# *NATURAL RESOURCE INVENTORY*

## *Manalapan Township*
## *Monmouth County, New Jersey*

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*December 2001*

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## INTRODUCTION

This Natural Resource Inventory (NRI) for Manalapan Township has been compiled pursuant to the authorization of the Mayor and Township Committee. The previous inventory of Manalapan's environmental resources was prepared in 1976. A geographic information system was used in the preparation of this completely new NRI to incorporate updated mapping and to generate high quality color maps.

In accordance with Municipal Land Use Law (N.J.S.A. 40:55D-1 et seq.), a municipal Master Plan is required to contain a land use plan element. An NRI is a compilation of basic environmental information that is an essential supplement to a land use plan. This document is therefore intended to be utilized by the Manalapan Township Environmental Commission, Planning and Zoning Boards, and Township Committee to aid in the identification of significant natural resources and the evaluation of environmental issues in land use planning.

Maps for this NRI were generated using Geographic Information Systems (GIS) software. A GIS facilitates the linking of digital spatial data that define the location and boundaries of natural and cultural resources to databases that contain information identifying the characteristics of each resource. Data used in this project was obtained from secondary sources including the New Jersey Department of Environmental Protection (NJDEP), the New Jersey Geological Survey (NJGS), the New Jersey Office of State Planning, and the Monmouth County GIS Management Office (MCGISMO). Compilation of the NJDEP data was completed in 1996/1997, the NJGS data was completed in 1998/1999, and the MCGISMO data was completed in 2000. Most data sets were used as received from the source agencies, but some were partially modified to include changes that have occurred since the original data was acquired or to include local information. The base map depicting Manalapan tax lots and roadways was created by CME Associates using Computer Aided Drafting and Design (CADD) software.

Maps for this NRI are provided at two different scales. Maps at a 1"=5000' scale are bound into this document, and a set of similar maps at a 1"=2,500' scale are attached separately. The larger scale maps are intended to assist in the assessment of individual land parcels.

**POPULATION**

Manalapan Township comprises an area of approximately 30.6 square miles. The Township population recorded in the year 2000 census is 33,423. There was a substantial growth in Township population over the four decades from 1960 to 2000. During these forty years, population increased from 3,990 to 33,423. (See Table 1 Population Trends) The ten-year growth from 1990 to 2000 is 25%. If this growth trend continues, the projected Township population would be approximately 37,000 by the year 2005 and 42,000 by the year 2020. Population increase in Manalapan has been directly related to new residential development. The total number of housing units increased from 9,029 in 1990 to 10,781 in the year 2000, as former farmland and woodland were converted to residential land use. Table 2 shows the number of certificates of occupancy issued by the Township between 1983 and 2000.

## TABLE 1

## POPULATION TRENDS

| Year | Population |
|---|---|
| 1850 | 1,910 |
| 1860 | 2,573 |
| 1870 | 2,286 |
| 1880 | 2,175 |
| 1890 | 2,002 |
| 1900 | 1,435 |
| 1910 | 1,375 |
| 1920 | 1,080 |
| 1930 | 1,464 |
| 1940 | 1,900 |
| 1950 | 3,137 |
| 1960 | 3,990 |
| 1970 | 14,049 |
| 1980 | 18,914 |
| 1990 | 26,716 |
| 2000 | 33,423 |

## TABLE 2

## CERTIFICATES OF OCCUPANCY ISSUED BY MANALAPAN TOWNSHIP

## BETWEEN 1983-2000

| Year | No. of C.O.'s | |
|---|---|---|
| 1983 | 249 (residential) | 13 (non-residential) |
| 1984 | 343 (residential) | 13 (non-residential) |
| 1985 | 362 (residential) | 8 (non-residential) |
| 1986 | 366 (residential) | 6 (non-residential) |
| 1987 | 390 (residential) | 5 (non-residential) |
| 1988 | 343 (combined residential and non-residential) | |
| 1989 | 102 (combined residential and non-residential) | |
| 1990 | 297 (combined residential and non-residential) | |
| 1991 | 317 (combined residential and non-residential) | |
| 1992 | 292 (combined residential and non-residential) | |
| 1993 | 260 (combined residential and non-residential) | |
| 1994 | 207 (combined residential and non-residential) | |
| 1995 | 187 (combined residential and non-residential) | |
| 1996 | 157 (combined residential and non-residential) | |
| 1997 | 278 (residential) | 2 (non-residential) |
| 1998 | 215 (residential) | 4 (non-residential) |
| 1999 | 196 (residential) | 12 (non-residential) |
| 2000 | 455 (residential) | 4 (non-residential) |

## CLIMATE

Manalapan Township has a continental climate, with the prevailing winds from the west-northwest in the winter months, and from the southwest during summer months. The buffering effects from the Atlantic Ocean on temperature are small. In an average year, the growing season extends from early April until mid to late October and lasts approximately 240 days. Rainfall averages approximately 44 inches per year, and is more or less evenly distributed month to month. Total annual snowfall accumulations average 24".

## LAND USE

The New Jersey Department of Environmental Protection has mapped twenty-six different types of land use within Manalapan Township. These land use types are interpreted from aerial color infrared photography, and do not reflect changes in land use that have occurred since the data was acquired. CME Associates has revised the NJDEP data by updating recent changes in residential development, and these changes are depicted on the Manalapan Land Use Map presented in this section. The Land Use Map is based on a land use and land cover classification system developed by the US Geological Survey and edited by NJDEP (U.S. Geological Survey, 1976). Brief definitions of each land use category mapped in Manalapan are provided in this section. Map units representing wetland areas are described in the Freshwater Wetlands section.

### *Other Urban or Built-Up Land*

This map unit includes urban areas that are not associated with active commercial, industrial, service, transportation, communications, or utility facilities. These areas are usually open lands, possibly with abandoned buildings in a state of ruin. Cemeteries are included in this category.

### *Altered Lands*

This map unit includes lands outside of an urban location that have been altered by human activities other than mining.

### *Athletic Fields (Schools)*

This category includes athletic fields that are only associated with schools.

***Brushland/Shrubland***

Areas mapped as brushland/shrubland are wooded lands that have a cover canopy between 0 and 20 feet in height. Brushland/shrubland can include early successional plant communities only a few years old as well as climax or near climax communities many years old.

***Commercial and Services***

The commercial and services land use coverage includes properties that contain buildings predominantly used for services and the sale of products. Also included in this map unit are support areas such as parking lots, driveways, and associated landscaped areas. Due to the limitations in the mapping process, some residential and industrial land uses may be contained within this map unit. Non-commercial land uses do not exceed one-third of the total area mapped as commercial and services.

***Confined Feeding Operations***

Confined feeding operations contain specialized livestock and poultry production businesses as well as other types of specialty farms.

***Coniferous Forest***

Lands mapped as coniferous forest have a cover canopy with an average tree height greater than 20 feet and contain at least 75% conifers.

***Coniferous/Deciduous Forest***

These forest areas contain both coniferous and deciduous trees, but the coniferous trees are more prevalent. Average tree height is greater than 20 feet.

***Cropland and Pastureland***

This map unit includes agricultural properties used for the production of crops and animal grazing. These areas may also include fallow farm fields.

***Deciduous Forest***

This map unit includes woodlands with an average tree height greater than 20 feet and at least 75% deciduous trees.

***Deciduous/Coniferous Forest***

These forest areas contain a mixture of deciduous and coniferous trees, but with deciduous trees being dominant. Average tree height is in excess of 20 feet.

***Extractive Mining***

One area of extractive mining is mapped within Manalapan, in the southwestern portion of the Township. Mining operations in the unconsolidated sediments of the New Jersey coastal plain typically involve the extraction of gravel, sand, or clay for construction materials.

***Industrial***

Light and heavy industrial land uses are included in this map unit.

***Lakes or Ponds***

Lakes and ponds depicted on the land use map are as small as one acre and are naturally enclosed. Manmade water impoundments are not included in this map unit, and are mapped separately as reservoirs. Millhurst Mill Pond is mapped as a

pond or a lake, whereas Taylorr's Lake (near the Route 33 Business Exit Ramp) is mapped as a reservoir.

***Orchards, Nurseries, Vineyards, and Horticulture Areas***

Land uses within these mapped areas include agricultural properties that are intensively managed for the production of ornamental plants, fruits, trees, and vegetable seedlings. Wholesale greenhouse operations are included herein.

***Other Agriculture***

Experimental agricultural fields, isolated structures for crop or equipment storage, and horse farms are depicted in this mapping unit.

***Recreation Land***

Areas depicted as recreation land have been specifically developed for recreational activities that are open to the general public.

***Reservoir***

Human created impoundments of at least 3 acres are included in this map unit. These water bodies may be created for irrigation, flood control, municipal water supplies, recreation, and landscaping.

***Transitional Areas***

Lands on which site work or construction has begun for a range of development types are mapped as transitional areas.

***Transportation, Communication, and Utilities***

Areas included in this category are limited access highways, railroad facilities, bus and truck terminals, airports, wetland rights-of-way, water treatment facilities, sewage treatment facilities, and communication towers.

***Undifferentiated Barren Land***

Undifferentiated barren land areas include cleared areas in a non-urban setting with exposed soil and sparse vegetative cover.

***Residential***

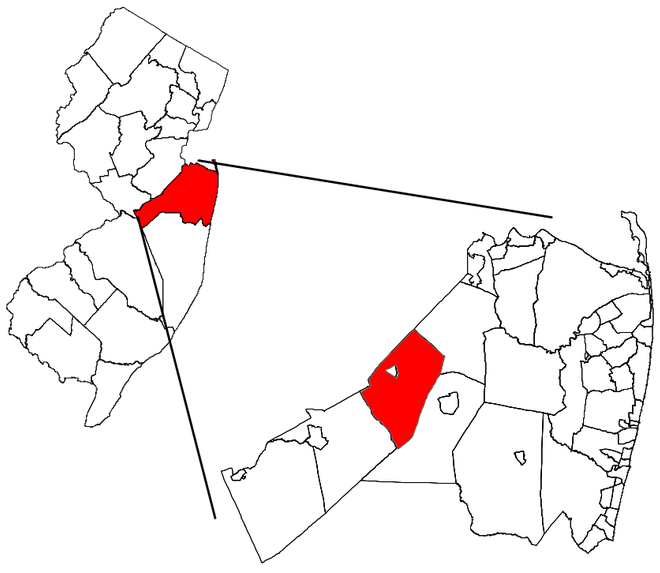
Single-family residential, multiple unit and mobile home residences are included in this land use category.

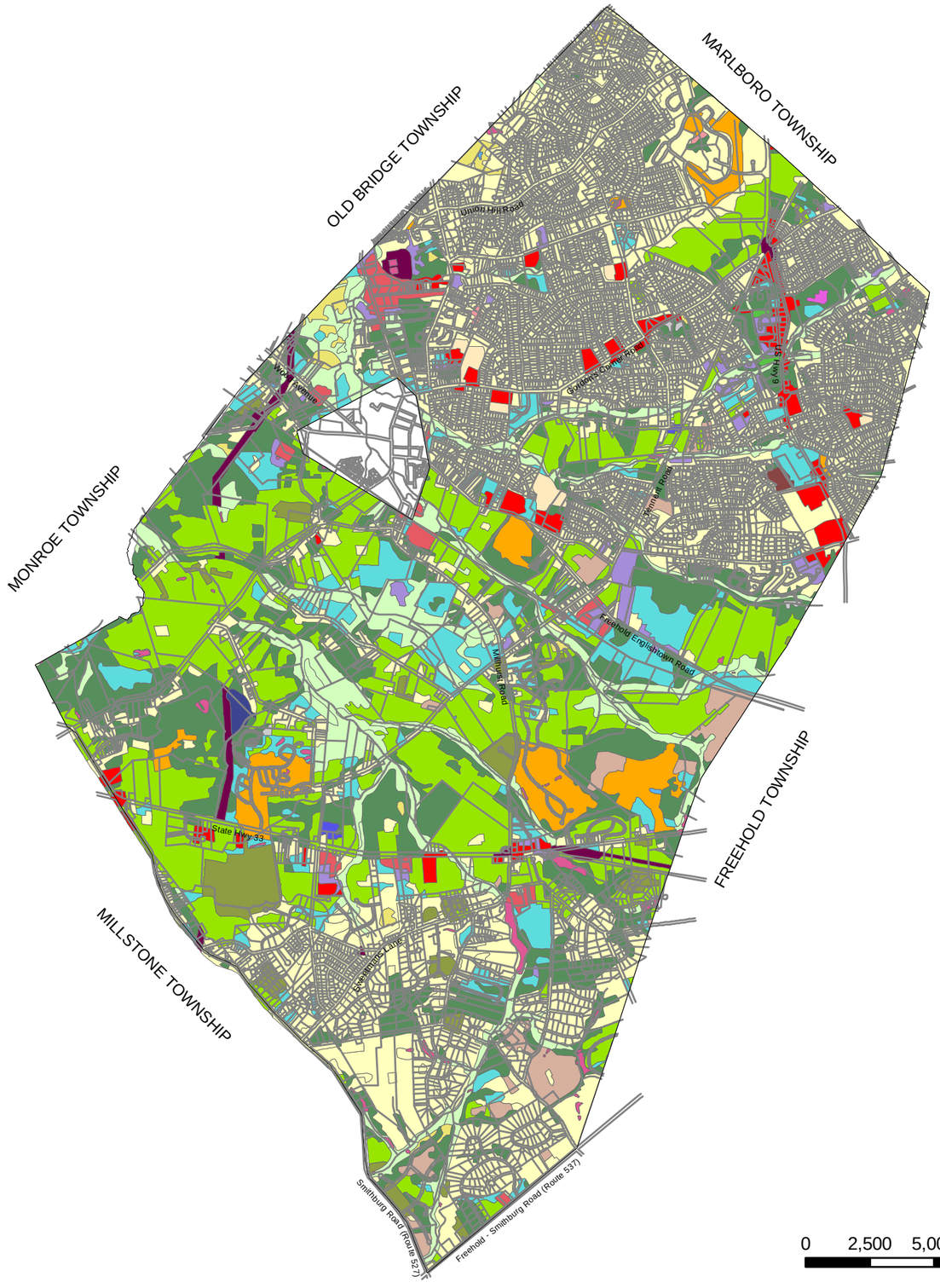
# LAND USE

## Manalapan Township, Monmouth County, NJ

**Legend**

- Other Urban Or Built-Up
- Altered Lands
- Athletic Fields (Schools)
- Brushland/Shrubland
- Commercial and Services
- Confined Feeding Operation
- Coniferous Forest
- Coniferous/Deciduous Forest
- Cropland and Pastureland
- Deciduous Forest
- Deciduous/Coniferous Forest
- Extractive Mining
- Freshwater Wetlands
- Industrial
- Lake or Pond
- Orch,Nurs,Vnyrd,Hort.Area
- Other Agriculture
- Recreational Land
- Reservoir
- Transitional Areas
- Transp./Comm./Utilities
- Undifferentiated Barren Land
- Residential
- Manalapan Roads
- Manalapan Parcels
- Manalapan Township Boundary






TOWNSHIP OF MANALAPAN

CME ASSOCIATES

H-MA-00046-01 7/18/01

Source: This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data. This secondary product has not been verified by the data originators.

## STATE DEVELOPMENT AND REDEVELOPMENT PLAN

The New Jersey State Development and Redevelopment Plan ("the Plan") was initially adopted in June of 1992. A new State Development and Redevelopment Draft Final Plan was adopted on March 1, 2001.

In 1985, the New Jersey State Legislature adopted the State Planning Act (under N.J.S.A. 52:18A-196 et. seq.). According to the New Jersey Office of State Planning, the Plan was developed because the State of New Jersey needed, sound and integrated statewide planning to "…conserve its natural resources, revitalize its urban centers, protect the quality of its environment, and provide needed housing and adequate public services at a reasonable cost while promoting beneficial growth, development, and renewal…" (New Jersey Office of State Planning, 2000). The Plan is designed to establish statewide planning objectives "regarding land use, housing, economic development, transportation, natural resource conservation, agriculture and farmland retention, recreation, urban and suburban redevelopment, historic preservation, public facilities and services, and intergovernmental coordination".

The Resource Planning and Management Structure of the Plan has two basic concepts: Planning Areas and Centers/Environs. Planning Areas are determined by type and intensity of development, proximity to existing developed areas, public and private infrastructure, and environmental resources. Five Planning Areas are defined:

- PA1: Metropolitan Planning Area - Designed to "promote growth, stabilize and revitalize communities, modernize infrastructure, and redesign areas of sprawl".
- PA2: Suburban Planning Area - Designed to "promote much of the statewide growth in centers and redesign areas of sprawl"

- PA3: Fringe Planning Area - Designed to “accommodate growth in centers and keep environs largely open”

- PA4: Rural Planning Area, which includes PA4B, the Rural/Environmentally Sensitive Planning Area - Designed to “promote a viable agricultural industry, protect large contiguous areas of farmland – including those on environmentally sensitive land – and accommodate growth in centers”.

- PA5: Environmentally Sensitive Planning Area, which includes PA5B, the Environmentally Sensitive/Barrier Island Planning Area - Designed to “protect environmental resources – including large areas of open lands and sensitive barrier islands – and accommodate growth in centers”.

Centers are defined as central places within planning areas where growth should be either attracted or contained, depending on the unique characteristics and growth opportunities of each center and the characteristics of the surrounding planning area in which it is located.

Environs are “areas outside centers and should be protected from the growth that occurs in centers”.

Three State planning areas are designated within Manalapan Township: the Suburban Planning Area (PA2), Fringe Planning Area (PA3), and Rural/Environmentally Sensitive Planning Area (PA4 & PA4B). In addition, Monmouth Battleground State Park is a designated park and recreation area. The largest coverage in the Township is the Suburban Planning Area. It should be noted that State Planning Areas generally do not coincide with the Township boundaries, but extend into adjacent municipalities. The New Jersey State Development and Redevelopment Plan should be referenced for specific details on how the designated State planning areas may affect various aspects of development within

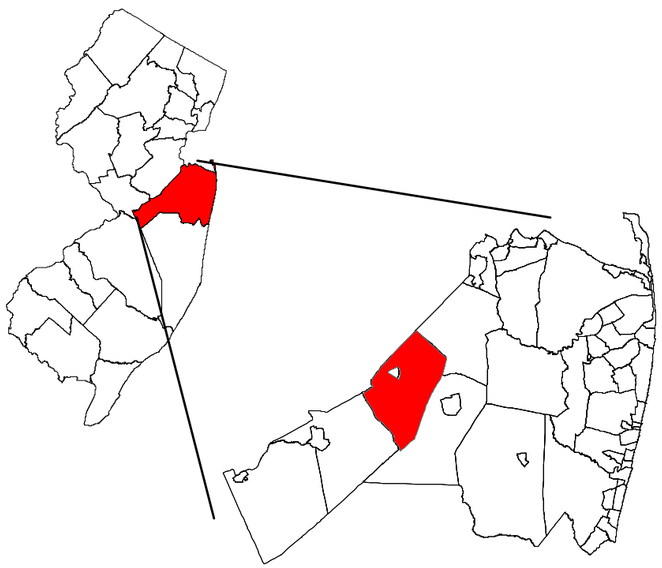
Manalapan Township. A copy of the Plan can be obtained from the New Jersey Office of State Planning, Department of Community Affairs (33 West State Street, P.O. Box 204, Trenton, NJ 08625-0204, Phone: 609-292-7156).

