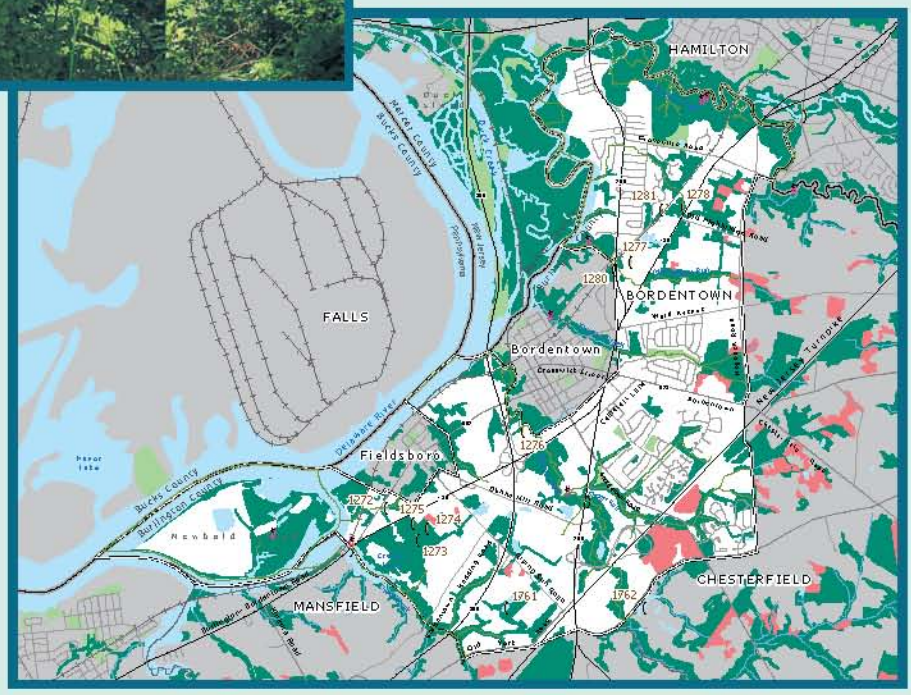
ENVIRONMENTAL RESOURCE INVENTORY

for the TOWNSHIP of

BORDENTOWN

BURLINGTON COUNTY, NEW JERSEY



prepared by:

Delaware Valley
Regional Planning
Commission

with:

The Environmental
Commission of
Bordentown Township

DECEMBER 2004

Created in 1965, the Delaware Valley Regional Planning Commission (DVRPC) is an interstate, intercounty and intercity agency that provides continuing, comprehensive and coordinated planning to shape a vision for the future growth of the Delaware Valley region. The region includes Bucks, Chester, Delaware, and Montgomery counties, as well as the City of Philadelphia, in Pennsylvania; and Burlington, Camden, Gloucester and Mercer counties in New Jersey. DVRPC provides technical assistance and services; conducts high priority studies that respond to the requests and demands of member state and local governments; fosters cooperation among various constituents to forge a consensus on diverse regional issues; determines and meets the needs of the private sector; and practices public outreach efforts to promote two-way communication and public awareness of regional issues and the Commission.

Our logo is adapted from the official DVRPC seal, and is designed as a stylized image of the Delaware Valley. The outer ring symbolizes the region as a whole, while the diagonal bar signifies the Delaware River. The two adjoining crescents represent the Commonwealth of Pennsylvania and the State of New Jersey.

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ACKNOWLEDGMENTS

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- The New Jersey Department of Environmental Protection, Office of Environmental Services
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Township Committee, Township of Bordentown
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The impetus for the creation of the document, and its guidance and review, came from the Bordentown Township Environmental Commission.

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Appreciation and thanks is extended to Bordentown Township resident Jan Bisco-Werner and to staff at various New Jersey state offices who provided information for this inventory.

INTRODUCTION

The purpose of an Environmental Resource Inventory is to identify and describe the natural resources of a community. A community's natural resources – its soil, water, air, forests, fields, and waterways – are fundamental to its character. They are the foundation for its economic success and its quality of life. The protection and wise use of those resources is essential to the public health, safety, and welfare of current and future residents. The Environmental Resource Inventory provides the basis for the development of methods and steps to preserve, conserve, and utilize those resources.

In the past, Bordentown Township's natural resources made the township an agricultural community. In addition, its position along the Delaware River and the growth of the transportation network that crosses Bordentown made the area an important industrial and commercial center in the 19th and 20th centuries. Today, as residential development in this part of Burlington County increases, the character of Bordentown Township is also undergoing change. Documentation of its resources has become a necessity, especially if it is to support residents of the future. Bordentown's remaining wetlands and tidal marshes, which provide significant habitat for endangered and threatened plants and animals, will be vital to the continued health of the community and the enjoyment of its citizenry.

Preparing an Environmental Resource Inventory requires gathering all the existing information that can be found about the community's resources, and presenting it in a form that is usable by a broad audience. The inventory reflects a particular moment in time, and it is assumed that it will be updated as new data becomes available.

Several documents and reports were utilized in preparing the *Environmental Resource Inventory for Bordentown Township*, including the 1990 Bordentown Township *Master Plan,* its periodic revisions, and a number of reference works. These are listed at the end of this document. The maps and data relating to Bordentown Township's natural resources are primarily derived from the New Jersey Department of Environmental Protection Geographic Information System mapping, and from *The Landscape Project* produced by the Endangered and Nongame Species Program of the New Jersey Fish and Wildlife Division.

BRIEF TOWNSHIP HISTORY

In 1849, the Borough of Bordentown was established within the Township of Chesterfield. It was formed from areas of Chesterfield and Mansfield townships and took its name from Joseph Borden (1687-1765), one of the original settlers of the Bordentown region. The Township of Bordentown was established in 1852. Its boundaries included the areas of what is known today as Bordentown Township, the City of Bordentown, and Fieldsboro Borough. Bordentown City separated from the township in 1867 and Fieldsboro Borough separated from the township in 1894.

Initially, the Bordentown area was called Farnsworth's Landing, named after Thomas Farnsworth, one of the original settlers of the area. Thomas Farnsworth, an English Quaker, first settled between Crosswicks Creek and Black's Creek in 1682, where the Delaware River meets Crosswicks Creek. He relocated from the downstream community of Burlington, New Jersey. At the time of Farnsworth's arrival there were approximately twenty-three farms already located along Black's Creek.

Thirty-six years later, in 1717, Joseph Borden arrived in the well-established Farnsworth's Landing. He very quickly acquired the majority of the land where Bordentown City is located today. In 1931 Bordentown Township expanded its borders north by annexing the piece of land bounded by Crosswicks Creek, Grovesville Road, and Hogback Road. Today, Bordentown Township occupies a total area of 9.31 square miles. Of this amount, 8.54 square miles is land, including marshland, and 0.77 square miles is water.

There were nearly 6,000 residents living in the Bordentown region during the 1870s. This large population was mainly due to the railroad and a Civil War era boom. From this point forward, the region felt a steady decline in population. In 1940, Bordentown Township had a population of 1,095, while the City of Bordentown had a population of 4,223. Suburbanization hit the Bordentown region in the 1950s. In 1950, both the population of the township and the city increased. Up until 1952, Bordentown Township was primarily rural. In 1960, however, the population of Bordentown Township skyrocketed, surpassing the population of the City of Bordentown. Since this time, the population of the township has steadily increased while the population of the city has steadily decreased. According to the 2000 census, Bordentown Township had a population of 8,380, while the City of Bordentown had a population of 3,969.

Prior to the arrival of English settlers, Native Americans occupied much of Burlington County. Recent archaeological finds show that humans have been present on the land within township boundaries for approximately 10,500 years. Early Native American communities relied on the township's natural resources until the arrival of Europeans. Indeed, most pre-European settlements were associated with stream corridors. Indian villages are known to have existed beside the Hamilton-Trenton marsh along the bluffs from 3,000 B.C.-100 A.D. They practiced primitive agriculture in the area from 350 A.D. The Lenape Indians were the original owners of the land, but by 1801, nearly a century after the arrival of the first settlers, they had sold virtually all of their land to the settlers and moved from the area.

Bordentown Township and the City of Bordentown have a rich history. During the course of the Revolutionary War, English troops often occupied the area. Moreover, the Bordentown region was home to many notable figures. According to a bicentennial history of Bordentown, *Bordentown 1682-1976*, "Bordentown, aside from being an active waterfront community, was a fashionable and aristocratic resort town to which many of Philadelphia's finest families traveled." Francis Hopkinson, a signer of the Declaration of Independence; Thomas Paine, a famous American journalist and writer; Clara Barton, founder of the Red Cross and the first free public school in Bordentown; and Joseph Bonaparte, the eldest brother of Napoleon and the ex-king of Naples and Spain; all resided in the City of Bordentown.

Throughout Bordentown's history, gristmills and brick making were important to the local economy. One particular mill, Dunns Mill, has a history spanning nearly 200 years, beginning in 1708, when Francis Davenport built the mill on Blacks Creek. From this point on, ownership of the mill changed hands numerous times. Both Samuel Farnsworth and Joseph Borden owned the mill at various points. However, in 1875, Martin Luther Dunn purchased it. The mill burned down in 1901 and was never rebuilt, but the land the mill occupied remained in the Dunn family until 1982. Today, all that remains is the foundation of the mill, on Blacks Creek off of Dunns Mill Road. Several remains of the clay pits used for brick making can also still be seen in the township, most notably along Rising Sun Road and along Dunns Mill Road.

Remains of a clay pit along Rising Sun Road

Bordentown is conveniently located between Philadelphia and New York. As a result of its location, the township became a major 19th century transportation center. In 1831, the Camden and Amboy steam-powered railroad made its debut in Bordentown, and in 1834, the Delaware-Raritan Canal opened. In the 1870s a riverboat operated between Philadelphia and Bordentown. In addition, a stagecoach, the Bordentown and New York Stage, carried passengers and the mail from Bordentown to a point just outside of New York. The Pennsylvania Railroad leased the railroad and the canal in 1871 and immediately began to close the canal, which by 1932 was completely closed. The railroad continued for another thirty years, ending its passenger service in 1963, although it continued to be used for freight. Forty years later, New Jersey Transit restored passenger service on the line, which is now called the River LINE and links Trenton and Camden.

During the late 19th century, trolley lines were created between Trenton, Bordentown, and Camden. However, in 1923, due to a trolley strike, bus service began running. Bus service eventually replaced trolley service in 1932. Today, buses have lost their importance because of the population's dependency on automobiles.

Bordentown Township's services have become increasingly sophisticated. In 1962, the township built a sanitary sewage collection and treatment system, now managed by the Bordentown Sewerage Authority. A full-time Bordentown Township police force was established in 1972. In 1953, Bordentown Township, along with the City of Bordentown, built their first joint elementary school. Prior to 1953, Bordentown Township had a sending agreement with the City of Bordentown. Additionally, in 1965, the first regional high school was constructed, and in 1982 a regional school district was formed.

After World War II, highways were built and the trucking industry began to replace railroad transport of both goods and people. Bordentown Township was primarily rural until the early 1950s. However, in the 1950s the New Jersey Turnpike was built and in the 1960s the construction of Interstate 295 began to bring major changes to Bordentown. Numerous housing developments began to be constructed on land previously used for farming.

View of Route 295 bridge over Crosswicks
Photo taken by Jan Bisco-Werner
Of the Bordentown Township Open Space Advisory Committee

Today, Interstate 295 and the New Jersey State Turnpike intersect Bordentown Township. By automobile, it takes approximately forty-five minutes to get to Philadelphia and sixty minutes to arrive in New York City. Presently, Bordentown Township is home to a wide array of people with a diverse set of occupations reflecting today's 21st century service and light manufacturing economies. Automobile transportation corridors provide the framework for land uses today. Many township residents commute throughout the region for employment. Bordentown Township has become a community with a substantial mix of industrial, commercial, and residential uses.

Bordentown's landscape continues to be dominated by the water that was so much a part of its early history – its Delaware riverfront, its three major stream corridors, and the acres of wetlands and marshes surrounding them. Recently, Bordentown Township has taken steps to recognize the importance of creating permanent open space and protecting land from development. During the early 1980s, the township invested in two parks, each costing about $1 million. Additionally, in 1999, there was a referendum asking Bordentown Township residents if they were in favor of preserving open space, including farmland, and preserving natural and scenic resources. The residents voted in favor of preservation and a $0.03 tax per $100 property valuation dedicated to creating and maintaining open space in Bordentown Township was established. It is estimated that this tax brings in $150,000 annually.

Route 295 crossing the Crosswicks Creek

Map 1: Bordentown Township

Source : NJDEP,NJDOT,DVRPC.
This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.

HAMILTON
FALLS
Duck Island
Mercer County
Bucks County
Pennsylvania
New Jersey
Duck Creek
Crosswicks Creek
Groveville Road
Jumpe Gut Run
206
295
Old Highbridge Road
130
Mile Hollow Run
BORDENTOWN
Ward Avenue
Thofntown Creek
Bordentown
Crosswick Street
Hogback Road
New Jersey Turnpike
Cemetery Lane
528
Bordentown
CHESTERFIELD
Chesterfield Road
Delaware River
662
Fieldsboro
Manor Lake
Bucks County
Burlington County
Dunns Mill Road
Blacks Creek
Laurel Run
Georgetown Road
Newbold Island
Crystal Lake
Rising Sun Road
Bordentown - Hedding Road
Burlington-Bordentown Road
Kinkora Road
Spring Hill Brook
MANSFIELD
Old York Road

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BORDENTOWN TOWNSHIP LOCATION, SIZE, AND LAND USE

Bordentown is an incorporated township located in the northern tip of Burlington County, New Jersey. Four communities border the township within Burlington County: Chesterfield Township to the east/southeast, the Borough of Fieldsboro and the City of Bordentown to the west, and Mansfield Township to the south/southwest. It is also bounded by Hamilton Township, in Mercer County, to the north/northeast. The north/northwestern boundary is the Crosswicks Creek, which forms the dividing line between Mercer and Burlington counties. Bordentown's western boundary is the Delaware River, which forms the dividing line between Pennsylvania and New Jersey, and the Crosswicks Creek, as it bends to the south before joining the Delaware.

In addition to Bordentown Township's mainland, Newbold Island, an island positioned in the Delaware River, is located within the township's boundaries. The southern half of the island is owned by Public Service Electric and Gas Company (PSE&G), and the vacant land on the northern end of the island is privately owned. At present, there is no development on Newbold Island, and a pair of mating bald eagles has been sighted there. In the past, there has been debate over what the proper use for the island should be. In the 1960s and 70s, a controversial nuclear power plant was proposed for the property, but this idea was later dismissed. More recently, there was a debate over whether to allow a 550-megawatt power station, proposed by Conectiv, to be built on the grounds of an old ship salvage yard, just off the coast of Newbold Island. For further historical information about Newbold Island, see the list of references listed in the back of this report.

Bordentown Township occupies 5,958 acres or 9.31 square miles situated on the coastal plain of New Jersey. It is in a region that is still mostly undeveloped, although most land within the township is occupied by residential development or industrial and commercial facilities that have arisen, in part, because of Bordentown's proximity to the Philadelphia and New York City metropolitan areas and easy access to major highways. Residential development in the last two decades, which was concentrated primarily in the north of the township, has been extending southward to the border with Mansfield Township. Still, as of 2002, 53% of Bordentown Township's land remained undeveloped as agricultural, wetlands, or forest.

The information in the tables that follow (tables 1, 2A, and 2B) are derived from two main sources: the NJDEP 95/97 Land Use and Land Cover Map and the DVRPC 2000 Land Use Map. The NJDEP map was originally compiled using infrared orthophotography to map vegetation and development. The DVRPC map was derived from interpretations of ortho-digital aerial photography. In 2002, NJDEP updated their infrared orthophotography images. These images became available to the public in 2004. As a result, the maps and the tables in this report reflect updates that were made to the original maps, based on review of the 2002 orthophotography. Table 2 has not been updated, given the specific nature of the data. In addition, areas under development in 2004 are marked with crosshatched patterns on Map 2A and Map 2B.

Table 1: Bordentown Township General Land Use & Land Cover Classes (1995/97 updated to 2002)

General Land Classes	Acres	%
Agriculture	715	12%
Barren Land	88	2%
Forest	1031	17%
Urban	2280	38%
Water	420	7%
Wetlands	1424	24%
Total	**5958**	**100.00%**

Source: NJDEP

Farms, fields, and woodlands
Photo taken by Jan Bisco-Werner
Of the Bordentown Township Open Space Advisory Committee

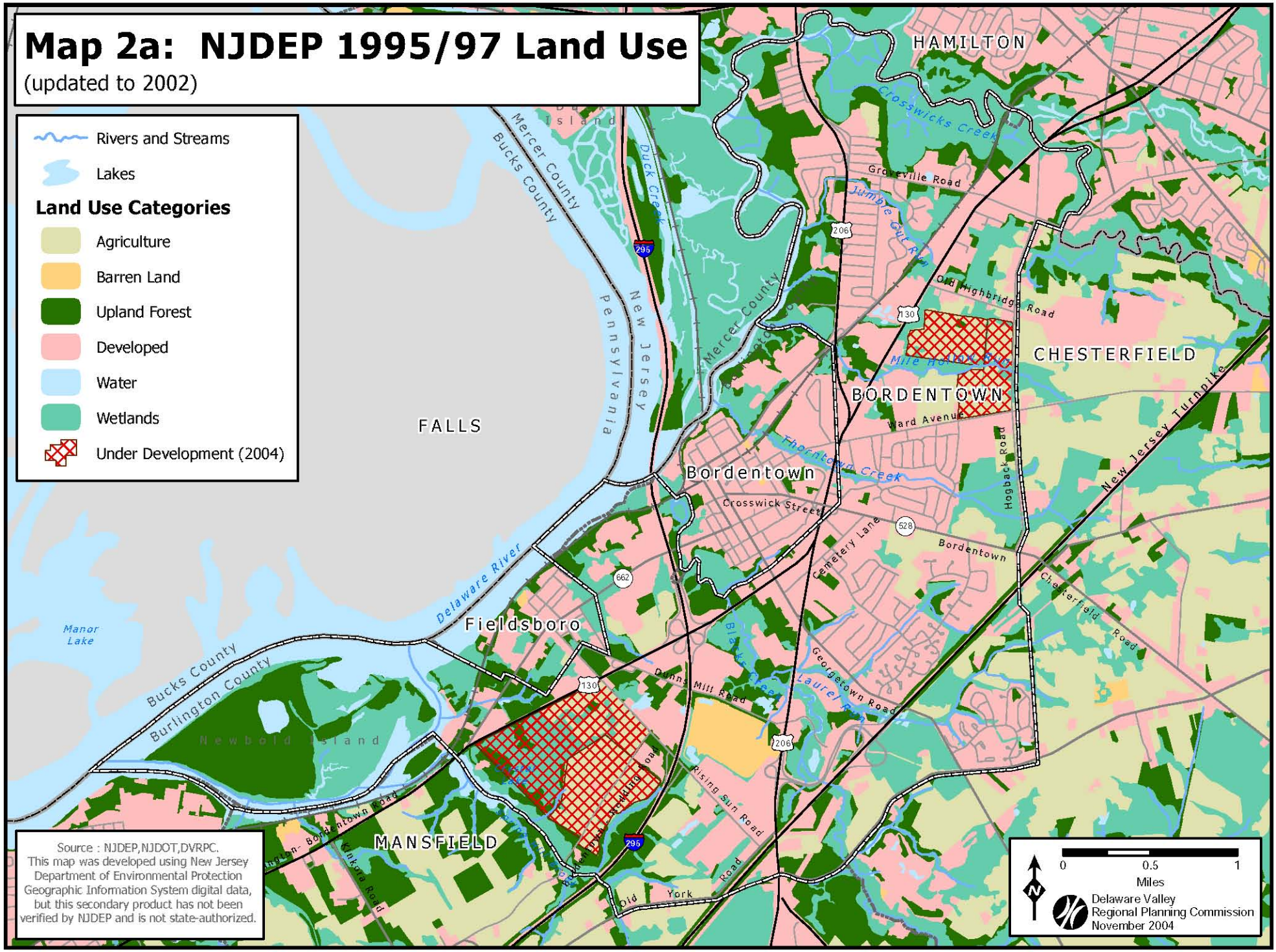
Table 2: Bordentown Township Specific Land Use (1995/97) NOT UPDATED TO 2002

Land Use Category	Acres	Percent
Managed wetland in built-up maintained rec area	0	0.00%
Natural lakes	1	0.02%
Coniferous forest (10-50% crown closure)	1	0.02%
Undifferentiated barren lands	1	0.02%
Coniferous brush/shrubland	2	0.03%
Wetland rights-of-way (modified)	3	0.05%
Coniferous forest (>50% crown closure)	4	0.06%
Orchards/vineyards/nurseries/horticulture areas	4	0.06%
Managed wetland in maintained lawn greenspace	4	0.06%
Mixed urban or built-up land	5	0.08%
Military reservations	5	0.09%
Mixed forest (>50% coniferous with 50% crown closure)	8	0.14%
Mixed forest (>50% deciduous with >50% crown closure)	10	0.17%
Former agricultural wetland (becoming shrubby, not built up)	10	0.17%
Other agriculture	10	0.17%
Streams and canals	11	0.19%
Mixed deciduous/coniferous brush/shrubland	25	0.42%
Athletic fields (schools)	28	0.47%
Artificial lakes	36	0.60%
Disturbed wetlands (modified)	57	0.95%
Herbaceous wetlands	57	0.96%
Recreational land	58	0.97%
Transitional areas	77	1.29%
Industrial	79	1.33%
Altered lands	87	1.46%
Deciduous forest (10-50% crown closure)	89	1.50%
Residential, rural, single unit	98	1.64%
Agricultural wetlands (modified)	111	1.87%
Deciduous scrub/shrub wetlands	120	2.02%
Residential, high density, multiple dwelling	125	2.10%
Residential, single unit, low density	198	3.32%
Freshwater tidal marshes	205	3.44%
Old field (<25% brush covered)	218	3.65%
Deciduous brush/shrubland	219	3.67%
Commercial/Services	244	4.10%
Transportation/Communications/Utilities	310	5.20%
Tidal rivers, inland bays, and other tidal waters	372	6.24%
Other urban or built-up land	400	6.72%
Deciduous forest (>50% crown closure)	479	8.03%
Residential, single unit, medium density	494	8.29%
Cropland and pasture land	756	12.69%
Deciduous wooded wetlands	937	15.73%
Total	**5958**	**100.00%**

Source: NJDEP

Map 2a: NJDEP 1995/97 Land Use

(updated to 2002)



Source : NJDEP,NJDOT,DVRPC.
This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.

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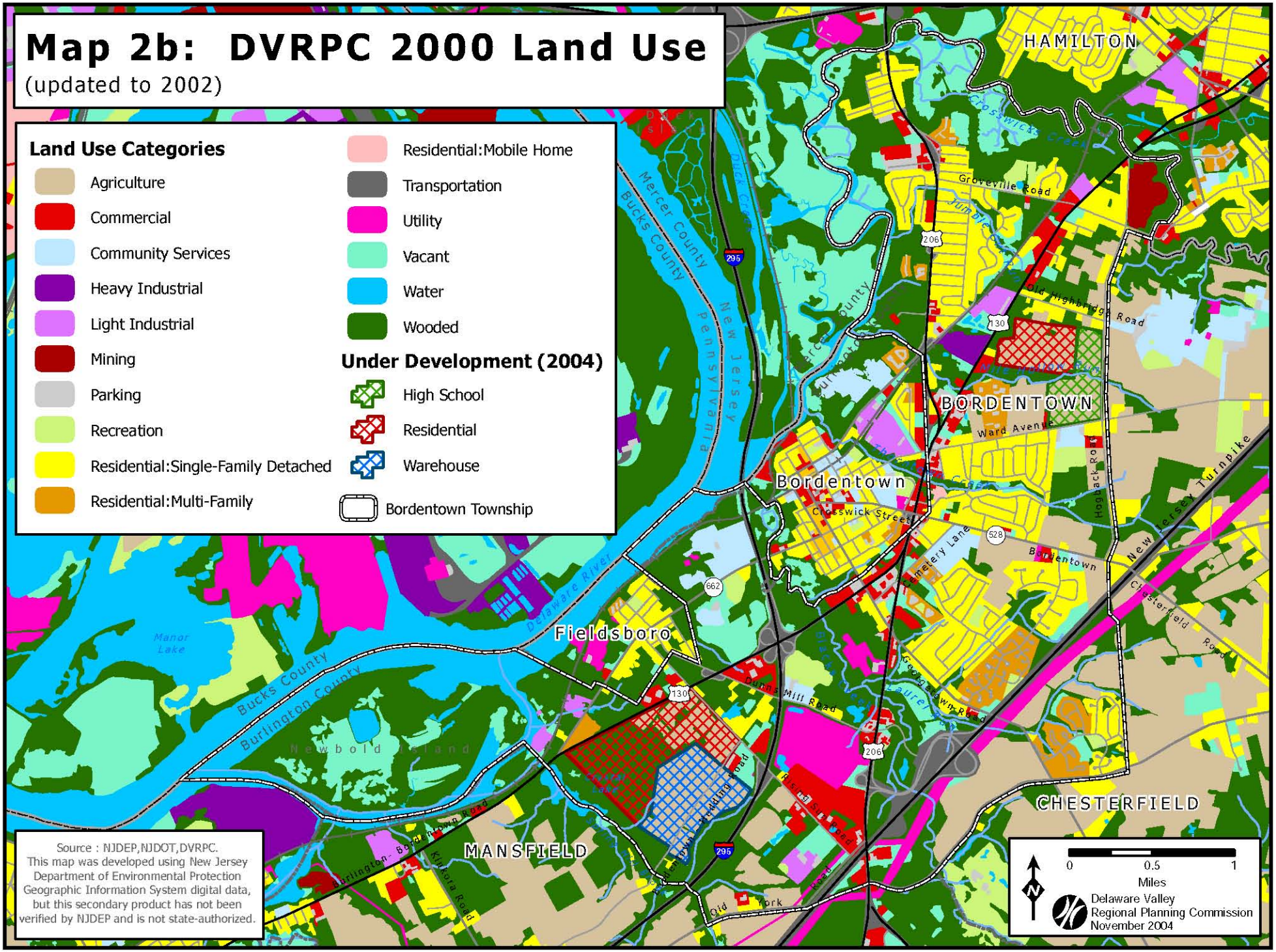
Table 3: DVRPC 2000 Land Use, Updated to 2002

Description	Acres	Percent
Residential:Single-Family Detached	886	14.88%
Residential:Multi-Family	172	2.88%
Parking:Multi-Family	15	0.25%
Residential:Mobile Home	3	0.05%
Manufacturing:Light Industrial	48	0.80%
Parking:Light Manufacturing	4	0.07%
Manufacturing:Heavy Industrial	20	0.34%
Transportation	325	5.45%
Utility	175	2.93%
Parking:Utility	1	0.02%
Commercial	262	4.40%
Parking:Commercial	63	1.06%
Community Services	107	1.80%
Parking:Community Services	6	0.10%
Recreation	75	1.26%
Parking:Recreation	2	0.03%
Agriculture	742	12.46%
Mining	34	0.57%
Wooded	2041	34.26%
Vacant	558	9.37%
Water	419	7.03%
Total	**5958**	**100.00%**

Source: DVRPC

Bordentown Township has several remaining farms


Map 2b: DVRPC 2000 Land Use
(updated to 2002)
Land Use Categories
Agriculture
Commercial
Community Services
Heavy Industrial
Light Industrial
Mining
Parking
Recreation
Residential:Single-Family Detached
Residential:Multi-Family
Residential:Mobile Home
Transportation
Utility
Vacant
Water
Wooded
Under Development (2004)
High School
Residential
Warehouse
Bordentown Township
Source : NJDEP,NJDOT,DVRPC.
This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.
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Miles
Delaware Valley Regional Planning Commission
November 2004
HAMILTON
BORDENTOWN
Bordentown
Fieldsboro
MANSFIELD
CHESTERFIELD
Mercer County
Bucks County
New Jersey
Pennsylvania
Delaware River
Burlington County
Newbold Island
Manor Lake
Crosswicks Creek
Groveville Road
Old Highbridge Road
Ward Avenue
Crosswick Street
Cemetery Lane
Hogback Road
Bordentown
Chesterfield
New Jersey Turnpike
Dunns Mill Road
Georgetown
Laurel
Black Creek
Burlington-Bordentown Road
Kinkora Road
Old York
206
130
295
662
528

NATURAL RESOURCES

PHYSIOGRAPHY

Physiography is the study of a location in relation to its underlying geology. New Jersey is characterized by four physiographic provinces. The rocky terrain of the Appalachian Province is at one extreme and the sands of the coast are at the other. Bordentown Township is located in the Atlantic Coastal Plain, the most southerly of these four provinces in New Jersey.

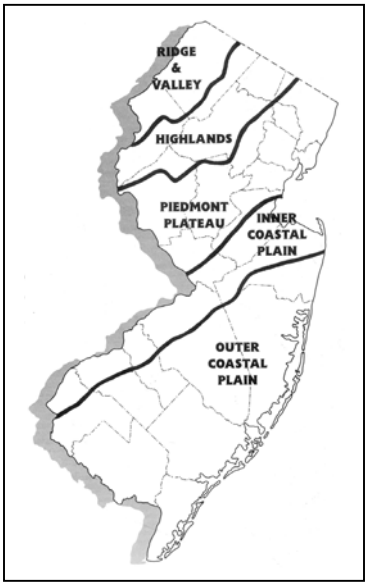


Figure 1: ***The Physiographic Regions of New Jersey***

The Atlantic Coastal Plain landscape extends from Massachusetts to Texas and is divided into Inner and Outer sections. In New Jersey the Inner Coastal Plain is made up of interbedded sand and clay. Deposits originating in the breakdown of Appalachian and Catskill sedimentary, metamorphic, and igneous rocks are interbedded with layers formed by oceanic (marine) deposition, which occurred as the ocean shoreline advanced and receded over geologic time. The Inner Plain layers date from the Cretaceous Period, 135 to 65 million years ago. Soils of the Inner Coastal Plain are quite fertile.

The Outer Coastal Plain was formed more recently than the Inner Coastal Plain. It was laid down by the ocean and developed during the mid-to-late part of the Cenozoic Period, 65 million years ago to the present. Outer Coastal Plain soils are less fertile than those of the Inner Plain and don't hold water as well.

The dividing line between the two segments of the Coastal Plain is a belt of low hills, which runs northeast and southwest through the southern half of New Jersey. These hills are the youngest of the Cretaceous formations and are largely made up of sand and marl formations. In Burlington County the hills can be identified between Arney's Mount in Springfield Township and Mt. Laurel. The Inner Coastal Plain lies to the west of the band of hills, with most of its surface waters draining toward the Delaware River. The Outer Coastal Plain slopes more gradually to the east, with drainage generally toward the Atlantic Ocean. Bordentown Township sits to the west of this boundary and is entirely on the Inner Coastal Plain.

TOPOGRAPHY AND SURFACE LANDSCAPES

Bordentown Township is a relatively small-sized municipality in Burlington County, with just under 6,000 acres, but the topography within the township varies. At the confluence of the Delaware River and Crosswicks Creek, the Bordentown landscape is dominated by wetlands bordered on the east by striking cliffs looking out over the Crosswicks and the Trenton/Hamilton marsh. To the south, the Blacks Creek and Crystal Creek stream corridors are heavily wooded with steep slopes along the banks, giving way to a gently rising landscape in between the

watersheds. The landscape along the Delaware River north and south of Fieldsboro is mostly inaccessible and largely undeveloped. The landscape on Bordentown's eastern side supports gently rolling farmland, reflective of the Burlington County farmbelt area directly adjacent, in Chesterfield Township.

The upland area is characterized by rich soils that once supported extensive beech-oak forests. Along the stream valleys, especially the Crosswicks Creek, are extensive freshwater tidal marshes and wet forests. The streams are relatively flat, as in all of southern New Jersey, with muddy and/or sandy bottoms. Smaller streams flowing to the larger channels form connecting networks of wetland marsh.

