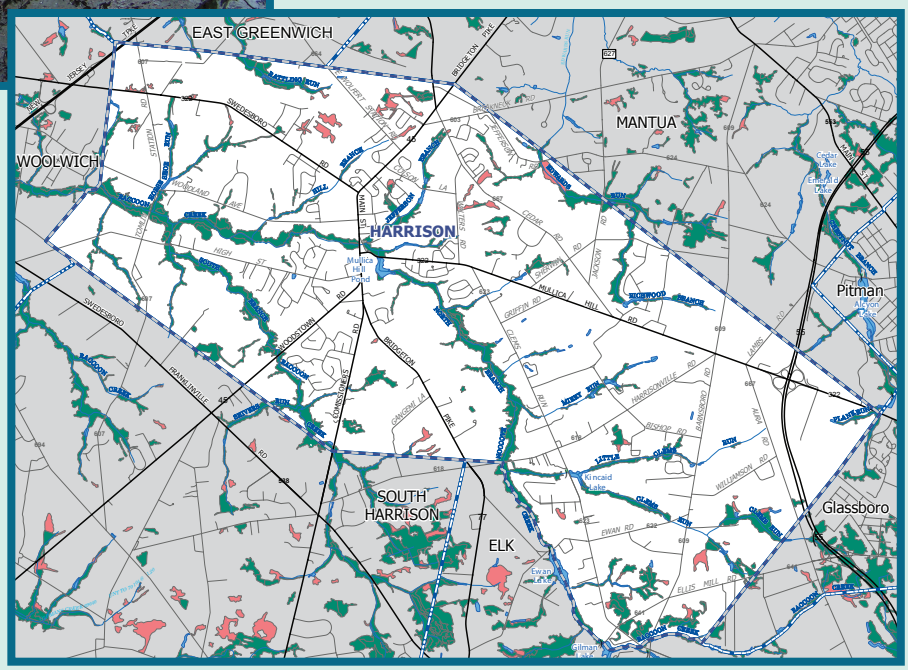
ENVIRONMENTAL RESOURCE INVENTORY

for the TOWNSHIP of

HARRISON

GLOUCESTER COUNTY, NEW JERSEY



prepared by:

Delaware Valley Regional Planning Commission

with:

The Environmental Commission of Harrison Township

APRIL 2005

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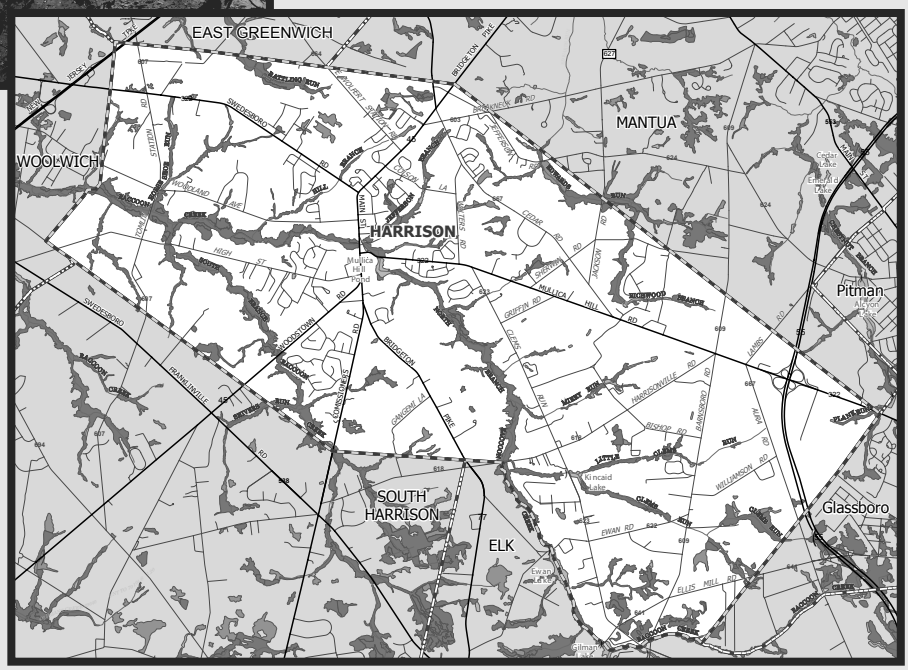

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APRIL 2005

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

This report was funded by the Association of New Jersey Environmental Commissions (ANJEC) Smart Growth Assistance Grant Program, funded by the Geraldine R. Dodge Foundation, and by the Township of Harrison. Funding was also provided by the Delaware Valley Regional Planning Commission's Open Space and Greenways Program. The authors are solely responsible for the report's findings and conclusions, which may not represent the official views or policies of the non-township funding agencies.

Cover Photo: *Mullica Hill Pond*. Source: DVRPC

HARRISON TOWNSHIP
ENVIRONMENTAL RESOURCE INVENTORY
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- The Township of Harrison
- The Delaware Valley Regional Planning Commission's Open Space and Greenways Program

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The impetus for the creation of this document, and its guidance and review, came from the Harrison Township Environmental Commission.

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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.

Harrison Township's natural resources have long shaped the lives of its inhabitants. The high-quality soils of Harrison played a major role in its early settlement by Europeans. Its position along Raccoon Creek made it a locally significant manufacturing center in the 19th century. With the historic village of Mullica Hill at its center, Harrison Township has adapted to fit a commercial niche as an interstate antiques destination in the latter part of the 20th century. Harrison's historic character and rural setting have also attracted medium-density residential development. As this activity increases, the character of Harrison Township is changing. Documentation of the community's environmental resources is a necessity, especially if Harrison is to support a healthy mix of agricultural, commercial, industrial and residential uses in the future.

Harrison's surface waters and groundwater resources will become increasingly important to its population and to that of neighboring communities. Its wetlands, upland forests, and grasslands, 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. Knowledge of the environmental resources of the township will allow its citizens to make informed decisions as they decide Harrison's future path and forge its emerging identity.

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

Several documents and reports were utilized in preparing the *Environmental Resource Inventory for Harrison Township*, including the Harrison Township *Master Plan* from 1999, along with a number of reference works. These are listed at the end of this document. The maps and data relating to Harrison Township's natural resources are derived principally from the New Jersey Department of Environmental Protection's (NJDEP's) 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

Harrison Township was formed on January 31, 1844 from land in Greenwich Township and Woolwich Township. Originally named Spicer Township in honor of affluent landowner Jacob Spicer, Harrison once included the area of present-day South Harrison Township and a small part of Elk Township. The township was later renamed in honor of General William Henry Harrison, the ninth president of the United States, who died 30 days after his inauguration in 1841.

Before European settlers arrived in the Delaware Valley, Native Americans populated the Gloucester County area. Recent archeological findings show that humans have been present in the region for approximately 10,000 years. Early Native American communities relied on the area's natural resources, such as Raccoon Creek, which sustained small Indian villages of the Narraticon tribe. The tribe and creek name was a version of the Lenape Indian word for "raccoon," which was an animal probably found in abundance in the area.

The first European settlers in the Delaware Valley were the Dutch, who founded a colony in New Jersey in 1624. In 1638, Swedish and Finnish settlers ventured to the Delaware Valley and a Scandinavian colony was established at the confluence of the Delaware River and Raccoon Creek in Logan Township. A few Swedish and Finnish families, accustomed to water travel, purchased land from the Indians and founded their own homesteads along the interior waterways. The largest settlement was at Swedesboro, on the Raccoon Creek downstream from Harrison Township.

In 1644, the Dutch ceded control of their New World holdings to the English. The Swedish/Finnish settlers remained, tending thriving farms and establishing successful trade with the Indians, especially for furs. These settlers gave shelter to the first group of English colonists who arrived on the English ship *Kent,* docking at Raccoon Creek in 1677.

The first documented European settlers in Harrison Township were members of the Mullica family (also spelled as Molica), who came originally from Finland, which, at that time, was governed by Sweden. Three Mullica brothers, John, Eric (junior), and William, purchased land on the north side of the Raccoon Creek in 1704 and established farming homesteads. While the Mullica brothers did not name or found the village, Mullica Hill is named for them, recognizing the first known property owners as well as the steep hills along either side of Raccoon Creek. In the 19th century, Mullica Hill became a small industrial area in Gloucester County, with a foundry, gristmill, and woolen mill along the Raccoon Creek raceway. Ewan, originally named Ewan's Mills, and later Ewansville, was established in the late 18th century. The hamlets of Jefferson and Five Points (Richwood) were established as smaller communities at the turn of the 19th century.

Because of the unusually rich farming soils, Harrison Township entered a long era of agricultural production. Early settlers raised grain, fruit and vegetables, and tended livestock. In the 19th century, rich marl deposits were discovered throughout southern New Jersey. Marl, a soil heavy in calcium and carbonated lime, was used as commercial fertilizer and was excavated and

exported throughout the Delaware Valley. The marl industry flourished especially in adjacent Mantua Township, with smaller operations located in Harrison Township. The removal of Harrison's marl for fertilizer unearthed prehistoric marine and reptilian species fossils. Glassboro State College continued excavations on Daminger Farm in the first half of the 20th century.

Source: DVRPC

Main Street is the location of numerous antique shops, which attract regional visitors.

From its earliest days, Harrison Township consisted of several small, loosely clustered residential communities, including the village of Mullica Hill, surrounded by numerous small active farm operations. The village developed steadily for 250 years, serving as a milling and agricultural shipment center. Spicerville, named after Jacob Spicer, was a Quaker community on the south bank of the Raccoon Creek, which was subsumed into Mullica Hill because of its proximity and topographic similarity to the prominent village. In 1991, the entire village of Mullica Hill was designated a historic place on both the National Register and the New Jersey Register because of its vernacular architecture. Harrison also designated the village as a local historic district with an accompanying historic preservation commission. Today, Mullica Hill is an example of the 18th and 19th century rural villages that are often the centers of our suburban townships throughout southern New Jersey. In the last 25 years, the Mullica Hill has become a regional destination for antique collectors and other shoppers patronizing associated specialty stores.

Ewan, in the southernmost section of the township bordering Elk Township, is a small hamlet named after Israel Ewan, a prominent 19th century proprietor. Thomas Iredell founded a saw and gristmill along the Raccoon Creek, and Ewan Lake is the lasting result of the mill's dam. Iredell's pattern brick farmhouses survive today, on either side of the lake; one in Elk Township on Mood's Road and the other in Harrison at Ewan Road and New Street. Jefferson, a crossroads town, is located one mile north of Mullica Hill along State Route 45 (Bridgeton Pike). Jefferson was also known as Cox's Hill in the early 19th century (circa 1808) and then as Allenboro (circa 1835). Today, Jefferson is the location of Clearview Regional High School and Junior High School, the Mill Valley subdivision, and the High Pointe subdivision. Richwood is another old village that has had many names, including Five Points, Campbell's Corner, Campbell's Store, Mount Pleasant, White Horse, and Hell Town. Three major roads converge in Richwood, creating a five-point intersection. Its present name dates to 1888. It rose to significance in the 1850s as rural road traffic increased with farmers bringing raw farm goods to Mullica Hill. Additionally, it possesses very sandy soils that are naturally suited for fruit

orchards. Today, Richwood is near the interchange of U.S. Route 322 and Route 55 and is the site of much current and proposed residential development. Farmland on the east side of Route 55 is slated for a technology office park owned and operated by Rowan University.

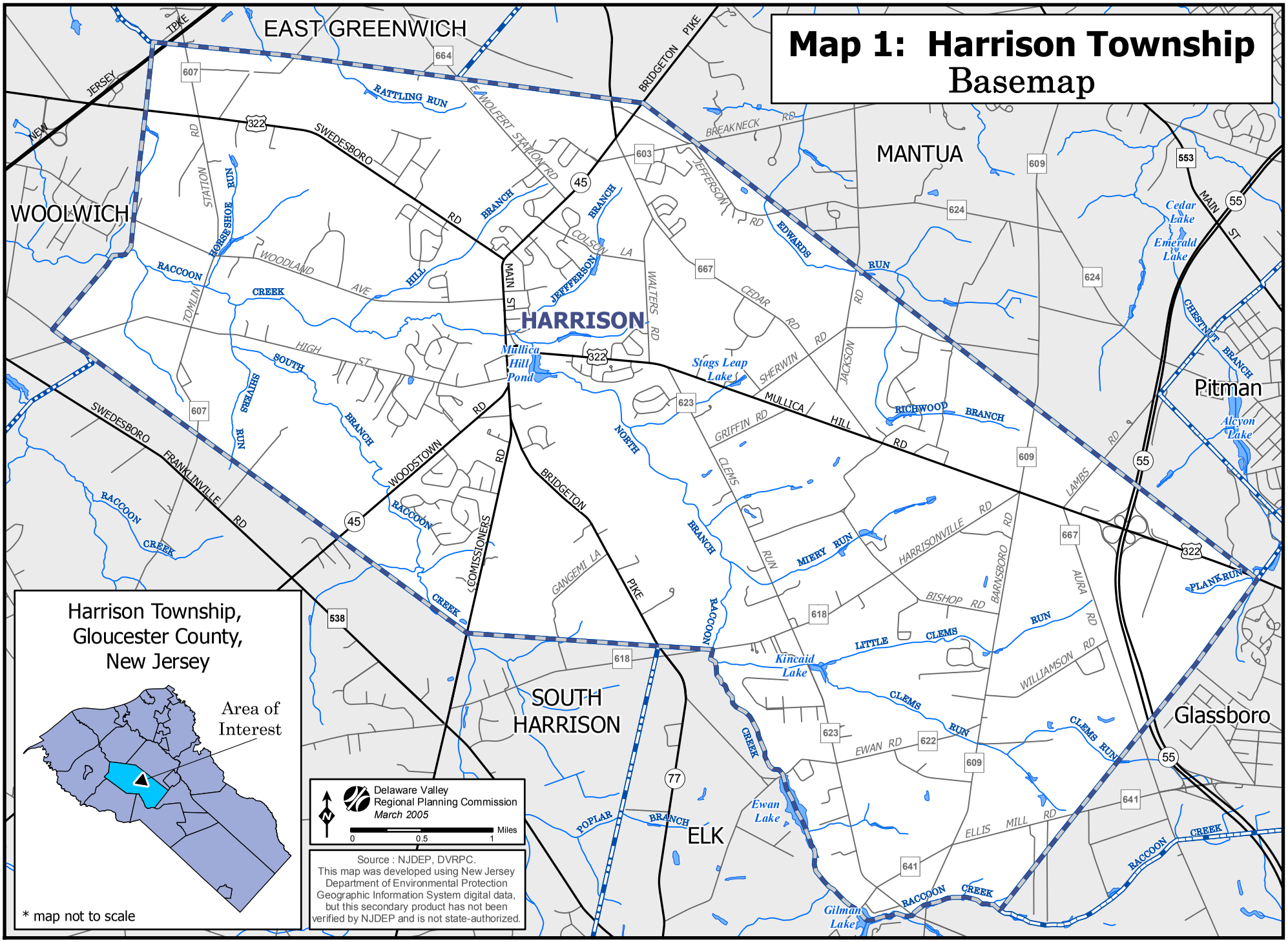
As in most of southern New Jersey, and especially Gloucester County, waterways were important to Harrison from its earliest days. Mullica Hill and Ewan were located along the Raccoon Creek so that water could be harnessed for mill operations. Throughout the 18th and 19th centuries, many mills that processed timber, corn, and flour for metropolitan markets operated along stretches of the creek.

Early roads were often impassible in certain seasons and bridges were either nonexistent or not kept in good repair. In the late 1800s, a railroad spur was built to Mullica Hill from the West Jersey Railroad. Mullica Hill became a destination for farmers sending their goods to market by rail. Road development in the 20th century changed the pattern of transportation again, and led to a decline in rail transport. U.S. Route 322 provided a major east-west access to most of Southern New Jersey's farmland. State Route 45 linked many of the major towns in Gloucester County. Today, Route 55 connects many residents to paying jobs outside of the township, county, and state.

Despite the growth of roads, Harrison remained a rural agricultural community until the late 1980s. The completion of Route 55 in 1988, with its interchange in the eastern part of the township, coupled with the increasing congestion in already-developed parts of southern New Jersey, made Harrison a scenic and accessible location for new bedroom communities. Harrison Township began receiving an abundance of suburban residential subdivisions on its former agricultural fields. This trend has continued into the 21st century and has brought a diversity of new residents to Harrison. It has changed the character of the community in some ways, although both new and old residents place a high value on the township's rural qualities, its historic nature, and its open spaces.

Source: DVRPC

Home located on residential street adjacent to Main Street


Map 1: Harrison Township
Basemap
EAST GREENWICH
WOOLWICH
MANTUA
HARRISON
SOUTH HARRISON
ELK
Pitman
Glassboro
Mullica Hill Pond
Stags Leap Lake
Kincaid Lake
Ewan Lake
Gilman Lake
Cedar Lake
Emerald Lake
Alcyon Lake
Harrison Township, Gloucester County, New Jersey
Area of Interest
* map not to scale
Delaware Valley Regional Planning Commission
March 2005
Miles
0
0.5
1
Source : NJDEP, 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.

HARRISON TOWNSHIP LOCATION, SIZE, AND LAND USE

Harrison is an incorporated township located in the center of Gloucester County, New Jersey. The township is bounded by six municipalities: East Greenwich Township to the northwest, Mantua Township to the north, Glassboro Borough to the east, Elk Township to the southeast, South Harrison Township to the south, and Woolwich Township to the west.

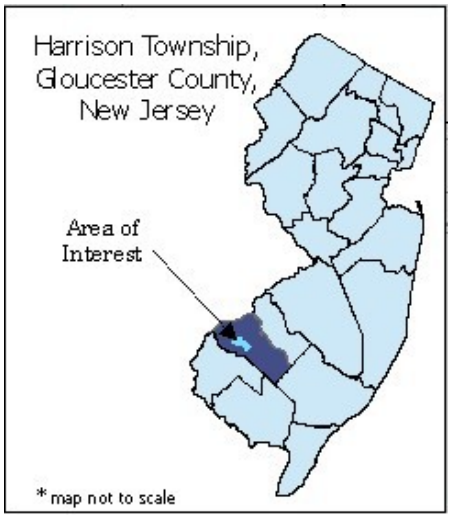


Figure 1: Harrison Township's location

At the heart of Harrison Township is the historic village of Mullica Hill, established in the early 1700s. Local roadways and the two-lane federal highway U.S. 322 flow through the historic district before connecting to major transportation corridors such as State Highway 55 and the New Jersey Turnpike. On its western end in Gloucester County, U.S. Route 322 connects to the Commodore Barry Bridge, crossing over the Delaware River.

Harrison Township occupies approximately 12,230 acres or 19.1 square miles on the coastal plain of New Jersey. Harrison's land use reflects its natural setting, its long agricultural past, and the successive waves of suburban residential development that have occurred since the end of World War II. Residential development is concentrated primarily in the center of the township along Main Street and Route 45 and along Route 322, although new subdivisions of residential housing are located in a widening, disconnected circle around that center. During the 1990s, Harrison increased its population by 4,000 residents, a 54 percent increase. As of 2000, nearly half of Harrison Township's land (5,900 acres) was still in agricultural production.[1]

Table 1 shows Harrison's land cover grouped into general categories based on the New Jersey Department of Environmental Protection's (NJDEP's) 1995/97 color infrared digital imagery updated with NJDEP's 2002 color aerial photography.[2]

Table 2 breaks down the 1995/97 general land cover categories into detailed land cover categories.[3]

Table 3 shows Harrison's land uses according to DVRPC's *Year 2000 Land Use Survey*, also updated to 2002.[4] See also **Map 2A, Map 2B** and **Map 3**.

---

[1] Number of acres determined by DVRPC Land Use data from 2000. Does not reflect land use changes in the last four years.
[2] The 1995/97 land cover dataset is NJDEP's most up-to-date comprehensive land use information. Updates to the general categories, based on NJDEP's 2002 color aerial photography, were performed by DVRPC in 2004.
[3] The land cover information in Table 2 is not updated to 2002.
[4] The DVRPC Year 2000 Land Use Survey is based on visual interpretation of aerial photography produced in March 2000 at a scale of 1:2,400. This data was also updated using NJDEP's 2002 color aerial photography.

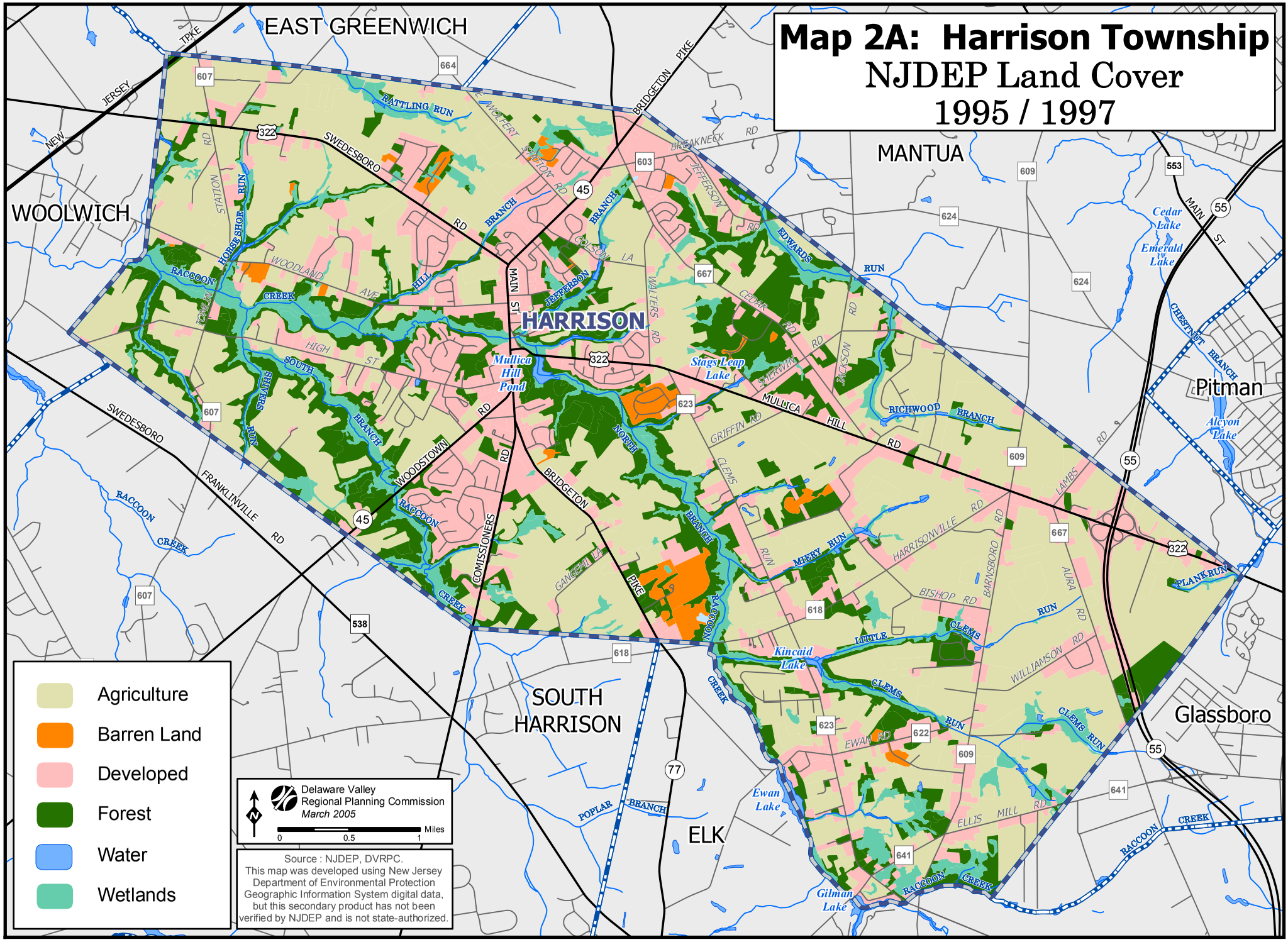

Map 2A: Harrison Township
NJDEP Land Cover
1995 / 1997
EAST GREENWICH
WOOLWICH
MANTUA
Pitman
Glassboro
SOUTH HARRISON
ELK
HARRISON
Mullica Hill Pond
Stags Leap Lake
Kincaid Lake
Ewan Lake
Gilman Lake
Cedar Lake
Emerald Lake
Alcyon Lake
Agriculture
Barren Land
Developed
Forest
Water
Wetlands
Delaware Valley Regional Planning Commission
March 2005
Miles
0
0.5
1
Source : NJDEP, 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.

Table 1: Harrison Township General Land Cover Classes (1995/97; updated to 2002)

General Land Classes	Acres	Percent
Agriculture	5,780.81	47.22%
Barren Land	191.01	1.56%
Developed	1,873.65	15.30%
Forest	3,260.34	26.63%
Water	64.18	0.52%
Wetlands	1,072.32	8.76%
Total	**12,242.31**	**100.00%**

Source: NJDEP, DVRPC

Source: DVRPC

A winter farm field on Harrisonville Road

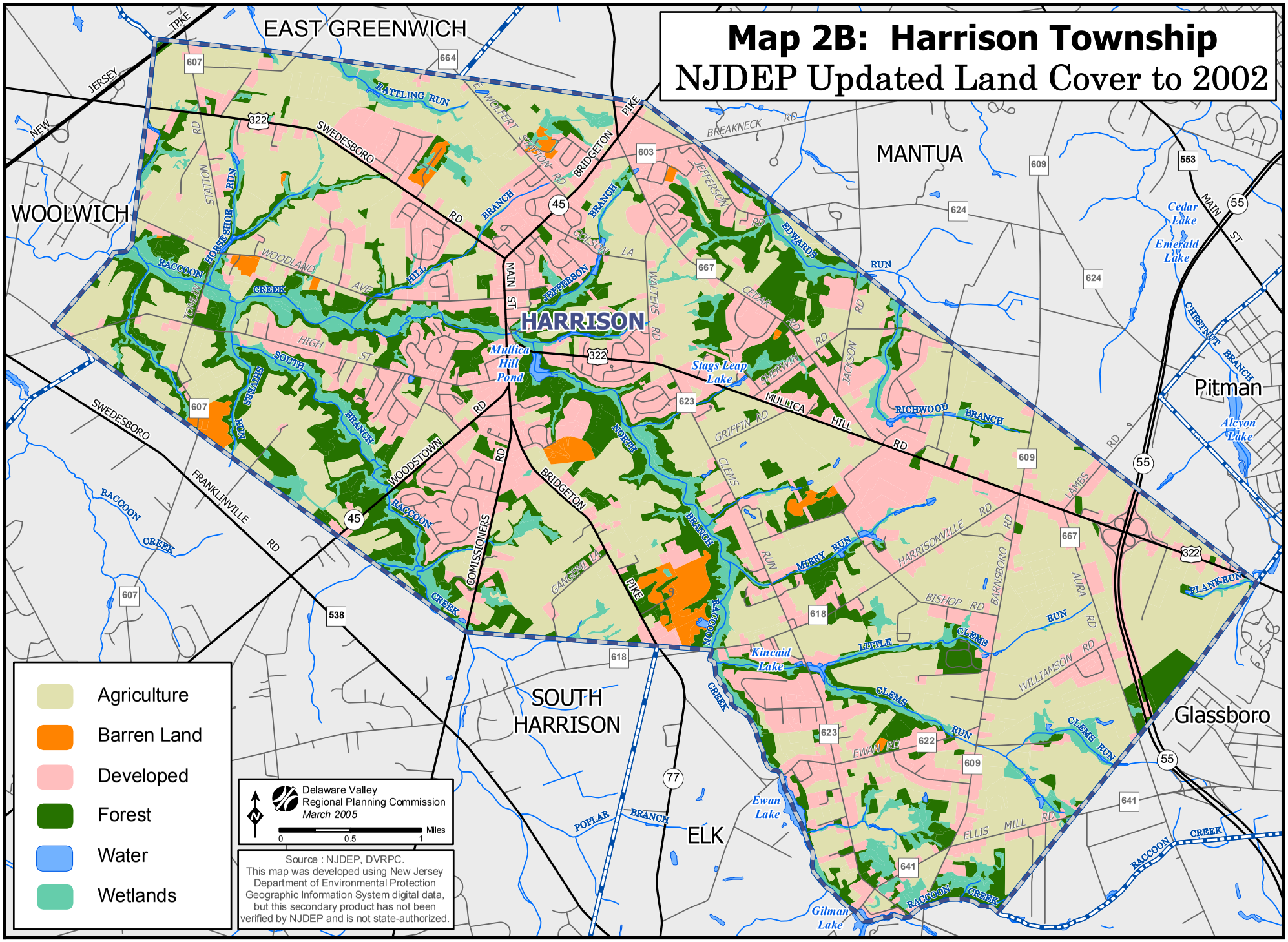
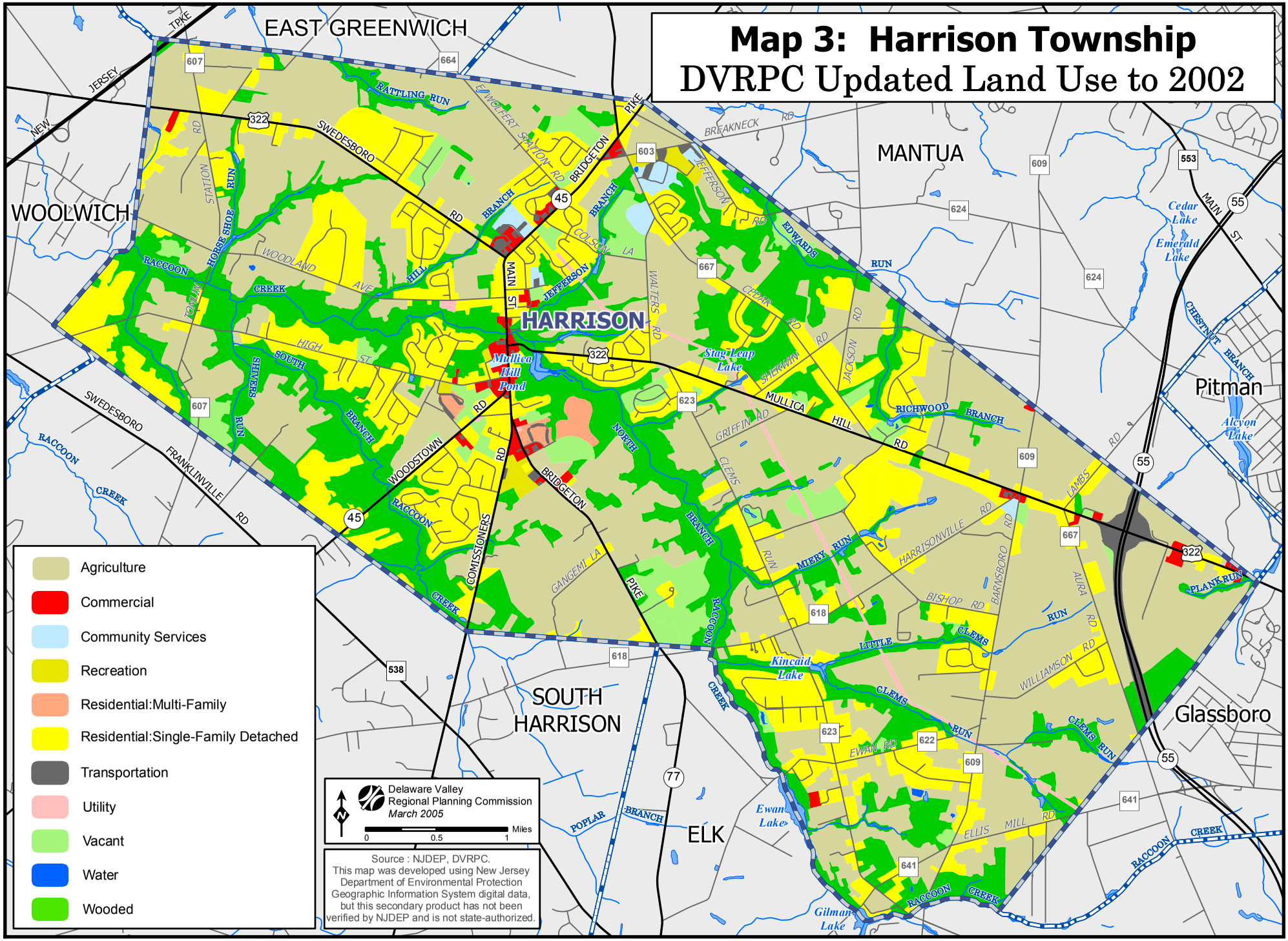

Map 2B: Harrison Township
NJDEP Updated Land Cover to 2002
EAST GREENWICH
WOOLWICH
MANTUA
HARRISON
SOUTH HARRISON
ELK
Pitman
Glassboro
Mullica Hill Pond
Stags Leap Lake
Kincaid Lake
Ewan Lake
Gilman Lake
Cedar Lake
Emerald Lake
Alcyon Lake
Agriculture
Barren Land
Developed
Forest
Water
Wetlands
Delaware Valley Regional Planning Commission
March 2005
Miles
0
0.5
1
Source : NJDEP, 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.

