

NATURAL RESOURCES INVENTORY

TOWNSHIP OF DENNIS **CAPE MAY COUNTY, NEW JERSEY**

DECEMBER 2007
REVISED MAY 2010

Adopted by the Dennis Township Planning Board on



Maser Consulting PA
American Metro Center
100 American Metro Boulevard
Suite 152
Hamilton, NJ 08619

Natural Resources Inventory

Township of Dennis

Cape May County, New Jersey

**December 2007
Revised May 2010**

Prepared by:

Marcia Shiffman, AICP, PP, LLA, Project Manager
Barbara Edelhauser, Environmental Scientist
William Olson, Environmental Scientist
Loren Kelly, Environmental Specialist
Jacqueline McCort, Environmental Specialist
Sharon White, Cultural Resources Specialist
Jill Slagle, Cultural Resources Specialist
Christopher Walker, Cultural Resources Specialist
Daniel Bloch, P.P., Project Planner



Maser Consulting PA

American Metro Center
100 American Metro Boulevard
Suite 152
Hamilton, NJ 08619

Table of Contents

EXECUTIVE SUMMARY	1
1.0 LOCATION.....	1
1.1 DENNIS TOWNSHIP LOCATION	1
1.2 REGULATORY JURISDICTIONS	4
1.2.1 Coastal Zone	4
1.2.2 Pinelands Management Area	6
1.3 EXISTING LAND USE AND LAND COVER.....	7
2.0 PHYSICAL RESOURCES AND CONDITIONS.....	10
2.1 CLIMATE.....	10
2.2 PHYSIOGEOGRAPHIC PROVINCE AND GEOLOGY	14
2.3 TOPOGRAPHY AND SLOPES.....	17
2.4 SOILS.....	17
2.4.1 Soils Limitations.....	20
2.4.2 Farmland Soils.....	23
2.5 CONTAMINATED SITES	25
3.0 WATER RESOURCES AND CONDITIONS.....	27
3.1 GROUNDWATER RESOURCES.....	27
3.1.1 Aquifers	27
3.1.2 Aquifer Recharge.....	29
3.1.3 Well Head Protection Areas	29
3.2 WETLANDS.....	33
3.3 WATERSHEDS	36
3.4 SURFACE WATER QUALITY	37
3.4.1 Shellfish Harvest Areas	38
3.5 FLOODWAYS AND FLOODPLAINS	41
4.0 BIOLOGICAL RESOURCES	44
4.1 BOTANICAL RESOURCES.....	44
4.1.1 Estuarine Plant Communities	46
4.1.2 Palustrine Plant Communities	48
4.1.3 Terrestrial Plant Communities	52
4.1.4 Rare Vegetation Communities.....	54
4.1.5 Rare Plant Species.....	55
4.2 ZOOLOGICAL RESOURCES	55
4.2.1 Aquatic Animals.....	56
4.2.2 Terrestrial Animals.....	61
4.3 RARE SPECIES AND SPECIES OF SPECIAL CONCERN.....	65
4.4 CRITICAL HABITATS AND SPECIAL ECOLOGICAL COMMUNITIES.....	68
4.4.1 Federal Habitat Complexes.....	68
4.4.2 State of New Jersey Critical Habitat Mapping	69
4.4.3 New Jersey Natural Heritage Program Priority Sites.....	72
5.0 CULTURAL RESOURCES	75
5.1 PREHISTORIC CONTEXT	75
5.1.1 Early Archaic	75
5.1.2 Middle Archaic	75
5.1.3 Late Archaic.....	76
5.1.4 Early and Middle Woodland.....	76

5.1.5	Late Woodland	76
5.2	HISTORIC CONTEXT	77
5.2.1	Cape May County	77
5.2.2	Dennis Township	77
5.3	INVENTORIED CULTURAL RESOURCES	78
5.4	OPEN SPACE/PUBLIC LAND	82
5.4.1	Open Space	82
5.4.2	Parks and Recreation Areas	85
5.5	AESTHETIC RESOURCES	86

Figures

1. Coastal Barrier Resources System Units
2. Seasonal Offshore Wind Direction
3. Physiographic Provinces of New Jersey
4. Groundwater Detail
5. Impact of Well on Groundwater Movement

Tables

1. Land Use/Land Cover, 2002
2. Temperatures Measured at Cape May 1 NW and Belleplain State Forest
3. Precipitation Measured at Cape May 2 NW and Belleplain State Forest
4. Soil Types of Dennis Township
5. Development Limitations of Soils
6. Known Contaminated Sites List
7. Classification Exception Areas/Well Restriction Areas
8. Surface Water Classifications of Dennis Township Waters
9. Plants of the Mesohaline/Oligohaline Subtidal Aquatic Bed
10. Plants of the Low Marsh Community
11. Plants of the High Marsh Community
12. Plants of the Brackish Tidal Marsh Community
13. Plants of the Freshwater Tidal Wetland Community
14. Plants of the Coastal Interdunal Marsh Community
15. Plants of the Coastal Plain Intermittent Pond Community
16. Plants of the Coastal Plain Atlantic White Cedar Swamp Community
17. Plants of the Liquidambar/Acer Hardwood Swamp Community
18. Plants of the Pine Barren Hardwood Swamp Community
19. Plants of the Pitch Pine Lowland Forest Community
20. Plants of the Cape May Lowland Swamp Community
21. Plants of the Dry Oak-Pine Forest Community
22. Plants of the Pine-Oak Forest Community
23. Plants of the Southern Coastal Plain Mixed Oak Community
24. Rare Plants of Dennis Township
25. New Jersey Freshwater Fishes
26. New Jersey Saltwater Fishes
27. New Jersey Mammals
28. Birds of Cape May County, New Jersey
29. Cape May County Reptiles
30. Cape May County Amphibians
31. Butterflies of Cape May County, New Jersey
32. Rare Wildlife of Dennis Township
33. Archaeological Subperiods
34. State Registered Historic Properties
35. Planning Board Designated Historic Sites

Maps

- Location (Page 2)
- 2002 Aerial Photography (Page 3)
- Regulatory Jurisdictions (Page 5)
- 2002 Land Use / Land Cover (Page 9)
- Geology (Page 16)
- Soils (Page 19)
- Soil Limitations for Septic Systems (Page 21)
- Soil Limitations for Dwellings with Basements (Page 22)
- Farmland Soils (Page 24)
- Known Contaminated Sites (Page 26)
- Water Resources (Page 32)
- Wetlands (Page 35)
- Watershed Management Areas (Page 40)
- Floodprone Areas (Page 43)
- Forest Coverage (Page 45)
- Threatened and Endangered Species (Page 71)
- Natural Heritage Priority Sites (Page 74)
- Cultural Resources (Page 81)
- Open Space (Page 83)

Disclaimer: Reference is made throughout this document to various information, including but not limited to maps, charts, and tables, which information was compiled, drafted or drawn by entities other than the Township of Dennis, its agents, servants or employees. The Township did not, and in most cases, cannot verify the accuracy of the information. This information is not adopted by the Township as its own statement(s) and shall not be deemed an admission in any context or in any proceeding.

\\Njncad\projects\2006\06000533\Reports\121807dnbNRI.doc

EXECUTIVE SUMMARY

This Natural Resources Inventory has been prepared to assist the Township in recognizing and understanding the unique resources present. It provides a tool to identify and protect these resources.

Dennis Township has never prepared an inventory of natural resources, although many resources were identified and mapped in prior Master Planning documents. A detailed Natural Resources Inventory informs the planning process by providing a factual basis for land use decision-making. The mapping and description of sensitive areas facilitates the proper use and protection of existing natural areas, the appropriate development of the remaining vacant, privately owned land parcels and the redevelopment of developed lands. This inventory can aid in refining zoning regulations and land use ordinances. The identification and understanding of natural systems and their inherent and regulatory limitations for development may prevent future environmental problems and associated mitigation costs. The inventory can identify possibilities for regional partnerships and planning activities that can improve environmental conditions and quality of life in the Township.

Dennis Township is located on the Outer Coastal Plain of New Jersey in the northeastern portion of Cape May County and represents one of its 16 municipalities. Dennis Township is surrounded to the north by Upper Township and Woodbine Borough, by Sea Isle City Borough to the east, Middle Township to the south and the Delaware Bay to the southwest and Cumberland County to the west.

Geologically, the Township is underlain by the unconsolidated sediments of the Cohansey and Cape May Formations. The Atlantic City 800-foot Sand Aquifer System of the Lower Kirkwood Formation provides drinking water to residents of Dennis Township. The water supply is accessed via private on-site individual wells. The easterly portions of the Township ultimately drain to the Atlantic Ocean and the westerly portions drain to Delaware Bay. Four subwatersheds further subdivide the Township: West Creek/East Creek/Riggins Ditch, Tuckahoe, Dennis Creek, Cape May Bays & Tributaries East.

The portions of the municipality adjacent to Delaware Bay, West Creek, East Creek, Dennis Creek, Sluice Creek and Townsend Sound and Ludlam Bay are all located within the Zone A, or 100-year floodplains of these waterways. Large expanses of wetlands are present. These wetlands include High and Low Saltmarsh, Brackish and Freshwater Tidal Marshes. There are also a number of upland plant communities present. These include the Marine Intertidal Gravel/Sand Beach, Dunegrass, Beach Heather, Shrub Thicket and Dune Woodland Communities. The extent of floral diversity in plant communities is mirrored by a similar diversity in fauna, particularly for birds and butterflies. Numerous threatened and endangered plants and animals are documented to occur in Dennis Township. Portions of Dennis Township are included within Natural Heritage Program Priority Sites.

The coastal marshes, bay islands and the Delaware Bayshore of Dennis Township host important overwintering, breeding and nesting bird populations. The Bayshore is the site of a huge Horseshoe Crab spawning event. The area has become a critically important migratory bird stopover, for species traveling to the Arctic. State and Federal wildlife agencies maintain considerable interest in the wildlife and habitat resources in the area.

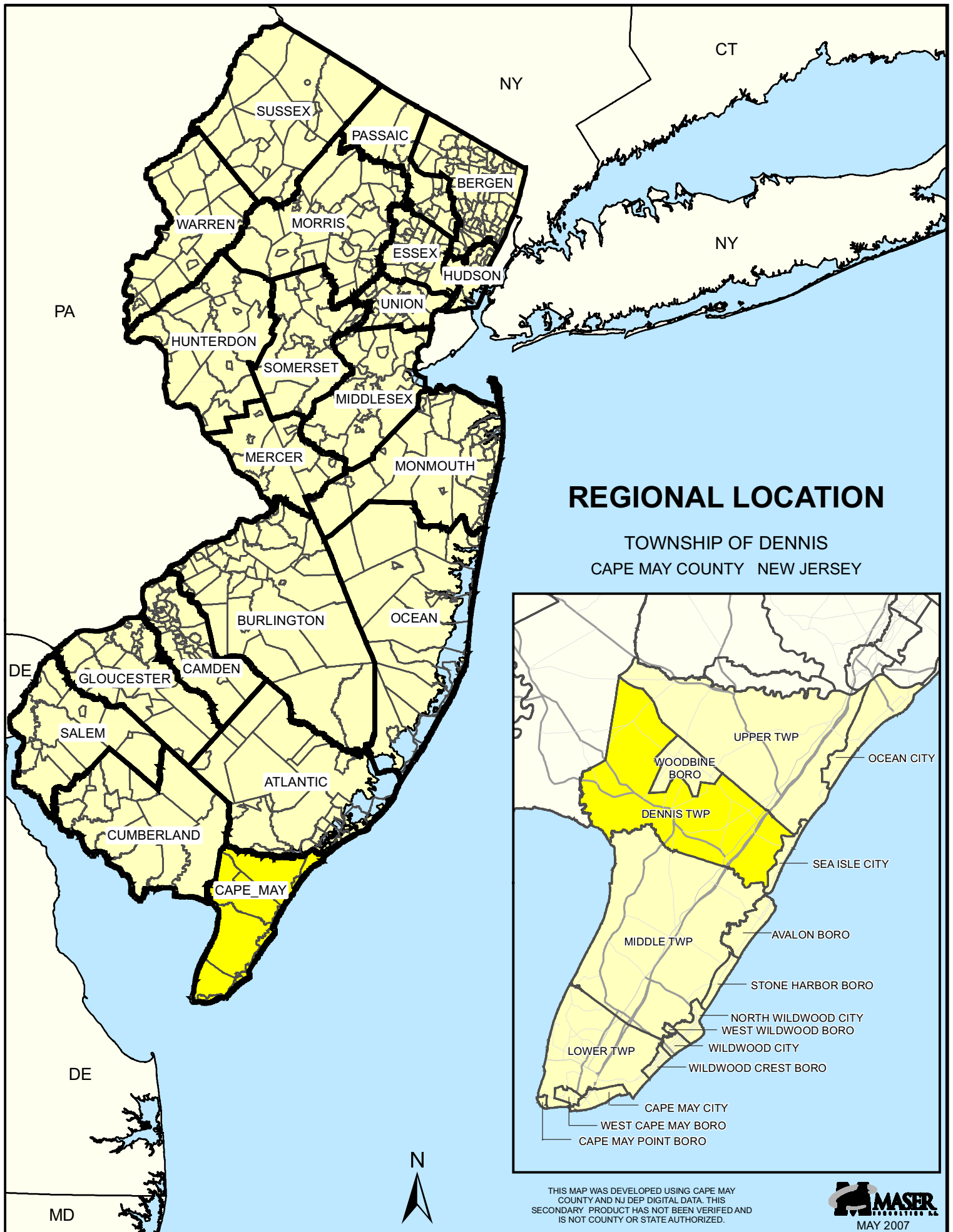
Dennis Township has retained many features of its historical heritage. There are 14 registered historic properties or districts, of which six are listed on the National Register of Historic Places. There are also eight registered prehistoric or archaeological sites. The sum of these resources and the awareness thereof helps to establish a sense of place for Township citizens. This inventory can provide the framework for planning and preservation. Valuable cultural resources can be preserved and the restoration of degraded resources can be undertaken. It is hoped that this Natural Resource Inventory will become an integral part of the planning process in the Township and that this Inventory will promote the protection and preservation of the unique natural and cultural resources of the Township for future generations.

1.0 LOCATION

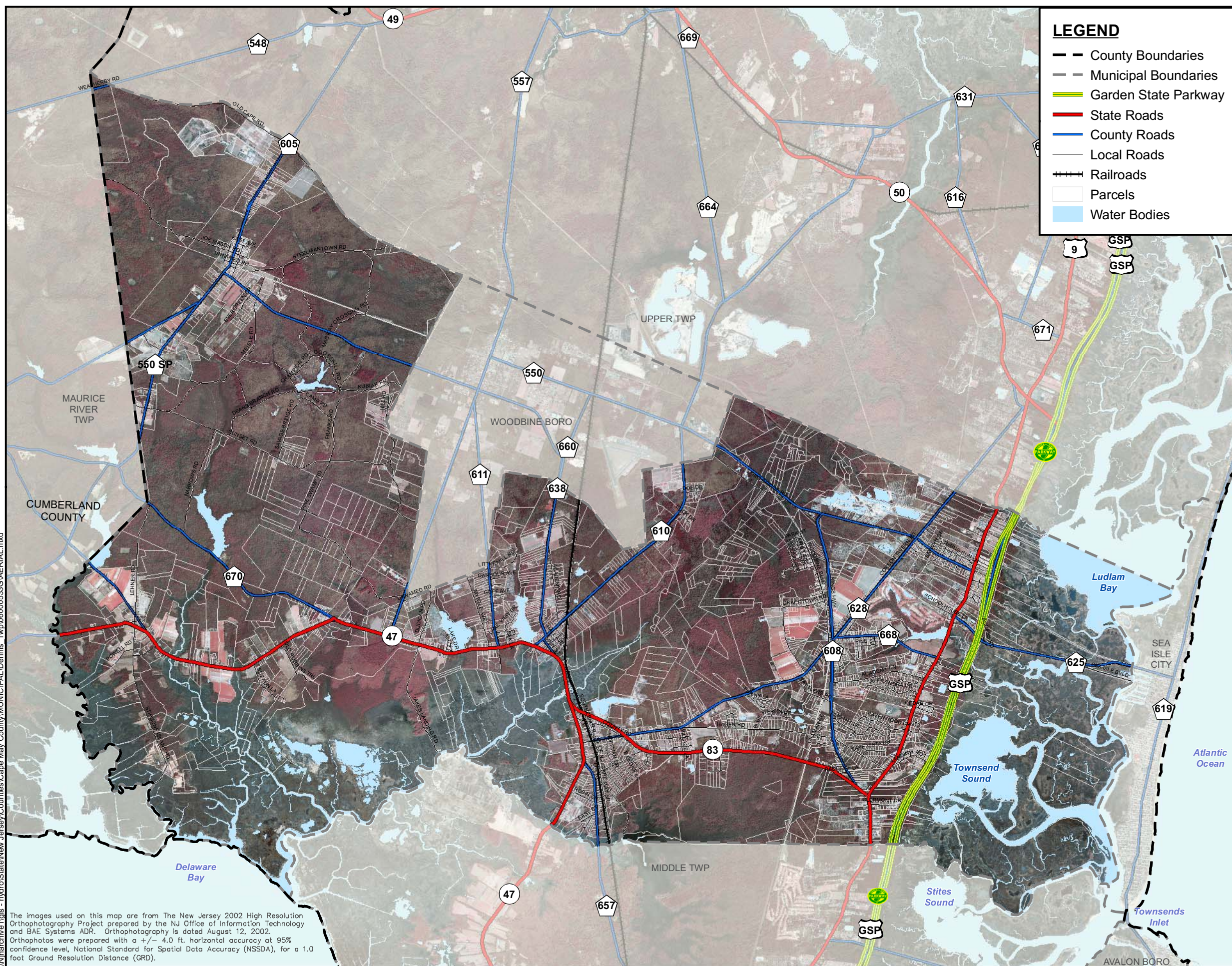
1.1 DENNIS TOWNSHIP LOCATION

Dennis Township is a rural community located in Cape May County, which occupies a portion of the peninsula at the southern tip of the State of New Jersey. All of Cape May County lies within the Coastal Plain Physiographic Province, characterized by the presence of unconsolidated deposits (loosely bound sediments) laid down over a long period of time. The Township was incorporated in 1827 as part of an Act of the New Jersey Legislature from portions of Upper Township. Additional portions were also taken from Sea Isle City in 1882 and from Woodbine in 1903. According to the 2000 U.S. Census, the Township has a total population of 6,492 people and has a total area of 64.3 miles.

Dennis Township is surrounded to the north by Upper Township and Woodbine Borough, by Sea Isle City Borough to the east, Middle Township to the south and the Delaware Bay to the southwest and Cumberland County to the west. Major roadways that run through Dennis Township include the Garden State Parkway, State Route 9, State Route 47 and Route 83. Dennis Creek and Middle Thorofare form large portions of the southerly boundary of the Township. Extensive tidal wetlands are located along the eastern shores of Dennis Township, including those associated with Ludlam Bay and Townsend Sound (see Location Map).



\\njarchive\gis - hydro\State\New Jersey\Counties\Cape May County\MUNICIPAL\Dennis_Twp\0600005333\AERIAL.mxd



The images used on this map are from The New Jersey 2002 High Resolution Orthophotography Project prepared by the NJ Office of Information Technology and BAE Systems ADR. Orthophotography is dated August 12, 2002. Orthophotos were prepared with a +/- 4.0 ft. horizontal accuracy at 95% confidence level, National Standard for Spatial Data Accuracy (NPSDA), for a 1.0 foot Ground Resolution Distance (GRD).

2002 AERIAL PHOTOGRAPHY

TOWNSHIP OF DENNIS

CAPE MAY COUNTY
NEW JERSEY



0 2,500 5,000 7,500 10,000 Feet

1 inch equals 6,000 feet

DIGITAL SPATIAL DATA SOURCES:
- CAPE MAY COUNTY GEOGRAPHIC INFORMATION SYSTEM
- NEW JERSEY DEPARTMENT OF COMMUNITY AFFAIRS, OFFICE OF SMART GROWTH
- NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF GEOGRAPHIC INFORMATION
- UNITED STATES DEPARTMENT OF AGRICULTURE, NATURAL RESOURCES CONSERVATION SERVICES
- NEW JERSEY OFFICE OF INFORMATION TECHNOLOGY, OFFICE OF GIS



NOVEMBER 2007

1.2 REGULATORY JURISDICTIONS

The State of New Jersey has established several areas within the State for extra protection. These are the Pinelands Area, the Coastal Zone, the New Jersey Meadowlands and the Highlands Region. Rules and regulations have been promulgated by the State to regulate development in these areas. The two jurisdictional areas that occur in Dennis Township are the Pinelands and the Coastal Zone.

1.2.1 Coastal Zone

The three major coastal statutes regulating the development in the Coastal Zone are the Wetlands Act of 1970, the Waterfront Development Law and the Coastal Area Facility Review Act. The Freshwater Wetlands Protection Act allows the regulation of activities in freshwater wetlands within the Coastal Zone, as well as in other parts of the state. The Flood Hazard Area Control Act Rules regulate activities in floodplains and streams.

The Federal Coastal Zone Management Act of 1972 gave States the authority to devise strategies and policies to manage development and use of coastal land and water areas. The State of New Jersey adopted the Coastal Area Facilities Review Act (CAFRA) to manage development in the Coastal Zone. As described in the Coastal Area Facility Review Act (CAFRA) - N.J.S.A. 13:19, the CAFRA boundary in Dennis Township begins on County Route 610 at the Borough of Woodbine municipal boundary, traverses southwesterly along County Route 610 to its intersection with State Route 47 in Dennisville, and follows State Route 47 in a northwesterly direction to the municipal boundary with Maurice River Township in Cumberland County. The coastal area lies to the east and south of this boundary as shown on the Regulatory Jurisdictions map.

The Coastal Permit Program Rules (N.J.A.C. 7:7) and the Coastal Zone Management Rules (N.J.A.C. 7:7E) are the implementing rules and regulations for CAFRA. Nearly all development located within 150 feet of the mean high water line of a tidal water body is subject to these regulations. Jurisdictional thresholds are higher between 150 and 500 feet from the mean high water line and higher still beyond 500 feet.

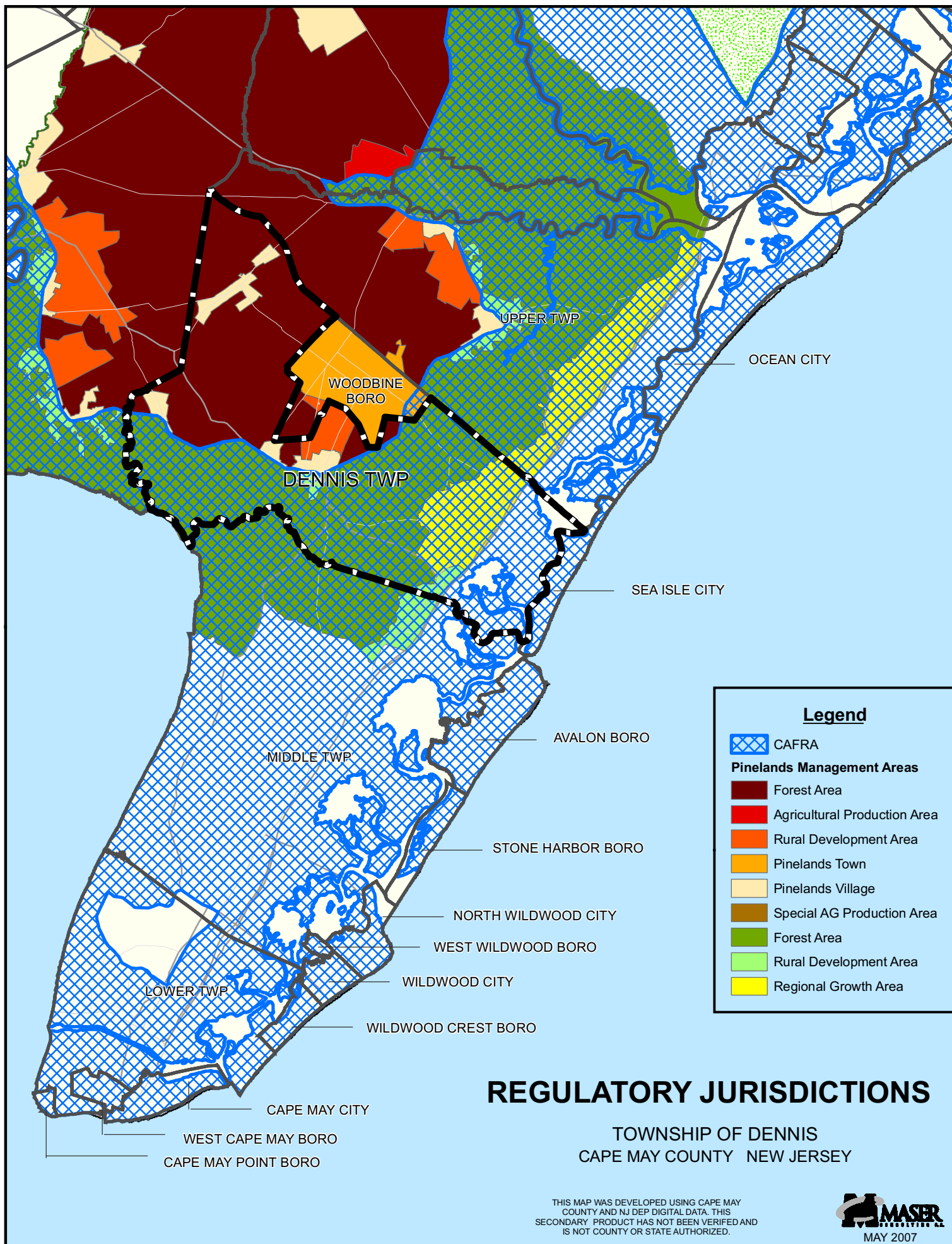
The development intensity allowed by the coastal regulations varies according to planning area in the coastal zone. The most impervious cover is allowed in designated CAFRA centers, which can be designated as Urban Centers, Regional Centers, Towns, Villages and Hamlets.

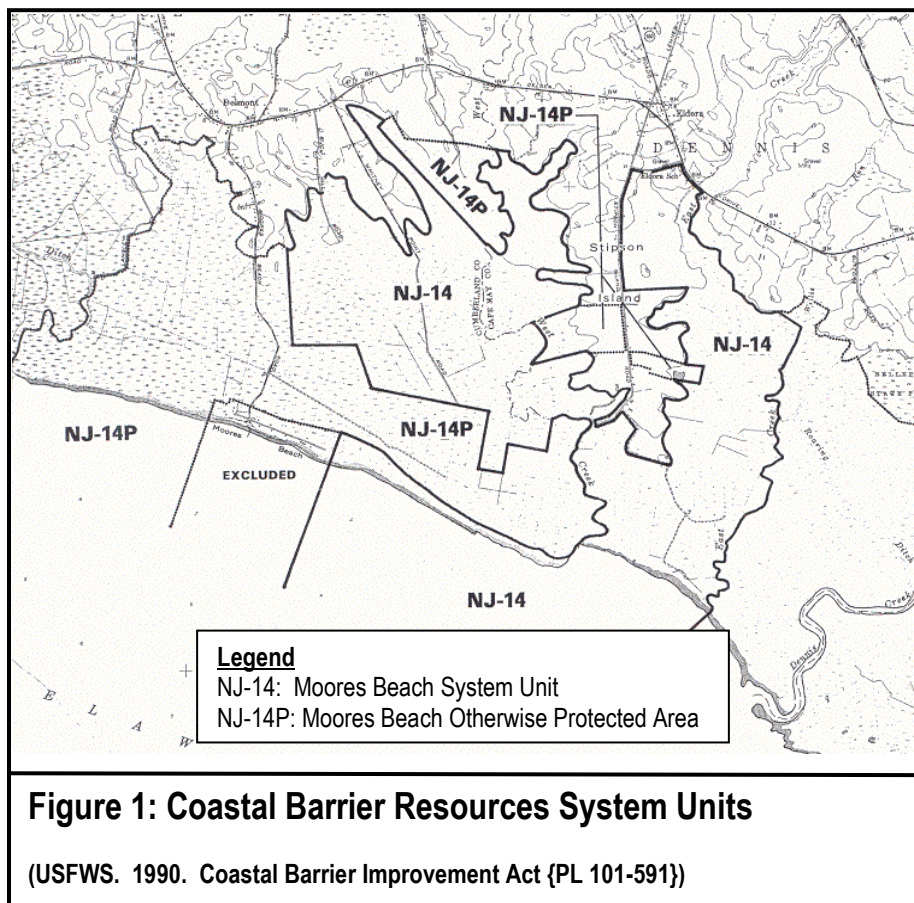
The most intensive development is allowed in regional centers, with less impervious cover allowable in town centers, the villages and still less in hamlets. Lands outside of CAFRA centers are divided into the following CAFRA planning areas:

- Metropolitan Planning Area
- Suburban Planning Area
- Coastal Fringe Planning Area
- Coastal Rural Planning Area
- Coastal Environmentally Sensitive Planning Area

Six CAFRA Centers were previously established in Dennis Township, however, as of March 15, 2007; these centers expired and are subject to reauthorization. The expired Centers were identified as:

- Clermont Coastal Hamlet
- Dennisville Coastal Village
- Eldora Coastal Hamlet
- Oceanview Coastal Hamlet
- South Dennis Coastal Village
- South Seaville Coastal Hamlet





The Coastal Barrier Resources Act of 1982 limits federal spending that might encourage development in coastal barrier areas, which are both hurricane-prone and characterized by abundant and important biological resources. A portion of one of the federal units of the John H. Chafee Barrier Resources System falls within Dennis Township. This is the Moores Beach Unit, in the southwestern portion of the Township. "System Units" are subject to the full scope of limitations prescribed by the law. "Otherwise Protected Areas" are only limited in that federal flood insurance will not be issued in these areas. The unit present in Dennis Township is shown in Figure 1. The Coastal Barrier Resources

System Units are located in the southwesterly portion of Dennis Township, adjacent and proximate to Delaware Bay Lands that are tidally flowed are owned by the State of New Jersey. Most activities proposed below the mean high water line of any tidal water body require review and approval from the NJDEP Bureau of Tidelands. The United States Army Corps of Engineers also regulates activities conducted below the mean high water line and within wetlands that are tributary to a tidal water body and located within 1,000 feet from the mean high water line.

1.2.2 Pinelands Management Area

The portion of Dennis Township, not located within the Coastal Zone, contained within the Pinelands Management Area. The authority to regulate development in the NJ Pinelands derives from the Pinelands Protection Act (NJSA 13:18A). This Act established the boundaries of the Pinelands Area and its sub-areas: the Pinelands Protection area and the Pinelands Preservation area and the Pinelands National Reserve. The Act also created the NJ Pinelands Commission, which is the regulatory agency for development in the Pinelands Area. Development in the Pinelands is regulated under the Pinelands Comprehensive Management Plan (NJAC 7:50). As shown on the Regulatory Jurisdictions Map, the Pinelands Comprehensive Management Plan designates the following areas within Dennis Township: Forest Area, Rural Development Area, and Pinelands Villages: Belleplain, Eldora, North Dennis, and Dennisville.