# STATE DEVELOPMENT AND REDEVELOPMENT PLAN

Manalapan Township, Monmouth County, NJ

## Legend

- 02.PA2 Suburban Planning Area
- 03.PA3 Fringe Planning Area
- 05.PA4B Rural/Environmentally Sensitive Planning Area
- 07.Park and Recreation Area
- Manalapan Roads
- Manalapan Parcels
- Manalapan Township Boundary



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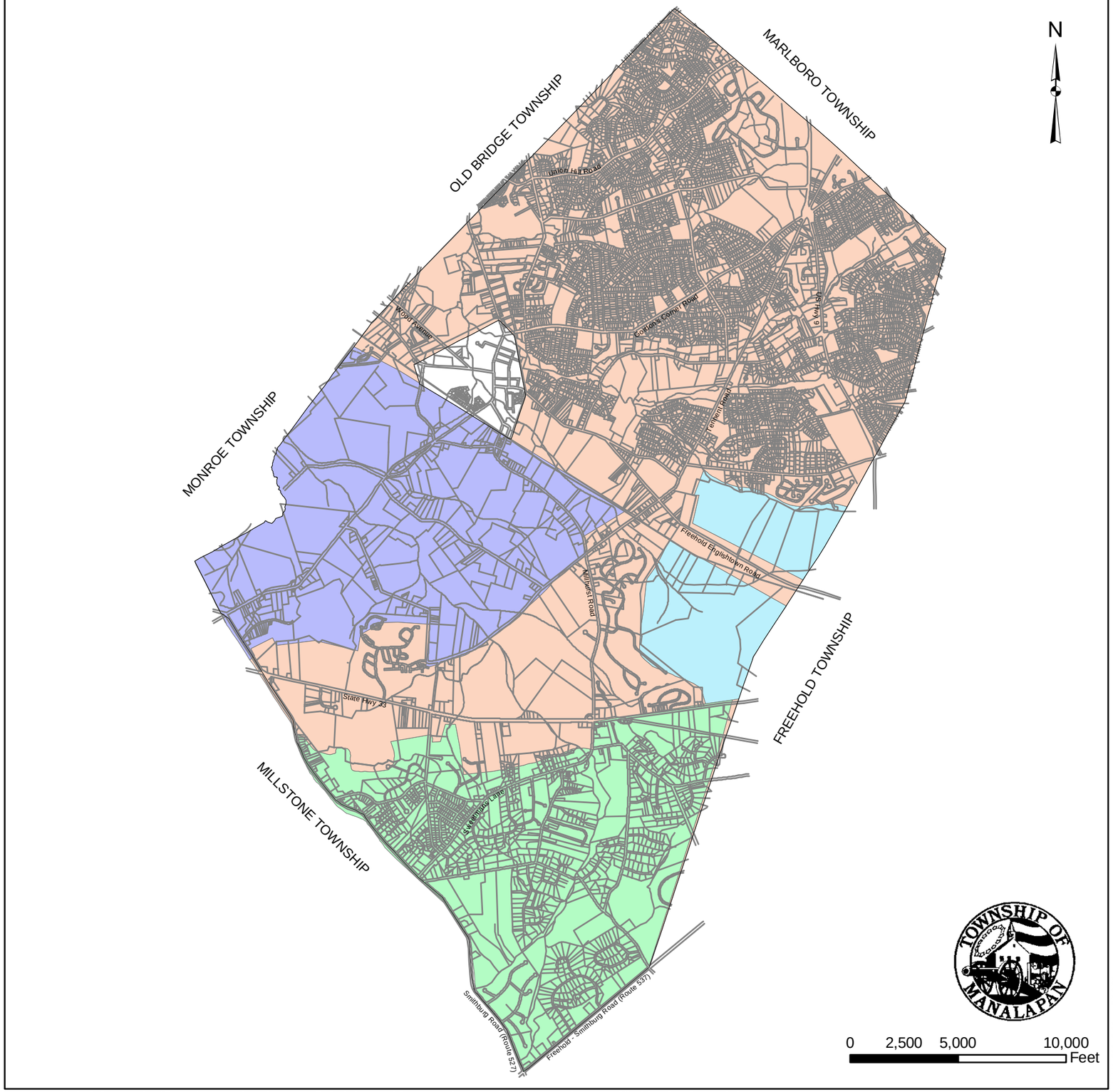


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## SANITARY SEWER SERVICE AREAS

This map represents the most current sanitary sewer service areas, as provided by the New Jersey Office of State Planning. The coverage shows the existing and future sewer service areas for the Township, for various types of existing and future wastewater management facilities.

The groundwater discharge areas (>20,000 GPD and <20,000 GPD) represent facilities that have NJPDES permits for the individual sites. Most of the southerly half of the Township is serviced by individual subsurface sewage disposal systems, while the northerly half is serviced by sewage collection systems and central treatment facilities.

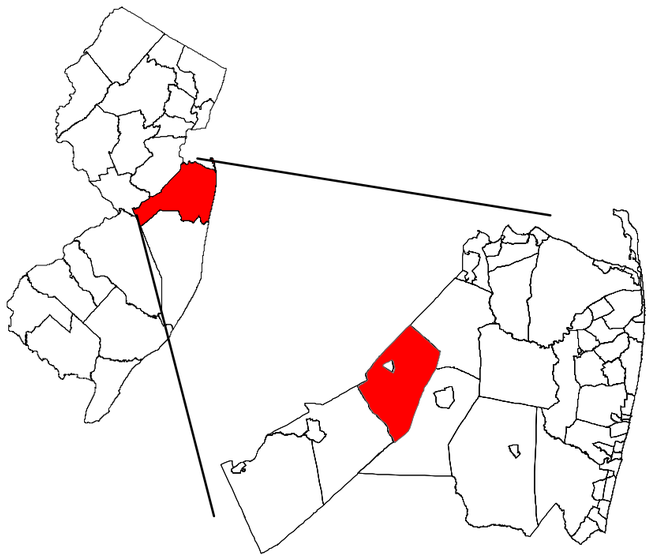
It should be noted that this plan is subject to change based upon Township, Western Monmouth Utilities Authority, and NJDEP approved sewer extensions.

# SEWER SERVICE AREAS

Manalapan Township, Monmouth County, NJ

## Legend

- Groundwater Discharge (less than 20,000 gpd)
- Groundwater Discharge (more than 20,000 gpd)
- Septic
- Surface water Discharge
- Manalapan Roads
- Manalapan Parcels
- Manalapan Township Boundary



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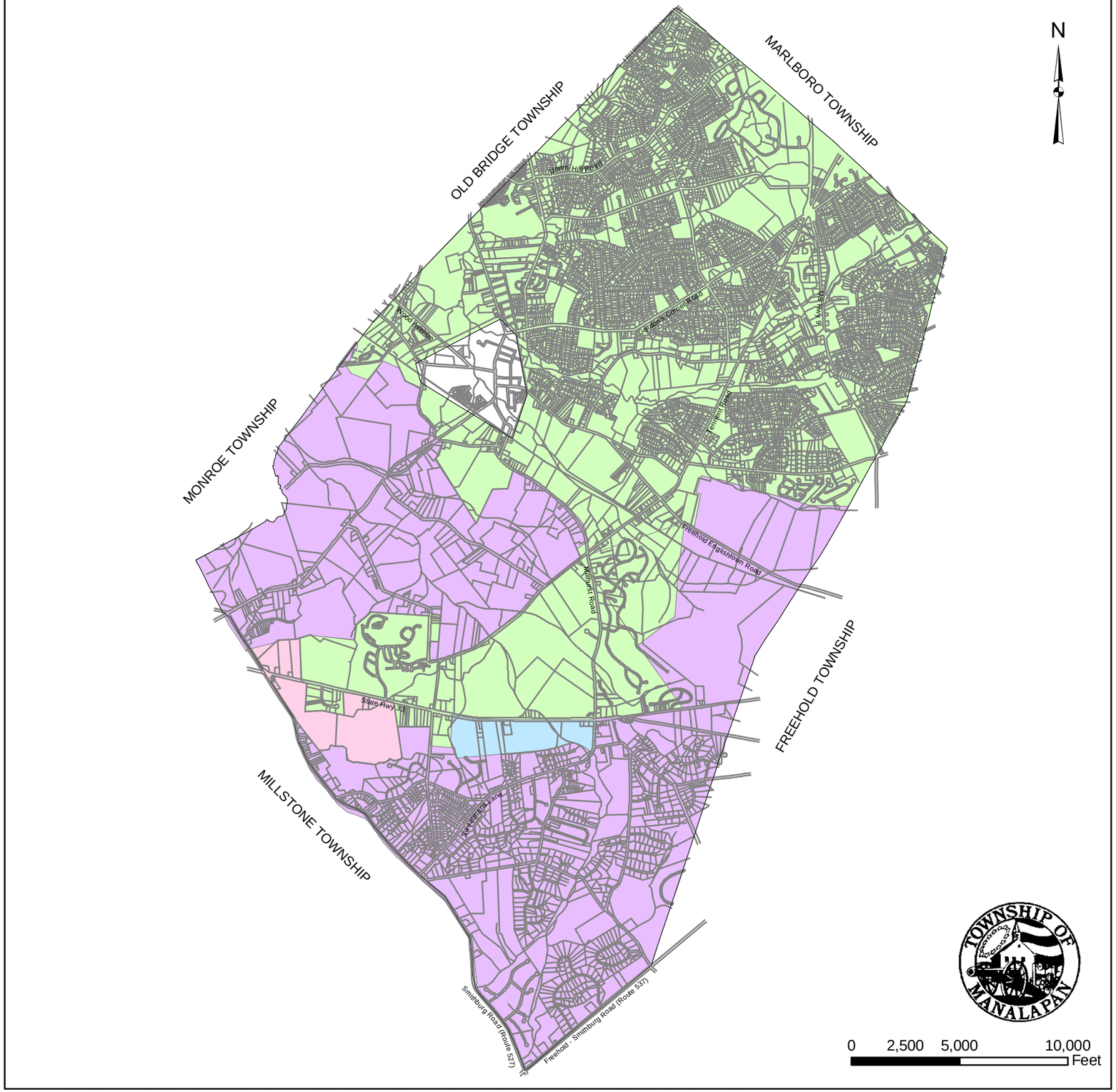


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## HISTORIC SITES

An inventory of historic sites in Monmouth County has been compiled by the Monmouth County Historical Association (1990), and this list was used to create the Manalapan Township Historic Sites Map. The County inventory was performed in accordance with criteria established by the National Historic Preservation Act of 1966. Extant aboveground structures which are considered significant to or representative of the County's history, culture, or architecture, were identified and documented in the inventory. Selection criteria included age, structural type, architectural style, and historical or cultural association. In general, sites at least 50 years old were considered for selection. The physical condition of a structure was also a factor in site selection.

Monmouth Battlefield State Park – The Battle of Monmouth occurred on June 28, 1778, as George Washington's Continental Army engaged the British Army along the road from Tennent to Monmouth Court House (present day Freehold-Englishtown Road). The park is located in both Manalapan and Freehold Townships, and preserves open space in the vicinity of the battlefield. Several historic structures are located within the park confines, including the John Conover House, the Reverend A.P. Cobb House, the Sutfin-Solomon House, the Old Tennent Church, and an early 19th century farmstead. Monmouth Battlefield is listed as a historic district on the National Historic Register.

John Conover House – This is a federal style farmhouse on the north side of Freehold-Englishtown Road.

19th Century Farmstead – This farm complex on the north side of Freehold-Englishtown Road includes an early 19th century farmhouse, with a wagon shed, smokehouse, barns, and grain silo constructed later in the 19th century.

Reverend A.P. Cobb House – This three-story Italianate style house on the south side of Freehold-Englishtown Road was constructed by the pastor of Tennent Church in 1870.

Sutfin-Solomon House – This structure on the south side of Freehold-Englishtown Road was originally constructed in 1770.

Old Tennent Church (Presbyterian Church of Freehold) – This Georgian style church was constructed during 1751-2 at the southeast corner of the Tennent Road and Craig Road intersection.

Joseph Forman House – This residence on the east side of Amberly Road West was originally constructed in the early 18th century.

James English House – This Greek revival farmhouse was constructed in 1885.

Robert Craig House – This is an example of a mid-nineteenth century farmhouse.

Nineteenth Century Farmstead – This farm complex on the south side of Craig Road includes two farmhouses, a wagon shed, and a barn. The earliest house was built in the mid-nineteenth century.

Nineteenth Century Residence – This federal style building on the south side of Craig Road was originally constructed in the early 19th century and has had several later alterations.

James English House – This residence on Gordon's Corner Road was originally constructed in 1740 and expanded in 1800.

Reid Family House – This residence on Iron Ore Road was originally constructed in 1839 with Federal and Greek revival style characteristics, and later expanded in a Victorian and Italianate style.

Eighteenth Century House – This Georgian style residence off of LaValley Road in the present day Quail Hill Boy Scout Reservation was originally constructed in 1770 and later altered.

Early Nineteenth Century House – This Italianate style house on Main Street near the Conrail Railroad tracks was constructed in 1810.

Early Twentieth Century Railroad Siding Complex – This site at the intersection of Main Street and the Conrail Railroad tracks includes a small office building and a grain elevator built between 1916 and 1920.

Late Eighteenth Century House – This is a Georgian style house on Main Street that was originally constructed in 1791 and later altered. Tennent Church purchased the structure in 1881 for use as a parsonage.

E. Ely House – This residence on Millhurst Road was constructed in 1865 in the Italianate style.

J.M. Quackenbush House – This residence on Morganville Road was constructed in 1860.

Woodville A.M.E. Church – This structure on Smithburg Road was constructed in 1836, and was one of the earliest African American churches in Monmouth County.

Historic Farmstead – This farm complex near the intersection of Millhurst Road and State Route 33 contains a mid-eighteenth century farmhouse, a late 19th century wagon shed, and a 1920's barn.

Historic Farmstead – This farm complex on the south side of State Route 33 near Smithburg Road includes a mid-nineteenth century Greek revival style farmhouse with a nineteenth-century wagon shed and barn.

George L. Hunt House – This federal style residence on the south side of State Route 33 was originally constructed in 1820.

Late Eighteenth Century House – This residence on State Route 33 was owned by John Rue Perrine from between 1837 and 1841 through 1889.

Clifford Snyder Grist Mill – This three-story mill located on the west side of Sweetman's Lane near Millhurst Pond was constructed in 1877.

Victorian Vernacular House – This residence was constructed in the late 19th-early 20th century.

Stillwell Farm – This farm complex on U.S. Route 9 near Pine Brook Road includes a Greek revival and Italianate style farmhouse constructed in 1850 as well as a later 19th century barn and wagon shed.

Late Eighteenth Century House – This structure at the northeast corner of Wickatunk Road and Morganville Road was originally constructed in 1797 with additions between 1810 and 1820. The site was operated as a tavern for most of the nineteenth century.

The Master Plan for Manalapan (Manalapan Township Planning Board, 1991) identifies the following additional sites of historical significance within the Township.

Dreyer House – This is an 18th century farmhouse on the south side of Freehold-Englishtown Road.

Millhurst School – This is a single story school building located at the southwest corner of State Route 33 and Millhurst Road.

Landmark Corridor – This includes the approaches to Tennent along Freehold-Englishtown Road, Main Street, and Tennent Road, providing access to Monmouth Battlefield and Old Tennent Church.

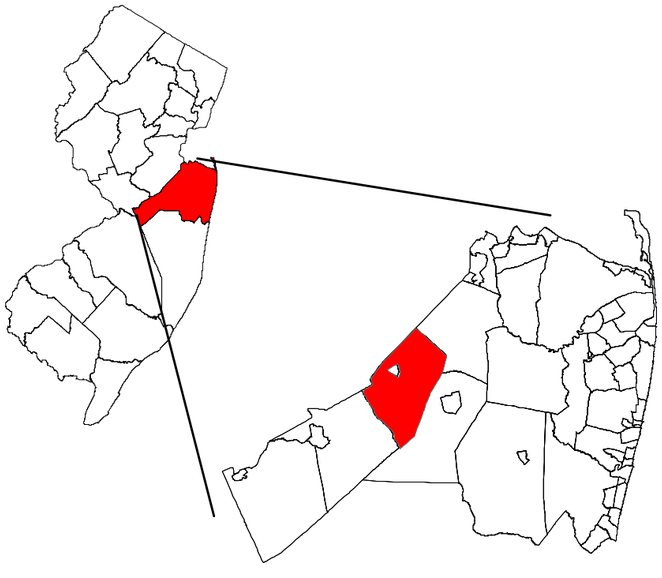
The Historic Preservation Plan Element of the Manalapan Master Plan designates all of the above-listed sites as Historic Landmarks. The plan includes a recommendation that preservation of these landmark sites be encouraged and the destruction or inappropriate alteration of landmark sites be discouraged.

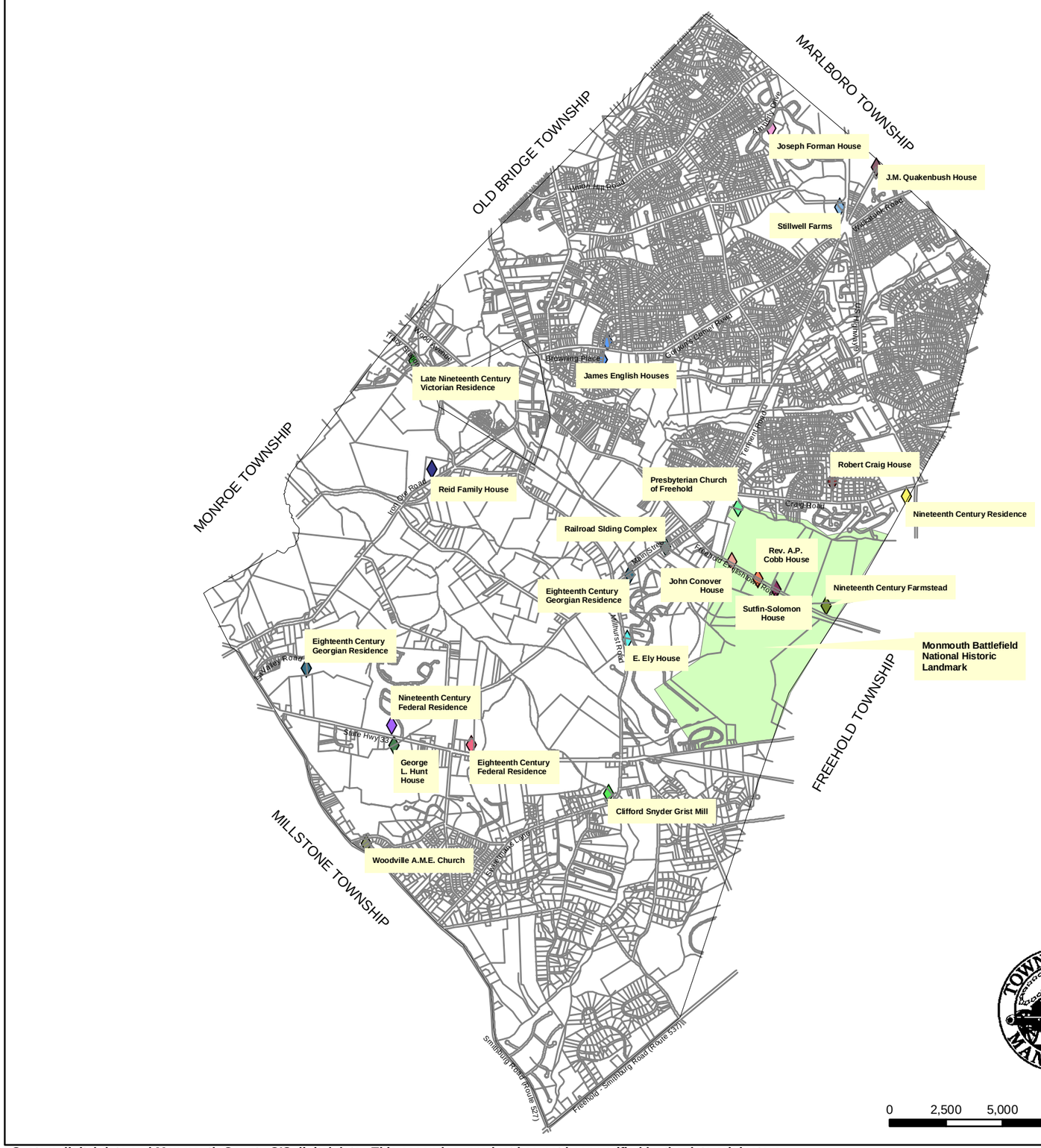
# HISTORIC SITES

## Manalapan Township, Monmouth County, NJ

**Legend**

- Clifford Snyder Grist Mill
- E. Ely House
- Eighteenth Century Federal Residence
- Eighteenth Century Georgian Residence
- George L. Hunt House
- J.M. Quakenbush House
- James English House
- John Conover House
- Joseph Forman House
- Late Nineteenth Century Victorian Residence
- Nineteenth Century Federal Residence
- Nineteenth Century Residence
- Nineteeth Century Farmstead
- Presbyterian Church of Freehold
- Railroad Siding Complex
- Reid Family House
- Rev. A.P. Cobb House
- Robert Craig House
- Stillwell Farm
- Sutfin-Solomon House
- Woodville A.M.E. Church
- Monmouth Battlefield State Park
- Manalapan Roads
- Manalapan Parcels
- Manalapan Township Boundary



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# GEOLOGY

## Physiography

Manalapan Township is located entirely within the Atlantic Coastal Plain physiographic province. The Coastal Plain is characterized by low lying terrain with open stream valleys and broad, gently sloping divides. Topography in the Coastal Plain is a result of the differential erosion of unconsolidated, gently dipping strata of gravel, sand, silt, and clay. Relatively resistant geologic formations erode less rapidly and typically form the higher elevations. The majority of Manalapan is at an elevation less than 200 feet, with the lowest areas along the northwest boundary of the Township at less than 80 feet. Hills with an elevation in excess of 200 feet are located in the south and southwest portions of the Township. The highest point in Manalapan Township is Locust Hill at an elevation in excess of 250 feet above mean sea level (NGVD 1929).

## Stratigraphy

The Atlantic Coastal Plain is mainly composed of strata of clay, silt, sand, and gravel deposited during the Cretaceous and Tertiary geologic time periods. These layers of unconsolidated sediment lie over a basement of much older Precambrian and early Paleozoic crystalline rock (schist and gneiss). The sedimentary formations dip gently toward the southeast (10 to 60 feet per mile), and generally thicken toward the southeast (Kümmel, 1940). In Manalapan Township, the total thickness of sedimentary strata lying over the crystalline basement ranges from approximately 550 feet along the northwest border up to approximately 850 feet along the southeast border.

