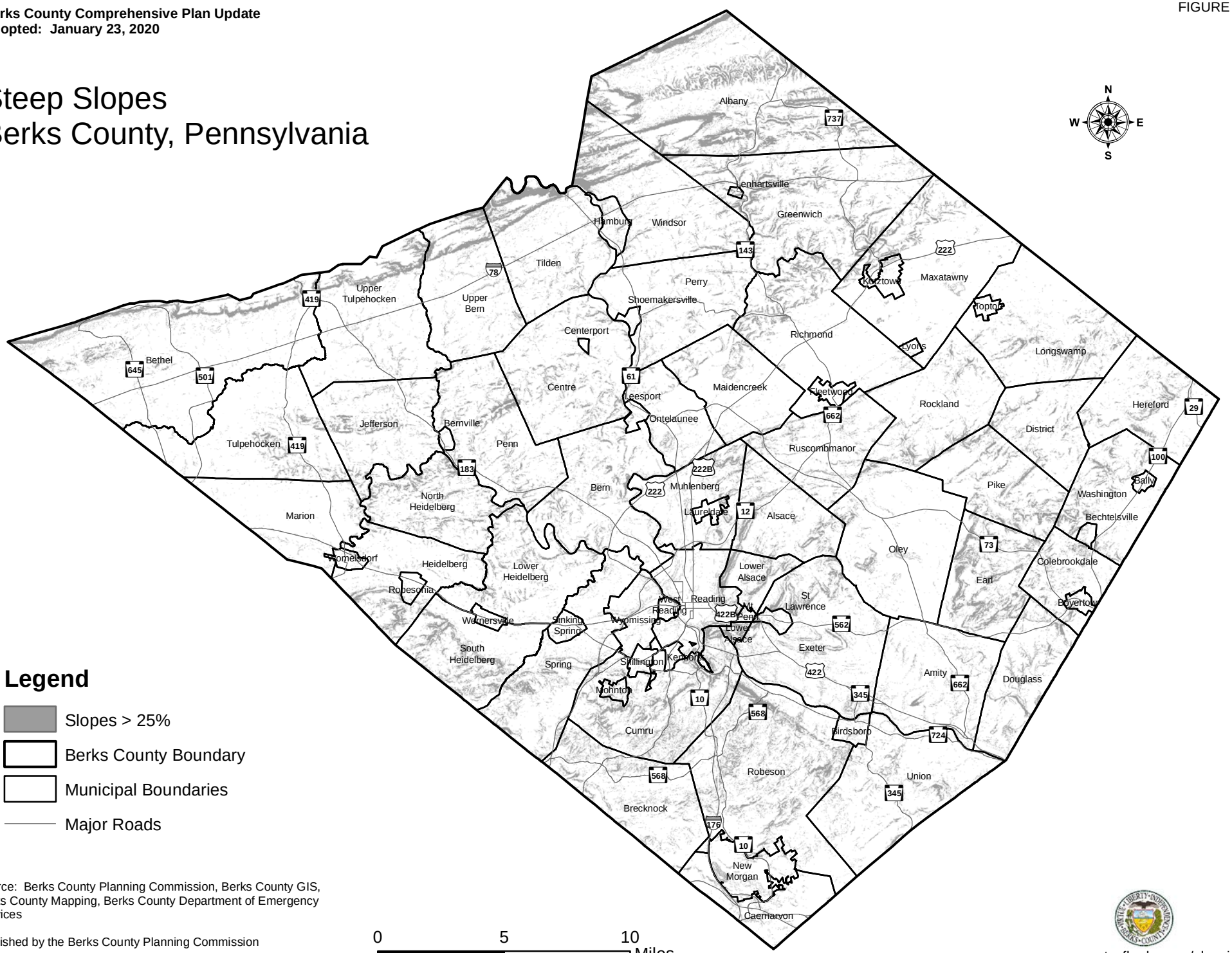
FIGURE 03

Steep Slopes
Berks County, Pennsylvania



Source: Berks County Planning Commission, Berks County GIS, Berks County Mapping, Berks County Department of Emergency Services

