

# Chapter Four

## Natural Resources

### INTRODUCTION

Natural resources play an important role in how land use has evolved in the Kennett Region. This chapter provides an overview of the major natural resources, their importance to the Region, and a summary of the municipal measures currently in place for their protection. This chapter analyzes these resources and protection measures on a regional basis to determine a common course of action for their protection.

Open Space, Recreation and Environmental Resources Plans were adopted by each of the participating municipalities in 1993. These plans were prepared under the County's Heritage Park and Open Space Municipal Grant Program and were required to include a relatively detailed inventory of municipal natural resources organized under the broad categories of water, land, and biotic resources. This chapter provides a compilation of the open space plans' natural resource information at the Regional level. For a more detailed discussion of individual resources at the local level, the municipal open space plans can be consulted. These open space plans are referenced at the end of this chapter.<sup>1</sup>

Also included in this chapter is an inventory of existing municipal protection measures currently included in each municipality's zoning and subdivision and land development ordinances. The purpose of this inventory is to determine where gaps in protection measures may exist at the regional level. Future chapters will include recommendations for addressing these gaps and determining what additional measures may be needed to protect regional natural resources. The overall goal for regional resource protection is to establish a common approach that each municipality can employ for the consistent management of resources.

This chapter analyzes the following information:

#### Water Resources:

- Watersheds and Stream Corridors
- Headwater Areas
- Floodplains
- Wetlands and Hydric Soils
- Groundwater Aquifers and Geology

#### Land Resources:

- Steep Slopes
- Prime Agricultural Soils

#### Biotic Resources:

- Woodlands
- Pennsylvania Natural Diversity Sites (PNDI)
- Locally Important Vegetation
- Habitat Areas

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<sup>1</sup> Descriptions of natural resources, their value in the ecosystem, and their vulnerability to disturbance are largely based on the work of the Brandywine Conservancy as presented in the Pennsbury and Pocopson open space plans.

Existing Protection Measures:

- Zoning Ordinance
- Subdivision Ordinance

## PLANNING IMPLICATIONS

The natural resources analysis of this chapter indicates the following planning implications for the Region:

- Watershed Protection** - Planning and management of water resources is most effectively carried out at the watershed level. The Region should monitor the watershed studies currently being conducted to determine the implications for water resource protection and follow through with their recommendations where appropriate.
- Headwater Protection** - Protection of headwater areas is important for maintaining the overall quality of the watershed. Consideration should be given to how these areas can best be protected consistently throughout the Region.
- Floodplain Protection** - Because disturbance of the floodplain creates a high potential for detrimental environmental impacts and threats to life and property, floodplains and areas of alluvial soils should remain undeveloped to the greatest extent possible. Floodplains should also be conserved for their potential regional recreational value in terms of the creation of trails and greenways.
- Wetlands Protection** - Wetlands and areas of hydric soils are important ecosystems, providing both wildlife habitat and storage and filtering areas for ground and surface water. While regulated at the State and Federal level, local requirements for identification and protection of wetlands throughout the Region is the most effective method for preserving this valuable resource.
- Groundwater Protection** - Because of its susceptibility to contamination and its high potential for groundwater yields, special protection measures are needed for the Cockeyville Marble formation. Such protection measures are currently in place in East Marlborough and Pennsbury townships. Protection for areas traversed by fault lines should also be considered. Consistent standards for the protection of groundwater, and these vulnerable areas in particular, should be adopted within the Region.
- Steep Slope Protection** - Limiting development of steep slopes is important for preventing erosion and sedimentation of streams. Consistent standards for limiting the disturbance of steep slopes should be incorporated into all municipal ordinances.
- Prime Agricultural Soils** - Prime agricultural soils, once developed, are lost forever for crop production. Unfortunately, the characteristics of these soils also make them most suitable for building. Measures for protecting this valuable economic and natural resource should be implemented, particularly in areas of the Region with continued active farming.
- Maintaining Natural Diversity** - Protecting the variety of habitats in the Region is vital to maintaining the natural diversity of plants and animals found here. Areas of contiguous woodlands, wooded stream corridors, wetlands, fields and pastures, and hedgerows are the primary vital habitats that need to be protected if the Region is to continue to maintain healthy ecosystems. Actions for addressing the issues of non-native invasive plant species and white tailed deer over-population on a Regional basis should be considered.
- Resource Protection Standards** - To most effectively protect sensitive environmental resources on a regional basis, resource protection standards should be made consistent between municipalities and

include specific disturbance limits. The identification and protection of natural resources should be the primary determinant for the location of appropriate development in the Region.

- ❑ **Regional Coordination** - Other areas related to natural resources where regional coordination should be considered include stormwater management, water supply planning, and sewage facilities planning. (See Chapter 7, Community Facilities and Services Inventory for additional discussion on water and sewage facilities.)

## **WATER RESOURCES**

Water is the single most important resource found in the Region. It is both essential to life and the primary force which shapes the landscape. Water flowing through the landscape supports the natural and human population. The creeks, streams, and rivers throughout Chester County have influenced settlement patterns and lifestyles since before the time of the first colonial settlers. Proper management of this resource to meet growing demands for its use, protect it from degradation, and improve water quality where needed is a complex and challenging task.