The highest elevation in the township is approximately 107 feet Mean Sea Level (USA), at a point located near the northeast quadrant of the 295 interchange with Route 130, close to Blacks Creek and the border with Bordentown City. The lowest elevations measure about 10 feet above Mean Sea Level and are found along the Delaware River, particularly where the Crosswicks and Blacks Creek meet the Delaware River and at Crystal Lake.

SOILS

Soil is the foundation for all land uses. A region's soil defines what vegetation is possible, influencing agricultural uses. It also determines how land can be developed for other purposes. Soil is a natural resource that cannot be replenished on the human time scale.

Bordentown's soils are predominantly clayey soils. The township's soils consist of 21 series types and 58 variations within those series (excluding water), as identified by the US Department of Agriculture's Natural Resources Conservation Service. These are listed in ***Table 5: Bordentown Township Soils*** and shown on **Map 3: Soils**.

Bordentown's soils are rich in agricultural value. Forty-five percent (44.6%) of the soils in Bordentown Township are considered Prime Farmlands (P-1). Prime Farmlands are lands that have the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops. They can sustain high yields of crops when managed with correct farming methods. Prime Farmlands are not excessively erodible or saturated with water for long periods of time and do not flood frequently.

Farmlands of Statewide Importance (S-1) occupy 10.2% of the township surface. These soils are close in quality to Prime Farmland and can sustain high yields of crops when correctly managed with favorable conditions. Of the remaining two classifications, only 0.4% of Bordentown's farmland is classified as Farmland of Local Importance (L-1), which are soils that can support the production of high value, regional, indigenous, horticultural crops like tomatoes, sweet corn, blueberries, strawberries, cranberries, and peaches.

See ***Table 4: Agricultural Values for Bordentown Soils***[1] below for the acreage of each of these categories of farmland.

Table 4: Agricultural Values for Bordentown Soils

Designation	Type	Area (In Acres)	Percent
P-1	Prime Farmland	2,649	44.6%
S-1	Statewide Importance	608	10.2%
L-1	Local Importance	21	0.4%
Other Soil	Wet soils, pits, steep slopes, etc.	2,300	38.7%
Water	Water	380	6%
Totals		**5,958**	**100%**

Source: NJ Farmlands Inventory, NJ Natural Resources Conservation Service

Soil Series

Several soil series appear more frequently in Bordentown Township than others, and are briefly described below.[2]

Keyport Series

The majority of Bordentown soils, 15.6 percent, are in the Keyport series. These soils tend to be moderately or well-drained, consisting of a moderate to fine texture, and formed on clay beds. Often they gently slope and are found in high positions. However, they can slope as much as 25 percent. In Bordentown, 7.6 percent of this series has a slope greater than 5 percent. Keyport soils have a high available water capacity and drain slowly. Water does not saturate the soil. Rather, the soil, when dry, cracks widely and crusts, reducing seed germination. It has moderate natural fertility, but it is not ideal for agriculture. This soil will support hardwood forest and limited types of crops. It is not a good soil for vegetables or fruits. However, it is a suitable soil for small grains, corn, soybeans, hay, and pastures. (Capability Units II, III, VI, and VII depending on slope)

Freehold Series

Slightly over 11 percent of Bordentown soils are a variation of the Freehold series. These soils, formed from sandy marine deposits, are mostly gently sloping and are well drained. Around stream beds, these soils may be steeply sloping. Freehold soils occur in close association with Collington, Colts Neck, Marlton, Westphalia, Woodstown, and Dragston soils. Freehold soils are easily worked for agricultural production and have low to moderate natural fertility. Different variations of these soils will support upland forests of oak and poplar and provide high quality wildlife habitat. These soils are well suited to many different vegetable crops and can

[1] See New Jersey Soils of Statewide Importance, New Jersey Natural Resources Conservation Service, September 24, 1990, available online at www.nj.nrcs.usda.gov/technical/soils/njfarmindex.html.
[2] Soil Conservation Service. *Soil Survey of Burlington County New Jersey*, USDA and New Jersey Agricultural Experiment Station, October 1971.

support various seasonal crops because the variations of soils warm at different times of the year. (Capability Units I, II, and IV depending on slope)

Urban Land Series
The Urban Land series consists of cut and filled land that is mostly developed. The land is used for residential, commercial, industrial, or highway purposes. Typically 70 percent of the original soil horizon has been destroyed in these areas. There are moderate limitations for woodland or wildlife and severe limitations for crops. Urban land is very impermeable and low in fertility where the original soil is removed. However, where the original soil is moved from one area to another area, the soil has moderate but slow permeability, due to compaction of the soil during construction. (Capability Suitability Unclassified)

Sassafras Series
Sassafras soils are the fourth most frequently occurring soil in Bordentown. Slopes can range from nearly level to very steep. These soils can support vegetation consisting of mixed oaks and scattered pines. They are considered farmland of statewide importance and have clay in their subsoil. Sassafras soils are easy to work, have a low natural fertility, and respond to fertilization. (Capability Units I, II, and III, depending on variation)

Woodstown Series
Variations of the Woodstown series make up over 6% of all acres in Bordentown Township. Historically, these soils have supported oak, beech, poplar, and pitch pine forests. This series is closely associated with Aura, Downer, Freehold and other soils, except that Woodstown is not well drained. These soils occur on terraces along large streams and in beds of gravel. Cultivation is hampered by wetness. (Capability Unit II)

Capability Units

I – Soils have few limitations that restrict their use.

II – Soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

III – Soils have severe limitations that reduce the choice of plants, require very careful management, or both.

IV – Soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

V – Soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, woodland, or wildlife habitat.

VI – Soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture, woodland, or wildlife habitat.

VII – Soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture, woodland, or wildlife habitat.

VIII – Soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife, water supply, or to aesthetic purposes.

Source: Soil Survey of Burlington County

Udorthents
This series consists of somewhat poorly drained to very poorly drained soils that have been altered mainly by filling. This type of soil is located mainly in low areas, such as depressions, drainage ways, and tidal marshes. (On-site investigation is needed to determine the suitability of this unit for any use)

Adelphia

Soils in the Adelphia series have a fluctuating water table and are moderately well drained. Their natural fertility is moderate and applied fertilizers do not leach readily. They have very little slope. They support native vegetation consisting of hardwood forest species. Various crops are suitable for this type of soil, including small grains, fruits, vegetables, sod, and nursery stock. These high value crops require better drainage, which these soils provide.

Holmdel

Soils in the Holmdel series have a moderately high seasonal water table and drain moderately well. Holmdel series soils have moderate to moderately high natural fertility. They respond well to added fertilizers. Most areas with these soil types have been cleared for crops. Small grains, fruits, and vegetables are all capable of growing in these soils. Often these soils receive both surface runoff and lateral ground water from higher soils.

Table 5: Bordentown Township Soils

Soil Type	Map Unit Name	Acres	Pecentage	Designation *
AdmA	Adelphia fine sandy loam, 0 to 2 percent slopes	123	2.1%	P-1
AdmB	Adelphia fine sandy loam, 2 to 5 percent slopes	24	0.4%	P-1
AdmkA	Adelphia fine sandy loam, clayey substratum, 0 to 2 percent slopes	78	1.3%	P-1
AdmkB	Adelphia fine sandy loam, clayey substratum, 2 to 5 percent slopes	32	0.5%	P-1
AdmmA	Adelphia Variant fine sandy loam, 0 to 2 percent slopes	34	0.6%	P-1
AdmmB	Adelphia Variant fine sandy loam, 2 to 5 percent slopes	9	0.2%	P-1
Coes	Colemantown loam	21	0.4%	L-1
ComA	Collington fine sandy loam, 0 to 2 percent slopes	44	0.7%	P-1
ComB	Collington fine sandy loam, 2 to 5 percent slopes	124	2.1%	P-1
ComC	Collington fine sandy loam, 5 to 10 percent slopes	37	0.6%	S-1
DoaA	Donlonton fine sandy loam, 0 to 2 percent slopes	58	1.0%	P-1
DobA	Donlonton loam, 0 to 2 percent slopes	107	1.8%	P-1
Fank	Fallsington fine sandy loam, clayey substratum	80	1.3%	S-1
Fmht	Fluvaquents, loamy, frequently flooded	237	4.0%	NA
FrfB	Freehold loamy sand, 0 to 5 percent slopes	40	0.7%	P-1
FrfC	Freehold loamy sand, 5 to 10 percent slopes	12	0.2%	S-1
FrmA	Freehold fine sandy loam, 0 to 2 percent slopes	13	0.2%	P-1
FrmB	Freehold fine sandy loam, 2 to 5 percent slopes	255	4.3%	P-1
FrmC	Freehold fine sandy loam, 5 to 10 percent slopes	18	0.3%	S-1
FrmD	Freehold fine sandy loam, 10 to 15 percent slopes	22	0.4%	NA
FrmE	Freehold fine sandy loam, 15 to 25 percent slopes	55	0.9%	NA
FrmkB	Freehold fine sandy loam, clayey substratum, 2 to 5 percent slopes	257	4.3%	NA
GabB	Galestown sand, 0 to 5 percent slopes	6	0.1%	NA
HodA	Holmdel fine sandy loam, 0 to 2 percent slopes	43	0.7%	P-1
HodB	Holmdel fine sandy loam, 2 to 5 percent slopes	11	0.2%	P-1
HodkA	Holmdel fine sandy loam, clayey substratum, 0 to 2 percent slopes	136	2.3%	P-1
HodkB	Holmdel fine sandy loam, clayey substratum, 2 to 5 percent slopes	81	1.4%	P-1
KenB	Keyport fine sandy loam, 2 to 5 percent slopes	220	3.7%	P-1
KeoA	Keyport loam, 0 to 2 percent slopes	126	2.1%	P-1
KeoB	Keyport loam, 2 to 5 percent slopes	134	2.3%	P-1

KeoC	Keyport loam, 5 to 10 percent slopes	183	3.1%	S-1
KeoD	Keyport loam, 10 to 15 percent slopes	159	2.7%	NA
KeoE	Keyport loam, 15 to 25 percent slopes	107	1.8%	NA
KrbA	Kresson loamy sand, 0 to 5 percent slopes	17	0.3%	S-1
Mamnv	Mannington-Nanticoke complex, very frequently flooded	242	4.1%	NA
PefB	Pemberton sand, 0 to 5 percent slopes	50	0.8%	NA
PHG	Pits, sand and gravel	21	0.4%	NA
PHM	Pits, clay	104	1.7%	NA
SaeA	Sassafras fine sandy loam, 0 to 2 percent slopes	110	1.8%	P-1
SaeB	Sassafras fine sandy loam, 2 to 5 percent slopes	209	3.5%	P-1
SaeC	Sassafras fine sandy loam, 5 to 10 percent slopes	34	0.6%	S-1
SaekA	Sassafras fine sandy loam, clayey substratum, 0 to 2 percent slopes	44	0.7%	P-1
SaekB	Sassafras fine sandy loam, clayey substratum, 2 to 5 percent slopes	193	3.2%	P-1
Shs	Shrewsbury fine sandy loam	42	0.7%	S-1
Shsk	Shrewsbury fine sandy loam, clayey substratum	37	0.6%	S-1
ThfB	Tinton sand, 0 to 5 percent slopes	131	2.2%	S-1
ThfC	Tinton sand, 5 to 10 percent slopes	16	0.3%	S-1
ThftB	Tinton sand, thick surface, 0 to 5 percent slopes	12	0.2%	NA
Udmc	Udorthents, dredged coarse materials	52	0.9%	NA
Udmf	Udorthents, dredged fine material	300	5.0%	NA
Udz	Udorthents, refuse substratum	31	0.5%	NA
USD	Urban land, sandy	378	6.4%	NA
USE	Urban land, sandy over clayey	26	0.4%	NA
USF	Urban land, clayey substratum	238	4.0%	NA
WATER	Water	380	6.4%	NA
WofA	Woodstown fine sandy loam, 0 to 2 percent slopes	87	1.5%	P-1
WofB	Woodstown fine sandy loam, 2 to 5 percent slopes	2	0.0%	P-1
WofkA	Woodstown fine sandy loam, clayey substratum, 0 to 2 percent slopes	179	3.0%	P-1
WofkB	Woodstown fine sandy loam, clayey substratum, 2 to 5 percent slopes	134	2.2%	P-1
Total Acreage		**5958**	**100.0%**	
Total Farmland Acreage		**3278**	**55.2%**	
Total Non-farmland Acreage		**2659**	**44.8%**	
Steep Slopes (15% + Slopes)		**162**	**2.7%**	

Source: NJDEP, Soil Survey of Burlington County, NRCS

***Explanation of Designations**

P–1	Prime Farmland
S–1	Statewide Importance
L–1	Local Importance
NA	Land not appropriate for farming, e.g. eroded, very steep slopes, pits permanently wet soils, water, etc.

Soil characteristics can severely restrict the use of sites for construction and development. ***Table 6: Soil Limitations for Development*** records the soils and their possible limitations for building

foundations and septic systems. As indicated in the table, the township has some soils that are severely limited for on–site septic systems. Septic systems require soils that have a low water table, below five feet, and slow permeability to allow for proper drainage of wastewater. High water tables, five feet or less from the surface, create a potential for erosion, wet basements, alteration of plant life, and early frost for agricultural crops.

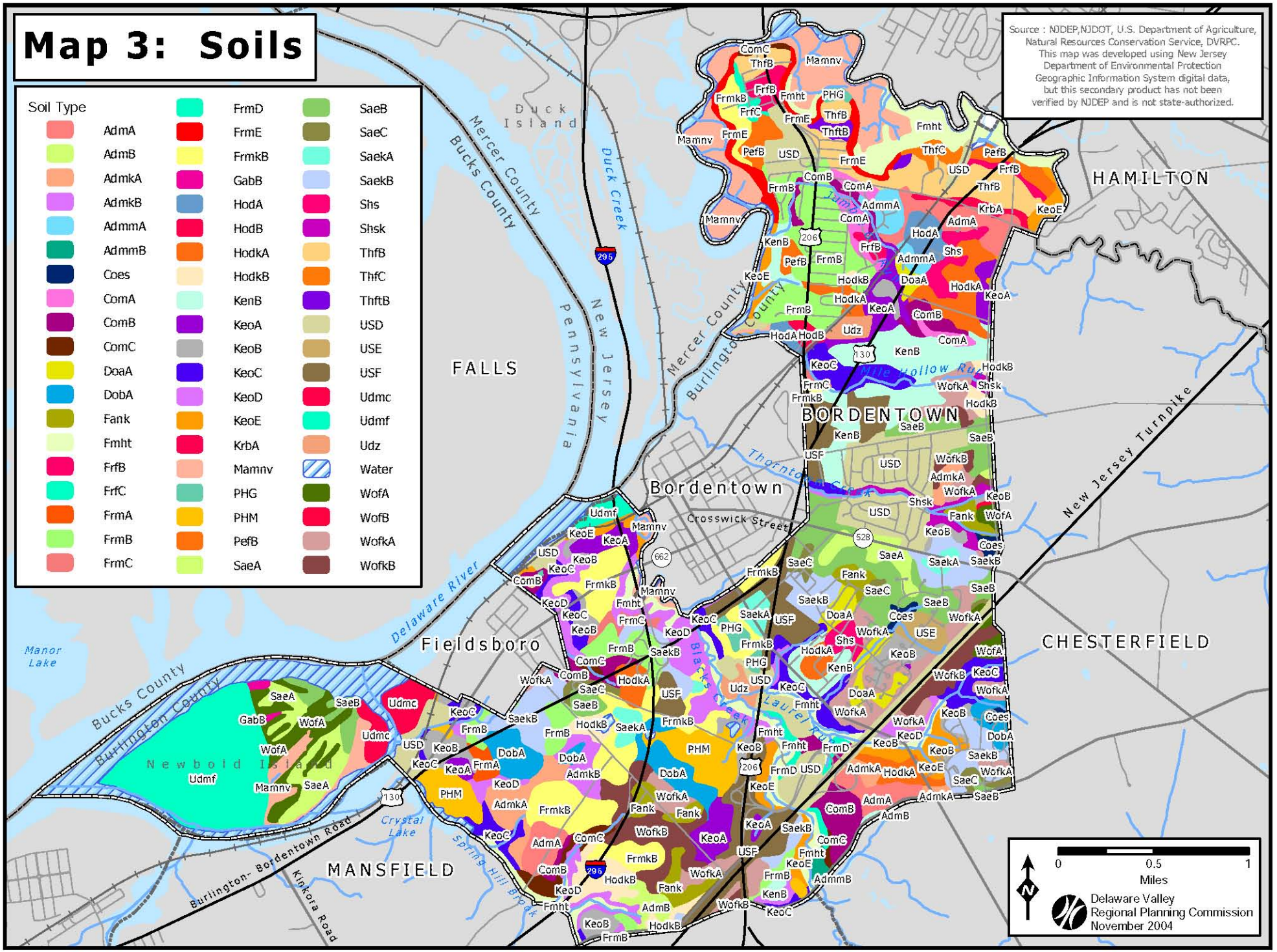
Photo taken by Jan Bisco-Werner
Of the Bordentown Township Open Space Advisory Committee

Table 6: Soil Limitations for Development

Soil Series	Soil Codes	Acreage	Building with Basement	Building without Basement	Septic Systems	Limitations
Keyport	KenB, KeoA, KeoB, KeoC, KeoD, KeoE	929	B	B	C	1,3
Freehold	FrfB, FrfC, FrmA, FrmB, FrmC, FrmD, FrmE, FrmkB	673	A	A	A	3
Urban Land	USD, USE, USF	642	A	A	A	
Sassafras	SaeA, SaeB, SaeC, SaekA, SaekB	590	A	A	A	
Woodstown	WofA, WofB, WofkA, WofkB	401	B	A	A	
Udorthents	Udmc, Udmf, Udz	384	C	C	C	1
Water	WATER	380	NA	NA	NA	
Adelphia	AdmA, AdmB, AdmkA, AdmkB, AdmmA, AdmmB	300	B	A	B	
Holmdel	HodA, HodB, HodkA, HodkB	271	B	A	B	
Mannington-Nanticoke	Mamnv	242	C	C	C	1
Fluvaquents	Fmht	237	C	C	C	1
Collington	ComA, ComB, ComC	206	A	A	A	1
Donlonton	DoaA, DobA	164	B	B	C	1
Tinton	ThfB, ThfC, ThftB	159	A	A	A	
Pits	PHG, PHM	125	A	A	A	
Shrewsbury	Shs, Shsk	79	C	C	C	
Fallsington	Fank	80	C	C	C	
Pemberton	PefB	50	B	A	B	
Colemantown	Coes	21	C	B	C	1
Kresson	KrbA	17	C	B	C	1
Galestown	GabB	6	A	A	A	
Total		**5,958**				

Key to Land Use Implications	*Key to Limitations*
A = Slight. Little or no limitation(s) or easily corrected by use of normal equipment and design techniques.	1: High water table (0 to 3 feet)
B = Moderate. Presence of some limitation, which normally can be overcome by careful design and management at somewhat greater cost.	2: Shallow depth to bedrock (less than 5 feet)
C = Severe. Limitations that, normally, cannot be overcome without exceptional, complex, or costly measures.	3: Strongly sloping (15% or over)

Source: *Soil Survey of Burlington County*


Map 3: Soils
Soil Type
AdmA
AdmB
AdmkA
AdmkB
AdmmA
AdmmB
Coes
ComA
ComB
ComC
DoaA
DobA
Fank
Fmht
FrfB
FrfC
FrmA
FrmB
FrmC
FrmD
FrmE
FrmkB
GabB
HodA
HodB
HodkA
HodkB
KenB
KeoA
KeoB
KeoC
KeoD
KeoE
KrbA
Mamnv
PHG
PHM
PefB
SaeA
SaeB
SaeC
SaekA
SaekB
Shs
Shsk
ThfB
ThfC
ThftB
USD
USE
USF
Udmc
Udmf
Udz
Water
WofA
WofB
WofkA
WofkB
Source : NJDEP,NJDOT, U.S. Department of Agriculture, Natural Resources Conservation Service, DVRPC. This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.
HAMILTON
FALLS
BORDENTOWN
Bordentown
Fieldsboro
CHESTERFIELD
MANSFIELD
Newbold Island
Duck Island
Mercer County
Bucks County
Burlington County
Duck Creek
New Jersey
Pennsylvania
Delaware River
Crosswick Street
New Jersey Turnpike
Manor Lake
Crystal Lake
Spring Hill Brook
Blacks Creek
Laurel Run
Jumping Brook
Little Hollow Run
Thornton Creek
Burlington- Bordentown Road
Kinkora Road
206
295
130
662
528
0
0.5
1
Miles
Delaware Valley Regional Planning Commission
November 2004

STEEP SLOPES

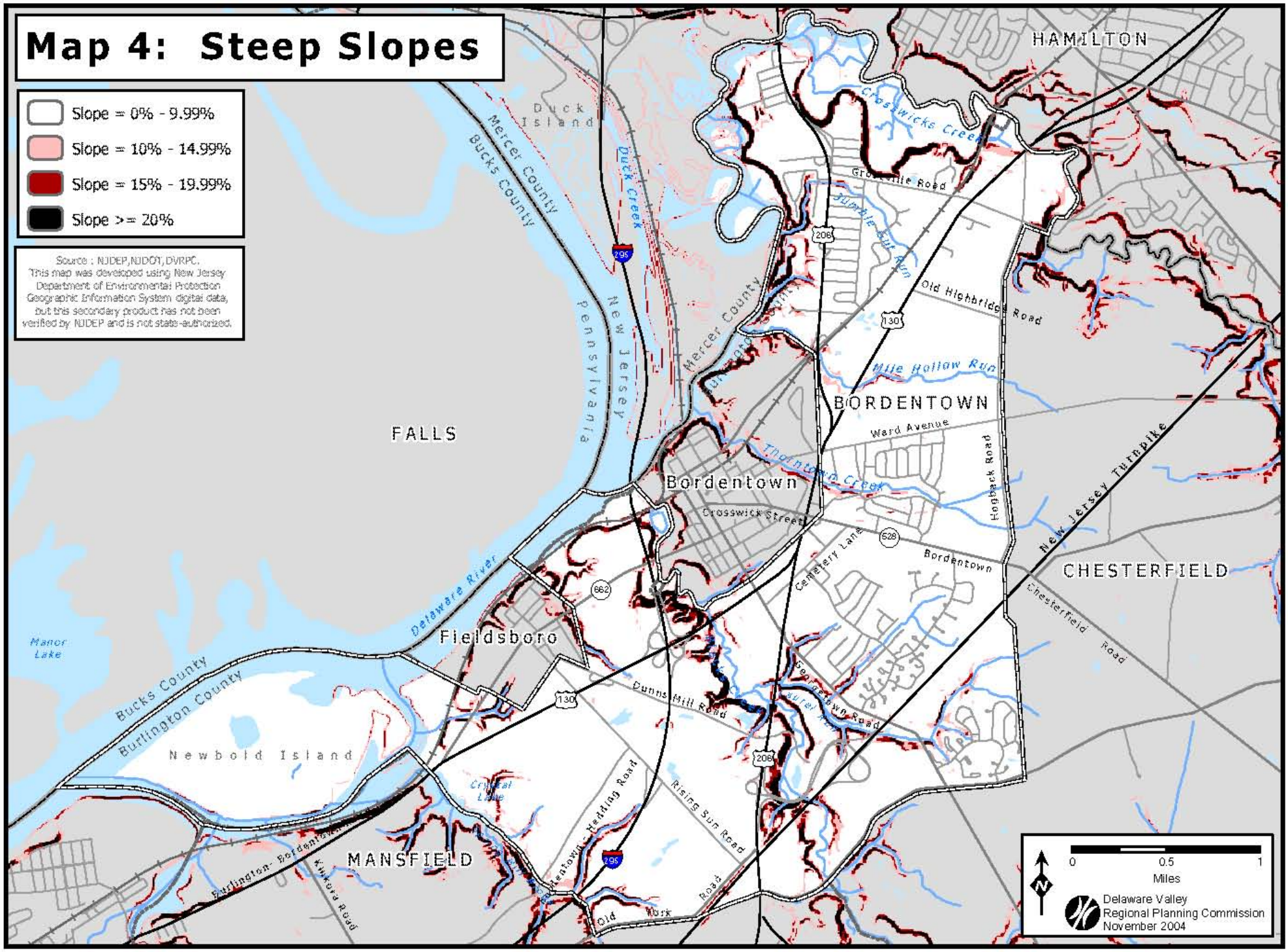
Only a small percent of Bordentown Township has slopes of over 10% (the percent of vertical rise to horizontal distance). However, certain areas of the township, mostly along waterways, have very steep slopes. The steepest slope in the township, an incline of 69%, is located along Black's Creek between Route 206 and the New Jersey Turnpike. The cliffs overlooking the Crosswicks Creek directly to the west of Route 206 have slopes of about 60%. Most of Bordentown's slopes are still well vegetated, but development has occurred on the edge of some of the very steep slopes. In these instances, it is important that natural buffers and other storm water best-management practices are used to separate the slope from the development and to prevent runoff from eroding the slope.

In general, development of steep slope areas is inadvisable because it can result in soil instability, erosion, sedimentation of the stream below, increased stormwater runoff and flooding. This causes habitat destruction and potential damage to property. Erosion on steep slopes is especially prevalent where excessive tree removal has taken place.

Most of Bordentown's slopes are made up of Keyport series soils. These soils tend to be moderately or well-drained, consisting of a moderate to fine texture, when on gentle slopes. However, they can slope as much as 25 percent. In Bordentown, 7.6 percent of this series has a slope greater than 5 percent.

Where steep slopes remain forested, often very old trees can be found, possibly even remnants of virgin (never cut) forest. In addition, it is possible that certain rare herbaceous plants could be found on forested steep slopes. However, no detailed inventory of these sites currently exists. An in-depth assessment of Bordentown Township's steep slope forests is needed and merits a special study. See **Map 4: Steep Slopes**.

Photo taken by Jan Bisco-Werner
Of the Bordentown Township Open Space Advisory Committee


Map 4: Steep Slopes
Slope = 0% - 9.99%
Slope = 10% - 14.99%
Slope = 15% - 19.99%
Slope >= 20%
Source : NJDEP,NJDOT,DVRPC.
This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.
HAMILTON
Duck Island
Mercer County
Bucks County
Pennsylvania
New Jersey
Duck Creek
Crosswicks Creek
Groveville Road
Jumpie Run
Old Highbridge Road
Mile Hollow Run
BORDENTOWN
Ward Avenue
Thornton Creek
Hogback Road
New Jersey Turnpike
FALLS
Bordentown
Crosswick Street
Cemetery Lane
Bordentown
CHESTERFIELD
Chesterfield Road
Delaware River
Fieldsboro
Manor Lake
Bucks County
Burlington County
Newbold Island
Dunns Mill Road
Rising Sun Road
Bordentown-Hedding Road
Burlington-Bordentown
Kinkora Road
MANSFIELD
Old York Road
295
130
206
662
528
0
0.5
1
Miles
N
Delaware Valley
Regional Planning Commission
November 2004

SURFACE WATER RESOURCES

All of Bordentown's land drains to the Delaware River by way of three main stream systems – the Crosswicks Creek system on the northwestern end of the township, the Blacks Creek across the center, and Spring Hill Brook on the southwestern end. The start of the main channel of each of these streams lies outside of Bordentown, in the townships to the east and southeast, although there are some tributaries that are wholly within Bordentown's boundaries.

Watersheds

A watershed is all the land that drains to a particular waterway such as a river, stream, lake, or wetland. The boundaries of a watershed are defined by the high points in the terrain, such as hills and ridges. A watershed includes not only the water body or waterway itself, but also the entire land area that drains to it. Large watersheds are made up of smaller ones, down to the catchment level of a local site. So, for example, the Delaware River watershed is made up of many smaller watersheds, such as the Crosswicks Creek. The Crosswicks Creek watershed, in turn, is formed of several subwatersheds, consisting of the land that drains to a major section or branch of the creek or to a large, branching tributary. These subwatersheds can be further subdivided into smaller ones, each surrounding the smaller tributaries that flow to the larger channel, and so on down to the catchment level. Watersheds are natural ecological units, where soil, water, air, plants, and animals interact in a complex relationship. The percentage of Bordentown Township land that is within each of the four watersheds is listed in the following table.

Table 7: Watersheds in Bordentown Township

Watershed	USGS Watershed Code (HUC 11 Number)	Stream classification	Acreage within Bordentown	% of Bordentown land	Subwatersheds (HUC 14 Numbers) within Bordentown
Crosswicks Creek (below Doctors Creek)	02040201**070**	FW2-NT	2,019	34%	02040201070**020**
Crosswicks Creek (Doctors Ck to New Egypt)	02040201**050**	FW2-NT	112	2%	02040201050**070**
Crafts Creek	02040201**090**	FW2-NT	2,118	36%	02040201090**030**
Blacks Creek	02040201**080**	FW2-NT	1,711	28%	02040201080**030**

Source: NJDEP

See **Map 5: Watersheds** and **Map 7: Surface Water, Wetlands, and Vernal Ponds.**

Crosswicks Creek Watershed

Crosswicks Creek at Groveville Road

The Crosswicks watershed is a complex system of streams that drains a total of 146 square miles of land. It crosses four counties - Monmouth County, Mercer County, Ocean County, and Burlington County - and fifteen municipalities – Millstone, Upper Freehold, Plumstead, Jackson, Hamilton, Washington, North Hanover, New Hanover, Chesterfield, Springfield, and Bordentown townships, the boroughs of Allentown and Wrightstown, and the cities of Trenton and Bordentown. The Crosswicks Creek Watershed covers an extensive portion of New Jersey Watershed Management Area 20, which also includes Blacks, Crafts and Assiscunk creek watersheds. In Bordentown, the Crosswicks watershed occupies 2,131 acres, including drainage to Jumble Gut Run, Mile Hollow Run, and Thorntown Creek.

The Crosswicks Creek complex system starts in Plumstead and Jackson townships, Ocean County; in Upper Freehold Township, Monmouth County; and in New Hanover Township, Burlington County. Fom these starting points, the creek's numerous branches eventually flow together to form the border between Hamilton Township and Bordentown Township. Here, the creek flows south through the Trenton-Hamilton-Bordentown Marsh, where it empties into the Delaware River, just below Prince Street, located in the City of Bordentown.

Jumble Gut Run, Mile Hollow Run and Thorntown Creek are all freshwater streams that flow to the Crosswicks. Jumble Gut Run and Mile Hollow Run are completely contained within Bordentown Township. However, the headwaters of Thorntown Creek begin in Chesterfield Township, to the east. Mile Hollow Run and Thorntown Creek are tidal only for a short portion of their length. Jumble Gut Run is tidal for its complete length.

Blacks Creek

The Crosswicks Creek corridor has wetlands along both sides for most of its length. Along its Bordentown extent, there is an extremely large wetland area, the Trenton-Hamilton-Bordentown Marsh. This freshwater tidal marsh is one of the premier wildlife areas in the state of New Jersey. Freshwater tidal marshes are rare and ecologically valuable. They support a wide variety of plant and wildlife species.

Blacks Creek Watershed

The Blacks Creek watershed covers an area of 30 square miles, of which 1,711 acres are located within Bordentown Township. The main waterway, Blacks Creek, is 13 miles long and flows northwest, from the Sykesville/Jacobstown area in the southeast, across Chesterfield and Bordentown townships, to the Delaware River. Blacks Creek forms the southern boundary between the City of Bordentown and Bordentown Township. While there are several tributaries to the creek, the main one is Bacons Run, which starts in Chesterfield Township, close to the southwestern edge where Chesterfield, Mansfield, and Springfield townships meet. Bacons Run continues its northwesterly flow into Mansfield Township where it joins the main branch of Blacks Creek.

There is one tributary of Blacks Creek, Laurel Run, located in Bordentown Township. It begins in both Bordentown Township and Chesterfield Township and meets Blacks Creek near Route 206. This is also the location where the waters of Blacks Creek are no longer tidal. A small amount of tidal marsh is located where Blacks Creek meets the Delaware River.