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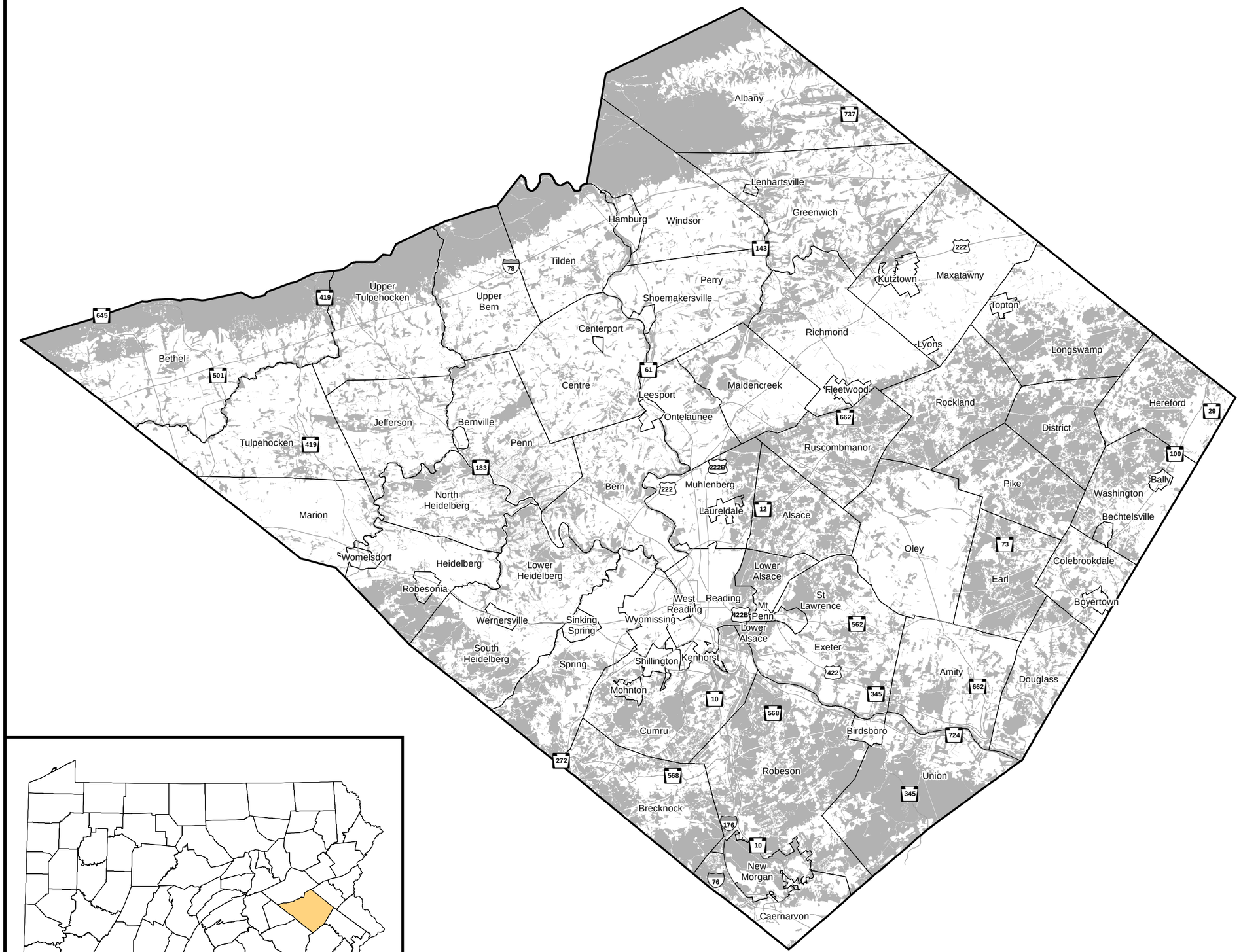
Forested Areas
Berks County, Pennsylvania



0 5 10 Miles

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Legend

- Forested Areas
- Berks County Boundary
- Municipal Boundaries
- Major Roads

Source: Berks County Planning Commission, Berks County GIS, Berks County Mapping, Berks County Department of Emergency Services