Table 2: Harrison Township Detailed Land Cover (1995/97; Not updated)

Land Use Categories	Acres	Percent
Agriculture - Cropland and pastureland	3,922.52	32.04%
Agriculture - Orchards, vineyards, nurseries, horticultural areas	2,189.37	17.88%
Forest - deciduous	1,423.39	11.63%
Residential, rural, single unit	1,285.26	10.50%
Wetlands - wooded (deciduous)	775.46	6.33%
Residential, single unit, low density	604.79	4.94%
Other urban or built-up land	218.21	1.78%
Agriculture - Other	180.73	1.48%
Brush/shrubland - old field (brush covered)	169.50	1.38%
Commercial/Services	129.22	1.06%
Wetlands - scrub/shrub (deciduous)	122.93	1.00%
Transitional areas	113.46	0.93%
Forest - mixed (deciduous dominated)	112.62	0.92%
Residential, single unit, medium density	112.32	0.92%
Brush/shrubland - mixed	106.51	0.87%
Transportation/Communications/Utilities	78.56	0.64%
Wetlands - agricultural (modified)	72.77	0.59%
Athletic fields (schools)	66.64	0.54%
Artificial lakes	64.18	0.52%
Residential, high density, multiple dwelling	58.11	0.47%
Forest - deciduous	45.88	0.37%
Wetlands - herbaceous	43.90	0.36%
Recreational land	43.63	0.36%
Extractive mining	39.33	0.32%
Altered lands	39.08	0.32%
Forest - mixed (coniferous dominated)	35.31	0.29%
Forest - coniferous	33.88	0.28%
Brush/shrubland - deciduous	31.40	0.26%
Wetlands - disturbed wetlands (modified)	28.55	0.23%
Wetlands - former agricultural (becoming shrubby, not built-up)	26.90	0.22%
Brush/shrubland - coniferous	25.05	0.20%
Wetlands - wooded - mixed (deciduous dominated)	16.89	0.14%
Forest - mixed (deciduous dominated)	7.45	0.06%
Mixed urban or built-up land	5.64	0.05%
Agriculture - Confined feeding operations	5.40	0.04%
Industrial	4.09	0.03%
Wetlands - scrub/shrub - mixed (deciduous dominated)	1.32	0.01%
Plantation	1.25	0.01%
Undifferentiated barren lands	0.34	0.00%
Wetlands - managed in maintained greenspace (modified)	0.30	0.00%
Total Land Cover	**12,224.31**	**100.00%**

Source: NJDEP, DVRPC

Map 3: Harrison Township
DVRPC Updated Land Use to 2002



Source: DVRPC

Heritage Station Winery and Farm Market, open year round, on Route 322.

Table 3: 2000 DVRPC Land Use for Harrison Township (updated to 2002)

Land Uses	Acres	Percent
Agriculture	5,544.49	45.32%
Residential: Single-Family Detached	2,909.40	23.78%
Wooded	2,752.21	22.50%
Vacant	487.82	3.99%
Commercial	108.80	0.89%
Transportation	84.18	0.69%
Community Services	69.67	0.57%
Water	69.21	0.57%
Utility	66.67	0.54%
Recreation	53.59	0.44%
Residential: Multi-Family	51.56	0.42%
Parking: Commercial	15.38	0.13%
Parking: Multi-Family	11.97	0.10%
Parking: Recreation	4.80	0.04%
Total	**12,229.75**	**100.00%**

Source: DVRPC

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. Harrison Township is located in the Atlantic Coastal Plain, the most southerly of these four provinces in New Jersey.

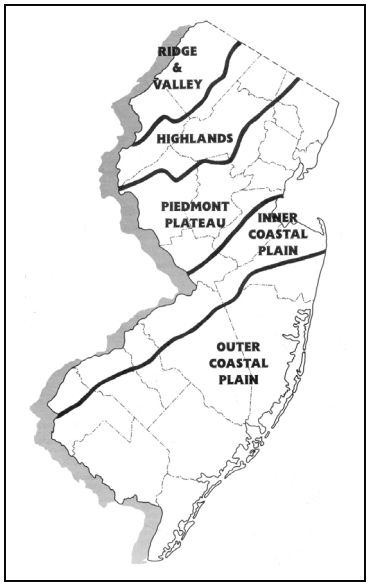


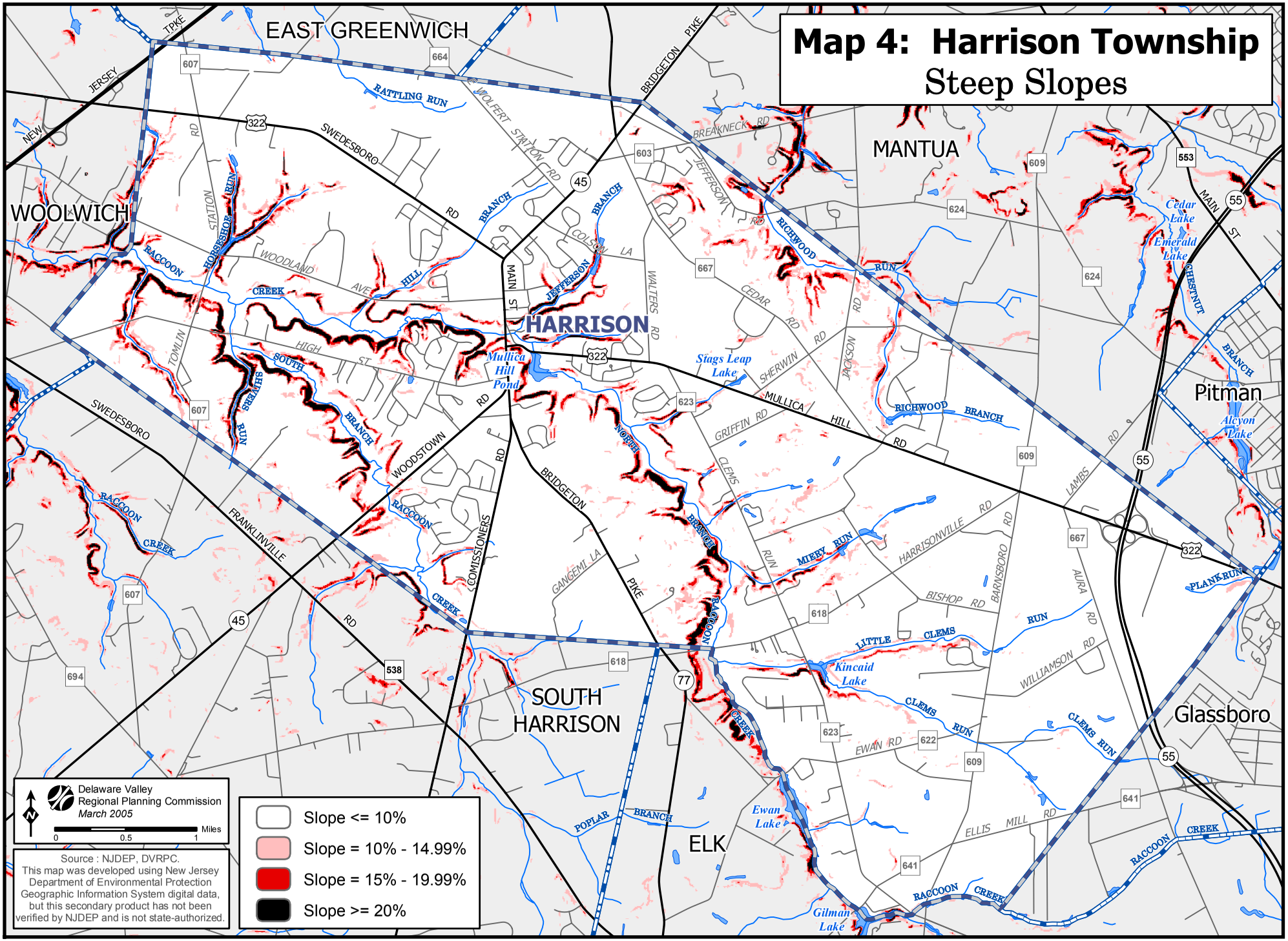
Figure 2: The Physiographic Regions of New Jersey

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 inter-bedded sand and clay. Deposits originating in the breakdown of Appalachian and Catskill sedimentary, metamorphic, and igneous rocks are inter-bedded 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 sandier and less fertile than those of the Inner Plain and don't hold water as well.

In the general vicinity of 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. The hills taper to fairly low elevations in Gloucester County but can be identified in the township. The Inner Coastal Plain lies to the west of the band of hills and the Outer Coastal Plain lies to the east.

Harrison Township is nearly bisected by the boundary between the Inner and Outer coastal plains, with rocks dating from both the Cretaceous and Cenozoic periods outcropping in the township. Although portions of Harrison are in the Outer Coastal Plain, most of the township's soils are generally regarded as agriculturally productive. This is because the drop in soil fertility between the Inner and Outer coastal plains is not sudden, but occurs as a gradual change eastward across the Outer Coastal Plain. While most of Harrison has good agricultural soils, a few miles to the east the soils become considerably sandier as the landscape begins to transition into the Pine Barrens.


Map 4: Harrison Township
Steep Slopes
EAST GREENWICH
WOOLWICH
MANTUA
HARRISON
SOUTH HARRISON
ELK
Pitman
Glassboro
Mullica Hill Pond
Stags Leap Lake
Kincaid Lake
Ewan Lake
Gilman Lake
Cedar Lake
Emerald Lake
Alcyon Lake
Delaware Valley Regional Planning Commission
March 2005
Miles
0
0.5
1
Slope <= 10%
Slope = 10% - 14.99%
Slope = 15% - 19.99%
Slope >= 20%
Source : NJDEP, 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.

TOPOGRAPHY

Harrison Township's position in central Gloucester County has given it a largely upland character with abundant high-quality agricultural soils. The valleys of the Raccoon Creek and its numerous tributaries bisect the gently rolling upland. The highest elevations in the township approach 160 feet above sea level and occur in several areas of residential development. One such point is known as Harry Ruder's Rock and located on Harrisonville Road and Bishops Road. The lowest point is found along the banks of the South Branch of Raccoon Creek west of Woodstown Road, at 50 feet above sea level.

The upland area is characterized by rich soils that once supported extensive beech-oak forests. Today, Harrison's upland forests are dominated by beech, oak, maple, and birch trees. Along the river valleys are freshwater wetlands and wet forests of sweet gum and red maple. The streams are relatively flat, as in all of southern New Jersey, with mostly muddy and/or sandy bottoms, although the bottoms of some stream segments are lined with small rounded rocks and pebbles. The agricultural western half of the township is mostly dominated by row crops such as corn and soybeans, but has some fruit orchards. Orchards are also concentrated in the northeastern corner of the township in Richwood.

Steep Slopes

Only a small portion of Harrison Township has slopes over 10 percent (the percent of vertical rise to horizontal distance). However, the steepest slopes are very steep indeed – up to 40 percent in some cases. Steep slopes are found almost entirely along the waterways of the township, including a variety of the smaller streams, and especially the south sides of Raccoon Creek's north branch. Most of these slopes are well vegetated, although farm fields and residential properties may extend to the edge of the plateau. In some locations development has occurred on more moderate slopes, particularly along Route 322. In a few areas buildings have been constructed on steep slopes. An example is the Naples Restaurant site where the effects of such construction are quite obvious.

Source: DVRPC
Steep slope along Route 322 and adjacent to the Old Mill Antiques property

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.

Where steep slopes remain forested, some very old trees can be found in Harrison Township. In addition, certain rare herbaceous plants can sometimes be found on forested steep slopes having Marlton soils, because of plant adaptation to the glauconitic nature of such soils. No detailed inventory of these sites exists at present, although some of the Harrison endangered plant records from the state's Natural Heritage Database (see Appendix B) are from these habitats. An in-depth assessment of Harrison's steep slope forests is needed and merits a special study. Some regions have been negatively affected by fertilizers from adjoining farm fields or by runoff from development, but there may still be sites that are intact. Harrison's steep slopes are depicted on **Map 4: Steep Slopes** on page 16.

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 also a natural resource that cannot be replenished on the human time scale.

Harrison Township soils consist of 26 series types and 64 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: Harrison Township Soils* and shown on **Map 5: Soils**.

Harrison's soils are rich in agricultural value. The most abundant of all soils in Harrison Township are those classified as Prime Farmland (P-1), which occupy 48 percent (5,871 acres) of the land surface. 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.

About 32 percent (3,998 acres) of soils in Harrison are classified as Statewide Importance (S-1). These soils are close in quality to Prime Farmland and can sustain high yields of crops when correctly managed under favorable conditions. Farmland of Local Importance (L-1), which consists of soils that can support the production of high value, regional crops like horticultural crops or indigenous foods, like cranberries and blueberries, occupy 3.1 percent of Harrison's farmland. The great majority of Harrison's soils are valuable and rich farmland soils. See *Table 4: Agricultural Values for Harrison Soils* for the acreage of each of these classes of farmland. See also **Map 6: Soil Quality** for a visual depiction.

Table 4: Agricultural Values for Harrison Soils

Designation	Type	Area (Acres)	Percent
P-1	Prime Farmland	5,871.2	48.1%
S-1	Statewide Importance	3,997.9	32.8%
L-1	Local Importance	378.8	3.1%
Other Soil	Wet soils, pits, steep slopes, Made land, etc.	1,897.7	15.6%
Water	Water	56.3	0.5%
Totals		**12,201.9**	**100.0%**

Source: NJ Farmlands Inventory, NJ Natural Resources Conservation Service

Soil Series

Several soil series appear more frequently in Harrison Township than others, and are briefly described as follows:

Sassafras Series
The most abundant soil series in Harrison Township is the Sassafras series. About 21 percent of Harrison is made up of Sassafras soils, which are usually found on sandy flats although slopes can range from nearly level to very steep. In Harrison, Sassafras soils are found in association with almost every stream. These soils can support vegetation consisting of mixed oaks and scattered pines. They are considered Prime soils and Farmland of Statewide Importance depending on slope. Sassafras soils are easy to work, have a low natural fertility, and respond to fertilization. (Capability Units I, II, and III, depending on variation)

Freehold Series
Thirteen percent of Harrison soils are a variation of the Freehold series. These soils, formed from sandy marine deposits, are mostly gently sloping and well drained. Around streambeds, these soils may be steeply sloping. Freehold soils occur in close association with Collington, Colts Neck, Marlton, Westphalia, Woodstown, and Dragston soils. Freehold dominates the northern part of the township, in close proximity to Rattling Run. Freehold soils are usually found with deposits of Marlton, but in Harrison, they also appear with Sassafras. 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 oaks and poplar, which provide high quality wildlife habitat. These soils are well suited to various seasonal crops because variations of Freehold soils warm at different times of the year. Freehold sandy loams are classed as Prime soils. (Capability Units I, II, and IV depending on slope)

Westphalia Series
The third most abundant soil type, accounting for 11 percent of all Harrison soils, are Westphalia soils. Westphalia soils were formed from a marine deposit of fine sand, and thus, are well drained and gently sloping. These soils once supported a native forest of mixed oaks, beech, yellow poplar, and holly. These soils are found throughout the township closely associated with Marlton and Freehold soils, but have less clay content. Westphalia soils are friable (easy to

crumble) and have low natural fertility but respond to fertilization. If cultivated, Westphalia soils may suffer from wind and water erosion but, on level terrain, Westphalia soils are considered Prime soils. (Capability Units II, III, IV, VII depending on slope)

Marlton Series

Marlton soils make up nearly 10 percent (3,211 acres) of Harrison soils and are well drained and found on gentle slopes or adjacent to streams. These soils are moderately fertile and high in potassium, although that nutrient is not readily available for plants. Marlton is closely associated with Freehold, Collington, Colemantown, and Kresson soils and they are commonly referred to as marl and greensand. A large belt of marl extends from Monmouth County southward to Salem County and the richest and most abundant deposits lie in New Jersey's coastal plain. This area of land was recognized as having prized agricultural value since colonial times. From the early 19th century into the 20th century, Marlton, and other marl soils rich in potassium and magnesium, were used as a natural fertilizer on lime-deficient soils. Today, marl is used as a water softener. Marlton soils do have a high content of clay, so they occasionally hold large amounts of water during wet seasons, which can make them unsuitable for early and late planting seasons. (Marlton on level terrain is classed as a Prime soil. Capability Units II, III, IV, and VI depending on slope)

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.

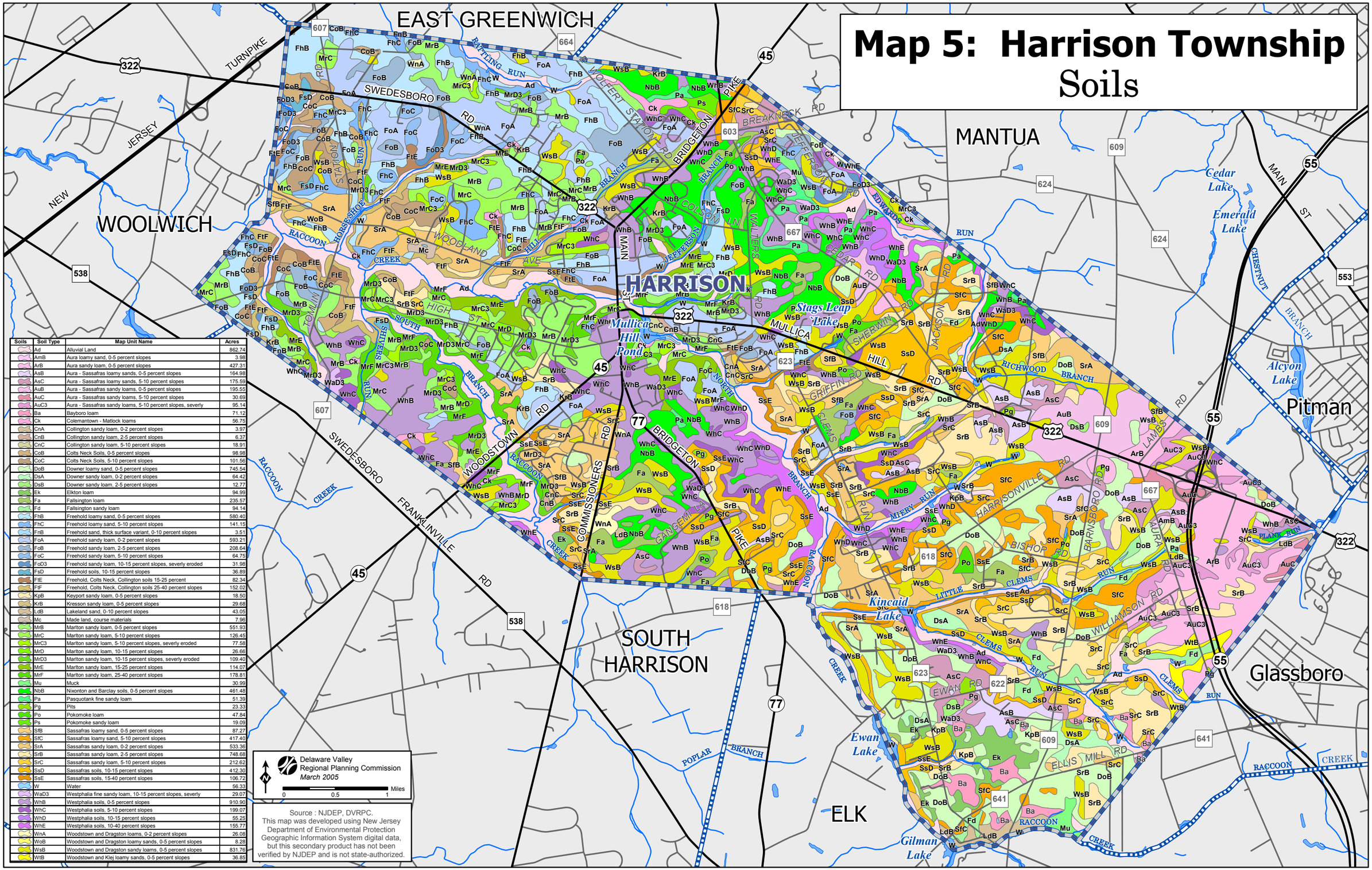
VII – Soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture, woodland, or wildlife habitat.

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.

Aura Series

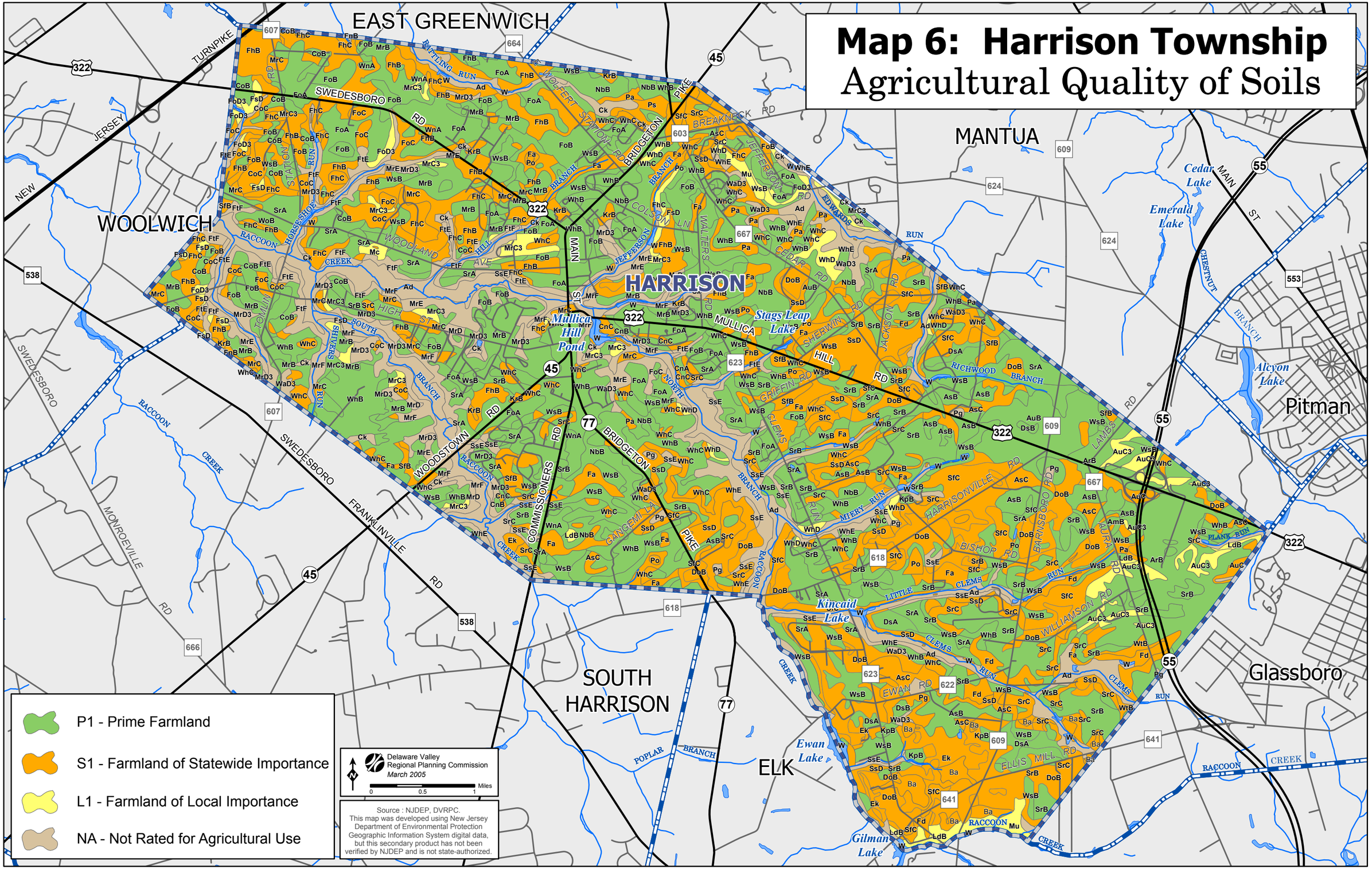
About 9 percent (1,098 acres) of Harrison soils are part of the Aura series. Aura soils are well drained and usually occupy the highest elevations in Gloucester County. In Harrison, Aura soils are the dominant soil series in the easternmost corner of the township in Richwood. Further west, Aura soils occupy the tops of hills. Aura soils occur in association with Sassafras, Downer, and Woodstown soils. Aura soils are moderately permeable in the subsurface layer, but runoff is rapid and erosion can be a problem, even on the gentle slopes found in Richwood. Plants with deep roots do not flourish on these soils because their roots cannot penetrate the firm lower layers. The pebbly topsoil impedes the growth of seedlings. Although these soils are low in fertility, they are well suited to growing fruit, flowers, and most types of vegetables. Special care and maintenance is needed to maintain organic matter and soil structure so that water can be absorbed. On level land and gentle slopes, Aura soils are considered Prime. (Capability Unit II, III, IV depending on slope)