### **Watersheds and Stream Corridors**

Watersheds - A watershed is an area of land, bounded by a ridge, that drains into a river or lake. Water flows from each ridgeline divide toward the stream within its basin. Much of the precipitation that falls in a watershed becomes part of the area's streams and groundwater while the remainder is transpired by plants or evaporated.

The Kennett Region is located within two major watershed drainage basins: the Clay (consisting of the Red and White Clay creeks) and the Brandywine. (See Map 4-1) Both of these basins flow into the Christina River which is, in turn, located in the larger Delaware River Basin. Fifty-six percent of the Region's area is located within the Clay watershed while the remaining 44 percent falls within the Brandywine watershed. All of Kennett Square and the majority of East Marlborough and Kennett are located within the Red Clay watershed, a sub-basin of the Clay watershed. All of Pocopson and most of Pennsbury are located within the Brandywine watershed. The northern section of Pocopson and a portion of East Marlborough is located within the Brandywine's West Branch sub-basin.

Planning and management of water resources is most effective when carried out at the watershed level. Because watersheds rarely follow political boundaries, water is one resource that is always better managed on a regional basis. Watershed protection comes in many forms including:

- Establishing effective stormwater management plans and systems,
- Protecting riparian buffers along stream corridors,
- Encouraging groundwater recharge,
- Reducing impervious surfaces, and
- Encouraging individuals to properly manage fertilizers, pesticides, household hazardous wastes, and on-lot septic systems.

It is important to remember that watersheds of the Region serve as a source of drinking water far beyond its boundaries. For all of these reasons, management of resources within the watershed has far reaching implications.

A study of the Christina River Basin by the inter-state Christina Basin Water Resources Management Committee has been going on for several years. Part I of the study was initiated in 1994 and consists of a

5-year stream monitoring and watershed modeling program aimed at controlling point sources of pollutants such as end-of-pipe wastewater discharge. Based on the results of this study, point source reduction programs will be developed which may include modified effluent limits and improvements to wastewater treatment plants. Part II of the Christina River Basin study consists of identifying non-point source pollutants such as urban and rural runoff. Based on the results of a non-point source load model and other techniques, sub-watersheds will be prioritized for water quality improvements and recommendations will be made as to how to achieve these improvements. The final draft of the Phase I and II Report was published in May 1998. The water quality study is expected to culminate in the year 2000 with the adoption of Total Maximum Daily Loads for the major streams of the Christina River Basin and the completion of a watershed management plan.

Stream Corridors - Within the watershed, "stream ordering" is used to classify streams and their tributaries. The smallest streams in the network have no tributaries and are called first order streams. When two first order streams join, they form a second order stream. Order one and two streams are important to long range planning because their watersheds often contain the best recharge areas and ground water yields. Roughly 70 percent of a given watershed consists of first and second order streams. Order three streams are larger and occur when two second order streams are joined together.

Within the Kennett Region there is only one stream corridor considered a "protected water" as designated by the Pennsylvania Department of Environmental Protection. A small portion of the East Branch of the White Clay in the extreme southwest corner of East Marlborough Township is classified as an "Exceptional Value Water." The Exceptional Value classification is the highest level of protection that the Commonwealth designates a stream. Because the level of protection is so high, permitting standards for stream discharge of sewage effluent are very stringent, generally making stream discharge sewage systems economically infeasible.

## **Headwater Areas**

Headwater areas are land areas which both drain into first order streams and which contain springs, marshes, and intermittent streams at the uppermost terminus of a stream. Headwater areas provide stream recharge into first order streams during periods of low flow and are important for maintaining groundwater flows. The headwater areas around first order streams often contain hydric or wet soils and provide important wildlife breeding areas. These streams are usually cleaner than larger order streambeds and are more likely to support trout and a variety of aquatic species and other wildlife.

In headwater areas, the exchange between ground and surface waters is the most rapid and direct. Streams in headwater areas, because of their modest flows and inability to flush themselves, are highly susceptible to degradation. Therefore, the ecological health of first order streams, and the watershed, is dependent on how land in headwater areas is used and maintained. Headwater areas maintained under a forest or dense meadow cover yield streams with higher water quality and greater biodiversity than those that are not. These areas are highly susceptible to contamination through earth disturbance and development should be limited.

## **Floodplains and Alluvial Soils**

Floodplains - The 100-year floodplain and the floodway shown on Map 4-1 are based on the Federal Emergency Management Agency (FEMA) maps. The 100 year floodplain represents the highest level of flooding that, on the average, is likely to occur every 100 years or, from another perspective, a flood level that has a 1 percent potential of occurring each year. The floodway is located within the 100-year floodplain. As defined by FEMA, this area must be reserved to carry the base floodwaters without increasing the base flood elevation more than one foot. This area is the most strictly regulated portion of

the floodplain; any obstructions within the floodway that might raise the base flood elevation are prohibited. The remainder of the 100-year floodplain beyond the floodway, known as the flood fringe, may be developed if structures are elevated or floodproofed. However, many communities choose to prohibit all or most development within the entire 100-year floodplain.