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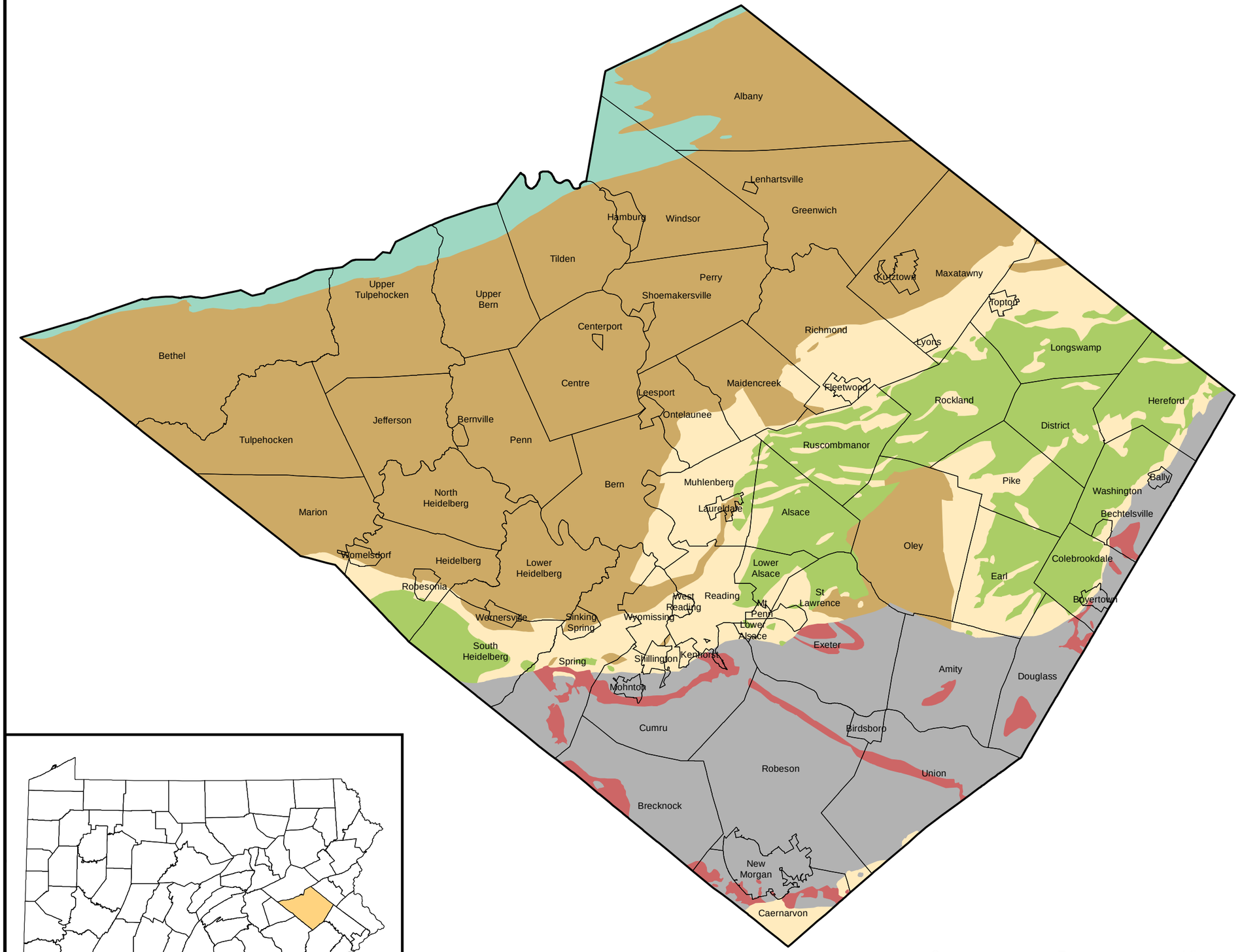
Geology
Berks County, Pennsylvania



Legend

- Berks County Boundary
- Municipal Boundaries

Geologic Period

- Precambrian
- Cambrian
- Ordovician
- Silurian
- Triassic
- Jurassic

Source: Berks County Planning Commission, Berks County GIS, Berks County Mapping, Pennsylvania Bureau of Topographic and Geologic Survey, Department of Conservation and Natural Resources