The Pinelands National Reserve is an area located outside of the regulated Pinelands Area. In Dennis Township this area overlaps the Coastal Zone. It is actually a federally designated area, consisting of approximately one million acres of land. This area was established under Section 502 of the National Parks and Recreation Act of 1978 (PL 95-625). Under a Memorandum of Agreement between the NJ Pinelands Commission and the NJDEP Land Use Regulation Program, the latter agency is the lead agency in review of development applications in the Pinelands National Reserve Area. The NJ Pinelands Commission is a reviewing agency and may provide comments on

development in this area. The Pinelands Reserve Area in the Township is located to the west of the Garden State Parkway. The New Jersey Pinelands Land Capability Map shows the Pinelands Reserve in Dennis Township as a Forest Area, Rural Development Area, and Regional Growth Area. The standards for development in these portions of the Pinelands Reserve should meet the density and other standards contained in the Pinelands Comprehensive Management Plan.

1.3 EXISTING LAND USE AND LAND COVER

The existing land use patterns within Dennis Township are depicted on the 2002 Land Use/Land Cover Map. It is evident that most land in the Township is publicly owned, consisting of environmentally-constrained land and wildlife management areas. The Township has nearly 50 percent of its total land mass covered by freshwater and tidal wetlands (see the Wetlands Map). There are large areas of land within the Township that are owned and managed by State and Federal agencies for the protection of threatened and endangered species and wildlife habitats. Agricultural lands comprise only 4.74 percent of the land cover in Dennis Township. Preserved farmland is shown on the Open Space Map, located in the Open Space section of this inventory. Cape May County provides funds for farmland and open space preservation.

The most significant regions of undevelopable land are located (1) along the entire eastern portion of the municipality between the Garden State Parkway and the barrier islands that is associated with tidal wetlands of Ludlam Bay and Townsend Sound; (2) along the southwestern coast of the municipality on the Delaware Bay; (3) the Great Cedar Swamp in the north-central portion of the Township; (4) Timber and Beaver Swamps along the south-central boundary with Middle Township; and (5) Belleplain State Forest in the western portion of the municipality. The wetlands of Great Cedar Swamp, Timber and Beaver Swamps, and Belleplain State Forest are mostly forested. Tidal wetlands associated with the Delaware Bay are generally located to the south of State Route 47.

Various forms of forest, including deciduous, coniferous and mixed forest, comprise almost 30% of the land cover in Dennis Township. Much of this forest is located in the northwestern portion of the Township, between Woodbine Borough and Maurice River Township in Cumberland County. Forested land also follows the boundary of the Great Cedar Swamp in the north-central portion of Dennis Township.

Residential uses account for approximately 6 percent of the land within the Township. The existing residential development consists mainly of single-family homes with the most concentrated areas located in Belleplain, South Seaville, Cedar Grove, Dennisville, and South Dennis. It is no surprise that most of Dennis Township's commercial developments are located along its major roadways, particularly along the U.S. Route 9 corridor. Industrial uses are minimal, and cover only 66 acres of land. These uses are generally located along County Routes 550, 605, and 608. Recreational lands, including school athletic fields, make up about 2 percent of the land cover in the Township.

Table 1: Land Use / Land Cover, 2002		
Land Use / Land Cover Classification	Acres	% of Twp
Urban Lands	4,161.68	10.13%
Residential	2,492.67	6.07%
Commercial	185.71	0.45%
Industrial	66.20	0.16%
Transportation/Communication/Utilities	319.44	0.78%
Cemetery	18.17	0.04%
Recreational Lands	858.40	2.09%
Other Urban Land	221.08	0.54%
Agricultural Lands	1,947.98	4.74%
Barren Lands	243.00	0.59%
Extractive Mining	127.80	0.31%
Beaches	2.16	0.01%
Barren Lands	56.52	0.14%
Forests	12,097.81	29.44%
Water	6,953.91	16.92%
Artificial Lakes	428.39	1.04%
Bridge Over Water	0.29	0.00%
Dredged Lagoon	1.74	0.00%
Natural Lakes	9.51	0.02%
Open Tidal Bays	40.28	0.10%
Streams And Canals	2.49	0.01%
Tidal Rivers, Inland Bays, And Other Tidal Waters	6,471.21	15.75%
Wetlands	20,059.88	48.82%
Dennis Township Total Land Area	41,093.61	100.00%
Source: NJDEP 2002 Land use/Land cover Update, Cape May Watershed Management Area, WMA-16, New Jersey Department of Environmental Protection (NJDEP), Office of Information Resources Management (OIRM), Bureau of Geographic Information and Analysis (BGIA), Published January 1, 2007, http://www.state.nj.us/dep/gis/digidownload/zips/lulc02/w16lu02_D.zip		

\\njarchive\gis - hydro\State\New Jersey\Counties\Cape May County\MUNICIPAL\Dennis_Twp\06000533\GULULC.mxd

LEGEND
- - County Boundaries
- - Municipal Boundaries
- - Garden State Parkway
- - State Roads
- - County Roads
- - Local Roads
- - Railroads
- - Parcels
- - Water Bodies

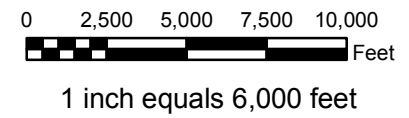
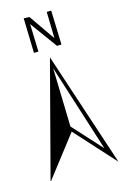
Land Use / Land Cover
Residential
Commercial / Services
Industrial
Athletic Fields (School)
Recreational Lands
Cemetery
Transportation / Communications / Utilities

Other Urban Lands
Agriculture
Beaches
Forests
Forested Wetlands
Wetlands
Barren Lands
Extractive Mining

2002 LAND USE / LAND COVER

TOWNSHIP OF DENNIS

CAPE MAY COUNTY
NEW JERSEY



DIGITAL SPATIAL DATA SOURCES:
- CAPE MAY COUNTY GEOGRAPHIC INFORMATION SYSTEM
- NEW JERSEY DEPARTMENT OF COMMUNITY AFFAIRS, OFFICE OF SMART GROWTH
- NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF GEOGRAPHIC INFORMATION
- UNITED STATES DEPARTMENT OF AGRICULTURE, NATURAL RESOURCES CONSERVATION SERVICES
- NEW JERSEY OFFICE OF INFORMATION TECHNOLOGY, OFFICE OF GIS



NOVEMBER 2007

2.0 PHYSICAL RESOURCES AND CONDITIONS

2.1 CLIMATE

The undulating flow of air masses, generally moving from west to east across the continent of North America dominates the climate of New Jersey. This pattern of air mass movement is called the westerlies. Since these streams of air vary in intensity and can be wet or dry, cold or warm, New Jersey weather is highly variable on a day to day basis. Despite its small size, differences in geology, proximity to the Atlantic Ocean and the pattern of north-south variation in the track of air masses across the State, allow five distinct climate regions to be delineated. These five regions are Northern, Central, Pine Barrens, Southwest and Coastal (Office of the New Jersey State Climatologist (ONJSC) 2006a).

Dennis Township is located in the Coastal region of the State of New Jersey in terms of climate characteristics. The adjacent Atlantic Ocean tempers and sometimes dominates the continental climate prevalent over inland areas. Because of this, seasonal temperatures are subject to less variation (ONJSC Accessed 2006a). The sea breeze causes local changes in temperature, humidity, wind speed, wind direction, cloud cover and sometimes precipitation. Weather forecasts for near-shore locales must consider the modifying effects of sea breezes on weather conditions for the general public, as well as for boaters (Dunk 2005). Since Dennis Township almost straddles the Cape May Peninsula, the Township will be subject to winds of the Delaware Bay as well as from the Atlantic Ocean.

In the autumn and winter, air over the ocean is warmer than over the land and ocean breezes moderate the cold. The opposite is true in the spring and summer, when the ocean's influence is cooling. During spring and summer, land heats more quickly than the water. As the air over land rises, cooler air over the ocean moves inland (ONJSC 2006a). The patterns of prevalent seasonal wind direction are shown on Figure 2.

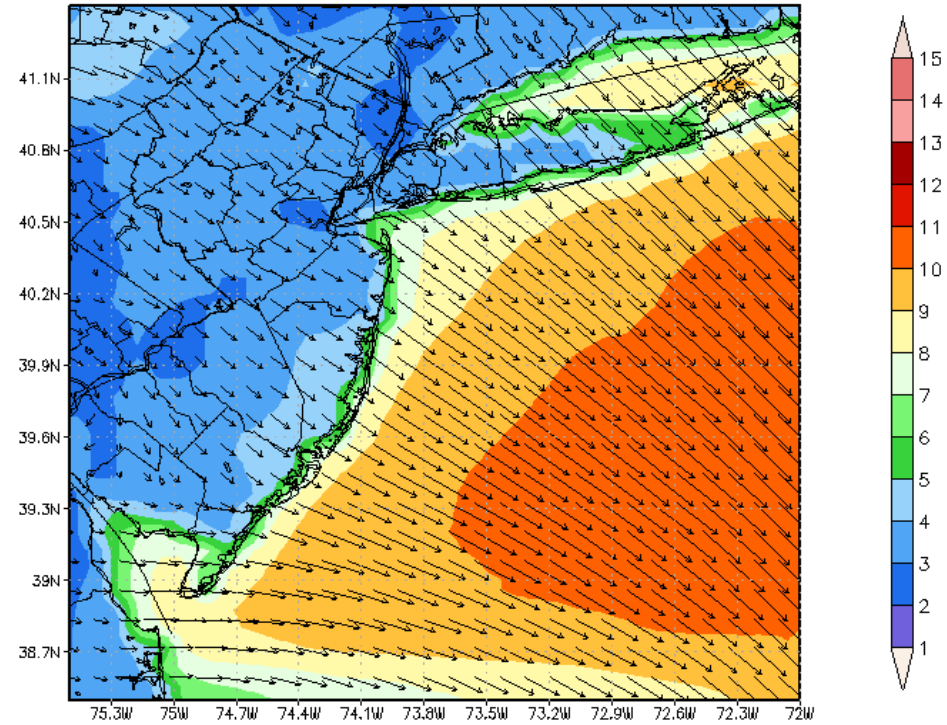
The distribution of sea surface temperatures along and near the shore both influences and is influenced by sea breezes. During prolonged periods of southwesterly wind flow resulting from pressure differences in the atmosphere, the upwelling of colder water from below the ocean surface can be induced. This upwelling can produce near-shore pockets of water that are at least 5 to 10 degrees Fahrenheit (F) colder than the surrounding ocean. These cold pockets of upwelling help to get sea breezes started (Dunk 2005).

The National Oceanic and Atmospheric Agency (NOAA) operates climate monitoring stations in Cape May County for which data is available on the web sites of the Office of the New Jersey State Climatologist and the Natural Resources Conservation Service NRCS. The nearest stations to Dennis Township are the Belleplain State Forest station and the Cape May 2 NW station. A large portion of Belleplain State Forest is located within Dennis Township.

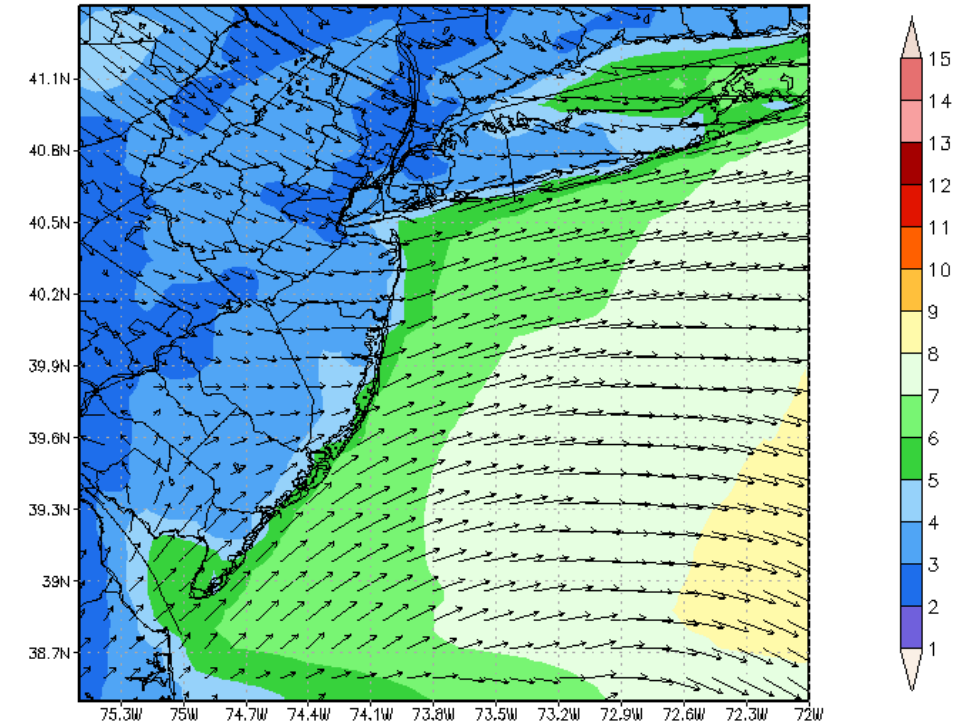
All stations in New Jersey have registered readings of 100 degrees Fahrenheit (F) or higher and have records of 0 degrees F or below. The average monthly temperatures, average daily minimum and maximum temperatures extending to the year 2006 are depicted in Table 2. The variation in the average monthly temperatures between the weather stations at Cape May 2 NW and Belleplain State Forest, do not vary greatly (only 0.6 degrees F) in their annual average temperature. These temperatures constitute a growing season that extends from approximately March 20 to November 30 in Dennis Township (Collins & Robichaud 1994).

FIGURE 2: SEASONAL OFF-SHORE WIND DIRECTION (DUNK 2005)

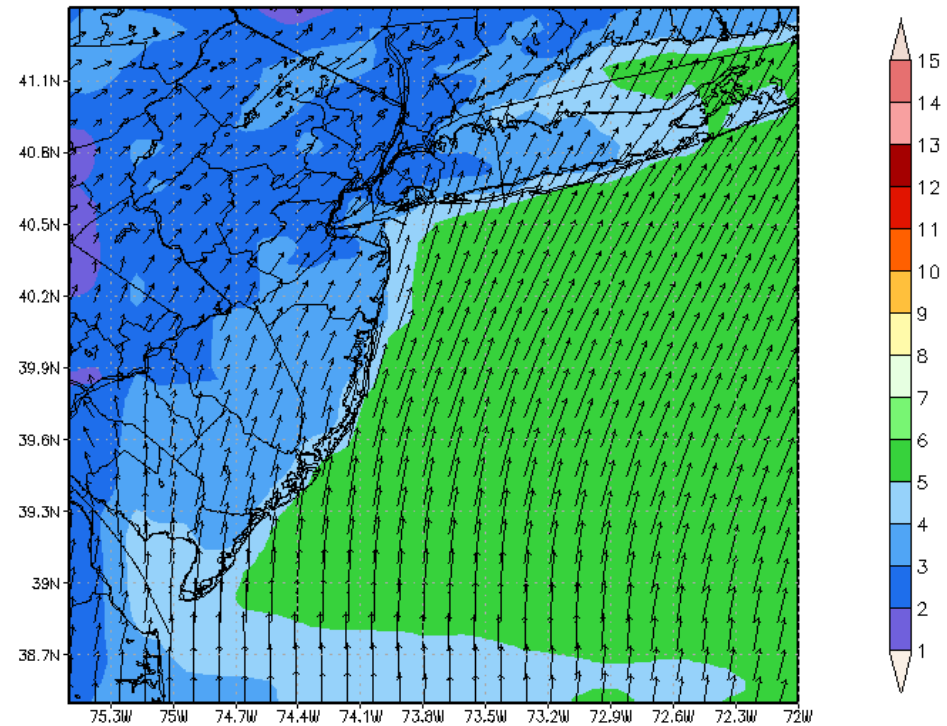
Winter (DJF) Average 10m Wind Speed [m/s] and Direction



Spring (MAM) Average 10m Wind Speed [m/s] and Direction



Summer (JJA) Average 10m Wind Speed [m/s] and Direction



Autumn (SON) Average 10m Wind Speed [m/s] and Direction

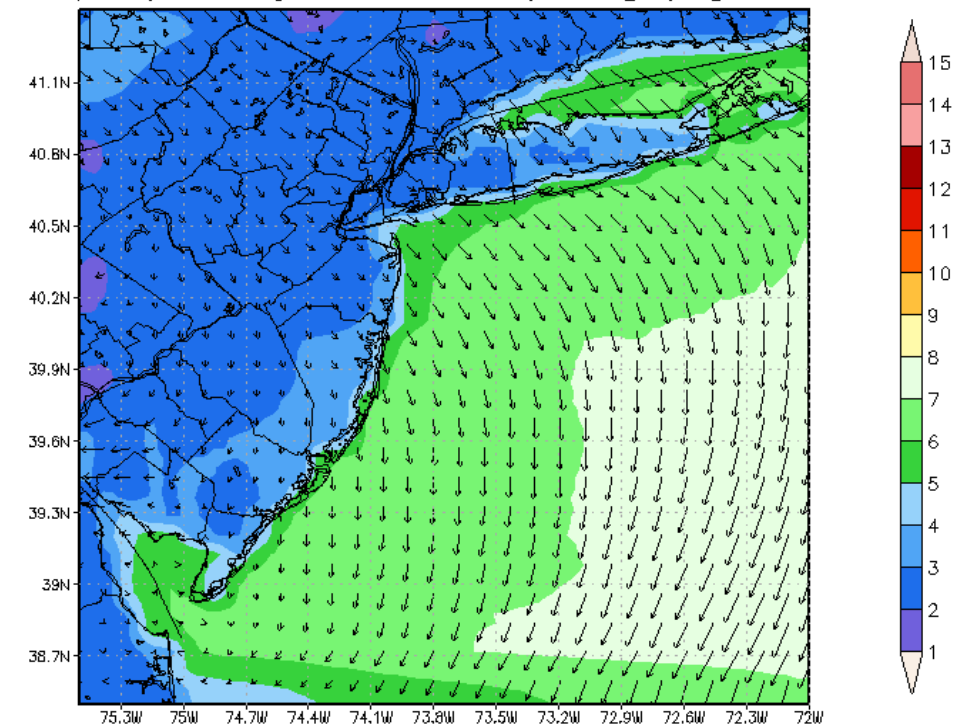


Table 2: Temperatures Measured at Cape May 2 NW¹ (CM 2 W) and Belleplain State Forest² (BSF) NOAA, NRCS

Month	Average Daily Minimum (°F)		Average Daily Maximum (°F)		Monthly Average (°F)	
	CM 2 W	BSF	CM 2 W	BSF	CM 2 W	BSF
January	28.0	23.4	41.7	44.3	34.9	34.0
February	28.6	24.1	42.8	46.2	35.7	35.2
March	35.0	30.6	49.8	53.8	42.4	42.2
April	43.3	38.9	59.1	64.5	51.2	51.7
May	52.8	48.8	68.7	74.8	60.7	61.9
June	61.8	58.2	77.5	82.6	69.7	70.4
July	67.3	63.3	82.6	86.3	74.9	74.8
August	66.5	62.1	81.5	84.6	74.0	73.4
September	61.6	55.1	76.8	79.0	69.2	67.1
October	50.8	43.2	66.5	68.9	58.7	56.1
November	41.5	34.7	56.1	58.1	48.8	46.4
December	31.9	26.5	45.7	47.6	38.9	37.1
Annual	47.4	42.4	62.4	66.0	54.8	54.2

1. Data from 1894 to 2006
2. Data from 1922 to 2006

In the State of New Jersey, the average annual precipitation ranges from about 40 inches along the southeast coast to 51 inches in north-central parts of the state. Coastal storms, often called “nor’easters”, frequently occur between October and April and can constitute a large proportion of the yearly precipitation amounts when they occur. These storms mainly impact coastal areas and may extend up to several hundred miles offshore, bringing strong winds and heavy rains. Typically at least one significant coastal storm occurs each winter, although as many as ten storms can be experienced in a season some years. Tropical storms and hurricanes, with their strong winds and storm surges can be extremely damaging to the natural and built environments (ONJSC 2006a).

Snowstorms in Cape May County produce an average of 14.2 inches of snowfall per year. The record snowfall to occur in one day at the Belleplain station was 14 inches on February 10, 1967 (up to 1990). The highest snow depth between 1961 and 1990 was 20 inches measured on February 19, 1979 (NOAA, NCDC accessed 2006). Table 3 below shows the average monthly precipitation and snowfall amounts recorded at the Belleplain State Forest and the Cape May 2 NW weather stations. The maximum monthly average snowfall at Belleplain station was for 4.1 inches. The largest monthly average recorded at the Cape May 2 NW station was 6.1 inches. An even larger difference between the amounts of precipitation observed at the two stations. The Belleplain State Forest station recorded 44.03 inches, while only 40.24 inches was received at the Cape May 2 NW station (ONJSC 2006a).

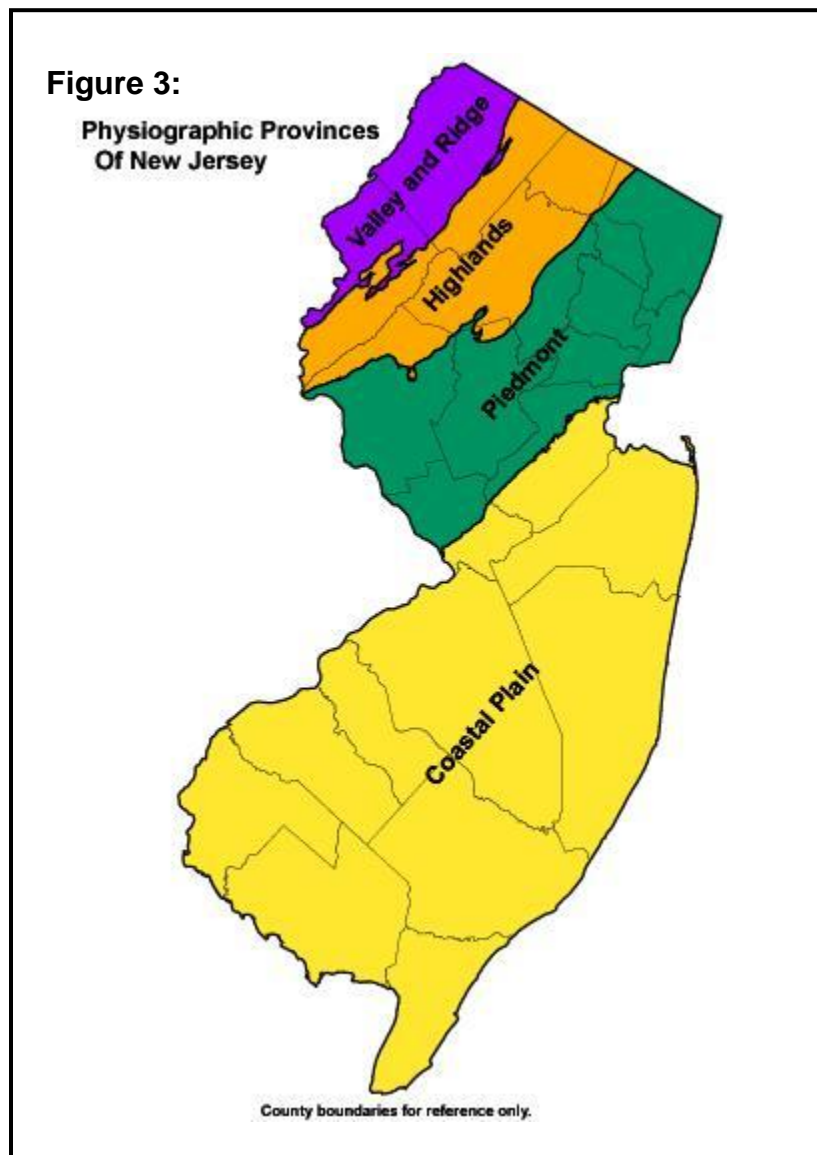
Table 3: Precipitation Measured at Cape May 2 NW¹ and Belleplain State Forest² (NOAA, NRCS)				
Month	Monthly Average Snowfall		Monthly Average Precipitation	
	BSF	CM 2 NW	BSF	CM 2 NW
January	3.5	3.8	3.38	3.25
February	4.1	6.1	3.04	2.83
March	2.0	1.7	4.13	3.76
April	0.1	0.1	3.59	3.25
May	0.0	0.0	3.43	3.29
June	0.0	0.0	3.20	3.10
July	0.0	0.0	4.19	3.54
August	0.0	0.0	4.96	4.05
September	0.0	0.0	3.62	3.14
October	0.0	0.0	3.50	3.10
November	0.4	0.3	3.45	3.19
December	2.0	1.8	3.54	3.27
Annual	unavailable	unavailable	44.03	40.24
1. Data from 1948 to 2006				
2. Data from 1922 to 2006				

The average temperature in New Jersey in June 2006 was 70.9 degrees Fahrenheit. This was 1.9 degrees F warmer than the 20th century average, the 18th warmest June in 112 years. New Jersey temperature has tended to rise 0.1 degrees Fahrenheit per decade over the period of record, which is 1895 to present. Annual precipitation rates have increased 0.03 inches per decade trend for the period of record (NOAA 2006).

As a coastal municipality, Dennis Township could experience significant impacts from global warming, if climate modelers are correct. There is a great deal of uncertainty as to whether global warming will actually cause increasing frequency or intensity of hurricanes and other storms; however the possibility cannot be entirely ruled out (Lively 1996). Notwithstanding, sea level rise is a certainty. Tide gauges in Cape May show an average sea level rise of 3.98 mm/year since 1965 (Cooper, Beevers & Openheimer 2005). As a result of sea level rise, the frequency of storm-associated floods will result, with the likelihood that events such as a 100-year storm and its attendant flooding could occur at intervals much less than 100 years (Gournich, Couch & Hartig 2002). Higher base water elevation means that storm surges associated with hurricanes and northeasters will be higher and extend further inland (Cooper, Beevers & Openheimer 2005).

2.2 PHYSIOGEOGRAPHIC PROVINCE AND GEOLOGY

areas that have similar rock types, geologic structures, landforms, and histories are organized into regions called Physiographic Provinces. New Jersey has four basic Physiographic Provinces, which make it a complex State for its small size. From northwest to southeast across the State, the provinces are (1) the Valley and Ridge, (2) Highlands, (3) Piedmont, (4) Coastal Plain (often divided into Inner and Outer Coastal Plain) (see Figure 3). Each name is descriptive of the rock belt that it identifies. Dennis Township is located within the Outer Coastal Plain Physiographic Province, which is the largest of the physiographic provinces in New Jersey (see the Geology Map). Its location within the Outer Coastal Plain provides the framework for a discussion of the geologic history of the Township (NJGS 2006). The Physiogeographic Provinces of New Jersey are shown on Figure 3.



The geology of the Coastal Plain is characterized by unconsolidated sand, gravel, silt, and clay thickening seaward from a featheredge at the Fall Line to more than 6,500 feet (ft) thick in southern Cape May County (Gill and Farlekas, 1976). As a geologic formation, the Coastal Plain exists not just in New Jersey, but along the entire Atlantic Coast from Maine to the Gulf of Mexico. Differences in the amount and type of erosion coupled with variability in underlying rock composition distinguish differences in sediments and shoreline types along its length. In general, the Atlantic Coastal Plain is flat and slopes gently seaward. John Tedrow (1986) describes the Coastal Plain in New Jersey as having moderate elevation with 80% – 90% lying below the 100 foot contour on a topographic map. Low ridges of sand parallel the coast offshore and are physically separated

from the coast by quiet water lagoons. Nearly 300 barrier islands exist between Massachusetts and Texas.

The Fall Line refers to the boundary between the Piedmont and Inner Coastal Plain. As a variety of forces, such as rain and snow, freeze and thaw, act on the mountains, small particles are worn away and carried in rain water, river flows and wind to be deposited eastward along the edge of the continental bedrock. Geologists are able to analyze the sediments. Many layers of sediment and particles form the Coastal Plain, which is a nearly horizontal surface which gently slopes to the edge of the Continental Shelf before steeply falling off under the Atlantic Ocean.

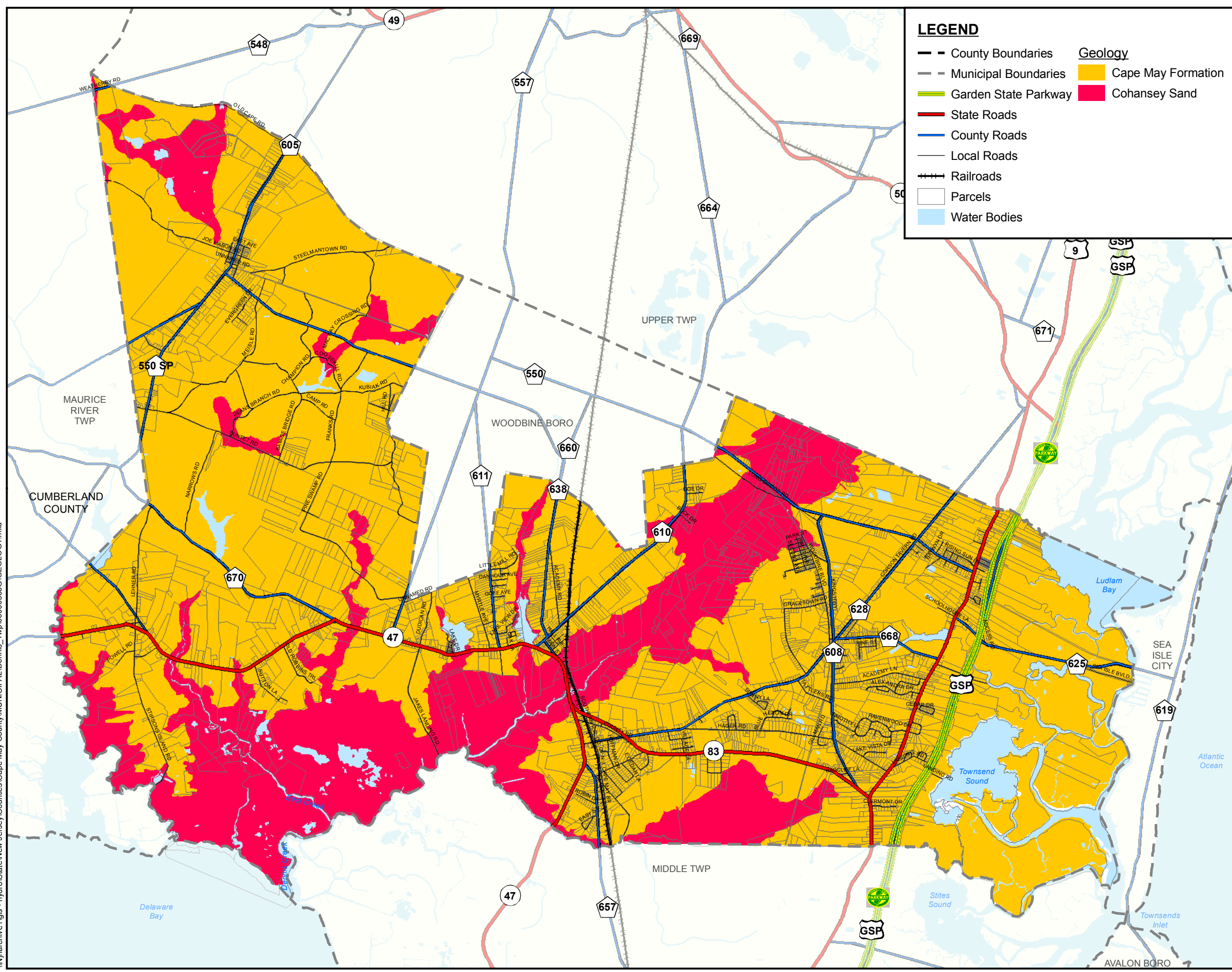
Over time, sea level fluctuates and acts upon the sediments. Wave action intensity increases with storms. During periods of higher ocean levels, which can completely cover the Coastal Plain sediments, marine deposits are added. The sediments are classified based on differences or similarities and the distinctions used to develop names for the layers. It would appear that the shoreline is a stable platform; however, geology is an on-going dynamic process. Change has occurred in the past, continues to take place at the present time and will continue into the future.