The primary function of the floodplain is to absorb and store large amounts of water which later becomes a source of aquifer recharge. Naturally vegetated floodplain areas help catch and filter sediments from floodwaters and reduce the velocity of sediment laden water. The natural vegetation of floodplains also filters water runoff by collecting and holding nutrients, chemicals, and other natural and man-made pollutants. Floodplains left in their natural state can provide valuable wildlife habitat and outdoor recreational opportunities.

Alluvial Soils - Alluvial soils are those soils which have been eroded, transported and deposited by flooding water over time and thus, generally indicate a strong potential for flooding (i.e. define floodplain boundaries). With the exception of the main branch of the Brandywine and some areas along the Red Clay Creek, most floodplains and areas of alluvial soils are narrow and found immediately adjacent to streams. Because few first order streams have FEMA mapped floodplains, the presence of alluvial soils can be used to define the extent of the floodplain in these unmapped areas. Alluvial soils in Chester County include Chewacla silt loam (Ch), Congaree silt loam (Cr), Wehadkee silt loam (We) Bowmansville silt loam (Bo), and Rowland silt loam (Ro, Rp) with the first three being most prevalent in the Region.

In addition to its important environmental functions, floodplain areas provide recreation, scenic, and open space opportunities. While floodplain land is generally narrow, it provides a valuable source of open space. Great potential exists to link existing parks and open space areas by using open space corridors along the many creeks and streams. However, use for passive recreation, such as hiking trails, must be balanced with other preservation and resource protection goals. For example, there will be areas where the provision of undisturbed wildlife habitat and corridors for the movement of wildlife is likely to be a higher priority than recreational access.

Because disturbance and development of floodplains creates a high potential for erosion, downstream sedimentation, upstream or downstream flooding, and potential threats to life and property, wildlife habitat, and water quality, floodplains and areas of alluvial soils should remain undeveloped and undisturbed to the greatest extent possible. Their potential value as greenways and passive recreational areas is another reason for protecting floodplains.

## **Wetlands and Hydric Soils**

Wetlands - Wetlands are recognized for being among the world's most productive ecosystems. Often found within important headwater areas, they offer critical wildlife habitat and are important storage areas for surface and ground water. Wetlands are protected under Section 404 of the Clean Water Act of 1977 by the Army Corps of Engineers and the Pennsylvania Department of Environmental Protection. From a regulatory standpoint, the presence of wetland areas is determined based on the site's soil, hydrology, and vegetation. Areas lacking any one of these three parameters are generally not considered wetlands. From a layman's perspective, any area with periodic standing water and hosting wetland vegetation such as cattails, skunk cabbage, red maple, and silver maple, is likely to fall within the official definition of a wetland.

There is no comprehensive inventory of wetlands. The National Wetlands Inventory (NWI) has identified certain wetland areas, based on aerial photography. (See Map 4-2) The NWI identified stream systems, certain marshy areas, stormwater detention areas, open excavations, and farm ponds as

wetlands. While other wetlands certainly exist, they were not identified, probably because of their small size or specific characteristics that make them difficult to identify from aerial photography. Identified wetlands in the Kennett Region primarily lie along stream corridors. Site specific wetland studies are needed to completely determine the full extent of wetlands in the Kennett Region.

**Hydric Soils** - Hydric or wet soils contain high amounts of moisture, are very poorly drained, and are typically found within floodplains and wetlands. Hydric soils are generally associated with headwater areas, are found in low-lying areas, at the fringes of floodplains, and sometimes in upland depressions. These soils have occasional standing water and/or a shallow depth to the underground watertable. In the absence of detailed wetlands mapping, hydric soils serve as an indicator of where wetlands are likely to be located. The hydric soils shown on Map 4-2, while generalized, offer the first “red flag” for potential wetlands determination.

Like the wetlands with which they often coincide, hydric soils provide a rich habitat for a diversity of plants and animals. Naturally vegetated areas with wet soils also filter sediments and pollutants. Hydric soils are an important indicator of where chronic or occasional wetness may weaken foundations or otherwise constrain construction. Failed on-lot septic systems, flooded basements, poor foundation stability, the disturbance of natural drainage and groundwater recharge areas, and the risk of surface and groundwater contamination are potential problems associated with hydric soils. For these reasons, development should be limited on hydric soils or precluded if it is determined to be in a wetland. Where development is permitted, precautions should be taken to avoid negative impacts to on and off site drainage patterns. Also, appropriate construction techniques should be employed to avoid damage to foundations and water seepage into dwellings.

Hydric soils in the Kennett Region include Wehadkee Silt Loam (We), Worsham Silt Loams (WoA and WoB), and to a limited extent, Chewacla Silt Loam (Ch). Glenville Silt Loams (GnA, GnB, and GnB2) often have hydric inclusions (Worsham soils) within their boundaries.

## Groundwater Aquifers and Geology

An aquifer is the underground area where fresh water is stored in voids within soil and rock and the cracks, fractures, and solution channels in bedrock. The water producing capability of an aquifer is largely determined by the geology and precipitation of an area. Because many residents in the Region are dependent on on-lot and public water systems that draw from groundwater, the protection of this resource is critical.

Figure 4-1 shows the domestic well yields experienced in the various geologic formations. An important factor illustrated by this figure is the wide variation in yields experienced within each geologic formation.