Each sedimentary formation of the Coastal Plain consists of a succession of strata of similar or variable characteristics that were deposited over a particular interval of geologic time. The surface outcrop patterns of the formations generally trend from southwest to

northeast. On a local scale, formation boundaries typically appear irregular due to their gentle dip and the effects of topography. Sedimentary strata of the Coastal Plain dip to the southeast, and the formations become successively younger toward the southeast. Brief descriptions of each formation that outcrops within the Township are obtained from Kümmel (1940).

*Woodbury Clay* (Kwb)

The *Woodbury* formation consists of black non-glauconitic clay deposited in a marine environment. Maximum thickness is approximately 50 feet. The Woodbury is the oldest formation to outcrop in Manalapan, and is conformable (transitions gradually) to the underlying Merchantville clay. The Woodbury and Merchantville form a hydrogeologic confining unit, impeding the movement of groundwater. In Manalapan, the Woodbury clay only outcrops along McGellairds Brook at the northwest boundary of the Township. Below the surface, the Woodbury is mapped under the entire Township.

*Englishtown Sand* (Ket)

The *Englishtown* formation consists of light colored, slightly micaceous quartz sand deposited in a near shore environment. Locally, sections of the sand may be cemented by iron oxide into masses of ironstone. Thin layers of clay may be present in places. Maximum thickness of the Englishtown sand is 140 feet. The contact with the underlying Woodbury is unconformable (abrupt). The Englishtown sand formation comprises the Englishtown aquifer system.

**TABLE**

**GEOLOGIC FORMATIONS OF MANALAPAN TOWNSHIP**

| AGE | FORMATION | HYDROGEOLOGIC UNIT | | THICKNESS (Feet) |
|---|---|---|---|---|
| Tertiary (70 mya) | Cohansey Sand | Kirkwood-Cohansey Aquifer System | | 0-30 |
| | Kirkwood Formation | | | 100 |
| | Vincentown Sand | Vincentown Aquifer | | 100 |
| | Hornerstown Marl | Confining Unit | | 30 |
| Upper Cretaceous (70-100 mya) | Red Bank and Tinton Sands | Red Bank sand | | 140 |
| | Navesink Formation | Confining Unit | | 25-40 |
| | Mount Laurel and Wenonah Sands | Wenonah-Mount Laurel Aquifer | | 40-80 |
| | Marshalltown Formation | Marshalltown-Wenonah Confining Unit | | 30-40 |
| | Englishtown Sand | Englishtown Aquifer System | | $\leq$ 140 |
| | Woodbury Clay | Merchantville-Woodbury Confining Unit | | 50 |
| | Merchantville Formation | | | 60 |
| | Magothy and Raritan Formations | Raritan-Magothy Aquifer System | Upper Aquifer | 50-200 |
| | | | Confining Unit | 50-150 |
| | | | Middle Aquifer | 50-150 |
| Pre-Cretaceous | Pre-Cambrian/Lower Paleozoic Schist and Gneiss | Bedrock Confining Unit | | ---- |

**Adapted from Pucci, Gronberg, & Pope (1989)**

*Marshalltown Formation* (Kmt)

The *Marshalltown* formation consists of strata of black sandy clay and glauconitic sand (greensand) deposited in a marine environment. Thickness ranges from 30 to 40 feet. The Marshalltown and lower part of the overlying Wenonah Formation form a hydrogeologic confining unit.

*Mount Laurel Sand and Wenonah Formation* (Kmw)

The *Mount Laurel Sand and Wenonah formations* are grouped together into a single unit. The lower section of this unit is the Wenonah, which consists of fine-grained micaceous quartz sand that is conformable to the underlying Marshalltown. The Mount Laurel is the upper section and consists of coarser grained quartz sand that is variably glauconitic. Sediment in both formations was deposited in a near shore marine environment. Combined thickness of the units ranges from 40 to 80 feet. The Mount Laurel sand generally constitutes an aquifer.

*Navesink Formation* (Kns)

The *Navesink formation* consists of green to black glauconitic quartz sand and clayey sand deposited in a marine environment. The Navesink is conformable to the underlying Mount Laurel sand and the overlying Red Bank sand. Thickness ranges from a maximum of 40 feet to less than 25 feet. The Navesink is a hydrogeologic confining unit.

*Red Bank and Tinton Sands* (Krb)

The *Red Bank and Tinton Sand* formations are typically grouped together as a mapping unit in Monmouth County. The Red Bank dominantly consists of coarse-grained yellowish, reddish brown, or gray quartz sand, locally cemented by iron

oxide. The Tinton consists of glauconitic sand and clay. Thickness of the Red Bank is up to 140 feet, and the Tinton is 10 to 20 feet thick. The Red Bank sand may locally yield small quantities of water and be considered an aquifer.

*Hornerstown Marl* (Tht)

The *Hornerstown* formation consists of dark green glauconitic sand and clay beds deposited in a marine environment. The Tertiary Age Hornerstown unconformably overlays the Cretaceous Age formations below. Total thickness is up to 30 feet. The Hornerstown is a confining unit. In Manalapan, Tertiary Age formations only outcrop near the south end of the Township.

*Vincentown Sand* (Tvt)

The *Vincentown* formation contains two facies (zones of distinct composition within the formation). One facies consists of calcareous sand with abundant marine fossils. A second facies consists of glauconitic quartz sand. This glauconite facies is dominant in Monmouth County. The Vincentown conformably overlies the Hornerstown, and is up to 100 feet thick. The Vincentown can potentially yield moderate quantities of water, but its occurrence in Manalapan is not extensive.

*Kirkwood Sand* (Tkw)

The *Kirkwood* formation consists of light-colored fine-grained micaceous quartz sand deposited in a near shore marine environment and unconformably overlying the Vincentown sand. Black lignitic clay occurs in some localities at the based of the Kirkwood. Total thickness of the Kirkwood is up to 100 feet. Portions of the Kirkwood are aquifers, but its occurrence in Manalapan Township is not extensive.

*Cohansey Sand* (Tch)

The *Cohansey* formation dominantly consists of quartz sand, although it locally may contain thin clay seams (laminae), thicker clay lenses, or lenses of gravel. Cohansey sediments were deposited in a near shore environment, generally disconformably overlying Kirkwood sands. The Cohansey is an important water table aquifer throughout much of the Coastal Plain, but its occurrence in Manalapan Township is restricted to a hilltop near Oakland Mills.

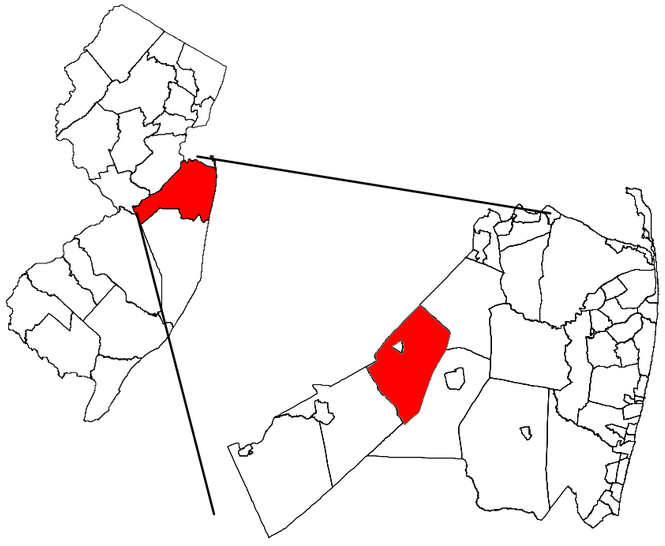
According to the NJDEP Technical Manual for Stream Encroachment, nine (9) of these formations (Raritan, Magothy, Merchantville, Woodbury, Englishtown, Marshalltown, Navesink, Red Bank, and Kirkwood) may contain iron sulfide minerals (pyrite or marcasite), that if exposed to air for a period of time can produce sulfuric acid. This material can drastically impact new and proposed vegetative cover and cause water pollution. The handling of this material should be done in accordance with the aforementioned NJDEP Stream Encroachment Manual.

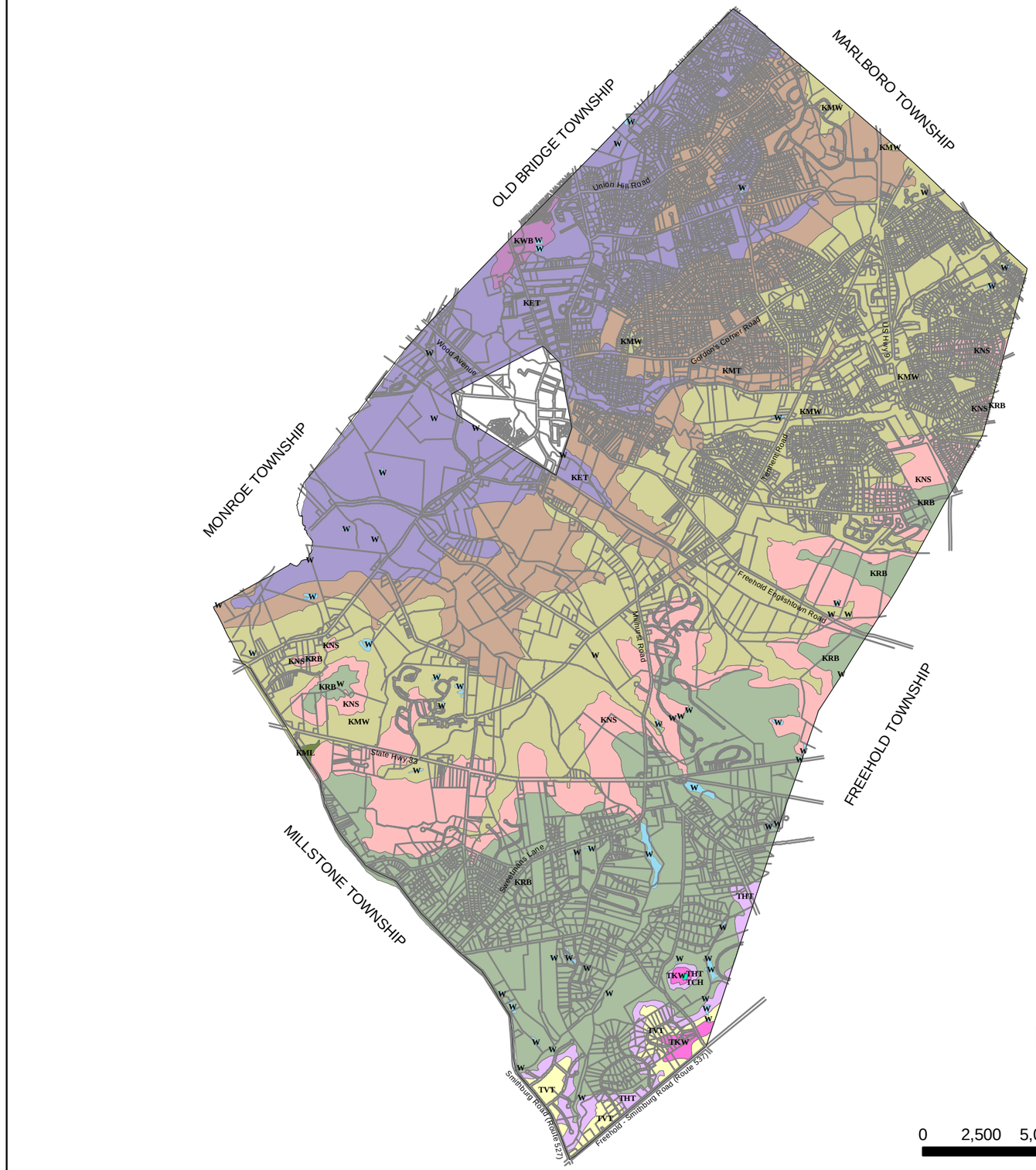
# SURFACE GEOLOGY

## Manalapan Township, Monmouth County, NJ

### Legend

- TCH - Cohansey Sand
- TKW - Kirkwood Sand
- TVT - Vincetown Sand
- THT - Hornerstown Marl
- KRB - Red Bank
- KNS - Navesink Marl
- KMW - Mount Laurel & Wenonah Sands
- KML - Mount Laurel Sand
- KMT - Marshalltown Formation
- KET - Englishtown Sand
- KWB - Woodbury Clay
- W - Water
- Manalapan Roads
- Manalapan Parcels
- Manalapan Township Boundary






TOWNSHIP OF MANALAPAN

CME ASSOCIATES

H-MA-00046-01 7/18/01

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## AQUIFERS

Aquifers are saturated geologic formations capable of yielding significant quantities of water under conventional pumping pressures. An unconfined aquifer is a near surface aquifer that has the water table as its upper boundary (also called a water table aquifer). A confined aquifer is a fully saturated unit bounded above and below by relatively impermeable formations called confining units. Aquifers underlying Manalapan Township include the Raritan-Magothy aquifer system, the Englishtown aquifer system, the Mount Laurel - Wenonah aquifer, and portions the Red Bank and Tinton sand formation.

Although the Raritan-Magothy aquifer system is not exposed at the surface within Manalapan, the formation is present at depth within the Township. The Raritan and Magothy formations are a complex sequence of interbedded sand, gravel, silt, and clay strata. In the northern Coastal Plain, this sequence can be divided for simplicity into upper and middle aquifers separated by a confining unit (Pucci, Gronberg, & Pope, 1989). Locally, the upper and middle aquifers may be respectively correlated to the Old Bridge sand and Farrington sand members of the Raritan-Magothy formations. A lower aquifer corresponding to the Potomic formation is absent in the northern Coastal Plain, and the middle aquifer is underlain directly by Pre-Cretaceous bedrock or by a clay layer that rests on bedrock. The Raritan-Magothy aquifer system is assigned rank “A” by the New Jersey Geological Survey, with an average yield of high capacity wells in excess of 500 gallons per minute. Water is typically fresh and moderately hard, with a near neutral pH. Elevated iron and manganese levels are common (NJDEP, 1996).

The Merchantville-Woodbury confining unit separates the Raritan-Magothy aquifer system from the overlying Englishtown aquifer system. The confining unit is comprised of silt and clay with thin layers of sand. An aquifer rank of “E” is assigned to the Merchantville-Woodbury formations, with an average yield of high capacity wells less than 25 gallons per minute.

The Englishtown sand has an extensive outcrop area in the northern portion of Manalapan Township where it is a water table (unconfined) aquifer. In the southern portion of the Township, these aquifers are bounded above and below by relatively low permeability confining units. The Englishtown aquifer system includes upper and lower sand units with localized clay beds. An aquifer rank of "B" is assigned to the Englishtown, with an average yield of high capacity wells between 250 and 500 gallons per minute.

The Marshalltown and lower portion of the Wenonah formation comprise a confining unit that separates the underlying Englishtown aquifer system and the overlying Mount Laurel-Wenonah aquifer. This confining unit is comprised of silt and clay with thin sand layers. The aquifer rank is "E", with an average yield of high capacity wells less than 25 gallons per minute.

The Mount Laurel-Wenonah aquifer is comprised of glauconitic sand overlying micaceous sand. These formations outcrop across central Manalapan, striking from southwest to northeast. An aquifer rank of "C" is assigned to the Mount Laurel-Wenonah, with an average yield of high capacity wells less than 25 gallons per minute. Water is typically fresh, moderately hard, and alkaline. Iron and manganese levels may be locally elevated. Calcium and magnesium levels decrease with depth (NJDEP, 1996).

The stratigraphic interval including the Navesink formation, Red Bank and Tinton sands, and Hornerstown marl are mapped as a composite confining unit that outcrops in the southern portion of Manalapan Township. This composite unit locally contains sandy intervals that may be important water table aquifers and are mapped as "composite confining unit aquifers". In Manalapan, these aquifers correspond to the Red Bank sand and the Tinton sand formations. Aquifer rankings range from "E" for confining members (average yield of high capacity wells less than 25 gallons per minute) to "B" for more permeable members (average yield of high capacity wells between 250 and 500 gallons per

minute). Water quality in the aquifers is generally good, although iron and manganese levels may be locally elevated (NJDEP, 1996).

Groundwater recharge is the transmission of water from the surface to the saturated zone beneath the water table. Areas of high aquifer recharge areas typically correspond to the outcrop occurrence of permeable strata that are hydraulically connected to an aquifer. Potential recharge areas therefore roughly correspond to areas where geologic formations comprising aquifers are exposed at the surface. Actual groundwater recharge is dependent on climate, soil characteristics, slope, vegetative cover, and land use. A method for quantitatively evaluating recharge areas and creating detailed groundwater recharge maps has been proposed by the New Jersey Geological Survey (Charles and Others, 1993).

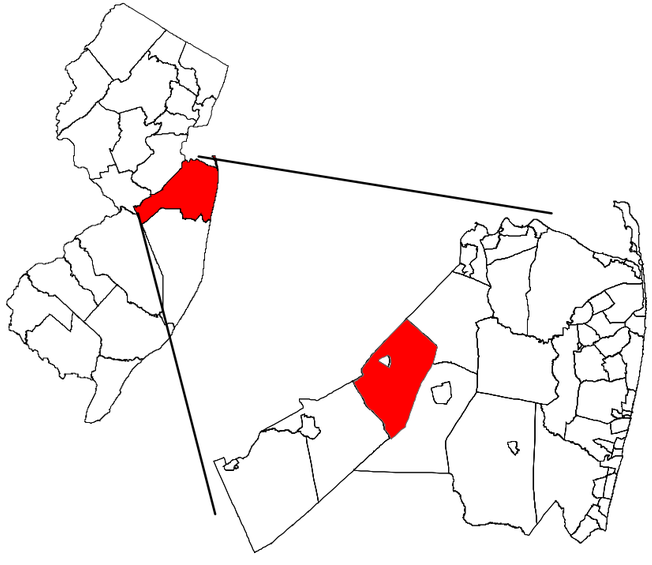
# Manalapan Township, Monmouth County, NJ

# AQUIFERS

## Legend

### AQUIFERS

- ccu - Composite confining unit
- ccua - Composite confining unit aquifer
- eas - Englishtown aquifer system
- mawcu - Marshalltown-Wenonah confining unit
- mewcu - Merchantville-Woodbury confining unit
- mlwa - Mt. Laurel-Wenonah aquifer
- Manalapan Roads
- Manalapan Parcels
- Manalapan Township Boundary



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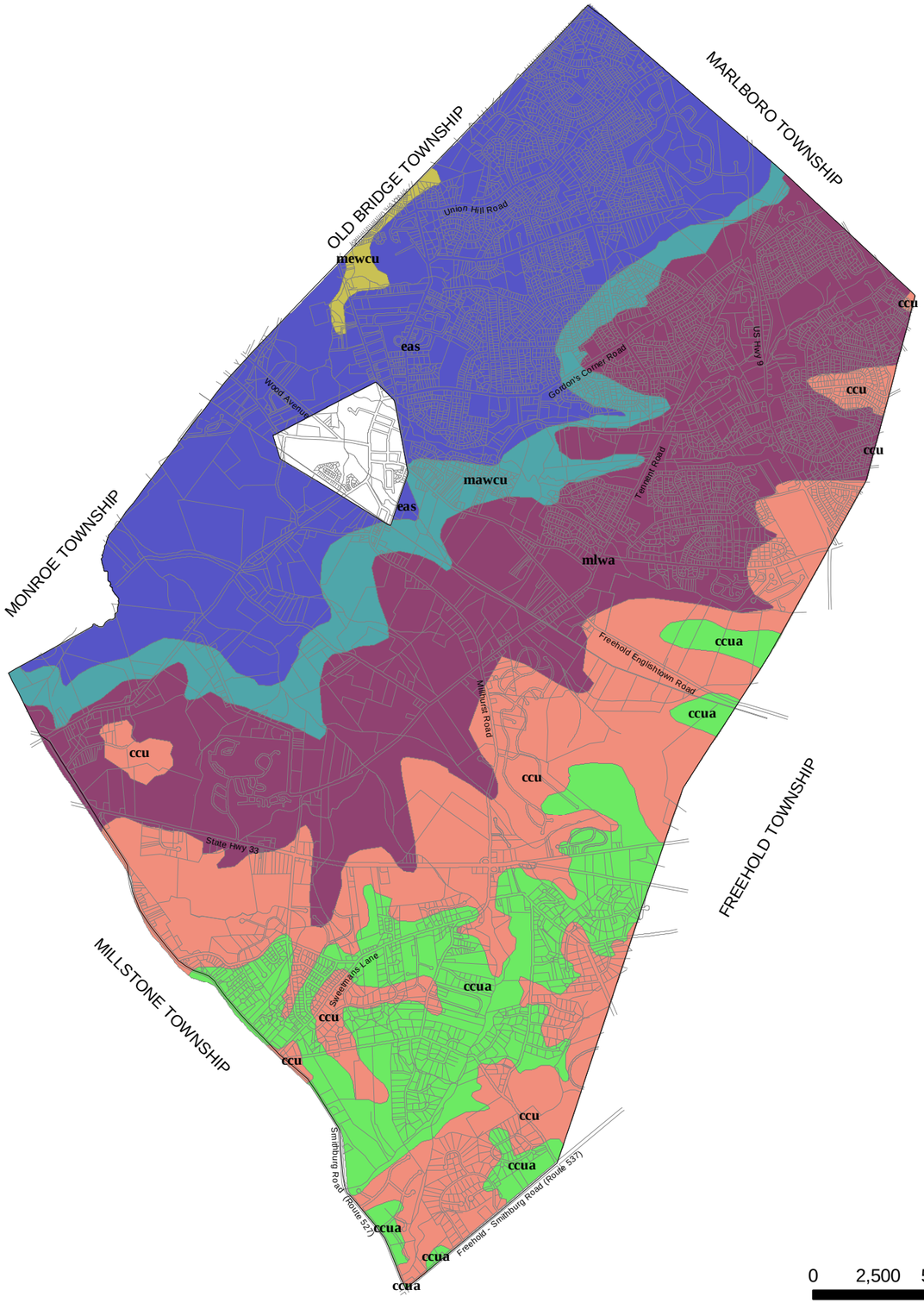



Source: This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data and NJGS GIS digital data. This secondary product has not been verified by the data originators.

