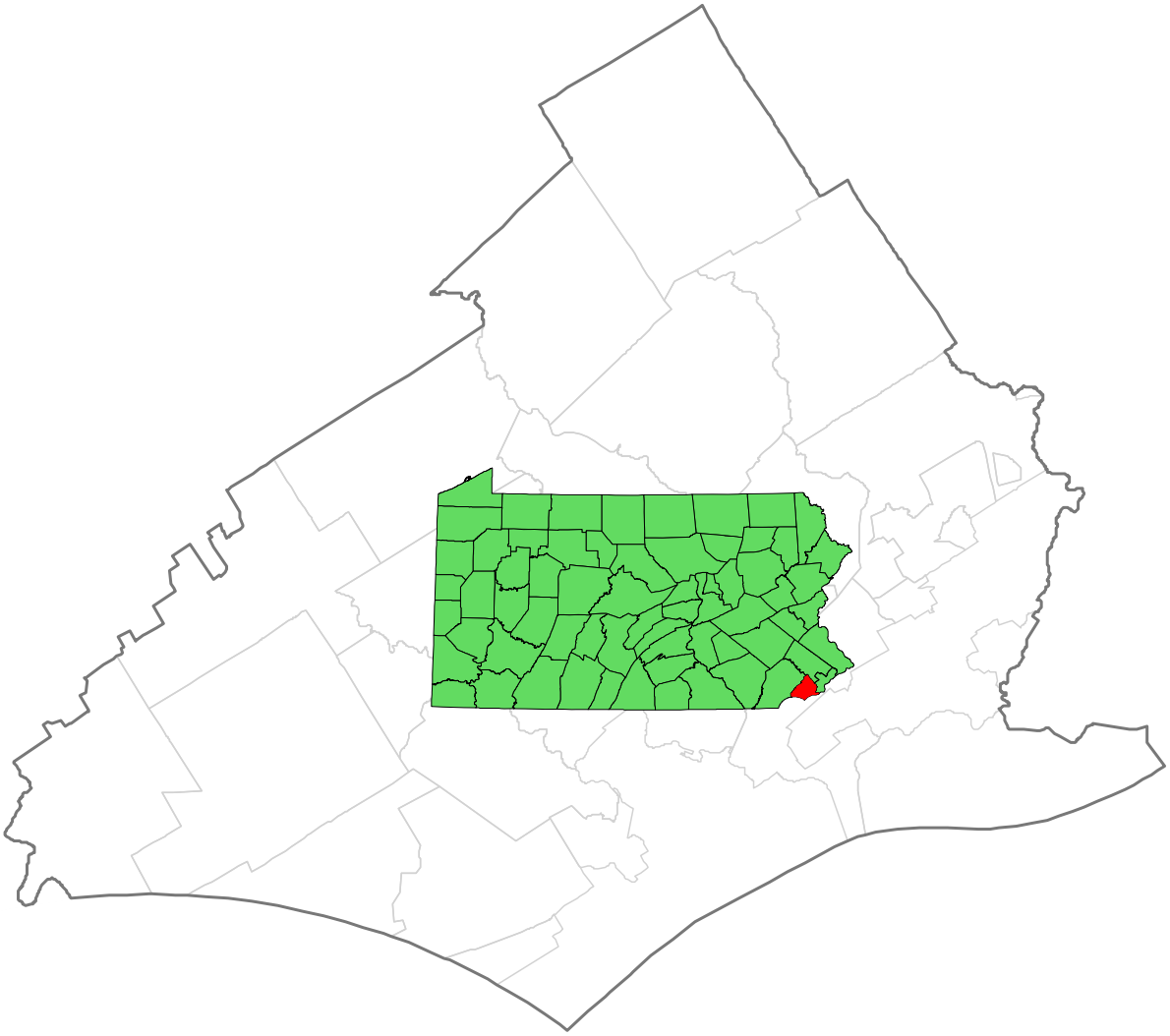
A Natural Areas Inventory of Delaware County, Pennsylvania



Document includes the original 1992 full report
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This Natural Areas Inventory was conducted by

Pennsylvania Science office
of
The Nature Conservancy
208 Airport Drive
Middletown, Pennsylvania 17057

for
The County of Delaware

A NATURAL AREAS INVENTORY

OF

DELAWARE COUNTY, PENNSYLVANIA

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Copies of this document may be obtained from:

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GLOSSARY

ATV - all-terrain-vehicle.

barrens - areas that are naturally infertile as a consequence of nutrient-poor soils; often form on resistant rock such as quartz, sandstone or highly weathered glacial material.

effluent - waste water from septic systems or stormwater sewers.

exotic - non-native; used to describe plant or animal species that were introduced by humans; examples include garlic mustard and Japanese honeysuckle; exotics may present a problem if they are more competitive than native species.

forb - non-grass herbaceous (non-woody) plant such as goldenrod.

graminoid - grass-like plant such as a sedge or a rush.

hydrology - water system of an area including both surface water and ground water.

natural community - an example of a plant assemblage that is relatively undisturbed or has recovered sufficiently to reflect the original plant community; only the best examples are considered for inclusion in the PNDI data base.

non-point - refers to diffuse sources of pollution such as stormwater runoff contaminated with oil or pesticides.

PNDI - Pennsylvania Natural Diversity Inventory

Potential Natural Area - area that may have desirable environmental characteristics, but needs a field survey to confirm; a preliminary category given to sites prior to field survey.

PSO - Pennsylvania Science Office of The Nature Conservancy (TNC)

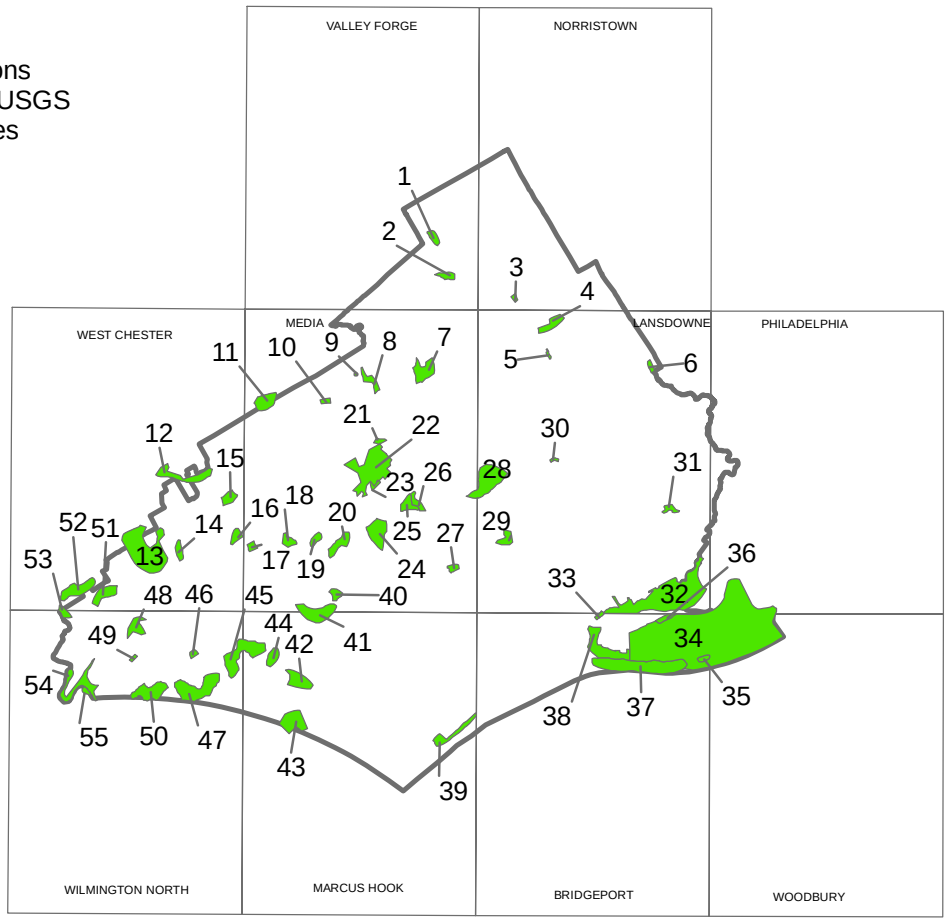
prescribed burning - burning under controlled conditions; needed to maintain communities such as serpentine barrens.

seeps - unchannelized springs; water flows to the surface saturating the soil; often support lush herbaceous vegetation.

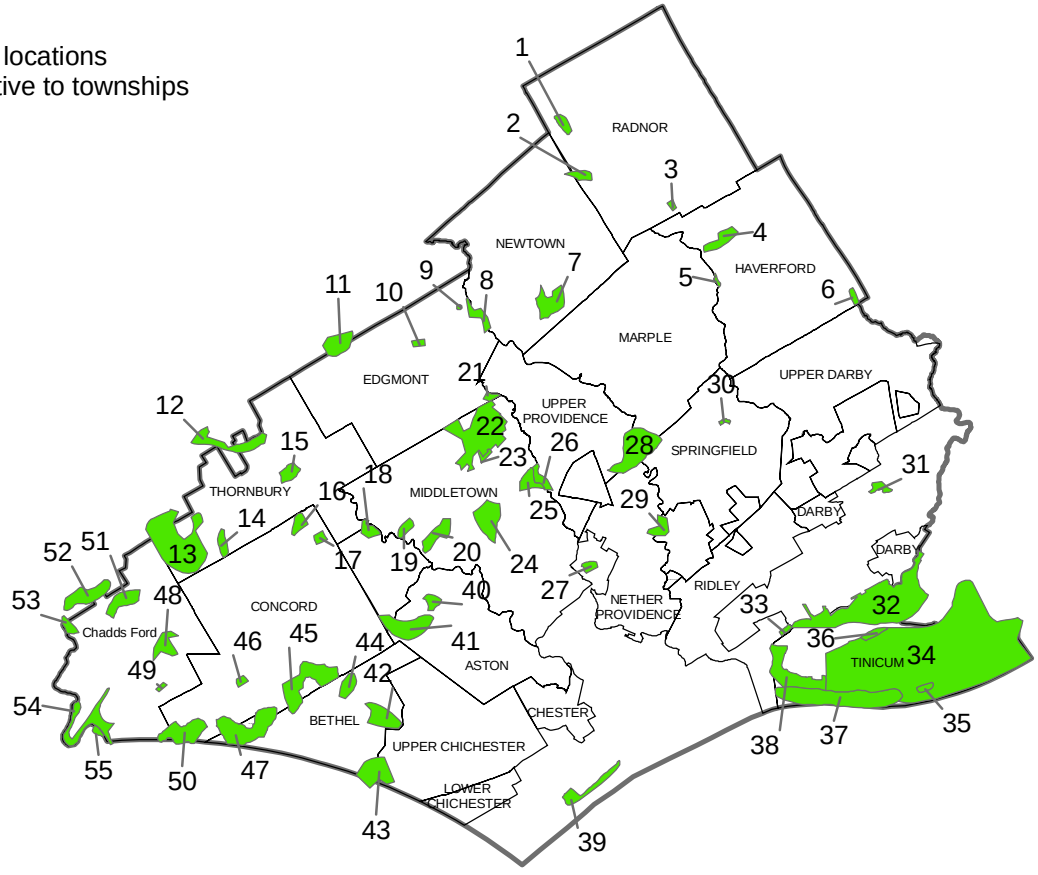
succession - natural process of vegetation change through time; over time, the plant species of a site will change in composition and structure as light and soil conditions change.

understory - layer of shrubs and small trees between the herbaceous layer and the canopy.

Site locations
relative to USGS
quadrangles



Site locations
relative to townships



Site Number	Site Name	USGS Quadrangle	Township
1	Radnor Woods	Valley Forge	Radnor
2	Skunk Hollow Woods	Valley Forge	Radnor, Newtown
3	Ithan Creek Wetland	Norristown	Radnor
4	State Hospital Woods	Lansdowne	Haverford
5	Darby Creek Valley Park	Lansdowne	Haverford
6	Fairmount Park	Lansdowne	Haverford
7	Hunter Run Seeps	Media	Newtown
8	Crum Creek Woods	Media	Newtown, Edgemont
9	Castle Rock	Media	Edgemont
10	Hunting Hill Woods	Media	Edgemont
11	Willistown Serpentine Barrens	Media	Edgemont
12	Cheyney Wetland	West Chester	Thornbury
13	Brinton Lake Wetland	West Chester	Thornbury
14	Bethlehem Church Woods	West Chester	Thornbury
15	Glen Mills School Woods	West Chester	Thornbury
16	Markham Woods	West Chester	Concord
17	Edgewood Memorial Park Woods	Media	Concord
18	Darling Woods	Media	Thornbury
19	Wawa Woods	Media	Middletown
20	Glenwood School Woods	Media	Middletown
21	Tyler Arboretum Woodlands	Media	Edgemont
22	Tyler Arboretum	Media	Middletown
23	Pink Hill Barrens	Media	Middletown
24	Williamson School Barrens	Media	Middletown
25	Mineral Hill Woods	Media	Middletown
26	Media Wetland	Media	Middletown, Upper Province
27	Long Point Woods	Media	
28	Lower Crum Reservoir	Media, Lansdowne	Marple, Upper Province, Nether Province, Springfield
29	Swarthmore College Woods	Lansdowne	Nether Province
30	Summit Road Woods	Lansdowne	Springfield
31	Mt. Zion Cemetery	Lansdowne	
32	John Heinz Nwr	Lansdowne	
33	Leedom Estates Park Site	Lansdowne, Bridgeport	Ridley
34	Tinicum Macrosite	Lansdowne, Philadelphia, Bridgeport, Woodbury	Tinicum
35	Hog Island	Bridgeport	Tinicum
36	Car Wash Marsh At Tinicum	Bridgeport	Tinicum
37	Little Tinicum Island	Bridgeport	Tinicum
38	Essington Wetlands	Bridgeport	Tinicum, Ridley
39	Chester Tidal Flats	Marcus Hook	
40	Crozierville Woods	Media	Aston
41	Chester Creek West Branch	Media, Marcus Hook	Aston
42	Spring Run Woods	Marcus Hook	Bethel
43	Sun Oil Woods	Marcus Hook	Bethel, Upper Chichester

44	Garnet Mine Road Woods	Marcus Hook	Bethel
45	Shavertown Woods / Clayton Park	Marcus Hook, Wilmington North	Bethel, Concord
46	Elam Woods	Wilmington North	Concord
47	Johnsons Corner/Naaman Creek Road Site	Wilmington North	Bethel, Concord
48	Brandywine Summit SE	Wilmington North	Chadds Ford
50	Beaver Valley Road Pipeline Site	Wilmington North	Chadds Ford
49	Quarry Woods	Wilmington North	Concord, Chadds Ford
51	Todd Woods	West Chester	Chadds Ford
52	Brinton Run Woods	West Chester	Chadds Ford
53	Chadds Ford Swamp	West Chester, Wilmington North	Chadds Ford
54	Brandywine Creek Corridor	Wilmington North	Chadds Ford
55	Smith Bridge Woods	Wilmington North	Chadds Ford

INTRODUCTION

Delaware County in southeastern Pennsylvania is a county of great variety. Intertidal marsh communities dominated by cattails and leafy spatterdock, and home to many resident and migratory birds, flourish along parts of the Delaware River. To the northwest, there are found picturesque farmland, scattered mature wood lots of beech, oak, and tulip tree, and wet meadows. West of Media, patches of serpentine rock support globally imperiled plants among an assortment of more common grasses and wildflowers. Along the several stream corridors that cross the county, one finds cool woodlands cloaking steep slopes and assorted floodplains and wetlands adjacent to the creeks. Although the scenic beauty of the county is great, intense development, both historically and recently, has diminished much of the original natural landscape. This report presents Delaware County's remaining outstanding natural heritage features - geologic, floral, and faunal - that deserve protection for enjoyment by future generations.

Delaware County's proximity to Philadelphia and Wilmington has made it a commuter's paradise. Major traffic arteries including I-95, I-476 (Blue Route) and Route 1, and numerous smaller highways criss-cross the county. Urban and suburban development has sprung up alongside these myriad roadways resulting in the loss of many scenic and natural environments. Wise planning is needed to maintain the remaining natural environments and associated plants and animals while allowing for continued development. To achieve a balance between economic growth and preservation of biological diversity, development must be guided away from the most environmentally sensitive areas. County and municipal government officials, the public, and developers must know the location and importance of environmentally sensitive areas in order to protect them. This knowledge of site location, quality, and significance can be used to avoid land-use conflicts and to allow for wise spending of limited conservation dollars.

The Natural Areas Inventory of Delaware County provides maps of the best natural areas (natural communities) and the locations of all known animal and plant species of special concern (endangered, threatened, or rare)*. A written description and a summary table of the sites that contain these elements, including quality, degree of rarity, and last-observed date, accompany each map. In addition, the locations of some areas that cannot be deemed natural are also included. These sites are significant
locally because they are tracts of open land that provide wildlife habitat, offer a diversity of plant species and habitats, or are relatively mature woods. Some may also be areas that can help protect or buffer water supply watersheds or are adjacent to already-existing parks or conservation lands. This report should be used in conjunction with other reports, such as open space plans prepared for Middletown Township

* Codes are used to identify these features on the maps. Rare plants and animals are subject to unauthorized collection and are not identified in the text in order to provide some measure of protection.

(Natural Lands Trust 1988) and Radnor Township (Carter van Dyke Associates 1991), as well as other detailed creek valley or watershed studies, in an effort to conserve remaining open and natural lands in the county.

An overall summary of the highest quality sites suggests protection and conservation options. The information and maps presented in this report provide a useful guide for planning development and as a supplement to municipal open space plans for parks and natural areas, and setting protection priorities for preservation of the most vulnerable sensitive areas.

DELAWARE COUNTY OVERVIEW

Climate, geology, hydrology, topography, and soils have contributed to the growth and development of the forests, wetlands, and other natural communities located in Delaware County. In addition, human and natural disturbances have played an important role in the evolution of these communities. A brief review of the geology, soils, vegetation types, and disturbance history of Delaware County sets the stage for the remainder of the report.

Geology

The northwestern two-thirds of Delaware County is located in the Piedmont Uplands section of the Piedmont Physiographic Province. The southeastern third of the county, along the Delaware River, is in the Coastal Plain Physiographic Province. Each region bears a distinctive landscape reflecting the underlying geology.

The Piedmont Uplands consists of complexly folded and faulted metamorphic and igneous rocks of Precambrian and Cambrian age (Geyer and Bolles 1979). Rock types include marble, schist, gneiss, quartzite, granite, and serpentinite. Weathering and erosion of these various rock types produces the rolling topography characteristic of much of the county. The major creeks cutting down through these rocks on a southerly passage to the Delaware River include from east to west: Cobbs Creek, Darby Creek, Crum Creek, Ridley Creek, Chester Creek, Naamans Creek, and Brandywine Creek. The varied geology of the county is revealed in boulders and rock outcrops exposed along these creeks.

The Coastal Plain has a gently undulating topography that is more subdued than that of the Piedmont Uplands. Unconsolidated to poorly consolidated layers of Quaternary-age sand, gravel, and clay underlie the Coastal Plain and dip gently to the east. Delaware County's thin sliver of Coastal Plain along the Delaware River has been heavily developed for industrial and residential use. Tinicum marsh (within the John Heinz National Wildlife Refuge) is one of the few remaining Coastal Plain natural communities in Pennsylvania. Here, Darby Creek, freed from the confining hard rock valley of the Piedmont, meanders in a broad swath on its final approach to the Delaware River.

Soils

Soils are important landscape components that reflect the underlying geology, provide the medium for plant growth, and determine land use to a large degree. Kunkle (1963) recognizes four soil associations in Delaware County.

The Glenelg-Manor-Chester association covers much of northern Delaware County and consists of shallow to deep, silty and channery soils on grayish brown schist and gneiss. Traditionally, agriculture, dairy farming, and livestock production were primary land uses associated with these soils. More recently, much of this land has undergone conversion to suburbia.

The Neshaminy-Glenelg association occurs in northern Delaware County and consists of moderately deep and deep, well drained, silty, channery, and gravelly soils on gabbro and granodiorite. According to Kunkle (1963), soils of this association are best suited to hay production and pasturage. As with the preceding association, much of the land occupied by these soils has been developed for residential communities.

The Neshaminy-Chrome-Conowingo association occurs as a broad belt west and north of Media and consists of moderately deep and deep, silty soils on serpentine. The soils of the association vary in drainage class with the Neshaminy being well drained and the Conowingo being moderately well drained to somewhat poorly drained. The unusual chemistry of the serpentine rock from which these soils derive - it is relatively rich in magnesium and poor in calcium and high in certain heavy metals - is reflected, to varying degrees, in the associated native vegetation and land use. Coastal Plain species such as blackjack oak (Quercus marilandica) and western prairie grasses such as prairie dropseed (Sporobolus heterolepis) thrive on the droughty serpentine soils. Where the serpentine effects are strongly expressed, agriculture has failed and has been abandoned for more fertile lands. Today, much of the area occupied by these unusual soils is in residential development.

The Beltsville-Sassafras-Butlertown association develops on Coastal Plain sediments which are found primarily along the Delaware River with a few, scattered patches occurring farther inland. The deep, silty or sandy soils of this association are not extensive in their occurrence in the county. While some of the lands occupied by these soils were farmed at one time, most of the land has been developed for industrial use or residential communities.

Vegetation Types

The vegetation in Delaware County reflects the environmental conditions associated with the different physiographic provinces and disturbance history.

The woodlands of Delaware County are located in the Piedmont Section of the Oak-Chestnut

Forest Region (Braun 1950). The Oak-Chestnut Region which extends from southern New England to northern Georgia was originally characterized by oaks and the American chestnut. Today, none of the original primary vegetation of this forest-type remains because the chestnut blight, which began in the early 1900's, eradicated a primary constituent of the forest community. At present, the forest of this region is classified as Mixed Oak Forest (Monk et al. 1990). Historical logging for lumber and fuel produced even-aged stands that range in age from 40 to 80 years (Keever 1972).

Forested north-facing slopes are often dominated by beech while south-facing slopes are often a mix of oaks and tulip poplar with beech a very minor component (Braun 1950). Common associates include red maple, white ash, hickory, black cherry, and sour-gum. Typical shrubs include spicebush, viburnums, and witch hazel. The herb layer is often lush with assorted ferns and wildflowers, many of which are spring ephemerals.

Oaks dominate the crests of hills. Shallow, droughty, nutrient-poor soils support a shrub layer dominated by huckleberry, blueberry, and mountain laurel and a sparse herb layer containing plants such as partridgeberry.

Serpentine-based communities represent anomalous vegetation types within the extensive Mixed Oak Forest. The structure and species composition of these communities range from very exposed rocky or gravelly outcrops supporting a handful of drought-tolerant species such as round-leaved fame-flower (Talinum teretifolium) and serpentine aster (Aster depauperatus) to open prairies containing assorted western grass species to forests of post oak (Quercus stellata) and blackjack oak with an understory of greenbrier. Disturbance such as fire affects the nature of the community and the degree to which the serpentine effect is expressed. If periodic disturbance is suppressed, the unique serpentine communities may succeed to the ordinary background Mixed Oak Forest community.

Wet meadows, marshes and swamps have formed on the alluvial floodplain soils along some streams and other water bodies. Water recedes from the wetlands as stream water levels drop and often dry by late summer. These wetlands receive water that is relatively well aerated and high in nutrients. Because of drying and aeration, fairly rapid decomposition processes preclude the accumulation of much organic matter. Red and silver maple, white and green ash, box elder, and willow are typical canopy species. Silky dogwood, arrowwood, and spicebush are common shrub species. A diversity of grasses, rushes, and sedges grow in open areas along with assorted herbs. Plant community and species zonation depends on flooding regimes and rates of soil drainage.

Intertidal communities that are alternately bathed and exposed twice a day by the shifting tide occur along the Delaware River and as far inland as the tidal influence extends. Mudflats occur in the lower part of the intertidal zone and are populated by scattered leafy emergents such as spatterdock and an assortment of arrowheads (Sagittaria spp.) with low, basal rosettes that are evident only at low tide. Marshes with robust grasses such as wild rice, bulrushes, and leafy emergents including pickerelweed, arrow arum, and common arrowhead occur in the upper part of the intertidal zone. Although these marshes are lush in mid-summer, they die back to bare mud each

winter.

Disturbance

The nature, scale, and frequency of disturbance are influential factors in the evolution and appearance of natural communities. Disturbance can be beneficial or destructive to the development and persistence of natural communities.

Fire, seen by most people as a destructive force, plays an important role in maintenance of serpentine barren communities. In its absence, open areas where many of the rare serpentine species grow, become overgrown with woody plants that shade out the light-loving species. Prescribed burning at Pink Hill in the Tyler Arboretum illustrates that controlled fires can be used to set back natural succession processes and maintain the desired serpentine plants.

In many cases, human disturbance has been clearly destructive. Large-scale disturbance associated with urbanization and suburbanization has completely eradicated existing natural communities. Along the Delaware/Chester County border in Edgmont Township, recent development has obliterated a serpentine prairie community; illegal trash dumping (in evidence in nearby Chester County) on unused serpentine land can be equally harmful in the long term.

The Tinicum marsh provides a classic example of human mis-management. Over time, the once-extensive marshland has shrunk in size as areas were filled for one reason or another. For many years, the marsh was a landfill receiving unknown quantities and qualities of trash. Construction of the Philadelphia Airport and the extensive highway network and numerous support facilities surrounding the airport took away additional wetland. Disposal of dredge spoil, continuing into the present, has further reduced the size and quality of marshland. A somewhat different impact to Tinicum marsh, was removal of gravels underlying the marsh near the I-95 Darby Creek bridge for highway fill. The subsequent conversion of productive marshland to open water resulted in the loss of extensive wild rice stands and the displacement of migratory birds that fed on rice grains in late summer and early fall. The U.S. Fish and Wildlife Service is attempting to maintain and improve the condition of the remaining marsh at Tinicum.

Some communities have recovered over a period of decades from activities such as logging and farming to a composition and structure approaching the pre-settlement state. Scattered mature wood lots in Delaware County provide a sense of the stature of the original forest. It is important to maintain a closed canopy in these mature forests to prevent the invasion of light-loving, exotic species.

The introduction and spread of exotic species across the landscape is a monumental problem in the protection of biodiversity. Many of these non-native plants outcompete the desirable native species. In woodlands throughout the county, garlic mustard (Alliaria petiolata), Japanese honeysuckle (Lonicera japonica), and bittersweet (Celastrus orbiculata) are nuisance species. Japanese knotweed (Polygonum cuspidatum) and mile-a-minute plant (Polygonum perfoliatum)

invade clearings and river shores. Common reed (Phragmites australis) and purple loosestrife (Lythrum salicaria) are aggressive, weedy species that creep into wetlands in the wake of disturbance and often overwhelm native species. Control of these weedy species is necessary for the long-term maintenance of high quality natural systems.

PENNSYLVANIA NATURAL DIVERSITY INVENTORY DATA SYSTEM

In order to plan the wise use of Delaware County's natural features, the Pennsylvania Science Office (PSO) of The Nature Conservancy (TNC) entered into a contract with the Delaware County Planning Department to provide environmental data for use in site evaluations throughout the county. PSO/TNC was selected because of its reputation, as well as its link to the Pennsylvania Natural Diversity Inventory (PNDI) database. PNDI was established in 1982 as a joint venture of PSO/TNC, the Pennsylvania Department of Environmental Resources, and the Western Pennsylvania Conservancy. In its ten years of operation, the PNDI database has become Pennsylvania's chief storehouse of information on outstanding natural habitat types (called natural communities in PNDI terminology), sensitive plant and animal species, heron rookeries, and several other noteworthy natural features. Over 7,000 detailed occurrence records, largely the result of field surveys, are stored in computer files and denoted on topographic maps. Additional data are stored in extensive manual files set up for over 150 natural community types, over 800 plant and animal species, about 650 managed areas, and for each of Pennsylvania's 881 7.5-minute USGS quadrangle maps.

Beginning in 1982, PSO collected primarily existing data on occurrences of elements of concern, drawing from publications, herbarium and museum specimens, and the knowledge of expert botanists, zoologists, ecologists, and naturalists. From this foundation, PSO has focused its efforts on, and begun systematic inventories of, the best occurrences of the priority elements.

The PSO has used this systematic inventory approach to identify the areas of highest natural integrity in Delaware County. These areas, comprised of natural communities with their characteristic species, represent an estimated 85-90 percent of the biological diversity of an area (The Nature Conservancy 1988); the other 10-15 percent consists of sensitive plant and animal species which occur both within and outside these natural communities. The full range of biological diversity within Delaware County can be conserved by protecting sites with the best occurrences of the county's natural communities and by protecting populations of the county's sensitive plant and animal species. The natural community and sensitive species data are the basis for judging the biological values of sites within the county.

NATURAL AREAS INVENTORY METHODS

Methods used in the Delaware County Natural Areas Inventory followed PNDI procedures and those developed in Illinois (White 1978) and Indiana (Anonymous 1985). The inventory

proceeds in three stages: 1) information is gathered from the PNDI database files, local experts, and map and air photo interpretation; 2) a reconnaissance flight provides an overview of the county; and 3) ground survey allows detailed documentation of site characteristics.

Map and Air Photo Interpretation

A list of natural features found in Delaware County was prepared from the PNDI database and from information volunteered by local individuals and organizations knowledgeable of the county. Photo interpreters familiarized themselves with the air photo characteristics of high quality natural communities already documented by PSO. Additional data such as vegetation maps, field surveys, and soil maps were consulted to increase understanding of the county's environment. Because vegetation must often be classified at an ecosystem level, it was critical that an ecologist or person with similar training interpret the maps and air photos.

Work progressed systematically within the area encompassed by each USGS topographic map. The natural area potential of all land parcels on a given USGS topographic map was assessed using aerial photographs. Areas extending into adjacent counties were examined in their entirety. Topographic maps to be used during field surveys were marked to indicate locations and types of potential natural areas based on aerial photo characteristics. For example, wood lots having a "puffy" canopy texture, indicating large tree crowns, were marked as potential mature forests. Light-colored open areas were marked as potential serpentine barrens.

Once some photo interpretation was completed, field surveys were conducted to determine what was actually on the ground to improve the accuracy and consistency of interpretation. Biologists finding minimally disturbed natural vegetation or species of special concern at a site outlined the site on a field map for future reference. In the lab, the photo signatures (characteristic patterns, texture, tone of vegetation, and other features on the photos) of these sites were compared with other areas found on the photos to identify similar plant communities that could be checked during future surveys. Biologists consistently finding poor quality sites associated with particular photo signatures could eliminate similar areas on the photos without field surveys.