Crafts Creek Watershed

The USGS has designated Spring Hill Brook and the water features on Newbold Island as part of the Crafts Creek watershed. However, they are actually independent waterways that flow directly to the Delaware River. The Crafts Creek watershed drains an area of 17 square miles and Crafts Creek is 8.5 miles long. Of the watershed, 2,118 acres are located in Bordentown Township.

Crystal Lake

Spring Hill Brook marks the boundary between Bordentown and Mansfield townships. It begins in Mansfield Township and flows northwest to form Crystal Lake before meeting the Delaware River. Spring Hill Brook is a freshwater stream and is tidal up to the dam at Crystal Lake.

Spring Hill Brook has one main channel without significant branching, although it does have several short tributaries. The only sizeable tributary in Bordentown begins at the intersection of Interstate-295 and Rising Sun Road and flows south to join the main channel. It is unnamed.

Streams

In Bordentown Township, there are a total of 32.5 stream miles flowing across the land. A few of the streams, located within all three of the township's main watersheds, are considered to be headwater streams. That is, they are the initial sections of stream channels with no contributing tributaries (first-order streams), or they are stream channels formed from only one branching

section of tributaries above them (second-order streams). The headwaters are where a stream is "born," and actually begins to flow. In Bordentown Township, 14.09 miles of the total 32.5 miles of streams are first- or second-order streams, or headwaters.

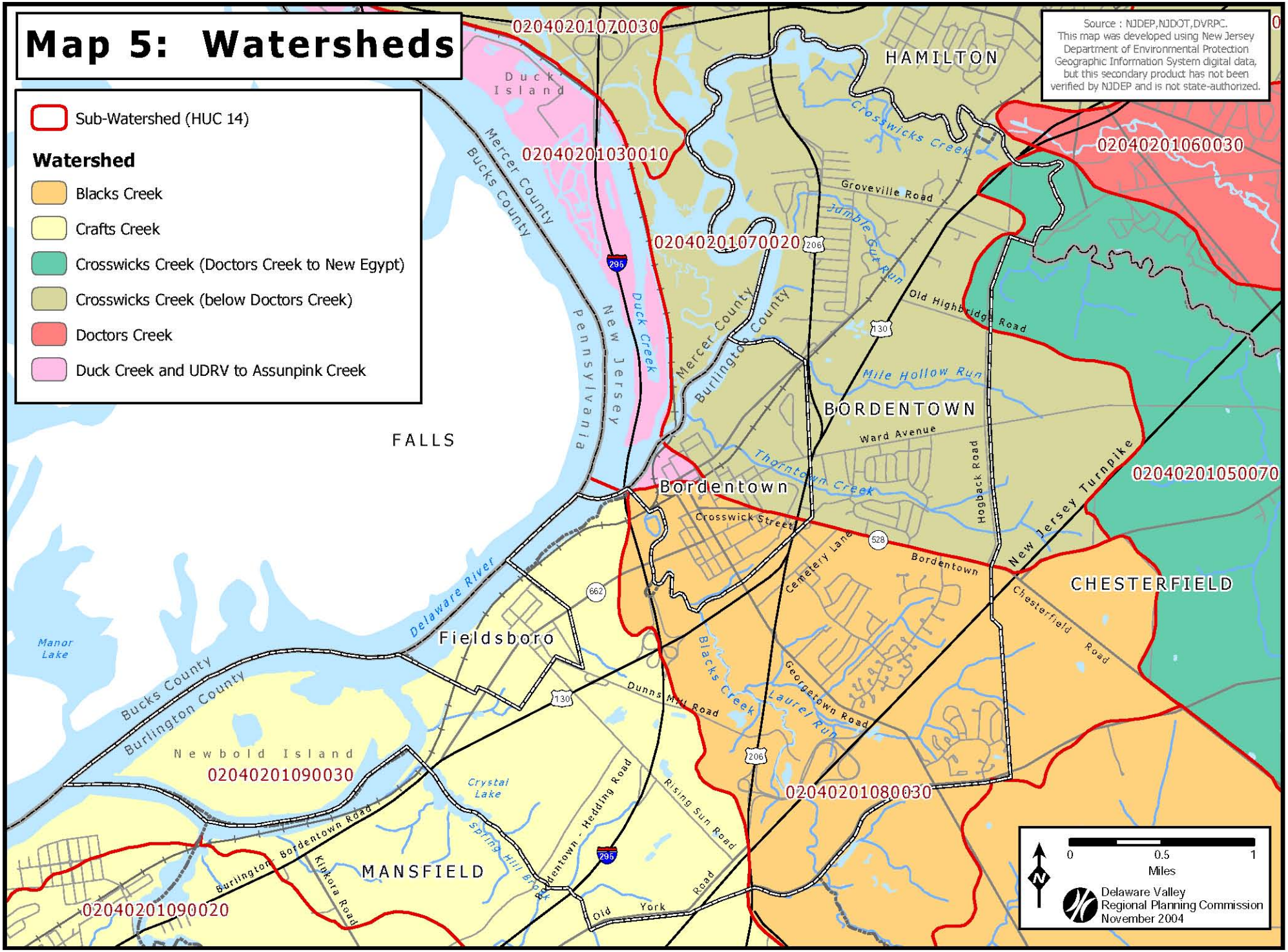
These headwaters are of particular importance because they tend to contain a diversity of aquatic species and their condition affects the water quality found downstream. They are also the most vulnerable to human intrusion. They drain only a small area of land, usually no larger than one square mile (640 acres). First- and second-order streams are narrow and often shallow, and are characterized by relatively small base flows. This makes them subject to greater temperature fluctuations, especially when forested buffers on their banks are removed. They are also easily oversilted by sediment-laden runoff and their water quality can be rapidly degraded. In addition, first-order streams are greatly affected by changes in the local water table because they are fed by groundwater sources. Headwaters are important sites for the aquatic life that is at the base of the food chain, and often serve as spawning or nursery areas for fish. See **Map 6: Stream Order.**

Table 8: Miles of Stream, by Stream Order

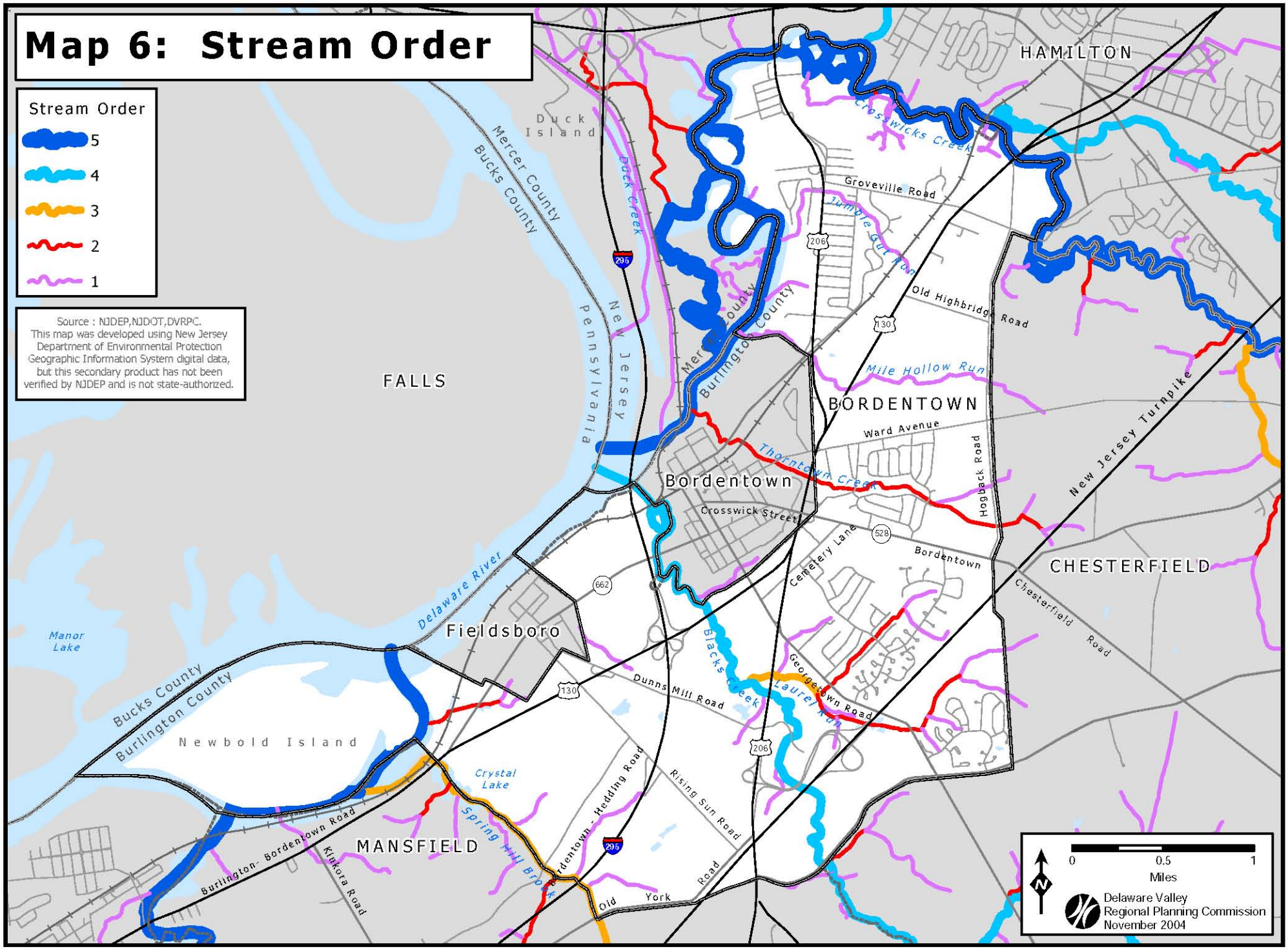
Stream Order	Miles
First Order streams (smallest)	10.64
Second Order streams	3.45
Third Order streams	2.31
Fourth Order streams	3.69
Fifth Order streams	9.14
Sixth Order streams	0.86
Ninety-ninth Order stream (Delaware River)	2.41
Total	**32.5**

Source: NJDEP

Photo taken by Jan Bisco-Werner
Of the Bordentown Township Open Space Advisory Committee


Map 5: Watersheds
Sub-Watershed (HUC 14)
Watershed
Blacks Creek
Crafts Creek
Crosswicks Creek (Doctors Creek to New Egypt)
Crosswicks Creek (below Doctors Creek)
Doctors Creek
Duck Creek and UDRV to Assunpink Creek
Source : NJDEP,NJDOT,DVRPC.
This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.
02040201070030
02040201030010
02040201060030
02040201070020
02040201050070
02040201080030
02040201090030
02040201090020
HAMILTON
FALLS
BORDENTOWN
Bordentown
CHESTERFIELD
Fieldsboro
MANSFIELD
Newbold Island
Duck Island
Crosswicks Creek
Groveville Road
Jumble Gut Run
Old Highbridge Road
Mile Hollow Run
Ward Avenue
Thorntown Creek
Hogback Road
New Jersey Turnpike
Crosswick Street
Cemetery Lane
Bordentown
Chesterfield Road
Georgetown Road
Laurel Run
Blacks Creek
Dunns Mill Road
Delaware River
Manor Lake
Crystal Lake
Spring Hill Brook
Bordentown - Hedding Road
Rising Sun Road
Old York Road
Bordentown Road
Kipkora Road
Burlington
Mercer County
Bucks County
Burlington County
New Jersey
Pennsylvania
Duck Creek
295
206
130
662
528
0
0.5
1
Miles
Delaware Valley Regional Planning Commission
November 2004

Map 6: Stream Order



Tidal Water

Bordentown Township has tidal waters on the Crosswicks Creek, Blacks Creek and Spring Hill Brooks. Tidal flows bring Delaware River water into the streams twice a day. Tidal flows both help and hinder maintenance of good water quality in affected streams. The flood (incoming) tide carries and leaves nutrients that are beneficial to aquatic organisms, but it also limits the regular flushing out of silt and pollutant-laden waters coming from upstream. Silt deposition within a stream tends to increase during ebb (outgoing) tides, although deposition is also a function of stream shape, the presence of specific flow barriers, and the quantity of silt (the load) being carried by the stream. See **Map 7: Surface Water, Wetlands, and Vernal Ponds.**

Lakes

There is one major lake in Bordentown Township: Crystal Lake. This open body of water is permanent water and was created by damming the stream. Although it is classified as a true lake by federal and state maps, this lake is actually formed by a man-made impoundment. True lakes do not exist in southern New Jersey. All the lakes in South Jersey were created with dams, in order to provide power for grist or saw mills, or to provide for recreation or flood control. Damming to power mills was an especially common practice in the 1800s. Many such dams have been replaced or rebuilt and thus are still present, although the mills are mostly gone throughout South Jersey.

Crystal Lake is 20.8 acres in size. The area surrounding the lake is a New Jersey Department of Environmental Protection bald eagle preserve, where entry is not permitted. Bordentown also has numerous unnamed ponds, such as the ponds in Northern Park, off of Rising Sun Road and off of Dunns Mill Road. Some are leftover clay pits that were once used by brick factories. There are no recreational use lakes in Bordentown Township.

See **Map 7: Surface Water, Wetlands, and Vernal Ponds**.

Wetlands

Wetlands support unique communities that serve as natural water filters and as incubators for many beneficial species. The term "wetland" is applied to areas where water meets the soil surface and supports a particular biological community. Under normal circumstances, wetlands are those areas that support a prevalence of defined wetland plants on a wetland soil. The US Fish & Wildlife Service designates all large vascular plants as wetland (hydric), non-wetland (non-hydric) or in-between (facultative). Wetland soils, also known as hydric soils, are areas where the land is saturated for at least seven consecutive days during the growing season. The source of water for a wetland can be a stream or lake edge, as well as groundwater that rises close to the land surface.

New Jersey protects freshwater wetlands under the New Jersey Freshwater Wetlands Protection Act Rules: N.J.A.C.A 7:7A. The law also protects transition areas or "buffers" around freshwater wetlands. The New Jersey freshwater wetlands maps provide guidance on where wetlands are found in New Jersey, but they are not the final word. Only an official determination from DEP, called a "letter of interpretation," can determine for sure if there are freshwater wetlands on a property. An LOI verifies the presence, absence, or boundaries of freshwater wetlands and transition areas on a site. Activities permitted to occur within wetlands are very limited and permits are required for most of them. Additional information on wetlands rules and permits is available through NJDEP and on their web site under "landuse." See **Sources of Information**, on page 91.

Bordentown Township has tidal freshwater marshes and freshwater wetlands along its interior stream corridors. Wetlands of all types total 1,504 acres within the township, of which 1,114 acres are interior wetlands, 205 acres are freshwater tidal marshes, and 185 acres are disturbed or modified wetlands. See **Map 7: Surface Water, Wetlands, and Vernal Ponds**.

Agricultural Wetlands

Agricultural wetlands occupy 111 acres of Bordentown Township. These "quasi-wetlands" are found scattered as small sites. Agricultural wetlands are lands under cultivation that are modified former wetland areas, but which still exhibit evidence of soil saturation in aerial infrared photo surveys. See **Map 7: Surface Water, Wetlands, and Vernal Ponds**.

The Natural Resources Conservation Service sponsors the Wetlands Reserve Program, a voluntary program that offers landowners a chance to receive payments for restoring and protecting wetlands on their property. This program provides technical and financial assistance to eligible landowners who can enroll eligible lands through permanent easements, 30-year easements, or restoration cost-share agreements.

Photo taken by Jan Bisco-Werner
Of the Bordentown Township Open Space Advisory Committee

Vernal Pools

Vernal pools are bodies of water that appear following snow melt and during spring rains but which disappear or are dry during the rest of the year. They are highly important sites for certain rare species of frogs and salamanders, called obligate breeders. Obligate breeders will only breed in vernal pools, because the pool's impermanence prevents residence by predators who would consume the eggs and young.

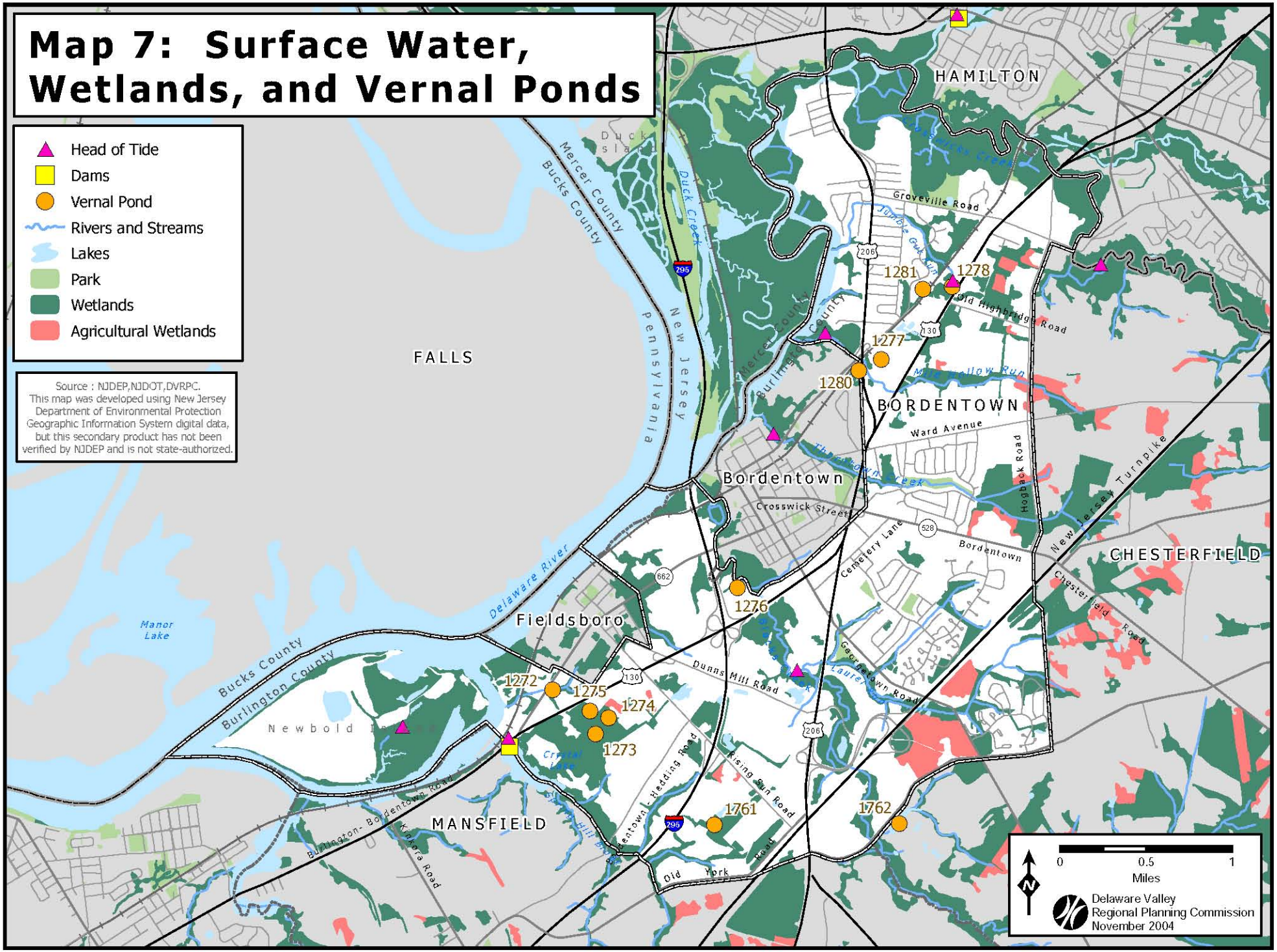
Vernal pools are so intermittent that their existence as wetlands has frequently not been recognized. Consequently, many of them have disappeared from the landscape, or have been substantially damaged. This, in turn, is a principal cause of the decline of their obligate amphibian species.

The New Jersey Division of Fish and Wildlife has been conducting a Vernal Pool Survey project since 2001, to identify, map, and certify vernal ponds through the state. Once a vernal pond is certified, regulations require that a 75-foot buffer be maintained around the pond. NJDEP's Division of Land Use Regulation oversees this designation and restricts development around vernal ponds by denying construction permits. Local municipalities can provide additional protection by instituting restrictive zoning or negotiating conservation easements on the land surrounding the pond.

The state has identified ten vernal ponds in Bordentown Township. Surveys of each pond are planned to determine what species are present and, indeed, if the pond is still in existence as a natural habitat. None of these sites had been surveyed as of May 2004. See **Map 7: Surface Water, Wetlands, and Vernal Pools**.

Photo taken by Jan Bisco-Werner
Of the Bordentown Township Open Space Advisory Committee

Map 7: Surface Water, Wetlands, and Vernal Ponds



Flood Hazard Areas

Flood hazard areas are defined as the combination of the 100-year floodplains and the adjacent flood fringe areas that help to hold and carry excess water during overflow of the normal stream channel. The 100-year floodplains are defined as the land area that will be inundated by the overflow of water resulting from a 100-year flood (a flood which has a 1% chance of occurring in any given year).

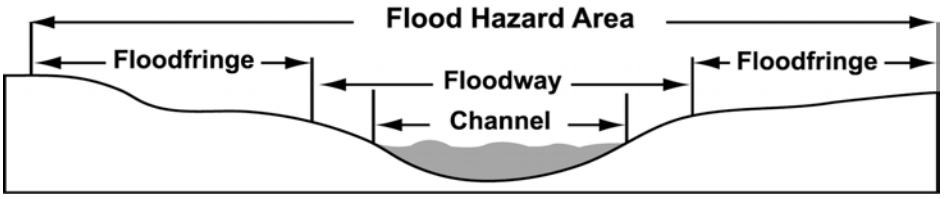


Figure 2*: Parts of a Flood Hazard Area*

Flood hazard areas require protection in order to prevent serious loss to residents. Equally important is the preservation of the environmentally sensitive aquatic communities that exist in these flood hazard areas, as well as in the stream corridors themselves. These communities are often the first link in the food chain of the aquatic ecosystem. In addition, floodplain areas serve the function of removing and mitigating various pollutants, through the uptake by their vegetation of excess chemical loads in the water and by the filtering of sediments generally. All efforts to maintain these flood hazard areas will help to preserve the flood-carrying capacity of the streams and their water quality.

In New Jersey and throughout the country, building in areas subject to flooding is regulated to protect lives, property, and the environment. New Jersey regulates construction in the flood plain under the Flood Hazard Area Control Act, N.J.S.A. 58:16A-50 et seq., and its implementing rules at N.J.A.C. 7:13. Activities that are proposed to occur in a flood hazard area will require issuance of a stream encroachment permit or a letter of non-applicability from the NJDEP. Additional information on floodplain activities is available from NJDEP and from their web site under "Landuse." See **Sources of Information**, at the end of the document.

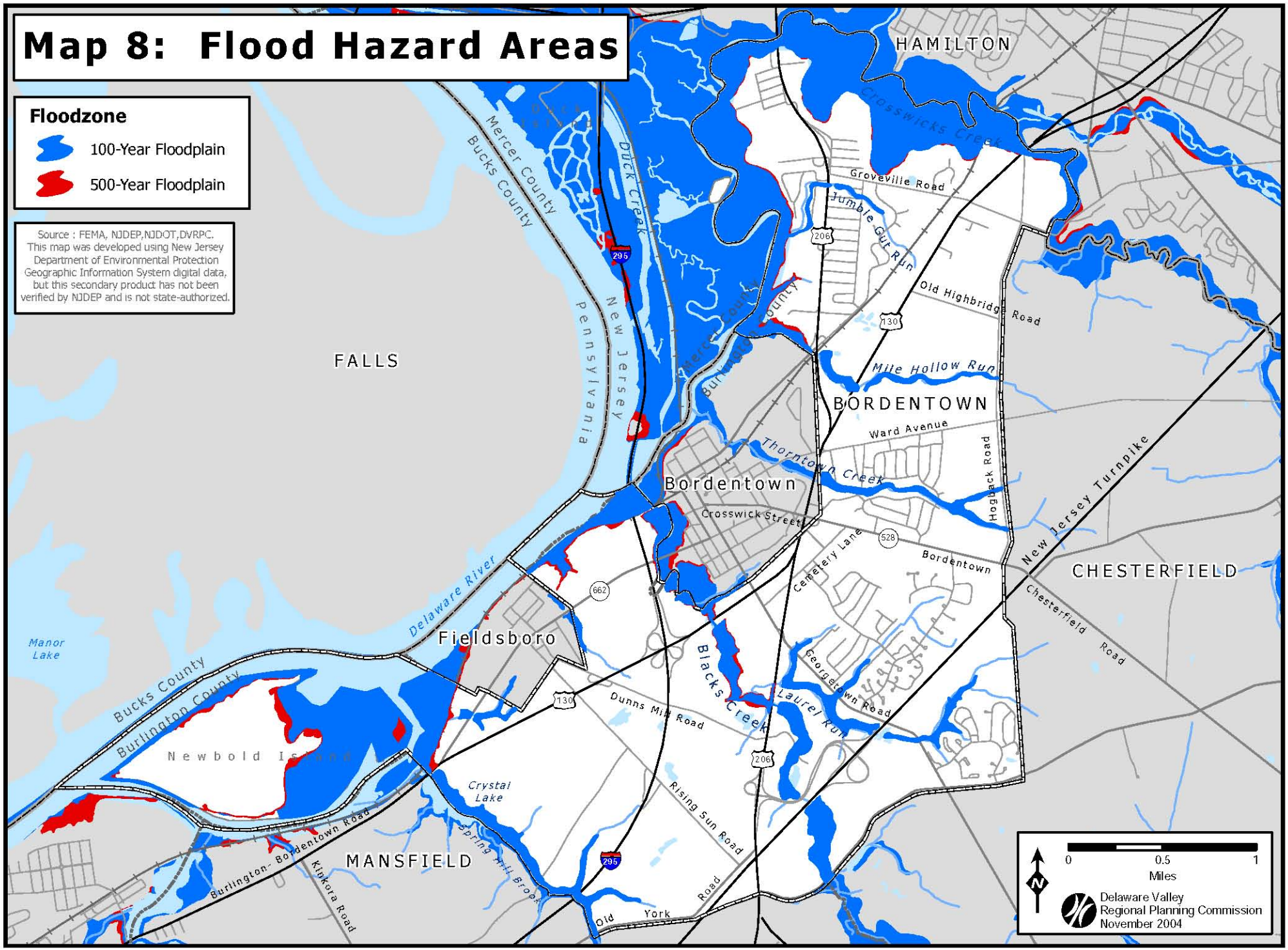
Seventeen and a half percent (17.5%) of Bordentown Township's land is characterized as flood hazard area, principally surrounding Spring Hill Brook, Blacks, Crosswicks, Thorntown, and Mile Hollow creeks. In addition, the Trenton-Hamilton-Bordentown Marsh is subject to flooding. See **Map 8: Flood Hazard Areas**.

Table 9: Flood Hazard Area Acreage

Category	Acres
Area inundated by 100-year flooding	987
Area inundated by 500-year flooding	56

Source: Federal Emergency Management Agency (FEMA)

Map 8: Flood Hazard Areas



Surface Water Quality

Water quality standards are established by federal and state governments to ensure that water is suitable for its intended use. The Federal Clean Water Act (P.L. 95-217) requires that wherever possible the water-quality standards provide water suitable for fish, shellfish, and wildlife to thrive and reproduce and for people to swim and boat. All waterbodies in New Jersey are classified by NJDEP as either freshwater (FW), pinelands water (PL), saline estuarine water (SE) or saline coastal water (SC). Freshwater is further broken down into freshwater that originates and is wholly within federal or state parks, forests, or fish and wildlife lands (FW1) and all other freshwater (FW2). The water quality for each of these groups must be able to support designated uses that are assigned to each waterbody classification (see *Surface Water Quality Standards N.J.A.C. 7:9B-1.12*). In addition to being classified as FW1 and FW2, fresh waterbodies are classified as trout-producing (TP), trout-maintaining (TM) or nontrout waters (NT). Each of these classifications may also be subject to different water quality standards.

Photo taken by Jan Bisco-Werner
Of the Bordentown Township Open Space Advisory Committee

The determination of whether or not water quality is sufficient to meet a waterbody's designated use(s) is based on numerous surface water quality parameters. Some examples of surface water quality parameters include fecal coliform, dissolved oxygen, pH, phosphorous, and toxic substances (see *N.J.A.C. 7:9B-1.14*). NJDEP also evaluates water quality by examining the health of aquatic life in a stream. NJDEP operates two water quality monitoriong networks: the Ambient Surface Water Monitoring Network (ASWM) and the Ambient Biomonitoring Network (AMNET). NJDEP runs the ASWM network in cooperation with USGS. This network contains 115 stations and monitors for nutrients (i.e., phosphorous and nitrogen), bacteria, dissolved oxygen, metals, sediments, chemicals, and other parameters. AMNET, which is administered solely by NJDEP, evaluates the health of in-stream benthic (bottom-dwelling) macroinvertebrate communities (aquatic life) as a biological indicator of water quality. This network includes 820 monitoring stations located throughout the state. Each station is sampled once every five years. The first round of sampling for all stations took place between 1992 and 1996 and the second round occurred between 1997 and 2001.

All the creeks in Bordentown are classified as FW2–NT, which means that they are freshwater streams that are not trout producing or trout maintaining water. According to NJDEP rules,

FW2-NT waters must provide for (1) the maintenance, migration and propagation of the natural and established biota; (2) primary and secondary contact recreation (i.e., swimming and boating); (3) industrial and agricultural water supply; (4) public potable water supply after conventional filtration and disinfections; and (5) any other reasonable uses. See ***Table 10: Water Quality Classifications of Streams in Bordentown Township.***

The one lake in Bordentown, Crystal Lake, is listed on the New Jersey 2002 Integrated List of Waterbodies as being eutrophic. The term eutrophic means the water is overly rich with organic nutrients, causing an abundance of plant life, particularly algae. The algae blocks light from getting to the water and in turn causes the extinction of other organisms.

Table 10: Water Quality Classifications of Streams in Bordentown Township

Streams	Classification
Spring Hill Brook	FW 2 – NT
Blacks Creek	FW 2 – NT
Crosswicks Creek	FW 2 – NT
Jumble Gut Run	FW 2 – NT
Mile Hollow Run	FW 2 – NT
Thorntown Creek	FW 2 – NT

Source: NJDEP

Bordentown Township Stream Water Quality

There are four AMNET sites within Bordentown Township or along its borders. NJDEP sampled each of the four AMNET sites in January 1993, in January 1998 and in January 2001. Each AMNET site is tested for only one water quality parameter – aquatic life. In the first two samplings, three of the four sites were rated as "moderately impaired" for aquatic life support, and one site on Doctors Creek was rated as "non-impaired." All four sites were rated as moderately impaired in the third sampling. Bordentown's AMNET stations are listed in ***Table 11: New Jersey AMNET Sampling Locations for Bordentown Township and 2004 Integrated Water Quality Monitoring and Assessment Report Status*** and are depicted on **Map 9: Water Quality – Nontidal Waters**.

New Jersey's Integrated Water Quality Monitoring and Assessment Report

The Federal Clean Water Act under Section 303(d) requires states to identify "Impaired Waters" where specific designated uses are not fully supported. Accordingly, NJDEP prepares a biennial list of impaired waters – the 303(d) List. The Federal Clean Water Act also requires states to periodically assess and report on the quality of all their waters, not just impaired waters. This biennial water quality report is entitled New Jersey's Water Quality Inventory Report (also known as the 305(b) Report). However, in 2002, the U.S. Environmental Protection Agency (EPA) recommended that states integrate their Water Quality Inventory Report [305(b)] and their Impaired Waterbodies List [303(d)]. Following EPA's guidance, NJDEP combined the 303(d) List and the 305(b) Report into a single document called the *2002 Integrated List of Waterbodies*. NJDEP is now preparing to finalize and release the *2004 Integrated List of Waterbodies*. The Integrated List of Waterbodies (for both 2002 and 2004) includes five sublists. Sublists 1 through 4 comprise what was formerly the 305(b) Report. Sublist 5 is the 303(d) List.