The Cockeysville Marble formation, a metamorphosed limestone, is the best producer of groundwater in the Region but, because it is a carbonate formation, should be protected from potential contaminants. (See Map 4-3 and Figure 4-1) The interaction of air and water creates a weak carbonic acid solution that can dissolve carbonate geologic formations and form underground solution channels. While groundwater availability may be high in carbonate formations, they are also the most susceptible to contamination. Pollutants entering the underlying water channels can be carried long distances in unpredictable ways. Pocopson Township is the only municipality in the Region without some inclusion of marble.

**Figure 4-1: Domestic Well Yields**

Geologic Formation	Range (gallons per	Median (gallons per
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	minute)	minute)
Marble	4 to 300 gpm	25 gpm
Quartzite	1 to 110 gpm	10 gpm
Schist	<1 to 400 gpm	13 gpm
Gneiss	<1 to 400 gpm	12 gpm
Pegmatite	n/a	n/a
Ultramafite	15 to 75 gpm	n/a

Sources: Geology, Hydrology, and Groundwater Quality of Chester County, Chester County Water Resources Authority and USGS, 1994.

Hardrock geologic formations such as gneiss, schist, and quartzite, are harder and more dense than marble and their value in terms of groundwater availability and recharge (and the potential for pollutant infiltration) is much less significant. While this geology does not preclude development due to contamination problems, the limited water yields present another limiting factor. Most of the Region is underlain by this hardrock geology.

Fractures or fault zones (also shown on Map 4-3) are linear geological features where displacement has occurred. They are typically areas of high groundwater yield that are susceptible to pollution because of the speed and distance contaminants are able to travel. Three fault lines traverse the Region in an east-west direction. One line is located in the northern section of Pennsbury where it splits near the intersection of Pocopson and Parkersville roads. From there the two lines continue through East Marlborough following the border of Cockeysville Marble to the south and the Wissahickon schist to the north. The other fault line traverses the center of Pennsbury and extends a short distance into Kennett Township, stopping at the Setters Quartzite formation. These areas should also be protected from possible groundwater contamination through the proper regulation of inappropriate land uses.

Groundwater Studies - Extensive studies of the Red Clay Creek Basin have also been undertaken by the U.S. Geological Survey in cooperation with the Red Clay Valley Association and the Chester County Water Resources Authority. The first study, published in 1993, described the geohydrology of the aquifer in the Red Clay Creek basin in Pennsylvania and Delaware. (See section on “Groundwater Aquifers”) The report presents a simulation of groundwater flow in the basin and summarizes water quality data. Although the results of the groundwater flow simulation from this study was questionable, the collected data can be used as a baseline for continuing assessment of groundwater quality in the basin.

The second Red Clay Creek study was published in 1996 and describes the relationship between groundwater quality and hydrogeologic and land use factors and surface water quality. The study found that concentrations of nitrate, sodium, and chloride and the frequency of pesticide detection was related to differences in land uses and human activities. For example, nitrate concentrations were generally greatest in agricultural and in industrial and commercial areas. An observed increase from 1970 to 1995 in nitrate concentration in base flow at the long-term monitoring station on the West Branch Red Clay Creek may be due to increases in nitrate concentrations in the groundwater. Because groundwater discharges to streams, the chemical composition of base flow is related to groundwater quality. The study concluded that changes in land use may result in changes to the groundwater system and ultimately in changes in base flow water quality. Based on the results of these previous studies, the Red Clay Valley Association has developed a pc-based groundwater flow model. This tool is suitable for use by local planners to evaluate the potential impacts of proposed withdrawal and land application projects.

## LAND RESOURCES

Land is a finite, non-renewable resource which, once degraded, may never fully recover. Land and water are intertwined so that whatever happens to the land will also affect the watershed. Therefore, land resources should be protected not only for their production value (agriculture, forests, and meadows) but because inappropriate uses and poor maintenance practices can lead to the degradation of water, wildlife, and plant resources.

Chester County and the Region fall entirely within the Piedmont Province, a band of gently undulating to steeply rolling countryside that stretches from the Hudson River to Georgia, sandwiched between the Atlantic Coastal Plain and the Blue Ridge. This Province is further divided into three sections based on geologic history and landscape - the Piedmont Uplands, Triassic Lowlands, and the Conestoga Valley. The entire Region (and over 80 percent of the County) is located in the Piedmont Uplands section. The varied resistance to weathering and erosion of the underlying geology has led to a hilly to gently rolling landscape of low ridges and narrow valleys. Most of the land in the Piedmont Uplands has been cleared for farmland or development. Usually only the steep hillsides and wet soils remain forested with a mix of oak, tulip poplar, and beech.

