



A. Background

Identifying sensitive environmental characteristics is integral to the establishment of targeted growth areas and establishing County-level development policies. The Greene County Comprehensive Plan includes an overview of the existing natural features and identifies specific developmental limitations attributed to the presence of these natural features (i.e., streams, floodplains, etc.) or anthropogenic sources (i.e., point source pollution, non-point source pollution, etc.).

The Natural Resources section of this comprehensive plan will be consistent with and may not exceed those requirements imposed under the Act of June 22, 1937 (P.L. 1987, No. 394), known as "The Clean Streams Law."

Existing Studies

There have been many reports and studies completed over the years that investigate natural resources, water quality, and other environmental issues in Greene County. The following have been reviewed and summarized to include findings and recommendations that relate to any of the issues addressed under this section.

Greene County Comprehensive Plan: Part I - Background Analysis and Part II – Final Report (1979)

The comprehensive plan focused on regional location analysis; physical features and existing land use; population and economy; housing analysis; thoroughfares; and community facilities. The background analysis found that the steep topography and poor access has inhibited development; 96 percent of land is undeveloped woodlands, agricultural land, or publicly owned open space; and that substantial amounts of developable land along the County's road system lie in flood hazard areas. The final report recommended that the County should locate new development in areas with suitable topography, access to utilities and access to employment; protect valuable county land resources including unique natural features, established neighborhoods, prime industrial sites and recreational areas; to foster coordination between various planning and administrative bodies in the county to avoid conflicts between land use, transportation, housing, utilities, services, conservation and community facilities.

Water Resources and the Effects of Coal Mining: Greene County, Pennsylvania (1987)

The study investigated the effects of coal mining on Greene County's water resources. As 20 percent of Pennsylvania's minable bituminous coal reserves are in Greene County, it is considered to be one of last major deposits of high-quality, high-Btu coal in the nation. The study found that Abandoned Mine Drainage (AMD) affected many of the sampled streams in eastern Greene County. In addition, the most productive water-bearing units

are sandstones and coal beds in Washington and Waynesburg formations less than 200 feet below the surface. Major groundwater-quality problems are high concentrations of iron, manganese, and hardness; minor problems include hydrogen sulfide gas, methane gas, and occasional high concentrations of chloride. Iron and manganese levels are above the Environmental Protection Agency (EPA) limits due to oxidation, not due to mining. The study recommended that well-depth be greater than 200 feet only in valley settings; wells should be installed, tested, and relative permanence determined during dry periods; and that wells should be drilled as wide as cost allows for more storage capacity.

Monongahela River Conservations Plan (1998)

The Monongahela River Conservation Plan (RCP) was completed in 1998 by Mackin Engineering. This plan addresses the stretch of river from the Mason-Dixon Line to where the river confluences with the Allegheny River at the Glenwood Bridge in the City of Pittsburgh to form the Ohio River. Management objectives were provided in the plan to assist in the future planning of the watershed.

Dunkard Creek Rivers Conservation Plan (2000)

The Dunkard Creek RCP was conducted by the Greene County Conservation District in conjunction with various agencies. The purpose of this study is to look at several issues and concerns that the public has brought to our attention via public meetings concerning the watershed. Once these issues are identified, recommended policies and actions will be undertaken to conserve, restore and/or enhance the river resources and values. This process ultimately included Dunkard Creek on the Pennsylvania Rivers Conservation Registry. The purpose of the Rivers Conservation Registry is to promote the conservation of rivers and river values, officially recognize community plans for conserving rivers and river values, and facilitate consistent state action with local river conservation plans. Within this plan is a management options plan for the watershed. This plan gives direction and options for remediation and/or protection options for the watershed.

RAG Emerald Resources Corporation - Whiteley Creek Watershed Mitigation (2001) A Biological Assessment of the Rudolph Run Watershed (2002)

The study was undertaken to assess existing water quality and biological conditions of Rudolph Run Watershed before corrective actions to reduce flood-related damage would occur. Based on parameters of this study, water quality in the watershed does not appear to be severely impacted. High stream flows have contributed to erosion.



Monongahela River Source Water Assessment Report (for Dunkard Valley Joint Municipal Authority, East Dunkard Water Association, and the Southwestern Pennsylvania Water Authority) (2002)

These studies were conducted to meet the 1996 Safe Drinking Water Act that requires a Source Water Assessment and Protection Program (SWAP) to evaluate all drinking water sources that serve public drinking supplies and to provide a mechanism for development of local protection programs. Potential sources for contamination (PSOCs) include point (water and sewer treatment plants, wildcat sewers, mining, power plants, chemical plants) and non-point sources (major transportation corridors and run-off from urban/developed areas). The most serious PSOC is the accidental release of materials along a transportation corridor. The studies found that Dooley Run and Dunkard Creek are affected by Abandoned Mine Drainage (AMD) and metals. The study recommended the development of a community based source water protection program to safeguard the public drinking supply based on the threats identified in the assessment.

Flow Measurement, Site Reconnaissance, and Proposed Remedial Action for Mine Discharges in the Lower Dunkard Creek Watershed (2002)

The study inventories Abandoned Mine Drainage problems from seven mine sites that discharge into Dunkard Creek and offers discharge remediation. Because of low pH values and/or topography (lack of suitable flat acreage), in situ neutralization is recommended, combined with mine sealing, wetlands, and open limestone channels.

North Fork of the Dunkard Fork of Wheeling Creek & Ryerson Lake (Duke Lake) Watershed Assessment (2003)

The Greene County Conservation District applied for and received funding to perform the Ryerson Lake watershed assessment project. This project was funded by the U.S. Environmental Protection Agency (U.S. EPA) and the Pennsylvania Department of Environmental Protection (PADEP) through the Nonpoint Source Program (Section 319). As part of this assessment, a comprehensive lake and watershed management plan was developed to improve and further protect the water quality of Ryerson Lake and its tributaries.

The comprehensive lake and watershed management plan for this project was developed using watershed-specific data and information. Watershed data and information were compiled, analyzed and mapped using GIS (Geographical Information System) software. Stream and lake data were collected and analyzed. Both water and pollutant (nutrients and sediment) budgets were determined for the Ryerson Lake watershed. Watershed investigations were performed to identify major sources of nutrients and sediments (nonpoint source pollution) to the lake and its streams.

Jackson Run Flood Study: Franklin Township & Waynesburg Borough (2004)

A study was conducted regarding the flooding problems along Jackson Run in Franklin Township and Waynesburg. In order to lessen the incidence of flooding in the study reach of Jackson Run, the following modifications are recommended:

1. For the open channel section between the existing 8 feet by 8 feet concrete box culvert through the railroad embankment and the outfall of the existing 10 feet by 7 feet concrete arch culvert under Greene Street, re-align and re-grade the channel to the lines and grades shown on Dwg. No. P-5, Plan View, Dwg. No. PR-1, Stream Profile and Dwg. No. SS-3, Stream Sections.
2. For the open channel section between the existing 10 feet by 7 feet concrete arch culvert under Greene Street and the 72 inch CMP outfall for the 60 inch RCP under High Street, trim the vegetation along the channel banks and remove any debris or rubbish in the channel.
3. Replace the existing 60 inch RCP under High Street with a 12 feet by 6 feet concrete box culvert. Modify the inlet channel to accommodate the wider and deeper culvert.
4. Re-align and re-grade the channel upstream and downstream of the existing bridge over Jackson Run near the intersection of Woodland Avenue and 7th Street. Remove accumulated sediment under the bridge.

Ruff Creek Watershed Assessment Report (2004)

Greene County Watershed Alliance completed a watershed assessment of upper Ruff Creek watershed to identify extent and degree of stream impairment. The study found that 23 percent of the streams in watershed are severely impaired with the most impairment on the mainstem. The recommendations stated that most of impaired streams will, at a minimum, require some bank grading and re-establishment of appropriate channel features (natural channel design); to restore riparian buffers in the watershed, and to fence out all livestock from stream corridor. The study also includes a Stream Restoration Plan.

Greene County Natural Heritage Inventory (2005)

A County Natural Heritage Inventory is designed to identify and map important biotic (living) and ecological resources. This information helps county, state, and municipal governments, the public, and business and industry plan development with the preservation of these environmentally important sites in mind. Biotic / ecological resources inherited by the citizens of this region include:

- Lands that support important components of Pennsylvania's native species biodiversity
- Populations of species that are facing imperilment at a state and/or global level, and their habitats



- Natural communities (assemblages of plants and animals) that are regionally important to biodiversity because they are exceptionally undisturbed and/or unique within the state
- Areas important for wildlife habitat, open space, education, scientific study, and recreation
- Areas that have been left relatively undisturbed by human activity
- Potential habitats for species of special concern

Environmental Resources

Greene County Conservation District

Every county in Pennsylvania, except Philadelphia, has a County Conservation District to support grassroots conservation efforts. The Greene County Conservation District is governed by a Board of Directors comprised of at least four farm directors, no less than two public directors, and one county commissioner. It is these directors that plan and direct the District programs, coordinate the help of governmental agencies, assign priority to requests for assistance from private landowners for resource development efforts, and serve the community. The policy of the Greene County Conservation District is to provide for the conservation of the soil, water and related resources of Greene County, for the control and prevention of soil erosion, and to preserve natural resources; assist in the control of floods; prevent impairment of dams and reservoirs; assist in maintaining the navigability of rivers and harbors; preserve wildlife; preserve the tax base; protect public lands; and protect and promote the health, safety and general welfare of the people of Greene County (<http://www.co.greene.pa.us/secured/gc/depts/ed/conserv/index.htm>).

Greene County Water Resources Program

The County of Greene and the Greene County Conservation District are partnering to establish a Water Resources Program to assist local municipalities and state agencies with certain aspects of water within the County. The program will result in an inventory and evaluation of the water resources as it relates to flood plains, stormwater, cultural, natural and recreational resource issues and concerns voiced by local municipalities. We are currently working with municipalities to inventory various issues of concern by interviewing each township or borough individually so that a needs assessment can be made for each municipality individually. Once this assessment is made then the County can assist the municipalities with finding proper resources to remedy situations.

Floodplain Monitoring Program

The Floodplain Monitoring Program is currently being contracted by the Conservation District. The Conservation District's primary activity under this program is to meet with municipal officials and review their administration/enforcement of their ordinance.

- District will review the current ordinance and check to see whether it is up-to-date
- Conduct a visual survey of the municipality for development in floodplains
- Provide training on floodplain map reading and usage
- Offer workshops and technical assistance

The result of this program is to get an understanding as to how the local municipalities administer and adheres to their ordinances and local understanding.

Greene County Watershed Alliance (GCWA)

The GCWA serves to protect and preserve the watersheds of Greene County, PA. GCWA was formed in October 2000 with the assistance of the Greene County Conservation District through the PADEP Growing Greener grant initiative, and became incorporated in May 2001 (<http://www.greenewatersheds.org/friends.html>). The GCWA is an independent, non-profit 501(c)3, volunteer organization dedicated to:

- Increase public understanding of watershed issues throughout Greene County
- Encourage understanding of watershed issues throughout Greene County
- Encourage the wise use, restoration, and conservation of natural resources that will promote sustainable land use and water quality.
- Serve as a central source for watershed information.
- Encourage the development of grass roots watershed organizations throughout the county.

Friends of Dunkard Creek

Friends of Dunkard Creek was developed through the assistance of the Greene County Watershed Alliance and a partnership with Greene County Conservation District. The purpose of this association is to preserve and protect the lower portion of Dunkard Creek to bring back recreational activity to the area.

Ten Mile Creek Watershed Conservancy

The Ten Mile Creek Watershed Conservancy was established in 1988 and has 127 members. The Conservancy was formed to be "a voice for the natural continuum of Ten Mile (Cusutha's) Creek and neighboring watersheds in Greene and Washington Counties" and their slogan is "Caring about the places no one is



saving." For more information about the group, visit their website: <http://www.pawatersheds.org/watersheddirectory/detail.asp?varOrgID=233>.

Wheeling Creek Watershed Conservancy

The Wheeling Creek Watershed has an existing watershed association titled Wheeling Creek Watershed Conservancy. The organization focuses on "Educating and Evaluating the Watershed for Preservation Project" and partners with West Greene School District and Richhill Township Supervisors.

Harry Enstrom Chapter of the Izaak Walton League of America (IWLA)

The Izaak Walton League of America (IWLA) was formed in 1922 to save outdoor America for future generations. Located in nearly 300 communities, local chapters of the IWLA are committed to restoring watersheds, reducing air pollution, fighting litter, protecting wildlife habitat and open spaces, and instilling conservation ethics in outdoor recreationists. The Henry Enstrom Chapter of the IWLA is headquartered in Waynesburg, Greene County (<http://www.iwla.org/index.php?id=581>).

Natural Infrastructure Atlas

The Southwestern Pennsylvania Commission (SPC), the Pennsylvania Department of Conservation and Natural Resources (DCNR), the Pennsylvania Environmental Council (PEC), and the Heinz Endowments, developed a project to examine the natural infrastructure of southwestern Pennsylvania. By identifying these elements and conducting analysis on their relationships to our communities, local governments can use these as a competitive advantage in today's economy.