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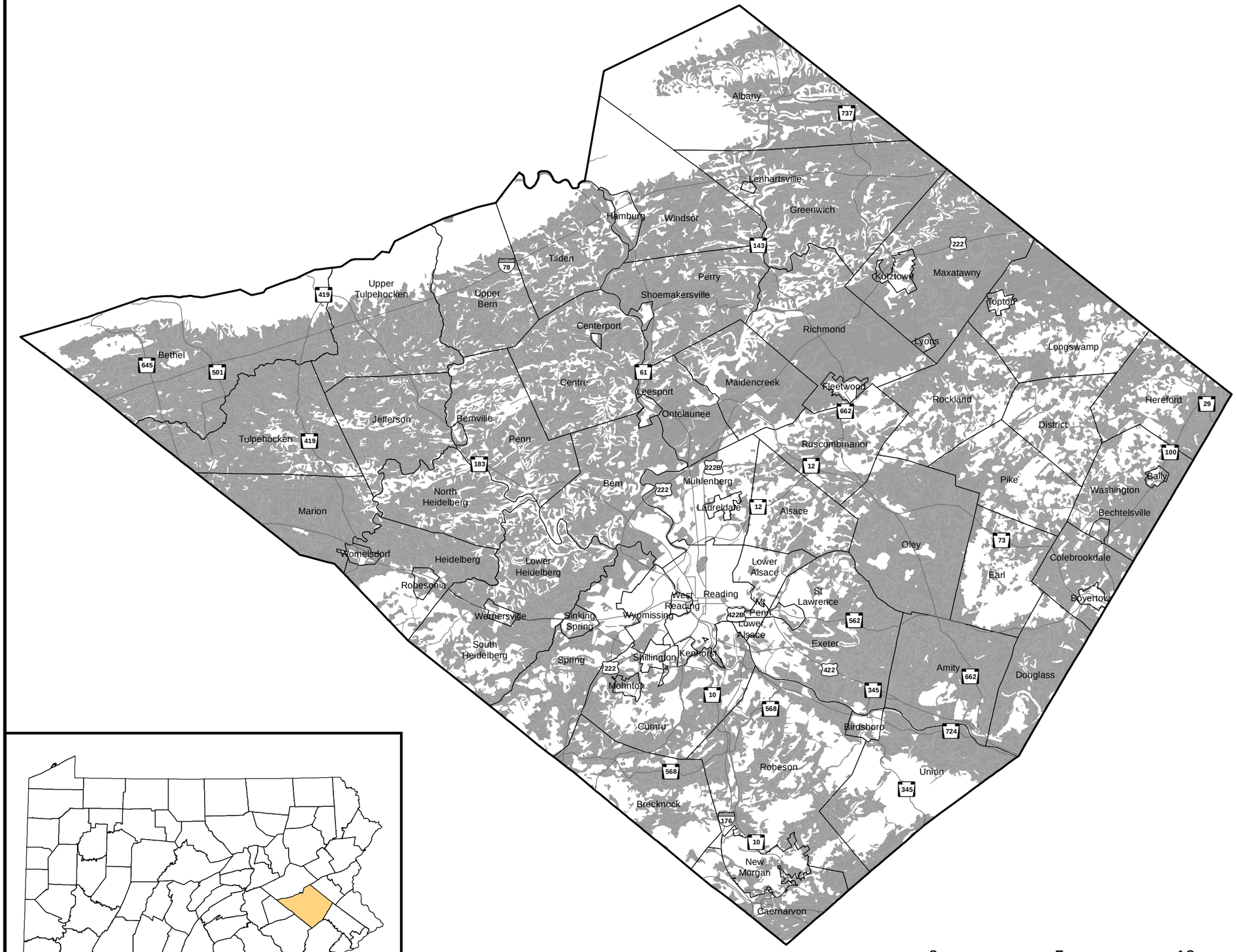
Agricultural Soils
Berks County, Pennsylvania



0 5 10 Miles

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Legend

- Agricultural Soils (Class I-IV)
- Soils (Class V-VIII)
- Berks County Boundary
- Municipal Boundaries
- Major Roads

Source: Berks County Planning Commission, Berks County GIS, Berks County Mapping, Berks County Department of Emergency Services, USDA NRCS