## **Steep Slopes**

For the purposes of this Plan, steep slopes are considered to include any land with a slope of over 15 percent. Very steep slopes are those of 25 percent or greater. Steep slopes in the Region are most concentrated in Pennsbury and Pocopson, particularly along the Brandywine and its tributaries, and the southern portion of Kennett Township along the Red Clay Creek and its tributaries. The remainder of the Region tends to have a more moderate to rolling terrain. (See Map 4-4)

Steep slopes are often covered by woodlands and have shallow soils that are easily eroded. Many stream valleys are bordered by steep slopes of 15 to 25 percent and more. Steep slopes are very vulnerable to erosion, particularly when natural vegetation has been disturbed. Once erosion has begun, it is often difficult and expensive to control. Erosion of steep slopes has a tendency to spread along the side slopes, eventually threatening larger areas and different properties. Because many steep slopes are wooded, there is a natural system of erosion protection in place as well as the provision of valuable wildlife habitat.

Limiting development on steep slopes is important for preventing soil erosion, minimizing pollution of surface waters, reducing flooding, preserving stream banks, and maintaining water flow in headwaters. Improper development of steep slopes can also lead to higher construction costs, increased rates of septic system failures<sup>2</sup>, and increased stormwater runoff. Ideally, steep slopes should be maintained under a dense forest or meadow cover to prevent erosion, stream sedimentation, and other problems associated with their development.

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<sup>2</sup> According to PA DEP Chapter 73, septic systems are not permitted on slopes of more than 25 percent and engineered systems are required at the upper end of the permitted range.

## **Prime Agricultural Soils**

Prime agricultural soils are soils designated as capability Class I, II, and III by the U.S.D.A. Soil Conservation Service. Prime agricultural land produces the highest yields with minimal inputs of energy and economic resources, and farming it results in the least damage to the environment. Class I soils have few limitations that restrict their use for farming. Class II soils have some limitations that reduce the choice of plants or require moderate conservation practices. Class III soils have more severe limitations that reduce the choice of plants, require special conservation practices, or both.

Prime agricultural soils occur for the most part on hilltops and gentle slopes and, by definition, do not occur on steep slopes. Class III soils are often found adjacent to stream valley areas and their accompanying alluvial or hydric soils. Soils not classified as I, II, or III are generally in areas of floodplains, wetlands, or steep slopes and are not considered suitable for agricultural use. Because Class I and II soils are also often the most suitable for building, many areas of prime soils in the Region and the County have already been developed.

Map 4-4 shows the location of prime agricultural soils in the Region. Overall, 60 percent of the Region (19,340 acres) consists of Class I, II, and III soils, with most prime agricultural soils falling in the Class II category (13,500 acres) and only a very small proportion (315 acres) falling in the Class I category. Class I and II soils are most prevalent in East Marlborough consistent with the historic and current levels of farming found there, with the Class II soils being by far the largest category. Class II prime agricultural soils (Glenelg soil types) are prevalent throughout the Kennett Township, with only small areas of Class I and III soils in the township. Pocopson and Pennsbury Townships contain significant areas of prime agricultural soils, fairly evenly divided between the Class II and III categories.

## **BIOTIC RESOURCES**

Biotic resources consist of the plant and wildlife of the Region and their habitats. This section discusses the importance of maintaining natural diversity and describes major habitat areas in the Region as well as significant plants and animals that have been identified for special protection.

### **Need For Natural Diversity**

Native ecosystems along the East Coast, whether wetlands, stream corridors, or woodlands, are fragmented and face a variety of negative impacts from human intrusion. One serious impact is the lowering of natural biodiversity. Biodiversity is the total variety and variability of living organisms and the ecological habitats in which they occur. Many human actions that involve the modification and adaptation of the natural environment lower biodiversity. Effective protection of the diverse communities of species and habitats native to the Region is dependent on knowledge of their extent and diversity, their whereabouts, their habitat requirements, and their interrelationships.

Undeveloped land can be divided into three broad categories: open field, forest, and wetlands. For the purpose of sustaining a healthy and diverse landscape, it is critical to retain sufficient areas of each of these habitat types as interconnected habitat networks throughout the Region.

## Woodlands

Nearly 30 percent of the Region (8,930 acres) is covered by woodlands. Major woodland areas of the Region are shown on Map 4-5. Chester County is located in the eastern deciduous forest biome, a large ecological community. Within this biome, the forests of the Region are part of what is called an oak-hickory association forest. This forest association produces large amounts of mast (nuts) and is generally dominated by the species shown in Figure 4-2.

**Figure 4-2: Typical Trees And Shrubs of the Region**

	<b>Canopy Trees</b>	<b>Understory Trees and Shrubs</b>
<b>Upland Areas</b>	Red, White, Black, And Scarlet Oaks; Mockernut, Bitternut, and Pignut Hickories; American Beech, White Ash, and Tulip Poplar	Flowering Dogwood, Sassafras, Ironwood, Spicebush, and Blackhaw, Mapleleaf, and Arrowood Viburnums
<b>Riparian Zones</b>	Red And Silver Maples, Sweet Gum, Red Ash, and Eastern Sycamore	Silky Dogwood, Box Elder, Common Witch Hazel, Spicebush, and Northern Arrowood Viburnum

Source: Pocopson Township Open Space, Recreation, and Environmental Resources Plan, Pocopson Township, Chester County, PA, February 1993, p. 51.

Woodlands in the Region are extremely varied, ranging from young woodlands with dense tangled understories to more mature woodlands which are well stratified and possess a greater diversity of canopy, subcanopy, understory, and forest floor species. Nearly all woodlands in the Region have been disturbed in some way by human activity. The majority of wooded areas are second and third growth timber and many continue to be selectively logged. In general, older, more mature woodlands are found on steep slopes while younger forests are more common in lowland areas.