Field Work

Experienced PSO biologists conducted field surveys to evaluate the naturalness of habitats and search for sensitive species.
Workers categorized the vegetation by natural community type for each site visited. An evaluation of quality was made for each natural community, care being taken to give reasons for the quality rank. Boundaries of the community types were redrawn, if needed, based on new field information. The Potential Natural Area (PNA) Inventory Form (Appendix III) was completed for each community with a quality-rank of "C" and above. Community information recorded included the

dominant, common, and other species as well as disturbances to the community. The presence of sensitive plants and animals was noted and marked on USGS topographic quadrangle maps. For sites of state-wide significance, more intensive study was made using PNDI Survey Forms.

Data Analysis

To organize the natural features data and set conservation priorities, each natural community or species (elements) is ranked using factors of rarity and threat on a state-wide (state element ranking) and range-wide (global element ranking) basis (see Appendix I). Each location of an element (an element occurrence) is ranked according to naturalness, its potential for future survival or recovery, its extent or population size, and any threats to it. Explanations of the six PNDI quality ranks are given in Appendix II. The element-ranking and element occurrence-ranking systems help PSO personnel to simultaneously gauge the singular importance of each occurrence of natural features and species such as Freshwater Intertidal Mudflat, Redbelly Turtle, and Serpentine Aster occurring in the county, as well as the state-wide or world-wide importance of these natural features. Obviously, sites with several highly ranked occurrences of high-ranked elements merit more immediate attention than sites with a few low-ranked occurrences of lower ranked elements.

Field data for natural communities of C-rank or better, and for all plant and animal species of concern found were synthesized with existing data and summarized on PNDI Element Occurrence Records for mapping and computerization. Mapped locations of natural features were then transcribed onto acetate map overlays for presentation to the county planners who will use and distribute this information.

Map Codes

All natural communities, species of special concern and geologic features are coded on the maps and described in the text. The codes are PNDI map codes that are unique to each element on a given USGS topographic map. Species are identified by code to prevent unauthorized collection and possible extirpation of the species at that site. Natural Communities are identified by **NC**, plants by **SP**, animals by **SA**, and geologic features by **GE**; all are followed by a three-digit code. Anyone seeking information on an individual site or species location may call or write the Pennsylvania Science Office of TNC; please provide the map code(s) and the corresponding map name(s) where applicable.

Priorities for Protection

A table with a priority listing of the county's natural community and species locations is presented in the Summary and Recommendations section. The table ranks sites from the most important and threatened to the least. The table lists the site name, topographic map, and pertinent information on importance, threats, management needs, and recommendations for protection.

Some sites of potential local significance are indicated on the maps and briefly discussed in

the text accompanying each map. These secondary sites are arranged in a separate table in the Summary and Recommendations section and ranked in approximate order of importance. They have been given qualitative ranks (high, medium, or low) according to size, level of disturbance, proximity to other open-space lands, and potential for sustaining a diversity of plant and animal life. These secondary-site ranks must be viewed as very approximate.

SUMMARY AND RECOMMENDATIONS

A meeting of TNC personnel is held annually to discuss the most important sites for protection of biological diversity in Pennsylvania; the following Delaware County sites are regarded as being significant for natural communities and species of special concern and contain some of the best natural areas in the state.

Since there is only limited money and personnel time that can be devoted to the pursuit of land conservation, two tables are presented to direct protection efforts towards the most important sites first. Table 1 lists all the known sites where exemplary natural communities and species of special concern are located in approximate order of importance for the protection of biological diversity. The table also summarizes their significance, any potential threats, and some recommendations for protection. Table 2 is a list of secondary sites that may include portions of parks that are already protected and sites that may be acceptable as additions to existing parks or as new county or municipal parks and passive recreation. The sites in Table 1 should be actively pursued for protection in order of importance while those in the second table might be targeted once protection of the Table 1 sites has been accomplished or as opportunities arise.

The following four sites from Table 1 are the most critical in Delaware County for maintaining biological diversity into the future. Each site is followed by its USGS topographic quadrangle map location. Figure 2 indicates the approximate location of these four sites in the county (see Figure 1 for municipality locations).

John Heinz National Wildlife Refuge at Tinicum (Lansdowne and Bridgeport Quadrangles): The largest Freshwater Interidal Marsh natural community in Pennsylvania is located here. Three plant species of special concern and eleven animal species of special concern have been documented within the refuge. The refuge is used by migrating waterfowl and songbirds as well as for nesting habitat. Its value as an environmental education center and field laboratory are well documented. Although it is protected by the U.S. Fish and Wildlife Service, pollution of upstream waters remains a problem. Contamination of animal species that utilize the marsh may reduce their populations or eventually eliminate them. Additional land acquisition and tougher water quality regulations and enforcement are encouraged.

Little Tinicum Island (Bridgeport Quadrangle). This may be the richest site for biodiversity in

Delaware County. Twelve intertidal plant species of special concern are found within the Freshwater Intertidal Mudflat natural community that surrounds the island. The mudflat along the northern perimeter of the island may be the best example of this natural community type in Pennsylvania.
The health of the Delaware River can be indirectly gauged from the species composition and appearance of the mudflat community.

The island is utilized by migratory birds and monarch butterflies can be found here in abundance during their fall migration. Fortunately, it is protected by the state and may be designated as a State Forest Natural Area by the Department of Environmental Resources.

There are problems with trash - both washed up on shore and left behind by visitors. An effort to educate users about the importance of the island and mudflat and regular clean up is needed.

Pink Hill Serpentine Barrens (Media Quadrangle). Serpentine Barrens are a globally rare natural community type which support a unique array of plants. Pink Hill harbors good-quality populations of two plant species of special concern, including one that is being considered for Federal Endangered species status. The area is owned and actively managed by Tyler Arboretum and serves as a model area for managing other Serpentine Barrens in the county.

Williamson School Serpentine Barrens (Media Quadrangle). This is another example of the globally rare Serpentine Barren natural community. Four plant species of special concern occur at this site. The natural community is somewhat degraded by ATV use and invasion of woody plants; management should address these needs. Efforts should be made to secure protection for this site.

The sites of statewide significance for the protection of biological diversity in Delaware County in approximate order of priority from the most important to the least.

County Rank[1]	Site Name (Municipality)	USGS Topo. Map	Natural Community, TNC Global and State Ranks[2], Importance, and Recommendations
1	John Heinz National Wildlife Refuge at Tinicum (Tinicum Twp. and Folcroft Boro - Delaware Co. and City of Philadelphia-Philadelphia Co.)	Lansdowne	Contains largest Freshwater Intertidal Marsh in PA; three intertidal plant species of special concern occur; several bird species of concern utilize and nest in the refuge; two other PE animals occur here; owned protected by U.S. Fish and Wildlife Service; water pollution and spread of exotic plants are perennial problems; protect and acquire adjacent lands.
1	Little Tinicum Island (Tinicum Twp.)	Bridge-port	Island in Delaware River provides habitat for PE animal and has best Freshwater Intertidal Mudflat natural community in PA; mudflat supports 12 plant species of concern; important for monitoring changes in flora of river; island owned by Bureau of Forestry of PA DER; severe trash problem should be addressed; protect mudflat areas from excessive disturbance.
1	Pink Hill	Media	Globally imperiled serpentine

	Serpentine Barrens (Middletown Twp.)		habitat; good populations of PT plant and PR plant; prescribed burning by **Tyler Arboretum** maintains open area; model for management of other serpentine barrens; site secure under Arboretum management.
1	Williamson School Serpentine Barrens (Middletown Twp.)	Media	Globally imperiled serpentine habitat; fair population of PT plant; three additional plant species of special concern; area behind

(continued)

County Rank[1]	Site Name (Municipality)	USGS Topo. Map	Natural Community, TNC Global and State Ranks[2], Importance, and Recommendations
			Riddle Memorial Hospital threatened by off-road vehicles and proposed construction; seek conservation easement over barrens and maintain open area through use of prescribed burning, hand removal of woody plants, or mowing.
2	Willistown Serpentine Barrens (Edgmont Twp.-Delaware Co. and Willistown Twp.-Chester Co.)	Media	Two areas of globally imperiled serpentine habitat; poor population of PT plant; three additional plant species of special concern; new development south of Rt. 926 has destroyed large area of habitat; landowners are encouraged to work with TNC land steward and/or Tyler Arboretum staff to maintain remnant habitat.
2	Johnson Corner Quarry/Woods (Bethel and Concord Twps.)	Wilming. North	Quarry supports 5 plant species of concern that have Coastal Plain affinities; small wet depressions threatened by succession and ATVs; surrounding woodland supports PR

			plant; suburban development threatens whole area; contact TNC land steward about maintaining open areas; maintain forest canopy.
3	Sun Oil Woods (Bethel and Upper Chichester Twps.)	Marcus Hook	Remnant Coastal Plain Forest natural community contains PE tree and PR wildflower; threatened by development; protect rare plants and stream corridor.

(continued)

County Rank[1]	Site Name (Municipality)	USGS Topo. Map	Natural Community, TNC Global and State Ranks[2], Importance, and Recommendations
4	SP549 (Birmingham Twp.)	West Chester	Fair population of PR plant growing in mature woods on edge of develop-yards; maintain closed canopy; secure permanent protection of whole creek valley.
4	SA502, SP575 (Tinicum Twp.)	Bridge-port	Small PE animal population and poor G5/S3 plant population inhabit "Car Wash Pond" adjacent to Radisson Hotel; loss of animal nesting habitat and polluted storm-water runoff from parking lot may reduce population size.
4	SA584 (Tinicum Twp.)	Bridge-port	G5/S3 bird species nests in old Westinghouse complex; continue monitoring of nesting population; work with landowner to maintain nesting site.
4	SP534, SP587 (Tinicum Twp.)	Bridge-port	Scattered, degraded tidal marshes support two PR plant species; protect such fragments from dredging and filling.

4	SA604 (Springfield, Upper Providence, and Marple Twps.)	Lansdowne	Good population of PE animal in Crum Reservoir; control erosion in watershed upstream of reservoir to limit sedimentation and loss of habitat in reservoir.
4	SP513 (Birmingham Twp.)	Wilming. North	Fair population of PR wildflower growing in mature, rich woodland along Brandywine Creek; benign ownership has maintained population at site for decades; now threatened by aggressive weedy species.

(continued)

County Rank[1]	Site Name (Municipality)	USGS Topo. Map	Natural Community, TNC Global and State Ranks[2], Importance, and Recommendations
4	SP524 (Birmingham Twp.)	Wilming. North	Small population of PR wildflower in mature mixed-hardwood woods in valley of tributary to Harvey Run; surrounding uplands slated for development; maintain woodland in current condition; prevent opening of canopy and invasion of exotics.
4	SP525 (Birmingham Twp.)	Wilming. North	Small population of PR wildflower along tributary to Beaver Creek near PA-DE state line.
4	SA505, SA511, SA512 (Tinicum Twp.)	Woodbury	Three bird species of concern utilize and nest on airport property; continue monitoring of nesting pairs; work with airport land manager to protect and manage known nesting sites.
4	SA508 (Birmingham Twp.)	Wilming. North	Large wetland complex along E side of Brandywine Creek at Chadds Ford; relatively natural; habitat for PE animal last observed in 1981 still

			intact; boardwalk provides good access; excellent educational and recreational resource; protected by The Brandywine Conservancy.
4	SA513, SP501 (Tinicum Twp.)	Woodbury	PE animal and PR intertidal plant occur in wetlands along Delaware River; protect surviving fragments from filling or dredging activities.
5	Fairmount Park (Haverford Twp.)	Lansdowne	Fair population of TU wildflower (SP558) grows in degraded young woodlot; dumping of brush and trampling are main threats.

(continued)

County Rank[1]	Site Name (Municipality)	USGS Topo. Map	Natural Community, TNC Global and State Ranks[2], Importance, and Recommendations
5	SP538	Bridge-port	Fair to poor population of PR inter-Park marsh; secure adjacent marsh lands from development.
5	SP605 (Collingdale Boro)	Lansdowne	Fair population of a S2 plant in a weedy thicket; species may not be native to this area.
5	SP606 (Haverford Twp.)	Lansdowne	Fair population of TU plant along sewer line clearing in park; maintain clearing by mowing after flowering in May.
5	SP513 (Concord Twp.)	Marcus Hook	Poor population of TU wildflower with Coastal Plain affinity grows along powerline cut in Clayton Park; succession is main threat.
5	SP532, SP542 (Middletown Twp.)	Media	Poor populations of two PR wildflower species grow in mature mixed mesophytic forest protected within Tyler Arboretum.

5	SP543 (Edgmont Twp.)	Media	Poor population of PR wildflower grows in Ridley Creek State Park; trampling and collection of plant are potential threats.
5	SP589 (Aston and Concord Twp.)	Media, Marcus Hook	Poor population of S2S3 aquatic plant grows in W. Branch of Chester Creek; maintain water quality in fast-developing area.
5	GE582 (Newtown Twp.)	Media	Large enstatite rock outcrop of geologic significance; protect from rock hounds.

(concluded)

County Rank[1]	Site Name (Municipality)	USGS Topo. Map	Natural Community, TNC Global and State Ranks[2], Importance, and Recommendations
5	SP522 (Radnor and Newtown Twps.)	Valley Forge	Poor population of PR wildflower in moderately mature beech forest along Darby Creek; exotic species such as privet pose main threat; area protected in Skunk Hollow Park.

[1] Sites are ranked from 1 to 5 with 1 indicating the highest priority for protection based on state or national significance, and 5 indicating the lowest priority for protection; ranks take into account potential threats, management needs and existing protection.

[2] See Appendix I for explanation of Global and State vulnerability ranks.

Areas of local significance in Delaware County based on size, diversity of wildlife and plant life, water quality protection, and recreation potential.

County Rank[1]	Site Name (Municipality)	USGS Topo. Map	Importance
High	Edgewood Memorial Park Woods (Concord Twp.)	Media	Stand of mature beech on NW slope adjacent to cemetery; non-weedy; provides wildlife habitat and green space; one of the best examples of this forest type left in the county; protect from logging.
High	Quarry Woods (Birmingham Twp.)	Wilming. North	Stand of old-growth beech, oak, and tulip tree on NW-facing slope above quarried valley; heavy deer browse has obliterated understory; parklike and aesthetically appealing; protect from logging and development.
Medium	Swarthmore College Woods (Swarthmore and Nether Providence Twps.)	Lansdowne	Large mature forest along Crum Creek contains numerous hemlocks; some exotics; protects water quality and provides educational and recreational opportunities for students and local residents; protect from logging; watch storm-water erosion along tributaries.
Medium	Garnet Mine Rd. Woods (Bethel Twp.)	Marcus Hook	Mature mixed mesophytic woods dominated by beech and tulip tree; relatively non-weedy; may have good spring wildflowers; provides wildlife habitat, green space, watershed protection; allow to mature undisturbed.
Medium	Spring Run Woods (Bethel Twp.)	Marcus Hook	Mature beech-dominated forest along Spring Run which is fed by numerous seeps; non-weedy; protected by DuPont Company; maintain closed

canopy.

(continued)

County Rank[1]	Site Name (Municipality)	USGS Topo. Map	Importance
Medium	Glenwood School Woods (Middletown Twp.)	Media	Large tract of moderately mature mixed mesophytic woods along tributary to Chester Creek; provides wildlife habitat, green
Medium	Hunter Run Seeps (Newtown Twp.)	Media	Young, moderately disturbed red maple/tussock sedge wetlands in seeps along Hunter Run; potential habitat for PE animal; may need to remove some shrubs and trees to maintain open light conditions.
Medium	Long Point Woods (Nether Providence Twp.)	Media	Xeric schist ridge along Ridley Creek supports mature beech and oak with mountain laurel and blueberry; high aesthetic appeal; protected as sanctuary; acquire surrounding open lands.
Medium	Media Wetland (Middletown and Upper Providence Twps.)	Media	Relatively large floodplain wetland typical of region; provides habitat, flood control, water-purification, open space; limit and control bordering development activities.
Medium	Brinton Lake Wetland (Thornbury Twp.)	West Chester	Large wetland bordering northwest edge of Brinton Lake; surrounded by suburbs; provides wildlife habitat and open space; maintain in present state.
Medium	Cheyney Wetland (Thornbury Twp.)	West Chester	Large, undisturbed, non-weedy wetland mosaic along Chester Creek; provides habitat for migratory waterfowl; has educational value;

			potential habitat for rare insects; maintain in present state.

(continued)

County Rank[1]	Site Name (Municipality)	USGS Topo. Map	Importance
Medium	Brandywine Corridor (Birmingham Twp.)	Wilming. North	Relatively undisturbed stretch of Brandywine Creek containing two large, moderately mature floodplain swamps and steep wooded slopes; important wildlife habitat; high scenic value; benign ownership has protected area from development; maintain in current state.
Low	Indian Rock Park Woods (Springfield Twp.)	Lansdowne	Mature woods on north-facing slope above Darby Creek; protected as parkland; provides wildlife habitat recreational opportunities, and stream protection; maintain closed canopy.
Low	Kent Park Woods (Marple Twp.)	Lansdowne	Mature north-facing woodland fragment in suburban park; contains one of largest black oaks seen in county; refrain from logging.
Low	Pilgrim Park Woods (Upper Darby Twp.)	Lansdowne	Heavily disturbed woodland along Darby Creek provides buffer against noise and dust generated by quarry operation.
Low	State Hospital Woods (Haverford Twp.)	Lansdowne	Moderately disturbed woodland along Darby Creek tributary; notable for size; protects water quality and provides open space and wildlife refuge.
Low	Summit Road Woods	Lansdowne	Small patch of mature beech and oak forest in residential area;

	(Springfield Twp.)		offers green space in heavily- from logging.

(continued)

County Rank[1]	Site Name (Municipality)	USGS Topo. Map	Importance
Low	Crozierville Woods (Aston Twp.)	Media	Moderately mature forest dominated by tulip tree and red oak with diverse herb layer containing many plants of Christmas fern; provides refuge for flora and fauna in fast-
Low	Crum Creek Woods (Edgmont and Newtown Twps.)	Media	Woodland corridor along Crum Creek above Geist Reservoir; protects water quality and provides wildlife habitat.
Low	Darling Woods (Thornbury Twp., Chester Heights	Media	Broadwing hawk nested here in 1991; protects nearby Chester Creek from excessive sediment load; abuts Boro)
Low	Hunting Hill Woods (Edgmont Twp.)	Media	Mature beech-dominated woodland in state park; potential for a rare plant species; maintain closed canopy.
Low	Mineral Hill Woods (Middletown Twp.)	Media	Large wooded tract west of Media contains serpentine outcrop provides open space, wildlife
Low	Wawa Woods (Middletown Twp.)	Media	Mature grove of beech on northwest slope above Rocky Run; interesting metamorphic rock outcrops; part of Rocky Run trail; maintain as is.
Low	Ithan Creek Wetland (Radnor Twp.)	Norristown	Somewhat weedy wetland with good representation of common, native wetland plants; adds to diversity of local landscape; provides some wildlife habitat and has educational value; protect from encroachment.

Low	Radnor Woods (Radnor Twp.)	Valley Forge	Moderately mature beech/oak forest on rocky slopes and floodplain along Little Darby Creek; creek

(concluded)

County Rank[1]	Site Name (Municipality)	USGS Topo. Map	Importance
			channel heavily eroded by high storm flows; fragment of original forest provides refuge for native flora and fauna and green space for humans; maintain closed canopy.
Low	Bethlehem Church Woods (Thornbury Twp.)	West Chester	Mature beech-dominated woodlot bordered by low-density housing; potential for a rare plant species; maintain in undisturbed condition.
Low	Glen Mills School Woods (Thornbury Twp.)	West Chester	Moderately mature to mature beech-dominated forest along tributary to Chester Creek; important for open space, wildlife habitat, potential for a rare plant, and stream quality protection; maintain habitat.
Low	Markham Woods (Concord Twp.)	West Chester	Small mixed hardwood forest recovering from heavy logging several decades ago; relatively non-weedy except in gaps; provides wildlife habitat and open space in area under heavy development pressure; allow to mature undisturbed.
Low	Elam Woods (Concord Twp.)	Wilming. North	Fragment of mature beech-dominated forest with some large tulip trees; has potential for spring wild- and green space for local residents.
Low	Shavertown Woods (Concord Twp.)	Wilming. North	Mature beech-dominated woodland; bordered by low-density housing;

	potential for a rare plant species; maintain in undisturbed condition.

[1]Sites are ranked from high to low as an indication of importance at the County or municipal level. These sites are of lower rank with regards to biodiversity than those in Table 1.

General Summary and Recommendations

Delaware County has several important sites for biological diversity that are already protected from development as federal or state lands. For example, the U.S. Fish and Wildlife Service owns and manages the John Heinz National Wildlife Refuge at Tinicum which has the best Freshwater Intertidal Marsh natural community in Pennsylvania and supports three state-rare intertidal plant species, nesting pairs of several bird species of special concern, and two other state-endangered animals. Little Tinicum Island, which has the best Freshwater Intertidal Mudflat natural community in Pennsylvania and supports 12 rare intertidal plant species and a state-endangered animal, is owned and managed by the Bureau of Forestry of the Pennsylvania Department of Environmental Resources. Ridley Creek State Park, the largest park in Delaware County, supports a state-rare wildflower and patches of locally significant woodland such as Hunting Hill woods.

County and municipal parks also contain species of concern and locally significant sites. Clayton Park (County) contains a wildflower that is considered imperiled in the state (S2) by The Nature Conservancy and some fairly mature beech woodland along its western edge. Fairmount Park (Haverford Twp.), adjacent to Cobbs Creek Park, supports a wildflower considered rare in the state (S3) by The Nature Conservancy. Indian Rock Park (Springfield Twp.), one of several parks along Darby Creek, contains a locally significant mature beech-dominated woodland that provides recreational opportunities in a densely-populated area and protects the water quality of the creek.

Some species of special concern and locally significant sites occur on private land owned by organizations dedicated to the protection of biological diversity. The Tyler Arboretum owns Pink Hill, a serpentine barren supporting a wildflower species being considered for listing as a Federally Endangered species (C2). To maintain this species and other rare, light-loving serpentine species, the staff of the arboretum periodically burns the hillside. The Brandywine Conservancy owns and protects a large marsh near Chadds Ford that offers habitat for a state-endangered animal last observed in 1981. The Natural Lands Trust owns Mill Hollow Woods which protects the water quality of Crum Creek and offers wildlife habitat in a fast-suburbanizing area. Long Point Wildlife Sanctuary along Ridley Creek is a locally significant dry oak woodland that offers wildlife habitat, water quality protection, and green space for local residents. Such sanctuaries should be encouraged along stream corridors and adjacent to existing park land.

Lands that support species of special concern or are designated as locally significant, but are not protected as park land or by conservation-minded groups or individuals, should be a top priority for protection in Delaware County. Private landowners with large land holdings will come under increasingly greater pressure to sell land for development. These private lands should be the focus of county and municipal efforts to protect biological diversity, open space, and the quality of life in Delaware County.

Williamson School Serpentine Barrens and buffer lands for the other top-ranked sites (rank 1) in Table 1 (locations illustrated in Figure 2) should be targeted immediately for protection. The site, and lands surrounding it, may be protected through a combination of acquisition and conservation

easements. It may also be possible to gain additional buffer lands for the high-priority sites that are already protected. Privately-owned sites that are ranked 2 through 5 in Table 1 should also receive protection, however conservation easement or a tax incentive may be more appropriate until the highest priority sites have been protected. It is important to remember that mere protection of sites is not enough to ensure the long-term persistence of species of special concern. In many cases, active management of sites is needed. Therefore, sites that are ranked high in terms of biological diversity and are protected as park land or by conservation groups should not be ignored. They should be monitored over time. The Nature Conservancy land steward should be consulted with questions regarding the needs of species of special concern and management strategies (see Appendix VII).

The sites listed in Table 2 do not have known populations of rare species or natural communities. Some are parks which offer passive recreation opportunities, and provide wildlife habitat, open space, and watershed protection. Adding to or creating new county or municipal parks can enhance passive recreation and natural habitat throughout the county. Creating parks around municipal water supplies such as Crum Creek can serve the dual purpose of providing an additional protective buffer around the water supply and offering assorted recreational opportunities. In addition, larger open-space areas can be set aside for wildlife since several purposes are served.

The importance of water bodies to biodiversity is illustrated by the great number of rare plant and animal species in the county associated with water. Protection of the wetlands and creeks of Delaware County and the Delaware River is essential for the protection of biodiversity, drinking water supplies, and attractive recreational resources. A cooperative effort must be made by town, county, state, and federal agencies, developers, and residents to lessen the impact of housing development on the water bodies and wetlands of the county. Municipalities should require minimum setbacks from all water bodies and wetlands to help protect water quality. Landowners can act on their own to protect water quality by forming watershed associations that voluntarily monitor and screen proposals for activities in a given watershed.

Where development is to occur, plans should provide for creating natural buffers between the construction site and wetlands or water bodies. Care should be taken to ensure that the wetland does not become an "island" surrounded by development. When a wetland is completely surrounded by development and isolated from other upland or wetland habitats, its wildlife value is greatly reduced. Cluster development allows for preservation of more open space and maintenance of corridors along which wildlife can move between habitats.

County and municipal governments and national and regional conservation organizations like The Nature Conservancy, the Natural Lands Trust, and The Brandywine Conservancy can do much to protect biologically important lands in Delaware County. However, these organizations cannot do all the work because of limited resources and personnel. Grassroots organizations such as Chester, Ridley, Crum Watersheds Association, Darby Creek Watershed Association, and others can play an important role in land protection. A public or private county-wide land trust may be of value in helping to coordinate protection efforts throughout the county. These groups can help with the many stages of land protection: 1) identification of landowners who

wish to protect their land, 2) crafting easements, 3) land acquisition, and 4) land stewardship and management.

In this report, the watersheds in which natural communities and species of special concern occur have been mapped. Ideally, all of the land outlined should be protected. However, in most cases, this complete protection of land will not be possible due to lack of funds or an unwillingness of the landowner to participate in protection efforts. We recommend fee title acquisition for the protection of important core areas within the watersheds where the species and communities actually occur. For surrounding areas, other forms of protection may be adequate.

It is important to maintain a flexible attitude and approach toward land protection since each protection effort is unique. Not all land can receive the same amount of protection nor do all activities need to be excluded. Current land uses that are not impacting the species of concern should be encouraged to continue. Conservation easements are designed to allow landowners the current use of their land while protecting the owner and the resource from outside development pressure. Where easements are not possible any proposals for significant land use changes should be closely scrutinized by county and municipal planners. Questions about the impacts of proposed development on species of concern may be directed to the Pennsylvania Science Office of The Nature Conservancy in Middletown, Pennsylvania.

The Delaware County Natural Areas Inventory is only a beginning, sites with good natural communities and species of special concern await discovery. Plant and animal populations are dynamic, changing over time in response to shifting environmental conditions. As information is added to the PNDI database, the Delaware County Natural Areas Inventory will be updated.

RESULTS

In the spring of 1991, the Delaware County Natural Areas Inventory began with a public meeting held at the Delaware County Government Center in Media. TNC staff solicited information about natural communities, endangered species, and important wildlife breeding areas from knowledgeable individuals and local conservation organizations. Field survey forms (Appendix IV) were distributed at the meeting and the response was quite good; detailed maps and species lists were submitted for many sites around the county.

Site Summaries by USGS Topographic Maps

Portions of Delaware County occur on 10 USGS topographic 7½ minute quadrangle maps (Figure 3). Communities, species of special concern, significant geologic features, and areas that may be of local importance for wildlife and open space have been located on these base maps (see sample map, Figure 4). The most important areas are represented on the maps in bold print. Natural communities and the most critical sites for species of concern have been given site names in bold upper case type, such as **LITTLE TINICUM ISLAND**, and are followed by natural community

and/or species map codes (e.g., **NC501**, **SA586**, **SP511**). Lesser quality sites with poor representations of communities or species of special concern have been outlined and noted with the map code number in bold type only. The area outlined represents the species' location and the watershed or subwatershed area where the elements (species or natural communities) are located. Development activities proposed within the encircled areas should be carefully assessed to determine the impact of the project on the species or communities before approval is granted. Consultation with the biologists of the Pennsylvania Science Office of The Nature Conservancy may be necessary to assess these impacts.

Finally, some sites have been mapped that do not appear to have species of special concern and are labeled with a site name in plain type. Although these sites bear clear signs of disturbance and cannot be considered natural, they have potential to serve as parks or as passive recreation and open space areas.

Each topographic map is accompanied by a table that lists all of the exemplary natural communities and species of special concern located on the map. The communities and species are identified by a PNDI map code unique to each element on that map. Following each of these elements is its global and state ranks (defined in Appendix I), federal and state protection status, the date last observed, and its quality rank (defined in Appendix II). Elements and priority sites are described in the text with reference to the
municipalities affected (in parentheses following each site name). In addition, sites of local significance, geologic features, and natural communities and species that are located primarily on adjacent maps are listed within an "Other" category. Lists of natural community types in Pennsylvania, species of special concern and descriptions of rare animals of Delaware County are provided in Appendix V and VI for further information.