Although all of the four AMNET stations in Bordentown were moderately impaired for aquatic life (benthic macroinvertebrates) only two of these stations were placed on Sublist 5 (303(d) List) in the 2004 Integrated Water Quality Monitoring and Assessment Report. The remaining stations were not placed on any water quality list because they were located in tidal water. NJDEP determined that sites located in tidal water could no longer be assessed and listed due to new water quality testing standards.

NJDEP has issued guidance for associating stream segments with monitoring stations. Based on this guidance the following waters in Bordentown are impaired for aquatic life: the entire Crosswicks Branch and all its tributaries.

For impaired waters (waters on *Sublist 5*), the state is required to establish total maximum daily loads (TMDLs). A TMDL represents the assimilative or carrying capacity of a waterbody, taking into consideration point and nonpoint sources of the pollutant of concern, natural background conditions and surface water withdrawals. A TMDL quantifies the amount of a pollutant a waterbody can assimilate without violating a state's water quality standards. A TMDL is intended to reduce pollutant loads so that a waterbody can meet its surface water quality standards.

Table 11: Water Quality of Nontidal Waters in the Region

Macroinvertebrate Assessments

Site ID	Water Body	Location	Municipality	January 1993 NJ Impairment Score	January 1998 NJ Impairment Score	January 2001 NJ Impairment Score
AN0126	Crosswicks Creek	Crosswicks Creek at Main St.	Hamilton	15	9	21
AN0130	Doctors Creek	Doctors Ck at Rt. 130	Hamilton	27	27	21
AN0131	Crosswicks Creek	Point Breeze	Bordentown Twp.	9	9	9
AN0134	Blacks Creek	Blacks Creek at Rt. 130	Bordentown Twp.	9	15	15

Source: NJDEP - Bureau of Freshwater and Biological Monitoring "Lower Delaware River Drainage Basin 2000-2001 Benthic Macroinvertebrate Data"

NJ Impairment Score	Biological Assessment
0-6	Severely Impaired
9-21	Moderately Impaired
24-30	Non-impaired

Source: NJDEP

Lake Program Assessment

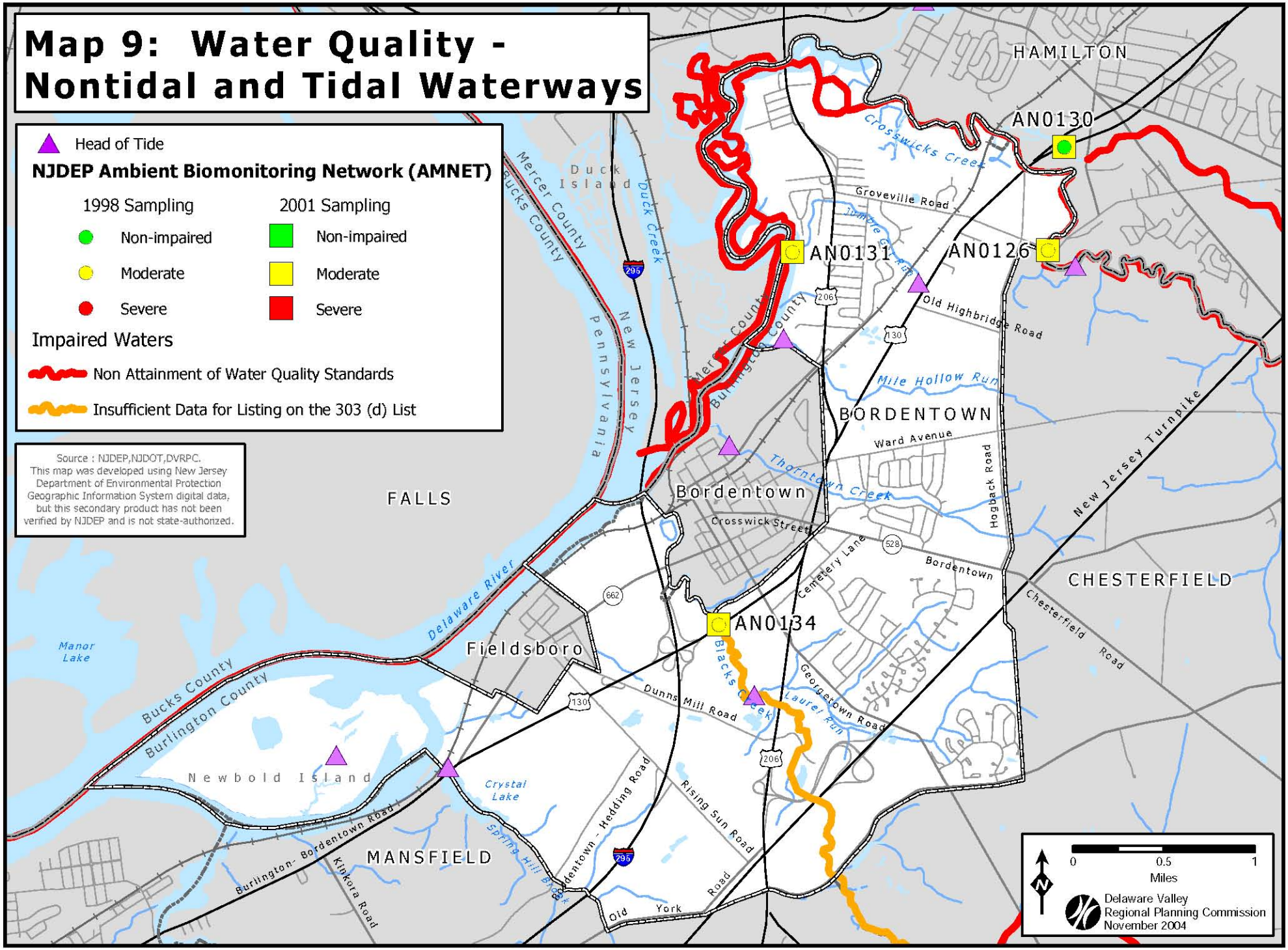
Site ID	Water Body	Location	Municipality	1998	2002
Crystal Lake - 20	Crystal Lake	Crystal Lake	Bordentown Twp.	1) Eutrophic 2) Fish consumption discouraged - Mercury in fish tissue	Eutrophic

Source: NJDEP

Stream surveys by local organizations are much needed, along with regular monitoring of water quality on all of a community's waterways. Knowing the actual condition of streams and stream banks, and planning for their improvement, requires fuller surveys and more frequent monitoring than the state can provide. The state only monitors main channels and only does biological assessments on a five-year cycle.

Photo taken by Jan Bisco-Werner
Of the Bordentown Township Open Space Advisory Committee

Map 9: Water Quality - Nontidal and Tidal Waterways



Causes of Water Quality Impairments

Stormwater Runoff and Impervious Cover

Stormwater runoff and other nonpoint source pollution (pollution coming from a wide variety of sources rather than from a single point such as a discharge pipe) have the largest effect on the water quality and channel health of streams in Bordentown. These sources are also the most difficult to identify and remediate because they are diffuse, widespread, and cumulative in their effect. Most nonpoint source pollution in the three watersheds is known to derive from stormwater drainage off paved surfaces such as streets, commercial/industrial areas, and residential sites (with and without detention basins), and from agricultural fields that lack adequate vegetative buffers. Some of this runoff comes to the waterways from similar sources in upstream townships and some of it derives from Bordentown land uses.

The volume of runoff that is carried to a stream also impacts stream channel condition. Increased volume usually results from increased impervious surface within a subwatershed. As an area becomes developed, more stormwater is directed to the streams from neighborhood storm drains, residential and commercial stormwater facilities, and road drainage. In general, scientists have found that levels of impervious cover of 10% or more within a subwatershed are directly linked to increased stormwater runoff, enlargement of stream channels, increased streambank erosion, lower dry weather flows, high stream temperatures, lower water quality, and declines in aquatic wildlife diversity. When impervious cover reaches 25% to 30%, streams are found to be severely degraded. Due to its dense development pattern, most of Bordentown City's land uses are greater than 25% impervious cover. In Bordentown Township, though, only about one-fifth of the land area has greater than 25% impervious cover. See **Map 10: Impervious Surface.**

Table 12: Acreage of Impervious Surface in Bordentown

Impervious Surface	Acres
Less Than 5%	4034
5 - 10%	419
10 - 25%	334
Greater Than 25%	1173
Total	**5960**

Source: NJDEP

Inadequate Stream Buffers

The stream buffer is the region immediately beyond the banks of a stream that serves to limit the entrance of sediment, pollutants, and nutrients into the stream itself. Stream buffers are quite effective at filtering substances washing off the land. The vegetation of the buffer traps sediment and can actually utilize (uptake) a percentage of the nutrients flowing from lawns and farm fields. When forested, a stream buffer promotes bank stability and serves as a major control of water temperature. The buffer region also serves as a green corridor for wildlife to move between larger forested habitat areas. This greenway can be utilized for recreation by residents as well, through trails, bikeways, and access points to the water for fishing and canoe/kayak launching.

The importance of a healthy, intact buffer zone (also referred to as a "riparian corridor") has been well documented scientifically over the past 20 years, especially for headwater streams. There is less agreement and much continuing research on the appropriate minimum width of a buffer. In literature on this issue, a recommended minimum buffer width of 100 feet is most common, with differing activities permitted in each of three zones within the buffer. Buffers of up to 300 feet are recommended for wildlife corridors and potential passive recreational use, such as walking trails.

The New Jersey Freshwater Wetlands Protection Act incorporates buffer requirements into its wetland protection regulations. The width of the "transition zone" extending beyond a wetland is determined by the value of the wetland, based on its current use and on the documented presence/absence of threatened or endangered species. Municipalities may not establish buffers on wetlands that exceed those required by the state statute. However, the municipality can make certain that those limits are accurate through its review of the wetlands delineation process, and it can also monitor use of the land within the transition area and take action against encroachments.

Restoration of stream buffers on agricultural lands is supported by various programs of the US Department of Agriculture and the New Jersey Department of Agriculture, such as the Conservation Reserve Program (CRP), administered by the USDA's Farm Service Agency (FSA). This program compensates farming landowners for the loss of land being converted to a buffer or other habitat. It also funds or directly creates new buffers where they are absent. Programs such as the Environmental Quality Incentive Program (EQIP), administered by the Natural Resources Conservation Service (NRCS) of USDA, encourage the "due care" management of agricultural lands, involving the proper levels of fertilizer and pesticide applications to farmland. It funds up to 75% of the costs of eligible conservation practices. These are all programs in which individual landowners volunteer to take part.

This stretch of Blacks Creek has an excellent vegetated buffer

Point Sources of Pollution

Point sources of pollution, which come from a single source or 'point" such as an industrial pipe discharge, are regulated by NJDEP through the New Jersey Pollution Discharge Elimination System (NJPDES). New Jersey created NJPDES in response to the Federal Clean Water Act of 1972, which mandated that each state develop water quality standards and regulate the amount of pollution entering water bodies. The act classified all water pollution into one of two categories: "point source" pollution and "nonpoint source" pollution, but only required states to regulate point sources.

NJDEP, through the Division of Water Quality and the Bureau of Point Source Permitting, administers the NJPDES program (*N.J.A.C. 7:14A*). Under NJPDES, any facility discharging domestic or industrial wastewater directly into surface or ground water must apply for and obtain a permit for discharging. Rather than creating individually tailored permits for each and every facility, the Division of Water Quality uses scientific standards to create and issue general permits for different categories of dischargers. Permits are available and required for surface water, ground water, storm water, combined sewer overflow, and residual discharges. NJDEP enforces the terms of NJPDES permits by visiting discharging facilities and conducting water quality, biological, and toxicological analyses, and thermal impact and cooling water assessments.

Under the Open Public Records Act (OPRA) of 2002, a list of active NJPDES permits is available. As of September 30, 2004, twenty-three NJPDES permits were issued to individual facilities in or around Bordentown Township. These are shown in ***Table 13: Bordentown Township NJPDES Permits.***

Since the adoption of the Federal Clean Water Act in 1972 and the implementation of NJPDES in subsequent years, water pollution from point sources has decreased drastically. NJDEP is now focusing on nonpoint sources of water pollution, which have increased as farmlands and forestlands are covered over with impervious materials like concrete, asphalt, and buildings.

Table 13: New Jersey Pollution Discharge Elimination System (NJPDES) Permits

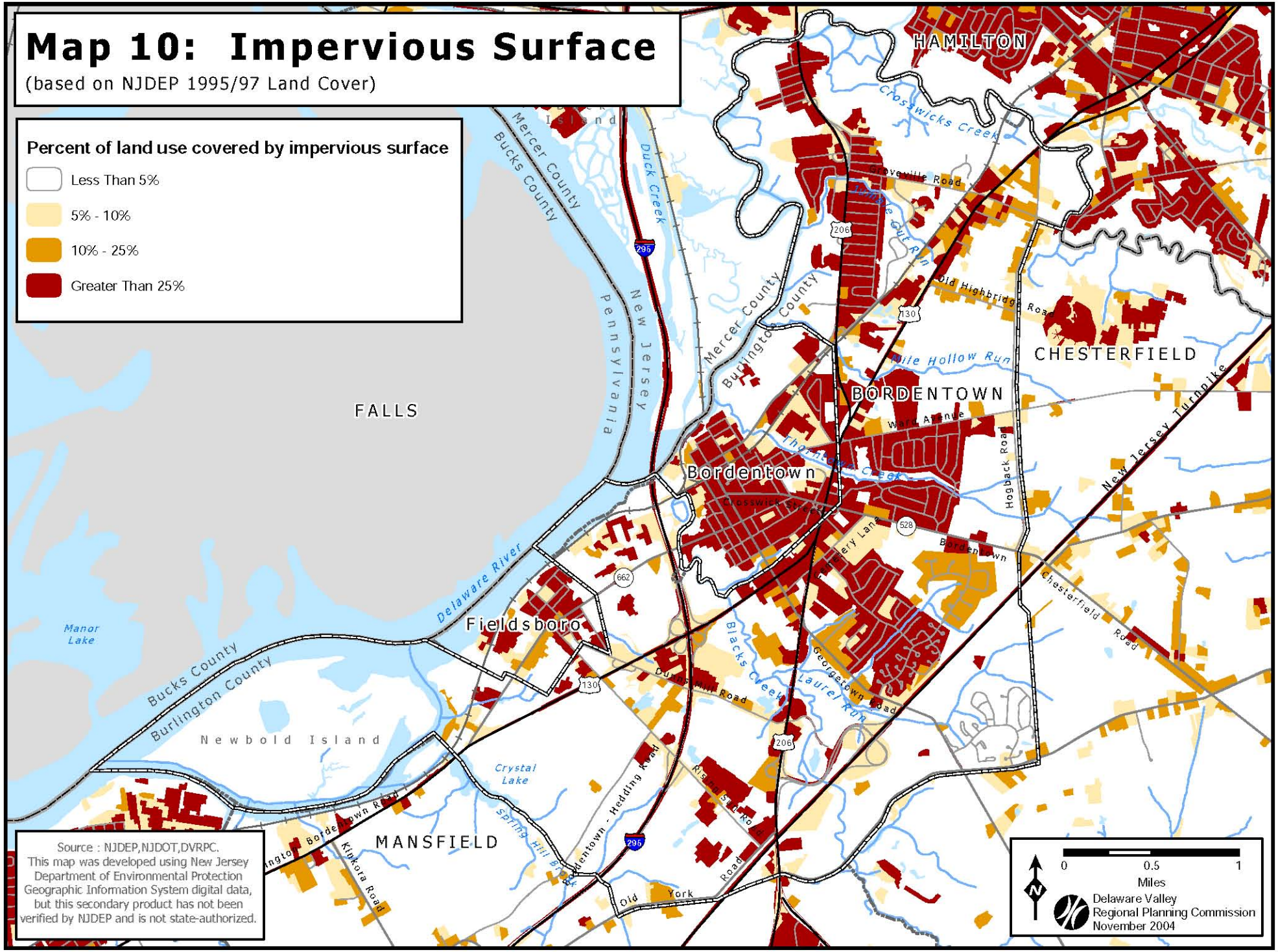
NJPDES Permit #	Facility Name	Municipality	Effective Start Date	Expiration Date	Discharge Category Description	Street Address
NJ0024678	Blacks Creek Water Treatment Plant	Bordentown Twp	6/1/03	5/31/06	Sanitary Wastewater	954 Farnsworth Avenue
NJG0110493	Woolston Construction Co Inc.	Bordentown Twp	6/1/02	5/31/07	Basic Industrial Stormwater	83 Old Amboy Road
NJ0051403	Colonial Pipeline Company, Allentown Station	Bordentown Twp	4/1/01	3/31/06	Discharge to Groundwater	Route 2 Box 32B
NJ0051403	Colonial Pipeline Company, Allentown Station	Bordentown Twp	4/1/01	3/31/06	Stormwater	Route 2 Box 32B

NJG0057631	Bordentown Junction Truck Stop	Bordentown Twp	6/1/02	5/31/07	Basic Industrial Stormwater	402 Rising Sun Road
NJG0110639	Parklands Reclamation Landfill	Bordentown Twp	6/1/02	5/31/07	Basic Industrial Stormwater	1070 Route 206
NJG0129801	Pilot Travel Center #382	Bordentown Twp	6/1/02	5/31/07	Basic Industrial Stormwater	2008 State Highway 206 S
NJG0154148	Bordentown Township	Bordentown Twp	4/1/04	2/28/09	Tier A Municipal Stormwater General Permit	1 Muncipal Drive
NJ0103829	Ocean Spray Cranberries Inc.	Bordentown City	7/1/00	6/30/05	Significant Indirect User	104 E Park Street
NJG0104272	Ocean Spray Cranberries Inc.	Bordentown City	2/1/04	1/31/09	Land Appl/Food Processing	104 E Park Street
NJG0110019	Ocean Spray Cranberries Inc.	Bordentown City	6/1/02	5/31/07	Basic Industrial Stormwater	104 E Park Street
NJG0112062	Mershon Concrete	Bordentown City	10/1/03	9/30/08	Concrete Products Manufacturing	Rt 130 S
NJG0135950	Jersey Bus Sales Inc.	Bordentown City	6/1/02	5/31/07	Basic Industrial Stormwater	2015 Rt 206 North
NJG0149438	Bordentown City	Bordentown City	4/1/04	2/28/09	Tier A Municipal Stormwater General Permit	324 Farnsworth Avenue
NJG0151751	AC Wagner Youth Correctional Facility	Chesterfield Twp	4/1/04	2/28/09	Public Complex Stormwater General Permit	Ward Avenue
NJG0155039	Garden State Correctional Facility	Chesterfield Twp	5/1/04	2/28/09	Public Complex Stormwater General Permit	Highbridge Road
NJ0026719	AC Wagner Youth Correctional Facility	Chesterfield Twp	8/1/02	7/31/07	Sanitary Wastewater	Ward Avenue
NJ0105392	Olde York Country Club	Chesterfield Twp	5/1/04	4/30/09	Discharge to Groundwater	Olde York Road
NJG0153559	Chesterfield Township	Chesterfield Twp	4/1/04	2/28/09	Tier B Municipal Stormwater General Permit	300 Bordentown Chesterfield Road
NJG0151971	Fieldsboro Borough	Fieldsboro Boro	4/1/04	2/28/09	Tier B Municipal Stormwater General Permit	18 Washington Street
NJ0026301	Hamilton Township WPCF	Hamilton Twp	2/1/04	7/31/06	Sanitary Wastewater	300 Hobson Avenue
NJ0028649	Bordentown City Water WFP	Hamilton Twp	2/1/00	1/31/05	Industrial Wastewater	Rt. 206 & White Horse Circle
NJG0101923	Bordentown City Water WFP	Hamilton Twp	9/1/03	8/31/08	Potable WTP Basins & Drying Beds	Rt. 206 & White Horse Circle

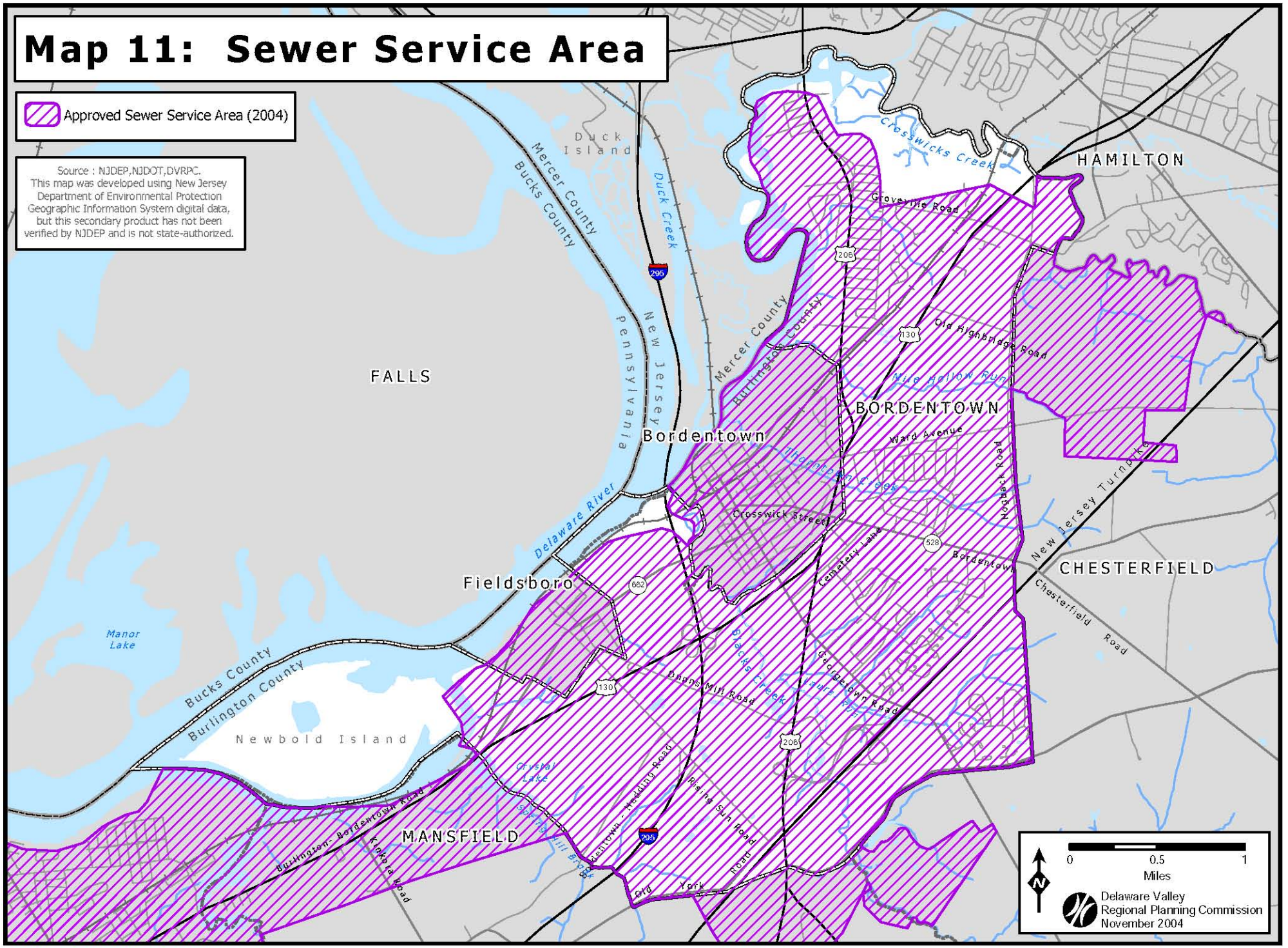
Source: NJDEP

Map 10: Impervious Surface

(based on NJDEP 1995/97 Land Cover)



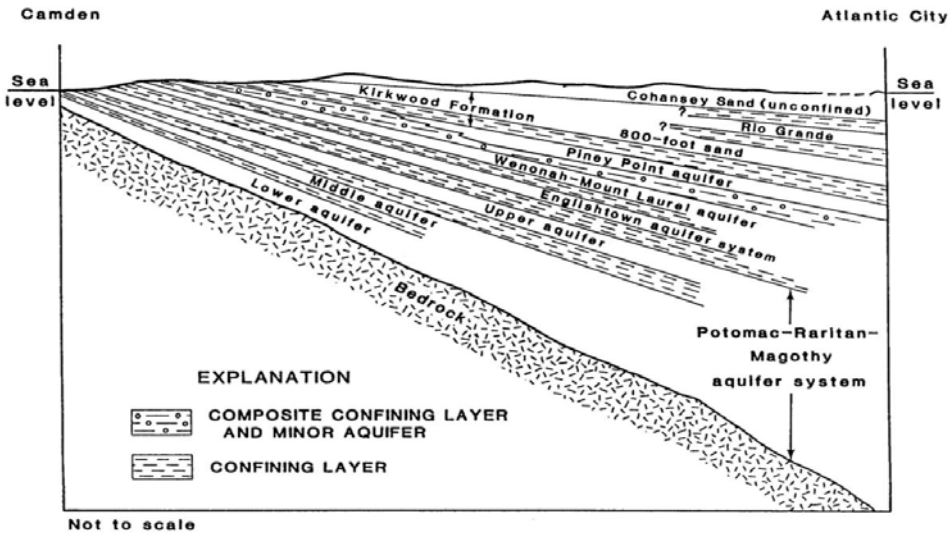
Map 11: Sewer Service Area



GROUNDWATER

The geology of the New Jersey Coastal Plain can be visualized as a tilted layer cake, with its "layers" or strata formed of gravels, sands, silts, and clays. The saturated gravel and sand layers, with their large pore spaces, are the aquifers from which water is drawn. The silt and clay layers, which impede the movement of water, are called confining beds.

A cross section across southern New Jersey from west to east would show that the aquifers are not horizontal but tilt toward the southeast, getting deeper as they cross the state toward the Atlantic Ocean. Because of this tilting, each aquifer emerges on the land surface in a sequential manner. The deepest strata emerge on the surface near the Delaware River. Where a layer emerges is its "outcrop" area. The Potomac–Raritan–Magothy (PRM) formation, the deepest and most abundant aquifer, is a major water source for Inner Coastal Plain communities and provides all of Bordentown Township's water. Other smaller aquifers on top of the PRM are the Englishtown and the Mt. Laurel – Wenonah. The two thick layers that overlie these older formations, beginning east of the inner/outer coastal plain divide, are the Kirkwood (lower) and the Cohansey (on top), which are so similar to each other that they are usually referred to by a combined, hyphenated name.



Source: U.S. Geological Survey

Figure 3: Aquifers of Southern New Jersey along a Line from Camden to Atlantic City

Drinking Water Supply

Potomac-Raritan-Magothy Aquifers (PRM)

The Potomac-Raritan-Magothy (PRM) is the principal formation underlying Bordentown Township. This multiple aquifer is actually a large series of formations that have been combined and described as a single unit because the individual formations – the Potomac group and the

Raritan and Magothy formations – are lithologically indistinguishable from one another over large areas of the coastal plain. That is, they are composed of materials of like kind and size laid down by both an advancing and retreating sea across southern New Jersey and by deposits of material that came from the breakdown and erosion of the Appalachian and Catskill mountains beginning in the Cretaceous Period (150 to 60 million years ago).

In the Delaware Valley, three aquifers have been distinguished within the PRM system, designated as lower, middle, and upper, and there are two confining units or layers between the three water-bearing strata. The aquifers themselves are made up largely of sands and gravels, locally interbedded with silt and clay. The lower aquifer sits on the bedrock surface. Confining beds between the aquifers are composed primarily of very fine-grained silt and clay sediments that are less permeable and thus reduce the movement of water between the aquifers. They also help to slow the entry of any contaminants on the surface down into the groundwater.

The PRM is the primary source of drinking water to New Jersey residents from Burlington to Salem counties, as well as to communities across the Delaware Bay in the state of Delaware. Because of such large usage, there has been a decline in PRM aquifer water levels. This became so serious that the New Jersey Department of Environmental Protection established Water Supply Critical Area #2 in 1986. All water supply companies within Critical Area #2 were given annual limits on water withdrawals in the PRM. Usage from the PRM was cut back by over 20% and no increases in pumping were allowed. Piping of treated Delaware River water filled the gap in much of the region.

Bordentown Township is outside the boundary of the critical area, but close to it. There is increased concern that additional pumpage from the aquifer in the borderline areas will necessitate the expansion of the critical area boundaries. Thus, water supply companies in northeastern Burlington County may have difficulty getting approvals from the New Jersey Department of Environmental Protection for any additional water allocations from the PRM.

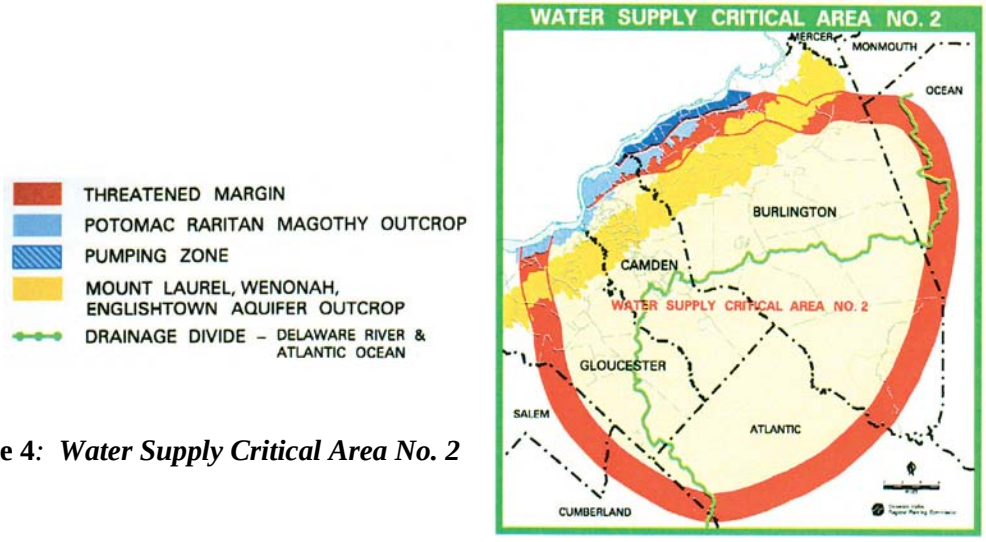


Figure 4*: Water Supply Critical Area No. 2*

Source: **DVRPC**

Geologic Outcrops

The outcrop area of the PRM, where it tilts upward to the surface, is under and immediately beside the Delaware River, and river water actually enters and recharges the upper and middle PRM aquifers. The majority of Bordentown's land is outside the PRM outcrop area, with the exception of the Crosswicks Creek area above Groveville Road, the area along the coast of the Delaware River, and Newbold Island. The upland portions of this outcrop area also have high groundwater recharge. See **Map 12: Geologic Outcrops** and **Map 13: Groundwater Recharge.** Because an outcrop is the area where the aquifer emerges on the land surface, preventing contamination of the land in outcrop areas is extremely important in order to maintain a safe drinking water supply.