Map 5: Harrison Township
Soils



Soils	Soil Type	Map Unit Name	Acres
	Ad	Alluvial Land	862.74
	AmB	Aura loamy sand, 0-5 percent slopes	3.98
	ArB	Aura sandy loam, 0-5 percent slopes	427.31
	AsB	Aura - Sassafras loamy sands, 0-5 percent slopes	164.98
	AsC	Aura - Sassafras loamy sands, 5-10 percent slopes	175.59
	AuB	Aura - Sassafras sandy loams, 0-5 percent slopes	195.55
	AuC	Aura - Sassafras sandy loams, 5-10 percent slopes	30.69
	AuC3	Aura - Sassafras sandy loams, 5-10 percent slopes, severly	95.14
	Ba	Bayboro loam	71.12
	Ck	Colemantown - Matlock loams	56.75
	CnA	Collington sandy loam, 0-2 percent slopes	3.97
	CnB	Collington sandy loam, 2-5 percent slopes	6.37
	CnC	Collington sandy loam, 5-10 percent slopes	18.91
	CoB	Colts Neck Soils, 0-5 percent slopes	98.98
	CoC	Colts Neck Soils, 5-10 percent slopes	101.56
	DoB	Downer loamy sand, 0-5 percent slopes	745.54
	DsA	Downer sandy loam, 0-2 percent slopes	64.42
	DsB	Downer sandy loam, 2-5 percent slopes	12.77
	Ek	Elkton loam	94.99
	Fa	Fallsington loam	235.57
	Fd	Fallsington sandy loam	94.14
	FhB	Freehold loamy sand, 0-5 percent slopes	580.40
	FhC	Freehold loamy sand, 5-10 percent slopes	141.15
	FnB	Freehold sand, thick surface variant, 0-10 percent slopes	3.51
	FoA	Freehold sandy loam, 0-2 percent slopes	593.21
	FoB	Freehold sandy loam, 2-5 percent slopes	208.64
	FoC	Freehold sandy loam, 5-10 percent slopes	64.75
	FoD3	Freehold sandy loam, 10-15 percent slopes, severly eroded	31.98
	FsD	Freehold soils, 10-15 percent slopes	36.89
	FtE	Freehold, Colts Neck, Collington soils 15-25 percent	82.34
	FtF	Freehold, Colts Neck, Collington soils 25-40 percent slopes	152.02
	KpB	Keyport sandy loam, 0-5 percent slopes	18.50
	KrB	Kresson sandy loam, 0-5 percent slopes	29.68
	LdB	Lakeland sand, 0-10 percent slopes	43.05
	Mc	Made land, course materials	7.96
	MrB	Marlton sandy loam, 0-5 percent slopes	551.93
	MrC	Marlton sandy loam, 5-10 percent slopes	126.45
	MrC3	Marlton sandy loam, 5-10 percent slopes, severly eroded	77.58
	MrD	Marlton sandy loam, 10-15 percent slopes	26.66
	MrD3	Marlton sandy loam, 10-15 percent slopes, severly eroded	109.40
	MrE	Marlton sandy loam, 15-25 percent slopes	114.07
	MrF	Marlton sandy loam, 25-40 percent slopes	178.81
	Mu	Muck	30.99
	NbB	Nixonton and Barclay soils, 0-5 percent slopes	461.48
	Pa	Pasquotank fine sandy loam	51.39
	Pg	Pits	23.33
	Po	Pokomoke loam	47.84
	Ps	Pokomoke sandy loam	19.09
	SfB	Sassafras loamy sand, 0-5 percent slopes	87.27
	SfC	Sassafras loamy sand, 5-10 percent slopes	417.40
	SrA	Sassafras sandy loam, 0-2 percent slopes	533.36
	SrB	Sassafras sandy loam, 2-5 percent slopes	748.68
	SrC	Sassafras sandy loam, 5-10 percent slopes	212.62
	SsD	Sassafras soils, 10-15 percent slopes	412.30
	SsE	Sassafras soils, 15-40 percent slopes	106.72
	W	Water	56.33
	WaD3	Westphalia fine sandy loam, 10-15 percent slopes, severly	29.07
	WhB	Westphalia soils, 0-5 percent slopes	910.90
	WhC	Westphalia soils, 5-10 percent slopes	199.07
	WhD	Westphalia soils, 10-15 percent slopes	55.25
	WhE	Westphalia soils, 10-40 percent slopes	155.77
	WnA	Woodstown and Dragston loams, 0-2 percent slopes	26.08
	WoB	Woodstown and Dragston loamy sands, 0-5 percent slopes	8.28
	WsB	Woodstown and Dragston sandy loams, 0-5 percent slopes	831.76
	WtB	Woodstown and Klej loamy sands, 0-5 percent slopes	36.85

Map 6: Harrison Township
Agricultural Quality of Soils



Woodstown Series

Woodstown soils occupy 7 percent (903 acres) of Harrison land and have historically supported oak, beech, poplar, and pitch pine forests. This series encompasses Woodstown and Dragston and Woodstown and Klej variations and is closely associated with Aura, Downer, Freehold and other soils. Woodstown soils are not well drained. These soils occur on terraces along large streams and in beds of gravel. These are considered prime soils or soils of statewide importance, but cultivation can be hampered by wetness. (Capability Unit II)

Alluvial Series

In Gloucester County, Alluvial soils consist of material deposited by streams that flow to the Delaware River. Alluvial soils form when materials from other soil layers are removed and deposited on flood plains by streams flowing through different kinds of soils and geologic materials. Most areas of alluvial land have large amounts of organic matter and groundwater is close to the surface. Seven percent (863 acres) of Harrison soils are Alluvial. (Capability Unit VII)

Downer Series

Nearly 7 percent (822 acres) of Harrison soils are Downer soils, which are considered to be soils typical of New Jersey agriculture and are listed as Prime Farmland and Farmland of Statewide Importance. These soils are moderately permeable, have a low available water capacity, warm early in the calendar year, and are easily worked. While natural fertility is low and added fertilizers leach too easily, Downer soils can support high value crops with proper management and irrigation. (Capability Units II and III depending on variation)

Nixonton and Barclay Series

Nixonton and Barclay soils occur in undifferentiated associations and make up about 4 percent (461 acres) of all Harrison soils. Nixonton and Barclay soils consist of fine sand with small amounts of mica and glauconite. These soils, especially Barclay, are somewhat poorly drained, nearly level in all deposits, and found in lower terrains. They often receive high amounts of runoff water from higher elevations. Barclay soils are not well suited for farming as they have low natural fertility and plowing is hindered by excessive groundwater. However, in Gloucester County, Barclay soils are always found in association with Nixonton, which are moderately well drained. This combination can be excellent for growing vegetables, nursery plants, and general farm crops. As a combination, they are considered Prime soils on level terrain. (Capability Unit II)

Table 5: Harrison Township Soils

Soil Code	Soil Name	Acres	Percentage of all Acres	Designation
Ad	Alluvial land	862.74	7.07%	NA
AmB	Aura loamy sand, 0-5 percent slopes	3.98	0.03%	P-1
ArB	Aura sandy loam, 0-5 percent slopes	427.31	3.50%	P-1
AsB	Aura-Sassafras loamy sands, 0-5 percent slopes	164.98	1.35%	P-1
AsC	Aura-Sassafras loamy sands, 5-10 percent slopes	175.59	1.44%	S-1
AuB	Aura-Sassafras sandy loams, 0-5 percent slopes	195.55	1.60%	P-1

HARRISON TOWNSHIP ERI

Soil Code	Soil Name	Acres	Percentage of all Acres	Designation
AuC	Aura-Sassafras sandy loams, 5-10 percent slopes	30.69	0.25%	S-1
AuC3	Aura-Sassafras sandy loams, 5-10 percent slopes, severely eroded	95.14	0.78%	L-1
Ba	Bayboro loam	71.12	0.58%	S-1
Ck	Colemantown-Matlock loams	56.75	0.47%	NA
CnA	Collington sandy loam, 0-2 percent slopes	3.97	0.03%	P-1
CnB	Collington sandy loam, 2-5 percent slopes	6.37	0.05%	P-1
CnC	Collington sandy loam, 5-10 percent slopes	18.91	0.15%	S-1
CoB	Colts Neck soils, 0-5 percent slopes	98.98	0.81%	P-1
CoC	Colts Neck soils, 5-10 percent slopes	101.56	0.83%	S-1
DoB	Downer loamy sand, 0-5 percent slopes	745.54	6.11%	S-1
DsA	Downer sandy loam, 0-2 percent slopes	64.42	0.53%	P-1
DsB	Downer sandy loam, 2-5 percent slopes	12.77	0.10%	P-1
Ek	Elkton loam	94.99	0.78%	S-1
Fa	Fallsington loam	235.57	1.93%	S-1
Fd	Fallsington sandy loam	94.14	0.77%	S-1
FhB	Freehold loamy sand, 0-5 percent slopes	580.40	4.76%	S-1
FhC	Freehold loamy sand, 5-10 percent slopes	141.15	1.16%	S-1
FnB	Freehold sand, thick surface variant, 0-10 percent	3.51	0.03%	S-1
FoA	Freehold sandy loam, 0-2 percent slopes	593.21	4.86%	P-1
FoB	Freehold sandy loam, 2-5 percent slopes	208.64	1.71%	P-1
FoC	Freehold sandy loam, 5-10 percent slopes	64.75	0.53%	S-1
FoD3	Freehold sandy loam, 10-15 percent slopes, severely eroded	31.98	0.26%	L-1
FsD	Freehold soils, 10-15 percent slopes	36.89	0.30%	L-1
FtE	Freehold, Colts Neck, and Collington soils, 15-25	82.34	0.67%	NA
FtF	Freehold, Colts Neck, Collington soils, 25-40 per.	152.02	1.25%	NA
KpB	Keyport sandy loam, 0-5 percent slopes	18.50	0.15%	P-1
KrB	Kresson sandy loam, 0-5 percent slopes	29.68	0.24%	S-1
LdB	Lakeland sand, 0-10 percent slopes	43.05	0.35%	L-1
Mc	Made land, coarse materials	7.96	0.07%	L-1
MrB	Marlton sandy loam, 0-5 percent slopes	551.93	4.52%	P-1
MrC	Marlton sandy loam, 5-10 percent slopes	126.45	1.04%	S-1
MrC3	Marlton sandy loam, 5-10 percent slopes, severely eroded	77.58	0.64%	L-1
MrD	Marlton sandy loam, 10-15 percent slopes	26.66	0.22%	NA
MrD3	Marlton sandy loam, 10-15 percent slopes, severely eroded	109.40	0.90%	NA
MrE	Marlton sandy loam, 15-25 percent slopes	114.07	0.93%	NA
MrF	Marlton sandy loam, 25-40 percent slopes	178.81	1.47%	NA
Mu	Muck	30.99	0.25%	L-1
NbB	Nixonton and Barclay soils, 0-5 percent slopes	461.48	3.78%	P-1
Pa	Pasquotank fine sandy loam	51.39	0.42%	S-1
Pg	Pits	23.33	0.19%	NA
Po	Pocomoke loam	47.84	0.39%	S-1
Ps	Pocomoke sandy loam	19.09	0.16%	S-1
SfB	Sassafras loamy sand, 0-5 percent slopes	87.27	0.72%	S-1

Soil Code	Soil Name	Acres	Percentage of all Acres	Designation
SfC	Sassafras loamy sand, 5-10 percent slopes	417.40	3.42%	S-1
SrA	Sassafras sandy loam, 0-2 percent slopes	533.36	4.37%	P-1
SrB	Sassafras sandy loam, 2-5 percent slopes	748.68	6.14%	P-1
SrC	Sassafras sandy loam, 5-10 percent slopes	212.62	1.74%	S-1
SsD	Sassafras soils, 10-15 percent slopes	412.30	3.38%	S-1
SsE	Sassafras soils, 15-40 percent slopes	106.72	0.87%	NA
W	Water	56.33	0.46%	Water
WaD3	Westphalia fine sandy loam, 10-15 percent slopes, severely eroded	29.07	0.24%	NA
WhB	Westphalia soils, 0-5 percent slopes	910.90	7.47%	P-1
WhC	Westphalia soils, 5-10 percent slopes	199.07	1.63%	S-1
WhD	Westphalia soils, 10-15 percent slopes	55.25	0.45%	L-1
WhE	Westphalia soils, 15-40 percent slopes	155.77	1.28%	NA
WnA	Woodstown and Dragston loams, 0-2 percent slopes	26.08	0.21%	P-1
WoB	Woodstown and Dragston loamy sands, 0-5 percent	8.28	0.07%	P-1
WsB	Woodstown and Dragston sandy loams, 0-5 percent	831.76	6.82%	P-1
WtB	Woodstown and Klej loamy sands, 0-5 percent slopes	36.85	0.30%	S-1
	Total Acreage	12,201.88	100.00%	
	Total Farmland Acreage	10,247.87	83.99%	
	Total Non-Farmland Acreage	1,954.01	16.01%	
	Steep Slopes (15%+ slopes)	789.73	6.47%	

Source: NJDEP (based on Soil Survey of Gloucester County)

*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 (five feet or more from the surface) and high permeability to allow for proper drainage of wastewater. Soils with high water tables (five feet or less from the surface) create a potential for erosion, wet basements, and low permeability, often allowing wastewater to collect near the surface.

Table 6: Soil Limitations for Development

Soil Series	Soil Codes	Acres	Building with Basement	Building without Basement	Septic Systems	Limitations
Alluvial	Ad	862.74	C	C	C	1, 2
Aura	AmB, ArB, AsB, AsC, AuB, AuC, AuC3	1093.24	A	A	A	3
Bayboro	Ba	71.12	C	B	C	
Colemantown-Matlock	Ck	56.75	B	A	C	1
Collington	CnA, CnB, CnC	29.25	A	A	A	
Colts Neck	CoB, CoC	200.54	A	A	A	
Downer	DoB, DsA, DsB	822.73	A	A	A	
Elkton	Ek	94.99	C	C	C	
Fallsington	Fa, Fd	329.71	A	A	B	
Freehold	FhB, FhC, FnB, FoA, FoB, FoC, FoD3, FsD	1,660.53	A	A	A	3
Freehold, Colts Neck, and Collington soils	FtE, FtF	234.36	C	C	C	3
Keyport	KpB	18.50	B	B	C	1,3
Kresson	KrB	29.68	C	B	C	1
Lakeland	LdB	43.05	A	A	A	
Made Land	Mc	7.96	B	B	B	1, 3
Marlton	MrB, MrC, MrC3, MrD, MrD3, MrE, MrF	1,184.90	B	A	B	1
Muck	Mu	30.99	C	C	C	1, 2, 3
Nixonton and Barclay soils	NbB	461.48	C	A	C	2, 3
Pasquotank	Pa	51.39	B	A	C	2, 3
Pits	Pg	23.33	A	A	A	3
Pocomoke	Po, Ps	66.93	B	B	B	
Sassafras	SfB, SfC, SrA, SrB, SrC, SsD, SsE	2,513.35	A	A	A	
Westphalia	WaD3, WhB, WhC, WhD, WhE	1,350.06	A	A	A	
Woodstown	WnA, WoB, WsB, Wt, WtB	902.97	C	B	C	1, 3
Total		**12,140.55**				

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 limitations, 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)

Sources: Soil Survey of Gloucester County, NJ Natural Resource Conversation Service, and Cook College of Rutgers University

SURFACE WATER RESOURCES

All of Harrison's land drains to the Delaware River. Most of the land surface drains by way of the main channel of the Raccoon Creek, which also forms the township's border with Elk and then flows across the center of Harrison Township. A small part of the township, along the northern border with Mantua Township, drains to Edwards Run – a tributary to the Mantua Creek. The northwestern corner of the township drains to Rattling Run, which is part of the Repaupo Creek system.

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. Large watersheds are made up of a succession of smaller ones, and smaller ones are made up of the smallest area – the catchment area of a local site. So, for example, the Delaware River watershed is made up of many smaller watersheds, such as the Raccoon Creek watershed. The Raccoon Creek watershed, in turn, is formed of several subwatersheds, consisting of the land that drains to a major tributary or branch of the creek, such as the Clems Run subwatershed. These subwatersheds can be further subdivided into smaller ones, each surrounding 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. Harrison Township contains three HUC 11 watersheds – the Raccoon Creek, the Mantua Creek and the Repaupo Creek watersheds.[5] The percentage of Harrison Township land that is within each of these three watersheds is listed in the following table.

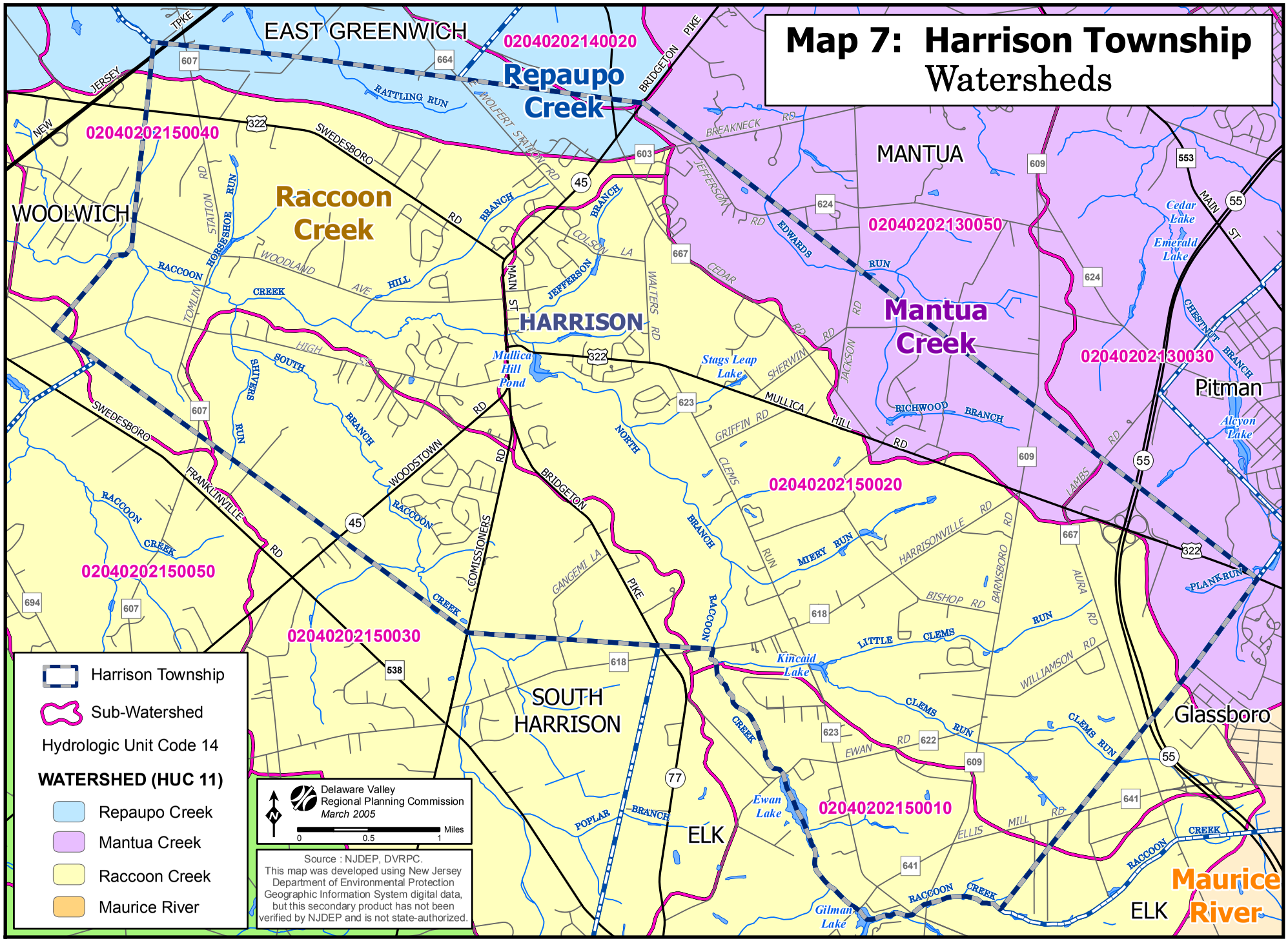
The percentage of Harrison Township land that is within each of the three watersheds is listed in *Table 7: Watersheds in Harrison Township*. See **Map 7: Watersheds** and **Map 8: Surface Water, Wetlands, and Vernal Ponds.**

Table 7: Watersheds in Harrison Township

Watershed	USGS Watershed Code (HUC 11 Number)	Stream Classification	Acreage within Harrison	Percent of Harrison land	Subwatersheds (HUC 14 Numbers) within Harrison
Mantua Creek	02040202**130**	FW2-NT	1,538	12.57%	02040202130030 02040202130050
Repaupo Creek	02040202**140**	FW2-NT	621	5.07%	02040202140020
Raccoon Creek	02040202**150**	FW2–NT	10,083	82.36%	02040202150010 02040202150020 02040202150030 02040202150040 02040202150050

Source: NJDEP

[5] "HUC" stands for Hydrological Unit Code, which is a numerical identification number given to every drainage system in the United States by the U.S. Geological Survey. HUC-11 codes are the 11-digit numbers applied to a part of a drainage area that is approximately 40 square miles in size. In the case of the Raccoon, Mantua, and Repaupo watersheds, the entire watershed is the HUC–11 area. HUC-11 areas are further subdivided into HUC-14 subwatersheds, with the identification number for each one having 14 digits.


Map 7: Harrison Township
Watersheds
EAST GREENWICH
02040202140020
Repaupo Creek
02040202150040
WOOLWICH
Raccoon Creek
MANTUA
02040202130050
Mantua Creek
02040202130030
Pitman
HARRISON
02040202150020
02040202150050
02040202150030
SOUTH HARRISON
ELK
02040202150010
Glassboro
Maurice River
Harrison Township
Sub-Watershed
Hydrologic Unit Code 14
WATERSHED (HUC 11)
Repaupo Creek
Mantua Creek
Raccoon Creek
Maurice River
Delaware Valley Regional Planning Commission
March 2005
Miles
0
0.5
1
Source : NJDEP, 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.

Raccoon Creek Watershed

Source: DVRPC

Raccoon Creek from Tomlin Station Road

The Raccoon Creek watershed contains approximately 40 square miles, of which 15.75 square miles is in Harrison Township. The main channel of the creek is 19 miles in total length and flows from Elk and South Harrison townships in the southeast, across Harrison, and on through Woolwich and Logan townships to the Delaware River. While there are several tributaries to the creek, the main one is the South Branch Raccoon Creek, which starts close to the western edge of the border between Elk and South Harrison townships. It flows northwestward into Harrison Township. The northern or main branch begins in Glassboro and Elk Township and flows northward into Harrison Township where it bends to the west before being joined by the South Branch. Less than a mile beyond the juncture of the two branches, the creek leaves Harrison and travels across the centers of Woolwich and Logan where it widens into extensive tidal wetland areas.

Raccoon Creek is navigable from the Delaware River up to Kings Highway in Woolwich. It is also tidal up to a point three-quarters-of-a-mile east of the New Jersey Turnpike in Woolwich. During the 18th and 19th centuries the creek was a transportation corridor between Mullica Hill and the larger downstream community of Swedesboro, which had wharves and piers from which bigger vessels carried cargo to Philadelphia and other ports.

The largest tributary to the main (north) branch Raccoon Creek within Harrison is formed by two tributaries, Clems Run and Little Clems Run, which come together at Lake Kincaid and flow as one channel to the main branch. Clem's Run begins in Glassboro and Little Clem's Run rises (starts) within Harrison. Other larger tributaries of the main (north) branch are Cartwheel and Gilman branches in Elk Township, and Miery, Jefferson, and Hill branches in Harrison. There are also many small, unnamed tributaries.

The South Branch Raccoon Creek is shorter than the main (north) branch. It begins in Elk and South Harrison townships. The only named tributary that is within Harrison's boundaries is Shivers Run.

There is little industry along the Raccoon today, although there once were several facilities in the Swedesboro area and there are still a few sites in Logan Township. The Harrison Township Wastewater Treatment Plant on Woodland Avenue sits beside the creek and there is another treatment plant similarly situated in Swedesboro. Both sewage treatment plants discharge treated effluent to the Raccoon Creek under NJPDES permits.

Mantua Creek Watershed

Mantua Creek drains 50.9 square miles and is 18.6 miles long. The Mantua Creek watershed covers approximately 2.4 square miles or 13 percent of Harrison Township. It consists of a small stretch of Edwards Run, a Mantua Creek tributary, along with a smaller tributary to Edwards Run that is called Richwood Branch. These stretches of creek flow through the northern section of Harrison. After leaving Harrison, Edwards Run flows in a northwesterly direction across Mantua Township, joining the main channel of the creek in East Greenwich.

Another small stream in this system is also located in Harrison Township. It is a tiny tributary to Plank Run, which, in turn, is a tributary to the main channel of the Mantua Creek. This unnamed stream is in the eastern-most corner of Harrison where the township meets both Glassboro and Mantua Township.

Mantua Creek's main branch rises in Glassboro and flows northwestward to the Delaware River just north of Paulsboro Borough. The mouth of the creek, at Paulsboro, is channelized where it flows through a British Petroleum refinery site. Just upstream of Paulsboro, the creek is bordered by extensive tidal marshes and mudflat areas. The creek is tidal from the Delaware River up to a point approximately one-half mile east of Route 632 in Mantua Township.

Mantua Creek has several large tributaries. Chestnut Branch and Edwards Run are the two largest ones, and each has various named and unnamed tributaries. Other sizeable tributaries of the main channel include the Monongahela Brook in Deptford Township, and Bees Branch, Bethel Run, Porch Branch, and Duffield Run in Washington Township.

Repaupo Creek Watershed

The Repaupo watershed is a complex of streams that drain a total of 41 square miles of land. In Harrison, this watershed occupies only a small portion (5 percent) of township land, consisting of the drainage to Rattling Run. This stream is the headwaters of Pargey Creek, which becomes Repaupo Creek west of Route 130 in Logan Township after it is joined by Still Run coming from Mantua Township.

The Repaupo Creek and its sister streams, Clonmell Creek, Little Timber Creek, and Moss Branch, all drain directly to the Delaware River. That is, they are actually separate watersheds but are grouped together as the Repaupo Creek watershed by U.S. Geological Survey classifications. This drainage complex is generally low-lying and characterized by extensive wetlands. Tide gates erected at the mouth of these streams prevent Delaware River tides from flowing inland. These were established by early settlers as a means of reclaiming the rich river floodplains for agricultural use. A system of dikes also helps prevent flooding in downstream areas of Greenwich Township.

Streams

There are a total of 33 stream miles flowing across Harrison Township, nearly 20 of which are first or second order (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.

Headwaters are of particular importance because they tend to contain a diversity of aquatic species and their condition affects downstream water quality. Because of their small size, they are highly susceptible to impairment by human activities on the land. 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 over-silted 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.

Table 8: Harrison Township Streams

Stream Order	Miles
First Order streams (smallest)	18.19
Second Order streams	3.68
Third Order streams	10.03
Fourth Order streams (Raccoon Creek main channel)	.95
Total	**32.85**

Source: NJDEP

Lakes and Ponds

There are numerous other small ponds and water impoundments and four named lakes in Harrison Township: Mullica Hill Pond, Ewan Lake, Gilman Lake, and Kincaid Lake. These open bodies are all permanent waters but are not naturally occurring – no naturally occurring lakes exist in southern New Jersey. Impounding the south branch of Raccoon Creek created Ewan Lake and Gilman Lake, which lie on the border between Harrison and Elk townships. Mullica Hill Pond is a millpond, created in the 18th century to power a gristmill. Ewan and Gilman lakes were also originally dammed to provide power for mills. The mill

Source: DVRPC

Mullica Hill Pond

buildings are long gone, but the lakes remained and provided scenic settings and recreation for summer homes that developed around them in the 20th century. These summer communities subsequently became permanent residential areas.

Lakes occupy a total of approximately 64 acres (less than one percent of all land area) within Harrison. Mullica Hill Pond, at nearly eight acres, is the only public water body and is stocked by the State with trout during the winter. Ewan Lake and Gilman Lake are the two largest lakes at 15 and six acres, respectively. Kincaid Lake is four acres in size. Ewan, Gilman, and Kincaid lakes are used for recreational purposes but are privately owned. See **Map 8: 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. The source of water for a wetland can be an estuary, river, stream, lake edge, or groundwater that rises close to the land surface. Under normal circumstances, wetlands are those areas that support a prevalence of defined wetland plants on a wetland soil. The U.S. 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. Wetlands are classified as either tidal (coastal) or nontidal (interior). Tidal wetlands can be either saline or freshwater. There are also special wetland categories to denote saturated areas that have been altered by human activities.

New Jersey protects freshwater (interior) 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, and 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 its web site under "landuse." See **Sources of Information**, page 85.

All of Harrison's wetlands are freshwater. Natural wetlands of all types total 1,089 acres within the township (8.9 percent of total land area), of which 792 acres are forested wetlands, and 169 acres are low-growing emergent, scrub/shrub or herbaceous wetlands. Because the township is completely inland and has no tidal sections of its waterways, Harrison has no tidal wetlands. See **Map 8: Surface Water, Wetlands, and Vernal Ponds**.

Harrison also includes approximately 183 acres (about 1 percent of total land area) of modified or disturbed wetlands. Modified wetlands are former wetland areas that have been altered by human activities and that no longer support typical wetland vegetation, or are not vegetated at all. Modified wetland areas do, however, show obvious signs of soil saturation and exist in areas

shown to have hydric soils on U.S. Soil Conservation Service soil surveys. Harrison's modified wetlands fall into the following categories: 29 acres of disturbed wetlands, 73 acres of agricultural wetlands, 27 acres of former agricultural wetlands and less than one acre of wetlands found in maintained greenspace or lawn. A more detailed description of all of Harrison's wetland areas is found in the *Biological Resources* section, under "Wetlands," page 57.

Agricultural Wetlands

Agricultural wetlands occupy 73 acres (less than 1 percent of total land area) of Harrison Township. These "quasi-wetlands" are found scattered as small sites primarily north of Mullica Hill, but many may have been replaced by recent residential development. 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 8: Surface Water, Wetlands, and Vernal Ponds**.