Woodlands provide protective cover for steep slopes and contribute to stream quality. Canopies of trees also play an important function by reducing the amount and intensity of rainfall, providing shade, and reducing the effect of extreme temperatures. Wooded areas serve as buffers from cold northwesterly wind, visual intrusions, and noise while providing scenic relief and increasing land value.

Critical Habitat Areas - Woodlands are critical in maintaining the natural diversity of the Region and provide vital habitat for native vegetation and wildlife. Large and mature forest stands, even though greatly altered by humans over time, are likely to support a considerable variety of species which would not occur in other habitats. Certain species of forest plants and wildlife depend specifically on the unique conditions of a healthy forest ecosystem. Many species of songbirds, particularly the colorful warblers, are specifically adapted to forest interior conditions and will not nest elsewhere. In addition, numerous species of wildflowers will only bloom on the rich, moist soils of the forest floor. These are only two examples of the critical role forest stands play in sustaining the natural diversity of the landscape.

Streamside woodlands are extremely complex ecosystems that protect streams. One of the most important functions these woodlands provide is as a filtering system. Streamside woodlands remove excessive nutrients and sediment from surface water runoff by slowing down surface water flow, thus allowing sediment to settle out before reaching open water. Streamside woodlands also provide shade to streams reducing thermal pollution and provide leaf material (detritus) which is the basis of the food chain in stream ecosystems.

Threats to Woodlands - Currently, two serious problems that affect the long term health and quality of woodland ecosystems are infestations of invasive, non-native plant species and high white tailed deer

populations. Like much of Chester County, woodlands are being overrun by aggressive, introduced non-native species. Because of their rapid growth, adaptability, propensity to reproduce, and a lack of control mechanisms found in the environment, species such as Norway Maple, Multiflora Rose, Autumn Olive, Oriental Bittersweet, Japanese Honeysuckle, and Mile-a-Minute Weed are outcompeting many native species and becoming the dominant species of the area. While providing cover and food for some wildlife, introduced invasive species have supplanted much of the native vegetation, resulting in a reduction of plant and wildlife diversity.

Non-native species impair forest regeneration by creating such dense masses that tree species will not grow or their growth is retarded. They replace native understory species by creating such dense growth that nothing can grow underneath it. Multiflora rose, where it grows along streams, is detrimental to the stream ecosystem because its foliage is unsuitable as a food source and it limits the amount of suitable leaf litter reaching the stream.

The white tail deer population in the Region has exploded for several reasons relating to human activities. Agriculture and suburbanization have provided excellent deer habitat in the form of “edge” conditions and browse areas. Several of the introduced, invasive plant species provide an excellent food source and natural deer predators have been eliminated. The increased deer population threatens the lands carrying capacity because of increased browsing in forests for the buds, seedlings, and shoots of native species. This browsing prevents the forest from being able to regenerate itself. While this problem will likely correct itself through the eventual starvation of deer, it presents a long term problem for the Region’s forests because it favors further establishment of aggressive, non-native plant species, further reducing biodiversity.

Woodlands in the Region - Wooded tracts are found throughout the Region, especially on steep slopes and in riparian zones where the land is poorly suited for building or agricultural purposes. Pocopson and Pennsbury in particular have numerous large wooded tracts coinciding with their higher concentrations of steep slopes. Smaller woodlands interspersed through agricultural areas are typical of those found in Kennett and East Marlborough townships. In the borough, a significant wooded area is located in Anson B. Nixon Park. Because of their high value for protecting water quality and as wildlife habitat, maintaining a critical mass of woodlands and not fragmenting the remaining wooded areas should be a priority for resource protection in the Region.

## **Pennsylvania Natural Diversity Sites**

The Pennsylvania Natural Diversity Inventory (PNDI) provides site specific information describing significant natural resources of the Commonwealth. The inventory locates and identifies the most uncommon natural features which create Pennsylvania’s unique natural diversity. A detailed study of these sites specific to the county, entitled the Chester County Natural Areas Inventory, was compiled and written by the Pennsylvania Science Office of the Nature Conservancy and published by the Chester County Planning Commission in 1994. This inventory contains information on the locations of rare, threatened, and endangered species and of the highest quality natural areas in the county. General management recommendations for the protection of the identified species also accompany each description. The exact locations and the species are not identified for their protection. Additional information can be obtained from the Pennsylvania Science Office of The Nature Conservancy if the municipality or landowner requires it.

Several PNDI sites are located within the Region. (See Map 4-5) Two PNDI sites containing rare plants are located in Pocopson. One is a grass found in the Wawaset Marsh, located on the border of East Bradford and Pocopson. The second species is in the Myrick Forest of the H.E. Myrick Conservation Center which is protected by the Brandywine Valley Association. Four plants of special concern are

located in or near the Red Lion Woods on the Longwood Property in East Marlborough. In Kennett Township, two plant species of special concern were identified in State Line Woods and one species at the Old Kennett Road site. According to the Kennett Joint Open Space Plan, there are a total of seven PNDI sites in the township including five species of plants and two species of animals. No sites were identified in Pennsbury or Kennett Square.