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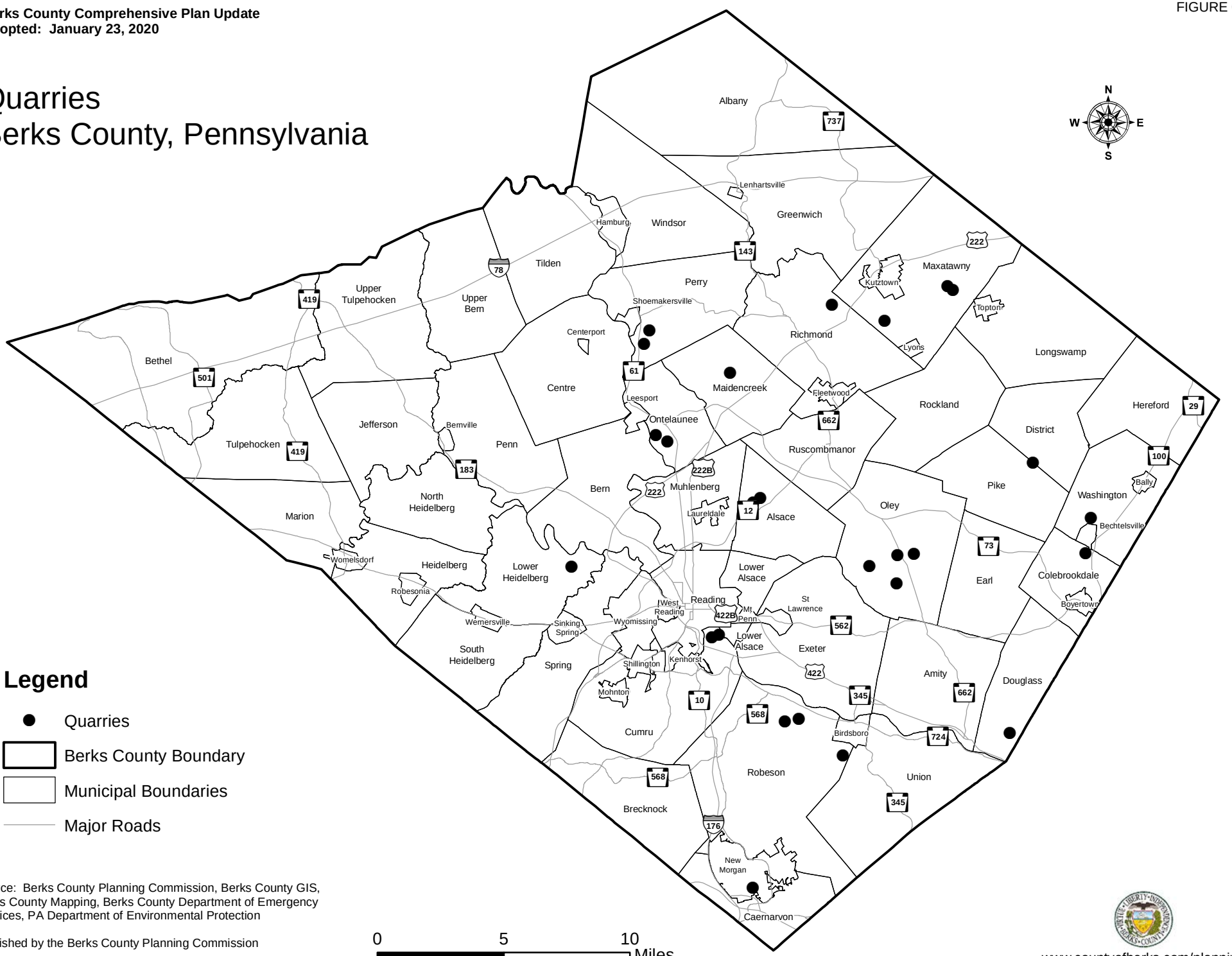
Adopted: January 23, 2020

FIGURE 07

Quarries
Berks County, Pennsylvania



Legend

- Quarries
- Berks County Boundary
- Municipal Boundaries
- Major Roads

Source: Berks County Planning Commission, Berks County GIS, Berks County Mapping, Berks County Department of Emergency Services, PA Department of Environmental Protection