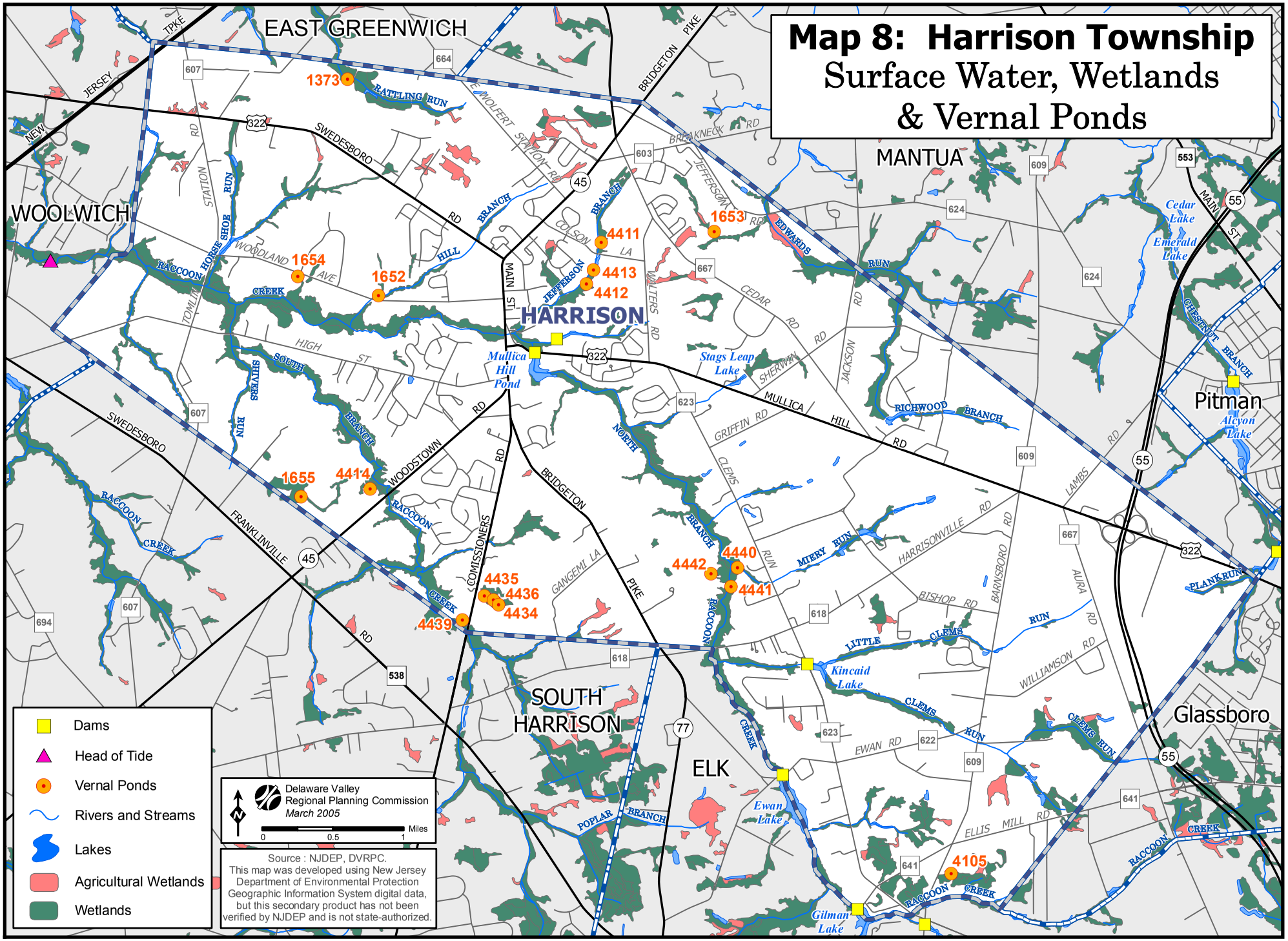
The Natural Resources Conservation Service sponsors the Wetlands Reserve Program, a voluntary program that offers landowners a chance to receive payments for restoring and protecting wetlands on their property, including agricultural wetlands. Restoring agricultural wetlands would require removing them from agricultural use and restoring them to their natural state. 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.

Vernal Pools

Vernal pools are bodies of water that appear following snowmelt 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 amphibians. Particular types of frogs and salamanders will only breed in vernal ponds (obligate breeders), which provide their offspring with a measure of protection because the pond's impermanence prevents residence by predators of 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 negotiating conservation easements on the land surrounding the pond or by instituting restrictive zoning such as passing a stream corridor protection overlay ordinance that specifically includes the vernal pools. A township can also include the pools in its official map.


Map 8: Harrison Township
Surface Water, Wetlands & Vernal Ponds
EAST GREENWICH
WOOLWICH
MANTUA
HARRISON
SOUTH HARRISON
ELK
Pitman
Glassboro
Mullica Hill Pond
Stags Leap Lake
Kincaid Lake
Ewan Lake
Gilman Lake
Cedar Lake
Emerald Lake
Alcyon Lake
1373
1653
4411
4413
4412
1654
1652
1655
4414
4442
4440
4441
4435
4436
4434
4439
4105
Dams
Head of Tide
Vernal Ponds
Rivers and Streams
Lakes
Agricultural Wetlands
Wetlands
Delaware Valley Regional Planning Commission
March 2005
0 0.5 1 Miles
Source : NJDEP, 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.

The state has identified 17 potential vernal pools in Harrison 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 April 2004.[6] See **Map 8: Surface Water, Wetlands, and Vernal Ponds.**

Floodplains

Areas naturally subject to flooding are called floodplains, or flood hazard areas. Floodplains encompass a floodway, which is the portion of a floodplain subject to high velocities of moving water, and the adjacent flood fringe, which helps to hold and carry excess water during overflow of the normal stream channel. The 100-year floodplain is defined as the land area that will be inundated by the overflow of water resulting from a 100-year flood (a flood that has a one percent chance of occurring in any given year).

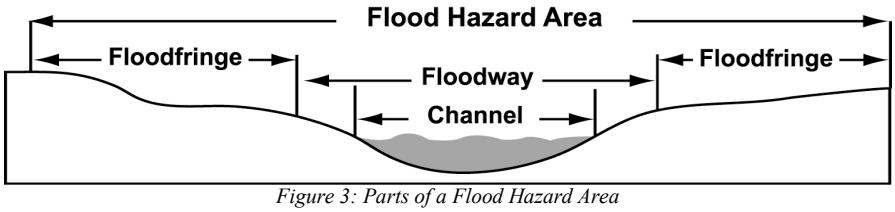


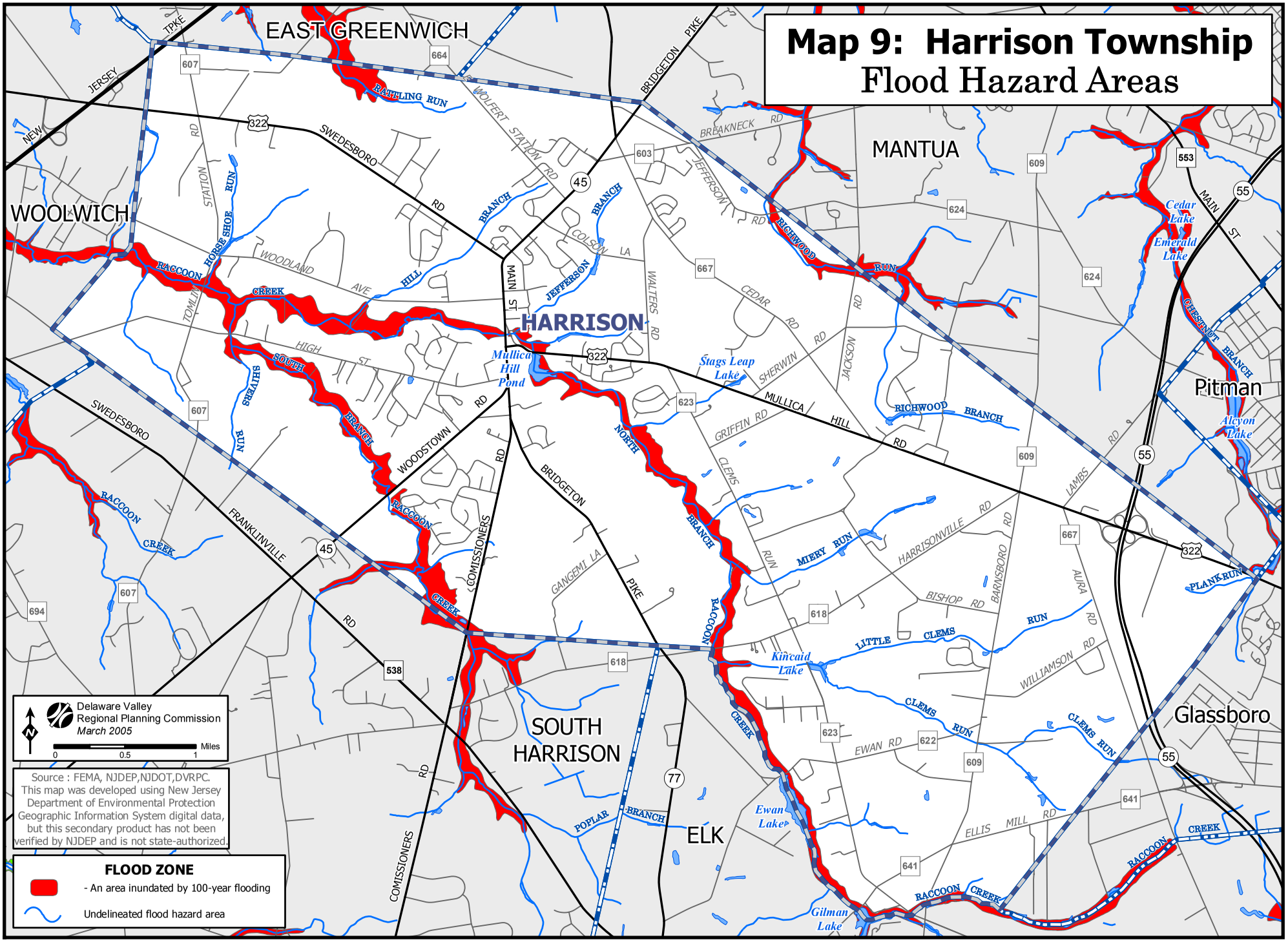
Figure 3: Parts of a Flood Hazard Area

Although the terms "flood hazard area" and "100-year floodplain" denote similar concepts, NJDEP defines them in slightly different ways. New Jersey's regulations define the flood hazard area as the area inundated by a flood resulting from the 100-year discharge increased by 25 percent. This type of flood is called the "flood hazard area design flood" and it is the flood regulated by NJDEP.

Floodplains require protection in order to prevent loss to residents, especially within the boundaries of the floodway. Equally important is the preservation of the environmentally sensitive aquatic communities that exist in floodplains. These communities are often the first link in the food chain of the aquatic ecosystem. In addition, floodplains 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 keep development out of floodplains will help to preserve the flood-carrying capacity of 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 hazard area 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 its web site under "Landuse." See **Sources of Information**, page 85.

[6] NJDEP and Rutgers Center for Remote Sensing and Spatial Analysis. http://www.dbcrssa.rutgers.edu/ims/vernal/, accessed 9/10/04.


Map 9: Harrison Township
Flood Hazard Areas
EAST GREENWICH
WOOLWICH
MANTUA
HARRISON
SOUTH HARRISON
ELK
Pitman
Glassboro
Mullica Hill Pond
Stags Leap Lake
Kincaid Lake
Ewan Lake
Gilman Lake
Cedar Lake
Emerald Lake
Alcyon Lake
RAFFLING RUN
WOLFERT STATION RD
BRIDGETON PIKE
BREAKNECK RD
JEFFERSON RD
RICHWOOD RUN
RICHWOOD BRANCH
CHESTNUT BRANCH
MAIN ST
SWEDESBORO RD
STATION RD
HORSE SHOE RUN
WOODLAND AVE
HILL BRANCH
COLSON LA
WALTERS RD
CEDAR RD
SHERWIN RD
JACKSON RD
MULLICA HILL RD
GRIFFIN RD
CLEMS RUN
LAMBS RD
HIGH ST
SHIVERS RUN
SOUTH BRANCH
NORTH BRANCH
WOODSTOWN RD
COMISSIONERS RD
GANGEMI LA
BRIDGETON PIKE
FRANKLINVILLE RD
RACCOON CREEK
MIERY RUN
HARRISONVILLE RD
BARNSBORO RD
BISHOP RD
AURA RD
LITTLE CLEMS RUN
WILLIAMSON RD
CLEMS RUN
EWAN RD
ELLIS MILL RD
POPLAR BRANCH
PLANK RUN
NEW JERSEY TPKE
Delaware Valley Regional Planning Commission
March 2005
Miles
0 0.5 1
Source : FEMA, 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.
FLOOD ZONE
- An area inundated by 100-year flooding
Undelineated flood hazard area

New Jersey's flood hazard area maps are not available in digital form. Consequently, it is only possible to approximate the spatial extent of the flood hazard area in Harrison by using the Federal Emergency Management Agency's (FEMA's) 100–year floodplain maps. FEMA's maps show that almost 590 acres or 5% of Harrison Township's land is within flood hazard areas. Nearly all of Harrison's floodplain areas are located along the main branches of Raccoon Creek North Branch, Raccoon Creek South Branch, and Edwards Run. Because these creeks lie in relatively steep-banked stream valleys, the extent of the floodplain in Harrison is somewhat limited, compared to other parts of Gloucester County. See **Map 9: Flood Hazard Areas**.

Surface Water Quality

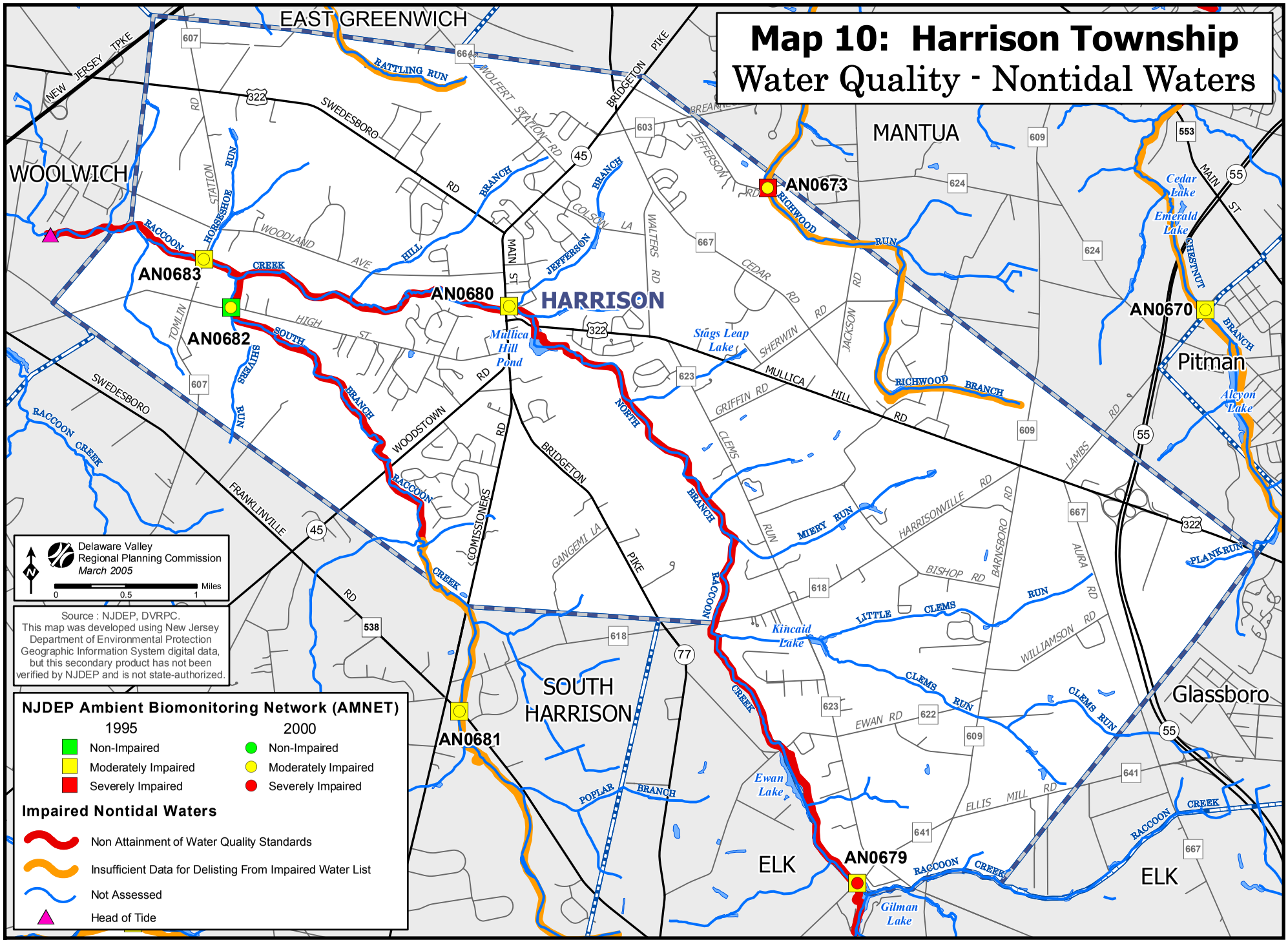
Water quality standards are established by federal and state governments to ensure that water is suitable for its intended use. The Federal Clean Water Act (P.L. 95-217) requires that wherever possible the water-quality standards provide water suitable for fish, shellfish, and wildlife to thrive and 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.

The entire length of Raccoon Creek within Harrison Township is classified as FW2–NT, which means that it is a freshwater stream that is not a trout producing or trout maintaining water. The remainder of Harrison's streams and tributaries are not listed by name in New Jersey's 2004 surface water classifications. According to NJDEP guidance, unnamed freshwater streams that flow into all FW2-NT waters should be classified as FW2 waters. Thus, Harrison's remaining streams are also FW2-NT waters. See *Table 9: Water Quality Classifications of Streams in Harrison Township*. 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 fishing); (3) industrial and agricultural water supply; (4) public potable water supply after conventional filtration and disinfection; and (5) any other reasonable uses.

Table 9: Water Quality Classifications of Streams in Harrison Township

Streams	Classification
Raccoon Creek	FW 2 – NT
Raccoon Creek South Branch	FW 2 – NT
Edwards Run	FW 2 – NT

Source: NJDEP


Map 10: Harrison Township
Water Quality - Nontidal Waters
EAST GREENWICH
WOOLWICH
MANTUA
HARRISON
SOUTH HARRISON
ELK
Pitman
Glassboro
AN0673
AN0670
AN0683
AN0682
AN0680
AN0681
AN0679
Mullica Hill Pond
Stags Leap Lake
Kincaid Lake
Ewan Lake
Gilman Lake
Cedar Lake
Emerald Lake
Alcyon Lake
RACCOON CREEK
RATTLING RUN
WOLFERT STATION RD
BRIDGETON PIKE
SWEDESBORO RD
NEW JERSEY TPKE
HORSESHOE RUN
STATION RD
WOODLAND AVE
HILL BRANCH
COLSON LA
JEFFERSON RD
WALTERS RD
CEDAR RD
RICHWOOD RUN
RICHWOOD BRANCH
MAIN ST
HIGH ST
TOMLIN
SHIVERS RUN
SOUTH BRANCH
NORTH BRANCH
WOODSTOWN RD
COMMISSIONERS RD
GANGEMI LA
GRIFFIN RD
CLEMS RUN
SHERWIN RD
JACKSON RD
MULLICA HILL RD
MIERY RUN
HARRISONVILLE RD
BARNSBORO RD
LAMBS RD
AURA RD
BISHOP RD
LITTLE CLEMS RUN
CLEMS RUN
WILLIAMSON RD
EWAN RD
ELLIS MILL RD
POPLAR BRANCH
PLANK RUN
CHESTNUT BRANCH
FRANKLINVILLE RD
Delaware Valley Regional Planning Commission
March 2005
Miles
0 0.5 1
Source : NJDEP, 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.
NJDEP Ambient Biomonitoring Network (AMNET)
1995
Non-Impaired
Moderately Impaired
Severely Impaired
2000
Non-Impaired
Moderately Impaired
Severely Impaired
Impaired Nontidal Waters
Non Attainment of Water Quality Standards
Insufficient Data for Delisting From Impaired Water List
Not Assessed
Head of Tide

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. Examples of these parameters include fecal coliform, dissolved oxygen, pH, phosphorous, and toxic substances. NJDEP also evaluates water quality by examining the health of aquatic life in a stream.

NJDEP operates two water quality-monitoring networks. In cooperation with the U.S. Geological Survey (USGS), it runs the Ambient Surface Water Monitoring Network (ASWM). This network contains 115 stations that monitor for nutrients (i.e., phosphorous and nitrogen), bacteria, dissolved oxygen, metals, sediments, chemicals, and other parameters.

The second water quality monitoring system is the Ambient Biomonitoring Network (AMNET), which is administered solely by NJDEP. It evaluates the health of aquatic life as a biological indicator of water quality.[7] 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 a second round occurred between 1997 and 2001.

Harrison Township Stream Water Quality

Only one site in Harrison is part of the USGS/NJDEP Ambient Surface Water Monitoring (ASWM) network at which chemical monitoring is conducted. This site is located on Edwards Run at Jefferson Road and is tested for dissolved oxygen, pH, ammonia, nitrogen, phosphorous, metals, and a wide range of organic and inorganic chemicals. The site was sampled 12 times between November 2000 and August 2002. The results of these samples are summarized in *Table 10: New Jersey ASWM Sampling Locations for Harrison Township and 2004 Integrated Water Quality Monitoring and Assessment Report Status* and the station location is depicted on **Map 10: Water Quality – Non-tidal Waters**.

There are five AMNET (aquatic life assessment) sites within Harrison Township or along its borders and one site upstream in South Harrison Township. NJDEP sampled each of the AMNET sites in July 1995 and again in July 2000. Each AMNET site is tested for only one water quality parameter – aquatic life. Specifically, the bottom-dwelling ("benthic") macroinvertebrates (insects, worms, mollusks, and crustaceans that are large enough to be seen by the naked eye) are collected. The composition and diversity of species present are directly related to water quality. More sensitive species "drop out" and are not found in more polluted waters.

In the first sampling:
One of the six sites was rated as "severely impaired" and four sites were rated as "moderately impaired" for aquatic life support. That is, the streams were able to maintain only moderately diverse populations of aquatic organisms. Only one site at the upper end of the Raccoon Creek South Branch (AN0682) was rated as "non-impaired."

[7] More specifically, AMNET monitors the diversity of communities of small bottom-dwelling aquatic organisms.

In the second sampling:
The severely impaired site was found to have "improved" and was only moderately impaired. Three of the four moderately impaired locations remained the same. One of the moderately impaired sites (AN0679) had declined and was severely impaired. The unimpaired site had declined in quality and had become moderately impaired. Harrison's AMNET stations are listed in *Table 11: New Jersey AMNET Sampling Locations for Harrison Township and 2004 Integrated Water Quality Monitoring and Assessment Report Status* and are depicted on **Map 10: 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. In 2002 and again in 2004 NJDEP issued the *Integrated Water Quality Monitoring and Assessment Report*, which included as "Sublist 5" those waters that are determined to be impaired. Other lists in the Report included waterways that are attaining standards (sublist 1) or where additional data is needed to determine their status (sublists 2 through 4).

Source: DVRPC

Raccoon Creek from Ellis Mill Road

The ASWM station on Edwards Run is listed on the 2004 *Integrated Report's* Sublist 5 ("Impaired Waters") for two parameters: phosphorous and fecal coliform. It is on Sublist 1 (fully attaining or non-impaired) for temperature, dissolved oxygen, pH, nitrate, dissolved solids, total suspended solids, and ammonia.

Although all of the six AMNET stations in or near Harrison were moderately or severely impaired for aquatic life in the 2000 round of monitoring, only four of these stations were placed on the 2004 *Integrated Report's* Sublist 5 as "Impaired Waters." The remaining two stations were placed on Sublist 3 because NJDEP determined that there was "insufficient data" to either list them as impaired or non-impaired with certainty.

In summary, the following waters in Harrison are impaired:

For fecal coliform and phosphorus:

- Edwards Run and all of its tributaries (including Richwood Branch) from their headwaters to the confluence of Edwards Run and Myers Creek in Mantua.

For aquatic life:

- The Rich Crow tributary in Elk Township that meets the main stem Raccoon Creek at Lake Gilman, from a point in Elk to Ellis Mill Road on the border of Harrison and Elk Townships.

- The main stem of the Raccoon Creek from Ellis Mill Road on the border with Elk Township to the confluence with the Jefferson Branch in Harrison
- The main stem of the Raccoon Creek from the confluence with the Jefferson Branch to the confluence with Horseshoe Run in Harrison
- The South Branch of Raccoon Creek from a point southeast of Woodstown Rd. to its confluence with the main stem of the Raccoon Creek just above High St. in Harrison.

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

Table 10: New Jersey ASWM Sampling Location for Harrison Township and the 2004 Integrated Water Quality Monitoring and Assessment Report Status

Site ID	Station Name/Waterbody	Municipality	Parameters Measured	Status	Sampling Dates	Data Source
01475090	Edwards Run at Jefferson	Mantua/Harrison	Phosphorus, Fecal Coliform	Impaired	11/00 - 8/02	NJDEP/USGS Data
01475090	Edwards Run at Jefferson	Mantua/Harrison	Temperature, Dissolved Oxygen, pH, Nitrate, Dissolved Solids, Total Suspended Solids, Unionized Ammonia	Attaining	11/00 - 8/02	NJDEP/USGS Data

Source: NJDEP

Table 11: New Jersey AMNET Sampling Locations for Harrison Township and the 2004 Integrated Water Quality Monitoring and Assessment Report Status

Site ID	Station Name/Waterbody	Municipality	Parameters Measured	1995 NJ Impairment Score*	2000 NJ Impairment Score*	Status - 2004 Integr. Report
AN0673	Edwards Run at Pitman - Jefferson Rd in Harrison	Harrison	Benthic Macroinvertebrates	3	12	Insufficient Data
AN0679	Raccoon Creek at Ellis Mill Rd in Elk	Harrison/Elk	Benthic Macroinvertebrates	9	6	Impaired
AN0680	Raccoon Creek at N. Main Street in Harrison	Harrison	Benthic Macroinvertebrates	21	21	Impaired
AN0682	Raccoon Creek S Br at High St in Harrison	Harrison	Benthic Macroinvertebrates	27	12	Impaired
AN0683	Raccoon Creek at Tomlin Station Rd in Harrison	Harrison	Benthic Macroinvertebrates	15	12	Impaired

Source: NJDEP

*** KEY:**

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

Causes of Water Quality Impairments

Stormwater Runoff

Stormwater runoff and other non-point 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 Harrison. These sources are also the most difficult to identify and remediate because they are diffuse, widespread, and cumulative in their effect. Most non-point source pollution in the Raccoon Creek watershed 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 Harrison land uses.

In March 2003 the NJDEP issued a new Stormwater Management Rule, as required by the US Environmental Protection Agency's Phase II Stormwater Management Program for Municipal Separate Stormwater Sewer Systems (MS4). The rule lays out guidance and requirements for management of and education about stormwater at the local level. It applies to all towns in New Jersey, all county road departments, and all public institutional facilities on large sites (such as hospitals and colleges). Beginning in 2004, municipalities were required to obtain a New Jersey Pollution Discharge Elimination System (NJPDES) general permit for the stormwater system and its discharges within their borders, which is considered to be owned and "operated" by the municipality.

Under the 2004 NJPDES permit, a town must meet certain specific requirements in planning, ordinance adoption, education, management of township facilities, and investigation of parts of the stormwater system. Fulfillment of these Statewide Basic Requirements is scheduled to occur over the course of five years.

See **Figure 4** on page 43 for details of the Statewide Basic Requirements of this program.

Impervious Coverage

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 percent or more within a subwatershed are directly linked to increased stormwater runoff, enlargement of stream channels, increased stream bank erosion, lower dry weather flows, higher stream temperatures, lower water quality, and declines in aquatic wildlife diversity. When impervious cover reaches 25 percent to 30 percent, streams can become severely degraded. *Table 12: Impervious Coverage in Harrison Township* shows the amount of various percentages of impervious cover in the township.

Table 12: Impervious Coverage in Harrison Township

Percent of Impervious Coverage	Harrison Acres
0 to 10%	10,329
11 to 15%	776
16 to 20%	333
21 to 25%	425
31 to 100%	379
Total Harrison Acreage	12,242

Source: NJDEP

Stormwater Management Statewide Basic Requirements
Towns, Highway Agencies, and Institutions

1. Control post-construction stormwater management in new development and redevelopment through:

    - Adoption of a stormwater management plan in accordance with N.J.A.C. 7:8.
    - Adoption and implementation of a stormwater control ordinance in accordance with N.J.A.C. 7:8. This ordinance requires retention on site of 100% of preconstruction recharge, and use of low-impact design in stormwater facilities, among other features.
    - Ensuring compliance with Residential Site Improvement Standards for stormwater management. The RSIS is currently being revised to incorporate the low-impact design and other requirements of the stormwater control ordinance.
    - Ensuring long-term operation and maintenance of Best Management Practices on municipal property.
    - Requiring that new storm drain inlets meet new design standards.

2. Conduct local public education:

    - Distribute educational information (about stormwater requirements, nonpoint source pollution, and stewardship) annually to residents and businesses and conduct a yearly "event" (such as a booth with these messages at a community day).
    - Have all municipal storm drain inlets labeled with some type of "don't dump" message.
    - Distribute information annually regarding fertilizer/pesticide application, storage, disposal, and landscaping alternatives.
    - Distribute information annually regarding proper identification, handling, and disposal of wastes including pet waste and litter.

3. Control improper disposal of waste through improved yard waste collection and through adoption of ordinances (pet waste, litter, improper dumping, and wildlife feeding).

4. Control solids and floatables through increased street sweeping, retrofitting storm drain inlets during road repairs, and instituting programs for stormwater facility management, for roadside erosion control, and for outfall pipe scouring/erosion.