This "natural infrastructure", which provides a broad array of services, products, and recreational opportunities, is a focal point for retaining and attracting residents and companies to the region. By leveraging the GIS and data capabilities of SPC, the project sponsors are developing an important tool for planning across the region. Not only will Natural Infrastructure provide a broad look across the counties, but local governments can also incorporate their own data to refine the analysis and expand the GIS capabilities within their community, ultimately leading to an improved planning process.

PA CleanWays of Greene County, Inc.

PA CleanWays of Greene County is a non profit organization that is working to empower Greene County residents to take action against illegal dumping and littering in their townships and communities. PA CleanWays provides education/outreach opportunities at local events and schools (<http://www.pacleanways.org/greene/index.html>).

Penn State Cooperative Extension

Penn State Cooperative Extension in Greene County gives local residents easy access to the resources and expertise of the Pennsylvania State University. Through educational programs, publications, and events, cooperative extension agents deliver unbiased, research-based information to Greene County citizens. They can answer your questions on a wide array of topics (website 2008). <http://greene.extension.psu.edu/>

Pennsylvania Department of Conservation and Natural Resources (DCNR), Bureau of Forestry

The Bureau of Forestry oversees Pennsylvania's 2.5 million acres of state forests, which in addition to producing valuable timber; also provide clean water, recreational opportunities, habitat for wildlife, and places to enjoy nature. While there are no state forests in Greene County, the Bureau also assigns a Bureau Service Forester to each county to advise residents on forest management and encourage sustainable forest management. Services provided include (http://www.dcnr.state.pa.us/forestry/serviceforesters_select.aspx):

- Forest management technical assistance
- Cost-share assistance
- Forest Stewardship Plans
- Regional planning advice
- Forestry and Water Best Management Practices advice
- Information and Education programs
- Urban and Community Forestry management
- Tree Planting
- Riparian Forest Buffer restoration

Pennsylvania Game Commission (PGC)

The Greene County region of the Pennsylvania Game Commission is within the 2nd District of eight as noticed by the state. The Game Commission handles the management, protection, habitat management, information and education of wildlife resources. For more information their website is <http://www.pgc.state.pa.us/>

Pennsylvania Fish and Boat Commission (PFBC)

The mission of the PFBC is "to provide fishing and boating opportunities through the protection and management of aquatic resources" (PFBC, 2005). Pennsylvania is divided into eight geographic districts and Greene County lies in the 2nd or Southwest District. The PFBC maintains a County Guide that provides the locations to obtain fishing licenses, boat registrations, launch permits, boat rentals (liveries), charter boats / fishing guides, and boating special regulations for each county in Pennsylvania and can be accessed via the website at: http://pfbc.state.pa.us/CountyGuide/County_Guide.htm.



Ralph K. Bell Bird Club

The Ralph K. Bell Bird Club, based in Greene County, was formed in October, 2006. The group was named in honor of their mentor and teacher Ralph K. Bell. This group of bird enthusiasts meets to learn about the birds of the area and perform bird counts and play a crucial role in the community. Meetings are held on the third Tuesday of every other month.

United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS)

NRCS staff works directly with farmers, ranchers, and others, to provide technical and financial conservation assistance. The guiding principles of the NRCS are service, partnership, and technical excellence.

NRCS helps landowners develop conservation plans and provides advice on the design, layout, construction, management, operation, maintenance, and evaluation of the recommended, voluntary conservation practices. NRCS activities include farmland protection, upstream flood prevention, emergency watershed protection, urban conservation, and local community projects designed to improve social, economic, and environmental conditions. NRCS conducts soil surveys; conservation needs assessments; and the National Resources Inventory to provide a basis for resource conservation planning activities and to provide an accurate assessment of the condition of the Nation's private lands (<http://www.nrcs.usda.gov/about>). The NRCS maintains state offices that provide more information related to locally operated conservation programs (<http://www.pa.nrcs.usda.gov/>).

Some other conservation organizations within Greene County include the Southwestern PA Woodlot Owners Association and the Ten Mile Creek Protection Network.

Natural Resources Snapshot

More than any other factor, physical features and resources have impacted the history and settlement of Greene County and continue to dictate development patterns. It has been well documented over the years, that the steep topography of Greene County has limited where and to what extent development has occurred. While there is more development in the central and eastern portions of the county than the western half, the entire County is blessed with a wealth of natural features. Significant features include the Monongahela River; South Fork of Ten Mile Creek High Quality Warm Water Fishery that includes Browns Creek, Grays Fork and the headwaters of South Fork Ten Mile Creek; trout stocked fisheries; biological diversity areas; landscape conservation areas; the Enlow Fork Natural Area; and state game lands, among others. The Natural Resources section provides an inventory of these environmentally important sites, identifies existing and potential threats, and offers recommendations that the County can implement to protect these sites from harmful impacts.



Greene County Landscape (Mackin, 2004)



B. Data & Analysis

Climate

The mean temperature for Greene County is 50.2 degrees Fahrenheit (°F) with a maximum mean monthly temperature of 71.1°F in July and a mean monthly low of 28.0°F in January. Precipitation averages just under 40 inches per year and is fairly evenly distributed throughout the year. May is the wettest month with an average of 4.2 inches per year and February is the driest month with 2.5 inches per year. For the years between 1971 and 2000, the average annual snowfall is 29.9 inches, with almost all of it coming between December and March (USDA, 2002).

Vegetation

Greene County is located within the Eastern Broadleaf Forest (Continental) Province (USGS, 2004). The USGS also identified the majority of the deciduous forestland in Greene County as oak-hickory forest (USGS, 2004). Several types of forestland are found in Greene County, including deciduous, coniferous, and a mix of both types. Deciduous forest land includes all forested areas that have a predominance of trees that lose their leaves when the frost-free season ends or the dry season begins (Anderson, 1976). Two pockets of coniferous forestland were identified near Boyd Run in Washington Township and near Fordyce Run in Gilmore Township.

The Natural Infrastructure Atlas indicates numerous areas in Greene County that are considered "prime areas for managed forestry" and several areas identified as "public land suitable for managed forestry." Forest reserves can be an important economic resource if properly managed and can also reduce stormwater runoff, capture and store carbon monoxide, and provide areas for recreation (PEC et al, 2005). Mapping that identifies these areas is found in the Natural Infrastructure Atlas. *Figure 4-1: Forest Resources* provides a visual depiction of forest lands (as per the most current land cover data). In addition, data from the Natural Infrastructure Project (distributed by the Southwestern Pennsylvania Commission) shows areas with oak and hickory forests and areas with maple, beech and birch forests.

Stream margins or riparian buffers throughout the county are composed of several species of riparian vegetation. Vegetation observed along some of the streams in the county included deer-tongue grass (*Dichanthelium clandestinum*), jewelweed (*Impatiens capensis*), smooth alder (*Alnus serrulata*), black cherry (*Prunus serotina*), birch (*Betula* spp.), and American beech (*Fagus grandifolia*). These riparian and wetland species function to alter floodwater flow, retain sediment and toxins from upland areas, stabilize and shade the stream margin, and deliver detritus matter to the stream. Riparian buffers are areas of vegetation that are maintained along the shore of a water body to protect stream water quality and stabilize stream channels and banks. Thus, these areas are essential for good water quality and aquatic habitats. These areas of tree buffers surrounding bodies of water should be preserved or replanted where feasible.

Riparian buffers provide additional benefits to landowners and the larger community by:

- Safeguarding water supplies by protecting groundwater recharge areas
- Providing flood control
- Providing stormwater management potential – natural vegetation provides a basis for innovative stormwater management systems. Stormwater flows from retention basins can be directed to, and allowed to flow through forested buffers to reduce nutrient and sediment loads
- Improving the health of cities, boroughs, and townships by improving water and air quality
- Stimulating economic opportunities such as by providing valuable open space, which may increase land values and, therefore, the tax base
- Providing some federal tax incentives to landowners (depending on a landowner's financial situation) willing and able to place some of their lands under conservation easements
- Cost savings by reducing grounds maintenance
- Providing recreation opportunities, and associated economic benefits for recreation-related businesses
- Providing educational and research opportunities for local schools and colleges
- Providing windbreak, shade, and visual buffer

Physiographic Characteristics & Geology

Pennsylvania is divided into numerous physiographic provinces, which are defined as regions in which all parts are similar in geologic structure, climate, relief, and have a unified geomorphic history. The majority of Greene County is located in the Waynesburg Hills Section of the Appalachian Plateaus physiographic province; a small section in the southeastern quadrant of the county is located in the Pittsburgh Low Plateau Section. The dominant topography in the region is very hilly with narrow hilltops and steep-sloped, narrow valleys and is underlain with sandstone, shale, red beds, and limestone. The highest elevations can be found along the divide between waters flowing directly into the Ohio River in the western portion of the County and waters flowing into the Monongahela River in the central / eastern portions of the County.

Slopes play a significant role when determining the extent and type of development that is being planned. Land with slopes in excess of 25 percent begins to cause serious problems for development. The slope and soils present on steep slopes are in balance with vegetation, underlying geology, and precipitation levels. If these steep slopes are actively used or the vegetation is removed, the soils become prone to erosion. In addition, Greene County's soils have high clay content and with the amount of rainfall in the area, regardless of the slope, the soils are prone to hydraulic instability.

For the Natural Infrastructure project, the Southwestern Pennsylvania Commission (SPC) developed slope data based on 20-foot USGS topographic lines. The topographic lines were 'reduced' to 100-foot topographic lines before being used to calculate slope, using algorithms in the Geographic Information System (GIS). The Natural Infrastructure project was regional in scope, and therefore data layers were created using the best available regional data. The SPC



encourages the recreation of data sets by counties and local municipalities if better data is available. Figure 4-2: Topography illustrates the locations of slopes within the county between zero and eight percent, between eight and 15 percent, between 15 and 25 percent, between 25 and 40 percent, and slopes over 40 percent. Table 4-1: Greene County Slope Data lists the percentages for each category.

Table 4-1: Greene County Slope Data	
Slope	Percent of Total Land
0-8%	31.0%
>8-15%	7.0%
>15-25%	17.6%
>25-40%	37.5%
>40%	6.8%
Source: SPC, 2000	

The flattest part of the County lies east of I-79, particularly along the PA Route 88 corridor and the Monongahela River. Just slightly over half of the County has a slope value of 25 percent or less. Almost 38 percent of the County contains slopes greater than 25 percent and another seven percent is in excess of 40 percent. The majority of these lands can be found in the western portion of the County. This data was compared to slope data associated with the various types of soil found in the County. The soil data showed that approximately 47 percent of the County has steep slopes in excess of 25 percent, a difference of just three percent when compared to that developed by SPC.

The Greene County Subdivision and Land Development Ordinance (SALDO) defines any slope, 25 percent or greater, as a "steep slope" and certain requirements have to be met for development of this land. The SALDO also states that anything over 40 percent cannot be developed.

The surface geology in the area originates from fluvial erosion and landslides and has a developed dendritic drainage pattern. Seven geologic formations are found in Greene County. Sandstone is the predominant rock type within the county; shale, limestone, siltstone, conglomerate, and coal layers are scattered within the sandstone. Figure 4-3: Bedrock Lithology depicts the geology of Greene County. Limestone can be found along the eastern edge of the County and along Ten Mile Creek, while shale is found only in the very southeastern edge of Greene County.

Soil Associations

Soil is produced through the interaction of five natural forces: climate, biological influences, parent material, topographic relief, and time. The degree and influence of each of these factors differ from place to place and influence individual characteristics of the soil.

General knowledge of the soil associations within an area is useful for planning. These associations can provide background information for determining suitable land uses for land tracts. In addition, this information is useful for watershed management, forestland management, and community development.

A soil association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. Taxonomy of associations is based on major soil groupings. The soils making up one association can occur in another but in a different pattern (NRCS, 2006). Three soil associations exist within Greene County (USDA, 1979) and are identified on *Figure 4-4: Soil Associations*.

1. Dormont-Culleoka – Moderately well drained and well drained; deep and moderately deep; gently sloping to very steep soils; on hilltops, ridges, benches, and hillsides
2. Dormont-Culleoka-Newark – Well drained to somewhat poorly drained; deep and moderately deep; nearly level to very steep soils; on hilltops, ridges, benches, hillsides, and floodplains
3. Glenford-Dormont-Library – Moderately well drained and somewhat poorly drained; deep, nearly level to sloping soils; on terraces and surrounding uplands

The majority of the county is comprised of the Dormont-Culleoka association. The major limitations correlated with this association include steep slopes, a tendency for erosion to occur, and a seasonal high water table. The Dormont-Culleoka-Newark association is located along the floodplains and hillsides adjacent to the following streams: Enlow Fork Wheeling Creek, Dunkard Fork (North and South Forks), South Fork Ten Mile Creek, and Whiteley Creek. Major limitations associated with this association are the steep slopes, the tendency for erosion to occur, a seasonal high water table, and occasional flooding. The Glenford-Dormont-Library association is located in the eastern portion of the county and a few isolated pockets in central and southeastern Greene County. The major limitations associated with this association include steep slopes, the tendency for erosion to occur, a seasonal high water table, and slow and moderately slow permeability.

