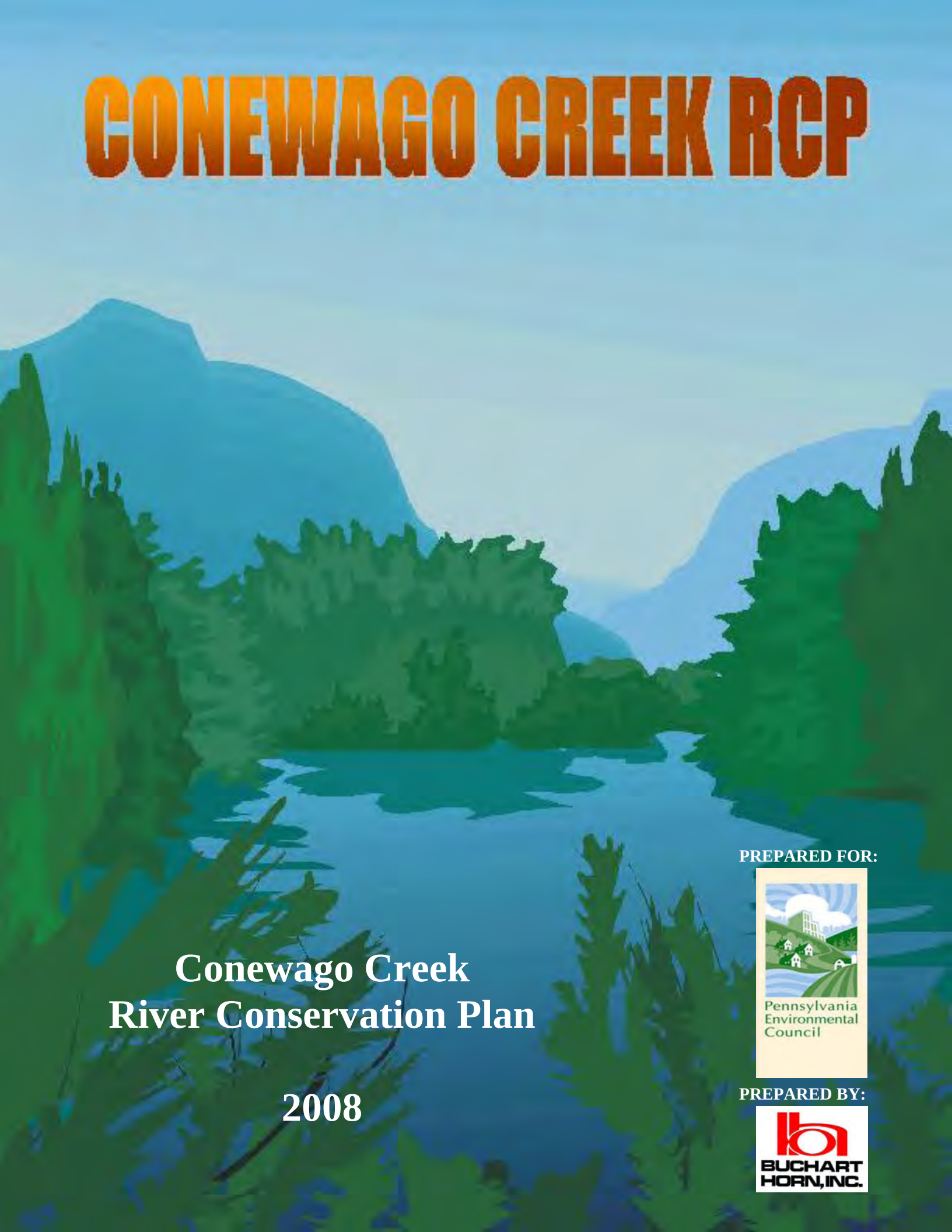
CONEWAGO CREEK RCP



Conewago Creek River Conservation Plan

2008

PREPARED FOR:

Pennsylvania Environmental Council

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TABLE OF CONTENTS

	Section
Executive Summary	**ES**
Introduction	**1**
Watershed Characteristics	**2**
Watershed Resources	**3**
General Watershed Issues, Concerns, Constraints, and Opportunities	**4**
General Recommendations	**5**
Sub-Watershed Detailed Analysis	**6**
References	**7**
Appendix A: *Growing Smarter Toolkit*	**A**
Appendix B: Example Ordinance (Wetlands - Investigation)	**B**
Appendix C: Example Ordinances – Wetlands Preservation	**C**
Appendix D: Example Ordinances – Forest/Tree Conservation	**D**
Appendix E: Example Ordinances – Riparian Buffer Protection	**E**

List of Figures

1.1-1	**Project Area Map**
1.1-2	**Stream Drainage Corridor Map**
2.2-1	**Relief Map**
2.2-2	**Hill Shade Map**
2.3-1	**Geologic Features Map**
2.3-2	**General Soils Map**
2.3-3	**Geologic Hazards Map**
2.3-4	**Mine Resources Map**
2.3-5	**Soil Slope Map**
2.5-1	**Land Cover Map**
2.5-2	**Importance of Forestry in Adams County**
2.5-3	**Zoning Map**
2.6-1	**Land Ownership Map**
2.6-2	**Population Density Map**
2.7-1	**Unique Features Map**
3.1-1	**Agricultural Preservation Map**
3.1-2	**Natural Resource Map**
3.1-3	**Water Quality Hazards Map**

3.2-1	**Hydrologic Cycle**
3.2-2	**Aquifers Map**
3.2-3	**Water Resources Map**
3.2-4	**Water Quality Map**
3.3-1	**T&E Prime Habitat Map**
3.3-2	**Species of Concern Prime Habitat Map**
3.4-1	**Resource Map**
3.4-2	**Historic Resources Map**
4.1-1	**Potentially Stressed and Water Challenged Areas Map**
4.1-2	**Water Stressed and Water Challenged Areas Map**
4.1-3	**Impervious Surface Change Map**
4.1-4	**Impervious Surface Change and Water Stressed and Water Challenged Areas Map**
4.2-1	**Hazard Analysis Map**
4.2-2	**Land Use Analysis Map**
4.2-3	**Zoning Analysis Map**
5.1-1	**Water Quality – High Priority Parcels Over 10 Acres - Recommendations Map**
5.1-2	**Soils Suitable for Infiltration and Aquifers - Recommendations Map**
5.1-3	**Soils Suitable for Infiltration and PSA and WCA – Recommendations Map**
5.1-4	**Effect of Trees on Stormwater**
5.1-5	**Forest Cover in PSA and WCA – Recommendations Map**
5.2-1	**3-Zone Buffer for Riparian Areas**
5.2-2	**Riparian Buffer Overlay Zone Map**
5.2-3	**Aerial Photo of Stream and Riparian Buffer Transitions**
5.3-1	**Prime Habitat Map**
5.3-2	**Critical Area Map**
5.3-3	**High Priority Parcels for Conservation and Critical Areas Map**
5.4-1	**Recreational Recommendations – Potential Access/Park Locations Map**
6.1	**Subwatershed Map Index**

EXECUTIVE SUMMARY

The Conewago Creek drains 510 square miles of steep mountain terrain, broad agricultural valleys, lush deciduous and coniferous forests, and several growing communities. As one of the largest subwatersheds within the Lower Susquehanna River drainage, the Conewago Creek has potential to greatly affect the condition of the Chesapeake Bay.

The Pennsylvania Environmental Council (PEC) recognizes this fact and in the fall of 2003 applied for funding to prepare a River Conservation Plan (RCP) for the entire watershed. PEC partnered with the Watershed Alliance of Adams County (WAAC) and the Watershed Alliance of York (WAY) to complete the project. Other project sponsors include the Adams County Planning Commission, the Adams County Conservation District, the York County Planning Commission, and the York County Conservation District. Funding for the project was awarded in the spring of 2004. PEC was quick to get started and after the steering committee was formed, the project was underway in June of 2004. Financial support was obtained from the Pennsylvania Department of Conservation and Natural Resources (PADCNR) with an in-kind match provided by the project partners, steering committee, and the consultants.

According to PADCNR, a River Conservation Plan is:

" A comprehensive watershed or river-corridor based study. This study requires an inventory of existing natural, recreational and cultural resources, analysis of the issues, concerns, and threats to watershed resources and values, and actions leading to the development of a long-term watershed management program."

In essence, the RCP is a large research project relying on available data and information to firmly establish the issues facing the entire watershed in an effort to develop the long-term management strategy. The first step in the process if the formation of a project steering committee consisting of concerned citizens, agency personnel, local government officials/representatives, and other stakeholders willing to serve the needs of the project. In addition to the steering committee, an extensive public involvement program is constructed to garner the input of the local citizens. To accomplish this, the Conewago Creek RCP included a series of public meetings throughout the watershed. In some cases, there are specific individuals, agencies, etc. which have a unique or otherwise extensive knowledge about the watershed. To reach these individuals, a key interview process was developed. Together, the public outreach programs help shape the RCP.

The Conewago Creek watershed rises from a low of 239 ft. at the Susquehanna River to almost 2000 ft. along the South Mountain Ridge in Adams County. In between exists a gently rolling broad valley dominated by farms, small communities, and a highly dissected pattern of springs, seeps, creeks and streams. The Conewago Watershed is underlain with unique geology which both affords many opportunities and severe limitations. In general, the watershed contains both soils and underlying geology suitable for groundwater recharge.

Land use within the watershed is dominated by agriculture at approximately 65% of the land area. While urban development does not constitute the largest land use, it is one of the most rapidly changing land uses (equivalent to impervious surface change). The areas of Dover, Hanover, and Biglerville have witnessed the most growth and development in recent years.

The Conewago Creek Watershed is home to a wide array of natural and man made resources. Prime farmland, land that is uniquely suited for crop cultivation, comprises the majority of land area within the watershed. The Natural Areas Inventory for both Adams and York Counties lists numerous other resources and the Pennsylvania Historic and Museum Commission identifies numerous archaeological and historic resources within the watershed. However, in addition to the resources identified in published reports and files, there are numerous other resources in existence.

By far the most precious resource within the watershed is water. The watershed is home to three unique aquifers that not only provide drinking water but also maintain base flow within all the streams and tributaries within the watershed. The aquifers have a few characteristics which limits the availability of water. The carbonate rock aquifer located in the southern portion of the watershed has the highest yields in the watershed and has a very high recharge rate, however, it is very susceptible to contamination. Furthermore, this area is considered to be a Potentially Stressed Area (PSA).

Other water resources include surface water lakes and impoundments, streams, and wetlands. There are four major surface water impoundments. Two of the impoundments are for drinking water and two are primarily for recreation, but provide other uses. In addition to the surface water impoundments the streams themselves are an important resource. There are approximately 2000 miles of designated stream reaches within the watershed. Several of these streams are designated high quality.

There are approximately 7000 acres of forested, emergent, and scrub-shrub wetlands within the watershed according to the National Wetland Inventory (NWI) maps. NWI maps are estimated to show 50% of all the wetlands present. One way to identify other possible locations of wetlands is through the identification of hydric soils. Hydric soils are soils that are subject to frequent flooding or saturation and therefore would support the establishment of wetland vegetation. Wetlands are natural filters of pollutants, provide valuable habitat to plants and animals, attenuate floods, and assist with groundwater recharge. Protecting these resources is important for sound watershed management.

The watershed is also home to a myriad of Threatened and Endangered Species, Species of Concern, and their respective habitats. Understanding the distribution, diversity, abundance, and population changes can give insight into watershed health. In some instances, the same geographic area could contain habitat for multiple species affording that area more significance.

At first it would seem as though cultural resources abound in the watershed. Cultural resources can generally be placed into two categories of recreational resources and historic resources. While recreational resources do exist in the form of state parks, state game lands, municipal parks, and state forest, review of project mapping reveals a potential lack of recreational opportunities particularly in close proximity or adjacent to the Conewago Creek and its major tributaries.

The Conewago Creek Watershed has a very distinctive history from pre-history (<1600 AD) to the post industrial development period (1950-present). Remnants of this history resides throughout the watershed in historic buildings and archaeological sites. The watershed was home to the Susquehannock Tribe who was most closely related to the Iroquois Tribe. During early colonial settlement, English, Germans, Scotch-Irish, and Quakers comprised the largest groups occupying the area. During community and commercial development (1750-1850, Revolutionary War) the watershed mostly supported the war effort by supplying men and supplies to the American Army. During industrial development the watershed saw two major events, the Civil War and the Industrial Revolution. The Post Industrial period of 1950-present saw the most significant changes in the watershed. Major manufacturing facilities sprang up throughout and the Fruitbelt put the watershed on a national map forever laying claim to some of the most productive orchards in the region.

Although the watershed is home to an abundance of natural and man-made resources, it is not without issues, concerns, and threats to those resources. The most significant issue facing the watershed is the lack of sustainable sources of groundwater and surface water resources. Approximately 1/3 of the land area within the watershed is located in either a Potentially Stressed Area (PSA) or a Water Challenged Area (WCA). A PSA is an area where existing or potential water withdraws are expected to exceed available resources and cause conflicts among the many users. A WCA is an area where natural conditions severely limit the availability groundwater resources to support growth and development.

Several areas within the watershed have been experiencing significant growth and development which further strains available resources. The greater Hanover area is located in a potentially stressed area, is located in the headwater area for the South Branch Conewago Creek, and is a hotbed of growth and development in recent years. Although the underlying geology is suitable for stormwater infiltration, infrastructure and appropriate policies are not in place to allow this to happen. Other areas of the watershed are not suitable for development because the underlying geology limits the availability of groundwater. These areas are also not well suited for infiltration of stormwater thus requiring the immediate discharge of retained stormwater to the nearest creek or stream.

Two watershed assessments for the watershed have identified locations throughout the watershed that are in sub-optimal to poor condition. As a result, water quality is the second most significant concern in the watershed. Often these concerns stem from stream health. Many stream reaches within the watershed are degraded thus contributing tons of sediment and nutrients per year to downstream receiving waters and ultimately the Chesapeake Bay. Many of these degraded stream reaches have many contributing

factors leading to their condition. Lack of riparian buffers, adjacent land use, unrestricted livestock access, and point discharges are all contributors to degraded stream health.

Another significant concerned identified in the RCP is the lack of public access to the Conewago and its major tributaries for fishing, canoeing, and kayaking. There is also a lack of public recreation facilities in the center and southern portion of the watershed. Lack of public access was a common theme in every public meeting held.

The RCP identifies both general and significant recommendations that strive to correct some of the most significant issues identified. The RCP is arranged to provide general recommendations for the entire watershed in Section 5 and more tailored recommendations for each sub-watershed in Section 6.

The overwhelming priority for all stakeholders of the watershed should be implementation of the RCP's recommendations. One way to accomplish this is through the adoption of municipal Environmental Advisory Councils (EACs). EACs have the ability to push for changes in ordinances and otherwise advise municipal officials on sound watershed health for long term sustainability of our shared resources.

The RCP identifies specific geographic areas that meet basic criteria to be eligible for agricultural preservation initiatives in both counties and strives to preserve open space in areas where groundwater resources are stressed or challenged. In addition, the RCP identifies specific geographic areas that should be preserved for their individual uniqueness. These areas may have multiple facets that combined make the area unique to the watershed. Preserving open space should be the highest priority in the short term. Other recommendations addressing groundwater resources are the adoption of a wetland/natural resource overlay zone, riparian buffer zones, forest conservation ordinance, and wetland identification and delineation ordinance.

SECTION 1.0 - Introduction

In June 2004, the Pennsylvania Environmental Council (PEC), a state-wide non-profit watershed organization, in partnership with the Watershed Alliance of Adams County (WAAC) and the Watershed Alliance of York (WAY), was awarded a grant from the Pennsylvania Department of Conservation and Natural Resources (PADCNR) for the preparation of a River Conservation Plan (RCP). PADCNR defines a RCP as:

> **"*A comprehensive watershed or river corridor-based study*. This study requires an inventory of existing natural, recreational and cultural resources, analysis of the issues, concerns and threats to river resources and values and specific recommendations that set forth priorities and actions leading to the development of a long-term watershed management program."**

To complete the task, PEC, in August 2004, contracted with a local consulting firm to assist in the completion of the RCP. In addition, PEC was required to obtain an in-kind services match for the grant. The in-kind services match is being obtained by garnering support of local agencies, organizations and municipalities.

Other notable contributions were provided by the following:

Adams County Planning Commission (ACPC)
York County Planning Commission (YCPC)
Adams County Conservation District (ACCD)
York County Conservation District (YCCD)
Cumberland County Planning Commission (CCPC)
York County Economic Development Corporation
Watershed Alliance of York (WAY)
Watershed Alliance of Adams County (WAAC)
EcoSolutions, Inc.
Hedgerow Land Ecology Services
Conewago Canoe Club
Trout Unlimited
Pennsylvania Department of Environmental Protection (PADEP)

The Conewago Creek Watershed drains approximately 510 square miles of rural agricultural land, forested areas, small urban centers, and rural residential neighborhoods (Figure 1.1-1). The watershed is located in south-central Pennsylvania and extreme northern Maryland within Adams County, PA, York County, PA, Cumberland County, PA and Carroll County, MD. The Conewago Creek is a major tributary to the lower Susquehanna River region and is approximately 53 nautical miles upstream from the Chesapeake Bay.

Due to its vastness, the Conewago Creek watershed has potential to contribute high amounts of sediment and nutrients to the Chesapeake Bay. High sediment loads and

See Figure 1.1-1 Project Area Map

nutrient loads are the primary source of water quality degradation within the Chesapeake Bay Watershed. Until now the Conewago Creek watershed and it's tributaries have been largely overlooked when it comes to protection, conservation, restoration and the funding necessary to protect it. Based on a recent "Unified Watershed Assessment" by the Pennsylvania Department of Environmental Protection (PADEP) the Conewago Creek Watershed has been categorized as a "High Priority: Category 1" watershed (Lower Susquehanna River Sub-basin). This watershed has received this classification because only a limited amount of background information is available and it has a high potential for impairment resulting from non-point source pollution (primarily agriculture).

Watershed protection is quickly becoming the most effective method to restoring our water resources. Several watersheds which surround the Conewago already have long term management plans in place which serve to assess, preserve, protect, and restore valuable watershed resources. The single aspect of our built and natural environment which affects every person regardless of race, creed, or religion is water, both quantity and most importantly, quality. It's one thing to have enough water, but the quality must be sufficient to support human and other users. Without sufficient quality water supplies, sustaining life becomes problematic.

Many state and federal agencies have been given regulatory control over the quality and quantity of our water resources. However, these agencies only have limited control due to changing regulations that are often influenced by elected officials. Everyone has a vested interest in preserving our water resources whether they realize it or not. In recent years there has been a significant increase in the number of local, grassroots environmental organizations. Usually these organizations are focused mainly on protection and restoration of watersheds such as the Watershed Alliance of Adams County and the Watershed Alliance of York. However, they can be other volunteer groups such as Trout Unlimited and the Isaac Walton League. These organizations have tremendous potential to reach local citizens and municipalities in an attempt to instill change in how we manage our watersheds and their resources. This plan is designed to be a long term management strategy that goes beyond the regulatory control of agencies. The plan identifies general and specific recommendations that we as citizens can implement on the local level that will hopefully increase water quality and quantity.

The RCP process is, in essence, a large research project. Typically the assessments have been completed and we know the locations of some problem areas. Sometimes the assessments do provide some general recommendations on how to deal with problems or issues. The RCP uses these assessments and many other sets of data to first perform an analysis, and then to identify general and specific solutions to those problems. Under the RCP process no new data is generated through an assessment. During the preparation of an RCP, other projects are going on simultaneously which may benefit or benefit from the RCP. Every attempt is made to coordinate with those other projects to reduce duplication of effort.

Other projects going on are the Little Conewago Act 167 Phase I, the Greater Hanover Source Water Protection Plan, Adams County Greenways Plan, Adams County

See Figure 1.1-2 Stream Drainage Corridor Map

Comprehensive Plan Update, various stream restoration projects, various park projects, and other projects by state agencies, local municipalities, and grassroots organizations.

This RCP is a continuation of the attempt to develop long term management strategies for the entire Commonwealth of Pennsylvania. Currently, there are RCP's for the Yellow Breeches Creek to the north, the Codorus Creek to the south and east, and the proposed Conococheague Creek to the west. As such, the written or text portion of this RCP makes an attempt to maintain some continuity between the other plans. DCNR recommends the River Conservation Plan focus on a river corridor approximately one (1) mile wide on either side of the main branches (Figure 1.1-2). However, this plan expands on that corridor to encompass the entire watershed and is then in essence, a watershed conservation plan. The Conewago RCP, like the Codorus Creek, takes the planning process one step farther by creating an interactive tool for use by municipalities in the watershed.

The concept of an interactive watershed tool resulted from the lack of use by most of the prepared RCPs. Most of these documents are not used the way they are intended and instead remain where they were first placed, on a shelf. To make the Conewago Creek Watershed RCP useful, an interactive watershed management tool based on GIS, the Conewago Creek Watershed Toolbox (CCWT), will be developed. The goal of the CCWT is to provide a unique, user-friendly, easily understandable interactive tool which enables the municipalities, planning officials and other groups and agencies to access the information, analysis, and recommendations of the RCP in an electronic format. A user of the CCWT surfs the watershed for information the way internet users surf websites for information. The written document portion of the RCP is meant to complement the CCWT. The written portion will also be provided in a PDF format on the CCWT.

The **Study Area** for the RCP is the entire 510 square mile watershed from its headwaters in South Mountain and Mason-Dixon Line areas in Adams County to the confluence with the Susquehanna River at York Haven in York County.

To evaluate the watershed, it was divided into sub-watersheds based on data received from the Pennsylvania Spatial Data Access (PASDA) and the York and Adams County Planning Commissions. Major watershed boundaries follow Pennsylvania's State Water Plan, while the sub-watershed boundaries follow DEP's Stormwater Management Program. In some instances it was necessary to "unofficially" name some of the sub-watersheds to eliminate confusion for the Watershed Toolbox.

Sections 2-5 describes and analyze the watershed in its entirety. There are general characteristics and observations made about the whole watershed irrespective of the sub-watershed boundaries. Section 6 describes the sub-watersheds in more detail and provides specific recommendations for each sub-watershed and the municipalities in which they lie.

SECTION 2.0 - General Characteristics of the Entire Watershed

2.1 Watershed Location, Size

The Conewago Creek Watershed is a major tributary of the Lower Susquehanna River Basin and is approximately 53 nautical miles upstream from the Chesapeake Bay. The watershed drains approximately 510 square miles of rural agricultural land, forested areas, small urban centers, and rural residential neighborhoods.

The watershed is located within Adams County, PA, York County, PA, Cumberland County, PA and Carroll County, MD. The Conewago Creek Watershed is one of the major watersheds in York and Adams Counties, Pa. In fact, approximately 95% of the watershed's total area is located in York and Adams County. A very small portion of the watershed is located in Cumberland County, PA, and Carroll County, MD. The watershed extends from extreme southwestern York County and northwestern Adams County around the South Mountain Area north and east to the confluence with the Susquehanna River at York Haven. The headwaters of the Conewago Creek's three main branches, the South, West, and Main stems, are located in southern York County along the Maryland-Pennsylvania border and the northwestern corner of Adams County (Figure 1.1-1).

2.2 Topographic Setting

The Conewago Creek Watershed is located in the Piedmont, and Ridge and Valley Physiographic Provinces. The Piedmont Physiographic Province covers most of Southeastern Pennsylvania and is characterized by low, gently rolling hills intersected by shallow streams. The Ridge and Valley Province is characterized by an area of ridges partly dissected by deep valleys. Local relief between valley bottoms and ridge tops is generally several hundred feet and can be as much as 1,000 feet (Figure 2.2-1).

The watershed has varied topography that ranges from lowland areas adjacent to the Susquehanna River, to rolling hills within the Piedmont Lowland Section to very steep areas in the Piedmont Upland Section.

Elevation ranges in altitude for a high almost 2,000 feet in the South Mountain Area to a low of approximately 240 feet along the Susquehanna River. Elevations of 400-700 feet in altitude are prominent in the northern, northeastern, and northwestern portion of the watershed. In the Piedmont Lowland Section, elevations tend to be lower, more in the range of 300-600 feet.

The Conewago Creek Watershed can be characterized as a broad valley of low relief bordered by more mountainous terrain on the west/northwest and the southeast sides of the watershed. The Conewago Mountains lie in a linear ridge

See Figure 2.2-1 Relief Map

See Figure 2.2-2 Hillshade Map

running north of Dover in York County almost to the Susquehanna River. This shallow ridge forms the divide between the Conewago and Little Conewago Creek drainage basins. The Little Conewago Creek watershed is include in this plan.

2.3 Geology and Soils

An understanding of a watershed's geology is critical for groundwater resource management because rock controls the abundance and occurrence of groundwater. Armed with the awareness of how geologic materials (rock) retain and transport groundwater allows the implementation of site-specific conservation techniques intended to promote groundwater recharge. The purpose of the section is to outline the watershed geology and associated aquifers, establish the geologic limitations that each aquifer poses, and define methods to promote groundwater recharge.

A. Watershed Geology & Aquifers

Watershed Geology

A physiographic province is a regional area of land that is composed of a particular type(s) of rock as a result of having undergone certain environmental processes over time, which distinguish it from other surrounding areas. Each province is distinguishable by its physical landforms, unique rock formations, and groundwater characteristics. Each physiographic province is comprised of similar sections, which can be further subdivided into formations or dominant lithological types; formations may be combined into groups or subdivided into members.

The two physiographical provinces within the Conewago Watershed are the Piedmont Province and the Ridge and Valley Province. The Piedmont Province consists of the Gettysburg-Newark Lowland, the Piedmont Lowland, and the Piedmont Upland Sections**.** The above referenced sections can be further subdivided into 25 formations or dominant lithological types. The Ridge and Valley Province consists of the South Mountain Section**.** The South Mountain Section can be further sub-divided into 6 formations or dominant lithological types. The Gettysburg-Newark Lowland Section underlies the bulk of the Conewago Creek Watershed, followed by the South Mountain Section, Piedmont Lowland Section, and finally the Piedmont Upland Section (Figure 2.3-1).

Each physiographical province within the Conewago Watershed was analyzed to determine the underlying bedrock's ability to store and transport groundwater. In order to make this determination, each formation that comprises the Conewago Watershed was assessed with special focus on porosity and permeability. Porosity and permeability are two of the primary factors that control the movement and storage of fluids in rocks and sediments and therefore these variables are important measures of aquifers ability to provide potable groundwater.

See Figure 2.3-1 Geological Features Map

Porosity is the ratio of the volume of openings (voids) to the total volume of material. Porosity represents the storage capacity of the geologic material. The primary porosity of a sediment or rock consists of the spaces between the grains that make up that material. Secondary porosity is a subsequent or separate porosity system in a rock, such as a joint, fracture, or fault, and often enhances the overall porosity of a rock. Secondary porosity can replace the primary porosity or coexist with it. Permeability is the capacity of a porous rock, sediment, or soil to transmit fluid. Permeability is a measure of the relative ease of fluid flow through a material.

Listed below are geologic descriptions of each physiographic province section. Table 2.3-1 through Table 2.3-4, which accompany this assessment, denote the formations that create each physiographic province. The porosity and permeability designations found on Tables 2.3-1 through 2.3-4 define porosity and permeability as low, moderate, and high. A designation of low indicates that a material is almost impermeable. A designation of moderate indicates that a material has the ability to support most residential, commercial, and industrial user needs. A designation of high indicates that a material has the potential to produce large quantities of groundwater. It should be noted that the above designations assume that water (precipitation) is available for storage and transportation.

Piedmont Province

The majority of the **Gettysburg-Newark Lowland Section** consists of rolling low hills and valleys developed on ***red sedimentary rock*** with isolated areas developed on ***diabase***. The bulk of the underlying sedimentary rock dips to the north / northwest. The basic drainage pattern is dendritic. Relief is generally in the area of 100 to 200 feet, but locally is up to 600 feet on some of the isolated hills. Elevation in the Gettysburg-Newark Lowland Section ranges from 20 to 1,355 feet. There are many outstanding geologic scenic features within this section, such as: Conewago Falls, Cornwall Mine, Dinosaur Rock, Eagle Rock, the Falls of French Creek, Governors Stables, the Monroe Border Fault, Ringing Rocks, Rock Hill, Sentinel Rock, and The Lookout.

The formations that create the Gettysburg-Newark Lowland Section are listed on Table 2.3-1.

The **Piedmont Lowland Section** consists of broad, moderately dissected valleys separated by broad low hills. The Section is developed primarily on ***limestone and dolomite rock***. Karst topography is common throughout this section. Local relief in the Section is generally less than 100 feet, but may be as much as 300 feet. Elevations in the Piedmont Lowland Section range from 60 feet to 700 feet. Drainage is basically a dendritic with some areas have virtually no pattern because of the well-developed subsurface drainage. There are many outstanding geologic scenic features within this section, such as: the Donegal Spring, the Fruitville Quarry Fossil Site,

Getz Farm Fossil Locality, Indian rock, Lititz Springs, and Rheems Quarry.

The formations that create the Piedmont Lowland Section are listed on Table 2.3-2.

The **Piedmont Upland Section** consists of broad, gently rolling hills and valleys. This upland area is developed mainly on ***metamorphic rocks***. These rocks usually have a very well developed plane (schistocity) that was formed during metamorphism. This plane dips at moderately steep angles to the south. In general the drainage pattern within this section is dendritic. Local relief is generally less than 300 feet, but it can be as much as 600 feet. Elevations in the section range from 100 to 1,220 feet, but are generally between 400 and 600 feet. There are many outstanding geologic scenic features within this section, such as: Black Barren Spring, Black Rock, Castle Rock, Chickies Rock, Chimney Rock, Conowingo Islands, Counselman Run Area, Devils Plunge Pool, Devils Pool, High Rock, Indian Rock, Marsh Creek Bog, Otter Creek Gorge, Pinnacle Overlook, Pulpit Rock, Serpentine Barrens, Tucquan Glen, and Wildcat Run Gorge.

The formations that create the Piedmont Upland Section are listed on Table 2.3-3.

Ridge and Valley Province

The **South Mountain Section** is an area of ridges partly dissected by deep valleys. This area is formed on ***metavolcanic and quartzite rocks***. Local relief between valley bottoms and ridge tops is generally several hundred feet and can be as much as 1,000 feet. The South Mountain Section's highest elevation is 2,080 feet; lowest, 450 feet. The ridges are formed of resistant rocks while the valleys have been eroded into less resistant rocks. There are many outstanding geologic scenic features within this section, such as: Bare Rock, Chimney Rocks, Columnar Jointed Volcanics, Devils Racecourse, Eagle Rock, Hammonds Rocks, Lewis Rocks, Mont Alto Gorge, Monument Rock, Stone Head, and The Narrows.

The formations that create the South Mountain Section are listed on Table 2.3-4.

Table 2.3-1: The formations that create the Gettysburg-Newark Lowland Section are listed as follows:

Formation Name	***Description / Dominate Lithology***	***Bedding, Fracturing, Weathering***	***Drainage***	***Porosity & Permeability***	***Groundwater (Median Yield)***
*Gettysburg	Shale and Sandstone	Moderately well-bedded; Moderately developed and abundant joints; Moderately resistant to weathering and weather to a moderate depth	Good surface drainage	Joint and bedding plane openings provide a secondary porosity of moderate magnitude; moderate permeability	66 gal/min
Quartz Fanglomerate	Quartz Conglomerate	Not Reported.	Not Reported.	Not Reported.	Not Reported.
Limestone Fanglomerate	Limestone Conglomerate	Not Reported.	Not Reported.	Not Reported.	Not Reported.
*Heilersburg Member of the Gettysburg Formation	Sandstone with Interbeds of Shale and Sandstone	Moderately well-bedded; Well developed and moderately abundant joints; Moderately resistant to weathering and moderately weather to a shallow depth	Good surface drainage	Primary porosity of moderate magnitude in weathered material and low magnitude in unaltered material. Joint and bedding plane openings provide a secondary porosity of moderate magnitude; low permeability	50 gal/min; 90% percent of domestic wells exceeded 18 gal/min from wells drilled to a depth of 275-feet or more.
*Gettysburg Conglomerate	Quartz Conglomerate	Well-bedded; Moderately developed and abundant joints; Moderately resistant to weathering	Good surface drainage	Joint, bedding, and fault plane openings provide a secondary porosity of low magnitude; low permeability	11 gal/min for non-domestic wells
*Diabase	Diabase	Not bedded; Well developed, moderately abundant joints; Highly resistant to weathering	Fair surface drainage	Joint openings provide a very low secondary porosity; low permeability	5 gal/min

Table 2.3-1: Gettysburg-Newark Lowland Section continued

Formation Name	***Description / Dominate Lithology***	***Bedding, Fracturing, Weathering***	***Drainage***	***Porosity & Permeability***	***Groundwater (Median Yield)***
Jurassic Aged Sedimentary Strata	Arkosic Sands	Not Reported.	Not Reported.	Not Reported.	Not Reported.
Beekmantown Group	Limestone and dolomite	Well-bedded; Moderately to well-developed and moderately abundant joints; Moderately resistant to weathering and slightly weathered to a moderate depth	Good surface drainage; minor subsurface drainage	Joint and solution channel openings provide a secondary porosity of low to moderate magnitude; low permeability	Yields of 50 gal/min in Lancaster County. Higher yields occur in fractures and solution cavities.
New Oxford Conglomerate	Quartz Conglomerate	Well-bedded; Moderately developed joints; Moderately resistant to weathering.	Good surface drainage	Low to moderate primary porosity; low permeability	14 gal/min
*New Oxford Formation	Sandstone and Shale	Well-bedded; Moderately developed joints; Slightly resistant to weathering.	Good surface drainage	High to moderate total effective porosity; moderate permeability.	66 gal/min

* Indicates the dominant formations within the province section.

Table 2.3-2: The formations that create the Piedmont Lowland Section are listed as follows:

Formation Name	***Description / Dominate Lithology***	***Bedding, Fracturing, Weathering***	***Drainage***	***Porosity & Permeability***	***Groundwater (Median Yield)***
Kinzers	Shale	Moderately well bedded; Moderately abundant, highly developed joints and cleavage patterns; Moderately resistant to weathering. Highly and deeply weathered.	Good surface drainage	Joint and cleavage plane openings provide a secondary porosity of moderate magnitude; moderate permeability	30 gal/min. Reported well yields range from less than 1 gal/min to 400 gal/min.
Ledger	Dolomite	Moderately well bedded; Moderately to well-developed, moderately abundant joints; Moderately resistant to weathering. Slightly to moderately weathered to a shallow depth.	Good surface and subsurface drainage	Joint, bedding plane openings, and solution channels provide a secondary porosity of low to high magnitude; low to high permeability	30 gal/min. Reported well yields range from less than 1 gal/min to 400 gal/min.
Vintage	Dolomite	Moderately well bedded; Moderately to well-developed, moderately abundant joints; Moderately resistant to weathering. Slightly to moderately weathered to a shallow depth.	Good surface drainage; little subsurface drainage	Joint and solution openings provide a secondary porosity of moderate magnitude; low permeability	30 gal/min.

Table 2.3-2: Piedmont Lowland Section continued

Formation Name	***Description / Dominate Lithology***	***Bedding, Fracturing, Weathering***	***Drainage***	***Porosity & Permeability***	***Groundwater (Median Yield)***
Antietam	Quartzite and Quartzite Schist	Moderately well to well bedded; Moderately to well-developed, moderately abundant joints; Highly resistant to weathering.	Good surface drainage	Joint and cleavage plane openings provide a secondary porosity of low magnitude; low permeability	20 gal/min.
Chickies	Quartzite and Quartzite Schist	Moderately well to well bedded; Moderately well developed, moderately abundant joints; Highly resistant to weathering.	Good surface drainage	Joint and cleavage plane openings provide a secondary porosity of very low magnitude; very low permeability	20 gal/min.
Antietam / Hapers	Schist and Phyllite	Moderately well bedded; Moderately developed, highly abundant joints; Moderately resistant to weathering. Highly and deeply weather.	Good surface drainage	Joint and cleavage plane openings provide a secondary porosity of low magnitude; low permeability	24 gal/min.
*Conestoga	Limestone and Shale	Crudely to poorly bedded; Poorly formed, moderately abundant joints; Moderately resistant to weathering.	Good surface drainage and minor subsurface drainage; few sinkholes	Joint and some solution channel openings provide a secondary porosity of low magnitude; moderate to low permeability	25 gal/min.

* Indicates the dominant formation within the province section.

Table 2.3-3: The formations that create the Piedmont Upland Section are listed as follows:

Formation Name	***Description / Dominate Lithology***	***Bedding, Fracturing, Weathering***	***Drainage***	***Porosity & Permeability***	***Groundwater Yield***
Kinzers	Shale	Moderately well bedded; Moderately abundant, highly developed joints and cleavage patterns; Moderately resistant to weathering. Highly and deeply weathered.	Good surface drainage	Joint and cleavage plane openings provide a secondary porosity of moderate magnitude; moderate permeability	30 gal/min. Reported well yields range from less than 1 gal/min to 400 gal/min.
Burgoon	Sandstone	Well developed bedding; Moderately developed joints; Generally, highly resistant to weathering.	Very good surface drainage	Overall a high total effective porosity; Generally, high permeability	Artesian flow can be expected and yields of over 300 gal/min are possible
Vintage	Dolomite	Moderately well bedded; Moderately to well-developed, moderately abundant joints; Moderately resistant to weathering. Slightly to moderately weathered to a shallow depth.	Good surface drainage; little subsurface drainage	Joint and solution openings provide a secondary porosity of moderate magnitude; low permeability	30 gal/min.
New Oxford Conglomerate	Quartz Conglomerate	Well-bedded; Moderately developed joints; Moderately resistant to weathering.	Good surface drainage	Low to moderate primary porosity; low permeability	14 gal/min
Marburg Schist	Schist and Phyllite	Not Reported.	Not Reported.	Not Reported.	Not Reported.

Table 2.3-3: Piedmont Upland Section continued

Formation Name	***Description / Dominate Lithology***	***Bedding, Fracturing, Weathering***	***Drainage***	***Porosity & Permeability***	***Groundwater Yield***
Chickies	Quartzite and Quartzite Schist	Moderately well to well bedded; Moderately well developed, moderately abundant joints; Highly resistant to weathering.	Good surface drainage	Joint and cleavage plane openings provide a secondary porosity of very low magnitude; very low permeability	20 gal/min.
Antietam / Hapers	Schist and Phyllite	Moderately well bedded; Moderately developed, highly abundant joints; Moderately resistant to weathering. Highly and deeply weather.	Good surface drainage	Joint and cleavage plane openings provide a secondary porosity of low magnitude; low permeability	24 gal/min.
Conestoga	Limestone and Shale	Crudely to poorly bedded; Poorly formed, moderately abundant joints; Moderately resistant to weathering.	Good surface drainage and minor subsurface drainage; few sinkholes	Joint and some solution channel openings provide a secondary porosity of low magnitude; moderate to low permeability	25 gal/min.

Table 2.3-4: The formations that create the South Mountain Section are listed as follows:

Formation Name	***Description / Dominate Lithology***	***Bedding, Fracturing, Weathering***	***Drainage***	***Porosity & Permeability***	***Groundwater Yield***
Burgoon	Sandstone	Well developed bedding; Moderately developed joints; Generally, highly resistant to weathering.	Very good surface drainage	Overall a high total effective porosity; Generally, high permeability	Artesian flow can be expected and yields of over 300 gal/min are possible
*Metarhyolite	Metarhyolite	Not Reported.	Not Reported.	Low storage; Low yield	4.5 gal/min. Known as one of the lowest yielding aquifers in the Commonwealth.
Greenstone Schist	Greenstone Schist	Not Reported.	Not Reported.	Low storage; Low yield	3.0 gal/min. Known as one of the lowest yielding aquifers in the Commonwealth.
Antietam	Quartzite and Quartzite Schist	Moderately well to well bedded; Moderately to well-developed, moderately abundant joints; Highly resistant to weathering.	Good surface drainage	Joint and cleavage plane openings provide a secondary porosity of low magnitude; low permeability	20 gal/min.
Weverton / Coudoun	Quartzite and Quartzose Conglomerate	Crudely bedded; Poorly formed highly abundant joints; Moderately resistant to weathering	Good surface drainage	Joint provide a secondary porosity of low magnitude; low permeability	20 gal/min.
Warrior	Limestone	Well bedded; Moderately well-developed, moderately abundant joints; Moderately resistant to weathering.	Good surface and subsurface drainage	Joint and solution channel openings provide a secondary porosity of low to moderate magnitude; low to high permeability	100 gal/min.

* Indicates the dominant formation within the province section.

B. Watershed Soils

The watershed is typified of soils formed of materials weathered from igneous (volcanic) and metamorphic (pressure and heat) rocks. The soils within the region have depths ranging from 40 to 70 inches and dominant slopes varying between 0 to 20 percent. Due to the level, deep nature of soils in the care, the Conewago Creek Watershed historically has been used for agriculture (Bureau of Resources Programming, 1980). According to the United States Department of Agriculture (USDA) general Soil Map for York and Adams Counties (Figure 2.3-2), the following major soil groups are present within the Conewago Creek Watershed:

Urban Land-Duffield-Hagerstown Association: Urban land that is nearly level to strongly sloping with very deep and well drained soils that formed in residuum from limestone found on ridges and in narrow valleys. Most of the soils of this association are found around West Manchester Township and Jackson Township.

Chester-Glenelg Association: This association is characterized by land that is gently sloping to moderately steep with deep to very deep well drained soils formed from schist, phyllite and saprolite on ridge tops and hills. These soils are mostly used for agriculture with some areas of urban land uses and woodland intermingled.

Mt. Airy-Glenelg-Manor Association: This association is characterized as land that is gently sloping to moderately steep with moderately to deep soils that are somewhat excessively drained to well drained and formed from schist and phyllite on ridges and hills. Land uses on these soils are predominately agriculture, with some areas of urban or recreational development and a few areas of woodland.

Conestoga-Clarksburg-Penlaw Association: This association is characterized as land that is nearly level to strongly sloping with very deep soils that are well drained to moderately well drained and formed in residuum from limestone and calcareous schist on nearly level to rolling uplands. These soils mainly support urban development with some cropland and recreational areas.

Penn-Landsdale-Readington Association: This association is characterized as land that is nearly level to strongly sloping with moderately deep and deep soils that are well drained and moderately well drained and formed from shale, siltstone, sandstone, and conglomerate on undulating to rolling uplands. These soils are mainly used for agricultural purposes with some urban development and woodlands.

See Figure 2.3-2 General Soils Map

Glendelg-Mt. Airy Association: Land that is gently sloping to moderately steep with moderately deep and deep soils which are well drained and somewhat excessively drained and formed from schist and phyllite on ridges and hills. These soils are mainly used for cropland, pasture, and woodland with some urban and recreational development.

Penn-Klinesville-Croton Association: This association is characterized as land that is nearly lever to very steep with shallow to deep soils that are poorly drained to somewhat excessively drained and formed from red shale, siltstone and fined-grained sandstone on steep ridges, hills and nearly level lowlands. These soils are mainly used as cropland or woodland with some areas of urban land uses.

Lehigh-Neshaminy Association: This association is characterized as land that is nearly level to very steep with deep to very deep soils that are somewhat poorly drained to well drained and formed from porcelanite and diabase on undulating to rolling ridges and hills. Land uses on these soils are predominately agriculture, woodland and recreation with some areas of urban development.

Penn-Abbottstown-Readington Association: Land that is nearly level to strongly sloping with moderately deep to deep with somewhat poorly drained to well drained and formed from shale, siltstone and sandstone on dissected uplands. These soils are mainly used for agriculture with some areas of urban land uses.

Edgemont-Highfield-Catoctin Association: Land that is gently sloping to very steep with moderately deep to very deep soils that are well drained to somewhat excessively drained and formed from quartzite, metabasalt and metarhyolie on ridges and hills. Land uses on these soils are predominately woodlands with some cropland and a few urban land uses.

Lewisberry-Steinberg Association: This association is characterized as land that is gently sloping to moderately steep with moderately deep to very deep that are well drained and formed from sandstone and conglomerate on dissected ridges and low hills. Land uses on these soils are predominately cropland and woodlands with a few areas of urban development.

Penn Association: Land that is gently sloping to very steep with moderately deep soils that are well drained and formed from sandstone, conglomerate and siltstone on ridges and hills. Land uses on these soils are predominately woodlands with some areas of agriculture and a few areas of urban development.

Highfield-Arendtsville-Rohrersville: This association is characterized as land that is gently sloping to moderately steep with deep to very deep soils that are well drained and formed from metabasalt, metarhyolite and conglomerate on footslopes. These soils are mainly used for agriculuture or woodlands with some urban land uses.

Soils and their characteristics are an important resource to every watershed. A thorough understanding of those characteristics can lead to better management practices. Of particular importance for watershed health is the understanding of soil permeability. Soil permeability is the rate at which water infiltrates and permeates through a particular soil group. As previously noted, soils with high permeability (Figure 2.3-2) will allow water to infiltrate the groundwater and recharge the aquifer quicker than soils with low permeability. Allowing precipitation to infiltrate the soil and recharge the aquifer is vitally important for the health of a watershed. Not only does it recharge the aquifer, but it also recharges our streams, keeping them healthy and cool during warmer periods.

Soils with low permeability are those in which water infiltrates the ground water at a very slow rate or not at all. Often, these soils tend to be hydric, and are sometimes associated with the presence of wetlands. It is this slow permeability which creates the unique habitat necessary for the existence of wetlands that are also vital to a watershed's overall health. Checking this document (Figure 3.2-1 and 3.2-3), or the revised York County Soil Survey (York County Conservation District, 717-840-7430) can direct a landowner or agent to the location where wetlands may be present. This is discussed in more detail in Section 3.2-E.

Fortunately for the Conewago Creek Watershed, permeable soils, or those that are suitable for infiltration (Figure 2.3-2), cover a large portion of the watershed. Overall they cover approximately 64% of the watershed area, or about 208,117 acres. However, not all of those acres are open space. Some of those areas are now impervious areas. This is why it is important to know where these soils are located and to protect and use them to our advantage. For instance, instead of requiring a developer to construct a typical stormwater management system whereby the water is simply held and released after a certain period of time, a municipality should require infiltration provided the site has soils suitable for infiltration. A thorough knowledge of the watershed and location of such soils can aid in the determination of where infiltration is possible.

Other notable geologic related features are geologic hazards, such as sink holes and other Karst topography features (Figure 2.3-3) and mine locations (Figure 2.3-4). Locating these features and avoiding impacts is important. Sink holes areas are highly unstable and the effects of sink holes can be catastrophic. Knowing where the mines are located and avoiding impacts to these sites is also important. Some of these areas are abandoned and some are still active.

In addition to knowing about soil permeability, geologic hazards, and mine locations, it is also important to understand which soils are susceptible to erosion either by wind or water. Figure 2.3-5 shows soil slopes within the watershed. Often, soil slope is directly correlated with soil erosion. Soil erosion causes numerous environmental problems from the loss of topsoil to the siltation of our waterways including the Chesapeake Bay. Protection of steep slopes and erosive soils is critical. Sedimentation is one of the leading, if not the leading, cause of pollution of the Bay. Siltation of the Bay covers valuable habitat for various life forms and the sediment can be laden with harmful chemicals and minerals such as nitrogen, phosphorous, and other elements found in fertilizers, herbicides, and pesticides. Impacts to steep slopes and erosive soils should be avoided if at all possible. Stabilization of these areas with native vegetation is important.

See Figure 2.3-3 Geological Hazards Map

See Figure 2.3-4 Mined Resources Map

See Figure 2.3-5 Soil Slope Map

2.4 Climate

The Conewago Creek Watershed is dominated by atmospheric flow patterns common to the humid continental regions lying in the North Temperate Zone. Most of the weather systems that influence the area originate either in Western Canada or the Central Plains of the United States and are steered eastward by the prevailing winds and the jet stream.

Another influencing weather phenomenon is the flow and primary source of precipitation associated with cyclonic circulation from the Gulf of Mexico northward through the watershed. As a result of the dominant easterly flow into the area, the moist airflow from the Atlantic Ocean, to the east, is a modifying factor rather than a controlling climatic factor. Periodically, considerable moisture is picked up by storms developing and moving north along the Atlantic seaboard. As a result, these disturbances, while not occurring often, usually bring moderate to heavy amounts of precipitation in the form of rain, and when temperatures are low enough, snow. The Great Lakes, ironically, have little impact on the climate of the region. This is due to the eastern movement of storms that form over the Great Lake region.

Weather, such as precipitation, droughts, temperature, wind direction and speed, relative humidity, and sunshine are measurable variables that affect the watershed. The region and watershed, on average, receive 41 inches of precipitation annually. The normal precipitation totals range from a minimum of 2.6 inches in February to a maximum of 4.3 inches in May. The mean annual number of days with snow cover of one inch or more is approximately 50 days.

The average annual temperature for the study area is 53°F. Seasonal average temperatures for the study area range from 32° F in the winter, 54° F in the fall, 52° F in the spring, and 73° F in the summer months. Within the last 30 years of recorded climate data the highest temperature recorded was 105° F in July 1936 and a low of -21° F in January 1994.

Winds are an important hydrologic factor because of their evaporative effects and their association with storm systems. The prevailing wind direction in the region is westerly during the winter months and southerly during the summer months. Relative humidity also affects evaporation processes in small streams and other waterbodies. The average annual relative humidity for the region is 75%.

2.5 Land Use/Land Cover and Zoning

A. Land Use/Land Cover

Overview

Conewago watershed consists of approximately 510 square miles of land. The largest land use within the watershed is row cropland and hay pasture, accounting for more than half of the land use at 65.87%. Urban development is relatively low with less than 5% of land use. Open water areas account for 1.20% of the land cover, mostly consisting of Lake Meade in the central portion of the watershed, Pinchot Lake in the northeast, and Long Arm Creek Reservoir and Sheppard Myers Reservoir in the very southern portion. The remaining land uses and land cover types are described below. Figure 2.5-1 Landuse Map provides a depiction of the various land use categories within the watershed.

Urban Development

Overall, the watershed is mostly undeveloped in terms of impervious surface. Urban development, including both high-density and low-density, accounts for 4.10% of the land use within the watershed. The amount of high-density urban development and low-density urban development is 1.36% and 2.74% of the total watershed land use, respectively. The primary high-density urban areas are located along the eastern boundary of the watershed, mostly within York County, with others located in the central portion of the watershed and the remaining located in the northwest. The largest urban areas include Hanover, West Manchester, McSherrystown, Dover, Manchester, York Haven, New Oxford, Abbotstown, East Berlin, Biglerville, Arendtsville, and Benderville. Most of the larger urban areas are identified as high-density urban development with surrounding low-density urban development.

Vegetative Cover

More than 92% of the watershed is covered with some type of vegetation, consisting of crops, hay, forest, and wetland. More than half of the land cover within the watershed is crop and pasture, 47.71% and 18.16%, respectively, totaling 65.87%.

The majority of the crop and pasture is located within the central portion of the watershed, extending eastward to the eastern boundary of the watershed, and extending northwest-ward to the Arendtsville, Biglerville, and Bendersville area.

The forest cover within the watershed is 26.48%, including forested (woody) wetland and emergent wetland, and consists of coniferous forest (1.23%), mixed forest (coniferous and deciduous)(4.90%), and deciduous forest (19.17%). The largest concentrations of forest within the watershed are located in the

See Figure 2.5-1 Land Cover Map

northeastern corner and the western/northwestern portion. These areas correspond to the more mountainous regions of the watershed. There are also large areas of forest in the southeastern portion of the watershed situated south of Abbotstown and north of Hanover, extending east and northeast along the watershed boundary as well as in the very southern part of the watershed near West Manheim township, extending into Carroll County, MD. There are many other areas of forest within the watershed that range in size from very small isolated areas of less than one acre to forests several hundred acres and greater.

Adams County has developed a fact sheet on the importance of forests and forest products within the county. See Figure 3.5-2 Importance of Forestry in Adams County for specific information on forest ownership, land use, forestry and wood products, and the economic contribution of both forests and agriculture within Adams County.

Quarries

There are three areas of quarries within the watershed. Two are located in the eastern portion of the watershed in Jackson Township and West Manchester Township. The third is located in the southern portion of the watershed in Oxford Township.

Wetlands

Wetlands are scattered throughout the watershed and generally are located within stream corridors. The primary type of wetland within the watershed is palustrine deciduous forested wetland and palustrine emergent wetland. The percentage of total land cover within the watershed for these wetland types is 0.90% for forested (woody) wetland and 0.28% for emergent wetland. See Section 4 Wetlands for additional information concerning wetlands within the watershed.

B. Zoning

Theoretically the primary purpose of zoning is to segregate uses that are thought to be incompatible; in practice, zoning is used as a permitting system to prevent new development from harming existing residents or businesses. Zoning is commonly controlled by local governments such as counties or municipalities, though the nature of the zoning regime may be determined by state or national planning authorities.

Zoning may include regulation of the kinds of activities which will be acceptable on particular lots (such as open space, residential,agricultural, commercial, or industrial), the densities at which those activities can be performed (from low-density housing such as single family homes to high-density such as high rise apartment), the height of buildings, the amount of space structures may occupy, the location of a building on the lot (setbacks), the proportions of the types of

See Figure 2.5-2 Importance of Forestry in Adams County

space on a lot (for example, how much landscaped space and how much paved space), and how much parking must be provided. The details of how individual planning systems incorporate zoning into their regulatory regimes varies though the intention is always similar.

Most zoning systems have a procedure for granting variances (exceptions to the zoning rules), usually because of some perceived hardship due to the particular nature of the property in question.

A detailed analysis of the zoning ordinances for each municipality is beyond the scope of the RCP. For the purposes of this report, the zoning of the watershed has been generalized (Figure 2.5-3). Attempts have been made to reference the zoning ordinances for each municipality as they pertain to natural resource protection. To the extent possible, this is included in Section 6.0, Sub-Watershed Detailed Analysis.

Zoning varies as much as land use across the watershed. As with land use, zoning is more agricultural and rural/light density residential toward the southern end of the watershed than it is toward the north. Most of the industrial/commercial zoning classifications are centered around urban centers such as West York Borough and Hanover Borough. As with land use, it is most important to understand how the different zoning classifications are arranged within the watershed. Table 2.5-1 below describes the various general zoning classifications and the acreage each classification covers within the watershed.

Table 2.5-1: Zoning Classifications and Acreage for the Conewago Creek Watershed.

Zoning	Acres	%
Unknown	10,676.706	2.3%
Agricultural	113,722.534	24.8%
Business/Offices/Apartments	1,642.069	0.4%
Commercial	6,727.89	1.5%
Commercial/Industrial	2,416.658	0.5%
Conservation/Open Space	181,493.991	39.6%
Community/Town Center	1,607.668	0.4%
Industrial	10,064.153	2.2%
Institutional	2.324	0.0%
Mixed Use	1,966.687	0.4%
Quarry	900.834	0.2%
Residential-Rural	126,285.506	27.5%
Village	650.514	0.1%
Village-Residential	608.885	0.1%

See Figure 2.5-3 General Zoning Map

Although governments control zoning, the various zones within a municipality are not permanent. This is both a curse and a blessing. It is possible to petition the appropriate zoning officials/board within the municipality for a rezoning of a particular zone. For example, a commercial developer owns or wishes to purchase a parcel of land to construct a new warehouse facility, but the parcel is zoned agriculture (which prohibits such uses). The developer may be able to petition the municipality for a reclassification of that zone, so that a permitted use is the construction of warehousing facilities. Which, in and of itself seems fine, but the zone across the street or adjacent to the parcel may be zoned R-1, which could represent single family, detached residential.

However, it may be possible to re-zone something for the benefit of the environment. There are cases in Pennsylvania where a municipality rezoned areas along a creek to prohibit most forms of development. For example, in Bushkill Township, Northampton County, Pennsylvania, the township supervisors created a nature zone around the woodlands surrounding the valuable waters of the Bushkill Creek, hoping to protect the riparian area.