Trenton-Hamilton-Bordentown Marsh by Route 206

Water Supply Wells

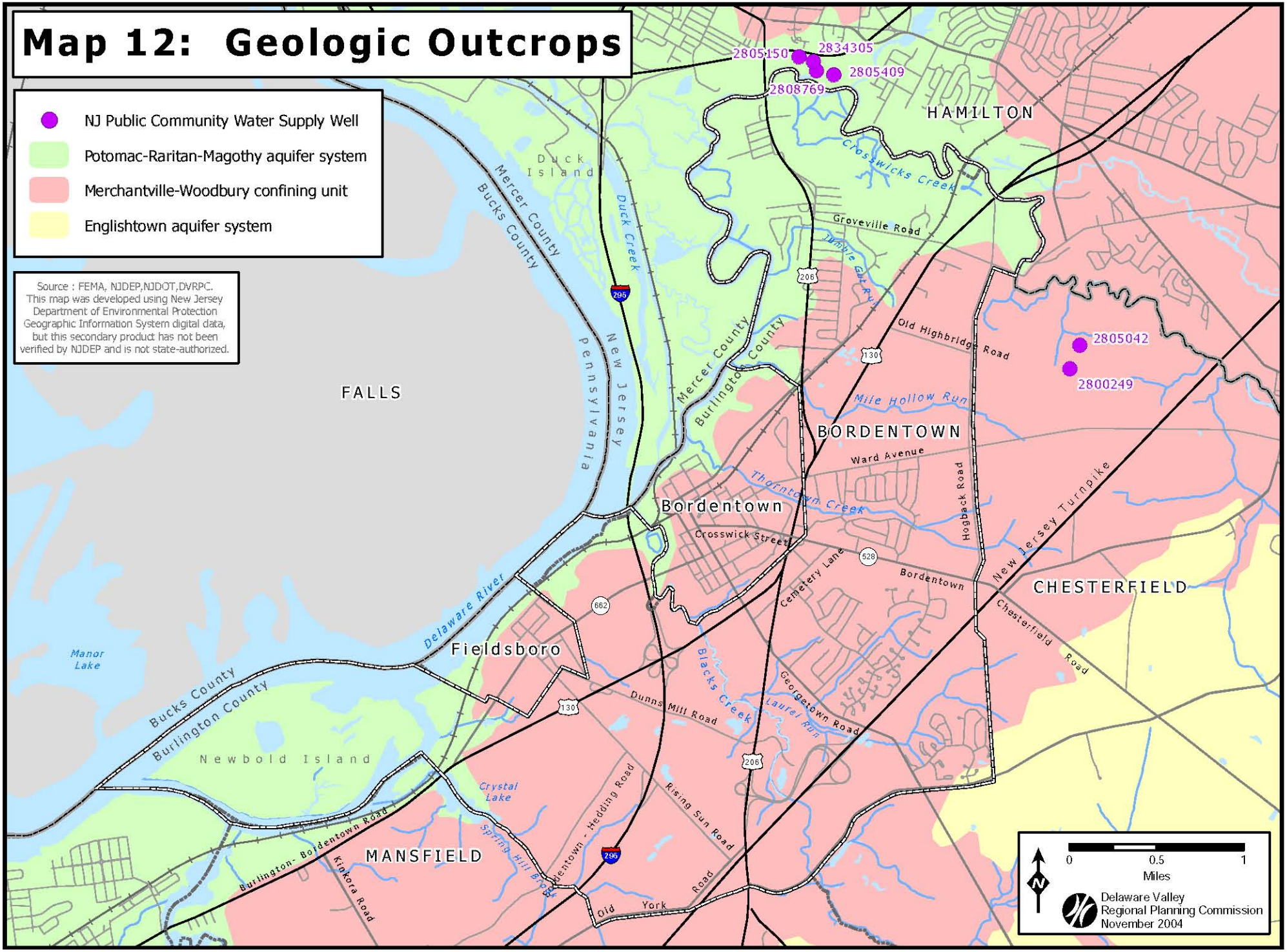
Bordentown Township receives its drinking water from the Bordentown City Water Department. This water is obtained from four wells located just north of Bordentown Township, in Hamilton Township. These wells tap into the middle layer of the PRM aquifer. See **Map 12: Geologic Outcrops.**

Table 14: Public Water Supply Wells

Well ID #	Original Owner	Aquifer	Depth to Top of Well Screen (feet)	Depth to Bottom of Well Screen (feet)
2800249	Albert C Wagner Youth Correctional Facility	Middle PRM	357	387
2805042	Albert C Wagner Youth Correctional Facility	Middle PRM	337	367
2805150	Bordentown Water Dept	Middle PRM	101	121
2805409	Bordentown Water Dept	Middle PRM	118	138
2808769	Bordentown Water Dept	Middle PRM	81	121
2834305	Bordentown Water Dept	Middle PRM	82	102

Source: NJDEP

Map 12: Geologic Outcrops



Groundwater Recharge

Recharge of groundwater is an important issue in southern New Jersey because of the dependence on aquifers for drinking supply and for agricultural use. The amount of rainwater that actually enters an aquifer is a function of many factors, including the nature and structure of the aquifer itself. The amount of precipitation that infiltrates the soil and reaches the saturated zone to become groundwater – the recharge of the aquifer – is also dependent on climatic conditions, the nature of the soil, and the vegetation of an area.

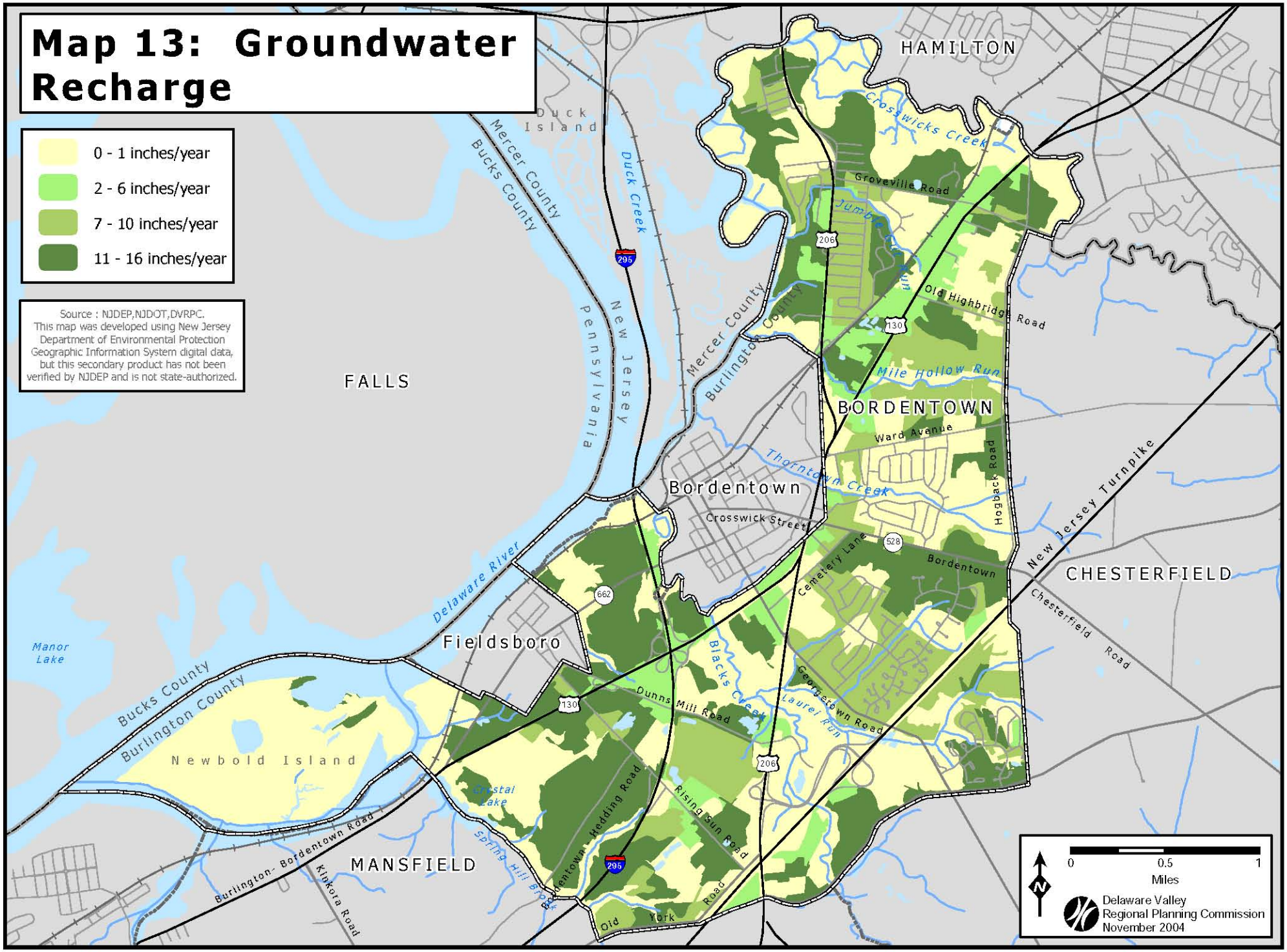
The New Jersey Geological Survey has developed a methodology for evaluating land areas for their ability to transmit water to the subsurface, using precipitation records, soil surveys, and land use/land cover data. The New Jersey Department of Environmental Protection has used this methodology to map and rank land areas throughout the state as to groundwater potential. Recharge is equivalent to the amount of precipitation that will reach the water table in an area with a particular combination of soils and land use. It is expressed as inches per year.

In Bordentown, lands with recharge of 11 to 16 inches per year, the highest in the township, are found in scattered patches, with the greatest concentration in areas along Bordentown-Hedding Road, the area between Bordentown City and Fieldsboro, along County Route 528, and north of Groveville Road. In the case of Bordentown, the recharge is to the upper PRM aquifer. See **Map 13: Groundwater Recharge**.

On these high recharge lands, the amount of paving and other impervious cover has the most detrimental impact, although they are also usually the places that are most suitable for building because they are on well-drained soils. Conversely, these are also regions where the dilution of substances from septic systems, such as nitrates, may require a larger land area because the soils are usually more "porous." For example, minimum average lot sizes of two to four acres are often needed for proper nitrate dilution from septic systems in areas having 10 or more inches per year of groundwater recharge.

Thorntown Creek

Map 13: Groundwater Recharge



BIOLOGICAL RESOURCES

When a community decides to protect wildlife and habitat, they choose to protect biodiversity, which enables many species, including humans, to thrive and live healthy lives. Biodiversity refers to the variety of genetic material within a species population, the variety of species (plants, animals, microorganisms) within a habitat, and the variety of ecosystems within a given region.[3] Biodiversity facilitates adaptation and evolution, improving a species' chance of survival as the environment changes. A diversity of plant and animal species is also necessary to maintain healthy human environments, working landscapes, and productive ecosystems. Lower organisms, many not well known, contribute to nutrient cycling, decomposition of organic matter, soil rehabilitation, pest and disease regulation, pollination, and water filtering. Once biodiversity declines, it is extremely hard for an ecosystem to recover or replace species.

Scientists have discovered and named somewhere between 1.5 and 1.8 million plant and animal species in the world. Of these, only 4,000 are mammals and 9,500 are birds. Over half of all known species are insects. Far more species, possibly 10 to 20 times the number of known species, are unknown to science. Alarmingly, this great diversity of species is now diminishing at an unprecedented rate. Researchers generally agree that the extinction rate is now catastrophically high, somewhere between one thousand and ten thousand times the rate before human beings began to exert significant pressure on the environment. Given these trends, and barring significant increases in conservation efforts, approximately one-half of the world's species will be gone by the end of this century.

Bordentown contains various types of ecosystems. Ecosystems are made up of abiotic factors (air, water, rocks, energy) and biotic factors (plants, animals, and microorganisms). Wooded wetlands, which are the most abundant type of natural ecosystem in Bordentown, occur where land is wet and undeveloped. Grasslands are the second most common ecosystem type in Bordentown, but the most abundant ecosystem when including grasslands-suitable habitat like pastureland and cropland. Along Bordentown's stream corridors and lakeshores are wetlands, which support plants that require constantly saturated soils; and within and around waterbodies are submerged communities, which require persistent standing water.

NATURAL VEGETATION

A region's vegetation is dependent on many factors, the most important of which are climate and soils. Bordentown's climate is cool and temperate with rainfall in the region averaging 46 to 48 inches per year. For a detailed description of Bordentown's soils see the *Soils* section on page 20.

Bordentown's natural vegetation types, along with human-influenced types of land cover, have been tabulated and mapped by NJDEP's 1995/97 land cover analysis. This data, based on infrared aerial photography, is the most recent available. The designation of a particular land

[3] Commonwealth of Australia. Department of the Environment, Sport and Territories. "Biodiversity Series Paper No. 1: Biodiversity and its value." 1993.

cover as a vegetation type is based on definitions provided by the Anderson Land Use Classification System, created by the U.S. Geologic Survey[4]. See **Map 14: Natural Vegetation (1995/97)**.

Table 15: Bordentown Township Natural Vegetation

Type of Vegetation	Acres	% of Total Land Area
Deciduous Forest	568	19%
Coniferous Forest	5	0.2%
Mixed Deciduous/Coniferous Forest	18	1%
Brushland/Shrubland	463	16%
Lakes	37	1%
Tidal Waters	375	13%
Tidal Wetlands	205	7%
Interior Wetlands	1114	38%
Modified Wetlands	185	6%
Total Natural Vegetation Land Cover	**2969**	**100%**

Source: NJDEP (1995/97 Land Cover)

Wetlands

Wild Rice

Wetlands are defined as areas that are inundated or saturated by surface or ground waters at a frequency to support vegetation suited for life in saturated soils. New Jersey's wetlands are located around the numerous interior stream systems, and along coastal rivers and bays. NJDEP classifies wetlands with naturally occurring vegetation into two major categories: (1) *coastal wetlands*, wetlands associated with tidal portions of the Delaware River system and waterways draining into the Atlantic Ocean; and (2) *interior wetlands*, wetlands found in nontidal lowlands associated with waterways, and isolated wetlands surrounded by uplands. NJDEP also identifies *modified wetlands*, which are areas that have been altered by human activities and do not support typical natural wetland vegetation, but which do show signs of soil saturation on aerial infrared surveys.

Wetlands are a critical ecological resource, supporting both terrestrial and aquatic animals and boasting biological productivities far greater than those found on dry land. Wetlands play a vital role in maintaining water quality by cleaning surface and ground waters. The ecological importance of wetlands, however, has not always been appreciated. For over three centuries people drained, dredged, filled and leveled wetlands to make room for development and agriculture. Although the pace of wetland destruction has slowed markedly in the past three decades, human activities have destroyed approximately 115 million of the original 221 million acres of wetlands in the United States since the beginning of European settlement.

Virtually all wetlands in Bordentown Township are found in association with the major streams and their tributaries. The greatest extent of emergent wetlands are found as freshwater tidal marshes along the main channel of the Crosswicks Creek, of which, the largest and most significant area is the Trenton-Hamilton-Bordentown Marsh. Some nontidal emergent wetlands are also found along Jumble Gut Run, Mile Hollow Run, Thorntown Creek, the upper portion of Blacks Creek, Laurel Run, and Spring Hill Brook.

In the tidal marshes, wild rice (Zizania aquatica) is perhaps the most distinctive native plant in these regions. This annual grass can grow to be nine feet tall and is an important food source for migratory waterfowl. It is often found near spatterdock and pickerelweed. Other plants found in the tidal marsh include broad-leaved cattail, water hemp, jewelweed, arrow arum, nodding beggar-ticks, and sneezeweed. Phragmites, an invasive plant, is found in disturbed areas of the Trenton-Hamilton-Bordentown Marsh, such as on Duck Island and along pipeline rights-of-way, as well as along the marsh's edges.[4]

Other wetlands in Bordentown are the extensive forested or shrubby wetlands located in the regions surrounding Crosswicks Creek, Newbold Island, Spring Hill Brook, Laurel Run, Blacks Creek, Mile Hollow Run, and Thorntown Creek. These wetlands are "palustrine" wetlands (stream-associated, versus "lacustrine" or lake-associated) and are usually covered with deciduous trees or shrubs, although some evergreen trees or shrubs may be present. Shrubs are also the dominant plants where wetlands are recovering from past impacts. See **Map 7: Surface Water, Wetlands, and Vernal Ponds**.

Blacks Creek

[4] Conversation with Mary Allessio Leck on 9/22/04.

In Bordentown, modified wetlands encompass agricultural wetlands, former agricultural wetlands, disturbed wetlands and wetlands that occur in maintained green spaces such as open lawns, golf courses, and storm water swales. Modified wetlands differ from non-modified wetlands in that they do not support the typical natural wetland vegetation found in analogous unaltered natural areas, although they do exhibit evidence of soil saturation. In total, modified wetlands occupy just 13 acres or less than 1 percent of Bordentown's total land area.

Upland Forests

Upland areas are those locations without water at or near the soil surface. Over 22 percent of Bordentown is comprised of upland forests. Most of Bordentown's original upland forests have been cleared and converted to farms or residential or commercial development. Nearly all old growth forests, because of their natural fertility, were cleared for farmland during colonial times. The remaining upland forests tend to be located near stream corridors or are patchy woodlands on less desirable soils associated with large farms.

The composition of upland forests in the township is largely one of mixed oaks – white, black, red, chestnut, and scarlet oaks – joined by beech, pignut and mockernut hickories, black walnut, tulip tree, and red maple. Beech/oak forest is found predominantly around the lower third of Blacks Creek, beginning at the Delaware River and heading east until Route 206. Past this point, the forest becomes a mixed oak forest. Additionally, hickories are found in abundance at the northeastern corner of the township, on Crosswicks Creek.

Dogtoothed violets and skunk cabbage are common along Blacks Creek and parts of Crosswicks Creek. The understory is dominated by flowering dogwood, black cherry, ironwood, and sassafras. Vines are common, including Virginia creeper, wild grapes, Japanese honeysuckle, and poison ivy. Spicebush, arrowwood, and black haw are common shrubs in moister locations.

Rhododendrons form a unique part of the Bordentown landscape. They are in abundance in parts of Bordentown Township, due to the very specific conditions they require. When located in the New Jersey Inner Coastal Plain, rhododendrons must be situated on north-facing slopes with Keyport soils. Bordentown Township has these conditions primarily along Blacks Creek, between Route 130 and Burlington Street, and also near Route 206. Rhododendrons, reaching 20 feet in height, have been spotted in these areas.

Crosswicks Creek Woodlands

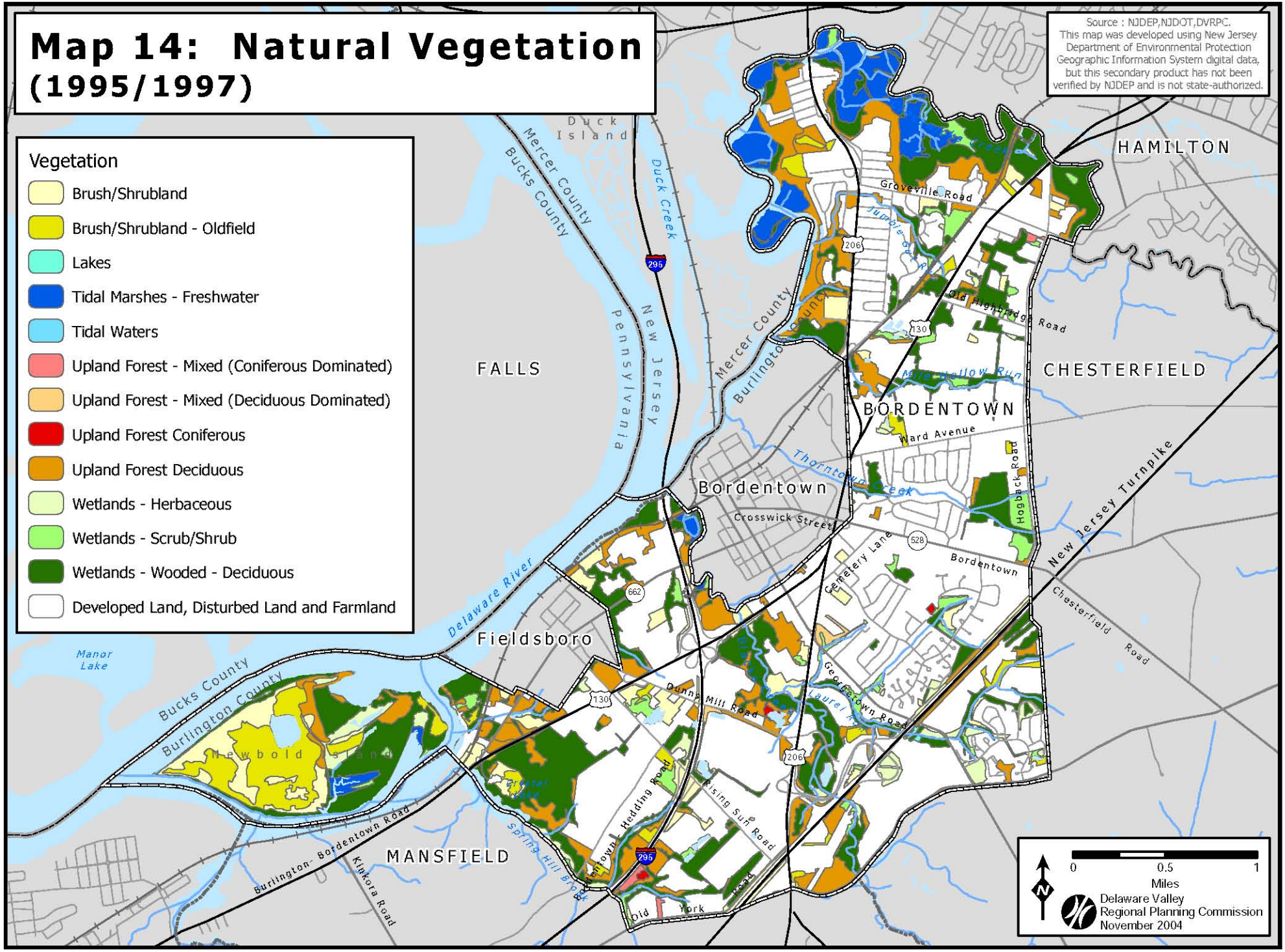
Grasslands and Agricultural Lands

A small percentage of Bordentown consists of brush or shrubland, principally in the form of fallow fields, pasture, and old fields. Old fields are lands that were cleared or disturbed at one time and then abandoned. Following abandonment, perennial herbs and grasses succeed to become the dominant species for a length of time from 3 to 20 years. Later, woody plants begin to take over. This habitat is visible especially along wood edges, roadsides, and in landscapes where mowing is infrequent and where woody plants are not yet the dominant vegetation. This habitat, along with agricultural cropland, constitutes "grassland" habitat utilized by species that forage or nest on open land.

In Bordentown, 218 acres or 3.7% of the township is classed as old fields, as of the 1995/97 land cover analysis by NJDEP. An additional 463 acres or approximately 7.7% of the township is brush or shrubland. The majority of old fields and brushland/shrubland within the township are located on the western half of Newbold Island. See **Map 14: Natural Vegetation (1995/97)**.

Photo taken by Jan Bisco-Werner
Of the Bordentown Township Open Space Advisory Committee

Map 14: Natural Vegetation (1995/1997)



LANDSCAPE PROJECT PRIORITY HABITATS

The Landscape Project, developed by the Endangered and Nongame Species Program of the NJDEP Division of Fish & Wildlife, documents the value of various types of habitats within New Jersey. It then ranks these habitats as to their importance. The highest ranking goes to habitat areas where there has been a documented occurrence of one or more species that are on either the federal or the state Threatened and Endangered Species lists and where there is a sufficient amount of habitat type to sustain these species ("critical habitat"). A second category includes habitats that have documented occurrences of species of special concern in New Jersey. Another rank consists of lands with habitat deemed suitable for species that are included in the higher categories but for which there are no documented occurrences or sightings ("suitable habitat").

Landscape Project data for Bordentown Township identifies locations with the most important habitats for wildlife and categorizes them as either "critical habitat" (the highest) or as "suitable habitat." It is important to preserve both levels of habitat, in order to maintain the diversity of species that still exists in the township. The rankings in Bordentown are primarily a result of the habitat being either critical or suitable for bald eagle nesting or foraging.

The Landscape Project data is based on mid-1990s information. It should be noted that since this time, Bordentown Township has developed a significant portion of their critical and suitable habitats. For example, a new residential subdivision and adjacent warehouse development, located northeast of Crystal Lake, is situated on land listed in the table that follows as critical or essential forested wetland habitat. Bald eagle habitat covers a large portion of the area. A 300-foot buffer was proposed to protect the bald eagle habitat from this development, however only a 150-foot buffer was approved. In addition, a new regional high school is being built on land classified as suitable grasslands habitat. The acreage listed in ***Table 16: Landscape Project Habitat Rankings – Acreage in Bordentown Township*** has not been adjusted to reflect these new developments on landscape priority habitats. See **Map 15: Landscape Project Habitat Priorities**.

Table 16: Landscape Project Habitat Rankings – Acreage in Bordentown Township

Type	Rank	Acres	Subtotals by Category	% of Total Landscape Project Acreage	% of Total Township Acreage
Emergent Wetlands	Suitable Habitat	58	355	1.74%	1%
	Critical Habitat	297		8.86%	5%
Grasslands	Suitable Habitat	629	710	18.79%	11%
	Critical Habitat	81		2.43%	1%
Upland Forest	Suitable Habitat	299	1,212	8.93%	5%
	Critical Habitat	913		27.28%	15%
Forested Wetlands	Suitable Habitat	600	1,069	17.93%	10%
	Critical Habitat	469		14.03%	8%
Total Landscape Project Acres		**3,346**	**3,346**	**100.00%**	**56%**
Total Township Acres		**5,958**			

Source: NJDEP

Landscape Project Data on Wetland Habitat

The Landscape Project divides wetland habitats into two types – forested and emergent wetlands. Forested wetlands support species such as foraging bald eagles that nest on Newbold Island and forage along Bordentown's creeks. They can also be home to various rare amphibians (frogs and salamanders). Emergent wetlands are marshy areas characterized by low-growing shrubs and herbaceous plants in standing water, usually. They can be tidal or nontidal. Animal species that can be found there include endangered turtles, rare fish, mollusks, crustaceans, and insects.

About 9% of the wetland acreage in Bordentown that is ranked as critical (the highest value) is emergent wetland (297 acres). All of Bordentown's tidal wetlands fall into the critical category, primarily due to the nesting and foraging needs of bald eagles and cooper's hawks, which range widely over these areas. Forested wetlands make up the other 14% of wetlands ranked at the highest level (469 acres). These include the Newbold Island area, plus scattered pockets within the Crosswicks, Blacks, and Spring Hill Brook drainages. Mile Hollow Run is classed as critical for part of its length. Emergent wetlands ranked at the suitable habitat level (58 acres) are found scattered, in small pockets, throughout Bordentown Township. Forested wetlands ranked at the suitable habitat level (600 acres) are prevalent along the upstream half of Crosswicks Creek, along Mile Hollow Run, and along the upstream portion of Black's Creek and its tributary, Laurel Run.

Landscape Project Data on Upland Forest Habitat

The Landscape Project has ranked upland forests in the same manner as wetlands. Bordentown's highest ranked "critical habitat" upland forests are found in a few larger patches to the east of

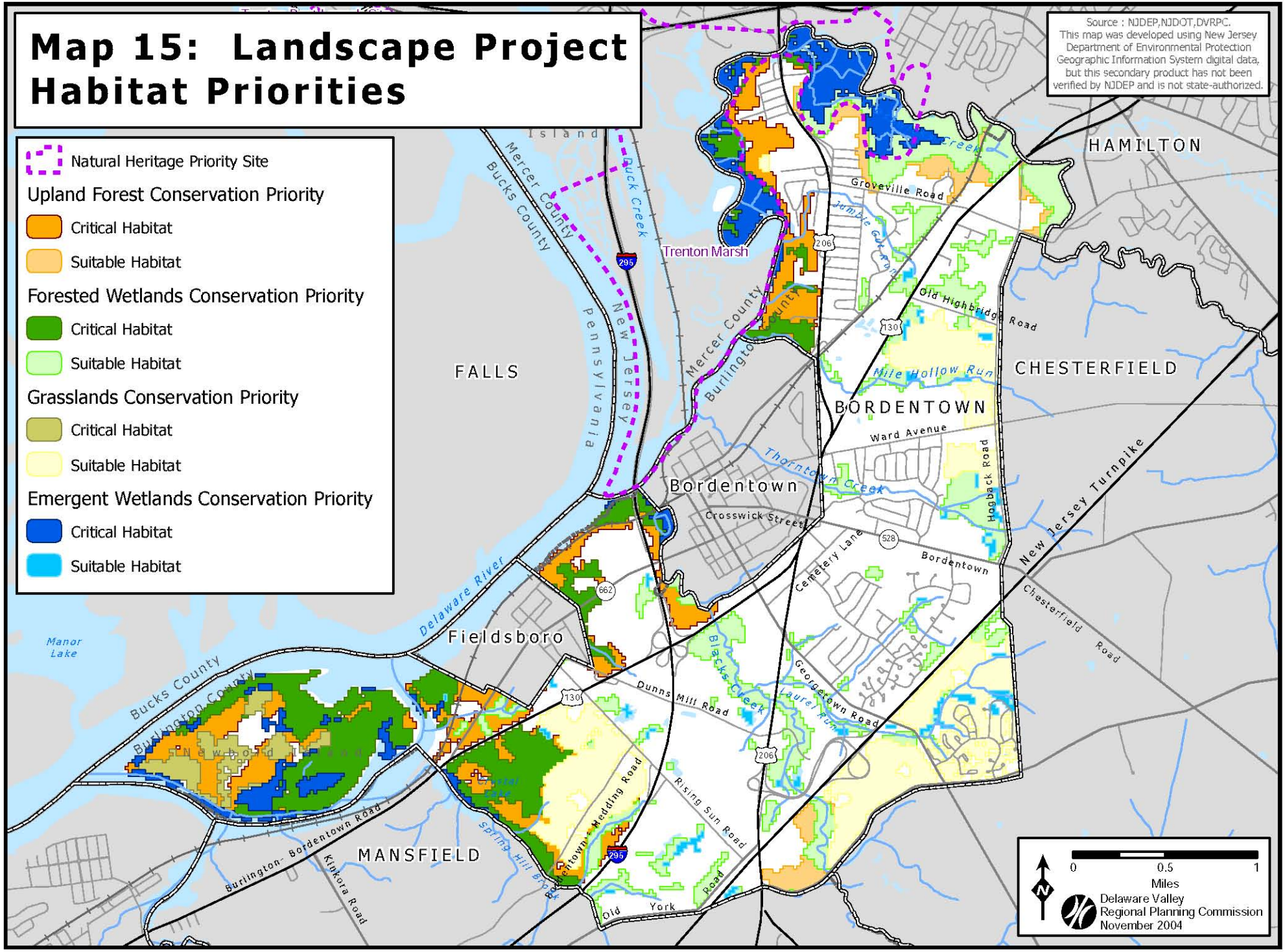
Crosswicks Creek, located adjacent to the Trenton-Hamilton-Bordentown Marsh, and in smaller parcels on Newbold Island and between Fieldsboro and Bordentown. Critical upland habitat constitutes 913 acres. Only 299 acres are ranked at the suitable level.

Landscape Project Data on Grassland Species Habitat

Nearly all of the land ranked as critical habitat for grassland-dependent species is located on Newbold Island (81 acres). Land rated at the lower level, as "suitable habitat," (629 acres) is located in the eastern part of the township, bordering Chesterfield Township. This area includes areas developed for housing and land that will be used for the construction of a new high school. Other "suitable" grassland sites are the open fields north of Spring Hill Brook, between Route 130 and I-295. Examples of grassland-dependent species that use this kind of habitat for nesting or feeding include various grassland birds. In Bordentown, foraging bald eagles are documented by the Landscape Project as relying on this habitat.

View of Newbold Island
Photo taken by Jan Bisco-Werner
Of the Bordentown Township Open Space Advisory Committee

Map 15: Landscape Project Habitat Priorities



ANIMAL COMMUNITIES

Although no comprehensive inventory of the different animal species within New Jersey, Burlington County, or Bordentown Township exists, there are records of sightings, biological studies of range, and assessment of endangered and threatened status. Using federal, state, scientific, and nonprofit sources, it is possible to identify and describe known and possible animal communities of Bordentown Township.

Invertebrates

Invertebrates are the basis of a healthy environment and are part of every food chain – either as food for amphibians and fish, or as a part of nutrient cycling systems that create and maintain fertile soils. Though they are the most abundant animal life forms, once extinct they are the hardest species to replace.

Invertebrates consist of insects (beetles, butterflies, moths, ants, termites, bees, wasps, and others), arachnids (spiders, ticks and mites), crustaceans (crayfish, microscopic copepods), mollusks (mussels, clams, snails and slugs), and worms.