Hydric Soil

As defined by the NRCS, a hydric soil is a soil that formed under conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic conditions in the upper part (USDA, 2004). Hydric soils support the growth and regeneration of hydrophytic (water-loving) vegetation. In addition, soils that are sufficiently wet because of artificial measures are classified as hydric soils. Also, soils in which the



hydrology has been artificially modified are hydric if the soil, in an unaltered state, was hydric.

The analysis of hydric soils has recently become an important consideration when performing any type of physical analysis of the community. These soils are important to identify and locate due to the fact that they provide the approximate location where wet areas may be found. Thus, the location of hydric soils is one indication of the potential existence of a wetland area.

Hydric soil imposes restrictions for development of land. These soils have severe surface and subsurface drainage characteristics, which result in significant development limitations, including restrictions on the placement of septic systems within a hydric soil area. There is one true hydric soil in the project area – Purdy Silt Loam. Most of the hydric soil within Greene County is found in the Muddy Creek and Little Whiteley Creek watersheds in the eastern portion of the county. However, 21 other soils in the project area could support wetlands if the proper hydrology exists. Hydric soils are mapped on *Figure 4-5: Hydrology*.

Prime Agricultural Soil

There are seven types of soil that are classified as Pennsylvania Prime Farmland soils and 16 types of soils classified as Additional Farmland of Pennsylvania Statewide Importance within the project area. Approximately five percent of land in Greene County is classified as a prime agricultural soil. The soil is scattered around the county with denser deposits in the eastern portion of the County and along South Fork Ten Mile Creek. *Figure 11-1: Agriculture* depicts the location of both the prime agricultural soils, along with Agricultural Security Areas and identified farmland.

Water Resources

Surface waters are defined in The Commonwealth of Pennsylvania Code Title 25 Environmental Protection Chapter 93 Water Quality Standards as "Perennial and intermittent streams, rivers, lakes, reservoirs, ponds, wetlands, springs, natural seeps and estuaries, excluding water at facilities approved for wastewater treatment such as wastewater treatment impoundments, cooling water ponds, and constructed wetlands used as part of a wastewater treatment process" (Pennsylvania Code, 1971).

Under Section 303(d) of the 1972 Clean Water Act, states, territories, and authorized tribes are required to develop lists of impaired waters (USEPA 2004). The water quality standards identify the uses for each water body and the scientific criteria needed to support that use. Minimum goals set by the Clean Water Act require that all waters be "fishable" and "swimmable." This section requires that these jurisdictions establish priority rankings for waters on the lists and develop Total Maximum Daily Loads (TMDLs) for these waters. A TMDL specifies the maximum amount of a pollutant that a water body can receive and still meet water quality standards, and allocates pollutant loadings among point and nonpoint pollutant sources. The Environmental Protection Agency's (EPA) implementing regulations (40 CFR Part 130) require:

- States to develop lists of impaired waters for which current pollution controls are not stringent enough to meet water quality standards (the list is used to determine which streams need TMDLs);
- States to establish priority rankings for waters on the lists based on severity of pollution and the designated use of the water body; states must also identify those waters for which TMDLs will be developed and a schedule for development;
- States to submit the list of waters to EPA every two years (April 1 of the even numbered years);
- States to develop TMDLs, specifying a pollutant budget that meets state water quality standards and allocate pollutant loads among pollution sources in a watershed, e.g., point and nonpoint sources; and
- The EPA to approve or disapprove state lists and TMDLs within 30 days of final submission.

Despite these requirements, states, territories, authorized tribes, and the EPA had not developed many TMDLs. Beginning in 1986, organizations in many states filed lawsuits against the EPA for failing to meet the TMDL requirements contained in the federal Clean Water Act and its implementing regulations. While the EPA has entered into consent agreements with the plaintiffs in several states, other lawsuits still are pending across the country.

In the cases that have been settled to date, the consent agreements require the EPA to backstop TMDL development, track TMDL development, review state monitoring programs, and fund studies on issues of concern (e.g., AMD, implementation of nonpoint source Best Management Practices (BMPs), etc.). These TMDLs were developed in partial fulfillment of the 1997 lawsuit settlement of American Littoral Society and Public Interest Group of Pennsylvania v. EPA.



The TMDL's developed for Greene County are:

- Dooley Run Watershed, EPA approved 4-7-07 located within the Dunkard Creek Watershed-pollutant-metals from AMD
- Dunkard Creek Watershed-EPA approved 4-4-07-pollutant-metals, siltation, suspended solids
- Whiteley Creek watershed-not approved as of Feb 2009-pollutant-Non Point Source Pollution-siltation
- Pumpkin Run Watershed-not approved as of Feb 2009-pollutant-Non Point Source Pollution-Nutrients/Organic Enrichment/low dissolved oxygen

Watersheds / Rivers / Streams

The PADEP protects waters within the state boundary under the following categories: aquatic life, water supply, recreation, special protection, and other. Under the "Special Protection" category, certain watercourses are given protection as High Quality Waters (HQ), meaning that the watercourse has excellent quality waters and environmental or other features that require special water quality protection (PADEP, 1999). To qualify as a Exceptional Value Water (EV), the water must be classified as HQ; the water is a surface water of exceptional ecological significance; and at least one of the following:

- (i) The water is located in a National wildlife refuge or a State game propagation and protection area.
- (ii) The water is located in a designated State park natural area or State forest natural area, National natural landmark, Federal or State wild river, Federal wilderness area or National recreational area.
- (iii) The water is an outstanding National, State, regional or local resource water.
- (iv) The water is a surface water of exceptional recreational significance.
- (v) The water achieves a score of at least 92% (or its equivalent) using the methods and procedures described in subsection (a)(2)(i)(A) or (B).
- (vi) The water is designated as a "wilderness trout stream" by the Fish and Boat Commission following public notice and comment.

Greene County is fortunate to have several streams that are designated as either HQ or EV. In addition, several streams and their tributaries have been designated as trout stocked fisheries (TSF) by the PADEP, which means these streams maintain stocked trout from February 15 to July 31 and maintains and propagates fish species and additional flora and fauna which are indigenous to a warm water habitat. Table 4-2: Streams provides a listing of the streams classified as HQ and/or TSF.

Table 4-2: Streams			
Stream Name	Municipality	Drainage Area (square miles)	Chapter 93 Protected Water Use
Unnamed Tributaries to NORTH FORK, DUNKARD FORK WHEELING CREEK	Aleppo Township Richhill Township	unknown	EV
Unnamed Tributary to OWENS RUN, ENLOW FORK	Morris Township Richhill Township	unknown	EV, WWF
BROWNS CREEK (and its tributaries)	Franklin Township Washington Township Morris Township Center Township	45.7	HQWWF
CLEAR RUN	Center Township Franklin Township	1.47	HQWWF
LIGHTNER RUN	Center Township	1.70	HQWWF
PURSELY CREEK (and its tributaries)	Wayne Township Center Township Franklin Township	13.2	HQWWF
RUSH RUN	Center Township	1.85	HQWWF
SOUTH FORK TEN MILE CREEK to mouth of BROWNS CREEK (and its tributaries)	Center Township Franklin Township	199.0	HQWWF
Monongahela River	All municipalities along the eastern border of the county	7,386	WWF
ENLOW FORK WHEELING CREEK (and its tributaries)	Morris Township Richhill Township	73.1	TSF
SOUTH FORK, DUNKARD FORK WHEELING CREEK (and its tributaries)	Jackson Township Richhill Township	28.0	TSF
WHITELEY CREEK (and its tributaries)	Whiteley Township Greene Township Perry Township	54.4	TSF
LAKE WILMA	Wayne Township	n/a	TSF
TEN MILE CREEK (source to South Fork Ten Mile Creek)	Morgan Township Jefferson Township	338.0	TSF

Notes: EV - exceptional vaule; HQWWF - high quality warm water fishery; TSF - trout stocked fishery (according to PADEP Chapter 93. Water Quality Standards



The major landscape feature for water resource studies is the watershed boundary. A watershed is defined by the United States Environmental Protection Agency (USEPA) as the area of land that catches rain and snow and drains or seeps into a marsh, stream, river, lake, or groundwater (USEPA, 2004). Because watersheds are defined by natural hydrology, they represent the most logical basis for managing water resources. The resource becomes the focal point, and managers are able to gain a more complete understanding of overall conditions in an area and the stressors, which affect those conditions. This entails a strategy that crosses municipal boundaries and requires a great deal of coordination, cooperation, and communication within and between municipalities sharing the same watershed.

Watersheds are delineated based on topography and ridgelines. Every river, stream, and tributary has an individual watershed, however, these individual watersheds are grouped together to form larger watersheds. All of Greene County is within the Ohio River watershed, which is Pennsylvania's second largest river basin, covering 15,614 square miles of the state west of the Allegheny Mountains (PADEP, Pennsylvania's Major River Basins, 2008)¹. The Monongahela River watershed is a sub-watershed of the Ohio River watershed and, therefore, any watercourse that drains into the Monongahela River is not only part of the Monongahela River watershed, but it also part of the larger Ohio River watershed. The Monongahela River forms the eastern boundary of Greene County and is one of the two major rivers (the second being the Allegheny River) that converge in Pittsburgh to form the Ohio River. Rivers, streams, and tributaries in the western portions of Greene County drain west directly into the Ohio River watershed; whereas, watercourses in the central and eastern portions of the county drain east into the Monongahela River sub-watershed. Enlow Fork of Wheeling Creek, Dunkard Fork of Wheeling Creek, and Pennsylvania Fork, of Fish Creek are the three main tributaries in Greene County that flow into the Ohio River Watershed; while Ten Mile Creek, South Fork Ten Mile Creek, Muddy Creek, Little Whitely Creek, Whitley Creek, and Dunkard Creek, Pumpkin Run, and Crooked Run are the eight main tributaries in Greene County that drain into the Monongahela River watershed. *Figure 4-5: Hydrology* depicts the boundaries of the major watersheds in Greene County:

- 1) **Crooked Run** is a 3rd order stream that originates in Dunkard Township and flows east until it empties into the Monongahela River. The stream has a drainage area of 7.09 square miles, which is partially located in West Virginia. The PADEP has classified Muddy Creek under Chapter 93 Water Quality Standards as WWF. According to PADEP's Internet website, no TMDLs have been approved for Muddy Creek watershed to date.
- 2) **Dunkard Creek** is a 3rd order stream that has a total drainage area of 235 square miles. Pennsylvania Fork Dunkard Creek and West Virginia Fork Dunkard Creek converge to form Dunkard Creek along the Pennsylvania – West Virginia border near the town of Brave, Greene County. The stream flows east along the PA/WV for approximately 10 miles and then heads northeast into PA until it empties into the Monongahela River at Poland Mines. The PADEP has classified this stream under

Chapter 93 Water Quality Standards as a WWF. According to PADEP, TMDLs were approved in April of 2007 for Dooley Run, which drains into Dunkard Creek approximately a mile south of Mt. Morris. Dooley Run is impaired by metals specifically total iron, total manganese, and total aluminum from abandoned mine drainage (AMD) and resource extraction. A remediation plan will need to be developed for Dunkard Creek Watershed in order to meet the water quality objectives outlined in the report.

A Rivers Conservation Plan was completed in 2000 for the Dunkard Creek Watershed. Biological, physical, and social/cultural characteristics of the watershed were discussed in the report and several major concerns were identified with AMD labeled as the number one problem and first priority in the watershed. Other issues listed in descending order of priority by the Plan include: Solid waste/trash dumps, erosion/sedimentation, education, sewage, water quality, and recreation/heritage. Since the publication of the Plan, a Pennsylvania based "Friends of Dunkard Creek" group was developed through the assistance of the Greene County Watershed Alliance and a partnership with Greene County Conservation District. The purpose of the development of this association was to unify the Dunkard Creek watershed.

- 3) **Dunkard Fork of Wheeling Creek** is a 3rd order stream that has a drainage area of 76.2 square miles. North Fork Dunkard Fork and South Fork Dunkard Fork converge to form Dunkard Fork along the PA S.R. 21 near the town of Ryerson Station, PA. The stream then goes on to flow northeast into West Virginia, where it eventually empties into Wheeling Creek. The PADEP has classified Dunkard Fork as a WWF and classified North Fork and South Fork as TSF. According to PADEP's Internet website, no TMDLs have been approved for the streams. The Pennsylvania Fish and Boat Commission (PFBC) officially approved Dunkard Fork, North Fork, and South Fork as "approved trout waters." Ryerson Station State Park is located within this Watershed.
- 4) **Enlow Fork of Wheeling Creek** is a 3rd order stream that has a drainage area of 73.1 square miles. The stream begins in Morris Township, Greene County and drains west into WV, serving as the north western border between Washington and Greene Counties, and eventually emptying into the Ohio River. The PADEP has classified this stream as a Trout Stocked Fishery (TSF) from the source to PA-WV state border (PADEP, 2005). According to PADEP's website, no Total Maximum Daily Loads (TMDL) have been approved for Enlow Fork Wheeling Creek (PADEP, 2005). The Pennsylvania Fish and Boat Commission (PFBC) has officially approved this stream as "approved trout waters", indicating that it meets criteria qualifying the stream to be stocked with trout by the PFBC. These waters are closed for all fishing from March 1 to 8:00 a.m. on opening day of trout season.