5. Improve maintenance yard operations, specifically for de-icing material storage, fueling operations, vehicle maintenance, and housekeeping operations.

6. Increase employee training about all of the above.

Figure 4: Stormwater Management Basic Requirements

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 ─ a greenway ─ for wildlife to move between larger forested habitat areas. Residents can utilize these greenways for recreation with the addition of trails, bikeways, and access points to 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.

Source: Scott VanEtten

Example of stream buffer maintained on private property adjacent to Horseshoe Run

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 percent of the costs of eligible conservation practices. These are all programs in which individual landowners volunteer to take part.

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 coming from a single source, such as an industrial pipe; and "nonpoint source" pollution, which comes from many diffuse sources. The 1972 act only required states to regulate point sources.

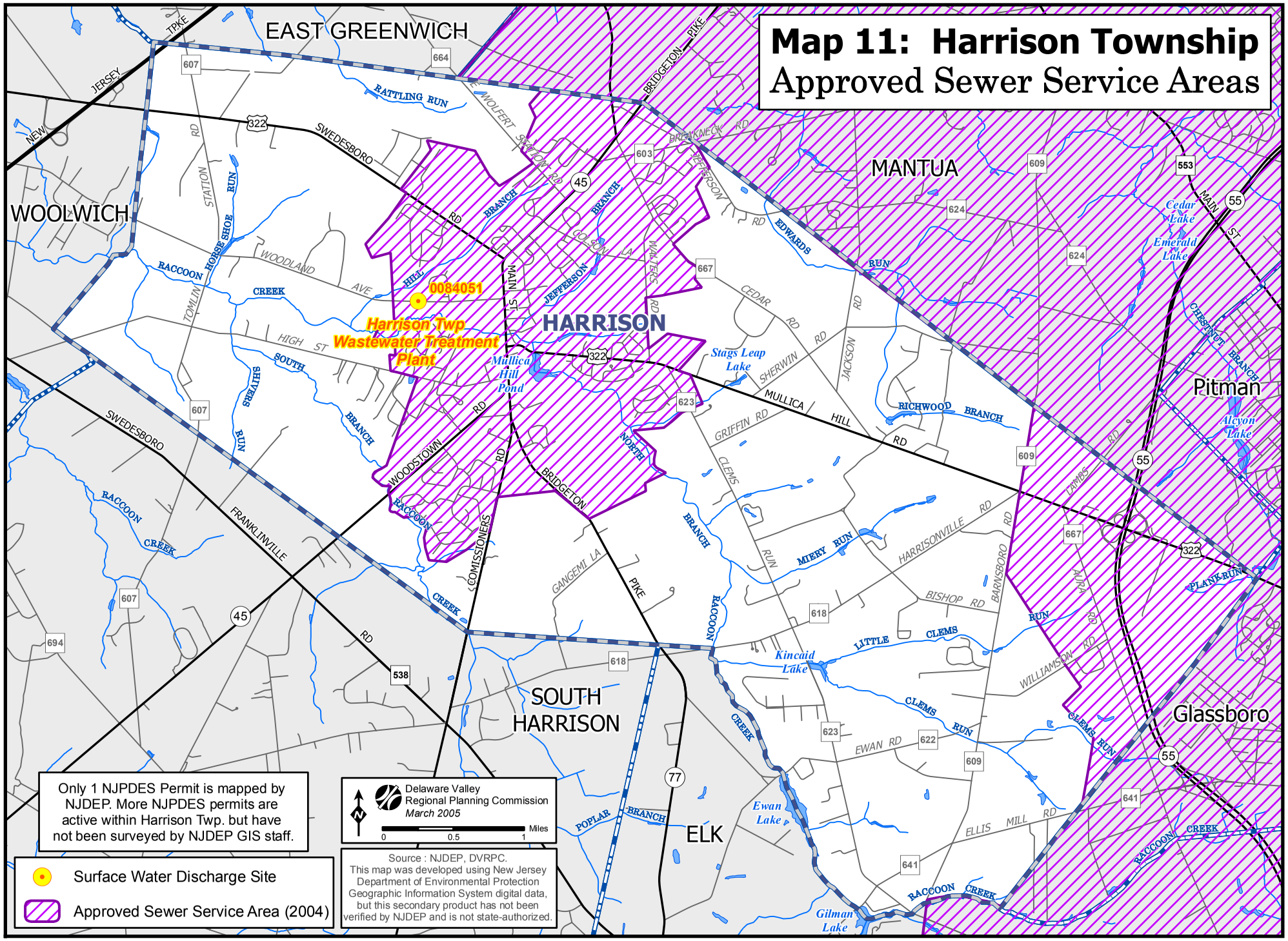
NJDEP, through the Division of Water Quality and the Bureau of Point Source Permitting, administers the NJPDES program. Under NJPDES, any facility discharging over 2,000 gallons per day (gpd) of wastewater directly into surface water or ground water (generally through a septic system) must apply for 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. NJDEP enforces the terms of the NJPDES permit by visiting discharging facilities and requiring facilities to conduct water quality, biological, and toxicological analyses and thermal impact and cooling water assessments periodically.

Under the Open Public Records Act (OPRA) of 2002, a list of active NJPDES permits is available. As of August 1, 2004, three NJPDES permits were issued to individual facilities in Harrison Township. These are shown in *Table 13: New Jersey Pollution Discharge Elimination Permit System (NJPDES) Permits*.

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

NJPDES Permit Number	Facility Name	Effective Start Date	Expiration Date	Discharge Type	Discharge Category Description	Street Address
NJG0135232	Wellcrest Farms Inc	7/1/03	2/29/08	Discharge to Groundwater, Discharge to Surface Water	Concentrated Animal Feeding Operation (CAFO) General Permit	455 Jefferson Rd
NJ0020532	Harrison Township Treatment Plant	9/1/02	8/31/07	Discharge to Surface Water	Sanitary Wastewater	40 Woodland Ave
NJG0150169	Harrison Township	4/1/04	2/28/09	Discharge to Groundwater, Discharge to Surface Water	Tier A Municipal Stormwater General Permit	114 Bridgeton Pike

Source: NJDEP, Division of Water Quality


Map 11: Harrison Township
Approved Sewer Service Areas
EAST GREENWICH
WOOLWICH
MANTUA
HARRISON
SOUTH HARRISON
ELK
Pitman
Glassboro
0084051
Harrison Twp Wastewater Treatment Plant
Mullica Hill Pond
Stags Leap Lake
Kincaid Lake
Ewan Lake
Gilman Lake
Cedar Lake
Emerald Lake
Alcyon Lake
Only 1 NJPDES Permit is mapped by NJDEP. More NJPDES permits are active within Harrison Twp. but have not been surveyed by NJDEP GIS staff.
Surface Water Discharge Site
Approved Sewer Service Area (2004)
Delaware Valley Regional Planning Commission
March 2005
Miles
0
0.5
1
Source : NJDEP, 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.

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. It outcrops to the northwest of Harrison Township, in Logan and Greenwich townships. Other smaller aquifers on top of the PRM are the Englishtown, the Mt. Laurel - Wenonah, and the Kirkwood-Cohansey. The Kirkwood-Cohansey is a formation composed of two thick layers, the Kirkwood (lower) and the Cohansey (upper), that overlie the older formations. It begins east of the inner/outer coastal plain divide and extends southeastward. Because Harrison straddles the coastal plain divide, the township contains a large area of the Kirkwood-Cohansey aquifer outcrop area. The westernmost extent of the Kirkwood-Cohansey aquifer outcrop is in neighboring Woolwich Township. See **Map 12: Geological Outcrops**.

Source: U.S. Geological Survey

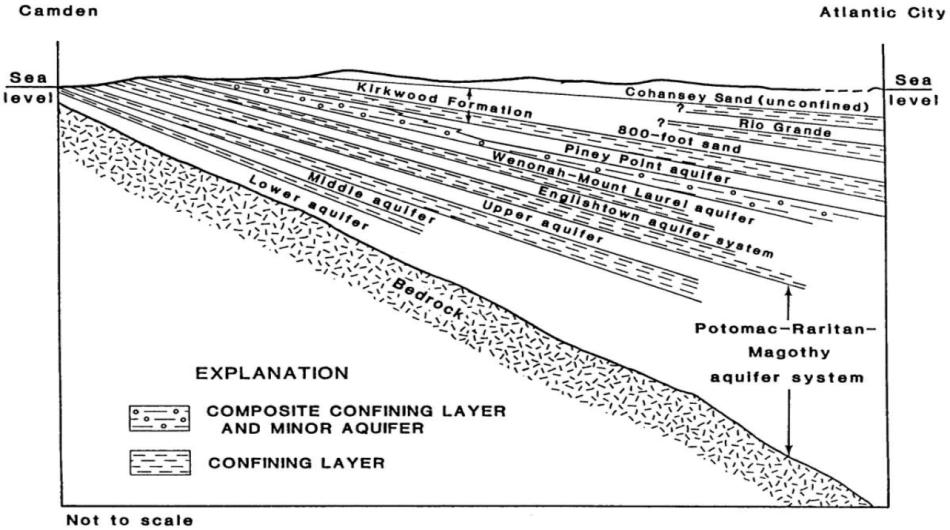


Figure 5: Aquifers of Southern New Jersey along a Line from Camden to Atlantic City

Geological Formations

Of the 16 geological formations that outcrop in Gloucester County, four outcrop in Harrison Township. Two of these formations are aquifers and two are confining beds. The oldest aquifer that outcrops in Harrison is the Wenonah-Mount Laurel aquifer system, composed of water-

bearing sands and gravels. The other aquifer that overlays the Wenonah-Mount Laurel aquifer and outcrops in Harrison Township is the Kirkwood-Cohansey aquifer system. See **Map 12: Geological Outcrops** for a visual depiction of the aquifer and confining bed outcrop areas. The Kirkwood-Cohansey aquifer system and Hornerstown and Navesink Composite Confining Units that outcrop in Harrison are described in the succeeding paragraphs.

Hornerstown and Navesink Composite Confining Units

Overlying the Wenonah-Mount Laurel aquifer and subjacent to the Kirkwood-Cohansey aquifer system lies a complex series of geologic units ranging in age from late Cretaceous to Miocene (23 to 150 million years ago) known as the Hornerstown and Navesink composite confining bed. The confining bed consists of the Navesink formation and, depending on location within the coastal plain, can include other geological units. In Harrison Township, Hornerstown sand outcrops alongside the Navesink formation. These layers were formed by the advancing and retreating of the sea across southern New Jersey, and thus are high in glauconite. The confining units have low to moderate permeabilities and are generally described together. This composite confining unit becomes thicker as it travels eastward from 50 feet in Harrison Township to 796 feet at Island Beach State Park.

Kirkwood-Cohansey Aquifer System

Kirkwood-Cohansey Aquifer System: The Kirkwood Formation, along coastal areas, appears as thick clay beds, with inter-bedded zones of sand and gravel. The Cohansey Sand, also of Miocene age, is coarser grain than the underlying Kirkwood Formation. It contains minor amounts of pebbly sand, and inter-bedded clay. Some local clay beds within the Cohansey Sand are relatively thick.

The surficial nature of the Kirkwood-Cohansey makes it vulnerable to contamination from various land uses. Industrial chemicals, fuel spill runoff, agricultural chemicals used for crop production and residential landscaping, pesticides, and products of septic tank effluent have all been found in water from the aquifer. Where possible, care must be taken to site wells to avoid proximity to deleterious land uses and contamination.

Aquifers

Several aquifers underlie parts of Harrison Township. Three major aquifers – Wenonah-Mount Laurel, Englishtown, and Potomac-Raritan-Magothy (PRM) – provide public and private drinking water for Harrison residents.

Wenonah-Mount Laurel Aquifer System and Englishtown Aquifer System

Some private wells most likely draw from the Wenonah-Mount Laurel aquifer system. The Wenonah-Mount Laurel aquifer is composed of the Wenonah Formation and the Mount Laurel Sand, both of the Late Cretaceous age (130 to 150 million years ago). It is thickest in

Burlington, Camden, Gloucester, and Salem counties, reaching 100 to 120 feet, with its top and base being approximately 175 feet and 205 feet below sea level, respectively.

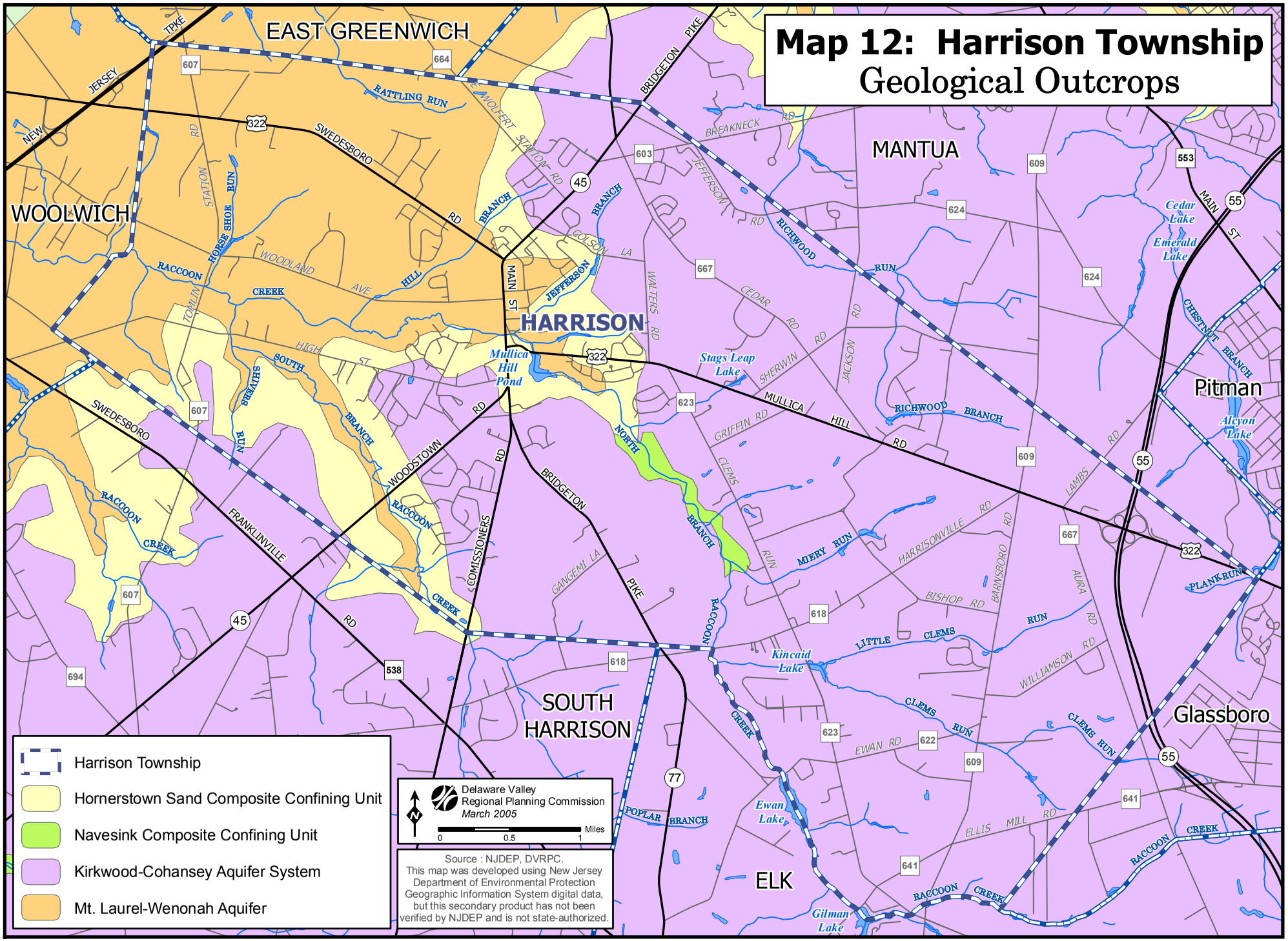
Some private wells in residential developments built more than 20 years ago may draw from the Englishtown aquifer system. The Englishtown Formation, also of late Cretaceous age, outcrops in the Inner Coastal Plain in an irregular band that extends from Raritan Bay to the Delaware River adjacent to Salem County. Where the Englishtown Formation is exposed, the primary components are fine- to medium-grained sands. In parts of Burlington, Camden, Gloucester, and Salem counties, the aquifer is commonly less than 40 feet thick. In Harrison Township, the top of the Englishtown aquifer is about 175 feet below ground surface and its base is 205 feet below sea level, making it about 30 feet thick. It is not a major source of water in Gloucester County due to its small size and greater proportion of fine-grained sediments, resulting in lower yields. More productive aquifers lie above and below it.

There is no comprehensive inventory of private wells – their depth or condition – available to municipalities. Well permits are held by the county health department, but there are many gaps in the records due to various factors, including well age. The recently enacted (2002) Private Well Testing Act requires state-certified laboratory water sampling and testing in order to sell a residential property. This will not identify what aquifers are being drawn upon by private wells, but it will eventually provide better documentation of the quality of drinking water from private wells in an area.

Potomac-Raritan-Magothy Aquifer System (PRM)

The Potomac-Raritan-Magothy (PRM) is the principal geological formation underlying Harrison Township and the primary source of drinking water for Harrison's public wells and most private ones. 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 (60 to 150 million years ago).

In the Delaware Valley, three aquifers have been distinguished within the PRM system, designated as lower, middle, and upper, divided by two confining units or layers between the three water-bearing strata. The aquifers themselves are largely made up of sands and gravels, locally inter-bedded 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.


Map 12: Harrison Township
Geological Outcrops
EAST GREENWICH
WOOLWICH
MANTUA
HARRISON
SOUTH HARRISON
ELK
Pitman
Glassboro
Mullica Hill Pond
Stags Leap Lake
Kincaid Lake
Ewan Lake
Gilman Lake
Cedar Lake
Emerald Lake
Alcyon Lake
Harrison Township
Hornerstown Sand Composite Confining Unit
Navesink Composite Confining Unit
Kirkwood-Cohansey Aquifer System
Mt. Laurel-Wenonah Aquifer
Delaware Valley Regional Planning Commission
March 2005
0 0.5 1 Miles
Source : NJDEP, 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.

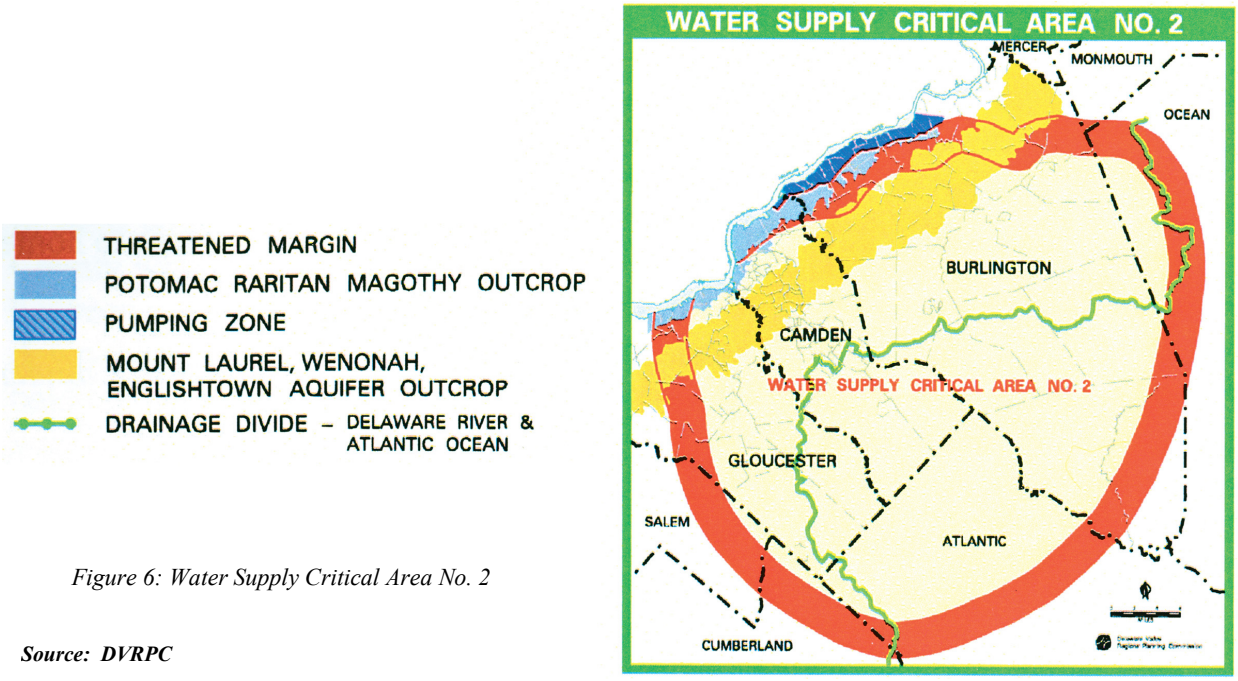


Figure 6: Water Supply Critical Area No. 2

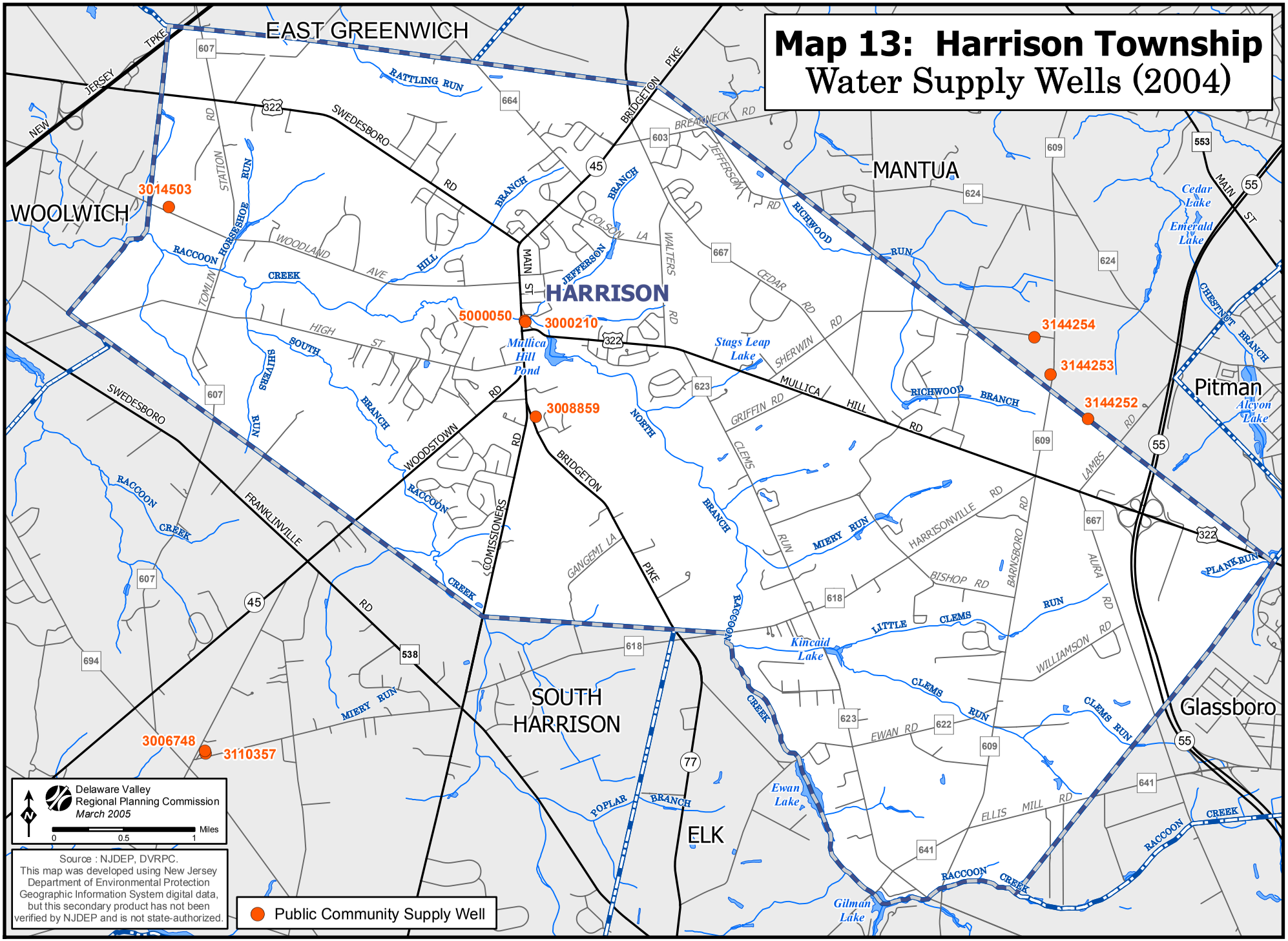
Source: DVRPC

The PRM is the primary source of drinking water to New Jersey residents from Burlington to Salem counties, as well as to communities in Delaware. Because of such high usage, PRM aquifer water levels have declined. 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 percent and no increases in pumping were allowed. Piping of treated Delaware River water filled the gap in much of the region. All of Harrison Township is within the boundary of the Critical Area.

There is increased concern that additional pumping from the aquifer in the borderline areas will necessitate the expansion of the Critical Area boundaries. Thus, water supply companies in Gloucester and Salem counties have and will continue to have difficulty getting approvals from the New Jersey Department of Environmental Protection for any additional water allocations from the PRM.

In Gloucester and Salem counties, use of the lower PRM aquifer for drinking water is limited due to high chloride concentrations (salt water intrusion). This is thought to be very ancient seawater within the lower aquifer, resulting from movement from the southeastern side, which is in contact with ocean water. Whatever the cause, most of the lower aquifer is not usable for drinking supply. There are also problems with salinity levels in the upper and middle PRM aquifers, especially for wells closest to the Delaware River where pumpage has increased the amount of slightly saline water from the river to be drawn into the aquifers.

The PRM does not outcrop in Harrison Township; rather it outcrops under and immediately beside the Delaware River in New Jersey and Pennsylvania. River water actually enters and recharges the upper and middle PRM aquifers.


Map 13: Harrison Township
Water Supply Wells (2004)
EAST GREENWICH
WOOLWICH
MANTUA
HARRISON
SOUTH HARRISON
ELK
Pitman
Glassboro
3014503
5000050
3000210
3008859
3144254
3144253
3144252
3006748
3110357
Mullica Hill Pond
Stags Leap Lake
Kincaid Lake
Ewan Lake
Gilman Lake
Cedar Lake
Emerald Lake
Alcyon Lake
Delaware Valley Regional Planning Commission
March 2005
Miles
0
0.5
1
Source : NJDEP, 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.
Public Community Supply Well

Water Supply Wells

There are four active public water supply wells at three sites in Harrison Township, as listed in *Table 14: Public Water Supply Wells* below. There are several public wells located in Mantua and operated by the Mantua Township Municipal Utility Authority that are close to Harrison's borders. All pump from the PRM. All public wells in the area are shown on **Map 14: Water Supply Wells**.

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)
3000210	South Jersey Water Supply Co	Upper PRM	234	265
3008859	South Jersey Water Supply Co	Upper PRM	308	348
3014503	South Jersey Water Supply Co	Upper PRM	198	248
5000050	South Jersey Water Supply Co	Upper PRM	285	285

Source: NJDEP

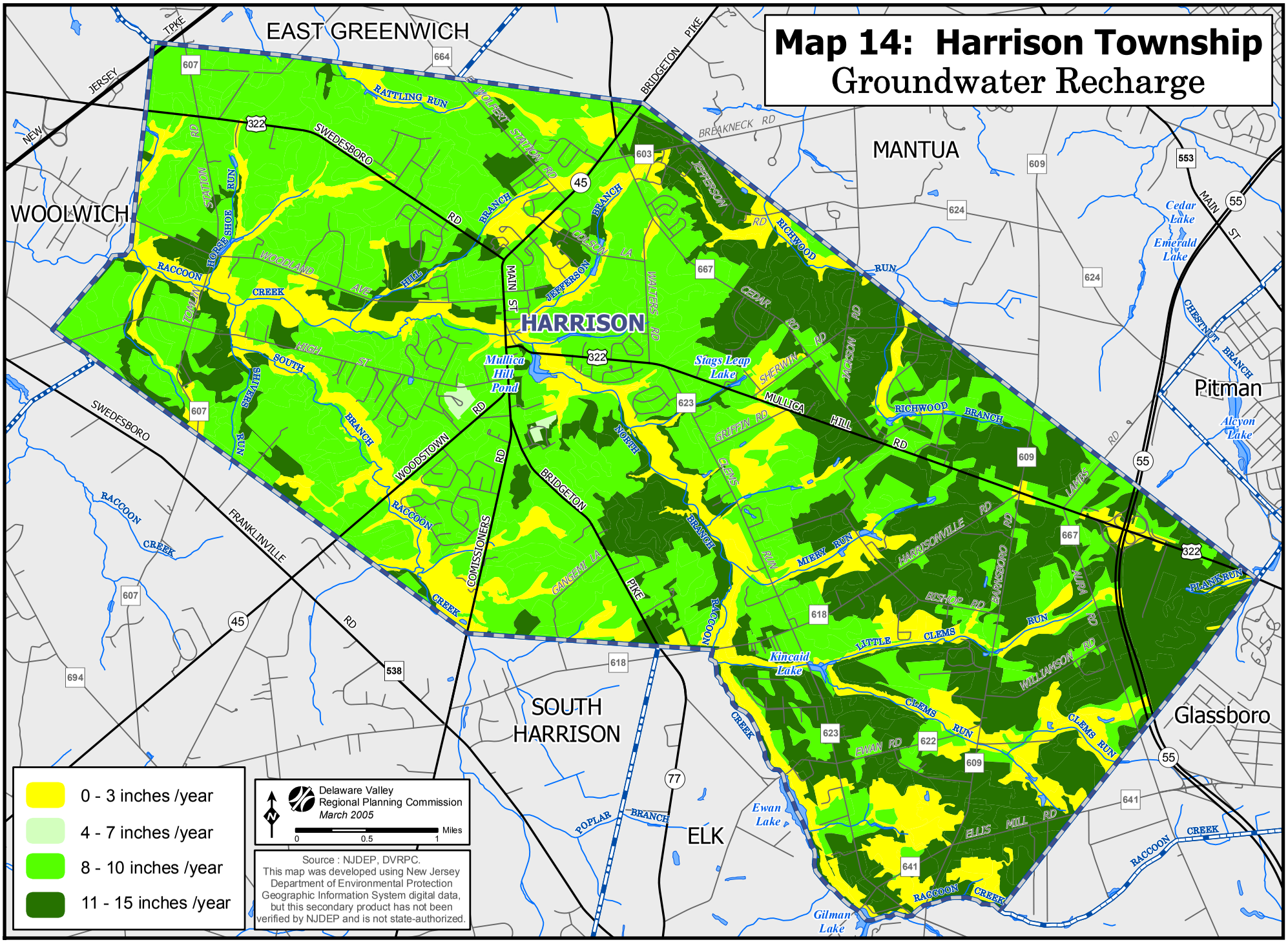
Groundwater Recharge

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 Harrison, lands with recharge of greater than 12 inches per year, the highest in the township, are found in sizable patches, with the largest areas in the eastern half of the township, especially in Richwood. Other high recharge land can be found to the south of Raccoon Creek in agricultural areas. In the case of Harrison, recharge is to the Wenonah-Mount Laurel and Kirkwood-Cohansey aquifers. See **Map 14: Groundwater Recharge**.