USGS QUADRANGLE MAP: Bridgeport

		TNC Rank*		Legal Status*		Last	
		Global	State	Fed.	State	Seen	Quality**
NATURAL COMMUNITIES:	595	G3G4	S1	N	N	9-15-1991	B
SPECIAL PLANTS:	510	G5	S3	N	PR	9-09-1991	C
	511	G5	S1	N	PE	9-09-1991	B
	512	G5	S3	N	PR	9-09-1991	C
	534	G5	S3	N	PR	9-09-1991	D
	538	G5	S2	N	PR	9-25-1991	CD
	575	G5	S3	N	N	7-22-1991	D
	587	G5	S3	N	PR	9-09-1991	C
	588	G4	S3	N	PR	9-15-1991	BC
	589	G5	S1	N	PE	9-15-1991	AB
	590	G5	S1	N	PE	9-15-1991	B
	591	G5	S3	N	N	9-15-1991	B
	592	G5	S1	N	PE	9-15-1991	B
	593	G4	S1	N	PT	9-15-1991	AB
	594	G?	N	N	N	9-15-1991	D
	596	G5	S1	N	PE	9-15-1991	AB
	597	G4	S3	N	PE	9-15-1991	D
	603	G4	S3	N	PR	07-26-94	BC
	605	G5T5	S1	N	PE	07-26-94	B
	606	G5	S3	N	PR	07-26-94	BC
	607	G5	S3	N	PR	07-26-94	C
	608	G3	S1	N	PT	07-26-94	C
	609	G4	S1	N	PE	07-26-94	B
	610	G5	S1	N	PE	07-26-94	B
SPECIAL ANIMALS:	502	G5	S2	N	PE	7-22-1991	E
	584	G5	S3	N	N	6-01-1991	E
	586	G5	S2	N	PE	6-01-1991	E
	613	G4	S1	E(S/A)	PE	1992	E

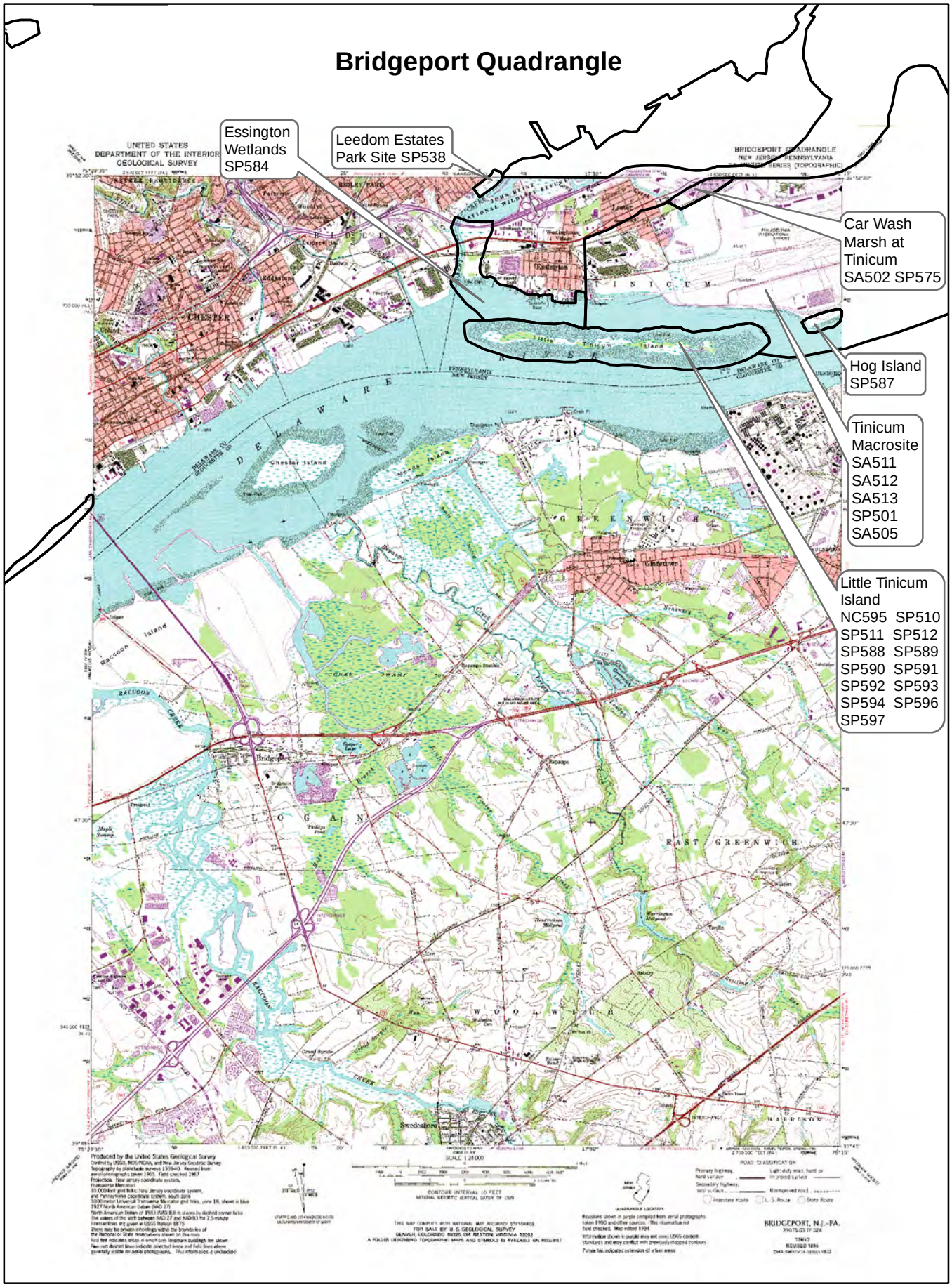
OTHER: Governor Printz Park, Little Tinicum Island, John Heinz National Wildlife Refuge at Tinicum, Willow Park, Leedom Estates Park (County), Chester Park, Washington

Park, Deshong Park, Taylor Arboretum.

* Please refer to Appendix I for an explanation of Ranks and Legal Status.

** Please refer to Appendix II for Quality ranks.

Bridgeport Quadrangle



Bridgeport Quadrangle:

LITTLE TINICUM ISLAND (Tinicum Twp.) is one of the most important sites in Delaware County. The two-mile long island in the Delaware River is owned and managed by the Bureau of Forestry. The mudflat surrounding the island and exposed at low tide is considered a good example of a Freshwater Intertidal Mudflat natural community (**NC595**). It is the largest mudflat in Pennsylvania and is important as a refuge for 12 rare intertidal plant species. These plant species can be grouped according to occurrence in the upper, middle, and lower parts of the intertidal zone. **SP510** (Pennsylvania Rare), **SP511** (Pennsylvania Endangered), **SP512** (Pennsylvania Rare), **SP593** (Pennsylvania Threatened), **SP594** (G?NE), and **SP597** (Pennsylvania Endangered) grow in the upper part of the intertidal zone in an area characterized by an abundance of leafy emergents such as spatterdock (Nuphar luteum), pickerelweed (Pontederia cordata), and arrow arum (Peltandra virginica) and assorted grass-like plants such as three-square (Scirpus pungens). In the middle part of the intertidal zone where most plants are relatively short and often form clumps, **SP588** (Pennsylvania Rare), **SP589** (Pennsylvania Endangered), **SP590** (Pennsylvania Endangered), **SP592** (Pennsylvania Endangered), and **SP596** (Pennsylvania Endangered) grow with arrowheads (Sagittaria graminea, S. rigida), false pimpernel (Lindernia dubia), and scattered patches of waterweed (Elodea nuttallii). **SP591** (G5/S3) is an aquatic that grows in the lowest part of the intertidal zone where little else survives. At low tide, this plant can be found in small puddles left on the exposed mud growing with other aquatics such as pondweed (Potamogeton pusillus). Although the extensive mudflat encircles the island, the flora grows best on the low-energy northern side. The southern shore experiences greater wave action and the wake of shipping channel traffic. It is quite sandy and supports dune plants such as sandbur (Cenchrus tribuloides).

In addition to harboring an assortment of rare intertidal plants, Little Tinicum Island provides habitat for **SA586**, which is part of the Pennsylvania Endangered animal population found elsewhere along the Delaware River (i.e., **SA513** on the Woodbury quadrangle) and in the John Heinz National Wildlife Refuge at Tinicum (i.e., **SA502** on the Lansdowne quadrangle).

The upland portion of the island is in poor shape. Weedy, early successional species are abundant and dredge spoil has been deposited on it. However, thousands of monarch butterflies use the island in the fall for resting and feeding before proceeding south.

Probably the most obvious problem of Little Tinicum Island is the trash strewn across it. Some is left by picknickers, but the majority washes up in storms and with the daily tidal inundation. Efforts to control littering are encouraged. Education of island visitors regarding the value of the area to rare plants and animals may help to reduce impacts.

SA502 (Tinicum Twp.) marks a population of a Pennsylvania Endangered animal inhabiting the open water and fringing wetland surrounding the new Radisson Hotel. The animal population in the pond is isolated from the populations in the John Heinz National Wildlife Refuge and in the Delaware River because there is little opportunity for immigration and emigration (J. Groves, pers. comm.). The construction of the hotel removed important upland nesting habitat. Stormwater runoff from the hotel parking lot should be prevented from entering and degrading the pond. A vegetated buffer between Route 291 and the pond should be maintained to help trap pollutants and screen the pond. At the edge of the pond at the base of the rip-rap shoreline, a very poor population a G5/S3 plant species (**SP575**) grows. The plant is quite secure at present.

SA584 (Tinicum Twp.) marks a pair of a G5/S3 bird species observed nesting in the old Westinghouse complex in 1991.

SP538 (Ridley Twp.) is a fair to poor population of a state-rare intertidal plant growing in a marsh along Darby Creek that is part of the **Leedom Estates Park**. The robust plant grows with narrow-leaved cattail (Typha angustifolia), jewelweed (Impatiens capensis), tearthumb (Polygonum sagittatum), sweetflag (Acorus calamus), clearweed (Pilea pumila), and arrow arum. The marsh is continuous with the large marsh protected in the **John Heinz National Wildlife Refuge**. Steps should be taken to secure remaining marsh lands from development to ensure the long-term persistence of rare plant species such as **SP538**.

SP587 (Tinicum Twp.) is a state-rare intertidal plant occurring in scattered tidal mudflat fragments along the Delaware River. This plant is part of the population occurring on the Woodbury quadrangle (**SP501**). Near Essington, **SP587** grows in association with **SP534**, a second state-rare intertidal plant, in scattered mudflat areas. Pickerelweed, arrow arum, mud plantain, and spatterdock are common cohorts of the rare species. Filling or dredging of mudflat areas should be avoided to maintain suitable conditions for theses and other species of concern. On the eastern edge of the Bridgeport quadrangle, **SP587** grows in a small tidal marsh that is located on the southern side of the large UPS complex. The marsh is weedy with scattered plants of purslane (Ludwigia peploides), purple loosestrife (Lythrum salicaria), and common reed (Phragmites australis). Less weedy plants include smartweed (Polygonum punctatum), pickerelweed, and cattail. The marsh is best left alone since it also provides suitable wildlife habitat.

SP603, SP605, SP606, SP607, SP608, SP609, SP610 -NEW- (Tinicum Twp.) "Darby Creek Mouth Mudflat"

This site consists of tidal mudflats and riverbank areas where Darby Creek meets the Delaware River opposite Little Tinicum Island. The vegetation consists of tidal marsh dominated by spatterdock and bulrushes, and adjacent areas of shallow water dominated by tape-grass (*Vallisneria americana*). Seven plant species of concern were found at this site. Fair to good-quality populations of **SP608, SP606** and **SP607** occur along the upper edge of the tidal zone. **SP603, SP605,** and **SP610** occur closer to the river, in the tidal mudflats, associated with bulrushes (*Schoenoplectus tabernaemontanae, S. pungens*) spatterdock (*Nuphar lutea*), and arrowhead (*Pontederia cordata*). **SP609** is an aquatic plant species which grows in the lowest and wettest portion of the tidal flat,

associated with pondweed (*Potamogeton spp.*).

This area is a highly industrialized portion of the Delaware River shoreline, although the species of concern appear to be doing well in the small areas of remaining habitat. Threats to the persistence of these populations, as well as to the more extensive tidal flats nearby on Little Tinicum Island, include oil spills and wave damage from large ship traffic (1998 update).

SA513 -NEW- (Chester City.) "Commodore Barry Bridge"

A Federally and PA-Endangered animal species has been observed nesting on the bridge since the late eighties and successfully reared young as recently as 1992. This species was extirpated from PA and the eastern U.S during the fifties and sixties due primarily to pesticide poisoning. Breeding was confirmed in 1987 following reintroduction programs in Philadelphia and other large cities. Threats to this species in urban habitats include pesticides, collectors, and traffic. The PA Game Commission monitors and manages nesting sites for this species. No map is included for this site (1998 update).

USGS QUADRANGLE MAP: Lansdowne

		TNC Rank*		Legal Status*		Last	
		Global	State	Fed.	State	Seen	Quality**
NATURAL COMMUNITIES:	511	U	S1	N	N	7-22-1991	B
SPECIAL PLANTS:	508	G5	S2	N	PR	7-22-1991	A
	509	G5	S3	N	PR	7-22-1991	A
	510	G5	S3	N	PR	7-22-1991	A
	558	G5	S3	N	TU	9-05-1991	D
	605	G5	S2	N	N	5-08-1991	C
	606	G5	S1	N	TU	5-08-1991	C
SPECIAL ANIMALS:	502	G5	S2	N	PE	6-01-1991	E
	+514	G4	S1	N	PE	6-01-1990	U
	515	G5	S2	N	PE	3-01-1991	E
	+516	G4	S1	N	PT	6-01-1989	U
	517	G5	S2	N	PT	6-01-1991	E
	521	G5	S3	N	N	6-01-1991	E
	+524	G5	S2	N	N	6-01-1991	E
	+526	G5	S3	N	N	6-01-1991	E
	527	G5	S2	N	N	7-22-1991	E
	563	G5	S1	N	N	6-01-1984	U
	603	G5	S3	N	N	6-01-1991	E
	604	G5	S2	N	PT	10-96	C

+ denotes nesting pairs in Philadelphia County

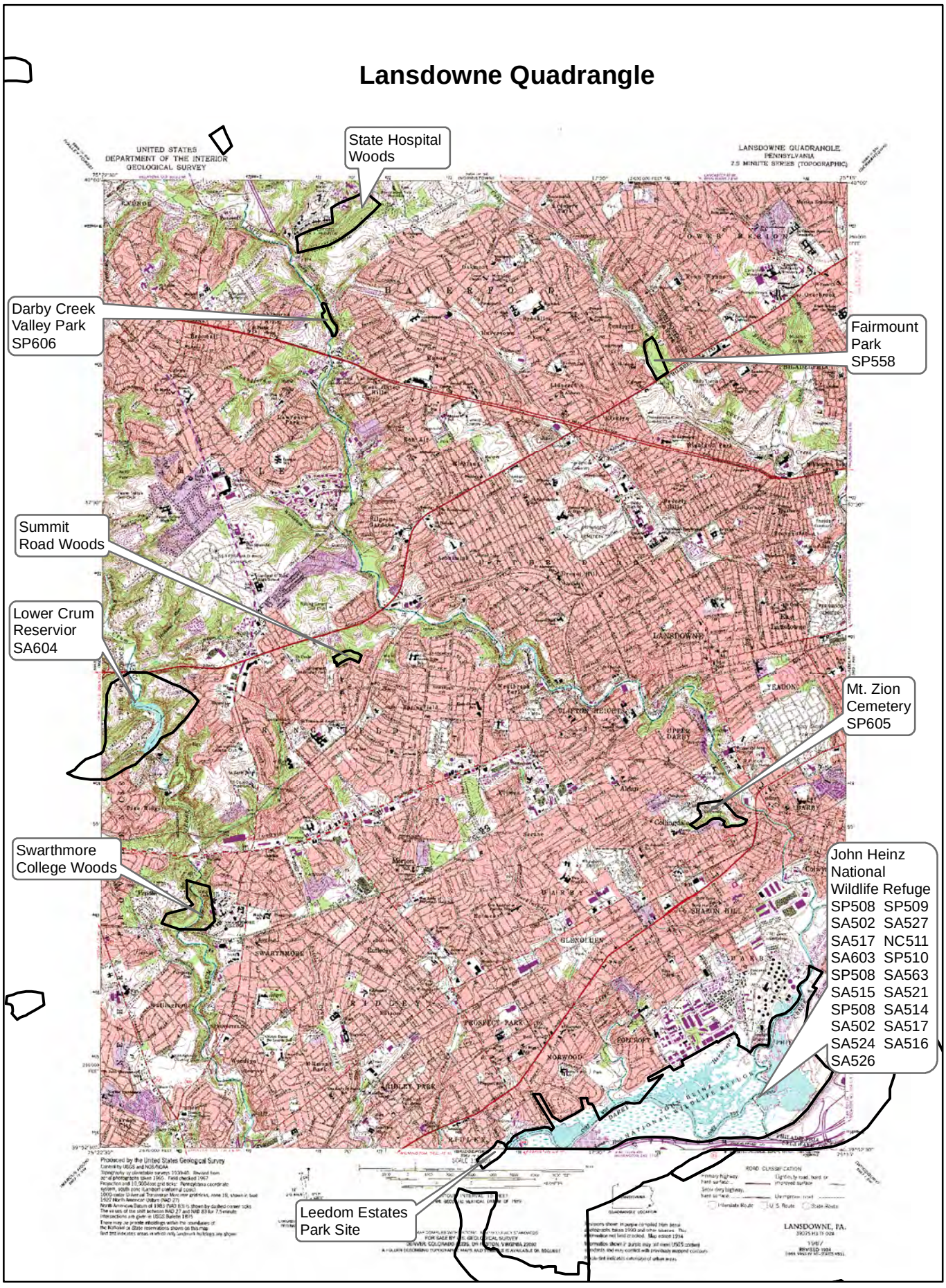
GEOLOGICAL FEATURES: None identified.

OTHER: Swarthmore College Woods, Summit Road Woods, State Hospital Woods, John Heinz National Wildlife Refuge at Tinicum, Smedley Park (County), Martin Park (County), Fairmount Park, Indian Rock Park, Walsh Park, Springfield Veterans Memorial Park, Pilgrim Park, Addington Manor Park, Naylor's Run Park, Darby Creek Valley Park, Powder Mill Valley Park, Gest Tract, Garrett Park (County), Shrigley Park (County), Kent Park in Upper Darby Twp. (County) and Kent Park in Marple Twp.

* Please refer to Appendix I for an explanation of Ranks and Legal Status.

** Please refer to Appendix II for Quality ranks.

Lansdowne Quadrangle



Lansdowne Quadrangle:

The **John Heinz National Wildlife Refuge at Tinicum** (Tinicum Twp. and Folcroft Boro - Delaware County, and the City of Philadelphia - Philadelphia County), located in the southeast corner of the Lansdowne quadrangle, is one of the most important sites in Delaware County. Here, the largest area of Freshwater Intertidal Marsh (**NC511**) in Pennsylvania occurs along Darby Creek. At scattered locations within the marsh, three state-rare intertidal plant species grow: **SP508**, **SP509**, and **SP510**. The marsh is characterized by great expanses of leafy emergents such as spatterdock (Nuphar luteum), pickerelweed (Pontederia cordata), and arrow arum (Peltandra virginica), stands of narrow-leaved cattail (Typha angustifolia), and masses of smartweed (Polygonum punctatum), beggarticks (Bidens laevis), and marsh mallow (Hibiscus moscheutos). Purple loosestrife (Lythrum salicaria) and common reed (Phragmites australis) are aggressive, weedy species that grow throughout the marsh.

In addition to providing a refuge for intertidal plants, the John Heinz National Wildlife Refuge, which includes scattered non-tidal wetlands and degraded upland fields and forests, provides nesting habitat and a migratory way station for many bird species. In 1991, numerous nesting pairs of **SA527**, a bird species considered imperiled (S2) at the state level by The Nature Conservancy, utilized the tidal marsh area. **SA517** indicates several nesting pairs of a state-threatened bird species which utilized the tidal marsh area and the nearby Impoundment in 1991. **SA563**, a species considered critically imperiled (S1) at the state level by The Nature Conservancy, was last observed nesting in the refuge in 1984. **SA521** and **SA603**, two pairs of a species considered rare at the state level (S3) by The Nature Conservancy, nested in the defunct Folcroft incinerator and under the elevated I-95 highway in 1991.

On the eastern side of the John Heinz National Wildlife Refuge in Philadelphia County is a large water body known as the "Impoundment". Several bird species of special concern nest here and utilize surrounding lands extending into Delaware County. **SA524** marks 45 nesting pairs of a species considered imperiled at the state level (S2) by The Nature Conservancy that nested on an island near the southern end of the Impoundment in 1991. Two pairs of a species (**SA526**) considered rare at the state level (S3) by The Nature Conservancy nested near the southern end of the Impoundment in 1991. Two pairs of a state-endangered bird species (**SA514**) nested at two locations in the Impoundment in 1990. **SA516** marks a nesting pair of a state-threatened species that was last observed in 1989.

Two other animals of special concern inhabit the John Heinz National Wildlife Refuge. **SA502** marks a relatively large population of a state-endangered animal that utilizes the tidal marsh area and the Impoundment. **SA515** indicates a state-endangered animal that occurs in a small water body between the Impoundment and the tidal marsh area.

Although the lands of the John Heinz National Wildlife Refuge are protected by the U.S. Fish and Wildlife Service, off-site activities continue to threaten the health and well-being of the marsh flora and fauna. Pollution in the form of sewage effluent, plastic debris, and contaminated stormwater runoff poses an ongoing threat. Tougher controls upstream are needed to reduce the

harmful inputs to the marsh. Acquisition of lands bordering the refuge is encouraged to maintain as large an area of functioning tidal wetland as possible.

SA604 (Marple, Nether Providence and Springfield Twps.) is a good population of a state-endangered animal inhabiting the Crum Reservoir (Old Springton Reservoir). The Philadelphia Suburban Water Company owns and restricts access to the reservoir. The relatively large, undisturbed water body seems to provide ideal conditions for the species. Observation of a juvenile in 1991 indicates that the population is reproducing. In late summer, the reservoir is full of algae and covered with waterfowl feathers from migratory and resident species. Arrowhead (Sagittaria latifolia), a favorite food item of several animal species, grows at the margin with purple loosestrife, cattail (Typha latifolia), yellow iris (Iris pseudacorus), purslane (Ludwigia peploides), common reed, jewelweed (Impatiens capensis), and marsh mallow. Snapping and painted turtles, water snakes, and green, pickerel, and wood frogs utilize the reservoir in addition to the species of concern. Although the reservoir landowner restricts swimming and ice skating, fishing for species such as bass and carp is permitted. To ensure that Crum Reservoir continues to provide suitable habitat for the state-endangered animal, steps should be taken to arrest erosion in the Crum Creek watershed upstream of the reservoir to reduce continued sedimentation in the reservoir. Consideration should also be given to controlling the quality of stormwater runoff to the reservoir.

SA520 -UPDATE- (Upper Providence Twp.) "Lower Crum Reservoir"
This site was revisited in 1995 and one young individual of **SA604** was observed. The state status of this species has been changed from endangered to threatened. Additional surveys are recommended to determine the extent of this population at the reservoir (1998 update).

Botanists searching a historical location for a fern of special concern found instead, a small population of a plant species being evaluated for state protection. This species, **SP605**, was located along the floodplain of Pusey Run within Mt. Zion Cemetery in Collingdale Boro. The shrub thicket is highly disturbed with many weedy species present. Since the species prefers disturbed sites and often escapes from cultivation, the "naturalness" of this population is somewhat in doubt.

Darby Creek Valley Park in Haverford Township harbors a small population of a TU plant that is considered to be critically imperiled (S1) within Pennsylvania by TNC. The plants are growing in a wet meadow along a clearing for a sewer line that parallels Darby Creek. The population is protected within the park; regular mowing of the sewer line is recommended to exclude woody species from crowding out the plants of special concern. Mowing will be most beneficial to the plants if it is done after the plants have flowered in May. Because the setting is very disturbed and some of the varieties of this species are not native, the site is not ranked very highly (Table 1).

SP558 (Haverford Twp.) marks a poor population of a Tentatively Undetermined species growing along a pathway in a highly disturbed deciduous woodland that is a part of **Fairmount Park** (Haverford Twp.) north of Cobbs Creek Park. The plant grows in association with jumpseed (Tovara virginiana), ragweed (Ambrosia artemisiifolia), stiltgrass (Microstegium vimineum), path rush (Juncus tenuis), and poison ivy (Toxicodendron radicans). Nearby, devil's-walking-stick (Aralia

spinosa), tulip tree (Liriodendron tulipifera) and white ash (Fraxinus americana) saplings, and canopy-sized sugar maples (Acer saccharum) grow. The plant population will probably continue to survive as long as light conditions do not change radically through either opening up or complete closing of the canopy. One possible threat is dumping of brush on the plants, although this activity seems to be confined to the edge of the woods near the Carroll Road cul-de-sac.

SWARTHMORE COLLEGE WOODS (Nether Providence and Swarthmore Twps.) cloaks the Crum Creek valley in the vicinity of Swarthmore College which owns a portion of the woodland. Although there is some invasion of exotic ornamentals into the woods and quite a number of trails criss-crossing the steep eastern slope, the overall quality of the woods is remarkably natural and aesthetically pleasing. Exotics aside, the native canopy species characterizing the woodland are oaks (Quercus spp.), hemlock (Tsuga canadensis), beech (Fagus grandifolia), and tulip tree. This is one of the few woodlands observed in Delaware County where hemlocks grow in substantial numbers. Shrubs include mountain laurel (Kalmia latifolia), maple-leaf viburnum (Viburnum acerifolium), and witch hazel (Hamamelis virginiana). The floodplain of Crum Creek is rather weedy with some Japanese knotweed (Polygonum cuspidatum). A well-worn foot/bike path parallels the creek. A tributary of Crum Creek flowing down the steep eastern valley wall has been severely eroded by high storm flows. Steps should be taken to improve stormwater management upslope. This woods including the western side which was not surveyed is significant at the local level and of medium to high priority for protection. The eastern slope is one of the few areas where chestnut oak (Quercus montana), mountain laurel, and hemlock grow in great numbers. The woods functions to protect the water quality of Crum Creek and to provide habitat for wildlife and a refuge for native plants. The woods also offers students and local residents a tranquil retreat and a place to observe some semblance of the original forest. The woods should be left alone. Logging should be prohibited.

SUMMIT ROAD WOODS (Springfield Twp.) refers to a small patch of mature woods immediately north of Summit Road and east of Springfield Memorial Park. The woods occurs on a gently-sloping north-facing hill in a residential area. The closed 100-foot canopy contains moderately mature to mature beech, white oak (Quercus alba), and red oak (Quercus rubra) with some tulip tree. The shrub layer is typical of the region with arrowwood (Viburnum dentatum), spicebush (Lindera benzoin), flowering dogwood (Cornus florida), and maple-leaf viburnum. In late summer, the herb layer was unremarkable with white wood aster (Aster divaricatus) present. However, the woodland holds great promise for spring ephemerals. The woodland is notable for the maturity of its canopy trees, the non-weedy nature of the mature section, the refuge it provides for native plants and animals, and the green space it offers local residents. Numerous trails indicate that the area is well-used. We recommend allowing the whole area including the younger, weedier sections north of the mature area along the tributary to Darby Creek to remain undisturbed and be set aside as permanent parkland or open space.

STATE HOSPITAL WOODS (Haverford Twp.) covers the valley of a Darby Creek tributary located to the south of Haverford State Hospital. The woods is notable for being a large patch of green space in a heavily developed area. As such, it provides open space for local residents, a refuge for wildlife, and watershed protection. The woods shows many signs of human disturbance. A

sewerline runs along the northern valley wall. The woods is sprinkled with planted exotics such as spruce (Picea sp.), white pine (Pinus strobus), and white birch (Betula papyrifera). The creek is crossed by several small concrete bridges. At the upper end the woods gives way to the backyards of private dwellings. The woodland provides habitat for wildlife such as deer, one of which was heard crashing through the undergrowth. The north-facing slope has some less disturbed, more natural areas supporting mature beech, white oak, and red oak. A deep gully eroded in this slope by stormwater runoff points to the need for improved stormwater management techniques upslope in the direction of Marple Road.

Indian Rock Park (Springfield Twp.) is a north-facing wooded slope above Darby Creek. The woods is notable for the maturity of its canopy trees, in particular the dominant beech and oak members. It is important to maintain this woodland fragment for the wildlife habitat, recreational opportunities, and stream protection it provides.

Kent Park (Marple Township) is a suburban park that is notable for the mature, wooded north-facing slope at its southeastern corner. The northern portion of the park is very ordinary with extensive mowed and paved areas and signs of human disturbance all along Trout Run. In contrast, the woods at its southern end is relatively untouched and should remain as such. A 70- to 80-foot closed canopy contains beech and scarlet (Quercus coccinea), white, red, and black oak (Quercus velutina). One of the largest black oaks seen in the county grows here. Several very large tulip trees also grace the slope. The understory contains maple-leaf viburnum, abundant beech saplings, witch hazel, flowering dogwood, and spicebush. The sparse herb layer consists of partridgeberry (Mitchella repens), white wood aster, New York fern (Thelypteris noveboracensis), violets, and woodfern (Dryopteris spinulosa). Like other mature woodland fragments scattered throughout the county, this one provides a refuge for native plants and animals and an aesthetically pleasing haven for people.

Pilgrim Park (Upper Darby Twp.) contains wooded slopes and forested floodplain along Darby Creek southwest of Pilgrim Gardens. Although the woods is quite weedy and littered with refuse, it provides a buffer against noise and dust generated by a quarry operation on the west side of Darby Creek. Portions of the west-facing slopes have fairly mature beech, oak, and tulip tree. The floodplain is uniformly immature and weedy with red maple (Acer rubrum) the predominant tree. Although the woods has been heavily disturbed - a sewerline parallels the creek, a rutted road attests to motorized and non-motorized vehicular traffic, large patches of broken glass and beer cans mark party spots - it continues to provide wildlife habitat (two deer were spotted in late summer) and watershed protection.

USGS QUADRANGLE MAP: Marcus Hook

		TNC Rank*		Legal Status*		Last	
		Global	State	Fed.	State	Seen	Quality**
NATURAL COMMUNITIES:	501	G?	S1	N	N	4-17-1991	CD
SPECIAL PLANTS:	502	G5	S1	N	PE	8-18-1983	B
	505	G4G5	S2	N	PR	4-17-1991	B
	506	G5	S3	N	PR	07-26-94	D
	513	G5	S2	N	TU	8-28-1991	D
	526	G5	S3	N	PR	07-26-94	C
	528	G5	S2	N	TU	09-14-95	BC

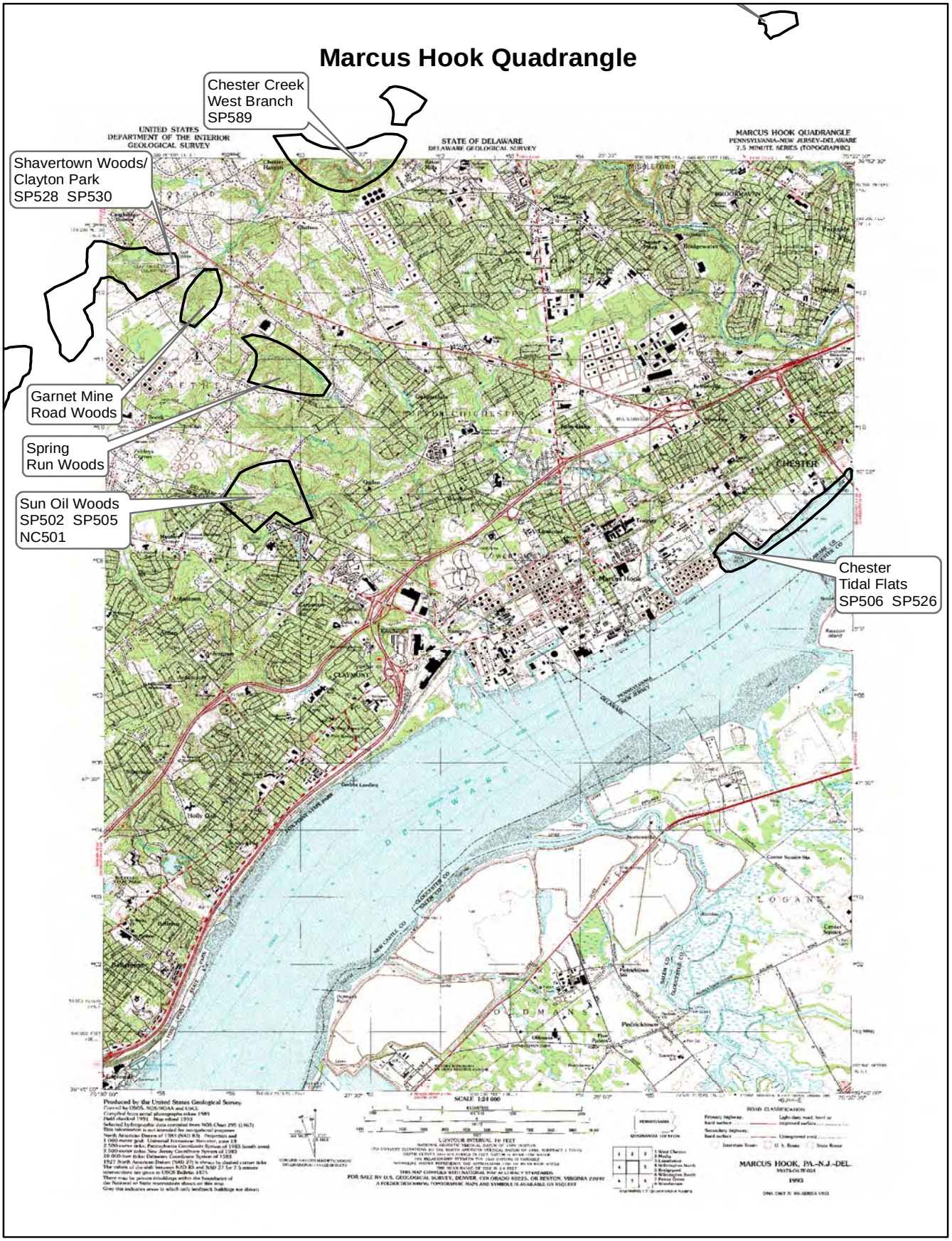
SPECIAL ANIMALS: None identified.