## STREAMS AND LAKES

Major surface hydrologic features within Manalapan Township are presented on the Streams and Lakes Map. A northeast-southwest trending drainage divide within the Coastal Plain is located to the southeast of the eastern Township line, and drainage within the Township is generally toward the northwest. Main streams in the north and central portions of the Township include McGellairds Brook and Weamaconk Creek, which combine to form Matchaponix Brook to the northwest of Englishtown. The headwaters of McGellairds Brook and Weamaconk Creek are located to the east of Manalapan in Freehold Township. Larger tributary streams in northern Manalapan include Tepehemus Brook, Milford Brook, and Pine Brook. These streams generally flow toward the west-southwest from highlands in Marlboro and Freehold. The main stream in the southern portion of the Township is Manalapan Brook, with headwaters in Millstone Township, Freehold Township, and southern Manalapan. Northwest of the Manalapan boundary, the Manalapan Brook and Matchaponix Brook turn generally northward and combine to form the South River near the town of Spotswood. The majority of Manalapan Township is thus part of the South River watershed and the Raritan River drainage basin. Some areas along the southwestern and southeastern Township lines may lie within the Millstone or Manasquan River watersheds.

All streams within Manalapan Township are classified as FW2-NT by the New Jersey Department of Environmental Protection (NJAC 7:9B; NJDEP, 1998). FW2 is a general surface water classification applied to fresh waters that are not considered to be of exceptional quality, significance, or resource value (i.e., not FW1 waters). NT is the designation for non-trout waters.

The New Jersey Department of Environmental Protection has divided the State into 20 Watershed Management Areas for the purposes of environmental planning and management. The major drainage systems of Manalapan Township are within Watershed

Management Area 9, which includes the mainstream Raritan River, South River, Lawrence Brook, Matchaponix Brook, and Manalapan River watersheds (NJDEP, 1996).

Water quality in the State is monitored by the NJDEP. Monitoring stations in the vicinity of Manalapan Township are located on Manalapan Brook at Federal Road in Monroe and on Matchaponix Brook near the confluence with Manalapan Brook. The most recent monitoring results publicly available were published in 1996 and reflect water quality conditions from 1991 through 1995 (NJDEP, 1996). Both the Manalapan Brook and the Matchaponix Brook were assessed as fully supporting primary contact recreation (swimmable use), indicating relatively low fecal coliform bacteria concentrations in these waters. Phosphorus levels in both streams were moderately elevated. Inorganic nitrogen was at an acceptable level in the Manalapan, but was extremely elevated in the Matchaponix. Testing for heavy metals suggested excessive lead levels in both streams, and an elevated zinc level in the Matchaponix Brook. Water quality in both streams was similar to conditions observed during the 1986 through 1990 assessment.

Several streams within the Manalapan and Matchaponix watersheds were assessed with regard to aquatic life support (macroinvertebrates) during the early 1990's (NJDEP, 1996). Manalapan Brook was assessed as severely impaired at the Federal Road monitoring site in Monroe, and McGellairds Brook was assessed as severely impaired at an Englishtown monitoring site. The Matchaponix, Tepehemus, Milford, Pine, and Weamaconk streams were all assessed as moderately impaired in the Manalapan Township area. An assessment of a stream as severely impaired indicates no support of aquatic life use, and moderately impaired indicates partial support.

A regional sewage treatment plant is located in western Manalapan near Clarks Mills. This plant has a discharge to Pine Brook upstream of the confluence with Matchaponix Brook. It is possible that the high nitrogen concentrations observed in the Matchaponix are related to this point source (NJDEP, 1996).

Principal land uses in the Manalapan Brook and Matchaponix/McGellairds Brook watersheds include suburban residential, commercial, and agricultural, with considerable residential and commercial development of former farm and woodland continuing to occur. Non-point source water quality problems associated with these land uses are related to runoff from acid producing soils, silt loadings, flooding, septic system leachate, fertilizers/pesticides/herbicides used on residential lawns, and stream bank destabilization. In Manalapan Township, recent sediment loading and flooding due to runoff from active construction sites and existing roadways has resulted in a severe decline in the quality of fish habitat (NJDEP, 1996).

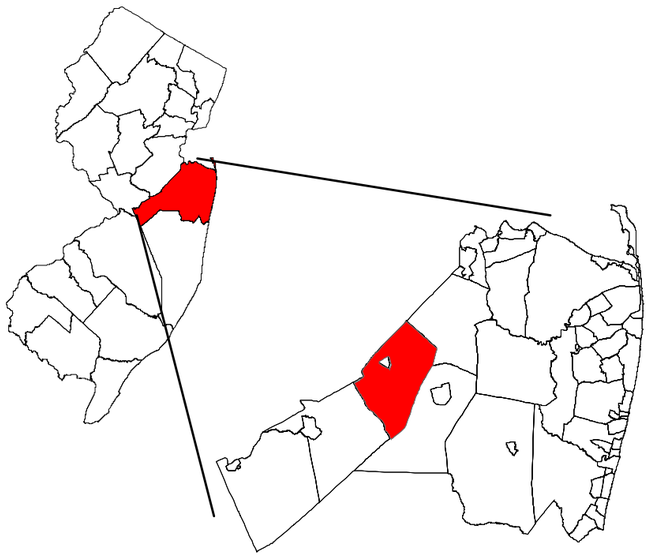
Ponds and lakes within Manalapan Township are generally manmade by excavation or impoundment, and have historically been used for agricultural irrigation or as mill sites. The largest lake in the Township is Millhurst Pond on Manalapan Brook, which is dammed at Sweetmans Lane.

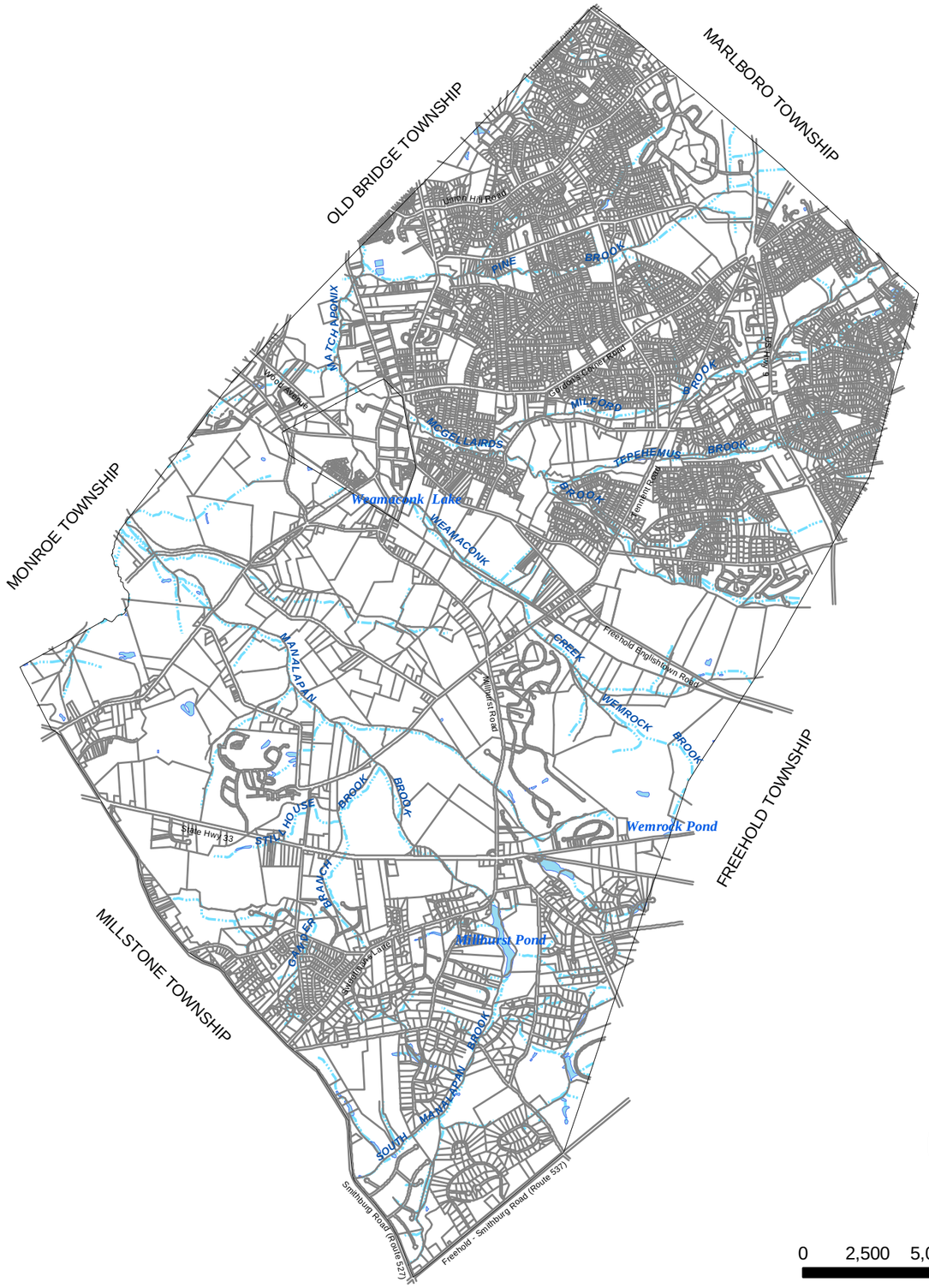
# STREAMS AND LAKES

Manalapan Township, Monmouth County, NJ

## Legend

- Lakes
- Streams
- Manalapan Roads
- Manalapan Parcels
- Manalapan Township Boundary



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Source: This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data. This secondary product has not been verified by the data originators.

## FLOOD-PRONE AREAS

The areas designated as flood-prone are based on readily available information on past floods rather than from detailed site specific surveys and inspections. These areas therefore represent approximate locations and boundaries, and should not be construed as exact locations for flood insurance or construction purposes.

In general, there is an average of 1 chance in 100 that these flood-prone areas will be inundated in any year. These mapped areas do not take into consideration the possible impacts of existing or proposed flood control structures, except where those effects were readily evaluated.

United States Geological Survey flood-prone areas are generally identified for urban lands where the upstream drainage basin exceeds 25 sq. mi. and rural humid lands where the upstream drainage basin exceeds 100 sq. miles. Flood-prone areas in smaller drainage basins may also be identified, depending on topography and potential use of the floodplains. Additional information on potential flood zones is available on Flood Insurance Rate Maps (FIRM) published by the Federal Emergency Management Association (FEMA).

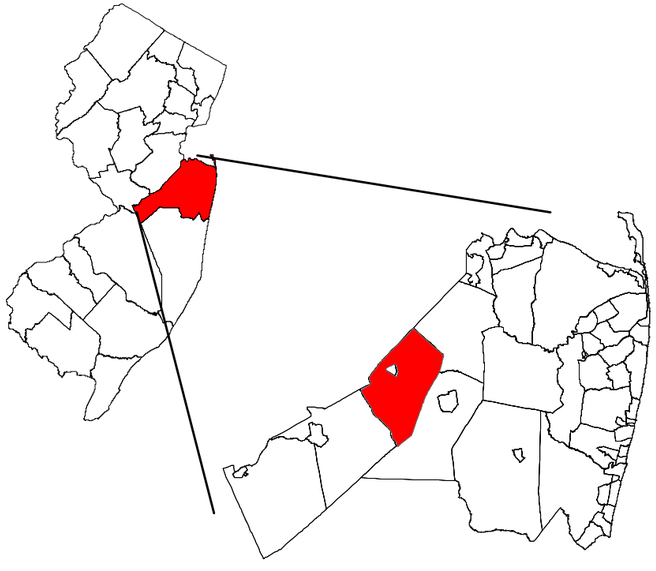
# FLOODPRONE AREAS

Manalapan Township, Monmouth County, NJ

## Legend

### FLOODPRONE AREAS

- USGS Documented Floodprone Area
- Undocumented Floodprone Area
- Water
- Manalapan Roads
- Manalapan Parcels
- Manalapan Township Boundary



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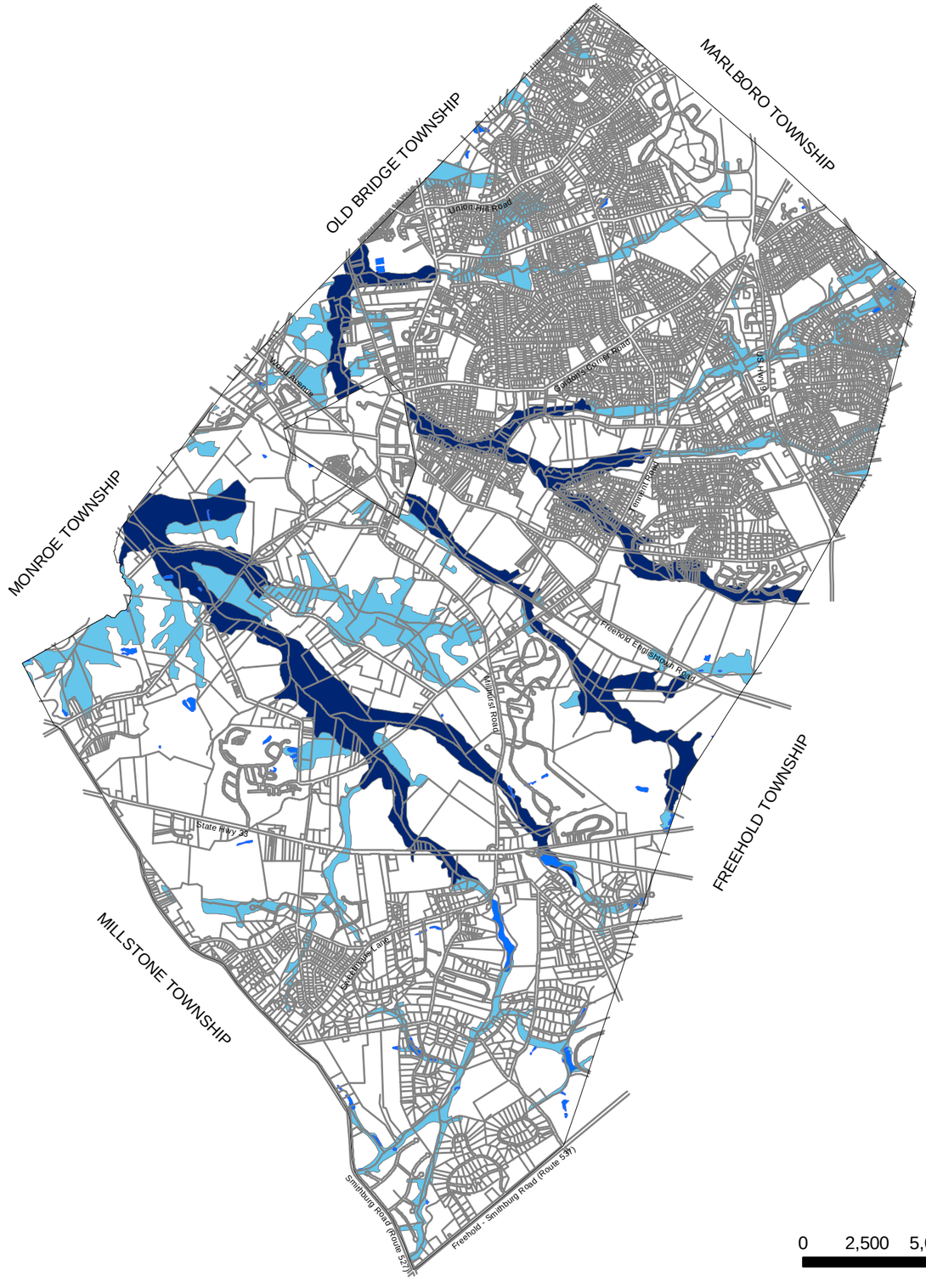


TOWNSHIP OF MANALAPAN

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## FRESHWATER WETLANDS

Wetlands are generally defined as areas that are inundated or saturated by surface or ground waters at a frequency and duration sufficient to support vegetation adapted for life in saturated soil conditions. The Freshwater Wetlands Map for Manalapan depicts wetlands within the Township as interpreted by the New Jersey Department of Environmental Protection from 1986 color aerial infra-red photography. These wetland areas are classified according to the U.S. Geological Survey Land Use and Land Cover classification system used for Land Use mapping. The wetlands map is intended for use as a planning guide to indicate areas that may potentially contain regulated wetlands. Actual determination of regulated areas is dependent on a field delineation of the wetland boundary.

Freshwater wetlands in Manalapan are commonly associated with stream corridors and broad stream valleys. General wetland types found within the Township include:

Deciduous Wooded Wetlands – This map unit includes closed canopy swamps associated with watercourses and marsh edges, as well as isolated wetlands. The wetlands are dominated by deciduous tree species (>75%) with an average height greater than 20 feet.

Coniferous Wooded Wetlands – This map unit includes closed canopy swamps dominated by coniferous tree species (>75%) with an average height greater than 20 feet.

Mixed Forest, Deciduous Wetlands – This map unit includes forested swamps of mixed deciduous and coniferous trees with deciduous trees prevalent (>50%), but not dominant (<75%). Average tree height is greater than 20 feet.

Mixed Forest, Coniferous Wetlands – This map unit includes forested swamps of mixed coniferous and deciduous trees with coniferous trees prevalent (>50%), but not dominant (<75%). Average tree height is greater than 20 feet.

Deciduous Shrub/Scrub Wetlands – This map unit includes brush/shrubland swamps with deciduous species less than 20 feet in height predominant (>75%).

Mixed Shrub/Scrub Wetlands – This map unit includes brush/shrubland swamps with mixed deciduous and coniferous species less than 20 feet high predominant.

Herbaceous Wetlands – This map unit includes non-tidal swamps dominated by non-woody plant species. Typical herbaceous wetlands may be located on open lake edges and floodplains, and in abandoned wet agricultural fields.

Natural Lakes – This map unit includes naturally enclosed, non-flowing bodies of water that are larger than 3 acres.

Artificial Lakes – This map unit includes impounded bodies of water larger than 3 acres.

Modified Agricultural Wetlands - This map unit includes cultivated lands that are former natural wetlands. These areas generally have hydric soils.

Managed Wetlands – This map unit includes modified former natural wetland areas that are managed for miscellaneous types of agriculture other than cropland and pasture land. Included in this category may be orchards, nurseries, sod and seed

farms, cranberry and blueberry farms, live stock feed lots, poultry farms, horse farms, and other specialty farms that have hydric soils.

Disturbed Wetlands – These areas are former natural wetlands that have been disturbed by clearing, filling, or excavating. The soil shows signs of saturation, but typical wetland vegetation is generally not supported.

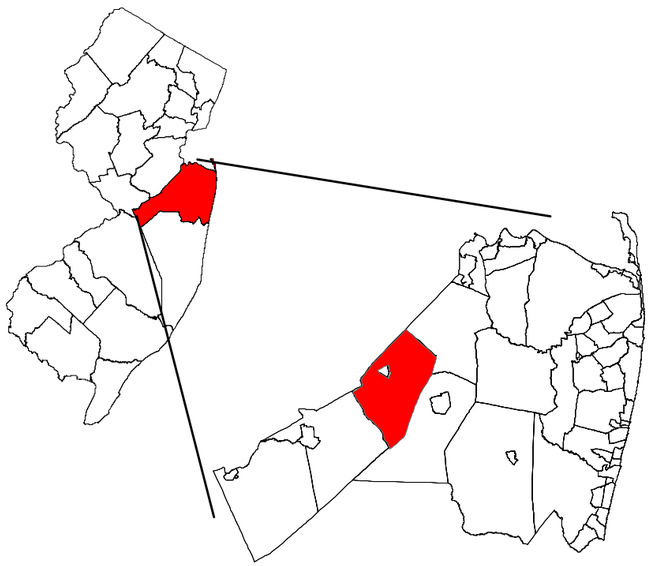
Wetland Rights-of-Way – These areas are former natural wetlands in rights-of-way. These areas have hydric soils but may not support the typical wetland vegetation found in adjacent unaltered wetlands.