In general, 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 areas of 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.


Map 14: Harrison Township
Groundwater Recharge
EAST GREENWICH
WOOLWICH
MANTUA
HARRISON
SOUTH HARRISON
ELK
Glassboro
Pitman
Mullica Hill Pond
Stags Leap Lake
Kincaid Lake
Ewan Lake
Gilman Lake
Cedar Lake
Emerald Lake
Alcyon Lake
0 - 3 inches /year
4 - 7 inches /year
8 - 10 inches /year
11 - 15 inches /year
Delaware Valley Regional Planning Commission
March 2005
Miles
0
0.5
1
Source : NJDEP, 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.

BIOLOGICAL RESOURCES

When a community protects wildlife and habitat, it is also protecting biodiversity, which is important for the health and productivity of the ecosystem and its inhabitants, including humans. Biodiversity refers to the variety of genetic material within a species population, the variety of species (plants, animals, microorganisms) within a community, and the variety of natural communities within a given region. 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.

Harrison contains numerous types of habitats, all of which are important for maintaining biodiversity. Upland forests, which are the most abundant type of natural habitat in Harrison, occur where land is dry and undeveloped. Forested Wetlands are the second most common ecosystem type in Harrison. Along Harrison's stream corridors and lakeshores are herbaceous wetlands, which support plants that require constantly saturated soils; and within and around waterbodies are submerged communities, which require persistent standing water. The following sections will identify and describe in more detail the plant and animal communities that inhabit these unique ecosystems within Harrison Township.

NATURAL VEGETATION

A region's vegetation is dependent on many factors, the most important of which are climate and soils. Harrison's climate is cool and temperate with rainfall averaging 42 to 44 inches per year. For a detailed description of Harrison's soils see the *Soils* section on page 18.

Harrison'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 cover as a vegetation type is based on definitions provided by the Anderson Land Use Classification System, created by the U.S. Geologic Survey. See **Map 15: Natural Vegetation (1995/97)**.

Source: DVRPC

Woodlands on the western side of Mullica Hill Pond

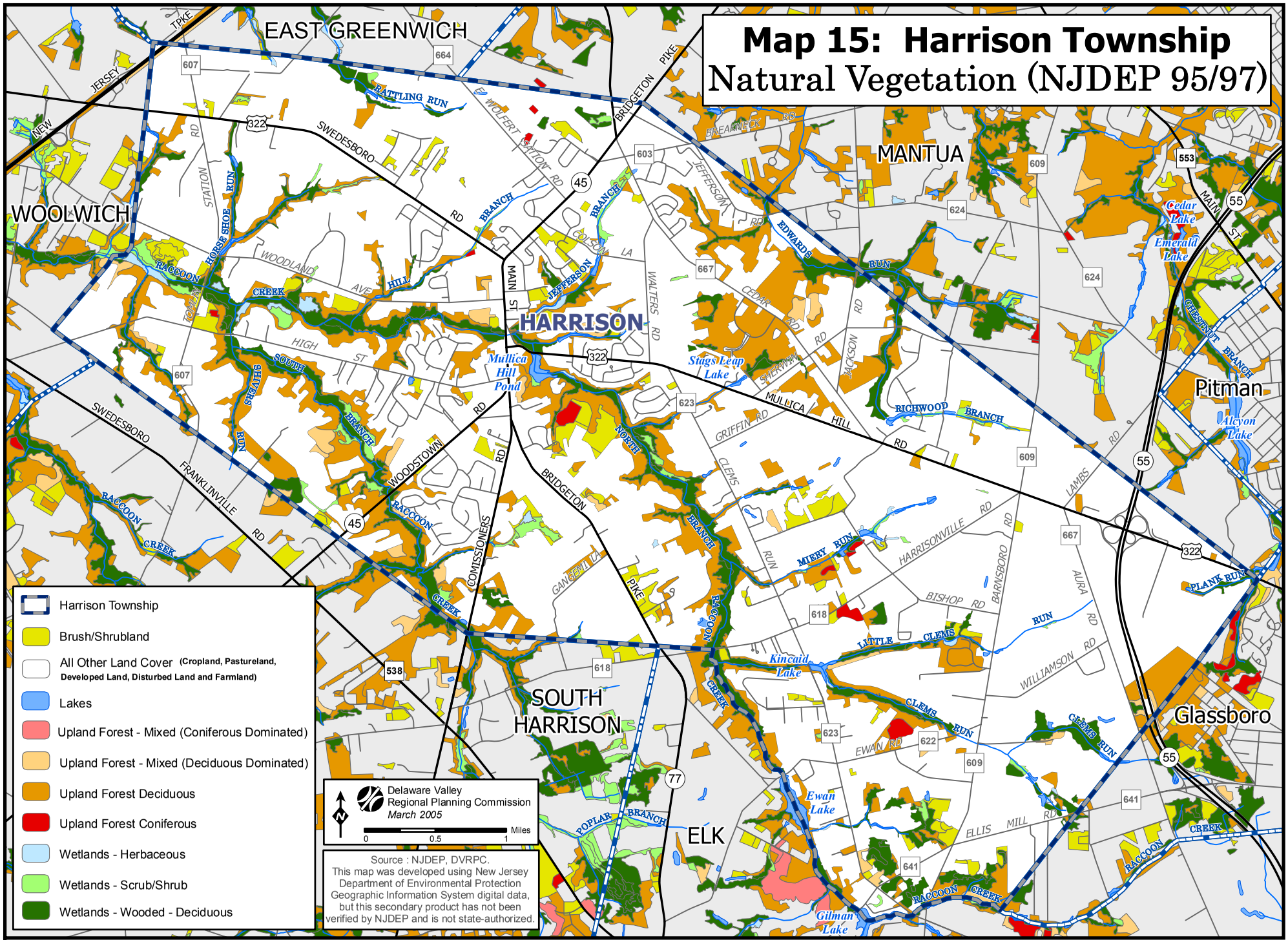

Map 15: Harrison Township
Natural Vegetation (NJDEP 95/97)
EAST GREENWICH
WOOLWICH
MANTUA
HARRISON
SOUTH HARRISON
ELK
Pitman
Glassboro
Harrison Township
Brush/Shrubland
All Other Land Cover (Cropland, Pastureland, Developed Land, Disturbed Land and Farmland)
Lakes
Upland Forest - Mixed (Coniferous Dominated)
Upland Forest - Mixed (Deciduous Dominated)
Upland Forest Deciduous
Upland Forest Coniferous
Wetlands - Herbaceous
Wetlands - Scrub/Shrub
Wetlands - Wooded - Deciduous
Delaware Valley Regional Planning Commission
March 2005
Miles
0
0.5
1
Source : NJDEP, 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.

Table 15: Harrison Township Natural Vegetation

Type of Vegetation	Acres	% of Total Land Area
Deciduous Forest	1,469.27	12.00%
Coniferous Forest	35.13	0.29%
Mixed Forest (>50% deciduous)	120.07	0.98%
Mixed Forest (>50% coniferous)	35.13	0.29%
Brushland/Shrubland	332.46	2.72%
Artificial Lakes	64.18	0.52%
Wetlands (deciduous wooded wetlands)	775.46	6.33%
Wetlands (mixed wooded wetlands)	16.89	0.14%
Wetlands (deciduous scrub/shrub wetlands)	122.93	1.00%
Wetlands (coniferous scrub/shrub wetlands)	0.91	0.01%
Wetlands (mixed scrub/shrub wetlands)	1.32	0.01%
Wetlands (herbaceous wetlands)	43.90	0.36%
Modified wetlands (agricultural wetlands)	72.77	0.59%
Modified wetlands (disturbed wetlands)	28.55	0.23%
Modified wetlands (former agricultural wetlands)	26.90	0.22%
Modified wetlands (managed wetland in maintained greenspace)	.30	0.00%
Total Vegetation Land Cover	3,146.17	25.69%

Source: NJDEP (1995/97 Land Cover)

Wetlands

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.

Nearly all wetlands in Harrison Township are found in association with major streams and their tributaries. Wetlands are dominant along the township's major waterways: Raccoon Creek's main branch, Raccoon Creek's South Branch, Little Clems Run, Clems Run, Edwards Run, and Rattling Run. Wetlands provide high-quality animal and plant habitat, purify the township's surface and ground waters, and create picturesque landscapes that add immeasurably to the quality of life for township residents. According to the Anderson Land Use Classification System, Harrison Township has three major types of wetlands: (1) wooded wetlands dominated by deciduous trees, (2) scrub/shrub wetlands dominated by deciduous woody plants, and (3) herbaceous wetlands.

Common throughout Harrison Township are deciduous wooded wetlands (sometimes referred to as forested wetlands). Deciduous wooded wetlands occupy about 792 acres (6.5 percent) of

Harrison's total land area and support mixed hardwoods that flourish in lowlands. Some common trees in Harrison's deciduous wooded wetlands are red maple, black tupelo, green ash, black willow, swamp white oak, willow oak, southern red oak, sweetgum, and American sycamore.

Source: Hunterdon County (NJ) Arboretum

Sweetgum seedpods

Closely associated with deciduous wooded wetlands are scrub/shrub wetlands, occupying less than 1 percent, about 125 acres, of Harrison. These wetlands are generally composed of young, medium-height, primarily deciduous woody plants. Harrison's scrub/shrub wetlands are composed of young saplings of red maple, box elder, and sweetgum, and dominated by shrub species like silky dogwood, red-osier dogwood, gray dogwood, meadowsweet, steeplebush, southern arrowhead, and hazel alder.

Large swaths of deciduous wooded and scrub/shrub wetlands, surrounded by protective upland forest, survive between residential developments along the Raccoon Creek's main and south branches. Wooded wetlands are also found to a lesser extent along Little Clems Run, and Clems Run. Almost no wetlands are found along Miery Run or Hill Branch. In the Mantua Creek Watershed, half of Edwards Run within the township and half of its tributary, Richwood Branch, are bordered by wooded wetlands. Rattling Run in the Repaupo watershed also has wetland forests along 50 percent of its length.

In Harrison, herbaceous wetlands are very rare, occupying only 44 acres, less than 1 percent of the township's land area. Herbaceous wetlands generally occur along lake edges, open floodplains, and former agricultural wetland fields. Herbaceous wetlands are found in close proximity to wooded wetlands along one of Harrison's major streams: the very western stretch of the main branch of Raccoon Creek running from the confluence of the main channel with an unnamed tributary to the north to the western border of the township. Herbaceous wetland plants include rice cutgrass, reed canary grass, pond lily, tearthumb, arrow-leafed tearthumb, broadleaf cattail, and the common reed (*Phragmites*).

Modified wetlands are areas that have been altered by human activities and do not support natural wetland vegetation, but which do show signs of soil saturation on aerial infrared surveys. Modified wetlands encompass agricultural wetlands, former agricultural wetlands, disturbed wetlands, and wetlands that occur in maintained greenspaces such as open lawns, golf courses, and storm water swales. In total, modified wetlands occupy just 128 acres or 1 percent of Harrison's total land area.

Upland Forests

Upland areas are those locations without water at or near the soil surface. Over 13 percent (1,660 acres) of Harrison is composed of upland forests, as of the 1995/97 land cover analysis by NJDEP. Most of Harrison's original upland forests have been cleared and converted to farms or residential or commercial development. Nearly all old growth forests were cleared for farmland during colonial times. The remaining upland forests are second, or third growth and tend to be located near stream corridors or are patchy woodlands on less desirable soils associated with large farms.

Upland forests are the third most abundant land cover type in Harrison, after pastureland and orchards. Approximately 1,660 acres (13.6 percent) of Harrison is upland forest, of which the great majority, 1,469 acres, is deciduous forest. The composition of Harrison's upland deciduous forests is largely one of mixed oaks – black, red, chestnut, Shumard and scarlet oaks – joined by other hardwoods such as paper birch, American beech, honey locust, hickory and sweetgum. The understory is dominated by flowering dogwood, black cherry, ironwood, and sassafras. Vines, such as Virginia creeper, wild grapes, Japanese honeysuckle, and poison ivy, are common. Spicebush, arrowwood, and black haw are common shrubs in moister locations.

Coniferous trees occur on about 35 acres (less than 1 percent) of Harrison. These forests are mostly made up of successional, or pioneer, plants like Virginia pine, scrub pine, and pitch pine, which will eventually be overgrown by dominant deciduous trees, such as ash, birch, oak, and hickory.

Grasslands and Agricultural Lands

NJDEP defines grassland habitat as brushland, shrubland or old fields that were cleared or disturbed at one time and then abandoned. Following abandonment, old fields are overgrown by perennial herbs and grasses. These pioneer plants remain the dominant species for 3 to 20 years time. Later, woody plants 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.

Nearly 3 percent (332 acres) of Harrison's land cover consists of brushland, shrubland or old fields. In Harrison, brushland is generally found adjacent to residential, commercial, and industrial development, while old fields occur more often near agricultural or wetland areas.

In addition to brushland and old fields, active agricultural cropland and pastureland is considered suitable "grassland" habitat for wildlife. That is, species that are grassland specialists will use agricultural cropland and pastureland as well as brushland and old fields. Agricultural cropland and pastureland is the single most abundant type of vegetative land cover in Harrison Township, accounting for about 32 percent (3,923 acres) of the township's land area in 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 categorizes these habitats into one of five groups according to their importance (five being the highest). Categories three through five include habitats throughout the state that possess two exceptional conditions: (1) a documented occurrence of one or more species on either the federal or the state threatened and endangered species lists, and (2) a sufficient amount of habitat type to sustain these species. These habitats are collectively known as "critical habitat." Categories one and two include habitats that either have a documented occurrence of a *species of special concern* in New Jersey or are habitat deemed suitable for species that are included on the state or federal threatened and endangered species lists but for which there are no documented occurrences or sightings. These habitats are labeled "suitable habitats."

The Landscape Project identifies both critical and suitable habitat in Harrison Township. 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 Harrison are primarily the result of habitat being either critical or suitable for rare bird species such as the Cooper's hawk, red-shouldered hawk, and vesper sparrow, or for endangered reptiles and amphibians such as bog turtle and tiger salamander. See **Map 16: Landscape Project Habitat Priorities**.

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

Category	Rank	ACRES	% of Total Habitat	% of All Harrison Land
Emergent Wetlands	Suitable Habitat (1)	127.36	1.59%	1.04%
Forested Wetlands	Suitable Habitat (1)	1,033.19	12.89%	8.44%
Upland Forest	Critical Habitat (5)	492.20	6.14%	4.02%
	Critical Habitat (4)	11.42	0.14%	0.09%
	Suitable Habitat (1)	395.27	4.93%	3.23%
Grassland	Critical Habitat (5)	712.74	8.89%	5.82%
	Critical Habitat (4)	1,653.16	20.62%	13.50%
	Suitable Habitat (1)	3,592.17	44.80%	29.34%
Total Habitat		**8,017.51**	**100.00%**	**65.49%**
Total Harrison Land		**12,241.85**		**100.00%**

Source: NJDEP

Landscape Project Data on Wetland Habitat

The Landscape Project divides wetland habitats into two types – forested and emergent wetlands. Emergent wetlands are marshy areas characterized by low-growing shrubs and herbaceous plants in standing water. About 127 acres (1 percent) in Harrison are identified as priority emergent wetlands habitat and are ranked at the suitable level. Animal species that can be found in these

wetland habitats include endangered turtles, rare fish, mollusks, crustaceans, and insects. Emergent wetlands are also important habitat for migratory waterfowl and passerines (smaller perching birds) such as migrating flycatchers and thrushes.

Source: Brian Horne

Wetlands may be found near man-made water features, like Stag Leap Pond

Harrison's forested wetlands are the second most common Landscape Project habitat type in the township, occupying 1,033 acres (8 percent of total land area). All are ranked as suitable habitat, rather than critical. Forested wetland habitat in Harrison is located along most stretches of Raccoon Creek's north and south branches. Forested wetlands support species such as migratory and nesting warblers, many of which are species of special concern. They can also be home to various rare amphibians (frogs and salamanders).

Landscape Project Data on Upland Forest Habitat

The Landscape Project ranks 7 percent (899 acres) of Harrison's total land cover as suitable or critical upland forest habitat. Over 500 acres (4.1 percent of total land area) are ranked as critical upland habitat and found associated with the main channel and tributaries of Raccoon Creek. An especially large concentration of critical upland forest habitat is found in the southwestern part of the township along Raccoon Creek South Branch and near preserved farmland. Suitable upland forest habitat can be found along both sides of Cedar Road spreading north to Edwards Run. This is habitat for Cooper's hawk nesting and hunting.

Landscape Project Data on Grassland Habitat

The Landscape Project designates nearly half the township as suitable or critical grassland habitat. The designated habitat lies between the branches of the Raccoon Creek and the encroaching human development. Approximately 2,366 acres of farmland (19 percent of total land area) are ranked as critical grassland-species habitat. These areas are found in the northwestern corner bordering East Greenwich Township and in the southeastern corner, encompassing nearly all of Richwood south of Route 322 and west of Route 55. Grassland-dependent species are the most threatened group of species in New Jersey,

Source: DVRPC

Fallow farmland on Tomlin Station Road provides habitat to grassland bird species

primarily because the most common form of grassland habitat, agricultural fields, is the most threatened habitat in the state due to development pressure and rising land values. Unfortunately, much of the critical grassland habitat in Harrison has been displaced by residential development. In Richwood, much of the critical grassland habitat is slated for commercial development.

Nearly all of Harrison's agricultural land is designated as critical or suitable grassland habitat because of some of the following reasons: (1) migrating birds cannot visually distinguish cropland from grassland; (2) cropland turns into grassland when it is fallow for one year or more; (3) some crops, like alfalfa and soybeans provide suitable nesting habitat for some birds, especially for sparrows; and (4) all or most of Endangered and Threatened birds are area-sensitive, requiring large ranges that include agricultural "grasslands." The Landscape Project includes this land in its assessment because agricultural lands provide important disturbance buffers between the rare and endangered wildlife species and humans, and between the rare species and widespread predatory animals like dogs and cats.

Examples of grassland-dependent species that use grassland habitat for nesting or feeding include the grasshopper sparrow, vesper sparrow, and some species of butterflies and moths. Harrison's designated grasslands provide habitat for these species and others such as the Eastern meadowlark and the bobolink that rely on agricultural lands, as well as for bog turtles that breed in wet areas found in agricultural fields.

ANIMAL COMMUNITIES

Although no comprehensive inventory of the different animal species within New Jersey, Gloucester County, or Harrison Township exists, there are records of sightings, biological studies of range, and assessment of endangered and threatened status. Using federal, state, and other scientific sources, it is possible to identify and describe known and possible animal communities of Harrison 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. Invertebrates consist of insects (beetles, butterflies, moths, dragonflies, ants, termites, bees, wasps, flies, and others), arachnids (spiders, ticks and mites), crustaceans (crayfish, microscopic copepods), mollusks (mussels, clams, snails, and slugs), and worms.

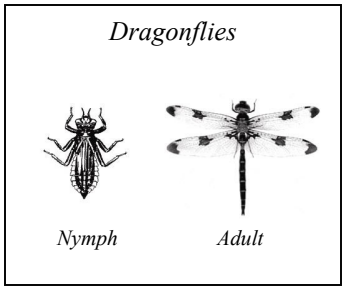


Figure 7: The Dragonfly Nymph – a Common Macroinvertebrate found in southern New Jersey's waterways

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. These communities consist largely of the juvenile stages of many insects, such as dragonflies and mayflies, as well as mollusks, crustaceans, and worms. Monitoring for diverse assemblages 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 (page 37).

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 freshwater mussels. At one time freshwater mussels were abundant in the streams of the area and were a major food source for native peoples. Parts of Raccoon Creek provided suitable mussel habitat. Unfortunately, due to destruction of suitable aquatic habitats by dams and pollution, the native mussel population has sharply declined, although they are still present in the Raccoon Creek. 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 Harrison'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 as threatened by the state. Some common mammals found in Harrison Township include cottontail rabbits, eastern gray squirrels, skunks, little brown bats, raccoons, and white-tailed deer.

Management of white-tailed deer is an issue in New Jersey. While many residents prize the presence of mammalian life, deer often come into conflict with humans in suburban areas. According to the US Department of Agriculture, deer cause more damage to agricultural crops than any other vertebrate wildlife species. Farmers in densely human-populated areas appear to be the most affected. Additionally, deer can devastate the understory of forests through overgrazing, destroying the growth of seedlings and young trees. Finally, as most motorists are aware, collisions between deer and automobiles frequently result in serious damage.

Controlling deer numbers has become increasingly difficult in New Jersey, primarily because suburban landscaping provides year-round food, which supports population growth; and because the principal method of culling the population – hunting – is not feasible in suburban environments.

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 sharp shooting, and employ traps and euthanasia to reduce deer numbers. Alternatively, communities and private landowners can choose to apply nonlethal, although more costly, 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.

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 for the winter. Not only is the state an important "rest stop" for birds migrating to warmer climates in Central and South America, but also the New Jersey Atlantic Coast and the Delaware Bay are major parts of the Eastern Flyway (established migratory air route) in North America.

Common birds in Harrison Township and Gloucester County are geese, ducks, vultures, woodpeckers, doves, swallows, crows, grackles, jays, robins, starlings, wrens, cardinals, finches, sparrows, and some hawks. Wild Turkeys are becoming increasingly common in the township. The red-shouldered hawk, an endangered bird species; the Cooper's hawk, a threatened bird species; and other rare and endangered species have been sighted in the township. According to the Landscape Project, Harrison contains suitable habitat for a variety of predatory birds including hawks, falcons, and eagles.

Source: Scott VanEtten

Hummingbirds can be found in Harrison Township

Another common bird is the Canada goose. The State of New Jersey 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. Therefore a

management program may 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 well documented in Harrison. 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 Pools section of this document (page 33). In Harrison, the eastern tiger salamander, coastal plain milk snake, and eastern box turtle, which are an endangered, threatened, and species of special concern, respectively, have also been sighted.

Fishes

When European settlers arrived in present-day Gloucester County, they encountered Native Americans who regularly fished along the inland streams and gathered shellfish 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, Harrison's freshwater streams have been documented as containing the following fish: sunfish, blue gill, pickerel, pumpkinseed, Eastern mudminnow, common shiner, largemouth bass, perch, darter, and the American eel.

An additional 20 fish species are documented for Harrison in the "Annotated Checklist and Distribution of New Jersey Freshwater Fishes…" by Rudolf G. Arndt (see Sources of Information). Both sets of records are included in the list of fish in Appendix A: *Vertebrate Animals Known or Probable in Harrison Township*.

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, or 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 Gloucester County: American eel, Striped bass, Hybrid striped bass, Channel catfish, White catfish, Bluegill sunfish, Brown bullhead, Largemouth bass, Common carp, Black crappie, Chain pickerel, Pumpkinseed sunfish, and Yellow perch. Recreational fishermen and women should regularly check for local fish advisories on NJDEP's Division of Science, Research and Technology web site: http://www.state.nj.us/dep/dsr/njmainfish.htm/.

Endangered Vertebrates

According to the Natural Heritage Database and the Landscape Project, a significant number of rare wildlife has been sighted in Harrison Township over the course of the past 100 years. Brief descriptions of a few such species and their preferred habitat, provided by the New Jersey Fish and Wildlife Service, follow.

The red-shouldered hawk (*Bueto lineatus*) is a soaring hawk about as big as a crow. The hawk requires mature wet woods such as riparian forests for breeding and mixed woodlands near old growth forests containing standing water for nesting. Red-shouldered hawks prefer a closed canopy of tall trees with an open sub-canopy and variable amounts of understory shrubs and seedlings. In southern New Jersey, these hawks are found in vast and contiguous freshwater wetlands, especially hardwood or mixed wood/cedar swamps containing maple, black gum, Sassafras, magnolia, and Atlantic white cedar. In Harrison, agricultural fields or low-density residential tracts usually surround these areas. The red-shouldered hawk avoids nesting near residences, roads, and development. Habitat loss and declines in population in the Northeast have resulted in the listing of this species as endangered in New Jersey, threatened in New York, and of special concern in Connecticut.

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 turtle 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 numbers of bog turtles in the nation are 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 and 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 Eastern tiger salamander (*Ambystoma tigrinum*) is an endangered species in New Jersey. There are many subspecies of tiger salamanders in North America. Agricultural practices and urban development threaten populations and many states have put this salamander on state endangered species lists. Tiger salamanders require both upland and wetland habitat that features suitable

ponds for breeding, forests for foraging, and soils for burrowing. Suitable breeding ponds are those that contain water long enough for the breeding season but dry up by the late summer, thus preventing the establishment of predatory fish populations. After the breeding season, Eastern tiger salamanders occupy old fields and deciduous forests. These upland habitats typically have sandy and gravelly soils that allow the salamanders to burrow easily.

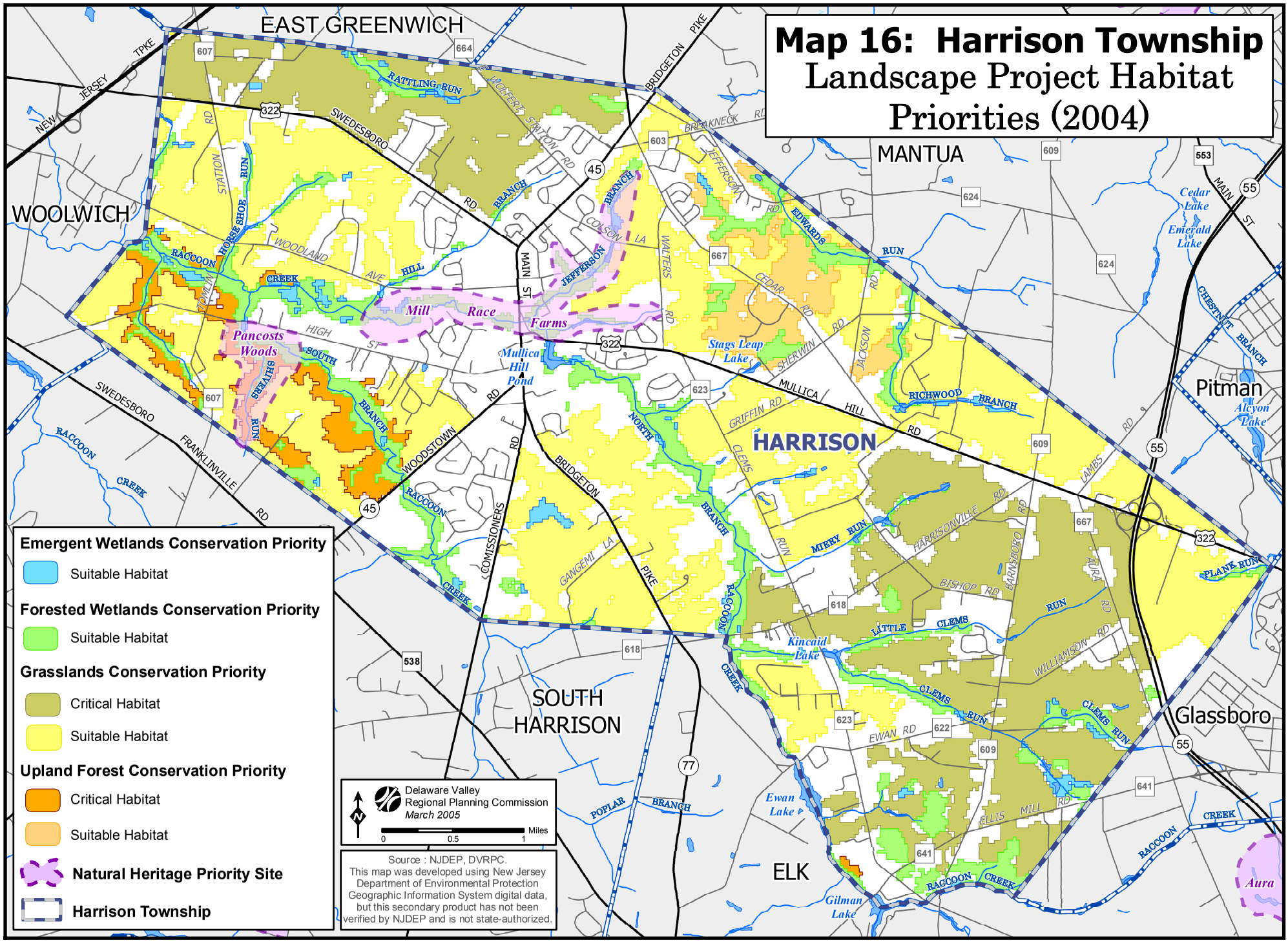
The vesper sparrow (*Pooecetes gramineus*) is an endangered species in New Jersey. The vesper sparrow prefers open habitats, such as cultivated fields, grasslands, old fields, and pastures. This species will, ideally, nest in an old field or fence-row adjacent to a cultivated area. Nests are found in herbaceous land cover that provides protection from predators and humans. The vesper sparrow was once a common summer bird in New Jersey. Due to their dependence on habitats created by farming, vesper sparrow populations started to decline in the 1950s as farm fields were replaced by residential development. In 1979, the bird was listed as threatened on the state list, and upgraded to endangered in 1984. It is also listed as endangered in Connecticut and Rhode Island, threatened in Massachusetts, and of special concern in New York.