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0 5 10 Miles

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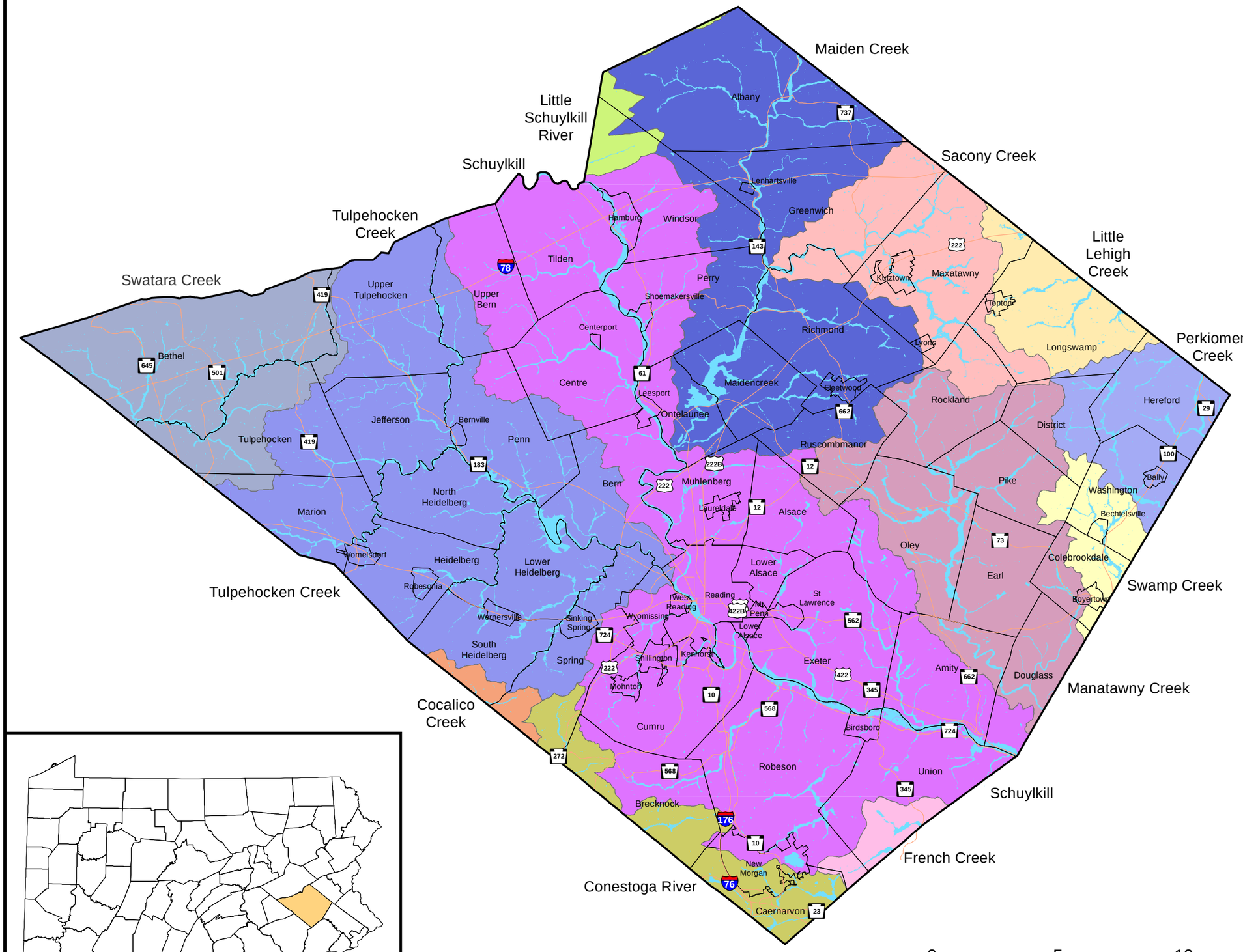
FIGURE 08

Berks County Comprehensive Plan Update
Adopted: January 23, 2020

Water Resources
Berks County, Pennsylvania



Watersheds

- Cocalico Creek
- Conestoga River
- French Creek
- Little Lehigh Creek
- Little Schuylkill River
- Maiden Creek
- Manatawny Creek
- Perkiomen Creek
- Sacony Creek
- Schuylkill
- Swamp Creek
- Swatara Creek
- Tulpehocken Creek
- Water Bodies
- 1% Floodplains
- Berks County Boundary
- Municipal Boundaries
- Major Roads

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Source: Berks County Planning Commission, Berks County GIS, Berks County Mapping, Berks County Department of Emergency Services, FEMA (Latest Effective Date: March 21, 2017)

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