OTHER: Spring Run Woods, Garnet Mine Road Woods, Clayton Park (County), Camp Upland Park (County), Crozier Park. See Media quadrangle for sp589.

* Please refer to Appendix I for an explanation of Ranks and Legal Status.

** Please refer to Appendix II for Quality ranks.

Marcus Hook Quadrangle



Marcus Hook Quadrangle:

Delaware County extends across the northern half of the Marcus Hook quadrangle. Here, Coastal Plain sediments lap onto the metamorphic and igneous rocks of the Piedmont Uplands in an area known as the Fall Zone. Mafic gneiss, schist, and anorthosite are dominant Piedmont rock types found in outcrops and weathered boulders in woods, fields, and streams throughout the area. A relatively thin strip of Coastal Plain sediments, unconsolidated sands and gravels, borders the Delaware River. Further west in the Piedmont proper, scattered patches of Coastal Plain sediments occur.

SUN OIL WOODS (Bethel and Upper Chichester Twps.) occurs along the scenic boulder-strewn West Branch of Naamans Creek. The more mature, less disturbed portion of the forest near the creek is considered a Coastal Plain Forest natural community (**NC501**). Although the woodland is not developed on the level, sandy soils typical of most Coastal Plain forests, it contains some Coastal Plain species such as sweetgum (Liquidambar styraciflua). **SP502**, a good population of a state-endangered tree, and **SP505**, a good population of a state-rare wildflower grow in the woods. The older woodland is characterized by an 80-foot canopy of beech (Fagus grandifolia), tulip tree (Liriodendron tulipifera), white oak (Quercus alba), and sweetgum, a shrub layer of maple-leaf viburnum (Viburnum acerifolium) and spicebush (Lindera benzoin), and a sparse herb layer. In mid-April, mayapple (Podophyllum peltatum), jack-in-the-pulpit (Arisaema triphyllum), dwarf ginseng (Panax trifolium), Christmas fern (Polystichum acrostichoides), and violet (Viola sororia) are common. In disturbed areas, Japanese honeysuckle (Lonicera japonica) and poison ivy (Toxicodendron radicans) dominate. Human impacts to the forest have been great: scattered stumps indicate recent logging; ATV trails cross the area; graffiti covers rocks in the creek; trash washed down the creek litters the rocky bed. Development of the area may be imminent based on wetland delineation flags along woodland streams and active construction at the south eastern edge of the woods. As much of the woodland should remain undisturbed as possible because it protects the water quality of Naamans Creek, provides green space for humans, and offers wildlife habitat. In mid-April, PSO staff observed the Louisiana water thrush, Carolina wren, belted kingfisher, common yellowthroat, field sparrow, red-bellied woodpecker, northern cardinal, and rufous-sided towhee in and near the woods.

SP513 (Concord Twp.) represents a poor population of a Coastal Plain wildflower whose state status is Tentatively Undetermined. The wildflower grows along a powerline corridor that crosses Clayton Park (County). The fall-blooming plant grows in an open area with assorted grasses, forbs, and weedy vines. Associates include beard grass (Schizachyrium sp.), goldenrods (Solidago rugosa, S. graminifolia), yarrow (Achillea millefolium), blackberry (Rubus sp.), and Japanese honeysuckle. The species of concern faces no obvious threats other than succession, which can be controlled by periodic removal of woody vegetation, and herbicide spraying which should be avoided in the vicinity of the plant between the second and third towers east of Bethel Road.

SP506, SP526 -NEW- (Chester City, Marcus Hook Boro.) "Chester Tidal Flats"

This site consists of two small tidal flat areas along a highly disturbed section of the Delaware River shoreline. The tidal marsh has been altered by dumping and contains the remains of pilings. The upland areas above the high tide line are dominated by exotics such as reed canary-grass (*Phalaris arundinacea* and purple loosestrife (*Lythrum salicaria*). Two species of concern were found just below high tide, where native vegetation persists. A fair-quality population of **SP526,** a PA-Rare plant species, occurs in a small intertidal marsh just north of the Commodore Barry Bridge, growing with dotted smartweed (*Polygonum punctatum*). A poor-quality population of another PA-Rare plant, **SP506**, occurs in a separate intertidal marsh nearby. Associated plants include spatterdock (*Nuphar lutea*), arrowhead (*Pontederia cordata*), and bulrushes (*Schoenoplectus tabernaemontanae, S. pungens*). Threats to the plant species of concern include pollution or filling in of the tidal marshes, and oil spills or wave damage from the Delaware River ship traffic(1998 update).

SP528 -NEW- (Concord Twp.) "Clayton Park"

This site consists of a pipeline R.O.W. in Clayton County Park, described in the original NAI as having **SP513**. A fair to good-quality population of another plant species of concern, **SP528**, was found here in 1995. Associated species include goldenrods (*Solidago spp.*), tick-treefoil (*Desmodium paniculatum*), partridge-pea (*Chamaecrista fasciculata*), Indian nut-grass (*Sorghastrum nutans*), and various other grasses. This species requires periodic disturbance to maintain open conditions at the site. However herbicide spraying or mowing early in the season would be detrimental to the species at this site. The buffer area for this site joins that of the Shavertown Woods site (**sp528, sp530**) on the Wilmington North Quadrangle (1998 update).

Downstream of the Route 261 bridge that crosses the West Branch of Chester Creek, **sp589**, an aquatic considered imperiled to rare in the state (S2S3) by The Nature Conservancy, grows. The plant clings to large rocks in fast-flowing water and grows in association with waterweed (Elodea sp.) and algae. The presence of the aquatic plants and at least two species of caddisfly indicate that the water quality is pretty good. Sewage inputs and erosion and sedimentation from cleared land should be controlled along the creek to maintain the aquatic flora and fauna. See Media Quadrangle for further description.

SPRING RUN WOODS (Bethel Twp.) is of local significance for its mature canopy trees and non-weedy understory, for its potential to support rare wildflower species, and for the wildlife habitat it provides. The forest is of medium priority for protection as it already receives some protection from the Dupont Company which owns the land. Except for a pipeline crossing, there is little additional disturbance in the upper end of the woods. The 90-foot closed canopy is diverse with beech, hickory (Carya spp.), red oak (Quercus rubra), sweetgum, red maple (Acer rubrum), and white ash (Fraxinus americana) as major species and black oak (Quercus velutina) and sour-gum (Nyssa sylvatica) as minor components. Tulip tree dominates younger areas. A shrub layer of variable cover includes witch hazel (Hamamelis virginiana), maple-leaf viburnum, lowbush blueberry (Vaccinium

pallidum), and spicebush with scattered plants of barberry (Berberis thunbergii), wild rose (Rosa multiflora), and raspberry (Rubus spp.). The herb layer, varying in cover as a function of shade, includes jack-in-the-pulpit, wintergreen (Chimaphila umbellata), mayapple, false Solomon's seal (Smilacina racemosa), and round-leaved violet (Viola rotundifolia). Ferns include beech fern (Phegopteris hexagonoptera), Christmas fern, New York fern (Thelypteris noveboracensis), and rattlesnake fern (Botrychium sp.). The seeps that feed the creek have skunk cabbage (Symplocarpus foetidus) and jewelweed (Impatiens capensis) associated with them. The forest seems little used except for a trail that parallels the creek. Moving away from the creek onto higher ground, one encounters young, weedy, early successional forests. The DuPont Company is encouraged to continue its benign management of the forest which provides a refuge for native flora and fauna and a recreational and educational resource for neighbors who participate in an annual nature walk sponsored by the DuPont Company.

GARNET MINE ROAD WOODS (Bethel Twp.) is a moderately mature to mature, mixed mesophytic woods that borders a tributary to Green Creek. The tall, closed canopy is fairly diverse with beech, tulip tree, and assorted oaks (black, red, white, and scarlet) as dominants. Spicebush, maple-leaf viburnum, and arrowwood are the primary shrubs. The herb layer is probably rich with spring ephemerals although this was difficult to assess at the end of August. Although the area bordering Garnet Mine Road was heavily disturbed by past earth-moving activities, the woods several hundred yards from the road shows few signs of recent human disturbance other than the occasional piece of trash. Deer browse was quite heavy throughout. The woods is among the better fragments of native Piedmont woodland in Delaware County and should be left alone. In its current state, it provides wildlife habitat, green space for humans, protection of stream water quality, and a refuge for native plants.

Clayton Park (Concord Twp.) is a relatively large park (County-owned) with a variety of habitats and land uses. The area of older trees on the north-facing slope along the western edge of the park near Bethel Road should remain undisturbed and in a natural state. This moderately mature stand of beech with some red oak is relatively non-weedy and exceptionally pleasant on a hot, muggy afternoon in late August. The predominance of beech is probably an artifact of past cutting of the more desirable lumber species such as oak. The shrub layer consists of spicebush and maple-leaf viburnum while the herb layer has common mesic species such as beech fern, Indian cucumber root (Medeola virginiana), white wood aster (Aster divaricatus), and jack-in-the-pulpit. Beech drops (Epifagus virginiana), surviving on the rotting beech leaves, are scattered across the forest floor. One beech tree was observed to be infested with beech-blight aphid. Expansion of the park to act as buffer zones for the mature stand is encouraged. \

Camp Upland Park (Brookhaven Boro) and **Crozier Park** (City of Chester) are two additional managed areas on the quadrangle.

USGS QUADRANGLE MAP: Media

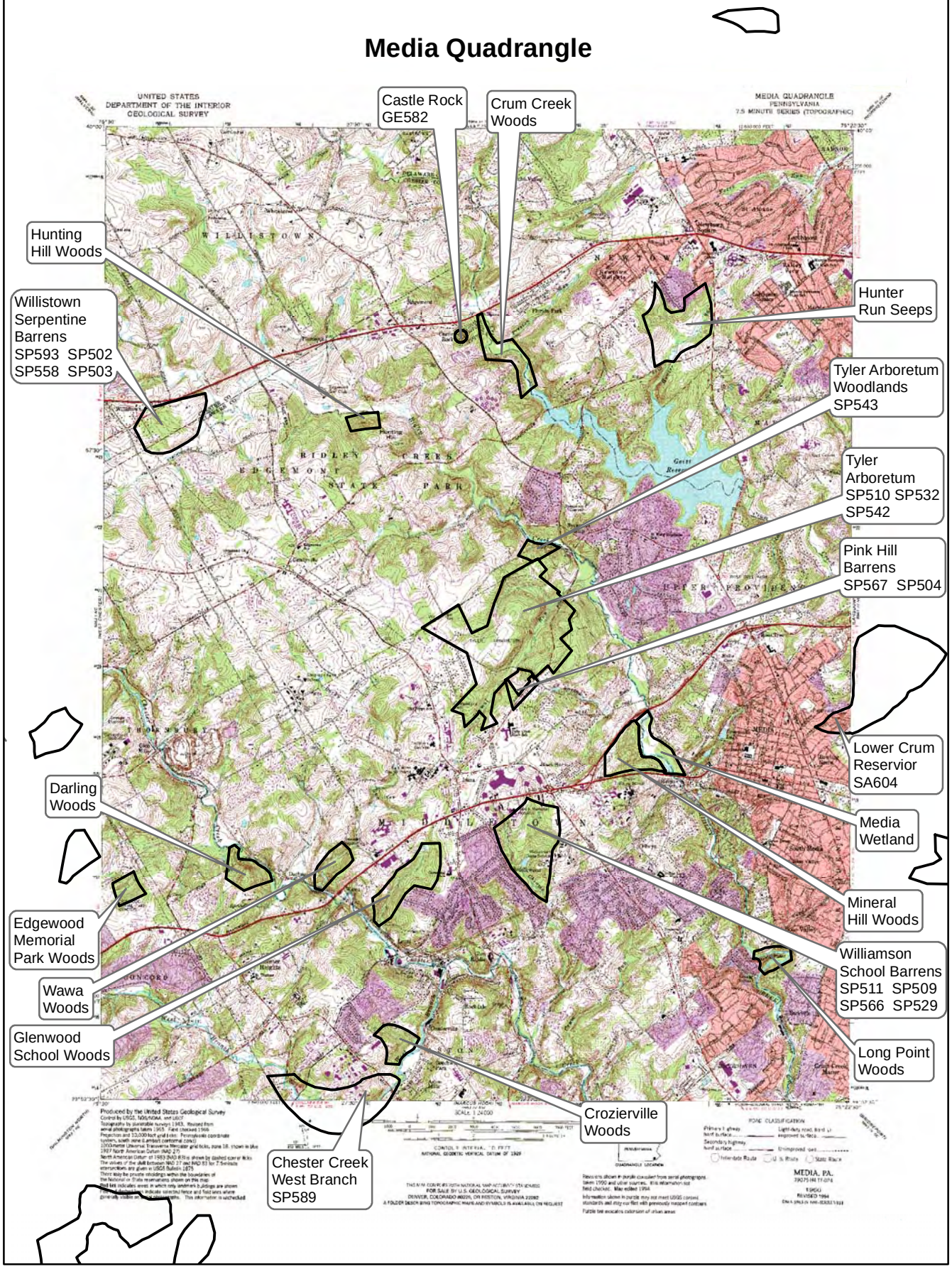
		TNC Rank*		Legal Status*		Last	
		Global	State	Fed.	State	Seen	Quality**
NATURAL COMMUNITIES: None identified.							
SPECIAL PLANTS:	502	G5?	S2	N	PT	7-01-1991	C
	503	G2Q	S2	C2	PT	7-05-1990	D
	504	G2Q	S2	C2	PT	7-08-1986	B
	509	G2Q	S2	C2	PT	9-05-1991	C
	510	G5	SU	N	TU	6-30-1983	A
	511	G5	S3	N	PR	9-05-1991	B
	529	G5	S2	N	PR	9-05-1991	C
	532	G4G5	S2	N	PR	12-14-1984	D
	542	G5	S3	N	PR	4-16-1991	D
	543	G5	S3	N	PR	12-14-1984	C
	558	G5	S2	N	PR	7-05-1990	E
	566	G5	S2	N	PR	8-07-1986	B
	567	G5	S2	N	PR	7-05-1990	B
	589	G5	S2S3	N	N	10-04-1991	D
	593	G5	S1	N	PE	7-05-1990	E
SPECIAL ANIMALS: None identified.							
GEOLOGICAL FEATURES:	582	G?	S?	N	N	1991	E

OTHER: Edgewood Memorial Park Woods, Glenwood School Woods, Hunter Run Seeps, Long Point Woods, Media Wetland, Crozierville Woods, Crum Creek Woods, Darling Woods, Mineral Hill Woods, Wawa Woods, Ridley Creek State Park, Mill Hollow Woods, Geist Reservoir, Hildacy, Rose Tree Park (County), Tyler Arboretum, Glen Providence Park. See Lansdowne quadrangle for sa604.

* Please refer to Appendix I for an explanation of Ranks and Legal Status.

** Please refer to Appendix II for Quality ranks.

Media Quadrangle



Media Quadrangle:

Delaware County covers most of the Media quadrangle which lies in the Piedmont Uplands. The underlying geology is varied with hornblende-bearing gneiss the predominant rock type. Several serpentinite bodies are scattered across the map. Castle Rock (**GE582**, Newtown Twp.) is a large outcrop of enstatite rock (Geyer and Bolles 1979) which is associated with serpentinite. The outcrop is significant for its mineralogy and for the commanding view it provides of the surrounding landscape. Three other serpentinite bodies on the Media quadrangle support the unusual serpentine barrens flora.

Four plant species of special concern grow on the **WILLIAMSON SCHOOL SERPENTINE BARRENS** (Middletown Twp.) which is bordered by residential development, the Riddle Memorial Hospital, and the Williamson Trade School. The plants grow in a small open area dominated by beard grass (Schizachyrium scoparium) and Indian grass (Sorghastrum nutans) and surrounded by a mixed oak forest that includes blackjack oak (Quercus marilandica). **SP509** is a fair population of a wildflower being considered for listing as a Federally Endangered species (C2). **SP566** marks a good population of a state-rare wildflower. **SP511** and **SP529** indicate good and fair populations, respectively, of state-rare grass-like plants. Although a certain amount of disturbance is needed to keep the area open for the light-loving rare plants, motorbikes and mountain bikes, which frequent the site, are much too destructive. They uproot the plants, compact the soil, and create erosion. Ideally, the area should be kept open through the use of periodic controlled burns. These fires reduce the fuel load and the encroaching woody plants which shade out the desirable species. Mowing at certain times of the year may also help. The landowner should consult the land steward at TNC (Appendix VII) for advice on protecting the rare plants. Plans for the Riddle Village Life Care Center on the site need to include a protection strategy for the natural community and the rare plants. Efforts should be made at all levels to protect this vestige of a globally imperiled plant community.

PINK HILL SERPENTINE BARRENS (Middletown Twp.) located on the southeast edge of the **Tyler Arboretum** supports two plant species of special concern. The open, northwest-facing serpentine slope is named for the "pinks" (Phlox subulata) which carpet the area in the spring. In the spring of 1991 a controlled burn was carried out by managers of the **Tyler Arboretum** in order to control the woody species that were invading the site and threatening the rare, light-loving species. **SP504**, a good population of a state-threatened wildflower being considered for Federal Endangered species status (C2), grows on bare rock and thin soil where little other vegetation grows. **SP567** marks a good population of a state-rare wildflower. The plants grow with a diversity of spring- and fall-blooming herbaceous species including ovate-leaved violet (Viola fimbriatula), lyre-shaped rock cress (Arabis lyrata), hairy chickweed (Cerastium arvense var. villosum), wood lily (Lilium philadelphicum), beard grass, Indian grass, wavy-leaved aster (Aster undulatus), assorted goldenrods (Solidago spp.), and slender-leaved mountain mint (Pycnanthemum tenuifolium). Nearby, an excellent population (**SP510**) of a plant whose state status is Tentatively Undetermined grows in two large patches. The plants are secure under the protection of the Tyler Arboretum.

Also in the **Tyler Arboretum**, **SP542** and **SP532** mark poor populations of two state-rare

wildflower species growing on a rich woodland slope dominated by mature tulip tree (Liriodendron tulipifera), oak (Quercus spp.), and beech (Fagus grandifolia) with a shrub layer of spicebush (Lindera benzoin). A diversity of spring ephemerals covers the wooded slope. Abundant spring wildflowers include wild leek (Allium tricoccum), cut-leaved toothwort (Dentaria laciniata), Virginia spring beauty (Claytonia virginica), bloodroot (Sanguinaria canadense), yellow trout-lily (Erythronium americanum), cleavers (Galium aparine), rue-anemone (Anemonella thalictroides), mayapple (Podophyllum peltatum), dwarf ginseng (Panax trifolium), and blue cohosh (Caulophyllum thalictroides). Less abundant, yet interesting, plants observed include pennywort (Obolaria virginica) and a showy wildflower previously thought to be rare in the state. The plants of special concern, the lovely spring wildflowers, and the mature woodland in which they grow are protected within the Tyler Arboretum. In addition, a moth new to Pennsylvania (SU/G4) was found here in 1991; further study is needed to determine the status of this species in the state.

The **WILLISTOWN SERPENTINE BARRENS** (Willistown and Edgmont Twps.) straddles the Chester-Delaware County border. According to old botanical accounts, the original barrens was quite extensive. Today, only two areas remain where the distinctive suite of serpentine plants grow on thin, droughty soils. In Chester County, immediately southeast of Willistown, near a utility substation along Route 926, is a small one-quarter acre grassy barrens that has the appearance of a weedy vacant lot. **SP502**, a state-threatened wildflower, grows there on serpentine rock and gravel. A poor population of **SP503**, a state-threatened wildflower being considered for listing as a Federal Endangered species (C2), also grows among an assortment of grasses and forbs including beard grass, hairy chickweed, whorled milkweed (Asclepias verticillata), and moss pink. The barrens, threatened by human and natural forces, is in dire need of management if the species of special concern are to be maintained on the site.

Closer to the county border and extending into Delaware County is a larger area of barrens which runs along a sloping ridge and includes dry forest dominated by post oak (Quercus stellata) and an impenetrable understory of greenbrier (Smilax rotundifolia), grassy prairie, gravel exposures, and marsh. Recently, much of the Delaware County portion of this barrens was destroyed by the construction of a new housing development. Now, the distinctive serpentine species survive in only a few remnant patches of grassy prairie and gravel exposures. **SP503** is a population of a wildflower being considered for listing as a Federal Endangered species (C2). **SP502** marks a state-threatened wildflower species, **SP558** indicates a state-rare wildflower, and **SP593** identifies a state-endangered grass. The landowners of the site are encouraged to protect the remaining areas of serpentine vegetation from development and off-road vehicular traffic. The TNC land steward (Appendix VII) and/or Tyler Arboretum staff should be contacted for advice on devising a management strategy for maintaining the desirable species at the site.

SP543 (Edgmont Twp.) a fair population of a state-rare wildflower, grows on a north-facing slope above Ridley Creek in **Ridley Creek State Park**. The wildflower grows in humus-rich soil under a canopy of mature tulip tree with some beech and oak and an open understory of flowering dogwood (Cornus florida), hornbeam (Carpinus caroliniana), and ironwood (Ostrya virginiana). The proximity of the population to the road renders it vulnerable to trampling and collection. Park

managers are aware of and protecting the species.

SP589 (Aston and Concord Twps.) is a poor population of an aquatic plant considered imperiled to rare in the state (S2S3) by The Nature Conservancy. The plant, last reported from the site in 1926, grows on scattered large rocks in the West Branch of Chester Creek downstream of the Route 261 bridge. The plant grows in fast-flowing water in association with waterweed (Elodea sp.) and algae. The presence of the aquatic plants and at least two species of caddisfly indicate that the water quality is pretty good. In addition, this stretch of Chester Creek is stocked with fish in the spring. To keep the water quality high, erosion and sedimentation from construction sites and sewage inputs from residential communities should be controlled along the creek.

EDGEWOOD MEMORIAL PARK WOODS (Concord Twp.) is a mature undisturbed beech forest on a northwest-facing slope adjacent to the cemetery. An 80- to 90-foot tall closed canopy contains the dominant beech and a mixture of tulip tree, red and white oak (Quercus rubra and Q. alba), shagbark and mockernut hickory (Carya ovata and C. tomentosa), white ash (Fraxinus americana), sour-gum (Nyssa sylvatica), red maple (Acer rubrum), and black birch (Betula lenta). Spicebush dominates the shrub layer which also contains maple-leaf viburnum (Viburnum acerifolium) and arrowwood (Viburnum dentatum). Mesic herbs, scattered in patches throughout the woodland, include maidenhair fern (Adiantum pedatum), silvery spleenwort (Athyrium thelypteroides), jack-in-the-pulpit (Arisaema triphyllum), white wood aster (Aster divaricatus), and mayapple. The stand was selectively logged a very long time. Beech trees that were left behind have grown into an attractive, mature stand. Scattered trails indicate that there is some recreational use of the area. The woods is locally significant and a high priority for protection because it covers a fairly large area, contains mature beech trees, is non-weedy except at the edges, and provides wildlife habitat and green space for humans. We recommend leaving the woods undisturbed.

GLENWOOD SCHOOL WOODS (Middletown Twp.) is a moderately mature, mixed mesophytic woods extending along an unnamed tributary to Chester Creek. Although the whole corridor is marked on the map for protection (thirty acres of which is owned by the township), only the area near Glenwood School was surveyed. Maintenance of the whole corridor as forest will help protect the water quality of Chester Creek. The closed forest canopy contains 90-foot red and black oak, tulip tree, beech, sour-gum, and white ash. An ordinary shrub layer consists of spicebush, maple-leaf viburnum, and arrowwood. Mesic herbs common in mid-summer include jack-in-the-pulpit, mayapple, Christmas fern (Polystichum acrostichoides), broad beech fern (Phegopteris hexagonoptera), New York fern (Thelypteris noveboracensis), white wood aster, and violet. The area has been selectively logged through time as indicated by stumps in varying stages of decay. Numerous overgrown roads and well-trod paths attest to past and recent activity in the woods. In gaps created by fallen trees and a pipeline cut, weedy young growth thrives. The diversity of younger and older growth and small seeps makes for diverse wildlife habitat. Scarlet tanagers, robins, red-bellied woodpeckers, and red-eyed vireos, heard in mid-summer, are among the many bird species that utilize the large forest. The PSO staff encourages maintenance of the forest. In addition to protecting water quality and providing wildlife habitat, the woods serves as an educational and recreational resource for local residents and Glenwood School students.

HUNTER RUN SEEPS (Newtown Twp.) refers to mucky wetlands formed by seeps along the valley walls of Hunter Run between Route 252 and Gradyville Road. These wetlands are potential habitats for a state-endangered animal which was found in the Newtown Square area in the 1950's. Although spring and summer surveys in 1991 failed to locate this species, it may still be in the area. The wetlands have many of the characteristics favored by this rare animal including an open canopy which admits a fair amount of sunlight, scattered tussock sedge hummocks, and muddy "runs" eroded by gently flowing water. Steps should be taken to maintain the open quality of the wetlands through the removal of woody vegetation.

The entire stream corridor is very young and crowded with remnant agricultural species such as apple and aggressive invasives such as multiflora rose, Japanese honeysuckle (Lonicera japonica), and garlic mustard (Alliaria petiolata). The wetlands have an open canopy of 30-foot tall red maple and clumps of assorted shrubs such as the ubiquitous spicebush, silky dogwood (Cornus amomum), and alder (Alnus sp.). Tussock sedge (Carex stricta), skunk cabbage (Symplocarpus foetidus), and sensitive fern (Onoclea sensibilis) dominate the herb layer while cinnamon fern (Osmunda cinnamomea), cattail (Typha latifolia), and reed canary grass (Phalaris arundinacea) are locally abundant. Pennsylvania bitter cress (Cardamine pensylvanica) and spring cress (Cardamine bulbosa) are prominent in the spring while cowbane (Oxypolis rigidior) appears in late summer. Although there is no evidence of recent disturbance along Hunter Run, wetland delineation flags observed in the summer of 1991 suggest that activities may be planned. The impacts of such activities on the wetlands and stream should be carefully assessed.

LONG POINT WOODS (Nether Providence Twp.) occurs on a schist ridge that juts perpendicular to Ridley Creek and is protected in the 13-acre **Long Point Wildlife Sanctuary**. The dry woods consists of an 80-foot partially-closed canopy predominated by white, red, black, and scarlet oak (Quercus coccinea) with some beech and tulip tree and a 40-foot subcanopy of beech, sour-gum, red maple, mockernut hickory, flowering dogwood, and American chestnut (Castanea dentata). Scattered maple-leaf viburnum, mountain laurel (Kalmia latifolia), and lowbush blueberry (Vaccinium pallidum) constitute the shrub layer. The site is very scenic with outcrops affording views of the creek. Unprotected lands surrounding the sanctuary should be secured to maintain the isolated quality of the site. These small sanctuaries provide wildlife habitat, a buffer area for the stream corridor, and open space for people living nearby. More of these kinds of parks and sanctuaries should be encouraged.

Approximately a quarter mile upstream of Long Point on the eastern side of Ridley Creek, scattered plants of umbrella magnolia (Magnolia tripetala) grow. Although this species is considered Pennsylvania-Rare, this occurrence is probably unnatural, an escape from nearby gardens.

MEDIA WETLAND (Upper Providence and Middletown Twps.) refers to the area bordering Ridley Creek north of the filtration plant along Baltimore Pike. A complex of forested, scrub/shrub, and graminoid robust emergent wetlands covers the broad floodplain created by the impounded creek. In areas of quiet open water, fragrant water lily (Nymphaea odorata) and water pennywort

(Hydrocotyle americana) carpet the surface. An open 30-to 40-foot canopy of white ash, box elder (Acer negundo), red maple, and black willow (Salix nigra) typifies the forested wetland areas. In scrub/shrub areas, silky dogwood, buttonbush (Cephalanthus occidentalis), alder (Alnus serrulata), and rose (Rosa palustris, R. multiflora) form impenetrable thickets. The diverse herbaceous layer, varying in composition and density as a function of changing light and moisture conditions, contains cattail, sedges (Carex lurida, C. frankii, C. crinita, C. lupulina), rice cutgrass (Leersia oryzoides), jewelweed (Impatiens capensis), skunk cabbage, tearthumbs (Polygonum arifolium, P. sagittatum), forget-me-not (Myosotis scirpioides), and many more species. Although the wetland plant species are ordinary, the wetland is important for the ecological functions it performs such as filtering stormwater runoff from upland areas. The wetland provides habitat for a variety of birds including the red-eyed vireo, American goldfinch, Carolina wren, green-backed heron, mallard, and wood duck which were noted in early July. Trails along both sides of the creek indicate moderate recreational use of the area. We recommend maintenance of the wetland in an undisturbed state and suggest that both sides of the creek be included in Gleave L. Baker Park.