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 the nest more than a third of a mile away from the nearest human inhabitant. While other raptor species were threatened due to hunting practices, 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 Harrison Township*.
See **Appendix B** for a list of *State Endangered and Threatened Species*.
See **Appendix C** for a list of *Rare Plant and Animal Species and Natural Communities Presently Recorded in the NJ Natural Heritage Database for Harrison Township*.

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 exemplary natural communities within the state that are critically important habitats for rare species. Preserving these areas is a top priority for efforts to conserve biological diversity in New Jersey.


Map 16: Harrison Township
Landscape Project Habitat Priorities (2004)
EAST GREENWICH
WOOLWICH
MANTUA
HARRISON
SOUTH HARRISON
ELK
Pitman
Glassboro
Mill Race Farms
Pancosts Woods
Mullica Hill Pond
Stags Leap Lake
Cedar Lake
Emerald Lake
Alcyon Lake
Kincaid Lake
Ewan Lake
Gilman Lake
Aura
Emergent Wetlands Conservation Priority
Suitable Habitat
Forested Wetlands Conservation Priority
Suitable Habitat
Grasslands Conservation Priority
Critical Habitat
Suitable Habitat
Upland Forest Conservation Priority
Critical Habitat
Suitable Habitat
Natural Heritage Priority Site
Harrison Township
Delaware Valley Regional Planning Commission
March 2005
Miles
0 0.5 1
Source : NJDEP, 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.

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 a site's high biological diversity value. 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, and especially through the latter agency's Landscape Project.

Harrison Township has within its borders 2 of only 410 NHP sites in New Jersey: (1) the **Mill Race Farms NHP Site** and (2) the **Pancosts Woods NHP Site**. The **Mill Race Farms NHP Site** is located along the Raccoon Creek's main branch in the center of the township adjacent to Mullica Hill Pond. The site's delineation extends to the north along the Jefferson Branch and east along another unnamed tributary which has its headwaters adjacent to Walters Road. It is a rich wooded ravine, containing habitat for one state-listed endangered animal species. The **Mill Race Farms NHP Site** has a biodiversity rating of B4, meaning the area is of moderate significance either because it is a possible site of a globally rare species *or* a state imperiled species was documented on the site.

The **Pancosts Woods NHP Site** is a wooded ravine located along a small stretch of Raccoon Creek's South Branch, bordering South Harrison Township. The site contains the headwaters of Shivers Run and is all woodlands within the ravine. The surrounding agricultural fields limit this site's boundaries. The site contains a state-listed endangered plant species and is the historical location for several other state endangered and special concern plant species. It has a biodiversity rating of B4, meaning the area is of moderate significance either because it is a possible site of a globally rare species or a state imperiled species was documented on the site. See **Map 16: Landscape Project Habitat Priorities** for the location of the NHP sites.

THE BUILT ENVIRONMENT

POPULATION

The 1990 US Census listed a population of 4,715 residents for Harrison Township. By the 2000 Census, this had grown to 8,788, which was a growth of 86 percent over the 1990 figures. DVRPC projections forecast 9,810 residents for Harrison Township by 2005 and 11,060 by 2010.

The majority (84 percent) of Harrison's population lives in single-family homes in the historic village of Mullica Hill, in numerous subdivision developments such as Country Manor, Bishop Lane, and Willowbrook Farm, all built between 1990 and the present, or scattered on individual lots throughout the active farming areas. According to US Census data, Harrison experienced an explosive residential housing boom between 1990 and 2000, as over 1,200 housing units were built, increasing the number of housing units by 70 percent. This trend is continuing as the Harrison Planning Board approved an additional 1,425 single-family homes in major subdivisions between 2000 and 2004 and continues to have applications coming in for review.

According to the 2000 Census, 2,922 residents are under the age of 18, which is over 32 percent of Harrison's total population. Of those residents 2,165 are children between the ages of 5 and 18. This age group represents those residents who are most physically active in the community and most likely to use public recreational facilities.

TRANSPORTATION

Harrison Township is relatively accessible compared to other parts of rural southern New Jersey. County roads may once have been dirt paths created by Native Americans, which became rural farming roads, and now serve as major traffic thoroughfares in the township. Bridgeton Pike was originally the Cohawkin Trail, a Native American trail that followed the high ridge along Raccoon Creek through Harrison. Portions of the colonial road still exist on the Gloucester County 4-H fairgrounds. Harrison's early economic development was a function of its accessible transportation routes, which utilized several significant modes to transport food products, shifting from 19th century rail lines to the 20th century's modern highways.

The modern transportation corridors that serve Harrison have also fostered much of its past and current state of development. In 1951 the state completed the New Jersey Turnpike. Although the turnpike crosses through Woolwich Township to the west of Harrison, it serves as a significant transportation artery for the entire region. Exit 2 of the Turnpike is within ¾ miles of Harrison's western border. State Route 55, which crosses Harrison on the east, was constructed between 1965 and 1989 and has dramatically increased the speed with which Harrison's residents can access the more built-up sections of the Philadelphia metropolitan region. Route 55 has one exit in Harrison Township on U.S. Route 322 leading to Glassboro (and Rowan University) to the east and Mullica Hill and Richwood to the west. State Route 45 (known as

Bridgeton Pike to the north of Mullica Hill and Woodstown Road to the south) is also a significant north-south road, bisecting Harrison's developed areas and connecting those cities historically central to agriculture and commerce in Gloucester and Salem counties, including Woodbury, Mantua, Woodstown, and the City of Salem. State Route 77 (Bridgeton Pike) starts in Mullica Hill, traverses through Salem County, and terminates in Bridgeton, Cumberland County.

U.S. Route 322 is the main (and often congested) thoroughfare in Harrison Township. It connects on the west with the New Jersey Turnpike, then with Interstate 295 (in Logan Township), and finally with the Commodore Barry Bridge over the Delaware River to Pennsylvania and Interstate 95. To the east it meets Route 55, and then bends through Glassboro on its way to Williamstown and on to Atlantic City. Harrison is thus at the center of important traffic flows. After Pennsylvania's I-476 extension was completed in the mid-1990s, traffic tripled on Route 322 as Pennsylvania residents utilized this linkage to Route 55 and shore towns on the southern New Jersey coast while New Jersey residents now have access to Philadelphia's western suburbs and their commercial and office centers via the Commodore Barry Bridge.

Source: DVRPC
Traffic on Route 322 makes access to Mullica Hill Pond difficult

Throughout the last century, government agencies explored the possibility of expanding U.S. Route 322 into a freeway or turnpike spur. Each time, plans were abandoned because of the local community's protest over eminent domain procedures. With increased residential development along Route 322 in Harrison, the opportunity to restructure and revision the road as an east-west freeway has disappeared. Within Harrison, farmers originally used Route 322 to travel between different farming properties. Now, farming along Route 322, especially in soil-rich Richwood, is severely affected by the traffic density.

County roads within the township include routes 581, 603, 607, 609, 618, 622, 623, 641, 664, and 667. These provide access and connections within the township and are remnants of past land uses that connected farming centers of activity. The majority of them run through or toward Richwood, Ewan, Jefferson, and Mullica Hill. In many cases, these formerly rural routes struggle to handle the increasing volumes of traffic associated with the township's suburban growth. Smaller roads in the township are a mixture of old rural lanes and newer subdivision thoroughfares.

HISTORIC RESOURCES

Protection and preservation of historic structures, lands, and views are of high importance to Harrison Township residents. The township has two sites – Butler Farm and Richwood Methodist Church – and one area – the Mullica Hill Historic District – on both the National and

State Registers of Historic Places. Three additional sites are on the New Jersey Register of Historic Places and one other site was issued a State Historic Preservation Office (SHPO) Opinion, which reviews a site's eligibility for inclusion on the State Register of historic places.[8] Nearly 250 other sites may have the potential to be listed as local, state or national landmarks, but have not been nominated by local citizens or identified by SHPO for such a designation. The township boasts numerous 18th and 19th century structures, including large farmsteads and charming storefronts, most of which are in Mullica Hill, but others are scattered throughout the township in Jefferson, Ewan, Richwood, and Lake Gilman.

See **Map 17: Historical and Cultural Resources** on page 74 and *Table 17: Sites listed on the National & State Registers of Historic Places* for sites currently listed on the National and State Registers. See **Appendix D** for a *Partial Inventory of Locally Significant Historic Sites in Harrison Township,* detailing the locations of sites outside the Mullica Hill Historic District that possibly warrant additional protection or are eligible for nomination to the National and State registers.

Table 17: Sites Listed on the National & State Registers of Historic Places

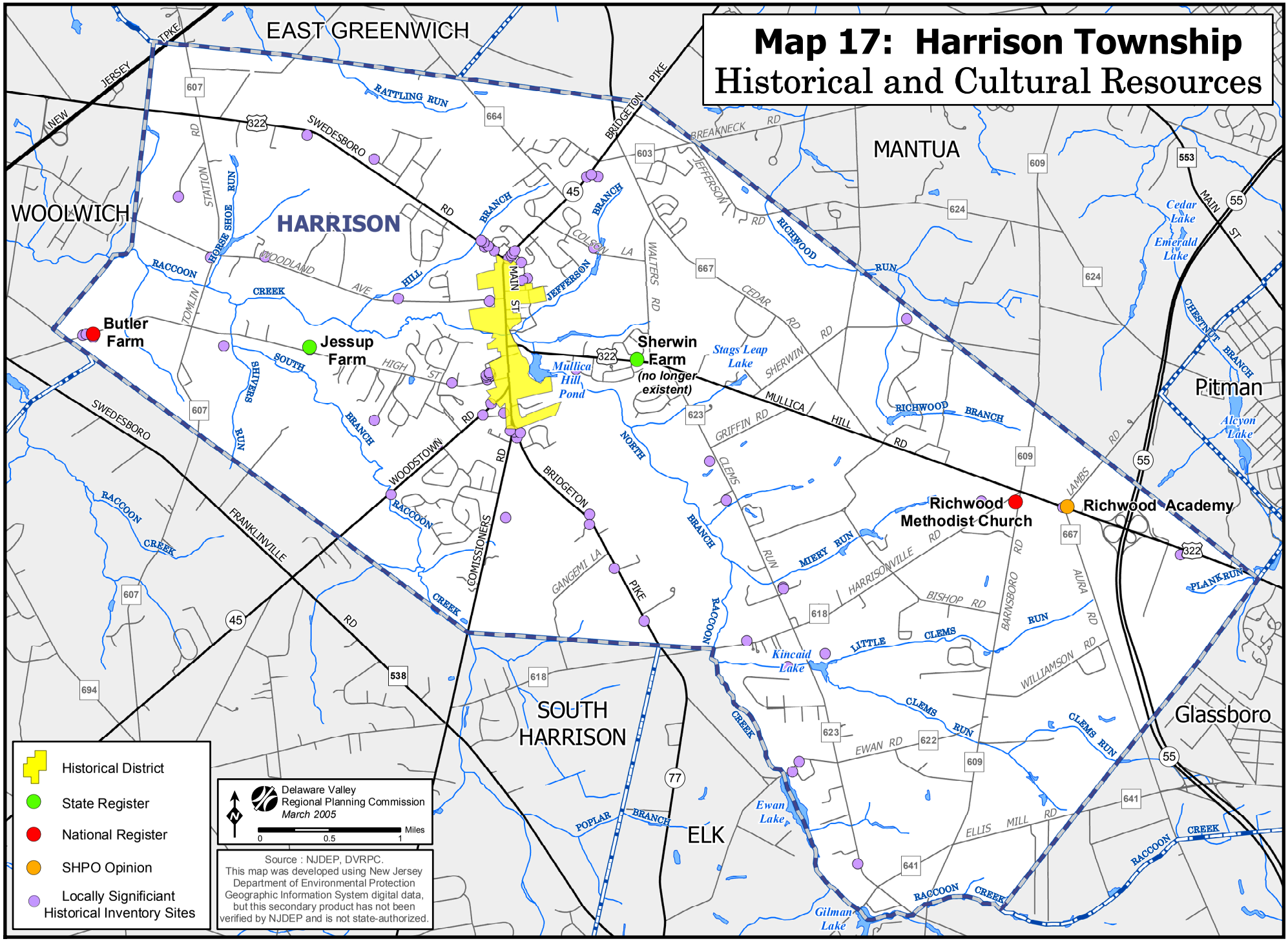
Name	Location	Register	State ID#
Butler Farm	High Street	National & State	1386
Jessup Farm	High Street	State	1388
Mullica Hill Historic District	East Ave, Woodstown Road, Church, High, Main Mill, New and Union streets	National & State	1389
Richwood Methodist Church	Elmer Road	National & State	1390
Richwood Academy	Corner of Lambs Road and US Route 322	State Historic Preservation Office Opinion	Opinion Number 3164
Sherwin Farm (no longer existent)	US Route 322	State	1391

Source: New Jersey State Historic Preservation Office

The Harrison Township Historical Society serves the township and collects and holds information on the community's historic resources. The Harrison Historic Preservation Commission oversees the Mullica Hill Historic District, which was nominated for inclusion on the national and state registers in 1991. The Historic District contains portions of the following streets: East Avenue, Woodstown Road, Church Street, High Street, Main Street, Mill Street, New Street, and Union Street. To support and sustain the historical, cultural, architectural, and social heritage of Harrison Township, the Historic Commission regulates façade and structural changes to buildings within the Mullica Hill Historic District and advises property owners on those buildings' architectural and historical significance. According to Township Ordinance 14-1992, property owners are required to obtain a Certificate of Appropriateness from the Historic

[8] Filing an Environmental Impact Statement (EIS) usually prompts the issuance of a SHPO Opinion. The use of federal funding for a project often triggers the required to perform an EIS, which may result in NJDEP recognizing possible threats to certain historic sites and identifying those sites as eligible for listing in the State Register of historic places.

Map 17: Harrison Township
Historical and Cultural Resources



Commission for any exterior work visible from a street on a building within the historic district. These regulations acknowledge the existence of particular historic assets in the township's oldest settlement – Mullica Hill, but Harrison has numerous other historic and cultural assets not protected by the Historic District Ordinance.

Aside from local ordinances regulating the appearance of historic structures, Harrison Township is also become a Certified Local Government (CLG), which makes federal and state funding available for program implementation and rehabilitation. It is the only municipality in Gloucester County that is designated a CLG. Jointly administered by the National Park Service and the SHPO, the CLG program provides technical assistance and funding to community-based preservation efforts. To participate, a municipality must maintain a historic preservation commission, survey local historic properties, provide opportunities for public participation in preservation activities, and develop and enforce local preservation laws.

There are also federal incentives for individuals, organizations, or firms who own historic properties and are interested in historic preservation. Interested parties can take advantage of the

Source: DVRPC

Mullica Hill Friends Meeting House and Cemetery

Rehabilitation Investment Tax Credit, a federal tax incentive to encourage the preservation and reuse of older income-producing properties, including offices, apartment buildings and retail stores.

Investing in historic preservation efforts can provide a municipality with important and impressive returns, and Harrison Township is a prime example. Private and public efforts in the Mullica Hill Historic District have created an attractive place to live, work and play and

stimulated new investment in the historic village. Historic Mullica Hill is a regional draw for antique collectors and tourists. Furthermore, historic preservation maintains Harrison Township's character, distinctly separating it from other rural and suburban communities.

TOWNSHIP UTILITIES AND SERVICES

Drinking Water

Residences in the more developed sections of Harrison, including Mullica Hill, are supplied with public drinking water by South Jersey Water Supply. Drinking water is derived primarily from public supply wells drilled into the PRM aquifer (see **Aquifers**, page 48) but is supplemented with water purchased from New Jersey American. Newer residential developments along Route 322, including Willowbrook Farm, Cider Press Estates, and Turtle Creek are also served with public water. Township residents that live in less developed areas, including southern and western Harrison, rely on private wells. As new development projects spread out into Harrison Township, especially in Richwood, part of which is included in the sewer service area, older properties on private wells and septic systems may be required to connect to public sewer and water.

Public drinking-water wells, owned and operated by South Jersey Water Supply, are listed in **Table 14** on *page 53*. **Map 13: Water Supply Wells** on *page 52* shows the location of public community water supply wells. These wells provide 100 percent of Harrison's public drinking water supply. In September of 2005, South Jersey Water Supply plans to connect to New Jersey-American Water Company's tri-county pipeline, which intakes Delaware River water through its treatment plant in Delran, Burlington County, and distributes water to places like Evesham, Mount Laurel, Camden City, Cherry Hill, and Deptford. The tri-county pipeline will help South Jersey Water Supply meet the needs of Harrison's increasing population, although at substantially higher cost. Currently, South Jersey maintains 2,133 service connections serving approximately 6,000 people (over 65 percent of the population) with public drinking water.

Sewer

As with public water, sewer service is provided to the more developed sections of Harrison, including Mullica Hill and newer developments like Willowbrook Farm along Route 45. The central part of Harrison Township and the area surrounding the Route 55 interchange in the eastern corner of the township are approved for sewer service, meaning residents in other areas, which are increasingly residential, will be responsible for their own private septic service. All public sewage treatment is provided through the Harrison Township Wastewater Treatment Plant, located on Woodland Avenue, which discharges to the main branch of the Raccoon Creek. There are future plans for a Richwood Wastewater Treatment Plant that would serve the approximately 1,000 acres near Route 55. The Gloucester County Utilities Authority (GCUA) does not serve any part of Harrison Township. The Harrison Wastewater Treatment Plant serves approximately 6,000 people.

See **Map 12: Approved Sewer Service Areas** for the location of the currently approved sewer service areas.

Township Services

Trash and Recycling

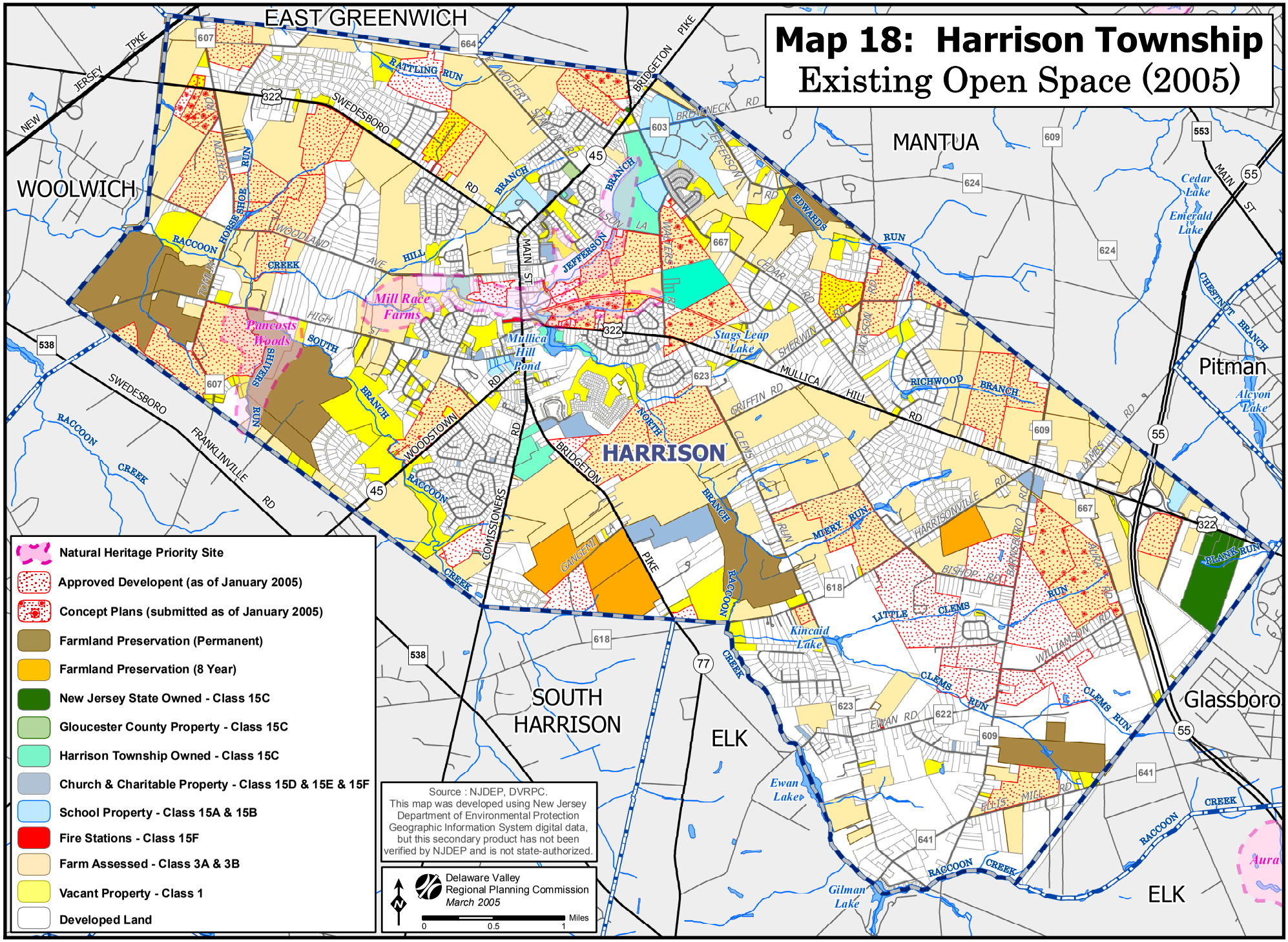
In Harrison Township, trash and recycling, including vegetation (grass, brush and leaves), are picked up on a weekly basis. Grass and leaves must be placed in Township Vegetative Recycling Bags, which residents must purchase. The township accepts commingled glass, metal cans and plastics (numbers 1 and 2 only) as well as mixed paper (newsprint, magazines, envelopes, letters, cereal boxes, telephone books and corrugated cardboard). Other items such as wood, carpeting, and furniture are collected curbside. Metal appliances, motor oil, oil filters, antifreeze, and empty propane tanks may be brought to the Township Recycling Center.

Education

Harrison Township has two public elementary schools – Harrison Township Elementary School and Pleasant Valley Elementary School. Harrison Township Elementary educates approximately 800 children in grades K through 3. Pleasant Valley educates 640 township children in grades 4 through 6. After finishing elementary school, Harrison Township students attend the Clearview Regional Middle and High Schools located in Harrison Township. Clearview serves over 2,000 students from Harrison and Mantua townships. In 2002, citizens in the Clearview School District approved a $39 million expansion and renovation proposal for the school complex, financed by a $24 million bond. Harrison Township is also home to the Friends School of Mullica Hill, a private school serving K through 8th grades, which is located on High Street.

Source: DVRPC
Pleasant Valley Middle School serves students from both Harrison and Mantua townships

Map 18: Harrison Township
Existing Open Space (2005)



Parks and Recreation

Harrison's Public Works Department maintains the township's recreational facilities and administers related recreation activities. The Recreation Commission enhances the Department's efforts by sponsoring community events throughout the year including Harrison Township Day, an annual Easter Egg Hunt and summer recreation programs.

The Ella Harris Recreation Park was until recently the principal recreation facility in the township. It is located on Bridgeton Pike and was under heavy and increasing use. In 2004 Harrison Township purchased a 47-acre site on Walters Road for recreational use and quickly established playing fields on it. The township also owns Mullica Hill Pond, which provides fishing opportunities but does not have easy access or a pier or dock. The Gloucester County 4-H organization owns fairgrounds in the township along Route 77 at which the 4-H Fair and New Jersey Peach Festival are held annually. The fairgrounds are used throughout the year by 4-H members and especially for numerous horse shows and competitions.

Source: DVRPC

Gloucester County 4-H Fairgrounds located on Bridgeton Pike

In 1999, Harrison Township residents approved a referendum to initiate a one-cent property tax dedicated to open space acquisition and preservation. At the same time, a one-cent property tax dedicated to farmland preservation was approved. The farmland tax was reauthorized and increased to 5 cents in a 2004 referendum and is expected to generate over $300,000 annually.

See **Map 18: Existing Open Space 2003**, which is included in this document for easy reference. For additional details on Harrison's open space and recreation needs and plans, see the *Open Space & Recreation Plan for the Township of Harrison.*

ENVIRONMENTAL ISSUES

KNOWN CONTAMINATED SITES

There are 296 contaminated sites in Gloucester County. Seven of these sites are located in Harrison Township. There are also two sites in Pitman Borough, two in Glassboro Borough and two in Mantua Township that are close to Harrison's borders. See *Table 19: Known Contaminated Sites in Harrison Township & Region*. See also **Map 19: 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, can be listed as Superfund sites, which make them eligible for federal cleanup funds. Other sites are handled by state or individual programs, or through private funds.

Twenty-nine hazardous waste sites in Gloucester County have been nominated for the National Priority List. Eleven of these sites are currently on the National Priority List, meaning they pose a major human health hazard and are in need of federal funds for cleanup. These sites are more commonly referred to as Superfund sites. One site in Harrison, the Henry Harris Landfill, was nominated for the National Priority List, but after an assessment period, was deemed not to be a major human health hazard. New Jersey's Bureau of Field Operations, Case Assessment section is currently evaluating the site to determine future remediation actions.

Adjacent to Harrison Township is the Lipari Landfill, another Superfund site, in Mantua Township. Although it is not in Harrison Township, its operation contaminated the groundwater in Mantua and Pitman. Lipari Landfill was one of the first Superfund sites and a nationwide example of successful remediation and reuse.

Underground Storage Tanks

There are a few commercial sites with underground storage tanks that have leaked to paving or to soil but which are not yet on the Known Contaminated Sites list. They are listed in *Table 18: Underground Storage Tanks in Harrison Township.* There may also be private residences in Mantua Township that still have underground storage tanks, used primarily to hold home heating oil. As these tanks age and rust they often begin to leak, which becomes a serious threat to the groundwater below them.

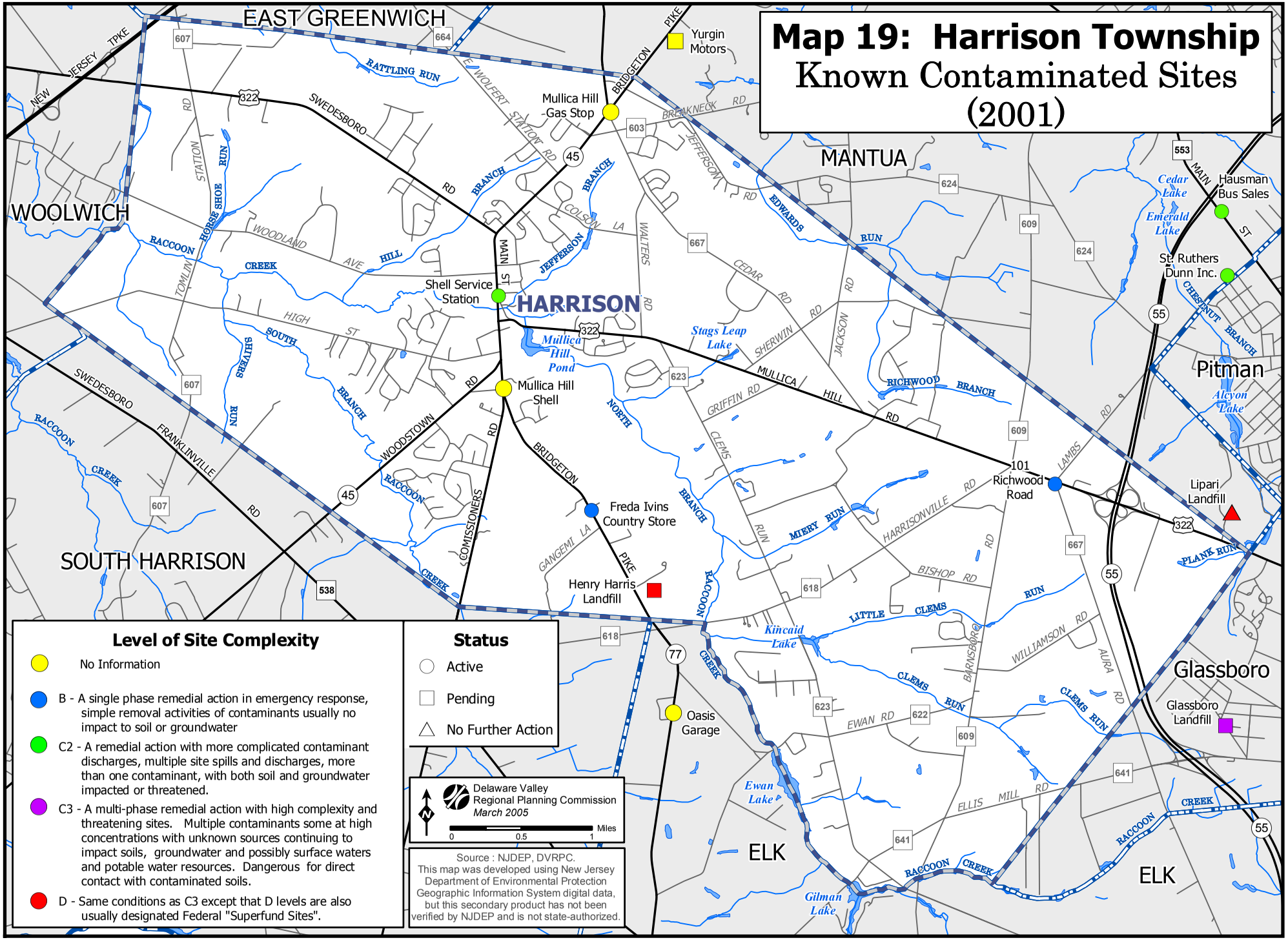

Map 19: Harrison Township
Known Contaminated Sites
(2001)
EAST GREENWICH
WOOLWICH
MANTUA
HARRISON
SOUTH HARRISON
ELK
Pitman
Glassboro
Yurgin Motors
Mullica Hill -Gas Stop
Shell Service Station
Mullica Hill Shell
Freda Ivins Country Store
Henry Harris Landfill
Oasis Garage
101 Richwood Road
Hausman Bus Sales
St. Ruthers Dunn Inc.
Lipari Landfill
Glassboro Landfill
Mullica Hill Pond
Stags Leap Lake
Kincaid Lake
Ewan Lake
Gilman Lake
Cedar Lake
Emerald Lake
Alcyon Lake
Level of Site Complexity
No Information
B - A single phase remedial action in emergency response, simple removal activities of contaminants usually no impact to soil or groundwater
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 multi-phase 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".
Status
Active
Pending
No Further Action
Delaware Valley Regional Planning Commission
March 2005
Miles
0 0.5 1
Source : NJDEP, 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.