2.6 Population Profile

As with most of the Lower Susquehanna River Basins in South Central Pennsylvania, the Conewago Creek sub-watershed is experiencing rapid growth and development. In fact, according to the US Census Bureau, York and Adams Counties are among Pennsylvania's fastest growing areas between 1990 and 2000. Both counties were in the top ten counties in Pennsylvania in growth between 1990 and 2000. During this time period, major growth areas in the watershed include Abbottstown, Biglerville, Hanover, Dover, New Oxford, East Berlin, Penn Township, Oxford Township, Dover Township, Jackson Township, West Manchester Township, Manchester Township, East Manchester Township, Latimore Township, and Reading Township. This is, in part, due to the watershed's proximity to Harrisburg, Pa and Baltimore, Md. Some of this rapid growth is occurring in the headwaters of the Conewago Creek in Penn and West Manheim Townships resulting in degradation of watershed resources in once pristine areas.

According to the 2000 Census York County saw an increase in population of 42,177 (12.4%) between 1990 and 2000. A significant portion of that growth occurred within the Conewago Creek Watershed, particularly in the areas of Warrington Township and Manchester Township. 92.8% of the population is white/Caucasian. The median household income in 1999 was $52,278. Adams County saw an increase of population of 13,018 (16.6%) between 1990 and 2000. The area of Abbottstown Borough had the most amount of growth within the Adams County portion of the watershed. The median household income in 1999 was $48,810.

Figure 2.6-1 shows land ownership within the watershed and Figure 2.6-2 shows the population distribution for the watershed. As can be expected, the majority of the population lives close to the more urban areas such as the Hanover Borough, West Manchester Township, Dover Township, Dover Borough, McSherrystown Borough and New Oxford Borough. Additionally, Warrington Township, Manchester Township, Abbottstown Borough, Carroll Township, Franklintown Borough and Oxford Township areas are experiencing an increase in growth and development. Comparing Figure 2.6-1 and Figure 2.6-2 provides an idea of where public recreation/game land is located relative to where growth is occurring.

Table 2.6-1: Population Growth in Municipalities within the Conewago Creek Watershed, 1990-2000

Municipality	County	State	1990 Population	2000 Population	% Change
Warrington Township	York	PA	1,275	4,435	247.8%
Manchester Township	York	PA	7,517	12,700	69.0%
Abbottstown Borough	Adams	PA	539	905	67.9%
Carroll Township	York	PA	3,287	4,715	43.4%
Franklintown Borough	York	PA	373	532	42.6%
Oxford Township	Adams	PA	3,437	4,876	41.9%
Union Township	Adams	PA	2,178	2,989	37.2%
East Manchester Township	York	PA	3,714	5,078	36.7%
Reading Township	Adams	PA	3,828	5,106	33.4%
Cooke Township	Cumberland	PA	90	117	30.0%
Manchester Borough	York	PA	1,830	2,350	28.4%
Huntington Township	Adams	PA	1,760	2,233	26.9%
Conewago Township	Adams	PA	4,532	5,709	26.0%
Penn Township	York	PA	11,658	14,592	25.2%
South Middleton Township	Cumberland	PA	10,340	12,939	25.1%
Tyrone Township	Adams	PA	1,829	2,273	24.3%
Lewisberry Borough	York	PA	314	385	22.6%
Ardentsville Borough	Adams	PA	693	848	22.4%
	Carroll	MD	123,372	150,897	22.3%
Dickinson Township	Cumberland	PA	3,870	4,702	21.5%
Newberry Township	York	PA	12,003	14,332	19.4%
West Manchester Township	York	PA	14,369	17,035	18.6%
Franklin Township	York	PA	3,852	4,515	17.2%
East Berlin Borough	Adams	PA	1,175	1,365	16.2%
Dover Township	York	PA	15,668	18,074	15.4%
Latimore Township	Adams	PA	2,209	2,528	14.4%
Heidelberg Borough	York	PA	2,622	2,970	13.3%
Paradise Township	York	PA	3,180	3,600	13.2%
Biglerville Borough	Adams	PA	993	1,101	10.9%
Menallen Township	Adams	PA	2,700	2,974	10.1%
Mount Pleasant Township	Adams	PA	4,076	4,420	8.4%
Fairview Township	York	PA	13,258	14,321	8.0%
Washington Township	York	PA	2,291	2,460	7.4%

York Haven Borough	York	PA	758	809	6.7%
Butler Township	Adams	PA	2,514	2,678	6.5%
Monaghan Township	York	PA	2,009	2,132	6.1%
West Manheim Township	York	PA	4,590	4,865	6.0%
Conewago Township	York	PA	4,997	5,278	5.6%
Cumberland Township	Adams	PA	5,431	5,718	5.3%
New Oxford Borough	Adams	PA	1,617	1,696	4.9%
York Springs Borough	Adams	PA	547	574	4.9%
Bendersville Borough	Adams	PA	560	576	2.9%
Hanover Borough	York	PA	14,339	14,535	1.4%
Straban Township	Adams	PA	4,565	4,539	-0.6%
Berwick Township	Adams	PA	1,831	1,818	-0.7%
Jackson Township	York	PA	6,244	6,095	-2.4%
McSherrystown Borough	Adams	PA	2,769	2,691	-2.8%
Dover Borough	York	PA	1,884	1,815	-3.7%
Wellsville Borough	York	PA	304	279	-8.2%
Hamilton Township	Adams	PA	4,126	2,044	-50.5%

Source: US Census Bureau

Table 2.6-2: County Population Trends

Municipality	1980	1990	2000	2010 Projection
York County	312,963	339,574	381,751	403,133
Adams County	68,292	78,274	91,292	115,050

Source: Adams County Planning Commission, York County Planning Commission

Table 2.6-4: County Age Distribution

	Adams County		York County	
	Number	Percent	Number	Percent
Under 5 years	5,405	5.9	23,220	6.1
5 to 9 years	6,465	7.1	26,998	7.1
10 to 14 years	6,952	7.6	27,856	7.3
15 to 19 years	6,810	7.5	25,228	6.6
20 to 24 years	5,573	6.1	19,464	5.1
25 to 34 years	11,426	12.5	50,026	13.1
35 to 44 years	15,001	16.4	65,675	17.2
45 to 54 years	12,662	13.8	55,784	14.6
55 to 59 years	4,620	5.1	20,284	5.3
60 to 64 years	3,762	4.1	15,734	4.1
65 to 74 years	6,631	7.3	26,972	7.1
75 to 84 years	4,469	4.9	18,413	4.8
85 years and over	4,556	1.7	6,107	1.6

Source: US Census Bureau

Table 2.6-5: County Population by Sex

	Adams County		York County	
	Number	Percent	Number	Percent
Male	44,787	49.1	187,667	49.2
Female	46,505	50.9	194,084	50.8

Source: US Census Bureau

See Figure 2.6-1 Land Ownership Map

See Figure 2.6-2 Population Density Map 2000 Census

2.7 Unique Features of the Watershed

In October 2004, the York County Planning Commission prepared the Environmental Resources Inventory for York County. The inventory is a component of the York County Comprehensive Plan. Features listed in the inventory are natural features and areas that are unique due to their rareness, irregularities, aesthetic qualities, or local significance. It is these qualities that separate them from other features in the watershed and steps should be taken to preserve these features.

The following is a list of those features that occur within the Conewago Creek Watershed and a brief description of each feature. Figure 2.7-1 shows the general locations of each feature.

Balanced Rock – Located at Boulder Point in Gifford Pinchot State Park, Warrington Township, Balanced Rock is an example of spheroidal weathering which has left a large rounded boulder balanced on two (2) smaller supports.

Conewago Falls– Located north of the mouth of Conewago Creek near York Haven Borough, the Conewago Falls are erosion resistant rocks formed of Triassic Shale that cross the Susquehanna River.

High Rock – Located in Paradise Township, these outcrops are an erosional feature formed of quartzite in the Pigeon Hills area. The site is known for its views of northern York County and scenic trails.

Midnight Cave – Located in Jackson Township, this cave is known to support a PA-Candidate-at-Risk animal species.

Old Toboggan Run Rocks – Located in Gifford Pinchot Park, Warrington Township, this rock feature was produced by frost wedging that cracked and separated large boulders of diabase. The resulting split has enabled trees to grow in the cracks and created passageways to walk through.

Pulpit Rock – Pulpit Rock is located in Heidelberg Township. This outcrop of quartzite provides a southern view of York County during the winter months. This feature also serves as a control point for the U.S. Coast and Geodetic Survey. Pulpit Rock sits on the drainage divide between the Conewago and Codorus Creek Watersheds.

Stone Head – Located in Franklin Township, this rock outcrop formed of quartzite is the result of weathering. The name of the outcrop comes from it resembling a human head**.**

Thomasville Quarry Cave – Located in Jackson Township, this cave is located in the eastern wall of the quarry. Within the cave, a concrete barrier has been

erected that seals off the passage. It is believed that this was done to keep water from entering the quarry operations.

In addition to the unique features listed above as part of the York County Comprehensive Plan, the Adams County Office of Planning and Development has identified Significant or Unique Agricultural Areas (Figure 2.7-1). The following areas are located in the Conewago Creek Watershed:

- Adams County Fruit Belt
- Abbottstown/East Berlin Buffer Area
- Bender's Church Area
- Buchanon Valley/High Mountain District
- East Calvary Agricultural Area
- Latimore Valley
- Lake Meade Watershed Area
- Mummasburg Road Corridor
- Red Bridge Farming District
- Storms Store/Stone Bridge Historic Area
- Thoroughbred Horse Farms
- Upper Rock Creek Open Area
- Zeigler Mill/West Butler Farming Area

As with all unique features, those listed above should be appreciated and protected, but left undisturbed. The dominance of caves within the watershed gives clear insight into the underlying geology of the area. While caves are unique and amazing features of the landscape, they can be very dangerous and attempts to enter any and all caves should be avoided. Furthermore, attempts to impact caves in any way, through development or otherwise, should also be avoided. The descriptions provided above are for reference purposes only and are not meant to be a detailed analysis of each feature. Figure 2.7-1 shows the locations of unique features of the watershed.

See Figure 2.7-1 Unique Features Map

SECTION 3.0 –Resources for the Entire Watershed

3.1 Land Resources

The Conewago Creek Watershed is vast and varied which affords its residents with numerous land resources ranging from forest products to minerals and soils. As noted in Section 2.0, approximately 25.3% of the watershed is forested. A majority of those forested areas are deciduous and hardwood species. Due to recent growth in new home construction, particularly in the southern, eastern, and central portions of the watershed, the forested areas are becoming more fragmented. One of the major problems with forests of the eastern United States is fragmentation. Fragmentation is the loss of connectivity of forested tracts which creates many smaller isolated patches of forest as opposed to large contiguous ones. This limits the type, abundance and diversity of plant and animal species that utilize forest ecosystems. Review of Figure 2.5-1 reveals extensive fragmentation of forested areas particularly in the central portion of the watershed. The largest areas of forest cover occur in the north eastern and western portion of the watersheds around the Conewago Mountains and South Mountain region respectively. Of particular importance again are those areas closest to the stream channels within the drainage corridor. Ideally, all streams should have a contiguous forested buffer not fragmented and connected to larger tracts of forested areas. This provides many benefits to the health of the environment. Certain species of birds and mammals live in older growth mature forests of substantial size. If forested areas are too small, they cannot survive. If larger forested areas are connected to each other by way of a forested stream corridor, these species of birds and mammals are able to travel greater distances to find food and shelter. Additionally, forested stream corridors have benefits to the streams themselves by maintaining bank stability, moderation of temperature, nutrient removal and erosion control (sediment from upslope areas).

Agricultural Land

The major land use and industry within the watershed is agriculture. This is due in large part to the high quality soils that are located in the watershed. As discussed previously, the watershed is characterized as a large planar valley bordered by steep ridges and rolling hills. Throughout the watershed there exist areas of unique agricultural importance. Some of these were discussed in the previous section under Section 2.7 - Unique Features. The western portion of the watershed contains the famous Adams County Fruit Belt that extends from the southern boundary of the watershed southwest of Arendtsville in a northeasterly direction along the eastern slopes of South Mountain. The Adams County Fruit Belt is one of, if not the most, productive fruit growing regions in the state. For this reason, it is a very important resource within the watershed and deserves special protection and preservation.

The Commonwealth of Pennsylvania keeps records of those soils that are considered to be prime farmland soils or soils of statewide importance. Figure 3.1-1 shows the locations and extent of prime farmland soils and soils of statewide importance. The Pennsylvania Municipalities Code (MPC) defines prime agricultural land as “land used

for agricultural purposes that contains soils of the first, second, and third class as defined by the United States Department of Agriculture Natural Resource and Conservation Services County Soil Survey. The classes that the MPC refers to are land capability classes based on suitability to grow most kinds of field crops, taking into account various limitations, risk of damage to the soil, and the way specific soils respond to use management. Under this system, there are eight (8) classes with Class 1 having the fewest limitations and Class 8 being unsuitable for cultivation.

Prime farmland soil is for the most part equally distributed throughout the watershed. There is a slightly greater concentration in the northern, northeastern, and southern portion of the watershed. Within the watershed there is approximately 2,833 acres of Class 1 farmland soil, approximately 135,688 acres of Class 2 farmland soil, and approximately 79,600 acres of Class 3 farmland soil.

In addition to prime agricultural land/prime farmland soils, there is an extensive network of farms that are preserved through various financial incentive land conservation programs such as Agricultural Security Areas and Agricultural Preservation Areas, Farm and Natural Land Trust, Land Conservancy, and Land Preservation Easements. The type and extent of data for each County within the watershed varies and therefore the number of both individual preserved land-holdings and overall acreage cannot be combined. Within the portion of the watershed situated in York County, there are 534 Preserved Farms and 14 land-holdings included in the Farm and Natural Land Trust. The total number of Preserved Farms (534) includes both land designated as an Agricultural Security Area or land designated as Agricultural Preservation Areas. Within the portion of the watershed situated in Adams County, there are 987 Preserved Farms and 23 land-holdings included in the Land Conservancy program. Within Adams County, the total number of Preserved Farms (987) includes both land designated as an Agricultural Security Area or land designated as a Preserved Farm. Within the portion of the watershed situated in Carroll County, Maryland there is 10 land-holdings included in the Land Preservation Easement Program. Data for Cumberland County agricultural areas is unavailable at this time. See Figure 3.1-1 Agricultural Preservation Map.

Another program is the Conservation Reserve Enhancement Program (CREP). CREP is a new Federal/State partnership with a goal of enrolling 100,000 acres of highly erodible cropland and marginal pastureland in conservation cover plantings. CREP sites located within the watershed can be found on Figure 3.1-1.

See Figure 3.1-1 Agricultural Preservation Map

See Figure 3.1-2 Natural Resources Map

Natural Areas

Recently, both Adams and York Counties went through a revision to their respective county Natural Areas Inventory (NAI). For the purposes of this report, a Natural Area shall be defined as a site previously identified by other sources wherein either an exemplary natural community or species of special concern exists. The use of the term Natural Area should not be confused with the State Forest Natural Areas which are specific management units designated by D.C.N.R./Bureau of Forestry.

Top Priority Natural Areas

All of the natural areas in the county are important to maintaining biodiversity in the region and the state. However, the following eight sites are the most critical in Adams and York County for maintaining biological diversity into the future (see Figure 3.1-2 for approximate locations of these sites). Detailed descriptions of all sites are included in this section.

Top Priority Natural Areas in Adams County

- **515: BUCHANAN VALLEY SITE** (Franklin Twp.) - A poor quality occurrence of a PA-Endangered animal was found near a forested wetland and braided stream channel complex with cattails, joe-pye-weed, and sedges. The species uses shallow rivulets found in marshy or boggy settings, as well as the adjacent woodlands and is therefore vulnerable to wetland alteration and destruction. The species may occur within other areas of this sub-watershed, although the limited extent of the habitat is not likely to support more than a small population of the species.

- **519: PINEY MOUNTAIN SWAMP** (Caledonia Park Quad., Franklin Twp.) - This site is a seep-derived forested swamp. Red maple is dominant in the canopy with pitch pine, eastern hemlock, white pine, and sassafras (Sassafras albidum) as associates. The shrub layer is a mixture of witch hazel and heath species, including mountain laurel blueberries, huckleberries, and swamp azalea. A small population of a plant species of special concern occurs in the swamp. This species has been observed growing and flowering on sphagnum hummocks in forest openings. This species appears to be limited to areas with seasonally wet soils and is therefore vulnerable to soil compaction and alteration of the hydrology of the site. This site is mostly within Michaux State Forest.

- **520: SAND SPRING SEEP** (Caledonia Park Quad., Franklin and Menallen Twps.) - This site is a mosaic of seep-derived wetland communities including shrub swamp, forested swamp, and small sedge-sphagnum openings. Dominant canopy species are red maple and hemlock. The thick shrub layer includes highbush blueberry, rhododendron, and mountain laurel with a ground cover of cinnamon fern, sedges, and grasses. Four plant species of special concern are known to occur here, including two PA-Endangered plant species. These species are vulnerable to soil disturbances and destruction of their wetland habitat. Any efforts to artificially make openings to

promote flowering of these species should be carefully evaluated beforehand. This site is mostly within Michaux State Forest.

- **521: RAM HILL SEEP** (Caledonia Park Quad., Menallen Twp.) - Good quality populations of two PAEndangered plant species are found at this site. One is a plant species more common in coastal plain wetlands. It occurs in only one boggy wetland in Adams County. At this site it grows under white pine, white oak, and red maple with mountain laurel, highbush blueberry, swamp azalea, and cinnamon fern. The second plant species of concern is growing in open upland areas at this site. It is associated with heath species including blueberries, huckleberries, and sweet fern. A fair to good population of a wildflower species of concern also occurs at the site. This site is mostly within Michaux State Forest.

- **525: CONEWAGO/OPOSSUM CREEK SITE** (Biglerville Quad., Butler Twp) - One individual of an animal of special concern was found along a branch of Conewago Creek. Surveys will continue to better assess the extent of the population. The creek is bordered by agricultural lands with little forested buffer to prevent bank erosion, sedimentation and nutrient loading. The animal species of concern requires relatively clean flowing waters. Restoring wooded buffers could benefit this rare species as well as the fisheries throughout Conewago Creek.

  The species identified from this site in the original NAI was determined to exist further east than previously reported. The species SA504 was added to the Conewago Creek / Plainview site, and the Conewago / Opossum Creek site was removed from the map.

- **526: CONEWAGO CREEK/PLAINVIEW** (Biglerville Quad., Butler, Straban & Tyrone Twps.) - This site supports an animal that has been recommended for PA-Endangered status. This animal was found along a forested stretch of Conewago Creek with crayfish, caddisfly larvae, minnows, and other invertebrates. This species occurs only in clean flowing streams with gravel bottoms and has suffered extensive declines throughout its range as a result of impacts to its habitat. Nutrient loading (e.g., from fertilizers, road salt, etc.) and sedimentation are particularly problematic for the species; efforts to prevent these problems can help prevent further decline of this population. Maintaining forested buffers along this section of stream, as well as at locations upstream helps to minimize erosion and siltation problems which in turn aids in protecting a diversity of stream life and the fisheries in general. State Game Lands 249 encompasses a portion of this site.

  This medium-sized low-gradient stream contains sections with shallow riffles over a gravel and cobble substrate, and is home to two animal species of concern. This site supports an unknown-quality population of a globally rare and PA Imperiled animal species that has been recommended for PA-Endangered status. During a visit to this site in 1998, several specimens of SA501 were observed. This species is particularly sensitive to sedimentation of the streambed, and changes in water chemistry due to nutrient run-off. A single specimen of another PA Imperiled PA Threatened animal species was also observed along this section of the creek in

1996. There appears to be very little suitable habitat for this species at this site, although it may exist nearby. The surrounding land is agricultural with some wooded buffers. Creating and maintaining forested buffers along this section of stream can help to minimize erosion and run-off problems, and help protect the diversity of stream life and the fisheries in general. Additional surveys are encouraged to assess the population status and habitat of these species.

- **527 & 528: CRANBERRY VALLEY** (Biglerville Quad., Tyrone Twp.) - Several small populations of a plant species of concern were found in roadside meadow situations. This species, which is generally found in swamps or on shores, was growing amongst more common disturbance site species including blackberry, multiflora rose (Rosa multiflora), wild grape (Vitis), and evening primrose (Oenothera biennis). The long-term viability of this population is questionable given the location and small size of the population. The current status of this species is Tentatively Undetermined, but it has been suggested for Pennsylvania Endangered status.

- **530: ARENDTSVILLE NARROWS RAVINE** (Arendtsville Quad., Menallen & Franklin Twps.) - A small population of a plant species of special concern was found on south-facing rock outcrops with mountain laurel (Kalmia latifolia), wild gooseberry (Ribes), blackberry (Rubus), rock polypody (Polypodium virginianum), and marginal shield fern (Dryopteris marginalis). The woodlands in this ravine help to maintain the cool microclimate required by this rare plant. The area also includes some older hemlocks on the northeast-facing slopes and is wellknown as one of the most scenic areas in the county. Additional area of local significance is included within ARENDTSVILLE NARROWS WOODS & SEEPS site described below.

- **531: BUSHY HILL SITE** (Arendtsville Quad., Franklin Twp.) –This site represents observations of a special animal species of concern along a tributary to Conewago Creek. Based on the limited availability of suitable breeding habitat in the area, this population is believed to be quite small. This species prefers slow shallow rivulets found in marshy or boggy settings, but makes use of the small woodland streams as well. Alteration of wetland habitat and obstruction of stream flow has caused this species to decline throughout its range. At this site, maintaining the wooded slopes can help to prevent erosion and protect water quality of this section of Conewago Creek and tributaries where this species lives.

- **No site #: CONEWAGO CREEK @ RT. 234 in ARENDTSVILLE -** (Arendtsville Quad Menallen & Franklin Twps.) This site contains two plant species of special concern. The first is a poor-quality population of a PA-Threatened plant species observed during a field visit in 1997. Found primarily along roadsides shaded by black locust (*Robinia pseudoacacia*), and blackberry bushes (*Rubus sp.),* this species is vulnerable to herbicide applications and excessive mowing. In 2000, a good to a marginal-quality population of a PA-Candidate plant species, was found on this site. This swamp forest with braided seeps and runs has canopy trees of hemlock (*Tsuga canadensis*), yellow birch (*Betula alleghaniensis*), red maple (*Acer rubrum*), black gum (*Nyssa sylvatica*),

beech, (*Fagus grandifolia*), white pine (*Pinus strobus*), and both black and white ashes (*Fraxinus nigra & F. americana*). The understory of this site is dominated by American hornbeam (*Carpinus caroliniana*), and spice bush (*Lindera benzoin*). The surrounding land consists of residences, farms, old fields & wood lots. Potential threats include development, road maintenance and mowing. Clearing upslope and downslope of the occurrence is a disturbance, but no immediate threats are apparent. The watershed of the tributaries should be carefully conserved. This is a new site and does not yet have a site ID number and has not yet been mapped.

- **609: KINGS PASTURE** (Hampton Quad., Reading Twp.) - "King's Pasture" - This abandoned marshy pasture has a very diverse herbaceous flora. Wetter areas of the site are dominated by grasses, sedges, skunk cabbage (Symplocarpus foetidus), and sensitive fern (Onoclea sensibilis). Woody species such as eastern red cedar (Juniperus virginiana), silky dogwood (Cornus ammomum), American elm (Ulmus americana), and boxelder occur primarily in adjacent hedge rows though there is some scattered encroachment into the open wetland. Four species of special concern are found here. In 1992 several hundred stems of one species of special concern were observed in the marshy areas, along with more than a hundred stems of a PA-threatened plant. The wet meadow also supports a fair population of another special concern species and a poor population of a PA-Endangered plant. Although this site has received drainage manipulation in the past further alteration of its hydrology could decrease the diversity of wetland species and lead to the decline of these species of special concern.

- **610: CONEWAGO CREEK/NEWCHESTER/SA509** (Hampton Quad., Reading & Straban Twps.) - An animal species that has been recommended for PA-Endangered status was discovered at this site in 1995. The stream flows over a series of cobbles and low ledges and supports common animals such as crayfish, freshwater clam (Pisidium), caddisflies, and several species of fish. Native plants such as lizards tail (Saururus cernuus), rice cut-grass (Leersia oryzoides), box-elder (Acer negundo), pin oak, sycamore, and elm line the stream edges. Clean flowing water is important for the survival of this species. Maintaining woodland buffers along the stream to minimize sedimentation and nutrient loading can help to protect both the rare animal as well as the fisheries here.

- **614: BRUSHTOWN WOODS** (McSherrytown Quad., Conewago, Union & Mount Pleasant Twps.) - A small population of a PA Endangered tree species occurs in a large section (approximately 50 acres) of riparian forest along the South Branch Conewago Creek. The forest is dominated by sycamore (Platanus occidentalis), hickory (Carya sp.), and ash (Fraxinus sp.). The species represented does not form pure stands but occurs as an infrequent member in some bottomland hardwood forest types. It prefers deep, moist, but well-drained soils such as those often found along river courses (Harlow & Harrar 1969), conditions which aptly describe this site. Some reproduction was apparent and it is likely that this population will persist for many years as long as the floodplain forest remains intact and stream flow is not altered.

- **615: STORM STORE BRIDGE WOODS** (McSherrytown Quad., Mount Pleasant & Oxford Twps.) - A small population of a PA Endangered tree occurs in a narrow strip of floodplain forest along South Branch Conewago Creek. At this site, the forest is dominated by pin oak, silver maple (Acer saccharinum), sycamore, hickory, and ash. This population, comprised of a dozen aging trees, is vulnerable to loss due to the small number of individuals, the lack of successful reproduction, and the limited amount of riparian forest habitat at this site. Reproduction may be impeded by the density of weedy non-native species (multiflora rose and garlic mustard) in some areas of the woodland or other factors. However, the mature trees could persist for many years if the woodland remains intact.

- **826: ARENDTSVILLE NARROWS WOODS & SEEPS** (Arendtsville Quad., Franklin & Menallen Twps.) - This Locally Significant site adjoins two sites for species of concern (530 &531). The locally significant site contains good quality forest and wetland habitat, including older hemlocks (Tsuga canadensis) and white pine 54 (Pinus strobus) on the higher slopes and mossy forested seeps along the upper reaches of the Conewago Creek. A ground survey of this area was not conducted, but the area has potential for at least one species of special concern. The woodlands provide scenic value and help to maintain the quality of Conewago Creek and the fisheries there. (West) Conewago Creek is a HQ-CWF throughout its basin from its source to Pleasant Dale Creek. Mountain Creek is a HQ-CWF throughout its basin from its source to the Adams/Cumberland County line.

- **827: CHESTNUT HILL WOODS** (Biglerville Quad., Butler & Tyrone Twps.) - This site is Locally Significant as a relatively large and diverse woodland for this predominantly agricultural area of the county. The area is dominated by hardwoods including oak, hickory, tulip poplar, and some beech with a well-developed shrub layer in the understory. Additional surveys are encouraged as only a portion of the site was field surveyed during this study.

  During a survey of the site in 2000, a sizable population of a State Imperiled PA-Endangered plant species was discovered. The site is dominated by red oak (*Quercus rubra*), and tulip poplar (*Liriodendron tulipifera*), but also included beech (*Fagus grandifolia*), red maple (*Acer rubrum*), and butternut (*Juglans cinerea*). A partial survey of the site found it to contain 24 overstory tree species, 30 understory tree and shrub species, and 65 herbaceous species, most of which were native. The surrounding land includes agricultural fields, pastures and private residences. Jeep lanes, exotic species, dumping, timber harvesting and development are disturbances and potential threats. Preservation of this site in its present condition is recommended.

- **828: LAUREL ROAD SWAMP** (Dickinson Quad., Menallen Twp.) is a Locally Significant natural community. It consists of a seep-derived hardwood swamp dominated by red maple, white pine, and white oak with an understory of swamp azalea, witch hazel, spicebush, and winterberry. The swamp is comprised of a dense network of braided seeps and streams, which meander through moss-covered

hummocks at the base of trees, shrubs, and ferns. The swamp contains a diversity of herbs, sedges, and grasses and provides good habitat for amphibians as well.

- **829: GREEN RIDGE BEND** (Hampton Quad., Hamilton Twp.) is a Locally Significant site along Conewago Creek that supports a diverse flora and fauna. The steep wooded slopes are dominated by chestnut oak, white oak, and flowering dogwood on the drier sections, and hemlock and sugar maple on the more mesic, north-facing slope. Rock outcrops support plants that are relatively uncommon in the county including rusty woodsia fern (Woodsia ilvensis), wild pink (Silene carolina), and others. The stream supports a diversity of freshwater mussels and fish. Great blue herons and osprey were also observed at the site. Maintaining a wooded buffer on both sides of the stream helps to maintain water quality for the benefit of both the fisheries and the shellfish here; the woodlands help to reduce run-off and siltation and the shade keeps water temperatures cool.

<u>Top Priority Natural Areas in York County</u>

- **1: CAMP TUCKAHOE** (Franklin Quad., Franklin Twp.) - In 1995, a very small population of rough-leaved aster was observed flowering in a small floodplain meadow along the upper reaches of Dogwood Run at Camp Tuckahoe. Moist soils, such as those found in swamps and bogs, are needed for the persistence of this species. Also the partial light provided by canopy gaps may be a necessity for this species to flower. Several additional patches and clumps of the imperiled in state plant species of special concern rough-leaved aster identified in the original NAI were located during visits to the site in 1996 and 1998.

  More searching of the upper reaches of Dogwood Run in both York and Cumberland Counties is necessary to establish the full extent of this occurrence.

- **2: STONE HEAD SITE** (Franklin Quad., Franklin Twp.) **–**Animal species that are rare or uncommon in state have been observed at this site on several occasions during the 1990's. Further surveys to determine the extent and viability of the population are recommended.

- **11: STATE GAME LANDS #243 SITE** (Franklin Quad., Franklin & Washington Twps.) - Horse-gentian was found at State Game Lands #243 (Franklin Twp.) in an early to mid-successional forest along a moderately sloping stream valley. Dominant canopy species included red oak, shagbark hickory, and sugar maple, and averaged approximately six (6) inches in diameter at breast height. The poorly developed shrub layer was composed mostly of tree saplings. The moderately diverse herb layer included a variety of herbs, ferns, sedges, and grasses, the most common of which were Christmas fern and horse balm. Less than a half dozen individuals of horse-gentian were observed at this site in the summer of 1995. There are no immediate threats to this occurrence, but more searching is needed to establish its full extent. Two (2) new plant species were found at this site during a field visit in 2001. The boundary of this site has been enlarged to accommodate these two (2) new species. A small population of the uncommon in state plant

species of concern eastern coneflower was found in a mowed field with a moist diabase substrate dominated by perennial herbs including Indian hemp, bush clover, New York ironweed and boneset. The existence of exotic plant species in the habitat pose a potential threat, but continuing the scheduled mowing in this area will help maintain this species. A small but reproducing population of shumard's oak, a critically state imperiled PA-Endangered tree species, was found at this site along forest edges and pipeline borders in conjunction with various oaks, American elm, shagbark hickory, red maple, spice bush and tree-of-heaven. This occurrence could be the northernmost known location in the range for this species. The current management practices employed at this site are suitable for the continued reproduction of this species. A more thorough survey for this species is encouraged. The site is mostly within State Game Lands #243.

- **12: NELLS HILL SWAMP SITE** (Wellsville Quad., Monaghan & Warrington Twp.) - In the original NAI, this site was listed as Locally Significant for its rich diversity of wetland flora and as a habitat type uncommon in the County. The rolling hills of this area was surveyed during 1996 and was found to contain an animal species of special concern the giant swallowtail, and two (2) plant species of special concern shumard's oak and horse-gentian. With these additions, the site has been removed from Table 2, and added to Table 1, and the corresponding site boundary expanded to accommodate these populations. Giant swallowtail represents an unknown quality population of a G5, S2 animal species of concern that relies on prickly-ash as a food source during its development. The prickly-ash exists within a shrub thicket of a floodplain forest. In 1996, a marginal quality population of shumard's oak, a critically state imperiled PA-Endangered plant species, was identified on this site. Though growing vigorously, the species exhibited very sparse reproduction. During a subsequent survey in 1997, a poor quality population of horse-gentian, a critically state imperiled PA plant species of special concern, was located. The surrounding land is wooded, with State Game Lands to the north and east. Canopy species of the forest include white ash, white oak and shagbark hickory, with an understory of spicebush, redbud and black-haw. There are no obvious threats. Additional surveys are recommended to assess the extent and habitat of these species at this location. This site is partially within State Game Lands #242.

- **13: BERMUDIAN CREEK at T809** (Franklin Quad., Washington Twp.)- Two (2) animal species of concern were found to inhabit the creek in this section of Bermudian Creek. These species depend on clean, freely moving water for their continued existence. Threats to these animal species include chemical and sediment runoff, and changes in the hydrology of the creek system. Maintaining a forested buffer along the creek banks will help these species persist at this site. Additional surveys of the creek are needed to reassess and monitor this animal population.

- **14: ALPINE ROAD SITE** (Wellsville Quad., Warrington Twp.) - A moderate size but poor quality population of hardleaved goldenrod grows partly on a road shoulder and partly in a successional field. It occurs on dry to mesic diabase derived

soils in open light. Associates include New England aster, tall fescue, gray goldenrod, Japanese honeysuckle, and white sweet-clover. This element, which is currently listed as a Tentatively Undetermined (TU) species, has been recommended for PA Endangered (PE) status.

- **15: STRAIGHT HILL SITE** (Wellsville Quad.,Warrington Twp.) - This site consists of a mosaic of plant cover types including bottomland and upland forests, early successional forests, and old fields. Element occurrences at this site occur in various locations within the site and, although the site is primarily in Gifford Pinchot State Park, element occurrences and the habitat that sustains them extend beyond Park boundaries. Cranefly orchid is a moderate to high quality population of a PA-Rare plant species and is found growing in well-drained humusy soil of a partially open mixed hardwoods forest. Hard-leaved goldenrod is a TU plant species that was first reported from the Park in 1967 and not found again until the County inventory in 1995. About 100 plants were found (many in flower) in open areas with red cedar, Indian grass, gray goldenrod and other herbaceous species. Hard-leaved goldenrod requires open areas; succession and subsequent shading is a potential threat. Some of the plants also occur close to the roadside so frequent mowing or spraying of herbicides are also potential threats to this rare plant. Potential habitat for hardleaved goldenrod, is found in patches throughout the site. Hard-leaved goldenrod has been suggested for PE status. Horse-gentian and showy skullcap occur near each other in a mid-successional forest at the toe of a gentle northwest facing slope. These elements occur in shade on mesic to slightly hydric soils. Showy skullcap represents a moderate sized population of a newly rediscovered PA-Extirpated plant species. The forest is dominated by ash, hickory, and elm with an understory of tree seedlings, white snakeroot, and bedstraw. A poor quality population of tooth-cup occurs in a wet forest opening. A small depression in the opening is periodically inundated by run-off from upslope. Associated species include swamp milkweed, Panic-grass, rushes, and red maple. Giant swallowtail, which is dependent on prickly-ash as a food source, has been observed at Gifford Pinchot State Park on several occasions. The primary threat to this species is the loss of prickly-ash. Henry's elfin was first observed at this site in 1981 and since then has been observed repeatedly. Little is known about this species aside from its preference for clearings and wood edges. A PA-Endangered animal species that has been sighted several times in the south end of the Park prefers slow shallow rivulets found in marshy settings and is vulnerable to wetland alteration and destruction. In 1996, 1999 and 2000, five (5) new species of concern were observed, one (1) animal and four (4) plants. The site boundaries have been modified subsequent to the original NAI to accommodate these additions. Olive hairstreak is a rare or uncommon in the state animal species whose host plant is red cedar. The dry, open areas with these shrubs are necessary habitat for this species. Additional surveys are recommended to more thoroughly assess this species and its habitat. In 1996, a good quality population of shumard's oak was identified as growing throughout the Park. This plant species was typically found along streams and moist lower slopes in association with various oaks, hickories, American elm, red maple, hackberry and black walnut. Selective logging or thinning is probably beneficial to this species. A single specimen of cranefly orchid was seen during a

visit in 2000. A more thorough survey for this species is recommended to determine the extent of the population. A good to marginal population of horse-gentian and good to excellent quality population of eastern coneflower were also found during a survey of the site in 2000. These species occupy an area that had previously been pasture, and would benefit from annual mowing. The associated plant species include Indian grass, purple-top grass, gray goldenrod, rough-leaved sunflower and cinquefoil. There is a limited amount of disturbance at the STRAIGHT HILL SITE from recreational uses. This site will be best protected by leaving it in its current condition.

- **16: BEAVER CREEK EAST** (Dover Quad.,Warrington Twp.) - A small but persistent population of tooth-cup occurs on alluvial deposits along Beaver Creek. These stream corridor areas are inundated at times of high water. The element occurs in open to somewhat open areas along with a variety of native and exotic herbs. Tree species lining the stream corridor include American elm, sycamore, and black willow. Puttyroot is found in the woods not too far from the creek. This PA-Rare plant occurs in a gap along with a variety of other herbaceous species including May-apple, wild ginger, and spring-beauty. Shrubs in the gap include spicebush and bladdernut, while the surrounding forest is mainly a mix of tulip poplar and oak. Preserving these occurrences will be best facilitated by leaving them undisturbed.

- **17: STRAIGHT HILL WOODS** (Dover Quad., Dover & Warrington Twps.) - Riverweed was found on a steep southerly facing rocky slope adjacent to Conewago Creek at this site during the original NAI. The somewhat open forest cover is composed of mixed hardwoods. Despite the rock outcrops, the soil is rich and supports a number of both native and on-native herbs. Riverweed has subsequently been delisted and is no longer tracked as a species of special concern.

- **18: BEAVER CREEK ROW** (Dover Quad., Warrington Twp.) - During the original NAI, hard-leaved goldenrod was growing on a powerline ROW near the point where the ROW crosses Beaver Creek at the site. Periodic removal of tree species from the ROW artificially created the open meadow habitat that is required by this species. Rich soils derived from diabase bedrock are also important for the occurrence of hard-leaved goldenrod at this site. This population of over 100 stems was found growing in association with goldenrods, Indian grass, bush-clover, tick-trefoil, Japanese honeysuckle, and pine saplings. During subsequent visits, grass-leaved rush, a previously unreported imperiled in state plant species of concern was seen. A more thorough search of the area is recommended. The surrounding land includes woods, scattered residences and agriculture. There were no apparent threats reported.

- **19: ROCK RIDGE WOODS** (Dover Quad., Warrington Twp.) - Puttyroot is found growing in the herb layer of a mixed hardwoods forest on a rocky south facing slope. Tree species include oaks, tulip poplar, basswood, ash, and hackberry. The exotic species wineberry and Japanese honeysuckle are common at this site and may eventually degrade the habitat needed by this PA-Rare plant.

- **20: ERNEY CLIFF** (Dover Quad., Conewago & Newberry Twps.) is a sparsely vegetated south facing eroded red shale cliff. It occurs on the outside curve of a sharp bend of the Conewago Creek rising steeply from the stream to a more gradually sloping hillside above. Vegetation cover is greatest along the stream and on the summit of the cliff. The plant community at this site is comprised of species tolerant of extremes in heat and lack of moisture. Woody vegetation on the cliff includes red cedar and dwarf hackberry. Native herbs include foamflower, Canada bluegrass, hairy-lip fern, and poison ivy. Exotic herbs, which are common, include Japanese honeysuckle, soapwort, and orpine. Wild oat is a mediocre occurrence found on lower elevations at this site. When last observed in July of 1995, many hundreds of stems of this species were flowering vigorously. The site has not been revisited to determine if there has been any change in the population of wild oat reported in the original NAI. Small-flowered crowfoot occurred at higher elevations at this site during the original NAI but has since been delisted and is no longer tracked as a species of special concern. A major threat to wild oat is loss of habitat to the aggressive exotic species Japanese honeysuckle.

- **21: LAUREL RUN** (Dover Quad., Conewago Twp.) is a Locally Significant site located at the head waters of Laurel Run, a tributary to Conewago Creek. This site includes a stream corridor dominated by eastern hemlock and a seepy woodland dominated by red maple. A wide diversity of herbs and shrubs are found within the woodland and the seeps create excellent habitat for amphibians.

- **22: SHADY LANE WOODS** (Dover Quad., Newberry Twp.) - This site is located in a mostly forested residential/rural area. Further surveys are required to fully document the existence of a zale moth at this site and to determine its quality.

- **23: CONEWAGO CREEK AT YORK HAVEN** (Steelton and Middletown Quad., East Manchester & Newberry Twps., & York Haven Boro.) - The yellow-crowned night-heron is an animal species of special concern which has been observed with young feeding along a stretch of the Conewago Creek near Brunners Island. The black-crowned night-heron has also been observed feeding along this stretch of the creek. Both of these species are crepuscular (active during twilight) and nocturnal, and require wetland habitat with shallow water such as marshes, lake shores, ponds, or wooded streams. Loss of habitat is a major threat.

- **33: MIDNIGHT CAVE** (West York Quad., Jackson Twp.) - This site was found to host an unknown quality population of the rare exotic PA-Candidate-at-risk animal species northern myotis during a survey in 1997. The species could be impacted by disturbance from people entering the cave, or changes to the cave entrance. Additional surveys are encouraged to assess the population status and habitat of this species.

- **34: EAST BERLIN MEADOW** (Abbottstown Quad., Paradise Twp.) - The least shrew, a PA-Endangered animal, has been observed several times at this site. The most recent observations were in 1993. The site has no distinguishing features aside

from its being a hay meadow. This species prefers open country with dense herbaceous vegetation, such as that of abandoned hay meadows, successional old fields, or marshes.

- **35: HIGH ROCK** (Hanover Quad., Heidelberg & Paradise Twps.) - Occurring on the forested high ground of the Pigeon Hills, this Geologic Feature consists of outcrops of lower Cambrian Chickies quartzite (Geyer and Bolles 1979). This well used site occurs within a xeric forest of chestnut oak, Virginia pine, red maple, and mountain laurel. The outcrops offer limited views of the piedmont uplands to the north during the summer. The view is probably expanded greatly during winter months when the trees are without their leaves.

  Natural areas are unique land areas that provide habitat for various species of plants and animals. In some cases, the Natural areas contain habitat for rare or threatened and endangered species. The natural areas within the watershed are located on Figure 3.1-2.

Land Use Water Quality Hazards

Review of existing files and coordination with local and state agencies revealed no superfund sites (Figure 3.1-3). However there are numerous pollution discharges (PCS), hazardous material sites (RCRA), and toxic material sites (TRIS) within the watershed. The highest concentration of these sites occurs within the greater Hanover region. This presents a problem for groundwater contamination since this area is also a potentially stressed area (PSA) for water resources. The soils are listed as excessively draining.

Although these sites are regulated by various state and federal agencies, it is important to understand where these sites are located. Regulatory guidance only controls the immediate site. However, knowing locations of potential toxic substances is critical to the protection of resources. Of particular importance is the location of these sources and their proximity to groundwater sources, aquifers, and underlying geology. As stated, a majority of these facilities are located in the greater Hanover area which is also a PSA, has a high recharge rate aquifer (and underlying geology), and has excessively draining soils. As a result, there is high potential for a spill to reach the potable water supply quickly.

See Figure 3.1-3 Water Quality Hazard Map

3.2 Water Resources

A. The Hydrologic Cycle

The hydrologic cycle is the process by which water is transported between the atmosphere and the earth's surface in a repeating cycle (atmosphere to earth and back to the atmosphere). Surface water, overland flow and groundwater are part of this cycle. Figure 3.2-1 below is a graphical representation of the hydrologic cycle over a watershed.

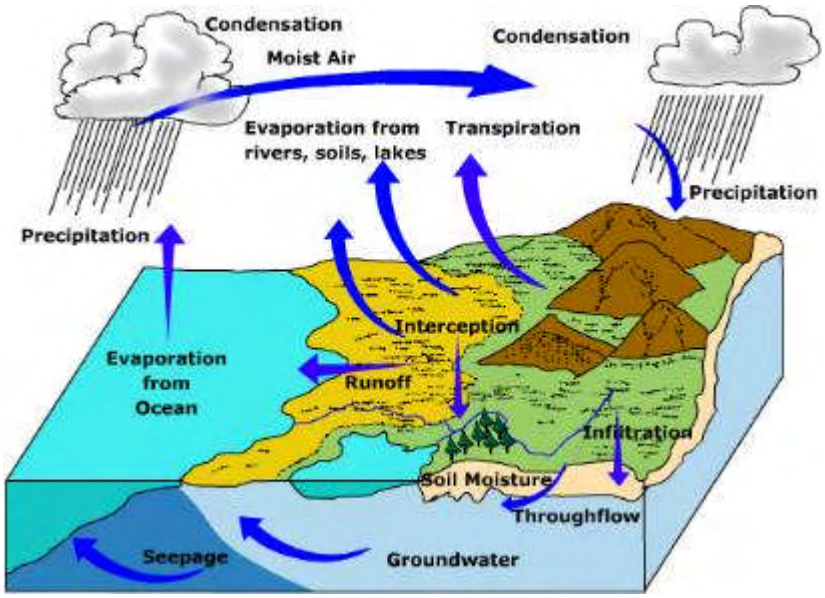

Figure 3.2-1: Hydrologic Cycle.
(Source: www.uwsp.edu)

B. Groundwater Resources - Watershed Aquifers

An aquifer refers to saturated permeable rocks of a geologic formation, group of formations, or part of a formation that is water bearing. Aquifers are assessed according to groundwater yields (available potable groundwater), sustainability (maintain constant potable groundwater production) and susceptibility to de-watering (over pumping and drought conditions).

There are 3 major aquifer types within the Conewago Watershed – Crystalline Rock Aquifer, Siliciclastic Rock Aquifer, and Carbonate Rock Aquifer (Figure 3.2-2). The South Mountain and Piedmont Upland sections of the Piedmont Province are predominately underlain with crystalline rocks. The Gettysburg-Newark Lowland Section is predominantly underlain with siliciclastic rocks except for the portions underlain with diabase, which is composed of crystalline rock. The Piedmont Lowland Section is predominantly underlain with carbonate rock.

Geologic Limitations of each Aquifer Type

The geologic limitations with respect to potable groundwater withdraws are a product of an aquifers ability to store (porosity) and transport (permeability) groundwater. Listed below is a brief description of each aquifer with the aforementioned highlighted.

***Crystalline Bedrock Aquifers* - South Mountain & Piedmont Upland Sections**

The **South Mountain section** of the Piedmont Province is predominately underlain with crystalline rocks. Crystalline bedrock consists of minerals that are hard (resistant to weathering) and packed closely together. Spaces between the individual mineral crystals are few, microscopically small, and generally unconnected. For the above stated reasons, porosity and permeability in crystalline bedrock aquifers is notoriously low. Most groundwater withdraws from crystalline rock occur from groundwater stored in fractures or joints (secondary porosity). Because crystalline rock is (highly) resistant to weathering the size and number of fractures and faults in the bedrock are limited and decrease with depth, so most significant water supplies are found within a few hundred feet of the surface.

Crystalline bedrock aquifers have the distinction of being the lowest yielding aquifers in Pennsylvania due their inability to store (porosity) and transport (permeability) groundwater. Crystalline bedrock not only presents a problem for groundwater withdraws but the nature of the rock also limits groundwater infiltration (aquifer recharge). Even in years of ample precipitation (recharge) the amount of rainfall that reaches the aquifer is minimal. Short-term aquifer yields in this section may not be representative of long-term sustainability.

The **Piedmont Upland Section** is predominantly underlain with crystalline rock and is subjected to the same limitations as the South Mountain Section.

***Siliciclastic Bedrock Aquifers* - Gettysburg-Newark Lowland Section**

The **Gettysburg-Newark Lowland Section** is predominantly underlain with siliciclastic rocks except for those portions underlain with diabase, which is composed of crystalline rock. Siliciclastic bedrock consists of moderately erodable, silica-based, non-carbonaceous sediments that were broken from preexisting rocks, transported elsewhere, and re-deposited before forming another rock – i.e. sandstones, siltstones, shales, and conglomerates. The porosity in siliciclastic rock can vary from low to high depending on the geologic formation. Siliciclastic bedrock can be moderately to highly weathered depending on the dominant mineral(s) and the rock exposure therefore secondary porosity and permeability can also vary from low to high depending on the geologic formation. Groundwater withdraws from siliciclastic bedrock occur from primary and secondary porosity sources.

Siliciclastic bedrock aquifers are known for moderate groundwater yields. The extent of weathering usually corresponds with the groundwater yield; the greater the weathering, the greater the yield. Weathered material also provides

ample conduits for groundwater infiltration (recharge). Seasonal precipitation amounts (recharge) will dictate the long-term ability of this aquifer to produce sustainable yields.

***Carbonate Bedrock Aquifers* - Piedmont Lowland Section**

The **Piedmont Lowland Section** is predominantly underlain with carbonate rock. Carbonate bedrock consists of moderately to highly erodable carbonate sediments, which were broken from preexisting rocks, transported elsewhere, and re-deposited before forming another rock - i.e. Limestones and dolomites. Carbonate rock has a moderate to high porosity and that can vary depending on the geologic formation. Carbonate bedrock can be moderately to highly weathered depending on the dominant mineral(s) and the rock exposure therefore secondary porosity and permeability can also vary from moderate to high. Groundwater withdraws from carbonate bedrock occur from primary and secondary porosity sources.

Carbonate bedrock aquifers have the distinction of being the highest yielding aquifers in Pennsylvania due their ability to store (porosity) and transport (permeability) groundwater. The extent of weathering usually corresponds with the groundwater yield; the greater the weathering, the greater the yield. Weathered material also provides ample conduits for groundwater infiltration (recharge). Seasonal precipitation amounts (recharge) will dictate the long-term ability of this aquifer to produce sustainable yields

See Figure 3.2-2 Aquifers Map

D. Surface Water Resources – Streams

Surface water accounts for 1.20 % of the land cover in Conewago Creek Watershed. The primary tributaries to Conewago Creek are South Branch of Conewago Creek and Bermudian Creek. Floodplains in the headwaters of the Conewago Creek are relatively narrow, but widen considerably in the course of the Creek's migration throughout the watershed.

The Commonwealth of Pennsylvania classifies streams according to a use designation. Each stream and/or stream reach is identified through a "designated use" as defined in Chapter 93.1 Water Quality Standards of the Pennsylvania Code. A "designated use" is defined in §93.1 as those uses specified in §§93.9a-93.9z for each waterbody or segment whether or not the use is being attained. Designated uses are regulations promulgated by the Environmental Quality Board (EQB) through the rulemaking process. An "existing use" is different than a "designated use." An "existing use" is defined in 25 Pa. Code §93.1 as "Those uses actually attained in the water body on or after November 28, 1975, whether or not they are included in the water quality standards". The same definition appears in the federal regulations at 40 CFR §131.3(e).

The streams within Conewago watershed include surface waters with a designation of Cold Water Fisheries (CWF), Warm Water Fisheries (WWF), or Trout Stocking Fisheries (TSF). These designations denote water uses that are to be protected within that stream. Each individual stream may have several designation classes depending on the determine water quality within specific reaches of the stream. The protected use for the various designations area as follows: CWF, the maintenance or propagation, or both, of fish species including the family Salmonidae and additional flora and fauna which are indigenous to a cold water habitat; WWF, the maintenance and propagation of fish species and additional flora and fauna which are indigenous to a warm water habitat; and TSF, the maintenance of stocked trout from February 15 to July 31 and maintenance and propagation of fish species and additional flora and fauna which are indigenous to a warm water habitat. The designation of HQ-High Quality Fisheries is a designation that provides special protection for streams or watersheds with high quality waters, environmental, or other features that require further protection. The designation of EV-Exceptional Value Fisheries is a designation given to streams that meet requirements based on location, recreational value, biological factors, designation as a wilderness trout stream, or being a surface water of exceptional ecological significance.

Seventy-one (71) stream reaches within the watershed are designated as a CWF and sixty-two (62) stream reaches are designated as High Quality Cold Water Fishery (HQ-CWF). CWF include Latimore Creek and West Conewago Creek and its unnamed tributaries. Lippencot Spring Creek and Sharps Run are designated as a HQ-CWF. The majority of the stream reaches within the watershed, one thousand one hundred sixty-eight (1,168) are designated as a WWF. WWF provide for the sustainment of fish, flora, and fauna that are indigenous to warm water habitats. Three hundred seventy-five (375) stream reaches within the watershed have a classification of TSF. These streams provide for the maintenance of stocked trout from February 15 to July 31 and,

in addition, the maintenance and propagation of warm water fish flora, and fauna. See Table 3.2-1 Conewago Creek Watershed Stream Use Designation.

The Susquehanna River, which is a WWF, forms the eastern border of York County. The confluence of Conewago Creek with the Susquehanna River is located within the upper northeastern corner of the watershed in York Haven, PA.

Table 3.2-1: Conewago Creek Watershed Stream Use Designation

Steam Use Designation	**Number of Designated Stream Reaches Within Conewago Watershed**	**Total Length of Stream (Miles)**
Cold Water Fishery (CWF)	71	91.83
High Quality Fishery (HQ)	62	65.06
Trout Stocked Fishery (TSF)	375	409.77
Warm Water Fishery (WWF)	1168	1457.94
Total Stream Miles		

Table 3.2-2: Sub-Watersheds and Chapter 93 Designations

Sub-Watershed Name	Chapter 93 Designation
1. Beaverdam Creek	WWF
2. Bennett Run	WWF
3. Bermudian Creek North	WWF
4. Bermudian Creek South	WWF
5. Brush Run	WWF
6. CCW-Plum Run	WWF
7. Conewago Creek East	WWF
8. Conewago Creek	WWF
9. Conewago Creek West	**HQF/CWF/WWF**
10. Davidsburg Run	WWF
11. Doe Run	WWF
12. Fox Run	**TSF**
13. Gardner Run	WWF
14. Honey Run	**TSF**
15. Indian Run	WWF
16. Latimore Creek North	WWF
17. Latimore Creek South	WWF
18. Laurel Run	WWF
19. Lippencot Spring Creek	**HQF**
20. Little Conewago Creek North	**TSF**
21. Little Conewago Creek South	**TSF**
22. Long Arm Creek	WWF
23. Markel Creek	WWF
24. Mud Run	WWF
25. Musser Run	WWF

26. North Branch Beaver Creek	WWF
27. North Branch Bermudian Creek	WWF
28. Opossum Creek	**TSF**
29. Pine Run	WWF
30. Pleasant Dale Creek	WWF
31. Plum Creek	WWF
32. Quaker Run	**TSF**
33. Red Run East	WWF
34. Red Run West	WWF
35. SBC-Moulston	WWF
36. Sharps Run	**HQF**
37. South Branch Beaver Creek	WWF
38. South Branch Conewago Creek	WWF
39. Stony Run	WWF
40. Swift Run	WWF
41. Wolf Run	WWF

Streams Not Attaining Designated Use

There are stream reaches within the watershed that do not meet the designated use per Chapter 93 of the PA Code and are classified as impaired by the Pennsylvania Department of Environmental Protection (DEP). A total of 48 stream reaches are on the impaired stream list and consist of the mainstem, tributaries, or particular reaches of Bennett Run, Conewago Creek, Musser Run, North Branch Bermudian Creek, Plum Creek, and South Branch Conewago Creek. See Table 3.3-3 –Stream Not Attaining Designated Use for detailed information on the particular streams and stream reaches.

The DEP has an ongoing program to assess the quality of waters in Pennsylvania and identify streams and other bodies of water that do not meet water quality standards (WQSs) as “impaired.” Water quality standards are comprised of the uses (including antidegradation) that waters can support and goals established to protect those uses. Uses include, among other things, aquatic life, human health, and recreation, while the goals are numerical or narrative water quality criteria that express the in-stream levels of substances that must be achieved to support the uses.