Macroinvertebrates are invertebrates that are visible to the naked eye but smaller than 50 millimeters. Benthic (bottom dwelling) macroinvertebrate communities provide a basis for ecological monitoring and are relatively simple to collect from shallow stream bottoms. Monitoring the presence of macroinvertebrates reveals the effect of pollutants over a long period of time. The Ambient Biomonitoring Network (AMNET) surveys streams for macroinvertebrate communities, which indicate certain levels of water quality, as was discussed in the Surface Water Quality section of this document.

There are nine endangered invertebrate species (two beetle species, four butterfly species, and three mussel species) and eight threatened invertebrate species (three butterfly species and five mussel species) in the State of New Jersey. Of particular interest are mussels; at one time freshwater mussels were abundant in the Delaware River and its tributaries and a major food source for native peoples. Unfortunately, due to over-harvesting, especially in the Delaware Bay in the 19th century, and destruction of suitable aquatic habitats by dams and pollution, the native mussel population has sharply declined and shows no signs of rebounding. Of those species on the New Jersey Endangered and Threatened list, one, the dwarf wedgemussel, is listed as endangered under the federal Endangered Species Act.

Vertebrates

Vertebrates are less numerous than invertebrates but their larger size makes them much more visible, and thus better studied and recorded. Fish species are fairly well documented, as are mammals. Birds that nest in the township are known, but migrants that depend on Bordentown's wet forests as stopover sites in which to rest and feed are not as thoroughly inventoried.

Mammals

Mammals appear to be abundant because they tend to be larger and live in habitats also ideal for human development. There are over 500 mammal species in New Jersey, of which, only nine are listed as endangered and none are listed by the state as threatened. Some common mammals found in Bordentown Township include cottontail rabbits, eastern gray squirrels, skunks, little brown bats, and raccoons.

Raccoon Tracks by the Water
Photo taken by Jan Bisco-Werner
Of the Bordentown Township Open Space Advisory Committee

Deer Management in New Jersey

While many residents prize the presence of mammalian life, certain mammals often come into conflict with humans in suburban areas. The White-Tailed Deer presents a classic case of this conundrum. Indeed, the argument over whether New Jersey has too many, just enough, or not enough deer often causes controversy. On one hand, there is inherent value in New Jersey's deer population; deer are a beloved symbol of wildlife, a visible subject for wildlife education and research, a part of human recreation activities like wildlife watching and hunting, and a food source for carnivores and humans. On the other hand, conflicts often arise when humans and deer compete for the same space. According to the US Department of Agriculture, deer cause more damage to agricultural crops than any other vertebrate wildlife species and farmers in densely human-populated areas appear to be the most affected. Additionally, deer can devastate the understory of forests through overgrazing, destroying the local ecosystem. Finally, as most motorists are well aware, collisions between deer and automobiles frequently result in serious damage.

Controlling deer numbers has become increasingly difficult in New Jersey for numerous reasons, including: (1) there are no natural deer predators, only humans; (2) suburban development patterns are spreading into rural areas; (3) some communities pass ordinances prohibiting hunting; (4) hunters have less access to land inhabited by deer; (5) some public and private groups oppose deer hunting; and (6) hunters are leaving the state to hunt in nearby states.

To minimize human-deer conflicts, the New Jersey Agricultural Experiment Station recommends both lethal and nonlethal deer management options for community-based deer management programs. For example, municipalities can extend the hunting season, issue depredation permits to private landowners, engage in sharpshooting, and employ traps and euthanasia to reduce deer numbers. Alternately, communities and private landowners can choose to apply more costly, nonlethal deer management strategies such as installing reflectors and reducing speed limits on rural roads to decrease deer-vehicle collisions, modifying habitat by planting bad tasting plants on commercial and residential properties, using taste-based and odor-based repellents, and employing traps and translocation techniques.

While current deer problems should be addressed, it is important to note that New Jersey's white-tailed deer population has actually remained relatively stable throughout the state over the past decade and that increasing conflicts between deer and human populations arise as suburban communities spread into once rural areas. The most effective way then to avoid a continuing expansion of conflicts between deer and humans is to preserve the wild habitats to which deer naturally belong.

Fish

When European settlers arrived in present-day Burlington County, they encountered Native Americans who regularly fished along the inland streams and gathered mussels in the Delaware River. Due to the unintended consequences of urban development, industrial advancement, and mechanized agriculture, the amount and diversity of aquatic life has decreased dramatically throughout most of New Jersey.

The New Jersey Division of Fish and Wildlife, under the Bureau of Freshwater Fisheries, monitors and actively aids the propagation, protection, and management of the state's freshwater fisheries. The bureau raises several million fish for stocking in suitable waterbodies, and conducts research and management surveys. Based on survey data supplied by the bureau, Bordentown's freshwater streams may contain the following fish: sunfish, blue gill, pickerel, pumpkinseed, common shiner, largemouth bass, perch, darter, and the American eel.

N.J. Department of Environmental Protection Freshwater Fish Advisories

Fishing provides enjoyable and relaxing recreation and many people like to eat the fish they catch. Fish are an excellent source of protein, minerals and vitamins, are low in fat and cholesterol, and play an important role in maintaining a healthy, well-balanced diet.

However, certain fish may contain toxic chemicals, such as polychlorinated biphenyls (PCBs), dioxins, and mercury, which accumulate in water and aquatic life. Chemical contaminants such as dioxin and PCBs are classified by the U.S. Environmental Protection Agency as probably cancer-causing substances in humans. Elevated levels of mercury can pose health risks to the human nervous system. Infants, children, pregnant women, nursing mothers, and women of childbearing age are considered to be at higher risk from contaminants in fish than other members of the general public. Since 1982, NJDEP catches fish at numerous sampling stations throughout the state and tests for contaminant levels, adopting advisories to guide residents on safe consumption practices.

NJDEP issued a fish advisory for the following species of fish in Burlington County: American Eel, Largemouth Bass, Brown Bullhead, Large Mouth Bass, Bluegill Sunfish, Black Crappie, White Catfish. Recreational fishermen and women should regularly check for local fish advisories on NJDEP's Division of Science, Research and Technology website: http://www.state.nj.us/dep/dsr/njmainfish.htm/.

U.S. EPA General Consumption Guidelines

- If possible, eat smaller amounts of several different types of fish rather than a large amount of one type that may be high in contaminants. Consume species of fish that have lower levels of contaminants, such as fluke or flounder.
- Smaller fish of a species will usually have lower chemical levels than larger fish in the same location because contaminants tend to build up in the fish over time. It is advisable to eat smaller fish (of legal size) more often than larger fish.

Source: NJDEP and NJ Department of Health and Senior Services. "A Guide to Health Advisories for Eating Fish and Crabs Caught in New Jersey Waters." 2004

Birds

There are over 500 species of birds in New Jersey, which is an exceptional number given the state's small size. New Jersey is an important location for migratory birds heading south and east for winter. Not only is the state an important "rest stop" for birds migrating to warmer climates in Central and South America, the New Jersey Atlantic Coast and the Delaware Bay are the termini for three to four major North American flyways (established migratory air routes).

Common birds in Bordentown Township and Burlington County are grebes, geese, ducks, owls, woodpeckers, swallows, sparrows, crows, robins, cardinals, finches, hummingbirds, and hawks. The bald eagles that nest on Newbold Island also forage along Crystal Lake, as well as in the Spring Hill Brook drainage, along the Delaware River, and over small portions of the Blacks Creek drainage. Eagles prefer fairly open waterways with adjoining forested habitat in which they can sit and watch for prey. They use such habitat throughout the year, provided it stays ice-free for most of the winter. The tributaries to the Delaware River, and the river itself, meet these requirements.

Additionally, the State of New Jersey now has a "resident" Canada goose population of approximately 100,000 birds that no longer migrate to more southern locales, and may double in the next 5 to 10 years. While geese are a valuable component of the urban/suburban environment, providing enjoyable wildlife opportunities for the public, they can also cause property and environmental damage. Goose droppings that wash into lakes during storm events can elevate coliform bacteria to unhealthy levels, closing lakes to swimming. Goose droppings limit human use of grassy areas in parks, and because geese can be quite aggressive during the nesting season, they can also injure humans.

However, removing geese or preventing them from residing in park areas is a difficult task. Because geese move freely, the most effective management solutions are best conducted at the community level. Canada geese are protected by the Migratory Bird Treaty Act; certain management programs may therefore require the US Department of Agriculture's approval and permits. Management techniques include planting shrubby vegetation around streams, lakes, and ponds to block waterfowl access; discouraging humans from feeding geese; and removing geese eggs and replacing with decoys.

Common Reptiles and Amphibians

Reptiles can be quite elusive when surveys attempt to document them. Some species, such as the endangered bog turtle, have been documented in Bordentown. Amphibians of some types are abundant, such as bullfrogs. Other species are rare because they depend on vernal ponds, as was discussed in the Surface Waters – Vernal Ponds section of this document.

Rare and Endangered Vertebrates

According to the Natural Heritage Database and the Landscape Project, a significantly large number of rare wildlife has been sighted in Bordentown Township over the course of 100 years.

Brief descriptions of the species and their preferred habitat, provided by the New Jersey Fish and Wildlife Service, follow.

The bald eagle *(Haliaeetus leucocephalus)* is our national symbol and a threatened species. As a result of overhunting, exposure to pesticides, and the encroachment of development on their habitat, they became close to extinction. Just recently they were taken off the endangered species list and put on the threatened species list. Eagles are territorial raptors. They attack other predatory intruders by diving at them at speeds of over 100 mph. In normal flight, the eagle can fly at 20 – 40 mph. Eagles choose nesting areas close to water that is rich with fish.

The bog turtle (*Clemmys muhlenbergii*) is an endangered species in many eastern states, including New Jersey, and is listed as threatened on the federal list. It is the smallest native species of its type in the United States. Bog turtles lay their eggs in stream banks and cover them with vegetation for protection. These turtles are one of the most difficult animals to find, as they are rare, elusive, and often dwell on swamp bottoms where they bury themselves in several inches of mud to escape predators. Suitable habitats are dwindling as wetlands are destroyed for human settlement or by pollution. The greatest number of bog turtles in the nation is found in the wetland areas of agricultural lands in northwestern and southwestern New Jersey.

Federal Endangered Species Act*

An "Endangered" species is in danger of extinction throughout all or a significant portion of its range

A "Threatened" species is one that is likely to become endangered in the near future

New Jersey Endangered Species Act**

An "Endangered" species is in danger of immediate extinction within the state due to one of several factors: loss or degradation of habitat, over-exploitation, predation, competition, disease, or environmental pollution.

A "Threatened" species is one that may become endangered if environment conditions continue to deteriorate. It is vulnerable due to one of several factors: small population size, restricted range, narrow habitat affinities, or significant population decline.

A species of "Special Concern" is one that warrants special attention because of the evidence of population decline, environmental deterioration, or habitat modification that would result in becoming threatened. Special Concern status also extends to species whose population size is unknown or unstudied.

* Definitions adapted from U.S. Fish and Wildlife Service, "Listing a Species as Threatened or Endangered: Section 4 of the Endangered Species Act." Washington, DC: February 2001.
** Definitions adapted from N.J. Division of Fish, Game, and Wildlife, Endangered and Non-game Species Program, "Status Definition." Trenton, NJ: April 2002.

The Cooper's hawk (*Accipiter cooperii*) is a member of the accipiter family – woodland hawks that prey on smaller birds – and is especially adapted to fly through dense cover chasing prey. In southern New Jersey, Cooper's hawks breed in remote wooded wetlands dominated by red maple or black gum. Adjacent upland pine or mixed oak/pine forests usually provide a buffer for nesting hawks. These hawks generally nest in sub-climax forests composed of trees 30 years or older creating a closed canopy. On average, a hawk will place his or her nest more than a third of a mile away from the nearest human inhabitant. While other raptor species were threatened due to hunting practices and predator elimination, Cooper's hawk populations were not threatened until widespread suburbanization. Additionally, the pesticide DDT impaired many bird species' reproduction and contributed to declining populations from the 1950s to 1970s. Populations began to recover due to the nationwide ban of DDT in 1972, coupled with the reforestation of old

fields throughout New Jersey. The hawk was listed as endangered in 1974 and downgraded to threatened in 1999 on the state list. The loss of large, contiguous forests remains a threat to this species and warrants the continued protection of Cooper's hawk nesting habitats.

See **Appendix A** for a list of *Vertebrate Animals Known or Probable in Bordentown Township*.
See **Appendix B** for an *Inventory of Black's Creek Vegetation*.
See **Appendix C** for an *Inventory of Trenton/Hamilton Marsh Vegetation*
See **Table 17** for a list of *Rare Wildlife Species or Habitat in Bordentown Township*
See **Table 18** for a list of *Rare Plant Species and Natural Communities Presently Recorded in the NJ Natural Heritage Database for Bordentown Township*

Photo Taken By Jan Bisco-Werner
Of the Bordentown Township Open Space Advisory Committee

NJ Natural Heritage database and Natural heritage priority sites

Natural Heritage Priority (NHP) sites are areas designated by the New Jersey Division of Parks and Forestry's Office of Natural Lands Management as critically important remaining habitat for rare species and as exemplary natural communities within the state. These areas are to be considered as top priorities for the preservation of biological diversity in New Jersey.

Designation as a Natural Heritage Priority site does not carry any specific requirements or restrictions on the land. Rather, the designation is made because of the high value of a site from a biological and diversity standpoint. Owners of NHP Sites are encouraged to become informed stewards of the property and to consider working with the local community or nonprofit groups to preserve the land permanently.

NHP designations are based on the records of the Natural Heritage Database, which lists documented sightings of endangered and threatened species. Information on particular sites may also be provided by the Nature Conservancy or by the NJDEP Endangered and Nongame Species Program, especially through the latter agency's Landscape Project.

Bordentown Township has within its borders one of only 410 NHP sites in the state of New Jersey. This is the **Trenton Marsh NHP Site** located along the Crosswicks Creek corridor on the northwestern side of the township. The Trenton Marsh is a tidal wetland area that straddles three municipalities: Bordentown Township, Hamilton Township, and the City of Trenton. The site contains a population of a state-listed endangered plant species, and a plant species of special concern. It has a biodiversity rating of B5, meaning that the area is of general biodiversity interest, which is a ranking of state significance.

See **Map 15: Landscape Project Habitat Priorities** for the location of the NHP site.

The Natural Heritage Database also lists for Bordentown several species of threatened and endangered plants and animals, or rare natural communities that have been found in other parts of the township. The sighting records for the plants (only) are shown on topographic maps. These indicate where the sightings occurred, although the map information is deliberately nonspecific. The principal locations with the most rare plant or community records are wide areas on Newbold Island and near the Crosswicks Creek, Blacks Creek, and Spring Hill Brook wetland corridors. Natural Heritage individual records of animals have been incorporated into the Landscape Project, but plant listings are not a basis for that modeling.

It is important to note that the Natural Heritage Database lists primarily those sightings that have been submitted to it, along with some ecological community data. It incorporates both historically and recently documented sightings. Areas without sightings may never have been surveyed. Conversely, land use in areas with sightings may have changed considerably over recent years, and the species once found there may be gone. Local surveys to update the database, and regular consultation of records before any development is approved are two measures that would help to increase threatened and endangered species' protection. See "Cautions and Restrictions on Natural Heritage Data" at the back of this report.

Table 17: Rare Wildlife Species or Habitat in Bordentown Township

RARE WILDLIFE SPECIES OR WILDLIFE HABITAT IN BORDENTOWN TOWNSHIP				
Common Name	**Scientific Name**	**Federal Status**	**State Status**	**State Rank**
Bald eagle foraging area	Haliaeetus leucocephalus	Threatened	Endangered	S1B, S2N
Bald eagle nest buffer	Haliaeetus leucocephalus	Threatened	Endangered	S1B, S2N
Bog turtle	Clemmys muhlenbergii	Threatened	Endangered	S2
Common map turtle	Graptemys geographica		Undetermined species	S3
Cooper's hawk	Accipiter cooperii		Threatened species	S3B, S4N
Eastern box turtle	Terrapene carolina		Special Concern	S5B
Eastern pondmussel	Ligumia nasuta		Threatened species	S1
Shortnose sturgeon	Acipenser brevirostrum	Endangered	Endangered	S3
Tidewater mucket	Leptodea ochracea		Threatened species	S1
Yellow lampmussel	Lampsilis cariosa		Threatened species	S1

Source: NJDEP, NJ Natural Heritage Database – see Appendix D for Cautions and Restrictions

Table 18: Rare Plant Species and Natural Communities Presently Recorded in the NJ Natural Heritage Database for Bordentown Township

Scientific Name	Common Name	Federal Status	NJ Status	State Rank
Ecosystems				
Freshwater Tidal Marsh Complex				S3
Vascular Plants				
Agastache nepetoides	yellow giant-hyssop			S2
Cacalia atriplicifolia	pale indian plantain		Endangered	S1
Asimina triloba	pawpaw		Endangered	S1
Bidens bidentoides	estuary burr-marigold			S2
Desmodium pauciflorum	few-flower tick-trefoil		Endangered	S1
Eriocaulon parkeri	parker's pipewort			S2
Ptelea trifoliate	wafer-ash		Endangered	S1
Ribes cynosbati	prickly gooseberry			SH

S1	Critically imperiled in NJ because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres)
S2	Imperiled in NJ because of rarity (6 to 20 occurrence)
S3	Rare in state with 21 to 100 occurrences (plant species in this category have only 21 to 50 occurrence). Includes elements that are widely distributed but with small populations/acreage. Or with restricted distribution but locally abundant.
S4	Apparently secure in state, with many occurrences
S5	Demonstrably secure in state and essentially ineradicable under present conditions
N	Refers to the non-breeding population of the element in the state
B	Refers to the breeding population of the element in the state
SH	Elements of historical occurrence in NJ. Despite some searching of historical occurrences and/or potential habitat, no existent occurrences are known.

Source: NJDEP, NJ Natural Heritage Database – see Appendix D for Cautions and Restrictions

THE BUILT ENVIRONMENT

POPULATION

The 1990 US Census listed a population of 7,683 residents for Bordentown Township. By the 2000 Census it had grown to 8,380, an increase of 8.3%. DVRPC forecasts 8,750 residents for Bordentown Township by 2005; 9,150 by 2010; and 10,360 by 2025. The number of jobs in Bordentown Township, according to the 2000 census, is 5,337. DVRPC's employment forecasts for 2005, 2010, 2020 and 2030 are 5,451; 5,532; 5,733; and 6,065 jobs, respectively.

TRANSPORTATION

Bordentown has always been at the center of good transportation, in comparison to many communities in southern New Jersey. Its transportation, especially commercial transport, has utilized every significant mode, from the days of water travel as the only practical conveyance, to the construction of rail lines (still in operation), to the 20th century's modern highways.

The modern transportation corridors that serve Bordentown have also fostered much of its past and current growth. These corridors include US Route 130, formerly the principal northeast–southwest highway close to the Delaware River, and US Route 206, which crosses Bordentown from north to south.

In 1951 the state completed the New Jersey Turnpike, which was a major addition to the transportation network. This road crosses Bordentown Township and has an interchange within the township that connects to Route 206. During the 1960s, Interstate 295 was built, which crosses Bordentown on a northwest–southwest path. I–295 has two interchanges within the township, and connects directly to Route 130 and Rising Sun Road.

County roads within the township include routes 660, 662, 545 and 528. These provide access and connections within the township and county and are remnants of past land uses that connected farming centers of activity. The majority of them run toward the City of Bordentown, which was a primary center for commerce in the region. Smaller roads in the township are a mixture of old rural lanes and newer subdivision thoroughfares.

In addition to excellent roadways, Bordentown Township also benefits from the newly restored passenger light-rail service, the River LINE. The River LINE was historically known as the Camden and Amboy Railroad and was reopened by New Jersey Transit (NJT) in the winter of 2004 after a 42-year hiatus in passenger service. Freight service operated on the line during the last four decades, and now operates only at night. The new light-rail line connects Trenton and Camden with a total of 20 stops in between. The service provides links to other NJT buses and trains, and to Amtrak and SEPTA in Trenton and to PATCO in Camden. The Bordentown station is located in Bordentown City, at Park Street and Prince Street.

TOWNSHIP UTILITIES AND SERVICES

Drinking Water

The Bordentown City Water Department provides water for the township. The water is derived from four artesian wells located just north of Bordentown Township, in Hamilton Township. See **Map 12: Geologic Outcrops.**

Sewer

All sewerage service is provided through the Bordentown Sewage Authority, which operates a treatment plant, located at 954 Farnsworth Avenue in Bordentown Township, with discharge into Blacks Creek. See **Map 11: Approved Sewer Service Areas** for the location of the currently approved sewer service area.

Township Services

Fire and Emergency

Medical emergencies in Bordentown Township are handled by the Bordentown Emergency Services (EMS)/Rescue Squad. The Bordentown EMS has both paid and volunteer staff who provide services 24 hours a day, seven days a week.

Two fire companies serve Bordentown Township, where a combination of volunteers and paid staff work together to assist each other in all areas of the township. They are the Mission Fire Company and the Derby Fire Company. The Mission Fire Company, located on Groveville Road, primarily serves the north end of Bordentown Township; and the Derby Fire Company, located on Crosswicks Road, primarily serves the south end of Bordentown. Mission Fire Company was established in 1950 and Derby Fire Company was established in 1959.

Police

The Bordentown Township Police Department employs 25 officers, which includes the chief, the lieutenant, 5 sergeants, 2 detectives, 14 patrolmen, and 2 special officers. The police department also employs 4 telecommunications operators and 1 secretary to the chief of police. The station is located in the municipal building.

Trash/Recycling

In Bordentown Township, trash and vegetation (brush and leaves), are picked up twice a week by a contracted service provider. Burlington County provides recycling service every two weeks. The county accepts commingled glass, cans and plastics (numbers 1 and 2 only) as well as mixed paper. Bulk collection occurs every other week on the second regularly scheduled collection day.

Education

Bordentown Township is part of a regional school district with the City of Bordentown. Two elementary schools - the Peter Muschal School, located on 323 Ward Avenue, and the Clara Barton School, located on 100 Crosswicks Street - educate children in pre-Kindergarten through 6th grade. The McFarland Middle School, located on 87 Crosswicks Street, educates 7th and 8th grade children.

Currently, the Bordentown Regional High School is located at 50 Dunnsmill Road and serves the children of Bordentown Township and the City of Bordentown for grades 9 through 12. Groundbreaking for a new Regional High School, on Ward Avenue, recently began and is scheduled for completion by fall of 2005. Because there will be an additional school building, there will be shifts among the remaining schools. The two elementary schools will remain, but will only serve the lower elementary school grades. An upper elementary school will be established and located in the current middle school building. The middle school will relocate to the building of the old regional high school.

Parks and Recreation

The Community Education/Recreation Council of Bordentown Township provides a variety of recreational and educational activities, including Little League Baseball and soccer. Bordentown Township has two community parks, Joseph Lawrence Park, located in the center of the township, and Northern Community Park, located at the north end of the township. In addition, there are several soccer and baseball fields available for use, including fields at Terry Field, located off of West Constitution Drive.

Altogether, there are 685 acres of municipal open space lands preserved as parkland, active recreation fields, natural resource protection and farmland, scattered around the township. The state protects 238 acres of land, primarily located along the banks of the Crosswicks Creek and Blacks Creek. Bordentown Township has one 78-acre preserved farm located to the east of the NJ Turnpike. See **Map 16 – Protected Lands**.

Bordentown Township has protected significant amounts of open space along the Crosswicks Creek, although a large area west of Route 206 remains unprotected. Bordentown's other major stream corridor, Blacks Creek, in the southern part of the township, also remains largely unprotected. To remedy this, the Bordentown Township Open Space Advisory Committee submitted "A Proposal for the Blacks Creek Greenway" to the township in December 2003. This plan documents the Blacks Creek corridor's natural resources, including forested ridge and valley formations, unique marshland, many large old beeches, tulip trees and oaks, and native stands of rhododendrons. The plan also emphasizes the area's cultural resources, including historic mills dating from the early 18th century, and scenic views from the ridgelines.

The Blacks Creek Greenway recommends the creation of additional community parks to (1) improve the quality of the township's park and recreation system, making it attractive for residents, visitors and potential businesses; (2) provide public recreational space in an area of the

township that is without public parks; (3) provide diverse active and recreational opportunities that are currently not available; (4) create opportunities for environmental and historical interpretation of unique sites; (5) allow safe public access to the greenway and its unique natural areas; and (6) ultimately improve the quality of life for township residents.

Ballfields, photo taken by Jan Bisco-Werner Of the Bordentown Township Open Space Advisory Committee

Northern Park

Township residents can use neighboring Bordentown City's park on the Delaware River, which has a boat ramp, beach and fishing pier; but Bordentown Township lacks its own riverfront access, despite its own significant frontage along the Delaware River. Many other communities are capitalizing on their waterfront assets. Improving and enhancing waterfront access can offer residents and visitors opportunities for strolling along promenades with unique scenic views, and boating and fishing activities, which can translate into improved quality of life and economic development for the community.

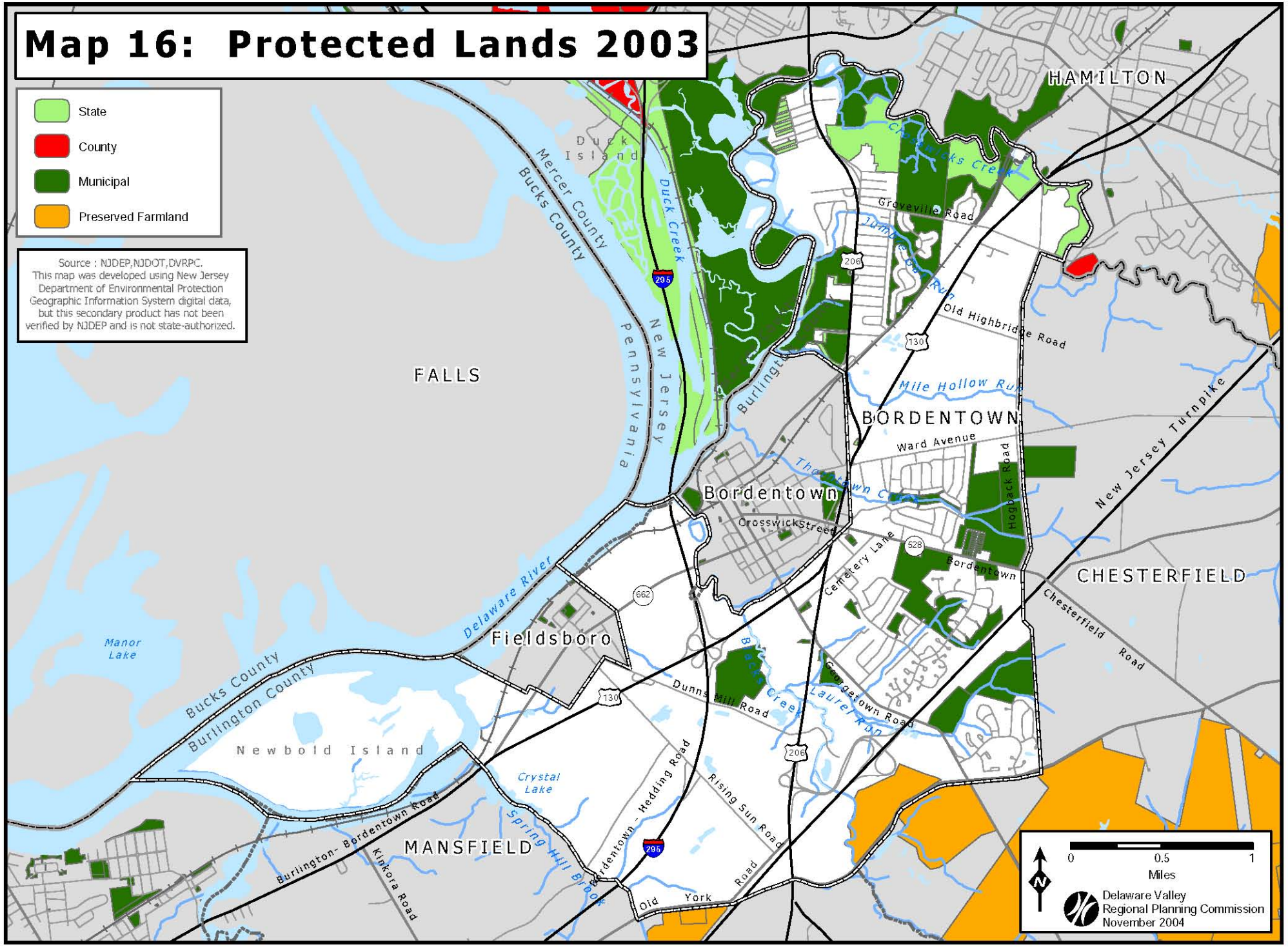
Two Views of Bordentown City's Waterfront Park

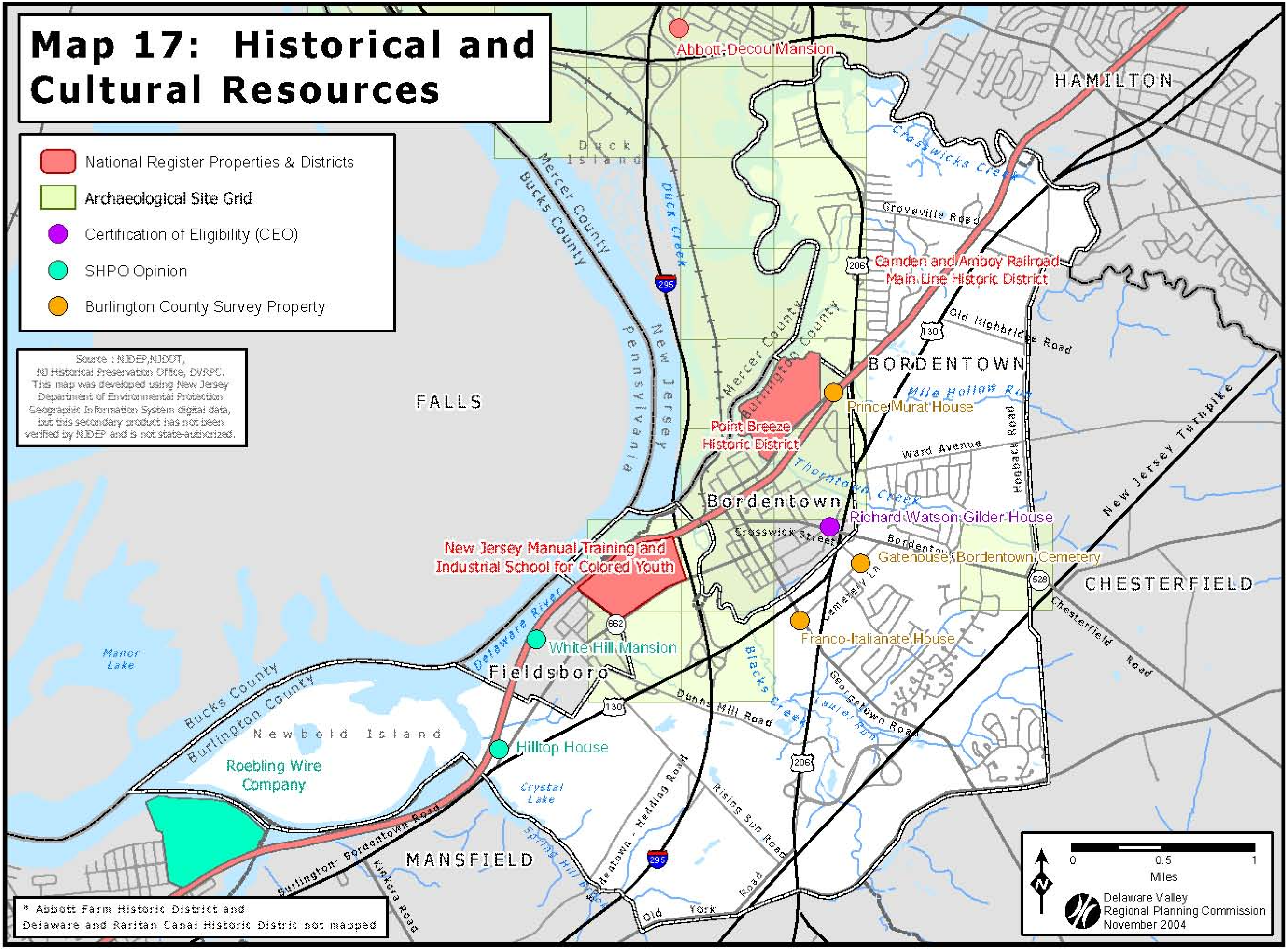
Historic Resources

Bordentown Township hosts several properties and districts on the National and State Registers of Historic Places, as well as places given Certificates of Eligibility (COE), a State Historic Preservation Officer Opinion (SHPO Opinion), and a few sites of local importance on the Burlington County Historical Survey. See **Map 17**: **Historical and Cultural Resources.** The Abbott Farm Historic District, on the National and State Registers (but not shown on the map), is an archaeological site of very early Native American settlements. The Camden and Amboy Railroad Historic District is also on the National and State Registers and follows the current ROW of the River LINE. The Delaware and Raritan Canal Historic District spans 100 yards to either side of the canal, and is also on the National and State Registers (but not shown on the map). Bordentown also hosts several prehistoric sites given DOE (Determinations of Eligibility) by the SHPO (State Historic Preservation Officer), which are shown on the archaeological site grid to prevent unauthorized excavations. They are referred to as the Black's Creek, Mile Hollow, and Thornton Creek prehistoric sites. The New Jersey Manual Training and Industrial School for Colored Youth is a campus of buildings near the Delaware River between Bordentown City and Fieldsboro. The Hilltop House, located on the Camden and Amboy Railroad near Newbold Island, was given a SHPO opinion in 1997.