The Wheeling Creek Watershed has an existing watershed association titled Wheeling Creek Watershed Conservancy. The organization focuses on "Educating and



Evaluating the Watershed for Preservation Project” and partners with West Greene School District and Richhill Township Supervisors.

- 5) **Little Whiteley Creek** is a 3rd order stream that originates in Cumberland Township and flows east, serving as the Cumberland / Greene Township border, until it empties into the Monongahela River. The stream has a drainage area of 9.03 square miles. The PADEP has classified this stream under Chapter 93 Water Quality Standards as a WWF. According to PADEP’s Internet website, no TMDLs have been approved for Little Whiteley Creek watershed to date. Little Whiteley Creek is not a tributary of Whiteley Creek.
- 6) The **Monongahela River** watershed, the largest of the sub-watersheds with a drainage area of 7,386 square miles, originates in Fairmont, WV and joins Allegheny River in Pittsburgh to form the Ohio River. The Pennsylvania Department of Environmental Protection (PADEP) has classified this river as a Warm Water Fishery (WWF), meaning that this type of stream maintains and propagates fish species and additional flora and fauna that are indigenous to a warm water habitat. It also is protected under the Navigation (N) use, meaning that this type of stream is used for the commercial transfer and transport of persons, animals, and goods.



Monongahela River (Mackin, 2004)

The Monongahela River has played a significant role in the history of the region. It has served as a transport avenue for runaway slaves who were heading north, a major transportation route for westward settlement during colonial times and later propelled the industries along its shores to worldwide importance and unequalled production. Along with its changing roles and functions, the Monongahela River itself has adapted. It has been transformed from a wide and shallow river to a slow-moving, deeply pooled, body of water.

The Monongahela River has approved TMDLs for two pollutants—chlordane and PCBs. Chlordane was used from 1948 until 1988 in the United States as a pesticide; it

is a persistent chemical (>20 years) and bioaccumulates in the environment and tissues of animals. PCBs are manmade chemicals that were used in transformers, paints, adhesives, caulking compounds, some filters, and carbonless copy paper. PCBs enter the environment in air, water, and soil during the manufacturing process.

The *Monongahela River Conservation Plan* (RCP) was completed in 1998 and contains management objectives to assist in the future planning of the watershed.

- 7) **Muddy Creek** is a 3rd order stream that has a total drainage area of 31.7 square miles. The stream originates in Jefferson Township and flows southeast to Baileys Crossroads, where South Branch enters, and then flows northeast until it empties into the Monongahela River. The PADEP has classified Muddy Creek under Chapter 93 Water Quality Standards as WWF. According to PADEP's Internet website, no TMDLs have been approved for Muddy Creek watershed to date.
- 8) **Pennsylvania Fork of Fish Creek** is a 3rd order stream that has a drainage area of 36.6 square miles. The stream originates in Jackson Township along S.R. 18, near Nettle Hill, and flows southwest into WV where it converges with West Virginia Fork, Fish Creek to form Fish Creek. The PADEP has classified Pennsylvania Fork as a TSF. According to PADEP's Internet website, no TMDLs have been approved for Pennsylvania Fork.
- 9) **Pumpkin Run** is a 5th order stream that is a tributary of the Monongahela River. Pumpkin Run originates in Jefferson and Cumberland Townships, flows east across Greene County for approximately 2 miles, and then heads north for approximately 3 miles until emptying into the Monongahela River near the Borough of Rice Landing. The PADEP has classified Pumpkin Run under Chapter 93 Water Quality Standards as a WWF. A TMDL has been developed by the PADEP and is expected to be approved in the fall of 2008.
- 10) **South Fork of Ten Mile Creek** is a 4th order stream that originates in Center Township, Greene County and flows northeast until it empties into Ten Mile Creek on the northeast boarder of Morgan Township. It has a drainage area of 199 square miles. The PADEP has classified this stream under Chapter 93 Water Quality Standards as a High Quality WWF (HQ-WWF) from its source to Browns Run and the remaining length as a WWF. The HQ designation means that this stream has excellent quality waters and contains environmental or other features that require special water quality protection. No TMDLs have been identified for South Fork Ten mile Creek (PADEP, 2005). The following tributaries to South Fork Ten Mile Creek are designated HQ-WWF: Browns Creek, Pursley Creek, Clear Run, Rush Run, Lightner Run, and a few unnamed tributaries.

In April of 2004, PA Cleanways supported a "clean-up" of Browns Creek. Trash was removed from the channel and the riparian area. In addition, native vegetation was planted in the riparian zone to restore quality to the stream.



- a. **Ten Mile Creek** is a 3rd order stream that has a drainage area of 338 square miles. Ten Mile Creek begins in South Franklin Township, Washington County and drains east for approximately 12 miles, serving as the north eastern border between Washington and Greene County, and eventually empties into the Monongahela River at Millsboro. The PADEP has classified this stream as a Trout Stocked Fishery (TSF) from the source to convergence with South Fork Ten Mile Creek and a Warm Water Fishery (WWF) from South Fork Ten mile Creek to the mouth. According to PADEP's Internet website, no TMDLs have been approved for Ten mile Creek (PADEP, 2005). The Pennsylvania Fish and Boat Commission (PFBC) has officially approved this stream (from S.R.18 downstream to S.R. 19) as "approved trout waters", indicating that they meet criteria qualifying them to be stocked with trout by the PFBC. These waters are closed for all fishing from March 1 to 8:00 a.m. on opening day of trout season.

Ten Mile Creek watershed has an existing watershed association titled Ten Mile Creek Watershed Conservancy. The watershed association's slogan is as follows: "A voice for the natural continuum of Ten Mile (Cusutha's) Creek and neighboring watersheds in Greene and Washington Counties, Pennsylvania "Caring about the places no one is saving." For more information about the group, visit their website: <http://www.pawatersheds.org/watersheddirectory/detail.asp?varOrgID=233>.

- 11) **Whiteley Creek** is a 3rd order stream that has a total drainage area of 54.4 square miles. It originates in Whiteley Township and flows east to the Monongahela River. The PADEP has classified this stream under Chapter 93 Water Quality Standards as a TSF from the source to S.R. 2011 bridge and a WWF from the bridge to the mouth (the Monongahela River). According to PADEP's Internet website, no TMDLs have been approved for Whiteley Creek watershed to date, although PADEP will have an approved plan at the end of 2008. The Pennsylvania Fish and Boat Commission (PFBC) has officially approved this stream (from the headwaters downstream to S.R. 0088) as "approved trout waters."

A watershed mitigation plan for Whiteley Creek (Foundation for California University, 1999) was implemented in 1999 to mitigate impacts incurred by RAG Emerald Resources Corporation during coal mining operations. Mitigation measures included planting 110 acres of warm seasons grasses, construct 23 border edge cuts, and restore 7.2 miles of stream bank (7.2 miles of fencing, 5 acres of wetland restoration, construction of 7 cattle crossings, 5 ramps, 1 watering trough, 2 H-braces, 26 spring gates, and 4 wire gates) along Whiteley Creek. Implementation measures and monitoring is ongoing. In addition, the Greene County Conservation District implemented a best management practices (BMP) for the watershed.

Wetlands

A wetland is defined by the United States Fish and Wildlife Service (USFWS) as any land transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. For purposes of this classification wetlands must have one or more of the following three attributes: (1) at least periodically, the land supports predominantly hydrophytes; (2) the substrate is predominantly undrained hydric soil; and (3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of the year (USFWS, 2004). The USFWS provides information on the characteristics, extent, and status of the Nation's wetlands and deepwater habitats and other wildlife habitats. The USFWS attributes causes of wetland losses to urban development, agriculture, silviculture and rural development.

The United States Fish and Wildlife Service (USFWS) has developed a National Wetland Inventory (NWI) as directed by the Emergency Wetland Resources Act of 1986. Mapping and additional information about Greene County's wetlands can be accessed on the US Fish and Wildlife Service's National Wetland Inventory (NWI) website: <http://www.fws.gov/wetlands/data/index.html>. *Figure 4-5: Hydrology* illustrates the known wetland locations within the project area.

Floodplains / Floodways

According to 25 Pa. Code § 106, the definition of a floodplain is "the 100-year floodway and that maximum area of land that is likely to be flooded by a 100-year flood as shown on the floodplain maps approved or promulgated by Federal Emergency Management Agency (FEMA)." A floodway is defined as "the channel of the watercourse and those portions of the adjoining floodplains, which are reasonably required to carry and discharge the 100-year flood." Floodplains are important to a community and its environment because they hold back storm flows and reduce destructive flooding downstream. In addition, they are very fertile habitat, providing for good cropland for agriculture as well as providing important shading for stream habitat. Also, floodplains provide an important linkage between aquatic and upland habitat.

The one hundred and five hundred-year floodplains are generally narrow and restricted by the steep slopes that border most of the corridor. *Figure 4-5: Hydrology* illustrates the floodplain locations within the project area. Flood management and insurance rates are coordinated through the National Flood Insurance Program. This program, which was established by the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973, was an effort to reduce the damage and hazards associated with flood events. To accomplish these goals, the Federal Emergency Management Agency (FEMA) conducts routine flood insurance studies, which investigate the severity and existence of flood hazards throughout the country. The results of these studies are then used to develop risk data that can be applied during land use planning and floodplain development.



In addition to the flood hazard data provided by FEMA, the National Weather Service (NWS) operates river forecast points at several locations along the Monongahela River. River stage information is available through recorded messages, the NWS Internet site (www.nws.noaa.gov/er/pitt), and the National Oceanic and Atmospheric Administration (NOAA) weather radio. Army Corps of Engineers (ACOE) also maintains copies of FEMA studies and related flood hazard investigations. This information as well as other flood hazard assistance is available through the ACOE, Pittsburgh District Office.

According to the ACOE, Pittsburgh District Office, there are no federally maintained or owned flood control dams present in Greene County. PA-647 and PA-648 dry dams in the Enlow Fork watershed were constructed and are flood retarding structures for Wheeling, WV as well as a levee system that was built by the ACOE in New Freeport.

Groundwater

Water quality and quantity are life sustaining elements for human habitation, and plant and animal life. In very fundamental terms, groundwater is water that has traveled through the soil to locations within the ground where saturation occurs and creates the water table. This area within the ground has rock and / or soil layers that can store and transmit water—these rock and soil layers are called aquifers. There are generally two types of aquifers—consolidated and unconsolidated. Consolidated aquifers are locations of rock (limestone, granite, etc.) that hold water in the fractures of the rock. Unconsolidated aquifers include areas of rock debris or soil that hold the water between the particles.

Groundwater is defined as water under the surface of the earth in the saturated zone (PADEP, 2001). It is found underground in the cracks and pores in soil, sand, and rocks and makes up the base flow of rivers and streams. Groundwater is used everyday for household, agricultural, and industrial needs. Fifty-one percent of the total United States and 99 percent of the rural population of the US uses groundwater for their source of drinking water (The Groundwater Foundation, 2003).

Groundwater is constantly on the move through filtration and pumping. Gravity causes groundwater to move from higher “recharge” areas to lower areas where the water leaves the ground through springs, streams, wetlands, etc. Generally such movement is confined to a single watershed. Groundwater is recharged through precipitation that falls to the ground and, what isn’t taken by runoff or evaporated, eventually enters the saturation zone. The highest levels of groundwater recharge occur in the late winter fall and through the spring. Land cover directly influences the rate and ability of precipitation to infiltrate the soil and recharge the groundwater. For instance, large areas of impervious surfaces eliminate infiltration areas and direct water from original aquifer zones. In contrast, areas that are forested have high infiltration rates due to the ability of the soil to constantly accept precipitation.

To maintain a plentiful high quality water supply, Greene County has 40,750 acres of good groundwater recharge areas but no prime groundwater recharge areas. These areas can

be found along the streams. Good groundwater recharge areas must have soils that are non-hydric and well drained to moderately-well drained; slopes less than 25 percent; bedrock depth less than or equal to three percent; land cover of agricultural, forested or low-density residential; no wetlands; further than 1,000 feet of an abandoned mine drainage (AMD) impacted stream; and lie within 1,000 feet of flood prone area. Prime groundwater recharge areas must also be locations within high volume groundwater (well) areas (PEC et al, 2005).

Groundwater production areas are based on the production of known non-residential groundwater wells in the County as reported by private property owners to the PADEP. Greene County has 215,910 acres of groundwater production areas that produce up to six gallons per minute (gpm) and 121,110 acres that produce between six and eight gpm; while just over 30,000 acres produce more than eight gpm. Ten Mile Creek and the area along the Monongahela River, particularly in the southeast portion of the County, have the highest groundwater production.

Surface water production areas represent watersheds that possess exceptional water quality and provide ideal water sources for public consumption. There are no areas within Greene County that produce prime surface water protection areas; 5,240 acres of good surface water protection areas, located near Dunkard Creek; and 54,690 acres of other surface water production areas, mainly located in the western and north central portions of the County.

Water Quality

Groundwater has been used for centuries as a source of drinking water. While water can become unsafe for human consumption, without treatment, due to naturally occurring minerals or contaminants such as iron, radon, etc, more often, is the contamination of water supplies from waste disposal, resource extraction, agricultural practices, and human development.