# WETLANDS

## Manalapan Township, Monmouth County, NJ

**Legend**

- AGRICULTURAL WETLANDS (MODIFIED)
- ARTIFICIAL LAKES
- CONIFEROUS WOODED WETLANDS
- DECIDUOUS SCRUB/SHRUB WETLANDS
- DECIDUOUS WOODED WETLANDS
- DISTURBED WETLANDS (MODIFIED)
- HERBACEOUS WETLANDS
- MANAGED WETLANDS (MODIFIED)
- MIXED FORESTED WETLANDS (CONIFEROUS DOM.)
- MIXED FORESTED WETLANDS (DECIDUOUS DOM.)
- MIXED SCRUB/SHRUB WETLANDS (DECIDUOUS DOM.)
- NATURAL LAKES
- WETLAND RIGHTS-OF-WAY (MODIFIED)
- Manalapan Roads
- Manalapan Parcels
- Manalapan Township Boundary



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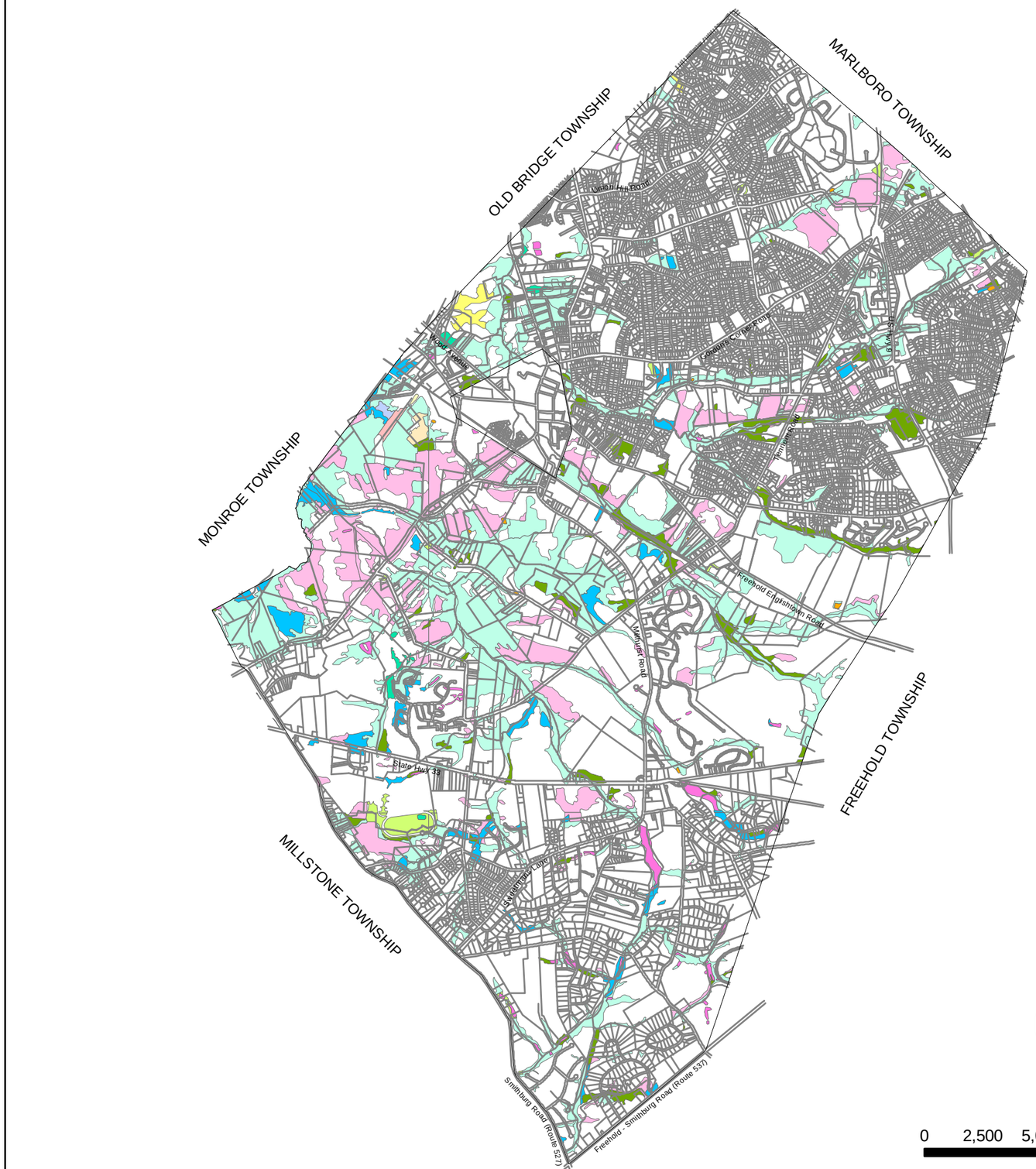


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Source: This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data. This secondary product has not been verified by the data originators.

# SOILS

## Soil Series

Abbreviated descriptions of the soils series that have been mapped in Manalapan Township are obtained from the Soil Conservation Service of the United States Department of Agriculture soil survey for Monmouth County (Jablonski & Baumley, 1989).

*Adelphia Series* (AeA, AeB, ALA)

The *Adelphia loam* is a deep, moderately well drained or somewhat poorly drained soil on uplands. A typical profile may include fine sandy loam from 0" to 14" deep, mottled olive brown sandy clay loam with 10% to 20% glauconite from 14" to 30" deep, and olive gray and yellowish-brown sandy loam and loamy sand from 30" to 60" deep. These soils have an apparent seasonal high water table of 1.5' to 4.0' below the surface from January through April. Adelphia soils are not on the New Jersey State Hydric Soils List.

*Atsion Series* (At)

The *Atsion Sand* consists of poorly drained soil in depressional areas and on broad flats. A typical profile may include black sand from 0" to 5" deep, light gray sand from 5" to 28" deep, dark reddish brown loamy sand from 28" to 34" deep, and light gray sand from 34" to 60" deep. Atsion Sand has a seasonal high water table between the surface and a depth of 1'. The Atsion series is listed as a Group 2 hydric soil in New Jersey.

*Colemantown Series* (Cm)

The *Colemantown loam* is a poorly drained soil found in depressional areas and on broad flats. A typical profile may include very dark brown loam from 0" to 9"

deep, mottled dark greenish-gray clay loam from 9” to 36” deep, and mottled dark greenish-gray stratified sandy clay loam to sandy clay from 36” to 60” deep. The seasonal high water table is generally perched and between the surface and 1’ deep. The Colemantown series is listed as a Group 1 hydric soil in New Jersey, and nearly always displays hydric conditions.

*Collington Series* (CnB, CnC2, CnD3, CRB)

The *Collington sandy loam* is a well-drained soil on divides and side slopes. A typical profile may include dark brown sandy loam from 0” to 11” deep, dark brown loam and sandy clay loam from 11” to 32” deep, and dark brown and brown sandy loam to coarse sandy loam from 32” to 60” deep. The depth to the seasonal high water table is greater than 72”. Collington soils are not included on the list of New Jersey hydric soils.

*Colts Neck Series* (CtB, CtC, CtC2, CtD2, CtE2)

The *Colts Neck* series consists of well-drained sandy loam soils on uplands. A typical profile may include a 10” thick dark reddish-brown plow layer, with reddish brown to dark reddish-brown sandy loam or sandy clay loam containing less than 10% glauconite from 10” to 35” deep, and reddish brown stratified loamy sand from 35” to 60” deep. Iron concretions and iron-cemented sandstone are common in the subsoil layers. The seasonal high water table is at a depth greater than 72”. The Colts Neck series is not included on the list of New Jersey hydric soils.

*Downer Series* (DnA, DnC, DUB)

The *Downer* series consists of deep, well drained soils on uplands. A typical soil profile may include dark brown loamy sand from 0” to 10” deep, strong brown

sandy loam from 10” to 26” deep, and strong brown gravelly loamy sand from 26” to 60” deep. Downer soils have a seasonal high water table greater than 6’ deep. The Downer series is not on the New Jersey hydric soils list.

*Elkton Series* (En)

The *Elkton loam* is a nearly level, poorly drained soil in depressional areas on broad flats. A typical profile may include a 4” surface layer of decomposed organic material and very dark gray loam, with mottled grayish brown silty clay from 4” to 36” deep, and gray silty clay loam from 36” to 60” deep. The seasonal high water table is between the surface and a depth of 1’ deep. Elkton loam is a Group 1 hydric soil in New Jersey, and nearly always displays hydric conditions.

*Evesboro Series* (EvB, EvC, EvE, EWB)

The *Evesboro sand* is an excessively drained soil on divides and side slopes. A typical profile of the Evesboro series may include decomposed organic matter and grayish brown sand from 0” to 4” deep, yellowish brown sand from 4” to 9” deep, yellowish brown sand subsoil from 9” to 34” deep, and yellowish brown sand substratum from 34” to 60” deep. The seasonal high water table is greater than 6’ deep. The Evesboro series is not on the New Jersey hydric soils list.

*Fallsington Series* (Fb)

*Fallsington loam* is a nearly level, poorly drained soil in depressional areas, along drainage ways, and on broad flats. A typical profile has a 10” thick surface layer of decomposed organic matter over mottled dark gray loam, with a mottled grayish brown sandy clay loam subsoil from 10” to 28” deep, and a substratum of mottled olive gray fine sandy loam from 28” to 44” deep, and dark yellowish brown

loamy sand from 44” to 60” deep. The Fallsington loam is a Group 2 hydric soil in New Jersey, and displays consistent hydric conditions in most places.

*Freehold Series* (FnA, FnC, FrB, FrC, FrC2, FrD, FrD2, FrE2, FsA, FUB)

The *Freehold* series consists of well-drained soils on divides and side slopes. A typical profile of the Freehold series may include dark yellowish brown loamy sand to sandy loam plow layer from 0” to 9” deep, dark brown sandy loam and sandy clay loam from 9” to 25” deep, brown sandy loam from 25” to 35” deep, and yellowish-brown loamy sand from 35” to 70” deep. The seasonal high water table is greater than 6’ deep. The Freehold series is not on the New Jersey hydric soils list.

*Hammonton Series* (HaB, HbA, HbB, HLA)

The *Hammonton* series consists of moderately well-drained and somewhat poorly drained soil in depressional areas and on low divides. A typical Hammonton series profile may include dark brown loamy sand to sandy loam from 0” to 10” deep, brownish yellow and yellowish brown sandy loam to loamy sand from 10” to 19” deep, mottled brownish yellow sandy loam from 19” to 31” deep, and light yellowish brown stratified loamy sand and gravelly sandy loam from 31” to 60” deep. The depth to the seasonal high water table is 1.5’ to 3.0’. Hammonton soils are listed as Group 3 hydric soils in New Jersey, displaying hydric conditions in few places.

*Holmdel Series* (HnA, HnB, HUA)

The *Holmdel* sandy loam is a moderately well to somewhat poorly drained soil in depressional areas and on low divides. A typical profile has a 10” thick dark grayish brown sandy loam surface layer, yellowish brown sandy loam from 10” to 20” deep, mottled yellowish brown sandy clay loam from 20” to 38” deep, and a mottled

yellowish brown and light olive brown sand and sandy loam substratum from 38” to a depth of 60” or more. The depth to the seasonal high water table is between 0.5’ to 4.0’. Holmdel soils are not on the New Jersey hydric soils list.

*Humaquepts* (HV)

*Humaquepts* consist of nearly level, deep, somewhat poorly drained to very poorly drained soils on flood plains along perennial and intermittent streams. These soils are subject to frequent flooding. Characteristics vary greatly from site to site, but Humaquepts generally consist of stratified loamy sand, sandy loam, loam, and silt loam that may include gravelly or mucky layers. The water covering some areas is several feet deep during flood stage. The seasonal high water table is between the surface and 1.5’ deep. Humaquepts are Group 1 hydric soils in New Jersey, and nearly always display consistent hydric conditions.

*Keyport Series* (KeA, KeB, KeC, KGB)

The *Keyport sandy loam* is a moderately well-drained soil in depressional areas and on low divides and side slopes. A typical profile may include 0” to 10” brown sandy loam, 10” to 18” yellowish brown silty clay loam, 18” to 44” mottled dark yellowish brown silty clay loam, and 44” to 60” gray silty clay loam. These soils have a seasonal high water table at 1.5’ to 4.0’ deep. The Keyport series is not listed on the New Jersey hydric soils list.

*Klej Series* (KlA, KmB, KUA)

The *Klej loamy sand* is a moderately well to somewhat poorly drained soil on low divides and in depressional areas. A typical Klej series profile may include an 11” thick surface layer of mottled organic material over very dark grayish brown

loamy sand, mottled brownish yellow loamy sand from 11” to 37” deep, and a yellowish brown gravelly loamy sand substratum from 37” deep to a depth of 60” or more. The KmB unit has a mottled gray clay substratum beginning at a depth of 50”. The seasonal high water table is between 1.5’ and 4.0’ deep. The Klej soil displays hydric conditions in a few places, and is listed as a Group 3 hydric soil in New Jersey.

*Lakehurst Series* (LaA)

The *Lakehurst sand* is a moderately well-drained to somewhat poorly-drained soil. A typical profile may include gray sand from 0” to 4” deep, light gray sand from 4” to 10” deep, brown loamy sand from 10” to 13” deep, mottled brownish yellow sand from 13” to 24” deep, mottled pale brown sand from 24” to 36” deep, and mottled light brownish gray sand substratum from 36” to 60” deep. This series has a depth to seasonal high water table ranging from 1.5’ to 3.5’. The Lakehurst sand is not on the New Jersey hydric soils list.

*Manahawkin Muck* (Ma)

The *Manahawkin Muck* is a nearly level and very poorly drained soil in wide depressional areas and on broad flats. This soil is commonly associated with swampy areas or bogs which have a high water table or are permanently inundated with standing water. The uppermost 30” is typically black and very dark gray muck, and the substratum is mottled dark gray loamy sand and sand. The seasonal high water table is between the surface and 1’ above the surface. Manahawkin muck nearly always displays hydric conditions and is a Group 1 hydric soil in New Jersey.

*Marlton Series* (MbC, MIB)

The *Marlton* series consists of well-drained to moderately well-drained soil on side slopes and divides. A typical profile may include an 8" thick very dark grayish-brown sandy loam or loam surface layer, a 38" thick very dark grayish-brown sandy clay loam and mottled dark olive gray clay loam and clay subsoil, and a mottled dark olive gray sandy loam substratum. The seasonal high water table is typically perched, and is between 2' to 5' below the surface. The Marlton series is not on the New Jersey hydric soils list.

*Pemberton Series* (PeA)

The *Pemberton loamy sand* is nearly level to gently sloping moderately well-drained and somewhat poorly drained soil on low divides. A typical profile has a brown loamy sand surface layer about 10" thick, a yellowish brown loamy sand subsurface layer 15" thick, a mottled dark yellowish brown and yellowish brown sandy clay loam subsoil 20" thick, and a mottled pale olive fine sandy loam substratum to a depth of 60" or more. The seasonal high water table is 1.0' to 4.0' below the surface. Pemberton soils are not on the New Jersey hydric soils list.

*Phalanx Series* (PhB)

The *Phalanx* loamy sand is a well-drained soil on divides and side slopes. A typical profile has a 2" thick dark brown loamy sand surface layer, a 5" thick brown loamy sand subsurface layer, a 31" thick strong brown and yellowish red loamy sand and sandy loam subsoil, and a yellowish red loamy sand substratum containing indurated layers of iron cemented sandstone. The seasonal high water table is more than 6' below the surface. The Phalanx soils series is not on the New Jersey hydric soils list.

*Pits Sand and Gravel* (PT)

This unit consists of disturbed areas that have historically been excavated for sand and gravel. Soils in these areas are typically sandy with varying amounts of gravel and fragments of iron cemented sandstone. The properties and characteristics of this map unit vary from location to location, and onsite investigation is generally required to determine suitability for an intended use.

*Sassafras Series* (SaB, SaC, SaD)

The *Sassafras* series consists of well-drained soils on divides and side slopes. A typical profile has brown sandy loam from 0" to 11" deep, yellowish-brown sandy loam and sandy clay loam from 11" to 30" deep, reddish yellow sandy loam from 30" to 36" deep, and reddish yellow stratified loamy sand and sandy loam from 36" to a depth of 60" or more. Depth to the seasonal high water table is greater than 72". The Sassafras series is not on the New Jersey hydric soils list.

*Shrewsbury Series* (Sn)

*Shrewsbury sandy loam* is a nearly level, poorly-drained soil in depressional areas, along drainage ways, and on broad flats. A typical profile may include a 9" thick surface layer with dark reddish brown, mottled partly decomposed organic matter over black sandy loam, mottled dark gray sandy loam from 9" to 13" deep, mottled grayish brown clay loam from 13" to 22" deep, mottled olive gray sandy clay loam from 22" to 31", and mottled dark greenish gray loamy sand from 31" to 60" deep. The seasonal high water table is from 0' to 1.0' deep. Shrewsbury soils display consistent hydric conditions in most places, and are listed as Group 2 hydric soils in New Jersey.

*Tinton Series* (ToA, ToC, ToD, TUB)

*Tinton loam sand* is a well-drained soil on divides and side slopes. A typical profile of the Tinton series may include dark brown loamy sand from 0" to 7" deep, yellowish brown loamy sand from 7" to 32" deep, dark yellowish brown sandy clay loam from 32" to 46" deep, and dark yellowish brown loamy sand from 46" to 60" deep. Depth to the seasonal high water table is greater than 6'. The Tinton series is not on the New Jersey hydric soils list.

*Udorthents* (UA, UD)

Areas mapped as *Udorthents* consist of soils that have been altered by excavating or filling. In filled areas these soils typically consist of loamy material that is more than 20" thick. The filled areas are on flood plains, in tidal marches, and on areas of moderately well drained to very poorly drained soils. Included with these soils in mapping are soils that may contain such materials as concrete, asphalt, metal, and glass, as well as areas of undisturbed soils. The properties and characteristics of these soils vary greatly from place to place, and onsite investigation is needed to determine suitability for most uses.

*Urban Land* (UL)

The *Urban land* map unit consists of areas that are more than 85% covered by impermeable surfaces. Urban land is typically covered by dwellings, roads, shopping centers, parking lots, and industrial areas. Relatively small areas of undisturbed soils and Udorthents may be included in this map unit. Properties and characteristics vary from site to site, and field investigation is needed to determine suitability for most intended uses. Urban land is mapped in complexes with various

undisturbed soil series where the areas of each are in an intricate pattern and it was not practical to map them separately.

*Woodstown Series* (WnB, WoA)

The *Woodstown* series consists of moderately well-drained soil in depressional areas, in swales, and on low divides. A typical profile may have a brown sandy loam or loam surface layer 3" thick, a yellowish brown sandy clay loam layer 15" thick, a mottled yellowish brown and light olive brown sandy clay loam and fine sandy loam layer 11" thick, a mottled light yellowish brown loamy fine sand layer 9" thick, and a yellowish brown gravelly loamy sand to a depth of 60" or more. Depth to the seasonal high water table is 1.5' to 2.5'. The Woodstown series is not on the New Jersey hydric soils list.