CROZIERVILLE WOODS (Aston Twp.) is a moderately mature forest dominated by 80-foot tulip tree and red oak on a northeast slope above a small tributary to the West Branch of Chester Creek. A subcanopy at 40-to 50-feet contains beech, red maple, mockernut hickory, and flowering dogwood. Spicebush, multiflora rose, black cherry (Prunus serotina), and maple-leaf viburnum form the shrub layer. In mid-summer the herb layer contains diverse species including Christmas fern in great numbers, broad beech fern, hay-scented fern (Dennstaedtia punctilobula), maidenhair fern, jack-in-the-pulpit, mayapple, partridgeberry (Mitchella repens), and false Solomon's seal (Smilacina racemosa). In spring, the woods is probably full of lovely wildflowers. Local residents can enter the woods along a trail paralleling the tributary. In addition to providing open space, the wooded slope protects the water quality of Chester Creek.

CRUM CREEK WOODS (Newtown and Edgmont Twps.) lines Crum Creek above Geist Reservoir. Protection of this wooded corridor is important for maintenance of stream and reservoir water quality in an area that has become very developed. Algae covering rocks indicates some nutrient enrichment. Fine material eroded from the upper watershed appears as a silty layer in the creek bottom. Loss of the wooded corridor would exacerbate these problems further. White ash, black walnut (Juglans nigra), slippery elm (Ulmus rubra), red maple, and sycamore (Platanus occidentalis) form a moderately closed 60-foot canopy in an area surveyed along the creek just upstream of the reservoir. A weedy understory contains multiflora rose, silky dogwood, spicebush, privet (Ligustrum vulgare), and crabapple. A second important function of the wooded corridor is to provide wildlife habitat. In mid-summer, the corridor was full of birds including great blue herons, red-bellied woodpeckers, wood ducks, mallards, scarlet tanagers, white-eyed vireos, yellowthroats, veerys, chickadees, kingfishers, Carolina wrens, and wood thrushes.

DARLING WOODS (Thornbury Twp. and Chester Heights Boro) is a moderately mature woods that abuts the Darlington Tract (Middletown Twp.) to the east and Natural Lands Trust property to the south. It is located on the east-facing slope along Chester Creek. Although the woods contain common native species in the canopy and many weedy species in the shrub and herb layers, it

is notable for providing nesting habitat for a broadwing hawk observed in the summer of 1991. In addition, the woods stems erosion of the moderate to steep slopes and subsequent sedimentation in, and degradation of, Chester Creek. Steps should be taken here to maintain a corridor of undisturbed, natural habitats along trails to minimize erosion and enhance the hiking experience.

WAWA WOODS (Middletown Twp.) is a mature beech-dominated forest on a northwest-facing slope along Rocky Run, a tributary to Chester Creek. An 80-foot closed canopy of beech with some red oak overtops a 20- to 40-foot subcanopy of red maple and beech. Heavy deer browse has stripped the shrub and herb layers to the ground. The forest is locally significant for the maturity of its trees and for the interesting outcrops of intensely folded rock exposed along the slope. Rocky Run Trail, part of the extensive trail network maintained by Middletown Township, parallels the creek in this area and provides access to the woods, although trespassing off the trail and into the woods is not permitted. It is important to maintain the woods in its current condition to protect the water quality of Rocky Run and to preserve the aesthetic quality of the trail corridor. As mapped for this study, it is partially owned by the Natural Lands Trust, the township (Darlington Tract), and private landowners (Natural Lands Trust 1988).

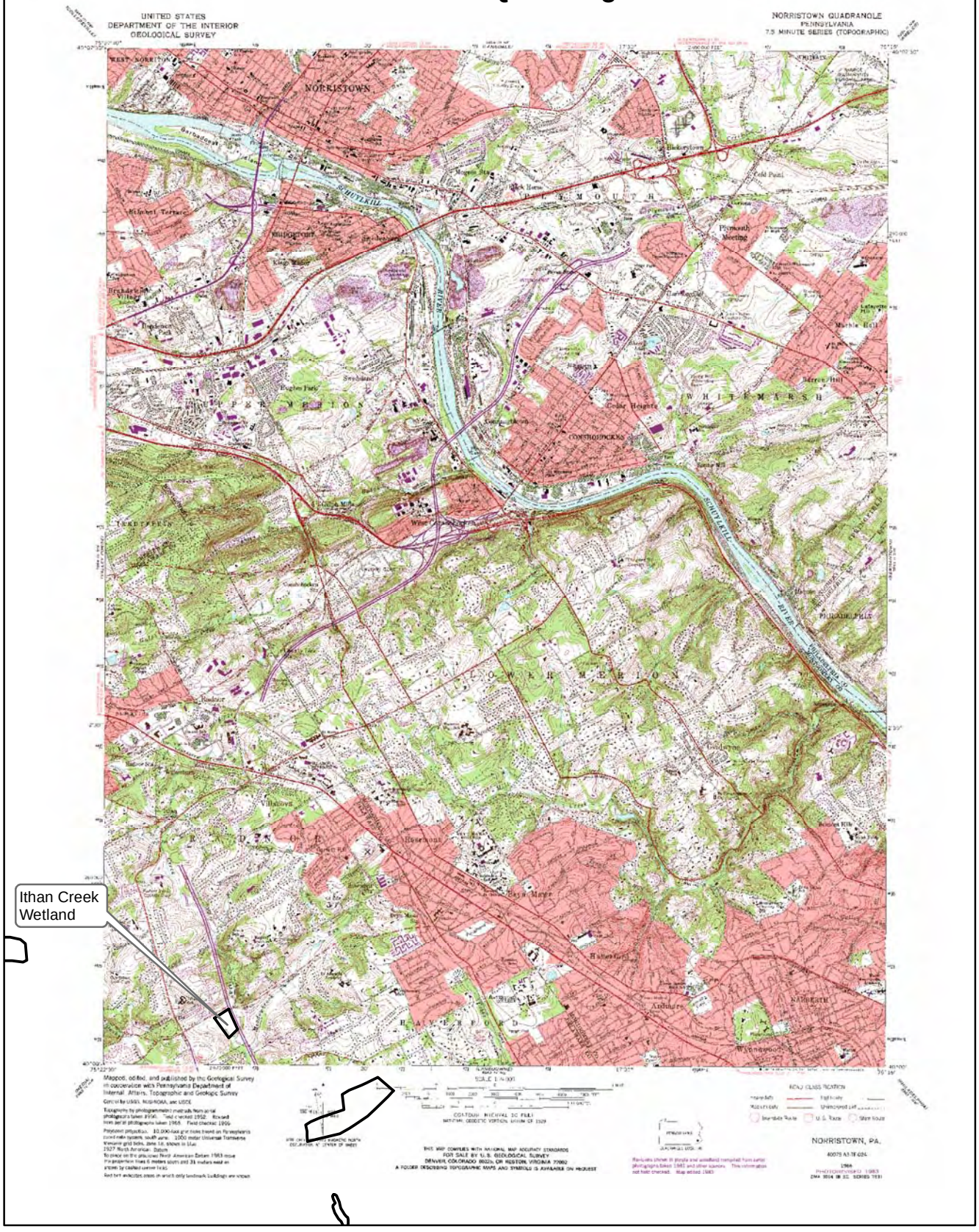
HUNTING HILL WOODS (Edgmont Twp.) in **Ridley Creek State Park** occurs on a moist, northwest-facing slope above Ridley Creek. The woods is locally significant for its large canopy trees, well-developed structure, wildlife habitat, recreational and educational value, and potential for a rare wildflower species. The 100- to 120-foot tall closed canopy includes tulip tree, white ash, beech, and red oak. A subcanopy at 30- to 40-feet includes beech, slippery elm, flowering dogwood, hornbeam, white and red oak, and hickory. The shrub layer includes bladdernut (Staphylea trifoliata), spicebush, and scattered barberry (Berberis thunbergii) and wineberry (Rubus phoenicolasius). The species-rich herb layer contains blue cohosh, bloodroot, wild leek, wild ginger (Asarum canadense), violets (Viola spp.), Christmas fern, rattlesnake fern (Botrychium sp.), beech fern, and maidenhair fern. Weedy species include garlic mustard, Virginia creeper (Parthenocissus quinquefolius), and stiltgrass (Microstegium vimineum). The woods is protected within the park.

MINERAL HILL WOODS (Middletown Twp.) is located west of Media and adjoins the floodplain wetland along Ridley Creek. This woodland is a mosaic of younger and older, less disturbed and more disturbed patches. Wissahickon schist underlies the lower slope (Berg and Dodge 1981) which supports the common canopy mix of red oak and tulip tree and the typical understory of maple-leaf viburnum and young beech. Serpentine underlies the upper slope where weed-covered tailings attest to past mining. Although scattered blackjack oaks indicate some serpentine influence in the area of the mine tailings, there is only one small patch of "barrens" occurring on a small serpentine outcrop along a roadcut in the middle of the woodland. Common serpentine associates including beard grass, hairy chickweed, moss pink, lyre-shaped rock-cress, and aster (Aster sp.) grow in an area approximately 300 square feet in size. At the top of the roadcut, scattered stems of blackjack oak grow in a tangled mass of greenbrier. It may be possible to rehabilitate a larger area of barrens through the use of cutting and fire. Protection of Mineral Hill Woods is important for the provision of open space for Media residents, and the protection of Ridley Creek immediately upstream of the filtration plant. In addition, the woods provides wildlife habitat for residential and

migratory animals such as the woodcock which was observed in early September of 1991.

Managed areas on the quadrangle include **Tyler Arboretum** (Middletown Twp.); **Ridley Creek State Park** (Edgmont, Middletown, and Upper Providence Twps.); **Rose Tree Park** (Upper Providence Twp.) and **Glen Providence Park** (Media and Upper Providence Twps.) which are both County-owned; **E. Wallace Chadwick Long Point Wildlife Sanctuary** (Nether Providence Twp.); **Geist Reservoir** (Marple, Newtown, and Upper Providence Twps.); and **Hildacy** (Marple and Upper Providence Twps.) and **Mill Hollow Woods** (Newtown Twp.) which are both owned by the Natural Lands Trust.

Norristown Quadrangle



	TNC Rank*		Legal Status*		Last	
	Global	State	Fed.	State	Seen	Quality**
NATURAL COMMUNITIES:	None identified.					
SPECIAL PLANTS:	None identified.					
SPECIAL ANIMALS:	None identified.					
OTHER:	Ithan Creek Wetland.					

Norristown Quadrangle:

Delaware County extends across the southwestern corner of the Norristown quadrangle. PSO staff did not find natural communities or species of special concern in this area.

ITHAN CREEK WETLAND (Radnor Twp.) is an area of local significance primarily because it offers wildlife habitat and adds some diversity to the local landscape. The wetland is of low priority for protection because it is quite weedy and severely impacted at its edges. The wetland is bordered by the Blue Route to the east, Bryn Mawr Avenue to the north, a residential community to the west, and Ithan Creek to the south. Scattered 30-foot tall black willow (Salix nigra) and silver maple (Acer saccharinum) are the dominant tree species. Scattered patches of silky dogwood (Cornus amomum) and wild rose (Rosa multiflora) are surrounded by a continuous cover of assorted wetland herbs, grasses, sedges, and rushes. Monkeyflower (Mimulus ringens), ironweed (Vernonia noveboracensis), joe-pye weed (Eupatorium fistulosum), and mountain mint (Pycnanthemum sp.) add hues of purple to the wetland in mid-summer. Stands of common cattail (Typha latifolia) are intermixed with areas dominated by species of sedge (Carex lurida), rush (Juncus effusus), bulrush (Scirpus cyperinus), and spike-rush (Eleocharis spp.). Purple loosestrife (Lythrum salicaria) and common reed (Phragmites australis) are weedy species abundant in the wetland. The proximity of the wetland to local schools and colleges makes it a convenient outdoor classroom. The wetland should be protected from further encroachment.

* Please refer to Appendix I for an explanation of Ranks and Legal Status.

** Please refer to Appendix II for Quality ranks.

USGS QUADRANGLE MAP: Philadelphia

	TNC Rank*		Legal Status*		Last	
	Global	State	Fed.	State	Seen	Quality**

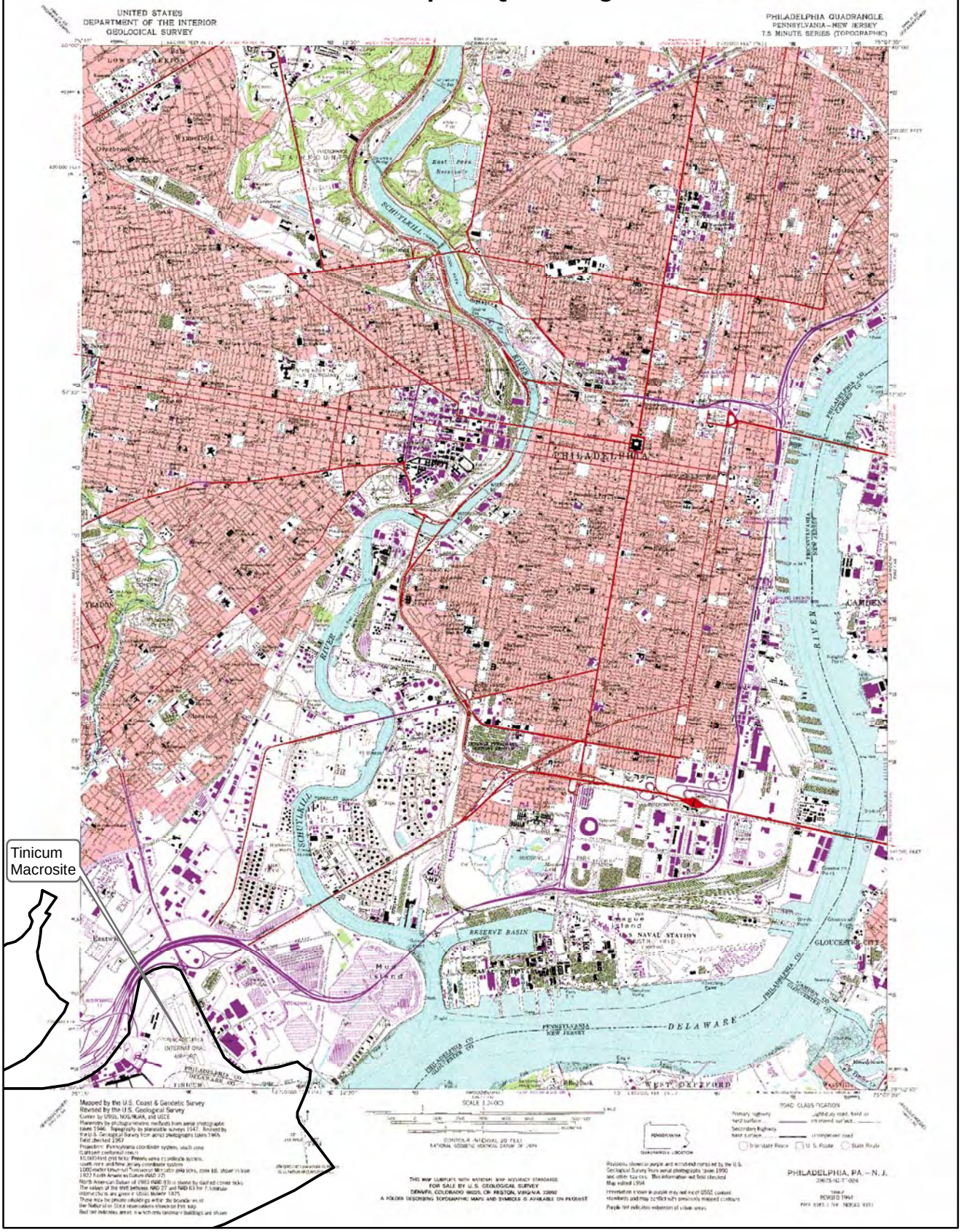
NATURAL COMMUNITIES: None identified.

SPECIAL PLANTS: None identified.

SPECIAL ANIMALS: None identified.

OTHER: Cobbs Creek Park (City of Philadelphia)

Philadelphia Quadrangle



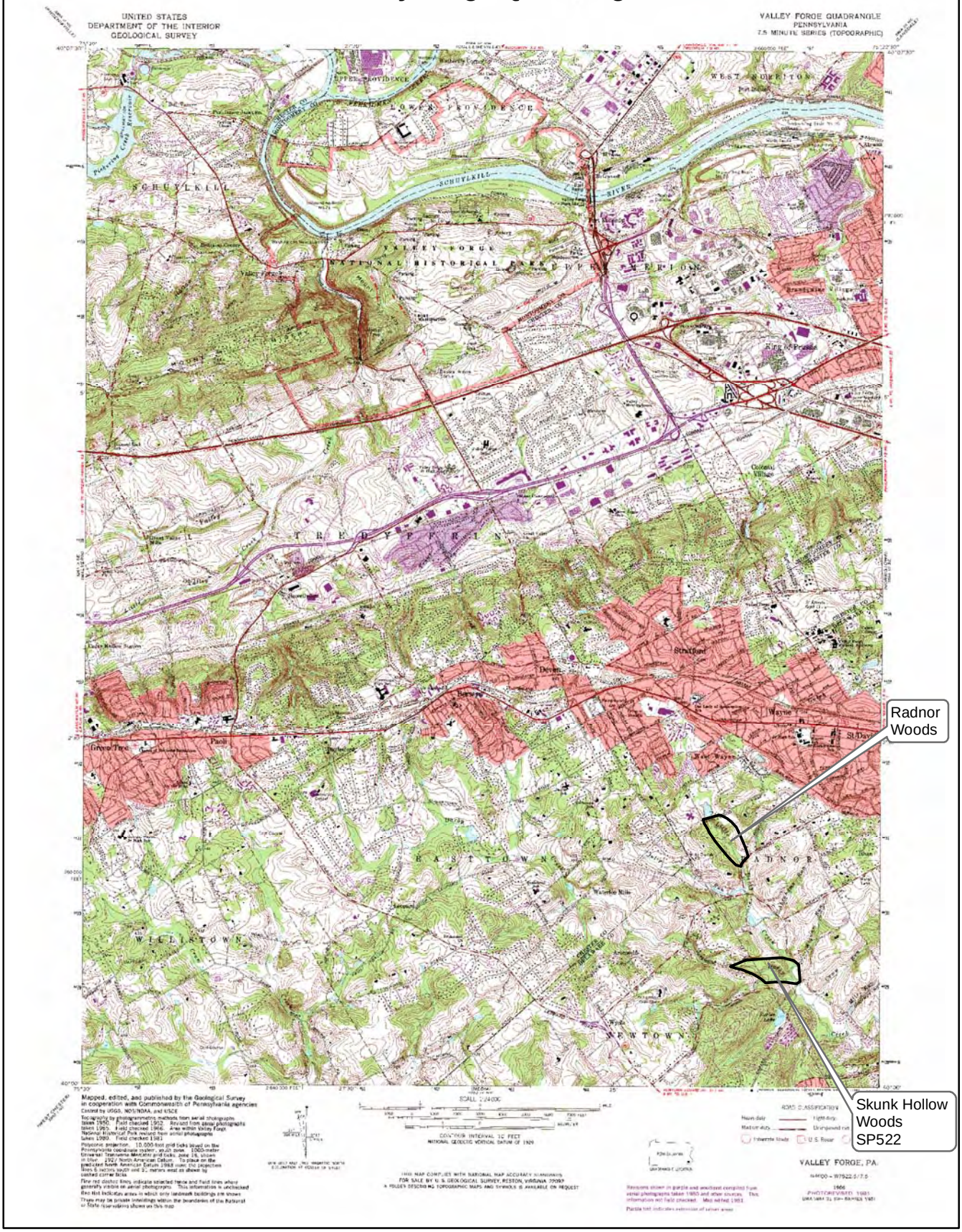
Philadelphia Quadrangle:

A very small area of Delaware County (Upper Darby Twp. and Yeadon Boro) occurs on the Philadelphia quadrangle. PSO staff did not find plants or animals of special concern in this part of the county. **Cobbs Creek Park**, owned by The City of Philadelphia, is very important in this urbanized area because it helps to protect the water quality of Cobbs Creek and provides a corridor for wildlife and open space for local residents. A notable portion of the park on the Philadelphia quadrangle is the moderately mature woods southeast of St. Louis School. On a gentle southeast-facing slope, 90-foot tall tulip tree (Liriodendron tulipifera), beech (Fagus grandifolia), and red oak (Quercus rubra) grow above an understory of beech sprouts, Norway maple (Acer platanoides), and flowering dogwood (Cornus florida). In mid-summer, the herb layer was sparse under the shade of the hardwood canopy and dense and weedy along paths. The floodplain at the base of the slope has a very different species composition. A well-trod trail indicates heavy use of the area. The mature forest should be maintained in a wooded condition. Selective removal of Norway maple will ensure persistence of the native species at the site. NO LITTERING signs or garbage cans may help with the unsightly trash problem.

* Please refer to Appendix I for an explanation of Ranks and Legal Status.

** Please refer to Appendix II for Quality ranks.

Valley Forge Quadrangle



USGS QUADRANGLE MAP: Valley Forge

	TNC Rank*		Legal Status*		Last	
	Global	State	Fed.	State	Seen	Quality**
NATURAL COMMUNITIES: None identified.						
SPECIAL PLANTS:	522 G5	S3	N	PR	3-23-1985	D
SPECIAL ANIMALS:	None identified.					
OTHER:	Radnor Woods.					

Valley Forge Quadrangle:

Delaware County extends across the southeastern corner of the Valley Forge quadrangle in an area of the Piedmont Uplands underlain by pyroxene-bearing gneiss.

SP522 (Radnor and Newtown Twps.) is a poor population of a state-rare wildflower growing in Skunk Hollow Park (Township) along Darby Creek. The plant grows on an east-facing slope above Darby Creek in a rich, somewhat rocky woodland dominated by beech (Fagus grandifolia) and oak (Quercus spp.). Associates of the plant include blue cohosh (Caulophyllum thalictroides), toothwort (Dentaria heterophylla), spring beauty (Claytonia virginica), and bloodroot (Sanguinaria canadensis). Although the plant colony was not found during a follow-up visit to the site in April 1991, there is still habitat available. The major threat to this rare species is the spread of exotic species such as privet (Ligustrum vulgare).

RADNOR WOODS (Radnor Twp.) is a fragment of moderately mature beech/oak woodland located along the rocky slopes and floodplain of Little Darby Creek immediately south of the reservoir along Maplewood Avenue. The forest is locally significant for its large canopy trees, the relative absence of understory weeds and potential for spring wildflowers along the slopes, and the refuge provided for wildlife. In addition, the forest offers open space to local residents. The less desirable aspects of the forest are the weediness of the floodplain understory and the heavily scoured and littered creek channel. The forest canopy should remain closed to prevent the invasion of exotic species.

* Please refer to Appendix I for an explanation of Ranks and Legal Status.

** Please refer to Appendix II for Quality ranks.

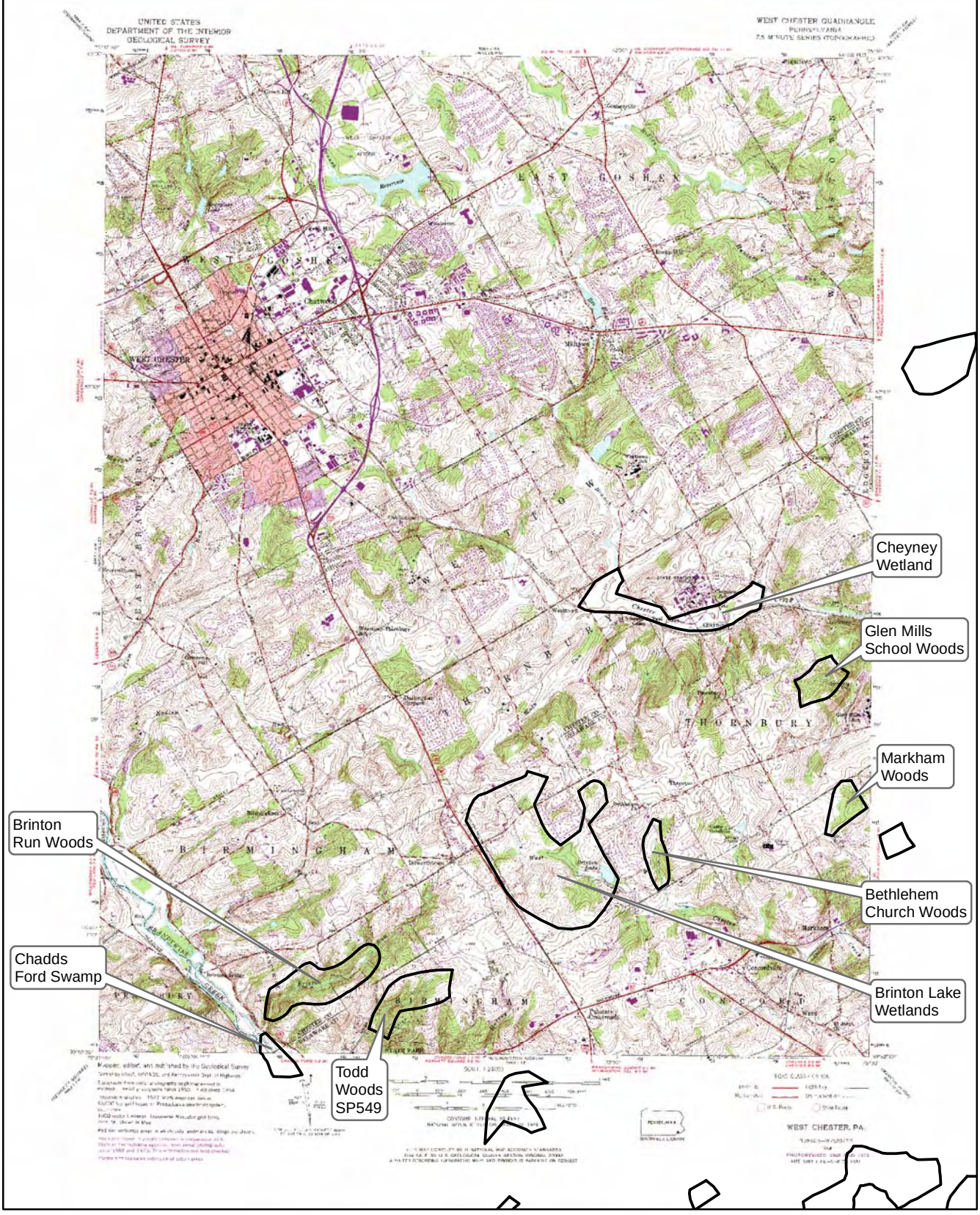
USGS QUADRANGLE MAP: West Chester

	TNC Rank*		Legal Status*		Last	
	Global	State	Fed.	State	Seen	Quality**
NATURAL COMMUNITIES:	None identified.					
SPECIAL PLANTS:	549	G4G5	S2	N	PR	4-26-1991 C
SPECIAL ANIMALS:	None identified.					
OTHER:	Brinton Lake Wetland, Cheyney Wetland, Glen Mills School Woods, Markham Woods, Bethlehem Church Woods, Brandywine Battlefield State Park, Camp Sunshine. See Wilmington North quad for SA508.					

* Please refer to Appendix I for an explanation of Ranks and Legal Status.

** Please refer to Appendix II for Quality ranks.

West Chester Quadrangle



West Chester Quadrangle:

Delaware County extends across the southeastern corner of the West Chester quadrangle in an area of the Piedmont Uplands underlain by hornblende-bearing gneiss.

SP549 (Birmingham Twp.) is a fair population of a state-rare wildflower growing in a rich mesic woodland drained by a tributary to the Brandywine Creek. Patches of the plant occur on the north and south side of the tributary. The patches on the north side are on the edge of a residential development and are threatened by expansion of backyards and brush disposal. A homeowner on Hunters Lane was informed of the population growing in her backyard and asked to participate in its protection. The patches on the southern side of the tributary are in a mature, undisturbed woodland and presumably less vulnerable. The woodland cloaking the steep north-facing slope consists of a 75-foot tall closed canopy of beech (Fagus grandifolia), tulip tree (Liriodendron tulipifera), and red oak (Quercus rubra) with an understory of beech and flowering dogwood (Cornus florida). The patchy shrub layer contains witch hazel (Hamamelis virginiana), maple-leaf viburnum (Viburnum acerifolium), and spicebush (Lindera benzoin). The diverse herb layer includes mayapple (Podophyllum peltatum), Virginia spring beauty (Claytonia virginica), perfoliate bellwort (Uvularia perfoliata), Christmas fern (Polystichum acrostichoides), grape fern (Botrychium sp.), rue-anemone (Anemonella thalictroides), jack-in-the-pulpit (Arisaema triphyllum), smooth yellow violet (Viola pensylvanica), cut-leaved toothwort (Dentaria laciniata), Indian cucumber root (Medeola virginiana), black snakeroot (Cimicifuga racemosa), partridgeberry (Mitchella repens), yellow trout-lily (Erythronium americanum), bloodroot (Sanguinaria canadensis), and dwarf ginseng (Panax trifolium). A portion of the creek valley is under the protection of a homeowners association. Efforts should be made to secure the remaining valley from development as it is one of the few intact wooded valleys in the area.

Along the Brandywine Creek, there is potential habitat for **SA508** (Birmingham Twp.), a state-endangered animal last observed in the vicinity of Chadds Ford in 1981. For a complete description of this area, see the Wilmington North quadrangle.

BRINTON LAKE WETLAND (Thornbury Twp.) is a moderately large, locally significant wetland on the northwest side of Brinton Lake along the West Branch of Chester Creek. Although the creek valley was probably always wet, impoundment of the creek enhanced and enlarged the original wetland. At the northern end a canopy of red maple (Acer rubrum) and white ash (Fraxinus americana) rises above a dense herbaceous cover of skunk cabbage (Symplocarpus foetidus). Moving to the southeast the canopy opens up and the wetland becomes more shrubby with scattered clumps of spicebush, silky dogwood (Cornus amomum), swamp rose (Rosa palustris), and alder (Alnus sp.). The herb layer contains tussock sedge (Carex stricta), sensitive fern (Onoclea sensibilis), Pennsylvania bitter cress (Cardamine pensylvanica), spring cress (Cardamine bulbosa), and greek valerian (Polemonium reptans) which has lovely blue flowers at the end of April. Although houses are situated along the creek valley, there appears to be relatively little human disturbance of the wetland. The marsh and scrub/shrub swamp provide excellent habitat for frogs, turtles, birds, and deer. A wooded buffer should be maintained around the wetland.

A northeast-facing slope along the northwestern edge of the Brinton Lake Wetland supports a narrow band of moderately mature rich woodland which is surprisingly non-weedy and could potentially harbor a rare wildflower. The woods consists of an 80-foot tall canopy of beech and tulip tree with some red oak and red maple, a shrub layer of spicebush, maple-leaf viburnum, and arrowwood (Viburnum dentatum), and a diverse herb layer. Attractive spring ephemerals such as mayapple, Virginia spring beauty, yellow trout-lily, toothwort, dwarf ginseng, false Solomon's seal (Smilacina racemosa), and violet (Viola pubescens), carpet the ground in April. The woods should be protected from development and cutting because it has potential for a rare wildflower species and it helps protect the wetland.