The geology of Dennis Township is depicted on the following page. The geological classification for the surface sediment layer, or veneer that crops out in Dennis Township, is called the Cape May Formation and is described by Tedrow as a "terraced" sediment layer, outcropping along the edge of the Cape May Peninsula. As a veneer, the Cape May Formation is a thin covering overlying the hydrologically productive Cohansey Formation. The Cape May deposits are visible inland on the edges of the many streams. The deposits were laid down during a time when the level of the ocean was 30 to 50 feet lower than today (Tedrow 1986).

Underlying the Cape May Formation and overlying the entire Cape May Peninsula is the Cohansey Formation which will be discussed in terms of its importance as a drinking water reservoir under Groundwater Resources. Refer to the Geology Map to view the extent of the formation within Dennis Township. The Cohansey Coastal Plain Sediments are described on the Bedrock Geologic Map of Central and Southern New Jersey as sediments that were laid down during the Miocene Era. The description includes sand, white to yellow, with local gravel and clay, locally stained red or orange-brown by iron oxides and/or cemented into large blocks of ironstone. Unweathered clay is typically dark gray, but weathers white in thin beds of ironstone. The unit is a mixture of marine and non-marine sediments. Sand, consisting of quartz and siliceous rock fragments, is found as medium-size grains and sorted from fine to coarse grains (Owens, et al 1998).

Crossbedding occurs, particularly in non-marine deposits. In some marine deposits, abundant burrows are present. The burrows have been identified as belonging to the fossil, *Ophiomorpha nodosa*. Studies of pollen found in the sediment provide information about plants which existed at the time the sediment was deposited (Owens, et al 1998). It should be noted that the Cohansey Unit, found on both the surface and subsurface in the Coastal Plain depending on location, is often associated with the older Kirkwood Formation (Owens, et al 1998).

\\njarchive\gis - hydro\State\New Jersey\Counties\Cape May County\Municipal\Dennis_Twp\06000533\GEOLOGY.mxd



LEGEND

--- County Boundaries	Geology
- - - Municipal Boundaries	Yellow Cape May Formation
--- Garden State Parkway	Pink Cohansey Sand
Red State Roads	
Blue County Roads	
Black Local Roads	
Black Railroads	
White Parcels	
Light Blue Water Bodies	

GEOLOGY

TOWNSHIP OF DENNIS

CAPE MAY COUNTY
NEW JERSEY



0 2,500 5,000 7,500 10,000 Feet
1 inch equals 6,000 feet

DIGITAL SPATIAL DATA SOURCES:
- CAPE MAY COUNTY GEOGRAPHIC INFORMATION SYSTEM
- NEW JERSEY DEPARTMENT OF COMMUNITY AFFAIRS, OFFICE OF SMART GROWTH
- NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF GEOGRAPHIC INFORMATION
- UNITED STATES DEPARTMENT OF AGRICULTURE, NATURAL RESOURCES CONSERVATION SERVICES
- NEW JERSEY OFFICE OF INFORMATION TECHNOLOGY, OFFICE OF GIS

2.3 TOPOGRAPHY AND SLOPES

Dennis Township exhibits very little topographic relief. According to United States Geological Survey (USGS) Topographic mapping, elevations range from sea level (0 feet) at the Delaware Bay and along the eastern coast to about 50 feet above sea level in the northwestern portion of the Township, near Belleplain. Slopes are minimal. Steep slopes occur infrequently, but can be encountered at the upland/wetland interface or where they are manmade, such as along roadway embankments.

2.4 SOILS

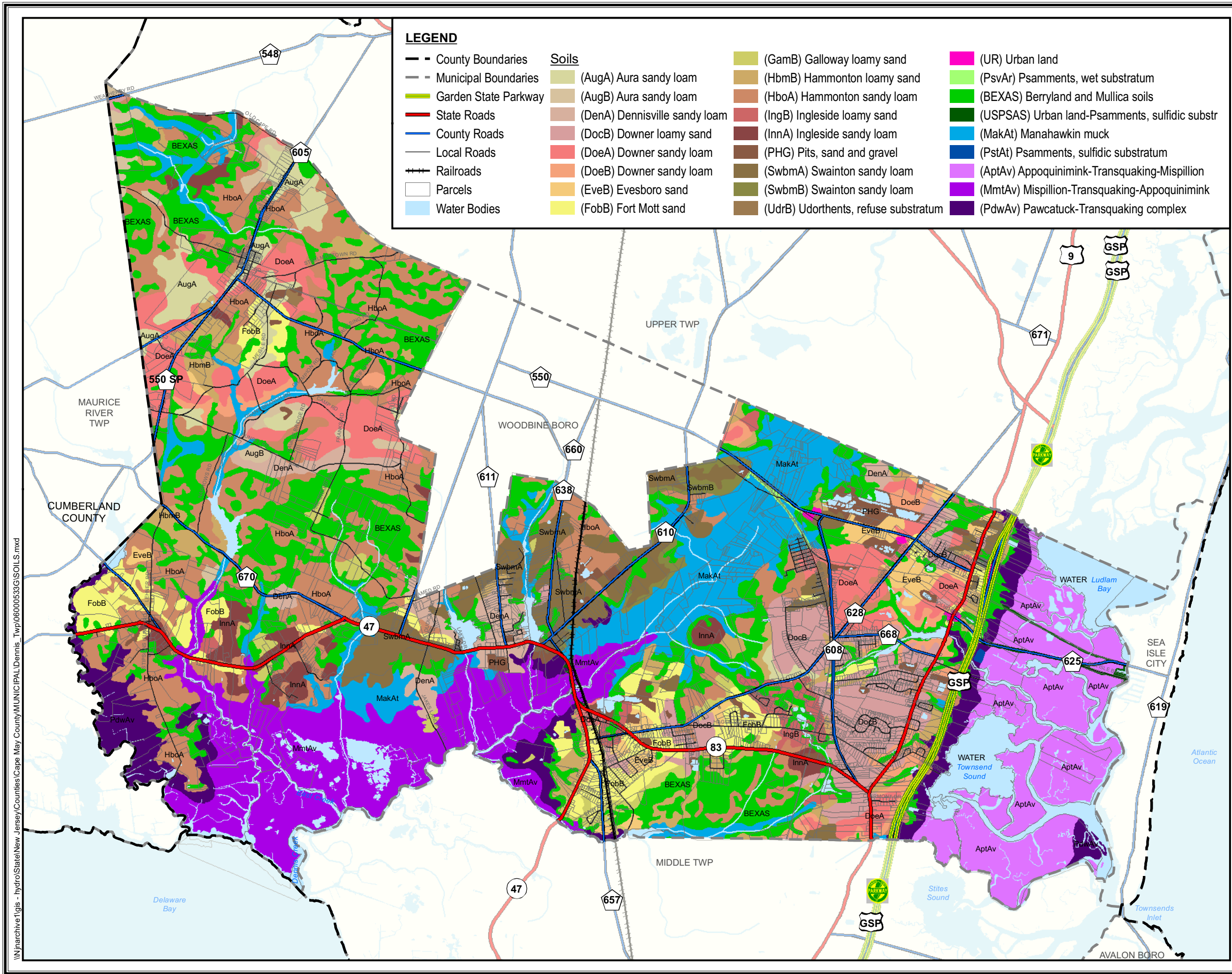
New Jersey is a small state, but varied in its geologic history, which allows it to display a variety of processes which have affected land masses since the beginning of time. These processes have created different landforms and topography. The eastern coast of the United States has undergone mountain building with volcanic eruptions followed by weathering from storms and glaciers. The soils of Dennis Township were formed in the sediments laid down in glacial outwash plains and marine sediments laid down when the ocean covered the current land area. Unlike soils in the northern part of the State which can be identified with a particular location, the Coastal Plain soils are influenced by greater variability during geologic formation and subsequent modification.

There are five factors in soil formation: (1) the composition of the parent material; (2) climate, particularly temperature and precipitation; (3) the effects of biota, or living organisms; (4) topography, including slope and elevation; and (5) time (Miller and Gardiner 1998). Throughout Cape May County, the climate and parent material are essentially uniform. It is the other three factors topography, biota, and time that lead to the 26 soils identified in Cape May County today.

The Soil Conservation Act of 1935 led to the establishment of the Soil Conservation Service. Through the Soil Conservation Service, the United States Department of Agriculture (USDA) has taken the lead in describing the characteristics of soils in New Jersey. Because of the complexity, soils are described as groups with similar characteristics, often based on location (NRCS 2006). The soils types found in Dennis Township are mapped on the Soils Map and described in Table 4 below.

Table 4: Soil Types of Dennis Township	
Appoquinimink-Transquaking-Mispillion complex (AptAv)	This soil is very frequently flooded. It is very poorly drained and annual ponding is frequent. The seasonal water table is at the surface. The parent material consists of loamy stream sediments over herbaceous material. This soil type is considered hydric.
Aura sandy loam (AugA and AugB)	The soils in this mapping unit are well-drained and are found on low hills. Annual flooding and annual ponding do not occur.
Berryland and Mullica soils (BEXAS)	The Berryland soil component is comprised of deep, very poorly drained soils in upland areas. The Mullica soil component is comprised of very deep, very poorly drained soils on flats and in depressions. Both were formed in coastal plain sediments. Annual flooding and ponding are occasional. Parent material consists of sandy stream deposits. This soil is considered hydric, and the seasonal high water table can reach the surface.
Dennisville sandy loam (DenA)	This well-drained soil is found on flats. Annual flooding and annual ponding do not occur. The seasonal high water table is at a depth of 4 feet below the surface. The parent material of the Dennisville sandy loam is sandy and/or loamy marine deposits.
Downer loamy sand (DocB)	This soil is well-drained. Annual flooding and ponding do not occur. The seasonal high water table is at a depth greater than 6 feet below the surface. The parent material consists of loamy and gravelly stream deposits.
Downer sandy loam (DoeA and DoeB)	The soils in this series are well-drained and are found on knolls and low hills. These soils were formed on loamy fluviomarine deposits and/or gravelly fluviomarine deposits. Annual flooding and annual ponding do not occur.
Evesboro sand (EveB)	The soils in this series are excessively drained, and are found on low hills in the landscape. Evesboro sands are not subject to annual flooding or annual ponding. These soils were formed in sandy wind or fluviomarine deposits.

Table 4: Soil Types of Dennis Township (continued)	
Evesboro sand (EveB)	The soils in this series are excessively drained, and are found on low hills in the landscape. Evesboro sands are not subject to annual flooding or annual ponding. These soils were formed in sandy wind or fluvio marine deposits.
Fort Mott sand (FobB)	This soil is a well-drained soil found on knolls. Annual flooding and ponding do not occur. The seasonal high water table is at a depth of 6 feet. The parent materials of Fort Mott sand are sandy wind deposits or fluvio marine deposits.
Galloway loamy sand (GamB)	Galloway series soils are deep, moderately well-drained soils found in upland areas. The seasonal high water table may reach 21 inches below the surface. There is neither annual flooding nor annual ponding.
Hammonton loamy sand (HbmB)	This soil is a very deep, moderately well-drained soil found in uplands. The Hammonton series soils formed in acidic, moderately coarse-textured coastal plain sediments. The minimum depth to the seasonal high water table is 18 inches. Annual flooding and annual ponding do not occur. This soil has low potential productivity for cultivated crops.
Hammonton sandy loam (HboA)	This soil is a very deep, moderately well-drained soil found in uplands. The Hammonton series soils formed in acidic, moderately coarse-textured coastal plain sediments. There is neither annual flooding nor annual ponding. The minimum depth to the seasonal high water table is 18 inches.
Ingleside loamy sand (IngB)	The soils in the Ingleside series are very deep, well-drained soils found on uplands and in slight depressions. These soils were formed in alluvial or marine sediments of the coastal plain. Annual flooding and ponding do not occur. This soil has medium potential productivity for cultivated crops.
Ingleside sandy loam (InnA)	The soils in the Ingleside series are very deep, well-drained soils found on uplands and in slight depressions. These soils were formed in alluvial or marine sediments of the coastal plain. Annual flooding and ponding do not occur. The seasonal high water table occurs at a depth of 42 inches. This soil has medium potential productivity for cultivated crops.
Manahawkin muck (MakAt)	This soil is a very deep, very poorly drained soil found in low-lying areas such as back swamps, lake basins and along freshwater channels where they meet tidal waters. Annual flooding and ponding are frequent. The seasonal high water table reaches the surface. This is a hydric soil.
Mispillion-Transquaking-Appoquinimink (MmtAv)	This soil complex consists of very deep, very poorly drained soils located on salt water tidal marshes, estuaries and tidally influenced rivers and creeks. Annual flooding is very frequent, and annual ponding is frequent. The seasonal high water table reaches the surface. This is a hydric soil complex.
Pawcatuck-Transquaking complex (PdwAv)	This soil series consists of very deep, very poorly drained soils found on tidal flats, brackish estuarine marshes and along tidally influenced rivers and creeks. Annual flooding is very frequent and ponding is frequent. The seasonal high water table is at the surface. This soil is not suitable for cultivated crops and is considered a hydric soil.
Pits, sand and gravel (PHG)	This soil mapping unit consists of gravel pits, which are anthropogenic features. The result is sandy material disturbed by human activity. These soils are well-drained and annual flooding and annual ponding do not occur.
Psamments, sulfidic substratum (PstAt)	These Psamments soils are excessively drained to well-drained sandy fill land that has been smoothed. Annual flooding and annual ponding are frequent. The seasonal high water table is at the surface. This soil is not suitable for cultivated crops.
Psamments, wet substratum (PsvAr)	These Psamments soils are moderately well-drained soils found on flats and in filled areas. Annual flooding is rare and annual ponding does not occur. The seasonal high water table is at a depth of 30 inches. The soil is not suitable for cultivated crops.
Swainton sandy loam (SwbmA and SwbmB)	The soils in this series are well-drained soils found on interfluvies, low hills and ridges. Swainton sandy loam is formed in loamy fluvio marine deposits over gravelly fluvio marine deposits. The seasonal high water table is at a depth of 6 feet. Annual flooding and annual ponding do not occur. This soil has low potential productivity for cultivated crops.
Udorthents, refuse substratum (UdrB)	The soils in this mapping unit are well-drained. This unit consists of fill material that has formed low hills. The parent material is comprised of loamy deposits spread over organic material. Annual flooding and ponding do not occur. This soil is not suitable for cultivated crops.
Urban land (UR)	The Urban Land soil type is used to describe areas where much of the surface has been covered by buildings, pavement or other forms of impervious cover.
Urban land-Psamments, sulfidic substratum complex (USPSAS)	The Urban Land soil type is used to describe areas where much of the surface has been covered by buildings, pavement or other forms of impervious cover. The Psamments series component is excessively drained to well-drained sandy fill land that has been smoothed. This Psamments soil component is excessively drained. Annual flooding is occasional, but annual ponding does not occur. The seasonal high water table of the Psamments series component is at the surface.



LEGEND
- - County Boundaries
- - Municipal Boundaries
- Garden State Parkway
- State Roads
- County Roads
- Local Roads
- Railroads
- Parcels
- Water Bodies

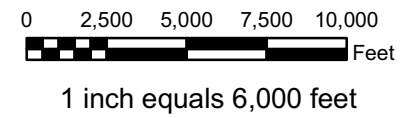
Soils
(AugA) Aura sandy loam
(AugB) Aura sandy loam
(DenA) Dennisville sandy loam
(DocB) Downer loamy sand
(DoeA) Downer sandy loam
(DoeB) Downer sandy loam
(EveB) Evesboro sand
(FobB) Fort Mott sand
(GamB) Galloway loamy sand
(HbmB) Hammonton loamy sand
(HboA) Hammonton sandy loam
(IngB) Ingleside loamy sand
(InnA) Ingleside sandy loam
(PHG) Pits, sand and gravel
(SwbmA) Swainton sandy loam
(SwbmB) Swainton sandy loam
(UdrB) Udorthents, refuse substratum

(UR) Urban land
(PsvAr) Psammets, wet substratum
(BEXAS) Berryland and Mullica soils
(USPSAS) Urban land-Psammets, sulfidic substratum
(MakAt) Manahawkin muck
(PstAt) Psammets, sulfidic substratum
(AptAv) Appoquinimink-Transquaking-Mispiration
(MmtAv) Mispiration-Transquaking-Appoquinimink
(PdAv) Pawcatuck-Transquaking complex

SOILS

TOWNSHIP OF DENNIS

CAPE MAY COUNTY
NEW JERSEY



DIGITAL SPATIAL DATA SOURCES:
- CAPE MAY COUNTY GEOGRAPHIC INFORMATION SYSTEM
- NEW JERSEY DEPARTMENT OF COMMUNITY AFFAIRS, OFFICE OF SMART GROWTH
- NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF GEOGRAPHIC INFORMATION
- UNITED STATES DEPARTMENT OF AGRICULTURE, NATURAL RESOURCES CONSERVATION SERVICES
- NEW JERSEY OFFICE OF INFORMATION TECHNOLOGY, OFFICE OF GIS

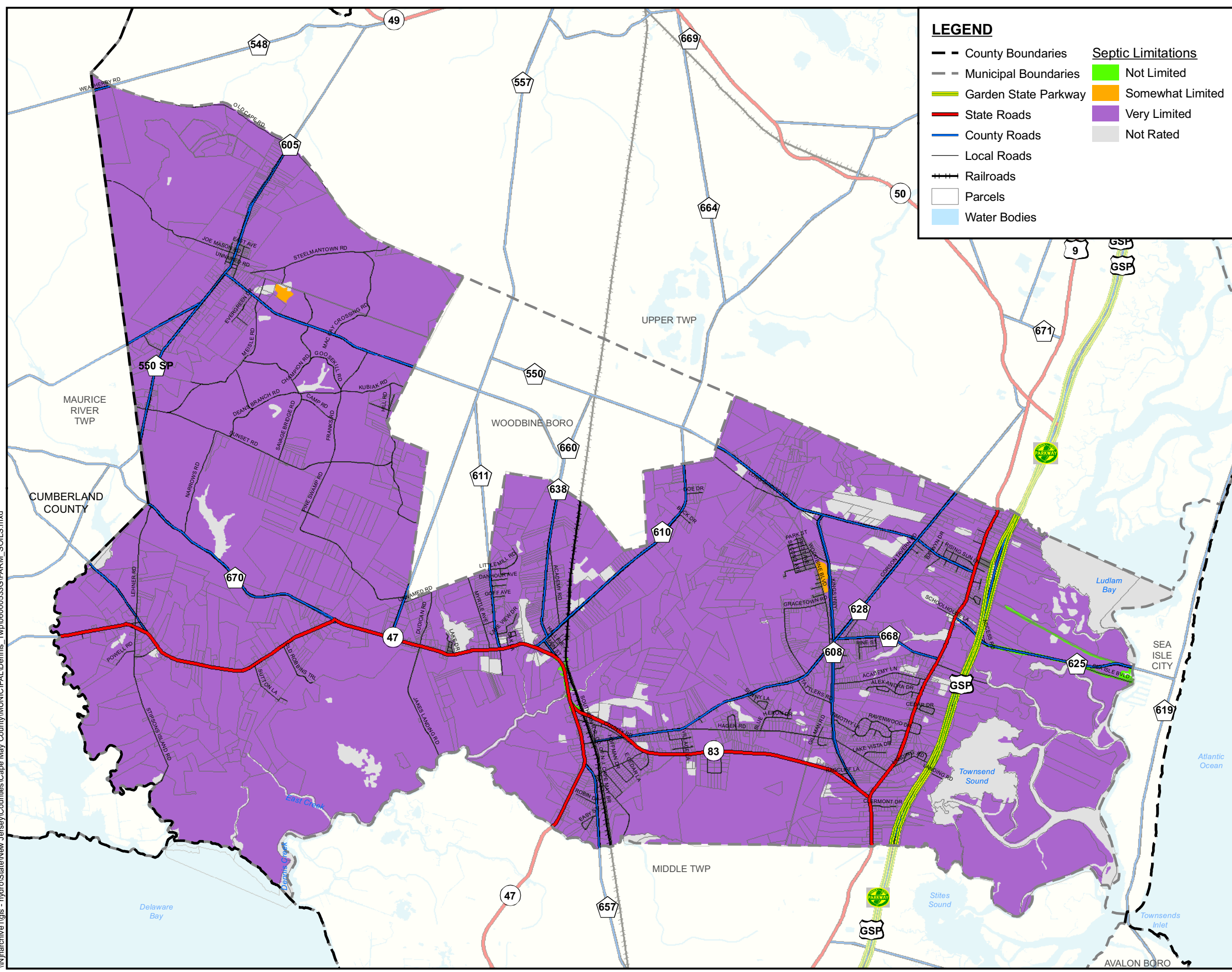
\\njarchive\lgis - hydro\State\New Jersey\Counties\Cape May County\MUNICIPAL\Dennis_Twp\06000533\GIS\SOILS.mxd

2.4.1 SOILS LIMITATIONS

Many of the soil types found in Dennis Township are very limited for certain types of development. This does not necessarily mean that the soils are undevelopable, but that development costs are likely to be unusually high. Maps included below depict Soil Limitations for Septic Systems and Soil Limitations for Dwellings with Basements. Soil parameters considered in the establishment of these ratings include slope, natural soil drainage, permeability rate and hazard of flooding. Table 5 below shows the limitations of Dennis Township soils for certain types of development.

Table 5: Development Limitations of Dennis Township Soils				
Mapping Unit	Depth to Seasonal High Water Table (feet)	Septic Limitations	Erosion Potential (Kw)	Limitations for Dwelling with Basements
Appoquinimink-Transquaking-Mispillion complex (AptAv)	0	Very limited	0.37	Very limited
Aura sandy loam (AugA and AugB)	>5	Very limited	0.24	Very limited
Berryland and Mullica soils (BEXAS)	0	Very limited	0.10	Very limited
Dennisville sandy loam (DenA)	4	Very limited	0.32	Very limited
Downer loamy sand (DocB)	>6	Very limited	0.20	Very limited
Downer sandy loam (DoeA and DoeB)	>5	Very limited	0.28	Very limited
Evesboro sand (EveB)	>5	Very limited	0.10	Very limited
Evesboro sand (EveB)	6	Very limited	0.05	Very limited
Fort Mott sand (FobB)	1.75	Very limited	0.17	Very limited
Galloway loamy sand (GamB)	1.5	Very limited	0.20	Very limited
Hammonton loamy sand (HbmB)	1.5	Very limited	0.32	Very limited
Hammonton sandy loam (HboA)	3.5	Very limited	0.20	Very limited
Ingleside loamy sand (IngB)	3.5	Very limited	0.20	Very limited
Ingleside sandy loam (InnA)	0	Very limited	0.05	Very limited
Manahawkin muck (MakAt)	0	Very limited	0.02	Very limited
Mispillion-Transquaking-Appoquinimink (MmtAv)	0	Very limited	0.02	Very limited
Pawcatuck-Transquaking complex (PdwAv)	0	Very limited	Null	Not rated
Pits, sand and gravel (PHG)	---	Not rated	0.20	Very limited
Psamments, sulfidic substratum (PstAt)	0	Very limited	0.20	Very limited
Psamments, wet substratum (PsvAr)	2.5	Very limited	0.32	Very limited
Swainton sandy loam (SwbmA and SwbmB)	6	Very limited	0.37	Not limited
Udorthents, refuse substratum (UdrB)	---	Somewhat limited	Null	Not rated
Urban land (UR)	---	Not rated	Null	Not limited
Urban land-Psamments, sulfidic substratum complex (USPSAS)	0	Not limited	0.37	Very limited

\\njarchive\lgis - hydro\State\New Jersey\Counties\Cape May County\MUNICIPAL\Dennis_Twp\06000533\G\FARM_SOILS.mxd



LEGEND

County Boundaries	Septic Limitations
Municipal Boundaries	Not Limited
Garden State Parkway	Somewhat Limited
State Roads	Very Limited
County Roads	Not Rated
Local Roads	
Railroads	
Parcels	
Water Bodies	

SOIL LIMITATIONS FOR SEPTIC SYSTEMS

TOWNSHIP OF DENNIS

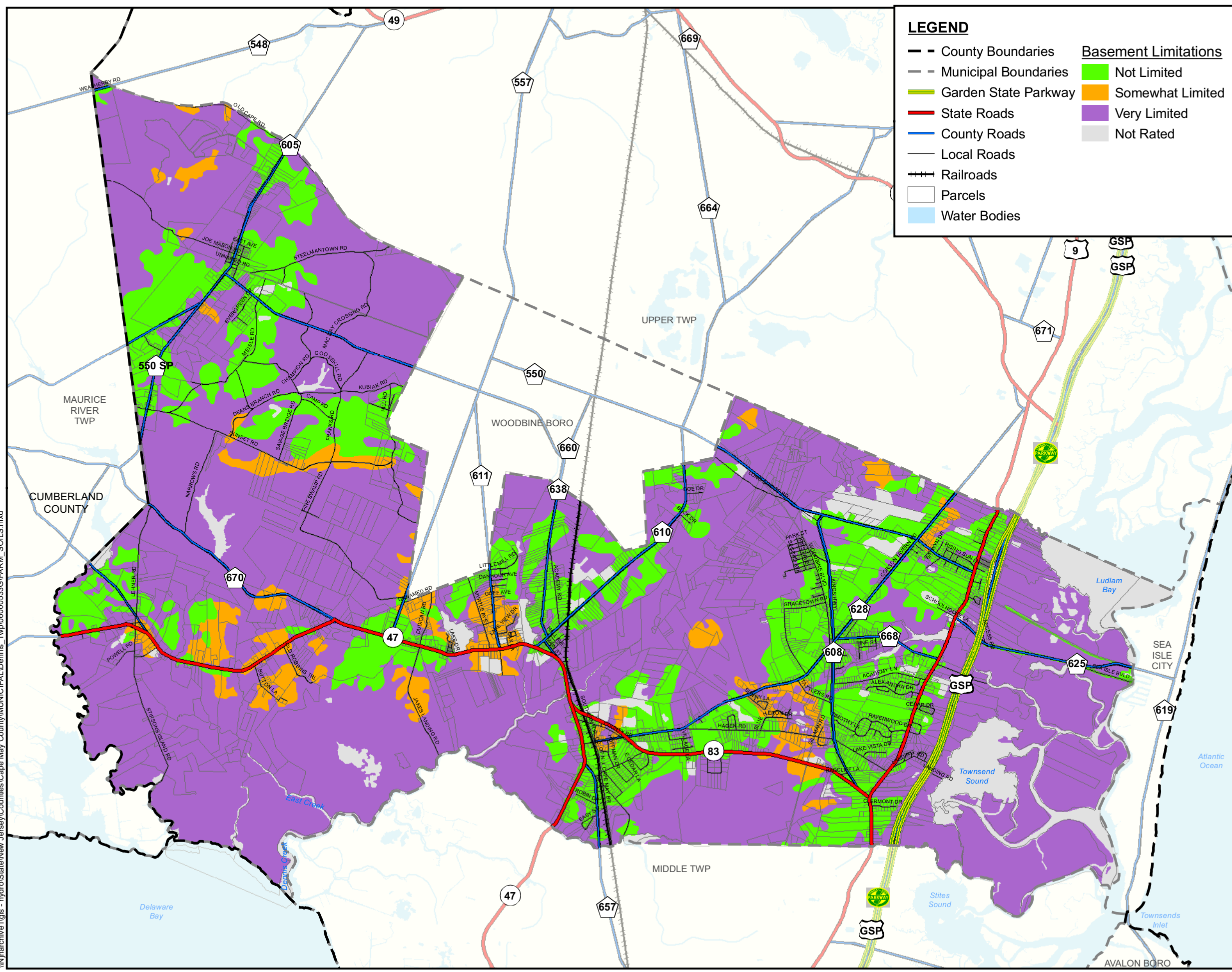
CAPE MAY COUNTY
NEW JERSEY



0 2,500 5,000 7,500 10,000 Feet
1 inch equals 6,000 feet

DIGITAL SPATIAL DATA SOURCES:
- CAPE MAY COUNTY GEOGRAPHIC INFORMATION SYSTEM
- NEW JERSEY DEPARTMENT OF COMMUNITY AFFAIRS, OFFICE OF SMART GROWTH
- NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF GEOGRAPHIC INFORMATION
- UNITED STATES DEPARTMENT OF AGRICULTURE, NATURAL RESOURCES CONSERVATION SERVICES
- NEW JERSEY OFFICE OF INFORMATION TECHNOLOGY, OFFICE OF GIS

\\njarchive\lgis - hydro\State\New Jersey\Counties\Cape May County\MUNICIPAL\Dennis_Twp\06000533\G\FARM_SOILS.mxd



LEGEND

--- County Boundaries	Basement Limitations
- - - Municipal Boundaries	Not Limited
— Garden State Parkway	Somewhat Limited
— State Roads	Very Limited
— County Roads	Not Rated
— Local Roads	
+++ Railroads	
□ Parcels	
□ Water Bodies	