Section 303(d) of the U.S. Clean Water Act requires states to list all impaired waters not supporting uses even after appropriate and required water pollution control technologies have been applied. For example, a waterbody impacted by a point source discharge that is not complying with its effluent limits would not be listed on the 303(d) list. The Department would correct the water impairment by taking a compliance action against the discharger. If the waterbody still did not meet water quality standards after achieving compliance with its permit requirements, it would be included on the 303(d) list of impaired waters. The 303(d) list includes the reason for impairment, which may be one or more point sources (like industrial or sewage discharges), or non-point sources (like abandoned mine lands or agricultural runoff).

In 2004, the Department of Environmental Protection (DEP) adopted an integrated format for Clean Water Act Section 305(b) reporting and Section 303(d) listing. This new report is entitled the "2004 Pennsylvania Integrated Water Quality Monitoring and Assessment Report" and satisfies the requirements of both Sections 305(b) and 303(d). The water quality status of Pennsylvania's waters is summarized using a five-part categorization of waters according to the Water Quality Standards (WQS) attainment status. The categories represent varying levels of WQS attainment, ranging from Category 1, where all designated water uses are met, to Category 5, where impairment by pollutants requires a TMDL to correct. Each DEP five-digit waterbody segment is placed in one of the WQS attainment categories. Different segments of the same stream may appear on more than one list if the attainment status changes as the water flows downstream. The listing categories are as follows:

Category 1: Waters attaining all designated uses.

Category 2: Waters where some, but not all, designated uses are met. Attainment status of the remaining designated uses is unknown because data are insufficient to categorize a water consistent with the state's listing methodology.

Category 3: Waters for which there are insufficient or no data and information to determine, consistent with the State's listing methodology, if designated uses are met.

Category 4: Waters impaired for one or more designated use but not needing a TMDL. States may place these waters in one of the following three subcategories:

- *Category 4A:* TMDL has been completed.
- *Category 4B:* Expected to meet all designated uses within a reasonable timeframe.
- *Category 4C:* Not impaired by a pollutant.

Category 5: Waters impaired for one or more designated uses by any pollutant. Category 5 includes waters shown to be impaired as the result of biological assessments used to evaluate aquatic life use even if the specific pollutant is not known unless the State can demonstrate that non-pollutant stressors cause the impairment or that no pollutant(s) causes or contribute to the impairment. Category 5 constitutes the Section 303(d) list that EPA will approve or disapprove under the CWA. Where more than one pollutant is causing the impairment, the water remains in Category 5 until all pollutants are addressed in a completed/EPA-approved TMDL or one of the delisting factors is satisfied.

Table 3.2-3: Stream Not Attaining Designated Use

303(d) List of Streams (w/ TMDL Dates) within Conewago Watershed*					
Stream Name	Code	Source/Cause	Use Assessed	List Date	TMDL Date
Bennett Run	8458	Upstream Impoundment/Siltation	Aquatic Life	2004	2017
Conewago Creek	8303	Unknown/Mercury	Human Health	2002	2011
Musser Run	8305	Agriculture/Suspended Solids	Aquatic Health	1998	2011
		Other/Suspended Solids		1998	2011
North Branch Bermudian Creek	8640	Agriculture/Siltation	Aquatic Health	2004	2017
		Agriculture/Nutrients		2004	2017
		Agriculture/Nutrients		2004	2017
		Agriculture/Nutrients		2004	2017
North Branch Bermudian Creek (Unnamed Trib 08660)	8660	Agriculture/Nutrients	Aquatic Health	2004	2017
		Agriculture/Siltation		2004	2017
North Branch Bermudian Creek (Unnamed Trib 08661)	8661	Agriculture/Nutrients	Aquatic Health	2004	2017
		Agriculture/Siltation		2004	2017
North Branch Bermudian Creek (Unnamed Trib 08662)	8662	Agriculture/Nutrients	Aquatic Health	2004	2017
		Agriculture/Siltation		2004	2017
North Branch Bermudian Creek (Unnamed Trib 08663)	8663	Agriculture/Nutrients	Aquatic Health	2004	2017
		Agriculture/Siltation		2004	2017
North Branch Bermudian Creek (Unnamed Trib 08664)	8664	Agriculture/Nutrients	Aquatic Health	2004	2017
		Agriculture/Siltation		2004	2017
North Branch Bermudian Creek (Unnamed Trib 08665)	8665	Agriculture/Nutrients	Aquatic Health	2004	2017
		Agriculture/Siltation		2004	2017

North Branch Bermudian Creek (Unnamed Trib 08666)	8666	Agriculture/Nutrients	Aquatic Health	2004	2017
		Agriculture/Siltation		2004	2017
North Branch Bermudian Creek (Unnamed Trib 08667)	8667	Agriculture/Nutrients	Aquatic Health	2004	2017
		Agriculture/Siltation		2004	2017
North Branch Bermudian Creek (Unnamed Trib 08668)	8668	Agriculture/Nutrients	Aquatic Health	2004	2017
		Agriculture/Siltation		2004	2017
North Branch Bermudian Creek (Unnamed Trib 08669)	8669	Agriculture/Nutrients	Aquatic Health	2004	2017
North Branch Bermudian Creek (Unnamed Trib 08670)	8670	Agriculture/Nutrients	Aquatic Health	2004	2017
North Branch Bermudian Creek (Unnamed Trib 08671)	8671	Agriculture/Nutrients	Aquatic Health	2004	2017
North Branch Bermudian Creek (Unnamed Trib 08672)	8672	Agriculture/Nutrients	Aquatic Health	2004	2017
		Agriculture/Siltation		2004	2017
North Branch Bermudian Creek (Unnamed Trib 08673)	8673	Agriculture/Nutrients	Aquatic Health	2004	2017
		Agriculture/Siltation		2004	2017
North Branch Bermudian Creek (Unnamed Trib 08674)	8674	Agriculture/Nutrients	Aquatic Health	2004	2017
		Agriculture/Siltation		2004	2017
North Branch Bermudian Creek (Unnamed Trib 08677)	8677	Agriculture/Nutrients	Aquatic Health	2004	2015
North Branch Bermudian Creek (Unnamed Trib 08678)	8678	Agriculture/Nutrients	Aquatic Health	2004	2015
Plum Creek	8881	Agriculture/Siltation	Aquatic Health	2004	2017
		Urban Runoff/Storm Sewers/Siltation		2004	2017

Plum Creek (Unnamed Trib 08882)	8882	Agriculture/Siltation	Aquatic Health	2004	2017
		Urban Runoff/Storm Sewers/Siltation		2004	2017
Plum Creek (Unnamed Trib 08883)	8883	Agriculture/Siltation	Aquatic Health	2004	2017
		Urban Runoff/Storm Sewers/Siltation		2004	2017
Plum Creek (Unnamed Trib 08886)	8886	Agriculture/Siltation	Aquatic Health	2004	2017
		Urban Runoff/Storm Sewers/Siltation		2004	2017
South Branch Conewago Creek	8813	Agriculture/Siltation	Aquatic Health	2004	2017
South Branch Conewago Creek (Unnamed Trib 08846)	8846	Agriculture/Siltation	Aquatic Health	2004	2017
South Branch Conewago Creek (Unnamed Trib 08847)	8847	Agriculture/Siltation	Aquatic Health	2004	2017
South Branch Conewago Creek (Unnamed Trib 08848)	8848	Agriculture/Siltation	Aquatic Health	2004	2017
South Branch Conewago Creek (Unnamed Trib 08849)	8849	Agriculture/Siltation	Aquatic Health	2004	2017
South Branch Conewago Creek (Unnamed Trib 08850)	8850	Agriculture/Siltation	Aquatic Health	2004	2017
South Branch Conewago Creek (Unnamed Trib 08851)	8851	Agriculture/Siltation	Aquatic Health	2004	2017
South Branch Conewago Creek (Unnamed Trib 08852)	8852	Agriculture/Siltation	Aquatic Health	2004	2017
South Branch Conewago Creek (Unnamed Trib 08853)	8853	Agriculture/Siltation	Aquatic Health	2004	2017
South Branch Conewago Creek (Unnamed Trib 08854)	8854	Agriculture/Siltation	Aquatic Health	2004	2017

South Branch Conewago Creek (Unnamed Trib 08855)	8855	Agriculture/Siltation	Aquatic Health	2004	2017
South Branch Conewago Creek (Unnamed Trib 08856)	8856	Agriculture/Siltation	Aquatic Health	2004	2017
South Branch Conewago Creek (Unnamed Trib 08857)	8857	Agriculture/Siltation	Aquatic Health	2004	2017
South Branch Conewago Creek (Unnamed Trib 08858)	8858	Agriculture/Siltation	Aquatic Health	2004	2017
South Branch Conewago Creek (Unnamed Trib 08864)	8858	Agriculture/Siltation	Aquatic Health	2004	2017
South Branch Conewago Creek (Unnamed Trib 08874)	8858	Agriculture/Siltation	Aquatic Health	2004	2017
South Branch Conewago Creek (Unnamed Trib 08878)	8858	Agriculture/Siltation	Aquatic Health	2004	2017
South Branch Conewago Creek (Unnamed Trib 08880)	8858	Agriculture/Siltation	Aquatic Health	2004	2017
South Branch Conewago Creek (Unnamed Trib 08888)	8858	Agriculture/Siltation	Aquatic Health	2004	2017
South Branch Conewago Creek (Unnamed Trib 08889)	8858	Agriculture/Siltation	Aquatic Health	2004	2017
South Branch Conewago Creek (Unnamed Trib 08890)	8858	Agriculture/Siltation	Aquatic Health	2004	2017
South Branch Conewago Creek (Unnamed Trib 08891)	8858	Agriculture/Siltation	Aquatic Health	2004	2017
South Branch Conewago Creek (Unnamed Trib 08892)	8858	Agriculture/Siltation	Aquatic Health	2004	2017
* From Category 5 of PADEP's 2004 Integrated Water Quality Monitoring and Assessment Report for State Water Plan 07F					

Surface Water Resources-Lakes and Reservoirs

Lakes and Reservoirs supply water to residents and industry within and outside of the watershed while at the same time providing opportunities for recreation and aesthetics. Surface water resources (major lakes) are limited to two lakes, Lake Meade and Pinchot Lake, and two water supply reservoirs, Long Arm Creek Reservoir and Sheppard Myers Reservoir, in the watershed. Lake Meade is located in the southern portion of the watershed. The damming of Mud Run with an earth dam created this lake in the 1960s. This lake was created to be the focal point of a residential/recreational community. Pinchot Lake is the largest lake in the watershed and is located in Gifford Pinchot State Park in the northeastern portion of the watershed. Long Arm Creek Reservoir and Sheppard Myers Reservoir are smaller lakes. They are located in West Manheim Township in the southern portion of the watershed.

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See Figure 3.2-3 Water Resources Map

II. Water Quality Assessment(s)

Prior to the preparation of this document, there had been several water quality and watershed assessments completed as well as continual monitoring by both state agencies and local volunteers. The additional studies and assessments collected data on such things as aquatic benthic macroinvertebrate communities, fin fish communities, and other chemical and biological parameters. Figure 3.2-4 shows the locations of sample sites for each data set obtained.

Aquatic benthic macroinvertebrates are aquatic insects that live on the bottom of streams and lakes for most of their life cycle. Certain types of macroinvertebrates are tolerant of lower water quality, whereas other types are not tolerant. As a result, it is possible to make a qualitative decision regarding water quality by identifying the species of macroinvertebrates in a given stream or waterway. Benthic macroinvertebrates are good indicators of watershed health because they:

- live in the water for all or most of their lives
- stay in areas suitable for their survival
- are easy to collect
- differ in their tolerance of amount and types of pollution
- are easy to identify in a laboratory
- often live for more than one year
- have limited mobility
- are integrators of environmental condition

From the spring of 2001 to August of 2002, scientists under the direction of Hedgrow Land Ecology Services collected stream morphology, biological, and chemical data at approximately 99 sites within the Adams County portion of the Conewago Watershed. According to this report ("Conewago Creek Watershed Assessment: Executive Summary), the condition of the Conewago Creek Watershed can be described as optimal, on a course geographic scale, in it's headwater regions and progresses to sub-optimal and marginal conditions as the creek flows north from Hanover and east from the South Mountain area. The degrading trend eastward is a direct result of changing land use and land cover. The western headwaters region is steep, highly dissected by streams, and has well drained stony soils. This region is largely preserved by the Michaux State Forest and Caledonia State Park. The density of degraded stream reaches is lowest in the western region and higher in the eastern where the relief is more gentle with broad valleys and rolling hills. Agriculture is more prevalent in this area.

See Figure 3.2-4 Water Quality Map

On a finer geographic scale, the conditions of the Conewago Creek Watershed very greatly. Conditions range from optimal to poor across the watershed in a random order. In most cases this lack or order can be attributed to change in land use and land cover. In general, marginal or poor conditions seem to coincide with livestock operations and pastures. However, in some cases where agricultural best management practices are in use, these areas are associated with sub-optimal and even optimal conditions. The same is true for other land uses, such as residential. The number of sites in Adams County (for the watershed assessment completed by Hedgerow) per class is as follows:

- Optimal – 11 sites
- Sub-Optimal – 31 sites
- Marginal – 36 sites
- Poor – 21 sites

The watershed assessment for Adams County provides valuable information regarding the overall conditions of the watershed with a focus on stream morphology. It provides needed insight into the effects of land use and land cover on our watershed resources. However, the assessment does have limitation as with all studies. The assessment focused on the central portion of the watershed in Adams County and did not include sites in the northern section or southern section around Hanover.

In 2003 an assessment of the York County portion of the watershed was conducted by the EcoSolutions, Inc. on behalf of the York County Conservation District. This assessment was both an "office" assessment and field visual assessment. However, although an attempt to maintain consistency with the Adams County assessment was made, scope and funding limitation prevented the assessment from collecting detailed data on macro-invertebrate, chemical, and stream morphological parameters. The assessment modeled the watershed using Pennsylvania State University's AvGWLF computer model to predict nutrient loads and sediment transport. A total of 22 sub-watersheds in the York County portion were assessed. Of those 22 sub-watersheds, there are approximately 10 sites with detailed information that can be mapped.

To assess the 10 sites, EcoSolutions, Inc. used EPA's Rabid Bio-Assessment Protocol for habitat. As was expected and predicted by the AvStreams and AvGWLF computer models, the impairment of resources mirrors that for Adams County, even though there are much fewer sites. On a course physiographic scale the watershed is in optimal condition around the northern headwater areas and is sub-optimal and marginal through the central valley and main stem areas. There were no sites classified as poor in the York County Assessment. Similar conclusions can be made about the source of impairment vs. land use as in Adams County. The number of sites in York County for each class are as follows:

- Optimal - 2 Sites
- Sub-Optimal - 6 Sites
- Maginal - 2 Sites
- Poor - 0 Sites

In addition to the two assessments described above, the Susquehanna River Basin has prepared, and continues to prepare, groundwater and water quality reports for the

Lower Susquehanna River Basin (SRBC) of which the Conewago Watershed is a major sub-watershed. The SRBC uses their own protocol and collects data on habitat, macro-invertebrates and water chemistry. There are approximately 9 sample sites located throughout the watershed. As with the other watershed assessments, the SRBC sites vary greatly in a random order from optimal (non-impaired/comparable to reference condition) to poor (non-supporting/severely impaired).

SRBC has not identified the potential causes of impairment. The number of sites from the SRBC report for each class are as follows:

- Optimal - 3 Sites
- Sub-Optimal - 4 Sites
- Marginal - 1 Site
- Poor - 1 Site

Please note: Data is still being received on the SRBC Water Quality and Biological Assessment of the Lower Susquehanna River Subbasin. This section will be expanded for future updates.

E. Wetlands

Wetlands are among the most important ecosystems on Earth. In the great scheme of things, the swampy environment of the Carboniferous Period produced and preserved many of the fossil fuels on which we now depend. In more recent biological and human time periods, wetlands are valuable as sources, sinks and transformers of a multitude of chemical, biological, and genetic materials. Although the value of wetlands for fish and wildlife protection has been known for several decades, some of the other benefits have been identified more recently.

Wetlands are sometimes described as the “kidneys of the landscape” because of the functions they perform in hydrologic and chemical cycles and because they function as the downstream receivers of wastes from both natural and human sources. They have been found to cleanse polluted waters, prevent floods, protect shorelines, and recharge groundwater aquifers.

Wetlands have also been called “biological supermarkets” for the extensive food chain and rich biodiversity they support. They play a major role in the landscape by providing unique habitats for a wide variety of flora and fauna. Now that we have become concerned about the health of the entire planet, wetlands are being described by some experts as carbon dioxide sinks and climate stabilizers on a global scale.

These values of wetlands are now being recognized and translated in to wetland protection laws, regulations, and management plans. Wetlands have been drained, ditched, and filled throughout history but never as quickly or as effectively as was undertaken in the United States beginning in the mid-1800’s. Since then more than half of the nation’s original wetlands have been drained. Many scientists, engineers, lawyers, and regulators are now finding it both useful and necessary to become specialists in wetland ecology and management in order to understand, preserve, and even reconstruct these fragile ecosystems.

Wetlands include swamps, bogs, marshes, mire, fens, and other wet ecosystems found throughout the world. The exact extent of wetlands is not known even though some wetland mapping resources do exist.

The most common mapping resource for wetlands is known as the National Wetland Inventory (NWI). NWI is a series of maps overlain on U.S. Geological Survey Topographic Maps that show the approximate location of wetlands. These maps were started in the 1960's by the U.S. Fish and Wildlife Service to map and classify the Nation's wetlands. The maps were created from aerial infrared imagery taken at a resolution of 1:60,000 to 1:130,000. Looking at infrared imagery one can identify wet signatures on the landscape. When the NWI maps were created, they used these wet signatures to identify and "delineate" the approximate location of wetlands. In some cases these maps were combined with hydric soil maps in an attempt to verify the presence of wetlands. As a result, the location of wetlands and the extent of wetlands in a given watershed can be assumed to be an estimate at best. We know that not all wetlands have been mapped and some experts estimate that as much as 50% of all wetlands have not been mapped.

The total wetland acreage within the watershed is 6,930 acres and accounts for 2.1% of the total watershed acreage of 329,952 acres. Wetlands within the watershed consist of three types: palustrine, lacustrine, and riverine. Palustrine wetlands are non-tidal wetlands dominated by trees, shrubs, and emergents. Lacustrine wetlands are deepwater habitat lacking trees, shrubs, and emergents. Riverine wetlands are wetlands and deepwater habitats contained within a stream/river channel. The total acreage for palustrine wetland is 4,704 and accounts for 68% of the total wetland within the watershed. The total acreage for lacustrine wetland is 1,060 and accounts for 15% of the total wetland. The total acreage for riverine wetland is 1,153 and accounts for 17% percent of the total wetland within the watershed.

Palustrine wetlands are scattered throughout the watershed and typically follow stream corridors. Lacustrine wetlands are found typically within farm areas although scattered ponds are found throughout the watershed. Riverine wetlands for mapping purposes are identified as the stream channels within the watershed and include both perennial and intermittent streams.

Palustrine wetlands comprise the majority of wetlands within the watershed and can be further categorized into palustrine emergent wetland, palustrine forested wetland, and palustrine open water wetland. Thirty-six percent (36%) of the palustrine wetland within the watershed is Emergent Wetland (PEM), seventeen percent (17%) is Forested Wetland (PFO), twelve percent (12%) is Scrub-Shrub wetland (PSS), and thirty-two percent (32%) is Open Water wetland (POW). The remaining three percent (3%) is categorized as Flat/Impounded/Temporary wetland which likely consists of temporary areas due to natural impoundments, compacted areas, and/or construction-related areas.

Review of the National Wetlands Inventory maps for the Conewago Creek Watershed (Figure 3.2-3) and the study area determined that there are only approximately 3,179 acres of mapped wetlands, which amounts to only 1.8% of the entire watershed area.

Hydric Soils

Hydric soils are soils that are subject to frequent flooding, ponding or saturation and is therefore poorly or very poorly drained, has a shallow water table, is oxygen deficient, and undergoes anaerobic conditions for a frequency and duration that is suitable for the growth and survival of hydrophytic vegetation.

There are seven Hydric Soils units within the watershed and consist of Baile, Bowmansville, Croton, Dunning, Hatboro, Lamington, and Watchung. Hydric soil units are scattered throughout the watershed although the largest concentration of the units occurs within the northern, central, and northwestern portion of the watershed. See Table 3.2-5 - Hydric Soil Map Units Within Conewago Watershed

Additionally, there are areas that are not mapped as hydric soils but still contain small areas of hydric soil, know as hydric soil inclusions. These map units, in general, do not meet the definition of hydric soils because they do not have one of the hydric soil indicators. A portion of these map units, however, has the potential to include hydric soils. The majority of wetlands are located within areas that are mapped as containing hydric soils but areas with hydric soil inclusions may exhibit wetland vegetation and can be an indicator of wetlands that are not identified on the National Wetland Inventory (NWI). There are twenty-two soil map units that contain hydric inclusions within Conewago Watershed. See Table 3.2-6 - Soil Map Units with Hydric Soil Inclusion Within Conewago Watershed.

Table 3.2-5: Hydric Soil Map Units Within Conewago Watershed

Hydric Soils Within Conewago Watershed	
Map Symbol	Map Unit Name
Ba	Baile Silt Loam
Bo	Bowmansville silt loam
CrA	Croton silt loam, 0 to 3 percent slopes
CrB	Croton silt loam, 3 to 8 percent slopes
Dy	Dunning silty clay loam
Hc	Hatboro silt loam
Lc	Lamington silt loam
WaA	Watchung silt loam, 0 to 3 percent slopes
WaB	Watchung silt loam, 3 to 8 percent slopes
WbB	Watchung silt loam, 0 to 3 percent slopes, extremely bouldery

Table 3.2-6: Soil Map Units with Hydric Soil Inclusions Within Conewago Watershed

Soils With Hydric Inclusions Within Conewago Watershed	
Map Symbol	Map Unit Name
AbA	Abbottstown silt loam, 0 to 3 percent slopes
AbB	Abbottstown silt loam, 3 to 8 percent slopes
Be	Bermudian silt loam
BgA	Birdsboro silt loam, 0 to 3 percent slopes
BgB	Birdsboro silt loam, 3 to 8 percent slopes
BgC	Birdsboro silt loam, 8 to 15 percent slopes
BuB	Buchanan channery loam, 3 to 8 percent slopes

BvB	Buchanan channery loam, 0 to 8 percent slopes, extremely stony
Cm	Codorus silt loam
EdB	Edgemont channery loam, 3 to 8 percent slopes
EdC	Edgemont channery loam, 8 to 15 percent slopes
GbB	Glenelg channery silt loam, 3 to 8 percent slopes
GbC	Glenelg channery silt loam, 8 to 15 percent slopes
GdA	Glenville silt loam, 0 to 3 percent slopes
GdB	Glenville silt loam, 3 to 8 percent slopes
HKB	Highfield, Catoctin, and Myersville soils, 0 to 8 percent slopes, very stony
LhA	Lehigh channery silt loam, 0 to 3 percent slopes
LhB	Lehigh channery silt loam, 3 to 8 percent slopes
LhC	Lehigh channery silt loam, 8 to 15 percent slopes
LhD	Lehigh channery silt loam, 15 to 25 percent slopes
LkB	Lehigh channery silt loam, 0 to 8 percent slopes, very stony
Lw	Linside silt loam
MdA	Mount Lucas silt loam, 0 to 3 percent slopes
MdB	Mount Lucas silt loam, 3 to 8 percent slopes
MeB	Mount Lucas silt loam, 0 to 8 percent slopes, very bouldery
MOB	Mt. Airy and Manor channery loams, 3 to 8 percent slopes
MOC	Mt. Airy and Manor channery loams, 8 to 15 percent slopes
MOD	Mt. Airy and Manor channery loams, 15 to 25 percent slopes
MtB	Mt. Zion gravelly silt loam, 3 to 8 percent slopes
NaB	Neshaminy channery silt loam, 3 to 8 percent slopes
NaC	Neshaminy channery silt loam, 8 to 15 percent slopes
Pa	Penlaw silt loam
RaA	Raritan silt loam, 0 to 3 percent slopes
RaB	Raritan silt loam, 3 to 8 percent slopes
ReA	Readington silt loam, 0 to 3 percent slopes
ReB	Readington silt loam, 3 to 8 percent slopes
RfA	Reaville channery silt loam, 0 to 3 percent slopes
RfB	Reaville channery silt loam, 3 to 8 percent slopes
RfC	Reaville channery silt loam, 8 to 15 percent slopes
RoB	Rohrersville silt loam, 3 to 8 percent slopes
RsB	Rohrersville silt loam, 0 to 15 percent slopes, very stony
Rw	Rowland silt loam
UeB	Urban land-Conestoga complex, 0 to 8 percent slopes

3.3 Biological Resources – Flora & Fauna

Biological resources of a watershed are those resources related to the flora (plants and vegetation) and fauna (animals). Understanding what species live in the watershed, their relative abundance and distribution can lead to conclusions about watershed health. Those species range from game species such deer, rabbit, squirrel and wild turkey, to fish and macroinvertebrates. It also incorporates different vegetative communities such as coniferous and deciduous forests and agricultural land.

Varieties in topography and vegetative cover provide for a substantial diversity of wildlife habitats within the watershed and study area. The seeds of herbaceous plants, such as bristlegrass, smartweeds, ragweed, and pigweed, provide food for small game birds such as quail and pheasant and numerous species of song birds. The vegetation of a watershed not only provides food for foragers, but also provides shelter, shade and when adjacent to a stream, provides bank stabilization and temperature moderation. The watershed was once covered with old growth forests dominated by oak and chestnut species. As the area was developed, the watershed was logged as much as three times prior to the state it is in now. As a result, the species found within the forested areas now consist of a mix of maples, yellow poplar, oaks, hickories and other hardwood and softwood species. However, the forested areas continue to provide valuable habitat for various wildlife species.

Flora

The vegetation within the watershed reflects the environmental conditions (geology, topography, soils, climate) and disturbance history, both natural and anthropogenic.

Adams County is located in the original Oak-Chestnut Forest Region, partly in the Piedmont Section and partly in the Northern Blue Ridge Section (Braun 1950). The American chestnut (Castanea dentata) was once a dominant feature of the Oak-Chestnut Forest, but was virtually eliminated with the introduction to North America of the chestnut blight fungus (Endothia parasitica) in 1904. Today the forest of this region is more aptly classified as Appalachian Oak Forest (Bailey 1980) or Mixed Oak Forest (Monk et al. 1990), dominated by white, red, scarlet, and black oaks, often mixed with tulip poplar, red maple, and/or beech, and ericaceous shrubs (e.g., blueberries, mountain laurel, etc.).

Very little of the forest cover of the Piedmont section remains, having been cleared for agriculture and development, or repeatedly logged for lumber and fuel (Keever 1973). On the Piedmont Section tulip poplar often becomes the dominant tree after logging, seeding in on the openings and then growing more quickly than other trees. As the forest matures, however, shade-tolerant species (such as red oak) replace tulip poplar because it does not regenerate under a closed canopy (Tryon 1980). Currently forested lands of the piedmont exist on areas such as rocky slopes and wetlands that are poorly suited to other uses. Some of the unforested Piedmont lands, particularly areas that were seldom or never plowed, support native vegetation similar to sites in Virginia as described by Braun (1950). These contain native grasses such as little blue stem (Schizachyrium scoparium), big blue stem (Andropogon spp.), and Indian grass (Sorghastrum nutans), and scattered small trees such as sassafras, persimmon, and/or red cedar.

The Northern Blue Ridge Section of the Oak-Chestnut forest in the watershed falls within the Blue Ridge physiographic province (the South Mountain area). Most of this area is forested with oaks and other hardwoods. Several notable variations in the typical "Mixed Oak Forest" composition (Monk et al. 1990) occur with relationship to soil, soil moisture, and topography. Drier ridge tops characterized by shallow nutrient poor soils are characterized by chestnut oak (Quercus montana) and black gum (Nyssa sylvatica) with red maple and other oaks as associates, and an understory of ericaceous shrubs including blueberries (Vaccinium spp.), huckleberries (Gaylussacia spp.), and mountain laurel (Kalmia latifolia). Some of these ridgetop woodlands also contain a significant component of pitch pine (Pinus rigida) and scrub oak (Quercus ilicifolia); areas known as Pitch pine-scrub oak barrens (Smith 1983). "Big Flat Barrens" on Caledonia Park quadrangle is an example of this community type.

Many of the stream corridors and adjacent north-facing slopes are dominated by hemlock (Tsuga canadensis) with a minor component of yellow birch (Betula alleghaniensis) and an understory of Rhododendron (Rhododendron maximum) and witch hazel (Hamamelis virginiana). Pin oak, swamp white oak, silver maple, ash, sycamore, and black walnut are frequent on the wetter floodplain soils, with understories including spicebush, violets, nettles (Urtica dioica), cut-leaved coneflower (Rudbeckia laciniata), golden alexanders (Zizea aurea) and other wildflowers. Several species of special concern are found on the wooded floodplains (e.g., "Seven Stars Floodplain", Fairfield quadrangle). In addition, floodplain forests also serve as a protective buffer against erosion and flood damage along many of the county's creeks.

The woolly adelgid, an exotic pest of the eastern hemlock has caused a high mortality rate among this area’s mature stands of hemlock. Because the hemlocks have helped stabilize soils along the riparian corridor and maintain cool water temperatures, the loss of these trees will likely impact the quality of the stream resources in the headwaters.

Wetlands include vegetation types important for the area, providing essential habitat for many plant and animal species. The type of wetland depends on soil type, disturbance, and length and duration of flooding. Many of the wetlands are associated with streams and include floodplain forests as described above, forested swamps such as those in the South Mountain area, shrub swamps, and graminoid marshes. In addition, many are seepage swamps, which are relatively small forested or shrub-dominated wetlands found on lower slopes where water emerges at the surface in a diffuse flow. These wetlands may be dominated by red maple with hemlock and yellow birch as associates, and an understory of rhododendron, swamp azalea (Rhododendron viscosum), spicebush (Lindera benzoin), and/or highbush blueberry (Vaccinium corymbosum). Common wetland herbs include skunk cabbage, violets (Viola spp.), manna grass (Glyceria spp.), sedges (Carex spp.), and ferns (e.g., cinnamon fern, royal fern, sensitive fern, etc.). Graminoid marshes--wetlands dominated by grasslike plants such as cattails, sedges, and grasses, are uncommon in the county. Because wetlands are relatively rare in south-central Pennsylvania, they are important refugia for plants as well as important habitat for nesting and migrating birds. Many other animals such as amphibians, turtles, dragonflies, and damselflies also depend on specific wetland habitats for all or a portion of their life cycles.

Threatened and Endangered Species, and Species of Concern

In addition to the common species of flora, according to the Department of Conservation and Natural Resources (DCNR), there are 5 species listed as Threatened or Endangered species located within the Conewago Creek Watershed. Table 3.3-1 lists these species.

Table 3.3-1: Summary of Threatened and Endangered Plant Species within Conewago Creek Watershed*

Common Name	Scientific Name	Status
Glade Spurge	*Euphorbia purpurea*	PE
Notheastern Bulrush	*Scirpus ancistrochaetus*	LE, PE
Showy Lady's Slipper	*Cypripedium reginae*	PT
Swamp Pink	*Arethusa bulbosa*	PE
Variable Sedge	*Carex polymorpha*	PE

PE - PA Endangered
PT - PA Threatened
LE - US Endangered
* DCNR Website of T&E Species of PA

The Pennsylvania Natural Diversity Inventory (PNDI) lists species of concern located in York, Adams and Cumberland Counties. These species may or may not be located within the watershed, however are located within the counties that encompass the watershed, thus have a high probability of being located within the watershed. These species are listed in Table 3.3-2

Table 3.3-2: Summary of Threatened and Endangered Plant Species within York, Adams & Cumberland Counties**

Common Name	Scientific Name	Status
A Sedge	*Carex tectinca*	PT
American Dragonhead	*Dracocephalum parviflorum*	TU
American Holly	*Ilex opaca*	PT
Arrow-feathered Three Awned	*Aristida purpurascens*	PT
Aster-like Boltonia	*Boltonia asteroides*	PE
Beard-tongue	*Penstemon laevigatus*	N
Bicknell's Hoary Rockrose	*Helianthemum bricknellii*	PE
Blackseed Needlegrass	*Piptochaetium avenaceum*	N
Branching Bur-reed	*Sparganium androcladum*	PE
Brome Grass	*Bromus kalmii*	TU
Brown Sedge	*Carex buxbaumii*	PR
Bull Sedge	*Carex bullata*	PE
Bushy Aster	*Symphyotrichum dumosum*	TU
Bushy St. John's-wort	*Hypericum densiflorum*	PT
Carolina Leaf-flower	*Phyllanthus caroliniensis*	PE
Carolina Petunia	*Ruellia caroliniensis*	PX
Common Hemicarpa	*Lipocarpha micrantha*	PE
Cranefly Orchid	*Tipularia discolor*	PR
Crested Dwarf Iris	*Iris cristata*	PE
Declined Trillium	*Trillium flexipes*	TU

Downy Lettuce	*Lactuca hirsuta*	N
Downy Lobelia	*Lobelia puberula*	PE
Downy Phlox	*Phlox pilosa*	PE
Dwarf Azalea	*Rhododendron atlanticum*	PE
Dwarf Huckleberry	*Gaylussacia dumosa*	PE
Dwarf Iris	*Iris verna*	PE
Eastern Coneflower	*Rudbeckia fulgida*	N
Eastern Gamma-grass	*Tripsacum dactyloides*	TU
Eastern Milk-pea	*Galactia regularis*	PX
Ellisia	*Ellisia nyctelea*	PT
Field Dodder	*Cuscuta pentagona*	N
Flat-stemmed Spike-rush	*Eleocharis compressa*	PE
Forked-chickweed	*Paronychia fastigiata var. nuttallii*	PE
Fringe-tree	*Chionanthus virginicus*	N
Glade Spurge	*Euphorbia purpurea*	PE
Golden Club	*Orontium aquaticum*	PR
Grass-leaved Rush	*Juncus biflorus*	TU
Great Indian-plantain	*Cacalia muehlenbergii*	N
Harbinger-of-spring	*Erigenia bulbosa*	PT
Hard-leaved Goldenrod	*Solidago rigida*	TU
Heller's Witchgrass	*Panicum oligosanthes*	TU
Hoary Puccoon	*Lithospermum canescens*	TU
Horrible Thistle	*Cirsium horridulum*	PE
Horse-gentian	*Triosteum angustifolium*	TU
Indian Wild Rice	*Zizania aquatica*	PR
Jeweled Shooting-star	*Dodecatheon radicatum*	PT
Junegrass	*Koeleria macrantha*	PX
Kidney-leaved Twayblade	*Listera smallii*	PE
Lance-leaf Loosestrife	*Lysimachia hybrida*	N
Leaf-cup	*Polymnia uvedalia*	N
Limestone Petunia	*Ruellia strepens*	PT
Lion's-foot	*Prenanthes serpentaria*	N
Lobed Spleenwort	*Asplenium pinnatifidum*	N
Low Rockrose	*Helianthemum propinquum*	N
Lupine	*Lupinus perennis*	PR
Many-flowered Umbrella Sedge	*Cyperus lancastriensis*	N
Missouri Gooseberry	*Ribes missouriense*	PE
Mistflower	*Eupatorium coelestinum*	TU
Netted Chainfern	*Woodwardia areolata*	PT
Nodding Pogonia	*Triphora trianthophora*	PE
Northeastern Bulrush	*Scirpus ancistrochaetus*	LE, PT
Northern Water-milfoil	*Myriophyllum sibiricum*	PE
Pencilflower	*Stylosanthes biflora*	TU
Plain Ragwort	*Senecio anonymus*	PR
Prickly-pear Cactus	*Opuntia humifusa*	PR
Pursh's Goldenrod	*Solidago purshii*	TU
Puttyroot	*Aplectrum hyemale*	PR

Quillwort	*Isoetes valida*	N
Red-head Pondweed	*Potamogeton richardsonii*	PT
River Bulrush	*Schoenoplectus fluviatilis*	PR
Rough-leaved Aster	*Eurybia radula*	N
Scarlet Ammannia	*Ammannia coccinea*	PE
Sedge	*Carex shortiana*	N
Shellbark Hickory	*Carya laciniosa*	N
Shining Ladies'-tresses	*Spiranthes lucida*	N
Short-fruited Rush	*Juncus brachycarpus*	PE
Short-leaf Pine	*Pinus echinata*	N
Showy Goldenrod	*Solidago speciosa var. speciosa*	N
Showy Lady's-slipper	*Cypripedium reginae*	PT
Showy Skullcap	*Scutellaria serrata*	PX
Shumard's Oak	*Quercus shumardii*	PE
Sida	*Sida hermaphrodita*	PE
Slender Day-flower	*Commelina erecta*	PX
Slender Golden-rod	*Solidago speciosa var. erecta*	PE
Small Beggar-ticks	*Bidens discoidea*	N
Smartweed Dodder	*Cuscuta polygornorum*	TU
Smooth Swallow-wort	*Cynanchum laeve*	PE
Southern Bog Clubmoss	*Lycopodiella appressa*	PT
Spearwort	*Ranunculus pusillus*	N
Spike Sedge	*Carex ormostachya*	N
Spreading Rockcress	*Arabis patens*	N
Spring Coral-root	*Corallorhiza wisteriana*	TU
St Andrew's-cross	*Hypericum stragulum*	N
Stalked Wild-petunia	*Ruellia pedunculata*	N
Sticky Golden-rod	*Solidago simplex ssp. randii var. racemosa*	PE
Stiff Cowbane	*Oxypolis rigidior*	TU
Striped Gentian	*Gentiana villosa*	TU
Swamp Dog-hobble	*Leucothoe racemosa*	TU
Swamp Lousewort	*Pedicularis lanceolata*	N
Swamp Pink	*Arethusa bulbosa*	PE
Sweet Bay Magnolia	*Magnolia virginiana*	PT
Sweet-shrub	*Calycanthus floridus var. laevigatus*	N
Tall Gramma	*Bouteloua curtipendula*	PT
Tawny Ironweed	*Vernonia glauca*	PE
Three-awned Grass	*Aristida dichotoma var. curtissii*	TU
Three-flowered Melic-grass	*Melica nitens*	PT
Thyme-leaved Pinweed	*Lechea minor*	N
Tooth-cup	*Rotala ramosior*	PR
Tufted Buttercup	*Ranunculus fascicularis*	PE
Twisted Yellow-eyed Grass	*Xyris torta*	N
Umbrella Magnolia	*Magnolia tripetala*	PT
Variable Sedge	*Carex polymorpha*	PE
Vasey's Eupatorium	*Eupatorium godfreyanum*	N

Virginia Bunchflower	*Melanthium virginicum*	N
Virginia Ground-cherry	*Physalis virginiana*	TU
Virginia Willow	*Itea virginiana*	TU
White Heath Aster	*Symphyotrichum ericoides*	TU
White Milkweed	*Asclepias variegata*	TU
White Trout-lily	*Erythronium albidum*	N
White Water-crowfoot	*Ranunculs aquatilis var. diffusus*	
Wild Bleeding-hearts	*Dicentra eximia*	PE
Wild Kidney Bean	*Phaseolus polystachios*	N
Wild Oat	*Chasmanthium latifolium*	TU
Wild Senna	*Senna marilandica*	TU
Winged-loosestife	*Lythrum alatum*	TU
Yellow-fringed Orchid	*Platanthera ciliaris*	TU
	Pyrola choranta	N
	Trillium cernuum	N

PE - PA Endangered
PT - PA Threatened
PR - PA Rare
PX - PA Extirpated
TU - Tentatively Undetermined
N - No Current Legal Status, but is under review
LE - US Endangered
** PNDI species within York, Adams & Cumberland Counties

Fauna

The animal species within the watershed are diverse and include both common species that are also generally found throughout south-central Pennsylvania as well as more unique species. Few if any bear are known to be within the watershed, but deer are abundant. Deer-related traffic accidents are common within this area. Other common game species include rabbits, squirrels, wild turkey, ruffed grouse, woodcock, and ring-necked pheasant (introduced by the Game Commission).

Native fish within the watershed include bass, brook trout, catfish, sunfish, suckers, shiners, pike, perch, and eels.

Threatened and Endangered Species, and Species of Concern

Numerous fauna species located within the watershed have either been listed as Threatened or Endangered or are considered a species of concern. There are 7 vertebrate species listed as Threatened or Endangered species located within the Conewago Creek Watershed. Table 3.3-3 lists these species. The habitats of Threatened and Endangered vertebrate species within the watershed are shown on Figure 3.3-1.

Table 3.3-3: Summary of Threatened and Endangered Vertebrate Species within Conewago Creek Watershed*

Common Name	Scientific Name	Status
Mammals		
Least Shrew	*Cryptotis parva*	PE
Allegheny Woodrat	*Neotoma magister*	PT
Reptiles and Amphibians		
Bog Turtle	Clemmys muhlenbergii	LT, PE
Red-bellied Turtle	*Pseudemys rubriventris*	PT
Birds		
Osprey	*Pandion haliaetus*	PT
Yellow-crowned Night-heron	*Nycticorax violaceus*	PE
Upland Sandpiper	*Bartamia longicauda*	PT

PE - PA Endangered
PT - PA Threatened
LT - US Threatened
* PNDI species lists for Adams, York & Cumberland Counties with habitats within watershed determined by GAP Analysis

Table 3.3-4 lists vertebrate species of concern located within the watershed (this list does not include listed Threatened or Endangered Species). The habitats of vertebrate species of concern within the watershed are shown on Figure 3.3-2.

Table 3.3-4: Summary of Vertebrate Species of Concern within Conewago Creek Watershed*

Common Name	Scientific Name	Status
Mammals		
Appalacian Cottontail	*Neotoma magister*	
Evening Bat	*Nycticeius humeralis*	
Nothern Myotis	*Myotis septentrionalis*	
Reptiles & Amphibians		
Eastern Hognose Snake	*Heterodon platirhinos*	
Timber Rattlesnake	*Crotalus horridus*	PC
Birds		
Black-crowned Night-heron	*Nycticorax nycticorax*	
Great Blue Heron	*Ardea herodias*	
Long-eared Owl	*Asio otus*	
Virgina Rail	*Rallus limicola*	

PC - Animals that could become endangered or threatened in the future. All are uncommon, have restricted distribution or are at risk because of certain aspects of their biology.
* PNDI species lists for Adams, York & Cumberland Counties with habitats within watershed determined by GAP Analysis

The Department of Conservation and Natural Resources (DCNR) lists 1 invertebrate species as being Endangered in the Conewago Creek Watershed. This is the Regal Fritillary (*Speyeria idalia*).

The Pennsylvania Natural Diversity Inventory (PNDI) lists species of concern located in York, Adams and Cumberland Counties. These species may or may not be located within the watershed, however are located within the counties that encompass the watershed, thus have a high probability of being located within the watershed. Table 3.3-5 lists these species.

Table 3.3-5: Summary of Invertebrate Species of Concern Within Conewago Creek Watershed*

Common Name	Scientific Name	Status
A Burying Beetle	*Nicrophorus marginatus*	
A Noctuid Moth	*Apharetra purpurea*	
A Noctuid Moth	*Platyperigea meralis*	
A Zale Moth	*Zale submediana*	
Biggers' Cave Amphipod	*Stygobromus biggersi*	
Black Dash	*Euphyes conspicuus*	
Broad Sallow Moth	*Xylotype capax*	
Brook Floater	*Alasmidonta varicosa*	
Bronze Copper	*Lycaena hyllus*	
Comet Darner	*Anax longipes*	
Elktoe	*Alasmidonta marginata*	
Footpath Sallow Moth	*Metaxaglaea semitaria*	
Giant Swallowtail	*Papilio cresphontes*	
Gray Petaltail	*Tachopteryx thoreyi*	
Green Floater	*Lasmigona subviridis*	
Henry's Elfin	*Callophrys henrici*	
Hoary Elfin	*Callophrys polios*	
Juniper Hairstreak	*Callophrys gryneus*	
Leonard's Skipper	*Hesperia leonardus*	
Mocha Emerald	*Somatochlora linearis*	
Pennsylvania Cave Amphipod	*Crangonyx dearolfi*	
Pine Woods Underwing	*Catocala sp. 1 nr. jair*	
Potomac Groundwater Amphipod	*Stygobromus tenuis potomacus*	
Price's Cave Isopod	*Caecidotea pricei*	
Pygmy Dragonfly	*Ophiogomphus howei*	
Rainbow Mussel	*Villosa iris*	
Regal Fritillary	*Speyeria idalia*	
Skillet Clubtail	*Gomphus ventricosus*	
Ski-tailed Emerald	*Somatochlora elongata*	
Smoky Rubyspot	*Hetaerina titia*	
Southern Pine Looper Moth	*Caripeta aretaria*	
Southern Variable Dart Moth	*Xestia elimata*	
Spatterdock Darner	*Rhionaeschna mutata*	
Triangle Floater	*Alasmidonta undulata*	
Yellow Lampmussel	*Lampsilis cariosa*	

Status – According to PNDI no state agency has been assigned to protect terrestrial invertebrates although federal status may exist for some species. Aquatic invertebrates are regulated by the Pennsylvania Fish and Boat Commission but have not been listed to date.

* PNDI Species within York, Adam & Cumberland Counties

See Figure 3.3-1 Threatened and Endangered Species Prime Habitat Map

Figure 3.3-2 Species of Concern Prime Habitat Map

3.4 Cultural Resources

A. Recreational

The State of Pennsylvania owns and operates (Figure 3.4-1) one park entirely within the watershed and one state forest that is partially located within the Conewago drainage area. Comprising of approximately 2,338 acres of park land and water open to the public and offer a wide variety of recreational opportunities for residents of the watershed and visitors. In addition to the state park, there are more local municipal parks located throughout the watershed, however there are no parks within the watershed that are owned and operated by York County.

Gifford Pinchot State Park- Named after Gifford Pinchot, considered the father of US forestry, this 2338 acre park is located in northern York County along PA 177 between the towns of Rossville and Lewisberry. The 340 acre manmade Lake Pinchot located within the park is an impoundment of North Branch Beaver Creek. Visitors to the lake can find a variety of water opportunities such as boating and sailing, rentals and launches, beaches and swimming, fishing and ice fishing and ice skating. In addition to water recreation, the park offers hike and bike trails, disc golf, horseback riding, picnicking, cross-country skiing, camping and group, cabin, and yurt rentals. In 1961, Governor David L. Lawrence dedicated Gifford Pinchot State Park. The Park supports many diverse habitats, which makes for excellent bird and wildlife watching.

Michaux State Forest- This state forest is partially located in the northwest quadrant of the watershed and comprises of over 83,000 acres. According to DCNR, this land is named in honor of Andre Michaux, a French botanist, dispatched by the King and Queen of France in 1785 to gather plants for the Royal Gardens. Michaux offers numerous activities including Caledonia State Park, which is located outside the watershed. About 39 miles of the Appalachian Trail runs through the forest.

Public hunting is permitted on State Game Lands within the Conewago Watershed as can be seen in table 3.4-1. For more information on seasons and limits visit www.huntingpa.com.

Table 3.4-1: State Gameland within the Watershed

State Game Land SGL #	Location	Acres
242	Rossville, York	1516
243	Franklin Township, York	1059
249	Heidlersville, Adams	1942

The lack of parks within the Conewago Basin is problematic for the citizens that live there. Creating open spaces provides financial, environmental, and health related benefits. Creating public parks along waterways is one of the best ways to protect and preserve not only the unique natural and historical character of the land but also the water and water quality. During public comment period for this RCP, a common concern from citizens and municipalities was the lack of public access and public open space along the creeks.

The creeks and streams of the watershed provided they are large enough to have a substantial base flow, offer canoeing and kayaking opportunities. The Conewago is great for the beginer kayaker/canoer or for a leasurely stroll with 69 miles (111 km) of Class A to Class 1 whitewater located upstream of the mouth when the water is high enough. The biggest hurdle to paddling the Conewago is the lack of public access to the waterway.

Another limiting factor for paddlers is low head dams and weirs (Figure 3.4-1). There are approximately 9 low head dams/weirs within the entire watershed. Table 3.4-3 shows the current dams including Emigs Mill Dam (Detters Mill) removed in early 2004 and Sharrer Dam removed in early 2006. Besides creating a required portage around the dam, the dams are dangerous to swimmers whether they are accidentally or intentionally swimming in the vicinity. Low head dams and weirs create a recirculating hole at the bottom of the dam where water spills into a deep hydraulic pool. These recirculating pools can trap a swimmer or paddler even if the person is wearing a Personal Flotation Device (PFD).

According to the PA DEP, 13 dams have been removed from the Conewago Creek since 1913. Two dam removals mentioned earlier were the result of a collaboration between American Rivers, PA Fish & Boat Commission and the U.S. Fish & Wildlife Service. These organizations focus primarily on removing the impediments to fish migration created by these dams. American Rivers and NOAA offer grants for dam removal. Information on these grants can be found at www.amrivers.org/noaagrants.

Table 3.4-3: Low Head Dams and Weirs Within the Conewago Watershed

County	Dam Name	Municipality	Stream	Quad Map	Lat.	Long.	Height	Length	Surface Area
Adams	*Sharrer Dam	Tyrone Township	Conewago Creek	Hampton	395424	770600	8	220	5
Adams	Browns Dam	Reading Township	Conewago Creek	Hampton	395542	770200	9	200	4
Adams	East Berlin Dam	Reading Township	Conewago Creek	Abbottstown	395554	765818	7	200	4
Adams	Dick's Dam	Hamilton Township	Conewago Creek	Hampton	395430	770336	8	350	7
Adams	Kitzmiller Diversion Dam	Union Township	South Branch Conewago Creek	Mcsherrystown	394551	770117	5	41	1
York	Shady Nook Dam	Dover Township	Big Conewago Creek	Abbottstown	395924	765600	4	140	3
York	Hykes Dam	Conewago Township	Big Conewago Creek	Dover	400606	764600	4	470	
York	Eisenhart Mill Dam	Washington Township	Conewago Creek	Abbottstown	395642	765748	8	200	26
York	*Emigs Mill Dam (Detters Mill)	Dover Township	Conewago Creek	Wellsville	400048	765536	10	200	5
York	Ort Mill Dam	Dover Township	Conewago Creek	Abbottstown	395754	765718	6	125	3
York	Hoover Dam	Wellsville Borough	Doe Run	Wellsville	400306	765630	5	30	0.5

***Dam has been removed**

In addition to the parks, gameland and boating, golfing is a popular form of recreation within the watershed. There are 6 public golf courses and 2 private. Table 3.4-2 lists each golf course and the watershed within which it is located.

Table 3.4-2: Golf Courses within the Watershed

Golf Course	Municipality	County	Sub-Watershed
Piney Apple Golf Course	Menallen Township	Adams	Conewago Creek West/ Opossum Creek
Flatbush Golf Course	Union & Mount Pleasant Townships	Adams	South Branch Conewago
Bridges Golf Course	Berwick Township	Adams	Beaver Creek
Briar Golf Course	West Manchester Township	York	Honey Run
Hanover Country Club	Paradise Township	York	Beaver Creek
Honey Run Golf and Country Club	West Manchester, York	York	Honey Run
South Hills Golf Club	Penn Township	York	Indian Run
Outdoor Country Club	Manchester Township	York	Little Conewago Creek

Golf Courses can be a source of sediments and nutrients to streams and it is not uncommon to find severely impaired streams located within a golf course. This is often the result of poor management techniques and lack of a good riparian zone with dense vegetation. The Hanover Country Club is a good example of impaired streams and golf courses (See Photos for South Branch Beaver Creek Section 6 Photos 37-A through C). Currently the HCC is planning to improve the highly degraded section of Beaver Creek South Branch. Although trees are superior for buffers, not all riparian zones need to be wooded. It is possible to maintain a stable bank with low growing vegetation that would not impede normal play and would provide a good rooting depth and density far superior to typical varieties of golf course grass.

Figure 3.4-1-Resources Map

B. Historic

The Conewago Watershed has a distinctive history that has transformed multiple times over the course of its existence. The information in this section is presented in five distinct eras:

- Prehistory (<1600)
- Early Colonial Settlement (1600 - 1750)
- Community and Commercial Development (1750 – 1850)
- Industrial Development (1850 – 1950)
- Post Industrial Development (1950 – Present)

Prehistory

The Conewago Creek Watershed is part of the larger Lower Susquehanna Valley Region. Archaeological findings in the area have indicated that the Lower Susquehanna Valley Region has been inhabited for more than 11,000 years (Mackin, 2002). The earliest inhabitants of the area were native peoples and nomadic hunters that used stabbing spears. They traveled in small, family oriented bands tracking migrating herds of big game. However, as the climate gradually changed, so did the populations (Kent, 1984). Approximately 8,000 years ago the Indians of the area began hunting smaller game due to diminished large game populations. The Indians had established family territories with advances in fishing and the gathering of fruits, nuts and berries. Around 6,000 years ago the atlatl (jointed spearthrower) was added to the Indians hunting weaponry. The atlatl allowed more accurate hunting from greater distances, thus easing the difficulty of hunting. Shellfish was added to the Indians diet and canoes were beginning to be used for travel. More than 3,000 years ago the Indians began cultivating the land, growing maize and tobacco, allowing the development of larger and more permanent villages (Wallace, 1999). These larger villages eventually developed their own identities, which led to more frequent and aggressive conflicts between the tribes.

The dominant Indian tribe in the region, at the time when European settlers were first arriving, was the Susquehannock Indian Tribe. The Susquehannock Indians were most closely related to the larger Iroquois Tribe. The Susquehannocks split from the larger Iroquois Tribe around 1450 (Kent, 1984). Prior to the European settlers the Iroquoian speaking Susquehannocks resided in villages on the lands east and west of the Lower Susquehanna River. There they built longhouses and cultivated the land. Prolonged war with other tribes, especially the Iroquois, and widespread disease led the demise of the Susquehannock Tribe by 1675 (Wallace, 1999).

A major Indian trail from Wrightsville, PA to Frederick, MD, called the Monocacy Path, traverses the watershed. The trail generally parallels the Lincoln Highway within the watershed.

By the time the area was being settled by the European Settlers, there were no Indian villages in York or Adams County. The watershed was most likely hunting grounds for the Susquehannocks and possibly other Indian tribes (Buchart-Horn, 2005).

Early Colonial Settlement

The first colonists settled in Pennsylvania in approximately 1643 and from that point slowly progressed west across the state. The first settlers began arriving in the watershed in the 1710s to 1720s. These settlers were predominately Marylanders pushing into Pennsylvania. During this time one of the significant disputes in the watershed and the region was between Pennsylvania and Maryland. Both Maryland (Lord Baltimore) and Pennsylvania (William Penn) laid claim to lands in both present-day Pennsylvania and Maryland.

An Englishman, named John Digges, laid claim to a highly controversial tract of land partially located within the watershed. Digges received a grant from Lord Baltimore for any land of his choice within the claims of Lord Baltimore. Digges chose a tract of land that was described to be located on the Little Conewago Creek and in conflict with Penn's land claims. This land became known as Digges' Choice. Digges' Choice contained 6,822 acres of land that mainly laid in what is currently Adams County, but extended to York County. Settlers began to purchase land under Digges, which led to Digges' Choice being considered the first settlement in what is currently Adams County. Pennsylvanians soon began purchasing titles to land from William Penn that overlapped Digges' claims. Conflicts among the settlers arose and continued for years (Warner, Beers, & Co., 1886).

Other instances of conflicts between Marylanders and Pennsylvanians were numerous. Several temporary boundaries and surveys were conducted to ease relations between the sides, however disputes still occurred with some leading to violence. Ultimately the Mason-Dixon survey in 1768 ended the disputes between Pennsylvania and Maryland permanently.

The 1720s-1730s led to two major cultural hearths (growth areas) in the watershed; Newberry (presently Newberry and Warrington Townships) and Hanover. A petition to the provincial council led to the formation of York County in 1749. Adams County divided from York County in 1800 (Schaefer, 1999).