The New Jersey Manual Training and Industrial School for Colored Youth

Map 16: Protected Lands 2003





Map 17: Historical and Cultural Resources
National Register Properties & Districts
Archaeological Site Grid
Certification of Eligibility (CEO)
SHPO Opinion
Burlington County Survey Property
Source : NJDEP,NJDOT, NJ Historical Preservation Office, DVRPC. This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.
* Abbott Farm Historic District and Delaware and Raritan Canal Historic Distric not mapped
Abbott-Decou Mansion
HAMILTON
Duck Island
Mercer County
Bucks County
Duck Creek
Crosswicks Creek
Groveville Road
Camden and Amboy Railroad Main Line Historic District
Old Highbridge Road
BORDENTOWN
Mile Hollow Run
Prince Murat House
Hogback Road
Ward Avenue
New Jersey Turnpike
Pennsylvania
New Jersey
Mercer County
Burlington County
Point Breeze Historic District
FALLS
Thornton Creek
Bordentown
Richard Watson Gilder House
Crosswick Street
Gatehouse, Bordentown Cemetery
CHESTERFIELD
Chesterfield Road
New Jersey Manual Training and Industrial School for Colored Youth
Franco-Italianate House
Delaware River
White Hill Mansion
Fieldsboro
Manor Lake
Blacks Creek
Laurel Run
Georgetown Road
Dunns Mill Road
Bucks County
Burlington County
Newbold Island
Hilltop House
Roebling Wire Company
Crystal Lake
Rising Sun Road
Spring Hill Brook
Burlington-Bordentown Road
Kinkora Road
MANSFIELD
Old York Road
0 0.5 1
Miles
Delaware Valley Regional Planning Commission
November 2004

ENVIRONMENTAL ISSUES

KNOWN CONTAMINATED SITES

There are 621 contaminated sites in Burlington County. Ten of these sites are located in Bordentown Township. There are additional contaminated sites close to Bordentown Township's borders, including nine sites in the City of Bordentown, ten in Hamilton Township (Mercer County), one in Fieldsboro Borough, and one in Mansfield Township. In addition to the known contaminated sites, a township official suspects that a site located across from Newbold Island, where a ship salvage yard once was located, may be contaminated. See ***Table 19: Known Contaminated Sites in Bordentown Township & Region*** on the following page**.** See also **Map 18: Known Contaminated Sites**.

The New Jersey *Known Contaminated Sites List* includes former factory sites, landfills, locations of current or former leaking underground storage tanks, sites where chemicals or wastes were once routinely discharged, and places where accidents have resulted in spills and pollution. Contamination may have affected soil, groundwater, surface water, or a combination of site conditions. The most dangerous sites, from a human health standpoint, are listed as Superfund sites. Superfund sites are eligible for federal cleanup funds. Other sites are handled by state or individual programs, or through private funds.

There is one Superfund site located in Bordentown Township, the Bordentown City Sanitary Landfill. According to the U.S. Environmental Protection Agency (EPA), a Superfund site is any land in the United States that has been contaminated by hazardous waste and identified by the Environmental Protection Agency as a candidate for cleanup because it poses a risk to human health and/or the environment. The Bordentown City Sanitary Landfill is located at the junction of Route 206 and Farnsworth Avenue and was identified for assessment in 1984. Preliminary assessment and site inspection took place in 1985, followed by a removal assessment in 2000. According to the Superfund Info System website, the most recent activity was an expanded site inspection and removal assessment that was completed in 2002. In addition, another Superfund site is located just outside Bordentown Township, in Hamilton Township. This site, the Duck Island Sanitary Landfill, was identified for assessment in 1980. A preliminary assessment took place later in 1980, followed by subsequent site inspections in 1982. According to the Superfund Info Systems website, there has been no activity at this location since 1982. Neither of these sites is listed on the National Priorities List (NPL). According to the EPA, the NPL is a list of the worst hazardous waste sites that have been identified by Superfund. Any site on the NPL is eligible for cleanup using Superfund Trust money. This information was retrieved using the Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS). CERCLIS is the national database and management system EPA uses to track activities at hazardous waste sites considered for cleanup under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), also known as Superfund. See ***Table 19: Known Contaminated Sites in Bordentown Township & Region***.

Table 19: Known Contaminated Sites in Bordentown Township & Region

Site ID	Name	Address	Town	Status	Lead Agency*	Remedial Level**	Superfund Site
NJD980774434	Bordentown Junction Truck Stop	Rte. 206 & Rising Sun Rd.	Bordentown Township	Pending	BFO-CA	D	
NJD986607604	Yates Industries Incorporated	88 Rte. 130 S.	Bordentown Township	Active	BEECRA	D	
NJL600096226	Paul's Service Center	Rte. 206 S.	Bordentown Township	Active	BUST	C2	
NJL600155568	Bill's Auto Service	1077 Rte. 206	Bordentown Township	Pending	BFO-CA	C1	
NJL800315137	Southgate Apartments	272 Ward Ave.	Bordentown Township	Pending	BFO-S	C1	
NJD000706168	Parklands Reclamation Sanitary Landfill	1070 Rte. 206	Bordentown Township	Pending	BFO-CA	C3	
NJD980766265	Yardville Youth Correctional Center	Highbridge Rd.	Bordentown Township	Active	BFO-S	C1	
NJL600122527	John's Car Care Center	232 Rte. 130	Bordentown Township	Active	BUST	C2	
NJD980769368	Bordentown City Sanitary Landfill	Rte. 206 & Farnsworth Ave.	Bordentown Township	Active	EPA	C3	Yes
NJL800308421	Route 130 & Bordentown Chesterfield Rd.	Rte. 130 & Bordentown Chesterfield Rd.	Bordentown Township	Active	BUST		
NJL600053334	Hess Service Station Bordentown City	Rte. 130 & 206	Bordentown City	Active	BUST	C2	
NJD002352490	Oceanspray Cranberries Incorporated	104 Park St. E.	Bordentown City	Active	BUST	C2	
NJL000010066	Bordentown Coal Gas (PSE&G)	Walnut & Willow Sts.	Bordentown City	Active	BCM	D	
NJD986599504	Exxon Service Station Bordentown City	Rte. 130 & Crosswicks Rd.	Bordentown City	Active	BUST	C2	
NJL800058539	Auto body shop (abandoned)	1 1/2 Crosswicks St.	Bordentown City	Active	BFO-IN	B	
NJL800314361	Mobil Service Station Bordentown	Rte. 130 & Farnsworth Ave.	Bordentown City	Active	BUST	C1	
NJL800520421	Valley Forge Rd.	Valley Forge Rd.	Bordentown City	Active	BFO-S	C1	
NJL800584914	201 Crosswick St.	201 Crosswicks St.	Bordentown City	Active	BFO-S	C1	
NJL800534778	Mercantanti Ford	Rte. 206 & Lucas Dr.	Bordentown City	Active	BUST		
NJD041762840	Stepan Chemical Company	4th St.	Fieldsboro Borough	Active	BFO-S	C2	
NJL800103509	J & S Auto Shop	30 Rte. 130	Bordentown Township	Pending	BUST	C1	
NJL000036665	Old Groveville Fire House	200 Main St.	Hamilton Township	Active	BUST	B	
NJD980505051	Duck Island Sanitary Landfill	1463 Lamberton Rd.	Hamilton Township	Active	BCM	C3	Yes
NJD002901817	Gulf Oil Corporation	Lamberton Rd.	Hamilton Township	Active	BFO-S	C2	
NJD986617660	Hamilton Township Water Pollution Control Division	300 Hobson Ave.	Hamilton Township	Active	BFO-S	C1	

NJD002330934	Kalex Chemical Products Incorporated	4407 S. Broad St.	Hamilton Township	Active	BFO-S	C2	
NJD986571958	Sunoco Service Station Hamilton Township	4364 S. Broad St.	Hamilton Township	Active	BUST	C2	
NJD002484004	Yardville Supply Company	4351 S. Broad St.	Hamilton Township	Pending	BFO-CA	C2	
NJD132383191	Mobil Oil Terminal	2785 Lamberton Rd.	Hamilton Township	Active	BCM	D	
NJL600075600	Gulf Service Station Hamilton Township	100 Yardville Allentown Rd.	Hamilton Township	Active	BUST	C2	
NJL500040571	T P Terminal Incorporated	1463 Lamberton Rd.	Hamilton Township	Active	BFO-S	C2	
NJD002482552	Consumers Oil Corporation	1473 Lamberton Rd.	Hamilton Township	Active	BUST	C2	
NJD986570448	Arco Petroleum Products	1470 Lamberton Rd.	Hamilton Township	Active	BEECRA	D	
NJL800268542	Dover Park Plaza Shopping Center	S. Broad St. & Sunnybrae Blvd.	Hamilton Township	Active	BFO-S	C2	
NJD980785786	Exxon Service Station Mansfield Township	Rtes. 206 & 68	Mansfield Township	Active	BUST	C2	

Source: NJDEP

***** See next page for explanations of Status, Lead Agencies, and Remedial Level

Status

Code	Meaning
NFA–A	No further action for a partial area of a site

Lead Agencies

Initials	Full Name
BCM	Bureau of Case Management
BEECRA	Bureau of Environmental Evaluation, Cleanup and Responsibility Assessment
BFCM	Bureau of Federal Case Management
BFO	Bureau of Field Operations
BFO–CA	Bur. of Field Operations – Case Assignment Section
BFO–S	Bur. of Field Operations – Southern
BUST	Bureau of Underground Storage Tanks

Explanation of Remedial Levels

Remedial Level	Explanation of Site Complexity
B	A single-phase remedial action in emergency response; simple removal activities of contaminants; usually no impact to soil or groundwater.
C1	A remedial action with simple sites; one or two contaminants localized to soil and the immediate spill or discharge area.
C2	A remedial action with more complicated contaminant discharges; multiple site spills and discharges; more than one contaminant, with both soil and groundwater impacted or threatened.
C3	A multiphase remedial action with high complexity and threatening sites. Multiple contaminants, some at high concentrations with unknown sources, continuing to impact soils, groundwater, and possibly surface waters and potable water resources. Dangerous for direct contact with contaminated soils.
D	Same conditions as C3 except that D levels are also usually designated federal "Superfund Sites."
ND	Not designated

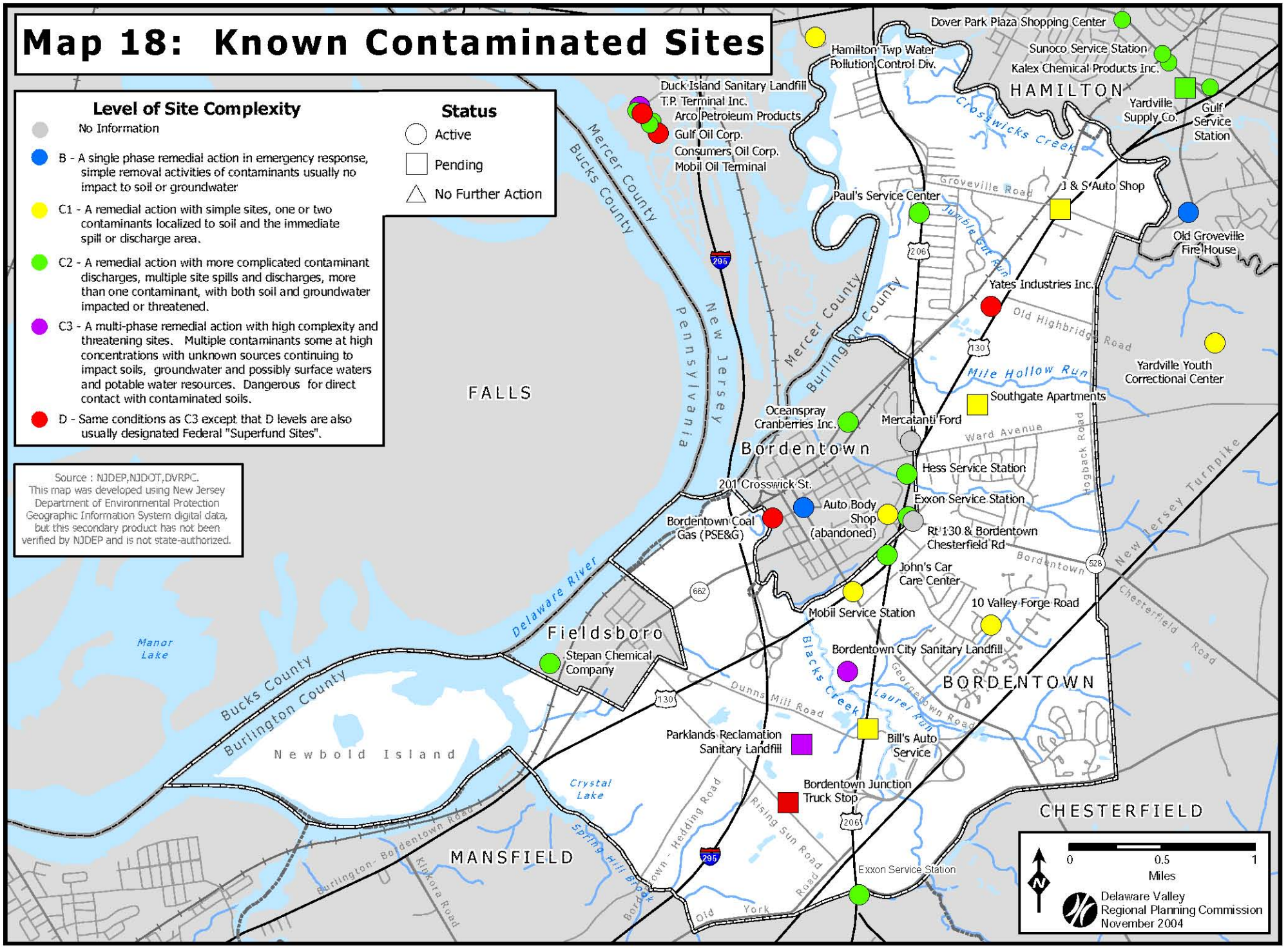
A case manager is assigned to every *Known Contaminated Site* case and can provide further information on each site. The case manager can be reached by contacting NJDEP's Site Remediation Program's lead agency, which is listed in the table for each site. Go to http://www.state.nj.us/dep/srp/kcs-nj/burlington/index.html for contact information.

PIPELINES IN BORDENTOWN TOWNSHIP

Bordentown Township is considering a natural gas pipeline proposal from the Transcontinental Gas Pipeline Corporation (Transco), a subsidiary of the Texas-based company Williams Corporation. Transco wants to expand their 10,500-mile pipeline, which runs from Texas to New York, through 90.3 miles of New Jersey. If approved, 3.5 of the 90.3 miles will cross Bordentown and Mansfield townships. According to the *Times of Trenton*, "The new pipeline would connect sections of an existing 36-inch pipeline to meet regional service needs."[5] There are several different routes that the pipeline could take. Two locations are located on the west side of the NJ Turnpike, near the Williamsburg Village neighborhood, and three locations are on the east side of the NJ Turnpike, near existing gas and electric public service easements. If approved, construction is anticipated for summer of 2005.

[5] Parente, Patricia. "Pipeline expansion plan to be outlined." *Times of Trenton.* June 18, 2004.

Map 18: Known Contaminated Sites



OVERVIEW OF STATE, COUNTY, REGIONAL, and LOCAL PLANS

LOCAL

In December of 2003, the Bordentown Township Open Space Advisory Committee published *A Blacks Creek Greenway Proposal*. This proposal documents the natural resources located near Black's Creek and recommends the creation of additional community parks along the Black's Creek corridor. The proposal suggests providing public recreational space in an area of the township that is without public parks, creating opportunities for environmental and historical interpretation of unique sites, and allowing for safe public access to the greenway.

REGIONAL

In June 2002, the Delaware Valley Regional Planning Commission (DVRPC) adopted *Horizons: The Year 2025 Land Use and Transportation Plan for the Delaware Valley*. The plan shows the majority of Bordentown Township designated as existing or future growth area, due to Bordentown's presence of sewer, water and transportation infrastructure. The 2025 Plan primarily seeks to concentrate future growth in existing centers, such as Trenton and Bordentown City. Additional new growth in the region is to be directed to areas with infrastructure in place, that are typically adjacent to existing developed areas, as is the case with Bordentown Township. In addition, the plan recommends that new development in growth areas create or maintain sense of place and focus on design and aesthetics, to avoid cookie-cutter and bland subdivision layouts. The 2025 Plan also includes an Open Space Element, which proposes preserving the region's sensitive environmental features including wetlands, stream corridors, and habitat for critical species. In Bordentown, Black's Creek, Crosswicks Creek, and Newbold Island are shown as proposed open space.

COUNTY

The Burlington County Department of Resource Conservation adopted the *Parks and Open Space Master Plan* in August 2002. The plan identifies five project areas: the Rancocas Creek Greenway, the Delaware River Greenway, Barker's Brook Project Area, Mason's Creek/Rancocas Creek/Southwest Branch Project Area, and the Pinelands Project Area. Bordentown Township falls into one of the project areas, the Delaware River Greenway. The Delaware River Greenway project area encompasses the Delaware River Heritage trail, a 50-mile loop trail linking Trenton and Palmyra to Tacony and Morrisville, Pennsylvania. Municipal spur trails will connect with the Delaware River Heritage Trail. These project areas represent where the county will focus its near-term preservation and park development efforts.

STATE

According to the *New Jersey State Development and Redevelopment Plan,* adopted by the New Jersey State Planning Commission on March 1, 2001, Bordentown Township falls into four planning areas. The most prevalent categories are PA1 (Metropolitan Planning Areas) and PA2 (Suburban Planning Areas). The PA1 designation surrounds the City of Bordentown, and

extends to the northern border of the township. A small sliver of land to the northeast and along the eastern border is designated as PA2. In addition, the majority of southern Bordentown Township is designated as PA2.

PA1 areas are so designated due to their proximity to large metropolitan centers, like Trenton. Generally they are older areas of the state that are already built-out. They are dense settlements, but often have large tracts of open space, mostly in the form of state or federal protected lands. In the future, New Jersey would like to see Metropolitan Planning Areas maintain their character and grow through a strategy of redevelopment. Less densely developed areas, car dependency, fragmentation, developable land, and sewer services characterize Suburban Planning Areas (PA2). These areas are expected to absorb most of the state's future growth. It is hoped that future development will be more compact, mixed-use, and focused around already developed centers.

The other two designations in Bordentown Township, Parks and Natural Areas and PA3 (Fringe Area), cover considerably less space. The Parks and Natural area is found along Crosswicks Creek. The area designated as Fringe Area (PA3) is Newbold Island. According to the state plan, fringe area is located on rural land that is not prime agricultural land or environmentally sensitive land. The state plan's intent for fringe areas is to protect natural resources and encourage growth in designated centers.

Newbold Island

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Appendix A: Vertebrate Animals Known, Probable, or Possible in the Township of Bordentown

Species	General Habitat	Township Locations
Mammals		
Opossum	All Habitats	Throughout
Short-tailed Shrew	Woodlands	Throughout
Eastern Mole	Uplands	Throughout
Star-nosed Mole	Uplands	Throughout, Occasional
Little Brown Bat	Uplands	Throughout
Eastern Pipistrel	Uplands	Throughout
Eastern Cottontail	All Habitats	Throughout, Common
Eastern Chipmunk	Woodlands	Throughout
Woodchuck	Woodlands and Fields	Throughout
Gray Squirrel	Woodlands	Throughout
White-footed Mouse	Woodlands	Throughout
Jumping Mouse	Fields	Throughout
Meadow Vole	Open Fields	Throughout
Red-backed Vole	Woodlands	Throughout
Muskrat	Wetlands	Throughout
Brown Rat	Wetlands, Homes, Farms	Throughout
House Mouse	Homes and Villages	Throughout
Red Fox	All Habitats	Throughout
Raccoon	All Habitats	Throughout
Long-tailed Weasel	Wetlands	Throughout
Striped Skunk	Uplands	Throughout
River Otter	Large Streams	
White-tailed Deer	All Habitats	Throughout
Mink	Wetlands	Throughout
Coyote	Woodlands and Fields	Throughout
Birds		
Pied-billed Grebe	Open Water	Lakes and Ponds, Tidal Waters
Double-crested Cormorant	Open Water	Lakes and Ponds, Tidal Waters
Great Blue Heron	Open Marsh, Lake Edges	Throughout
Great Egret	Open Marsh, Lake Edges	Throughout
Snowy Egret	Open Marsh, Lake Edges	Throughout
Green-backed Heron	Open Marsh, Lake Edges	Throughout
Mute Swan	Open Water	Large Lakes
Snow Goose	Winter Migrant in Fields	Open Farms
Canada Goose	Open Water, Fields	Throughout
Wood Duck	Forested Wetlands	Throughout
Green-winged Teal	Wetlands	Winter Migrant
Black Duck	Marsh, Lakes	Throughout
Mallard	Wetlands	Throughout
Gadwall	Open Water	Winter Migrant

Species	General Habitat	Township Locations
Blue-winged Teal	Wetlands	Winter Migrant
Northern Shoveler Duck	Open Water	Winter Migrant
Ring-necked Duck	Open Water	Winter Migrant
Greater & Lesser Scaup	Open Water	Winter Migrant
Bufflehead	Open Water	Winter Migrant
Hooded Merganser	Open Water	Winter Migrant
Ruddy Duck	Open Water	Winter Migrant
Black Vulture	Open Fields	Throughout
Turkey Vulture	All Habitats	Throughout
Osprey	Open Water	Lakes and Ponds, Tidal Waters
Bald Eagle	Open Water	Stream Corridors
Northern Harrier	Open Fields	Throughout
Sharp-shinned Hawk	Woodlands	Throughout
Cooper's Hawk	Woodlands	Throughout
Red-Shouldered Hawk	Woodlands	Throughout
Broad-winged Hawk	Woodlands	Throughout
Red-tailed Hawk	All Habitats	Throughout
American Kestrel	Open Fields	Throughout
Ringed-neck Pheasant	Old Fields, Farms	Released; Throughout
Wild Turkey	Woodlands	Throughout
Bobwhite	Old Field, Woodlands	Throughout
Killdeer	Bare Ground, Lake Edges	Throughout
Lesser Yellowlegs	Lake Edges	Throughout
Solitary Sandpiper	Lake Edges	Throughout
Spotted Sandpiper	Lake Edges	Throughout
American Woodcock	Wetland Forests	Throughout
Laughing Gull	Open Water, Parking Lots	Summer Visitor
Ring-billed Gull	Open Water, Parking Lots	Throughout
Herring Gull	Open Water, Dumps	Winter Visitor
Common Tern	Open Water	Summer; Delaware River
Rock Dove	Houses and Bridges	Villages
Mourning Dove	Woodlands	Throughout
Black-billed Cuckoo	Woodlands	Occasional
Yellow-billed Cuckoo	Woodlands	Throughout
Barn Owl	Farmland	Throughout
Eastern Screech Owl	Woodlands	Throughout
Great Horned Owl	Woodlands	Throughout
Barred Owl	Wetland Forests	Wooded Wetlands
Saw-whet Owl	Wetland Forests	Wooded Wetlands
Common Nighthawk	Upland Woodlands	Summer Night Sky
Chimney Swift	Bridges, House Chimneys	Villages
Ruby-throated Hummingbird	Woodlands and Fields	Throughout; Common
Belted Kingfisher	Wetlands	Throughout
Red-headed Woodpecker	Upland Forest	Endangered; Documented
Red-bellied Woodpecker	Woodlands	Throughout
Yellow-bellied Sapsucker	Woodlands	Fall Migrant

Species	General Habitat	Township Locations
Downy Woodpecker	Woodlands	Throughout; Common
Hairy Woodpecker	Woodlands	Throughout
Northern Flicker	Woodlands	Throughout; Common
Wood Pee-wee	Woodlands	Upland Woods
Eastern Phoebe	Woodlands	Throughout
Great Crested Flycatcher	Woodlands	Upland Woods
Eastern Kingbird	Fields, Farmland	Throughout
Purple Martin	Open Fields, Wetlands	Villages
Tree Swallow	Wetlands	Throughout
Barn Swallow	Buildings, Bridges	Throughout
Blue Jay	Woodland	Throughout; Common
American Crow	All Habitats	Throughout, Common
Carolina Chickadee	Woodlands	Throughout, Common
Eastern Tufted Titmouse	Woodlands	Throughout, Common
White Breasted Nuthatch	Woodlands	Throughout
Brown Creeper	Woodlands	Throughout
Carolina Wren	Edges, Yards	Throughout
House Wren	Villages, Edges	Throughout
Golden and Ruby crowned Kinglets	Woodlands	Winter Migrant
Eastern Bluebird	Edges	Throughout
Wood Thrush	Woodlands	Throughout
American Robin	All Habitats	Throughout, Common
Catbird	Woodlands, Edges	Throughout
Mockingbird	Hedgerows, Yards	Throughout, Common
Brown Thrasher	Woodlands	Throughout
Cedar Waxwing	Old Fields, Young Woodlands	Throughout
Starling	Villages	Throughout; Pest
White-eyed Vireo	Woodlands	Throughout
Philadelphia Vireo	Woodlands	Migrant
Red-eyed Vireo	Woodlands	Wetland Forests
Marsh Wren	Tidal Marsh	Raccoon and Oldmans
Yellow Warbler	Upland Forest	Throughout
Chestnut-side Warbler	Woodlands	Migrant
Black-throated Blue Warbler	Woodlands	Migrant
Yellow-rumped Warbler	Woodlands	Throughout
Pine Warbler	Woodlands	Throughout
Prairie Warbler	Shrubby Areas	Throughout
Palm Warbler	Pine Woodlands	Throughout
Black and White Warbler	Pine Woodlands	Migrant
American Redstart	Rich Woodlands	Throughout
Ovenbird	Woodlands	Throughout
Yellowthroat	Shrubby Areas	Throughout
Scarlet Tanager	Woodlands	Throughout
Cardinal	Edges	Throughout; Common
Indigo Bunting	Edges, Old Fields	Throughout

Species	General Habitat	Township Locations
Rufus sided Towhee	Pine Woodlands	Throughout
Chipping Sparrow	Woodlands	Throughout
Field Sparrow	Old Fields	Throughout
Song Sparrow	Old Fields	Throughout
White-throated Sparrow	Woodlands	Winter Migrant
Dark-eyed Junco	Woodlands	Winter Migrant
Red-winged Black Bird	Open Wetlands, Marsh	Throughout
Common Grackle	All Habitats	Throughout; Common
Brown-headed Cowbird	Open Areas	Throughout; Pest
Orioles: Orchard and Baltimore	Woodlands	Throughout
House Finch	Open Areas	Throughout
Red Crossbill	Pine Woodlands	Winter Migrant
Pine Siskin	Woodlands	Winter Migrant
American Goldfinch	Open Areas, Old Fields	Throughout
House Sparrow	Villages, Old Fields	Throughout; Common
Reptiles		
Bog Turtle	Muddy Agricultural Fields/Wetlands	Endangered
Common Snapping Turtle	Ponds and Lakes	Throughout
Stinkpot Turtle	Wetlands	Throughout
Spotted Turtle	Freshwater Wetlands and Ponds	Throughout
Eastern Box Turtle	Uplands	Throughout
Red-bellied Turtle	Lakes and Ponds	Throughout
Eastern Painted Turtle	Lakes and Ponds	Throughout
Northern Fence Lizard	Uplands	Throughout
Northern Water Snake	Wetlands	Throughout
Garter Snake	All Habitats	Throughout
Eastern Ribbon Snake	Wetlands	Throughout
Southern Ring neck Snake	Woodlands	Throughout
Northern Black Racer	Edges	Throughout
Rough Green Snake	Woodlands	Throughout
Black Rat Snake	All Habitats	Throughout
Amphibians		
Red-backed Salamander	Woodlands	Throughout
Fowlers Toad	Uplands	Throughout
Spring Peeper	Wetlands	Throughout
Bull Frog	Lakes and Ponds	Throughout
Green Frog	Wetlands	Throughout
Wood Frog	Woodlands	Throughout
Southern Leopard Frog	Wetlands	Throughout
Fish		
Alewife	Streams	Crosswicks Creek
Bass, largemouth	Streams	Crosswicks Creek
Bass, striped	Streams	Crosswicks Creek

Species	General Habitat	Township Locations
Bluegill	Streams	Blacks Creek
Bullhead, brown	Streams	Crosswicks Creek
Carp, common	Streams	Crosswicks Creek
Catfish, channel	Streams	Crosswicks Creek
Catfish, white	Streams	Crosswicks Creek
Crappie, black	Streams	Blacks Creek, Crosswicks Creek
Dace, blacknose	Streams	Blacks Creek
Darter, tessellated	Streams	Blacks Creek, Crosswicks Creek
Eel, American	Streams/Lakes	Crystal Lake/SpringHill Brook, Blacks Creek, Crosswicks Creek
Fallfish	Streams	Blacks Creek
Goldfish	Streams	Crosswicks Creek
Herring, blueback	Streams	Crosswicks Creek
Hogchoker	Streams	Crosswicks Creek
Lamprey, American brook	Streams	Blacks Creek, Crosswicks Creek
Minnow, silvery	Streams	Blacks Creek, Crosswicks Creek
Muskellunge, tiger	Streams	Crosswicks Creek
Perch, white	Streams	Crosswicks Creek
Pickerel, redfin	Streams/Lakes	Crystal Lake/Spring Hill Brook
Pumpkinseed	Streams/Lakes	Crystal Lake/Spring Hill Brook, Crosswicks Creek
Shad, American	Streams	Crosswicks Creek
Shiner, common	Streams	Blacks Creek, Crosswicks Creek
Shiner, golden	Streams	Crosswicks Creek
Shiner, satinfin	Streams	Blacks Creek, Crosswicks Creek
Shiner, spottail	Streams	Blacks Creek, Crosswicks Creek
Sucker, white	Streams	Blacks Creek, Crosswicks Creek
Sunfish, bluespotted	Streams/Lakes	Crystal Lake/Spring Hill Brook
Sunfish, redbreast	Streams	Blacks Creek, Crosswicks Creek

Source: Modified from the Franklin Township Environmental Resource Inventory, Compiled by Joseph Arsenault.