SOIL LIMITATIONS FOR DWELLINGS WITH BASEMENTS

TOWNSHIP OF DENNIS

CAPE MAY COUNTY
NEW JERSEY



0 2,500 5,000 7,500 10,000 Feet
1 inch equals 6,000 feet

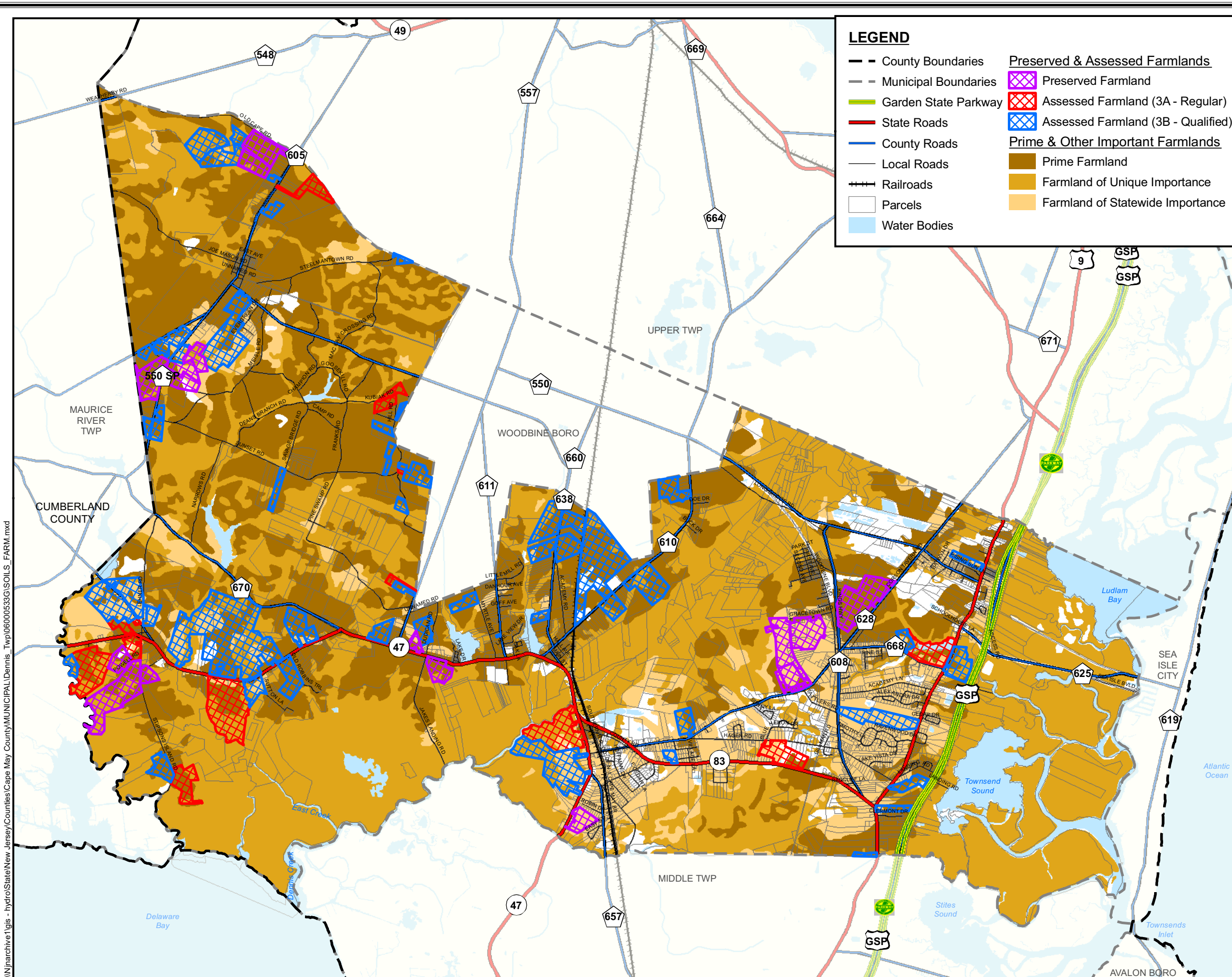
DIGITAL SPATIAL DATA SOURCES:
- CAPE MAY COUNTY GEOGRAPHIC INFORMATION SYSTEM
- NEW JERSEY DEPARTMENT OF COMMUNITY AFFAIRS, OFFICE OF SMART GROWTH
- NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF GEOGRAPHIC INFORMATION
- UNITED STATES DEPARTMENT OF AGRICULTURE, NATURAL RESOURCES CONSERVATION SERVICES
- NEW JERSEY OFFICE OF INFORMATION TECHNOLOGY, OFFICE OF GIS

2.4.2 Farmland Soils

While not even 5 percent of the land in Dennis Township is under active cultivation, soils suitable for agriculture are found in many portions of the Township. Prime Farmland Soils, Soils of Statewide Importance and Farmland of Unique Importance have been mapped for Dennis Township. These soils are shown on the Farmland Soils Map. The NRCS classification of Prime Farmland Soils include soils contained in the Land Capability Class I and selected soils from Land Capability Class II, as listed in the County Soil Survey. These soils exhibit the optimum quality, growing season and available moisture to support continued economically viable yields of crops. These soils do not exhibit negative characteristics, such as susceptibility to erosion, saturation or flooding (NRCS 1990a).

Soils of Statewide Importance are soils contained in Land Capability Class II and III. These soils are only slightly less favorable for agriculture than Prime Farmland Soils and may produce similarly high yields. Farmland Soils of Unique Importance consist of soils that can be used for the production of high value food, fiber or horticultural crops. Privately owned lands (as of 2006) that are assessed farmlands according to the Township tax records are also shown on the Farmland Soils Map. A majority of farmland soils are publicly owned lands or wetlands.

\\njarchive\gis - hydro\State\New Jersey\Counties\Cape May County\Municipal\Dennis_Twp\06000533\GIS\SOILS_FARM.mxd



FARMLAND SOILS

TOWNSHIP OF DENNIS

CAPE MAY COUNTY
NEW JERSEY



0 2,500 5,000 7,500 10,000
Feet

1 inch equals 6,000 feet

DIGITAL SPATIAL DATA SOURCES:
- CAPE MAY COUNTY GEOGRAPHIC INFORMATION SYSTEM
- NEW JERSEY DEPARTMENT OF COMMUNITY AFFAIRS, OFFICE OF SMART GROWTH
- NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF GEOGRAPHIC INFORMATION
- UNITED STATES DEPARTMENT OF AGRICULTURE, NATURAL RESOURCES CONSERVATION SERVICES
- NEW JERSEY OFFICE OF INFORMATION TECHNOLOGY, OFFICE OF GIS



MAY 2007

2.5 CONTAMINATED SITES

Contaminated properties identified in NJDEP databases, were used to compile the list of contaminated sites. Often soils are contaminated at these sites, by leaking underground chemicals, fuel storage tanks or by surface spills. Information gathered from the databases indicates that the contaminant source is often unknown and the potential for groundwater contamination is present. The NJDEP websites called "Data Miner" and "Public Records, (OPRA)" which can be accessed from the homepage (<http://www.state.nj.us/dep/index.html>) can provide more information concerning the status of each incident. The following Contaminated Sites Map shows the site by name. Two categories of contaminated sites are shown. Class A sites have on-site sources of contamination. Class C sites are closed cases, but with deed restrictions that may limit activities and uses on the site.

Table 6: Known Contaminated Sites List (NJDEP, Division of Site Remediation and Waste Management 2006)			
NJDEP Site ID	Site Name	Site Address	Class
9694	Belleplain State Forest	County Route 550	A
9695	Pineland Village	2210 Route 47	A
44926	J P Collins Co	Main St & Corson Tavern Rd	A
95074	Petersburg Road Ground Water Contamination	Petersburg Road	A
57775	Café 47	1414 Route 47	A
9569	Mobil #57705	MP 182	A
13057	Cedar Lane Gulf Enterprises	1922 Route 9	A
44935	Windy Acres	Main Street	C
9705	Oceanview Gulf	2276 Route 9	A
49882	Oceanview Exxon	Route 9 & Old School Rd	A
52945	Sandra T Struble	590 Main Street	A

In areas where NJDEP groundwater standards are not met, a Classification Exception Area (CEA) is established. The CEA ensures the use of the aquifer in that area is restricted until standards are achieved. NJDEP maintains a list of Currently Known Extent (CKE) (NJDEP Site Remediation Program 2007). The following CEA sites are found in Dennis Township:

Table 7: Classification Exception Areas/Well Restriction Areas, 2006				
Site ID	Location	Block/Lot	Date	Acres
Minmar Marine Basin	14 Olde Sea Isle Boulevard	275/4	July 11, 1997	3.3818
Windy Acres Nursery	407 Main Street	251/112.01 & 112.02	January 10, 2000	4.77229
Exxon Service Station	Route 9 & Old School Rd.	245/55	August 25, 2001	0.09881

These CEAs are mapped on the Known Contaminated Sites Map.

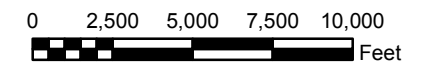
LEGEND

- County Boundaries
- Municipal Boundaries
- Garden State Parkway
- State Roads
- County Roads
- Local Roads
- Railroads
- Parcels
- Water Bodies
- Well Restriction Areas (CEA)
- Known Contaminated Sites**
 - Class A: Sites with On-Site Sources of Contamination
 - Class C: Closed Sites with Restrictions

**KNOWN
CONTAMINATED
SITES**

**TOWNSHIP
OF
DENNIS**

CAPE MAY COUNTY
NEW JERSEY



1 inch equals 6,000 feet

DIGITAL SPATIAL DATA SOURCES:
- CAPE MAY COUNTY GEOGRAPHIC INFORMATION SYSTEM
- NEW JERSEY DEPARTMENT OF COMMUNITY AFFAIRS, OFFICE OF SMART GROWTH
- NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF GEOGRAPHIC INFORMATION
- UNITED STATES DEPARTMENT OF AGRICULTURE, NATURAL RESOURCES CONSERVATION SERVICES
- NEW JERSEY OFFICE OF INFORMATION TECHNOLOGY, OFFICE OF GIS



NOVEMBER 2007

\\njarchive\gis - hydro\State\New Jersey\Counties\Cape May County\MUNICIPAL\Denmis_Twp\06000533\G\CONTAM.mxd

3.0 WATER RESOURCES AND CONDITIONS

Whether found underground or flowing on the earth's surface, water is a critical resource for life. For human society, water is necessary for drinking, agriculture and industry. Humankind's attraction to water for its aesthetic and recreational qualities is important intrinsically. Economically, surface water resources form a basis for tourism and fisheries income. Water resources, such as wetlands, streams and bays provide habitat for wildlife. The groundwater and surface water resources of Dennis Township are described below.

3.1 GROUNDWATER RESOURCES

Groundwater is found below the ground surface in the spaces between soil and sediment particles in unconsolidated sediment and in the cracks and pore space within bedrock. Groundwater discharge contributes the baseflow of streams. Overpumping of surficial aquifers for human uses or severe drought can diminish the amount of water available for discharge to a stream, jeopardizing its flow, in some cases. Groundwater also has been subject to degradation by underground septic disposal, over-application of fertilizers and pesticides and leaking underground fuel and other chemical storage tanks. This experience has shown that it is technically and economically much easier to take steps to avoid contamination than it is to restore the resource to the original state.

3.1.1 Aquifers

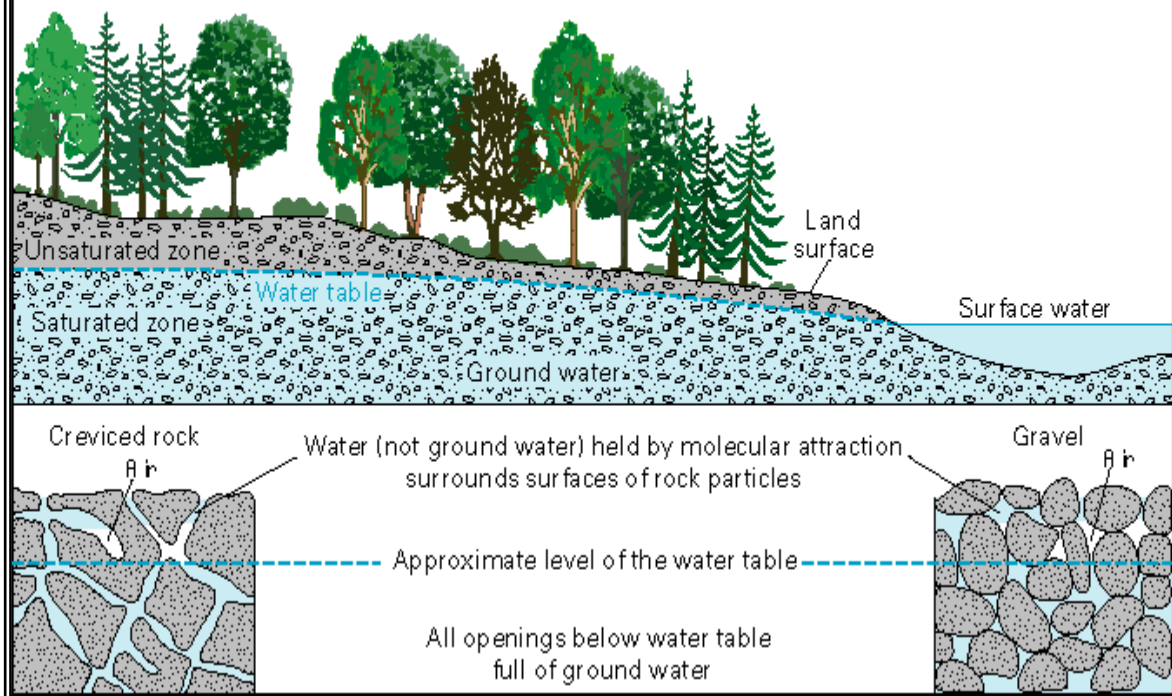
An aquifer is defined by the USGS as "A formation, group of formations, or part of a formation that contains sufficient saturated, permeable material to yield significant quantities of water to wells and springs" (USGS, <http://capp.water.usgs.gov/aquiferBasics/>). Ground water is one of our most important resources. The underground rock, described in the Geology section and accompanying soils which are described more fully in the Soil section, provide a framework for storing ground water. Between rock and within the soil are spaces or openings that store water and allow fresh water, or precipitation, to replenish or recharge the supply.

Rainfall is able to flow through the pores or empty spaces between the rock and soil to add or replenish (recharge) the existing ground water supply. When the process of recharge occurs quickly, we say the rock or soil is permeable. Water, in useful amounts, which naturally collects within soil or rock under ground and that can be removed easily by pumping (as in a well) is called an aquifer. If ground water seeps out into the surface, it is called a spring.

Figure 4 shows how the ground below the water table (the blue area) is saturated with water. The "unsaturated zone" above the water table (the greenish area) still contains water (plant roots live in this area), but is not totally saturated with water.

Sometimes there is another layer, which is not as permeable and does not allow rain to easily flow into stored groundwater. This is an example of a confining layer and its presence defines a "confined aquifer". Freshwater aquifers along the coast of the Atlantic Ocean, such as those located in Cape May County, are bordered by saline groundwater.

Figure 4: Groundwater Detail (USGS 1999)



Withdrawals from these aquifers can cause the movement of the surrounding saltwater. Saltwater intrusion has been documented throughout the east coast of the United States. Withdrawal can change the patterns of groundwater flow and discharge to coastal ecosystems, which can alter the salinity of coastal waterways and wetlands. During 1960-90, saltwater intrusion forced the abandonment of at least 10 public-supply wells, 3 industrial-supply wells, and more than 100 domestic-supply wells in Cape May County, N.J. (Lacombe and Carleton 2002). New Jersey's first desalination plant was built in Cape May New Jersey. The NJDEP and USGS are currently evaluating the rates of saltwater intrusion and depletion of Cape May County aquifers to determine if current rates of water use are sustainable for future potable and ecological water supplies needs (Lacombe, et al 2006).

In Cape May County, five ground water reservoirs or freshwater aquifers have been mapped and studied by County, State and Federal agencies such as USGS. These aquifers are named as follows:

- **Holly Beach water bearing zone** is a shallow water bearing zone that is in direct contact with seawater
- **Estuarine Sand Aquifer** (about 50' thick)
- **Cohansey Aquifer** (varies from 60' – 180' thick)
- **Rio Grande water bearing zone** (50' – 100' thick)
- **Atlantic City Sand** (800' thick)

The sediments underlying Cape May County consist mostly of unconsolidated gravel, sand, silt, clay and shell fragments. In most cases, these materials are permeable and readily allow rainfall to recharge ground water supplies, in most cases. These sediments are also capable of storing large amounts of water.

According to the map named "Aquifers of New Jersey" (Herman, et. al., 1998) and the NJDEP iMap, the Kirkwood-Cohansey aquifer system underlies a majority of the municipality, with exception of the areas associated with the Cape May wetlands. These areas are underlain by the Holly Beach water bearing zone.

The Kirkwood-Cohansey aquifer system is an unconfined or water-table aquifer composed of sand and gravel with lenses of silt and clay. No confining layers separate this aquifer from the ground surface. The Cohansey aquifer is confined in Cape May County and is underlain by confined Kirkwood aquifers. Leakage to confined parts of the aquifer provides water, which is fresh, acidic and highly corrosive, as well as low in dissolved solids. Less corrosive waters are common in confined aquifers and the salinity of the water within the Cohansey and Kirkwood aquifers may be elevated due to the close proximity of coastal areas. Iron and manganese levels are locally elevated and sodium chloride type water is common (Herman, et al 1998).

The Holly Beach water zone is composed of sand, gravel and silt. Clay is present where there are areas thicker than 50 feet. The water-table aquifer includes beach, dune, deltaic and marine sands, as well as recent alluvium. The Estuarine Clay confining unit and the Estuarine Sand aquifer underlie the Holly Beach water bearing zone. The water found within this aquifer is fresh, acidic and corrosive and it contains low dissolved solids. The corrosive nature of the water decreases in confined parts near the coastal areas of the aquifer. Sodium chloride water is common, due to the proximity of the aquifer to the coastal waters (Herman, 1998). The Holly Beach water bearing zone which is at or near sea level, is in direct connection with seawater and therefore has limited use for freshwater supply. However, Holly Beach supplies non-potable uses.

One of the principal water resource issues within Cape May County is drinking water supply. The resource is largely dependent upon groundwater that is in turn highly vulnerable to saltwater intrusion from the west, south and east, especially in the southern portion of the peninsula. According to the 1994 Township of Dennis Master Plan, Dennis Township residents have no public water or sewerage service and no plans for such services in the foreseeable future; therefore, water is only available to residences via private on-site individual wells or non-community water systems (Dennis Township Planning Board 1994).

The USGS in cooperation with NJDEP have studied water supply issues and released the report entitled *Hydrogeologic Framework, Availability of Water Supplies, and Saltwater Intrusion, Cape May County, New Jersey, Water-Resources Investigations Report 01-4246* in 2002, which was consulted for this Inventory. The report provides guidelines for future withdrawal volumes and recommended well locations in order to safeguard potable water supplies in the future. Alternative strategies for safeguarding freshwater include conservation and groundwater recharge using recycled supplies.

3.1.2 Aquifer Recharge

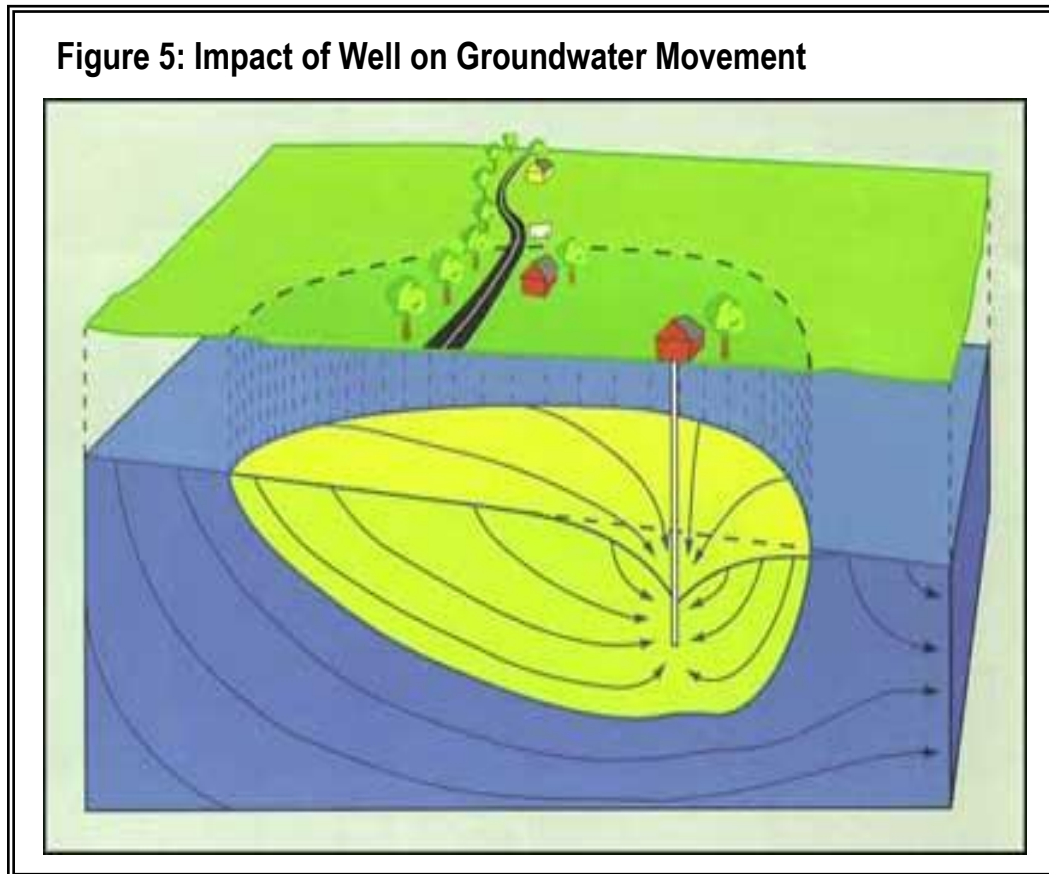
The NJ Geological Survey ("NJGS") has developed a method to estimate ground water recharge for Cape May County. Land-use, soil and climate data were combined to generate ground water recharge rates shown on the Water Resources Map. New Jersey receives an average of 44 inches of precipitation annually, of which approximately 15 to 39 inches recharge the groundwater reservoir by seeping into the ground.

According to Aquifers of New Jersey (Herman, et. al., 1998), the aquifer rank associated with the Kirkwood-Cohansey aquifer system is B-A, which yields a median of 250 to 500 (B) or 500+ gallons (A) per minute. According to this resource, multiple rankings indicate that more than one area was analyzed with varying results, most likely due to the existing lithologic and structural influences. Holly Beach water bearing zone is C, which yields a median of 100 to 250 gallons per minute. According to the New Jersey Department of Environmental Protection iMap and Water Resources Map, the majority of the municipality contains wetlands and open waters and therefore does not have recharge ranks in these areas. Recharge ranks of 11-15 inches per year and 8 to 10 inches per year are located throughout the municipality, as well as a few areas of 1-7 inches per year and scattered areas of hydric soils.

3.1.3 Well Head Protection Areas

For a community such as Dennis Township, in which water is supplied via wells drilled into the ground, groundwater quality protection is a primary concern and knowledge about potential contamination and how contaminants can

travel help safeguard the water supply. Safeguarding the susceptible area to prevent contaminants from entering the water supply is important for individual wells, as the entire municipality utilizes wells. Wells become vulnerable to contamination when contaminated groundwater accrues within the area that a well draws water from. When a well is pumping, groundwater moves toward it. The diagram below demonstrates the movement of groundwater through the soil in three dimensions resulting from the use of a well.



Since the municipality receives its water supply from the ground, it is important to prevent sources of pollution from entering the groundwater. According to Dennis Township's Water Quality Management Plan (1995, 2001), pollutant sources surrounding wells include those from septic systems, aboveground and underground storage tanks and cemeteries. Since the Township does not utilize sewers and only utilizes individual, on-site septic systems, groundwater contamination as a result of faulty septic systems is highly possible. Well Head Protection Areas are extremely important for the municipality.

Utilizing the concept of time of travel (TOT), which is the time that it takes a particle of water to reach a well intake, the NJDEP has developed a "Tier System" to distinguish three zones that can be shown on a map, in terms of TOT to the well intake. Having established the area of land and the influence of well water withdrawal, based upon geology and soil characteristics, flow analysis has been generated for movement over 2 years, 5 years and 12 years. The colored tiers, one for each time period, provide a visual guide to the surface area, which needs protection to safeguard a well's supply of water (Spayd and Johnson 2003).

The NJDEP has mapped "Wellhead Protection Areas" around public wells, so that extra care can be taken in the development of these areas. According to the NJDEP iMap, the municipality itself does not contain any public community wells; however, as multiple wellhead protection locations are mapped for noncommunity water systems

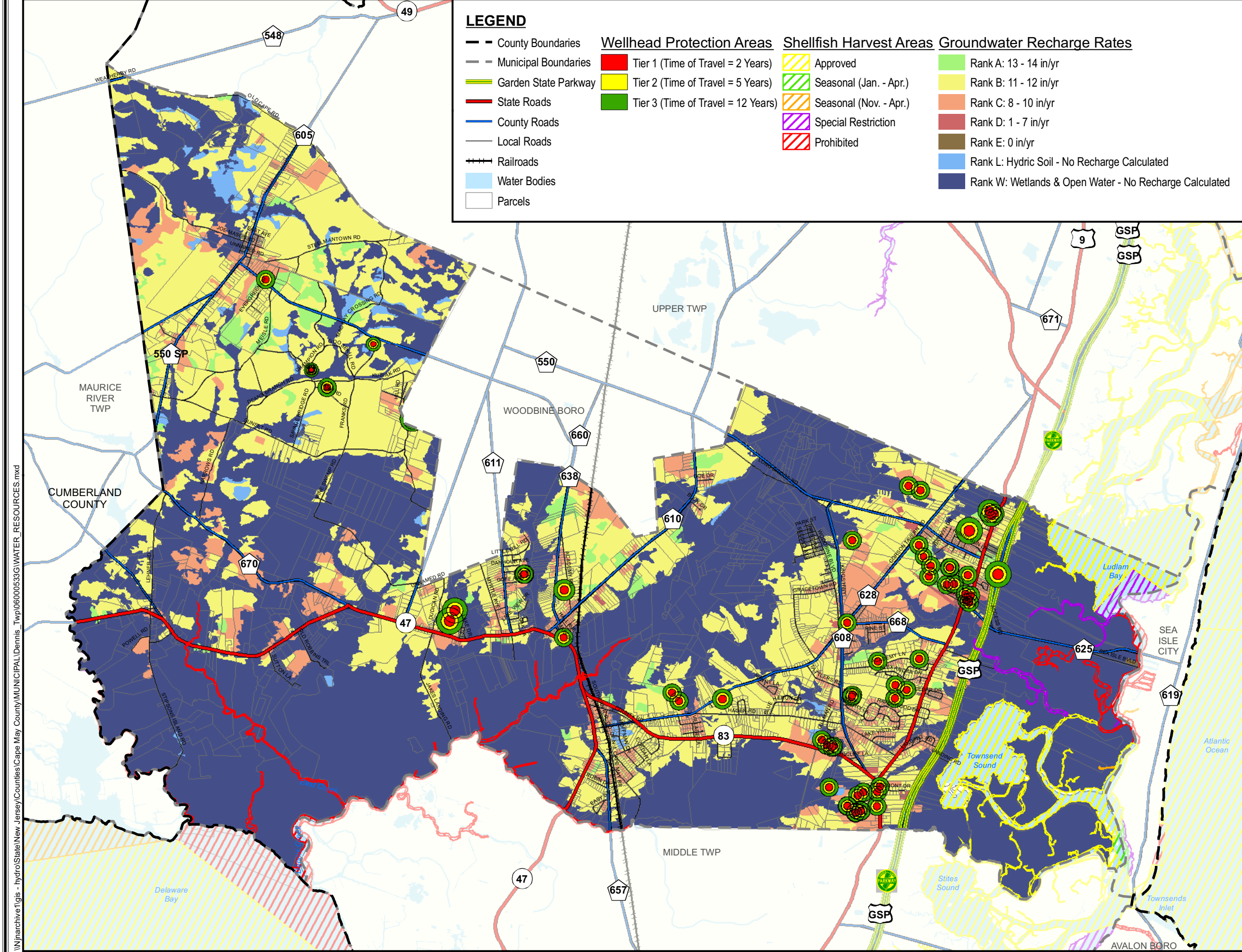
throughout the municipality. Noncommunity water systems include wells for establishments such as: schools, hospitals, restaurants, office buildings and rest stops that have their own drinking water source (NJDEP Source Water Protection Program 2005). The State maintains a Well Head Protection Area Inventory, which has mapped "Wellhead Protection Areas" around the wells.

The Water Resources map depicts wells that have been studied in Dennis Township as part of the Wellhead Protection Program. The three areas around the well are distinguished by colors. Each colored ring or Tier designates the time interval, which will allow a substance to travel horizontally to the water supply reservoir when influenced by water withdrawal. Wellhead Protection Areas are shown in Red (2 year, Tier #1), Yellow (5 year as Tier 2) and Green (defining the 12 year area of horizontal movement of Tier #3. Understanding how drinking water is susceptible to contamination is the first step in developing protection for the supply.

Cape May County also developed a Well Head Protection Program, designed to "locate and delineate domestic well cluster areas within the country for current and future ground-water resource preservation" (WQMP, 1995, 2001). At the time of the Water Quality Management Plan report (1995, 2001), Dennis Township had approximately 1,960 dwelling units within the municipality. Of those, approximately 11.8% or 231 wells were located within a Well Head Protection cluster (WQMP, 1995, 2001).

The Wellhead Protection and Aquifer sections describe recharge as it relates to the highly permeable soils (sands / sediments) found in Dennis Township. The factors facilitating recharge are the same that influence contamination when chemicals or hazardous materials are exposed to the open ground. In addition to estimates of ground water recharge rates, NJDEP has mapped sites where ground water contamination has been identified. A separate map provides the location of all known contaminated sites found in Dennis Township.

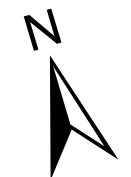
As mentioned previously, in areas where NJDEP groundwater standards are not met, a Classification Exception Area (CEA) is established. The CEA ensures the use of the aquifer in that area is restricted until standards are achieved. The sites found in Dennis Township are listed in Table 6 in the Contaminated Sites section of this report and shown on the Contaminated Sites Map.



WATER RESOURCES

TOWNSHIP OF DENNIS

CAPE MAY COUNTY
NEW JERSEY



0 2,500 5,000 7,500 10,000
Feet

1 inch equals 6,000 feet

DIGITAL SPATIAL DATA SOURCES:
- CAPE MAY COUNTY GEOGRAPHIC INFORMATION SYSTEM
- NEW JERSEY DEPARTMENT OF COMMUNITY AFFAIRS, OFFICE OF SMART GROWTH
- NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF GEOGRAPHIC INFORMATION
- UNITED STATES DEPARTMENT OF AGRICULTURE, NATURAL RESOURCES CONSERVATION SERVICES
- NEW JERSEY OFFICE OF INFORMATION TECHNOLOGY, OFFICE OF GIS



MAY 2007

3.2 WETLANDS

Wetlands occur in between dry uplands and land that is permanently inundated with water (USFWS 1985). Activities in wetlands have been regulated under Section 404 of the Clean Water Act, since its passage in 1972. For the purpose of the regulation of wetlands, the Federal definition follows. Wetlands are:

“Those areas that are inundated or saturated by surface or groundwater at a frequency or duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil condition” (EPA, 40 CFR 230.3 and CE 33 CFR 328.3).