The early settlers of the Newberry cultural hearth were mainly composed of English Quakers and Germans. The Hanover cultural hearth was composed of settlers of three major origins: the Germans, Scotch-Irish and English. The English were the first immigrants in these cultural hearths; however the Germans shortly took over as the major nationality throughout the entire watershed (Schaefer, 1999). These early settlers were given land for free or were sold for very little amounts. Large tracts of forests covered the majority of the watershed when these settlers arrived. These forests consisted of stands of Oak, Chestnut, Hickory, Poplar and Ash. Once the settlers had their track of land their first task was clearing land for their log cabin (in a few cases stone houses) and a small garden (Sheets, 1991).

As large tracts of land were cleared, the soils were found to be very productive for grains. However, the first farmers, English Quakers, found the soil to lose productivity quickly and turned to wasteful methods of farming. The Quakers would clear new land to farm as soon as the soils turned unproductive. As more and more Germans moved

into the watershed more conservative farming methods, such as crop rotation, for farming began being used. Grain became the most productive crops grown in the watershed. This led to mills being built along streams to grind the grain into flour, which eased transport to Philadelphia and Baltimore. The first mills in the watershed were the Martin Weigle Mill, located along the Little Conewago Creek and a mill in Paradise Township owned by George Jacobs (Sheets, 1991).

The French and Indian war is considered a major part of Pennsylvania history and a significant event during this time period; however due to the lack of Indian settlements areas throughout the watershed played relatively insignificant roles in the war. The majority of conflicts in the war were located north and west of the watershed.

Community and Commercial Development

The most significant event during this time period was the Revolutionary War; however no significant battles were fought within the watershed. The watershed mainly supported the war efforts by providing men and supplies for the American Army (Warner, Beers, & Co., 1886).

During this time period communities began to grow as more immigrants settled within the watershed and existing families grew. At the beginning of the time period most settlers and their families were farmers. Within a relatively short period of time all of the good land for farming was taken. Since farming was becoming less of an option, new settlers and family members created new industries beginning with agricultural related industries. The discovery of significant iron ore deposits led to new industries and trades such as specialized iron workers (Schaefer, 1999).

As the communities grew more specialized industries and trades were being started. Some of these early specialized trades include tailors, shoemakers, clockmakers, candlemakers and weavers. The general store was created to sell the goods of these specialized trades. As time went on additional industries began to develop. These include slaughterhouses, canning operations, breweries and distilleries. Growing fruit became popular in the watershed during this time period (Sheets, 1991). Currently, the majority of the “Fruit Belt” is located within the watershed.

The watershed’s agricultural products and other goods were being distributed to larger cultural areas during this time period. Roads were created to cities such as York, Lancaster, Philadelphia and Baltimore. The first road in the watershed followed the old Indian path called the Monocacy Path. This road was originally called Monocacy Road, although it is now called the Lincoln Highway.

The majority of the current municipalities were created during or before this time period. York County Townships and Boroughs located within the watershed are as follows with their approximate formation dates: Newberry Township (1736), Manchester Township (1740), Warrington Township (1743), Monaghan Township (1747), Dover Township (1749), Paradise Township (1749), Heidelberg Township (1750), West Manchester Township (1799), Washington Township (1802), Fairview Township (1803), Franklin Township (1811), Conewago Township (1818), Carroll Township (1831), Lewisberry Borough (1832), Hanover Borough (1856), Jackson

Township (1857), West Manheim Township (1858), Dover Borough (1864), Franklintown Borough (1869), Manchester Borough (1869), Penn Township (1880), East Manchester Township (1887), Wellsville Borough (1892) and York Haven Borough (1892). Adams County Townships and Boroughs located within the watershed are as follows with their approximate formation dates: Huntington Township (1745), Menallen Township (1745), Tyrone Township (1745), Straban Township (1746), Reading Township (1746), Berwick Township (1747), Mount Pleasant Township (1749), Cumberland Township (1749), Conewago Township (1801), Latimore Township (1807), Hamilton Township (1810), Abbottstown Borough (1835), Union Township (1841), Oxford Township (1847), Butler Township (1849), York Springs Borough (1868), East Berlin Borough (1870), New Oxford Borough (1874), McSherrystown Borough (1882) and Biglerville Borough (1903). Benderville and Ardentsville Borough were formed prior to 1900.

Industrial Development

The most significant events during this time period were the Civil War, Industrial Revolution, Great Depression and WWI and WWII; however only the Civil War and Industrial Revolution directly affected residents within the watershed.

The Battle of Gettysburg, largely considered the most famous and important battle of the Civil War, was located just south and west of the watershed. This battle was located within several miles of the watershed. The Battle of Hanover is a lesser known confrontation that occurred within the watershed. The Battle of Hanover may have had a significant impact on the Battle of Gettysburg.

The Battle of Hanover was between Union Calvary General H. Judson Kilpatrick and Confederate Calvary General Jeb Stuart. The Union soldiers delayed the Confederate calvary from joining General Lee's army in Gettysburg. General Lee heavily relied on his calvary to be his eyes and ears on and around the battlefield. Without his calvary present until late on the second day of the three day battle, General Lee was unable to dislodge Union troops. Arguably, this delay significantly affected the battle and resulted in the Confederate loss.

The Industrial Revolution brought about change in the watershed. Agriculture still remained the primary industry throughout the watershed, however industries including, iron works, cigar manufacturers, canneries and wagon manufacturers began growing.

Several developments occurred during this time period to increase the efficiency of farming. These developments included the development of mechanical equipment, such as tractors, and the creation and use of commercial fertilizers and soil conditioners. The usage of these developments allowed farmers to cultivate more crops with less manpower. In the watershed, agriculture and industry went hand in hand during this period. Crops such as fruits and tobacco led to prosperity of canneries and cigar manufacturers which spurred other industries such as cigar box manufacturers. Several other food processors were established due to the local agricultural products. These businesses include Hanover Foods, Knouse Foods, and UTZ's potato chips, all of which are still prospering today.

As goods began being produced in larger quantities and demand in other areas increased, railways were created. Railways dominated the transportation industry within the watershed until the early 1900s. With the production and increase usage of automobiles roads began to be created in larger quantities and enhanced. The highly used traditional dirt roads were being replaced with asphalt highways.

The end of this time period saw the demise of several prominent industries throughout the watershed. Mills, iron works, cigar manufacturers, wagon manufacturers and brick makers did not last throughout the entire time period.

Post Industrial

This time period led to many significant changes. Transportation changed almost completely from railways and trolleys to automobiles and buses. According to the US Census Bureau the two major counties in which the watershed is located are in the top 10 of the fastest growing counties in Pennsylvania. Due to the fast growth rate, farmland throughout the watershed is being converted to subdivisions. The York County Transportation Authority and the Adams County Transit Authority are the only 2 forms of public transportation within the watershed. Four smaller sized airports, Bermudian Valley Airpark, Kampel Airport, Hanover Airport and York Airport, are located within the watershed. The locations of these airports is as follows: Bermudian Valley Airpark is near East Berlin, Kampel Airport is near Wellsville, Hanover Airport is near Hanover and York Airport is near York. Three of the four airports are grass-surfaced airports with York Airport being surfaced with asphalt. These airports can be utilized to move goods throughout and out of the watershed.

Agriculture is still the primary industry within the watershed; however other industries provide substantial employment within the watershed. These include Hanover Foods, UTZ's potato chips, Mott's Inc., and Knouse Foods. Numerous other industries exist in and around the watershed.

Population growth is projected to continue throughout the watershed. This growth will have a profound effect on the development patterns and changes in labor force in the watershed. Farmland is projected to continue to diminish due to development changing the landscape and major industry in the watershed.

Through coordination with the Pennsylvania Historic and Museum Commission (PHMC) and review of their files, it has been determined that there are numerous sites throughout the watershed which are historic, cultural resources for watershed residents. There are approximately 41 archaeological sites and numerous historic sites within the watershed. Among these historic sites, 12 historic structures and 3 historic districts are listed on the National Register of Historic Places (Figure 3.4-2). For a detailed description or review of the historic resources within the watershed, please contact the Pennsylvania Historic and Museum Commission.

See Figure 3.4-2 Historic Resources Map

SECTION 4.0 – General Watershed Issues, Concerns, Constraints and Opportunities

Data collection and analysis in sections 1-3 have provided a broad picture of the existing conditions of the Conewago Creek Watershed and potential influences or impacts. As we've discovered, the Conewago Creek Watershed is a very unique geographic region. While the area does have it's problems, not unlike other watersheds in the Lower Susquehanna River drainage basin, it also has some very unique features. In this section, we'll discuss in some detail, the issues and concerns facing the watershed and some of the opportunities that exist.

To prepare a comprehensive list of issues, concerns, threats, and opportunities within the watershed, the project included an extensive public outreach campaign. The public outreach campaign consisted of holding a series of public meetings throughout the watershed to inform the public of the project, the goals of the project, and the need for public input. Surveys were used to garner additional information about the watershed from the public perspective. In addition to the public meetings, a key interview process was conducted. The key interview process consisted of the steering committee identifying individuals that have a unique and valuable understanding of the watershed, or watershed issues in the Lower Susquehanna River drainage, and representatives of local municipalities throughout the watershed. Each individual or group was contacted either in person, or through telephone interviews.

Obtaining input from the public and key individuals is not easy, and getting people to respond is difficult. Many individuals feel they have little to offer. It then becomes the job of the interviewer to educate the interviewee on the purpose of the project and how they may contribute. As a result, response to the public meetings and key interview process is inconsistent. While every attempt is made to obtain information from every municipality and key individual, it is nearly impossible to do so. As a result, some individuals respond well, sharing their concerns and providing valuable information about the watershed. Other individuals simply don't respond at all. This results in having more information for one area than another.

Once responses to surveys were collected and the results of the key interview process were tabulated, the steering committee reviewed the comments and concerns. It was then the task of the steering committee to determine which comments and concerns were appropriate for inclusion in the WCP. Not every comment, or related topic, can be discussed in the WCP. In some cases, it's not within the scope of a WCP, and in some cases, due to content, time constraints, other regulations, etc., the topic is more appropriate for another forum.

Included below is a list of general concerns and comments, divided by subject, received from the key interview and public involvement process. List A includes comments received through the key interview process which primarily came from municipalities. List B contains comments from the public meetings. These lists are not exhaustive.

List A: Key Interview

Unique natural or manmade features of the watershed.

- Conewago Narrows above Arendtsville
- Adams County Fruitbelt
- Fly Fishing Area East of Arendtsville
- Horse Farms around Hanover
- Opossum Creek
- High Quality Trout Fishing
- Hanover Shoe Farms
- New Chester Area
- Hanover Country Club
- Beecherstown Area
- East Berlin Dam
- Lake Meade
- Pinchot State Park
- Old Red-Sandstone Bridge Pier – Dover Borough
- Plum Run Creek

Issues and Concerns

- Loss and/or Protection of Threatened and Endangered Species Habitat
- Loss and/or Protection of Fruitbelt Orchards
- Nutrient Management from Agricultural Resources (CAFOs)
- Stormwater Runoff from Residential Development
- Lack of Recreational Areas Along Creek(s)
- Protection of Headwater Areas for Supply
- Ensure DEP/EPA/F&WLS Regulation Compliance
- Water Supply and Over-drilling
- Loss of Critical Wetland Resources
- Unmanaged Growth
- Increase in Impervious Cover
- Unregulated Stormwater Runoff from Residential Homes
- Floodplain Encroachments – Flooding
- Removal of Dam Upstream of Rte 234 in East Berlin
- Nutrient Load/Water Quality Issues with Lake Meade
- Pollution from Agricultural Land
- Loss of Vegetated Buffers (Land Owner Clearing)
- Maintaining Trout Fishery
- Water Quality and Quantity
- Residential Development
- Significant Lack of Stream Access Points
- Lack of Stream Corridor Hike/Bike Trails

- Golf Course Runoff
- Commercial Water Use
- Illegal Dumping Near Streams

Opportunities

- Establishing a Forest Legacy Program
- PA Highlands and Natural Conservancy Interest
- Coordination of Organizations and Agency's for a Common Goal
- DCNR Grants
- Stream Erosion and Need to Protect Banks
- Working With EASI Volunteer Monitors
- Interest of Landowners Along Creek
- Mandatory Conservation Efforts – Low Flow Toilets
- Land Preservation Efforts
- Water Re-use
- Improving Water Quality of Lake Meade for Downstream Neighbors
- More Uniform Zoning
- Stream Restoration
- Additional Fishing Opportunities
- More Public Access
- Protection/Restoration of Historic Sites
- East Berlin Community Park
- Water Quality Monitoring
- Increase Vegetative Buffers (Write Into Local Ordinances)
- Protection of Forests and Forest Resources
- Joint Comprehensive Planning
- Repair of On-lot Septic Systems

Threats

- Rapid Residential Development
- Loss of Farmland
- Lack of Zoning and Enforcement
- Lack of Cooperation Between Municipalities
- Lack of "Next Generation" Farmers
- Over-Drilling (Water Wells)
- Lack of On-lot Septic System Management
- Lack of Watershed Education
- Removal of Dam in East Berlin Would Cause Harm
- Loss of Open Space
- Agricultural Runoff
- Invasive Species
- Irresponsible Landuse

- Landowner Resistance
- Trash in Waterways
- Landowner On-lot Disposal of Trash (Burning/Burying)
- Logging
- Degradation of Natural Resources
- Quarrying and Industrial Development in Headwater Areas of Little Conewago Creek

Vision

- Protection of Headwaters, Historic and Natural Resources
- Protection of Greenways Along Streams
- Public Access for Fishing and Hiking
- Reduction in Nutrient Pollution
- Better Stormwater Management
- Wildlife Access to Riparian Buffers Throughout Watershed
- Stream Bank Stabilization and Stream Stability
- Managed Growth to Sustain Creek Resources
- 50' Riparian Buffer Around All Streams In Entire Watershed
- Protection of Forested Headwaters
- Financial Benefits Offered for Preservation
- Maintaining Dam in East Berlin for Water Supply
- Conewago Restored to Contribute High Quality Water to Chesapeake Bay
- Additional Watershed Organizations Keeping Watch Over Conewago
- Adopt-A-Stream Program
- Reduction in Sediment Entering Creek and Bay
- Buffer Preservation
- Include Preservation/Conservation Measures in Municipal Comprehensive Plans

Projects

- PA Highland Coalition Regional Greenway Plan
- York County Designation as Forest Legacy Area and Adams County's Potential
- Natural Area Inventories
- Adams County Fruitbelt Historic District Eligibility/Application
- Hanover Country Club Stream Restoration (Abottstown)
- Developments Along Rte. 234 Adjacent to Creek
- Planned Park in East Berlin
- Planned Park/Park Improvements in Arendtsville
- Adams County Water Budget
- Adams County Hazard Mitigation Plan
- New Sewage Treatment Plant for Lake Meade
- New Sewage Conveyance Lines for Conewago Park Drive and Laughman's Bottom Area along Conewago Creek.

- Numerous Developments in Straban Township
- Several Dam Removal Projects
- Hanover Water Resources Plan
- West Manheim Township Planned Park Adjacent to Hanover Reservoir

Comments

- "Water is key to life, it sustains all habitats. Both human and non-human species rely on the Conewago Creek and it's watershed area. The reason we live where we do is a result of having a sufficient water supply – if it isn't there in the future, we won't be there either."
- More Public Access for Fishing and Boating

Responses listed above are, for the most part, exactly as received from the interview. Some slight corrections and/or abbreviations have been made to save space and consolidate similar thoughts.

List B: Public Meeting/Surveys

Protecting Water Quality and Quantity

- Irrigation During Drought Conditions and Act 220
- Waste Water Treatment and Malfunctioning Septic Systems
- Sediment Load in Creeks from Agriculture and Development
- Sediment Problem in Bermudian Creek
- Farming Close to Streams – Lack of Buffers
- Stormwater Runoff
- Maintaining Chapter 93 Designated Use Standards
- Mining Runoff

Involving Municipalities

- Need to Integrate Planning Efforts
- Increase in Development in Headwater Areas
- Preserving Cultural and Heritage Values – Fruit Belt
- Varied Geology and Effects (Development Pressure)

Parks and Recreation

- Need More Access to Streams
- Green Ribbon Commission/Parks
- Recreational Opportunities Lacking

Protecting Wildlife and Sensitive Ecosystems

- Fragmented Wildlife Habitat
- Need for Municipal Protection of Floodplains
- Riparian Vegetation Lacking – Stream Instability
- Protection of Holly Bog – Special Wildlife Area
- Limited Wetlands Protection
- Wise Water Resource Management to Protect Aquatic Species

Nutrient Management – Regulatory

- Agricultural Nutrient Management – Pollution from Poor Manure Management

Nutrient Management – Non-Regulatory

- Increase in Number of Small "Hobby Horse" Farms on Small Lots

Infrastructural Changes

- Bridges Acting as Dams – Debris Jams
- Old Dams – Remove Low Head Dams
- Old Dams – Save/Maintain Historic Dams in Good Condition
- Emergency Service Water Supply – Hydrants Running Dry

Comments from the public outreach campaign were received and similar thoughts were grouped. Titles were given to each group based on the apparent theme of the combined comments. The results of this process are the groupings provided above.

An attempt was made to contact the individual or interviewee as a follow-up to the original comment where needed. Not every follow-up resulted in additional clarification or comment.

The comments received above are combined with research and data obtained throughout the project. Based on this combined approach, major issues and concerns facing the watershed were identified as a priority.

4.1 Water Quantity

One of the most significant issues facing the Conewago Creek Watershed is availability of water resources particularly for consumptive use. The Susquehanna River Basin Commission evaluated groundwater resources within the Susquehanna drainage basin in New York, Pennsylvania, and Maryland. Their evaluation and results, *Groundwater Management Plan for the Susquehanna River Basin*, published in June 2005, identified 8 Potentially Stressed Areas (PSAs) and 2 Water Challenged Areas (WCAs) within the entire basin (See Figure 4.1-1). A PSA is characterized as an area where existing or projected water withdrawals and uses are expected to exceed long-term

sustainability of the resource or cause conflicts among the many users. A WCA is characterized as an area where the natural conditions (soil types, topography,

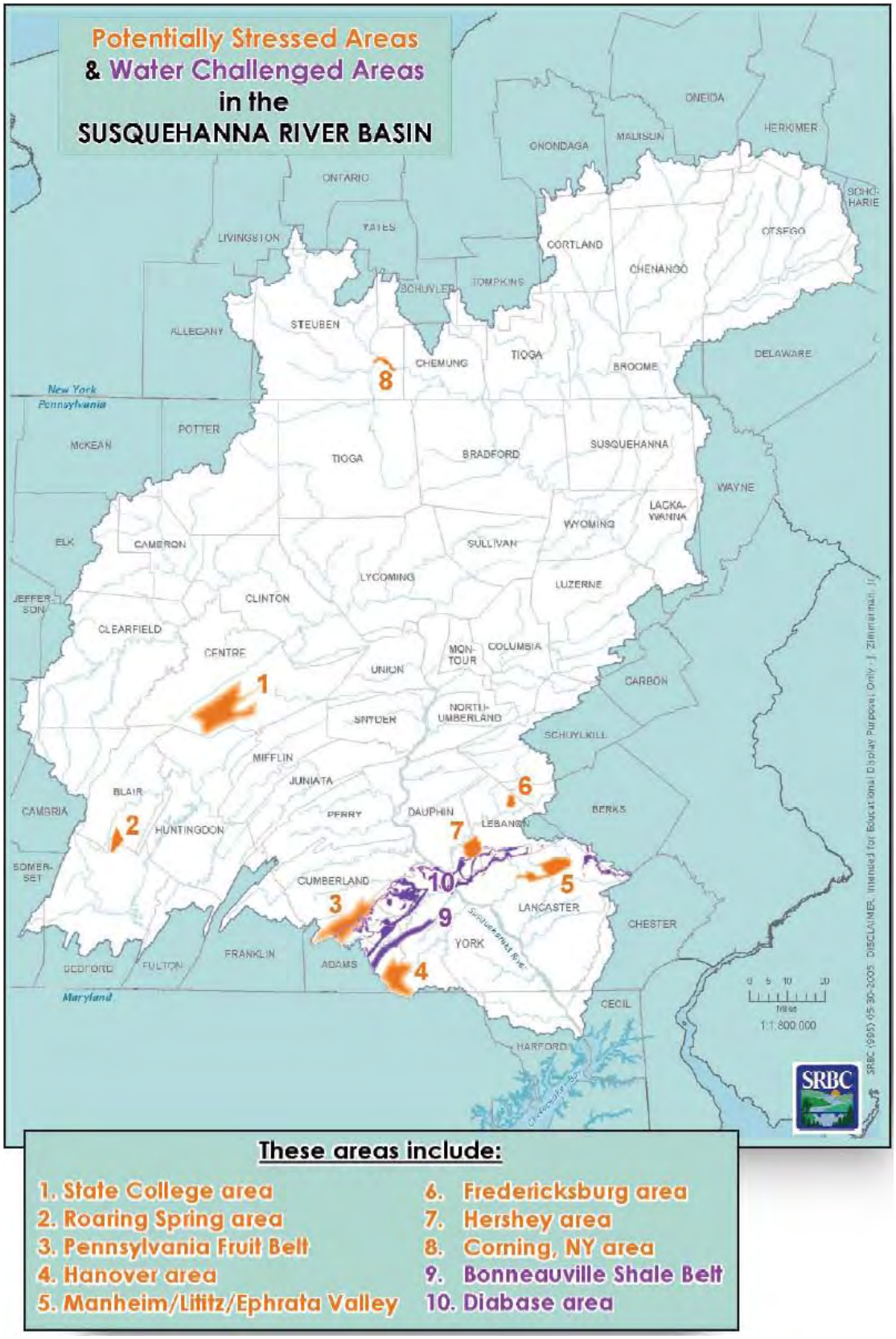


Figure 4.1-1: Potentially Stressed and Water Challenged Areas

underlying geology, etc.) severely limit the ability of groundwater resources to support growth, development, and exploration of those resources. Approximately 75% of the land area covering the PSAs is located in the Lower Susquehanna River basin. Of that 75%, approximately 55-60% of the PSA areas reside in the Conewago Creek Watershed. The Pennsylvania Fruit Belt PSA is located at the western portion of the watershed in the Adams County Fruit Belt area along the eastern flanks of the South Mountain Ridge. The Hanover Area PSA is located in the southern portion of the watershed around Hanover, PA, which is also the headwaters for the South Branch Conewago Creek (Figure 4.1-2).

Approximately 70% of the WCAs are located in the Conewago Creek Watershed. The Bonneauville Shale Belt is located in the central portion of the watershed generally oriented in a southwest to northeast direction. The Diabase Area WCA is located toward the northern portion of the watershed and runs from Straban Township in the west to Lewisberry in the northeast.

The single biggest factor affecting PSAs and WCAs is impervious area, which limits the ability of rainwater to infiltrate the ground and recharge underlying aquifers. Not only is the amount of impervious surface important, but the rate at which impervious surface is increasing is also important. Figure 4.1-3 shows the rate of impervious surface change throughout the watershed. Figure 4.1-4 shows the PSAs and WCAs over Figure 4.1-3 to show where the highest increase in impervious area is relative to the location of the PSAs and WCAs.

In addition, the growth and development within Adams and York Counties, as can be seen on the Impervious Surface Change Map, Figure 4.1-3, is occurring in headwater areas in the South Branch Conewago Creek, Little Conewago Creek, and West Branch/Main Stem Conewago Creek. Headwaters are those areas where streams begin. They are the furthest point upstream and drain to larger streams and rivers. Of all streams and rivers within a watershed, they are the most important.

Headwater streams perform many valuable functions, which maintain the health and sustainability of larger river networks, provided they themselves are healthy. Healthy headwater areas, those that are forested and protected, reduce the amount of sediment entering a river system, reduce the amount of nutrients entering the watershed, control the flow of water to larger streams, provide beneficial wildlife habitat corridors, and are an important area for groundwater recharge. Headwater streams are often located far up in the landscape, regardless of overall watershed slope, at the groundwater/surface interface. As a result, these areas tend to control the flow of water to and from a given system. This feature of headwater areas maintains flow in downstream rivers even during drought conditions.

Within the Conewago Watershed, the greatest increase in impervious surface is occurring in these headwater areas (Figure 4.1-3). As a result, this valuable

Figure 4.1-2 Water Stressed and Water Challenged Areas Map

Figure 4.1-3 Impervious Surface Change Map

See Figure 4.1-4 Impervious Surface Change from 1985-2000 and with Water Stressed Areas Map

groundwater/surface interface is being converted to impervious surfaces thereby eliminating the effectiveness of headwater streams.

The headwater areas are underlain with the Crystalline Bedrock and Carbonate Bedrock Aquifers. From Section 3.2 and Figure 3.2-2 we know that the Crystalline Bedrock Aquifer has the poorest recharge potential of any aquifer within the Conewago Watershed. The Crystalline Bedrock Aquifer is primarily located in the South Branch Conewago Creek Sub-watershed and along the western flanks of South Mountain Ridge in the Latimore Creek, Opossum Creek, Spring Creek, and Conewago Creek "West" sub-watersheds.

Adjacent to the Crystalline Bedrock Aquifer to the north is the Carbonate Rock Aquifer, which has the distinction of being one of the highest yielding aquifers in the entire state. The aquifer is known for having a fast recharge time due to primary and secondary porosity and excellent permeability. However, the same qualities that make the aquifer one of the best yielding also create an aquifer that has a high potential for contamination. Water entering the aquifer through surface soils permeates the geology at relatively high rates. This affords little time for filtration and creates a high potential for contamination. Minor spills of toxic substances could enter the groundwater relatively rapidly.

The remainder of the watershed is located within the Siliciclastic Bedrock Aquifer which affords moderate groundwater recharge. This area comprises the majority of the watershed.

4.2 Water Quality Concerns

As we have seen in Section 3.2, much of the watershed contains streams and waterways that are impaired by one or more variables. There are approximately 61 sites within the watershed, which are classified as either marginal or poor. These impairments are mostly related to stream bank erosion and fluvial geomorphological impairments such as abandoned floodplains, and loss of channel stability. In many cases these areas are adjacent to agricultural areas.

In addition to the sites identified above, there are 48 stream segments within 6 sub-watersheds, as listed in Table 3.2-3, that are on the Pennsylvania Department of Environmental Protection Section 303(d) list of impaired waters. These streams must maintain a Total Maximum Daily Load (TMDL) established for the source/cause of impairment, if, or when, one has been established.

As discussed in Section 3.2-II, historical and current data on macro-invertebrate and fish communities indicate poor to good water quality throughout the watershed. According to the assessments, abundance of sensitive macro-invertebrate species could increase provided in stream habitat and general water quality (pollution) were improved.

These impairments to water quality can be attributed to a variety of causes. The increasing population in our suburban and rural areas, particularly in the south, has substantial impacts to water quality and quantity. Development of traditional rural/agricultural areas to accommodate the emigration from the urban areas threatens the aesthetics, quality of life, and quality of the environment, which made these areas so appealing in the first place. Poor land use planning and dysfunctional zoning in and around the watershed and particularly the drainage corridor will destroy the values of the watershed.

Not only is the growth and development of the rural areas an issue, but traditional farming practices are also a major source of declining water quality. Too often livestock are allowed free access to streams, which greatly deteriorates the stream banks and water quality. In addition poor farming techniques, such as non-contour farming, and farming directly adjacent to streams and waterways, causes massive erosion problems and results in the loss of the watershed's valuable soils that are either prime farmland soils or soils suitable for infiltration. As mentioned earlier, the Conewago Watershed is supported economically by a large agricultural community. While agricultural land is becoming more valuable and there is a concerted effort to preserve these lands, without proper conservation measures, our natural resources will experience degradation.

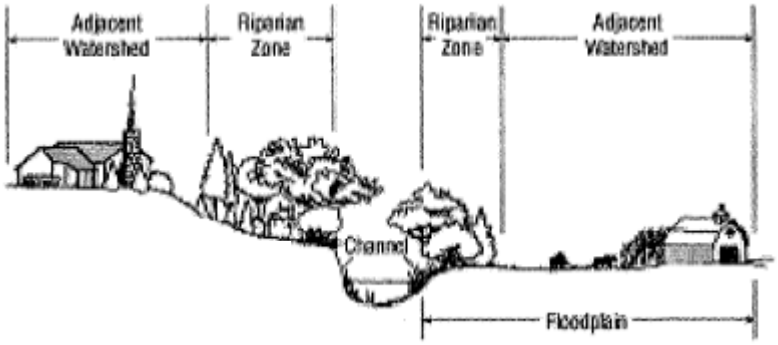
Photo 4.2-1: Facing northwest toward farm with unrestricted livestock access.

Other factors also affect, or have the potential to affect, water quality such as hazardous and toxic waste. Usually these materials are the result of industrial operations or the treatment of sewage. As we have stated, areas of the watershed are underlain with porous, or permeable, soils and geology. These areas are more susceptible to contamination of groundwater and hence base flow in the corresponding streams and water bodies.

Figure 4.2-1 shows the locations of optimal through poor assessment sites in relation to the locations of known superfund sites, toxic release sites and others. Figure 4.2-2 shows the locations of assessment sites in relation to land use and Figure 4.2-3 shows the location of assessment sites in relation to zoning.

4.3 Riparian Buffers

Riparian zones, or buffers, are transitional areas between land and water environments. Riparian areas have unique plant and soil characteristics often much different than the land and water environments they connect.



Undisturbed riparian zones teem with wildlife and dense vegetation such as grasses, shrubs, and larger tree species such as willows, oaks, maples, hemlocks, and sycamores. Riparian areas protect and stabilize the adjacent waterbody and perform many vital functions including, but not limited to: stream bank/shoreline stabilization, moderation of temperature, attenuation of floodwaters, improvement of water quality, and enhancement of wildlife habitat.

According to the watershed assessments, the Conewago Creek lacks riparian buffers and what riparian areas are in tact, are not in good condition. Many of the riparian zones are too narrow to offer any benefits and most are not forested and contain vegetation that cannot stabilize the bank nor offer temperature moderation. Too often the riparian area is degraded due to unrestricted livestock and human access.

Riparian areas, sometimes referred to as buffers, are one of the most important features of a landscape for the protection of water quality and quantity. Understanding the functions and benefits of riparian areas is critical to watershed planning. Many of the improvements to water quality and quantity needed in a watershed, can be achieved through the restoration of these areas.

Unfortunately, there are no efficient methods for analyzing the extent and quality of riparian buffers for an entire watershed. Tools are being developed utilizing specialized aerial photography that will enable watershed planners to evaluate the

extent and health of riparian buffers. There is no expected release date at this time for these new tools. It is possible to conduct cursory reviews of riparian areas based on current aerial photography, although this is time consuming, costly, and the accuracy is dependent on the quality of the photo and year it was taken.

Photo 4.3-1: Facing west toward severely eroded streambank within watershed. Stream has little functioning riparian area.

4.4 Soil Erosion/Loss

Due to poor land management and uses, the watershed is experiencing significant soil erosion and loss. This soil is washed downstream to receiving waters and ultimately the Chesapeake Bay. Sediment is the leading cause of impairment to the Chesapeake Bay. Sediment covers the floor of the bay, which severely affects the ability of valuable Bay organisms to grow and reproduce. In addition, suspended sediments can block much needed sunlight that no longer can penetrate to the Bay's floor. While it is tough to estimate the amount of soil lost each year, some estimates of soil loss through streambank erosion, and other sources, amount to more than 216,000 tons/year. These estimates account primarily for streambank erosion and do not consider soil loss through streambeds, agricultural lands, barren land, and construction sites with malfunctioning erosion control measures.

Photo 4.4-1: Facing south toward stream with high erosion rates within the watershed.

Soil and sediment deposition is one of, if not the most, significant causes of the decline in productivity of the Chesapeake Bay Estuary, of which the Conewago Creek is a major tributary through the Susquehanna River. Sedimentation of the bay causes complete communities of clams, oysters, kelp beds, and the famous Maryland Blue Crab to disappear. Suspended sediments in the bay block valuable light from reaching the organisms on the bay floor. These same sediments often have nutrients bonded to them from agricultural, commercial and recreational (golf courses) sources. Because of the increase in nutrient load, algal blooms form, which also block sunlight from reaching the bay floor. Some of these algal blooms can be toxic to fish and humans. This process is known as *eutrophication.*

Natural eutrophication is the process by which lakes gradually age and become more productive. It normally takes thousands of years to progress. However, humans, through their various cultural activities, have greatly accelerated this process in thousands of lakes around the globe. Cultural or anthropogenic "**eutrophication**" is water pollution caused by excessive plant nutrients.

Humans add excessive amounts of plant nutrients (primarily phosphorus, nitrogen, and carbon) to streams and lakes in various ways. Runoff from agricultural fields, field lots, urban lawns, and golf courses is one source of these nutrients. Untreated, or partially-treated, domestic sewage is another major source. Sewage was a particular source of phosphorus to lakes when detergents contained large amounts of phosphates. The phosphates acted as water softeners to improve the cleaning action, but they also proved to be powerful stimulants to algal growth when they were washed or flushed into lakes.

The excessive growth, or"blooms", of algae promoted by these phosphates changed water quality in Lake Erie and many other lakes. These algal blooms led to oxygen depletion and resultant fish kills. Many native fish species disappeared,

to be replaced by species more resistant to the new conditions. Beaches and shorelines were fouled by masses of rotting, stinking algae. A means to control this problem became a paramount need.

Using small, natural lakes as experimental systems, scientists at the Experimental Lakes Area (ELA) were able to add various combinations of nutrients and determine which of the major plant nutrients (carbon, nitrogen, phosphorus) was the key to controlling cultural eutrophication in lakes. Over a number of years, seven different ELA lakes were experimentally fertilized in various ways. Two of these lakes were particularly important in demonstrating that phosphorus was the key nutrient for the control of eutrophication.

Aqua Link, Inc completed a study of Lake Meade in 2006 for the Lake Meade Property Owners Association, Inc. The Report, entitled "Lake Meade Phase I Diagnostic-Feasibility Study", is a two-part study designed to determine the current conditions of Lake Meade and its surrounding watershed. Data was collected from numerous tests during the 2005 year. According to the data Lake Meade was highly eutrophic or slightly hypereutrophic in 2005. The largest pollutant impacting the lake and the surrounding watershed is nutrients such as nitrates and phosphates. High amounts of nutrients were found in the lake (the highest levels occurred during storm events) that resulted in blue-green algal blooms. These algal blooms greatly reduced the levels of dissolved oxygen and allowed for the buildup of potentially toxic ammonia nitrogen that exacerbated the internal release of nutrients from in-lake sediments. These blooms significantly reduced water clarity, impacting the overall aesthetics of the lake. Reduced dissolved oxygen levels also typically result in a lack of diversity within the fish communities.

Sources for the nutrient impacts were identified in the study. According to the report, the single largest problem affecting water quality was the well-maintained lawns in the direct drainage area and the lack of a good riparian buffer surrounding the lake. Plants have the ability to sequester the nutrient pollution before entering the lake during storm events. Agriculture is the largest land use identified within the watershed. Good riparian buffers were found maintained between major streams and active agriculture lands. Mud Run was identified as the largest contributor to the lake's water budget. This tributary is also the largest source of nutrients entering the lake. Other sources of pollution identified were atmospheric inputs, waterfowl, and internal release via in-lake sediment. Three point sources were identified releasing into Mud Run. These sources were two very small private home systems (400 gallons per day) and Bermudian Springs School District (permitted for 30,000 gallons per day).

Although eutrophication is not reported to be a significant problem within the watershed, sound watershed planning principles must take into account the effects to downstream receiving waters and communities. As discussed earlier, the Conewago Creek is a major tributary to the Susquehanna River, which is in turn a major tributary to the Chesapeake Bay estuary. As a result, understanding

eutrophication, including the causes of it, is important in a watershed management plan.

It is understood that within the Conewago Creek watershed there is excessive amounts of sediment being lost from riparian areas, agricultural fields, and the streams themselves. What is not known, is the amount of phosphorus that is being transported with this sediment. Some estimates in the York County Conewago Creek Watershed Assessment are as high as 66,000 lbs/year of total phosphorous. As a result, reducing soil loss and erosion should be a major priority of watershed stakeholders.

Legacy Sediments

Legacy Sediments are sediments that were once deposited and trapped behind mill dams of the 18th, 19th, and 20th centuries. In most cases these mill dams are no longer standing. Mill dams were built directly over streams creating small ponds as the water of the stream backed up. Water from a mill pond was then released into a mill race which flowed to a mill house. The water in the race was used to power a large water wheel where inside the mill house this wheel was used to power various types of equipment. It was this process that helped power a new generation of settlers in the United States and led to the industrial revolution.

As the water backed up behind the dams, fine sediments dropped out over time. Eventually the mill ponds would fill up and instead of removing the sediments, a new mill pond was constructed further upstream.

Today a majority of the mill dams are long gone. But the sediment that collected behind the dam is not. This sediment is often very fine sediment laden with nutrients from fertilizers of the period. The sediment deposition behind the dams in essence raised the height of the stream as much as 10’ depending on where the dam was constructed and on which stream. Today the stream has to find some way to change its elevation to reconnect to the original channel downstream. In most cases, the stream downcuts through this fine sediment. As it does it washes the sediment down stream and abandons it’s effective floodplain. Therefore most smaller storm events can leave the channel to utilize a floodplain to deposit sediments and reduce energy of the flood. As a result, the entire flood event is contained in the channel which cannot handle the volume and velocity of stormwater. As the stream continues to downcut, the stream banks become too high to maintain and the banks begin to slough off into the channel contributing more legacy sediments to the watershed.

York County has benefited from research done at Franklin and Marshall College by having a map of all the historic mill dams that once existed in York and Lancaster Counties. However, no such project has been started to map the historic locations of mill dams in Adams County. Knowing the historic locations of mill dams and possible legacy sediments is important to understanding the health of a watershed and the health of the Chesapeake Bay. It is of great concern that we don’t know the exact extent of mill dams in the Conewago Watershed.

There are ways of dealing with Legacy Sediments, but first we have to know where they are most likely to exist. Chances are high that were legacy sediments exist, there exist serious stream erosion problems.

4.5 Stormwater Management Concerns/Issues

Stormwater is directly tied to water quantity and quality. Stormwater management is the detention, retention, control, and release of stormwater runoff often associated with impervious surfaces. Stormwater management is a relatively new (past 40 years) technique that is part of almost every sub-division/land development ordinance.

Often, developers and land owners are required to match the post-development runoff to that of the pre-development conditions. On a small scale, and on a project-by-project basis, this works. However, stormwater from impervious surfaces is a major cause of stream degradation, soil loss, and streambank instability.

Every stream has a natural sediment load balance for a given watershed. If there is too much sediment in the water, such as from agricultural runoff, that sediment can settle out onto the bed of the stream and cause islands and significant point bars. If there is not enough sediment in the water, the stream will pull sediment from it's banks and bed, cause down cutting of the stream channel, which then causes bank instability and collapse. This sediment is then transported downstream.

Some stormwater management ordinances require, or are going to require, infiltration of stormwater for portions of smaller storm events. As we have discussed, the Conewago Creek Watershed is starved for water. Current technologies in stormwater management release water to downstream rivers and streams as opposed to infiltration of that water back into the aquifers. This is of great concern in the Conewago Creek Watershed.

4.6 Hazardous Waste/NPDES

Review of existing files and coordination with local and state agencies revealed 1 superfund site located within the watershed (Figure 3.1-3). In addition to superfund sites, there are numerous discharges into the streams in the watershed.

Table 4.6-1 lists the permitted National Pollution Discharge Elimination System (NPDES) outfalls and which streams they are discharging into.

Table 4.6-1: NPDES-Permitted Discharges in Codorus Creek Watershed (7-H)					
Name	**Municipality**	**Permit No.**	**Receiving Stream**	**Stream Code**	**Discharge Type[1]**
Aumillers West	Newberry Twp	PAR603516			ISW
Brunner Island Stream Electric Station					
Conewago Twp Sewer Authority WWTP	Conewago Twp	PA0084425	Little Conewago Creek		POTW
Conewago Valley MHP	Newberry Twp	PA0080080	Conewago Creek		PSTP
Dover Borough	Dover Boro	PA0021644	Fox Run		POTW
Dover Twp Water Systems					
Eric Engle					
Fed Ex Freight East York Terminal					
Gateway Unlimited, Inc.	Franklin Twp	PA0083801	UNT of North Branch Bermudian Creek		PSTP
Getty Property Corp., Inc.					
Gifford Pinchot State Park	Warrington Twp	PA0032800	Conewago Creek		PSTP
Gifford Pinchot State Park	Warrington Twp	PA0085219	Beaver Creek		IW/SW
Hanover Borough Regional WWTP	Hanover Boro	PA0026875	South Branch Conewago Creek		POTW
Hanover Cold Storage	Penn Twp	PA0087009	UNT South Branch Conewago Creek		IW/SW
Harmony Grove Landfill	Dover Twp	PA0085863	UNT of Davidsburg Run		IW/SW
Hostetter Management Co.					
J&A Mobile Home and Court	Newberry Twp	PA0040789	Conewago Creek		PSTP
Laurelwood MHP STP	Newberry Twp	PA0081396	UNT of Bennett Run		PSTP
Lewisberry Area Joint Authority WWTF					
Llewellyns MHP	Conewago Twp	PA0030171	UNT of Little Conewago Creek		PSTP
LWB Refractories Co.	West Manchester Twp	PA0087328	UNT of Honey Run		IW/SW
Miller Chem & Fertilizer	Conewago Twp	PAR233501			ISW
Miller's Skyview MHP	Newberry Twp	PA0080683	UNT of Bennett Run		PSTP
Mountain View Terrace MHP					
New Life for Girls Home	Conewago Twp	PA0082163	UNT of Laurel Run		PSTP
New Oxford Municipal Authority	New Oxford Boro	PA0020923	South Branch Conewago Creek		POTW
Newberry Farms MHP	Newberry Twp	PA0082619	Conewago Creek		PSTP
Northwood Manor	Newberry Twp	PA008137	UNT of Conewago		PSTP

			Creek		
Out Door World Time Share Campground					
Paradise MHP	Paradise Twp	PA0083721	UNT of Beaver Creek		PSTP
Pfaltzgraff Company					
Roadway Express Incorporated	Jackson Twp	PAR803613			ISW
Robert Chappell					
Shawn Campbell					
Souriau USA Incorporated	Manchester Twp	PAR113536			ISW
Terry & Laverne MTRS Incorporated	Conewago Twp	PAG05355 8			GW
Walmor Auto Salvage	Franklin Twp	PA0080861	North Branch Bermudian Creek		PSTP
Witmers Auto Salvage	Warrington Twp	PAR603521			ISW
York Haven Power Company					
York Haven WWTP	York Haven Boro	PA0081566	Conewago Creek		POTW

Notes:
1 PSTP = Private Sewage Treatment Plant, IW/SW = Industrial Waste/Storm Water, POTW = Publicly-Owned Treatment Works (Sewage), GW = Treated Groundwater, SWD = Surface Water Diversion (from Susquehanna River to Lake Redman for Water Supply), SFTF = Single Family Treatment Facility

The Chesapeake Bay 2010 agreement has placed significant pressure on the Pennsylvania Department of Environmental Protection (DEP) to reduce the amount of nutrients entering the Bay from Pennsylvania streams. The permitted discharge of these nutrients, specifically nitrogen and phosphorous, by point sources, such as those listed above, will be limited and/or reduced in the future. A decision as to how to determine these limits has been accomplished (Chesapeake Bay Tributary Strategy Point Source Sub-Committee).

4.7 Biological Resource Concerns and Issues

Several previous studies have been performed for Conewago Creek Watershed and have resulted in various determinations of watershed health and protection recommendations. One particular study, The Conewago Creek Watershed Assessment (August 2002), identified a method of evaluating the condition of the stream using both a coarse scale description and a fine scale desicription. Both scales are a reflection of land cover and use. The coarse scale description is useful for evaluating the density of impaired sites and energy flow continuity in stream systems. The finer scale description is useful for evaluating actual habitat conditions (water quality, stream hydraulics, and habitat structure) experienced by those organisms that live in the stream (fish, macroinvertebrates, amphibians) and those organisms that live on the stream (birds, reptiles, mammals, insects, and

riparian vegetation.) Both the coarse and finer scale descriptions may be useful for evaluating the impacts by and impacts on human land uses. The coarse scale results indicate a watershed that is in optimal condition in its headwaters, progresses to suboptimal and finally marginal condition as the Creek flows generally eastward. This degrading tendency is a direct result of changes in land use and, as a result, changes in land cover. However, land use is a direct reflection of changes in topography, geology, hydrology, and local climate. The western headwaters region is steep, highly dissected by streams, and has well-drained stony soils. This region is not suitable for agriculture and is largely preserved in Michaux State Forest. The density of degraded stream reaches is lower in the western region. The eastern region of the watershed has rolling land, fewer minor tributaries and ephemeral streams, and good agricultural soils. The eastern region is excellent for agriculture and associated village and residential development and the density of degraded reaches is higher.

The finer scale description reveals a watershed whose condition pattern is very patchy. Conditions range from optimal through suboptimal, marginal, and poor. This patchy condition pattern is a result of both the type of land uses and the way in which these land uses are managed. For example, livestock pasture is often associated with marginal or poor conditions, but, in a few cases, where best management practices are being used, livestock pasture is associated with optimal and suboptimal conditions. The same is true of residential land use. If there is sufficient buffer to remediate negative impacts, it is not uncommon to find vastly different conditions in relatively close proximity to each other.

Analysis at both the coarse and finer scales in the Conewago Creek Watershed reveal one major conclusion, the more vegetated the land cover the better the condition of the stream. In addition to the presence of vegetation, the vertical and lateral density of vegetation has a major impact on stream condition. In other words, the density of plant order of different heights and the width of the vegetation belt along a stream both affect stream condition. And both become increasingly important with increases in slope and in conjunction with certain land uses.

Disturbance

Other reports, particularly the Natural Area Inventory for both York and Adams County, identify disturbance to the natural environment as a major component of overall change in the health of natural areas. The nature, scale and frequency of disturbance are influential in the evolution and appearance of natural communities and associated rare species. Disturbance can be beneficial or destructive to the development and persistence of natural communities.

Some examples of natural disturbances are flooding, fire and deer browsing. While often regarded as a detrimental impact, both fire and small-scale flooding can be beneficial to certain communities or rare species. Fire is important in maintaining

some plant communities such as the Pitch pine-scrub oak barrens. Floodplain forests benefit from the periodic scouring and deposition of sediments as streams overtop their banks. At the same time, streamside wetland communities hold excess water, thus reducing the scale of flooding downstream. In contrast, deer have been blamed for a number of negative impacts on Pennsylvania flora and fauna (Rhoads et al. 1992): a reduction in the amount of understory, poor regeneration of some species, decreased songbird diversity, and direct loss of rare plants.

In many cases, human disturbance has been clearly destructive to natural habitats and species associated with them. Although necessary, farming, mining and development are disturbances that have completely eradicated some natural communities and habitats. For example, old-growth forests are virtually non-existent although occasional old trees may be encountered; many wetland habitats have been filled or altered, resulting in the loss of some of the native plants and animals of these sites. Although some species are aided by on-site disturbance (e.g., clearing or mowing), human disturbance is detrimental to others. With wide-ranging human disturbance, some plant and animal species may be completely eradicated from an area because they cannot compete or survive under the new conditions.

An increasing threat to these communities and natural habitats is the introduction and spread of exotic (i.e. non-native), invasive species across the landscape. Invasive species are very aggressive and adaptable to environmental change and result in decreased biological diversity and can create economic hardships. Of special concern is mile-a-minute weed (*Polygonum perfoliatum*), purple loosestrife (*Lythrum salicaria)*, Japanese knotweed (*Polygonum cuspidatum*), garlic mustard (*Alliaria petiolata*), autumn olive (*Elaeagnus umbellata*), multiflora rose (*Rosa multiflora*), Japanese honeysuckle (*Lonicera japonica*), bush honeysuckles (*Lonicera maackii, L.* x *bella*, *L. xylosteum*, *L. fragrantissima*, *L. morrowii*, *L. standishii*, *L. tatarica*), Japanese barberry (*Berberis thunbergii*), burning bush (*Euonymus alatus*), and Japanese stilt-grass (*Microstegium vimineum*),

Invasive species often take over native communities and usually offer little habitat to other native species of birds and mammals. This is compounded by the continued growth and construction in the watershed. The subsequent loss of wetlands, floodplains, riparian areas, and forested habitats reduces habitat for threatened and endangered species.

Because of the aggressive and adaptable nature of invasive species, exposed and/or disturbed ground is particularly vulnerable to growth and establishment of these species. Once established, eradication can be difficult hence the need to stabilize exposed areas with native vegetation. Invasive species often out-compete native species for available resources. Of high priority in the watershed is mile-a-minute weed, which acts as a vegetative blanket over native low-growing vegetation.

Control of these problematic, non-native species is necessary for the long-term maintenance of high quality natural systems. Discouraging the use of these and other potentially weedy exotics in and around natural areas can help prevent further encroachment. Some nurseries now carry a selection of tree, shrub and herbaceous species that are native to Pennsylvania, and these are recommended where plantings are necessary in or adjacent to natural areas. *The Vascular Flora of Pennsylvania* (1993) is a helpful reference for determining whether a plant species is native to the state or not.

Other Resource Concerns

Numerous other unique resources exist throughout the watershed. The watershed is home to a number of sensitive areas including wetlands, floodplains, threatened and endangered species and their habitat, and other unique features such as the Narrows, Adams County Fruit Belt, various natural areas, and unique geologic conditions. These areas are not automatically protected by resource agencies such as the Pennsylvania Department of Environmental Protection (PADEP), Environmental Protection Agency (EPA), Pennsylvania Department of Conservation and Natural Resources (PADCNR), Pennsylvania Fish and Boat Commission (PAFBC), and others. While wetlands and floodplains are considered a protected resource through U.S. Army Corps of Engineers and/or PADEP, it is possible to obtain permits to impact these resources. Special zoning designations can help protect and preserve resources. However zoning is subject to frequent changes. Specific municipal ordinances are often the best means of preserving such resources.

4.8 Cultural Resource Issues

At first it might appear that there are sufficient recreational areas within the watershed, however, most of those areas have seen an increasing number of visitors. As the population of the watershed increases and becomes redistributed, there will be a strain on the existing facilities. Review of Figure 3.4-1 shows that most of the municipal and state parks are located toward the northern and western sections of the basin. There is a recreational resource gap located in the south central portion of the watershed. The Appalachian Trail does traverse the northern boundary of the watershed.

Adams and York Counties have very few public recreational opportunities along or nearby the Conewago Creek. According to the Parks, Recreation, and Open Space For Tomorrow report by the Adams Planning Commission, Adams County has no specialized recreation facilities which can accommodate moderate to large crowds and which offer facilities such as an amphitheater, performing arts center, or trail networks designed to meet the walking, hiking or bicycling needs of all age segments of the populations. Boat access for canoes and kayaks are also few.

During the public outreach campaign and key interview process, a resounding issue was the lack of public access within the watershed. Furthermore, there is a lack of information on where current public access is located.

As was discussed in Section 3.4 B., the Conewago Creek Watershed has a significant and colorful past. Numerous examples of this varied history remain today (See Figure 3.4-2), but could be threatened by development and other pressures including lack of funding for restoration and maintenance.

4.9 Funding

A major obstacle to conservation, restoration and preservation of watershed resources is funding. Depending on what recommendations are provided for a given area, restoration of watershed resources can be expensive. There are several sources of funding available for a variety of non-profit and government agencies, however, these funding sources are subject to the whims of budgetary constraints and political changes. This is why proper planning is important so that our watersheds don't require as much restoration as they do preservation. Preservation of resources can be as simple and inexpensive (compared to stream restoration) as fencing off a stream corridor to keep livestock away from the channel and provide an opportunity for the riparian zone to get re-established.

However, according to the Chesapeake Bay Foundation, the Environmental Protection Agency has determined that the Bay is not continuing to decline, nor is it getting better. While recent efforts to increase the health of the Bay, as required in the Chesapeake Bay 2000 Agreement, have kept the Bay from declining further, those efforts apparently are not enough. Funding, and where the funding is spent, is important to Bay restoration efforts. Sedimentation of the Bay is the leading cause of impairment. Through research, it is known that a majority of that sediment is coming from the creeks and streams themselves, and not just the landscape. However, stream restoration using natural channel design techniques is expensive. Although stream restoration is expensive, it is necessary to begin the restoration of the Chesapeake Bay.

4.10 Current Efforts and Opportunities

Fortunately for the watershed, there are numerous school groups, universities, non-profit organizations, municipalities, and government resource agencies, which are conducting studies and completing projects that analyze and protect the watershed. These projects range from stream restoration using natural channel design principles and detailed water quality surveys to community involvement programs such as stream clean-ups. By partnering with other agencies and organizations, groups can form alliances that make an effort more feasible and stronger. Below is a brief list of current projects within the Conewago Creek Watershed. Please note that this is not an exhaustive list and may not contain some projects.

A. Conewago Creek Act 167

The Adams and York County Planning Commissions are attempting to work together toward an Act 167 plan for the entire watershed. The York County Planning Commission is currently completing an Act 167 Stormwater Management Plan for the Little Conewago Creek Watershed. Phase I of the plan has been completed. The plan addresses stormwater management on a watershed level as opposed to a municipal level. When completed, the Little Conewago Creek Act 167, Stormwater Management Plan will compliment the objectives of the River Conservation Plan.

B. Adams County Comprehensive Plan Update

The Adams County Planning Commission is in the process of updating their Comprehensive Plan. One of the components of the plan is the County Greenways Plan. The Conewago Creek RCP will benefit from, and benefit, the County Greenways Plan.

C. Adams County Greenways Plan

The Adams County Department of Planning and Development is in the process of preparing the Adams County Greenways Plan. A greenways plan is a network of preserved land that connects to each other to form corridors for recreation, protection of habitat, and preservation of open space.

D. South Mountain Regional Comprehensive Plan

Regional Planners are in the process of preparing a regional comprehensive plan for the South Mountain Region.

E. Conewago Creek Narrows Restoration

The Adams County Conservation District has applied for funding to restore a portion of the Conewago Creek in the western portion of the watershed on the eastern face of South Mountain along Route 234.

F. Adams County Fruit Belt Rural Historic District

The eastern face of South Mountain is home to some of the most productive orchard crops in Pennsylvania. The area, known as the Adams County Fruit Belt was nominated to be listed on the National Register of Historic Places as a Rural Historic District. Such a designation will afford an additional level of protection for the region.

G. Conewago Creek Watershed Critical Water Planning Area

The Adams County Office of Planning and Development and York County Planning Commission has petitioned the Pennsylvania Department of Environmental Protection to establish portions of York and Adams Counties as a Critical Water Planning Area.

SECTION 5.0 – Watershed Recommendations

In general, the Conewago Creek River Conservation Plan has been prepared in accordance with the *Growing Smarter Toolkit, a Catalog of Financial and Technical Resources* prepared by the Governor's Center for Local Government Services and the recently released *Pennsylvania Stormwater Best Management Practices Manual, December 2006*. The entire *Growing Smarter Toolkit* document is provided as an attachment in Appendix A. Additionally, many of the recommendations and Best Management Practices which are described below are "in-line" with the Pennsylvania Chesapeake Bay Tributary Strategy Program and implementation of these practices will help Pennsylvania achieve it's required goals set forth in the Chesapeake 2000 Agreement.

The Growing Smarter Toolkit lists the current technical and financial assistance programs available for Pennsylvania communities as they strive to address issues related to farmland preservation, open space preservation, environmental protection and conservation, infrastructure, transportation, historic preservation, urban revitalization, affordable housing, brownfield restoration and land recycling, and intergovernmental cooperation. As with the RCP, the Growing Smarter Toolkit is designed to aid municipalities as they address these issues now and in the future. Many of the recommendations within the Conewago RCP are built around sound principles which can be addressed by utilizing the Growing Smarter Toolkit.