Solid waste, human waste, chemical treatment products, resource extraction, farming, and land use can all affect the quality of water and availability of water. The presence of any one of these things can degrade water quality or even change the level of water from which to draw. Human waste and animal manure are two common causes of water contamination in rural areas. Human development or activities can cause significant damage to the natural occurring recharge and filtration of groundwater thereby reducing the availability of drinking water.

The detection of water contamination is difficult and expensive. Existing wells and water sources can be tested for contaminants but this does not provide a manner by which to determine the extent of pollution. Furthermore, some contaminants are harder to detect due to their chemical makeup. For instance, pollutants react differently when they come into contact with water and may float, sink, or mix with the groundwater thereby requiring a variety of methods to be identified. Finally, the treatment of contaminated groundwater is



expensive and difficult. Therefore, it is commonly accepted that the only solution is prevention of contamination.

In Pennsylvania, the Department of Environmental Protection is responsible for overseeing a variety of programs (authorized through legislation) that address water contamination. Many of these programs have been developed in response to federal legislation directing the state government to implement protection measures for water quality and availability. However, implementation must occur at the local level and most often requires a multi-municipal approach as watersheds do not follow political boundaries. Municipalities have the authority to implement land use regulations that control development and human activities.

Residents not on a public water system rely on water from privately owned and maintained wells. The Commonwealth of Pennsylvania does not govern private wells. The Master Well Owner Network (MWON) is an organization of volunteers who provide education on the construction, maintenance, and management of private water systems in Pennsylvania. As of April 2005, 243 volunteers, representing 55 counties throughout the commonwealth, were trained as Master Well Owners. To date, these Master Well Owners have educated over 6,500 homeowners and reported over 28,000 media contacts. (Source, <http://www.dcnr.state.pa.us/topogeo/groundwater/mwon.aspx>).

The availability of water is protected under **Act 220 known, as "The Water Resources Planning Act,"** which requires the Department of Environmental Protection to conduct a statewide water withdrawal and use registration and reporting program. Act 220, as amended on November 25, 2002, establishes a water resource planning policy for the Commonwealth of Pennsylvania. The information gathered from this program will be used to update the State Water Plan, identify Critical Water Planning Areas and develop Critical Area Resource Plans. The State Water Plan is a policy and guide for water resources. Its main goal is to provide information, prioritize issues and provide recommendations to guide municipalities, counties and state agencies. The plan is NOT legally binding and is completely VOLUNTARY.

The Act requires that public water systems that exceed 10,000 gallons a day must register and report their water use to DEP (no fees will be assessed to register or report). Alternative regulations will be developed for water users with withdrawals between 10,000 and 50,000 gallons and there will be no metering of homeowner wells. Critical Water Planning Areas will be identified on a multi-municipal watershed basis, where the demand for water exceeds, or is projected to exceed, available supplies.

Once established, Critical Water Planning Areas would serve as the planning boundary for the creation of a more detailed Critical Area Resource Plan or "water budget" for that area. Critical Area Resource plans will be submitted for review and comment to the Official Planning Agency and governing body of each municipality in the identified area prior to final recommendation. The Critical Area Resource Plans will be developed under the guidance of the regional committees in conjunction with a watershed advisory committee.

The plans will include a water availability evaluation, assess water quality and water quantity issues, and identify existing and potential adverse impacts on water resources uses.

The impetus behind Water Resources Planning Act (Act 220) is to protect the quality and availability of water resources. The Comprehensive Plan includes a discussion of natural resources within the project area including water resources and quality and potential impacts associated with development, agriculture, and mineral extraction. One focus of this Comprehensive Plan is to protect water resources to ensure the ongoing availability of a safe water supply and to acknowledge that:

- Lawful activities such as the extraction of minerals can impact water supply sources and such activities are governed by statutes regulating mineral extraction that specify replacement and restoration of water supplies affect by such activities.
- Commercial agriculture production can impact water supply sources.

Point Source Pollution

Point source, or end of pipe, pollutants are easily identified and can be directly traced to their source (e.g., industrial discharges, municipal discharges, stormwater discharges, combined sewer overflow discharges, and concentrated animal feeding operations (CAFO)). All point source discharges require a National Pollutant Discharge Elimination System (NPDES) permit, established by Section 402 of the 1972 Clean Water Act. According to the EPA's Envirofacts Warehouse Internet website (http://oaspub.epa.gov/enviro/ef_home2.water), 56 facilities have been issued NPDES permits in Greene County (EPA, 2005).

Non-Point Source Pollution

Non-Point Sources (NPS) include all other forms of pollution that are not point sources (e.g., abandoned mine drainage, agriculture, urban runoff, atmospheric deposition, construction activities, on-lot sewage systems, leachate from landfills, and silviculture).

Sedimentation

Sediment from roads, farms, construction sites, logging, and a host of other sources is the largest single contributor of pollution of Pennsylvania's waters (www.dirtandgravelroads.org). The Dirt & Gravel Road Maintenance Program was enacted into law in April 1997, as Section 9106 of the PA Vehicle Code to establish "environmentally sound maintenance." The program provides dedicated and earmarked funding to eliminate stream pollution caused by dust and sediment from unpaved roads. Across the state, 12,000 sites have been identified where road runoff negatively impacts a stream. County Conservation Districts are the local program administrators and annual funding is provided to them



based on identified need. Funding is available to all municipalities and other entities that provide maintenance to dirt and gravel roads after successful completion of a required two-day Environmentally Sensitive Maintenance (ESM) training.

County Conservation Districts have until the end of 2008 to complete a voluntary countywide assessment. The Assessment consists of inspecting unpaved roads in the field and locations where unpaved road runoff affects stream quality should be made into "worksites." Worksites are then evaluated using established criteria to determine the overall "pollution potential" for the site and become the basis of the Dirt and Gravel Road Program in the County (www.dirtandgravelroads.org).

The primary sediment pollution control entity at the County level is the Greene County Conservation District 102/105 program under the delegation of the PADEP. The 102/105 program reviews Erosion and Sediment Control Plans for earth disturbance activities as well as issuing PAG-2 NPDES permits, ESCGP-1 permits, and PASPGP-3 permits. These permits are essential to the monitoring and recording of development activity near waterways or of a large enough scope to potentially create sediment pollution.

Legacy Sediment

The PADEP defines legacy sediment as "sediment that (1) was eroded from upland slopes during several centuries of intensive land clearing, agriculture, and milling (in the eastern U.S., this occurred from the late 17th to late 19th Centuries); (2) collected along stream corridors and valley bottoms, burying pre-settlement streams, floodplains, wetlands, and dry valleys; and that altered the hydrologic, biologic, aquatic, riparian, and chemical functions of pre-settlement streams and floodplains; (3) accumulated behind ubiquitous low-head mill dams in slackwater environments, resulting in thick accumulations of fine-grained sediment, which distinguishes "legacy sediment" from fluvial deposits associated with meandering streams; (4) can also accumulate as coarser grained, more poorly sorted colluvial (not associated with stream transport) deposits, usually at valley margins; (5) can contain varying amounts of total phosphorus and nitrogen, which contribute to nutrient loads in downstream waterways from bank erosion processes. Widespread indicators of impaired streams and watersheds due to legacy sediments include high banks, rapid rates of bank erosion, high sediment loads in streams, habitat degradation (aquatic and riparian), and diminished recharge of groundwater and denitrification capability." The Greene County Watershed Alliance was awarded \$230,964 in Growing Greener grant money in 2006 for natural stream channel design to rectify bank

erosion and channel migration on the South Fork of Ten Mile Creek Watershed.

Abandoned Mine Drainage

Abandoned Mine Drainage (AMD) is a source of NPS from a complex interaction involving sulfides and oxygen during the mining process. After mines are abandoned, drainage flowing from these sites often decreases the pH of streams and rivers affected by the drainage. Additionally, it can elevate concentrations of heavy metals and suspended solids within impacted waterways (Frey, 1996). AMD remains the single biggest source of surface water impairment in the state of Pennsylvania. Many serious problems arise from AMD, including contaminated drinking water, plant and animal growth and reproductive problems, and corrosion of infrastructure. AMD is both a severe ecological and economical problem. Sources of AMD are scattered throughout the county as a result of past mining. *Figure 4-5: Hydrology* illustrates the location of the identified mine problems in the project area, as identified in the Natural Infrastructure Project completed by the Southwestern Pennsylvania Commission (SPC). Each site numbered (0-24) and the details of each are listed in Table 4-3: Identified Abandoned Mine Drainage (AMD) Problem Areas. In addition, Dunkard Creek is identified as a fishery (warm water fishery) that is impacted by AMD. As the fourth largest coal producing state, Pennsylvania has more than 250,000 acres of abandoned mine lands, refuse banks, old mine shafts and other relics, according to the DEP. As a result of these abandoned lands and subsequent mine drainage, more than 2,400 miles of stream are polluted and don't meet water quality standards because of this pollution. Thus, besides sedimentation, AMD remains as the single biggest source of surface water impairment in the state of Pennsylvania.



Abandoned Mine Drainage (Mackin, 2007)



Table 4-3: Identified Abandoned Mine Drainage (AMD) Problem Areas

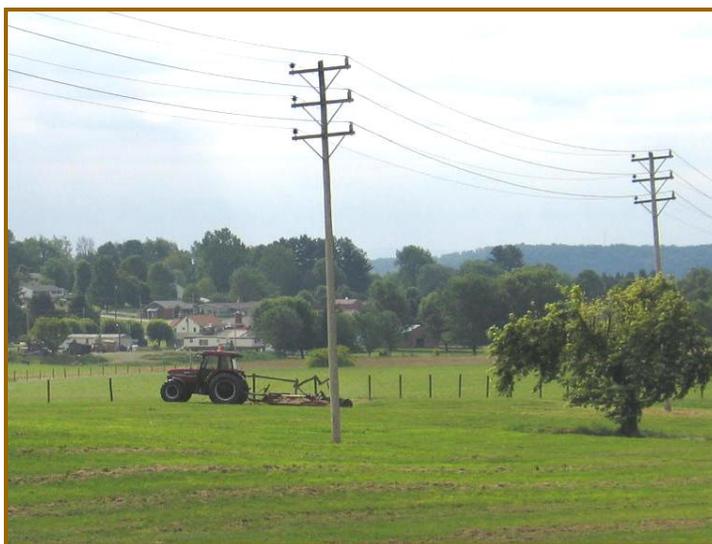
Site #	Location	Owner	Funding Source	Mine Type	Priority	Cost of Completed Project	Cost of Funded Project	Cost of Unfunded Project	Type
0	Nardei Construction	Private	Interim Coal Site Funding	Surface	2	\$344,944	\$0	\$0	Dangerous Highwall
1	Chartiers	Private	Rural Abandoned Mine Program	Surface & Underground	1	\$0	\$0	\$103,697	Surface Burning
2	Rices Landing	Private	Rural Abandoned Mine Program	Surface & Underground	1	\$0	\$0	\$3,000	Vertical Opening
3	Ten Mile Creek	Private	Rural Abandoned Mine Program	Surface & Underground	1	\$19,070	\$0	\$0	Portal
4	Dry Tavern	Private	Rural Abandoned Mine Program	Surface & Underground	1	\$0	\$65,265	\$0	Dangerous Impoundment
5	Dry Tavern	Private	Rural Abandoned Mine Program	Surface & Underground	1	\$0	\$5,000	\$0	Portal
6	Dry Tavern	Private	Rural Abandoned Mine Program	Surface & Underground	1	\$0	\$16,436	\$0	Dangerous Highwall
7	Ten Mile Creek	Private	Rural Abandoned Mine Program	Surface & Underground	1	\$0	\$7,474	\$0	Portal
8	Waynesburg	Private	Rural Abandoned Mine Program	Surface & Underground	1	\$1,640	\$0	\$0	Portal
9	Ten Mile Creek	Private	Rural Abandoned Mine Program	Surface & Underground	1	\$14,275	\$0	\$0	Portal
10	Stoney Point	Private	Rural Abandoned Mine Program	Surface & Underground	1	\$0	\$8,060	\$0	Portal
11	Barbe	Private	Rural Abandoned Mine Program	Underground	1	\$0	\$0	\$10,000	Portal
12	Ten Mile Creek	Private	Rural Abandoned Mine Program	Surface & Underground	1	\$58,513	\$0	\$0	Portal
13	Menear	Private	Rural Abandoned Mine Program	Underground	1	\$0	\$0	\$15,000	Portal
14	Juracko	Private	Rural Abandoned Mine Program	Surface & Underground	1	\$0	\$0	\$11,050	Portal
15	Taylorstown	Private	Rural Abandoned Mine Program	Surface & Underground	1	\$5,000	\$0	\$30,000	Portal
16	Taylorstown	Private	Rural Abandoned Mine Program	Surface & Underground	1	\$15,924	\$0	\$0	Subsidence-Prone Area
17	Taylorstown	Private	Rural Abandoned Mine Program	Surface & Underground	1	\$0	\$0	\$393,958	Dangerous Highwall
18	Mather	Unknown	Pre-SMCRA Coal Grant Program	Underground	2	\$0	\$0	\$105,000	Hazardous Equipment or Facilities
19	Mather	Unknown	Pre-SMCRA Coal Grant Program	Underground	2	\$0	\$2,440,000	\$6,255,000	Dangerous Pile or Embankment
20	Mather	Unknown	Pre-SMCRA Coal Grant Program	Underground	2	\$0	\$0	\$1,200,000	Surface Burning
21	Chartiers Southwest	Unknown	Pre-SMCRA Coal Grant Program	Underground	2	\$0	\$0	\$10,000	Gases: Hazardous or Explosive
22	Chartiers Southwest	Unknown	Pre-SMCRA Coal Grant Program	Underground	2	\$0	\$0	\$1	Vertical Opening
23	Monongahela River E.	Unknown	Pre-SMCRA Coal Grant Program	Underground	2	\$0	\$0	\$100,000	Dangerous Pile or Embankment
24	Poland Mines	Private	Pre-SMCRA Coal Grant Program	Surface & Underground	2	\$91,019	\$0	\$0	Dangerous Highwall

Source: Natural Infrastructure Atlas, SPC 2005

To combat AMD in the state, several programs have been created. These most recent efforts started in 1992 with the establishment of the "10 Percent Set Aside Program," which utilizes federal abandoned mine land grant funds to address AMD. Additional funding in the state has also come from the Appalachian Clean Streams Initiative, bond forfeiture, and Pennsylvania's new "Growing Greener" program. As a result of these programs and funding, 19 separate treatment facilities have been constructed in cooperation with other agencies, including the Natural Resources Conservation Service, the U.S. Army Corps of Engineers, the Environmental Protection Agency's 319 non-point source program, county conservation districts, and local watershed associations.