CHEYNEY WETLAND (Thornbury Twp.) is a complex of relatively undisturbed, non-weedy forested, scrub/shrub, and marshy areas located on the broad floodplain of a 1 1/2 mile stretch of the East Branch of Chester Creek near Cheyney University. Dry to mesic fields of common grasses and forbs border the wetland. The wetland plant species are ordinary and typical of the region. Scattered islands of 30- to 40-foot tall silver maple (Acer saccharinum), ash (Fraxinus spp.), box elder (Acer negundo), and willow (Salix sp.) are interspersed with depressions where water collects in the spring and following floods. In open swales, sweetflag (Acorus calamus), reed canary grass (Phalaris arundinacea), woolgrass (Scirpus cyperinus), and tussock sedge flourish amongst silky dogwood, swamp rose, and buttonbush (Cephalanthus occidentalis). In the wettest open areas, burreed (Sparganium americanum), water plantain (Alisma plantago-aquatica), arrowhead (Sagittaria latifolia), spike-rush (Eleocharis spp.), and soft rush (Juncus effusus) thrive. Migratory waterfowl favor these areas in early spring when water is ponded to a depth of one to two feet. In mid-June, red-wing blackbirds, song sparrows, and robins were observed in the wetland. In addition to providing wildlife habitat, the wetland mosaic serves to filter runoff from upland fields and maintain the quality of Chester Creek. The variety of habitats and diversity of plant species makes the wetland an excellent educational resource for nearby schools offering natural history classes. The wetland and surrounding habitats continue to provide potential habitat for several rare species of insects including the regal fritillary butterfly last noted in the area in 1889 and the long-legged green darner (a dragonfly) last seen in 1936. The wetland and adjacent upland buffers should be maintained.

GLEN MILLS SCHOOL WOODS (Thornbury Twp.) refers to the wooded area northwest of the school. A north-south trending gas pipeline bisects the woods. Survey of the western half and a small portion of the eastern half revealed that the former area is moderately mature to mature and in fairly good condition while the eastern area is more disturbed and somewhat weedy. The western half of the woods has an 80-foot tall closed canopy dominated by beech and tulip tree with some shagbark hickory (Carya ovata), a spicebush-dominated shrub layer, and a moderately diverse herb layer. Although stumps attest to past cutting, there is little recent disturbance except near bordering homes. The woods is locally significant for the maturity of its trees, the provision of wildlife habitat and green space for humans, and the potential for a rare wildflower species. Protection of the water quality of Chester Creek can be aided by maintaining the woodland around the small stream that flows into Chester Creek. In areas where homeowners rely on septic systems to handle domestic waste it is extremely important that vegetation buffers remain along water bodies.

MARKHAM WOODS (Concord Twp.) is a small mixed hardwood forest recovering from heavy logging several decades ago. The canopy is composed of tulip tree, beech, red and white oak, and hickory. The subcanopy consists of numerous small stems of red maple, tulip tree, and some flowering dogwood. The moderate cover of shrubs includes maple-leaf viburnum, spicebush, and witch hazel. Scattered plants of wild ginger (Asarum canadense), blue cohosh (Caulophyllum thalictroides), and jack-in-the-pulpit occur within the sparse herb layer of late summer; springtime vegetation is probably more lush and more diverse. Occasional stems of tree-of-heaven (Ailanthus altissima) and princess-tree (Paulownia tomentosa) grow in gaps created by past logging or windthrow. While the species composition is very typical of the region, the forest is important to protect for the wildlife habitat and open space it provides. The woodland is bordered on its western edge by cornfield and appears to be in little danger of development at the present time. However, it is not too early to think about setting aside this small woodland fragment since western Delaware County will come under increasingly heavy development pressure.

BETHLEHEM CHURCH WOODS (Thornbury Twp.) occurs in a valley drained by a tributary to the West Branch of Chester Creek. The southern part of the woods immediately north of Old Mill Road is old pasture and very weedy. However, several hundred yards north of Old Mill Road, the woods becomes more mature and loses its weedy character. The woods is locally significant because it is one of the few remnant pieces of woodland in the area, is fairly mature, and is not over-run with exotics. Furthermore, the woods may contain a rare wilflower species. At present, a 90- to 100-foot closed canopy of beech, tulip tree, and red oak shades the valley. In places, the woods has a parklike quality. The patchy shrub layer includes abundant spicebush, witch hazel, maple-leaf viburnum, and hazelnut (Corylus sp.). The diverse herb layer contains mayapple, smooth Solomon's seal (Polygonatum biflorum), bloodroot, yellow trout-lily, wild geranium (Geranium maculatum), Virginia spring beauty, toothwort, Christmas fern, and jack-in-the-pulpit. Homeowners bordering the woodland should refrain from cutting down trees along the woodland edge as this activity will encourage the spread of light-loving weedy species into the forest.

Brandywine Battlefield State Park (Birmingham Twp.) and **Camp Sunshine** (Thornbury Twp.) are two additional managed areas on the West Chester quadrangle.

USGS QUADRANGLE MAP: Wilmington North

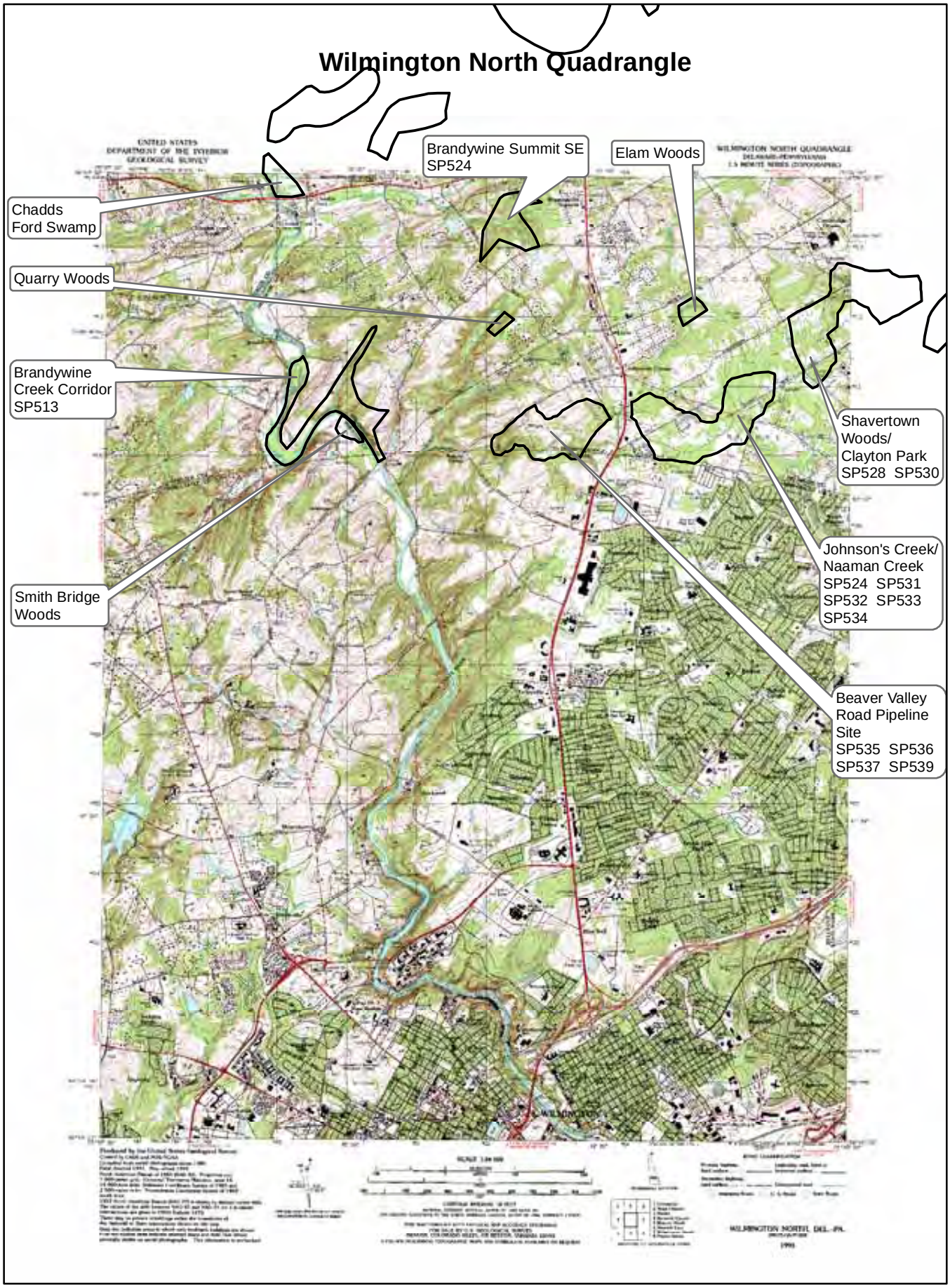
		TNC Rank*		Legal Status*		Last	
		Global	State	Fed.	State	Seen	Quality**
NATURAL COMMUNITIES: None identified.							
SPECIAL PLANTS:	513	G5	S3	N	PR	4-26-1991	C
	517	G5	S2	N	TU	8-24-1990	B
	520	G5	S3	N	N	10-06-1989	D
	521	G5	S1	N	PE	10-06-1989	E
	522	G5	S2	N	N	4-17-1991	B
	523	G5	S1	N	PE	7-16-1990	D
	524	G4G5	S2	N	PR	2-1990	E
	525	G4G5	S2	N	PR	2-1990	E
	526	G4G5	S2	N	PR	4-17-1991	CD
	528	G5	S3S4	N	TU	07-02-94	D
	529	G5	S1S2	N	TU	10-01-95	BC
	530	G5	S1	N	PE	07-22-95	D
	531	G5	S2	N	TU	09-09-95	C
	532	G5	S3S4	N	TU	09-09-95	D
	533	G5	S1	B	PE	09-09-95	C
	534	G5	S1	N	PE	09-09-95	D
	535	G5	S2	N	TU	07-18-95	B
	536	G5	S1	N	PE	08-02-95	BC
	537	G5	S3	N	PE	08-22-95	C
	539	G5	S2S2	N	TU	10-05-96	B
	540	G5	S1	N	PE	10-05-96	B
SPECIAL ANIMALS:	508	G5	S2	N	PE	8-05-1981	U

OTHER: Quarry Woods, Brandywine Creek Corridor, Shavertown Woods, Elam Woods, Brandywine Battlefield State Park.

* Please refer to Appendix I for an explanation of Ranks and Legal Status.

** Please refer to Appendix II for Quality ranks.

Wilmington North Quadrangle



Wilmington North Quadrangle:

Delaware County extends across the northern part of the Wilmington North quadrangle which lies in the Piedmont Uplands. The two main rock types of the area are mafic gneiss and schist with scattered pegmatite dikes. A patch of Coastal Plain sands and gravels lies atop the crystalline bedrock and extends from the vicinity of Johnsons Corner south into the State of Delaware.

JOHNSONS CORNER QUARRY AND WOODS (Bethel and Concord Twps.) is located southeast of Johnsons Corner. For many years, sands and gravels (coastal plain deposits) were quarried from the area leaving behind a wet, sandy irregular surface. This provided habitat for several species of Coastal Plain plants to colonize. These species are found in abundance on the Coastal Plain of New Jersey, but are very rare in Pennsylvania. Five species of special concern that have a Coastal Plain affinity grow in sandy, wet depressions south and north of Pyle Road. One depression supports **SP522**, a good population of a wildflower with an S2 rank, **SP520**, a state-endangered rush, and **SP521**, a rush with an S3 rank. Scattered young red maple (Acer rubrum) and sweetgum (Liquidambar styraciflua), steeplebush (Spiraea tomentosa), small-headed beaked rush (Rhynchospora capitellata), cranberry (Vaccinium macrocarpon), and peat moss (Sphagnum spp.) are associates of the rare plants. Common reed (Phragmites australis) is invading and should be removed to maintain the open light conditions needed by the plants. Nearby, a second wet depression supports a good population of a clubmoss (**SP517**) whose state status is Tentatively Undetermined. Off-road vehicular traffic in this second depression should be curtailed.

A state-rare wildflower (**SP526** - Bethel Twp.) grows in the rocky woods southeast of the quarry. The mature forest consists of 80- to 90-foot beech (Fagus grandifolia), tulip tree (Liriodendron tulipifera), shagbark hickory (Carya ovata), and white oak (Quercus alba) with a shrub layer of spicebush (Lindera benzoin), arrowwood (Viburnum dentatum), and maple-leaf viburnum (Viburnum acerifolium), and a sparse herb layer of mayapple (Podophyllum peltatum), yellow trout-lily (Erythronium americanum), and Virginia spring beauty (Claytonia virginica). The rare wildflower appears secure at present. Dumping of brush and grass clippings near the southern edge of the woods is not affecting the plant at present, but should not extend further into the forest. Adding to the importance of the woods is the wildlife habitat that it provides for various birds, including red-bellied woodpeckers which inhabit the dead trees scattered in the woods. Protection of the woods is important in this fast-suburbanizing area.

On the north side of Pyle Road (Bethel Twp.), **SP523**, a state-endangered wildflower, grow in scraped areas with early successional trees and shrubs. In late summer, one can see a spectacular display of yellow-flowering beggarticks (Bidens aristosa) covering sandy mounds along with the less obvious wild bean (Strophostyles umbellata) and bush clover (Lespedeza intermedia). Wild bean, like the species of concern, has a Coastal Plain affinity and is rather rare in Pennsylvania.

To maintain the plants at the site, development and off-road vehicular traffic must be controlled. Consideration should also be given to controlling succession, the natural process of vegetation structure and species composition change through time. To maintain the open light

conditions favored by the rare plants, woody vegetation and invading common reed will have to be removed.

SA508 (Birmingham Twp.) marks the population of a state-endangered animal that was last observed in 1981 in a large wetland on the east side of Brandywine Creek at Chadds Ford. Although the species has not been seen recently, it may still inhabit the site based on the availability of habitat. The wetland, a mosaic of forest, scrub/shrub, and robust emergent marsh, is owned and managed by The Brandywine Conservancy. In forested areas, black willow (Salix nigra), silver maple (Acer saccharinum), box elder (Acer negundo), red maple, ash (Fraxinus spp.), and pin oak (Quercus palustris) form an open canopy. Silky dogwood (Cornus amomum) and rose (Rosa palustris and R. multiflora) are the dominant shrubs of the wetland and commonly clump to form impenetrable thickets. The herb layer is very diverse with a rich assortment of forbs, grasses, and graminoids. Dominant forbs include jewelweed (Impatiens capensis), tearthumbs (Polygonum sagittatum and P. arifolium), skunk cabbage (Symplocarpus foetidus), sensitive fern (Onoclea sensibilis), arrowhead (Sagittaria latifolia), and bur reed (Sparganium eurycarpum) which forms large patches. Cattail (Typha latifolia), sweetflag (Acorus calamus), soft rush (Juncus effusus), great rush (Scirpus tabernaemontani), reed canary grass (Phalaris arundinacea), and rice cutgrass (Leersia oryzoides) are among the assortment of graminoids and grasses growing in the wetland. The variety of plants and mix of wetland types provides for a diversity of animals. Red-bellied woodpecker, tufted titmouse, American crow, indigo bunting, gray catbird, redwing blackbird, great blue heron, and common egret were observed in late June. Migratory waterfowl probably utilize the habitat in spring and fall. The expanses of cattail and burreed may be utilized by black and Virginia rails and the American and least bittern although these birds were not observed during the survey. Benign ownership of the wetland has maintained the site in a fairly natural, undisturbed, non-weedy state. A boardwalk provides access to the interior of the wetland, enhancing its recreational and educational value. Furthermore, the wetland is very scenic and adds to the pastoral richness of the Brandywine Creek valley.

SP524 (Birmingham Twp.) is a small population of a state-rare wildflower growing in a mature forest cloaking a small valley adjacent to Harvey Run. The upper part of the valley where the stream is most deeply incised is in very good shape and should be maintained in an undisturbed condition. A tall closed canopy (90-to 100-feet) of beech, tulip tree, and red oak (Quercus rubra) shades the understory in which maple-leaved viburnum, witch hazel (Hamamelis virginiana), and arrowwood grow. Mayapple, Christmas fern (Polystichum acrostichoides), jack-in-the-pulpit (Arisaema triphyllum), and additional species comprise the herb layer. Skunk cabbage, violets (Viola spp.), and jewelweed grow in scattered seeps emanating from the valley walls. An unknown portion of the wooded valley is owned by a camp located on the eastern side of the creek. A trail paralleling the creek provides easy access to the forest. In addition to the species of special concern, the forest is significant for its maturity, lack of exotic species, representation of the native forest, educational and recreational value, and wildlife habitat. Moving further downstream and onto the surrounding uplands, the woods becomes younger and very weedy. Although these areas are less desirable, they are still important to maintain in a wooded condition to act as buffer for the central mature section.

SP525 (Birmingham Twp.) is a small population of a state-rare wildflower growing along a

tributary to Beaver Creek near the Pennsylvania-Delaware state line.

SP513 (Birmingham Twp.) marks a fair population of a state-rare wildflower growing on a wooded south-facing slope that rises above the Brandywine Creek. The plant grows under a canopy of beech and a patchy shrub layer of spicebush with a diversity of spring-blooming wildflowers including wild ginger (Asarum canadense), Virginia spring beauty, cut-leaved toothwort (Dentaria laciniata), mayapple, smooth yellow violet (Viola pensylvanica), and bluebells (Mertensia virginica). The site is relatively undisturbed by human activity. The main threat to the population is invasion of exotics such as garlic mustard (Alliaria petiolata), which is abundant in the creek valley and Japanese honeysuckle (Lonicera japonica). The site is privately-owned and appears secure into the foreseeable future.

QUARRY WOODS (Birmingham Twp.) is a locally significant site having high priority for protection. A grove of very large beech and oak trees grows in a relatively small area on the northwest-facing slope of a valley that was heavily disturbed by past mining. A tributary to Beaver Creek flows in the valley. Although sufficient time has elapsed for the valley to become forested, it is very young and weedy. In striking contrast is the mature stand of hardwoods growing on the slope. Shade and intense deer browse have combined to produce a sparse understory that appears park-like. Elsewhere in the area, a tangled, impenetrable mass of early-successional vines and shrubs characterizes the understory. The old-growth stand should be protected from logging and development. Serious consideration should be given to setting the stand aside as parkland for the enjoyment of future generations. This patch contains some of the largest and, presumably most mature, beech and oak in the county.

BRANDYWINE CREEK CORRIDOR (Birmingham Twp.) refers to a relatively undisturbed stretch of creek extending from Rocky Hill Road south to Smith Bridge. A variety of habitats including floodplain forests and mesic to xeric wooded slopes, such as the one on which **SP513** grows, occur within the corridor. Two large floodplain forests are among the most extensive and least disturbed in the county. A 50- to 60-foot canopy of ash (Fraxinus spp.), box elder, and silver maple, a spicebush shrub layer, and an herb layer dominated by stinging nettle (Urtica dioica), garlic mustard, avens (Geum sp.), Japanese honeysuckle, and poison ivy (Toxicodendron radicans) typify the floodplain forests. Although the herb layer is dull and weedy in mid-summer, it is brilliant in spring with assorted spring ephemerals including the bluebell. Scattered ephemeral ponds supporting arrow arum (Peltandra virginica) serve as breeding grounds for reptiles and amphibians. The levee, adjacent to the creek and extending along it, supports some impressive trees including sycamore (Platanus occidentalis), tulip tree, basswood (Tilia americana), and pin oak. Steep wooded slopes along the creek support mature beech and oak (Quercus spp.) and add to the overall diversity of wildlife habitat. The most significant feature of the corridor is the diversity of wildlife it supports. In late June, PSO biologists observed the red-eyed vireo, barn swallow, wood thrush, least flycatcher, cedar waxwing, red-bellied woodpecker, northern cardinal, veery, great blue heron, gray catbird, belted kingfisher, tufted titmouse, Carolina wren, white-breasted nuthatch, and ruby-throated hummingbird in a survey of the corridor.

SHAVERTOWN WOODS (Concord Twp.) is a locally significant site having low priority for protection. It has some potential for supporting plant species of special concern and is relatively mature, free of exotic species, and of moderate visual appeal. The woods located south of the intersection of Bethel Road and Shavertown Road has an 80-foot closed canopy of beech, tulip tree, red maple, and red oak. Spicebush with some maple-leaved viburnum and witch hazel composes the shrub layer. The herb layer includes mayapple, yellow trout-lily, dwarf ginseng (Panax trifolium), cut-leaved toothwort, violets (Viola affinis, V. rotundifolia), jack-in-the-pulpit, Virginia spring beauty, and assorted sedges, ferns, and summer-flowering herbs. Although rotten stumps indicate past logging, there has been little recent disturbance of the forest. This small woodland fragment provides a refuge for native plant and animal species and should remain undisturbed.

SP528, SP530 -NEW, UPDATE- (Bethel and Concord Twps) "Shavertown Woods"
locally significant area in the original NAI. Two plant species of concern have since been found nearby. A poor-quality population of a plant species **(SP528)** with a state status of Tentatively Undetermined was found in 1995, in a wet thicket adjacent to a powerline cut. Associated plants include red maple (*Acer rubrum*), southern arrow-wood (*Viburnum dentatum*), pinxter flower (*Rhododendron periclymenoides*), winterberry (*Ilex verticillata*), spicebush (*Lindera benzoin*), greenbriar (*Smilax rotundifolia*), black cherry (*Prunus serotina*), skunk cabbage (*Symplocarpus foetidus*), and various sedges (*Carex spp.*) and goldenrods (*Solidago spp.*) Some dumping has occurred in this wetland. A single individual of a PA-Endangered plant species, **SP530**, was found growing in an old field south of Shavertown Woods. Sweet-gum seedlings (*Liquidambar styraciflua*), dewberry (*Rubus flagellaris*), hardhack (*Spiraea tomentosa*), dogbane (*Apocynum cannabinum*), and grasses are the dominant vegetation. Maintaining the oldfield and the powerline R.O.W. by late season mowing would benefit the species of concern. The buffer area for this site joins that of Clayton County Park (**SP513, SP528**) on the Marcus Hook quadrangle (1998 update).

ELAM WOODS (Concord Twp.) is a moderately mature beech-dominated forest having low priority for protection at the local level. The woods is fairly typical of the region with beech, tulip tree, and oaks dominating the canopy, and maple-leaf viburnum and spicebush in the shrub layer. Herbaceous plants include New York fern (Thelypteris noveboracensis), mayapple, jack-in-the-pulpit, and Indian cucumber root (Medeola virginiana). As the forest becomes surrounded by development, its importance as a refuge for the native flora and fauna increase. A long-time neighbor of the woods referred to it as "primeval" and commented on the assortment of spring-blooming wildflowers that flourish in its herb layer. Local residents use the area for recreation as evidenced by numerous trails. ATV use should be minimized as it causes trail erosion. Logging of the forest should be avoided since opening of the canopy encourages weedy species now mostly found in scattered gaps.

SP529, SP531, SP532, SP533, SP534 -NEW - (Bethel and Concord Twps.) "Namaan Creek Road Site"
early successional woods along Namaan Creek Road. Five plant species of concern occur at the site. These species require open conditions and occur in several disturbed or edge habitats at the site. A fair to good-quality population of **SP529** occurs in an active pasture, associated with goldenrods (*Solidago*

rugosa, S. nemoralis), aster (*Aster lateriflorus*), beak-rush (*Rhynchospora capitellata*), tickseed-sunflower (*Bidens polylepis*), and grasses (*Panicum spp.* and others). The population appears to be doing well despite some grazing pressure from horses. A fair quality population of **SP531** occurs in a retention basin along Namaan Creek Road, associated with sweet-gum (*Liquidambar styraciflua*) seedlings, spike-rushes (*Eleocharis spp*), beak-rush, soft rush and other rushes (*Juncus effus, J. tenuis, J. marginatus, J. acuminatus*). A poor-quality population of **SP532** occur in a young sweet-gum and red maple (*Acer rubrum*) woods. Associated species include red maple, sweet-gum, black-gum (*Nyssa sylvatica*), highbush blueberry (*Vaccinium corymbosum*), southern arrow-wood (*Viburnum dentatum*), and partridgeberry (*Mitchella repens*). Natural succession to more mature forest is a threat to this population. **SP533**, a PA-Endangered plant species, occurs in a wet meadow/ thicket at the edge of a young woods. Goldenrods, grasses, beggar tick-seed, sweet-gum, and the exotic shrub multiflora rose (*Rosa multiflora*) are associated vegetation. Another PA-Endangered plant, **SP534**, occupies a shallow ditch at the edge of the same woods. This is a poor-quality population, growing underneath black-gum, maleberry, and chokeberry, and associated with panic-grass (*Panicum dichotomum*), beak-rush, and sphagnum moss (*Sphagnum*).

Development or other disturbances such as off-road traffic are threats to the persistence of these species of concern which have persisted in small pockets of habitat amidst residential areas. The effects of natural succession should also be monitored, as management may be necessary to maintain the open conditions favored by these rare species. The buffer area for this site has been combined with that for the nearby Johnsons Corner Quarry and Woods site (1998 update).

SP535, SP536, SP537, SP539, SP540 -NEW- (Bethel and Concord Twps) "Beaver Valley Road Pipeline Site"

Five new plant species of concern were found in the Beaver Creek Valley. **SP535** and **SP536** both occur in a moist, open area of a powerline cut, dominated by sedges, rushes, goldenrods, milkweed, and mountain-mint. **SP537** occurs in similar habitat north of the pipeline cut at the top of a southeast-facing slope. Encroachment by shrubs and vines such as oriental bittersweet and japanese honeysuckle are threats to **SP537**. A good-quality population of a PA-Endangered plant species, **SP540**, is found in a low wet meadow in partial light. Associated plant species include red maple (*Acer rubrum*), winterberry (*Ilex verticillata*), marsh fern (*Thelypteris palustris*), cinnamon fern (*Osmunda cinnamomea*), stilt grass (*Microstegium vimineum*, heal-all (*Prunella vulgaris*), sedges (*Carex spp.*), and violets (*Viola spp.*). Finally, a good-quality population of **SP539** is found in a wet, lower-slope meadow on the pipeline R.O.W., associated with goldenrod (*Solidago spp.*), aster (*Aster spp.*), heal-all, hyssop skullcap (*Scutellaria integrifolia*), little bluestem (*Schizachrium scoparium*), stilt grass, and field beadgrass (*Tofieldia glutinosa*).

The species of concern at this site all require open conditions such as those found along the pipeline R.O.W. Maintaining the pipeline R.O.W. by annual, late season mowing, rather than summer mowing or herbicide use, will allow these species to persist (1998 update).

Brandywine Battlefield State Park (Birmingham Twp.) is a managed area on the Wilmington North quadrangle.

USGS QUADRANGLE MAP: Woodbury

		TNC Rank*		Legal Status*		Last	
		Global	State	Fed.	State	Seen	Quality**
NATURAL COMMUNITIES: None identified.							
SPECIAL PLANTS:	501	G5	S3	N	PR	9-09-1991	C
SPECIAL ANIMALS:	505	G5	S2	N	PT	6-01-1987	U
	511	G5	S1	N	PE	6-01-1991	E
	512	G5	S2	N	N	6-01-1991	E
	513	G5	S2	N	PE	9-09-1991	E

OTHER: None identified.

* Please refer to Appendix I for an explanation of Ranks and Legal Status.

** Please refer to Appendix II for Quality ranks.

Woodbury Quadrangle

Woodbury Quadrangle:

A small, heavily disturbed portion of Delaware County covers the northwestern corner of the Woodbury quadrangle. The Philadelphia International Airport with its myriad runways and mown fields covers the northern area. To the south, the Delaware River shoreline has been extensively manipulated for industrial use. Despite the heavy hand of man, several species of concern inhabit the area.

Three bird species of special concern occur on the Woodbury quadrangle (Tinicum Twp.). **SA505** marks the approximate location of a grassy area on airport property where a state-threatened bird species last nested in 1987. **SA511** marks the approximate location of a 1991 nesting pair of a state-endangered bird species. A pair has nested at the same site for the last ten years according to a local bird expert. In approximately the same area, one pair of a species considered imperiled at the state level (S2) by The Nature Conservancy nested in 1991. Two pairs of the same species nested here in 1990.

SA513 (Tinicum Twp.) is a state-endangered animal inhabiting an open water body that was created by the Army Corps of Engineers north of Hog Island Road. **SP501**, a robust state-rare plant species, grows along the edge of this water body in association with purple loosestrife (Lythrum salicaria), common reed (Phragmites australis), and cattail (Typha sp.). The surrounding uplands provide suitable conditions for **SA513** which requires dry sandy soil for nesting. The animal will probably continue to utilize the site as long as the area is left alone. The individual observed at the site is part of the regional population which includes **SA586** found on Little Tinicum Island on the Bridgeport quadrangle and **SA502** found in the John Heinz National Wildlife Refuge at Tinicum on the Lansdowne quadrangle.

SP501 (Tinicum Twp.) occurs in scattered tidal wetland fragments along the Delaware River. The plants observed on the Woodbury quadrangle are part of the regional population which includes **SP587** found at scattered sites on the Bridgeport quadrangle. The plant is a ready colonizer of the upper intertidal zone and should continue to be found in the area as long as some habitat remains.

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APPENDICES

APPENDIX I. FEDERAL AND STATE STATUS, AND NATURE CONSERVANCY RANKS

FEDERAL STATUS

U.S. FISH AND WILDLIFE SERVICE CATEGORIES OF ENDANGERED AND THREATENED PLANTS AND ANIMALS

The following definitions are extracted from the September 27, 1985 U.S. Fish and Wildlife Service notice in the Federal Register:

LE--Taxa formally listed as endangered.

LT--Taxa formally listed as threatened.

PE--Taxa proposed to be formally listed as endangered.

PT--Taxa proposed to be formally listed as threatened.

S--Synonyms.

C1--Taxa for which the Service currently has on file substantial information on biological vulnerability and threat(s) to support the appropriateness of proposing to list them as endangered or threatened species.

C2--Taxa for which information now in possession of the Service indicates that proposing to list them as endangered or threatened species is possibly appropriate, but for which substantial data on biological vulnerability and threat(s) are not currently known or on file to support the immediate preparation of rules.

C3--Taxa that are no longer being considered for listing as threatened or endangered species. Such taxa are further coded to indicate three categories, depending on the reason(s) for removal from consideration.