The NJDEP has taken over the regulation of freshwater and coastal wetlands in the State, although the US Army Corps of Engineers maintains jurisdiction over wetlands tributary to tidal waterbodies in conjunction with NJDEP oversight. Wetlands which are regulated under New Jersey’s Freshwater Wetlands Protection Act (N.J.A.C. 7:7A) are identified and delineated using the U.S. Army Corps of Engineer’s three-parameter approach. Wetlands must exhibit evidence that the seasonal high water table occurs near the surface, hydrophytic vegetation must be present, and evidence that water stands or flows through the area should be evident (Federal Interagency Committee for Wetland Delineation 1989).

The freshwater wetlands (FWW) included in this data set were originally mapped under the Fresh Water Wetlands Mapping Program, an effort undertaken to support the Freshwater Wetlands Protection Act, which was enacted in 1988. Using aerial photography captured in 1986 as the basis, a comprehensive, mapped inventory of non-tidal wetlands within New Jersey was produced. Mapped wetlands were classified according to the U.S Fish and Wildlife Service Cowardin Classification System. While these wetland delineations are not regulatory lines, they represent important resource data in determining potential wetland resources. In 1995, NJDEP acquired aerial imagery, and began updating the Land Use/Land Cover (LU/LC) layer from 1986. The 1986 layer was examined with the new imagery, and areas of change delineated, with any new line work and land use codes needed to map the changes added to the base data set. This updated LU/LC layer is identified as the 1995/97 LU/LC update. This information is shown on the Wetlands Map.

Approximately 37% of total land mass in Dennis Township is occupied by freshwater (non-tidal) wetlands, while approximately 12% of total land mass in the Township is occupied by tidal or saltwater wetlands.

Freshwater wetlands are found associated with:

- Timber and Beaver Swamps
- Great Cedar Swamp
- Belleplain State Forest

Saltwater wetlands have formed adjacent to the main tidal water bodies of:

- Ludlam Bay
- Townsend Sound
- Dennis Creek
- East Creek
- Sluice Creek
- Delaware Bay

The U.S. Fish and Wildlife Service has designated several wetlands on the Cape May Peninsula as priority wetland sites under the Federal Emergency Wetlands Resources Act of 1986, including Cape Island/Pond Creek, Great Cedar Swamp (Cape May National Wildlife Refuge), Great Egg/Jarvis, and Sewall Point. The Cape May marshes (Delaware Bay) and Great Egg/Jarvis wetlands (Atlantic coast) are focus areas under the Atlantic Coast Joint Venture of the North American Waterfowl Management Plan. Acquisition and protection of 7,690 hectares (19,000 acres) in the Cape May marshes is recommended (USFWS, 1986).

Freshwater wetlands are regulated by the NJDEP, under the Freshwater Wetlands Protection Act Rules (N.J.A.C. 7:7A). Wetlands boundaries delineated under the three-parameter approach are approved by the NJDEP. The NJDEP issues a Letter of Interpretation agreeing to the boundary and indicating the width of the regulated wetlands buffer associated with the wetland. Some activities are prohibited in wetlands and wetlands buffers, while other activities are allowed, but are restricted in areal extent. In some cases, mitigation is required for the disturbance or destruction of wetlands. In these cases, wetlands must be created, an existing wetland must be enhanced or a monetary donation to a wetlands mitigation bank must be made.

Coastal Wetlands are regulated by the NJDEP under two separate jurisdictions. Wetlands that occur adjacent to tidal waterbodies are coastal wetlands in the generic sense. The Coastal Permit Program Rules define coastal wetlands for regulatory purposes as wetlands mapped by the NJDEP in the late 1970s and early 1980s. This mapping is available from the NJDEP Bureau of Tidelands. Wetlands shown outshore of wetlands depicted on these maps are regulated under coastal regulations. If wetlands have encroached further inshore of the upper wetlands boundary shown on the NJDEP mapping, these wetlands are considered to be freshwater wetlands for jurisdictional purposes, irrespective of whether or not the wetlands are tidally influenced or saltwater wetlands. The Coastal Permit Program Rules regulate activities in mapped coastal wetlands.

As mentioned, the NJDEP also determines the size of a wetlands buffer assigned to freshwater wetlands. Activities in these buffers are also regulated. Humanmade ditches and swales are considered ordinary resource value wetlands and are assigned a buffer of zero feet. A buffer width of 150 feet is assigned to exceptional resource value wetlands. Wetlands known to contain threatened or endangered animal species or critical habitat for such species would be assigned this larger buffer width. Intermediate resource value wetlands, which are generally all wetlands that cannot be categorized as ordinary or exceptional resource value wetlands, are assigned a buffer of 50 feet.

Wetlands can be adversely affected by a variety of human activities. Wetlands losses directly occur through the building of roads and other development. Farmers have installed field tiles in the past, which act to drain field that would be considered to be wetlands without drainage. Pollutants and excess nutrients are discharged to wetlands and adjacent waterbodies through both point sources from industrial and sewage treatment. Global warming poses additional threats to wetlands in Dennis Township. Coastal wetlands will be subject to inundation, allowing the salt front to migrate further inland. Freshwater wetlands may become saline. Unless adequate land is available for wetlands to shift inland through potential accretion, freshwater wetlands will be lost (Cooper, Beevers & Oppenheimer 2005).

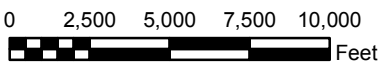
LEGEND

- | | |
|---|--|
| <ul style="list-style-type: none">County BoundariesMunicipal BoundariesGarden State ParkwayState RoadsCounty RoadsLocal RoadsRailroadsParcelsWater Bodies | <p>Tidal Wetlands</p> <ul style="list-style-type: none">Freshwater / Brackish Tidal WetlandsSaline Marsh <p>Non-Tidal (Freshwater) Wetlands</p> <ul style="list-style-type: none">Herbaceous WetlandsScrub / Shrub WetlandsWooded WetlandsAtlantic White Cedar WetlandsFormer Agricultural Wetlands (Becoming Shrubby, Not Built-Up)Managed / Modified / Built-Up Wetlands |
|---|--|

WETLANDS

**TOWNSHIP
OF
DENNIS**

CAPE MAY COUNTY
NEW JERSEY



1 inch equals 6,000 feet

DIGITAL SPATIAL DATA SOURCES:
- CAPE MAY COUNTY GEOGRAPHIC INFORMATION SYSTEM
- NEW JERSEY DEPARTMENT OF COMMUNITY AFFAIRS, OFFICE OF SMART GROWTH
- NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF GEOGRAPHIC INFORMATION
- UNITED STATES DEPARTMENT OF AGRICULTURE, NATURAL RESOURCES CONSERVATION SERVICES
- NEW JERSEY OFFICE OF INFORMATION TECHNOLOGY, OFFICE OF GIS



NOVEMBER 2007

\\njarchive\gis - hydro\State\New Jersey\Counties\Cape May County\MUNICIPAL\Denmis_Twp\060005333G\WETLANDS.mxd

3.3 WATERSHEDS

The New Jersey Department of Environmental Protection defines watershed as “the area of land that drains into a body of water such as a river, lake, stream or bay. It is separated from other systems in the area by high points such as hills or slopes. It includes not only the waterway itself, but also the entire land area that drains to it” (NJDEP Division of Watershed Management, 2005).

NJDEP has divided the State of New Jersey into 20 Watershed Management Areas. The entire municipality is located within the Atlantic Coastal Drainage Basin. This basin drains lands located adjacent to the Atlantic Ocean all along the eastern seaboard of the United States. The easterly portion of the Township drains to Delaware Bay, before it discharges to the Atlantic Ocean. The municipality is located within the both the Great Egg Harbor Watershed Management Area #15 (north/northeastern fringe of the municipality) and the Cape May Watershed Management Area #16 (remaining areas of the municipality) for NJDEP purposes. These Watershed Management Areas are among several in New Jersey, which drain to the Atlantic Ocean. Refer to the Watershed Management Areas Map to view the Watershed Management Areas boundaries.

In addition to the NJDEP Watershed Management Area designation, the USGS uses watershed units for the purpose of surface water management. The USGS designated Hydrologic Unit Codes (HUC 11 and HUC 14) for watersheds. The USGS devised these codes by dividing and sub-dividing the United States into successively smaller hydrologic units. These units contain four categories or levels: regions, sub-regions, accounting units, and cataloging units. The region portion of a Hydrologic Unit is an area, based on surficial topography, containing the drainage area of a major river or major coastal area. A sub-region divides the region into areas drained by one river system, a reach of a river and its tributaries in that reach, a closed basin(s), or a group of streams forming a coastal drainage area. The accounting unit separates sub-regions into 352, smaller watershed units. These accounting units are further subdivided into 2,150 smaller watershed units (USGS 2007). The number after the letters HUC (Hydrologic Unit Code) indicate the number of digits in the unit name. Since the code of a HUC 14 watershed has more digits than a HUC 11 watershed, the HUC 14 is a smaller watershed unit, nested within a HUC 11 watershed area.

The HUC 11 and HUC 14 areas are displayed on the Watershed Map. At the HUC 11 level, Dennis Township is divided into four different regions: West Creek/East Creek/Riggins Ditch (HUC 11: 02040206210), Tuckahoe River (HUC 11: 02040302070), Dennis Creek (HUC 11: 02040206220), Cape May Bays & Tributaries East (HUC 11: 02040302080). The subwatersheds of the HUC 11 watersheds subdivide Dennis Township into smaller drainage areas (HUC 14 areas) within the larger Great Egg Harbor and Cape May Watersheds. These subwatersheds are listed below:

West Creek/East Creek/Riggins Ditch HUC 11:

- West Creek (above Route 550) – HUC 14: 02040206210020
- West Creek (Paper Mill Road to Route 550) – HUC 14: 02040206210030
- West Creek (below Paper Mill Road to Moores Bch) – HUC 14: 02040206210040
- Savages Run (above East Creek Pond) – HUC 14: 02040206210050
- East Creek – HUC 14: 02040206210060

Tuckahoe River HUC 11:

- Tarkiln Brook (Tuckahoe River) – HUC 14: 02040302070050
- Mill Creek/Back Run (Tuckahoe River) – HUC 14: 02040302070060
- Cedar Swamp Creek/Cedar Swamp (above Route 50) – HUC 14: 02040302070080

Dennis Creek HUC 11:

- Dennis Creek (Jakes Landing Road to Route 47) – HUC 14: 02040206220030
- Dennis Creek (below Jakes Landing Road) – HUC 14: 02040206220040

- Dennis Creek/Cedar Swamp (Route 47 to Route 550)
- Sluice Creek – HUC 14: 02040206220020

Cape May Bays and Tributaries East HUC 11:

- Corson Inlet & Sound/Ludlam Bay – HUC 14: 02040302080020
- Mill Creek/Sunks Creek/Big Elder Creek – HUC 14: 02040302080030
- Cape May Bays (Reubens Wharf – Big Elder Creek) – HUC 14: 02040302080040

3.4 SURFACE WATER QUALITY

Cape May County, located at the southernmost point of New Jersey, contains a continuation of the Atlantic Coastal Plain along its eastern border. The County is 267 square miles in area and is bounded on the north by Atlantic and Cumberland Counties, on the east by the Atlantic Ocean and on the west and south by Delaware Bay. The region is characterized by a low-lying, gently rolling plain whose highest point is 54 feet above sea level and whose surface is largely covered by wet soils and wetlands. Land Swamps (Great Cedar, Timber and Beaver Swamps) occupy the north-central part of the County. Most, if not all, streams are tidal in their lower reaches and terminate by flowing into fresh water swamps that, in turn, discharge to saltwater marshes near the shore (USFWS, 1997).

The NJDEP has established use designations in its Surface Water Quality Standards (N.J.A.C. 7:9-4.1). These designations are described briefly below.

- **FW** – signifies fresh waters and include all nontidal and tidal waters with a salinity of less than 3.5 parts per thousand.
- **FW-1** – fresh waters that originate in and are wholly within federal or state parks, forests, fish and wildlife lands, and other special holdings, that are to be maintained in their natural state of quality and not subject to any man-made wastewater discharges.
- **FW-2** – refers to fresh waters that are not designated FW1 or PL.
- **PL** – includes all waters within the boundaries of the Pinelands Area, as established in the Pinelands Protection Act.
- **SE** – is a general surface water classification of waters with a salinity greater than 3.5 parts per thousand.
- **C1** (Category One) – waters are to be protected “...from measurable changes in water quality characteristics because of their clarity, color, scenic setting, other characteristics of aesthetic value, exceptional ecological significance, exceptional recreational significance, exceptional water supply significance, or exceptional fisheries resource(s)” (NJDEP 2005, p. 3).

All classifications have designated uses. For example, FW2 waters are designated for maintenance, mitigation and propagation of natural land and established biota, for primary and secondary contact recreation, for industrial and agricultural water supply, for public potable water supply after conventional filtration treatment (a series of sedimentation, resulting in substantial particulate removal but no consistent removal of chemical constituents) and disinfection and for other reasonable uses. SE1 designated uses are for shellfish harvesting in accordance with N.J.A.C. 7:12, for the maintenance, migration and propagation of the natural and established biota, for primary and secondary contact recreation and for any other reasonable uses.

According to the same rules, “all those streams and segments of streams that flow directly into the Atlantic Ocean or into back bays of the Ocean which are not included elsewhere in this list, are not within the boundaries of the Pinelands Protection or Preservation Areas and are not mapped as C1 waters by the Department are classified as FW2-NT/SE (NJDEP 2005). Therefore, all unnamed and uncoded tributaries within the drainage area of Dennis are classified as FW2-NT/SE1 waters. The surface water classifications are shown in the table below.

Table 8: Surface Water Quality Classifications of Dennis Township Waters	
Waterbody	Water Quality Classification
Tarkiln Brook	PL
East Creek (Savages Run)	PL, FW1, FW2-NT/SE1 (C1)
West Creek	PL, FW1
Mill Creek	PL
Willis Run	FW2-NT/SE1
Old Robins Branch	FW2-NT/SE1
Dennis Creek	FW2-NT/SE1 (C1)
Sluice Creek	FW2-NT/SE1 (C1)
Crow Creek	FW2-NT/SE1(C1)
Goshen Creek	SE1 (C1)
Roaring Ditch	FW2-NT/SE1 (C1)

Multiple uncoded/unnamed tributaries associated with the tidal swamps and wetlands within Dennis Township are also designated as C1 waterways. Waters that are classified by the NJDEP as Category One (C1) waters receive extra protection under the State's Stormwater Management Rules (N.J.A.C.7:8). These rules apply to development projects that involve the disturbance of at least one acre of land or the placement of an additional one quarter acre of impervious cover on a site. Special water resource protection areas must be established along all waters designated C1. This includes perennial or intermittent streams that drain into or upstream of the C1 waters as shown on the USGS Quadrangle Maps or in the County Soil Surveys, within the associated HUC 14 drainage area. These areas will consist of a 300-foot special water resource protection buffer on each side of the waterway. C1 waters are shown on the Watershed Management Areas Map.

These special water resource protection buffers pose limitations on development. I buffer areas without previous development such as parking areas or active agricultural fields, the plant community must remain undisturbed or the area must be allowed to revegetate in accordance with natural succession. Even in the case where disturbance is present, the buffer may not be reduced to less than 50 feet wide. Stormwater must be discharged outside of the buffer, so no anadromous outfall structures are permitted within the buffer (NJDEP 2004).

3.4.1 Shellfish Harvest Areas

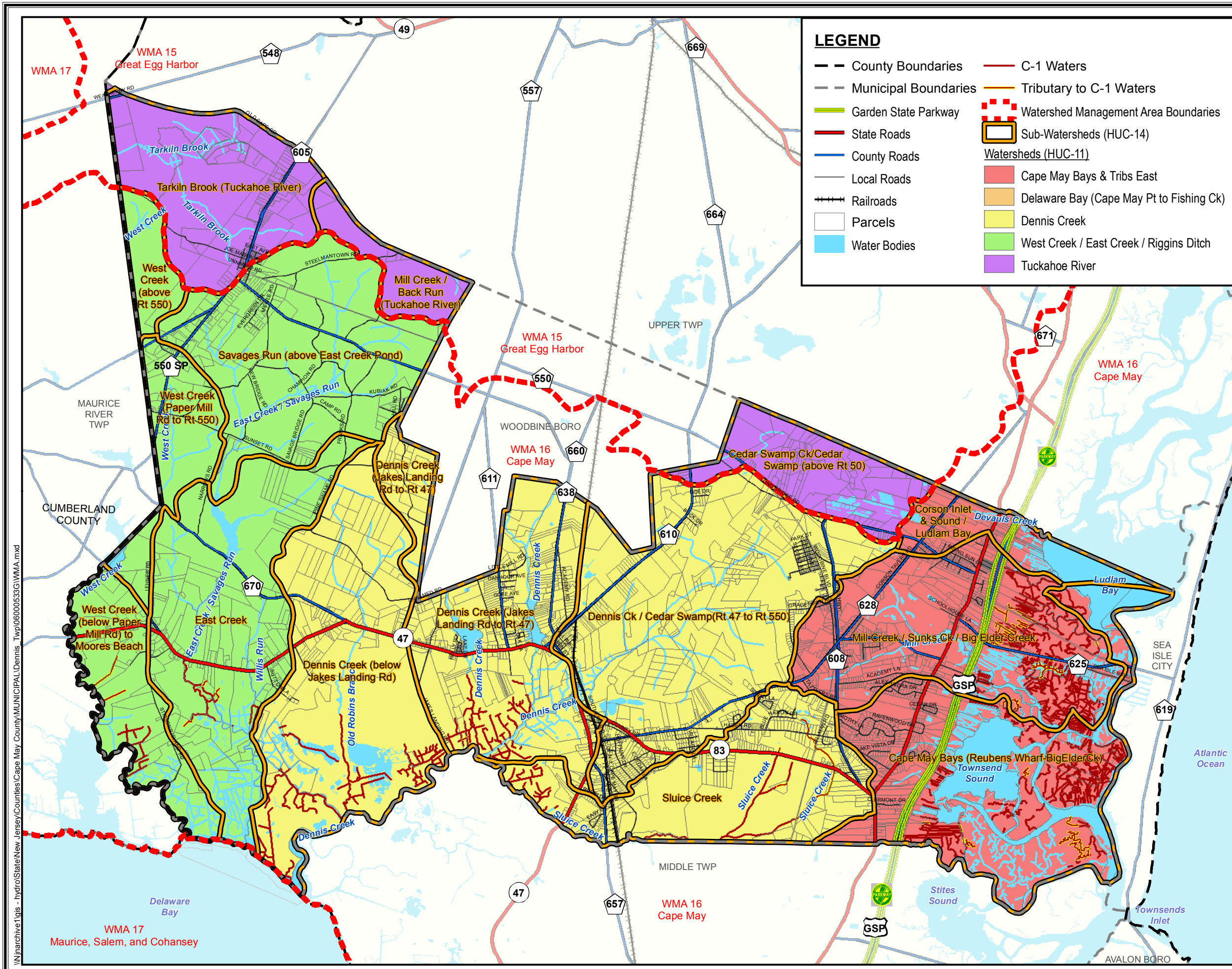
The NJDEP Bureau of Marine Monitoring periodically assesses water quality in the location of shellfish beds to determine the safety of ingesting shellfish growing there. The transmission of shellfish-borne infectious diseases begins with the contamination of growing waters with fecal matter. Contamination can reach shellfish growing waters through nadromous runoff from urban and agricultural areas from direct discharges such as wastewater treatment facilities and septic systems. Since shellfish filter large quantities of water through their bodies while feeding, microorganisms, heavy metals and chemicals become concentrated in their tissues, which can lead to disease or poisoning in human ingesting contaminated shellfish (Watkins, 1998).

The NJDEP Bureau of Marine Monitoring maps areas with shellfish classification, including approved, prohibited, seasonal (November to April), seasonal (January to April), and special restricted areas. In approved areas, clams oysters and mussels may be harvested at all times of the year. In areas classified as Seasonal, shellfish may be harvested during specified months of the year. In Special Restricted Areas, shellfish harvesting is prohibited unless shellfish are processed to remove pollutants in a depuration plant, under a special NJDEP permit. Areas classified as prohibited are condemned for shellfish harvesting. It is not allowed in these areas, due to polluted conditions.

The Water Resources map depicts the shellfish harvest classification areas. The map shows the following classifications for Dennis Township waters:

- **Portion of Ludlam Bay** (Special Restricted)
- **Ludlam Thoroughfare** (Prohibited)
- **Sunks Creek** (Prohibited)
- **Mill Creek** (Special Restricted)
- **Townsend Channel** (Seasonal: January to April)
- **Delaware Bay** (Prohibited)
- **Dennis Creek** (Prohibited)
- **Sluice Creek** (Prohibited)
- **Crow Creek** (Prohibited)
- **Roaring Ditch** (Prohibited)

All other areas are considered to be approved for shellfish harvesting.



WATERSHED MANAGEMENT AREAS

TOWNSHIP OF DENNIS

CAPE MAY COUNTY
NEW JERSEY



0 2,500 5,000 7,500 10,000
Feet

1 inch equals 6,000 feet

DIGITAL SPATIAL DATA SOURCES:
- CAPE MAY COUNTY GEOGRAPHIC INFORMATION SYSTEM
- NEW JERSEY DEPARTMENT OF COMMUNITY AFFAIRS, OFFICE OF SMART GROWTH
- NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF GEOGRAPHIC INFORMATION
- UNITED STATES DEPARTMENT OF AGRICULTURE, NATURAL RESOURCES CONSERVATION SERVICES
- NEW JERSEY OFFICE OF INFORMATION TECHNOLOGY, OFFICE OF GIS



NOVEMBER 2007

\\njarchive1\gis - hydro\State\New Jersey\Counties\Cape May County\MUNICIPAL\Denmis Twp\060005333\G\WMA.mxd

3.5 FLOODWAYS AND FLOODPLAINS

Cape May County can be described as a relatively flat peninsula which can be frequently inundated by flood waters. Floods typically occur as a result of hurricanes and storms which bring “abnormally high tides, extremely strong winds, high waves and breakers” (Dennis Township Planning Board 1994).

The Federal Emergency Management Agency (“FEMA”) has mapped flood areas. The USGS has also delineated flood prone areas and areas of coastal flooding. FEMA Flood Zone Designations and USGS floodprone areas mapping is shown on the following map. According to the FEMA mapping (Community Panel Nos. 340552 0005 A, 340552 0010 B, 340552 0015 A, 340552 0020 B, 340552 0025A) for Dennis Township, the portions of the municipality adjacent to Delaware Bay, West Creek, East Creek, Dennis Creek, Sluice Creek and the tidal waterbodies of the Atlantic Ocean are all located within the Zone A, or 100-year floodplains of these waterways. The X zone indicates areas outside of the 100-year and 500-year floodplains. The ANI zone (areas not included) covers parts of State-owned lands.

The NJDEP regulates development in floodplains under the Flood Hazard Area Control Act Rules (N.J.A.C. 7:13). The NJDEP recently approved new Flood Hazard Area Control Act Rules. In order to minimize the impacts of development on flooding, NJDEP now allows no net fill in all non-tidal flood hazard areas of the State. Near-stream vegetation protection buffers are replaced with new riparian zones that are 50, 150 or 300 feet in width along each side of surface waters throughout the State, depending on the environmental resources being protected. The most protective 300-ft riparian zone will be applicable to waters designated as Category One and certain upstream tributaries. Certain waters supporting trout, or habitats of threatened or endangered species critically dependant on the watercourse to survive, or watercourses which flow through areas that contain acid-producing soil deposits, receive a 150-ft riparian zone (NJDEP DLUR 2007).

The Department has also amended N.J.A.C. 7:7 and 7:7E to incorporate the new flood hazard area and riparian zone standards into the review of all CAFRA and Waterfront Development permits, thereby eliminating a gap in the previous rules under which development in tidal areas was not reviewed under the same standards that applied to non-tidal areas (NJDEP DLUR 2007).

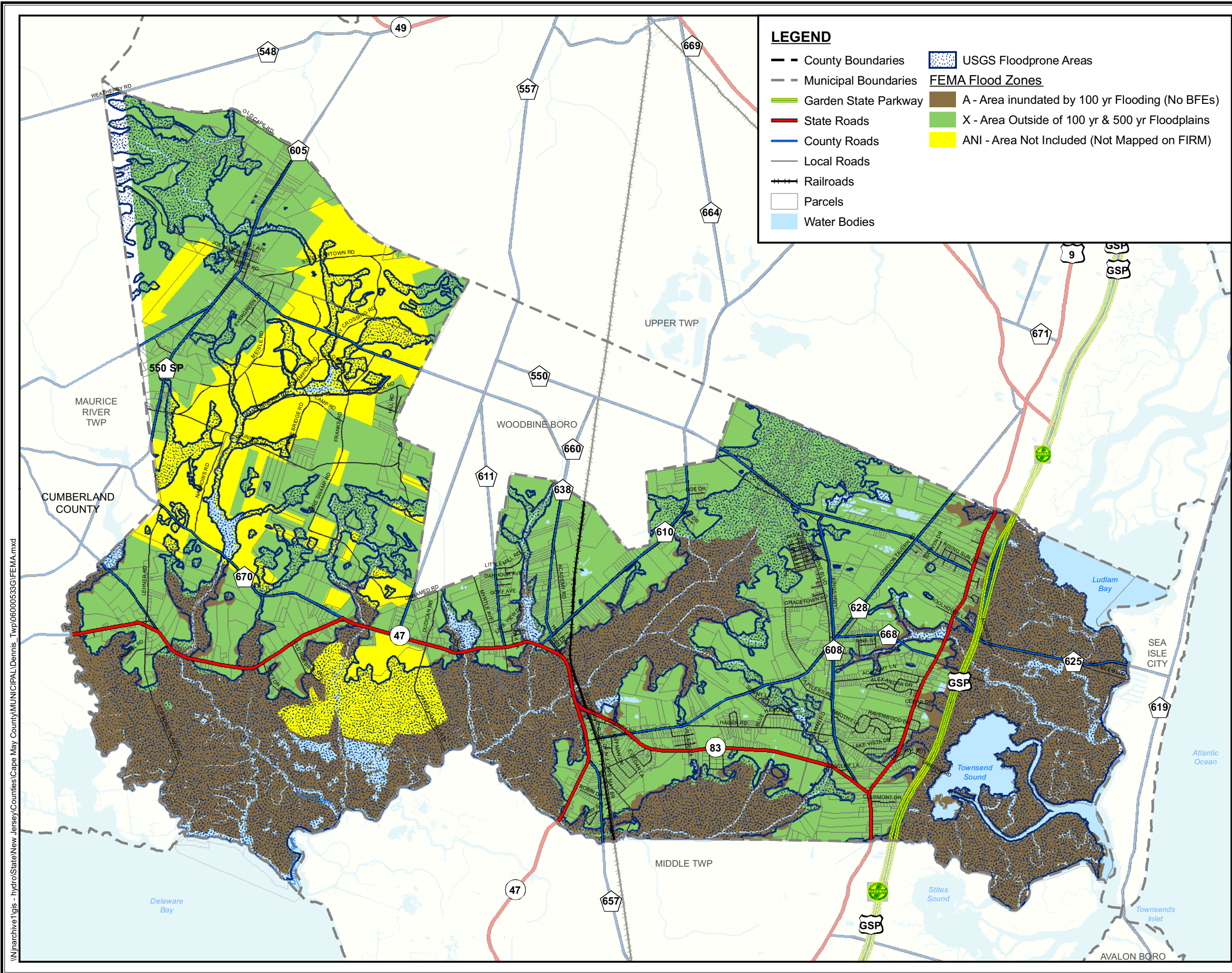
The Dennis Township Master Plan (1994) states that some parts of Cape May County become inundated by flood waters. Two major storms have hit the County within the last century. The hurricane of 1944 resulted in tides cresting 7.6 feet above sea level along the Atlantic Ocean side of the County. During the a flood in 1962, mud and other debris associated with the flood was found 6.3 feet above the normal high water mark on top of the Route 47 Bridge (Dennis Township Planning Board 1994). The 1994 Dennis Township Master Plan lists three (3) types of flood areas that, under no circumstances, no development should be built within these areas due to the high risk of flooding. They are the following:

- **Maximum Tide of Record** – the high water mark of the September 1944 hurricane on the ocean side and the March 1962 high water mark on the Delaware Bay side.
- **Intermediate Regional Tide** – the tide that has an average frequency of occurrence in the order of once in 100 years, although the tide may occur in any years. It is based on statistical analyses of tide records available for the general region.
- **Standard Project Tide** – a hypothetical flood, estimated by the Army Corps of Engineers that may be expected from the most severe combination of meteorological and hydrologic conditions that are considered reasonably characteristic of the geographic region involved, excluding any rare combinations.

According to the Cape May County 2006 Hurricane Conference Local Impacts Report, minor tidal flooding begins to occur within Cape May County at an elevation of 6.7 feet above Mean Lower Low Water (“MLLW”). At 7.5 feet above MLLW, moderate tidal flooding will occur and at 8.7 feet, severe tidal flooding will occur within the County (Foster, 2006). Three separate storms have occurred in the last 25 years, including Hurricane Gloria in September 1985, that have been associated with high water levels beyond the 8.7 foot water mark. Two additional storm events had

flooding higher than the 7.5 foot moderate tidal flooding mark (Foster, 2006). As mentioned previously, the sea level rise associated with global warming is expected to increase the frequency of what is currently considered to be the 100-year flood. A rise of mean sea level to the 2-foot elevation contour (50% probability of occurring by 2050) would mean that the 100-year flood would become the 30-year flood (Cooper, Beevers & Oppenheimer 2005). Higher base water elevations also mean that storm surges will exhibit higher flood elevations and extend further inland. Planning for increased flood hazards is clearly important for a municipality like Dennis Township, with a large portion of low elevation land. As stated by Cooper, et al (2005),

“Episodic flooding events due to storm surges are often perceived as natural disasters’, not failures in land use planning and building code requirements...However, current research suggests that property damage related to coastal hazards is highly dependent on the design and elevation of the homes, buildings and other structures near the shoreline” (Cooper, Beevers & Oppenheimer 2005).