This section provides general recommendations for the preservation, conservation, and restoration of watershed resources for the entire watershed. These are not project specific. They represent some basic principles that residents of a watershed should incorporate into zoning, land use, and their everyday lives. As previously described, the watershed has been broken down into smaller watersheds based on data from the Commonwealth of Pennsylvania, the York County Planning Commission, and the PASDA GIS webservice. As a result, these sub-watersheds do not necessarily represent those listed elsewhere. In Section 6.0 of this document we look at each of those sub-watersheds in more detail and provide more specific recommendations for each one.

Often the best protection and conservation strategies are the simplest and the most straightforward. The overall recommended protection and conservation strategies for the watershed consist of the following key components:

- local protection of natural resources at the municipal level,
- basic education about current issues affecting the watershed,
- organization of local citizens and stakeholders to become invested and active in watershed protection and conservation,
- lower cost-high benefit restoration and preservation efforts,
- and continued research and assessment of both the problem and the strategies implemented to solve the problem

Protection and Conservation at the Local Level

Implementation of local protection efforts is critical to the ultimate success of any natural resource conservation effort. Little protection measures currently exist other than municipal PEMA floodplain overlay district guidelines. Therefore, crucial to the protection of natural resources within the watershed are not only the implementation of protection and conservation measures, but also an investment by the local municipalities as a stakeholder in the overall protection of their natural resources. It is vital for the local tiers of government to recognize the true importance of conserving their natural resources for the long-term good of their residents, become both interested and invested in the conservation approaches, and to become firm leaders and environmental stewards for their residents. The local residents will follow their lead to protect their natural resources for future generations.

The following sets forth a series of initial conservation strategy recommendations for use at the local governmental level:

- Develop ordinances and policy for conservation of natural resources that limit or restrict development within identified sensitive areas. This is likely the single most effective strategy at the local governmental level.
- County and township officials can encourage landowners whose land includes waterways to maintain vegetated buffer zones along streams. Vegetated buffers (preferably of PA-native plant species) help reduce erosion and sedimentation and help to shade and cool the water. This in turn benefits aquatic animal life, including the fisheries. These buffers also provide habitat for other wildlife species and help to create a diversity of habitats along the creek or stream.
- Scrutinize development proposals for their impact on entire watersheds not just the immediate impact area. Certainly, new housing and commercial development can be given close scrutiny before it is allowed in the areas outlined in this report and careful review can be required within any watershed in the county. Local governments can also require minimum setbacks from all water bodies to help protect water quality.
- Development plans should provide for creating natural buffers between the development and the core preserve area, be it a barrens community, wetland or water body. Care should be taken to ensure that protected natural areas do not become "islands" surrounded by development. When a wetland or woodland is completely surrounded by development, even though there are no direct impacts, the site is effectively isolated and its value for wildlife is reduced. Cluster development could be used to allow the same amount of development

but on much less land in such areas, but most importantly, leave much of the land intact as corridors for wildlife and native plants.

Education

- Develop literature to identify and state the problems and issues within respective areas.
- Hold public events for concerned citizens and stakeholders in order to relay information to those interested parties and also to obtain feedback.
- Develop and implement best management practices educational programs for specific types of land uses and users (cattle farmers, summer cottage communities).
- Use examples of stream degradation (erosion, dirty water flooding,) as teaching mechanisms about the impacts of poor land use management on streams.
- Inform landowners, the public, and elected officials about state and federally funded programs that address water quality and conservation issues.

Local Organization

- Formation of an overall Conewago Creek Watershed Association to engage local citizens to take an active part in the management of their watershed, including the conservation and protection measures employed and the management of proposed development. This group can assist with the identification of landowners that wish to protect their land, provide information about easements to landowners, perhaps acquire land, and provide management and stewardship once the land is protected.
- Formation of sub-watershed associations and "Friends-Of" organizations in densely urban, rural, and agricultural areas because sub-watersheds are the functional scales for physical and biological systems and stakeholder communities. Additional efforts could include a volunteer monitoring and screening of local proposed development and its planning and review process.

Restoration and Preservation

- Plant riparian buffers.
- Conduct floodplain restoration and protection where feasible.
- Fence livestock out of streams and stabilize stream crossings.
- Identify stream reaches that can be stabilized or repaired through channel geometry restoration in conjunction with land use management change and long term preservation.
- Identify good quality stream reaches for preservation and as educational tools.
- Channel stabilization or full restoration for determined reaches where damage cannot be repaired by simpler methods.

- Any identified Natural Areas that have been ranked as the highest priority for protection need (identified as a 1 or 2 notation from the previously performed Natural Areas Inventory for both York County and Adams County 1996) should be targeted immediately for privately-owned lands at these sites may be protected through a combination of conservation easements and acquisition to encourage current land use or make improvements in land use where needed.
- Implement management plans and conservation easements for both public and private lands. This can be done in cooperation through each local municipality. Management plans on public and private lands should address species of special concern and natural communities and assess the need for additional acres to complete protection. Each element located within a given site will need to be addressed in new management plans for that area. Many of the already-protected sites are in need of additional land to complete protection and/or are in need of management to ensure the continued existence of the associated natural elements. Efforts are already underway to refine management plans for some of the high quality natural areas on public lands throughout the watershed.
- Protection of the reservoirs, wetlands, rivers, and creeks within the watershed is vital, especially those that protect sensitive species, bio-diversity, and supply drinking water. Many of the sites containing rare species, natural communities or locally significant habitats within the watershed are associated with water. Protection of these watersheds is the only way to ensure the viability of natural habitats and water quality. Cooperative efforts on land use among municipal, county, state, and federal agencies, developers, and residents can lessen the impact of development on the watersheds and plant communities of the county. Protecting natural areas around municipal water supply watersheds provides an additional protective buffer around the water supply and habitat for wildlife and may also provide low-impact recreation opportunities.
- Minimize encroachment on the parks and conservation lands throughout the watershed. Existing parks and conservation lands provide habitat for a number of plant and animal species and may be important not only on a county-wide level, but also on a regional scale. For example, they may serve as nesting or wintering areas for birds or as stop-over areas during migration. Where appropriate, more land should be added or agreements worked out with adjacent landowners to minimize encroachments that may threaten native flora and fauna.

Research

- Develop assessment methods to track the identified problems and the implemented strategies for resolution.
- Focus future water chemistry testing on reaches identified for possible restoration or changes in land use management.

- Create a clearinghouse to centralize access to channel morphology, habitat structure, and water quality data and incorporate thorough metadata so that the data is available to all those interested.

Section 5 focuses on recommendations that strive to resolve some of the issues and concerns identified in Section 4. There are broad categories of solutions and Best Management Practices available through a variety of sources that, if implemented, will begin the process of watershed restoration and preservation. However, these solutions or techniques would apply to almost any watershed. This section attempts to identify a few of these general techniques that would be more appropriate for the Conewago Creek Watershed's issues. In addition to the general recommendations for good watershed health, this section also strives to identify other techniques which are tailored to the Conewago Watershed. Many of the issues and concerns in Section 4 were not confined to a single sub-watershed. Many included multiple sub-watersheds. Section 6 looks at the sub-watersheds in more detail.

5.1 Water Quantity

Through research, data collection, public outreach, and municipal coordination, it is apparent that the single biggest issue facing the Conewago Creek Watershed is related to water quantity. As was discussed in Section 4, the Conewago Watershed is home to several Potentially Stressed and Water Challenged Areas (PSA and WCA respectively). There is a need to identify and protect Critical Water Recharge Areas pursuant to the Safe Drinking Water Act. In addition, growth and development is occurring in these areas which are also the headwater areas for the Conewago Creek. As we now know, headwater areas have the ability to recharge aquifers among other things. Most of the development, which results in an increase in impervious surfaces, is paving over the headwater areas reducing the ability of the aquifers to recharge. The headwater areas are loosing open space at an alarming rate which greatly affects the aquifers ability to recharge. This is particularly troublesome in the Conewago Watershed. While many communities are experiencing growth and development, other areas are not as stressed for water supply as is the Conewago Watershed. Presented below are a few custom strategic techniques developed to maintain open space and aquifer recharge.

A. Detailed Water Budget

A detailed water budget must be developed for municipalities in both York and Adams counties. This is particularly important in the Potentially Stressed and Water Challenged Areas. Water budgets can be developed in several different ways. Both the Pennsylvania Department of Environmental Protection and the Susquehanna River Basin Commission can prepare water budgets. However, DEP has jurisdictional control that exceeds that of SRBC.

Act 220 of 2002 in Pennsylvania mandated that the State update it's State Water Plan by 2008 and then update every 5 years thereafter. The State Water Plan must provide an inventory of surface and groundwater resources, assessments and projects for existing and future needs, non-withdrawal needs, identification of existing and potential problems, conflicts among users, and identification and selection of recommendations. The State was divided into 6 water planning regions. The Conewago Creek Watershed is located in the "Juniata River, Lower Susquehanna River, Gunpowder, Northeast, and Elk Creek Basins" regional planning area.

The first step in obtaining a water budget through DEP is to submit a Critical Water Planning Area (CWPA) nomination form. The specific steps involved in the nomination are provided on the DEP website at www.depweb.state.pa.us and the navigating to Act 220 (State water planning) under water topics at the top of the webpage. Once the nomination has been accepted, the process begins toward the development of a Critical Area Resource Plan (CARP or "water budget").

The first step in obtaining a water budget through SRBC is to contact the senior hydrologist via telephone at 717-238-0425 extension 218. Where DEP manages water throughout the state, SRBC only manages water throughout the Susquehanna River drainage basin. The components of each plan, or water budget, are similar at both agencies. However, because SRBC focuses on just the Susquehanna River drainage basin, of which the Conewago Creek is a sub-watershed, enables a quicker response to nominations or requests for detailed water budgets.

A nomination to DEP has been made to designate portions of the Conewago Watershed as a CWPA around Hanover in the South Branch Conewago Creek sub-watershed. This nomination was made by the York County Planning Commission and Adams County Office of Planning and Development. To date, no response has been received from DEP. This nomination is limited to a small portion of the watershed. A nomination to SRBC should be made requesting the development of a detailed water budget for the entire watershed with focus on the Water Challenged and Potentially Stressed Areas.

At this time funding, although very limited, is available for the completion of water budgets and/or CWPA through State resources. However, completion of a detailed water budget does not have to be completed by a resource agency. It is possible for one or more municipalities within the watershed, or other agency/entity, to fund and complete a detailed water budget on their own provided it is reviewed by and in accordance with DEP/SRBC. Depending on time constraints, it may be more expedient to complete the detailed water budget outside of DEP/SRBC. Also funding should be secured for the continued operation and maintenance of the real-time stream gage USGS 01573825 West Conewago Creek at East Berlin, PA to assist in developing detailed water budgets.

B. Agricultural Preservation

The leading industry within the Conewago Watershed is related to agricultural production. Approximately 66% of the land cover within the watershed is agricultural. One of the concerns of the watershed is the preservation of this agricultural heritage and restricting growth and development on agricultural lands. Most, if not all, counties within Pennsylvania have one or more programs established to help preserve farmland in some way or another. Some programs preserve through purchasing the property and other programs preserve through purchasing an agricultural and/or open space easement. Programs in York and Adams Counties are voluntary where the landowners must identify themselves to the appropriate agency. Once the landowners identify themselves, the properties are evaluated on multiple levels and the owners get an overall rating. Provided the rating is high enough, the landowners qualify for that particular program. While this program attempts to preserve farmland that has higher resource value, it is not a strategic approach based on watershed issues.

Agricultural preservation can be a valuable tool in watershed restoration and protection. Agricultural preservation is typically funded and the landowner who is preserving has a financial incentive to do so. Strategic preservation of agricultural land can maintain open space, preserve streams and wetlands, and protect species and areas of concern. Once a landowner qualifies for inclusion in an agricultural preservation program, a farmland conservation plan is typically required. Conservation plans usually require protection of streams, wetlands, habitat, soil, etc. This project looked at agricultural preservation in York and Adams Counties to determine what methodology is used and how each program relates to watershed protection and restoration.

Rating criteria was obtained from both York and Adams Counties agricultural preservation organizations. Common rating criteria between the two were identified and used as a baseline for which to qualify for either program. Common themes that were selected were adjacency to other preserved land including state parks, state forests, and farmland and total acreage of the parcel. Parcels that were adjacent to other land had a higher ranking. Parcels that were adjacent to other preserved land and had higher acreage, usually more than 50 acres, got an even higher ranking. Both County agencies and organizations also ranked for presence of wetlands, unique habitat, habitat for threatened and endangered species, etc. however, their weighting was varied, so only adjacency and total acreage was used. Typically parcels with higher rankings are funded and parcels with lower rankings are not. Parcels meeting these general requirements were identified in the entire watershed.

Once these parcels were identified, they were placed over the Potentially Stressed and Water Challenged Areas. The objective was to determine which parcels meet general criteria for inclusion in an agricultural program and if preserved would

maintain open space for groundwater recharge. Once these parcels were mapped, it was determined that the rating criteria of 50 acres or more was too large. Therefore, parcels which were at least 10 acres in size, adjacent to other preserved land, and fall within either a Potentially Stressed or Water Challenged Area were mapped. These parcels can be seen on Figure 5.1-1. This map also identifies parcels that are greater than, or equal to, 50 acres in size. Tables 5.1-1 through 5.1-4.

See Figure 5.1-1 Recommendations Map Water Quality High Priority Parcels Over 10 Acres

See Tables 5.1-1 – 5.1-4

5.1-4 identify each parcel and provide basic information that was available for that parcel.

The parcels identified on Figure 5.1-1 and in tables 5.1-1 through 5.1-4 are the highest priority parcels for preservation in the entire watershed. Preservation of these parcels would preserve valuable open space within the Potentially Stressed and Water Challenged Areas. Because these parcels meet criteria for agricultural preservation, a matching grant program can be established so that the various agricultural preservation organizations are not required to obtain 100% funding form their normal sources. Matching grants can be obtained from sources associated with the Conewago WCP.

C. Stormwater Management

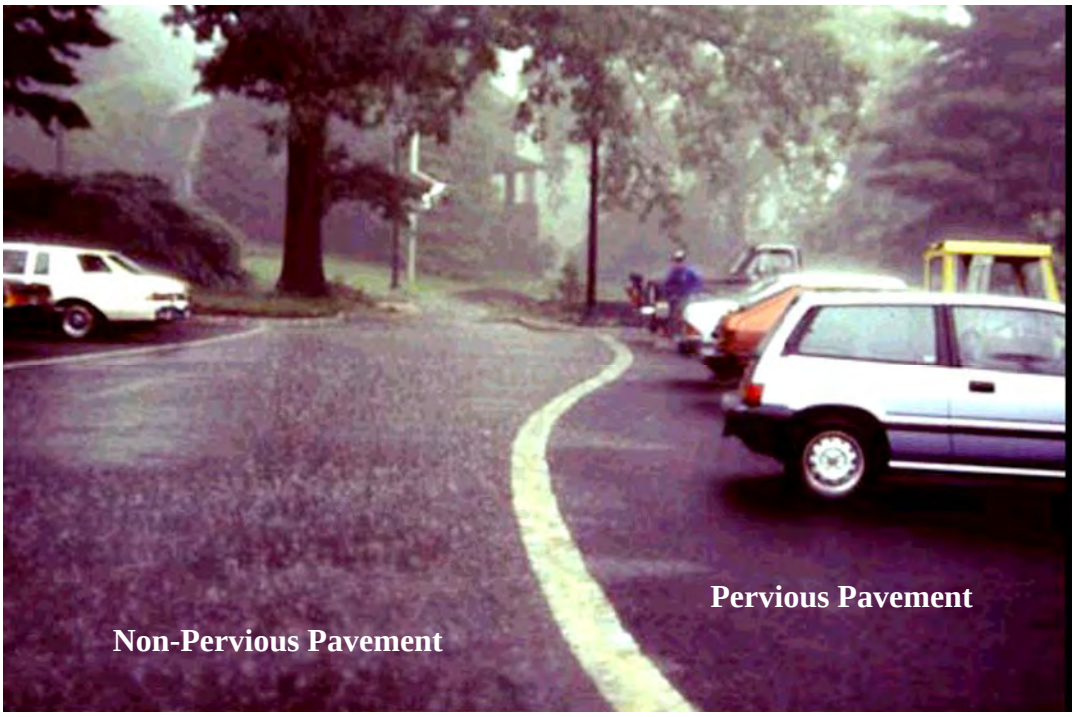
As discussed, stormwater management is critical to the protection of our aquifers, streams, and waterways. Even though there are some municipalities within the watershed that do not have stormwater management ordinances, those municipalities which do have a stormwater ordinance are not managing stormwater in a way which protects the environment. This is not to single out each municipality, but rather cast light on how we as a society manage stormwater. Particularly in areas like the Conewago Watershed. Stormwater management was born out of the need to manage stormwater for environmental reasons. Unfortunately, it has become apparent that in the presence of good intentions, stormwater management techniques that are employed in most stormwater management ordinances do not manage on a regional level. Rather they are site specific which, when the stormwater is released, causes several problems. Several of those problems include, but are not limited to, increase in energy and quantity of flows after a storm's peak discharge, release of stormwater into conveyances instead of back into the aquifers, and increased sediment load.

One way to alleviate just one of the multiple problems with stormwater is to infiltrate as much stormwater runoff as possible. This is particularly important in the areas identified as Potentially Stressed and Water Challenged. The presence of soils potentially suitable for infiltration (Figure 2.3-1) was previously discussed in Section 2.3. The soils suitable for infiltration were mapped with the aquifers of the watershed (Figure 5.1-2) and with the Potentially Stressed and Water Challenged Areas (Figure 5.1-3).

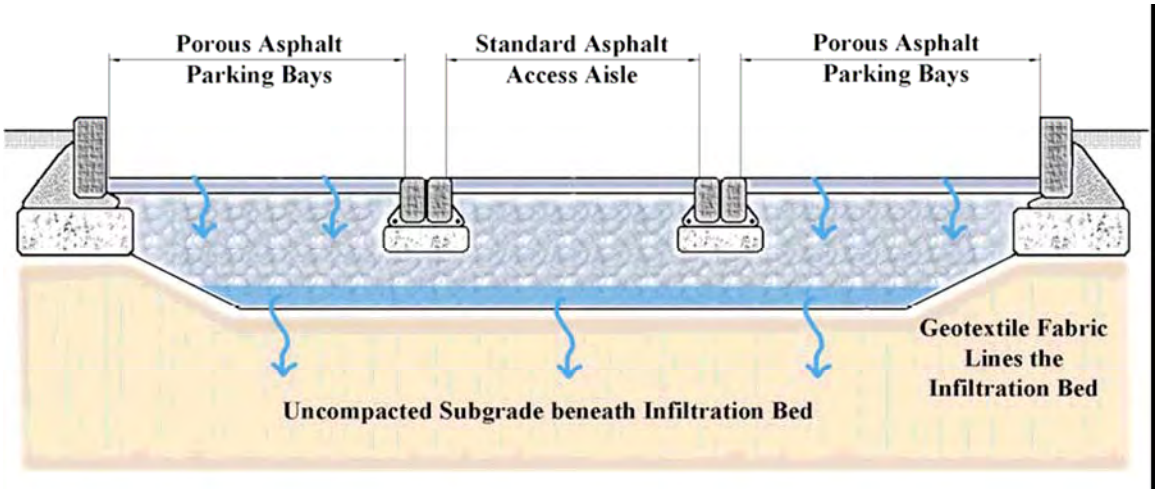
Maximizing the infiltration potential in these areas is critical. Listed below are several BMPs which are recommended for those areas where soils suitable for infiltration are located in either Potentially Stressed or Water Challenged Areas. Municipal stormwater management ordinances should be revised to indicate the following BMPs are required on sites within these areas (more detailed descriptions of these and other stormwater BMPs can be found in the Pennsylvania Stormwater Best Management Practices Manual, December 2006).

See Figure 5.1-2 Recommendations Map Soil Suitability for Infiltration and Aquifers

Figure 5.1-3 Recommendations Map Soil Infiltration Map in Potentially Stressed and Water Challenged Areas


Pervious Pavement
Non-Pervious Pavement

porous
asphalt
standard
asphalt



Source: PA Stormwater BMP Manual, December 2006

1. **Pervious Pavement with Infiltration Bed** – Provided they are maintained correctly, pervious pavement on new pavement for parking lots, sidewalks, walking paths, playgrounds, plazas, tennis courts, and other similar uses. Pervious pavement can come in different forms. In this context it shall permit other types of surfaces which allow stormwater to infiltrate through the primary surface to the aquifer. Other types of surfaces are, but not limited to: pervious bituminous asphalt, pervious concrete, paver blocks, and turf and/or gravel filled geo-grids.

2. **Infiltration Basin** – Infiltration basins are shallow impounded areas created to temporarily store and infiltrate stomwater runoff. Ideally the basins are constructed without disturbance of native existing vegetation. The basins can vary in size so that smaller ones can be incorporated throughout a project site. Smaller basins are easier to construct in an existing site as a retrofit stormwater BMP.
3. **Subsurface Infiltration Bed** – Subsurface infiltration are typically well vegetated areas on highly permeable soils or other media. The subsurface is a uniform aggregate bed for temporary storage and infiltration of stormwater. These work particularly well for open lawns, meadows, passive recreation areas, and some playfields.
4. **Infiltration Trench** – An infiltration trench is a linear trench with a perforated pipe at a minimum slope set inside and backfilled with aggregate. Infiltration trenches work particularly well as part of the conveyance system.
5. **Rain Gardens/Bioretention** – There are two types of bioretention: off-line and on-line areas. Off-line bioretention areas consist of sand and soils mixtures planted with native plants, which receive runoff from overland flow or from a diversion structure in a traditional drainage system. On-line bioretention areas have the same composition as off-line areas, but are located in grass swales or other conveyance systems that have been modified to enhance pollutant removal by settling and biofiltration. Bioretention is an efficient method for removing a wide variety of pollutants, such as suspended

solids and nutrients. It can also be an effective means of reducing peak runoff rates and recharging groundwater by infiltrating runoff.

6. **Dry Well/Seepage Pit –** A dry well or seepage pit, is an underground storage and infiltration device used to capture runoff from roofs of structures. Roofs contribute a significant amount of impervious surface to a watershed.
7. **Constructed Filter –** A constructed filter is a structure or excavated area containing materials (sands, compost, organic material, etc.) that filter runoff to remove sediments, metals, hydrocarbons, and other pollutants.
8. **Vegetated Swale/Conveyance –** Vegetation is natures filter. A vegetated swale is a shallow surface conveyance that is densely planted with a variety of herbaceous, shrub, and tree species. Used in combination with other techniques identified above, they are excellent at attenuating flow, filtering runoff, and in some cases, infiltration of stormwater.

The BMPs presented above have been chosen because of their suitability for the Conewago Watershed and the issues being resolved. More detail about these BMPs can be obtained by referencing the PA Stormwater BMP Manual (December 2006) available either through DEP directly or through DEP's website.

Municipalities located within, or portions located within, Potentially Stressed and Water Challenged Areas should revise existing stormwater management

ordinances to create a zone around the PSAs and WCAs. Projects in these zones would be required to infiltrate the increase of stormwater runoff using one or more of the above techniques. However, because the PSAs and WCAs also fall within aquifers which infiltrate very rapidly, great care must be taken to filter runoff prior to reaching the infiltration area. There is a high risk for contamination of groundwater in these areas. Therefore, most infiltration techniques must be combined with a filtration system (vegetated swale, rain garden/bioretention, constructed filter, etc.).

Additionally, some of these areas are also karst areas (Figure 2.3-3). Karst areas are a unique geologic condition primarily limited locally to limestone geology. Karst areas have severely fractured bedrock that contain many voids, caverns, caves, and spaces filled with fines. When these fines are washed away, from concentrated flow, the surface collapses and a sinkhole forms.

While it may seem infiltration is complicated in these areas, not infiltrating stormwater runoff will continue to degrade the current condition of the aquifers in the watershed. Infiltration and recharge of the aquifers is so critical that retrofitting of existing basins, while currently expensive, may become economically more viable than alternatives when the aquifers are truly stressed.

D. Tree/Forest Management

Approximately 26% of the watershed is forested, either deciduous or coniferous. Native forests, or at a minimum old growth forests, have many benefits to a watershed. They provide habitat for forest dwellers, they produce oxygen, the sequester carbon from the atmosphere, they provide a source of economy as timber, and they help in the attenuation of floods and the recharge of aquifers and groundwater resources. It is in this capacity that protection and preservation of forests and trees becomes vital to the long term sustainability of the Conewago Watershed.

Trees help with stormwater in the following ways:

- Organic material from leaf litter and other tree detritus tends to increase infiltration rates by increasing pore spaces in soil
- Organic material also increases the moisture-holding capacity of these sites
- Root mats of trees break up most soils further improving infiltration and moisture-holding capacity
- Deep roots tend to improve the rates of percolation of water from upper soil horizons into lower substrates
- Trees take up water through their roots that is eventually transpired onto leaf surfaces and evaporated
- Tree roots act as natural pollution filters (biofilters) using nitrogen, phosphorus and potassium
- Intercept rainwater on leaves, branches and trunks – slowing its movement
- Evaporation of some of this intercepted precipitation of the tree surfaces

- Absorption of a small portion into leaves or stems
- Leaf litter and other organic matter can hold precipitation and stemflow on a site, reducing the amount and peak rates of runoff
- Roots and trunk bases of mature trees tend to create hollows and hummocks on the ground

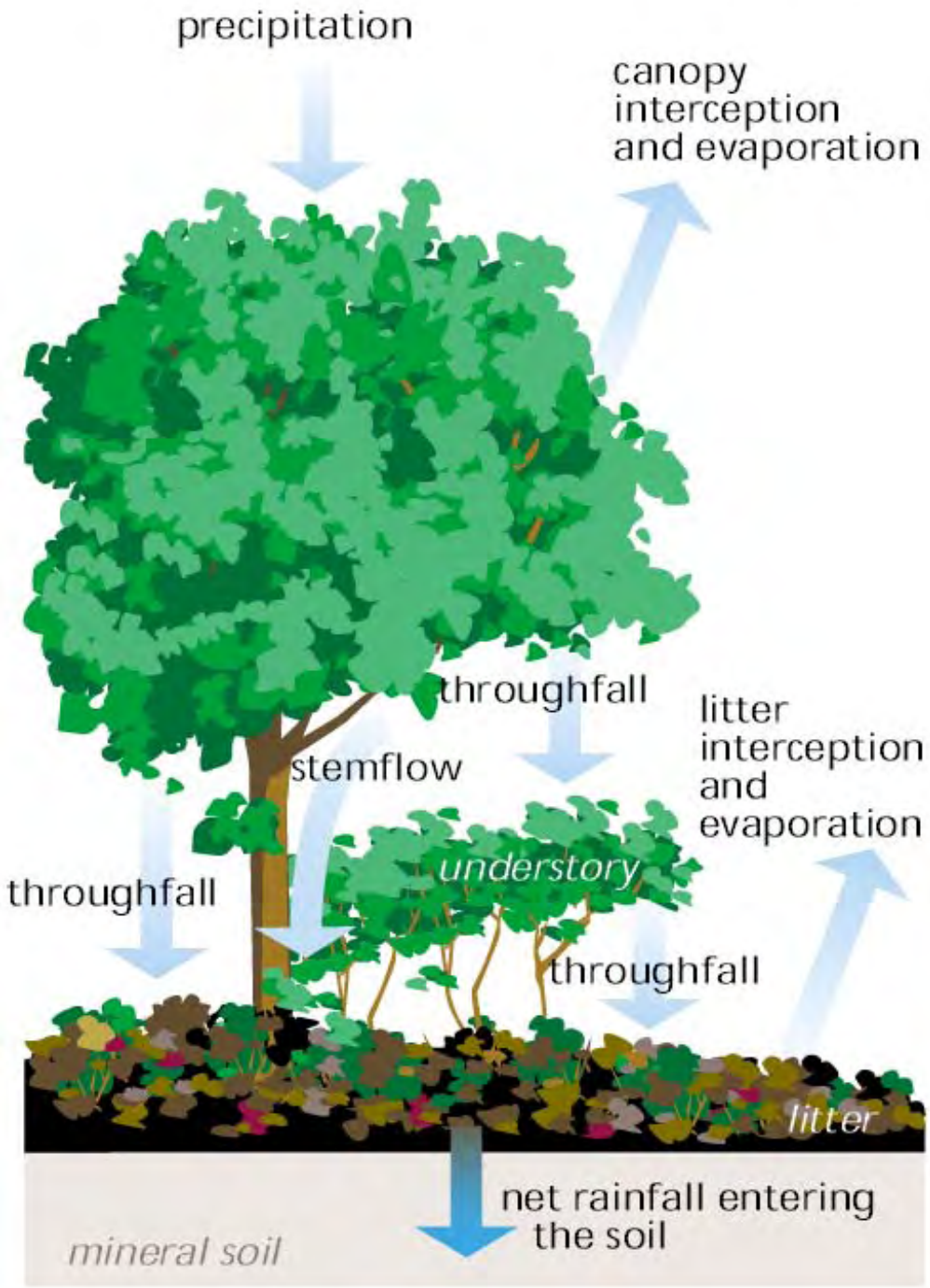


Figure 5.1-4: Effect of trees on stormwater.

See Figure 5.1-5 Recommendations Map Forest Cover in Potentially Stressed & Water Challenged Areas

Figure 5.1-5 shows the PSAs and WCAs with forest cover, both coniferous and deciduous. Trees and forests located in these areas are a vital resource to the watershed. In this capacity, forests within these areas should be protected through restrictive zoning or other means/ordinances. In particular the following municipalities should adopt a forest/tree conservation ordinance:

- Arendtsville Borough
- Benderville Borough
- Biglerville Borough
- East Berlin Borough
- McSherrystown
- Hanover
- Latimore Township
- Reading Township
- Oxford Township
- Berwick Township
- Penn Township
- West Manheim Township
- Union Township

These municipalities were either fully or partially located in a PSA or WCA and had a high rate of increase in impervious surface. This equates to the loss of forest cover and open space.

Forests and trees should be protected throughout the watershed, but it is critical that they be protected in Potentially Stressed and Water Challenged Areas. A forest and tree conservation ordinance should be developed for those municipalities within the PSAs and WCAs. Two examples of forest and/or tree conservation ordinances are provided in Appendix D.

5.2 Water Quality – Land Use and Zoning

The second most important issue facing the Conewago Watershed is related to water quality. Not only is there not enough water in the watershed, but the quality of the water is compromised. The water quality issues manifest themselves in the streams and waterways throughout the watershed. The primary sources of impairment are sedimentation from unstable channels and high levels of nutrients. Stream bank instability is a major source of the sediment entering the watershed and ultimately the Chesapeake Bay. From basic assessments, it has been concluded that stream bank instability is related to lack of riparian buffers and agricultural access to the streams.

A. Riparian Buffer Overlay Zone

Streams need to be protected and preserved for they provide residents with many benefits ranging from water supply and healthy ecosystems to recreational opportunities. To minimally preserve streams and waterbodies, we must first

adopt overlay zones that represent a buffer on both sides of all streams. Various sources site different dimensions of the buffer. The Tennessee Forestry BMP manual indicates as little as 25' is sufficient while Virginia's Forestry BMP manual indicates a 50' minimum buffer and Wisconsin's Forestry BMP manual indicates as much as 100' should be the minimum buffer width. Forestry BMP manuals are not the only documents to discuss buffer widths. Other sources, such as the Pennsylvania Handbook of Best Management Practices for Developing Areas (PA BMP), indicate that buffer widths can vary depending on the objectives of the buffer. The best buffers are those that are forested adjacent to the stream. Forested buffers provide numerous benefits over grasses; benefits including, but not limited to: temperature moderation, increased streambank stabilization, and forested habitat corridors for forest dwelling species of animals.

According to the PA BMP manual, one accepted standard for riparian forest buffers is called the *3-zone buffer*. The width of each of the three zones in a 3-zone buffer will vary depending on the size of the stream and the topographic setting. However, according to the PA BMP manual, 85 feet is sufficient in most small and medium sized streams to incorporate the functions of the three zones. Figure 5.2-1 below illustrates the 3-zone forested buffer.

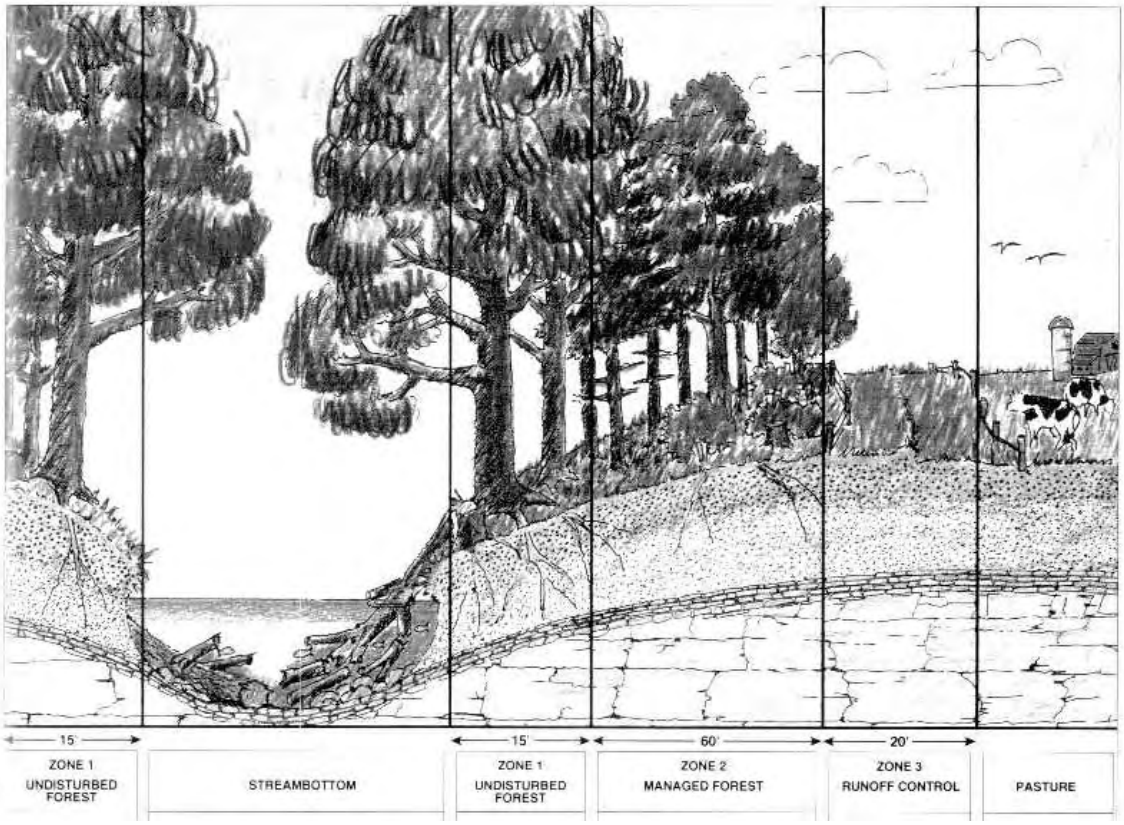
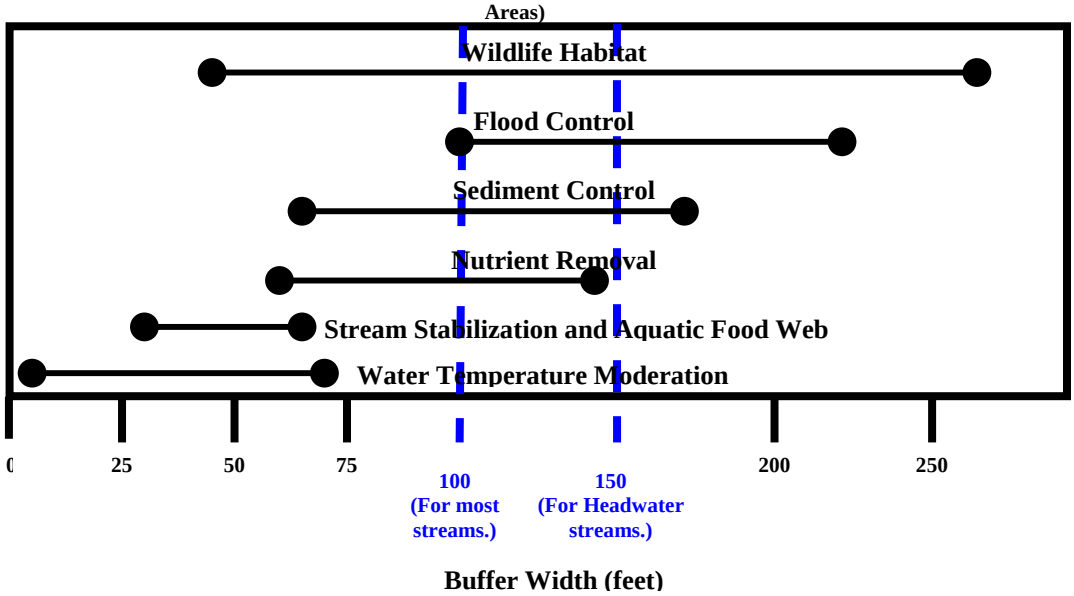


Figure 5.2-1: *3-zone* buffer for riparian areas.
(Source: Pennsylvania Handbook of Best Management Practices for Developing Areas)

As was described above, riparian buffers can vary greatly in width depending on which method/manual is used to establish the buffer. Table 5.2-1 below was taken from the PA BMP manual and is a graphical representation of the benefits achieved for various buffer widths. To determine the appropriate buffer widths, the consultant for the project, in conjunction with planners at the York County Planning Commission, assessed Table 5.2-1 below to determine what the recommended width of a Riparian Buffer Zone should be. One of the most significant issues affecting the streams throughout the watershed is stream instability.

Table 5.2-1 **(Source: Pennsylvania Handbook of Best Management Practices for Developing Areas)**



Other issues include water temperature, nutrient and sediment load, and forest fragmentation (lack of habitat). It was determined that the goals of a Riparian Buffer Zone should be to stabilize the stream banks, moderate water temperature, reduce sediment and nutrient loads, increase wildlife habitat, and to the extent possible, flood attenuation. After deciding on the goals and objectives of the buffer, it was determined that the most prudent yet feasible buffer width to capture as many of the goals and objectives as possible, is 100' on both sides of all streams. However, because we know that headwater areas are a place for groundwater recharge, a minimum buffer width of 150' is recommended. This has been established based on the needs of the watershed and the feasibility of implementation. A 100' buffer incorporates as many functions as possible without being too restrictive to landowners. However, some municipalities may wish to increase the size of the buffer, which is beneficial to the environment, and should be permitted. It is important to understand that it is the first 25-30 feet of a buffer which stabilizes the streambanks the most. The most important functionality within the Conewago Creek Watershed that buffers can play, is that of streambank stabilization.

See Figure 5.2-2 Recommendations Water Quality Map

The exact restrictions of use within a buffer zone can vary greatly from no use, to limited uses, to limited uses within varying distances from the bank. For instance within a 100' buffer the first 30' (Zone A) should be a "no use" or "limited use" zone where most types of activities are prohibited. This could include restriction of mowing/removal of the vegetation and restricted livestock access. Approved impacts may be such things as non-impervious (crushed stone or gravel) recreational trails (pedestrian, bicycling, and/or equestrian) which require very little or no removal of vegetation.

Within the remaining 70' (Zone B) the restrictions are less, but there may still be restrictions on earth disturbances such as buildings and other impervious surfaces.

However, mowing and other "soft" impacts (those which don't create exposed soils, or impervious surfaces) are permitted. Zone B is the preferable location for such things as linear trails. Zone A is the preferable location for perpendicular or skewed direct access trails. However, neither one of these Zones should allow impervious trails such as bituminous paving.

On-site sewage disposal systems should be exempted from earth disturbance and buffer restrictions as such systems are permitted within 50 feet of surface waters by PADEP regulations. This Riparian Buffer Zone should be adopted by all municipalities within a watershed. Figure 5.2-2 shows the recommended Riparian Overlay Zone.

Municipalities, particularly within the PSAs and WCAs should develop a riparian buffer ordinance particularly within the headwater areas. Examples of riparian buffer ordinances are provided in Appendix E.

B. Riparian Buffer Restoration – Assessment of Needs

Not only should we protect existing riparian buffers, but we should also strive to restore buffers wherever possible. Currently no detailed assessment exists that inventories the status of riparian buffers. However, a cursory review of riparian buffers can be achieved using aerial photography (Figure 5.2-3). This cursory review will only provide a snapshot about the width and possible composition of the riparian area. Unfortunately it will not give detailed information about slope, detailed species composition, quality, etc.

It is recommended that a cursory review of riparian buffers be conducted using aerial photography with limited ground confirmation. This effort can be combined with identification of stream instability issues described below.

C. Stream Restoration – Natural Channel Design

The York and Adams County Conewago Creek Watershed Assessments identified stream instability as a major source of sediment and nutrients entering the

watershed and ultimately the Chesapeake Bay. Unstable streams will eventually find a stable state on their own, but not in the near future. Before becoming stable, lateral migration, down valley meander migration, head cuts, loss of sinuosity, and over widening of the channel will contribute thousands of tons of sediment to the Chesapeake Bay.

Figure 5.2-3: Aerial photo of stream and riparian buffers in Red Run West sub-watershed, Reading Township.

In today's climate, streams cannot achieve and maintain stability without human intervention even though it's human intervention which caused the instability. We've discussed the benefits of buffers in section 5.2-A above, however, buffers only maintain stable streams. Unstable streams compromise not only themselves, but riparian buffers as well.

In the past stream stability was achieved through the extensive use of hard engineering techniques such as concrete walls, gabion baskets, and concentrated flow in culverts and concrete swales. We now know that with the best of intentions, our previous efforts and approaches to stream stability don't work. Concrete walls are undermined and fall into the channel, gabions can't withstand repeated storm events, and concrete swales degrade over time, destroy aquatic habitat, and create a dangerous area close to populated areas.

New techniques to achieve stream stability have been used successfully and are more natural in appearance and function. These techniques are referred to as Natural Channel Design, Stream Restoration, or Natural Stream Stabilization. All three terms, and others, are used to describe the same basic idea of using natural features (boulders, rocks, logs, root wads, etc.) and natural stream dimensions (correct size and shape for the watershed) to achieve stream stability. Streams are

dynamic systems that are always in a slow state of transition. When this transition is too fast, instability occurs without an end in sight. Natural channel design attempts to restore and stabilize degraded and unstable streams with natural techniques that allow a slow state of transition. If done correctly it is difficult to distinguish between a restored stream using natural channel design and a naturally stable stream.

Approximately 5-10 years ago funding was available to assess watersheds to identify all the stream reaches and label which ones were stable, and which ones were not. This was a very time consuming and expensive approach to the identification of stream reach stability which worked very well. Funding for this level of detail is no longer available. Unfortunately it is nearly impossible to develop a map of the unstable reaches and develop a priority list of streams to be restored.

Stream restoration is very expensive compared to the cost of maintaining healthy streams with buffers and fencing livestock out of the channels. However, as discussed, buffers and fencing won't stabilize unstable streams. Stream restoration is necessary to reduce pollution and sediments being contributed by the Conewago Watershed to the Chesapeake Bay.

Aerial photography, while not always accurate, can provide a snapshot of what might be on the ground. Combined with limited field visits, it is possible to obtain a general assessment of stream and riparian buffer stability. It is recommended that a cursory stream stability and riparian buffer assessment be conducted using aerial photography. Depending on the level of detail required, the cost for performing this work is estimated at $10,000 – $25,000. This would only be a cursory view of existing conditions and would likely not provide a detailed data set that might be used to determine amount of sediment erosion, bank heights, and other variables.

Legacy Sediments

To fully understand the extent of stream instability problems throughout the watershed, it is important to map and identify the locations of possible presence of Legacy Sediments. To accomplish this task, locations of historic mill dams should be mapped and incorporated into either an update to the Conewago Creek WCP or a separate stream stability assessment for the Conewago Creek Watershed. Ultimately this task would be combined with the stream stability assessment described above for a comprehensive look at stream stability within the Conewago Watershed. This also can be done with research, aerial photography and limited site visits. It is estimated that adding this task would increase the cost approximately $5,000 - $7,000.

D. Lake Improvements

According to the Aqua Link, Inc study of Lake Meade, 2006, they suggested recommendations for both in-lake practices and BMPs for the Lake Meade Sub-watershed. Brief summaries of the recommendations are addressed below. For more detail regarding the plan, please reference the Aqua Link, Inc.'s Lake Meade Phase I Diagnostic-Feasibility Study, November 15, 2006.

1. In-Lake Management Practices

Aeration- Aeration is the process in which air is deliberately introduced into the lake water. There are two types of applicable methods of aeration for Lake Meade. They are methods that destratify the lake water column thereby providing for complete recirculation of the entire land and methods that only aerate the hypolimnion (deep water area) without destratification.

Phosphorus Inactivation- Phosphorous inactivation is a lake restoration that initially removes phosphorus from the water column and then retards the release of phosphorus via in-lake sediments. When added to a lake, certain salts will form precipitates that settle on the lake bottom. If enough materials are added, a layer of this floc may blanket lake sediment and bind with the phosphorus released by this sediment.

Algaecides- Algaecides are chemicals applied to lakes to control excessive algal growth by affecting the individual organism's ability to photosynthesize. This is an effective and inexpensive method for controlling excessive algae growth. However the copper in the copper sulfate algaecides has been shown to be toxic to certain fish species and must be applied by a PA licensed commercial applicator with a proper permit. Also algae growth can begin again after just days of treatment. Therefore this method is a potentially questionable short-term method for treating excessive algae growth.

Herbicides- This plan offers four methods of control for controlling nuisance levels of aquatic vegetation. These methods include: physical, biological, chemical, and habitat manipulation. Of these methods, Aquatic Link suggests that the most applicable lake management technique is aquatic herbicides. These herbicides are capable of killing the entire plant, the entire plant except for the roots, or only selective plants depending on which type is used. However like the algaecide, herbicide must be applied by a PA licensed commercial applicator with a proper permit.

2. Lake Watershed Best Management Practices (BMPs)

This section will not go into great detail since it has been discussed in the Lake Meade Study. The recommendations for BMPs for Lake Meade

include bank stabilization and protection, riparian buffers, and stormwater retrofits.

Aqua Links also reports on the importance of conservation and nutrient management plans, land acquisition and protection, adopting ordinances for protecting water quality, establishing lower phosphorus limits for point sources, performing stream and riparian assessments, environmental education and lake and stream water quality monitoring.

E. Agricultural BMP's

Agriculture plays a major role in the Conewago Creek Watershed's economy and land use patterns. Pollutants from the watershed's farmlands can have a major impact upon the watershed's water resources. As a result, it is important that farms throughout the watershed incorporate agricultural BMP's into conservation plans that preserve the economic productivity of farms, as well as preserve the quality of water resources. As was discussed there are several problems relating to water quantity and quality throughout the watershed. Preserving farmland and incorporating some of the techniques described below will play an important part in restoring the quantity and quality of the water resources within the Conewago Watershed.

The following are some agricultural best management practices from the Pennsylvania Conservation Partnership publication "A Conservation Catalog Practices for the Conservation of Pennsylvania's Natural Resources."

Contour Farming

Contour farming is the practice of farming around hills or slopes near to the contour of the land to reduce soil erosion. This is already a widely used practice throughout the watershed.

Contour Stripcropping

This BMP incorporates contour farming with the practice of alternating narrow strips of different crops on the contour of the land to again, reduce soil erosion. This practice is also widely used throughout the watershed.

Conservation Buffers

Conservation buffers utilize areas of land maintained in permanent vegetation that help control pollutants from runoff as well as improving wildlife habitat. Various types of conservation buffers include contour buffer strips, filter strips, field borders, and riparian forest buffers.

Crop Residue Management

This is the practice whereby crop residue (parts of the crop not harvested, such as corn stalks) is incorporated into a conservation plan to help protect soil surfaces. The crop residue remains on the soil surface and is not plowed under during the next sowing season. Soil erosion is reduced at the same time soil quality is enhanced due to retained soil moisture and increased organic matter.

Grassed Waterway

A grassed waterway is a natural or constructed swale that directs and controls concentrated runoff from agricultural fields. A grassed waterway can slow runoff and prevent excess soil erosion by directing runoff away from fields.

No Till

No-till refers to planting crops into a narrow slot or opening in the soil created by coulter, row openers, or other devices for the purpose of inserting seed or transplants at the time of planting. This practice can greatly reduce erosion and sedimentation through minimizing disturbance of the soil surface and leaving crop residue on the surface.

Nutrient Management

Nutrient management plans establish methods for applying farm produced nutrient sources to agricultural lands in order to maximize crop production while minimizing water pollution. Such plans often include structural best management practices to control barnyard runoff while collecting manure in properly designed manure storage facilities. A manure storage facility can prevent contamination of clean water while allowing farmers to maximize the application process to farm fields.

Terraces and Diversions

Terraces and diversions are channels that are constructed across slopes and are designed to transform long sloped areas into a series of shorter slopes. These practices slow runoff rates and direct flow from slopes in a non-erosive manner. Terraces are designed so crops can be planted on them. Diversions are built to be permanently vegetated on steeper slopes.

Additional information on the above listed agricultural BMPs can be obtained by calling the Natural Resource Conservation Service, United States Department of Agriculture.

5.3 Resource Protection

Other unique resources are located throughout the Conewago Watershed ranging from prime habitat for threatened and endangered species to unique geologic features to wetlands to scenic vistas. Unlike other features which are protected through various Federal, State, and local resource agencies, these features are unprotected from impacts due to development, deforestation, and other changing land uses. While threatened and endangered species are protected, their habitat is not. Wetlands are regulated, but not permanently protected. This section attempts to identify these unique resources and find solutions to protect, preserve, and restore them.

A. Wetland and Floodplain Preservation

In section 3.2-E we discussed the importance of wetlands and floodplains to a watersheds health. Unfortunately, these resources remain unprotected from development and changing land uses. Wetlands in Pennsylvania are regulated by the Pennsylvania Department of Environmental Protection and the U.S. Army Corps of Engineers such that they may not be impacted without first obtaining a permit. However, it is possible to obtain permits to install bridges, culverts, homes, etc. in wetlands. Depending on the size of impact, mitigation of those impacts is likely required. Mitigation has several different forms from donating money to a wetland bank, to reducing impacts through design changes, to creating wetlands were they previously did not exist. None of these mitigation measures can replace the benefits of natural wetlands. Often the functions and values of mitigated wetland impacts are permanently lost. Therefore permanent protection of these resources is required for long term watershed sustainability.

Municipalities should adopt a wetland (and floodplain) overlay zone that permanently protects such resources. Examples of wetland protection ordinances are provided in Appendix C. No construction or impacts are permitted within this zone. Because not all wetlands are mapped and the locations known, municipalities should incorporate the requirement that all subdivision and land development plans provide a delineation of wetlands. It is important to understand that the delineation of wetlands involves scientific research and field investigations to determine the site conditions that may, or may not, qualify an area as wetlands. Therefore, all wetland studies should be performed by a qualified wetland scientist. Persons deemed qualified are to have at a minimum a bachelor's degree in biology, botany, zoology, ecology, or environmental sciences. In general, other professionals, such as engineers, landscape architects, surveyors, planners, and geologists are not considered qualified until they can provide proof of specialized training and experience beyond their discipline. An example of an ordinance with a wetlands section, provided by East Caln Township, is provided in Appendix B.

Additionally, all wetlands should be surveyed and mapped with the mapping submitted to the respective County Planning Commission for inclusion in the Watershed Toolbox. As we have discussed, the existing mapping for the watershed's wetlands is inaccurate and does not depict all of the wetlands within the watershed. By requiring all of the wetlands to be identified, surveyed and mapped, we can then begin to build an accurate inventory of wetlands within the watershed. This is needed to update known wetlands on the NWI maps as discussed in Section 3.2-E. Figure 3.2-3 shows the locations of the wetlands and floodplains.

B. Natural Resource Zone

The Conewago Watershed is home to a wide variety of other natural features including habitat for rare and endangered species of birds, mammals, reptiles, insects, and plants. The watershed also has other unique features such as the horse farms of the Hanover area, the Adams County Fruitbelt, the Conewago Narrows above Arendtsville, unique geologic features, locations of National, State, local, and historic significance.

As various data was collected and assessed, it became evident that there are particular areas within the watershed that exhibit a greater combination of unique attributes than other areas. To identify these areas, various maps were combined and laid on top of each other. Figure 5.3-1 is a Prime Habitat Map that shows the locations of habitat for Threatened and Endangered Species and Species of Concern. Please note that this map does not depict the actual location of the species, merely the suitable habitat necessary for that species. This map was combined with the Unique Features Map (Figure 2.7-1), Agricultural Preservation Map (Figure 3.1-1), Natural Resources Map (Figure 3.1-2), Water Resources Map (Figure 3.2-3), Resources Map (Figure 3.4-1), Historic Resources Map (Figure 3.4-2), and other known features and sites to create a map which identifies areas where multiple resources reside in the same location (intersects). Figure 5.3-2 Critical Area Map shows locations of these unique areas.

These key areas are categorized for the purposes of the RCP as "Area of Concern", "Critical Area", and "Super-Critical Area". An Area of Concern is defined as an area in which two (2) or more features (as listed above) occupy the same geographic location. A Critical Area is defined as an area in which three (3) to four (4) features occupy the same geographic location and a Super Critical Area is defined as an area in which four (4) or more features occupy the same geographic location.

The Areas of Concern, Critical Areas, and Super-Critical Areas are distributed throughout the watershed and in most cases closely follow stream corridors. There are individual locations as well as smaller clusters of Areas of Concern and Critical Areas within the central, eastern and southern portion of the watershed. The largest concentration of these designated key areas is located in the northwest

portion of the watershed, extending into the northern section. This area corresponds to the area with the greatest concentration of forest cover, highest amount of State Forest, highest concentration of sensitive species, and highest concentration of high quality streams. The northwestern and northern portion of the watershed also contains the areas designated as Super-Critical Areas. The largest Super-Critical Areas are located in and northwest of Arendtsville, east of Biglerville, east of Gun Club Road in Huntington township, west of Baltimore Road in Franklin township, and southwest of Rosstown Road in Warrington township.

See Figure 5.3-1 Prime Habitat Map

See Figure 5.3-2 Agricultural Preservation Map

It is vital that the general protection and conservation recommendations provided in this section be extended to the areas identified as Areas of Concern, Critical Areas, and Super-Critical Areas. These areas are the best natural resource areas and need to be afforded the maximum protection for the overall health of the watershed.

One way to protect these areas is through preservation of open space and agricultural land. As was previously discussed, both Adams and York Counties have programs available to landowners to provide financial reimbursement in exchange for placing their land in conservation programs or easements.

C. Land Use and Zoning – Other Forms of Preservation

As has been discussed in this document, current land use and zoning practices while common, do not necessarily make an attempt to preserve the watershed and it's resources. Many of the features of a watershed that appeal to so many of its residents are not protected. The following is an abbreviated list of techniques that can be used to preserve open space, agricultural land, and unique features at the municipal level.

Alternative Development Designs

Many existing ordinances, whether they involve stormwater management, subdivision/land development, or zoning are restrictive to alternate designs, especially with regard to new development. Most ordinances have a specific set of requirements for how developments should be designed. Such regulations include a number of criteria from how wide the streets are to be, to requiring curbs, and, in some instances, may not permit alternate land use practices such as low impact or cluster developments. Municipalities should be concerned with protection of environmental resources and in particular, water. Therefore, ordinances should protect environmental resources and, where appropriate, allow options for alternate designs. Such designs may involve streets of reduce widths, and cluster developments or development designs preserving open space in addition to more standard land development design.

See Figure 5.3-3 High Priority Parcels for Conservation

Cluster Development – This technique provides design flexibility to permit the concentration of development on smaller lot sizes with lesser setbacks in the least sensitive areas of a parcel. This permits the remaining area of the site to be integrated as open space and preserves the environmentally sensitive areas such as steep slopes, woodlands, wetlands, floodplains, natural areas, and prime agricultural lands.