- 3A - Taxa for which the Service has persuasive evidence of extinction.
- 3B - Names that, on the basis of current taxonomic understanding, usually as represented in published revisions and monographs, do not represent taxa meeting the Act's definition of "species".
- 3C - Taxa that have proven to be more abundant or widespread than was previously believed and/or those that are not subject to any identifiable threat.

N--None; the species has not been considered for federal protection.

Appendix I (Continued.)

STATE STATUS

PLANTS:

PE - Pennsylvania Endangered - A classification of plant species which are in danger of extinction throughout most or all of their natural range within this Commonwealth, if critical habitat is not maintained or if the species is greatly exploited by man. This classification shall also include any populations of plant species that have been classified as Pennsylvania Extirpated, but which subsequently are found to exist in this Commonwealth.

PX - Pennsylvania Extirpated - A classification of plant species
believed by the Department to be extinct within this Commonwealth. These plant species may or may not be in existence outside this Commonwealth. If plant species classified as Pennsylvania Extirpated are found to exist, the species automatically will be considered to be classified as Pennsylvania Endangered.

PR - Pennsylvania Rare - A classification of plant species which are uncommon within this Commonwealth. All species of native wild plants classified as Disjunct, Endemic, Limit of Range and Restricted are included within the Pennsylvania Rare classification.

PT - Pennsylvania Threatened - A classification of plant species which may become endangered throughout most or all of their natural range within this Commonwealth, if critical habitat is not maintained to prevent further decline in this Commonwealth, or if the species is greatly exploited by man.

PV - Pennsylvania Vulnerable - A classification of plant species which are in danger of population decline within Pennsylvania because of their beauty, economic value, use as a cultivar, or other factors which indicate that persons may seek to remove these species from their native habitats.

TU - Tentatively Undetermined - A classification of plant species which are believed to be in danger of population decline, but which cannot presently be included within another classification due to taxonomic uncertainties, limited evidence within historical records, or insufficient data.

N - None - A classification of plant species which are believed to be endangered, rare, or threatened, but which have not yet been included within another classification due to delays created by required regulatory review processes.

Appendix I (Continued.)

ANIMALS:

The following state statuses are used by the Pennsylvania Game Commission and the Pennsylvania Fish Commission for animal species.

LE - Listed Endangered

Game Commission - Species in imminent danger of extinction or extirpation throughout their range in Pennsylvania if the deleterious factors affecting them continue to operate. These are: 1) species whose numbers have already been reduced to a critically low level or whose habitat has been so drastically reduced or degraded that immediate action is required to prevent their extirpation from the Commonwealth; or 2) species whose extreme rarity or peripherality places them in potential danger of precipitous declines or sudden extirpation throughout their range in Pennsylania; or 3) species that have been classified as "Pennsylvania Extirpated", but which are subsequently found to exist in Pennsylvania as long as the above conditions 1 or 2 are met; or 4) species determined to be "Endangered" pursuant to the Endangered Species Act of 1973, Public Law 93-205 (87 Stat. 884), as amended.

Fish Commission - Endangered Species are all species and subspecies of fish[1] which: (1) have been declared by the Secretary of the United States Department of the Interior to be threatened with extinction and appear on the Endangered Species List or the Native Endangered Species list published in the Federal Register; or, (2) have been declared by the Executive Director (PaFC) to be threatened with extinction and appear on the Pennsylvania Endangered Species List published in the Pennsylvania Bulletin.

LT - Listed Threatened

Game Commission - Species that may become endangered within the foreseeable future throughout their range in Pennsylvania unless the causal factors affecting the organism are abated. These are: 1) species whose populations within the Commonwealth are decreasing or have been heavily depleted by adverse factors and while not actually endangered, are still in critical condition; or 2) species whose populations may be relatively abundant in the Commonwealth but are under severe threat from serious adverse factors that have been identified and documented; or 3) species whose populations are rare or peripheral and in possible danger of severe decline throughout their range in Pennsylvania; or 4) species determined to be "Threatened" pursuant to the Endangered Species Act of 1973, Public Law 93-205

Appendix I (Continued.)

(87-Stat. 884), as amended, that are not listed as "Pennsylvania Endangered".

Fish Commission - Threatened Species are all species and subspecies of fish[1] which:

(1) have been declared by the Secretary
of the United States Department of the Interior to be in such small numbers throughout their range that they may become endangered if their environment worsens and appear on a Threatened Species List published in the Federal Register; or, (2) have been declared by the Executive Director (PaFC) to be in such small numbers throughout their range that they may become endangered if their environment worsens and appear on the Pennsylvania Threatened Species List published in the Pennsylvania Bulletin.

N - None - A classification of animal species which have not been considered for protection under state regulations.

[1] The word "fish" when used as a noun in this context includes all game fish, fish bait, bait fish, amphibians, reptiles, and aquatic organisms.

Appendix I (Continued.)

GLOBAL ELEMENT RANKS

G1 = Critically imperiled globally because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extinction.

G2 = Imperiled globally because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extinction throughout its range.

G3 = Either very rare and local throughout its range or found locally (even abundantly at some of its locations) in a restricted range or because of other factors making it vulnerable to extinction throughout its range; in terms of occurrences, in the range of 21 to 100.

G4 = Apparently secure globally, though it may be quite rare in parts of its range, especially at the periphery.

G5 = Demonstrably secure globally, though it may be quite rare in parts of its range, especially at the periphery.

GH = Of historical occurrence throughout its range, i.e., formerly part of the established biota, with the expectation that it may be rediscovered (e.g., Bachman's Warbler).

GU = Possibly in peril range wide but status uncertain; need more information.

GX = Believed to be extinct throughout its range (e.g., Passenger Pigeon) with virtually no likelihood that it will be rediscovered.

Appendix I (Concluded.)

STATE ELEMENT RANKS

S1 = Critically imperiled in state because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extirpation from the state.

S2 = Imperiled in state because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extirpation from the state.

S3 = Rare or uncommon in state (on the order of 21 to 100 occurrences.

S4 = Apparently secure in state, with many occurrences.

S5 = Demonstrably secure in state and essentially in eradicable under present conditions.

SA = Accidental in state, including species which only sporadically breed in the state.

SE = An exotic established in state; may be native elsewhere in North America (e.g., house finch).

SH = Of historical occurrence in the state with the expectation that it may be rediscovered.

SN = Regularly occurring, usually migratory and typically nonbreeding species for which no significant or effective habitat conservation measures can be taken in the state.

SR = Reported from the state, but without persuasive documentation which would provide a basis for either accepting or rejecting (e.g., misidentified specimen) the report.

SRF = Reported falsely (in error) from the state but this error persisting in the .

SU = Possibly in peril in state but status uncertain; need more information.

SX = Apparently extirpated from the state.

APPENDIX II Pennsylvania Natural Diversity Element Occurrence Quality-Ranks

Quality Rank*	Explanation
A	Excellent occurrence: all A-rank occurrences of an element merit quick, strong protection. An A-rank community is nearly undisturbed by humans, or has nearly recovered from early human disturbance; it is further distinguished by being an extensive, well-buffered, etc. occurrence. An A-rank population of a sensitive species is large in area and number of individuals, stable, it not growing, shows good reproduction, and exists in natural habitat.
B	Good occurrence: protection of the occurrence is important to the survival of the element in Pennsylvania, especially if very few or no A-rank occurrences exist. A B-rank community is still recovering from early disturbance or recent light disturbance but eventually will reach A-rank, or it is nearly undisturbed or nearly recovered from disturbance but is less than A-rank because of significantly smaller size, poorer buffer, etc. A B-rank population of a sensitive species is at least stable, in a minimally disturbed habitat, and of moderate size and number.
C	Fair occurrence: protection of the occurrence helps conserve the diversity of a region's or county's biota and is important to state-wide conservation if no higher-ranked occurrences exist. A C-rank community is in an early stage of recovery from disturbance, or its structure and composition have been altered such that the original vegetation of the site will never rejuvenate, yet with management and time partial restoration of the community is possible. A C-rank population of a sensitive species is in a clearly disturbed habitat, small in size and/or number, and possibly declining.
D	Poor occurrence: protection of the occurrence may be worthwhile for historical reasons or only if no higher ranked occurrences exist. A D-rank community is severely disturbed, its structure and composition been greatly altered, and recovery to original conditions, despite management and time, essentially will not take place. A D-rank population of a sensitive species is very small with a high likelihood of dying out or being destroyed, and exists in a highly disturbed and vulnerable habitat.
E	Verified as extant, but has not been given a rank.
U	Status is unknown; availability of habitat and recent observance suggests that species may still inhabit area.

* Intermediate ranks may also be assigned.

APPENDIX III POTENTIAL NATURAL AREA SURVEY FORM
THE NATURE CONSERVANCY

COUNTY:_____NO.
QUADNAME/CODE:

Site Name:_____ PHOTO NO./DATE:
Location:_____ Township:

Air Survey Surveyors:_____ Date:

FOREST AGE			CUTTING			GRAZING			RECVRY POT			PRIORITY*		
yng	mat	old	lt	hvy	clr	lt	mod	hvy	gd	fr	pr	hi	med	lo
Wetland														
Marsh														
Meadow														
Shrub														
Seep														
Fen														
Bog														
Pond Shore														
Conifer														
Hdw-Cnfr														
Hardwood														
Floodpln														
Upland														
Ser Barr														
Gras Land														
Lim Barr														
Rck Glade														
Pine Sav														
Oak Sav														
Pine For														
Oak For														
Hdw For														
Hdw-Cnfr														
Cliff														

*E=Eliminate

Ground Survey Surveyors:_____ Date:

Community Type	Eliminate	No	Natural	Quality-Rank

Appendix III (concluded.)

Comment:

THE NATURE CONSERVANCY
POTENTIAL NATURAL AREAS SURVEY FORM--NATURAL COMMUNITY

NATURAL COMMUNITY (C rank or better)
Map the exact boundary around ranked portions of natural community.
EO-RANK:_____WHY?

COMMON PLANTS (or attach species list):

OTHER PLANTS:

DOMINANTS OF THE PLANT COMMUNITIES (PC) IN THE NATURAL COMMUNITY:
1.
2.
3.
4.
SIGNS OF DISTURBANCE:

SPECIAL PLANT (map) FREQUENCY/HOW MANY? IN HOW MUCH AREA PC#

ANIMALS:

Surveyor:_____ Address & Phone

Date of Observation_____Site Name

Quadrangle Name_____ Exact Location of
Site (please be specific & include a map or sketch)

Owner:
Owners Attitude Toward Conservation:

Site Elevation:_____ Size of Site (acres):

Source of Lead:

Current Land Use:

Type of Area: _Old Growth Forest; __Marsh; __Shrub Swamp;
__Forested Swamp; __Bog; __Natural Pond.
Written Description: Try to convey a mental image of the site features (including vegetation, significant animals & plants,aquatic features, land forms, geologic substrata, scenic qualities, etc.):

Evidence of Disturbance:

Site Condition Compared to Your Last Visit:

Please attach any additional information, species list, etc.
Please send completed report forms to Pennsylvania Science Office of The Nature Conservancy,
34 Airport Drive, Middletown, PA 17057
(717)948-3962.
Additional forms may be obtained from this office. Thank you for your contribution.

APPENDIX V. CLASSIFICATION OF NATURAL COMMUNITIES IN PENNSYLVANIA
(DRAFT)

COMMUNITY NAME	MAP	GLOBAL	STATE
ESTUARINE COMMUNITIES			
DEEPWATER SUBTIDAL COMMUNITY	EAA	G?	S1
SHALLOW-WATER SUBTIDAL COMMUNITY	EAB	G?	S1
FRESHWATER INTERTIDAL MUDFLAT	EBA	G3G4	S1
FRESHWATER INTERTIDAL MARSH	ECA	G3G4	S1
RIVERINE COMMUNITIES			
LOW-GRADIENT EPHEMERAL/INTERMITTENT CREEK	RAA	G?	S5
LOW-GRADIENT CLEARWATER CREEK	RAB	G?	S3S4
LOW-GRADIENT CLEARWATER RIVER	RAC	G?	S2S3
LOW-GRADIENT BROWNWATER CREEK	RAD	G?	S2S3
MEDIUM-GRADIENT EPHEMERAL/INTERMITTENT CREEK	RBA	G?	S5
MEDIUM-GRADIENT CLEARWATER CREEK	RBB	G?	S3
MEDIUM-GRADIENT CLEARWATER RIVER	RBC	G?	S?
MEDIUM-GRADIENT BROWNWATER CREEK	RBD	G?	S3
HIGH-GRADIENT EPHEMERAL/INTERMITTENT CREEK	RCA	G?	S5
HIGH-GRADIENT CLEARWATER CREEK	RCB	G?	S3
HIGH-GRADIENT CLEARWATER RIVER	RCC	G?	S?
HIGH-GRADIENT BROWNWATER CREEK	RCD	G?	S?
WATERFALL AND PLUNGEPOOL	RDA	G?	S3S4
SPRING COMMUNITY	REA	G?	S1S2
SPRING RUN COMMUNITY	REB	G?	S1S2
LACUSTRINE			
GLACIAL LAKE	LAA	G?	S1
NONGLACIAL LAKE	LAB	G?	S2
ARTIFICIAL LAKE	LAC		
NATURAL POND	LBA	G?	S2S3
ARTIFICIAL POND	LBB		
NATURAL POOL	LCA	G?	S?
EPHEMERAL/FLUCTUATING NATURAL POOL	LCB	G?	S1
ARTIFICIAL POOL	LCC		
EPHEMERAL/FLUCTUATING LIMESTONE SINKHOLE	LCD	G?	S1

Appendix V (Continued.)

COMMUNITY NAME	MAP CODE	GLOBAL RANK*	STATE RANK*
PALUSTRINE COMMUNITIES			
ACIDIC BROADLEAF SWAMP	PAA	G5	S1S2
CIRCUMNEUTRAL BROADLEAF SWAMP	PAB	G?	S2S3
BOREAL CONIFER SWAMP	PAC	G?	S2
NORTHERN CONIFER SWAMP	PAD	G?	S3S4
BROADLEAF-CONIFER SWAMP	PAE	G?	S3S4
FLOODPLAIN SWAMP	PAF	G?	S1
CALCAREOUS SEEPAGE SWAMP	PAG	G?	S1
ACIDIC SHRUB SWAMP	PAH	G5	S3
CIRCUMNEUTRAL SHRUB SWAMP	PAJ	G?	S3
GRAMINOID MARSH	PBA	G?	S3
ROBUST EMERGENT MARSH	PBB	G?	S2
MIXED GRAMINOID-ROBUST EMERGENT MARSH	PBC	G?	S2S3
CALCAREOUS MARSH	PBD	G?	S1
GLACIAL BOG	PCA	G?	S2S3
NONGLACIAL BOG	PCB	G?	S3
RECONSTITUTED BOG	PCC		
SHRUB FEN	PDA	G2G3	S1
BASIN GRAMINOID-FORB FEN	PDB	G?	S1
HILLSIDE GRAMINOID-FORB FEN	PDC	G?	S1
CIRCUMNEUTRAL SEEP COMMUNITY	PEA	G?	S3?
CALCAREOUS SEEP COMMUNITY	PEB	G?	S1
ACIDIC SEEP COMMUNITY	PEC	G?	S3?
RIVERSIDE SEEP COMMUNITY	PED	G?	S2?
TERRESTRIAL COMMUNITIES			
BOREAL FOREST	TAA	G?	S?
NORTHERN CONIFER FOREST	TBA	G5	S3S4
NORTHERN HARDWOOD FOREST	TBB	G?	S3S4
NORTHERN HARDWOOD-CONIFER FOREST	TBC	G?	S3
XERIC CENTRAL HARDWOOD FOREST	TCA	G?	S5
XERIC CENTRAL CONIFER FOREST	TCB	G?	S3S4
XERIC CENTRAL HARDWOOD-CONIFER FOREST	TCC	G?	S3
PITCH PINE-SCRUB OAK BARRENS	TCD	G2G3	S1S2
DRY-MESIC ACIDIC CENTRAL FOREST	TCE	G?	S5

DRY-MESIC CALCAREOUS CENTRAL FOREST	TCF	G?	S2S3
MESIC CENTRAL FOREST	TCG	G?	S2
TALUS SLOPE FOREST	TCH	G?	S2?
COASTAL PLAIN FOREST	TEA	G?	S1
FLOODPLAIN FOREST	TFA	G?	S2
RIVER GRAVEL COMMUNITY	TGA	G?	S4S5
EASTERN SERPENTINE BARRENS	THA	G2	S1
APPALACHIAN SHALE BARREN	THB	G?	S1

COMMUNITY NAME	MAP CODE	GLOBAL RANK*	STATE RANK*
APPALACHIAN SAND BARREN	THC	G?	S?
BOULDER FIELD	THD	G?	S5
CALCAREOUS CLIFF COMMUNITY	THE	G?	S2
ACIDIC CLIFF COMMUNITY	THF	G?	S5
SHALE CLIFF COMMUNITY	THG	G?	S2
RIVERSIDE OUTCROP COMMUNITY	THJ	G?	S1S2
CALCAREOUS RIVERSIDE OUTCROP COMMUNITY	THJA	G?	S1
ACIDIC ROCKY SUMMIT COMMUNITY	THK	G?	S1S2
CALCAREOUS ROCKY SUMMIT COMMUNITY	THM	G?	S1
<u>SUBTERRANEAN COMMUNITIES</u>			
SOLUTION CAVE TERRESTRIAL COMMUNITY	SAA	G?	S3
SOLUTION CAVE AQUATIC COMMUNITY	SAB	G?	S3
TECTONIC CAVE COMMUNITY	SAC	G?	S3S4
TALUS CAVE COMMUNITY	SAD	G?	S2S4
<u>DISTURBED COMMUNITIES</u>			
BARE SOIL	DAA		
MEADOW/PASTURELAND	DAB		
CULTIVATED LAND	DAC		
SUCCESSIONAL FIELD	DAD		
YOUNG MISCELLANEOUS FOREST	DAE		
CONIFER PLANTATION	DAF		

* Not all natural communities have been assigned a global or state rank; disturbed and artificial communities are not assigned ranks.

Appendix V (Continued.)

The following is a brief description and list of species typically found in the natural communities of Delaware County.

Coastal Plain Forest (HTEA): A forest community occurring on the level, sandy to gravelly soils of the Coastal Plain in southeastern Pennsylvania.

Sweetgum (Liquidambar styraciflua)
Willow Oak (Quercus phellos)
Red Maple (Acer rubrum)
Common Persimmon (Diospyros virginiana)
Sweet Bay Magnolia (Magnolia virginiana)
Swamp-White Oak (Quercus bicolor)
White Oak (Quercus alba)
Beech (Fagus grandifolia)

Freshwater Intertidal Marsh (HECA): A marsh community influenced by the tides such that the substrate is regularly exposed and submerged. Freshwater vascular plants often with low rosette plants in the understory are dominant.

Indian Wild Rice (Zizania aquatica)
Cattail (Typha latifolia)
Arrowhead (Sagittaria latifolia)
Spatterdock (Nuphar luteum)
Arrow Arum (Peltandra virginica)
Waterhemp Ragweed (Amaranthus cannabinus)

Freshwater Intertidal Mudflat (HEBA): A community inhabiting the intertidal zone of estuarine bays, creeks, and major rivers and having a substrate that is regularly exposed and submerged. The muddy substrate is often exposed between the plants.

Spatterdock (Nuphar luteum)
Three-square (Scirpus pungens)
Indian Wild Rice (Zizania aquatica)
Waterhemp Ragweed (Amaranthus cannabinus)
Arrowhead (Sagittaria subulata)
Water Smartweed (Polygonum punctatum)

APPENDIX VI. SPECIAL PLANTS AND ANIMALS OF DELAWARE COUNTY

---------- PLANTS

SCIENTIFIC NAME	COMMON NAME
ALETRIS FARINOSA	COLIC-ROOT
AMARANTHUS CANNABINUS	WATERHEMP RAGWEED
APLECTRUM HYEMALE	PUTTYROOT
ASTER DEPAUPERATUS	SERPENTINE ASTER
CYNANCHUM LAEVE	SMOOTH SWALLOW-WORT
CYPERUS ENGELMANNII	ENGELMANN'S FLATSEDGE
CYPERUS ODORATUS	RUSTY FLATSEDGE
ECHINOCHLOA WALTERI	WALTER'S BARNYARD-GRASS
ELEOCHARIS OBTUSA VAR. PEASEI	WRIGHTS SPIKE-RUSH
ELEOCHARIS PARVULA	LITTLE-SPIKE SPIKE-RUSH
ELEPHANTOPUS CAROLINIANUS	ELEPHANT'S FOOT
EUTHAMIA TENUIFOLIA	GRASS-LEAVED GOLDENROD
FIMBRISTYLIS ANNUA	ANNUAL FIMBRY
HETERANTHERA MULTIFLORA	MULTIFLOWERED MUD-PLANTAIN
JUNCUS BIFLORUS	GRASS-LEAVED RUSH
JUNCUS DICHOTOMUS	FORKED RUSH
LYCOPODIUM APPRESSUM	A CLUBMOSS
PLUCHEA ODORATA	SALT-MARSH FLEABANE
PODOSTEMUM CERATOPHYLLUM	RIVERWEED
QUERCUS FALCATA	SPANISH OAK
SAGITTARIA CALYCINA VAR. SPONGIOSA	LONG-LOBED ARROW-HEAD
SAGITTARIA SUBULATA SUBULATA	ARROW-HEAD
SCIRPUS FLUVIATILIS	RIVER BULRUSH
SCIRPUS SMITHII	SMITH'S BULRUSH
SCLERIA PAUCIFLORA	FEW FLOWERED NUTRUSH
SENECIO ANONYMUS	PLAIN RAGWORT
SPIRANTHES VERNALIS	GRASSLEAF LADIES'-TRESSES
SPOROBOLUS HETEROLEPIS	PRAIRIE DROPSEED
TALINUM TERETIFOLIUM	ROUND-LEAVED FAME-FLOWER
TIPULARIA DISCOLOR	CRANEFLY ORCHID
ZANNICHELLIA PALUSTRIS	HORNED PONDWEED
ZIZANIA AQUATICA	INDIAN WILD RICE

ANIMALS

SCIENTIFIC NAME	COMMON NAME
ASIO FLAMMEUS	SHORT-EARED OWL
BARTRAMIA LONGICAUDA	UPLAND SANDPIPER
BOTAURUS LENTIGINOSUS*	AMERICAN BITTERN
CASMERODIUS ALBUS	GREAT EGRET
CIRCUS CYANEUS	NORTHERN HARRIER
CISTOTHORUS PALUSTRIS	MARSH WREN
IXOBRYCHUS EXILIS	LEAST BITTERN
NYCTICORAX NYCTICORAX*	BLACK-CROWNED NIGHT-HERON
PSEUDEMYS RUBRIVENTRIS	REDBELLY TURTLE
RALLUS ELEGANS*	KING RAIL
RALLUS LIMICOLA*	VIRGINIA RAIL
RANA UTRICULARIA	COASTAL PLAIN LEOPARD FROG
TYTO ALBA	BARN-OWL

* NESTING PAIRS OBSERVED IN PHILADELPHIA COUNTY.

LIFE HISTORY OF ANIMALS OCCURRING IN DELAWARE COUNTY

(Asio flammeus) short-eared owl

The short-eared owl breeds from northern Alaska to northern Labrador and south to California, Utah, Colorado, Missouri, Illinois, Ohio, and Virginia. It winters mostly from southern Canada to southern California, southern Mexico, the Gulf Coast, and Florida. The short-eared owl also occurs in the Old World, Hawaii, and Greater Antilles. In Pennsylvania, it is present statewide during migration and winters sporadically throughout the state in suitable habitat. There is only one breeding pair recorded within the state. The owl utilizes open country including meadows, marshes, and open woodland and nests on the ground in slight depressions. The owl hunts at dawn and dusk for small mammals, small birds, and insects. Clutch size ranges from four to seven.

(Bartramia longicauda) upland sandpiper

The upland sandpiper breeds from north-central Alaska to southern New Brunswick, south to eastern Washington, Idaho, Colorado, Texas, southern Illinois, Ohio, and Maryland. It winters in South America. In Pennsylvania, the upland sandpiper is present statewide during migration. Breeding pairs occur in the southern half and northwest corner of the state. The species utilizes grasslands, especially prairies, dry meadows, and pastures where it feeds on insects and other small terrestrial

invertebrates. It nests on the ground among grasses. A clutch of four eggs is laid between May and June. Young, incubated by both parents, hatch from 21 to 24 days later.

(Botaurus lentiginosus) American bittern

The American bittern's breeding range extends from southeastern Alaska to Newfoundland south to southern California, central Kansas, Mexico, and Florida. It winters from southwest British Columbia, northern Nevada, northern Texas, the Ohio valley, and New York south to Panama and the West Indies. In Pennsylvania, it is common statewide during migration. Breeding occurs mostly in the northern part of the state. The American bittern utilizes freshwater, brackish, and saltwater marshes, bogs, wet fields, and swamps. It eats mainly fishes, crayfishes, amphibians, insects, mice, and shrews. It lays its eggs in a platform nest hidden by vegetation and located just a few inches above the water. Clutch size ranges from two to six. The American bittern is mostly solitary, but may nest in loose colonies.

(Casmerodius albus) great egret

The great egret's breeding range extends from Oregon, Wisconsin, and Maine south to southern South America. In winter, it occurs north to North Carolina. The species also occurs in the Old World. In Pennsylvania, the great egret is present statewide during migration. Tens of breeding pairs occur within the state. During the day, the great egret forages for fishes, amphibians, snakes, snails, crustaceans, insects, and small mammals in marshes, swampy woods, tidal estuaries, lagoons, streams, lakes, ponds, fields, and meadows. It nests in tall trees near water usually with other colonial water birds. Clutch size ranges from one to six.

(Circus cyaneus) northern harrier

The northern harrier's breeding range extends from northern Alaska to northern Saskatchewan and southern Quebec south to northern Baja California, southern Texas, southern Missouri, West Virginia, and southeast Virginia. It winters from southern Canada to northern South America and the Antilles. It also occurs in the Old World. In Pennsylvania, it is present statewide during migration and is a casual resident in winter. Most breeding pairs occur in the southeast portion of the state, although some are also found in the Poconos. The northern harrier utilizes marshes, meadows, grasslands, and cultivated fields. It perches on the ground or on stumps or posts. It eats small mammals, frogs, small snakes, lizards, crayfishes, insects, small birds, and carrion. It usually flies low when hunting, capturing its prey on the ground. In the southeastern U.S., the species commonly eats mammals caught in freshwater marshes and birds caught in salt marshes. The northern harrier nests on the ground, in low shrubs, in tall weeds or reeds. Clutch size ranges from three to nine.

(Cistothorus palustris) marsh wren

The marsh wren is a species whose breeding range extends from central British Columbia across southern Canada to New Brunswick and south to southern California, northern Mexico, Texas, and Florida. The species winters in coastal areas throughout its breeding range and in the interior of North America from southern U.S. states to southern Mexico. In Pennsylvania, the marsh wren is present statewide during migration and is a casual winter resident. Most records of nesting pairs come from the southeast corner of the state. The marsh wren inhabits freshwater and brackish marshes and favors stands of cattail, reeds, and bulrush. It mainly eats insects. Clutch size ranges from three to ten. There are two, sometimes three, broods per year.

(Ixobrychus exilis) least bittern

The least bittern breeds from Oregon, Montana, southern Manitoba, southern Ontario, and New Brunswick south through Mexico, Central America, the Bahamas, and Antilles, to central South America. In the winter, it occurs from California, southern Texas, and Florida south to Colombia. In Pennsylvania, it is found statewide during migration. Breeding records come from about 12 counties scattered throughout the state. This species is very secretive which may account for the lack of records. The least bittern utilizes tall vegetation primarily in freshwater marshes and, less commonly, in coastal brackish marshes. It eats small fishes, amphibians, leeches, slugs, crustaceans, insects, and, occasionally, small mammals. It nests in dense vegetation typically less than one meter above the water or on the ground close to open water. Clutch size ranges from four to five.

(Nycticorax nycticorax) black-crowned night-heron

The black-crowned night heron's breeding range extends from Washington, southern Idaho, Saskatchewan, Minnesota, and Nova Scotia south to South America. In the winter, it ranges north to Oregon, Utah, New Mexico, Texas, the lower Ohio valley, the Gulf Coast, and southern New England. It also occurs in the Old World and on Pacific islands. In Pennsylvania, it is present statewide during migration. It is a casual resident in winter until open water freezes. Most breeding records come from the southeastern portion of the state. The black-crowned night heron utilizes marshes, swamps, wooded streams, lake shores, ponds, and lagoons. It tolerates salt, brackish, and fresh water conditions. It feeds opportunistically on fishes, amphibians, and invertebrates obtained in shallow water and on small mammals and young birds taken on land. Eggs are laid on platform nests in groves of trees near coastal marshes or on marine islands. Clutch size ranges from three to five.

(Pseudemys rubriventris) redbelly turtle

The redbelly turtle is a species that is distributed in the Mid-Atlantic coastal plain from southern New Jersey to North Carolina and westward along the Potomac River to eastern West Virginia. There is a

disjunct population in Plymouth County, Massachusetts. In Pennsylvania, the turtle was historically common along the Delaware River and its major tributaries and along the lower Susquehanna River. Habitat destruction and pollution have almost eliminated this species from those areas. The turtle inhabits relatively large deep water bodies including creeks, lakes, ponds, and marshes. The omnivorous turtle occurs in both freshwater and brackish conditions and prefers water bodies with soft, muddy bottoms and an abundance of aquatic vegetation. The redbelly turtle wanders on land in early spring and fall during the breeding period. It typically lays eggs in a nest dug in soft soil in an open area usually within 100 yards of water. It often nests in tilled or disturbed soil. A clutch of eight to twenty eggs is laid in June to July, hatching ten to fifteen weeks later. The turtle reaches sexual maturity in five to six years.

(Rallus elegans) king rail

The breeding range of the king rail extends from Minnesota across the northern United States and southern Ontario to southern New England and south to southern Texas, southern Louisiana, central Mississippi, central Alabama, and south Florida. It also occurs in Cuba, on the Isle of Pines, and in Mexico. It winters north to southern Texas and Florida. In Pennsylvania, the king rail is present in low numbers statewide during migration. Breeding records are from the southeastern part of the state. The king rail utilizes freshwater and brackish marshes and swamps. It forages in shallow water and on mudflats for crustaceans, insects, small fishes, seeds of weeds and aquatic plants, and grain. It nests on the ground, on grass tussocks or water-side vegetation, or builds on raised plants growing in shallow water. Clutch size ranges from six to fifteen.