There are no guarantees that these important natural sites will be protected. If a municipality desires to protect these areas, they can use the powers granted to them under the Municipalities Planning Code. At a minimum, developers should be required to identify these sites on subdivision or land development plans and provide a statement indicating possible adverse affects on the species and proposed mitigation efforts. The use of lot averaging and cluster development can be used to steer development away from sensitive natural sites.

## Locally Important Vegetation

Locally important vegetation was required to be defined and identified by individual municipalities in the county funded open space plans. Locally important vegetation may be considered to include those types of resources that add character, beauty, and a sense of history to the Region. Pennsbury, for example, chose to define this resource as mature woodlands, large specimen trees, and hedgerows. The following summary provides a brief overview of important vegetation identified within each municipality:

East Marlborough Township	The Open Space Task Force identified ten large historic trees which, because of their size, are worthy of preservation.
Pennsbury Township	Important vegetation identified included the mature woodland on Hill Girt Farm near Route 100 and the row of large sycamores that line a section of Fairville Road.
Kennett Township	Mature wooded areas called “historic woodlands” were identified. These woodlands are remnants of the virgin forest and scattered throughout the township typically in areas that were not suited for crops.
Kennett Square Borough	The open space plan identified the Kennett Beech located in Anson B. Nixon Park, noted as one of the last examples of its kind.
Pocopson Township	The township identified nearly 100 sites with significant vegetation including 70 specimen trees or grove sites, two areas of extensive evergreen forest, two roads lined with mature rows of trees (allees), two areas with high concentrations of wildlife flowers, two sites with rare plant species (PNDI sites), and 13 sites possessing mature woodlands or woodlands with high concentrations of large canopy tree species. The high number and distribution of significant vegetation in Pocopson was attributed to the long history of agricultural land use and because relatively little change has occurred in how individual parcels are used and where property lines are maintained. Den trees (standing dead trees) were also identified as an important and ubiquitous resource in the township because they provide both food and habitat to wildlife.

Individual municipal open space plans should be consulted for the location and more detailed information on these locally identified resources.

## **Habitat Areas and Biodiversity**

Habitat refers to a region or area where a plant or animal naturally grows or lives. The Pennsbury and Pocopson open space plans, in particular, include detailed discussions of the major habitats found in this area of the County and the role they play in maintaining natural diversity. The need for natural diversity and a summary of these various habitats are described below.

Streams and Wetlands - Stream corridors and wetland areas have a very high habitat value, as they exhibit the largest total amount of living organic matter. The multitude of trees, shrubs, and herbs which grow naturally along stream corridors and in floodplain wetland areas provide structural complexity, cover, and a variety of food sources adjacent to water. The combination of these characteristics makes the stream and wetland ecosystem an extremely valuable habitat for many species of plants and wildlife native to the Region. Because riparian areas are often interconnected and undeveloped, they serve as important wildlife corridors through which wildlife can pass unmolested and reach other areas. Because of their importance to water quality and wildlife, any disturbance of these areas should be avoided whenever possible or minimized and mitigated when disturbance must occur.

Wooded Stream Corridors - Many streams in the Region are bordered by woodlands. In addition to important habitat, streamside woodlands provide important environmental functions such as: shading and cooling stream water; functioning as a natural filtering system by slowing the flow of water over the land's surface, allowing sediment and stream polluting nutrients to settle out rather than being deposited into stream water; and helping to prevent erosion by holding the soil of the streambanks in place. Stretches of streams that are not adjacent to woodlands are considered vulnerable areas within the system.

Open Lands - Open lands, including fields, meadows, and pastures, are also an important habitat for plants and animals. While these areas are the only habitats created through regular maintenance, they add to the overall diversity of the Region. Open lands which are managed as meadows are often rich with a wide variety of native grass, sedge, and wildflower species. This rich vegetation provides a major source of seeds, herbaceous material, and insects for local wildlife. Where fields, meadows, and pastures are situated next to forests, the edge between both habitat types provides a unique combination of food and cover for wildlife.

Agricultural lands, including field crops, orchards, pastures, and hayfields, provide food for humans and livestock, but also provide habitat and food for wildlife. Meadows and hayfields in particular provide an additional habitat to the overall ecosystem. These areas provide a food source for browsers, rodents, and many species of seed eating birds. Tall meadow provides suitable habitat and nesting sites for birds (pheasant and numerous songbirds) and small rodents, a base element in the food chain. Prior to harvest, crops are consumed by wildlife whenever possible. More importantly, after harvest, many species of wildlife pick over the stubble of field crops in search of 'lost' seeds and grains. This occurs in the fall and winter when other sources of food are scarce and is a particularly important food source for several species of game birds including pheasant, canada geese, and other species of waterfowl.