Agriculture

Because approximately 40 to 45 percent of the project area is classified as agriculture, pollution from unmanaged agricultural practices contributes to the degradation of the waterways and groundwater (for more information on Agriculture, see Chapter 11). Fertilizers, manure, pesticides, and silt from agricultural lands can contribute to heavy siltation, nutrient accumulation, and suspended solids within stream and groundwater systems. In addition, unrestricted access of livestock into streams also creates harmful effects, such as, stream bank erosion, sedimentation and excessive nutrient enrichment.



Agricultural Land (Mackin, 2004)



Sewage Discharge

Sewage discharge is another form of non-point source pollution. The majority of the County, particularly in the west and southeast, does not have public sewerage. Raw sewage discharge often results in elevated levels of fecal coliform bacteria, which can lead to potential health risks. In addition, untreated sewage discharge leads to an increase in nutrients in a stream system leading to an increase in Biological Oxygen Demand (BOD) making it more difficult for macroinvertebrates and fish to survive.

Urban Runoff

Increased urban development results in an increased pollution load that reaches area water bodies, and therefore, is considered another form of non-point source pollution. Natural landscapes, such as forests, fields, and wetlands, are porous and act as natural filtering systems that help to carry rainwater and snowmelt runoff gradually toward receiving waters. Urban areas, on the other hand, are nonporous and, as a result, storm drains are installed to quickly channel runoff from roads and other impervious surfaces into receiving streams and/or treatment areas (in cases of Combined Sewer Overflow systems). This runoff contains sediment from development and new construction; oil, grease and toxic chemicals from automobiles; nutrients and pesticides from turf management and gardening; viruses and bacteria from failing septic systems; road salts; and heavy metals and reaches receiving waters quickly, traveling at a high velocity. This large volume of quickly flowing runoff has the potential to erode stream banks, damage streamside vegetation, widen stream channels, and carry pollutants such as directly to the stream (USEPA, 2004).

Extraction

An additional non-point source of water pollution in the project area may arise from oil and gas extraction (for more information on energy and extraction, see Chapter 12). Because water is used as a primary lubricant or coolant during all phases of extraction—exploration, well development, production and site abandonment—the water has the opportunity to mix with a variety of chemicals and materials. Although all these processes create waste water, the majority is produced during production and site abandonment. In addition to improper disposal of waste water, this water pollution can also be in form of brine, waste pit sludge, and erosion and sedimentation.

Chloride, sodium, calcium, magnesium, and potassium are typically found in high concentrations, within waste water that is produced during oil and

gas extraction. Some other substances found in waste water include:

- Organic compounds: benzene, naphthalene, toluene, phenanthrene, bromodichloromethane, and pentachlorophenol;
- Inorganics: lead, arsenic, barium, antimony, sulfur, and zinc (EPA, 1992).

Because this waste water is contaminated with a wide variety of chemicals, it can pose a threat to water resources and the natural environment in general, if not discarded properly. However, the PA Clean Streams Law helps to minimize such impacts through its regulation over oil and gas wells operations.

In regards to abandoned or orphaned wells, the concern over water pollution is due to the potential of reservoir fluid migrating to fresh water aquifers and contaminating drinking supplies. When this occurs, the primary contaminant would be saline formation water that could pollute fresh water aquifers and possibly even surface waters.

An estimated 7,563 wells in Pennsylvania had been identified and approved as orphans, as of December 10, 1997. Since 1988, only ninety-four orphan wells have been plugged, which still leaves 7,469 more that need addressed. 550 of those wells are known to be causing health, safety or environmental problems. These orphan wells have been identified in 25 counties. According to the DEP, Greene County has approximately 1,164 oil and gas wells. Thirty-nine are known to be orphaned wells, of which only one has been plugged, leaving the others as a potential threat to water resources and the surrounding environment.

The Pennsylvania DEP maintains copies of oil and gas well locations and any environmental violations or contamination as a result of production; however, concerning environmental impacts from byproducts, the DEP doesn't maintain any documentation. This information as well as other information relating to the wells within the County is available through the PADEP, Southwest District Office. For information on oil and gas wells, see Chapter 12: Energy & Extraction.



Stormwater Management

Both the quality and quantity of water resources are impacted by the natural occurrence of precipitation and the ability of surface waters to handle the additional flow as well as groundwater to recharge itself. Surface waters and groundwater can both be impacted negatively by human development and/or activities. For instance, development can reduce the effective infiltration of water through soil to provide the necessary recharging of aquifers. Certain development activities can reduce the effectiveness of natural systems to accommodate large water flows thereby causing flooding and erosion.

In populated areas, sewer systems have been constructed to accommodate rain events and transport water via underground sewer lines to locations away from developed areas. Oftentimes the end distribution point is directly into surface waters such as creeks or rivers. Typically, the stormwater is collected once it runs off of streets, buildings, construction areas, etc. which leaves the water contaminated by the pollutants present in these areas. The MS4 Stormwater Management Program is a plan to reduce polluted stormwater conveyed by municipal separate storm sewer systems (MS4) into local waterways. The National Pollutant Discharge Elimination System (NPDES) program provide procedural steps for MS4's that to prevent or treat stormwater prior to release into the environment. Small MS4 programs (MS4's not serving populations greater than 100,000) are charged to reduce the discharge of pollutants, protect water quality, and comply with the Clean Water Act. At this time, Greene County does not have any MS4 communities.

The Stormwater Management Act of 1978 (Act 167) provides the legal authority for counties to prepare a stormwater management plan for the management of stormwater based on the physical and hydrologic characteristics of a watershed. The goal of the legislation is to control the non-point pollution of streams and tributaries. Act 167 plans are designed to limit the negative effects of rain events on streams, groundwater, floodplains, and storm sewers by controlling increased volumes and rates of stormwater runoff. Act 167 requires that counties develop and adopt stormwater plans and update those plans every five years. The management of storm events, water runoff, and flooding must be undertaken from a regional level, beyond political boundaries so as to encompass the watershed that directs the flow of the water. It has been found that the most effective method to address concerns with stormwater and flooding is to enhance the infiltration of water or storing excessive water for a period of time until the water flows can be accommodated. Such methods include both built and natural tools.

County governments are responsible for the development of a watershed stormwater plan. The development of such a plan must occur following consultation with municipalities and residents. The public involvement component includes establishing a Watershed Plan Advisory Committee. Additionally, the County is responsible for reviewing and updating the watershed stormwater plan a minimum of every five years. Greene County initiated their Act 167 Plan in 2008.

The implementation of a Stormwater Management Plan is at the local municipal level. Each municipality enacts or amends local ordinances to comply with recommendations contained within the County Stormwater Plan. Municipalities are to undertake such action within two years of the County's adoption of the Plan. In the event that a municipality fails to take the appropriate legislative action, the DEP can authorize the State Treasurer to withhold any Commonwealth funds that the municipality may be receiving.

Municipalities are obligated to enforce the County's plan through municipal ordinances. The Act 167 Plan should not be considered a comprehensive land use plan, but a supplement to a municipally directed Comprehensive Plan. The municipal level of control is essential to the overall success of the Act 167 Plan due to the interconnected element of the watershed. It should be noted that the Act 167 plan serves as an enforcement mechanism for future development that could increase stormwater flows. While existing problems related to stormwater runoff or flooding would be identified in an Act 167 Plan, there is no legal obligation for municipalities to correct existing drainage deficiencies only to prepare remediation measures for future development.

The Pennsylvania Department of Environmental Protection (DEP) is the state agency responsible for coordinating the completion of Act 167 Plans. DEP works closely with the County to identify watersheds for study, the scope of the study, and all reviews and approvals of the plan. DEP also makes available model ordinances to ease the implementation of the Plan at the local level. DEP has prepared a single purpose stormwater ordinance, a single purpose stormwater ordinance for rural municipalities, an amendment to a subdivision and land development ordinance, and amendment to building codes, and an amendment to a zoning ordinance. DEP advises municipalities to coordinate their legislative review of the model ordinances with the County Planning Commission and County Conservation District. Examples of a few of the requirements contained in the model ordinances include the following:

Suggested amendments to the building code include:

1. Add:
 - a. Roof Top Storage of Stormwater
 - i. The design of large roof surfaces shall consider the storage of precipitation on the roof structure.
 - b. Parking lot surfaces—parking lots shall be graded with rolled or compacted cinders, gravel or other approved materials including porous pavement, where feasible.
 - c. Stormwater drainage of parking lots—this revision addresses the design of parking lots to include seepage pits and/or detention basins to control runoff of water.



Suggested methods of implementation through municipal zoning

1. Alternative no. 1— general provisions to amend an existing zoning ordinance
 - a. Define impervious surface, define Peak Rate of Stormwater Runoff, add district regulations to limit impervious surfaces and control Peak Rate of Stormwater Runoff.
2. Alternative no. 2— create an overlay district for stormwater management within the municipal zoning ordinance
3. Alternative no. 3— enact performance zoning
 - a. The property owner or developer is required to identify and map natural features and adhere to specific buffering standards.

Suggested amendments to Subdivision and Land Development Ordinance

1. Amend the purpose of the ordinance to include stormwater management principles.
2. Amend the ordinance to include provision for developers to determine stormwater management criteria and complete a preliminary plan and final plan.
3. Enact design criteria to follow within specific areas of the municipality.

Enact a Single Purpose Ordinance

1. This is a stand-alone ordinance to regulate the rate and quality of stormwater, control accelerated soil erosion, to stormwater districts, to review stormwater management plans, to issue land disturbance permits and collect fees, and insure the maintenance of permanent stormwater management structures.

Enact a Single Purpose Ordinance for Rural Municipalities

1. DEP provides a simplified model ordinance and is developed in consultation with the County Planning agency and Conservation District.

Design standards can be enacted to reduce stormwater runoff on buildings and encourage infiltration of water into the soil. Septic systems management programs can be implanted to ensure that human waste or the treatment chemicals do not pollute groundwater through the malfunction of treatment systems.

The quality of water in streams, rivers, lakes, ponds, and groundwater is important because it impacts the biological, physical, and chemical processes that take place in these waters directly. Because all water within a watershed and across watershed boundaries is directly or indirectly related, any impacts to one form bear an influence on all of the other forms. Human impacts are typically in one of two forms of pollution—point source and non-point source.

Ecological Habitats & Environmentally Sensitive Areas

State Game Lands

The State Game Lands (SGL) system was established in 1920 by the Pennsylvania Game Commission (PGC) to ensure wild animals always have food and shelter. This system currently contains about 300 separate tracts comprising a total of about 1.4 million acres (PGC, 2008).

Three SGL, #179, #223, and #302, are located within Greene County, as shown on *Figure 4-6: Ecological Habitats*. The SGL's attract hunters, especially in the fall and winter, which can help the local economy. The SGL's also help protect wildlife and preserve hunting and provide recreational opportunities for local residents. Each SGL has an individual management plan designed to improve wildlife habitat and provide recreational opportunities. However, according to the PGC, Greene County SGL are under-hunted and underutilized.

SGL	Location	Size (acres)
#179	Aleppo, Gilmore, and Jackson Townships	5,386
#223	Cumberland, Dunkard, Greene, and Whitley Townships	7,223
#302	Richhill Township	1,084

Source: Greene County Website, 2008

SGL #179 includes a 300 yard rifle range on Rinehart Road in Jackson Township and in 2005, was voted one of the top ten hunting spots in Pennsylvania by WTAE Channel 4 news (www.pittsburghchannel.com).