Comprehensive Plan – A comprehensive plan is a community's guide for future growth and development. The plan creates a blueprint for future land use patterns and provides an opportunity for a municipality to balance environmental needs with local economic needs.

Low Impact Development – Low impact development minimizes site alteration by utilizing multiple small scale structural BMPs uniformly distributed throughout a development in order to mimic the natural hydrology of the site and reduce the impacts of development.

Overlay Zoning – This technique involves the establishment of a special purpose zoning district that is superimposed over an existing zoning district or districts. The overlay zone provides additional standards for a particular area based on special conditions such as environmentally sensitive factors. Examples include floodplain overlay districts, steep slope overlay districts, natural resource overlay districts, and wellhead protection overlay districts.

Stormwater Ordinance – A stormwater ordinance is a planning tool used to establish standards by which to manage stormwater runoff resulting from land development.

Subdivision and Land Development Ordinance – A subdivision and land development ordinance is a tool used to implement a comprehensive plan. It sets forth provisions regulating the layout and design for the subdivision and development of land in a community.

Zoning Ordinance – A zoning ordinance is a tool which divides all land in a municipality into zones or districts and thereby regulates the use of the land, location of development, and the density of development.

Watershed Based Planning – This type of planning is based on watershed boundaries, not municipal boundaries. Developmental impacts occur in watersheds whose boundaries do not necessarily match municipal boundaries. Therefore, problems with these effects are best resolved on a watershed level as opposed to a municipal level.

5.4 Cultural and Recreational Resource Needs

By far the largest cultural need within the Conewago Creek Watershed is education. Key to homeowner compliance and public "buy-in" for preserving and managing a watershed is educating the public about the watershed, raising awareness, and instilling in the public a sense of value for the watershed. Currently there are few watershed groups that have begun watershed education programs. There is a lack of concerted efforts to educate the public from watershed groups. One way to educate the public is through an interpretive stream watershed signage program at trailheads, stream crossings, and at stream access points. It is important for municipalities to incorporate a watershed education campaign into their municipal planning objectives. Such a program has far reaching affects and will benefit the entire watershed.

Although there appear to be many opportunities for recreation within the watershed, the existing facilities may not suffice when considering the growth and redistribution of the population within the watershed and study area. There is a significant lack of access to streams and waterways. Based on correspondence with the Conewago Canoe Club and other organizations, parking is extremely limited and as a result residents are forced to park illegally if they wish to utilize the creek for canoeing, kayaking and fishing.

Approximately 24 locations have been identified throughout the watershed as potential access points or parks that would allow access to creeks and streams. A majority of these points are located on the main stem from around Arendtsville to the far eastern border of the watershed. Although these locations are indicated with a point on the corresponding map (Figure 5.4-1), they could be linear in nature to allow additional legal access for fishing, boating, etc. In addition, each location could be expanded into a park for additional recreational opportunities.

In general, trails, pedestrian, cycling, or otherwise, are valuable recreational facilities that serve to not only provide recreational opportunities, but also as a measure of preserving valuable watershed resources both through the preservation of riparian areas and as educational tools about streams, wetlands, wildlife and other watershed resources. This plan supports such trails as recreational, preservation, and educational facilities throughout the watershed. In some instances, access points along a stream can be combined with other projects such as a rail trail. This would create a larger project which may make it easier to identify project partners and receive funding.

The Conewago Creek offers canoeists and kayakers unique opportunities for boating. However, between the lack of access points and several dams the Conewago Creek Watershed, very few boaters are utilizing this aspect of the

See 5.4-1 Recreational Recommendations Potential Access/Park Locations

Conewago. Abandoned dams which impede flow and cause safety hazards should be removed. Specifically, there are nine dams on the main stem of the Conewago Creek. Two of these dams occur upstream and downstream of East Berlin Borough. Both of these dams were milldams and are not used for flood capacity or source water. There are other natural alternatives, rock structures such as cross-veins, j-hooks, and "w"-weirs, which can allow safe passage of boaters and dam enough water to maintain recreational usage if this is a concern. Efforts should be made to remove the dams and restore the area to a more natural environment that reestablishes flow through the Borough of East Berlin.

In addition to recreational needs within the watershed, there are also possibilities for cultural needs in the form of historic renovation and re-use. The watershed is host to a number of historic resources, both architectural and archaeological sites. Steps should be made to preserve archaeological sites and impacts to these resources should be avoided.

Development greatly affects a watershed's health. To developers, it appears to be much more advantageous to develop vacant land than it is to renovate or demolish, and subsequently rebuild, existing buildings. Re-development of abandoned commercial, industrial, and to some extent residential buildings has many benefits to a community and a watershed.

5.5 Build Municipal Partnerships with Watershed Groups and Non-Profit Organizations

There are several watershed organizations and other non-profit groups throughout the watershed which are routinely involved with the restoration, preservation or conservation of watershed resources. The municipalities in the watershed should build working partnerships with these and other groups to form stronger alliances which will help the municipalities achieve some of their goals.

These watershed groups have strong networks of volunteers which they can pull together for various projects ranging from streambank planting days to watershed cleanup days. These groups also have experience preparing grants and as a result can help municipalities write and apply for various grants to do various projects ranging from park development to stream restoration and habitat enhancement.

5.6 Formation of Municipal Environmental Advisory Councils (EACs)

An Environmental Advisory Council is a group of 3-7 community residents, appointed by local elected officials that advise elected officials on the protection, conservation, management, promotion and use of natural resources within its territorial limits. EAC members devote time and energy to assist elected and appointed officials in protecting the environment. EACs **do not regulate**, they advise. They can act on a municipal or multi-municipal level. Municipalities are

authorized to establish EACs through Act 177 of 1996, originally Act 148 of 1973.

Through the legislature, Pennsylvania has chosen to delegate much of its power to regulate land to the local government. As a result, the Commonwealth of Pennsylvania has 2,572 local governing bodies. The decisions these governing bodies make on a variety of issues, from land use designations to stream corridor protection, have direct impacts on natural resources within individual municipalities and beyond. EACs, as part of local government, work directly with municipal officials to help them make environmentally sound decisions and protect the health and quality of life of our communities. For additional information on EACs, including how to form an EAC and an EACs responsibility, please contact the Pennsylvania Environmental Council at 717-230-8044 or via the internet at www.eacnetwork.org.

5.7 Conewago Creek RCP and Conewago Creek Watershed Toolbox

The Conewago Creek River Conservation Plan and Conewago Creek Watershed Toolbox were developed as a tool for municipalities to use to make better land and watershed use decisions. As such, this tool should be referenced on a regular basis for information relating to specific issues within each sub-watershed and municipality. The Conewago Creek Watershed Toolbox (CCWT) is a municipality's tool and has been developed to eliminate the need for referencing this document. All of the information contained within this document is included in the CCWT in a PDF format document for reference purposes. The municipalities are strongly encouraged to use this tool as it was intended, to keep track of projects and developments, to aid developers in making sound land use decisions, and to plan and implement projects identified as a priority.

SECTION 6.0 – Sub-Watershed Detailed Analysis

(This section is incomplete and will be updated for the next submittal.)

The study area of the Conewago Creek Watershed was divided into sub-watersheds based on data received from PASDA and the Pennsylvania Department of Environmental Protection. Some of the sub-watersheds had to be unofficially named in order for the Conewago Creek Watershed Toolbox (CCWT) to distinguish one from the other. Table 6.1 below lists (alphabetically) the sub-watersheds studied in more detail and their designated use(s).

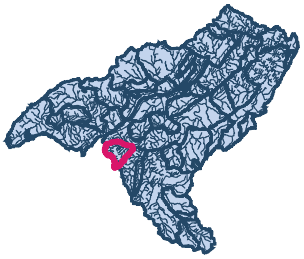
Table 6.1: Sub-watersheds studied in more detail and their designated use(s).

Sub-Watershed Name	Chapter 93 Designation
1. Beaverdam Creek	WWF
2. Bennett Run	WWF
3. Bermudian Creek North	WWF
4. Bermudian Creek South	WWF
5. Brush Run	WWF
6. CCW-Plum Run	WWF
7. Conewago Creek	WWF
8. Conewago Creek West	**HQF/CWF/WWF**
9. Conewago Creek East	WWF
10. Davidsburg Run	WWF
11. Doe Run	WWF
12. Fox Run	**TSF**
13. Gardner Run	WWF
14. Honey Run	**TSF**
15. Indian Run	WWF
16. Latimore Creek North	WWF
17. Latimore Creek South	WWF
18. Laurel Run	WWF
19. Lippencot Spring Creek	**HQF**
20. Little Conewago Creek North	**TSF**
21. Little Conewago Creek South	**TSF**
22. Long Arm Creek	WWF
23. Markel Creek	WWF
24. Mud Run	WWF
25. Musser Run	WWF
26. North Branch Beaver Creek	WWF
27. North Branch Bermudian Creek	WWF
28. Opossum Creek	**TSF**
29. Pine Run	WWF
30. Pleasant Dale Creek	WWF
31. Plum Creek	WWF
32. Quaker Run	**TSF**
33. Red Run East	WWF
34. Red Run West	WWF
35. SBC-Moulston	WWF
36. Sharps Run	**HQF**
37. South Branch Beaver Creek	WWF
38. South Branch Conewago Creek	WWF

39. Stony Run	WWF
40. Swift Run	WWF
41. Wolf Run	WWF

WWF – Warm Water Fishes
CWF – Cold Water Fishes
HQ CWF – High Quality Cold Water Fishes
TSF – Trout Stocked Fishery

Included in each of the following sub-watershed sections is a printed report from the Conewago Creek Watershed Toolbox. Included in those reports are data specific to each sub-watershed. A brief discussion of those reports with recommended projects or changes to land use and zoning are included after the printed reports.



REPORT FOR THE BEAVERDAM CREEK WATERSHED

GENERAL INFORMATION
Total Area of SubWatershed: 4617.08 acres
Total Stream Length = 24.22 miles
Total Road Length = 26.35 miles
Total Wetland Area = 106.27 acres
Total Public Land Area: 0 acres
Total Floodplain Area: 295.74 acres
Total Acres Hydric Soils: 1189.53 acres
Total Acres Hydric Inclusion: 2230.65 acres
Total Area of Soils Suitable for Infiltration: 1450.07 acres

LANDUSE
Coniferous Forest: 36.78 acres
Deciduous Forest: 382.32 acres
Emergent Wetland: 12.05 acres
Hay Pasture: 778.82 acres
High Density Urban: 0.22 acres
Low Density Urban: 64.4 acres
Mixed Forest: 278.38 acres
Open Water: 38.82 acres
Row Crops: 2734.58 acres
Transitional: 223.59 acres
Woody Wetland: 66.94 acres

GENERALIZED ZONING
Commercial: 499.99 acres
Employment Center: 88.62 acres
Residential: 4028.48 acres

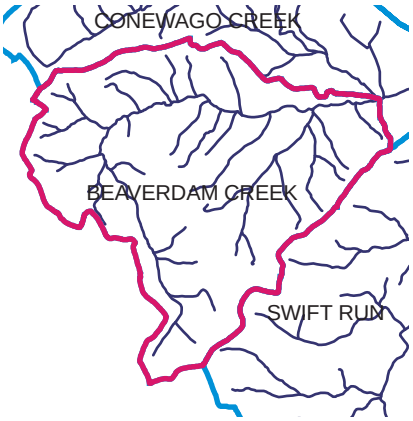
OTHER INFORMATION
Total Impervious Surface Area (2000): 45.1 acres
Total Number of Assessment Sites: 4
Total Area 'Natural Areas': 0 acres
Total Miles 303d List Streams: 0 miles
Total Area 303d List Water Bodies: 0 acres
Number of CREP Sites: 1
Total Preserved Agricultural Land: 321.32 acres
Total Area of Historic Districts: 0 acres
Total Area of Concern: 2200.01 acres
Total Critical Area: 110.46 acres

Total Super-Critical Area: 0 acres

Municipalities in this Watershed:
STRABAN,

GENERAL RECOMMENDATIONS FOR THIS WATERSHED:

1. Creation of Wetland Protection Ordinance
2. Preservation of Red Bridge Farming District in Straban Township
3. Restoration Due to Poor Water Quality - Sediments and Nutrients
4. Infiltration Requirements in Stormwater Management Ordinance
5. Formation of EAC for Straban Township
6. Forest and Tree Conservation Ordinance for Water Challenged Area
7. Riparian Buffer Ordinance
8.
9.
10.



1. Beaverdam Creek Watershed

Beaverdam Creek Watershed is located in the western portion of the Conewago Creek Watershed entirely in Straban Township.

Municipalities: Straban Township

I Issues and Concerns:

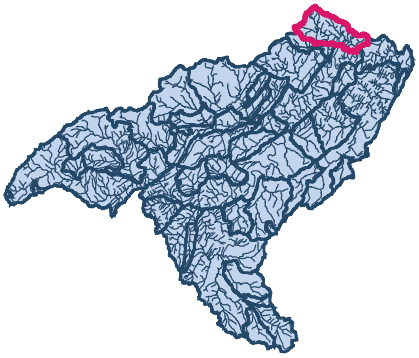
There are 4 assessment sites located within the Beaverdam sub-watershed ranging from suboptimal to poor. Almost half the land area within the watershed is an Area of Concern and Critical Area.

II. Recommendations

Creation of Wetland Protection Ordinance
Preservation of Red Bridge Farming District in Straban Township
Restoration Due to Poor Water Quality - Sediments and Nutrients
Infiltration Requirements in Stormwater Management Ordinance
Formation of EAC for Straban Township
Forest and Tree Conservation Ordinance for Water Challenged Area
Riparian Buffer Ordinance

Photo 1-A: Beaverdam Creek Upstream from Red Bridge Road

Photo 1-B: Beaverdam Creek Downstream from Red Bridge Road



REPORT FOR THE BENNETT RUN WATERSHED

GENERAL INFORMATION
Total Area of SubWatershed: 9166.54 acres
Total Stream Length = 37.29 miles
Total Road Length = 78.76 miles
Total Wetland Area = 148.4 acres
Total Public Land Area: 7.51 acres
Total Floodplain Area: 249.88 acres
Total Acres Hydric Soils: 649.41 acres
Total Acres Hydric Inclusion: 1307.94 acres
Total Area of Soils Suitable for Infiltration: 6941.49 acres

LANDUSE
Coniferous Forest: 130.97 acres
Deciduous Forest: 3470.12 acres
Emergent Wetland: 29.23 acres
Hay Pasture: 1158.67 acres
Low Density Urban: 200.04 acres
Mixed Forest: 351.6 acres
Open Water: 52.55 acres
Row Crops: 3681.93 acres
Transitional: 84.3 acres
Woody Wetland: 7.37 acres

GENERALIZED ZONING
Agriculture: 2302.69 acres
Commercial: 95.21 acres
Conservation/Open Space: 299.71 acres
Industrial: 297.06 acres
Residential: 6144.28 acres
Village Center: 27.48 acres

OTHER INFORMATION
Total Impervious Surface Area (2000): 106.03 acres
Total Number of Assessment Sites: 1
Total Area 'Natural Areas': 0 acres
Total Miles 303d List Streams: 1.35 miles
Total Area 303d List Water Bodies: 0 acres
Number of CREP Sites: 13
Total Preserved Agricultural Land: 549.61 acres
Total Area of Historic Districts: 19.56 acres
Total Area of Concern: 466.85 acres
Total Critical Area: 229.58 acres

Total Super-Critical Area: 0 acres

Municipalities in this Watershed:
LEWISBERRY,
NEWBERRY,
FAIRVIEW,

GENERAL RECOMMENDATIONS FOR THIS WATERSHED:

1. Restoration of Degraded Stream Reaches - 303d listed
2. Riparian Buffer Ordinance
3. Wetland Preservation Ordinance
4. Preserve Priority Parcels
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10.

2. Bennett Run Watershed

Bennett Run Sub-watershed is located in the extreme northeastern corner of the Conewago Watershed entirely in York County. It is largely a rural agricultural and forested area but does contain the village of Lewisberry. Land use within the watershed is almost an even mix of agriculture and forested. Development is primarily rural residential an not large lot subdivision.

Municipalities: Lewisberry, Newberry Township, Fairview Township

I. Issues and Concerns

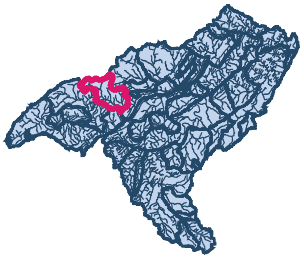
Approximately 1.5 miles of stream within the watershed are listed on the 303d list of impaired streams.

II. Recommendations

Restoration of Degraded Stream Reaches - 303d listed
Riparian Buffer Ordinance
Wetland Preservation Ordinance
Preserve Priority Parcels

Photo 2-A: Bennett Run upstream from Sheep Bridge Road

Photo 2-B: Bennett Run downstream from Sheep Bridge Road



REPORT FOR THE BERMUDIAN CREEK NORTH WATERSHED

GENERAL INFORMATION
Total Area of SubWatershed: 9512.21 acres
Total Stream Length = 29.38 miles
Total Road Length = 52.73 miles
Total Wetland Area = 272.85 acres
Total Public Land Area: 459.54 acres
Total Floodplain Area: 526.23 acres
Total Acres Hydric Soils: 1086.3 acres
Total Acres Hydric Inclusion: 2472.42 acres
Total Area of Soils Suitable for Infiltration: 7004.29 acres

LANDUSE
Coniferous Forest: 98.02 acres
Deciduous Forest: 1253.86 acres
Emergent Wetland: 21.61 acres
Hay Pasture: 2508.89 acres
High Density Urban: 1.33 acres
Low Density Urban: 96.41 acres
Mixed Forest: 527.06 acres
Open Water: 57.83 acres
Row Crops: 4406.97 acres
Transitional: 349 acres
Woody Wetland: 191.2 acres

GENERALIZED ZONING
Commercial/Industrial: 4.32 acres
Conservation/Open Space: 8389.93 acres
Industrial: 156 acres
Residential: 910.14 acres
Village: 8.59 acres

OTHER INFORMATION
Total Impervious Surface Area (2000): 61.17 acres
Total Number of Assessment Sites: 0
Total Area 'Natural Areas': 0 acres
Total Miles 303d List Streams: 0 miles
Total Area 303d List Water Bodies: 0 acres
Number of CREP Sites: 0
Total Preserved Agricultural Land: 772.85 acres
Total Area of Historic Districts: 0 acres
Total Area of Concern: 5512.49 acres
Total Critical Area: 1897.73 acres

Total Super-Critical Area: 52.63 acres

Municipalities in this Watershed:
MENALLEN,
TYRONE,
DICKINSON,
HUNTINGTON,

GENERAL RECOMMENDATIONS FOR THIS WATERSHED:

1. Permanent Protection of Super Critical Areas
2. Forest and Tree Conservation Ordinance
3. Wetland Preservation Ordinance
4. Riparian Buffer Ordinance - Min. 150 ft Buffer
5. Preservation of Areas of Concern and Critical Areas
6. Preserve Priority Parcels
7. Riparian Buffer Assessment Funding
8. Formation of Joint Municipal EAC
9.
10.

3. Bermudian Creek North Watershed

Bermudian Creek North Sub-watershed is located along the northern boundary of the Conewago Creek Watershed as the base of South Mountain. The sub-watershed is primarily agriculture. There are incorporated towns, boroughs, or villages within the sub-watershed.

Municipalities: Menhallen Township, Tyrone Township, Dickinson Township, Huntington Township

I. Issues and Concerns

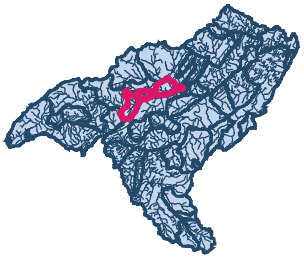
Almost the entire watershed is located in a Potentially Stressed Area and over half the land area is either an Area of Concern, Critical Area, or Super-Critical Area.

II. Recommendations

Permanent Protection of Super Critical Areas
Forest and Tree Conservation Ordinance
Wetland Preservation Ordinance
Riparian Buffer Ordinance - Min. 150 ft Buffer
Preservation of Areas of Concern and Critical Areas
Preserve Priority Parcels
Riparian Buffer Assessment Funding
Joint Municipal EAC

Photo 3-A: Bermudian Creek North upstream from Creek Road

Photo 3-B: Bermudian Creek North downstream from Creek Road



REPORT FOR THE BERMUDIAN CREEK SOUTH WATERSHED

GENERAL INFORMATION
Total Area of SubWatershed: 7373.75 acres
Total Stream Length = 24.84 miles
Total Road Length = 45.03 miles
Total Wetland Area = 485.72 acres
Total Public Land Area: 0 acres
Total Floodplain Area: 760.52 acres
Total Acres Hydric Soils: 1423.1 acres
Total Acres Hydric Inclusion: 3477.91 acres
Total Area of Soils Suitable for Infiltration: 2506.3 acres

LANDUSE
Coniferous Forest: 59.67 acres
Deciduous Forest: 481.87 acres
Emergent Wetland: 37.89 acres
Hay Pasture: 1460.21 acres
Low Density Urban: 34.09 acres
Mixed Forest: 376.56 acres
Open Water: 15.57 acres
Row Crops: 4296.86 acres
Transitional: 233.7 acres
Woody Wetland: 377.27 acres

GENERALIZED ZONING
Commercial: 0.34 acres
Commercial/Industrial: 715.42 acres
Conservation/Open Space: 5264.71 acres
Residential: 1280.76 acres
Unknown: 145.28 acres

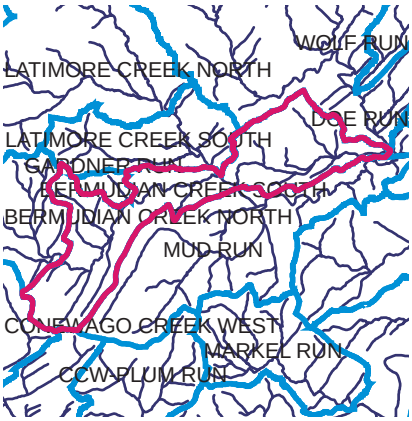
OTHER INFORMATION
Total Impervious Surface Area (2000): 19.27 acres
Total Number of Assessment Sites: 1
Total Area 'Natural Areas': 0 acres
Total Miles 303d List Streams: 0 miles
Total Area 303d List Water Bodies: 0 acres
Number of CREP Sites: 1
Total Preserved Agricultural Land: 544.15 acres
Total Area of Historic Districts: 0 acres
Total Area of Concern: 2393.29 acres
Total Critical Area: 536.24 acres

Total Super-Critical Area: 69.28 acres

GENERAL RECOMMENDATIONS FOR THIS WATERSHED:

1. Restoration of Degraded Stream Reaches to Repair "Sub Optimal" Ranking
2. Infiltration Requirements in Stormwater Management Ordinance
3. Forest and Tree Conservation Oridinance
4. Riparian Buffer Ordinance - Min. 100 ft Buffer
5. Permanent Protection of Super Critical Areas
6. Preserve Priority Parcels
7. Preservation of Areas of Concern and Critical Areas
8. Formation of Joint Municipal EAC
9.
10.

Municipalities in this Watershed:
TYRONE,
HUNTINGTON,
LATIMORE,
WASHINGTON,



4. Bermudian Creek South Watershed

Bermudian Creek South Watershed is located southeast of Bermudian Creek north. The watershed is primarily agriculture with very little forest cover.

Municipalities: Tyrone Township, Huntington Township, Latimore Township, Washington Township

I. Issues and Concerns

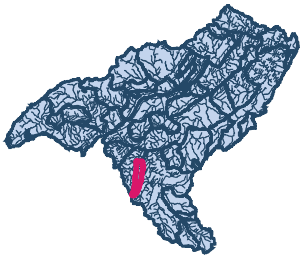
Almost half the watershed contains Areas of Concern, Critical Areas, and Super-Critical Areas.

II. Recommendations

Restoration of Degraded Stream Reaches to Repair "Sub Optimal" Ranking
Infiltration Requirements in Stormwater Management Ordinance
Forest and Tree Conservation Ordinance
Riparian Buffer Ordinance - Min. 100 ft Buffer
Permanent Protection of Super Critical Areas
Preserve Priority Parcels
Preservation of Areas of Concern and Critical Areas
Formation of Joint Municipal EAC

Photo 4-A: Bermudian Creek South upstream from Baltimore Pike

Photo 4-B: Bermudian Creek South downstream from Baltimore Pike



REPORT FOR THE BRUSH RUN WATERSHED

GENERAL INFORMATION
Total Area of SubWatershed: 2134.2 acres
Total Stream Length = 7.87 miles
Total Road Length = 10.4 miles
Total Wetland Area = 59.63 acres
Total Public Land Area: 0 acres
Total Floodplain Area: 108.9 acres
Total Acres Hydric Soils: 345.31 acres
Total Acres Hydric Inclusion: 1014.6 acres
Total Area of Soils Suitable for Infiltration: 1203.05 acres

LANDUSE
Coniferous Forest: 34.53 acres
Deciduous Forest: 117.82 acres
Emergent Wetland: 17.93 acres
Hay Pasture: 513.28 acres
Low Density Urban: 14.81 acres
Mixed Forest: 110.54 acres
Open Water: 5.01 acres
Row Crops: 1198.46 acres
Transitional: 88.33 acres
Woody Wetland: 33.38 acres

GENERALIZED ZONING
Commercial: 3.78 acres
Conservation/Open Space: 1694.73 acres
Employment Center: 63.35 acres
Residential: 371.21 acres

OTHER INFORMATION
Total Impervious Surface Area (2000): 8.14 acres
Total Number of Assessment Sites: 0
Total Area 'Natural Areas': 0 acres
Total Miles 303d List Streams: 0 miles
Total Area 303d List Water Bodies: 0 acres
Number of CREP Sites: 0
Total Preserved Agricultural Land: 29.85 acres
Total Area of Historic Districts: 91.13 acres
Total Area of Concern: 145.98 acres
Total Critical Area: 21.79 acres

Total Super-Critical Area: 0 acres

Municipalities in this Watershed:
MOUNT PLEASANT,
STRABAN,

GENERAL RECOMMENDATIONS FOR THIS WATERSHED:

1. Preserve Priority Parcels
2. Infiltration Requirements in Stormwater Management Ordinance
3. Riparian Buffer Ordinance - Min. 150 ft Buffer
4. Forest and Tree Conservation Ordinance
5. Protection of Storm Store/Stone Bridge Historic Area
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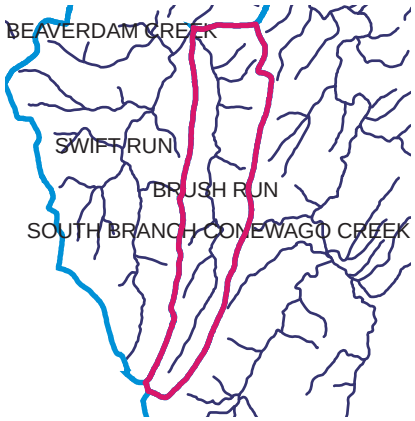


5. Brush Run Watershed

Brush Run Watershed is located in the southern portion of the Conewago Watershed almost entirely in Mount Pleasant Township. The watershed is largely rural with no major settlements. Land use is primarily agriculture.

Municipality: Mount Pleasant Township, Straban Township

I. Issues and Concerns

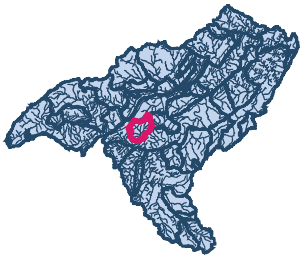
The watershed is located entirely in a Water Challenged Area. This watershed is in close proximity to the growing areas of Gettysburg and Hanover. During drier summer months the groundwater resources cannot sustain base flow.

II. Recommendations

Preserve Priority Parcels
Infiltration Requirements in Stormwater Management Ordinance
Riparian Buffer Ordinance - Min. 150 ft Buffer
Forest and Tree Conservation Ordinance
Protection of Storm Store/Stone Bridge Historic Area

Photo 5-A: Brush Run upstream from Brickcrafters Road

Photo 5-B: Brush Run downstream from Brickcrafters Road



REPORT FOR THE CCW-PLUM RUN WATERSHED

GENERAL INFORMATION
Total Area of SubWatershed: 3990.19 acres
Total Stream Length = 14.68 miles
Total Road Length = 15.27 miles
Total Wetland Area = 136.85 acres
Total Public Land Area: 0 acres
Total Floodplain Area: 387.21 acres
Total Acres Hydric Soils: 1199.16 acres
Total Acres Hydric Inclusion: 1684.43 acres
Total Area of Soils Suitable for Infiltration: 1576.93 acres

LANDUSE
Coniferous Forest: 23.89 acres
Deciduous Forest: 357.92 acres
Emergent Wetland: 29.86 acres
Hay Pasture: 886.1 acres
Low Density Urban: 10.89 acres
Mixed Forest: 192.37 acres
Open Water: 10.4 acres
Row Crops: 2221.93 acres
Transitional: 160.51 acres
Woody Wetland: 96.22 acres

GENERALIZED ZONING
Commercial/Industrial: 11.05 acres
Conservation/Open Space: 3919.06 acres
Residential: 68.9 acres

OTHER INFORMATION
Total Impervious Surface Area (2000): 4.61 acres
Total Number of Assessment Sites: 6
Total Area 'Natural Areas': 0.57 acres
Total Miles 303d List Streams: 0 miles
Total Area 303d List Water Bodies: 0 acres
Number of CREP Sites: 0
Total Preserved Agricultural Land: 25.1 acres
Total Area of Historic Districts: 0 acres
Total Area of Concern: 1256.86 acres
Total Critical Area: 74.8 acres

Total Super-Critical Area: 0 acres

Municipalities in this Watershed:
READING,
TYRONE,

GENERAL RECOMMENDATIONS FOR THIS WATERSHED:

1. Riparian Buffer Ordinance - 100 ft min.
2. Infiltration Requirement in Stormwater Management Ordiance for WCA
3. Preserve Priority Parcels
4. Restoration of Degraded Stream Reaches
5. Forest and Tree Conservation Ordiance
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6. CCW - Plum Run Watershed

The Conewago Creek West "Plum Run Watershed" is located in the central portion of the watershed in parts of Reading and Tyrone Townships. Largely agriculture, this subwatershed has a gentle relief which flows south to the main stem of the Conewago Creek. There are 6 assessment sites located in Plum Run Watershed.

Municipalities: Reading Township, Tyrone Township

I. Issues and Concerns

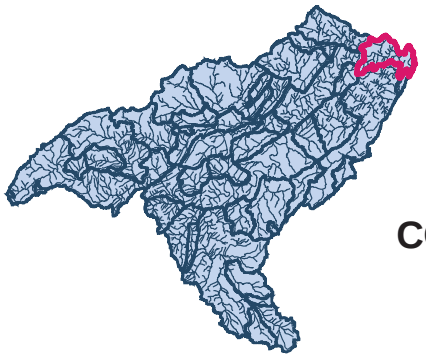
The assessment sites range from sub-optimal to poor and portions of the sub-watershed are located in a Water Challenged Area (WCA).

II. Recommendations

Riparian Buffer Ordinance - 100 ft min.
Infiltration Requirement in Stormwater
Management Ordiance for WCA
Preserve Priority Parcels
Restoration of Degraded Stream Reaches
Wetland Preservation Ordinance
Forest and Tree Conservation Ordiance

Photo 6-A: Plum Run upstream from Plum Road

Photo 6-B: Plum Run downstream from Plum Road



REPORT FOR THE CONEWOGO CREEK EAST WATERSHED

GENERAL INFORMATION
Total Area of SubWatershed: 7239.46 acres
Total Stream Length = 27.52 miles
Total Road Length = 77.75 miles
Total Wetland Area = 367.11 acres
Total Public Land Area: 73.14 acres
Total Floodplain Area: 724.45 acres
Total Acres Hydric Soils: 319.69 acres
Total Acres Hydric Inclusion: 1137.43 acres
Total Area of Soils Suitable for Infiltration: 5490.35 acres

LANDUSE
Coniferous Forest: 153.49 acres
Deciduous Forest: 3023.7 acres
Emergent Wetland: 37.32 acres
Hay Pasture: 694.36 acres
High Density Urban: 35.13 acres
Low Density Urban: 571.89 acres
Mixed Forest: 220.06 acres
Open Water: 200.43 acres
Row Crops: 2204.68 acres
Transitional: 91.99 acres
Woody Wetland: 6.56 acres

GENERALIZED ZONING
Agriculture: 2489.01 acres
Commercial: 14.19 acres
Conservation/Open Space: 2304.1 acres
Industrial: 322.2 acres
Residential: 2013.15 acres
Unknown: 194.26 acres

OTHER INFORMATION
Total Impervious Surface Area (2000): 309.72 acres
Total Number of Assessment Sites: 1
Total Area 'Natural Areas': 96.88 acres
Total Miles 303d List Streams: 7.32 miles
Total Area 303d List Water Bodies: 0 acres
Number of CREP Sites: 16
Total Preserved Agricultural Land: 774.88 acres
Total Area of Historic Districts: 0 acres
Total Area of Concern: 995.78 acres
Total Critical Area: 883.64 acres

Total Super-Critical Area: 55.45 acres

Municipalities in this Watershed:
EAST MANCHESTER,
CONEWAGO,
YORK HAVEN,
NEWBERRY,

GENERAL RECOMMENDATIONS FOR THIS WATERSHED:

1. Preserve Priority Parcels
2. Permanent Protection of Super Critical Areas
3. Installation of Access Points Nos. 1-4 on Bowers Bridge Road, ly Road, Hykes Mill/Hill-N-Dale Road, and Sipe Road
4. Formation of Joint Municipal EAC
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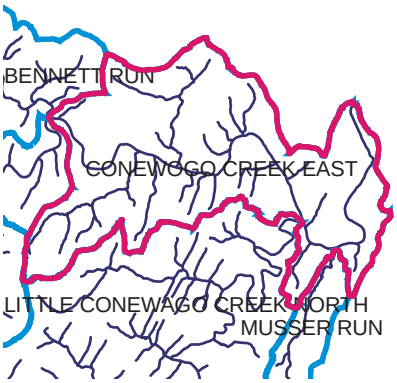


7. Conewago Creek "East" Watershed

The Conewago Creek East Watershed is located at the eastern boundary of the watershed from the mouth with the Susquehanna River. The watershed is a fairly even mix of forest and agriculture.

Municipalities: East Manchester Township, Conewago Township, York Haven Borough, Newberry Township

I. Issues and Concerns

The primary concern is the lack of public legal access to this area.

II. Recommendations

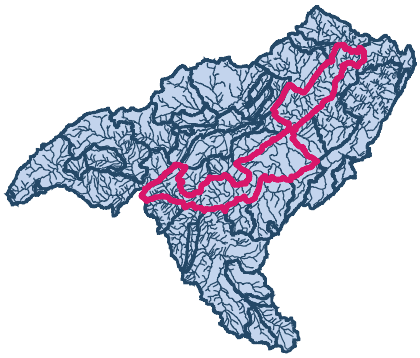
Preserve Priority Parcels
Permanent Protection of Super Critical Areas
Installation of Access Points Nos. 1-4 on Bowers Bridge Road, Cly Road, Hykes Mill/Hill-N-Dale Road, and Sipe Road
Formation of Joint Municpal EAC

Photo 7-A: Conewago Creek East downstream from George Street Bridge

Photo 7-B: Conewago Creek East upstream toward George Street Bridge from Creek Bottom Road

Photo 7-C: Conewago Creek upstream from Susquehanna Trail

Photo 7-D: Conewago Creek downstream from Susquehanna Trail



REPORT FOR THE CONEWAGO CREEK WATERSHED

GENERAL INFORMATION
Total Area of SubWatershed: 40819.27 acres
Total Stream Length = 145.17 miles
Total Road Length = 283.23 miles
Total Wetland Area = 1705.26 acres
Total Public Land Area: 96.63 acres
Total Floodplain Area: 4523.03 acres
Total Acres Hydric Soils: 5301.24 acres
Total Acres Hydric Inclusion: 13070.63 acres
Total Area of Soils Suitable for Infiltration: 26110.59 acres

LANDUSE
Coniferous Forest: 582.22 acres
Deciduous Forest: 8885.96 acres
Emergent Wetland: 126.85 acres
Hay Pasture: 7383.52 acres
High Density Urban: 121.19 acres
Low Density Urban: 307.93 acres
Mixed Forest: 1401.78 acres
Open Water: 1043.87 acres
Row Crops: 20119.57 acres
Transitional: 607.02 acres
Woody Wetland: 238.88 acres

GENERALIZED ZONING
Agriculture: 8681.43 acres
Commercial: 88.72 acres
Commercial/Industrial: 21.04 acres
Conservation/Open Space: 21728.92 acres
Employment Center: 94.3 acres
Industrial: 0.02 acres
Mixed Use: 189.19 acres
Residential: 8243.02 acres
Unknown: 841.98 acres
Village: 237.42 acres
Village Center: 672.71 acres

OTHER INFORMATION
Total Impervious Surface Area (2000): 282.86 acres
Total Number of Assessment Sites: 38
Total Area 'Natural Areas': 667.11 acres
Total Miles 303d List Streams: 0 miles
Total Area 303d List Water Bodies: 0 acres
Number of CREP Sites: 11
Total Preserved Agricultural Land: 4345.33 acres
Total Area of Historic Districts: 177.82 acres
Total Area of Concern: 2826.27 acres
Total Critical Area: 1678.86 acres

Total Super-Critical Area: 10.63 acres

GENERAL RECOMMENDATIONS FOR THIS WATERSHED:

1. Preserve Priority Parcels
2. Installation of Access Points Nos. 5-14
3. Wetland Preservation Ordinance
4. Riparian Buffer Ordinance - 100 ft min.
5. Preserve Natural Areas
6. Infiltration requirements in Stormwater Ordinance for WCAs and PSAs
7. Formation of Multi-Municipal EAC
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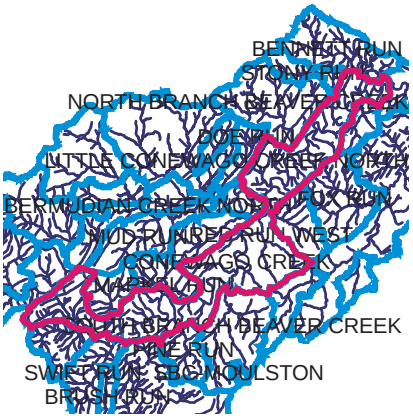
Municipalities in this Watershed:
HAMILTON,
MOUNT PLEASANT,
STRABAN,
EAST BERLIN,
JACKSON,
PARADISE,
BUTLER,
READING,
TYRONE,
HUNTINGTON,
WELLSVILLE,
WASHINGTON,
DOVER,
CONEWAGO,
WARRINGTON,
NEWBERRY,



8. Conewago Creek Watershed

The Conewago Creek Watershed is primarily the main stem of the Conewago Creek from the western boundary in Straban Township to almost the eastern boundary in Newberry Township. The watershed has a wide valley with gentle relief and is flanked on both sides by mountains.

Municipalities: Hamiliton Township, Mount Pleasant, Straban Township, East Berlin Borough, Jackson Township, Paradise Township, Butler Township, Reading Township, Tyrone Township, Huntington Township, Wellsville Borough, Washington Township, Dover Borough, Conewago Township, Warrington Township, Newberry Township

I. Issues and Concerns

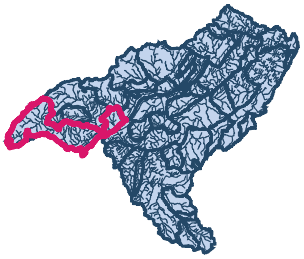
There are 38 assessment sites located within the sub-watershed which range from optimal to poor. However, a majority of the sites are either marginal or poor. The impacts appear to be related to landuse. Land use is primarily agriculture. Portions of the western part of the watershed are located in a Water Challenged Area. There is limited access to the creek which is suitable for parkland, boating, fishing and other activities.

II. Recommendations

Preserve Priority Parcels
Installation of Access Points Nos. 5-14
Wetland Preservation Ordinance
Riparian Buffer Ordinance - 100 ft min.
Preserve Natural Areas
Infiltration requirements in Stormwater Ordinance for WCAs and PSAs
Support East Berlin Community Park
Formation of Multi-Municipal EAC

Photo 8-A: Conewago Creek upstream from Route 234 in East Berlin

Photo 8-B: Conewago Creek downstream from Route 234 in East Berlin



REPORT FOR THE CONEWAGO CREEK WEST WATERSHED

GENERAL INFORMATION
Total Area of SubWatershed: 28489.08 acres
Total Stream Length = 103.26 miles
Total Road Length = 169.47 miles
Total Wetland Area = 685.57 acres
Total Public Land Area: 804.96 acres
Total Floodplain Area: 2503.61 acres
Total Acres Hydric Soils: 3769.02 acres
Total Acres Hydric Inclusion: 8170.76 acres
Total Area of Soils Suitable for Infiltration: 19169.57 acres

LANDUSE
Coniferous Forest: 832.02 acres
Deciduous Forest: 7311.58 acres
Emergent Wetland: 39.02 acres
Hay Pasture: 4378.84 acres
High Density Urban: 126.43 acres
Low Density Urban: 326.45 acres
Mixed Forest: 2970.87 acres
Open Water: 133.72 acres
Row Crops: 10784.59 acres
Transitional: 1067.34 acres
Woody Wetland: 517.54 acres

GENERALIZED ZONING
Agriculture: 5656.22 acres
Commercial: 276.29 acres
Commercial/Industrial: 15.63 acres
Conservation/Open Space: 17835.84 acres
Employment Center: 62 acres
Industrial: 117.94 acres
Residential: 3778.06 acres
Unknown: 938.21 acres
Village: 95.84 acres

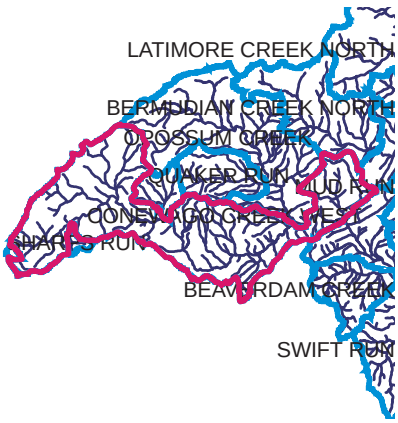
OTHER INFORMATION
Total Impervious Surface Area (2000): 339 acres
Total Number of Assessment Sites: 19
Total Area 'Natural Areas': 1645.49 acres
Total Miles 303d List Streams: 0 miles
Total Area 303d List Water Bodies: 0 acres
Number of CREP Sites: 7
Total Preserved Agricultural Land: 957.69 acres
Total Area of Historic Districts: 0 acres
Total Area of Concern: 13993.55 acres
Total Critical Area: 8191.93 acres

Total Super-Critical Area: 539.36 acres

Municipalities in this Watershed:
CUMBERLAND,
STRABAN,
ARENDTSVILLE,
BIGLERVILLE,
FRANKLIN,
BUTLER,
MENALLEN,
TYRONE,
HUNTINGTON,

GENERAL RECOMMENDATIONS FOR THIS WATERSHED:

1. Permanent Protection of Super Critical Areas
2. Protection of Narrows
3. Restoration of Conewago Creek in Narrows
4. Preserve Priority Parcels
5. Forest and Tree Conservation Ordinance
6. Installation of Access Ponts Nos. 15-17 on Stone Jug Road, Narrows Road, and Narrows Road/Shippensburg Road
7. Formation of Multi-Municipal EAC
8. Wetland Preservation Ordinance
9. Riparian Buffer Ordinance - 150 ft Min.
10. New Park and Park Upgrades in Arendtsville Borough, Restoration of Degraded Stream Reaches in and around Arendtsville



9. Conewago Creek West Watershed

The Conewago Creek West Watershed is one of the most unique sub-watershed in the entire watershed. It is home to many unique areas including natural areas, the Narrows, the fruitbelt, critical habitat, and unique geologic features to name just a few. This sub-watershed forms the headwaters for the main stem of the Conewago Creek and is located in a mountainous region on the eastern side of South Mountain. The area is rich in natural and cultural diversity and includes many resources which should be preserved for generations to come.

Municipalities: Cumberland Township, Straban Township, Arendtsville Borough, Biglerville Borough, Franklin Township, Butler Township, Menhallen Township, Tyrone Township, Huntington Township

I. Issues and Concerns

Although very unique the sub-watershed is facing some serious issues. Within the Narrows along Narrows Road, the Conewago Creek is highly unstable and threatens multiple landowners property, fish and aquatic life habitat, and a state road. Additionally, the area is located within a Potentially Stressed Area (PSA). Legal access is limited given the quality of the watershed for recreation and fishing.

II. Recommendations

Permanent Protection of Super Critical Areas
Protection of Narrows
Restoration of Conewago Creek in Narrows
Preserve Priority Parcels
Forest and Tree Conservation Ordinance
Installation of Access Ponts Nos. 15-17 on Stone Jug Road, Narrows Road, and Narrows Road/Shippensburg Road
Formation of Multi-Municipal EAC
Wetland Preservation Ordinance
Riparian Buffer Ordinance - 150 ft Min.
New Park and Park Upgrades in Arendtsville Borough, Restoration of Conewago Creek Erosion Areas in Borough and Adjacent Landowners

Photo 9-A: Conewago Creek Narrows

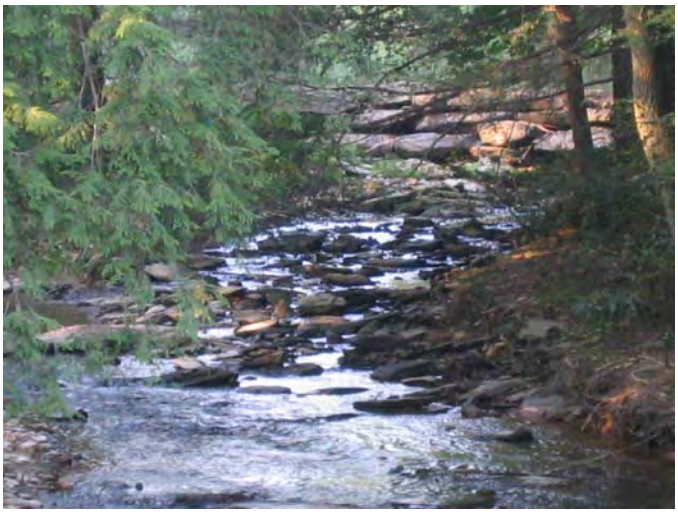


Photo 9-B: Conewago Creek Narrows

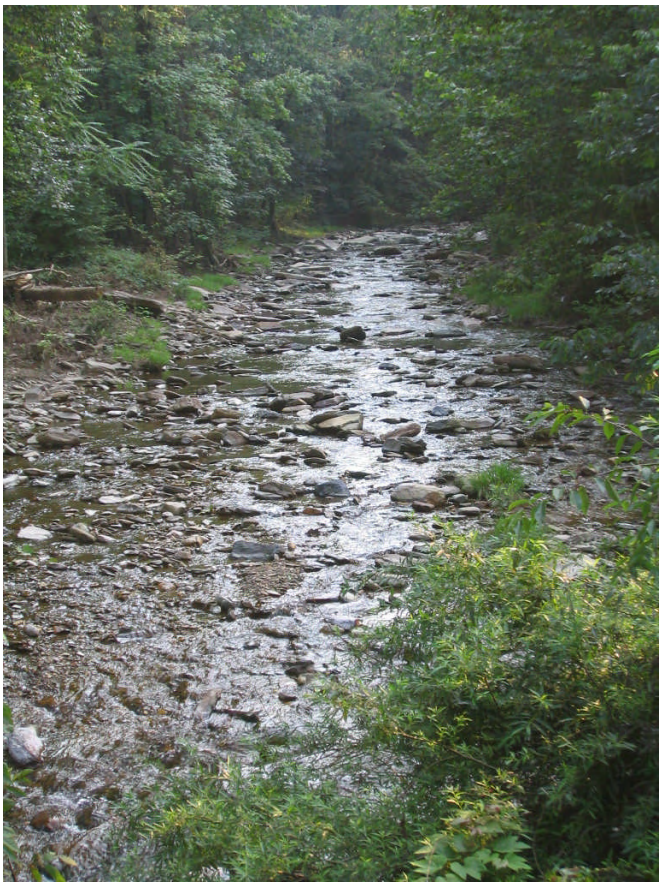


Photo 9-C: Conewago Creek Narrows

Photo 9-D: Conewago Creek Narrows

Photo 9-E: Narrows showing erosion issues

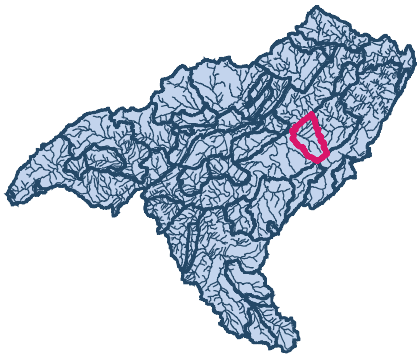
Photo 9-F: Narrows showing erosion issues

Photo 9-G: Narrows showing erosion issues

Photo 9-H: Narrows showing erosion issues

Photo 9-I: Narrows showing erosion issues

Photo 9-J: Narrows showing erosion issues



REPORT FOR THE DAVIDSBURG RUN WATERSHED

GENERAL INFORMATION
Total Area of SubWatershed: 4993.57 acres
Total Stream Length = 13.16 miles
Total Road Length = 21.95 miles
Total Wetland Area = 12.33 acres
Total Public Land Area: 0 acres
Total Floodplain Area: 238.54 acres
Total Acres Hydric Soils: 145.25 acres
Total Acres Hydric Inclusion: 799.34 acres
Total Area of Soils Suitable for Infiltration: 4219.95 acres

LANDUSE
Coniferous Forest: 28.51 acres
Deciduous Forest: 547.36 acres
Emergent Wetland: 0.44 acres
Hay Pasture: 1279.07 acres
Low Density Urban: 40.18 acres
Mixed Forest: 235.08 acres
Open Water: 4.88 acres
Row Crops: 2784.07 acres
Transitional: 72.65 acres
Woody Wetland: 1.3 acres

GENERALIZED ZONING
Agriculture: 3242.31 acres
Commercial: 15.68 acres
Conservation/Open Space: 1702.52 acres
Residential: 33.07 acres

OTHER INFORMATION
Total Impervious Surface Area (2000): 18.65 acres
Total Number of Assessment Sites: 1
Total Area 'Natural Areas': 0 acres
Total Miles 303d List Streams: 0 miles
Total Area 303d List Water Bodies: 0 acres
Number of CREP Sites: 3
Total Preserved Agricultural Land: 1119.71 acres
Total Area of Historic Districts: 0 acres
Total Area of Concern: 157.28 acres
Total Critical Area: 1.91 acres

Total Super-Critical Area: 0 acres

Municipalities in this Watershed:
DOVER,

GENERAL RECOMMENDATIONS FOR THIS WATERSHED:

1. Infiltration Requirement in Stormwater Ordinance for WCA
2. Forest and Tree Conservation Ordinance
3. Wetland Preservation Ordinance
4. Riparian Buffer Ordinance - 100 ft. Min.
5. Restoration of Sub-Optimal Rating
6. Preserve Priority Parcels
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10. Davidsburg Run Watershed

Davidsburg Run is located in the eastern portion of the watershed in Dover Township. It is characterized as primarily agriculture and rural residential.

Municipalities: Dover Township

I. Issues and Concerns

The primary issue is related to water quality from stream instability. Portions of the watershed are also located in a Water Challenged Area.

II. Recommendations

Infiltration Requirement in Stormwater Ordinance for WCA

Forest and Tree Conservation Ordinance

Wetland Preservation Ordinance

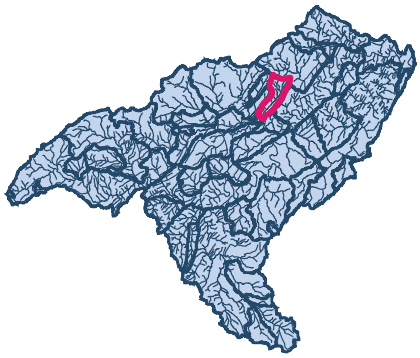
Riparian Buffer Ordinance - 100 ft. Min.

Restoration of Sub-Optimal Rating

Preserve Priority Parcels

Photo 10-A: Davidsburg Run upstream from Davidsburg Road

Photo 10-B: Davidsburg Run downstream from Davidsburg Road



REPORT FOR THE DOE RUN WATERSHED

GENERAL INFORMATION
Total Area of SubWatershed: 3191.7 acres
Total Stream Length = 12.47 miles
Total Road Length = 24.83 miles
Total Wetland Area = 20.03 acres
Total Public Land Area: 7.59 acres
Total Floodplain Area: 11.61 acres
Total Acres Hydric Soils: 707.83 acres
Total Acres Hydric Inclusion: 2155.58 acres
Total Area of Soils Suitable for Infiltration: 448.74 acres

LANDUSE
Coniferous Forest: 24.8 acres
Deciduous Forest: 469.35 acres
Emergent Wetland: 6.94 acres
Hay Pasture: 463.63 acres
Low Density Urban: 98.92 acres
Mixed Forest: 112.91 acres
Open Water: 6.07 acres
Row Crops: 1991.79 acres
Transitional: 17.32 acres

GENERALIZED ZONING
Agriculture: 1791.69 acres
Residential: 1059.09 acres
Unknown: 339.18 acres
Village Center: 1.75 acres

OTHER INFORMATION
Total Impervious Surface Area (2000): 67.25 acres
Total Number of Assessment Sites: 1
Total Area 'Natural Areas': 0 acres
Total Miles 303d List Streams: 0 miles
Total Area 303d List Water Bodies: 0 acres
Number of CREP Sites: 8
Total Preserved Agricultural Land: 859.17 acres
Total Area of Historic Districts: 110.25 acres
Total Area of Concern: 37.52 acres
Total Critical Area: 12.14 acres

Total Super-Critical Area: 0 acres

Municipalities in this Watershed:
WELLSVILLE,
WASHINGTON,
WARRINGTON,

GENERAL RECOMMENDATIONS FOR THIS WATERSHED:

1. Preservation of Historic District and Rural Setting
2. Restoration of Sub-Optimal Rating
3. Riparian Buffer Ordinance - 150 ft. Min.
4. Wetland Preservation Ordinance
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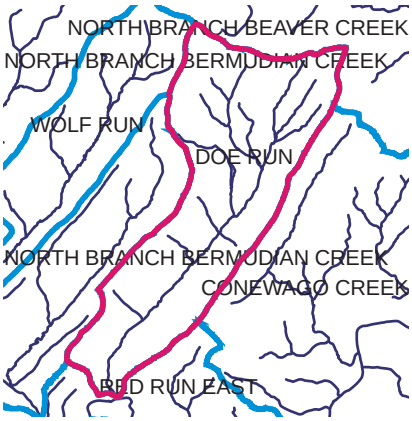

11. Doe Run Watershed

Doe Run watershed is located in the northern portion of the watershed in York County. Encompassing approximately 3100 acres of primarily agricultural and forested land, the watershed is a small headwater tributary to the Conewago Creek.

Municipalities: Wellsville Borough, Washington Township, Warrington Township

I. Issues and Concerns

The primary concern in the watershed is related to water quality. There is also a historic district located in the watershed. Critical Areas and Areas of Concern are located in the watershed.

II. Recommendations

Preservation of Historic District and Rural Setting

Restoration of Sub-Optimal Rating

Riparian Buffer Ordinance - 150 ft. Min.