Hedgerows - Hedgerows are one of the most important features in a farm landscape and, while decreasing in quality and quantity, they do exist throughout the Region. Hedgerows and thickets are often found defining property lines, lining roads, protecting small streams and drainageways, and defining pastures or fields within a single property. Hedgerows serve as windbreaks which help to prevent erosion of adjacent agricultural lands and stabilize stream banks. Wildlife living in adjacent areas meet

and overlap in hedgerows. Hedgerows provide food in the form of a variety of fruits, buds, and insects and cover in their tangled thickets which provide nesting sites and a means of escape from predators for animals that normally feed in adjacent open fields and meadows. Fields and meadows possessing hedgerows support a more varied and higher population of wildlife than those which do not have hedgerows.

Hedgerows are even more threatened by non-native invasive species than are woodlands. Because the invasive species thrive in high light conditions, the understory is almost exclusively dominated by invasive species such as multiflora rose, oriental bittersweet, japanese honeysuckle, and mile-a-minute weed. The tree component of hedgerows remains dominated by native species such as black cherry, red mulberry, tulip poplar, and sassafras.

Conclusion - The above information provides a broad overview of the habitats found in the Kennett Region. An extensive inventory and analysis of local vegetation and wildlife would be the next step in identifying and refining the habitat types of the Region and in taking further steps toward their protection. An inventory at this level is beyond both the scope of this plan and that of the local open space plans. However, future joint efforts of the Region could include the completion of such an inventory and steps that need to be taken to maintain or even improve the natural diversity of the area.

## EXISTING PROTECTION MEASURES

The following tables provide a summary of the existing natural resource protection measures in each Kennett Region municipality. This information provides guidance concerning where the Region’s ordinances could be made more consistent in their protection of natural resources. Creating consistency in protection measures, in conjunction with the other recommended actions of the resource protection plan (Chapter Nine), will provide a basis for protecting resources on a regional level.

**Figure 4-3: Zoning Ordinance Natural Resource Protection Measures**

Protection Measures	East Marlborough	Kennett Township	Kennett Square	Pennsbury Township	Pocopson Township
Flood Hazard District/Protection	✓	✓	✓	✓	✓
Groundwater Protection District	✓			✓	
Lot Averaging/Cluster Provisions	✓	✓		✓	✓
Minimum buildable area required per lot				✓	
Ponds and Pond Shorelines Protection				✓	
Riparian Buffer/Stream Protection		✓			
Steep Slope Protection Standards	✓	✓*	✓	✓	✓
Tree or Woodlands Protection	✓	✓		✓	✓*
Watercourses (other than floodplain standards)				✓	
Wetlands/Wetland Margin Protection		✓	✓	✓	✓

Source: Chester County Planning Commission, Municipal Zoning Ordinances

\*No specific limits on disturbance.

**Figure 4-4: Subdivision And Land Development Ordinance Natural Resource Protection Measures**

Protection Measures	East Marlborough	Kennett Township	Kennett Square	Pennsbury Township	Pocopson Township
Conservation and/or Site Analysis Plan showing natural features, proposed disturbance, and protection measures	✓	✓	✓	✓	✓*
Tree/Woodlands Protection Standards	✓	✓		✓	✓
Stormwater Management/Erosion Control	✓**	✓		✓***	✓
Riparian Buffer Protection Standards		✓			
Other Vegetation Protection (hedgerows, specimen vegetation)		✓		✓	
Establishment of Community Trails					✓

Source: Chester County Planning Commission, Municipal Subdivision and Land Development Ordinances

\*Require natural features to be shown, but protection standards not very specific.

\*\*Controlled through a separate ordinance.

\*\*\*Also have a “Land Disturbance Ordinance” and are working on an update to the stormwater management provisions of the subdivision and land development ordinance.

All municipalities in the Region have at least some resource protection standards in place. Generally, major resources that could have the most impact if developed, such as floodplains, steep slopes, woodlands, and wetlands have some degree of protection. Because it is already largely built up, the borough has protection measures for fewer resources than the surrounding townships, but does have specific protection measures for floodplains, steep slopes, and wetlands. All municipalities in the Region at least require that natural resources be identified on a conservation or site analysis plan. In some cases, a municipality lists a resource and recommends protection, but without specific disturbance limits it is hard to enforce these standards. To most effectively protect sensitive environmental resources on a regional basis, resource protection standards should be made consistent between municipalities and include specific disturbance limits.

## References

The following references were the primary source of the natural resources inventory information. Existing protection measures information was taken directly from municipal ordinances.

East Marlborough Township Open Space, Recreation, and Environmental Resources Plan, prepared by the Township Open Space Task Force and Glackin Associates, Newtown Square, PA with the assistance of Conservation Advisors, Chadds Ford, PA and Susan Forster, Abington, PA, August 1993.

Kennett Square Borough and Kennett Township Parks, Recreation, and Open Space Plan, prepared by the Park, Recreation, and Open Space Task Force and Urban Research and Development Corporation, Bethlehem, PA, August 1993.

Pennsbury Township Open Space, Recreation, and Environmental Resources Plan, prepared by the Township Open Space Task Force Committee and the Environmental Management Center of the Brandywine Conservancy, Chadds Ford, PA, January 1993.

Pocopson Township Open Space, Recreation, and Environmental Resources Plan, prepared by Township Open Space Task Force, the Environmental Management Center of the Brandywine Conservancy, Chadds Ford, PA and Gaia Design: Landscape Architecture and Planning, Kennett Square, PA, February 1993.