## TABLE

## SELECTED SOIL PROPERITES

| MAP UNIT | SOIL SERIES | SLOPE % | DEPTH TO SHWT (feet) | DRAINAGE CLASS | FLOODING FREQUENCY | SURFICIAL PERMEABILITY (in/hr) | HYDRO-LOGIC GROUP | SURFACE EROSION POTENTIAL K-FACTOR |
|---|---|---|---|---|---|---|---|---|
| AeA | Adelphia Loam | 0-2 | 1.5-4.0 | Moderately well to somewhat poorly drained | None | 0.6-6.0 | B/C | 0.32 |
| AeB | | 2-5 | | | | | | |
| ALA | Urban Land Complex | 0-5 | | | | | | |
| At | Atsion Sand | 0-2 | 0-1.0 | Poorly drained | None | 6.0-20 | C/D | 0.17 |
| Cm | Colemantown Loam | 0-2 | 0-1.0 | Poorly drained | Occasional | 0.2-2.0 | C/D | 0.43 |
| CnB | Collington sandy loam | 2-5 | >6.0 | Well drained | None | 0.6-6.0 | B | 0.28 |
| CnC2 | | 5-10 | | | | | | |
| CnD3 | | 10-15 | | | | | | |
| CRB | Urban land complex | 0-10 | | | | | | |
| CtB | Colts Neck sandy loam | 2-5 | >6.0 | Well drained | None | 0.6-2.0 | B | 0.28 |
| CtC | | 5-10 | | | | | | |
| CtC2 | | 5-10 | | | | | | |
| CtD2 | | 10-15 | | | | | | |
| CtE2 | | 15-25 | | | | 2.0-20 | | |
| DnA | Downer loamy sand | 0-5 | >6.0 | Well drained | None | 6.0-20 | B | 0.20 |
| DnC | | 5-10 | | | | | | |
| DUB | Urban land complex | 0-10 | | | | 2.0-6.0 | | 0.28 |
| En | Elkton loam | 0-2 | 0-1.0 | Poorly drained | Rare | 0.6-2.0 | C/D | 0.43 |
| EvB | Evesboro sand | 2-5 | >6.0 | Excessively Drained | None | 6.0-20 | A | 0.17 |
| EvC | | 5-10 | | | | | | |
| EvE | | 15-25 | | | | | | |
| EWB | Urban land complex | 0-10 | | | | | | |
| Fb | Fallsington loam | 0-2 | 0-1.0 | Poorly drained | None | 0.6-6.0 | B/D | 0.28 |

## TABLE
## SELECTED SOIL PROPERTIES (continued)

| MAP UNIT | SOIL SERIES | SLOPE % | DEPTH TO SHWT (feet) | DRAINAGE CLASS | FLOODING FREQUENCY | SURFICIAL PERMEABILITY (in/hr) | HYDRO-LOGIC GROUP | SURFACE EROSION POTENTIAL K-FACTOR |
|---|---|---|---|---|---|---|---|---|
| FnA | Freehold loamy sand sandy loam | 0-5 | >6.0 | Well drained | None | 6.0-20 | B | 0.20 |
| FnC | | 5-10 | | | | 0.6-6.0 | | 0.28 |
| FrB | | 2-5 | | | | | | |
| FrC | | 5-10 | | | | | | |
| FrC2 | | 5-10 | | | | | | |
| FrD | | 10-15 | | | | | | |
| FrD2 | | 10-15 | | | | | | |
| FrE2 | | 15-25 | | | | | | |
| FsA | Loam | 0-2 | | | | | | |
| FUB | Urban land complex | 0-10 | | | | | | |
| HaB | Hammonton loamy sand, sandy loam | 0-3 | 1.5-3.0 | Moderately well to somewhat poorly drained | None | 6.0-20 | B | 0.20 |
| HbA | | 0-2 | | | | 2.0-6.0 | | 0.28 |
| HbB | | 2-5 | | | | | | |
| HLA | Urban land complex | 0-3 | | | | | | |
| HnA | Holmdel sandy loam | 0-2 | 0.5-4.0 | Moderately well to somewhat poorly drained | None | 0.6-6.0 | C | 0.28 |
| HnB | | 2-5 | | | | | | |
| HUA | Urban land complex | 0-5 | | | | | | |
| HV | Humaquepts | 0-2 | 0.0-1.5 | Somewhat poorly drained to very poorly drained | Frequent | Properties Variable | | |
| KeA | Keyport sandy loam | 0-2 | 1.5-4.0 | Moderately well drained | None | 0.6-6.0 | C | 0.37 |
| KeB | | 2-5 | | | | | | |
| KeC | | 5-10 | | | | | | |
| KGB | Urban land complex | 0-10 | | | | | | |
| KlA | Klej loamy sand | 0-3 | 1.5-2.0 | Moderately well to somewhat poorly drained | None | >6.0 | B | 0.17 |
| KmB | | 0-5 | | | | 6.0-20 | | |
| KUA | Urban land complex | 0-3 | | | | >6.0 | | |
| LaA | Lakehurst sand | 0-2 | 1.5-3.5 | Moderately well to somewhat poorly drained | None | 6.0-20 | A | 0.17 |

## TABLE

## SELECTED SOIL PROPERTIES (continued)

| MAP UNIT | SOIL SERIES | SLOPE % | DEPTH TO SHWT (feet) | DRAINAGE CLASS | FLOODING FREQUENCY | SURFICIAL PERMEABILITY (in/hr) | HYDRO-LOGIC GROUP | SURFACE EROSION POTENTIAL K-FACTOR |
|---|---|---|---|---|---|---|---|---|
| Ma | Manahawkin Muck | 0-2 | +1.0-0.0 | Very poorly drained | Frequent | 6.0-20 | D | 0.17 |
| MbC | Marlton sandy loam | 5-10 | 2.0-5.0 | Well to moderately well drained | None | 0.6-6.0 | C | 0.43 |
| MlB | Marlton loam | 2-5 | 2.0-5.0 | | | | | |
| PeA | Pemberton loamy sand | 0-5 | 1.0-4.0 | Moderately well to somewhat poorly drained | None | 2.0-6.0 | B | 0.20 |
| PhB | Phalanx loamy sand | 0-10 | >6.0 | Well drained | None | >6.0 | B | 0.20 |
| PT | Pits sand & gravel | Properties variable | | | | | | |
| SaB | Sassafras sandy loam | 2-5 | >6.0 | Well drained | None | 0.6-6.0 | B | 0.28 |
| SaC | | 5-10 | | | | | | |
| SaD | | 10-15 | | | | | | |
| Sn | Shrewsbury sandy loam | 0-2 | 0-1.0 | Poorly drained | None | 0.6-6.0 | C/D | 0.32 |
| ToA | Tinton loamy sand | 0-5 | >6.0 | Well drained | None | 0.6-6.0 | A | 0.20 |
| ToC | | 5-10 | | | | | | |
| ToD | | 10-25 | | | | | | |
| TUB | Urban land complex | 0-5 | | | | | | |
| UA | Udorthents smoothed | Properties variable | | | | | | |
| UD | Urban land complex | Properties variable | | | | | | |
| WnB | Woodstown sandy loam | 2-5 | 1.5-2.5 | Moderately well drained | None | 0.6-6.0 | C | 0.28 |
| WoA | Woodstown loam | 0-2 | | | | | | |

NOTES:

1. SHWT is apparent seasonal high water table; a '+' sign indicates a water table above the surface of the soil.

2. Urban land complexes are undifferentiated areas of soil and urban land (impermeable surfaces). Properties for urban land vary greatly from site to site.

## Soil Properties

The Soil Survey of Monmouth County, New Jersey (Jablonski & Baumley, 1989) contains information on soil properties, characteristics, and limitations pertaining to agriculture, woodland management, recreation, wildlife habitat, site development, sanitary facilities, construction materials, water management, engineering, and hydrology. A table of selected properties for the soil types occurring in Manalapan Township is included in this document.

### *Texture*

*Textural classes* are defined by the relative proportion of sand, silt, and clay particles in a soil mass. Sand includes soil particles ranging in size from 2mm to 0.05mm; silt particles range from 0.05mm to 0.002mm; clay particles are smaller than 0.002mm (U.S.D.A. System of Soil Textural Classification). The sand size fraction may be subdivided into very coarse, coarse, medium, fine, and very fine sand. Gravel includes particles greater than 2mm.

### *Slope*

Slope is the inclination of the land surface from the horizontal. The slope between two points on the land surface is thus the difference in elevation divided by the horizontal distance between the points, which may be expressed as a percentage. Moderate to severe limitations on site development are generally associated with slopes in excess of 10% (slope classes D and E).

### *Seasonal High Water Table*

The water table is the surface below which a soil is saturated. The elevation of this surface varies spatially and with time, and is usually highest in the winter and

early spring. A perched water table occurs where a saturated zone overlies an unsaturated zone, usually due to the presence of a low permeability layer impeding the vertical movement of ground water. Moderate limitations on site development are generally associated with a depth to the seasonal high water table less than 4 feet; severe limitations exist for groundwater shallower than 1 foot below the land surface. A Depth to Water Table Map for Manalapan Township is included in this document.

*Drainage Class*

Drainage is the removal of excess surface and subsurface water. The Soil Conservation Service defines seven classes of natural soil drainage (Jablonski & Baumley, 1989).

Excessively Drained: Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep.

Somewhat Excessively Drained: Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff.

Well Drained: Water is removed from the soil readily, but not rapidly. Well drained soils are commonly medium textured.

Moderately Well Drained: Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat Poorly Drained: Water is removed slowly enough that the soil is wet for significant periods during the growing season. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly Drained: Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very Poorly Drained: Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Very poorly drained soils are commonly level or depressed and are frequently ponded.

*Flooding*

Flooding is the temporary covering of the soil surface by flowing water due to overflowing streams or runoff from adjacent slopes. The Soil Conservation Service

has estimates of the frequency, duration, and probable period of occurrence of flooding for each soil series. There are five categories for flooding frequency:

| | |
|---|---|
| None | Flooding is not probable; |
| Rare | Flooding is unlikely but possible under unusual weather conditions (near 0 to 5 percent chance of flooding in any year); |
| Occasional | Flooding occurs infrequently under normal weather conditions (5 to 50 percent chance of flooding in any year); |
| Common | This term is used when classification as occasional or frequent does not affect interpretations; |
| Frequent | Flooding occurs often under normal weather conditions (more than a 50 percent chance of flooding in any year). |

Soil survey information on flooding is based on the physical characteristics and typical landscape position of a soil series. The Federal Emergency Management Association (FEMA) has more detailed information available as part of the National Flood Insurance Program. FEMA delineated flood zones are based on detailed topographic surveys and hydraulic engineering calculations. A Flood-Prone Areas Map for Manalapan Township is included in this document.

*Permeability*

Permeability is the property that characterizes a soils ability to transmit water or air. The permeability of a particular soil is dependent on the size, shape, and structural arrangement of the soil particles. Soil Survey estimates of permeability are reported as the number of inches per hour that water moves vertically downward through saturated soil. The following terms are used to describe permeability in soil descriptions:

| | |
|---|---|
| Very Slow | < 0.06 in/hr |
| Slow | 0.06-0.2 in/hr |
| Moderately Slow | 0.2-0.6 in/hr |
| Moderate | 0.6-2.0 in/hr |
| Moderately Rapid | 2.0-6.0 in/hr |
| Rapid | 6.0-20 in/hr |
| Very Rapid | > 20 in/hr |

Surficial permeability refers to water movement through the surface of an undisturbed soil profile. The Soil Survey of Monmouth County contains permeability estimates for additional horizons in the profile of each soil type. Soil permeability can be a critical parameter in the design of septic system disposal fields and certain types of drainage systems. Soil survey estimates of permeability are typically used as a planning guide to identify areas of potentially permeable soils. Actual permeability is generally assessed by onsite investigation and evaluation or laboratory testing.

*Hydrologic Group*

Soil series are assigned to one of four hydrologic groups according to the estimated stormwater runoff that would occur during long-duration storms. The groupings assume a soil to be unvegetated, and are determined by the rate at which a soil intakes water when thoroughly wet.

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to

excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to two groups, the first grouping refers to runoff when the soil is drained (relatively low water table) and the second grouping refers to runoff when the soil is undrained (relatively high water table). Hydrologic soil groupings are used to estimate runoff in stormwater management design.

*Erosion Potential*

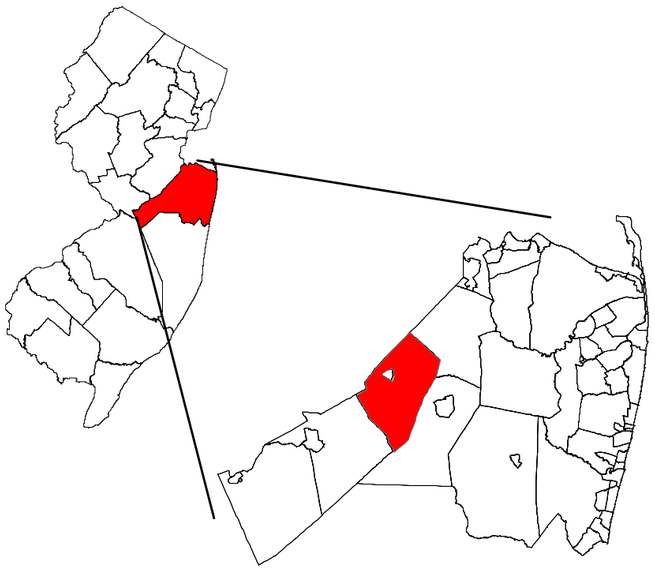
Soil erosion is the removal of soil material from the land surface by the action of rainfall and surface runoff. The K-factor is used to indicate the susceptibility of a soil to sheet and rill erosion (sheet erosion is the removal of a layer of soil material; rill erosion is the removal of soil in a network of shallow, steep-sided channels). Estimates of the K-factor are primarily based on the percentage of silt, sand, and organic matter in a soil. Values of K range from 0.05 to 0.69, with higher values indicating a greater susceptibility to sheet and rill erosion by water.

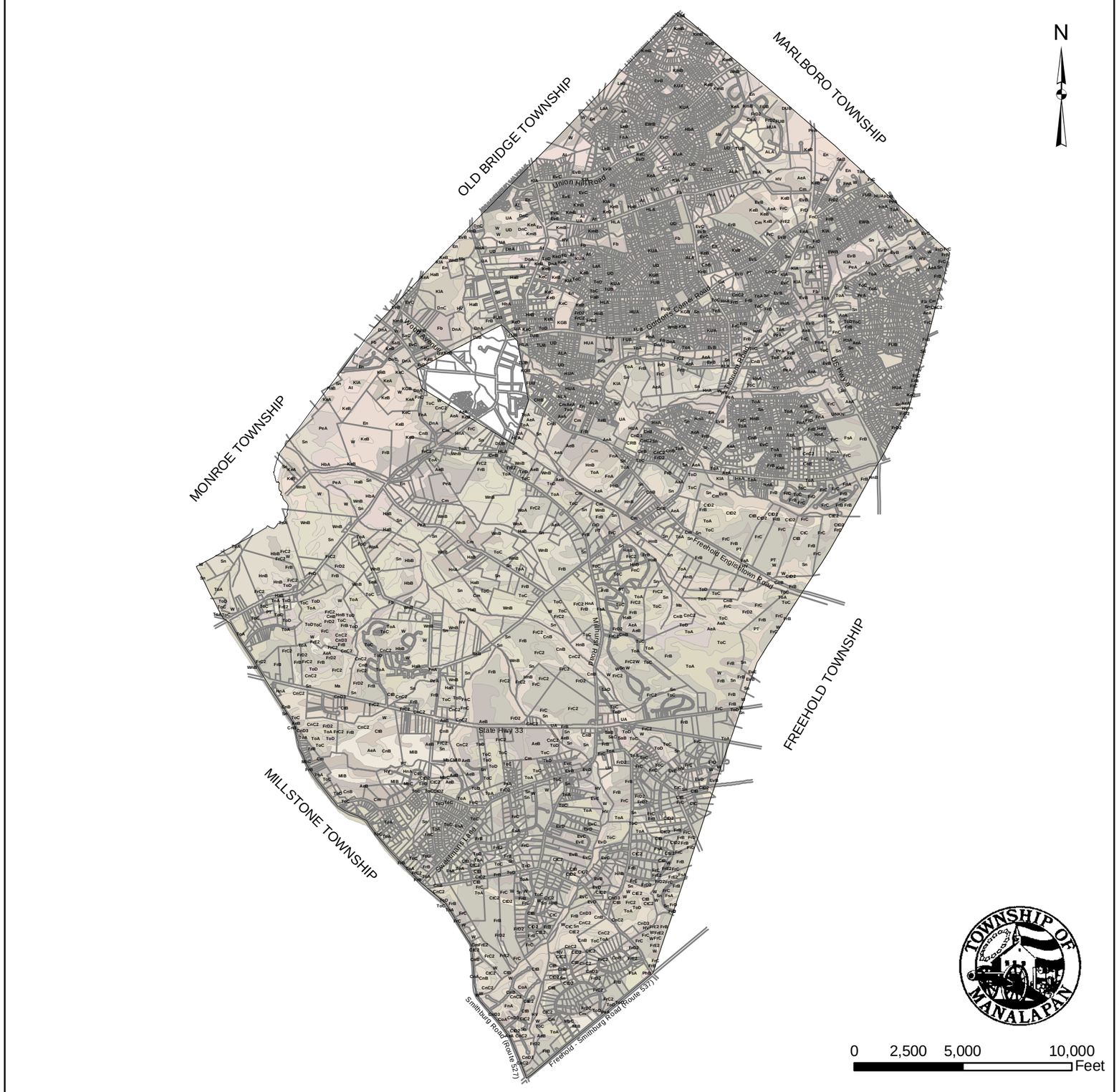
# SOILS

## Manalapan Township, Monmouth County, NJ

**Legend**

- ALA-Adelphia Loam
- Urban Land Complex
- AeA-Adelphia Loam
- AeB-Adelphia Loam
- At-Atsion Sand
- CRB-Collington Sandy Loam
- Cm-Colemantown Loam
- CnB-Collington Sandy Loam
- CnC2-Collington Sandy Loam
- CnD3-Collington Sandy Loam
- CoA-Collington Loam
- CtB-Colts Neck Sandy Loam
- CtC-Colts Neck Sandy Loam
- CtC2-Colts Neck Sandy Loam
- CtD2-Colts Neck Sandy Loam
- CtE2-Colts Neck Sandy Loam
- DUB-Downer Sandy Loam
- DnA-Downer Loamy Sand
- DnC-Downer Loamy Sand
- DoA-Downer Sandy Loam
- EWB-Evesboro Sand
- En-Elkton Loam
- EvB-Evesboro Sand
- EvC-Evesboro Sand
- EvD-Evesboro Sand
- EvE-Evesboro Sand
- FUB-Freehold Sandy Loam
- Fb-Fallsington Loam
- FnA-Freehold Loamy Sand
- FnC-Freehold Loamy Sand
- FrB-Freehold Sandy Loam
- FrC-Freehold Sandy Loam
- FrC2-Freehold Sandy Loam
- FrD-Freehold Sandy Loam
- FrD2-Freehold Sandy Loam
- FrE2-Freehold Sandy Loam
- FsA-Freehold Loam
- HLA-Hammonton Sandy Loam
- HUA-Holmdel Sandy Loam
- HV-Fluvaquentic Humaquepts (Alluvial Land)
- HaB-Hammonton Loamy Sand
- HbA-Hammonton Sandy Loam
- HbB-Hammonton Sandy Loam
- HnA-Holmdel Sandy Loam
- HnB-Holmdel Sandy Loam
- KGB-Keyport Sandy Loam
- KUA-Klej Loamy Sand
- KeA-Keyport Sandy Loam
- KeB-Keyport Sandy Loam
- KeC-Keyport Sandy Loam
- KeD-Keyport Sandy Loam
- KlA-Klej Loamy Sand
- KmB-Klej Loamy Sand
- LaA-Lakehurst Sand
- LeB-Lakewood Sand
- Ma-Manahawkin Muck
- MbC-Marlton Sandy Loam
- MlB-Marlton Loam
- PT-Pits, Sand and Gravel
- PeA-Pemberton Loamy Sand
- PhB-Phalanx Loamy Sand
- PhD-Phalanx Loamy Sand
- SaB-Sassafrass Sandy Loam
- SaC-Sassafrass Sandy Loam
- SaD-Sassafrass Sandy Loam
- Sn-Shrewsbury Sandy Loam
- TUB-Tinton Loamy Sand-Urban Land Complex
- ToA-Tinton Loamy Sand
- ToC-Tinton Loamy Sand
- ToD-Tinton Loamy Sand
- UA-Udorthents-Smoothed
- UD-Udorthents-Urban Land Complex
- UNKN-Unknown
- W-Water
- WnB-Woodstown Sandy Loam
- WoA-Woodstown Loam
- Manalapan Roads
- Manalapan Parcels
- Manalapan Township Boundary






CME ASSOCIATES

TOWNSHIP OF MANALAPAN

H-MA-00046-01 7/18/01

Source: This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data. This secondary product has not been verified by the data originators.

## PRIME FARMLAND

The Prime Farmland Map for Manalapan Township is based on data provided by the Natural Resource Conservation Service (NRCS). Prime farmland is generally defined by the U.S. Department of Agriculture as land with the soil quality, growing season, and moisture supply needed to produce a sustained high yield of crops while employing conventional farming methods. This mapping therefore identifies the location and extent of the most suitable land for producing crops. Prime farmland will typically meet the following criteria (Jablonski & Baumley, 1989):

- adequate and dependable moisture supply;
- favorable temperature and length of growing season;
- soils have acceptable levels of acidity or alkalinity;
- soils have few or no rocks;
- soils are permeable to water and air;
- soils are not excessively erodible;
- land is not saturated with water for long periods and does not flood frequently during the growing season or is protected from flooding;
- slope is mainly 0 to 6 percent.

In addition, land classified as prime farmland is either in active agricultural production or is available for that use. Areas of water or urban or built-up land are generally not identified as prime farmland. The NRCS (formerly the SCS, Soil Conservation Service) mapping does not reflect some relatively recent changes from agricultural to non-agricultural land use that have occurred since the mapping was completed. Some areas shown as prime farmland in Manalapan Township therefore overlap with developed residential or commercial land and would not be currently classified as prime farmland.

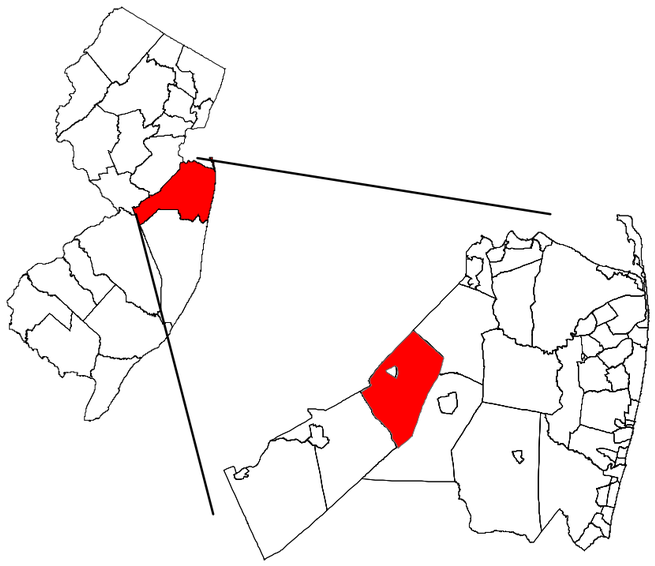
Lands that meet the criteria for prime farmland are generally gently sloping with well to moderately well drained, sandy loam and loamy sand soils. In Manalapan Township, prime farmland generally corresponds to Collington, Colts Neck, Freehold, Hammonton, Holmdel, Keyport, Marlton, Sassafras, and Woodstown soils in areas of agricultural land use.