SGL #223 includes a rifle range and Wetland Restoration Project. The Wetland Restoration Project is being completed by the PGC in cooperation with Ducks Unlimited, Greene County Prison, Greene County Vo-Tech School, Izaak Walton League of America, PennDOT, Pheasants Forever, and the U.S. Fish & Wildlife Service. An observation platform is available for citizens for bird watching. Recently, the PGC announced that it has approved an oil and gas lease with Atlas America LLC to drill for gas in 2,031 acres of SGL #223 in Dunkard and Greene Townships. Atlas will be permitted to drill up to 13 wells on the lease site and they must comply with state regulations, the standard lease agreement, and post a \$25,000 performance bond. Reclamation after the drilling will be completed and must enhance the habitat for wildlife. Part of the agreement includes the Game Commission receiving 139 acres of land adjacent to SGL #265 in Fayette County, royalties and free natural gas (Observer-Reporter article on 4-29-08).



SGL #302 is the smallest SGL in the County but home to an Audubon Important Bird Area. The area has breeding populations of Cerulean, yellow-throated, and Kentuck warblers; Louisiana warbler, Acadia flycatcher, and summer tanager. (Sources-Greene County's website and www.pa.audobon.org)

SGL #223 contains 5.5 miles of designated routes for horses and bicycles that are in compliance with regulations that went into effect on February 1, 2003. Under the regulations, anyone who rides a non-motorized vehicle, conveyance or animal on State Game Lands must do so only on designated routes. Such riding activities will not be permitted, except on Sundays or on roads open to public travel, from the last Saturday in September to the third Saturday in January, and after 1 p.m. from the second Saturday in April to the last Saturday in May. This does not apply to anyone lawfully engaged in hunting, trapping or fishing on State Game Lands.

There are no designated routes for snowmobiles in any of the three State Game Lands in Greene County. State Game Lands 179 and 223 contain public shooting ranges which are open year-round, from 8 a.m. until sunset, except for Sunday mornings, unless otherwise posted.



SGL 179 (Mackin, 2004)

Important Bird Areas

An Important Bird Area (IBA) is a site of special significance to breeding or non-breeding birds, which, on some basis, can be distinguished from surrounding areas (PA Audubon Society, 2004). It is also a site that is recognized globally for its bird conservation value. The National Audubon Society administers this program in the United States and these areas are monitored by volunteer efforts. IBAs were established to promote habitat conservation by focusing attention on ways to avoid habitat fragmentation, suburban sprawl, and over browsing by deer.

One IBA is located in Greene County and is shown on *Figure 4-6: Ecological Habitats*. Enlow Fork (located within State Game Land #302), also known as Enlow Fork Natural Area, is an approximately 1,000-acre publicly owned IBA. Special representations by the IBA include a Pennsylvania Species of Special Concern—Summer Tanager (*Piranga Rubra*) and the habitat type is considered to be rare, threatened, or unusual within the state or region. In addition, this habitat is found to be an exceptional representative of a characteristic natural or near-natural habitat within its physiographic province (PA Audubon Society, 2004).

Natural Heritage Inventory Areas

The Greene County Natural Heritage Inventory (NHI) is a record of the native biological diversity within the political boundaries of Greene County. The major purpose of this inventory is to provide county and local governments and community groups with a valuable tool to assist them in their planning efforts. Not only can this inventory guide local development, it can also give suggestions for protecting significant natural heritage resources in Greene County. Greene County's NHI was completed in May 2005 by the Western Pennsylvania Conservancy (WPC). The NHI lists seven general recommendations for protecting Natural Heritage Areas (NHAs) within Greene County:

1. Consider conservation initiatives for NHAs on private land;
2. Prepare management plans that address species of special concern and natural communities;
3. Protect bodies of water;
4. Provide for buffers around NHAs;
5. Reduce fragmentation of surrounding landscape;
6. Encourage the formation of grassroots organizations; and
7. Manage for invasive species.

The Natural Heritage Inventory has not only located areas of significance, it has also ranked them according to amount, degree, and rate of protection (Exceptional, High, and Notable). This Inventory utilizes two classifications of Natural Heritage Areas and suggested development restraints: Biological Diversity Areas (BDA) and Landscape Conservation Areas (LCA). *Figure 4-6: Ecological Habitats* illustrates the locations of



both the BDAs and LCAs. Most of the 'exceptional' BDAs and LCAs are located along Ten Mile Creek and Dunkard Creek, making these two critical areas in need of protection.

Biological Diversity Areas (BDA)

A Biological Diversity Area (BDA) is defined as "an area containing plants or animals of special concern at state or federal levels, exemplary natural communities, or exceptional native diversity. BDAs include both the immediate habitat and surrounding lands important in the support of these special elements" (Greene County NHI, 2005). BDAs are given attributes according to their sensitivity to human activities and their significance.

Special Species Habitat – An area that includes natural or human influenced habitat that harbors one or more occurrences of plants or animals recognized as state or national species of special concern.

High Diversity Area – An area found to possess a high diversity of species of plants and animals native to the county.

Community/Ecosystem Conservation Area – An area that supports a rare or exemplary natural community (assemblage of plants and animals), including the highest quality and least disturbed examples of relatively common community types.

The Inventory suggests that disturbances, except for special cases, associated with all land uses be eliminated from the site and its buffer. If a disturbance is necessary, the Inventory suggests contacting the appropriate resource agency.

BDAs are also categorized according to their significance for protecting biological diversity and ecological integrity in the region. Significance ranks are 'Exceptional', 'High', 'Notable', and 'County', in order of importance. According to the Greene County NHI, sites of exceptional significance merit quick, strong and complete protection. Six "Exceptional", five "High", and 42 "Notable" BDAs have been recognized within the County. One BDA, Cumberland Wetland BDA, has "County Significance."

Landscape Conservation Areas (LCA)

An LCA is defined as "a large contiguous area that is important because of its size, open space, habitats, and/or inclusion of one or more BDAs" (Greene County NHI, 2005). Although an LCA includes a variety of land uses, it typically has not been heavily disturbed and thus retains much of its natural character. LCAs are given attributes according to their type and significance. LCAs can be either Forest Block LCAs, which are the most feasible places for the development of large,

contiguous forest ecosystems, or Watershed LCAs, which are watersheds that support important aquatic resources.

The Inventory suggests that certain land-uses, including construction of new roads and utility corridors, non-conservation timber harvesting, clearing or disruption of large pieces of land, and other activities that divide and alter the character of the landscape, should be avoided.

LCAs are also categorized according to their significance for protecting biological diversity and ecological integrity in the region the same way BDAs are, with significance ranks of 'Exceptional', 'High', 'Notable', and 'County', in order of importance. The contiguous nature of LCAs is essential to its character and importance, so care must be taken that fragmentation is minimized during development. Three "Exceptional", one "High", and one "Notable" LCA have been identified within the County. Seven LCAs have "County Significance."

Environmental Concerns

Air Quality

Air pollution is the nation's largest environmental health risk. Two hundred million tons of toxic emissions pollute the air in the United States each year. Much of this pollution is created by human influences, such as industry, power plants, cars, and trucks. Since air pollution is not confined to a specific area, it affects everyone.

Two of the largest sources of air pollution in the county are from Allegheny Energy's Hatfield's Ferry and Fort Martin power plants (NRDC, 2004). Hatfield's Ferry power station is located in Monongahela Township along the shore of the Monongahela River; Fort Martin power station is located in Madsville, West Virginia. Although Fort Martin is not within the political boundary of Greene County, the power station's emissions affect the human and animal population of the county.

Each year, the two power stations release nitrogen oxides, sulfur oxides, heavy metals, and particulate matter (NRDC, 2004). High emissions of these chemicals result in negative health effects on humans and animals. Lung damage, heart disease, asthma, respiratory illness, and cancer are documented effects from acute and chronic exposure to some or all of these toxins.

Hazardous or Nuisance Areas

An inventory of hazardous and toxic waste sites was conducted for Greene County using the US Environmental Protection Agency's (USEPA) Right-to-Know Network database (USEPA, 2004). This query system identifies waste management facilities listed within the following regulatory databases:



1. Resource Conservation and Recovery Information System (RCRIS)
2. Comprehensive Environmental Response, Cleanup, and Liability Information System (CERCLIS)

RCRIS Sites

Resource Conservation and Recovery Act (RCRA) allows the federal government through the auspices of the USEPA to control hazardous waste from the "cradle-to-grave." This includes the generation, transportation, treatment, storage, and disposal of hazardous waste. RCRA also set forth a framework for the management of non-hazardous wastes (USEPA, 2006). The Right-to-Know Network database was used to identify any Large Quantity Generators (LQG) located within the county. LQGs are operations that produce >2,200 lbs. of hazardous waste in any given month of the year. Results of this search indicated that there are 12 LQGs in the county; none of these LQGs were noted as having any current violations as of June 2004.

A review of RCRIS was also used to identify the number of Small Quantity Generators (SQG) located within the watershed. There were 34 SQGs identified in the County. No SQGs were found to have current violations as of June 2004.

No Treatment, Storage, and Disposal (TSD) facilities were located within the County.

CERCLIS Sites

Comprehensive Environmental Response, Cleanup, and Liability Act (CERCLA) provides a Federal "Superfund" to clean up uncontrolled or abandoned hazardous-waste sites as well as accidents, spills, and other emergency releases of pollutants and contaminants into the environment. Through the Act, EPA was given power to seek out those parties responsible for any release and assure their cooperation in the cleanup (USEPA, 2006). The CERCLIS database provides listings of regulated hazardous waste sites along with the federal environmental legislation related to these sites. Using a CERCLIS query, no Pennsylvania Superfund Sites (NPL) or active CERCLIS sites were identified within Greene County.

Landfills

There are no active municipal waste landfills located within Greene County. Allegheny County and Greene County are the only two counties in southwestern Pennsylvania that do not have land suitable for a landfill while Butler, Indiana and Armstrong Counties offer the most land suitable for a landfill, as per the Natural Infrastructure Project (PEC et al, 2005). There are 14 inactive landfills located in Greene County.

Table 4-5: Inactive Landfills

Municipality	Facility Name	Location
Cumberland	Cumberland Township Landfill	Air Shaft Road
Cumberland	Nemacolin Landfill	Old Side Road
Cumberland	Rices Landing Boro Dump	Hathaway Road
Center	Center Township Landfill	School Road
Dunkard	Shannopin Disposal Facility	Holbert Stretch Road
Franklin	Waynesburg	North Woodland Avenue
Gray	Gray Township Landfill	School Road
Monongahela	Kois Landfill	Kois Road
Morgan	Morgan Township Landfill	Short Street / First Street
Morris	Morris Township Landfill	T479
Perry	Perry Landfill	Hobbs Run Road / Haines Ridge Road
Richhill	Richhill Township	T347
Washington	Washington Township Landfill	Tower Road
Wayne	Wayne Township Landfill	Morris Run Road

Source: DEP

Illegal Dumping / Littering

Littering has significant environmental, economical, and aesthetic impacts to an area. Both the aquatic and terrestrial environment is affected by both physical and chemical littering. Water pollution results from the improper or illegal disposal of chemicals. Littering impacts a community economically by increasing the cost to the taxpayer. Cleaning up litter is approximately nine times more expensive than collecting trash from trash receptacles (PADEP, 2004). Trash could also potentially reduce property value in a community. The presence of litter has a negative impact on the aesthetic value of a community and can reduce the quality of life for some individuals.

Littering and illegal dumping is a problem in Greene County; abandoned tires, cans and bottles, scrap lumber, furniture, and even appliances are found at various locations around the County. The Greene County Conservation District completed the removal of illegal dumps throughout the Dunkard Creek Watershed. The Conservation District has publicized this issue in newspapers, the District’s newsletter, and the GreeneSaver. The PA Cleanways of Greene County, Inc. and its volunteer have contributed a significant amount in the reduction of these dumps and littering havens. Reporting illegal dumps via



the PA Cleanways website (<http://www.pacleanways.org/greene/illegaldumpsurvey.html>) alerts the volunteer group to specific areas that need attention (PA Cleanways, 2006).

Areas of Unstable Geology

Sinkholes

Sinkholes are a feature of subsidence, which is when the Earth's surface moves downward as a result of chemical and physical weathering of carbonate bedrock in Pennsylvania (DCNR, 2004). This subsidence can also occur as a result of underground mining, excessive pumping of groundwater, and subsurface erosion due to the failure of existing utility lines.

A review of the DCNR Bureau of Topographic and Geologic Survey Limestone and Dolomite Distribution in Pennsylvania map indicates that the majority of the county is underlain by flat-lying, generally thin, but locally thick, limestone beds, which are discontinuous in places and are commonly interbedded with shale. An on-line review of the sinkhole inventory (DCNR, 2007) indicates that no sinkholes have been reported within the County, however Greene County reported a sinkhole in Taylortown, Dunkard Township, due to previous mining activity.

Landslides

Landslides are defined as the movement of an unstable mass of rock, unconsolidated earth, or debris down a slope. Both natural and human factors can affect the stability of slopes within the county. These include slope steepness, water sources, old landslides, support removal, and alternative of surface and subsurface drainage. Earthquakes can be a landslide trigger in many areas of the world, but are not known to cause landslides in Pennsylvania. The cause of a landslide is nearly always a combination of effects working together.