Wetland Preservation Ordinance

Photo 11-A: Doe Run upstream from Harmony Grove Road

Photo 11-B: Doe Run downstream from Harmony Grove Road

REPORT FOR THE FOX RUN WATERSHED

GENERAL INFORMATION
Total Area of SubWatershed: 9098.32 acres
Total Stream Length = 33.76 miles
Total Road Length = 109.4 miles
Total Wetland Area = 37.7 acres
Total Public Land Area: 129.97 acres
Total Floodplain Area: 430.67 acres
Total Acres Hydric Soils: 248.94 acres
Total Acres Hydric Inclusion: 1154.86 acres
Total Area of Soils Suitable for Infiltration: 7005.25 acres

LANDUSE
Coniferous Forest: 36.88 acres
Deciduous Forest: 1206.24 acres
Emergent Wetland: 7.68 acres
Hay Pasture: 1559.23 acres
High Density Urban: 24.16 acres
Low Density Urban: 863.88 acres
Mixed Forest: 280.05 acres
Open Water: 28.47 acres
Row Crops: 4924.75 acres
Transitional: 166.29 acres
Woody Wetland: 0.67 acres

GENERALIZED ZONING
Agriculture: 1877.43 acres
Business: 1.54 acres
Commercial: 351.24 acres
Conservation/Open Space: 3182.07 acres
Industrial: 255.91 acres
Mixed Use: 426.57 acres
Residential: 2930.91 acres
Unknown: 346.09 acres
Village Center: 72.64 acres

OTHER INFORMATION
Total Impervious Surface Area (2000): 491.15 acres
Total Number of Assessment Sites: 0
Total Area 'Natural Areas': 0 acres
Total Miles 303d List Streams: 0 miles
Total Area 303d List Water Bodies: 0 acres
Number of CREP Sites: 20
Total Preserved Agricultural Land: 808.41 acres
Total Area of Historic Districts: 77.87 acres
Total Area of Concern: 380.24 acres
Total Critical Area: 41.18 acres

Total Super-Critical Area: 0 acres

Municipalities in this Watershed:
DOVER,
CONEWAGO,

GENERAL RECOMMENDATIONS FOR THIS WATERSHED:

1. Infiltration Requirements in Stormwater Management Ordinance for WCA
2. Forest and Tree Conservation Ordinance
3. Wetland Preservation Ordinance
4. Riparian Buffer Ordinance - 150 ft. Min
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12. Fox Run Watershed

Fox Run is located in the northeastern portion of the watershed in York County. The watershed is primarily rural residential, agriculture, and suburban residential. The growing community of Dover is located in this watershed.

Municipalities: Dover Borough, Conewago Township

I. Issues and Concerns

The primary concern in Fox Run Watershed is the growth and development occurring in the southern portion of the watershed which is within the WCA. In addition, there are approximately 400 acres of Critical Areas and Areas of Concern within the watershed.

II. Recommendations

Infiltration Requirements in Stormwater Management Ordinance for WCA
Forest and Tree Conservation Ordinance
Wetland Preservation Ordinance
Riparian Buffer Ordinance - 150 ft. Min

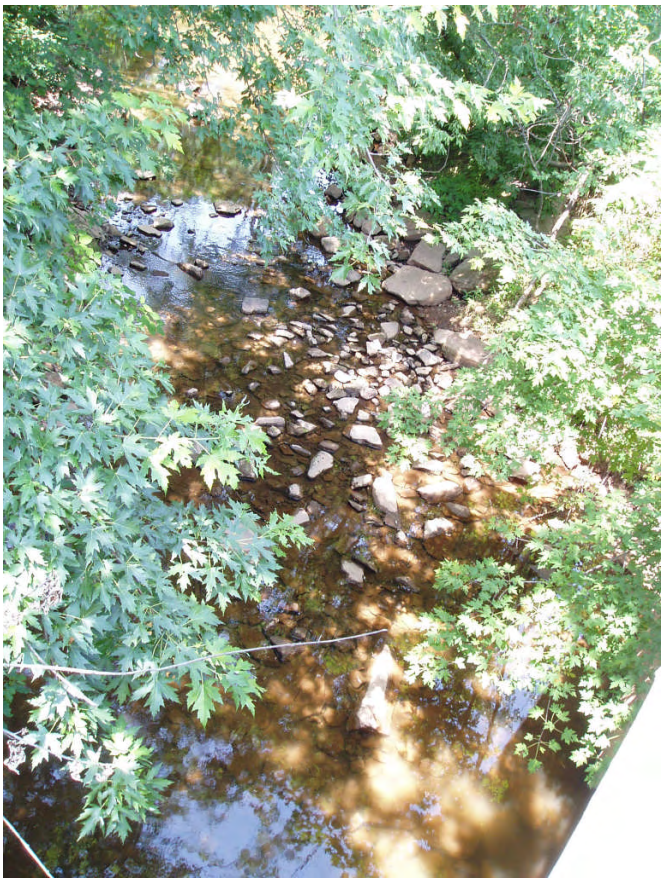
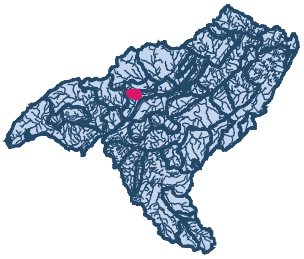


Photo 12-A: Fox Run upstream from Cardinal Road

Photo 12-B: Fox Run downstream from Cardinal Road

Photo 12-C: Fox Run upstream from Fox Run Road

Photo 12-D: Fox Run downstream from Fox Run Road



REPORT FOR THE GARDNER RUN WATERSHED

GENERAL INFORMATION
Total Area of SubWatershed: 445.06 acres
Total Stream Length = 0.78 miles
Total Road Length = 8.2 miles
Total Wetland Area = 1.2 acres
Total Public Land Area: 0 acres
Total Floodplain Area: 8.41 acres
Total Acres Hydric Soils: 30.49 acres
Total Acres Hydric Inclusion: 251.1 acres
Total Area of Soils Suitable for Infiltration: 223.04 acres

LANDUSE
Coniferous Forest: 5.05 acres
Deciduous Forest: 25.66 acres
Emergent Wetland: 0.22 acres
Hay Pasture: 84.16 acres
Low Density Urban: 56.25 acres
Mixed Forest: 27.15 acres
Open Water: 1.33 acres
Row Crops: 221.96 acres
Transitional: 23.2 acres
Woody Wetland: 0.08 acres

GENERALIZED ZONING
Commercial/Industrial: 195.93 acres
Conservation/Open Space: 51.33 acres
Residential: 176.92 acres
Village: 10.24 acres
Village Residential: 11.23 acres

OTHER INFORMATION
Total Impervious Surface Area (2000): 34.66 acres
Total Number of Assessment Sites: 0
Total Area 'Natural Areas': 0 acres
Total Miles 303d List Streams: 0 miles
Total Area 303d List Water Bodies: 0 acres
Number of CREP Sites: 0
Total Preserved Agricultural Land: 0 acres
Total Area of Historic Districts: 0 acres
Total Area of Concern: 187.03 acres
Total Critical Area: 0.66 acres

Total Super-Critical Area: 0 acres

Municipalities in this Watershed:
YORK SPRINGS,
HUNTINGTON,
LATIMORE,

GENERAL RECOMMENDATIONS FOR THIS WATERSHED:

1. Preserve Priority Parcels
2. Forest and Tree Preservation Ordinance
3. Wetland Preservation Ordianance
4. Riparian Buffer Ordinance - 150 ft. Min.
5. Infiltration Requirements in Stormwater Management Ordinance
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13. Gardner Run Watershed

Gardner Run watershed is a small watershed located in the north central portion of the watershed. It is characterized as being primarily rural residential and agriculture. The community of York Springs is located within this watershed.

Municipalities: York Springs, Huntington Township, Latimore Township

I. Issues and Concerns

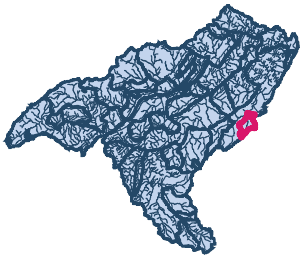
The primary concern is that half of the watershed is either a Critical Area or Area of Concern. Additionally, portions of this small watershed area located adjacent to a PSA and /or within a WCA. Stream degradation from poor land use practices is also a concern.

II. Recommendations

Preserve Priority Parcels
Forest and Tree Preservation Ordinance
Wetland Preservation Ordianance
Riparian Buffer Ordinance - 150 ft. Min.
Infiltration Requirements in Stormwater Management Ordinance

Photo 13-A: Gardner Run upstream at Ernst Mill Road

Photo 13-B: Gardner Run downstream at Ernst Mill Road



REPORT FOR THE HONEY RUN WATERSHED

GENERAL INFORMATION
Total Area of SubWatershed: 2297.72 acres
Total Stream Length = 3.4 miles
Total Road Length = 27.38 miles
Total Wetland Area = 17.29 acres
Total Public Land Area: 0 acres
Total Floodplain Area: 85.6 acres
Total Acres Hydric Soils: 0 acres
Total Acres Hydric Inclusion: 520.89 acres
Total Area of Soils Suitable for Infiltration: 1691.34 acres

LANDUSE
Coniferous Forest: 6.88 acres
Deciduous Forest: 37.66 acres
Emergent Wetland: 1.03 acres
Hay Pasture: 456.49 acres
Low Density Urban: 192.14 acres
Mixed Forest: 85.45 acres
Open Water: 15.84 acres
Quarries: 41.76 acres
Row Crops: 1438.78 acres
Transitional: 21.63 acres

GENERALIZED ZONING
Agriculture: 679.97 acres
Apartment/Office: 3.32 acres
Commercial: 30.42 acres
Conservation/Open Space: 224.86 acres
Industrial: 366.98 acres
Quarry: 449.92 acres
Residential: 542.27 acres

OTHER INFORMATION
Total Impervious Surface Area (2000): 107.53 acres
Total Number of Assessment Sites: 0
Total Area 'Natural Areas': 7.36 acres
Total Miles 303d List Streams: 0 miles
Total Area 303d List Water Bodies: 0 acres
Number of CREP Sites: 14
Total Preserved Agricultural Land: 141.34 acres
Total Area of Historic Districts: 0 acres
Total Area of Concern: 47.58 acres
Total Critical Area: 9.13 acres

Total Super-Critical Area: 0 acres

Municipalities in this Watershed:
JACKSON,
WEST MANCHESTER,
DOVER,

GENERAL RECOMMENDATIONS FOR THIS WATERSHED:

1. Riparian Buffer Ordinance - 150 ft. Min
2. Wetland Preservation Ordinance
3. Restoration of Degraded Stream Reaches
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14. Honey Run Watershed

Honey Run watershed is a headwater watershed located along the southern boundary of the watershed in York County. There is a popular golf course located within the watershed.

Municipalities: Jackson Township, West Machester Township, Dover Borough

I. Issues and Concerns

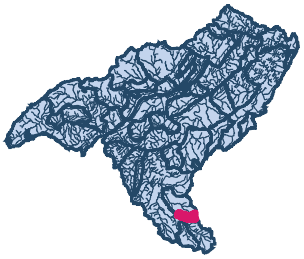
There are approximately 7 acres of Natural Areas located within the watershed which should be preserved.

II. Recommendations

Riparian Buffer Ordinance - 150 ft. Min
Wetland Preservation Ordinance
Restoration of Degraded Stream Reaches

Photo 14-A: Honey Run upstream from 234

Photo 14-B: Honey Run downstream from 234



REPORT FOR THE INDIAN RUN WATERSHED

GENERAL INFORMATION
Total Area of SubWatershed: 1161.24 acres
Total Stream Length = 2.85 miles
Total Road Length = 18.87 miles
Total Wetland Area = 16.56 acres
Total Public Land Area: 4.8 acres
Total Floodplain Area: 59.69 acres
Total Acres Hydric Soils: 1.81 acres
Total Acres Hydric Inclusion: 702.39 acres
Total Area of Soils Suitable for Infiltration: 884.5 acres

LANDUSE
Coniferous Forest: 2.75 acres
Deciduous Forest: 31.21 acres
Emergent Wetland: 1.95 acres
Hay Pasture: 207.01 acres
Low Density Urban: 123.59 acres
Mixed Forest: 89.35 acres
Open Water: 7.01 acres
Row Crops: 688.68 acres
Transitional: 8.46 acres
Woody Wetland: 1.13 acres

GENERALIZED ZONING
Commercial: 53.31 acres
Conservation/Open Space: 286.76 acres
Residential: 832.01 acres

OTHER INFORMATION
Total Impervious Surface Area (2000): 63.6 acres
Total Number of Assessment Sites: 0
Total Area 'Natural Areas': 0 acres
Total Miles 303d List Streams: 0 miles
Total Area 303d List Water Bodies: 0 acres
Number of CREP Sites: 1
Total Preserved Agricultural Land: 0 acres
Total Area of Historic Districts: 0 acres
Total Area of Concern: 39.22 acres
Total Critical Area: 2.38 acres

Total Super-Critical Area: 0 acres

Municipalities in this Watershed:
WEST MANHEIM,
PENN,
UNION,
CONEWAGO,

GENERAL RECOMMENDATIONS FOR THIS WATERSHED:

1. Infiltration Requirements in Stormwater Management Ordinance
2. Riparian Buffer Ordinance - 150 ft. Min
3. Wetland Preservation Ordinance
4. Forest and Tree Conservation Ordinance
5. Alternative Development Allowance in Ordinances
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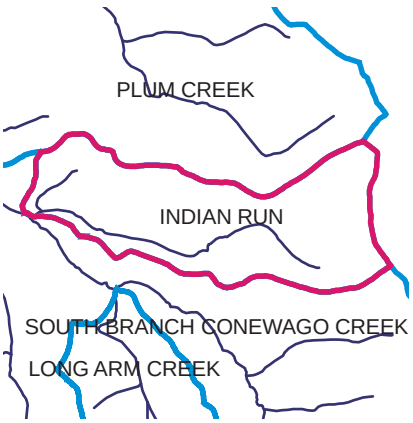


15. Indian Run Watershed

The Indian Run watershed is located in the South Branch Conewago Creek sub-watershed in the southern potion of the watershed south of Hanover. No major communities are located within the watershed. The watershed is characterized as being primarily agriculture.

Municipalities: West Manheim Township, Penn Township, Union Township, Conewago Township

I. Issues and Concerns

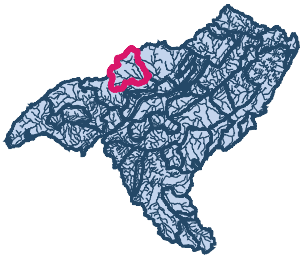
The primary concern for Indian Run is the location within a PSA and the recent growth in the area. Additionally, it is a headwater sub-watershed.

II. Recommendations

Infiltration Requirements in Stormwater Management Ordinance
Riparian Buffer Ordinance - 150 ft. Min
Wetland Preservation Ordinance
Forest and Tree Conservation Ordinance
Alternative Development Allowance in Ordinances

Photo 15-A: Indian Run upstream from Narrow Road

Photo 15-B: Indian Run downstream from Narrow Road



REPORT FOR THE LATIMORE CREEK NORTH WATERSHED

GENERAL INFORMATION
Total Area of SubWatershed: 10407.25 acres
Total Stream Length = 23.25 miles
Total Road Length = 54.44 miles
Total Wetland Area = 271.05 acres
Total Public Land Area: 0 acres
Total Floodplain Area: 668.4 acres
Total Acres Hydric Soils: 691.06 acres
Total Acres Hydric Inclusion: 1747.57 acres
Total Area of Soils Suitable for Infiltration: 9033.63 acres

LANDUSE
Coniferous Forest: 107.42 acres
Deciduous Forest: 1913.61 acres
Emergent Wetland: 40.82 acres
Hay Pasture: 2370.37 acres
Low Density Urban: 12.28 acres
Mixed Forest: 623.24 acres
Open Water: 77.92 acres
Row Crops: 4713.31 acres
Transitional: 425.45 acres
Woody Wetland: 122.9 acres

GENERALIZED ZONING
Commercial/Industrial: 35.67 acres
Conservation/Open Space: 8792.8 acres
Residential: 74.19 acres
Unknown: 2894.99 acres

OTHER INFORMATION
Total Impervious Surface Area (2000): 4.81 acres
Total Number of Assessment Sites: 1
Total Area 'Natural Areas': 223.95 acres
Total Miles 303d List Streams: 0 miles
Total Area 303d List Water Bodies: 0 acres
Number of CREP Sites: 0
Total Preserved Agricultural Land: 615.19 acres
Total Area of Historic Districts: 0 acres
Total Area of Concern: 6149.55 acres
Total Critical Area: 2448.32 acres

Total Super-Critical Area: 2.76 acres

Municipalities in this Watershed:
SOUTH MIDDLETON,
HUNTINGTON,
LATIMORE,
FRANKLIN,

GENERAL RECOMMENDATIONS FOR THIS WATERSHED:

1. Preserve Priority Parcels
2. Riparian Buffer Ordinance - 150 ft. Min.
3. Forest and Tree Conservation Ordinance
4. Wetland Preservation Ordinance
5. Protection of Super Critical Areas
6. Infiltration Requirements in Stormwater Management Ordinance
7. Restrictive Zoning for Critical Areas and Areas of Concern
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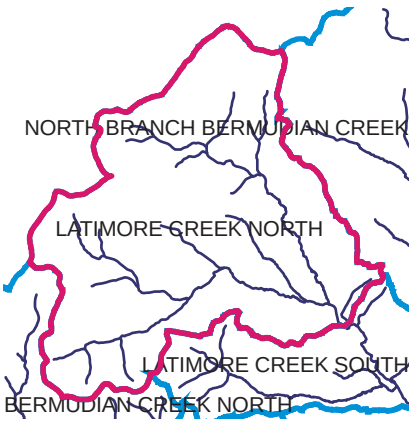


16. Latimore Creek North Watershed

Latimore Creek North is located along the northern boundary of the watershed in Adams County. The headwater areas for this watershed begin on the southeastern faces of South Mountain. There are no major communities within this watershed and it is characterized as being primarily rural agriculture.

Municipalities: South Middleton Township, Huntington Township, Latimore Township, Franklin Township

I. Issues and Concerns

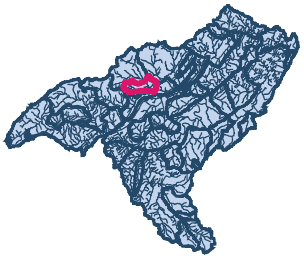
The primary concern is the location of the watershed within a PSA. Approximately 80% of the land area within the watershed is either a Super-Critical Area, Critical Area, or Area of Concern. There are approximately 224 acres of Natural Areas located within the watershed.

II. Recommendations

Preserve Priority Parcels
Riparian Buffer Ordinance - 150 ft. Min.
Forest and Tree Conservation Ordinance
Wetland Preservation Ordinance
Protection of Super Critical Areas
Infiltration Requirements in Stormwater Management Ordinance
Restrictive Zoning for Critical Areas and Areas of Concern

Photo 16-A: Latimore Creek North upstream from Mountain Road

Photo 16-B: Latimore Creek North Downstream from Mountain Road



REPORT FOR THE LATIMORE CREEK SOUTH WATERSHED

GENERAL INFORMATION
Total Area of SubWatershed: 3548.77 acres
Total Stream Length = 11.55 miles
Total Road Length = 23.53 miles
Total Wetland Area = 65.79 acres
Total Public Land Area: 0 acres
Total Floodplain Area: 373.85 acres
Total Acres Hydric Soils: 352.2 acres
Total Acres Hydric Inclusion: 1066.55 acres
Total Area of Soils Suitable for Infiltration: 2297.95 acres

LANDUSE
Coniferous Forest: 34.27 acres
Deciduous Forest: 180.72 acres
Emergent Wetland: 21.19 acres
Hay Pasture: 769.64 acres
Low Density Urban: 131.47 acres
Mixed Forest: 162.39 acres
Open Water: 8.24 acres
Row Crops: 2084.78 acres
Transitional: 120.93 acres
Woody Wetland: 35.14 acres

GENERALIZED ZONING
Commercial/Industrial: 140.12 acres
Conservation/Open Space: 2395.01 acres
Residential: 982.44 acres
Unknown: 6.39 acres
Village: 1.2 acres
Village Residential: 26.61 acres

OTHER INFORMATION
Total Impervious Surface Area (2000): 93.33 acres
Total Number of Assessment Sites: 0
Total Area 'Natural Areas': 0 acres
Total Miles 303d List Streams: 0 miles
Total Area 303d List Water Bodies: 0 acres
Number of CREP Sites: 1
Total Preserved Agricultural Land: 441.17 acres
Total Area of Historic Districts: 0 acres
Total Area of Concern: 1043.32 acres
Total Critical Area: 644.59 acres

Total Super-Critical Area: 0 acres

Municipalities in this Watershed:
YORK SPRINGS,
HUNTINGTON,
LATIMORE,
FRANKLIN,

GENERAL RECOMMENDATIONS FOR THIS WATERSHED:

1. Installation of Access Point No. 22 - Latimore Valley Road
2. Preserve Priority Parcels
3. Riparian Buffer Ordinance - 100 ft. Min.
4. Wetland Preservation Ordinance
5. Infiltration Requirement in Stormwater Management Ordinance
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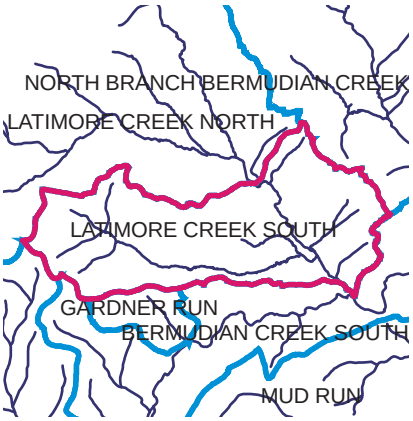


17. Latimore Creek South Watershed

Latimore Creek South watershed is located in the north central portion of the watershed in Adams County. It is characterized as being primarily agriculture with the community of York Springs located within it's boundaries.

Municipality: York Springs, Huntington Township, Latimore Township, Franklin Township

I. Issues and Concerns

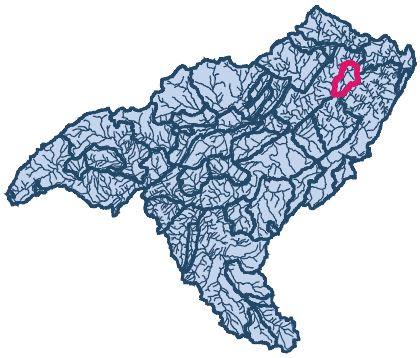
Portions of the watershed are located within a PSA. Approximately 50% of the land area is either a Critical Area or Area of Concern.

II. Recommendations

Installation of Access Point No. 22 - Latimore Valley Road
Preserve Priority Parcels
Riparian Buffer Ordinance - 100 ft. Min.
Wetland Preservation Ordinance
Infiltration Requirement in Stormwater Management Ordinance

Photo 17-A: Latimore Creek South upstream from Latimore Road

Photo 17-B: Latimore Creek South downstream from Latimore Road



REPORT FOR THE LAUREL RUN WATERSHED

GENERAL INFORMATION
Total Area of SubWatershed: 2694.01 acres
Total Stream Length = 8.38 miles
Total Road Length = 10.36 miles
Total Wetland Area = 3 acres
Total Public Land Area: 0 acres
Total Floodplain Area: 45.34 acres
Total Acres Hydric Soils: 0 acres
Total Acres Hydric Inclusion: 83.32 acres
Total Area of Soils Suitable for Infiltration: 2689.06 acres

LANDUSE
Coniferous Forest: 53.87 acres
Deciduous Forest: 2370.3 acres
Hay Pasture: 63.8 acres
Low Density Urban: 1.53 acres
Mixed Forest: 21.23 acres
Open Water: 1.78 acres
Row Crops: 144.89 acres
Transitional: 36.64 acres

GENERALIZED ZONING
Agriculture: 21.62 acres
Conservation/Open Space: 2672.39 acres

OTHER INFORMATION
Total Impervious Surface Area (2000): 0.44 acres
Total Number of Assessment Sites: 0
Total Area 'Natural Areas': 104.2 acres
Total Miles 303d List Streams: 0 miles
Total Area 303d List Water Bodies: 0 acres
Number of CREP Sites: 1
Total Preserved Agricultural Land: 0 acres
Total Area of Historic Districts: 0 acres
Total Area of Concern: 150.58 acres
Total Critical Area: 0 acres

Total Super-Critical Area: 0 acres

Municipalities in this Watershed:
DOVER,
CONEWAGO,

GENERAL RECOMMENDATIONS FOR THIS WATERSHED:

1. Protection of Natural Areas
2. Riparian Buffer Ordinance - 100 ft. Min.
3. Infiltration Requirements in Stormwater Management Ordinance
4. Wetland Preservation Ordinance
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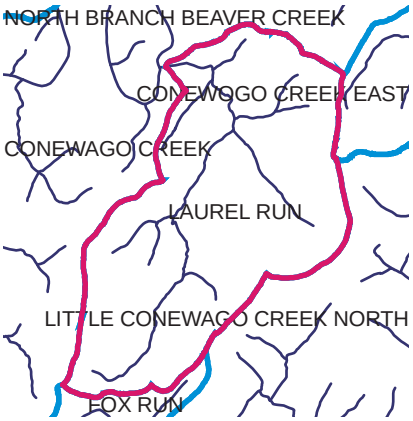


18. Laurel Run Watershed

Laurel Run is located in eastern portion of the watershed in York County. This small watershed is characterized as being a headwater watershed that is primarily forested.

Municipalities: Dover Township, Conewago Township

I. Issues and Concerns

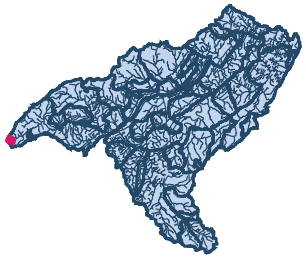
There are approximately 150 acres of Areas of Concern and 105 acres of Natural Areas.

II. Recommendations

Protection of Natural Areas
Riparian Buffer Ordinance - 100 ft. Min.
Infiltration Requirements in Stormwater Management Ordinance
Wetland Preservation Ordinance

Photo 18-A: Laurel Run upstream from Copenhaffer Road

Photo 18-B: Laurel Run downstream from Copenhaffer Road



REPORT FOR THE LIPPENCOT SPRING CREEK WATERSHED

GENERAL INFORMATION
Total Area of SubWatershed: 161.98 acres
Total Stream Length = 0.49 miles
Total Road Length = 0.64 miles
Total Wetland Area = 2.21 acres
Total Public Land Area: 0 acres
Total Floodplain Area: 2.7 acres
Total Acres Hydric Soils: 0 acres
Total Acres Hydric Inclusion: 17.32 acres
Total Area of Soils Suitable for Infiltration: 144.66 acres

LANDUSE
Coniferous Forest: 6.98 acres
Deciduous Forest: 142.86 acres
Hay Pasture: 2.16 acres
Mixed Forest: 0.92 acres
Open Water: 0 acres
Row Crops: 6.97 acres
Transitional: 0.61 acres
Woody Wetland: 1.47 acres

GENERALIZED ZONING
Agriculture: 9.23 acres
Conservation/Open Space: 147.99 acres

OTHER INFORMATION
Total Impervious Surface Area (2000): 0 acres
Total Number of Assessment Sites: 0
Total Area 'Natural Areas': 4.07 acres
Total Miles 303d List Streams: 0 miles
Total Area 303d List Water Bodies: 0 acres
Number of CREP Sites: 0
Total Preserved Agricultural Land: 0 acres
Total Area of Historic Districts: 0 acres
Total Area of Concern: 31.67 acres
Total Critical Area: 231.95 acres

Total Super-Critical Area: 0 acres

Municipalities in this Watershed:
FRANKLIN,

GENERAL RECOMMENDATIONS FOR THIS WATERSHED:

1. Protection of Natural Areas
2. Riparian Buffer Ordinance - 150 ft. Min.
3. Forest and Tree Conservation Ordinance
4. Wetland Preservation Ordinance
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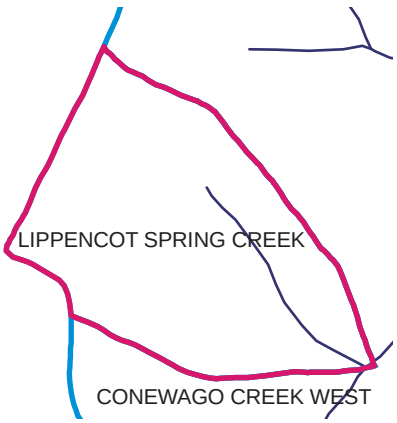


19. Lippencot Spring Creek Watershed

Lippencot Spring is located in the far western tip of the watershed in Adams County. The watershed is almost entirely forested.

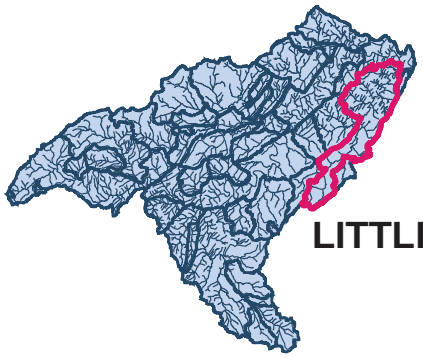
Municipality: Franklin Township

I. Issues and Concerns

The watershed is located in a PSA and the entire area of the watershed is either an Area of Concern or Critical Area.

II. Recommendations

Protection of Natural Areas
Riparian Buffer Ordinance - 150 ft. Min.
Forest and Tree Conservation Ordinance
Wetland Preservation Ordinance



REPORT FOR THE LITTLE CONEWAGO CREEK NORTH WATERSHED

GENERAL INFORMATION
Total Area of SubWatershed: 25933.68 acres
Total Stream Length = 89.45 miles
Total Road Length = 316.62 miles
Total Wetland Area = 148.44 acres
Total Public Land Area: 235.45 acres
Total Floodplain Area: 1879.96 acres
Total Acres Hydric Soils: 520.51 acres
Total Acres Hydric Inclusion: 4314.93 acres
Total Area of Soils Suitable for Infiltration: 19847.24 acres

LANDUSE
Coniferous Forest: 287.29 acres
Deciduous Forest: 2928.34 acres
Emergent Wetland: 13.17 acres
Hay Pasture: 4350 acres
High Density Urban: 1020.75 acres
Low Density Urban: 2506.12 acres
Mixed Forest: 781.36 acres
Open Water: 69.6 acres
Quarries: 118.65 acres
Row Crops: 13526.43 acres
Transitional: 313.4 acres
Woody Wetland: 18.47 acres

GENERALIZED ZONING
Agriculture: 11956.5 acres
Apartment/Office: 173 acres
Business: 272 acres
Commercial: 429.63 acres
Conservation/Open Space: 1499.8 acres
Industrial: 2972.4 acres
Quarry: 0.5 acres
Residential: 8629.61 acres
Unknown: 0.22 acres

OTHER INFORMATION
Total Impervious Surface Area (2000): 2119.41 acres
Total Number of Assessment Sites: 0
Total Area 'Natural Areas': 448.24 acres
Total Miles 303d List Streams: 0 miles
Total Area 303d List Water Bodies: 0 acres
Number of CREP Sites: 52
Total Preserved Agricultural Land: 4418.56 acres
Total Area of Historic Districts: 266.21 acres
Total Area of Concern: 1213.45 acres
Total Critical Area: 322.11 acres

Total Super-Critical Area: 0 acres

Municipalities in this Watershed:
JACKSON,
WEST MANCHESTER,
DOVER,
EAST MANCHESTER,
CONEWAGO,

GENERAL RECOMMENDATIONS FOR THIS WATERSHED:

1. Installation of Access Point No. 23 - Greenbriar Road
2. Riparian Buffer Ordinance - 100 ft. Min.
3. Wetland Preservation Ordinance
4. Forest and Tree Conservation Ordinance
5. Infiltration Requirements in Stormwater Management Ordinance
6. Protection of Natural Areas
7. Preservation of Critical Areas and Areas of Concern
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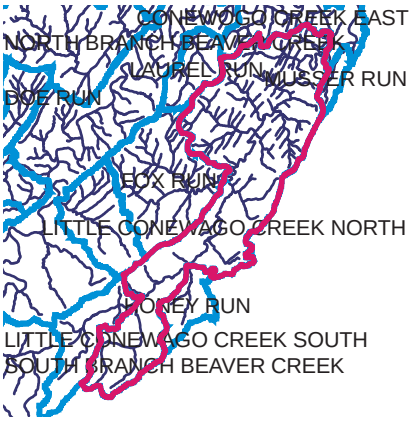


20. Little Conewago Creek North Watershed

Little Conewago Creek North watershed is one of the largest sub-watersheds of the entire Conewago Creek Watershed. It is located along the southern boundary of the watershed in York County. Land use is primarily agriculture.

Municipality: Jackson Township, West Manchester Township, Dover Township, East Manchester Township, Conewago Township

I. Issues and Concerns

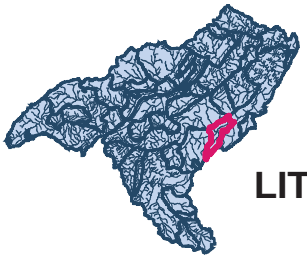
There are approximately 2000 acres of Critical Areas, Areas of Concern, and Natural Areas within the watershed.

II. Recommendations

Installation of Access Point No. 23 - Greenbriar Road
Riparian Buffer Ordinance - 100 ft. Min.
Wetland Preservation Ordinance
Forest and Tree Conservation Ordinance
Infiltration Requirements in Stormwater Management Ordinance
Protection of Natural Areas
Preservation of Critical Areas and Areas of Concern

Photo 20-A: Little Conewago Creek North Branch upstream from Susquehanna Trail

Photo 20-B: Little Conewago Creek North Branch downstream from Susquehanna Trail



REPORT FOR THE LITTLE CONEWAGO CREEK SOUTH WATERSHED

GENERAL INFORMATION
Total Area of SubWatershed: 4553.32 acres
Total Stream Length = 9.01 miles
Total Road Length = 24.32 miles
Total Wetland Area = 56.21 acres
Total Public Land Area: 4.35 acres
Total Floodplain Area: 155.25 acres
Total Acres Hydric Soils: 264.59 acres
Total Acres Hydric Inclusion: 1265.89 acres
Total Area of Soils Suitable for Infiltration: 3865.71 acres

LANDUSE
Coniferous Forest: 58.44 acres
Deciduous Forest: 954.45 acres
Emergent Wetland: 9.97 acres
Hay Pasture: 836.2 acres
Low Density Urban: 29.57 acres
Mixed Forest: 167.09 acres
Open Water: 8.84 acres
Row Crops: 2430.88 acres
Transitional: 49.08 acres
Woody Wetland: 8.68 acres

GENERALIZED ZONING
Agriculture: 3181.61 acres
Commercial: 44.46 acres
Conservation/Open Space: 1282.61 acres
Residential: 44.74 acres

OTHER INFORMATION
Total Impervious Surface Area (2000): 17.27 acres
Total Number of Assessment Sites: 0
Total Area 'Natural Areas': 0 acres
Total Miles 303d List Streams: 0 miles
Total Area 303d List Water Bodies: 0 acres
Number of CREP Sites: 4
Total Preserved Agricultural Land: 1028.84 acres
Total Area of Historic Districts: 0 acres
Total Area of Concern: 142.28 acres
Total Critical Area: 64.02 acres

Total Super-Critical Area: 0 acres

Municipalities in this Watershed:
JACKSON,
PARADISE,
DOVER,

GENERAL RECOMMENDATIONS FOR THIS WATERSHED:

1. Riparian Buffer Ordinance - 150 ft. Min.
2. Forest and Tree Conservation Ordinance
3. Wetland Preservation Ordinance
4. Infiltration Requirements in Stormwater Management Ordinance
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21. Little Conewago Creek South Watershed

The Little Conewago Creek South watershed is located along the southern boundary of the watershed in York and Adams Counties. The watershed is characterized as being primarily agriculture. There are no major communities within this watershed.

Municipalities: Jackson Township, Paradise Township, Dover Township

I. Issues and Concerns

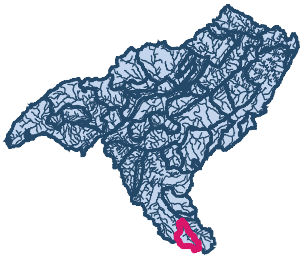
The primary concern is the partial location within a WCA. There are approximately 200 acres within either a Critical Area or Area of Concern.

II. Recommendations

Riparian Buffer Ordinance - 150 ft. Min.
Forest and Tree Conservation Ordinance
Wetland Preservation Ordinance
Infiltration Requirements in Stormwater Management Ordinance

Photo 21-A: Little Conewago Creek South upstream from Route 234

Photo 20-B: Little Conewago Creek downstream from Route 234



REPORT FOR THE LONG ARM CREEK WATERSHED

GENERAL INFORMATION
Total Area of SubWatershed: 3612.14 acres
Total Stream Length = 8.08 miles
Total Road Length = 23.04 miles
Total Wetland Area = 554.69 acres
Total Public Land Area: 175.84 acres
Total Floodplain Area: 425.54 acres
Total Acres Hydric Soils: 86.31 acres
Total Acres Hydric Inclusion: 2014.56 acres
Total Area of Soils Suitable for Infiltration: 798.95 acres

LANDUSE
Coniferous Forest: 40.6 acres
Deciduous Forest: 312.61 acres
Emergent Wetland: 21.45 acres
Hay Pasture: 406.12 acres
Low Density Urban: 11.4 acres
Mixed Forest: 61.43 acres
Open Water: 277.11 acres
Row Crops: 1019.94 acres
Transitional: 61.05 acres
Woody Wetland: 15.89 acres

GENERALIZED ZONING
Agriculture: 2107.24 acres
Commercial: 52.99 acres
Conservation/Open Space: 891.66 acres
Institutional: 1.16 acres
Residential: 589.04 acres

OTHER INFORMATION
Total Impervious Surface Area (2000): 13.28 acres
Total Number of Assessment Sites: 0
Total Area 'Natural Areas': 0 acres
Total Miles 303d List Streams: 1.96 miles
Total Area 303d List Water Bodies: 0 acres
Number of CREP Sites: 0
Total Preserved Agricultural Land: 0 acres
Total Area of Historic Districts: 0 acres
Total Area of Concern: 314.41 acres
Total Critical Area: 31.49 acres

Total Super-Critical Area: 0 acres

Municipalities in this Watershed:
WEST MANHEIM,
UNION,

GENERAL RECOMMENDATIONS FOR THIS WATERSHED:

1. Riparian Buffer Ordinance - 150 ft. Min.
2. Forest and Tree Conservation Ordinance
3. Infiltration Requirements in Stormwater Management Ordinance
4. Preserve Priority Parcels
5. Wetland Preservation Ordinance
6. Restoration of Degraded Stream Reaches
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22. Long Arm Creek Watershed

The Long Arm Creek watershed is located in the southern portion of the watershed southwest of Hanover. It is characterized as a rural headwater watershed. Long Arm Run Reservoir is located within the watershed.

Municipalities: West Manheim Township, Union Township

I. Issues and Concerns

The watershed is located in a PSA and contains about 2 miles of streams listed as impaired (303.d list). Approximately 345 acres of Areas of Concern and Critical Areas are located within the watershed.

II. Recommendations

Riparian Buffer Ordinance - 150 ft. Min.
Forest and Tree Conservation Ordinance
Infiltration Requirements in Stormwater Management Ordinance
Preserve Priority Parcels
Wetland Preservation Ordinance
Restoration of Degraded Stream Reaches

Photo 22-A: Long Arm Run upstream from Old Westminster Road

Photo 22-B: Long Arm Run downstream from Old Westminster Road

Photo 22-C: Long Arm Run Reservoir

Photo 22-D: Long Arm Run Reservoir

REPORT FOR THE MARKEL RUN WATERSHED

GENERAL INFORMATION
Total Area of SubWatershed: 4326.67 acres
Total Stream Length = 17.74 miles
Total Road Length = 22.71 miles
Total Wetland Area = 80.76 acres
Total Public Land Area: 0 acres
Total Floodplain Area: 266.84 acres
Total Acres Hydric Soils: 1031.98 acres
Total Acres Hydric Inclusion: 1944.82 acres
Total Area of Soils Suitable for Infiltration: 2486.37 acres

LANDUSE
Coniferous Forest: 14.4 acres
Deciduous Forest: 392.78 acres
Emergent Wetland: 19.46 acres
Hay Pasture: 948.47 acres
High Density Urban: 0.22 acres
Low Density Urban: 20.02 acres
Mixed Forest: 167.55 acres
Open Water: 17.9 acres
Row Crops: 2636.52 acres
Transitional: 65.23 acres
Woody Wetland: 44.02 acres

GENERALIZED ZONING
Commercial/Industrial: 103.51 acres
Conservation/Open Space: 4152.01 acres
Residential: 72.58 acres

OTHER INFORMATION
Total Impervious Surface Area (2000): 10.79 acres
Total Number of Assessment Sites: 15
Total Area 'Natural Areas': 125.46 acres
Total Miles 303d List Streams: 0 miles
Total Area 303d List Water Bodies: 0 acres
Number of CREP Sites: 1
Total Preserved Agricultural Land: 569.75 acres
Total Area of Historic Districts: 0 acres
Total Area of Concern: 1108.99 acres
Total Critical Area: 79.38 acres

Total Super-Critical Area: 0 acres

Municipalities in this Watershed:
READING,

GENERAL RECOMMENDATIONS FOR THIS WATERSHED:

1. Preserve Priority Parcels
2. Infiltration Requirements in Stormwater Management Ordinance
3. Riparian Buffer Ordinance - 150 ft. Min
4. Wetland Preservation Ordinance
5. Forest and Tree Conservation Ordinance
6. Protect Natural Areas
7. Preservation of Areas of Concern
8. Formation of Joint-Municipal EAC
9.
10.

23. Markel Run Watershed

Markel Run is located in the center of the watershed in Adams County. Over half the watershed is used for agricultural production.

Municipality: Reading Township

I. Issues and Concerns

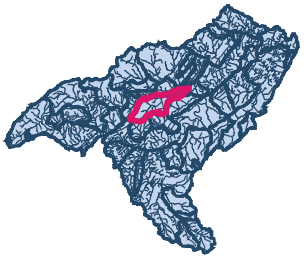
Approximately 50% of the area is designated as a Natural Area, Area of Concern, or Critical Area. Approximately half the land area of the watershed is located within a PSA.

II. Recommendations

Preserve Priority Parcels
Infiltration Requirements in Stormwater Management Ordinance
Riparian Buffer Ordinance - 150 ft. Min
Wetland Preservation Ordinance
Forest and Tree Conservation Ordinance
Protect Natural Areas
Preservation of Areas of Concern
Formation of Joint-Municipal EAC

Photo 23-A: Mackerl Run upstream from Mackerl Run Road

Photo 23-B: Mackerl Run downstream from Mackerl Run Road



REPORT FOR THE MUD RUN WATERSHED

GENERAL INFORMATION
Total Area of SubWatershed: 8090.85 acres
Total Stream Length = 25.1 miles
Total Road Length = 75.73 miles
Total Wetland Area = 391.8 acres
Total Public Land Area: 0 acres
Total Floodplain Area: 991.69 acres
Total Acres Hydric Soils: 1994.54 acres
Total Acres Hydric Inclusion: 4475.67 acres
Total Area of Soils Suitable for Infiltration: 3179.03 acres

LANDUSE
Coniferous Forest: 75.93 acres
Deciduous Forest: 773.83 acres
Emergent Wetland: 32.84 acres
Hay Pasture: 1417.8 acres
High Density Urban: 0.95 acres
Low Density Urban: 607.47 acres
Mixed Forest: 338.1 acres
Open Water: 328.36 acres
Row Crops: 4255.46 acres
Transitional: 199.49 acres
Woody Wetland: 60.54 acres

GENERALIZED ZONING
Conservation/Open Space: 6182.57 acres
Residential: 1616.35 acres
Unknown: 308.21 acres

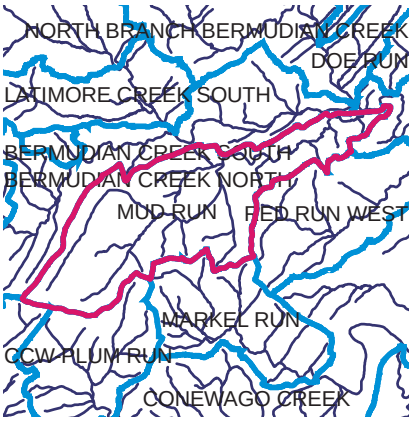
OTHER INFORMATION
Total Impervious Surface Area (2000): 397.87 acres
Total Number of Assessment Sites: 0
Total Area 'Natural Areas': 0 acres
Total Miles 303d List Streams: 0 miles
Total Area 303d List Water Bodies: 0 acres
Number of CREP Sites: 0
Total Preserved Agricultural Land: 878.07 acres
Total Area of Historic Districts: 0 acres
Total Area of Concern: 2910.47 acres
Total Critical Area: 1182.63 acres

Total Super-Critical Area: 46.54 acres

Municipalities in this Watershed:
READING,
TYRONE,
HUNTINGTON,
LATIMORE,
WASHINGTON,

GENERAL RECOMMENDATIONS FOR THIS WATERSHED:

1. Support Lake Meade Restoration Strategies
2. Riparian Buffer Ordinance - 150 ft. Min.
3. Forest and Tree Conservation Ordinance
4. Infiltration Requirements in Stormwater Management Ordinance - In Suitable Soils
5. Protection of Super Critical Areas
6. Preserve Priority Parcels
7. Wetland Preservation Ordinance
8. Restoration of Degraded Stream Reaches
9. Municipal EAC
10.



24. Mud Run Watershed

Mud Run Watershed is located in the north central portion of the watershed and surrounds the community of Lake Meade. Approximately 60% of the watershed is used for agricultural production.

Municipalities: Reading Township, Tyrone Township, Huntington Township, Latimore Township, Washington Township

I. Issues and Concerns

Degradation of Lake Meade has resulted in fish kills and other problems. There are approximately 47 acres of Super Critical Areas located within the watershed. Portions of the watershed are located in a WCA.

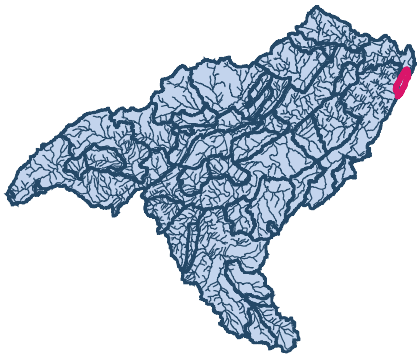
II. Recommendations

Support Lake Meade Restoration Strategies
Riparian Buffer Ordinance - 150 ft. Min.
Forest and Tree Conservation Ordinance
Infiltration Requirements in Stormwater Management Ordinance - In Suitable Soils
Protection of Super Critical Areas
Preserve Priority Parcels
Wetland Preservation Ordinance
Restoration of Degraded Stream Reaches
Municipal EAC

Photo 24-A: Mud Run upstream from Stoney Point Road

Photo 24-B: Mud Run downstream from Stoney Point Road

Photos 24 C & D: Lake Meade



REPORT FOR THE MUSSER RUN WATERSHED

GENERAL INFORMATION
Total Area of SubWatershed: 870.16 acres
Total Stream Length = 2.92 miles
Total Road Length = 12.93 miles
Total Wetland Area = 5.6 acres
Total Public Land Area: 0.54 acres
Total Floodplain Area: 32.48 acres
Total Acres Hydric Soils: 39.19 acres
Total Acres Hydric Inclusion: 34.22 acres
Total Area of Soils Suitable for Infiltration: 648.86 acres

LANDUSE
Coniferous Forest: 5.23 acres
Deciduous Forest: 39.1 acres
Hay Pasture: 110.41 acres
Low Density Urban: 263.39 acres
Mixed Forest: 26.72 acres
Open Water: 2.13 acres
Row Crops: 420.32 acres
Transitional: 2.87 acres

GENERALIZED ZONING
Agriculture: 299.31 acres
Apartment/Office: 11.96 acres
Community Center: 39.73 acres
Conservation/Open Space: 0 acres
Industrial: 21.25 acres
Residential: 494.51 acres
Unknown: 235.94 acres

OTHER INFORMATION
Total Impervious Surface Area (2000): 168.33 acres
Total Number of Assessment Sites: 0
Total Area 'Natural Areas': 0 acres
Total Miles 303d List Streams: 2.53 miles
Total Area 303d List Water Bodies: 0 acres
Number of CREP Sites: 1
Total Preserved Agricultural Land: 396.81 acres
Total Area of Historic Districts: 0 acres
Total Area of Concern: 11.32 acres
Total Critical Area: 0 acres

Total Super-Critical Area: 0 acres

Municipalities in this Watershed:
MANCHESTER,
EAST MANCHESTER,

GENERAL RECOMMENDATIONS FOR THIS WATERSHED:

1. Restoration of 303.d Listed Stream Reaches
2. Riparian Buffer Ordinance - 150 ft. Min.
3. Wetland Preservation Ordinance
4.
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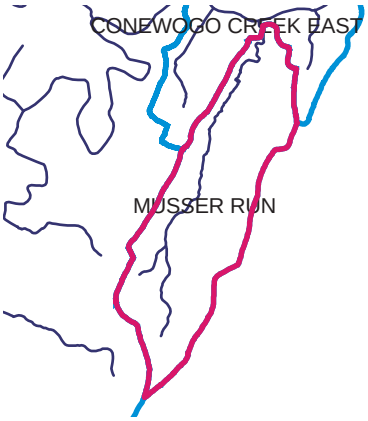


25. Musser Run Watershed

Musser Run is a headwater watershed located in the eastern end of the Conewago Creek watershed in York County. Primary land use is agriculture. There are no developed communities within this watershed.

Municipalities: Manchester Township, East Manchester Township

I. Issues and Concerns

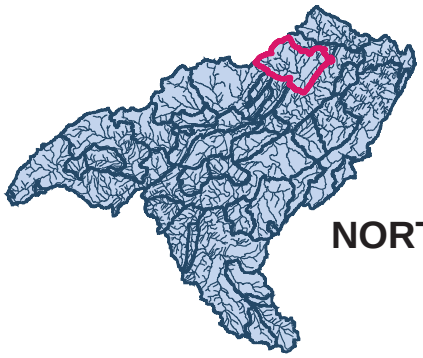
There are approximately 2.5 miles of impaired streams in the watershed on the 303.d list.

II. Recommendations

Restoration of 303.d Listed Stream Reaches
Riparian Buffer Ordinance - 150 ft. Min.
Wetland Preservation Ordinance

Photo 25-A: Musser Run upstream from Creekbottom Road

Photo 25-B: Musser Run downstream from Creekbottom Road



REPORT FOR THE NORTH BRANCH BEAVER CREEK WATERSHED

GENERAL INFORMATION
Total Area of SubWatershed: 11919 acres
Total Stream Length = 39.49 miles
Total Road Length = 63.36 miles
Total Wetland Area = 927.69 acres
Total Public Land Area: 3303.23 acres
Total Floodplain Area: 727.75 acres
Total Acres Hydric Soils: 2413.5 acres
Total Acres Hydric Inclusion: 3826.08 acres
Total Area of Soils Suitable for Infiltration: 6587.91 acres

LANDUSE
Coniferous Forest: 177.01 acres
Deciduous Forest: 6835.16 acres
Emergent Wetland: 24.76 acres
Hay Pasture: 886.19 acres
Low Density Urban: 99.52 acres
Mixed Forest: 322.72 acres
Open Water: 445.39 acres
Row Crops: 2881.25 acres
Transitional: 186.3 acres
Woody Wetland: 60.91 acres

GENERALIZED ZONING
Agriculture: 4294.86 acres
Commercial: 432.85 acres
Conservation/Open Space: 6518.14 acres
Residential: 339.16 acres
Village Center: 333.99 acres

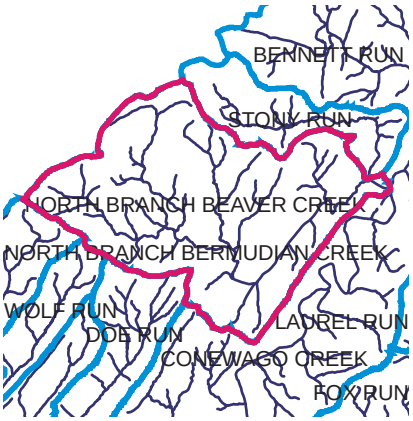
OTHER INFORMATION
Total Impervious Surface Area (2000): 46.56 acres
Total Number of Assessment Sites: 1
Total Area 'Natural Areas': 3527.77 acres
Total Miles 303d List Streams: 0 miles
Total Area 303d List Water Bodies: 361.2 acres
Number of CREP Sites: 5
Total Preserved Agricultural Land: 1081.84 acres
Total Area of Historic Districts: 0 acres
Total Area of Concern: 2238.33 acres
Total Critical Area: 3119.21 acres

Total Super-Critical Area: 977.92 acres

Municipalities in this Watershed:
CARROLL,
WARRINGTON,
MONAGHAN,
NEWBERRY,

GENERAL RECOMMENDATIONS FOR THIS WATERSHED:

1. Installlation of Access Point No. 21 - Bull Road
2. Protection of Super Critical Areas
3. Protection of Critical Areas and Areas of Concern
4. Forest and Tree Conservation Ordinance
5. Riparian Buffer Ordinance - 150 ft. Min.
6. Restoration of 303.d Listed Water Body - Pinchot Lake
7. Protection of Natural Areas
8. Preserve Priority Parcels
9. Infiltration Requirements in Stormwater Management Ordinance
10. Regional EAC



26. North Branch Beaver Creek Watershed

North Branch Beaver Creek watershed is located along the northern boundary of the Conewago Watershed in York County. Primary land use is forest. There are no major communities located within the watershed. Pinchot State Park and Lake is located within the watershed as is Ski Roundtop.

Municipalities: Carroll Township, Warrington Township, Monaghan Township, Newberry Township

I. Issues and Concerns

The watershed is located within a WCA. There are approximately 977 acres of Super-Critical Areas in the watershed and approximately 8800 acres of Natural Areas, Areas of Concern, and Critical Areas in the watershed. Pinchot Lake is listed as an impaired water body on the 303.d list.