\\njarchive\gis - hydro\State\New Jersey\Counties\Cape May County\MUNICIPAL\Dennis_Twp\060005333\G\FEMA.mxd

4.0 BIOLOGICAL RESOURCES

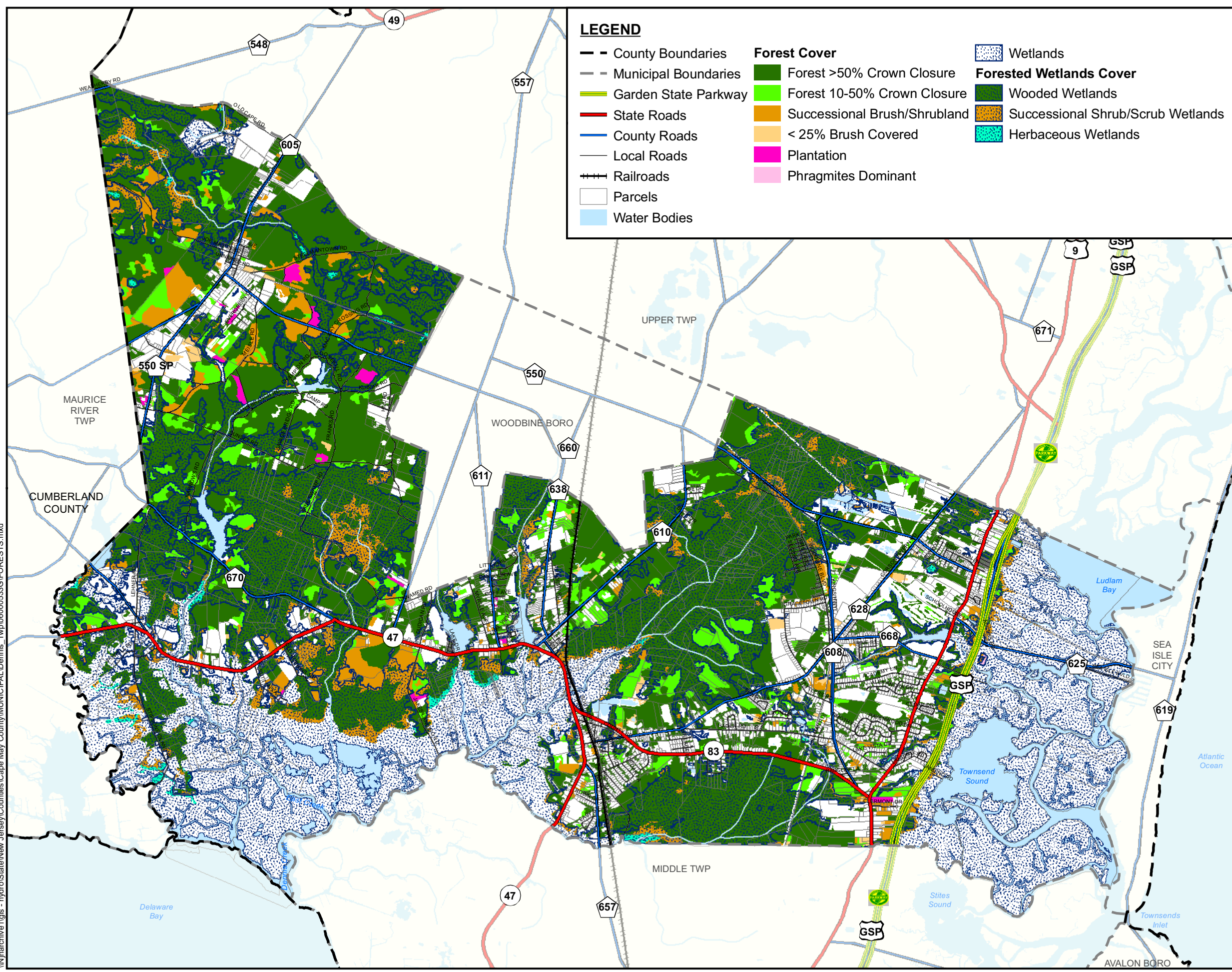
Biological resources include the botanical (plant) and zoological (animal) related attributes of an area. Botanical resources include the flora (plants characteristic of a region, period, or special environment), and vegetation (plant life or total plant cover of an area as in plant communities or habitats) and the zoological resources include the invertebrate and vertebrate animals and animal communities. Rare, threatened and endangered species and species of special concern also are considered within this section.

4.1 BOTANICAL RESOURCES

Dennis Township extends geographically from the Atlantic Ocean shoreline in the eastern section to the Delaware Bay to the west. Freshwater streams and rivers flow from the interior section of the Township east and west into brackish then marine conditions with respect to salinity. Wetlands range from tidal saltmarshes to freshwater cedar bogs and red maple swamps. General wetland types are shown on the Wetlands Map. Forests grade from Coastal Plain Oak and Oak-Pine Forests to Pine Barren Forest types. Successional vegetation, which colonizes sites after human or natural disturbance, runs a similar gamut from coastal to interior types. Forest cover mapped for various successional plant communities is shown on the Forest Coverage Map. Since a large proportion of Dennis Township consists of protected lands, many of its plant communities are of exceptional quality, containing threatened and endangered plants and community types.

Plant habitats can be divided into different types of communities. Plant communities will be discussed at a greater level of detail in this section. New Jersey has tried utilizing a number of different approaches to classify plant communities. This inventory description follows Breden, 2001 and Collins and Anderson, 1994. Plant communities present in this portion of Cape May County include the following systems: Estuarine, Palustrine and Terrestrial. The NJDEP forest cover map layer, showing various vegetation communities does not precisely match these plant community classifications, since plant communities are not mapped in the same degree of detail that botanists have identified in New Jersey plant communities. Plant inventory lists provided are typical of the plant communities likely to occur in Dennis Township. A site-specific inventory was not performed.

\\njarchive\lgis - hydro\State\New Jersey\Counties\Cape May County\MUNICIPAL\Dennis_Twp\060000533\GIS\FORESTS.mxd



LEGEND

- | | | |
|---|---|---|
| <ul style="list-style-type: none">County BoundariesMunicipal BoundariesGarden State ParkwayState RoadsCounty RoadsLocal RoadsRailroadsParcelsWater Bodies | Forest Cover <ul style="list-style-type: none">Forest >50% Crown ClosureForest 10-50% Crown ClosureSuccessional Brush/Shrubland< 25% Brush CoveredPlantationPhragmites Dominant | Wetlands <ul style="list-style-type: none">Wetlands Forested Wetlands Cover <ul style="list-style-type: none">Wooded WetlandsSuccessional Shrub/Scrub WetlandsHerbaceous Wetlands |
|---|---|---|

FOREST COVERAGE

TOWNSHIP OF DENNIS

CAPE MAY COUNTY
NEW JERSEY



0 2,500 5,000 7,500 10,000 Feet
1 inch equals 6,000 feet

DIGITAL SPATIAL DATA SOURCES:
- CAPE MAY COUNTY GEOGRAPHIC INFORMATION SYSTEM
- NEW JERSEY DEPARTMENT OF COMMUNITY AFFAIRS, OFFICE OF SMART GROWTH
- NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF GEOGRAPHIC INFORMATION
- UNITED STATES DEPARTMENT OF AGRICULTURE, NATURAL RESOURCES CONSERVATION SERVICES
- NEW JERSEY OFFICE OF INFORMATION TECHNOLOGY, OFFICE OF GIS



MAY 2007

4.1.1 Estuarine Plant Communities

The Estuarine System consists of deepwater tidal habitats and adjacent tidal wetlands where ocean water is diluted by freshwater runoff from the land. Estuaries are generally considered to be low-energy systems due to the absence of wave action. Salinities can vary from 0.5 ppt to 30 ppt. Four communities are found in Dennis Township that are part of the Estuarine System. They are Polyhaline Subtidal Aquatic Bed, Mesohaline/Oligohaline Subtidal Aquatic Bed, Salt Marsh Complex and Brackish Tidal Marsh Complex.

The Polyhaline Subtidal Aquatic Bed communities are found behind barrier islands on the Outer Coastal Plain. The common algae found in this community are Sea Lettuce (*Ulva lactuca*), Green Fleece (*Codium fragile*) and Redweed (*Gracilaria spp.*). Eelgrass (*Zostera marina*) and Beaked Ditch-Grass (*Ruppia nadromo*) are the common vascular plants and Sago Pondweed (*Stuckenia pectinata*) and Horned-Pondweed (*Zannichellia palustris*) are found in bay areas where the salinity is lower.

The Mesohaline/Oligohaline Subtidal Aquatic Bed community is found in lower salinity portions of the coastal rivers. Included in this community are coastal salt ponds, large ponds adjacent to ocean or tidal bays which are occasionally breached by storm tides. The vascular plants found in this community are listed in the following.

Table 9: Plants of the Mesohaline/Oligohaline Subtidal Aquatic Bed			
Common Name	Scientific Name	Common Name	Scientific Name
Redhead Pondweed	<i>Potamogeton perfoliatus</i>	Ribbon-Leaf Pondweed	<i>Potamogeton epihydrus</i>
Slender Pondweed	<i>Potamogeton pusillus</i>	Redhead Grass	<i>Potamogeton perfoliatus</i>
Water Celery	<i>Vallisneria americana</i>	Naiad	<i>Najas flexilis</i>
Hooded Arrowhead (submerged form)	<i>Sagittaria calycina</i>	Parker's Pipewort (submerged form)	<i>Eriocaulon parkeri</i>
Redhead Pondweed	<i>Potamogeton perfoliatus</i>	Ribbon-Leaf Pondweed	<i>Potamogeton epihydrus</i>
Slender Pondweed	<i>Potamogeton pusillus</i>	Redhead Grass	<i>Potamogeton perfoliatus</i>
Eastern Grasswort	<i>Lilaeopsis chinensis</i>		

The Salt Marsh Complex community occupies saline reaches of estuaries. Low marsh areas which experience twice daily flooding are dominated by Saltmarsh Cordgrass (*Spartina alterniflora*). The following lists the dominants and associates found in the low marsh areas.

Table 10: Plants of the Low Marsh Community (after Collins and Anderson 1994, pp. 204)			
Common Name	Scientific Name	Common Name	Scientific Name
Salt-marsh Cordgrass	<i>Spartina alterniflora</i>	Spike Grass	<i>Distichlis spicata</i>
Salt-meadow grass	<i>Spartina patens</i>	Black Grass	<i>Juncus gerardi</i>
Big Cordgrass	<i>Spartina cynosuroides</i>	Sea Lavender	<i>Limonium carolinianum</i>
Perennial Salt Marsh Aster	<i>Symphyotrichum tenuifolium</i>	Seaside Mallow	<i>Kosteletzkya virginica</i>
Slender Glasswort	<i>Salicornia europaea</i>	Woody Glasswort	<i>Salicornia virginica</i>
Orache	<i>Atriplex patula</i>	Salt Marsh Sand Spurrey	<i>Spergularia maritima</i>
Salt-marsh Fleabane	<i>Pluchea odorata</i>	Switchgrass	<i>Panicum virgatum</i>



High marsh areas are flooded less often and are dominated by plant species that can tolerate the salt accumulation that occurs when areas are periodically flooded with salt water. Much of the water eventually evaporates, leaving the salts behind.

The plants found in this community are listed in the table below.

Table 11: Plants of the High Marsh Community (after Collins and Anderson 1994, pp. 206)			
Common Name	Scientific Name	Common Name	Scientific Name
Shrubs		Shrubs	
Marsh Elder	<i>Iva frutescens</i>	Bayberry	<i>Morella pensylvanica</i>
Groundsel Bush	<i>Baccharis halimifolia</i>		
Herbs		Herbs	
Salt-meadow grass	<i>Spartina patens</i>	Spike Grass	<i>Distichlis spicata</i>
Big Cordgrass	<i>Spartina cynosuroides</i>	Black Grass	<i>Juncus gerardi</i>
Perennial Salt Marsh Aster	<i>Symphyotrichum tenuifolium</i>	Sea Lavender	<i>Limonium carolinianum</i>
Salt Marsh Bulrush	<i>Scirpus robustus</i>	Seaside Goldenrod	<i>Solidago sempervirens</i>
Beaked spike-rush	<i>Eleocharis rostellata</i>	Salt Marsh Cockspur Grass	<i>Echinochloa walteri</i>
Orache	<i>Atriplex patula</i>	Seaside Gerardia	<i>Agalinus maritima</i>
Salt Marsh Sand Spurrey	<i>Spergularia maritima</i>	Sea-pink	<i>Sabatia stellaris</i>
Slender Glasswort	<i>Salicornia europaea</i>	Woody Glasswort	<i>Salicornia virginica</i>
Switchgrass	<i>Panicum virgatum</i>	Rose Mallow	<i>Hibiscus moscheutos</i>
Seaside Mallow	<i>Kosteletzkya virginica</i>		

The frequency of tidal inundation distinguished the High Marsh from the Low Marsh Community. The Low Marsh Community is flooded twice daily by tides. The High Marsh is generally inundated only during spring high tides, which occur twice monthly or during coastal storms. Water evaporates from the Marsh and salts are left behind. Therefore, soils tend to be saltier in this community. The High Marsh is fringed by a drier area that floods even less frequently. Woody plants begin to colonize this zone. The plants from the latter zone are included in the list of plants commonly found in the High Marsh Community (Collins & Anderson 1994).

Brackish tidal marshes occupy zones in estuaries where fresh and salt water mix. The following dominants and associate plant species are found in this community.

Table 12: Plants of the Brackish Tidal Marsh Community (after Collins and Anderson 1994, pp. 208, Breden 1989, p. 170)			
Common Name	Scientific Name	Common Name	Scientific Name
Shrubs		Shrubs	
Marsh Elder	<i>Quercus ilicifolia</i>	Indigo Bush	<i>Amorpha fruticosa</i>
Groundsel Bush	<i>Baccharis halimifolia</i>	Few others	
Herbs		Herbs	
Salt-meadow grass	<i>Spartina patens</i>	Spike Grass	<i>Distichlis spicata</i>
Big Cordgrass	<i>Spartina cynosuroides</i>	Black Grass	<i>Juncus gerardi</i>
Perennial Salt Marsh Aster	<i>Symphyotrichum tenuifolium</i>	Sea Lavender	<i>Limonium carolinianum</i>
Salt Marsh Bulrush	<i>Scirpus robustus</i>	Seaside Goldenrod	<i>Solidago sempervirens</i>
Beaked spike-rush	<i>Eleocharis rostellata</i>	Salt Marsh Cockspur Grass	<i>Echinochloa walteri</i>
Orache	<i>Atriplex patula</i>	Seaside Gerardia	<i>Agalinus maritima</i>
Salt Marsh Sand Spurrey	<i>Spergularia maritima</i>	Sea-pink	<i>Sabatia stellaris</i>
Slender Glasswort	<i>Salicornia europaea</i>	Woody Glasswort	<i>Salicornia virginica</i>
Switchgrass	<i>Panicum virgatum</i>	Rose Mallow	<i>Hibiscus moscheutos</i>
Seaside Mallow	<i>Kosteletzkya virginica</i>		

4.1.2 Palustrine Plant Communities

The Palustrine system contains all non tidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens. In addition, it includes wetlands that occur in tidal areas where the salinity is below 0.5 ppt. The only tidal Palustrine plant community found in Dennis Township is the Freshwater Tidal Marsh Complex.



Upstream of the further reach of salty ocean waters, tidal influence extends into strictly freshwater areas. Here plants no longer need to be salt-tolerant, but they must endure daily inundations and fluctuating water levels. The plant community that develops under these conditions is called a Freshwater Tidal Wetland Community.

The NJDEP Natural Heritage Program has recognized the importance of tidally influenced wetland communities found in Dennis Township are valuable in their own right and as habitat for threatened and endangered plant and animal species. Many acres of freshwater tidal wetlands are included within Natural Heritage Priority Sites within the Township boundaries.

Table 13: Plants of the Freshwater Tidal Wetland Community (after Collins and Anderson 1994, pp. 208, Breden 1989, p. 170)

Common Name	Scientific Name	Common Name	Scientific Name
Shrubs		Shrubs	
Buttonbush	<i>Cephalanthus occidentalis</i>	Silky Dogwood	<i>Cornus amomum</i>
Few others			
Herbs		Herbs	
Wild Rice	<i>Zizania aquatica</i>	Narrow-leaved cattail	<i>Typha angustifolia</i>
Broad-leaved cattail	<i>Typha latifolia</i>	Halberd-leaved Tearthumb	<i>Bidens cernua</i>
Common Reed	<i>Phragmites australis</i>	Nodding Beggar-ticks	<i>Polygonum sagittatum</i>
Blue Flag	<i>Iris versicolor</i>	Arrow-leaved Tearthumb	<i>Amaranthus cannabinus</i>
Rose Mallow	<i>Hibiscus moscheutos</i>	Water Hemp	<i>Ambrosia trifida</i>
Bur-marigold	<i>Bidens laevis</i>	Great Ragweed	<i>Helenium autumnale</i>
Jewelweed	<i>Impatiens capensis</i>	Sneezeweed	<i>Helenium autumnale</i>
Pickernelweed	<i>Pontederia cordata</i>	Arrow arum	<i>Peltandra virginica</i>
Rice Cutgrass	<i>Leersia oryzoides</i>	Spatardock	<i>Nuphar advena</i>
Woolgrass	<i>Scirpus cyperinus</i>	Broad-leaved Arrowhead	<i>Sagittaria latifolia</i>
Dotted Smartweed	<i>Polygonum punctatum</i>	Sweet Flag	<i>Acorus calamus</i>

There are many nontidal Palustrine plant communities represented in Dennis Township. They can be divided into Open Canopy and Forested communities. The nontidal, open canopy Palustrine communities include Coastal Interdunal Marsh, Coastal Plain Intermittent Ponds, and Pine Barren Shrub Swamp. The nontidal, forested Palustrine communities include Coastal Plain Atlantic White Cedar Swamp, Liquidambar/Acer Hardwood Swamp, Pine Barren Hardwood Swamp, Pitch Pine Lowland Forest, and Cape May Lowland Swamp. The Coastal Interdunal Marsh occupies lows areas between dunes along the coast. These communities are likely to be found along the Delaware Bayshore and on bay islands to the west of the Garden State Parkway. These communities can be dominated by robust emergents, shrubs or even shrub thickets. The following plant species are dominants and associates of this community.



Table 14: Plants of the Coastal Interdunal Marsh Community (after Breden 1989, p. 174)			
Common Name	Scientific Name	Common Name	Scientific Name
Trees		Trees	
Red Maple	<i>Acer rubrum</i>	Few others	
Red Cedar	<i>Juniperus virginiana</i>		
Shrubs		Shrubs	
Highbush Blueberry	<i>Vaccinium corymbosum</i>	Poison Ivy	<i>Toxicodendron radicans</i>
Rugose Rose	<i>Rosa rugosa</i>	Groundsel Bush	<i>Baccharis halimifolia</i>
Bayberry	<i>Morella pensylvanica</i>	Red Chokeberry	<i>Aronia arbutifolia</i>
Herbs		Herbs	
Common Reed	<i>Phragmites australis</i>	Bald Spike-Rush	<i>Eleocharis erythropoda</i>
Broad-leaved cattail	<i>Typha latifolia</i>	White Thoroughwort	<i>Eupatorium album</i>
Rose Mallow	<i>Hibiscus moscheutos</i>	Small Evening Primrose	<i>Oenothera perennis</i>
Marsh Fern	<i>Thelypteris palustris</i>	Nodding Beggar-ticks	<i>Osmunda cinnamomea</i>
Bushy Bluestem	<i>Andropogon glomeratus</i>	Arrow-leaved Tearthumb	<i>Osmunda regalis</i>
Fern Flat Sedge	<i>Cyperus filicinus</i>	Water Hemp	<i>Polygonum pensylvanicum</i>
Rusty Flat Sedge I	<i>Cyperus odoratus</i>	Great Ragweed	<i>Ambrosia trifida</i>

Coastal Plain Intermittent Pond communities are dominated by herbaceous vegetation and several ponds have been surveyed in New Jersey for endangered plants and animals. Dominants, associates and some rare plant species found in this community are listed in the following table.

Table 15: Plants of the Coastal Plain Intermittent Pond Community (after Breden 1989, p. 176)			
Common Name	Scientific Name	Common Name	Scientific Name
Herbs		Herbs	
Walter's Sedge	<i>Carex striata</i> var. <i>brevis</i>	Warty Panic Grass	<i>Panicum verrucosum</i>
Netted Nut Rush	<i>Scleria reticularis</i>	Common Panic Grass	<i>Panicum capillare</i>
Pink Tickseed	<i>Coreopsis rose</i>	Smooth Saw-Grass	<i>Cladium mariscoides</i>
New Jersey Muhly	<i>Muhlenbergia torreyana</i>	Small-fruited Spike-Rush	<i>Eleocharis microcarpa</i>
Rare Species		Rare Species	
Canby's Lobelia	<i>Lobelia canbyi</i>	Floating Heart	<i>Nymphoides cordata</i>
Boykin's Lobelia	<i>Lobelia boykinii</i>	Slender Arrowhead	<i>Sagittaria teres</i>
Wright's Panic Grass	<i>Dichanthelium wrightianum</i>	Short-beak Beak Sedge	<i>Rhynchospora nitens</i>
Mudbank Crown Grass	<i>Paspalum dissectum</i>	Narrow-leaved Primrose-Willow	<i>Ludwigia linearis</i>
Hirst's Panic Grass	<i>Dichanthelium hirstii</i>	Wrinkled Joint-Tail Grass	<i>Coelorachis rugosa</i>
Small's Yellow-Eyed Grass	<i>Xyris smalliana</i>	Horsetail Spike-Rush	<i>Eleocharis equisetoides</i>
Bryophytes		Bryophytes	
Large-leaved Peatmoss	<i>Sphagnum macrophyllum</i>	Lescur's Peatmoss	<i>Sphagnum lescurii</i>



The Pine Barren Shrub Swamp community is found in the Outer Coastal Plain and is dominated by Leatherleaf (*Chamaedaphne calyculata*) and associates of Highbush Blueberry (*Vaccinium corymbosum*) and/or Inkberry (*Ilex glabra*). Virginia Chainfern (*Woodwardia virginica*) and Sphagnum moss are common ground covers.

The Coastal Plain Atlantic White Cedar Swamp community forms along streams or in low areas of the Coastal Plain. Atlantic White Cedar (*Chamaecyparis thyoides*) dominates with over 50% of the tree canopy. The associate plant species are listed in the following table.

Table 16: Plants of the Coastal Plain Atlantic White Cedar Swamp Community (Breden 1989, p. 182)			
Common Name	Scientific Name	Common Name	Scientific Name
Dominant Tree		Trees	
Atlantic White Cedar	<i>Chamaecyparis thyoides</i>	Red Maple	<i>Acer rubrum</i>
		Blackgum	<i>Nyssa sylvatica</i>
		Sweetbay	<i>Magnolia virginiana</i>
Shrubs		Shrubs	
Highbush Blueberry	<i>Vaccinium corymbosum</i>	Sweet Pepperbush	<i>Clethra alnifolia</i>
Leucothoe	<i>Leucothoe racemosa</i>	Dangleberry	<i>Gaylussacia frondosa</i>
Inkberry	<i>Ilex glabra</i>	Swamp Azalea	<i>Rhododendron viscosum</i>
Herbs		Herbs	
Curly Grass Fern	<i>Schizaea pusilla</i>	Dragon's Mouth Orchid	<i>Arethusa bulbosa</i>
Rose Pogonia Orchid	<i>Pogonia ophioglossoides</i>		
Bryophytes		Bryophytes	
Sphagnum moss	<i>Sphagnum fallax</i>	Sphagnum moss	<i>Sphagnum flavicomans</i>
Sphagnum moss	<i>Sphagnum magellanicum</i>	Sphagnum moss	<i>Sphagnum pulchrum</i>
Sphagnum moss	<i>Sphagnum recurvum</i>		

The Liquidambar/Acer Hardwood Swamp community is dominated by Sweetgum (*Liquidambar styraciflua*) and Red Maple (*Acer rubrum*) and is found on the Inner Coastal Plain and along fringes of the Outer Coastal Plain of southern New Jersey. The plant species found in this community are listed in the following table.

Table 17: Plants of the Liquidambar/Acer Hardwood Swamp Community (Breden 1989, p. 185)			
Common Name	Scientific Name	Common Name	Scientific Name
Dominant Trees		Dominant Trees	
Sweetgum	<i>Sweetgum</i>	Red Maple	<i>Acer rubrum</i>
Trees		Trees	
Blackgum	<i>Nyssa sylvatica</i>	Sweetbay	<i>Magnolia virginiana</i>
Shrubs		Shrubs	
Arrowwood	<i>Viburnum dentatum</i>	Spicebush	<i>Lindera benzoin</i>
Highbush Blueberry	<i>Vaccinium corymbosum</i>	Sweet Pepperbush	<i>Clethra alnifolia</i>
Swamp Azalea	<i>Rhododendron viscosum</i>		

The Pine Barren Hardwood Swamp community is found on areas of the Outer Coastal Plain where the typical Pine Barrens soils dominate the area. This community is dominated by Red Maple (*Acer rubrum*). The other plant species found in this community can be found on the following table.



Table 18: Plants of the Pine Barren Hardwood Swamp Community (Breden 1989, p. 185)			
Common Name	Scientific Name	Common Name	Scientific Name
Dominant Trees		Dominant Trees	
Red Maple	<i>Acer rubrum</i>		
Trees		Trees	
Pin Oak	<i>Quercus palustris</i>	Willow Oak	<i>Quercus phellos</i>
Southern Red Oak	<i>Quercus falcata</i>	Tulip Tree	<i>Liriodendron tulipifera</i>
American Beech	<i>Fagus grandifolia</i>	Swamp White Oak	<i>Quercus bicolor</i>
Ash	<i>Fraxinus spp.</i>	Elm	<i>Ulmus spp</i>
Sassafras	<i>Sassafras albidum</i>	American Holly	<i>Ilex opaca</i>
Common Persimmon	<i>Diospyros virginiana</i>		
Shrubs		Shrubs	
Highbush Blueberry	<i>Vaccinium corymbosum</i>	Leatherleaf	<i>Chamaedaphne calyculata</i>
Sweet Pepperbush	<i>Clethra alnifolia</i>	Leucothoe	<i>Leucothoe racemosa</i>
Swamp Azalea	<i>Rhododendron viscosum</i>	Dangleberry	<i>Gaylussacia frondosa</i>

The Pitch Pine Lowland Forest is a Pitch Pine (*Pinus rigida*) dominated wetland forest with a well developed understory shrub layer. The ground water level lies just below the soil surface. The wet sandy soils in this community allows for its diverse suite of species. Openings in Pitch Pine Lowland Forest provide excellent habitat for herbaceous plants such as orchids, grasses, sedges and rushes as well as flowering forbs. A number of rare species can be found in this community. Plant species characteristic of this community can be found in the following table.

Table 19: Plants of the Pitch Pine Lowland Forest Community (Breden 1989, p. 185)			
Common Name	Scientific Name	Common Name	Scientific Name
Dominant Trees		Dominant Trees	
Pitch Pine	<i>Pinus rigida</i>		
Shrubs		Shrubs	
Sheep Laurel	<i>Kalmia angustifolia</i>	Bog Huckleberry	<i>Gaylussacia dumosa</i>
Sweet Pepperbush	<i>Clethra alnifolia</i>	Staggerbush	<i>Lyonia mariana</i>
Highbush Blueberry	<i>Vaccinium corymbosum</i>	Leucothoe	<i>Leucothoe racemosa</i>
Swamp Azalea	<i>Rhododendron viscosum</i>	Dangleberry	<i>Gaylussacia frondosa</i>
Typical Groundcover Species		Typical Groundcover Species	
Sand Myrtle	<i>Leiophyllum buxifolium</i>	Pyxie Moss	<i>Pyxidanthra barbulata</i>
Turkey Beard	<i>Xerophyllum asphodeloides</i>	Orange Milkwort	<i>Polygala lutea</i>
Pine Barren Reed Grass	<i>Calamovilfa brevipilis</i>		
Wet Swale Species		Wet Swale Species	
Walter's Sedge	<i>Carex striata</i> var. <i>brevis</i>	Slender Iris	<i>Iris prismatica</i>
Redroot	<i>Lachnanthes tinctoria</i>	Red-top Panic Grass	<i>Panicum rigidulum</i>
Virginia Chainfern	<i>Woodwardia virginiana</i>	Hidden-fruit Bladderwort	<i>Utricularia geminiscapa</i>
Engelmann's Arrowhead	<i>Sagittaria engelmanniana</i>	Striped Bladderwort	<i>Utricularia striata</i>
Atlantic Manna Grass	<i>Glyceria obtusa</i>		
Rare species		Rare species	
Canby's Lobelia	<i>Lobelia canbyi</i>	Bunched Beak-Sedge	<i>Rhynchospora cephalantha</i>
Livid Sedge	<i>Carex livida</i>	New Jersey Muhly	<i>Muhlenbergia torreyana</i>
Long's Bulrush	<i>Scirpus longii</i>		

The Cape May Lowland Swamp community typically occurs along the headwaters of streams where they are likely to be fed by groundwater discharge. Plant species found in this community are listed in the following table.

Table 20: Plants of the Cape May Lowland Swamp Community (Breden 1989, p. 187)			
Common Name	Scientific Name	Common Name	Scientific Name
Canopy Trees		Canopy Trees	
Red Maple	<i>Acer rubrum</i>	Sweetgum	<i>Liquidambar styraciflua</i>
Pumpkin Ash	<i>Fraxinus profunda</i>	Blackgum	<i>Nyssa sylvatica</i>
Understory Trees		Understory Trees	
Sweetbay	<i>Magnolia virginiana</i>	American Holly	<i>Ilex opaca</i>
Shrubs		Shrubs	
Sweet Pepperbush	<i>Clethra alnifolia</i>	Spicebush	<i>Lindera benzoin</i>
Virginia Sweetspire	<i>Itea virginica</i>	Swamp Azalea	<i>Rhododendron viscosum</i>
Southern species		Southern species	
Swamp Chestnut Oak	<i>Quercus michauxii</i>	Water Oak	<i>Quercus nigra</i>
Willow Oak	<i>Quercus phellos</i>	Swamp Cottonwood	<i>Populus heterophylla</i>
Rare species		Rare species	
Glade Spurge	<i>Euphorbia purpurea</i>	Greater Marsh St. Johnswort	<i>Triadenum walteri</i>
Greater Marsh St. Johnswort	<i>Triadenum walteri</i>	American Featherfoil	<i>Hottonia inflata</i>
Pumpkin Ash	<i>Quercus profunda</i>	Southern Twayblade	<i>Listera australis</i>
Swamp Cottonwood	<i>Populus heterophylla</i>	Swamp Chestnut Oak	<i>Quercus michauxii</i>

4.1.3 Terrestrial Plant Communities

Terrestrial plant communities include habitats that are often termed “uplands.” These upland communities have non-hydrophytic vegetation (vegetation not characteristic of wetlands), non-hydric soils (soils not characteristic of wetlands) and negative wetland hydrology (hydrology not characteristic of wetlands). Similar to the Palustrine System, the Terrestrial System is divided up into Open Canopy communities and into Forested communities. The typical open canopy, upland plant communities are likely to be earlier successional stages of forest communities or areas where disturbance is maintained, such as farm fields.