According to the DCNR Bureau of Topographic and Geologic Survey Areas of Pennsylvania that are susceptible to landslides mapping, the majority of Greene County falls within the highest susceptibility to landslides in the Commonwealth. This is due to the Permian with Dormont-Culleoka soils that can be found throughout the County (see *Figure 4-4: Soil Associations*). Only the most southeastern portion of the county falls within the high to moderate category.

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C. Development Strategies

The impacts of resource extraction, land development, and agricultural practices have also had a major impact on the natural environment and water quality. Many mitigation and remediation projects are underway throughout Greene County in an effort to “clean up” the environment and maintain the rural character that is cherished by residents and visitors alike. The most important lesson to be learned is the County and its municipalities must plan today in order to implement enforcement measures that ensure that the quality of life and natural resources are preserved for the future. Land use decisions must take the natural environment into account and future development should not have a negative impact on these integral resources.

The protection and conservation of natural resources and the rural integrity of Greene County is precious to the residents. Throughout the public involvement process, residents noted the need to protect and enhance watershed quality, the Monongahela River and other waterways, green and open space throughout the County, and other vital resources. The most important issues regarding open space and the environment were the need to prevent new and clean up old damage to the environment from mining and other related activities and the need to clean up illegal dump sites and roadside litter.

GOAL: Identify & mitigate issues that affect water quality & quantity

Strategy Develop and implement a countywide water resources inventory and evaluation program. The program will address the following:

1. Floodplain Monitoring Program (DCED) – monitor and prevent development in the floodplain and assure municipalities are overseeing proper permit and ordinance requirements.
2. Stormwater Management Plan (DEP) – provide for the correct conveyance of water to enhance water quality and minimize pollution.

Strategy: Direct efforts to Dunkard Creek and implement the recommendations contained in the Dunkard Creek River Conservation Plan.

Strategy: Conduct a Rivers Conservation Plan for Ten Mile Creek, Whiteley Creek, Little Whiteley Creek, Muddy Creek, and Pumpkin Run.

Strategy: Begin Phase 1 and 2 activities pursuant to achieving compliance with PA Act 167 (Stormwater Management) with technical and funding assistance from PADEP.

Strategy: Seek a greater state allocation to address problem areas identified through the County’s Dirt & Gravel Roads Program and encourage municipalities to participate in the program.

Strategy: Continue support of the Erosion and Sediment Control permitting program and evaluate the possibility of enforcement.

Strategy: Support and pursue funding for a monitoring program that involves local conservation organizations and local schools and universities to monitor upgrading designations of streams throughout the county.

Strategy: Obtain funding to complete Total Maximum Daily Load (TMDL) remediation plans on a watershed basis. The plans should identify the necessary corrective actions to achieve the reductions called for by TMDL studies, set milestones for these actions in a ten- year time frame, and outline funding strategies for implementation.

Strategy: Encourage PADEP to approve innovative technologies for septic treatment.

Strategy: Continue to implement recommendations contained in the Monongahela River Conservation Plan (RCP, 1998):

3. Develop a watershed database to coordinate conservation activities among governmental agencies, private organizations, and the general public
4. Establish a relationship with the Appalachian Clean Streams Initiative
5. Implement a volunteer trash removal or land stewardship program to clean and preserve the river corridor
6. Coordinate with PADEP's Bureau of Abandoned Mine Reclamation to identify "problem area" abandoned mine sites within the study corridor for reclamation and funding prioritization
7. Investigate the potential for utilizing abandoned tipples and other structures as public fishing piers
8. Develop fishing access at public parks
9. Encourage citizen monitoring and reporting of industrial and residential effluent violations
10. Encourage the preservation of the ecological and visual quality of the river corridor by planting a vegetative barrier along the river's edge where feasible
11. Identify or create a regional land trust to preserve and protect sensitive ecological habitats or historical properties
12. Coordinate with local officials and private industry to enforce stormwater management regulations and erosion control methods
13. Enforce deficient municipalities to establish compliance with existing sewage treatment regulations by preparing and updating formal Act 537 sewage facilities plans and prioritizing construction of sewage treatment facilities and/or sewage line extensions in unserved areas



GOAL: Assess & mitigate negative impacts from resource extraction

Strategy: Develop a GIS database to identify and track resource extraction activities and planned extraction areas.

Strategy: Identify and nominate significant hydrological units in the County to a PADEP Regional Committee for consideration as a Critical Water Planning Area (CWPAs) under the Water Resources Planning Act, Act 220 of 2002 (Act). The Act provides for identification of CWPAs, defined as "significant hydrologic unit where existing or future demands exceed or threaten to exceed the safe yield of available water resources."

Strategy: Track subsidence in streams caused by mining that result in increased wetlands and changing floodplains.

GOAL: Address abandoned mine drainage (AMD)

Strategy: Direct efforts to obtain funding to address identified abandoned mine drainage (AMD) problem areas as listed in Table 4.3 in Chapter 4 Natural Resources of the Greene County Comprehensive Plan.

Strategy: Pursue funding to inventory and map all AMD discharge sites.

Strategy: Participate and cooperate regarding interstate and state efforts to identify, quantify, and treat surface eruptions of AMD from deep mines in the Monongahela Basin.

Strategy: Research methods to treat AMD on a large-scale. Potential partners include the West Virginia University Water Institute; Pennsylvania, the federal government along with state, county and municipal governments within the Monongahela River Watershed (both in Pennsylvania and West Virginia); and companies currently involved in AMD treatment and remediation. Funding should be pursued through government avenues, regardless of its ultimate source (such as a tax on coal production).

Strategy: Research methods to treat AMD similar to natural gas as follows:

- Find point sources where high volume recovery can be affected while simultaneously ensuring that recovery from these areas will not permit an increase in elevation of the overall subterranean AMD pool (thus eliminating the possibility of future eruptions);
- Connect these point sources by pipeline;
- Economically connect these pipelines to (ideally) one central treatment facility. The concentrated volume of AMD will lower the cost of recovery of marketable products (ferric oxides, manganese, and concrete additives to name a few), and

provide a large source of water for consumptive, industrial, agricultural, or non-potable use.

GOAL: Assess & mitigate negative impacts from landslides

Strategy: Continue to update the GIS database to identify, prioritize, and track the status of landslides in Greene County.

Strategy: Educate landowners and municipal officials on proper disposal of fill that reduce the chance of landslides

Strategy: Provide funding to assist municipalities to mitigate landslide issues.

GOAL: Reduce the negative environmental effects and damage to community character caused by littering & illegal dumping

Strategy: Identify a responsible party to organize watershed organizations, local college level and high school level environmental clubs, and other interested members of the public to develop a program.

Strategy: Implement a public education campaign on economic impacts from damage to environment as well as to the image/aesthetics of Greene County.

Strategy: Increase fines for littering and dumping.

Strategy: Develop and enforce a county or municipal ordinance for littering prevention.

Strategy: Develop a GIS database to identify and track illegal dump sites and prioritize for clean up activities with the PA CleanWays of Greene County, Inc.

Strategy: Provide funding to the PA CleanWays of Greene County, Inc. to assist with the clean ups of illegal dump sites.

GOAL: Incorporate environmental protection concepts into County planning & development

Strategy: Become active members in the Pennsylvania Planning Association (including the local chapter, the Southwestern Pennsylvania Chapter).



- Strategy:** Increase knowledge of staff by sending them to training opportunities and conferences.
- Strategy:** Ensure that all plans reviewed by the planning staff are checked for compliance to MPC requirements, county plans, and local ordinances and comprehensive plans.
- Strategy:** Provide staff to meet with municipal governments and planning commissions to review plan submissions and compliance with the County Comprehensive Plan and County SALDO.
- Strategy:** Implement the recommendations from the Greene County Comprehensive Recreation, Parks and Trails/Greenways Plan (2008) to develop a greenways network.
- Strategy:** Implement the recommendations from the Monongahela River Conservation Plan.
- Strategy:** Revisit existing site development ordinances, with the aim of incorporating "green development" incentives, which will reduce the volume of stormwater, beautify the landscape, and facilitate the recharging of groundwater resources.
- Strategy:** Prepare the development of written memorandums of understanding between the County and municipalities to review all developments requiring earth disturbance or affecting the resource base or existing / planned infrastructure.

GOAL: Increase the availability & effectiveness of recycling efforts

- Strategy:** Support efforts to develop recycling events throughout the County.
- Strategy:** Hire a Recycling Coordinator.
- Strategy:** Establish a permanent recycling site with convenient weekend and evening hours.
- Strategy:** Develop a partnership with stores or sites in the County where recycling containers can be placed in locations that are easily accessible to the public (i.e. shopping areas).
- Strategy:** Encourage municipalities to include recycling costs in garbage fees and implement mandatory recycling.
- Strategy:** Revise the County Web Page to include highly visible and attractive sites that can provide information on recycling and waste removal.

GOAL: Improve cooperation & coordination between environmental & conservation groups to increase public support & involvement

Strategy: Encourage the establishment of Environmental Advisory Councils.

Strategy: Increase public education and support through an Environmental Education Specialist in the conservation district to educate the general public, municipal officials, teachers etc.

GOAL: Protect ecologically sensitive areas

Strategy: Encourage municipalities and developers to use the Greene County Natural Heritage Inventory as a tool when planning for future development.

Strategy: Promote the reuse of vacant, underutilized and/or abandoned industrial sites and brownfields.

Strategy: Ensure that planning staff or other county agency has the knowledge to educate site owners and host municipalities about reuse opportunities (i.e. funding sources, partners, and remediation efforts).

Strategy: Develop literature that can be distributed to the general public and municipal officials on reuse of industrial sites.

Strategy: Create a GIS database of all potential sites for reuse which would include acreage, ownership, utilities, infrastructure available, taxes, etc.

Strategy: Ensure that economic strategies incorporates environmental issues and actions.

Strategy: Establish incentives to develop or reuse sites (model zoning incentives, financial, etc).

Strategy: Encourage landowners to enroll ecologically important land into the Conservation Reserve Enhancement Program (CREP) through the Farm Service Agency, in partnership with the Western Pennsylvania Conservancy (WPC), USDA Natural Resource conservation Service and Pennsylvania Game Commission. For more information on CREP, visit <http://www.pgc.state.pa.us/crep/site/default.asp>.



GOAL: Minimize the impacts of flooding

Strategy: Develop and implement a Countywide Stormwater Management strategic plan.

Strategy: Update the County SALDO to include stormwater best management practices.

Strategy: Protect floodplains by establishing the floodplain monitoring program through the Greene County Conservation District and Greene County Department of Economic Development and encourage municipalities to at minimum follow floodplain ordinances and possibly update ordinances to be more stringent.

Strategy: Adopt a County Riparian Buffer policy that aligns with the Commonwealth's criteria for streamside buffer restoration, established through the efforts to restore the Chesapeake Bay Watershed with the following criteria:

1. A buffer must be at least 35 feet wide from the top of the streambank to the buffer's uphill edge (a width of 50 to 100 feet is strongly encouraged);
2. A buffer must contain at least two species of trees or shrubs, or a combination of trees and shrubs; natural regeneration is acceptable where nearby trees native to the area can provide a natural source of seeds, and where invasive plant species can be controlled; buffers established around wetlands may also count towards the goal; and
3. Conservation of existing forested streamside areas should occur within at least a 100-foot wide corridor.

Strategy: Develop a model Riparian (Stream) Buffer Ordinance for use by Greene County municipalities.

Strategy: Conduct a municipal education program to present the model Riparian Buffer Ordinance at municipal Planning Commission and governing body meetings. The educational program should include the benefits of wetlands in minimizing flooding and stream channel flooding regulations.

GOAL: Encourage maintenance & management of forested or wooded open space & promote the conduct of forestry as a sound & economically viable use of forested land

Strategy: Encourage the use of sound logging techniques and educate municipalities and landowners of the benefits associated with forestry activities.

Strategy: Assist municipalities to develop land use regulations that implement Best Management Practices that address logging and forestry.

Strategy: Contact the Bureau of Forestry Service Forester for assistance. This bureau has a forester assigned to every county in Pennsylvania and is available to provide technical assistance.

Strategy: Improve enforcement of logging sites for Erosion and Sediment control through the Greene County Conservation District.

GOAL: Avoid the loss of open space & greenspace from development & transportation improvements

Strategy: Develop a "mitigation bank" for the replacement of wetlands impacted by transportation projects.

Strategy: Develop transportation projects that allow for strategic wildlife passage in a manner that does not harm the traveling public. Such methods can include elevating a road structure, installing larger culverts, and building bridges.

Strategy: Transportation mitigation measures should include trails and bicycle lanes to allow for alternative transportation modes, such as walking and bicycling, to take place in urban settings and along transportation corridors previously designed exclusively for automobiles.

Strategy: Request that future transportation improvements include reforestation of hillsides and right-of-ways with native vegetation.

Strategy: Request that future transportation improvements include mitigation measures for greenspace such as steeping slopes to minimize right-of-way requirements, creating a vegetation clear zone along the edge of the roadway to discourage wildlife entry, and preserving existing habitat within the proposed right-of-way whenever possible.

Strategy: Utilize Transportation Enhancement monies for the purchase of easements to protect and extend greenways.

Strategy: Support transportation legislation that includes protection of open space and habitats (currently done with wetlands).