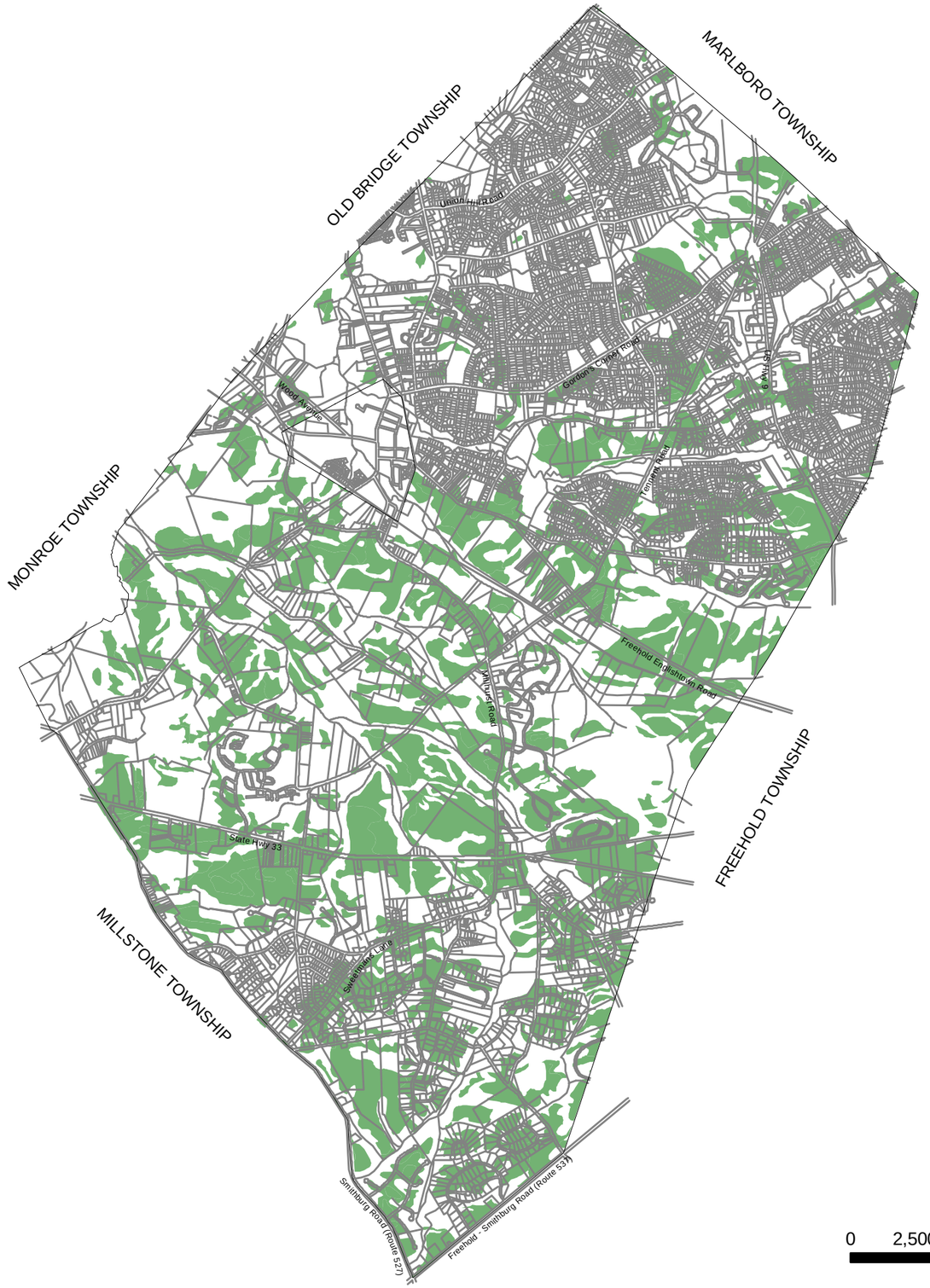
# PRIME FARMLAND

Manalapan Township, Monmouth County, NJ

## Legend

- Prime Farmland
- ManalapanRoads
- ManalapanParcels
- Manalapan Township Boundary






TOWNSHIP OF MANALAPAN

CME ASSOCIATES

H-MA-00046-01 7/18/01

Source: This map was developed using U.S. Department of Agriculture , Soil Conservation Service digital data entitled State Soil Geographic (STATSGO) data. This secondary product has not been verified by the data originators.

## DEPTH TO WATER TABLE

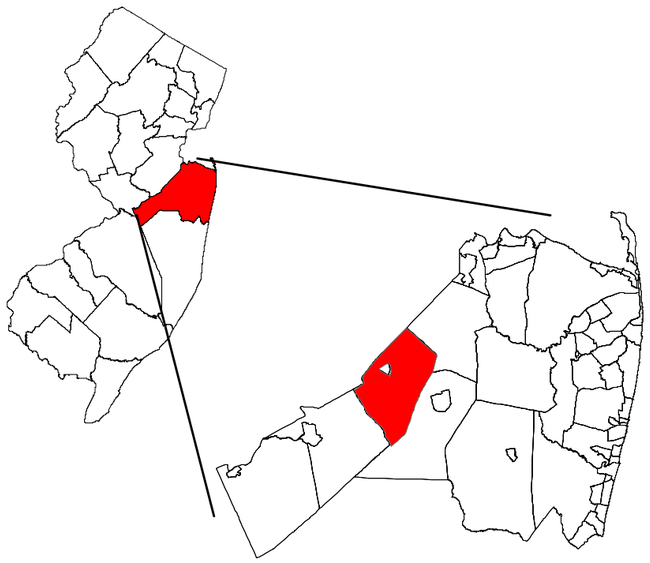
The depth to water table map has been complied from data provided in the Monmouth County Soil Survey. The ranges presented show the depths predicted for the seasonal high water table, usually at its peak between January and late April. This information can be used to identify limitations for the construction of individual subsurface sewage disposal systems, building foundations, subsurface utility line installations, agriculture, and stormwater management basins.

# DEPTH TO WATER TABLE

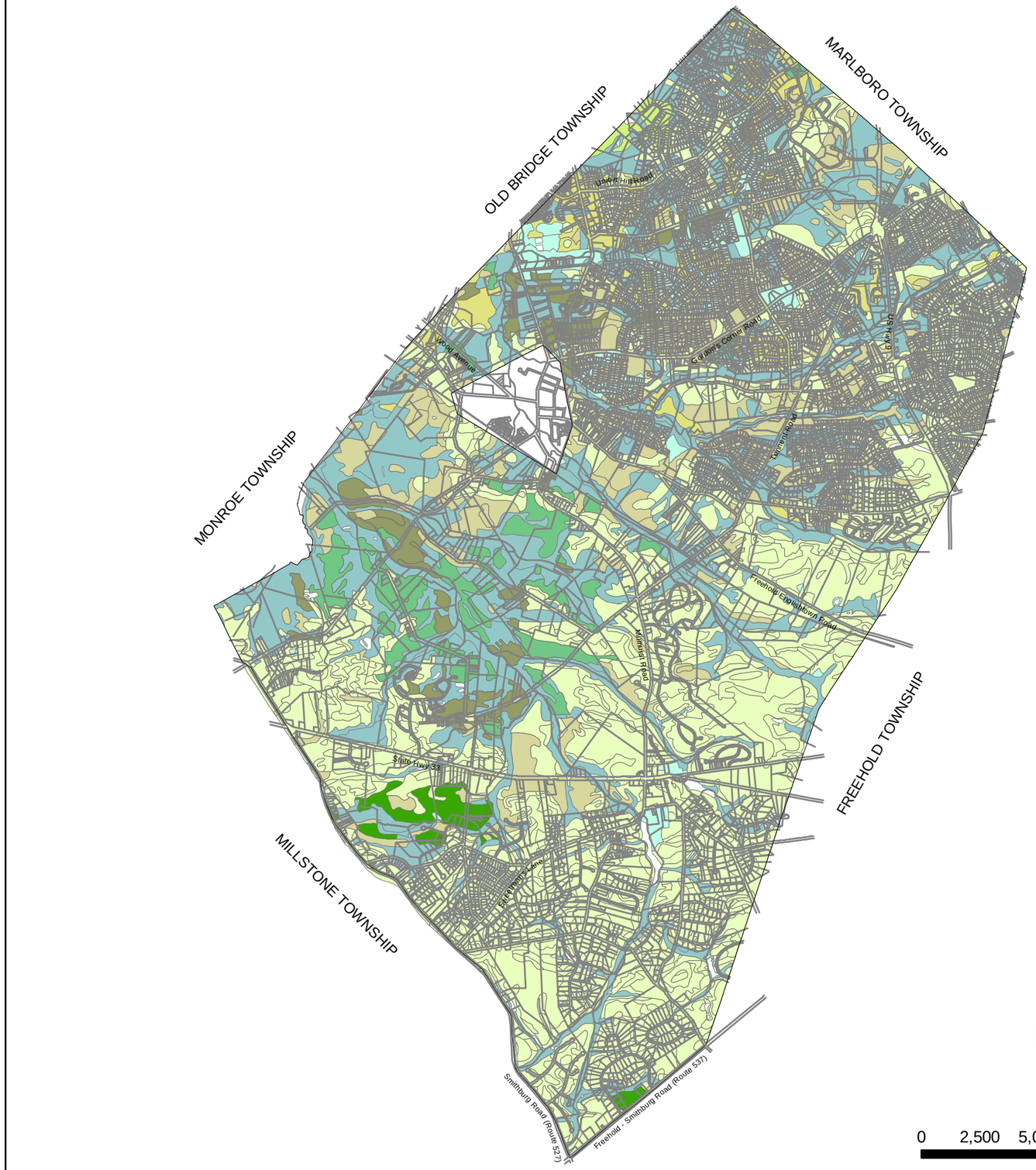
Manalapan Township, Monmouth County, NJ

## Legend

- 0 - 1.0
- 1.5 - 2.0
- 1.5 - 2.5
- 1.5 - 3.0
- 1.5 - 3.5
- 1.5 - 4.0
- 2.0 - 5.0
- >6.0
- variable
- Manalapan Township Boundary
- Manalapan Parcels
- Manalapan Roads



CME ASSOCIATES




TOWNSHIP OF MANALAPAN

H-MA-00046-01 7/1/01

Source: This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data. This secondary product has not been verified by the data originators.

## FORESTS

There are four different types of forest coverage mapped in the Township: coniferous forest, coniferous/deciduous forest, deciduous forest, and deciduous/coniferous forest. Of these four forest types, the deciduous forest is by far the most abundant.

Coniferous forest exists mostly in the northwest portion of the Township, near the Middlesex County border, and at scattered locations in the southeast section of the Township. Only a single confined stand of coniferous/deciduous forest is identified within the municipality, and is located in the northeast corner, near Route 9.

Deciduous forests within the upland portions of Manalapan commonly include the following species:

Dominant Trees

| | |
|---|---|
| White Oak | (Quercus alba) |
| Red Oak | (Quercus rubrum) |
| Black Locust | (Robinia psuedoacacia) |
| Scarlet Oak | (Quercus coccinea) |
| Black Oak | (Quercus velutina) |
| Tulip | (Liriodendron tulipifera) |
| American Beech | (Fagus grandifolia) |
| Chestnut Oak | (Quercus prinus) |

Non-Dominant Trees

| | |
|---|---|
| Shagbark Hickory | (Carya ovata) |
| Pignut Hickory | (Carya glabra) |
| Black Birch | (Betula lenta) |
| White Ash | (Fraxinus americana) |
| Red Cedar | (Juniperus virginiana) |
| Black Cherry | (Prunus serotina) |
| American Holly | (Ilex opaca) |
| White Mulberry | (Morus alba) |
| Sugar Maple | (Acer saccharum) |

| | |
|---|---|
| Flowering Dogwood | (Cornus florida) |
| Tree-of-Heaven | (Ailanthus altissima) |
| Black Walnut | (Juglans nigra) |

The following tree species commonly occur in deciduous forests within the lowland portions of the Township:

Dominant Trees

| | |
|---|---|
| Red Maple | (Acer rubrum) |
| Silver Maple | (Acer saccharinum) |
| Pin Oak | (Quercus palustris) |
| Gray Birch | (Betula populifolia) |
| Sweetgum | (Liquidambar styraciflua) |
| Blackgum | (Nyssa sylvatica) |

Non-Dominant Trees

| | |
|---|---|
| Green Ash | (Fraxinus pennsylvatica) |
| River Birch | (Betula nigra) |
| Box Elder | (Acer negundo) |
| American Hornbeam | (Carpinus caroliniana) |
| Sweetbay Magnolia | (Magnolia virginiana) |
| American Sycamore | (Platanus occidentalis) |
| Black Willow | (Salix nigra) |

Within the limited areas identified as coniferous forest, the overall dominant conifer is Pitch Pine (Pinus rigida). Minor occurrences of White Pine (Pinus strobus) can also be expected, but these are most likely introduced by man. The coniferous-forested areas in the Township exist as small clusters within larger deciduous forested areas in the southeastern section of the Township, and as larger independent stands in the northwest portion of the Township.

The G.I.S. coverage also includes mixed coniferous/deciduous forest and deciduous/coniferous forest types within the Township. Woodlands mapped as

coniferous/deciduous forest are dominated by coniferous trees, and woodlands mapped as deciduous/coniferous forest are dominated by deciduous trees.

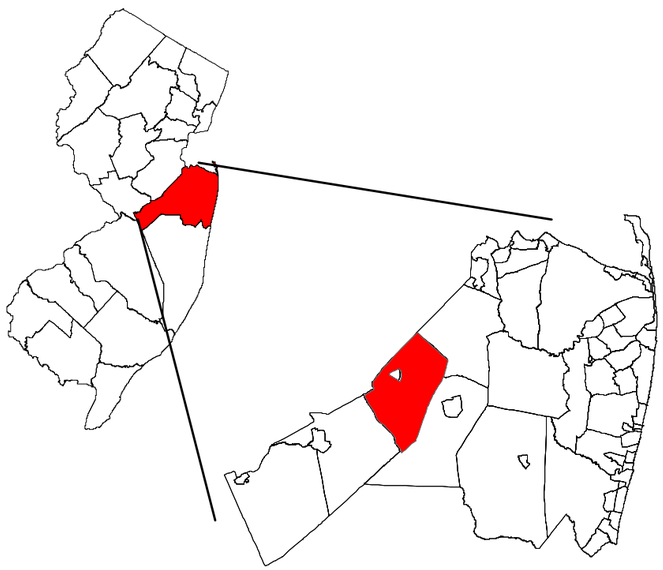
This G.I.S. mapping is a general assessment of the Township's woodlands, and is intended for overall planning purposes. A site-specific assessment of forest types typically requires an onsite inspection and evaluation.

# FORESTS

Manalapan Township, Monmouth County, NJ

## Legend

- Coniferous Forest
- Coniferous/Deciduous Forest
- Deciduous Forest
- Deciduous/Coniferous Forest
- Manalapan Roads
- Manalapan Parcels
- Manalapan Township Boundary




TOWNSHIP OF MANALAPAN

CME ASSOCIATES

H-MA-00046-01 7/18/01

Source: This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data. This secondary product has not been verified by the data originators.

## RARE SPECIES AND NATURAL COMMUNITIES

This map coverage has been provided by the N.J. Department of Environmental Protection, Division of Parks and Forestry, Office of Natural Lands Management.

The term rare has been utilized by the Natural Lands Management Office to include both endangered and threatened plant and animal species, and species that could potentially become endangered or threatened if the population continues a downward trend. Also included within this coverage are natural communities.

# APPENDIX I

# WILDLIFE

## WILDLIFE

Lists of the mammals, birds, reptiles, amphibians, and fish common to western Monmouth County were adapted from State checklists generated by the New Jersey Division of Fish and Wildlife. Wildlife habitats found within Manalapan include openland habitat (cropland, pasture, meadows, and scrub-shrub terrain), woodland habitat (deciduous and coniferous forests), and wetland habitat (marshes, swamps, and other shallow water areas). These generalized habitat types are typically intermingled with each other and with the increasing suburban environment in the Township. Relatively larger parcels of wildlife habitat in Manalapan generally coincide with the cropland, forest, and wetland areas shown on the land use map.

The Natural Heritage Program of the New Jersey Department of Environmental Protection Division of Parks and Forestry maintains a database on rare plants, animals, and natural communities in the State. A list of rare species for which there are records of sightings within Monmouth County is included here. This list includes vertebrate, invertebrate, and vascular plant species that are listed as endangered or threatened in the State of New Jersey (N.J.A.C. 7:25). Endangered species are defined as those whose prospects for survival within the State are in immediate danger due to one or many factors including habitat loss, over exploitation, predation, competition, or disease. An endangered species requires immediate assistance or extinction will probably follow. Species listed as threatened may become endangered if conditions surrounding the species begin to or continue to deteriorate. The potential for a particular rare species to be present in the Township is dependent on the presence of suitable habitat. Identification of suitable habitat generally requires a field evaluation by an experienced wildlife biologist.

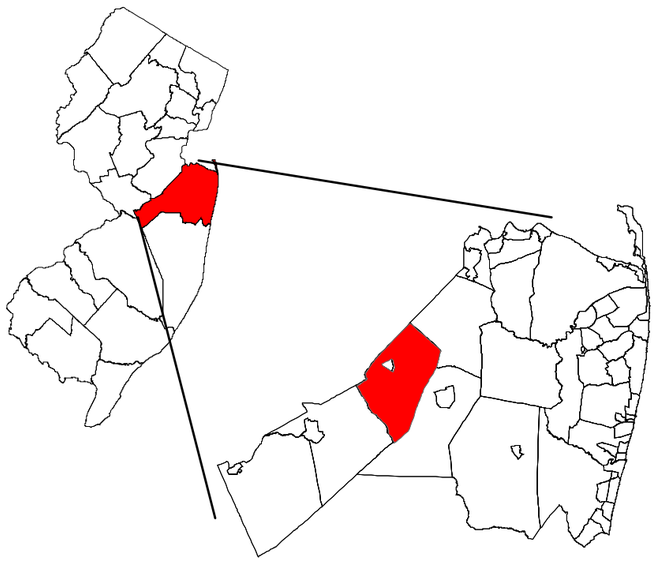
# Rare Species and Natural Communities

Manalapan Township, Monmouth County, NJ

## Legend

### PRECISION

- Both - Location is Both Precise and/or Within 1.5 Miles
- M - Location of Rare Species and Natural Occurrences Within 1.5 Miles
- None - No Documented Occurences of Rare Species or Natural Occurrences
- S - Precise Location of Rare Species and Natural Occurrences
- Manalapan Township Boundary
- Manalapan Parcels
- Manalapan Roads



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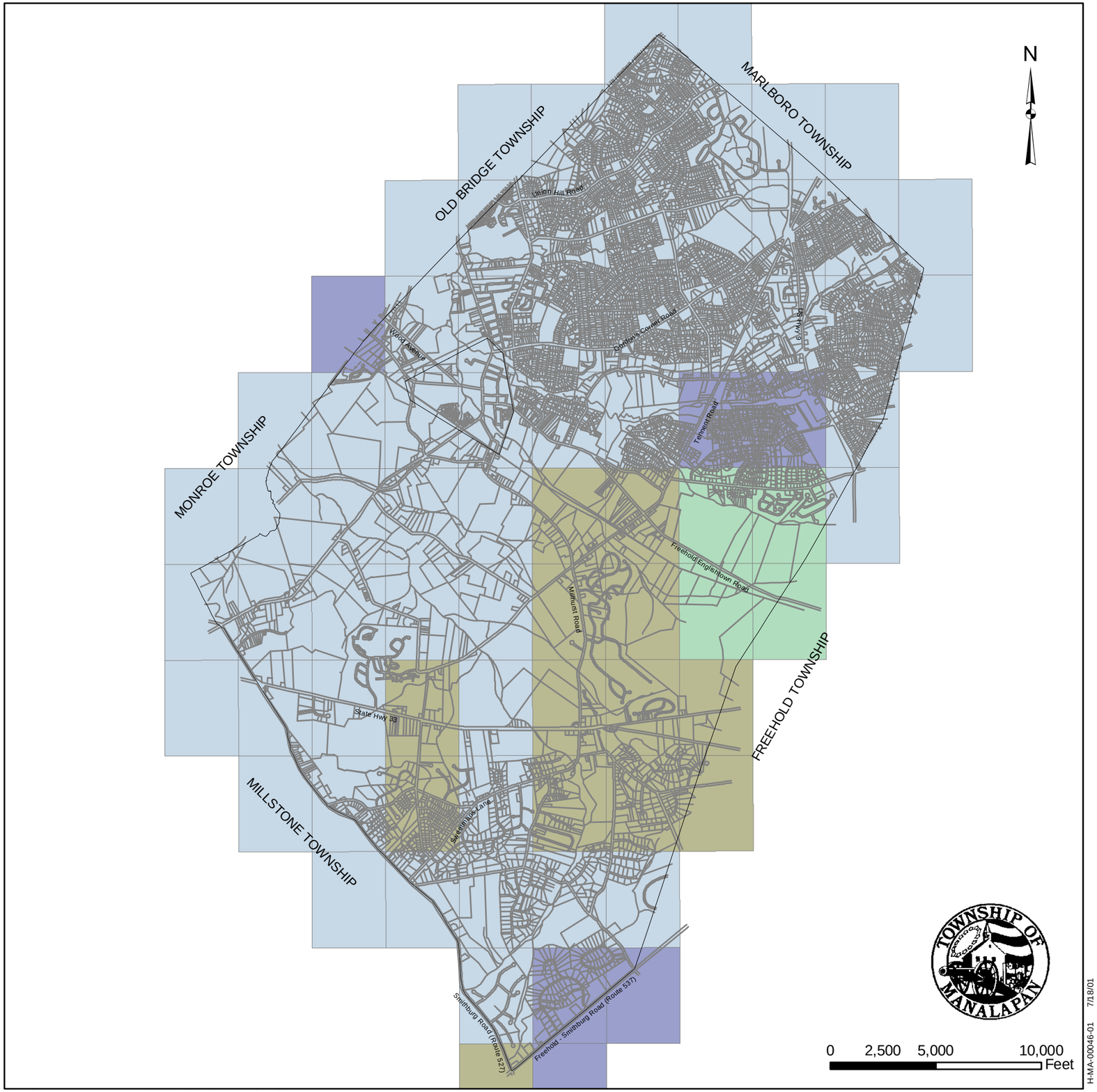


H-MA-00046-01 7/18/01

Source: This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data and NJGS GIS digital data. This secondary product has not been verified by the data originators.