(Rallus limicola) Virginia rail

The Virginia rail's breeding range extends from southern British Columbia to Newfoundland, south to northwestern Baja California, southern Arizona, west to central Texas, Missouri, Ohio, North Carolina, Louisiana, central Mexico, and South America. It winters from southern British Columbia to northern Baja California and north to the Gulf Coast and North Carolina. In Pennsylvania, it is present in low numbers statewide during migration and is a casual resident in winter. It breeds in suitable habitat at scattered localities throughout the state. The Virginia rail utilizes freshwater, and occasionally brackish, marshes favoring cattails, reeds, and deep grasses. It feeds on insects and other invertebrates, seeds of aquatic plants, and duckweed. It probes into the mud with its bill. The Virginia rail nests in marsh vegetation usually less than 30 cm above water level. Clutch size ranges from five to twelve eggs.

(Rana utricularia) coastal plain leopard frog

The coastal plain leopard frog is distributed in the lowlands of the southeastern United States, from southern New York to the Florida Keys and west to eastern Kansas and eastern Texas. In

Pennsylvania, the species is restricted to the lower Delaware River valley coastal plain. Extensive habitat destruction and limited available habitat have reduced this species' occurrence in Pennsylvania. The frog inhabits freshwater and slightly brackish wetlands. It is most often found in permanent and semi-permanent woodland ponds and brackish marshes. Adults eat various small invertebrates. Larvae eat organic debris, algae, and small invertebrates. Several thousand eggs are laid from March to June. Aquatic larvae may metamorphose in the summer or fall or overwinter and metamorphose the following year.

(Tyto alba) barn-owl

The barn-owl is a G5/S3 species that is distributed from southern Canada and northern U.S. south to South America. Populations in northern North America are partially migratory with some individuals migrating as far south as southern Mexico and the West Indies. The owl also occurs in the Old World. In Pennsylvania, the barn-owl is present statewide during migration and most common in the southern two-thirds of the state. Breeding occurs throughout the state. The barn-owl eats small mammals and some birds. It nests in buildings, caves, crevices on cliffs, burrows, and hollow trees. It uses nest boxes if available. Clutch size ranges from three to eleven.

APPENDIX VII. MANAGEMENT AND STEWARDSHIP

For further information on management and stewardship of natural areas and of rare, threatened and endangered species sites, the reader is directed to:

Director of Science and Stewardship
Pennsylvania Chapter of
The Nature Conservancy
1211 Chestnut St.
Suite 1210
Philadelphia, PA 19107
(215) 963-1400

A NATURAL AREAS INVENTORY OF DELAWARE COUNTY, PENNSYLVANIA
Update -- 1998

Submitted to:
The County of Delaware

Pennsylvania Science Office
of
The Nature Conservancy
34 Airport Drive
Middletown, Pennsylvania 17057

These data are a supplement to the Delaware County Natural Areas Inventory (NAI) completed in 1992. Included are new findings of species of special concern and natural communities in the county since the time of the NAI. There are also updates on species and communities (elements) reported in the original document. In some cases the site quality rank has changed and/or the state rarity rank (S rank) has changed. The format follows that of the Delaware County NAI. There are tables for each USGS quadrangle map listing all new or updated elements by their PA Natural Diversity Inventory code. The corresponding page number from the original NAI is given for each USGS quadrangle table. Each table provides the global and state rarity ranks, state legal status, site quality, and the date last observed for each element. Following the table is a brief narrative for each site, noting whether it is a NEW occurrence or an UPDATE. All new or updated locations are also listed in order of importance in Table 1, ranked by relative importance compared to all sites included in the original NAI.

Sections of USGS maps accompany the text, showing the location of each NEW site only. The area outlined on the maps represents the species' locations as well as the watershed or subwatershed area where the elements (species or natural communities) are located. Proposed development activities within the encircled areas should be carefully assessed to determine the impact of the project on the species or communities before approval is granted. Consultation with the biologists of the Pennsylvania Science Office of The Nature Conservancy may be necessary to assess potential impacts.

These maps can be transcribed onto the original maps produced for the 1992 NAI. The new site boundaries are also included in GIS format on the enclosed disk. These boundaries are included as polygons in an Arc-View file (UTM projection, Zone 18, NAD83) titled "delawupd.shp". The USGS quadrangle, municipality, and associated elements for each polygon are included in this file. The text of

this report is saved to an MS-Word file titled "delawupd.doc". Questions about this supplement or the original NAI can be directed to either Donald S. Cameron, NAI coordinator, or Richard M. Ring, assistant ecologist, at the address on the title page.

Table 1. Addendum to Table 1 of Delaware CNAI of 1992. New or updated (since 1992) sites of statewide significance for the protection of biological diversity in Delaware County. Sites are listed in approximate order of priority from the most important (rank=1) to the least (rank=5). Only new or updated sites are included, ranked by relative importance compared to all sites included in the original NAI.

County Rank[1]	Site Name or Code (municipality)	USGS Topo. Map	TNC and Ranks[2], Importance and Recommendations
2	"Darby Creek Mouth Mudflat" SP603, SP605, SP606, SP607, SP608, SP609, SP610 (Tinicum Twp.)	Bridgeport	This site consists of tidal mudflats and riverbank areas at the confluence of Darby Creek and the Delaware River. Seven plant species of concern were found at this site. This is a highly industrialized area, although the species of concern appear to be doing well in the small areas of remaining habitat. Threats to the persistence of these populations include oil spills and wave damage from large ship traffic. The buffer area for this site connects with the Heinz National Wildlife Refuge and Little Tinicum Island sites.
2	"Namaan Creek Road Site" SP529, SP531, SP532, SP533, SP534 (Bethel and Concord Twps.)	Wilmington North	Five plant species of concern occur at the site. These species require open conditions and occur in disturbed or edge habitats at this site. The site consists of several areas of wet meadow and early successional woods along Namaan Creek Road. The site boundary is combined with the Johnson Corner Quarry/Woods site from the original NAI.
3	"Beaver Valley Road Pipeline Site" SP535, SP536, SP537, SP539, SP540 (Bethel and Concord Twps.)	Wilmington North	Five new plant species of concern were found in the Beaver Creek Valley. The species of concern at this site all require open conditions such as those found along the pipeline R.O.W. Maintaining the pipeline R.O.W. by annual, late season mowing, rather than summer mowing or herbicide use, will benefit these species.

[1] Sites are ranked from 1 to 5 with 1 being the highest priority sites for protection based on state or national significance, and 5 indicating the lowest priority for protection. Ranks take into account potential threats, management needs, and existing protection. Sites of similar rank are listed alphabetically quadrangle.

[2] See Appendix F of the original NAI for an explanation of Global and State vulnerability ranks.

Table 1. continued

County Rank[3]	Site Name or Code (municipality)	USGS Topo. Map	TNC and State Ranks, Importance and Recommendations
4	"Lower Crum Reservoir" SA604 (Springfield, Upper Providence, and Marple Twps.)	Lansdowne	This site was revisited in 1995 and one young individual of a PA-Threatened animal species was observed. Additional surveys are recommended to determine the extent of this population in the reservoir.
4	"Clayton County Park" SP528 (Concord Twp.)	Marcus Hook	A fair to good-quality population of a new plant species of special concern, SP528, was found here in 1995. This population requires periodic disturbance to maintain open conditions at the site. The buffer area for this site joins the Shavertown Woods site on the Wilmington North quad.
5	"Shavertown Woods" SP528, SP530 (Bethel and Concord Twps)	Wilmington North	This site was included as a locally significant area in the original NAI. Two plant species of concern have since been discovered along a powerline R.O.W. nearby, in old field and wet thicket habitats. Maintaining the powerline R.O.W. by late-season mowing is recommended.. The buffer area for this site joins that of Clayton County Park on the Marcus Hook quad.
5	"Chester Tidal Flats" SP506, SP526 (Chester City, Marcus Hook Boro.)	Marcus Hook	This site consists of two small tidal flat areas along a highly disturbed section of the Delaware River shoreline. It supports two species of special concern. Threats to the site include pollution or filling in of tidal marshes, and oil spills or wave damage from the Delaware River.

[3] Sites are ranked from 1 to 5 with 1 being the highest priority sites for protection based on state or national significance, and 5 indicating the lowest priority for protection. Ranks take into account potential threats, management needs, and existing protection. Sites of similar rank are listed alphabetically quadrangle.

USGS QUADRANGLE MAP: Lansdowne (57)

	Code	TNC Ranks* Global	State	Legal Status Fed.	State	Last Seen	Quality**
NATURAL COMMUNITIES:							
SPECIAL PLANTS:							
SPECIAL ANIMALS:	604	G5	S2	N	PT	10-96	C
OTHER:							

Lansdowne Quadrangle:

SA520 -UPDATE- (Upper Providence Twp.) "Lower Crum Reservoir"

This site was revisited in 1995 and one young individual of **SA604** was observed. The state status of this species has been changed from endangered to threatened. Additional surveys are recommended to determine the extent of this population at the reservoir.

USGS QUADRANGLE MAP: Wilmington North (67)

	Code	TNC Ranks* Global	State	Legal Status Fed.	State	Last Seen	Quality**
NATURAL COMMUNITIES:							
SPECIAL PLANTS:	528	G5	S3S4	N	TU	07-02-94	D
	529	G5	S1S2	N	TU	10-01-95	BC
	530	G5	S1	N	PE	07-22-95	D
	531	G5	S2	N	TU	09-09-95	C
	532	G5	S3S4	N	TU	09-09-95	D
	533	G5	S1	B	PE	09-09-95	C
	534	G5	S1	N	PE	09-09-95	D
	535	G5	S2	N	TU	07-18-95	B
	536	G5	S1	N	PE	08-02-95	BC
	537	G5	S3	N	PE	08-22-95	C
	539	G5	S2S2	N	TU	10-05-96	B
	540	G5	S1	N	PE	10-05-96	B
SPECIAL ANIMALS:							
OTHER:							

Wilmington North Quadrangle:

SP529, SP531, SP532, SP533, SP534 -NEW - (Bethel and Concord Twps.) "Namaan Creek Road Site"

This site consists of several areas of wet meadow and early successional woods along Namaan Creek Road. Five plant species of concern occur at the site. These species require open conditions and occur in several disturbed or edge habitats at the site. A fair to good-quality population of **SP529** occurs in an active pasture, associated with goldenrods (*Solidago rugosa, S. nemoralis)*, aster (*Aster lateriflorus*), beak-rush (*Rhynchospora capitellata*), tickseed-sunflower (*Bidens polylepis*), and grasses (*Panicum spp.* and others). The population appears to be doing well despite some grazing pressure from horses. A fair quality population of **SP531** occurs in a retention basin along Namaan Creek Road, associated with sweet-gum (*Liquidambar styraciflua*) seedlings, spike-rushes (*Eleocharis spp*), beak-rush, soft rush and other rushes (*Juncus effus, J. tenuis, J. marginatus, J. acuminatus*). A poor-quality population of **SP532** occur in a young sweet-gum and red maple (*Acer rubrum*) woods. Associated species include red maple, sweet-gum, black-gum (*Nyssa sylvatica*), highbush blueberry (*Vaccinium corymbosum*), southern arrow-wood (*Viburnum dentatum*), and partridgeberry (*Mitchella repens*). Natural succession to more mature forest is a threat to this population. **SP533**, a PA-Endangered plant species, occurs in a wet meadow/ thicket at the edge of a young woods. Goldenrods, grasses, beggar tick-seed, sweet-gum, and the exotic shrub multiflora

rose (*Rosa multiflora*) are associated vegetation. Another PA-Endangered plant, **SP534**, occupies a shallow ditch at the edge of the same woods. This is a poor-quality population, growing underneath black-gum, maleberry, and chokeberry, and associated with panic-grass (*Panicum dichotomum*), beak-rush, and sphagnum moss (*Sphagnum*).

Development or other disturbances such as off-road traffic are threats to the persistence of these species of concern which have persisted in small pockets of habitat amidst residential areas. The effects of natural succession should also be monitored, as management may be necessary to maintain the open conditions favored by these rare species. The buffer area for this site has been combined with that for the nearby Johnsons Corner Quarry and Woods site.

SP528, SP530 -NEW, UPDATE- (Bethel and Concord Twps) "Shavertown Woods"

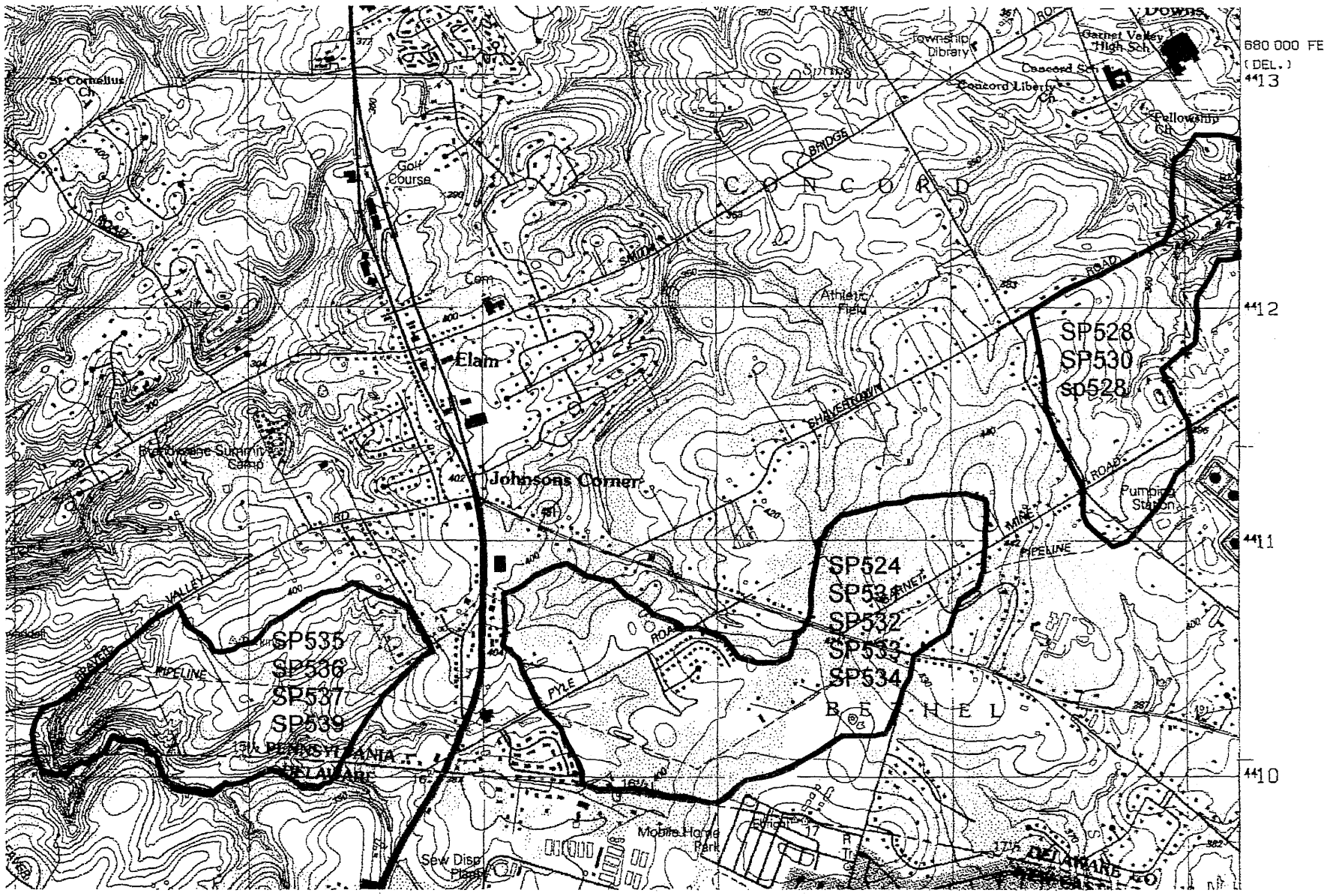
This site was included as a locally significant area in the original NAI. Two plant species of concern have since been found nearby. A poor-quality population of a plant species **(SP528)** with a state status of Tentatively Undetermined was found in 1995, in a wet thicket adjacent to a powerline cut. Associated plants include red maple (*Acer rubrum*), southern arrow-wood (*Viburnum dentatum*), pinxter flower (*Rhododendron periclymenoides*), winterberry (*Ilex verticillata*), spicebush (*Lindera benzoin*), greenbriar (*Smilax rotundifolia*), black cherry (*Prunus serotina*), skunk cabbage (*Symplocarpus foetidus*), and various sedges (*Carex spp.*) and goldenrods (*Solidago spp.*) Some dumping has occurred in this wetland. A single individual of a PA-Endangered plant species, **SP530**, was found growing in an old field south of Shavertown Woods. Sweet-gum seedlings (*Liquidambar styraciflua*), dewberry (*Rubus flagellaris*), hardhack (*Spiraea tomentosa*), dogbane (*Apocynum cannabinum*), and grasses are the dominant vegetation. Maintaining the oldfield and the powerline R.O.W. by late season mowing would benefit the species of concern. The buffer area for this site joins that of Clayton County Park **(sp513, sp528)** on the Marcus Hook quadrangle.

SP535, SP536, SP537, SP539, SP540 -NEW- (Bethel and Concord Twps) "Beaver Valley Road Pipeline Site"

Five new plant species of concern were found in the Beaver Creek Valley. **SP535** and **SP536** both occur in a moist, open area of a powerline cut, dominated by sedges, rushes, goldenrods, milkweed, and mountain-mint. **SP537** occurs in similar habitat north of the pipeline cut at the top of a southeast-facing slope. Encroachment by shrubs and vines such as oriental bittersweet and japanese honeysuckle are threats to SP537. A good-quality population of a PA-Endangered plant species, **SP540**, is found in a low wet meadow in partial light. Associated plant species include red maple (*Acer rubrum*), winterberry (*Ilex verticillata*), marsh fern (*Thelypteris palustris*), cinnamon fern (*Osmunda cinnamomea*), stilt grass (*Microstegium vimineum*, heal-all (*Prunella vulgaris*), sedges (*Carex spp.*), and violets (*Viola spp.*). Finally, a good-quality population of **SP539** is found in a wet, lower-slope meadow on the pipeline R.O.W., associated with goldenrod (*Solidago spp.*), aster (*Aster spp.*), heal-all, hyssop skullcap (*Scutellaria integrifolia*), little bluestem (*Schizachrium scoparium*), stilt grass, and field beadgrass (*Tofieldia glutinosa*).

The species of concern at this site all require open conditions such as those found along the pipeline R.O.W. Maintaining the pipeline R.O.W. by annual, late season mowing, rather than summer mowing or herbicide use, will allow these species to persist.

Wilmington North Quadrangle



Scale 1:24000

0.5 0 0.5 Miles

USGS QUADRANGLE MAP: Marcus Hook (75)

	Code	TNC Ranks* Global	State	Legal Status Fed.	State	Last Seen	Quality**
NATURAL COMMUNITIES:							
SPECIAL PLANTS:	506	G5	S3	N	PR	07-26-94	D
	526	G5	S3	N	PR	07-26-94	C
	528	G5	S2	N	TU	09-14-95	BC
SPECIAL ANIMALS:							
OTHER:							

Marcus Hook quadrangle:

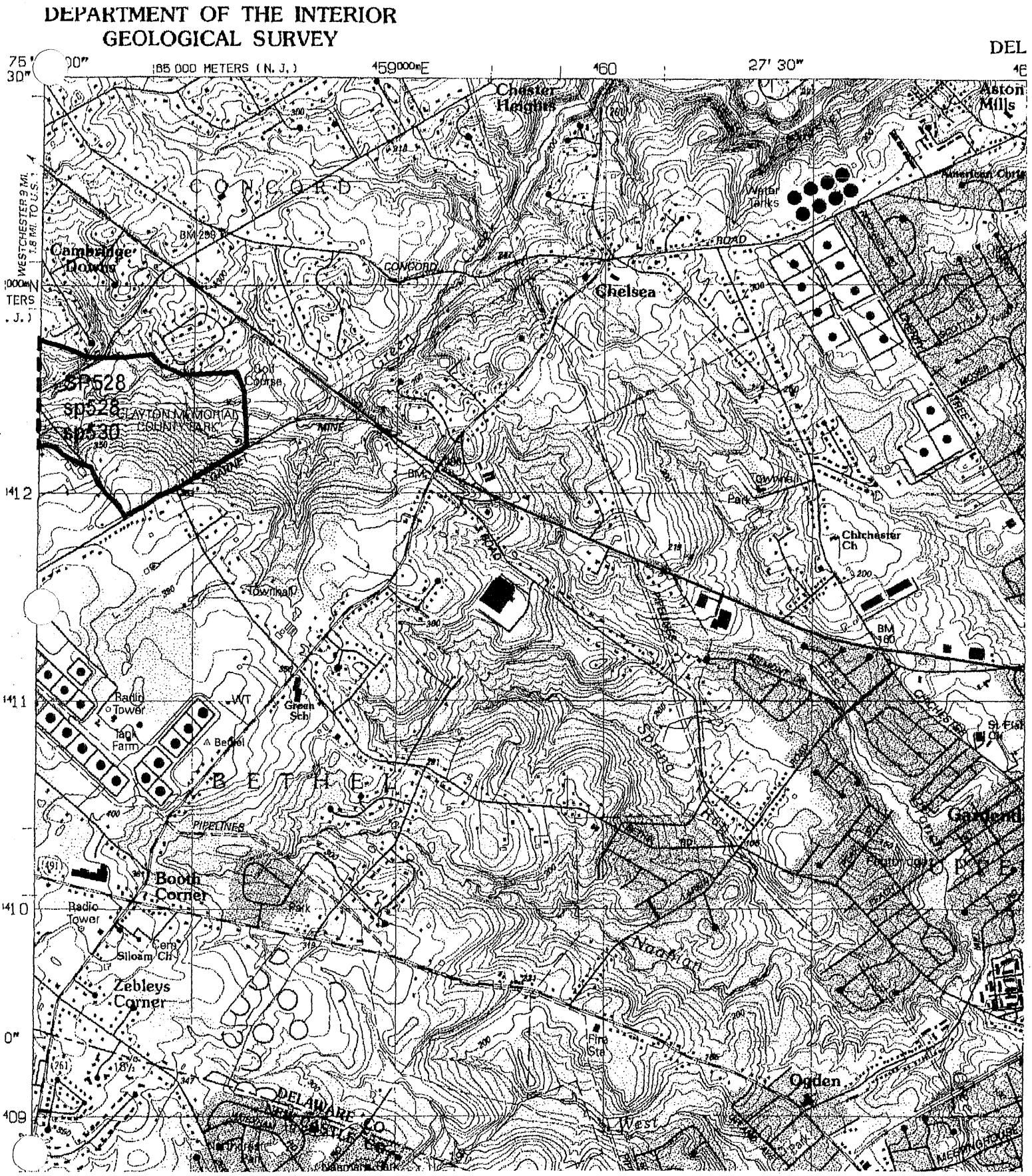
SP506, SP526 -NEW- (Chester City, Marcus Hook Boro.) "Chester Tidal Flats"

This site consists of two small tidal flat areas along a highly disturbed section of the Delaware River shoreline. The tidal marsh has been altered by dumping and contains the remains of pilings. The upland areas above the high tide line are dominated by exotics such as reed canary-grass (*Phalaris arundinacea* and purple loosestrife (*Lythrum salicaria*). Two species of concern were found just below high tide, where native vegetation persists. A fair-quality population of **SP526,** a PA-Rare plant species, occurs in a small intertidal marsh just north of the Commodore Barry Bridge, growing with dotted smartweed (*Polygonum punctatum*). A poor-quality population of another PA-Rare plant, **SP506**, occurs in a separate intertidal marsh nearby. Associated plants include spatterdock (*Nuphar lutea*), arrowhead (*Pontederia cordata*), and bulrushes (*Schoenoplectus tabernaemontanae, S. pungens*). Threats to the plant species of concern include pollution or filling in of the tidal marshes, and oil spills or wave damage from the Delaware River ship traffic.

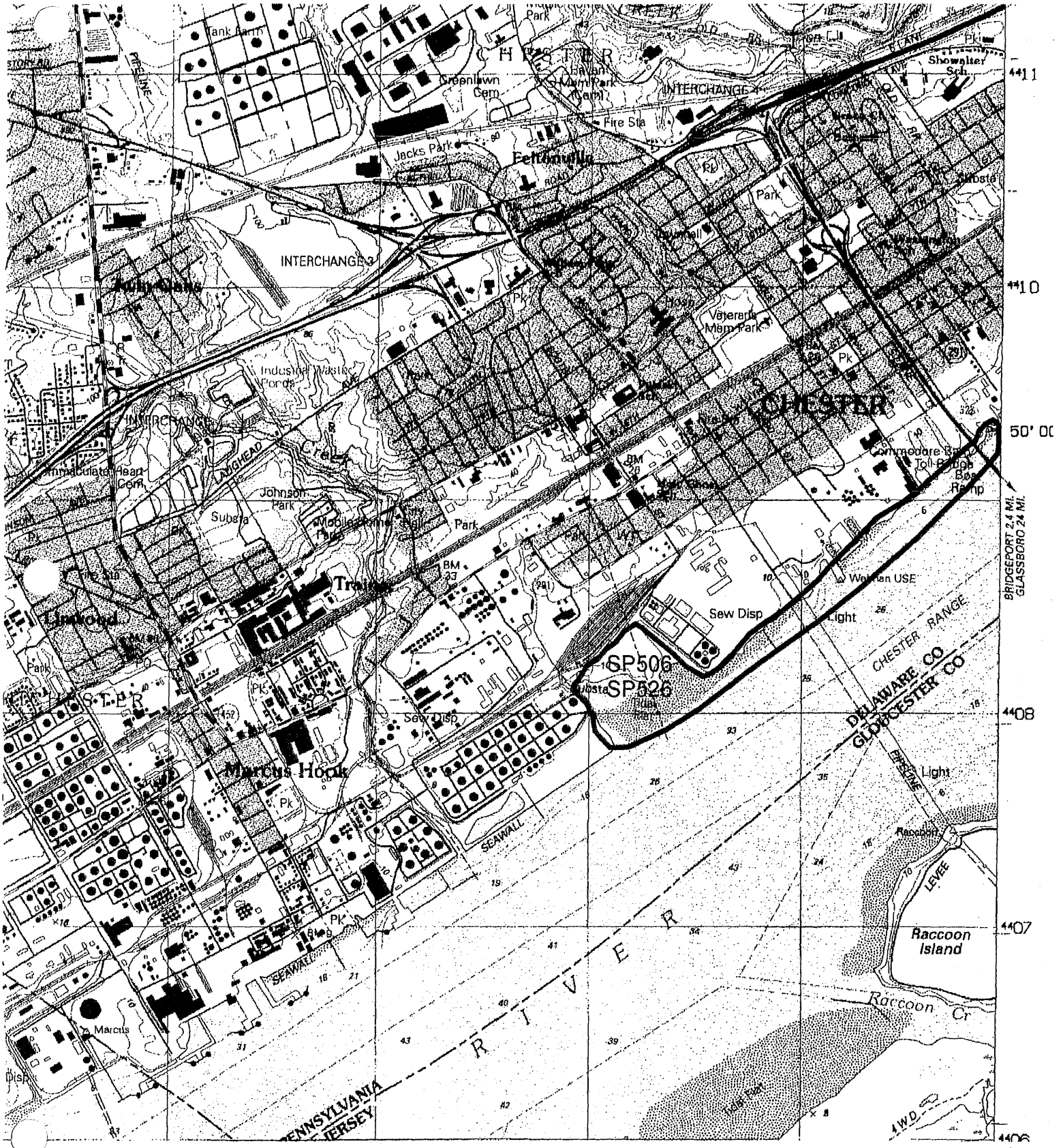
SP528 -NEW- (Concord Twp.) "Clayton Park"

This site consists of a pipeline R.O.W. in Clayton County Park, described in the original NAI as having **SP513**. A fair to good-quality population of another plant species of concern, **SP528**, was found here in 1995. Associated species include goldenrods (*Solidago spp.*), tick-treefoil (*Desmodium paniculatum*), partridge-pea (*Chamaecrista fasciculata*), Indian nut-grass (*Sorghastrum nutans*), and various other grasses. This species requires periodic disturbance to maintain open conditions at the site. However herbicide spraying or mowing early in the season would be detrimental to the species at this site. The buffer area for this site joins that of the Shavertown Woods site (**sp528, sp530**) on the Wilmington North Quadrangle.

Marcus Hook Quadrangle



Marcus Hook Quadrangle



Scale 1:24000

0.5 0 0.5 1 Miles

USGS QUADRANGLE MAP: Bridgeport (81)

	Code	TNC Ranks* Global	State	Legal Status Fed.	State	Last Seen	Quality**
NATURAL COMMUNITIES:							
SPECIAL PLANTS:	603	G4	S3	N	PR	07-26-94	BC
	605	G5T5	S1	N	PE	07-26-94	B
	606	G5	S3	N	PR	07-26-94	BC
	607	G5	S3	N	PR	07-26-94	C
	608	G3	S1	N	PT	07-26-94	C
	609	G4	S1	N	PE	07-26-94	B
	610	G5	S1	N	PE	07-26-94	B
SPECIAL ANIMALS:	613	G4	S1	E(S/A)	PE	1992	E
OTHER:							

Bridgeport quadrangle:

SP603, SP605, SP606, SP607, SP608, SP609, SP610 -NEW- (Tinicum Twp.) "Darby Creek Mouth Mudflat"

This site consists of tidal mudflats and riverbank areas where Darby Creek meets the Delaware River opposite Little Tinicum Island. The vegetation consists of tidal marsh dominated by spatterdock and bulrushes, and adjacent areas of shallow water dominated by tape-grass (*Vallisneria americana*). Seven plant species of concern were found at this site. Fair to good-quality populations of **SP608, SP606** and **SP607** occur along the upper edge of the tidal zone. **SP603, SP605,** and **SP610** occur closer to the river, in the tidal mudflats, associated with bulrushes (*Schoenoplectus tabernaemontanae*, *S. pungens*) spatterdock (*Nuphar lutea*), and arrowhead (*Pontederia cordata*). **SP609** is an aquatic plant species which grows in the lowest and wettest portion of the tidal flat, associated with pondweed (*Potamogeton spp.*).

This area is a highly industrialized portion of the Delaware River shoreline, although the species of concern appear to be doing well in the small areas of remaining habitat. Threats to the persistence of these populations, as well as to the more extensive tidal flats nearby on Little Tinicum Island, include oil spills and wave damage from large ship traffic.

SA513 -NEW- (Chester City.) "Commodore Barry Bridge"

A Federally and PA-Endangered animal species has been observed nesting on the bridge since the late eighties and successfully reared young as recently as 1992. This species was extirpated from PA and the eastern U.S during the fifties and sixties due primarily to pesticide poisoning. Breeding was confirmed in 1987 following reintroduction programs in Philadelphia and other large cities.

Threats to this species in urban habitats include pesticides, collectors, and traffic. The PA Game Commission monitors and manages nesting sites for this species. No map is included for this site.