Fish Species Source: NJ DEP - Division of Fish and Wildlife - Bureau of Freshwater Fisheries

Appendix B: Inventory of Blacks Creek Vegetation

Scientific Name	Common Name	Location	Specific Area
Acer negundo	box elder	Wooded Wetlands	2,3,4
Acer rubrum	red maple	Shrub Forest/Wooded Wetlands/Open Fields/Lowland Forest	2,3,4
Ailanthus altissima	tree-of-heaven	Lowland Forest	3
Betula nigra	river birch	Wooded Wetlands	2,3,4
Carya ovalis	shagback hickory	Upland Forest	3
Cornus florida	flowering dogwood	Upland Forest	2
Cornus kousa	kousa dogwoods	Non-native landscape plants	4
Erythronium americanum	dog-toothed violets	Creek Bank	3
Fagus grandifolia	american beech	Upland Forest	1,2,3
Hamamelis virginiana	Witchhazel	Upland Forest	2
Impatiens capensis	Jewelweed	Freshwater Marshes	1,2,4
Iris versicolor	blue flag iris	Freshwater Marshes	1
Juniperus virginiana	small red cedars	Open Field	2,4
Ligustrum sp.	understory privet	Wetlands	4
Lindera benzoin	Spicebush	Freshwater Marshes	1,2,3,4
Liquidambar styraciflua	Sweetgum	Upland Forest	3,4
Liriodendron tulipifera	Tulip tree	Upland Forest	1,2,3,4
Lonicera japonica	honeysuckle	Invasive Species	1,2,3,4
Nuphar advena	spatterdock	Freshwater Marshes	1
Pinus sp.	non-native pines	Non-native landscape plants	4
Pinus strobus	White pine	Upland Forest	3
Prunus serotina	Black cherries	Upland Forest/Lowland Forest	1,2,3,4
Quercus alba	White oak	Upland Forest	1,2,3,4
Quercus montana	chestnut oak	Upland Forest	1,2
Quercus paluatrus	pin oak	Upland Forest/Wooded Wetlands	2,3,4
Quercus rubra	red oak	Upland Forest	2,3
Rhododendron maximun	rosebay rhododendron	Upland Forest	2,3
Rhus radicans	poison ivy	Invasive Species	1,2,3,4
Rosa multiflora	multiflora rose	Invasive Species	1,2,3,4
Rubus sp.	blackberry	Invasive Species	1,2,3
Sassafras albidum	sassafras	Open Fields	2,4
Smilax rotundifolia	greenbriar	Invasive Species	1,4
Symplocarpus foetidus	skunk cabbage	Wetlands	4
Vaccinium Sp.	blueberry	Freshwater Marshes	1,2
Viburnum acerifolium	mapleleaf viburnum	Wooded Wetlands	4

Viburnum dentatum	arrowwood	Freshwater Marshes	1,2,4
Viburnum prunifolium	blackhaw viburnum	Wetlands	4
Vinca minor	vinca	Upland Forest	3
Vitis sp.	fox grape	Invasive Species	2,4
Zizania aquatica	wild rice	Freshwater Marshes	1,2

Area #1 (Between Delaware River and Burlington Street)
Area #2 (Between Burlington Street and Route 130)
Area #3 (Between Route 130 and Route 206)
Area #4 (Between Route 206 and NJ Turnpike)

Source: Bordentown Township Open Space Advisory Committee. *The Proposal for the Blacks Creek Greenway - An Analysis Area with Recommendations.* Dec 1, 2003

Appendix C: Inventory of Trenton/Hamilton Marsh Vegetation

Scientific Name	Common Name	Location
Acalypha virginica	mercuryweed	Disturbed Land
Acer negundo	box elder	Forest
Acer platanoides	Norway maple	Forest
Acer rubrum	red maple	Shrub Forest, Forest
Acer Saccharinum	Silver maple	Shrub Forest, Forest
Achillea millefolium	bloodwort	Disturbed Land
Acnida cannabina	tidalmarsh amaranth	Stream Bank, Levee, High Marsh
Acorus calamus	calamus / sweetflag	Stream Bank, High Marsh, Shrub Forest
Agastache scrophulariifolia	purple giant hyssop	Forest
Agrostis alba	bentgrass	Shrub Forest
Ailanthus altissima	tree-of-heaven	Disturbed Land
Alisma subcordatum	American water plantain	High Marsh, Shrub Forest
Alliaria officinalis	alliaria	Forest
Allium vineale	wild garlic	Forest
Alnus rugosa	(du roi) spreng	Shrub Forest, Forest
Alnus serrulata	alder	Wetlands (including shrub forest)
Ambrosia artemisiifolia	ragweed	Disturbed Land
Ambrosia trifida	giant ragweed	Stream Bank, Levee, High Marsh, Shrub Forest
Amorpha fruticosa	false indigo	Open Upland
Amphicarpa bracteata	American hogpeanut	Forest
Andropogon gerardii	big bluestem	Open Upland
Andropogon scoparius	bluestem	Open Upland
Andropogon virginicus	broomsedge	Open Upland
Anthemis cotula	chamomile	Disturbed Land
Apios americana	groundnut	Wetlands (including shrub forest)
Apocynum androsaemifolium	bitterroot	Open Upland
Apocynum cannabinum	dogbane	Disturbed Land
Arabis laevigata	smooth rockcress	Forest
Arisaema triphyllum	jack in the pulpit	Forest
Aristida dichotoma	churchmouse threeawn	Open Upland
Arthraxon hispidus	hairy jointgrass	Disturbed Land
Asarum canadense	canadian wild ginger	Forest
Asclepias incarnata	rose milkweed	Wetlands (including shrub forest)
Asclepias syriaca	broadleaf milkweed	Disturbed Land
Asparagus officinalis	asparagus	Disturbed Land
Asplenium platyneuron	ebony spleenwort	N/A
Aster divaricatus	serpentine aster	Disturbed Land

Aster pilosus	white heath aster	Shrub Forest, Forest
aster puniceus	purplestern aster	Wetlands (including shrub forest)
Aster simplex	aster	Disturbed Land
Aster vimineus	aster	Disturbed Land
Athyrium filix-femina	ladyfern	N/A
Berberis vulgaris	beet	Forest
Betula nigra	river birch	Shrub Forest, Forest
Betula populifolia	grey birch	Forest
Bidens bidentoides	delmarva beggarticks	Wetlands (including shrub forest)
Bidens comosa	beggartick	Wetlands (including shrub forest)
Bidens connata	purplestem beggarticks	Wetlands (including shrub forest)
Bidens coronata	crowned beggerticks	Disturbed Land
Bidens frondosa	bur marigold	Levee, High Marsh
Bidens laevis	smooth beggertick	Stream Bank, Levee, High Marsh, Shrub Forest
Bidens polylepis	beggartick	Wetlands (including shrub forest)
Boehmeria cylindrica	small-spike false nettle	High Marsh, Shrub Forest, Forest
Botrychium	rattlesnake fern	N/A
Botrychium dissectum	cutleaf grapefern	N/A
Broussonetia papyrifera	paper mulberry	Disturbed Land
Cabomba caroliniana	Carolina fanwort	Wetlands (including shrub forest)
Callitriche heterophylla	differentleaf waterstarwort	Stream Bank
Caltha palustris	yellow marsh marigold	Wetlands (including shrub forest)
Capsella bursa-pastoris	shepard's purse	Disturbed Land
Cardamine bulbosa	bulb bittercress	High Marsh, Shrub Forest
Cardamine pensylvanica	Pennsylvania bittercress	High Marsh, Shrub Forest
Carex crinita	fringe sedge	Wetlands (including shrub forest)
Carex grayi	Gray's sedge	Wetlands (including shrub forest)
Carex intumescens	greater blatter sedge	Wetlands (including shrub forest)
Carex lacustris	hairy sedge	Wetlands (including shrub forest)
Carex lupulina	hop sedge	Forest
Carex projecta	necklace sedge	Wetlands (including shrub forest)
Carex rosea	rosy sedge	Forest
Carex scoparia	broom sedge	Shrub Forest
Carex squarrosa	squarrose sedge	Wetlands (including shrub forest)
Carex stipata	owlfruit sedge	Shrub Forest
Carex straminea	eastern straw sedge	Disturbed Land
Carex stricta	upright sedge	Wetlands (including shrub forest)
Carex vulpinoidea	fox sedge	Wetlands (including shrub forest)
Carpinus caroliniana	American hornbeam	Forest
Carya cordiformis	butternut hickory	Forest
Carya ovata	shagbark hickory	Forest
Cassia fasciculata	partridge pea	Open Upland
Cassia nictitans	cassia	Open Upland

Catalpa bignonioides	southern catalpa	Disturbed Land
Celastrus scandens	American bittersweet	Forest
Celtis occidentalis	hackberry	Forest
Centaurea maculosa	spotted knapweed	Disturbed Land
Cephalanthus occidentalis	buttonbush	High Marsh, Shrub Forest
Ceratophyllum demersum	hornwort	Wetlands (including shrub forest)
Chelidonium majus	celandine	Forest
Chelone glabra	white turtlehead	Shrub Forest
Chenopodium album	lambsquarters	Disturbed Land
Chenopodium ambrosioides	Mexican tea	Disturbed Land
Chimaphila maculata	striped prince's-pine	Forest
Chrysanthemum leucanthemum	ox-eye daisy	Disturbed Land
Cicuta bulbifera	bulb waterhemlock	Wetlands (including shrub forest)
Cicuta maculata	common waterhemlock	Levee, High Marsh, Shrub Forest
Cinna arundinacea	stout wood reed-grass	Shrub Forest, Forest
Circaea quadrisulcata	enchanter nightshade	Forest
Cirsium arvense	field turtle	Disturbed Land
Cirsium vulgare	bull thistle	Disturbed Land
Claytonia virginica	spring beauty	Forest, Wetlands (including shrub forest)
Clematis dioscoreifolia	clematis	Forest
Clematis virginiana	devil's darning needles	Forest
Clethra alnifolia	coastal sweetpepperbush	Forest
Commelina communis	Asiatic dayflower	Disturbed Land
Convolvulus sepium	hedge false bindweed	Wetlands (including shrub forest)
Cornus amomum	silky dogwood	Shrub Forest
Cornus florida	flowering dogwood	Forest
Coronilla varia	crownvetch	Disturbed Land
Corydalis flavula	pale corydalis	Forest
Cuscuta gronovii	scaldweed	Stream Bank, Levee, High Marsh, Shrub Forest
Cycloloma atriplicifolium	tumple ringweed	Disturbed Land
Cyperus dentatus	toothed flatsedge	Disturbed Land
Cyperus erythrorhizos	red-root flatsedge	Shrub Forest
Cyperus filiculmis	flatsedge	Disturbed Land
Cyperus ovularis	flatsedge	Forest
Cyperus strigosus	strawcolored flatsedge	Shrub Forest
Dactylis glomerata	orchard grass	Disturbed Land
Daucus carota	queen anne's lace	Disturbed Land
Dennstaedtia punctilobula	eastern hayscented fern	N/A
Desmodium canescens	hoary tickclover	Forest
Desmodium cuspidatum	largebract ticktrefoil	Open Upland
Dianthus armeria	deptford pink	Disturbed Land
Dicentra cucullaria	dutchman's breeches	Forest
Digitaria sanguinalis	crabgrass	Disturbed Land

Dioscorea batatas	yam	Disturbed Land
Dioscorea villosa	wild yam	Shrub Forest, Forest
Diospyros virginiana	persimmon	Forest
Dryopteris noveboracensis	wood fern	N/A
Dryopteris spinulosa	wood fern	N/A
Dryopteris thelypteris	wood fern	N/A
Dulichium arundinaceum	threeway sedge	Shrub Forest
Eleocharis acicularis	needle spikerush	Wetlands (including shrub forest)
Eleocharis obtusa	blunt spikerush	Wetlands (including shrub forest)
Eleusine indica	goose grass	Open Upland
Elodea nuttallii	nuttall waterweed	Wetlands (including shrub forest)
Elymus virginicus	Virginia wild rye	Forest
Epilobium coloratum	purple-leaf willowherb	Shrub Forest
Equisetum arvense	field horsetail	N/A
Equisetum fluviatile	water horsetail	N/A
Eragrostis hypnoides	creeping love grass	Wetlands (including shrub forest)
Eragrostis spectabilis	petticoat-climber	Open Upland
Erechtites hieracifolia	burnweed	Shrub Forest
Eriocaulon parkeri	estuary pipewort	Wetlands (including shrub forest)
Erythronium americanum	dogtooth violet	Forest
Euonymus alatus	burning bush	Disturbed Land
Eupatorium dubium	coastalplain joepyeweed	Shrub Forest, Forest
Eupatorium hyssopifolium	hyssopleaf thoroughwort	Open Upland
Eupatorium perfoliatum	boneset	Disturbed Land
Eupatorium purpureum	sweetscented joepyeweed	Shrub Forest, Forest
Eupatorium rugosum	snakeroot	Forest
Euphorbia corollata	flowering spurge	Open Upland
Fagopyrum sagittatum	buckwheat	Forest
Fagus grandifolia	American beech	Open Upland
Festuca rubra	red fescue	Disturbed Land
Fraxinus americana	white ash	High Marsh, Shrub Forest, Forest
Fraxinus pennsylvanica	green ash	Shrub Forest, Forest
Froelichia gracilis	slender snake-cotton	Disturbed Land
Galium aparine	bedstraw	Wetlands (including shrub forest)
Galium obtusum	blunt-leaf bedstraw	Shrub Forest
Galium tinctorium	stiff marsh bedstraw	Disturbed Land
Geum canadense	white avens	Wetlands (including shrub forest)
Geum laciniatum	rough avens	Forest
Glechoma hederacea	ground ivy	Disturbed Land
Glyceria pallida	mannagrass	Wetlands (including shrub forest)
Glyceria septentrionalis	floating mannagrass	Forest
Gnaphalium obtusifolium	rabbit tobacco	High Marsh
Gratiola neglecta	clammy hedge-hyssop	Stream Bank

Helenium autumnale	sneezeweed	Disturbed Land
Helianthus annuus	southeastern sunflower	Disturbed Land
Helianthus decapetalus	thinleaf sunflower	Forest
Helianthus tuberosus	Jerusalem artichoke	Disturbed Land
Heracleum maximum	common cowparsnip	High Marsh
Heteranthera multiflora	bouquet mudplantain	Pond, Shrub Forest
Hibiscus palustris	hibiscus moscheutos	High Marsh, Shrub Forest
Hieracium pratense	field hawkweed	Open Upland
Hordeum jubatum	foxtail barley	Disturbed Land
Hosta plantaginea	fragrant plantain lily	Disturbed Land
Houstonia caerulea	azure bluet	Open Upland
Humulus japonicus	japanese hop	Disturbed Land
Hypericum mutilum	dwarf st. john's wort	Disturbed Land
Hypericum perforatum	st. john's wort	Disturbed Land
Hystrix patula	hystrix	Wetlands (including shrub forest)
Ilex opaca	American holly	Forest
Ilex verticillata	common winterberry	Wetlands (including shrub forest)
Impatiens capensis	jewelweed	Stream Bank, Levee, High Marsh, Shrub Forest, Forest
Iris pseudacorus	paleyellow iris	High Marsh, Shrub Forest
Iris versicolor	harlequin blueflag	Wetlands (including shrub forest)
Juncus acuminatus	sharp-fruit rush	Disturbed Land
Juncus effusus	common rush	High Marsh, Shrub Forest
Juncus tenuis	field rush	Forest
Jussiaea repens	jussiaea	Wetlands (including shrub forest)
Justica americana	none	Wetlands (including shrub forest)
Krigia virginica	Virginia dwarfdandelion	Open Upland
Lactuca biennis	tall blue lettuce	Forest
Lactuca canadensis	canada lettuce	Disturbed Land
Lamium amplexicaule	common henbit	Disturbed Land
Laportea canadensis	Canada woodnettle	Forest
Lechea villosa	pinweed	Open Upland
Leersia oryzoides	rice cut grass	High Marsh,Shrub Forest, Forest
Leersia virginica	white grass	Disturbed Land
Lemna minor	common duckweed	Wetlands (including shrub forest)
Lemna spp.	duckweed	High Marsh, Pond-like, Pond
Leonurus cardiaca	motherwort	Disturbed Land
Lepidium spp.	pepperweed	Disturbed Land
Lespedeza capitata	roundhead lespedeza	Open Upland
Lespedeza intermedia	intermediate lespedeza	Open Upland
Ligustrum vulgare	wild privet	Open Upland
Lilium spp.	lily	Wetlands (including shrub forest)
Linaria canadensis	Canada toadflax	Open Upland

Lindera benzoin	northern spicebush	Wetlands (including shrub forest), Forest
Lindernia dubia	yellow-seed false pimpernel	Wetlands (including shrub forest)
Liquidambar styraciflua	sweetgum	Shrub Forest, Forest
Liriodendron tulipifera	Tulip tree	Forest
Lobelia cardinalis	cardinal flower	Wetlands (including shrub forest)
Lobelia inflata	indian tobbaco	Disturbed Land
Lobelia siphilitica	Great blue lobelia	Wetlands (including shrub forest)
Lolium perenne	perennial ryegrass	Disturbed Land
Lonicera japonica	Chinese honeysuckle	Forest
Lonicera morrowii	morrow's honeysuckle	Disturbed Land
Lonicera xylosteum	Dwarf honeysuckle	Open Upland
Ludwigia alternifolia	seedbox	Disturbed Land
Ludwigia palustris	marsh primrose-willow	Levee
Luzula multiflora	common woodrush	Disturbed Land
Lycopus americanus	American water	Wetlands (including shrub forest)
Lycopus virginicus	Virginia bugelweed	Shrub Forest
Lysimachia ciliata	fringed loosestrife	Shrub Forest
Lythrum alatum	wing-angle loosestrife	High Marsh
Lythrum salicaria	purple loosestrife	High Marsh, Shrub Forest
Melilotus alba	white sweetclover	Disturbed Land
Melilotus officinalis	yellow sweetclover	Disturbed Land
Microstegium vimineum	Japanese stillgrass	Forest
Mikania scandens	climbing hempvine	High Marsh, Shrub Forest, Forest
Mimulus alatus	sharpwing monkeyflower	Wetlands (including shrub forest)
Mimulus ringens	allegheny monkeyflower	Disturbed Land
Mollugo verticillata	carpetweed	Disturbed Land
Monotropa uniflora	indianpipe	Forest
Morus alba	mulberry	Forest
Myosotis laxa	bay forget-me-not	Shrub Forest
Myriophyllum heterophyllum	broadleaf water-milfoil	Wetlands (including shrub forest)
Myriophyllum spicatum	Eurasian water-milfoil	Wetlands (including shrub forest)
Nasturtium officinale	nasturtium	High Marsh, Shrub Forest
Nuphar advena	pondlily	Stream Channel, Stream Bank, Levee, High Marsh, Pond-like, Pond
Nymphaea odorata	American waterlily	Wetlands (including shrub forest)
Nyssa sylvatica	blackgum	Shrub Forest, Forest
Oenothera biennis	common evening primrose	Disturbed Land
Onoclea sensibilis	sensitive fern	N/A
Orontium aquaticum	goldenclub	Wetlands (including shrub forest)
Osmorhiza longistylis	aniseroot	Forest
Osmunda cinnamomea	cinnamon fern	N/A
Osmunda claytoniana	interrupted	N/A

Osmunda regalis	royal fern	N/A
Oxalis stricta	yellow woodsorrel	Forest
Panicum anceps	beaked panicum	Forest
Panicum clandestinum	deer-tongue witchgrass	Disturbed Land
Panicum latifolium	panicgrass	Wetlands (including shrub forest)
Panicum stipitatum	panicgrass	Wetlands (including shrub forest)
Panicum virgatum	switchgrass	Open Upland
Parthenocissus quinquefolia	American ivy	Shrub Forest, Forest
Paulownia tomentosa	princess tree	Forest
Peltandra virginica	green arrow arum	Stream Bank, Levee, High Marsh, Pond-like, Pond, Shrub Forest
Penthorum sedoides	ditch stonecrop	Disturbed Land
Phalaris arundinacea	reed canary grass	Levee, High Marsh
Philadelphus coronarius	sweet mock orange	Forest
Phragmites australis	common reed	High Marsh
Physocarpus opulifolius	Atlantic ninebark	Forest
Phytolacca americana	pokeweed	Forest
Pilea pumila	Canada clearweed	Stream Bank, Levee, High Marsh, Shrub Forest, Forest
Pinus rigida	pitch pine	Open Upland
Plantago aristata	bottlebrush indianwheat	Disturbed Land
Plantago lanceolata	English plantain	Disturbed Land
Plantago rugelii	blackseed plantain	Disturbed Land
Platanus occidentalis	american sycamore	Forest
Poa compressa	Canada bluegrass	Disturbed Land
Poa trivialis	rought bluegrass	High Marsh, Shrub Forest
Podophyllum peltatum	may apple	Forest
Polygonatum biflorum	king solomon's seal	Forest
Polygonum amphibium	water smartweed	Wetlands (including shrub forest)
Polygonum arifolium	halberdleaf tearthumb	Stream Bank, Levee, High Marsh, Shrub Forest
Polygonum cespitosum	oriental ladysthumb	Disturbed Land
Polygonum cuspidatum	fleeceflower	Disturbed Land
Polygonum hydropiperoides	swamp smartweed	Wetlands (including shrub forest)
Polygonum lapathifolium	curlytop smartweed	Disturbed Land
Polygonum orientale	princesfeather	Disturbed Land
Polygonum pensylvanicum	Pennsylvania smartweed	Disturbed Land
Polygonum punctatum	dotted smartweed	Stream Bank, Levee, Pond-like
Polygonum sagittatum	arrow-leaf tearthumb	Levee, Forest
Polygonum scandens	climbing knotweed	Forest
Polystichum acrostichoides	christmas fern	N/A
Pontederia cordata	pickerelweed	Stream Channel, Stream Bank, Pond-like, Pond, Shrub Forest
Populus grandidentata	bigtooth aspen	Disturbed Land

Populus tremuloides	quaking aspen	Disturbed Land
Potamogeton crispus	curly pondweed	Pond-like, Pond
Potamogeton diversifolius	waterthread	Wetlands (including shrub forest)
Potamogeton epihydrus	ribbonleaf pondweed	Wetlands (including shrub forest)
Potamogeton pectinatus	sago pondweed	Wetlands (including shrub forest)
Potentilla simplex	common cinquefoil	Forest
Prunella vulgaris	common selfheal	Disturbed Land
Prunus serotina	black cherry	Shrub Forest, Forest
Pteretis pensylvanica	none	N/A
Ptilimnium capillaceum	herbwilliam	Wetlands (including shrub forest)
Pycnanthemum muticum	clustered mountainmint	Forest
Pycnanthemum virginianum	Virginia mountainmint	Open Upland
Pyrus prunifolia	pear	Open Upland
Quercus palustris	pin oak	Forest
Quercus Phellos	willow oak	Forest
Quercus rubra	northern red oak	Forest
Ranunculus abortivus	smallflower buttercup	Forest
Ranunculus longirostris	longbeak buttercup	Wetlands (including shrub forest)
Ranunculus sceleratus	celeryleaf buttercup	High Marsh, Shrub Forest, Forest
Rhexia virginica	common meadowbeauty	Disturbed Land
Rhus copallina	dwarf sumac	Open Upland
Rhus glabra	smooth sumac	Wetlands (including shrub forest)
Rhus radicans	poison ivy	Shrub Forest, Forest
Rhus typhina	staghorn sumac	Open Upland
Robinia pseudo-acacia	black locust	Open Upland
Rosa multiflora	multiflora rosa	Open Upland, Forest
Rosa palustris	swamp rose	Shrub Forest
Rubus pensylvanicus	blackberry	Wetlands (including shrub forest)
Rubus phoenicolasius	Japanese wineberry	Forest
Rudbeckia hirta	blackeyed susan	Disturbed Land
Rudbeckia laciniata	cutleaf coneflower	Wetlands (including shrub forest)
Rumex crispus	curley dock	Disturbed Land
Rumex obtusifolius	bitter dock	Forest
Sagittaria latifolia	broadleaf arrowhead	Stream Bank, Levee, High Marsh, Shrub Forest
Sagittaria rigida	sessilefruit arrowhead	Wetlands (including shrub forest)
Sagittaria subulata	awl-leaf arrowhead	Wetlands (including shrub forest)
Salix fragilis	crack willow	Disturbed Land
Salix humilis	prairie willow	Disturbed Land
Salix rigida	willow	Shrub Forest, Forest
Salix spp.	willow	Shrub Forest
Sambucus canadensis	American elder	Shrub Forest, Forest
Saponaria officinalis	bouncing bet	Disturbed Land
Sassafras albidum	sassafras	Shrub Forest, Forest

Scirpus cyperinus	bulrush	Shrub Forest, Forest
Scirpus fluviatilis	bulrush	High Marsh
Scirpus polyphyllus	leafy bulrush	Disturbed Land
Scirpus pungens	bulrush	Wetlands (including shrub forest)
Scrophularia marilandica	Maryland figwort	Forest
Scutellaria epilobiifolia	skullcap	Wetlands (including shrub forest)
Scutellaria integrifolia	hemlet flower	Open Upland
Scutellaria lateriflora	blue skullcap	Shrub Forest
Senecio aureus	golden ragwort	Forest
Setaria faberi	Chinese foxtail	Disturbed Land
Setaria glauca	bristlegrass	Open Upland
Sisyrinchium angustifolium	common blue-eyedgrass	Open Upland
Sium suave	common waterparsnip	Levee, High Marsh, Shrub Forest
Smilacina racemosa	smilacina	Forest
Smilax herbacea	herbaceous greenbriar	Forest
Smilax rotundifolia	bullbriar	Forest
Soidago juncea	early goldenrod	Disturbed Land
Soildago sempervirens	seaside goldenrod	Wetlands (including shrub forest)
Solanum dulcamara	bitter nightshade	Forest
Solanum nigrum	black nightshade	Disturbed Land
Solidago caesia	wreath goldenrod	Forest
Solidago graminifolia	goldenrod	Disturbed Land
Solidago rugosa	wrinkleleaf goldenrod	Disturbed Land
Sorghastrum nutans	yellow indian-grass	Open Upland
Sparganium americanum	American burreed	Wetlands (including shrub forest)
Sparganium eurycarpum	broadfruit burreed	Wetlands (including shrub forest)
Spartina pectinata	prairie cordgrass	Wetlands (including shrub forest)
Specularia perfoliata	none	Disturbed Land
Spergularia rubra	purple sandspurry	Open Upland
Spiraea latifolia	spiraea	Wetlands (including shrub forest)
Spiraea tomentosa	steeplebush	Disturbed Land
Spirodela polyrhiza	giant duckweed	Wetlands (including shrub forest)
Stachys palustris	marsh hedgenettle	Wetlands (including shrub forest)
Stachys tenuifolia var. hispida	hedge nettle	Wetlands (including shrub forest)
Stellaria longifolia	longleaf starwort	Wetlands (including shrub forest)
Symplocarpus foetidus	skunk cabbage	Forest
Taraxacum officinale	common dandelion	Disturbed Land
Taxus spp.	Yew	Disturbed Land
Teucrium canadense	american germander	Forest
Thalictrum polygamum	meadowrue	Shrub Forest
Tilia americana	American basswood	Forest
Tovara virginiana	none	Forest
Trichostema dichotomum	blue curls	Open Upland

Trifolium agrarium	clover	Disturbed Land
Trifolium arvense	rabbit-foot clover	Disturbed Land
Trifolium pratense	red clover	Disturbed Land
Trifolium repens	Dutch clover	Disturbed Land
Triodia flava	none	Open Upland
Typha angustifolia	narrow-leaf cattail	High Marsh
Typha latifolia	broadleaf cattail	High Marsh, Pond-like, Shrub Forest
Ulmus rubra	slippery elm	Forest
Utricularia intermedia	flat-leaf bladderwort	Wetlands (including shrub forest)
Utricularia vulgaris	bladderwort	Wetlands (including shrub forest)
Uvularia sessilifolia	sessile-leaf bellwort	Forest
Vaccinium corymbosum	highbush blueberry	Forest
Vallisneria americana	American eelgrass	Wetlands (including shrub forest)
Verbascum blattaria	moth mullein	Disturbed Land
Verbascum thapsus	common mullein	Disturbed Land
Verbena urticifolia	white verbena	Forest
Veronica longifolia	long-leaf speedwell	Open Upland
Veronica peregrina	neckweed	Levee
Viburnum dentatum	arrowood	Shrub Forest, Forest
Viburnum prunifolium	blackhaw	Shrub Forest, Forest
Viola kitaibeliana	violet	Open Upland
Viola sororia	common blue violet	Shrub Forest, Forest
Vitis aestivalis	summer grape	Forest
Vitis labrusca	foxgrape	Forest
Vitis riparia	riverbank grape	Forest
Vitis vulpina	wild grape	Disturbed Land
Wisteria floribunda	Japanese wisteria	Forest
Wolffia columbiana	columbia watermeal	Wetlands (including shrub forest)
Woodwardia areolata	chainfern	N/A
Xanthium strumarium	cockleburr	Disturbed Land
Zizania aquatica	annual wildrice	Stream Channel, Stream Bank, Levee, High Marsh, Pond-like, Shrub Forest

Source (Scientific Name): Allessio Leck, Mary; Robert L. Simpson; Dennis F. Whigham; and Charles F. Leck. "Plants of the Hamilton Marshes: A Delaware River Freshwater Tidal Wetland." *Bartonia* No. 54: pp.1-17, 1988.

Source (Common Name): *USDA Integrated Taxonomic Information System*

Appendix D:

CAUTIONS AND RESTRICTIONS ON NATURAL HERITAGE DATA

The quantity and quality of data collected by the Natural Heritage Program is dependent on the research and observations of many individuals and organizations. Not all of this information is the result of comprehensive or site-specific field surveys. Some natural areas in New Jersey have never been thoroughly surveyed. As a result, new locations for plant and animal species are continuously added to the database. Since data acquisition is a dynamic, ongoing process, the Natural Heritage Program cannot provide a definitive statement on the presence, absence, or condition of biological elements in any part of New Jersey. Information supplied by the Natural Heritage Program summarizes existing data known to the program at the time of the request regarding the biological elements or locations in question. They should never be regarded as final statements on the elements or areas being considered, nor should they be substituted for on-site surveys required for environmental assessments. The attached data is provided as one source of information to assist others in the preservation of natural diversity.

This office cannot provide a letter of interpretation or a statement addressing the classification of wetlands as defined by the Freshwater Wetlands Act. Requests for such determination should be sent to the DEP Land Use Regulation Program, P.O. Box 401, Trenton, NJ 08625-0401.

The Landscape Project was developed by the Division of Fish & Wildlife, Endangered and Nongame Species Program to map critical habitat for rare animal species. Some of the rare species data in the Landscape Project is in the Natural Heritage Database, while other records were obtained from other sources. Natural Heritage Database response letters will list all species (if any) found during a search of the Landscape Project. However, any reports that are included with the response letter will only reference specific records if they are in the Natural Heritage Database. This office cannot answer any inquiries about the Landscape Project. All questions should be directed to the DEP Division of Fish and Wildlife, Endangered and Nongame Species Program, P.O. Box 400, Trenton, NJ 08625-0400.

This cautions and restrictions notice must be included whenever information provided by the Natural Heritage Database is published.

NJ Department of Environmental Protection
Division of Parks and Forestry
Natural Lands Management

Title of Report: **Environmental Resource Inventory for Bordentown Township, Burlington County, New Jersey**

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ABSTRACT: This publication documents the natural and community resources of Bordentown Township, Burlington County, New Jersey. The natural resource information includes descriptions, tables and maps of land use; soils; steep slopes; drinking water wells; aquifers; watersheds; streams and lakes; wetlands, flood plains; impacts on water resources; vegetation including forests and grasslands; animal communities; threatened and endangered species; and contaminated sites. Community resources that are briefly described include population, transportation, township utilities and services, protected open space and historic resources. A short history of the township is also included.

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BORDENTOWN

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