The forested, upland plant communities found in Dennis Township include Dry Oak-Pine Forest, Dry Pine-Oak Forest, and Mesic Southern Coastal Plain Mixed Oak Forest.

The Dry Oak-Pine Forest community is the oak dominated forest of the outer coastal plain. The dominant trees usually cover 40% or more of the ground. Pitch Pine is present in nearly all stands, although, Short-leaf Pine outnumbers Pitch Pine in some stands. At least three subtypes of Dry Oak-Pine Forests have been described. They are the Mixed Oak-Pine Forest, the Oak Hilltop Forest and the Scarlet Oak-Short-leaf Pine Forest.

In the Mixed Oak-Pine Forest, either Black Oak or Southern Red Oak dominates depending on where it is located on the Coastal Plain in New Jersey. Chestnut Oak, Scarlet Oak and White Oak are also present, but vary in their abundance. Post Oak is present also and is usually more abundant than Blackjack Oak. Pines form about 50% of the basal area in these stands.

The Oak Hilltop Forests dominated by Chestnut Oak and Black Oak form about 90% of the canopy. They occur on many small hilltops and a few larger areas in the Pine Barrens. Woody growth covers about 25% of the ground and is a mix of Dangleberry, Scrub Oak, Black Huckleberry and Early Lowbush Blueberry.

The Scarlet Oak-Shortleaf Pine Forests occur on the eastern half of the Pine Barrens and north of the Mullica River, therefore this forest type is not likely present in Cape May County.

Table 21: Plants of the Dry Oak-Pine Forest Community (after Collins and Anderson 1994, p. 180-180, Whittaker 1998, p. 318-319, and Breden, 1989, p. 195)

Common Name	Scientific Name	Common Name	Scientific Name
Trees		Trees	
White Oak	Quercus alba	Black Oak	Quercus velutina
Chestnut Oak	Quercus prinus	Post Oak	Quercus stellata
Shrubs and Vines		Shrubs and Vines	
Scrub Oak	Quercus illicifolia	Dwarf Chestnut Oak	Quercus prinoides
Early Lowbush Blueberry	Vaccinium pallidum	Black Huckleberry	Gaylussacia baccata
Dangleberry	Gaylussacia frondosa	Bayberry	Morella pensylvanica
Late Lowbush Blueberry	Vaccinium angustifolium	Sheep Laurel	Kalmia angustifolia
Common Name	Scientific Name	Common Name	Scientific Name
Herbs		Herbs	
Bracken fern	Pteridium aquilinum	Rattlesnake Weed	Hieracium venosum
Pennsylvania Sedge	Carex pensylvanica	Cow-wheat	Melampyrum lineare
Little Bluestem	Schizachyrum scoparium	Goat's Rue	Tephrosia virginica
Wild Indigo	Baptisia tinctoria	Indian Pipe	Monotropa uniflora



The Dry Pine-Oak Forest community is dominated in most stands by Pitch Pine. Black Oak, Chestnut Oak, Scarlet Oak, Post Oak and White Oak cover no more than 25% of the ground, while Pitch Pine contributes to 50% or more of the ground. The shrub understory is either dominated by Black Huckleberry and Early Lowbush Blueberry or by Scrub Oak emerging above the heaths. Three subtypes of Dry Pine-Oak Forest communities have been described.

Table 22: Plants of the Pine-Oak Forest Community (after Breden 1989 p.195, Collins and Anderson 1994, p. 174-175, Olsson 1998 p.250, Whittaker 1998, p. 319)

Common Name	Scientific Name	Common Name	Scientific Name
Dominant Trees		Other Trees	
Pitch Pine	Pinus rigida	Shortleaf Pine	Pinus echinata
Trees		Black Oak	Quercus velutina
Chestnut Oak	Quercus prinus	Post Oak	Quercus stellata
White Oak	Quercus alba	Scrub Oak	Quercus illicifolia
Scarlet Oak	Quercus coccinea	Sassafras	Sassafras albidum
Shrubs and Vines		Shrubs and Vines	
Scrub Oak	Quercus illicifolia	Eastern Teaberry	Gaultheria procumbens
Blackjack Oak	Quercus marilandica	Staggerbush	Lyonia mariana
Dangleberry	Gaylussacia frondosa	Black Huckleberry	Gaylussacia baccata
Early Lowbush Blueberry	Vaccinium pallidum	Glaucous Greenbrier	Smilax glauca
Sweet Fern	Comptonia peregrina	Common Greenbrier	Smilax rotundifolia
Late Lowbush Blueberry	Vaccinium angustifolia	Wild Indigo	Baptisia tinctoria
Heath	Arctostaphylos uva-ursi	Trailing arbutus	Epigaea repens
Herbs		Herbs	
Golden Heather	Hudsonia ericoides	Little Bluestem	Schizachyrum scoparium
Bracken fern	Pteridium aquilinum	Rattlesnake Weed	Hieracium venosum
Pennsylvania Sedge	Carex pensylvanica	Frostweed	Helianthemum canadense
Wild Indigo	Baptisia tinctoria	Goat's Rue	Tephrosia virginica
Sweet Goldenrod	Solidago odora	Ipecac Spurge	Euphorbia ipecacuanhae
Pine Barren's Sandwort	Arenaria caroliniana	Stiff Aster	Aster linariifolius



Of the Mesic Coastal Plain Mixed Oak Forest community, there are three subtypes and it is one of these subtypes: the Southern Coastal Plain Mixed Oak Forest that is found in Cape May County. It is dominated by Southern Red

Oak, Willow Oak, Sweetgum, Red Maple, American Beech, American Holly and Flowering Dogwood. The plant species found in this subtype are listed in the following table.

Table 23: Plants of the Southern Coastal Plain Mixed Oak Forest Community (Breden 1989 p. 198)			
Common Name	Scientific Name	Common Name	Scientific Name
Dominant Trees		Dominant Trees	
Willow Oak	<i>Quercus phellos</i>	Southern Red Oak	<i>Quercus falcata</i>
Sweetgum	<i>Liquidambar styraciflua</i>	Red Maple	<i>Acer rubrum</i>
American Holly	<i>Ilex opaca</i>	American Beech	<i>Fagus grandifolia</i>
Flowering Dogwood	<i>Cornus florida</i>		
Trees		Other Trees	
Swamp Chestnut Oak	<i>Quercus michauxii</i>	Water Oak	<i>Quercus nigra</i>
Shrubs and Vines		Shrubs and Vines	
Arrowwood	<i>Viburnum dentatum</i>	Black Huckleberry	<i>Gaylussacia baccata</i>
Glaucous Greenbrier	<i>Smilax glauca</i>	Bayberry	<i>Morella pensylvanica</i>
Highbush Blueberry	<i>Vaccinium corymbosum</i>	Sweet Pepperbush	<i>Clethra alnifolia</i>
Virginia Creeper	<i>Parthenocissus quinquefolia</i>	Poison Ivy	<i>Toxicodendron radicans</i>
Swamp Azalea	<i>Rhododendron viscosum</i>		
Herbs		Herbs	
Bracken fern	<i>Pteridium aquilinum</i>	Rattlesnake Weed	<i>Hieracium venosum</i>
Pennsylvania Sedge	<i>Carex pensylvanica</i>	Cow-wheat	<i>Melampyrum lineare</i>
Spotted Wintergreen	<i>Chimaphila maculate</i>	Stemless Lady's Slipper	<i>Cypripedium acaule</i>
Indian Pipe	<i>Montropa uniflora</i>		

4.1.4 RARE VEGETATION COMMUNITIES

The State's Natural Heritage Program maintains a database of rare plant communities and rare plant species. According to this database, nine types of rare plant communities occur in Dennis Township. These are:

- Walter's Sedge Coastal Plain Intermittent Pond
- Coastal Plain Intermittent Pond and
- Spikerush-Yelloweyed Grass Coastal Plain Intermittent Pond

Three variations of the Coastal Plain Intermittent Pond community are represented in Dennis Township. This community is described under the Palustrine system of plant communities.

4.1.5 RARE PLANT SPECIES

The NJDEP's Natural Heritage Program contains a number of species of special concern which are recorded from Dennis Township. These species are assigned several classifications. These are:



- LP – species listed by the New Jersey Pinelands Commission indicating that these taxa are endangered or threatened within their legal jurisdiction and are included in the New Jersey Pinelands Comprehensive Management Plan
- E – endangered, native New Jersey plant species whose survival in the State or nation is in jeopardy
- LT – species listed by the Federal government as threatened
- LE – species listed by the Federal government as endangered
- SH – species element rank by the NJ NHP as elements of historical occurrence in NJ
- S1 – species element rank by the NJ NHP as critically imperiled in New Jersey because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres)
- S2 – species element rank by the NJ NHP as imperiled in New Jersey because of rarity (6 to 20 occurrences).
- S3 - species element rank by the NJ NHP as rare in the state with 21 to 50 occurrences. Includes elements which are widely distributed in the state, but with small populations/acreage or elements with restricted distribution, but locally abundant. Not yet imperiled in the state, but may soon be if current trends continue (NJDEP, NHP, 2007).

Table 24: Rare Plant Species of Dennis Township (Lord 2007)

Scientific name	Common Name	Status/Rank	Scientific name	Common Name	Status/Rank
Desmodium strictum	Pineland Tick-Trefoil	LP S2	Panicum hemitomon	Maiden-cane	LP S2
Eleocharis quadrangulata	Angled Spike-rush	S2	Panicum wrightianum (2)	Wright's Panic Grass	S2
Eleocharis tortilis	Twisted Spike-rush	LP S1 E	Paspalum dissectum	Mudbank Crown Grass	S2
Eupatorium resinosum	Pine Barren Boneset	LP S2 E	Pinus taeda	Loblolly Pine	S2
Gentiana autumnalis	Pine Barren Gentian	LP S3	Plantago pusilla	Dwarf Plantain	LP SH E
Helonias bullata (2)	Swamp-pink	LP S3 E LT	Polygonum densiflorum	Dense-flower Knotweed	LP S1 E
Hottonia nadrom (2)	Featherfoil	LP S1 E	Potamogeton oakesianus	Oakes' Pondweed	S2
Lemna puerpusilla	Minute Duckweed	S2	Rhynchospora filifolia	Thread-leaf Beaked-rush	LP S1 E
Listera australis (2)	Southern Twayblade	LP S2	Rhynchospora inundata (2)	Slender Horned-rush	LP S2
Lobelia boykinii	Boykin's Lobelia	LP S1 E	Rhynchospora scirpoides (2)	Long-beak Bald-rush	S2
Lobelia canbyi	Canby's Lobelia	LP S3	Sagittaria australis	Southern Arrowhead	LP S1 E
Muhlenbergia torreyana (2)	Pine Barren Smoke Grass	LP S3	Sclerolepis uniflora (2)	Bog Buttons	LP S2
Nuphar microphyllum (2)	Small Yellow Pond-lily	LP SH E	Triadenum walteri	Walter's St. John's-wort	LP S1 E
Panicum aciculare	Bristling Panic Grass	LP SH E	Utricularia resupinata (2)	Reversed Bladderwort	LP S1 E

4.2 ZOOLOGICAL RESOURCES

As with plant resources, Dennis Township can support a great diversity of wildlife, including many threatened and endangered species, because of the diversity of habitats within the Township. Many species are present at the northerly limits of their range. Since Dennis Township encompasses both coastal habitats, including tidal wetlands, and interior habitats, specialized coastal species, as well as common and widespread species, have the potential to be present.

4.2.1 AQUATIC ANIMALS

The surface waters of Dennis Township range from salty ocean waters to brackish rivers and creeks to freshwater rivers and streams and ponds. The vertebrate aquatic biota, or animals with backbones, are the fishes. The State of New Jersey supports the populations of 85 freshwater fish. The waters of the Township are not known to support trout populations, since they require cooler waters than those present in Dennis Township. However, Brook Trout are known to occur in South Jersey streams, since they are tolerant of relatively low pH. Anadromous fish, such as American eel, Herring or Shad migrate upstream and breed in the freshwater portions of rivers discharging to saltwater bays and the ocean (NJDEP, DFW, Bureau of Freshwater Fisheries 2000).

Water quality is excellent in Pinelands stream waters. Pinelands waters are low in dissolved solids and are quite acidic, with pH averaging 4.4. While these high-quality acid waters support indigenous fish and amphibian communities that are tolerant of the acidity of the waters, they are inhospitable to many non-indigenous plant and animal species (USFWS, SNE-NYB Coastal Program 1997). On the periphery of the Pine Barrens and in areas where water characteristics are altered by agriculture or development, higher levels of pH allow a greater number of fish species to survive (Hastings 1998). Freshwater and nadromous fish are listed in the table below. Saltwater fish also occur in the waters of Delaware Bay and seasonally in the extensive estuarine waters in the Township. Freshwater fish species found in New Jersey streams, ponds and lakes are listed in the table below.

Table 25: New Jersey Freshwater Fishes (NJDEP, DFW 2005)

Common Name	Scientific Name	HP	Common Name	Scientific Name	HP
American Brook Lamprey	<i>Lampetra appendix</i>	N	Sea Lamprey	<i>Petromyzon marinus</i>	N
Atlantic Sturgeon	<i>Acipenser oxyrinchus</i>	N	Blueback Herring	<i>Alosa aestivalis</i>	N
Shortnose Sturgeon	<i>Acipenser brevirostrum</i>	N	Hickory Shad	<i>Alosa mediocris</i>	N
Brook Trout	<i>Salvelinus fontinalis</i>	N	Alewife	<i>Alosa pseudoharengus</i>	N
Gizzard Shad	<i>Dorosoma cepedianum</i>	N	American Shad	<i>Alosa sapidissima</i>	N
Rainbow Smelt	<i>Osmerus mordax</i>	N	Bowfin	<i>Amia calva</i>	I
Redfin Pickerel	<i>Esox americanus</i>	N	Eastern Mudminnow	<i>Umbra pygmaea</i>	N
Chain Pickerel	<i>Esox niger</i>	N	Northern Pike	<i>Esox lucius</i>	I
Goldfish	<i>Carassius auratus</i>	E	Muskellunge	<i>Esox masquinon</i>	I
Quillback	<i>Carpoides cyprinus</i>	N	Common Carp	<i>Cyprinus carpio</i>	E
Eastern Silvery Minnow	<i>Hybognathus regius</i>	N	Cutlips Minnow	<i>Exoglossum maxillingua</i>	N
Comely Shiner	<i>Notropis amoenus</i>	N	Golden Shiner	<i>Notemigonus crysoleucas</i>	N
Bridle Shiner	<i>Notropis bifrenatus</i>	N	Satinfin Shiner	<i>Cyprinella analostana</i>	N
Common Shiner	<i>Luxilus cornutus</i>	N	Ironcolor Shiner	<i>Notropis chalybaeus</i>	N
Swallowtail Shiner	<i>Notropis procne</i>	N	Spottail Shiner	<i>Notropis husdonius</i>	N
Fathead Minnow	<i>Pimephales promelas</i>	I	Spotfin Shiner	<i>Cyprinella spiloptera</i>	N
Blacknose Dace	<i>Rhinichthys atratulus</i>	N	Bluntnose Minnow	<i>Pimephales notatus</i>	I
Creek Chub	<i>Semotilus atromaculatus</i>	N	Longnose Dace	<i>Rhinichthys cataractae</i>	N
Grass Carp	<i>Ctenopharyngodon idella</i>	E	Fallfish	<i>Semotilus corporalis</i>	N
Creek Chubsucker	<i>Erimyzon oblongus</i>	N	White Sucker	<i>Catostomus commersoni</i>	N
White Catfish	<i>Ameiurus catus</i>	N	Northern Hog Sucker	<i>Hypentelium nigricans</i>	N
Yellow Bullhead	<i>Ameiurus natalis</i>	N	Black Bullhead	<i>Ameiurus melas</i>	I
Channel Catfish	<i>Ictalurus punctatus</i>	I	Brown Bullhead	<i>Ameiurus nebulosus</i>	N
Margined Madtom	<i>Noturus insignis</i>	N	Tadpole Madtom	<i>Noturus gyrinus</i>	N
Banded Killifish	<i>Fundulus diaphanus</i>	N	Pirate Perch	<i>Aphredoderus sayanus</i>	N
Eastern Mosquitofish	<i>Gambusia holbrooki</i>	N	Mummichog	<i>Fundulus heteroclitus</i>	N
Fourspine Stickleback	<i>Apletes quadracus</i>	N	Mosquitofish	<i>Gambusia affinis</i>	I
Ninespine Stickleback	<i>Pungitius pungitius</i>	N	Threespine Stickleback	<i>Gasterosteus aculeatus</i>	N
Striped Bass	<i>Morone saxatilis</i>	N	White Perch	<i>Morone americana</i>	N
Rock Bass	<i>Ambloplites rupestris</i>	I	Mud Sunfish	<i>Acantharchus pomotis</i>	N
Bluespotted Sunfish	<i>Eieacanthus gloriosus</i>	N	Blackbanded Sunfish	<i>Eieacanthus chaetodon</i>	N

Green Sunfish	<i>Lepomis cyanellus</i>	I	Banded Sunfish	<i>Eieacanthus obesus</i>	N
Bluegill	<i>Lepomis macrochirus</i>	I	Pumpkinseed	<i>Lepomis gibbosus</i>	N
Warmouth	<i>Lepomis gulosus</i>	I	Redbreasted Sunfish	<i>Lepomis auritus</i>	N
Largemouth Bass	<i>Micropterus salmoides</i>	I	Smallmouth Bass	<i>Micropterus dolomieu</i>	I
Black Crappie	<i>Pomoxis nigromaculatus</i>	I	White Crappie	<i>Pomoxis alularis</i>	I
Tessellated Darter	<i>Etheostoma olmstedii</i>	N	Swamp Darter	<i>Etheostoma fusiforme</i>	N
Shield Darter	<i>Percina peltata</i>	N	Yellow Perch	<i>Perca flavescens</i>	N
Slimy Sculpin	<i>Cottus cognatus</i>	N	Walleye	<i>Sander vitreus</i>	I
Hogchoker	<i>Trinectes maculatus</i>	N	Oriental Weatherfish	<i>Misgurnus anguillicaudatus</i>	E
HP- Historical Presence E – Exotic N – Native I – Introduced					

The Delaware Bayshore is one of the most important breeding sites for Horseshoe Crabs (*Limulus polyphemus*). The eggs of the crabs are the nutrient rich food that powers the last leg of the journey to the Arctic for several migratory waterfowl. The bays, estuaries and marine waters of New Jersey can be home to 28 marine mammals and 336 marine finfish at some point during the year. The marshes and tidal creeks of the Cape May peninsula are important nursery areas for Summer flounder, Bluefish, American eel and blue crab, among others. Ken Able, of Rutgers University, has compiled extensive lists of marine fish which can be found in New Jersey waters. The historical status of each species in terms of abundance and season of occurrence is also indicated (NJDEP, DFW 2005).

Table 26: New Jersey Saltwater Fishes (NJDEP, DFW 2005)

Common Name	Scientific Name	Status	Common Name	Scientific Name	Status
Atlantic Hagfish	<i>Myxine glutinosa</i>	R	Clearnose Skate	<i>Raja eglanteria</i>	A
Sea Lamprey	<i>Petromyzon marinus</i>	C	Little Skate	<i>Raja erinacea</i>	A
Sand Tiger	<i>Odontaspis Taurus</i>	A	Rosette Skate	<i>Raja garmani</i>	C
Bigeye Thresher Shark	<i>Alopias superciliosus</i>	O	Barndoor Skate	<i>Raja laevis</i>	C
Thresher Shark	<i>Alopias vulpinus</i>	R	Winter Skate	<i>Raja ocellata</i>	A
Basking Shark	<i>Cetorhinus maximus</i>	R	Thorny Skate	<i>Raja radiata</i>	O
White Shark	<i>Carcharodon carcharias</i>	R	Southern Stingray	<i>Dasyatis americana</i>	R
Shortfin Mako	<i>Isurus oxyrinchus</i>	R	Roughtail Stingray	<i>Dasyatis centroura</i>	C
Porbeagle	<i>Lamna nasus</i>	R	Atlantic Stingray	<i>Dasyatis sabina</i>	R
False Cat Shark	<i>Pseudotriakis microdon</i>	R	Bluntnose Stingray	<i>Dasyatis say</i>	O
Chain Dogfish	<i>Scyllorhinus rotifer</i>	A	Spiny Butterfly Ray	<i>Gymnura altavela</i>	R
Silky Shark	<i>Carcharhinus falciformis</i>	R	Smooth Butterfly Ray	<i>Gymnura micrura</i>	
Bull Shark	<i>Carcharhinus leucas</i>	R	Spotted Eagle Ray	<i>Aetobatus narinari</i>	R
Blacktip Shark	<i>Carcharhinus limbatus</i>	R	Bullnose Ray	<i>Myliobatis freminvillei</i>	O
Dusky Shark	<i>Carcharhinus obscurus</i>	CS	Cownose Ray	<i>Rhinoptera bonasus</i>	OS
Sandbar Shark	<i>Carcharhinus plumbeus</i>	AS	Manta	<i>Manta birostris</i>	R
Tiger Shark	<i>Galeocerdo cuvier</i>	R	Devil Ray	<i>Mobula mobular</i>	R
Smooth Dogfish	<i>Mustelus canis</i>	A	Bonnethead	<i>Sphyrna tiburo</i>	R
Lemon Shark	<i>Negaprion brevirostris</i>	R	Smooth Hammerhead	<i>Sphyrna zygaena</i>	R
Blue Shark	<i>Prionace glauca</i>	C	Spiny Dogfish	<i>Squalus acanthias</i>	ASF
Atlantic Sharpnose Shark	<i>Rhizoprionodon terraenovae</i>	R	Atlantic Angel Shark	<i>Squatina dumeril</i>	CSF
Scalloped Hammerhead	<i>Sphyrna lewini</i>	R	Smalltooth Sawfish	<i>Pristis pectinata</i>	R
Shortnose Sturgeon	<i>Acipenser brevirostrum</i>	C	Atlantic Torpedo	<i>Torpedo nobiliana</i>	R
Atlantic Sturgeon	<i>Acipenser oxyrinchus</i>	R	Gafftopsail Catfish	<i>Bagre marinus</i>	R
Ladyfish	<i>Elops saurus</i>	R	Rainbow Smelt	<i>Osmerus mordax</i>	T
Tarpon	<i>Megalops atlanticus</i>	R	Rainbow Trout	<i>Oncorhynchus mykiss</i>	R
Bonefish	<i>Albula vulpes</i>	R	Atlantic Salmon	<i>Salmo salar</i>	R
American Eel	<i>Anguilla rostrata</i>	A	Brown Trout	<i>Salmo trutta</i>	R
Green Moray	<i>Gymnothorax funebris</i>	R	Longtooth Anglemouth	<i>Gonostoma elongatum</i>	R
Spotted Moray	<i>Gymnothorax moringa</i>	R	Mullers Pearlsides	<i>Maurolicus muelleri</i>	R
Speckled Worm Eel	<i>Myrophis punctatus</i>	R	Oceanic Lightfish	<i>Vinciguerria nimbaria</i>	R
Margined Snake Eel	<i>Ophichthus cruentifer</i>	O	Shortnose Greeneye	<i>Chlorophthalmus agassizi</i>	C
Palespotted Eel	<i>Ophichthus ocellatus</i>	R	Inshore Lizardfish	<i>Synodus foetens</i>	O

Conger Eel	<i>Conger oceanicus</i>	C	Snakefish	<i>Trachinocephalus myops</i>	R
Blueback Herring	<i>Alosa aestivalis</i>	A	White Barracudina	<i>Notolepis rissoi</i>	R
Hickory Shad	<i>Alosa mediocris</i>	C	Duckbill Barracudina	<i>Paralepis atlantica</i>	R
Alewife	<i>Alosa pseudoharengus</i>	A	Sharpchin Barracudina	<i>Paralepis coregonoides</i>	R
American Shad	<i>Alosa sapidissima</i>	T	Glacier Lanternfish	<i>Benthoosema glaciale</i>	R
Atlantic Menhaden	<i>Brevoortia tyrannus</i>	A	Smallfin Lanternfish	<i>Benthoosema suborbitale</i>	R
Atlantic Herring	<i>Clupea harengus</i>	CW	Horned Lanternfish	<i>Ceratoscopelus maderensis</i>	C
Gizzard Shad	<i>Dorosoma cepedianum</i>	O	Warming's Lanternfish	<i>Ceratoscopelus warmingi</i>	R
Round Herring	<i>Etrumeus teres</i>	O	Longfin Lanternfish	<i>Diogenichthys atlanticus</i>	R
Scaled Sardine	<i>Harengula jaguana</i>	R	Benoit's Lanternfish	<i>Hygophum benoiti</i>	R
Atlantic Thread Herring	<i>Opisthonema oglinum</i>	O	Slender Lanternfish	<i>Hygophum reinhardtii</i>	R
Spanish Sardine	<i>Sardinella aurita</i>	O	Winged Lanternfish	<i>Lampanyctus alatus</i>	R
Striped Anchovy	<i>Anchoa hepsetus</i>	C	Largescale Lanternfish	<i>Symbolophorus veranyi</i>	R
Bay Anchovy	<i>Anchoa mitchilli</i>	A	Antenna Codlet	<i>Bregmaceros atlanticus</i>	R
Silver Anchovy	<i>Engraulis eurystole</i>	O	Cusk	<i>Brosme brosme</i>	R
Fourbeard Rockling	<i>Enchelyopus cimbrius</i>	R?	Gag	<i>Mycteroperca microlepis</i>	R
Atlantic Cod	<i>Gadus morhua</i>	CWS	Glasseye snapper	<i>Priacanthus cruentatus</i>	R
Haddock	<i>Melanogrammus aeglefinus</i>	OWS	Blackline Tilefish	<i>Caulolatilus cyanops</i>	R
Offshore Hake	<i>Merluccius albidus</i>	C	Tilefish	<i>Lopholatilus chamaeleonticeps</i>	A
Silver Hake	<i>Merluccius bilinearis</i>	A	Bluefish	<i>Pomatomus saltatrix</i>	A
Atlantic Tomcod	<i>Microgadus tomcod</i>	C	Cobia	<i>Rachycentron canadum</i>	R

Table 26: New Jersey Saltwater Fishes (NJDEP, DFW 2005) (continued)

Common Name	Scientific Name	Status	Common Name	Scientific Name	Status
Pollock	<i>Pollachius virens</i>	C	Sharksucker	<i>Echeneis naucrates</i>	R
Red Hake	<i>Urophycis chuss</i>	A	Whitefin Sharksucker	<i>Echeneis neucratoides</i>	R
Carolina Hake	<i>Urophycis earlii</i>	R	Marlinsucker	<i>Remora osteochir</i>	R
Spotted Hake	<i>Urophycis regia</i>	C	Remora	<i>Remora remora</i>	R
White Hake	<i>Urophycis tenuis</i>	O	White Suckerfish	<i>Remorina albescens</i>	R
Fawn Cusk-eel	<i>Lepophidium profundorum</i>	A	African Pompano	<i>Alectis ciliaris</i>	R
Striped Cusk-eel	<i>Ophidion marginatum</i>	C	Yellow Jack	<i>Caranx bartholomaei</i>	R
Crested Cusk-eel	<i>Ophidion welschi</i>	R	Blue Runner	<i>Caranx crysos</i>	OSF
Oyster Toadfish	<i>Opsanus tau</i>	A	Crevalle Jack	<i>Caranx hippos</i>	CSF
Goosefish	<i>Lophius americanus</i>	C	Horse-eye Jack	<i>Caranx latus</i>	R
Striated Frogfish	<i>Antennarius striatus</i>	R	Bar Jack	<i>Caranx ruber</i>	O
Sargassumfish	<i>Histrio histrio</i>	R	Atlantic Bumper	<i>Chloroscombrus chrysurus</i>	R
Redeye Gaper	<i>Chaunax stigmaeus</i>	R	Round Scad	<i>Decapterus punctatus</i>	R
Clearwing Flyingfish	<i>Cypselurus comatus</i>	R	Pilotfish	<i>Naucrates ductor</i>	R
Bandwing Flyingfish	<i>Cypselurus exciliens</i>	R	Leatherjack	<i>Oligoplites saurus</i>	O
Spotfin Flyingfish	<i>Cypselurus furcatus</i>	R	Bigeye Scad	<i>Selar crumenophthalmus</i>	R
Atlantic Flyingfish	<i>Cypselurus melanurus</i>	R	Atlantic Moonfish	<i>Selene setapinnis</i>	OS
Flying Halfbeak	<i>Euleptorhampus velox</i>	R	Lookdown	<i>Selene vomer</i>	OS
Ballyhoo	<i>Hemiramphus brasiliensis</i>	R	Greater Amberjack	<i>Seriola dumerili</i>	R
Silverstripe Halfbeak	<i>Hyporhamphus unifasciatus</i>	O	Almaco Jack	<i>Seriola rivoliana</i>	R
Flat Needlefish	<i>Ablennes hians</i>	R	Banded Rudderfish	<i>Seriola zonata</i>	OS
Atlantic Needlefish	<i>Strongylura marina</i>	CS	Florida Pompano	<i>Trachinotus carolinus</i>	CS
Agujon	<i>Tylosurus acus</i>	R	Permit	<i>Trachinotus falcatus</i>	CS
Atlantic Saury	<i>Scomberesox saurus</i>	R	Palometa	<i>Trachinotus goodei</i>	CS
Sheepshead Minnow	<i>Cyprinodon variegatus</i>	A	Rough Scad	<i>Trachurus lathami</i>	R
Marsh Killifish	<i>Fundulus confluentus</i>		Cottonmouth Jack	<i>Uraspis secunda</i>	R
Banded Killifish	<i>Fundulus diaphanous</i>	A	Dolphin	<i>Coryphaena hippurus</i>	CS
Mummichog	<i>Fundulus heteroclitus</i>	A	Atlantic Pomfret	<i>Brama brama</i>	R
Spotfin Killifish	<i>Fundulus luciae</i>	C	Schoolmaster	<i>Lutjanus apodus</i>	R
Striped Killifish	<i>Fundulus majalis</i>	A	Red Snapper	<i>Lutjanus campechanus</i>	R
Rainwater Killifish	<i>Lucania parva</i>	C	Cubera Snapper	<i>Lutjanus cyanopterus</i>	R
Eastern Mosquitofish	<i>Gambusia holbrocki</i>	C	Gray Snapper	<i>Lutjanus griseus</i>	OS
Rough Silverside	<i>Membras martinica</i>	C	Yellowtail Snapper	<i>Ocyurus chrysurus</i>	R