Table 18: Underground Storage Tanks in Harrison Township

Case ID	Tank Number	Name	Address	Town	Status	Lead Agency	Remedial Level*
91-06-07-0933		Kincaid Builders	389 Bishop Road	Harrison	Active	BFO-IN	
	323516	Harrison Township Wastewater Treatment Plant	Woodland Avenue	Harrison	NFA-A	BFO-IN	B
95-06-05-1537-23	124003	Harrison Administration Building	110 Main Street South	Harrison	NFA-A	BUST	C1

Source: NJDEP

Table 19: Known Contaminated Sites in Harrison Township & Region

Site ID	Name	Address	Town	Status	Lead Agency*	Remedial Level*
NJL600224414	Mullica Hill Shell	Route 77 and 581	Harrison	Active	BUST	
NJL800488025	Oasis Garage	Route 77	Harrison	Active	BUST	B
NJL800522369	Mullica Hill Gas Stop	Route 45 and Cedar Road	Harrison	Active	BUST	
NJL800589772	Private Residences	Richwood Road	Harrison	Active	BUST	B
NJD980505226	Henry Harris Landfill	Bridgeton Pike	Harrison	Pending	BFO-CA	D, but not a Superfund site or major hazard
NJD986594034	Shell Service Station	W. Main and Union Sts	Harrison	Active	BUST	C2
NJL800618977	Freda Ivins Country Store	Route 77	Elk	Active	BUST	
NJL800478455	Lews Auto Service	High and Main Streets	Glassboro	Active	BUST	C2
NJL900000555	Glassboro Borough Landfill	Kentucky Avenue	Glassboro	Pending	BFO-CA	C3
NJD980505416	Lipari Landfill	Route 322	Mantua	NFA-A	BC	D
NJD982790966	Yurgin Motors	Route 45	Mantua	Pending	BFO-CA	NA
NJD002349751	Struthers Dunn Incorporated	568 Lambs Road	Pitman	Active	BFO-S	C2
NJL800069940	Hausman Bus Sales	North Broadway	Pitman	Active	BFO-S	C2

Source: NJDEP

* See table below for explanations of Status, Lead Agencies, and Remedial Level

Explanation of Codes

Code	Status	Lead Agencies
NFA–A	No further action for a partial area of a site	
BFO		Bureau of Field Operations
BFO-CA		Bur. of Field Operations – Case Assignment Section
BFO-IN		Bur. of Field Operations – Initial Notice Section
BFO-S		Bur. of Field Operations – Southern
BUST		Bur. 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."
NA	Not assessed

RADON

Radon is a radioactive gas that comes from the natural decay of uranium found in nearly all soils. It is invisible, odorless, and tasteless. It moves up through the ground to the air above, and into all types of homes through cracks and other holes in foundations. A build-up of radon-contaminated air within a home can pose a long-term health hazard to residents, specifically for lung cancer. The only method of detection is to conduct a test of the air within a home. Fortunately, radon testing is inexpensive.

If radon levels are high in a home, NJDEP suggests that the homeowner take the following actions: (1) prevent radon from entering the house by repairing cracks and insulation; and (2) dilute radon concentrations currently in the house.

NJDEP classifies townships into three categories as to the risk of having high radon levels. Harrison Township is listed as a Tier 1 municipality with high risk of having high radon levels in homes. Tier 3 is the lowest level. NJDEP estimates that the average radon level found in a Harrison home is 3.59 picocuries per liter in air. The level at which homeowners should take immediate action is 4.0 picocuries per liter in air. Harrison Township makes available informational videotapes for residents, obtainable at the Municipal Clerk's office.

SOURCES OF INFORMATION

SECTION 1: INTRODUCTION

The New Jersey State Development and Redevelopment Plan. New Jersey State Planning Commission. Adopted March 1, 2001.

Harrison Township. *Master Plan*, prepared by Remington & Vernick Engineers, adopted September 1999 (with updates through September 2004).

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To learn more about a contaminated site, contact one of the lead agencies overseeing the case or visit the web site: <http://www.state.nj.us/dep/srp/>. Site Remediation and Waste Management, formerly known as the Site Remediation Program, is a program unit within NJDEP that provides financial aid and technical guidance in cleaning up the state's more serious contaminated sites that pose a danger to human health and the environment. SRWM maintains an inventory of 38,000 sites, of which 25,000 require no further remediation action. The bureaus within SRWM are listed below for easy reference:

Bureau	Acronym	Telephone No.	Bureau	Acronym	Telephone No.
Case Management	BCM	(609) 633-1455	Field Operation - Case Assignment Section	BFO-CA	(609) 292-2943
Construction	BC	(609) 984-2991	Field Operations - Initial Notice	BFO-IN	(609) 633-0708
Emergency Response Region I	BER-I	(973) 669-3955	Field Operations - Northern Field Office	BFO-N	(973) 669-3960
Emergency Response Region II	BER-II	(609) 584-4130	Field Operations - Southern Field Office	BFO-S	(609) 584-4150
Environmental Evaluation, Cleanup and Responsibility Assessment	BEECRA	(609) 777-0899	Fund Management, Compliance and Recovery	BFMCR	(609) 633-0719
Environmental Measurements and Site Assessment	EMSA	(609) 584-4280	Site Management	BSM	(609) 984-2990
Underground Storage Tanks	BUST	(609) 292-8761			

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APPENDIX A: Vertebrate Animals Known or Probable in the Township of Harrison

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, Common
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 residential areas	Throughout
Red Fox	All Habitats	Throughout
Raccoon	All Habitats	Throughout, Common
Long-tailed Weasel	Wetlands	Throughout
Striped Skunk	Uplands	Throughout, Common
White-tailed Deer	All Habitats	Throughout, Common
Mink	Wetlands	Throughout
Coyote	Woodlands and Fields	Throughout
Birds		
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
Blue-winged Teal	Wetlands	Winter Migrant
Northern Shoveler Duck	Open Water	Winter Migrant
Ring-necked Duck	Open Water	Winter Migrant

Species	General Habitat	Township Locations
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
Northern Harrier	Open Fields	Throughout
Sharp-shinned Hawk	Woodlands	Throughout
Cooper's Hawk	Woodlands	Throughout
Red-shouldered Hawk	Wetland Forests	Throughout; Endangered
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
Rock Dove	Houses and Bridges	Residential areas
Mourning Dove	Woodlands	Throughout, Common
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	Residential areas
Ruby-throated Hummingbird	Woodlands and Fields	Throughout
Belted Kingfisher	Wetlands	Throughout
Red-headed Woodpecker	Upland Forest	Raccoon Creek forests
Red-bellied Woodpecker	Woodlands	Throughout
Yellow-bellied Sapsucker	Woodlands	Fall Migrant
Downy Woodpecker	Woodlands	Throughout
Hairy Woodpecker	Woodlands	Throughout
Northern Flicker	Woodlands	Throughout; Common
Wood Pee-wee	Woodlands	Upland Woods
Eastern Phoebe	Woodlands	Throughout

Species	General Habitat	Township Locations
Great Crested Flycatcher	Woodlands	Upland Woods
Eastern Kingbird	Fields, Farmland	Throughout
Purple Martin	Open Fields, Wetlands	Agricultural areas
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	Edge of Woodlands	Edges, Yards
House Wren	Edge of Woodlands	Throughout
Golden and Ruby crowned Kinglets	Woodlands	Winter Migrant
Eastern Bluebird	Edge of Woodlands	Throughout
Wood Thrush	Woodlands	Throughout
American Robin	All Habitats	Throughout, Common
Catbird	Edge of Woodlands	Throughout
Mockingbird	Edge of Woodlands	Throughout, Common
Brown Thrasher	Woodlands	Throughout
Cedar Waxwing	Old Fields, Young Woodlands	Throughout
Starling	All Habitats	Residential areas; Pest
White Eyed Vireo	Woodlands	Throughout
Philadelphia Vireo	Woodlands	Migrant
Red-eyed Vireo	Woodlands	Wetland Forests
Yellow Warbler	Upland Forest	Throughout
Chestnut-sided 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	Edge of Woodlands	Throughout; Common
Indigo Bunting	Edges of Old Fields	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
Common Grackle	All Habitats	Throughout; Common

Species	General Habitat	Township Locations
Brown-headed Cowbird	Open Areas	Throughout; Pest
Orioles: Orchard and Baltimore	Woodlands	Throughout
House Finch	Open Areas	Throughout
Pine Siskin	Woodlands	Winter Migrant
American Goldfinch	Open Areas, Old Fields	Throughout
House Sparrow	Old Fields	Residential areas; 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	Edge of Woodlands	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 Frogs	Wetlands	Throughout
Wood Frog	Woodlands	Throughout
Southern Leopard Frog	Wetlands	Throughout
Fishes		
American Brook Lamprey	Streams	Throughout
Sea Lamprey	Rivers and Streams	Possible
American Eel	All Waters	Throughout
Alewife	Rivers and Streams	Possible
Goldfish	Streams and Lakes	Throughout
Golden Shiner	Streams and Ponds	Throughout
Satinfin Shiner	Streams	Throughout
Common Shiner	Streams	Throughout
Comely Shiner	Streams	Probable
Bridle Shiner	Rivers and Streams	Rare
Spottail Shiner	Rivers and Streams	Throughout
Common Carp	Rivers, Streams, and Lakes	Throughout

Species	General Habitat	Township Locations
Eastern Silvery Minnow	Rivers and Streams	Throughout
Fallfish	Streams	Possible
White Sucker	Streams	Throughout
Creek Chub-sucker	Streams	Throughout
Brown Bullhead	River, Lakes and Streams	Throughout
Yellow Bullhead	River, Lakes and Streams	Possible
Tadpole Madtom	Lakes and Streams	Throughout
Redfin Pickerel	Streams, Lakes and Ponds	Throughout
Chain Pickerel	Lakes and Streams	Throughout
Eastern Mudminnow	Streams	Throughout
Pirate Perch	Streams	Throughout
Banded Killifish	Streams and Ponds	Probable
White Perch	Rivers, Streams, Lakes and Ponds	Throughout
Mud Sunfish	Streams and Swamps	Probable
Bluespotted Sunfish	Streams and Ponds	Throughout
Redbreast Sunfish	Lakes and Streams	Probable
Bluegill	All Waters	Throughout
Pumpkinseed	All Waters	Throughout
Large mouth Bass	Lakes, ponds	Throughout
Black Crappie	Lakes, ponds	Throughout
Tessellated (Johnny) Darter	Streams	Probable
Swamp Darter	Swamps	Probable
Yellow Perch	Streams	Probable

Source: Modified version of Table 11 of the *Environmental Resource Inventory for Franklin Township, Gloucester County New Jersey*. Fish data obtained from NJ Division of Fish & Wildlife, Bureau of Fisheries and from Arndt, Rudolf G. "Annotated Checklist and distribution of New Jersey Freshwater Fishes…" See Biological Resources in Sources of Information, p. 87.

APPENDIX B: State Endangered and Threatened Species

Birds			
Endangered		**Threatened**	
American Bittern	*Botaurus lentiginosos*	Bobolink	*Dolichonyx oryzivorus* BR
Eagle, bald	*Haliaeetus leucocephalus* BR **	Eagle, bald	*Haliaeetus leucocephalus* NB **
Falcon, peregrine	*Falco peregrinus*	Hawk, Cooper's	*Accipiter cooperii*
Goshawk, northern	*Accipiter gentilis* BR	Hawk, red-shouldered	*Buteo lineatus* NB
Grebe, pied-billed	*Podilymbus podiceps**	Night-heron, black-crowned	*Nycticorax nycticorax* BR
Harrier, northern	*Circus cyaneus* BR	Night-heron, yellow-crowned	*Nyctanassa violaceus*
Hawk, red-shouldered	*Buteo lineatus* BR	Knot, red	*Calidris canutus* BR
Owl, short-eared	*Asio flammeus* BR	Osprey	*Pandion haliaetus* BR
Plover, piping	*Charadrius melodus***	Owl, barred	*Strix varia*
Sandpiper, upland	*Batramia longicauda*	Owl, long-eared	*Asio otus*
Shrike, loggerhead	*Lanius ludovicianus*	Rail, black	*Laterallus jamaicensis*
Skimmer, black	*Rynchops niger* BR	Skimmer, black	*Rynchops niger* NB
Sparrow, Henslow's	*Ammodramus henslowii*	Sparrow, grasshopper	*Ammodramus savannarum* BR
Sparrow, vesper	*Pooecetes gramineus* BR	Sparrow, Savannah	*Passerculus sandwichensis* BR
Tern, least	*Sterna antillarum*	Sparrow, vesper	*Pooecetes gramineus* NB
Tern, roseate	*Sterna dougallii***	Woodpecker, red-headed	*Melanerpes erythrocephalus*
Wren, sedge	*Cistothorus platensis*		

Reptiles			
Endangered		**Threatened**	
Rattlesnake, timber	*Crotalus h. horridus*	Snake, northern pine	*Pituophis m. melanoleucus*
Snake, corn	*Elaphe g. guttata*	Turtle, Atlantic green	*Chelonia mydas***
Snake, queen	*Regina septemvittata*	Turtle, wood	*Clemmys insculpta*
Turtle, bog	*Clemmys muhlenbergii***		
Atlantic hawksbill	*Eretmochelys imbricata***		
Atlantic leatherback	*Dermochelys coriacea***		
Atlantic loggerhead	*Caretta caretta***		
Atlantic Ridley	*Lepidochelys kempi***		

Amphibians			
Endangered		**Threatened**	
Salamander, blue-spotted	*Ambystoma laterale*	Salamander, eastern mud	*Pseudotriton montanus*
Salamander, eastern tiger	*Ambystoma tigrinum*	Salamander, long-tailed	*Eurycea longicauda*

Treefrog, southern gray	*Hyla chrysocelis*	Treefrog, pine barrens	*Hyla andersonii*
Invertebrates			
Endangered		**Threatened**	
Beetle, American burying	*Nicrophorus mericanus***	Elfin, frosted (butterfly)	*Callophrys irus*
Beetle, northeastern beach tiger	*Cincindela d. dorsalis***	Floater, triangle (mussel)	*Alasmidonta undulata*
Copper, bronze	*Lycaena hyllus*	Fritillary, silver-bordered (butterfly)	*Bolaria selene myrina*
Floater, brook (mussel)	*Alasmidonta varicosa*	Lampmussel, eastern (mussel)	*Lampsilis radiata*
Floater, green (mussel)	*Lasmigona subviridis*	Lampmussel, yellow (mussel)	*Lampsilis cariosa*
Satyr, Mitchell's (butterfly)	*Neonympha m. mitchellii***	Mucket, tidewater (mussel)	*Leptodea ochracea*
Skipper, arogos (butterfly)	*Atrytone arogos arogos*	Pondmussel, eastern (mussel)	*Ligumia nasuta*
Skipper, Appalachian grizzled (butterfly)	*Pyrgus wyandot*	White, checkered (butterfly)	*Pontia protodice*
Wedgemussel, dwarf	*Alasmidonta heterodon***		
Mammals		**Fishes**	
Endangered		**Endangered**	
Bat, Indiana	*Myotis sodalis***	Sturgeon, shortnose	*Acipenser brevirostrum***
Bobcat	*Lynx rufus*		
Whale, black right	*Balaena glacialis***		
Whale, blue	*Balaenoptera musculus***		
Whale, fin	*Balaenoptera physalus***		
Whale, humpback	*Megaptera novaeangliae***		
Whale, sei	*Balaenoptera borealis***		
Whale, sperm	*Physeter macrocephalus***		
Woodrat, Allegheny	*Neotoma floridana magister*		

**** Also on the federal Endangered and Threatened list**

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

APPENDIX C: Rare Plant and Animal Species and Natural Communities Presently Recorded in the NJ Natural Heritage Database for Harrison Township

Scientific name	Common Name	Federal Status*	NJ Status*	State Rank**
Vascular Plants				
Agastache nepetoides	Yellow giant-hyssop			S2
Corallorhiza wisteriana	Spring coralroot			SX
Cacalia atriplicifolia	Pale Indian plantain		E	S1
Asclepias variegate	White milkweed			S2
Cyperus retrofractus	Rough flatsedge		E	SH
Desmodium strictum	Pineland tick-trefoil			S2
Doellingeria infirma	Cornel-leaf aster			S2
Luzula Acuminata	Hairy wood-rush		E	S2
Tipularia discolor	Cranefly orchid			S3
Phaseoulus polystachios varpolystachios	Wild-kidney bean			S2
Phlox maculata var maculata	Spotted phlox			S3
Sphenonpholis pensylvanica	Swamp oats			S2
Spiranthes odorata	Fragrant ladies' tresses			S2
Vernonica glauca	Broad-leaf ironweed		E	S1
Vulpia elliotea	Squirrel-tail six-weeks grass		E	S1
Utricularia biflora	Two-flower bladderwort		E	S1
Vertebrates				
Falco sparverius	American kestrel		INC/S	S3
Dolichonyx oryzivorus	Bobolink		T/T	S2
Clemmys muhlenbergii	Bog turtle	LT	E	S2
Accipiter cooperii	Cooper's hawk		T/T	S3, S4
Lampropelits traingulum triangulum x L. t. elapsoides	Coastal plain milk snake			
Terrapene carolina	Eastern box turtle			S5
Sturnella magna	Eastern meadowlark		D/S	S3, S4
Ambystoma tigrinum tigrinum	Eastern tiger salamander		E	S2
Ammodramus savannarum	Grasshopper sparrow		T/S	S2
Buteo lineatus	Red-shouldered hawk		E	S1, S2
Passerculus sandwichensis	Savannah sparrow		T/T	S2, S4
Pooecetes gramineus	Vesper sparrow		E	S1, S2

*** Key to Federal and State Status Codes**

T	Threatened species – may become endangered if conditions surrounding the species begin to or continue to deteriorate.
E	Endangered species – one whose prospects for survival within the state are in immediate danger due to one or many factors.
INC	Increasing species – population has exhibited a significant increase
S	Stable species
D	Declining species – species that exhibited a continued decline in population numbers of the years.

**** Key to State Element Rank**

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 occurrences).
S3	Rare in state with 21 to 50 occurrences. Includes elements which 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.
SX	Elements that have been determined or are presumed to be extirpated from New Jersey. All historical occurrences have been searched and a reasonable search of potential habitat has been completed. No longer a conservation priority.
SH	Element of historical occurrence in New jersey. No extant occurrences are known, but not all historical occurrences have been surveyed, and unsearched potential habitat remains. Remains a conservation priority.

APPENDIX D: Partial Inventory of Locally Significant Historic Sites in Harrison Township (outside Mullica Hill Historic District)

Structure Name	Address	Survey Name (if available) & Survey Date
Earlington Avenue		
Shea House	10 Earlington AVE	9/20/89
Church of the Holy Name of Jesus	17 Earlington AVE	9/20/89
Church of the Holy Name of Jesus	22 Earlington AVE	9/20/89
New Street		
Wilke House	10 New ST	9/20/89
House27	New ST	Gloucester County Cultural Resource Survey, 2/1/87
House29	New ST	Gloucester County Cultural Resource Survey, 3/1/86
House30	New ST	Gloucester County Cultural Resource Survey, 3/1/86
House31	New ST	Gloucester County Cultural Resource Survey, 3/1/86
House28	New ST	Gloucester County Cultural Resource Survey, 3/1/86
Main Street		
Alestra House	10 South Main ST	9/20/89
Evans House	103-105 North Main ST	9/20/89
Haines House	109 North Main ST	9/20/89
Kirby Insurance Company	95 North Main ST	9/20/89
Brown House	97 North Main ST	9/20/89
Bunty House	99 North Main ST	9/20/89
House20	Main ST	Gloucester County Cultural Resource Survey, 3/1/86
House15	Main ST	Gloucester County Cultural Resource Survey, 3/1/86
House23	Main ST	Gloucester County Cultural Resource Survey, 3/1/86
House22	Main ST	Gloucester County Cultural Resource Survey, 3/1/86
House26	Main ST	Gloucester County Cultural Resource Survey, 3/1/86
House21	Main ST	Gloucester County Cultural Resource Survey, 3/1/86
House12	Main ST	Gloucester County Cultural Resource Survey, 3/1/86
House35	Main ST	Gloucester County Cultural Resource Survey, 3/1/86
House11	Main ST	Gloucester County Cultural Resource Survey, 3/1/86
House13	Main ST	Gloucester County Cultural Resource Survey, 3/1/86

Structure Name	Address	Survey Name (if available) & Survey Date
House25	Main ST	Gloucester County Cultural Resource Survey, 3/1/86
House24	Main ST	Gloucester County Cultural Resource Survey, 3/1/86
House18	Main ST	Gloucester County Cultural Resource Survey, 3/1/86
House17	Main ST	Gloucester County Cultural Resource Survey, 3/1/86
House19	Main ST	Gloucester County Cultural Resource Survey, 3/1/86
House16	Main ST	Gloucester County Cultural Resource Survey, 3/1/86
Iredell House	Main ST	3/1/86
Archibald Moffett House	Main ST	Gloucester County Cultural Resource Survey, 6/1/86
State Highway 45		
Old Toll House	17 Woodstown RD (State HWY 45)	9/20/89
Brigandi House	24-26 Woodstown RD (State HWY 45)	9/20/89
Victorian 1900 house	Woodstown RD (SE State HWY 45)	Gloucester County Cultural Resource Survey, 5/1/86
1860 house	Woodstown RD (SW State HWY 45)	Gloucester County Cultural Resource Survey, 5/1/86
US Highway 322		
Dunn House	19 Swedesboro RD (US HWY 322)	9/20/89
Howard House	20 Swedesboro RD (US HWY 322)	9/20/89
Hauson House	20 Swedesboro RD (US HWY 322)	9/20/89
Jackson House	26 Swedesboro RD (US HWY 322)	9/20/89
Federal-Greek 1840 house	Swedesboro RD (US HWY 322)	Gloucester County Cultural Resource Survey, 5/1/86
Claypool House	Swedesboro RD (US HWY 322)	8/1/86
Clendening House	Swedesboro RD (US HWY 322)	8/1/86
Former Candy Box	Swedesboro RD (US HWY 322)	8/1/86
Kimayre House	Swedesboro RD (US HWY 322)	8/1/86
Hughes House	Swedesboro RD (US HWY 322)	8/1/86
Woodbury1890 house	Swedesboro RD (US HWY 322)	Gloucester County Cultural Resource Survey, 5/1/86
Mullica Hill 1830 house	Mullica Hill RD (US HWY 322)	Gloucester County Cultural Resource Survey, 5/1/86
Kerrshaw House	Swedesboro RD (US HWY 322)	9/20/89
Dutch 1920 house	Mullica Hill RD (S US HWY 322)	Gloucester County Cultural Resource Survey, 5/1/86
Georgian 1811 house	Mullica Hill RD (S US HWY 322)	Gloucester County Cultural Resource Survey, 5/1/86
Woodland Avenue		
Hoffman House	19 Woodland AVE	9/20/89

Structure Name	Address	Survey Name (if available) & Survey Date
Mullica Second Empire house	NE Woodland AVE	Gloucester County Cultural Resource Survey, 5/1/86
High Street		
Steven Robinson House	46 High ST	9/20/89
Anna Robinson House	48 High ST	9/20/89
Butler Farm (National & State Registers)	High ST	Gloucester County Cultural Resource Survey, 5/1/86
Mount Calvary Baptist Church	High ST	Black Historic Sites in New Jersey, 6/8/90
Falwell house	High ST	Gloucester County Cultural Resource Survey, 5/1/86
Jessup Farm (State Register)	NW High ST	Gloucester County Cultural Resource Survey, 5/1/86
Ewan Road		
Penned House	Ewan RD	Gloucester County Cultural Resource Survey, 5/1/86
Ewan Road Greek Revival	Ewan RD	Gloucester County Cultural Resource Survey, 5/1/86
Ewan Road 1880 house	Ewan RD	Gloucester County Cultural Resource Survey, 5/1/86
Harrisonville Road		
Richwood Baptist Church	Harrisonville RD	Black Historic Sites in New Jersey, 6/8/90
Harrisonville-Richwood Road Farm	Harrisonville-Richwood RD	Gloucester County Cultural Resource Survey, 5/1/86
French Plantation	Richwood Harrisonville RD	Gloucester County Cultural Resource Survey, 5/1/86
State Highway 77		
Brigandi House	Bridgeton PIKE (State HWY 77)	9/20/89
White House Farmhouse	Bridgeton PIKE (State HWY 77)	9/20/89
Puglisi Farm	Bridgeton PIKE (State HWY 77)	9/20/89
Oasts house	Bridgeton PIKE (SE State HWY 77)	Gloucester County Cultural Resource Survey, 5/1/86
Wellacrest Farms	Bridgeton PIKE (State HWY 77)	Gloucester County Cultural Resource Survey, 5/1/86
Barns 1900	Bridgeton PIKE (State HWY 77)	Gloucester County Cultural Resource Survey, 5/1/86
Georgian 1790 house	Bridgeton Pike (W State HWY 77)	Gloucester County Cultural Resource Survey, 5/1/86
Ewan-Austin	Bridgeton Pike (NW State HWY 77)	Gloucester County Cultural Resource Survey, 5/1/86
Other Roads		
Joshua Moore House	Aura-Mullica Hill RD	1/27/78
Colson-Warner	Colson LN	Gloucester County Cultural Resource Survey, 5/1/86
Ballinger Farm	Commisioners RD	9/20/89

Structure Name	Address	Survey Name (if available) & Survey Date
Mullica Hill 1800 house	Creek RD	Gloucester County Cultural Resource Survey, 5/1/86
Richwood Methodist Church (National & State Registers)	Elmer RD	7/22/77
Heiling-West, Richwood	Heiling RD	Gloucester County Cultural Resource Survey, 5/1/86
Snowden House	Hill ST	Gloucester County Cultural Resource Survey, 5/1/86
Snowden-Woodstown house	Hill ST	Gloucester County Cultural Resource Survey, 5/1/86
Richwood Academy (SHPO Opinion)	NW Lambs RD	9/29/97
Bridges		
Bridge: State HWY 55 over S. Branch of Raccoon Crk	State HWY 55	New Jersey Historic Bridge Survey, 8/1/91
Bridge: Aura-Mullica Hill Road over Clems Run	Aura-Mullica Hill RD	New Jersey Historic Bridge Survey, 8/1/91
Bridge: US HWY 322 over Branch of Raccoon Creek	US HWY 322	New Jersey Historic Bridge Survey, 8/1/91
Bridge: US HWY 322 over Raccoon Creek	US HWY 322	New Jersey Historic Bridge Survey, 8/1/91
Bridge: Mullica Hill-Swedesboro Road over S. Raccoon Creek	Mullica Hill-Swedesboro RD	New Jersey Historic Bridge Survey, 8/1/91

Source: NJ State Historic Preservation Office, 2004. The Gloucester County Cultural Resource Survey was completed and published in 1987 by SHPO.

DELAWARE VALLEY REGIONAL PLANNING COMMISSION

Publication Abstract

Title: ***Environmental Resource Inventory for Harrison Township, Gloucester County, New Jersey***

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Geographic Area Covered: Harrison Township, Gloucester County, New Jersey

Key Words: Environment, environmental resource inventory, environmental commission, conservation, master planning, natural resources, Gloucester County, Mullica Hill, Harrison Township.

ABSTRACT

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

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