## MAMMALS OF WESTERN MONMOUTH COUNTY

| COMMON NAME | SCIENTIFIC NAME | COMMON NAME | SCIENTIFIC NAME |
|---|---|---|---|
| Oppossum | Didelphis marsupialis | Red Squirrel | Tamiasciurus hudsonicus |
| Smokey Shrew | Sorex fumeus | Southern Flying Squirrel | Glaucomys volans |
| Short-tailed Shrew | Blarina brevicauda | Beaver | Castor candensis |
| Least Shrew | Crytotis parva | White-footed Mouse | Peromyscus leucopus |
| Eastern Mole | Scalopus aquaticus | Red-backed Vole | Clethrionomys gapperi |
| Star-nosed Mole | Condylura cristata | Meadow Vole | Microtus pennsylvanicus |
| Little Brown Bat | Myotis lucifugus | Pine Vole | Microtus pinetorum |
| Keen Myotis | Myotis septentrionalis | Muskrat | Ondatra zibethicus |
| Small-footed Myotis | Myotis leibii | Southern Bog Lemming | Synaptomys cooperi |
| Silver-haired Bat | Lasionycteris noctivagans | Brown Rat | Rattus norvegicus |
| Eastern Pipistrel | Pipistrellus subflavus | House mouse | Mus musculus |
| Big Brown Bat | Eptesicus fuscus | Meadow Jumping Mouse | Zapus hudsonius |
| Red Bat | Lasiurus borealis | Red Fox | Vulpes vulpes |
| Hoary Bat | Lasiurus cinereus | Gray Fox | Urocyon cinereoargenteus |
| Eastern Cottontail | Sylvilagus floridanus | Raccoon | Procyon lotor |
| New England Cottontail | Sylvilagus transitionalis | Long-tailed Weasel | Mustela frenata |
| European Hare | Lepus capensis | Mink | Mustela vison |
| Eastern Chipmunk | Tamias striatus | Striped Skunk | Mephitis mephitis |
| Woodchuck | Marmota monax | River Otter | Lutra canadensis |
| Gray Squirrel | Sciurus carolinensis | White-tailed Deer | Odocoileus virginianus |

## REPTILES OF WESTERN MONMOUTH COUNTY

| COMMON NAME | SCIENTIFIC NAME | COMMON NAME | SCIENTIFIC NAME |
|---|---|---|---|
| Common Snapping Turtle | Chelydra s. serpentina | Eastern Garter Snake | Thamnophis s. sirtalis |
| Stinkpot | Sternotherus odoratus | Eastern Ribbon Snake | Thamnophis s. sauritus |
| Eastern Mud Turtle | Kinosternon s. subrubrum | Eastern Smooth Earth Snake | Virginia v. valeriae |
| Spotted Turtle | Clemmys guttata | Eastern Hognose Snake | Heterodon platyrhinos |
| Bog Turtle | Clemmys muhlenbergi | Northern Ringneck Snake | Diadophis punctatus edwardsi |
| Wood Turtle | Clemmys insculpta | Eastern Worm Snake | Carphophis a. amoenus |
| Eastern Box Turtle | Terrapene c. carolina | Northern Black Racer | Coluber c. constrictor |
| N. Diamondback Terrapin | Malaclemys t. terrapin | Rough Green Snake | Opheodrys aestivus |
| Red-eared Turtle | Pseudemys scripta elegans | Corn Snake | Elaphe g. guttata |
| Eastern Painted Turtle | Chrysemys p. picta | Black Rat Snake | Elaphe o. obsolete |
| Northern Fence Lizard | Sceloporus undulates hyacinthinus | Northern Pine Snake | Pituophis m. melanoleucus |
| Five-lined Skink | Eumeces fasciatus | Eastern King Snake | Lampropeltis g. getulus |
| Northern Water Snake | Nerodia s. sipedon | Eastern Milk Snake | Lampropeltis t. triangulum |
| Northern Brown Snake | Storeria d. dekayi | Northern Scarlet Snake | Cemophora coccinea copei |
| Northern Red-bellied Snake | Storeria o. occipitomaculata | Timber Rattlesnake | Crotalus h. horridus |

## AMPHIBIANS OF WESTERN MONMOUTH COUNTY

| COMMON NAME | SCIENTIFIC NAME |
|---|---|
| Marbled Salamander | Ambystoma opacum |
| Spotted Salamander | Ambystoma maculatum |
| Eastern Tiger Salamander | Ambystoma t. tigrinum |
| Red-spotted Newt | Notophthalmus v. viridescens |
| Northern Dusky Salamander | Desmognathus f. fuscus |
| Red-backed Salamander | Plethodon c. cinereus |
| Four-toed Salamander | Hemidactylium scutatum |
| Northern Red Salamander | Pseudotriton r. ruber |
| Eastern Mud Salamander | Pseudotriton m. montanus |
| Northern Two-lined Salamander | Eurycea b. bislineata |
| Eastern Spadefoot Toad | Scaphiopus h. holbrookii |
| Fowler's Toad | Bufo woodhousii fowleri |
| Northern Cricket Frog | Acris c. crepitans |
| Northern Spring Peeper | Hyla c. crucifer |
| Pine Barrens Treefrog | Hyla andersonii |
| Northern Gray Treefrog | Hyla versicolor |
| New Jersey Chorus Frog | Pseudacris triseriata kalmi |
| Bullfrog | Rana catesbeiana |
| Carpenter Frog | Rana virgatipes |
| Green Frog | Rana clamitans melanota |
| Wood Frog | Rana sylvatica |
| Pickerel Frog | Rana palustris |
| Northern Leopard Frog | Rana pipiens |

## BIRDS OF WESTERN MONMOUTH COUNTY

| COMMON NAME | SCIENTIFIC NAME |
|---|---|
| American Bittern | Botaurus lentiginosos |
| Red-Winged Blackbird | Agelaius phoeniceus |
| Northern Bobwhite | Colinus virginianus |
| Indigo Bunting | Passerina cyanea |
| Northern Cardinal | Cardinalis cardinalis |
| Catbird | Dumetella carolinensis |
| Black-Capped Chicadee | Parus atricapillus |
| Carolina Chicadee | Parus carolinensis |
| Brown-Headed Cowbird | Molothrus ater |
| American Crow | Corvus brachyrhynchos |
| Mourning Dove | Zenaida macroura |
| American Black Duck | Anas rubripes |
| Mallard | Anas platyrhynchos |
| Wood Duck | Aix sponsa |
| Northern Common Flicker | Colaptes auratus |
| Great Crested Flycatcher | Myiarchus crinitus |
| Olive-Sided Flycatcher | Contopus borealis |
| American Goldfinch | Carduelis tristis |
| Boat-tailed Grackle | Quiscalus major |
| Common Grackle | Quiscalus quiscula |
| Evening Grosbeak | Hesperiphona vespertinus |
| Rose-breasted Grosbeak | Pheucticus ludovicianus |
| Great Black-backed Gull | Larus marinus |

## BIRDS OF WESTERN MONMOUTH COUNTY

| COMMON NAME | SCIENTIFIC NAME |
|---|---|
| Herring Gull | Larus argentatus |
| Osprey | Pandion haliaetus |
| Ovenbird | Seiurus aurocapillus |
| Eastern Screech Owl | Otus asio |
| Barred Owl | Strix varia |
| Great Horned Owl | Bubo virginianus |
| Ring-Necked Pheasant | Phasianus colchicus |
| Eastern Phoebe | Sayornis phoebe |
| American Redstart | Setophaga ruticilla |
| American Robin | Turdus migratorius |
| Spotted Sandpiper | Actitis macularia |
| Yellow-Bellied Sapsucker | Sphyrapicus varius |
| Snowy Egret | Egretta thula |
| Song Sparrow | Melospiza melodia |
| Starling | Sturnus vulgaris |
| Barn Swallow | Hirundo rustica |
| Cliff Swallow | Hirundo pyrrhonota |
| Tree Swallow | Tachycineta bicolor |
| Chimney Swift | Chaetura pelagica |
| Scarlet Tanager | Piranga olivacea |
| Brown Thrasher | Toxostoma rufum |
| Wood Thrush | Hylocichla mustelina |
| Tufted Titmouse | Parus bicolor |
| Rufous-Sided Towhee | Pipilo erythrophthalmus |

## BIRDS OF WESTERN MONMOUTH COUNTY

| COMMON NAME | SCIENTIFIC NAME |
|---|---|
| Red-eyed Vireo | Vireo olivaceus |
| Laughing Gull | Larus atricilla |
| Ruffed Grouse | Bonasa umbellus |
| Red-shouldered Hawk | Buteo lineatus |
| Red-tailed Hawk | Buteo jamaicensis |
| American Kestrel | Falco sparverius |
| Green-backed Heron | Butorides striatus |
| Great Blue Heron | Ardea herodias |
| Ruby-throated Hummingbird | Archilochus colubris |
| Blue Jay | Cyanocitta cristata |
| Dark-eyed Junco | Junco hyemalis |
| Killdeer | Charadrius vociferus |
| Eastern Kingbird | Tyrannus tyrannus |
| Belted Kingfisher | Ceryle alcyon |
| White-breasted Nuthatch | Sitta carolinensis |
| Northern Oriole | Icterus galbula |
| Yellow-throated Vireo | Vireo flavifrons |
| Turkey Vulture | Cathartes aura |
| Black and White Warbler | Miniotilta varia |
| Black-throated Blue Warbler | Dendroica caerulescens |
| Blue-winged Warbler | Vermivora pinus |
| Yellow-throated Warbler | Dendroica dominica |
| Cedar Waxwing | Bombycilla cedrorum |
| American Woodcock | Philohela minor |

## BIRDS OF WESTERN MONMOUTH COUNTY

| COMMON NAME | SCIENTIFIC NAME |
|---|---|
| Downy Woodpecker | Picoides pubescens |
| Hairy Woodpecker | Picoides villosus |
| Red-bellied Woodpecker | Melanerpes carolinus |
| Eastern Wood Pewee | Contopus virens |
| Carolina Wren | Thryothorus ludovicianus |
| House Wren | Troglogytes aedon |
| Canada Goose | Branta Canadensis |
| Eastern Bluebird | Sialia sialis |
| Northern Mockingbird | Mimus polyglottos |
| Yellow-Rumped Warbler | Dendroica coronata |
| White-Throated Sparrow | Zonotrichia albicollis |
| House Sparrow | Passer domesticus |
| House Finch | Carpodacus mexicanus |
| Rock Dove | Columba livia |
| Sharp-Shinned Hawk | Accipiter striatus |
| Purple Martin | Progne subis |

## FISH OF WESTERN MONMOUTH COUNTY

| COMMON NAME | SCIENTIFIC NAME |
|---|---|
| Largemouth bass | Micropterus salmoides |
| Chain pickerel | Esox niger |
| Grass pickerel | Esox spp. |
| Bluegill sunfish | Lepomis macrochirus |
| Pumpkinseed sunfish | Lepomis gibbosus |
| Bluespotted sunfish | Enneacanthus gloriosus |
| Redbreast sunfish | Lepomis auritus |
| Golden shiner | Notemigonus crysoleucas |
| Brown bullhead | Ictalurus nebulosus |
| Black crappie | Pomoxis nigromaculatus |
| White sucker | Catostomus commersoni |
| Creek chubsucker | Erimyzon oblongus |
| Fallfish | Semotilus corporalis |
| Johnny darter | Etheostoma nigrum |
| Mudminnow | Umbra pygmaea |
| American eel | Anguilla rostrata |
| Brown trout | Salmo trutta |
| Carp | Cyprinus carpio |

## RARE SPECIES OF MONMOUTH COUNTY (VERTEBRATES)

| COMMON NAME | SCIENTIFIC NAME | FEDERAL STATUS | STATE STATUS |
|---|---|---|---|
| Cooper's Hawk | Accipiter Cooperii | | E |
| Grasshopper Sparrow | Ammodramus savannarum | (PS) | T/T |
| Upland Sandpiper | Bartramia longicauda | | E |
| Piping Plover | Charadrius melodus | (LE-LT) | E |
| Wood Turtle | Clemmys insculpta | | T |
| Bog Turtle | Clemmys muhlenbergii | (LT-T(S/A)) | E |
| Timber Rattlesnake | Crotalus horridus horridus | | E |
| Bobolink | Dolichonyx oryzivorus | | T/T |
| Bald Eagle | Haliaeetus leucocephalus | (PS) | E |
| Pine Barrens Treefrog | Hyla andersonii | | E |
| Red-headed Woodpecker | Melanerpes erythrocephalus | | T/T |
| Yellow-crowned Night-heron | Nyctanassa violacea | | T/T |
| Osprey | Pandion haliaetus | | T/T |
| Savannah Sparrow | Passerculus sandwichensis | | T/T |
| Northern Pine Snake | Pituophis melanoleucus | | T |
| Pied-billed Grebe | Podilymbus podiceps | | E/S |
| Vesper Sparrow | Pooecetes gramineus | | E |
| Black Skimmer | Rynchops niger | | E |
| Least Tern | Sterna antillarum | (PS) | E |
| Barred Owl | Strix varia | | T/T |

Source: NJDEP Natural Heritage Program Database 1999

Key: E – Endangered State Status
T – Threatened Stat Status
LE – Endangered Federal Status
LT – Endangered Federal Status
PS – Potential Similarity of Appearance Species

## RARE SPECIES OF MONMOUTH COUNTY (INVERTEBRATES)

| COMMON NAME | SCIENTIFIC NAME | FEDERAL STATUS | STATE STATUS |
|---|---|---|---|
| A Noctuid Moth | Apamea apamiformis | | |
| A Noctuid Moth | Chytonix sensilis | | |
| Northeastern Beach Tiger Beetle | Cicindela dorsalis dorsalis | LT | E |
| Pine Barrens Bluet | Enallagma recurvatum | | |
| Henry's Elfin | Incisalia henrici | | |
| Frosted Elfin | Incisalia irus | | |
| Golden-winged Skimmer | Libellula auripennis | | |
| Coastal Swamp Metarranthis | Metarranthis pilosaria | | |
| A Satyr | Neonympha areolata septentrionalis | | |
| Sunflower Borer Moth | Papaipema necopina | | |
| Yellow edged pygarctia | Pygarctia abdominalis | | |
| Regal Fritillary | Speyeria idalia | | |
| A Noctuid Moth | Zale curema | | |

Source: NJDEP Natural Heritage Program Database 1999

Key: E – Endangered State Status
T – Threatened Stat Status
LE – Endangered Federal Status
LT – Endangered Federal Status
PS – Potential Similarity of Appearance Species

## RARE SPECIES OF MONMOUTH COUNTY (VASCULAR PLANTS)

| COMMON NAME | SCIENTIFIC NAME | FEDERAL STATUS | STATE STATUS |
|---|---|---|---|
| Yellow Giant Hyssop | Agastache nepetoides | | |
| Sea-Beach Pigweed | Amaranthus pumilus | LT | E |
| Wild Wormwood | Artemisia campestris ssp caudate | | |
| Red Milkweed | Asclepias rubra | | |
| White Milkweed | Asclepias variegata | | |
| Cornel-Leaved Aster | Aster infirmus | | |
| Low Rough Aster | Aster radula | | E |
| Pale Indian Plantain | Cacalia atriplicifolia | | E |
| Pickering's Reedgrass | Calamagrostis pickeringii | | E |
| Pine Barren Reedgrass | Calamovilfa brevipilis | | |
| Barratt's Sedge | Carex barrattii | | |
| Clustered Sedge | Carex cumulata | | E |
| Variable Sedge | Carex polymorpha | | E |
| Spiny Coontail | Ceratophyllum echinatum | | E |
| Pear Hawthorn | Crataegus calpodendron | | E |
| Fleshy Hawthorn | Crataegus succulenta | | E |
| Lancaster Flatsedge | Cyperus lancastriensis | | |
| Coast Flatsedge | Cyperus polystachyos | | E |
| Trailing Tick-Trefoil | Desmodium humifusum | | E |
| Larger Buttonweed | Diodia virginiana | | E |
| Leatherwood | Dirca palustris | | |
| Parker's Pipewort | Eriocaulon parkeri | | |

Source: NJDEP Natural Heritage Program Database 1999

Key: E – Endangered State Status
T – Threatened Stat Status
LE – Endangered Federal Status
LT – Endangered Federal Status
PS – Potential Similarity of Appearance Species

## RARE SPECIES OF MONMOUTH COUNTY (VASCULAR PLANTS CONTINUED)

| COMMON NAME | SCIENTIFIC NAME | FEDERAL STATUS | STATE STATUS |
|---|---|---|---|
| Pumpkin Ash | Fraxinus profunda | | E |
| Pine Barren Gentian | Gentiana autumnalis | | |
| Sea-Beach Milkwort | Glaux maritime | | E |
| Swamp-Pink | Helonias bullata | LT | E |
| Whorled Pennywort | Hydrocotyle verticillata | | |
| New Jersey Rush | Juncus caesariensis | | E |
| Northern Blazing Star | Liatris scariosa var novae-angliae | | E |
| Mudweed | Limosella subulata | | E |
| Sandplain Flax | Linum intercursum | | E |
| Southern Twayblade | Listera australis | | |
| Hairy Woodrush | Luzula acuminata | | E |
| Climbing Fern | Lygodium palmatum | | |
| Slender Water-Milfoil | Myriophyllum tenellum | | E |
| Virginia False-Gromwell | Onosmodium virginianum | | E |
| Mistletoe | Phoradendron serotinum | | |
| Sea-Side Plantain | Plantago maritime | | |
| Slender Plantain | Plantago pusilla | | E |
| Purple Fringeless Orchid | Platanthera peramoena | | E |
| Sea-Beach Knotweed | Polygonum glaucum | | E |
| Torrey's Mountain Mint | Pycnanthemum torrei | | E |
| Greenish-Flowered Wintergreen | Pyrola chlorantha | | E |
| Sea-Side Crowfoot | Ranunculus cymbalaria | | E |

Source: NJDEP Natural Heritage Program Database 1999

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## RARE SPECIES OF MONMOUTH COUNTY (VASCULAR PLANTS CONTINUED)

| COMMON NAME | SCIENTIFIC NAME | FEDERAL STATUS | STATE STATUS |
|---|---|---|---|
| Grass-like Beaked Rush | Rhynchospora globularis | | E |
| Knieskern's Beaked Rush | Rhynchospora knieskernii | LT | E |
| Pale Beak Rush | Rhynchospora pallida | | |
| Heart-Winged Sorrell | Rumex hastatulus | | |
| Southern Arrow Head | Sagittaria australis | | E |
| Shining Willow | Salix lucida | | |
| Salt Marsh Bulrush | Scirpus maritimus | | E |
| Slender Nut Rush | Scleria minor | | |
| Sea-Side Arrow-Grass | Triglochin maritimum | | E |
| Pine Barren Bellwort | Uvularia puberula var nitida | | E |
| Narrow-Leaved Vervain | Verbena simplex | | E |

Source: NJDEP Natural Heritage Program Database 1999

Key: E – Endangered State Status
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