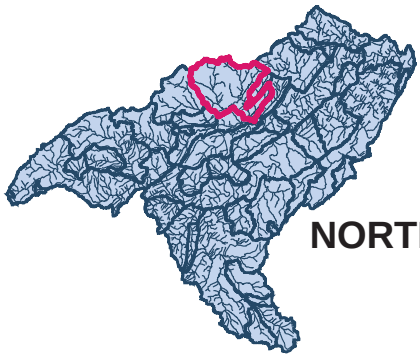
II. Recommendations

Installlation of Access Point No. 21 - Bull Road
Protection of Super Critical Areas
Protection of Critical Areas and Areas of Concern
Forest and Tree Conservation Ordinance
Riparian Buffer Ordinance - 150 ft. Min.
Restoration of 303.d Listed Water Body - Pinchot Lake
Protection of Natural Areas
Preserve Priority Parcels
Infiltration Requirements in Stormwater Management Ordinance
Regional EAC

Photo 26-A: North Beaver Creek upstream from Bull Road

Photo 26-B: North Beaver Creek downstream from Bull Road

Photos 26-C through G: Pinchot Lake at Gifford Pinchot State Park



REPORT FOR THE NORTH BRANCH BERMUDIAN CREEK WATERSHED

GENERAL INFORMATION
Total Area of SubWatershed: 18304.46 acres
Total Stream Length = 52.92 miles
Total Road Length = 110.41 miles
Total Wetland Area = 681.85 acres
Total Public Land Area: 1222.28 acres
Total Floodplain Area: 695.65 acres
Total Acres Hydric Soils: 2366.29 acres
Total Acres Hydric Inclusion: 5334.52 acres
Total Area of Soils Suitable for Infiltration: 11861.28 acres

LANDUSE
Coniferous Forest: 69.56 acres
Deciduous Forest: 2282.66 acres
Emergent Wetland: 71.36 acres
Hay Pasture: 3755.22 acres
Low Density Urban: 219.28 acres
Mixed Forest: 961.27 acres
Open Water: 61.78 acres
Row Crops: 10118.56 acres
Transitional: 543.23 acres
Woody Wetland: 221.72 acres

GENERALIZED ZONING
Agriculture: 2031.65 acres
Apartment/Office: 11.58 acres
Commercial: 18.28 acres
Conservation/Open Space: 939.05 acres
Residential: 5386.17 acres
Unknown: 19331.09 acres

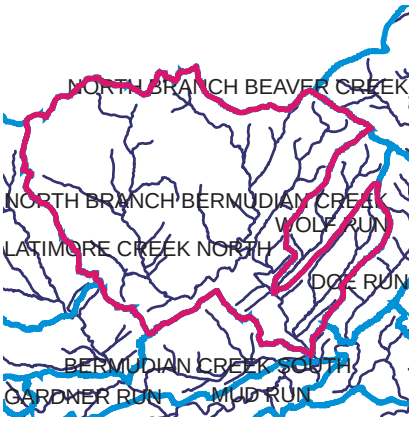
OTHER INFORMATION
Total Impervious Surface Area (2000): 141.51 acres
Total Number of Assessment Sites: 1
Total Area 'Natural Areas': 1360.24 acres
Total Miles 303d List Streams: 19.47 miles
Total Area 303d List Water Bodies: 0 acres
Number of CREP Sites: 8
Total Preserved Agricultural Land: 2377.89 acres
Total Area of Historic Districts: 0 acres
Total Area of Concern: 7027.88 acres
Total Critical Area: 3429.61 acres

Total Super-Critical Area: 763.66 acres

Municipalities in this Watershed:
LATIMORE,
WASHINGTON,
FRANKLINTOWN,
CARROLL,
WARRINGTON,

GENERAL RECOMMENDATIONS FOR THIS WATERSHED:

1. Protection of Super Critical Areas
2. Preservation of Critical Areas and Areas of Concern
3. Preserve Priority Parcels
4. Infiltration Requirements In Stormwater Management Ordinance
5. Riparian Buffer Ordinance - 150 ft. Min.
6. Restoration of 303.d Listed Stream Reaches
7. Forest and Tree Conservation Ordinance
8. Wetland Preservation Ordinance
9. Restoration of Sub-Optimal Ranking
10. Protection of Natural Areas



27. North Branch Bermudian Creek Watershed

North Branch Bermudian Creek is located along the northern boundary of the Conewago Creek Watershed in York County. Primary land use is agriculture. Franklintown is located within this watershed.

Municipalities: Latimore Township, Washington Township, Franklintown, Carroll Township, Warrington Township

I. Issues and Concerns

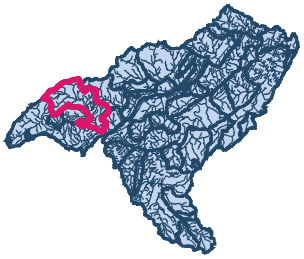
There are approximately 19 miles of impaired streams on the 303.d list in this watershed. In addition, there are approximately 764 acres of Super-Critical Areas to be preserved. Portions of the watershed are located in a WCA. Natural Areas, Areas of Concern, and Critical Areas comprise approximately 65% of the land area.

II. Recommendations

Protection of Super Critical Areas
Preservation of Critical Areas and Areas of Concern
Preserve Priority Parcels
Infiltration Requirements In Stormwater Management Ordinance
Riparian Buffer Ordinance - 150 ft. Min.
Restoration of 303.d Listed Stream Reaches
Forest and Tree Conservation Ordinance
Wetland Preservation Ordinance
Restoration of Sub-Optimal Ranking
Protection of Natural Areas

Photo 27-A: Bermudian Creek North upstream from Short Cut Road

Photo 27-B: North Branch Bermudian Creek North downstream from Short Cut Road



REPORT FOR THE OPOSSUM CREEK WATERSHED

GENERAL INFORMATION
Total Area of SubWatershed: 17323.93 acres
Total Stream Length = 61.95 miles
Total Road Length = 129.19 miles
Total Wetland Area = 278.51 acres
Total Public Land Area: 401.24 acres
Total Floodplain Area: 1862.59 acres
Total Acres Hydric Soils: 1773.04 acres
Total Acres Hydric Inclusion: 3074.84 acres
Total Area of Soils Suitable for Infiltration: 13439.07 acres

LANDUSE
Coniferous Forest: 265.77 acres
Deciduous Forest: 4752.78 acres
Emergent Wetland: 20.8 acres
Hay Pasture: 3763.02 acres
Low Density Urban: 149.68 acres
Mixed Forest: 1175.53 acres
Open Water: 142.61 acres
Row Crops: 6247.13 acres
Transitional: 669.7 acres
Woody Wetland: 136.74 acres

GENERALIZED ZONING
Business: 19.55 acres
Commercial: 30.45 acres
Conservation/Open Space: 13252.8 acres
Employment Center: 555.99 acres
Industrial: 24.85 acres
Residential: 2385.5 acres
Unknown: 1602.17 acres
Village: 276.08 acres

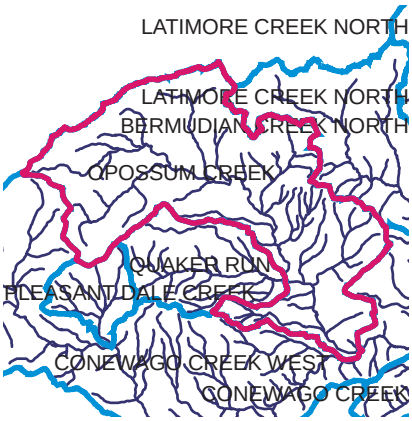
OTHER INFORMATION
Total Impervious Surface Area (2000): 91.81 acres
Total Number of Assessment Sites: 8
Total Area 'Natural Areas': 401.73 acres
Total Miles 303d List Streams: 0 miles
Total Area 303d List Water Bodies: 0 acres
Number of CREP Sites: 7
Total Preserved Agricultural Land: 1129.51 acres
Total Area of Historic Districts: 0 acres
Total Area of Concern: 8238.8 acres
Total Critical Area: 7232.64 acres

Total Super-Critical Area: 41.12 acres

Municipalities in this Watershed:
BUTLER,
BENDERVILLE,
MENALLEN,
TYRONE,
COOKE,
DICKINSON,

GENERAL RECOMMENDATIONS FOR THIS WATERSHED:

1. Protection of Super-Critical Areas
2. Protection of Natural Areas
3. Preserve Priority Parcels
4. Infiltration Requirements in Stormwater Management Ordinance
5. Riparian Buffer Ordinance - 150 ft. Min.
6. Forest and Tree Conservation Ordinance
7. Wetland Preservation Ordinance
8. Installation of Access Point No. 24 - Old Carlisle Road
9. Restoration of Degraded Stream Reaches - Sub-Optimal through Poor
10. Regional EAC



28 Opossum Creek Watershed

Opossum Creek is located in the northwestern portion of the Conewago Creek watershed in the Adams County Fruitbelt. The community of Bendersville is located within the watershed. Primary land use is agriculture and forest. Opossum Creek is located along the south faces of South Mountain.

Municipalities: Butler Township, Bendersville Borough, Menhallen Township, Tyrone Township, Cooke Township, Dickinson Township

I. Issues and Concerns

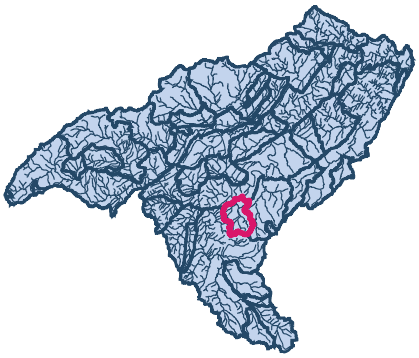
Almost the entire watershed is located in a Super-Critical Area, Critical Area, Area of Concern, or Natural Area. Additionally, the watershed is located in a PSA. There is a lack of legal public access points in the watershed.

II. Recommendations

Protection of Super-Critical Areas
Protection of Natural Areas
Preserve Priority Parcels
Infiltration Requirements in Stormwater Management Ordinance
Riparian Buffer Ordinance - 150 ft. Min.
Forest and Tree Conservation Ordinance
Wetland Preservation Ordinance
Installation of Access Point No. 24 - Old Carlisle Road
Restoration of Degraded Stream Reaches - Sub-Optimal through Poor
Regional EAC

Photo 28-A: Opossum Creek upstream

Photo 28-B: Opossum Creek downstream



REPORT FOR THE PINE RUN WATERSHED

GENERAL INFORMATION
Total Area of SubWatershed: 4262.5 acres
Total Stream Length = 14.9 miles
Total Road Length = 34.68 miles
Total Wetland Area = 90.64 acres
Total Public Land Area: 0 acres
Total Floodplain Area: 359.52 acres
Total Acres Hydric Soils: 588.21 acres
Total Acres Hydric Inclusion: 1429.84 acres
Total Area of Soils Suitable for Infiltration: 2594.07 acres

LANDUSE
Coniferous Forest: 32.33 acres
Deciduous Forest: 540.78 acres
Emergent Wetland: 17.06 acres
Hay Pasture: 703.81 acres
High Density Urban: 61.64 acres
Low Density Urban: 85.02 acres
Mixed Forest: 152.61 acres
Open Water: 17.14 acres
Row Crops: 2562.49 acres
Transitional: 30.55 acres
Woody Wetland: 58.89 acres

GENERALIZED ZONING
Commercial: 87.95 acres
Conservation/Open Space: 1199.48 acres
Employment Center: 255.23 acres
Mixed Use: 512.76 acres
Residential: 1948.53 acres
Unknown: 513.97 acres

OTHER INFORMATION
Total Impervious Surface Area (2000): 98.98 acres
Total Number of Assessment Sites: 2
Total Area 'Natural Areas': 0 acres
Total Miles 303d List Streams: 0 miles
Total Area 303d List Water Bodies: 0 acres
Number of CREP Sites: 3
Total Preserved Agricultural Land: 510.38 acres
Total Area of Historic Districts: 2.51 acres
Total Area of Concern: 295.1 acres
Total Critical Area: 36.02 acres

Total Super-Critical Area: 0 acres

Municipalities in this Watershed:
OXFORD,
ABBOTTSTOWN,
HAMILTON,
BERWICK,

GENERAL RECOMMENDATIONS FOR THIS WATERSHED:

1. Preserve Priority Parcels
2. Infiltration Requirements in Stormwater Management Ordinance
3. Preserve Historic District
4. Riparian Buffer Ordinance - 100 ft. Min.
5. Wetland Preservation Ordinance
6. Restoration of Degraded Stream Reaches
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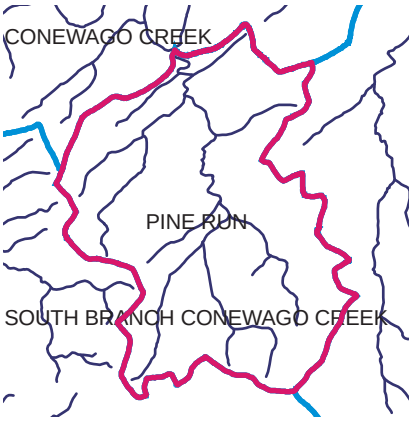


29 Pine Run Watershed

Pine Run is located in the central portion of the watershed north of Hanover. Primary land use is agriculture. There are no developed communities within the watershed.

Municipalities: Oxford Township, Abbottstown Borough, Hamilton Township, Berwick Township

I. Issues and Concerns

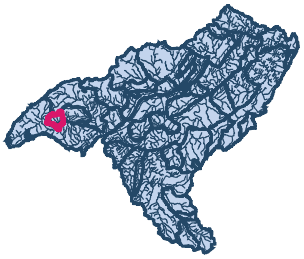
Portions of the watershed are located within a WCA. There are approximately 335 acres of Critical Areas and Areas of Concern.

Recommendations

Preserve Priority Parcels
Infiltration Requirements in Stormwater Management Ordinance
Preserve Historic District
Riparian Buffer Ordinance - 100 ft. Min.
Wetland Preservation Ordinance
Restoration of Degraded Stream Reaches

Photo 29-A: Pine Run upstream from Pine Run Road

Photo 29-B: Pine Run downstream from Pine Run Road



REPORT FOR THE PLEASANT DALE CREEK WATERSHED

GENERAL INFORMATION
Total Area of SubWatershed: 1906.92 acres
Total Stream Length = 7.55 miles
Total Road Length = 13.03 miles
Total Wetland Area = 24.2 acres
Total Public Land Area: 8.95 acres
Total Floodplain Area: 206 acres
Total Acres Hydric Soils: 90.45 acres
Total Acres Hydric Inclusion: 294.95 acres
Total Area of Soils Suitable for Infiltration: 1763.75 acres

LANDUSE
Coniferous Forest: 9.98 acres
Deciduous Forest: 510.08 acres
Emergent Wetland: 2.96 acres
Hay Pasture: 410.71 acres
Low Density Urban: 9.89 acres
Mixed Forest: 137.73 acres
Open Water: 17.88 acres
Row Crops: 733.92 acres
Transitional: 66.96 acres
Woody Wetland: 6.77 acres

GENERALIZED ZONING
Agriculture: 0.01 acres
Conservation/Open Space: 1864.96 acres
Residential: 41.96 acres

OTHER INFORMATION
Total Impervious Surface Area (2000): 5.7 acres
Total Number of Assessment Sites: 5
Total Area 'Natural Areas': 0 acres
Total Miles 303d List Streams: 0 miles
Total Area 303d List Water Bodies: 0 acres
Number of CREP Sites: 0
Total Preserved Agricultural Land: 14.71 acres
Total Area of Historic Districts: 0 acres
Total Area of Concern: 1166.69 acres
Total Critical Area: 596.37 acres

Total Super-Critical Area: 1.73 acres

Municipalities in this Watershed:
FRANKLIN,
MENALLEN,

GENERAL RECOMMENDATIONS FOR THIS WATERSHED:

1. Protection of Super-Critical Areas
2. Preserve Priority Parcels
3. Infiltration Requirements in Stormwater Management Ordinance
4. Riparian Buffer Ordinance - 150 ft. Min.
5. Forest and Tree Conservation Ordinance
6. Regional EAC
7. Wetland Preservation Ordinance
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30. Pleasant Dale Creek Watershed

Pleasant Dale Creek is located in the western portion of the Conewago Watershed on the eastern face of South Mountain in Adams County. Primary land use is agriculture.

Municipalities: Franklin Township, Menhallen Township

I. Issues and Concerns

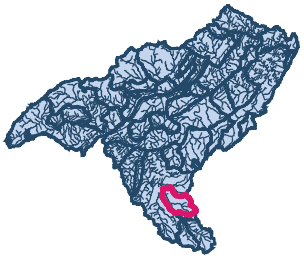
There are approximately 2000 acres of Super-Critical Areas, Critical Areas, and Areas of Concern located within the watershed. The watershed is located within a PSA and the Adams County Fruitbelt.

II. Recommendations

Protection of Super-Critical Areas
Preserve Priority Parcels
Infiltration Requirements in Stormwater Management Ordinance
Riparian Buffer Ordinance - 150 ft. Min.
Forest and Tree Conservation Ordinance
Regional EAC
Wetland Preservation Ordinance

Photo 30-A: Pleasant Dale Creek upstream from Celebration Road

Photo 30-B: Pleasant Dale Creek downstream from Celebration Road



REPORT FOR THE PLUM CREEK WATERSHED

GENERAL INFORMATION
Total Area of SubWatershed: 5771.22 acres
Total Stream Length = 11.88 miles
Total Road Length = 134.19 miles
Total Wetland Area = 86.4 acres
Total Public Land Area: 37.69 acres
Total Floodplain Area: 380.21 acres
Total Acres Hydric Soils: 243.91 acres
Total Acres Hydric Inclusion: 2334.42 acres
Total Area of Soils Suitable for Infiltration: 3184.08 acres

LANDUSE
Coniferous Forest: 16.41 acres
Deciduous Forest: 38.81 acres
Emergent Wetland: 30.36 acres
Hay Pasture: 743.8 acres
High Density Urban: 1753.11 acres
Low Density Urban: 470.28 acres
Mixed Forest: 164.35 acres
Open Water: 10.1 acres
Row Crops: 2474.14 acres
Transitional: 30.71 acres
Woody Wetland: 38.72 acres

GENERALIZED ZONING
Apartment/Office: 53.75 acres
Business: 149.74 acres
Commercial: 153.68 acres
Commercial/Industrial: 347.82 acres
Conservation/Open Space: 1755.6 acres
Industrial: 222.79 acres
Office: 1.6 acres
Residential: 2900.61 acres
Unknown: 11.1 acres
Village Residential: 198.11 acres

OTHER INFORMATION
Total Impervious Surface Area (2000): 1727.19 acres
Total Number of Assessment Sites: 0
Total Area 'Natural Areas': 0 acres
Total Miles 303d List Streams: 6.4 miles
Total Area 303d List Water Bodies: 0 acres
Number of CREP Sites: 107
Total Preserved Agricultural Land: 73.45 acres
Total Area of Historic Districts: 128.39 acres
Total Area of Concern: 135.4 acres
Total Critical Area: 23.81 acres

Total Super-Critical Area: 0 acres

Municipalities in this Watershed:
PENN,
MCSHERRYSTOWN,
HANOVER,
CONEWAGO,
MOUNT PLEASANT,

GENERAL RECOMMENDATIONS FOR THIS WATERSHED:

1. Infiltration Requirements in Stormwater Management Ordinance
2. Riparian Buffer Ordinance - 150 ft. Min.
3. Forest and Tree Conservation Ordinance
4. Restoration of 303.d Listed Stream Reaches
5. Wetland Preservation Ordinance
6. Preserve Priority Parcels
7. Regional EAC
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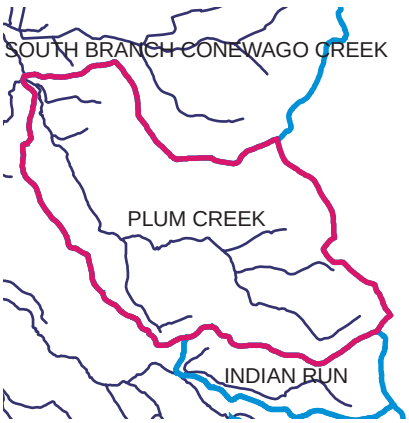


31. Plum Creek Watershed

Plum Creek is located in the southern portion of the watershed in the greater Hanover area. The growing communities of Hanover and McSherrystown are located within the watershed. Primary land use is a mix of urban and agriculture.

Municipalities: Penn Township, McSherrystown Borough, Hanover Borough, Conewago Township, Mount Pleasant

I. Issues and Concerns

This region of the watershed is experiencing rapid growth and development. This development is occurring in a PSA. There are approximately 6 miles of impaired streams on the 303.d list. There are approximately 158 acres of Areas of Concern and Critical Areas.

II. Recommendations

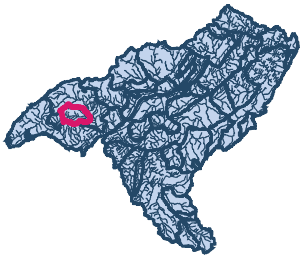
Infiltration Requirements in Stormwater Management Ordinance
Riparian Buffer Ordinance - 150 ft. Min.
Forest and Tree Conservation Ordinance
Restoration of 303.d Listed Stream Reaches
Wetland Preservation Ordinance
Preserve Priority Parcels
Regional EAC

Photo 31-A: Plum Creek upstream from Chapel Road

Photo 31-B: Plum Creek downstream from Chapel Road

Photo 31-C: Plum Run upstream from Plum Road

Photo 31-D: Plum Run downstream from Plum Road



REPORT FOR THE QUAKER RUN WATERSHED

GENERAL INFORMATION
Total Area of SubWatershed: 4324.87 acres
Total Stream Length = 19.41 miles
Total Road Length = 21.58 miles
Total Wetland Area = 113.01 acres
Total Public Land Area: 104.67 acres
Total Floodplain Area: 410.23 acres
Total Acres Hydric Soils: 407.92 acres
Total Acres Hydric Inclusion: 811.39 acres
Total Area of Soils Suitable for Infiltration: 3637.68 acres

LANDUSE
Coniferous Forest: 13.88 acres
Deciduous Forest: 870.48 acres
Emergent Wetland: 5.42 acres
Hay Pasture: 1136.97 acres
Low Density Urban: 10.35 acres
Mixed Forest: 233.69 acres
Open Water: 24.28 acres
Row Crops: 1779.32 acres
Transitional: 157.22 acres
Woody Wetland: 93.2 acres

GENERALIZED ZONING
Business: 11.74 acres
Commercial: 402.4 acres
Conservation/Open Space: 3849.44 acres
Residential: 41.89 acres
Village: 19.57 acres

OTHER INFORMATION
Total Impervious Surface Area (2000): 4.82 acres
Total Number of Assessment Sites: 1
Total Area 'Natural Areas': 0 acres
Total Miles 303d List Streams: 0 miles
Total Area 303d List Water Bodies: 0 acres
Number of CREP Sites: 0
Total Preserved Agricultural Land: 462.29 acres
Total Area of Historic Districts: 0 acres
Total Area of Concern: 2440.4 acres
Total Critical Area: 1957.85 acres

Total Super-Critical Area: 26.13 acres

Municipalities in this Watershed:
BUTLER,
BENDERVILLE,
MENALLEN,

GENERAL RECOMMENDATIONS FOR THIS WATERSHED:

1. Preserve Priority Parcels
2. Protection of Super-Critical Areas
3. Infiltration Requirements in Stormwater Management Ordinance
4. Forest and Tree Conservation Ordinance
5. Wetland Preservation Ordinance
6. Regional EAC
7. Riparian Buffer Ordinance - 150 ft. Min.
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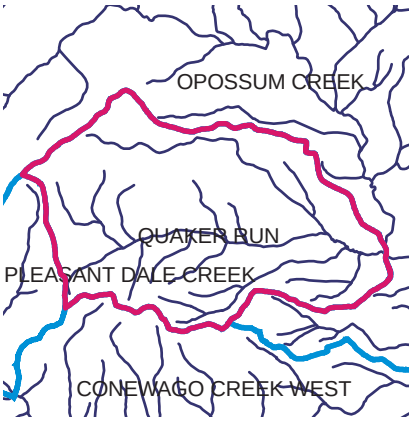


32. Quaker Run Watershed

Quaker Run is located in the western portion of the watershed in Adams County along the eastern slope of South Mountain. Primary land use is agriculture. The community of Bendersville is partially located in the watershed.

Municipalities: Butler Township, Benderville Borough, Menhallen Township

I. Issues and Concerns

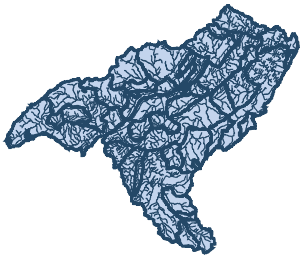
The watershed is located in a PSA and the Adams County Fruit Belt. There are 26 acres of Super-Critical Areas and approximately 4400 acres of Areas of Concern and Critical Areas.

II. Recommendations

Preserve Priority Parcels
Protection of Super-Critical Areas
Infiltration Requirements in Stormwater Management Ordinance
Forest and Tree Conservation Ordinance
Wetland Preservation Ordinance
Regional EAC
Riparian Buffer Ordinance - 150 ft. Min.

Photo 32-A: Quaker Run upstream from Route 34

Photo 32-B: Quaker Run downstream from Route 34



REPORT FOR THE RED RUN EAST WATERSHED

GENERAL INFORMATION
Total Area of SubWatershed: 2790.82 acres
Total Stream Length = 11.3 miles
Total Road Length = 15.94 miles
Total Wetland Area = 143.05 acres
Total Public Land Area: 10.29 acres
Total Floodplain Area: 290.75 acres
Total Acres Hydric Soils: 418.01 acres
Total Acres Hydric Inclusion: 970.09 acres
Total Area of Soils Suitable for Infiltration: 1379.57 acres

LANDUSE
Coniferous Forest: 50.48 acres
Deciduous Forest: 840.62 acres
Emergent Wetland: 6.6 acres
Hay Pasture: 510.55 acres
Low Density Urban: 29.62 acres
Mixed Forest: 98.8 acres
Open Water: 68.69 acres
Row Crops: 1160.46 acres
Transitional: 22.66 acres
Woody Wetland: 2.34 acres

GENERALIZED ZONING
Residential: 1522.34 acres
Unknown: 1268.47 acres

OTHER INFORMATION
Total Impervious Surface Area (2000): 14.71 acres
Total Number of Assessment Sites: 2
Total Area 'Natural Areas': 122.72 acres
Total Miles 303d List Streams: 0 miles
Total Area 303d List Water Bodies: 0 acres
Number of CREP Sites: 0
Total Preserved Agricultural Land: 305.61 acres
Total Area of Historic Districts: 0 acres
Total Area of Concern: 250.31 acres
Total Critical Area: 183.09 acres

Total Super-Critical Area: 2.24 acres

Municipalities in this Watershed:
WASHINGTON,

GENERAL RECOMMENDATIONS FOR THIS WATERSHED:

1. Permanent Protection of Super Critical Areas
2. Riparian Buffer Ordinance - 100 ft min.
3. Installation of Access Point No. 20 on Creek Road
4. Preserve Priority Parcels
5. Infiltration Requirements in Stormwater Management Ordinance for WCA
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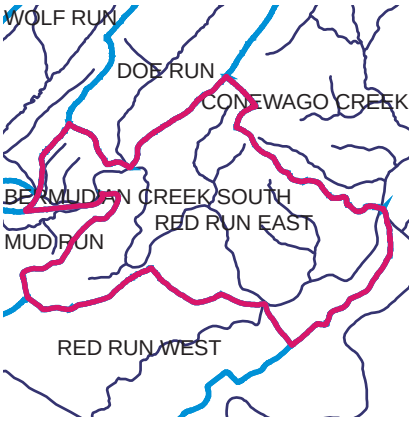


33. Red Run East (Bermudian Creek) Watershed

Red Run East watershed (Bermudian Creek) is located in the east central portion of the watershed in York County. Primary land use is agriculture. There are no developed communities within the watershed.

Municipalities: Washington Township

I. Issues and Concerns

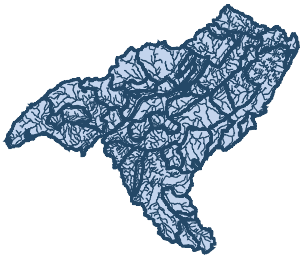
There are approximately 450 acres of Natural Areas, Areas of Concern, Critical Areas, and Super-Critical Areas located within the watershed. There is also a lack of legal public access to the creek.

II. Recommendations

Permanent Protection of Super Critical Areas
Riparian Buffer Ordinance - 100 ft min.
Installation of Access Point No. 20 on Creek Road
Preserve Priority Parcels
Infiltration Requirements in Stormwater Management Ordinance for WCA

Photo 33-A: Red Run East upstream from Davidsburg Road

Photo 33-B: Red Run East downstream from Davidsburg Road



REPORT FOR THE RED RUN WEST WATERSHED

GENERAL INFORMATION
Total Area of SubWatershed: 4971.32 acres
Total Stream Length = 13.18 miles
Total Road Length = 20.78 miles
Total Wetland Area = 48.92 acres
Total Public Land Area: 0 acres
Total Floodplain Area: 236.41 acres
Total Acres Hydric Soils: 650.26 acres
Total Acres Hydric Inclusion: 1959.53 acres
Total Area of Soils Suitable for Infiltration: 3120.82 acres

LANDUSE
Coniferous Forest: 51.02 acres
Deciduous Forest: 1046.84 acres
Emergent Wetland: 3.5 acres
Hay Pasture: 968.6 acres
Low Density Urban: 22.52 acres
Mixed Forest: 232.7 acres
Open Water: 22.24 acres
Row Crops: 2577.5 acres
Transitional: 28.59 acres
Woody Wetland: 17.75 acres

GENERALIZED ZONING
Conservation/Open Space: 2549.89 acres
Residential: 1588.88 acres
Unknown: 849.91 acres

OTHER INFORMATION
Total Impervious Surface Area (2000): 11.81 acres
Total Number of Assessment Sites: 0
Total Area 'Natural Areas': 1.94 acres
Total Miles 303d List Streams: 0 miles
Total Area 303d List Water Bodies: 0 acres
Number of CREP Sites: 3
Total Preserved Agricultural Land: 245.07 acres
Total Area of Historic Districts: 0 acres
Total Area of Concern: 83.82 acres
Total Critical Area: 0.42 acres

Total Super-Critical Area: 0 acres

Municipalities in this Watershed:
READING,
WASHINGTON,

GENERAL RECOMMENDATIONS FOR THIS WATERSHED:

1. Preserve Priority Parcels
2. Infiltration Requirements in Stormwater Management Ordinance
3. Forest and Tree Conservation Ordinance
4. Wetland Preservation Ordinance
5. Protection of Natural Areas
6. Regional/Joint Municipal EAC
7. Preservation of Areas of Concern
8. Riparian Buffer Ordinance - 150 ft. Min.
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34. Red Run West (Red Run) Watershed

Red Run Watershed is located in the center of the watershed in York and Adams Counties. Primary land use is agriculture.

Municipalities: Reading Township, Washington Township

I. Issues and Concerns

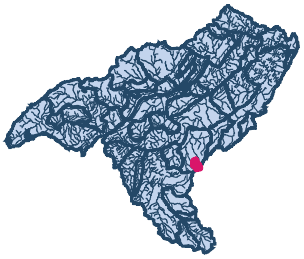
Portions of the watershed are located in a WCA. There are approximately 53 acres of Natural Areas and Areas of Concern within the watershed.

II. Recommendations

Preserve Priority Parcels
Infiltration Requirements in Stormwater Management Ordinance
Forest and Tree Conservation Ordinance
Wetland Preservation Ordinance
Protection of Natural Areas
Regional/Joint Municipal EAC
Preservation of Areas of Concern
Riparian Buffer Ordinance - 150 ft. Min.

Photo 34-A: Red Run West upstream from Bakers Watering Trough Road

Photo 34-B: Red Run West downstream from Bakers Watering Trough Road



REPORT FOR THE SBC-MOULSTON WATERSHED

GENERAL INFORMATION
Total Area of SubWatershed: 484.28 acres
Total Stream Length = 1.35 miles
Total Road Length = 4.64 miles
Total Wetland Area = 0.6 acres
Total Public Land Area: 0 acres
Total Floodplain Area: 4.23 acres
Total Acres Hydric Soils: 0 acres
Total Acres Hydric Inclusion: 95.47 acres
Total Area of Soils Suitable for Infiltration: 472.29 acres

LANDUSE
Coniferous Forest: 27.63 acres
Deciduous Forest: 231.04 acres
Hay Pasture: 48.42 acres
Low Density Urban: 1.9 acres
Mixed Forest: 16.43 acres
Open Water: 0.89 acres
Row Crops: 151.24 acres
Transitional: 6.71 acres

GENERALIZED ZONING
Conservation/Open Space: 338.69 acres
Residential: 161.06 acres

OTHER INFORMATION
Total Impervious Surface Area (2000): 0.86 acres
Total Number of Assessment Sites: 0
Total Area 'Natural Areas': 17.96 acres
Total Miles 303d List Streams: 0 miles
Total Area 303d List Water Bodies: 0 acres
Number of CREP Sites: 0
Total Preserved Agricultural Land: 0 acres
Total Area of Historic Districts: 0 acres
Total Area of Concern: 36.7 acres
Total Critical Area: 0 acres

Total Super-Critical Area: 0 acres

Municipalities in this Watershed:
PENN,
HEIDELBERG,
BERWICK,
PARADISE,

GENERAL RECOMMENDATIONS FOR THIS WATERSHED:

1. Riparian Buffer Ordinance - 100 ft. Min.
2. Protection of Natural Areas
3. Wetland Preservation Ordinance
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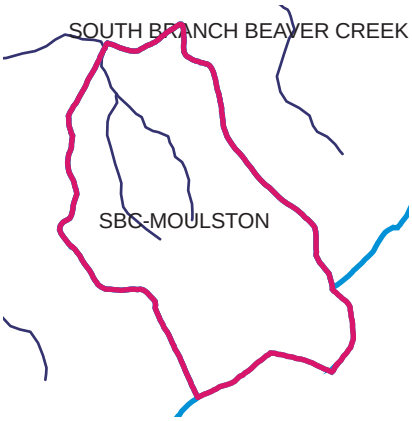


35. SBC-Moulstown Branch Watershed

The Moulstown Branch Watershed is located in the southern portion of the watershed in York and Adams Counties along the southern boundary of the Conewago watershed. Primary land use is a mix of agriculture and forest.

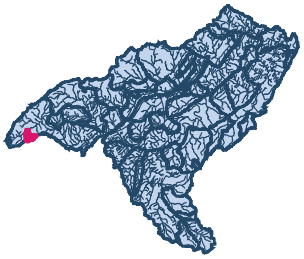
Municipalities: Penn Township, Heidelberg Township, Berwick, Paradise Township

I. Issues and Concerns

There are approximately 50 acres of Natural Areas and Areas of Concern located within the watershed.

II. Recommendations

Riparian Buffer Ordinance - 100 ft. Min.
Protection of Natural Areas
Wetland Preservation Ordinance



REPORT FOR THE SHARPS RUN WATERSHED

GENERAL INFORMATION
Total Area of SubWatershed: 455.86 acres
Total Stream Length = 1.92 miles
Total Road Length = 1.71 miles
Total Wetland Area = 0.67 acres
Total Public Land Area: 0 acres
Total Floodplain Area: 25.74 acres
Total Acres Hydric Soils: 1.57 acres
Total Acres Hydric Inclusion: 160.91 acres
Total Area of Soils Suitable for Infiltration: 406.36 acres

LANDUSE
Coniferous Forest: 9.21 acres
Deciduous Forest: 224.37 acres
Emergent Wetland: 0.22 acres
Hay Pasture: 50.39 acres
Low Density Urban: 0.22 acres
Mixed Forest: 88.35 acres
Open Water: 0.59 acres
Row Crops: 65.84 acres
Transitional: 16.65 acres

GENERALIZED ZONING
Agriculture: 281.01 acres
Conservation/Open Space: 171.18 acres

OTHER INFORMATION
Total Impervious Surface Area (2000): 0.07 acres
Total Number of Assessment Sites: 0
Total Area 'Natural Areas': 0 acres
Total Miles 303d List Streams: 0 miles
Total Area 303d List Water Bodies: 0 acres
Number of CREP Sites: 0
Total Preserved Agricultural Land: 0 acres
Total Area of Historic Districts: 0 acres
Total Area of Concern: 432.89 acres
Total Critical Area: 13.74 acres

Total Super-Critical Area: 0 acres

Municipalities in this Watershed:
FRANKLIN,

GENERAL RECOMMENDATIONS FOR THIS WATERSHED:

1. Preserve Priority Parcels
2. Infiltration Requirements in Stormwater Management Ordinance
3. Forest and Tree Conservation Ordinance
4. Riparian Buffer Ordinance - 150 ft. Min.
5. Wetland Preservation Ordinance
6. Protection of Critical Areas and Areas of Concern
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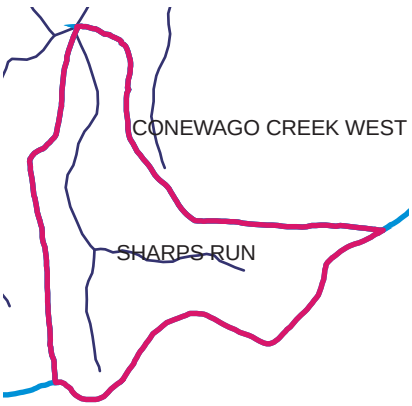


36. Sharps Run Watershed

Sharps Run watershed is located in the western portion of the Conewago Watershed in Adams County along the eastern slope of South Mountain. Primary land use is forest. There are no developed communities within the watershed. The watershed is located within the Adams County Fruit Belt.

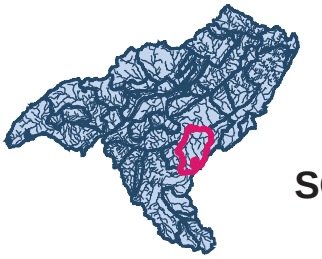
Municipalities: Franklin Township

I. Issues and Concerns

The entire watershed is either located in a Critical Area or Area of Concern.

II. Recommendations

Preserve Priority Parcels
Infiltration Requirements in Stormwater Management Ordinance
Forest and Tree Conservation Ordinance
Riparian Buffer Ordinance - 150 ft. Min.
Wetland Preservation Ordinance
Protection of Critical Areas and Areas of Concern



REPORT FOR THE SOUTH BRANCH BEAVER CREEK WATERSHED

GENERAL INFORMATION
Total Area of SubWatershed: 10823.68 acres
Total Stream Length = 23.96 miles
Total Road Length = 94.22 miles
Total Wetland Area = 216.08 acres
Total Public Land Area: 14.46 acres
Total Floodplain Area: 524.13 acres
Total Acres Hydric Soils: 792.7 acres
Total Acres Hydric Inclusion: 2700.31 acres
Total Area of Soils Suitable for Infiltration: 8974.9 acres

LANDUSE
Coniferous Forest: 133.5 acres
Deciduous Forest: 1618.98 acres
Emergent Wetland: 3.64 acres
Hay Pasture: 2089.55 acres
High Density Urban: 48.33 acres
Low Density Urban: 206.38 acres
Mixed Forest: 374.13 acres
Open Water: 48.34 acres
Row Crops: 6105.44 acres
Transitional: 113.47 acres
Woody Wetland: 81.52 acres

GENERALIZED ZONING
Agriculture: 3369.42 acres
Commercial: 317.62 acres
Conservation/Open Space: 1774.14 acres
Employment Center: 7.75 acres
Industrial: 64.88 acres
Mixed Use: 67.61 acres
Residential: 5113.06 acres
Town Center: 26.69 acres
Village: 1.56 acres
Village Residential: 125.84 acres

OTHER INFORMATION
Total Impervious Surface Area (2000): 152.56 acres
Total Number of Assessment Sites: 4
Total Area 'Natural Areas': 38.87 acres
Total Miles 303d List Streams: 0 miles
Total Area 303d List Water Bodies: 0 acres
Number of CREP Sites: 4
Total Preserved Agricultural Land: 2529.45 acres
Total Area of Historic Districts: 249.45 acres
Total Area of Concern: 481.64 acres
Total Critical Area: 63.52 acres

Total Super-Critical Area: 0 acres

Municipalities in this Watershed:
PENN,
HEIDELBERG,
ABBOTTSTOWN,
HAMILTON,
BERWICK,
EAST BERLIN,
PARADISE,

GENERAL RECOMMENDATIONS FOR THIS WATERSHED:

1. Preserve Priority Parcels
2. Protect Natural Areas
3. Restoration of Degraded Stream Reaches
4. Riparian Buffer Ordinance - 100 ft. Min.
5. Protection of Critical Areas and Areas of Concern
6. Infiltration Requirements in Stormwater Management Ordinance
7. Regional EAC
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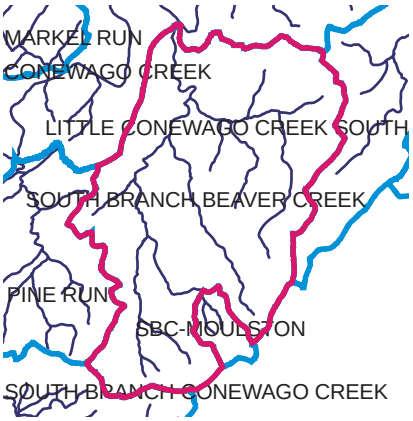


37. South Branch Beaver Creek Watershed

South Branch Beaver Creek is located along the southern boundary of the Conewago Watershed in York and Adams Counties. Primary land use within the watershed is agriculture. There are no developed communities within the watershed.

Municipalities: Penn Township, Heidelberg Township, Abbottstown Borough, Hamilton Township, Berwick, East Berlin, Paradise Township

I. Issues and Concerns

There are approximately 581 acres of Natural Areas, Areas of Concern, and Critical Areas within the watershed that should be protected. There are several severely unstable stream reaches throughout the watershed, but are undocumented.

II. Recommendations

Preserve Priority Parcels
Protect Natural Areas
Restoration of Degraded Stream Reaches
Riparian Buffer Ordinance - 100 ft. Min.
Protection of Critical Areas and Areas of Concern
Infiltration Requirements in Stormwater Management Ordinance
Riparian Buffer and Stream Stability Assessment
Regional EAC

Photo 37-A: Problem site on Beaver Creek at Hanover Country Club looking downstream

Photo 37-B: Problem site on Beaver Creek at Hanover Country Club looking upstream

Photo 37-C: Problem site on Beaver Creek at Hanover Country Club looking downstream

Photo 37-D: Beaver Creek upstream from Route 234

REPORT FOR THE SOUTH BRANCH CONEWAGO CREEK WATERSHED

GENERAL INFORMATION
Total Area of SubWatershed: 36486.62 acres
Total Stream Length = 128.2 miles
Total Road Length = 354.82 miles
Total Wetland Area = 904.27 acres
Total Public Land Area: 132.99 acres
Total Floodplain Area: 2918.56 acres
Total Acres Hydric Soils: 3547.59 acres
Total Acres Hydric Inclusion: 16065.66 acres
Total Area of Soils Suitable for Infiltration: 21001.76 acres

LANDUSE
Coniferous Forest: 310.19 acres
Deciduous Forest: 2834.26 acres
Emergent Wetland: 183.77 acres
Hay Pasture: 6844.88 acres
High Density Urban: 1114.68 acres
Low Density Urban: 1086.42 acres
Mixed Forest: 1034.99 acres
Open Water: 662.36 acres
Quarries: 272.23 acres
Row Crops: 19341.29 acres
Transitional: 627.22 acres
Woody Wetland: 324.8 acres

GENERALIZED ZONING
Agriculture: 5654.59 acres
Apartment/Office: 19.81 acres
Business: 113.37 acres
Commercial: 496.68 acres
Commercial/Industrial: 826.17 acres
Community Center: 92.8 acres
Conservation/Open Space: 10218.29 acres
Employment Center: 129.69 acres
Industrial: 431.62 acres
Mixed Use: 344 acres
Office: 7.62 acres
Residential: 11805.02 acres
Town Center: 61.98 acres
Unknown: 11994.03 acres
Village Residential: 247.1 acres

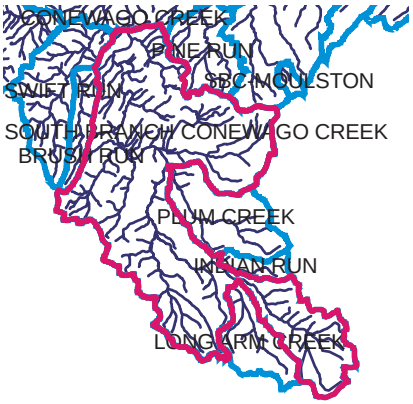
OTHER INFORMATION
Total Impervious Surface Area (2000): 1704.38 acres
Total Number of Assessment Sites: 1
Total Area 'Natural Areas': 359.63 acres
Total Miles 303d List Streams: 27.73 miles
Total Area 303d List Water Bodies: 0 acres
Number of CREP Sites: 66
Total Preserved Agricultural Land: 982.71 acres
Total Area of Historic Districts: 75.31 acres
Total Area of Concern: 1961.03 acres
Total Critical Area: 262.59 acres

Total Super-Critical Area: 0 acres

GENERAL RECOMMENDATIONS FOR THIS WATERSHED:

1. Installation of Access Points Nos. 18 & 19 - Oxford Road and Kohler Mill Road
2. Infiltration Requirements in Stormwater Management Ordinance
3. Protection of Natural Areas
4. Riparian Buffer Ordinance - 100 ft. Min on Mainstem
5. Riparian Buffer Ordinance - 150 ft. Min. on Headwater Streams
6. Restoration of 303.d Listed Stream Reaches
7. Forest and Tree Conservation Ordinance
8. Wetland Preservation Ordinance
9. Formation of EAC
10. Preserve Historic Districts

Municipalities in this Watershed:
WEST MANHEIM,
PENN,
UNION,
MCSHERRYSTOWN,
HANOVER,
CONEWAGO,
NEW OXFORD,
HAMILTON,
BERWICK,
MOUNT PLEASANT,



38. South Branch Conewago Creek Watershed

South Branch Conewago Creek is located in the south central portion of the Conewago Creek Watershed and consists the main stem of the South Branch Conewago Creek. Primary land use is agriculture. This watershed is the fastest growing and developing sub-watersheds of the Conewago Creek watershed.

Municipalities: West Manheim Township, Penn Township, Union Township, McSherrystown Borough, Hanover Borough, Conewago Township, New Oxford Borough, Hamilton Township, Berwick, Mount Pleasant

I. Issues and Concerns

Explosive growth and development in headwater areas in a PSA leading to water quantity and quality problems. 27 miles of impaired streams on the 303.d list. There are approximately 2500 acres of Natural Areas, Areas of Concern, and Critical Areas within the watershed.

II. Recommendations

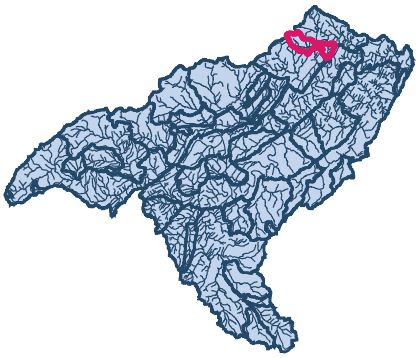
Installation of Access Points Nos. 18 & 19 - Oxford Road and Kohler Mill Road
Infiltration Requirements in Stormwater Management Ordinance
Protection of Natural Areas
Riparian Buffer Ordinance - 100 ft. Min on Mainstem
Riparian Buffer Ordinance - 150 ft. Min. on Headwater Streams
Restoration of 303.d Listed Stream Reaches
Forest and Tree Conservation Ordinance
Wetland Preservation Ordinance
Formation of EAC
Preserve Historic Districts

Photo 38-A: Conewago Creek South Branch upstream from Fleshman Mill Road

Photo 38-B: Conewago Creek South Branch downstream from Fleshman Mill Road

Photo 38-C: Conewago Creek South Branch upstream from Route 30

Photo 38-C: Conewago Creek South Branch downstream from Route 30



REPORT FOR THE STONY RUN WATERSHED

GENERAL INFORMATION
Total Area of SubWatershed: 2963.64 acres
Total Stream Length = 9.09 miles
Total Road Length = 12.52 miles
Total Wetland Area = 113.9 acres
Total Public Land Area: 0 acres
Total Floodplain Area: 0.02 acres
Total Acres Hydric Soils: 740.42 acres
Total Acres Hydric Inclusion: 674.28 acres
Total Area of Soils Suitable for Infiltration: 1496.89 acres

LANDUSE
Coniferous Forest: 26.7 acres
Deciduous Forest: 2157 acres
Emergent Wetland: 4.74 acres
Hay Pasture: 161.73 acres
Low Density Urban: 2.94 acres
Mixed Forest: 46.57 acres
Open Water: 5.8 acres
Row Crops: 475 acres
Transitional: 34.21 acres
Woody Wetland: 49.01 acres

GENERALIZED ZONING
Agriculture: 306.24 acres
Commercial: 280.34 acres
Conservation/Open Space: 1257.97 acres
Residential: 1119.09 acres

OTHER INFORMATION
Total Impervious Surface Area (2000): 1.64 acres
Total Number of Assessment Sites: 0
Total Area 'Natural Areas': 41.1 acres
Total Miles 303d List Streams: 0 miles
Total Area 303d List Water Bodies: 0 acres
Number of CREP Sites: 1
Total Preserved Agricultural Land: 278.54 acres
Total Area of Historic Districts: 0 acres
Total Area of Concern: 421.97 acres
Total Critical Area: 21.76 acres

Total Super-Critical Area: 0 acres

Municipalities in this Watershed:
WARRINGTON,
MONAGHAN,
NEWBERRY,
FAIRVIEW,

GENERAL RECOMMENDATIONS FOR THIS WATERSHED:

1. Infiltration requirements in Stormwater Management Ordinance
2. Forest and Tree Conservation Ordinance
3. Riparian Buffer Ordinance - 150 ft. Min.
4. Wetland Preservation Ordinance
5. Preserve Priority Parcels
6. Protection of Natural Areas
7. Regional EAC
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39. Stony Run Watershed

Stony Run is located in the northeastern portion of the watershed in York County. Primary land use is forest. There are no developed communities within the watershed.

Municipalities: Warrington Township, Monaghan Township, Newberry Township, Fairview Township

I. Issues and Concerns

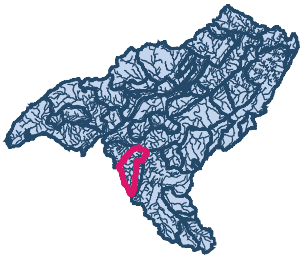
There are approximately 480 acres of Natural Areas, Areas of Concern, and Critical Areas located within the watershed. The watershed is located within a WCA.

II. Recommendations

Infiltration requirements in Stormwater Management Ordinance
Forest and Tree Conservation Ordinance
Riparian Buffer Ordinance - 150 ft. Min.
Wetland Preservation Ordinance
Preserve Priority Parcels
Protection of Natural Areas
Regional EAC

Photo 39-A: Stoney Run upstream from Bull Road

Photo 39-B: Stoney Run downstream from Bull Road



REPORT FOR THE SWIFT RUN WATERSHED

GENERAL INFORMATION
Total Area of SubWatershed: 6569.59 acres
Total Stream Length = 26.61 miles
Total Road Length = 32.34 miles
Total Wetland Area = 62.9 acres
Total Public Land Area: 12.67 acres
Total Floodplain Area: 396.99 acres
Total Acres Hydric Soils: 1642.75 acres
Total Acres Hydric Inclusion: 3235.15 acres
Total Area of Soils Suitable for Infiltration: 2957.48 acres

LANDUSE
Coniferous Forest: 97.13 acres
Deciduous Forest: 660.9 acres
Emergent Wetland: 11.36 acres
Hay Pasture: 1388.59 acres
Low Density Urban: 69.46 acres
Mixed Forest: 452.37 acres
Open Water: 27.09 acres
Row Crops: 3532.19 acres
Transitional: 301.27 acres
Woody Wetland: 28.91 acres

GENERALIZED ZONING
Commercial: 121.7 acres
Conservation/Open Space: 3180 acres
Employment Center: 350.75 acres
Residential: 2818.23 acres

OTHER INFORMATION
Total Impervious Surface Area (2000): 45.61 acres
Total Number of Assessment Sites: 1
Total Area 'Natural Areas': 0 acres
Total Miles 303d List Streams: 0 miles
Total Area 303d List Water Bodies: 0 acres
Number of CREP Sites: 0
Total Preserved Agricultural Land: 581.16 acres
Total Area of Historic Districts: 100.58 acres
Total Area of Concern: 329.31 acres
Total Critical Area: 21.6 acres

Total Super-Critical Area: 0 acres

Municipalities in this Watershed:
MOUNT PLEASANT,
STRABAN,

GENERAL RECOMMENDATIONS FOR THIS WATERSHED:

1. Preserve Priority Parcels
2. Infiltration Requirements in Stormwater Management Ordinance
3. Riparian Buffer Ordinance - 150 ft. Min.
4. Forest and Tree Conservation Ordinance
5. Wetland Preservation Ordinance
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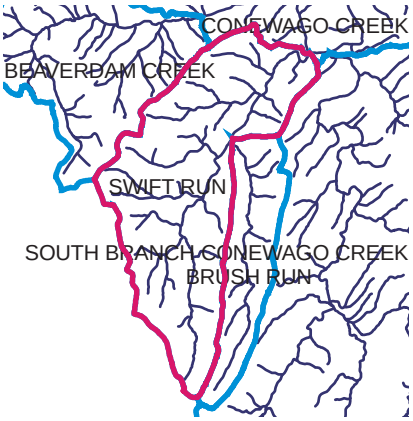


40. Swift Run Watershed

Swift Run is located in the southwestern portion of the watershed in Adams County west of Hanover. Primary land use is agriculture.

Municipalities: Mount Pleasant, Straban Township

I. Issues and Concerns

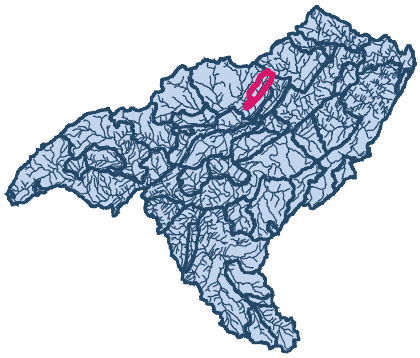
The watershed is located in a PSA and WCA and includes approximately 350 acres of Areas of Concern and Critical Areas within the watershed.

II. Recommendations

Preserve Priority Parcels
Infiltration Requirements in Stormwater Management Ordinance
Riparian Buffer Ordinance - 150 ft. Min.
Forest and Tree Conservation Ordinance
Wetland Preservation Ordinance

Photo 40-A: Swift Run upstream from Brickcrafters Road

Photo 40-B: Swift Run downstream from Brickcrafters Road



REPORT FOR THE WOLF RUN WATERSHED

GENERAL INFORMATION
Total Area of SubWatershed: 1864.92 acres
Total Stream Length = 7 miles
Total Road Length = 7.99 miles
Total Wetland Area = 10.22 acres
Total Public Land Area: 18.02 acres
Total Floodplain Area: 10.9 acres
Total Acres Hydric Soils: 53.84 acres
Total Acres Hydric Inclusion: 799.99 acres
Total Area of Soils Suitable for Infiltration: 1044.01 acres

LANDUSE
Coniferous Forest: 20.39 acres
Deciduous Forest: 220.93 acres
Emergent Wetland: 0.22 acres
Hay Pasture: 349.43 acres
Low Density Urban: 8.04 acres
Mixed Forest: 90.98 acres
Open Water: 4.46 acres
Row Crops: 1159.07 acres
Transitional: 11.4 acres
Woody Wetland: 0.02 acres

GENERALIZED ZONING
Agriculture: 868.84 acres
Conservation/Open Space: 264.74 acres
Residential: 642.74 acres
Unknown: 88.6 acres

OTHER INFORMATION
Total Impervious Surface Area (2000): 3.45 acres
Total Number of Assessment Sites: 1
Total Area 'Natural Areas': 0 acres
Total Miles 303d List Streams: 0 miles
Total Area 303d List Water Bodies: 0 acres
Number of CREP Sites: 0
Total Preserved Agricultural Land: 1002.12 acres
Total Area of Historic Districts: 0 acres
Total Area of Concern: 15.02 acres
Total Critical Area: 26.28 acres

Total Super-Critical Area: 0 acres

Municipalities in this Watershed:
WASHINGTON,
WARRINGTON,

GENERAL RECOMMENDATIONS FOR THIS WATERSHED:

1. Riparian Buffer Ordinance - 100 ft. Min.
2. Wetland Preservation Ordinance
3. Restoration of Degraded Stream Reaches
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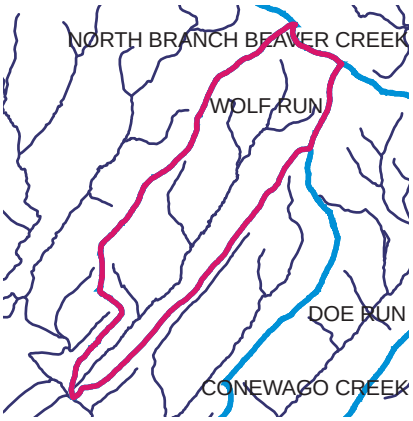

41. Wolf Run Watershed

Wolf Run is located in the northern portion of the watershed in York County. There are no developed communities within the watershed. Primary land use is agriculture.

Municipalities: Washington Township, Warrington Township

I. Issues and Concerns

Stream degradation from lack of riparian buffers. There are approximately 41 acres of Critical Areas and Areas of Concern within the watershed.

II. Recommendations

Riparian Buffer Ordinance - 100 ft. Min.
Wetland Preservation Ordinance
Restoration of Degraded Stream Reaches

Photo 41-A: Wolf Run upstream from Krulltown Road

Photo 41-B: Wolf Run downstream from Krulltown Road

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