Inland Silverside	<i>Menidia beryllina</i>	A	Vermillion Snapper	<i>Rhomboplites aurorubens</i>	R
Atlantic Silverside	<i>Menidia menidia</i>	A	Tripletail	<i>Lobotes surinamensis</i>	
Deep Water Squirrelfish	<i>Holocentrus bullisi</i>	R	Irish Pompano	<i>Diapterus auratus</i>	R
Dusky Squirrelfish	<i>Holocentrus vexillarius</i>	R	Spotfin Mojarra	<i>Eucinostomus argenteus</i>	R
Buckler Dory	<i>Zenopsis cochlifera</i>	C	Silver Jenny	<i>Eucinostomus gula</i>	R
Fourspine Stickleback	<i>Apeltes quadracus</i>	C	Tidewater Mojarra	<i>Eucinostomus harengulus</i>	R
Threespine Stickleback	<i>Gasterosteus aculeatus</i>	C	Flagfin Mojarra	<i>Eucinostomus melanopterus</i>	R
Ninespine Stickleback	<i>Pungitius pungitius</i>	R	Pigfish	<i>Orthopristis chrysoptera</i>	R
Bluespotted Cornetfish	<i>Fistularia tabacaria</i>	R	Sheepshead	<i>Archosargus probatocephalus</i>	R
Longspine Snipefish	<i>Macrorhamphosus scolopax</i>	R	Sea Bream	<i>Archosargus rhomboidalis</i>	R
Lined Seahorse	<i>Hippocampus erectus</i>	CSF	Spottail Pinfish	<i>Diplodus holbrooki</i>	R
Opossum Pipefish	<i>Micropis brachyuros</i>	R	Pinfish	<i>Lagodon rhomboides</i>	R
Northern Pipefish	<i>Syngnathus fuscus</i>	A	Scup	<i>Stenotomus chrysops</i>	A
Chain Pipefish	<i>Syngnathus louisianae</i>	R	Silver Perch	<i>Bairdiella chrysoura</i>	C
Sargassum Pipefish	<i>Syngnathus pelagicus</i>	R	Spotted Seatrout	<i>Cynoscion nebulosus</i>	R
Flying Gurnard	<i>Dactylopterus volitans</i>	R	Weakfish	<i>Cynoscion regalis</i>	A
Blackbelly Rosefish	<i>Helicolenus dactylopterus</i>	A	Banded Drum	<i>Larimus fasciatus</i>	R
Spinycheek Scorpionfish	<i>Neomerinthe hemingwayi</i>	R	Spot	<i>Leiostomus xanthurus</i>	C-A
Highfin Scorpionfish	<i>Pontinus rathbuni</i>	R	Southern Kingfish	<i>Menticirrhus americanus</i>	O

Table 26: New Jersey Saltwater Fishes (continued)					
Common Name	Scientific Name	Status	Common Name	Scientific Name	Status
Barbfish	<i>Scorpaena brasiliensis</i>	R	Horned Whiff	<i>Citharichthys cornutus</i>	R
Mushroom Scorpionfish	<i>Scorpaena inermis</i>	R	Angelfin Whiff	<i>Citharichthys gymnorhinus</i>	R
Smoothcheek Scorpionfish	<i>Scorpaena isthmensis</i>	R	Bay Whiff	<i>Citharichthys spilopterus</i>	R
Spotted Scorpionfish	<i>Scorpaena plumieri</i>	R	Smallmouth Flounder	<i>Etropus microstomus</i>	C
Acadian Redfish	<i>Sebastes fasciatus</i>	O	Gulf Flounder	<i>Paralichthys albigitata</i>	R
Armored Searobin	<i>Peristedion miniatum</i>	C	Summer Flounder	<i>Paralichthys dentatus</i>	A
Northern Searobin	<i>Prionotus carolinus</i>	A	Fourspot Flounder	<i>Paralichthys oblongus</i>	C
Striped Searobin	<i>Prionotus evolans</i>	A	Windowpane	<i>Scophthalmus aquosus</i>	C
Sea Raven	<i>Hemitripterus americanus</i>	C	Dusky Flounder	<i>Syacium papillosum</i>	R
Grubby	<i>Myoxocephalus aeneus</i>	C	Witch Flounder	<i>Glyptocephalus cynoglossus</i>	C
Longhorn Sculpin	<i>Myoxocephalus octodecemspinosus</i>	C	American Plaice	<i>Hippoglossoides platessoides</i>	R
Shorthorn Sculpin	<i>Myoxocephalus scorpius</i>	R	Atlantic Halibut	<i>Hippoglossus hippoglossus</i>	R
Alligatorfish	<i>Aspidophoroides monopterygius</i>	R	Winter Flounder	<i>Pleuronectes americanus</i>	A
Lumpfish	<i>Cyclopterus lumpus</i>	R	Yellowtail Flounder	<i>Pleuronectes ferrugineus</i>	C
Atlantic Seasnail	<i>Liparis atlanticus</i>	R	Hogchoker	<i>Trinectes maculatus</i>	C
Inquiline Seasnail	<i>Liparis inquilinus</i>	C	Blackcheek Tonguefish	<i>Symphurus plagiosa</i>	R
White Perch	<i>Morone americana</i>	A	Orange Filefish	<i>Aluterus schoepfi</i>	R
Striped Bass	<i>Morone saxatilis</i>	A	Gray Triggerfish	<i>Balistes capriscaus</i>	R
Wreckfish	<i>Polyprion americanus</i>	R	Queen Triggerfish	<i>Balistes vetula</i>	R
Swallowtail Bass	<i>Anthias woodsi</i>	O	Ocean Triggerfish	<i>Canthidermis sufflamen</i>	O
Black Sea Bass	<i>Centropristis striata</i>	A	Fringed Filefish	<i>Monacanthus ciliatus</i>	R
Red Grouper	<i>Epinephelus morio</i>	R	Planehead Filefish	<i>Monacanthus hispidus</i>	R
Warsaw Grouper	<i>Epinephelus nigritus</i>	R	Scrawled Cowfish	<i>Lactophrys quadricornis</i>	R
Snowy Grouper	<i>Epinephelus niveatus</i>	R	Trunkfish	<i>Lactophrys trigonus</i>	R
Black Grouper	<i>Mycteroperca bonaci</i>	R	Smooth Trunkfish	<i>Lactophrys triqueter</i>	R
Northern Kingfish	<i>Menticirrhus saxatilis</i>	C	Web Burrfish	<i>Chilomycterus antillarum</i>	R
Atlantic Croaker	<i>Micropogonias undulatus</i>	C	Spotted Burrfish	<i>Chilomycterus atinga</i>	R
Black Drum	<i>Pogonias cromis</i>	C	Striped Burrfish	<i>Chilomycterus schoepfi</i>	O
Red Drum	<i>Sciaenops ocellatus</i>	O	Porcupinefish	<i>Diodon hystrix</i>	R
Red Goatfish	<i>Mullus auratus</i>	R	Smooth Puffer	<i>Lagocephalus laevigatus</i>	OS
Spotted Goatfish	<i>Pseudupeneus maculatus</i>	R	Northern Puffer	<i>Spherooides maculatus</i>	CS
Bermuda Chub	<i>Kyphosus sectatrix</i>	R	Checkered Puffer	<i>Spherooides testudineus</i>	R
Atlantic Spadefish	<i>Chaetodipterus faber</i>	R	Ocean Sunfish	<i>Mola mola</i>	O
Foureye Butterflyfish	<i>Chaetodon capistratus</i>	R	Wahoo	<i>Acanthocybium solandri</i>	R
Spotfin Butterflyfish	<i>Chaetodon ocellatus</i>	F	Frigate Mackerel	<i>Auxis thazard</i>	R
Banded Butterflyfish	<i>Chaetodon striatus</i>	R	Little Tunny	<i>Euthynnus alletteratus</i>	CS
Gray Angelfish	<i>Pomacanthus arcuatus</i>	R	Skipjack Tuna	<i>Katsuwonus pelamis</i>	R
Sergeant Major	<i>Abudefduf saxatilis</i>	R	Blue Marlin	<i>Makaira nigricans</i>	R
Striped Mullet	<i>Mugil cephalus</i>	A	White Marlin	<i>Tetrapterus albidus</i>	C
White Mullet	<i>Mugil curema</i>	A	Black Ruff	<i>Centrolophus niger</i>	R
Great Barracuda	<i>Sphyraena barracuda</i>	R	Black Fathead	<i>Cubiceps baxteri</i>	R
Northern Sennet	<i>Sphyraena borealis</i>	C	Barrelfish	<i>Hyperoglyphe perciformis</i>	R
Atlantic Threadfin	<i>Polydactylus octonemus</i>	R	Harvestfish	<i>Peprilus alepidotus</i>	O
Tautog	<i>Tautoga onitis</i>	A	Butterfish	<i>Peprilus triacanthus</i>	A
Cunner	<i>Tautoglabrus adspersus</i>	C	Freckled Driftfish	<i>Psenes cyanophrys</i>	R
Emerald Parrotfish	<i>Nicholsina usta</i>	R	Bluefin Driftfish	<i>Psenes pellucidus</i>	R
Ocean Pout	<i>Macrozoarces americanus</i>	C	Bigeye Squaretail	<i>Tetragonurus atlanticus</i>	R
Snakeblenny	<i>Lumpenus lumpretaeformis</i>	R	Twospot Flounder or Spottail Flounder	<i>Bothus robbinsi</i>	R
Arctic Shanny	<i>Stichaeus punctatus</i>	R	Gulf Stream Flounder	<i>Citharichthys arctifrons</i>	A
Radiated Shanny	<i>Ulvaria subbifurcata</i>	R	Blue Tang	<i>Acanthurus coeruleus</i>	R
Rock Gunnel	<i>Pholis gunnelus</i>	R	Oilfish	<i>Ruvettus pretiosus</i>	R
Atlantic Wolffish	<i>Anarhichas lupus</i>	R	Atlantic Cutlassfish	<i>Trichiurus lepturus</i>	R
Northern Stargazer	<i>Astroscopus guttatus</i>	O	Atlantic Bonito	<i>Sarda sarda</i>	O

Table 26: New Jersey Saltwater Fishes (continued)

Common Name	Scientific Name	Status	Common Name	Scientific Name	Status
Striped Blenny	<i>Chasmodes bosquianus</i>	O	Chub Mackerel	<i>Scomber japonicus</i>	R
Crested Blenny	<i>Hypleurochilus germinatus</i>	R	Atlantic Mackerel	<i>Scomber scombrus</i>	A
Feather Blenny	<i>Hypsoblennius hentz</i>	O	King Mackerel	<i>Scomberomorus cavalla</i>	O
Seaweed Blenny	<i>Parablennius marmoratus</i>	R	Spanish Mackerel	<i>Scomberomorus maculatus</i>	O
American Sand Lance	<i>Ammodytes americanus</i>	A	Cero	<i>Scomberomorus regalis</i>	O
Northern Sand Lance	<i>Ammodytes dubius</i>	A	Albacore	<i>Thunnus alalunga</i>	C
Fat Sleeper	<i>Dormitator maculatus</i>	R	Yellowfin Tuna	<i>Thunnus albacares</i>	C
Darter Goby	<i>Gobionellus boleosoma</i>	R	Bigeye Tuna	<i>Thunnus obesus</i>	O
Highfin Goby	<i>Gobionellus oceanicus</i>	R	Bluefin Tuna	<i>Thunnus thynnus</i>	CS
Naked Goby	<i>Gobiosoma bosc</i>	A	Swordfish	<i>Xiphias gladius</i>	CS
Seaboard Goby	<i>Gobiosoma ginsburgi</i>	O	Sailfish	<i>Istiophorus platypterus</i>	R
Ocean Surgeon	<i>Acanthurus bahianus</i>	R			

A – Abundant AS – Abundant in summer ASF – Abundant in spring and fall F – Frequent R – Rare

T – Threatened C – Common C-A – Common-abundant CS – Common in summer

CSF – Common in summer and fall CW – Common in winter CWS – Common in winter and spring O – Occasional

OS – Occasional in summer

OSF – Occasional in summer and fall

OWS – Occasional in winter and spring

4.2.2 TERRESTRIAL ANIMALS

The numerous terrestrial and aquatic habitat types present were discussed in the Botanical Resources section. Coastal habitats include salt marsh complexes. Interior habitats include upland and lowland forests, intermittent coastal plain ponds, hardwood swamps, cedar swamps and savannah. Agriculture and other human activities, such as abandoned quarries, create disturbed habitat types that are attractive to certain types of wildlife. The variety of habitat types present in Dennis Township can be considered home to many species of wildlife. Generally, the unique ecosystems of the Cape May peninsula lead to a vast array of wildlife species in a small geographic area. Dozens of species of native mammals are known to reside in the New Jersey Pinelands and Southern New Jersey. The mammals of New Jersey are listed in the table below. Four of the bats in the table below are only present during migration (USFWS, SNE-NYB Coastal Program 1997).

**Table 27: New Jersey Mammals (NJDEP, DFW 2005b, Wolgast 1998)**

Common Name	Scientific Name	Status	Common Name	Scientific Name	Status
Opossum	<i>Didelphis marsupialis</i>	S	Eastern Cottontail	<i>Sylvilagus floridanus</i>	S
Masked Shrew	<i>Sorex cinereus</i>	S	Eastern Chipmunk	<i>Tamias striatus</i>	S
Short-tailed Shrew	<i>Blarina brevicauda</i>	S	Woodchuck	<i>Marmota monax</i>	S
Least Shrew	<i>Cryptotis parva</i>	U	Gray Squirrel	<i>Sciurus carolinensis</i>	S
Eastern Mole	<i>Scalopus aquaticus</i>	S	Red Squirrel	<i>Tamiasciurus hudsonicus</i>	S
Star-nosed Mole	<i>Condylura cristata</i>	U	Southern Flying Squirrel	<i>Glaucomys volans</i>	U
Little Brown Bat	<i>Myotis lucifugus</i>	S	Beaver	<i>Castor canadensis</i>	IN C
Keen Myotis	<i>Myotis septentrionalis</i>	U	Marsh Rice Rat	<i>Oryzomys palustris</i>	S
Silver-haired Bat	<i>Lasionycteris noctivagans</i>	U	White-footed Mouse	<i>Peromyscus leucopus</i>	S
Eastern Pipistrel	<i>Pipistrellus subflavus</i>	U	Red-backed Vole	<i>Clethrionomys gapperi</i>	S
Big Brown Bat	<i>Eptesicus fuscus</i>	S	Meadow Vole	<i>Microtus pennsylvanicus</i>	S
Red Bat	<i>Lasiurus borealis</i>	S	Pine Vole	<i>Microtus pinetorum</i>	S

Hoary Bat	<i>Lasiurus cinereus</i>	U	Muskrat	<i>Ondatra zibethicus</i>	S
Meadow Jumping Mouse	<i>Zapus hudsonius</i>	U	Southern Bog Lemming	<i>Synaptomys cooperi</i>	U
Red Fox	<i>Vulpes vulpes</i>	S	House Mouse	<i>Mus musculus</i>	I
Black Bear	<i>Ursus americanus</i>	INC	Gray Fox	<i>Urocyon cinereoargenteus</i>	S
Long-tailed Weasel	<i>Mustela frenata</i>	S	Raccoon	<i>Procyon lotor</i>	S
Mink	<i>Mustela vison</i>	S	Striped Skunk	<i>Mephitis mephitis</i>	S
River Otter	<i>Lutra canadensis</i>	S	White-tailed Deer	<i>Odocoileus virginianus</i>	D
Coyote	<i>Canis latrans</i>				
St – Status E – Endangered D – Decreasing INC – Increasing S – Stable U – Undetermined I – Introduced P – Peripheral					



The diversity of terrestrial fauna in Dennis Township is exemplified by its birds. Cape May County, New Jersey is renowned for its bird diversity. Famous ornithologists, such as Alexander Wilson, George Ord and William and Spencer Baird have worked in Cape May County. John James Audubon painted in the saltmarshes of the Great Egg Harbor Estuary (USGS 2006).

The County is a peninsula encompassing many habitat types. It is strategically located along East Coast migratory bird flyways. Dennis Township is situated in the northern portion of the peninsula, with the Atlantic coastal marshes



to the east and the Delaware Bay and Bayshore to the southwest. Colonial waterbird species, such as Black-crowned Night Heron (*Nycticorax nycticorax*), Little Blue Heron (*Egretta caerulea*), Snowy Egret (*Egretta thula*), Glossy Ibis (*Plegadis falcinellus*), and Forster's Tern (*Sterna forsteri*) can be found in the estuarine habitats of the eastern and southwestern portions of the Township. Forested wetlands, another habitat found in Dennis Township, are favored by neotropical songbirds as stopover places during migration. The list of bird species below includes birds found in Cape May County, the waters of Delaware Bay, and offshore to a distance of 50 miles (USGS 2006).

Table 28: Birds of Cape May County, New Jersey (USGS 2006) (continued)				
Common Name	Common Name	Common Name	Common Name	Common Name
Red-winged Blackbird	Common Loon	Windsor Warbler	James Creeper	Savannah Owl
Swainson's Warbler	Greater Shearwater	Song Sparrow	Audubon's Sparrow	Eastern Screech Owl
Wilson's Storm Petrel	American White Pelican	Brown Pelican	Northern Oriole	Short-eared Owl
White-bellied Noddy	Hooded Warbler	Long Bunting	Canada Warbler	Red-winged Blackbird
Great Cormorant	Bubble-crested Cormorant	American Bittern	Least Bittern	Great Horned Owl
Prothonotary Warbler	Summer Tanager	Chipping Sparrow	Northern Cardinal	Boat-tailed Grackle
Glossy Ibis	White Ibis	Wood Duck	Brant	Snowy Owl
Common Yellowthroat	Blue Grosbeak	Yellow-throated Warbler	Dickcissel	Barred Owl
Green-winged Teal	American Black Duck	Northern Pintail	Blue-winged Teal	Swainson's Warbler
Yellow-breasted Chat	Gray-breasted Grosbeak	European Sharp-tailed Sparrow	American Widgeon	Long-eared Owl
Canvasback	Redhead	Ring-necked Duck	Greater Scaup	Northern Saw-whet Owl
Dickcissel	American Tree Sparrow	Nelson's Sharp-tailed King Eider	Prarie Warbler	Connecticut Warbler
Lesser Scaup	Common Elder	SWW	Harlequin Duck	Common Nighthawk
Oldsquaw	Black Scoter	SWW	White-winged Scoter	Chuck Will's Widow
Nashville Warbler	Carolinian Warbler	Kentucky Warbler	American Redstart	White-throated Sparrow
Common Goldeneye	Common Goldeneye	Hooded Merganser	Common Merganser	Red-eyed Vireo
Eastern Towhee	Louisiana Waterthrush	Fox Sparrow	Black-and-white Swallow-tailed Kite	Horned Lark
Red-breasted Merganser	Ruddy Duck	Osprey	Warbler	Purple Martin
Mississippi Kite	Bald Eagle	Ring-necked Pheasant	Ruffed Grouse	Field Sparrow
Sharp-shinned Sparrow	Sharp-shinned Sparrow	Sharp-shinned Sparrow	Sharp-shinned Sparrow	Bay-breasted Warbler
Gray-colored Sparrow	Indigo Bunting	Grasshopper Sparrow	Mourning Warbler	American Redstart
Savannah Sparrow	Link Sparrow	Virginia Sparrow	Canada Warbler	Swamp Sparrow
Field Sparrow	Black-bellied Sparrow	Vesper Sparrow	Northern Mockingbird	Eastern Bluebird
Hooded Sparrow	White-crowned Sparrow	American Cootie	Barn Swallow	Veery
Cattle Egret	Northern Harrier	Greater Yellowlegs	Willet	Gray Catbird
Green Heron	Sharp-shinned Hawk	Lesser Yellowlegs	Spotted Sandpiper	Ruby-throated Hummingbird
Black-crowned Night Heron	Cooper's Hawk	Solitary Sandpiper	Upland Sandpiper	Red-headed Woodpecker
Yellow-crowned Night Heron	Northern Goshawk	Northern Bobwhite	Whimbrel	Red-bellied Woodpecker
Tundra Swan	Red-shouldered Hawk	Marbled Godwit	Hudsonian Godwit	Hairy Woodpecker
Mute Swan	Broad-winged hawk	Ruddy Turnstone	Red Knot	Rock Dove
Black-bellied Plover	Swainson's Hawk	Sanderling	Semipalmated Sandpiper	White-winged Dove
American Golden-plover	Red-tailed Hawk	Western Sandpiper	Least Sandpiper	Mourning Dove
Semipalmated plover	Rough-legged Hawk	White-rumped Sandpiper	Pectoral Sandpiper	Eastern Wood Pewee
Piping Plover	American Kestrel	Baird's Sandpiper	Purple sandpiper	Acadian Flycatcher
Killdeer	Merlin	Dunlin	Stilt Sandpiper	Willow Flycatcher
American Oystercatcher	Peregrine Falcon	Buff-breasted Sandpiper	Ruff	Eastern Phoebe
Black-necked Stilt	Golden Eagle	Short-billed Dowitcher	Long-billed Dowitcher	Western Kingbird
American Avocet	Common Snipe	American Woodcock	Wilson's Phalarope	Eastern Kingbird
Red-necked Phalarope	Red Phalarope	Pomarine Jaeger	Parasitic Jaeger	No. Rough-winged Swallow
Gull-billed Tern	Caspian Tern	Sandwich Tern	Royal Tern	Cliff Swallow
Roseate Tern	Arctic Tern	Common Tern	Forster's Tern	Golden-crowned Kinglet
Least Tern	Black Tern	Black Skimmer	Dovekie	Ruby-crowned Kinglet
Razorbill	Belted Kingfisher	Least Flycatcher	Chimney Swift	Blue-gray Gnatcatcher
Laughing Gull	American Crow	Great Crested Flycatcher	Yellow-bellied Sapsucker	Swainson's Thrush
Little Gull	Fish Crow	Scissor-tailed Flycatcher	Downy Woodpecker	Gray-cheeked Thrush
Common Black-headed Gull	Blue Jay	Barn Swallow	Northern Flicker	Eastern Meadowlark
Bonaparte's Gull	White-breasted Nuthatch	Carolina Wren	Black-billed Cuckoo	Brewer's Blackbird
Ring-billed Gull	Tufted Titmouse	Winter Wren	Yellow-billed Cuckoo	Orchard Oriole
Herring Gull	Red-breasted Nuthatch	Sedge Wren	Olive-sided Flycatcher	Baltimore Oriole
Iceland Gull	Bicknell's Thrush	Marsh Wren	Yellow-bellied Flycatcher	Brown-headed Cowbird
Lesser Black-backed Gull	American Robin	House Wren	Alder Flycatcher	Red Crossbill
Glaucous Gull	Brown Thrasher	Wood Thrush	Cedar Waxwing	Rusty Blackbird
Great Black-backed Gull	Loggerhead Shrike	American Pipit	White-eyed Vireo	Common Grackle
Northern Mockingbird	Yellow Warbler	Hermit Thrush	Blue-headed Vireo	Evening Grosbeak
Northern Shrike	Chestnut-sided Warbler	European Starling	Yellow-throated Vireo	American Goldfinch
Blue-winged Warbler	Magnolia Warbler	Yellow-throated Warbler	Warbling Vireo	Purple Finch
Golden-winged Warbler	Cape May Warbler	Pine Warbler	Philadelphia Vireo	House Finch
Tennessee Warbler	Black-throated Blue Warbler	Prairie Warbler	Red-eyed Vireo	Lapland Longspur
Orange-crowned Warbler	Black-throated Green Warbler	Black-and-white Warbler	Palm Warbler	Yellow-headed Blackbird
Northern Parula	Blackburnian Warbler	Louisiana Waterthrush	Bay-breasted Warbler	



Southern New Jersey is home to numerous herptile species (reptiles and amphibians). As is the case for plants and other terrestrial animals, one of the reasons for this diversity is that many species are at the limits of their ranges, particularly southern Coastal Plain species. Coastal Plain Intermittent Ponds provide important breeding habitat for amphibians (USFWS, SNE-NYB Coastal Program 1997). Because Dennis Township has a diverse array of habitats, as described in the Botanical Resources section, many of the below listed species may be present.

Table 29: Cape May County Reptiles (NJDEP, DFW 2001 NJDEP, DFW 2005)					
Common Name	Scientific Name	Status	Common Name	Scientific Name	Status
Common Snapping Turtle	<i>Chelydra serpentina</i>	S	Common Musk Turtle	<i>Sternotherus odoratus</i>	S
Eastern Mud Turtle	<i>Kinostemon s. subrubrum</i>	U	Spotted Turtle	<i>Clemmys guttata</i>	SC
Bog Turtle	<i>Clemmys muhlenbergii</i>	E	Eastern Box Turtle	<i>Terrapene c. carolina</i>	SC
Red-eared Slider	<i>Malaclemys t. terrapin</i>	U	Eastern Painted Turtle	<i>Chrysemys p. picta</i>	U
Redbelly Turtle	<i>Pseudemys rubriventris</i>	U	Northern Brown (DeKay's) Snake	<i>Storeria d. dekayi</i>	S
Northern Water Snake	<i>Nerodia s. sipedon</i>	S	Eastern Garter Snake	<i>Thamnophis s. sirtalis</i>	S
Northern Redbelly Snake	<i>Storeria o. occipitamaculata</i>	S	Eastern Smooth Earth Snake	<i>Virginia v. valeriae</i>	U
Eastern Ribbon Snake	<i>Thamnophis sauritis sauritis</i>	S	Northern Ringneck Snake	<i>Diadophis punctatus edwardsi</i>	S
Eastern Hognose Snake	<i>Heterodon platyrhinos</i>	D	Southern Ringneck Snake	<i>Diadophis p. punctatus</i>	S
Eastern Worm Snake	<i>Carphophis a. amoenus</i>	U	Northern Black Racer	<i>Coluber constrictor constrictor</i>	U
Rough Green Snake	<i>Ophedrys vernalis</i>	S	Black Rat Snake	<i>Elaphe o. obsoleta</i>	U
Eastern King Snake	<i>Lampropeltis g. getula</i>		Northern Pine Snake	<i>Pituophis m. melanoleucus</i>	T
Scarlet King Snake	<i>Lampropeltis triangulum elapsoides</i>	SC	Coastal plain Milk Snake intergrade	<i>Lampropeltis t. triangulum X L. t. elapsoides elapsoides</i>	SC
Five-lined Skink	<i>Eumeces fasciatus</i>	U	Northern Fence Lizard	<i>Sceloporus undulatus hyacinthus</i>	S
St – Status E - Endangered D - Decreasing INC - Increasing S - Stable U – Undetermined I - Introduced P - Peripheral					

At least 100 certified and potential vernal pools are located within Dennis Township (CRSSA and ENSP). These pools are important breeding areas for many amphibians. Since vernal pools dry up every year, they do not support the fish populations that would prey on amphibian eggs and young. The table below contains amphibians that may occur in the Township.

Table 30: Cape May County Amphibians (NJDEP, DFW 2001 NJDEP, DFW 2005)					
Common Name	Scientific Name	Status	Common Name	Scientific Name	Status
Marbled Salamander	<i>Ambystoma opacum</i>	SC	Eastern Tiger Salamander	<i>Ambystoma t. tigrinum</i>	E
Red-spotted Newt	<i>Notophthalmus v. viridescens</i>	D	Four-toed Salamander	<i>Hemidactylum scutatum</i>	D
Red-backed Salamander	<i>Plethodon c. cinereus</i>	S	Eastern Mud Salamander	<i>Pseudotriton m. montanus</i>	T
Northern Red Salamander	<i>Pseudotriton r. ruber</i>	D	Fowler's Toad	<i>Bufo woodhousii fowleri</i>	SC
Eastern Spadefoot Toad	<i>Scaphiopus h. holbrookii</i>	D	Northern Cricket Frog	<i>Acris c. crepitans</i>	U
Northern Gray Treefrog	<i>Hyla versicolor</i>	S	Northern Spring Peeper	<i>Hyla c. crucifer</i>	S
New Jersey Chorus Frog	<i>Pseudacris triseriata kalmi</i>	S	Bullfrog	<i>Rana catesbeiana</i>	S
Carpenter Frog	<i>Rana virgatipes</i>	SC	Green Frog	<i>Rana clamitans melanota</i>	S
Wood Frog	<i>Rana sylvatica</i>	S	Southern Leopard Frog	<i>Rana spenocephala</i>	S
Pickerel Frog	<i>Rana palustris</i>	S			
St – Status E - Endangered D - Decreasing INC - Increasing S - Stable U – Undetermined I - Introduced P - Peripheral					

The incredible diversity observed in bird species also holds true for butterflies. In addition to its importance for migratory birds, Cape May County is a crossroads for huge migrations of Monarch butterflies and the common Green Darner, a dragonfly species (Russell, et al 1998, USFWS 2007). Wright and Sutton (1999) have compiled the list below based on review of private and museum collections and entomology literature.

Table 31: Butterflies of Cape May County, New Jersey (Wright & Sutton 1999)			
Common Name	Common Name	Common Name	Common name
Pipevine Swallowtail	Banded Hairstreak	Aphrodite Fritillary	Appalachian Brown
Zebra Swallowtail	Striped Hairstreak	Regal Fritillary	Georgia Satyr
Black Swallowtail	Southern (No.) Hairstreak	Silver-Bordered Fritillary	Little Wood Satyr
E. Tiger Swallowtail	Brown Elfin	Meadow Fritillary	Common Wood Nymph
Spicebush Swallowtail	Frosted Elfin	Pearl Crescent	Monarch
Palamedes Swallowtail	Henry's Elfin	Baltimore	Silver-Spotted Skipper
Checkered White	Eastern Pine Elfin	Question Mark	Long-Tailed Skipper
Cabbage White	'Olive' Juniper Hairstreak	Eastern Comma	Hoary Edge
Falcate Orange tip	Hessel's Hairstreak	Gray Comma	Southern Cloudywing
Clouded Sulphur	White M Hairstreak	Compton Tortoiseshell	Northern Cloudywing
Orange Sulphur	Gray Hairstreak	Mourning Cloak	Hayhurst's Scallopwing
Cloudless Sulphur	Red-Banded Hairstreak	American Lady	Sleepy Duskywing
Little Yellow	Eastern Tailed Blue	Painted Lady	Juvenal's Duskywing
Sleepy Orange	'Northern' Spring Azure	Red Admiral	Horace's Duskywing
Harvester	Coastal Holly Azure	Common Buckeye	Zarucco Duskywing
American Copper	Summer Azure	Red-Spotted Purple	Wild Indigo Duskywing
Bronze Copper	American Snout	Viceroy	Common Checkered Skipper
Bog Copper	Gulf Fritillary	Hackberry Emperor	Common Sootywing
Great Purple Hairstreak	Variegated Fritillary	Tawny Emperor	Swarthy Skipper
Coral Hairstreak	Great Spangled Fritillary	Eyed Brown	Clouded Skipper
Least Skipper	European Skipper	Fiery Skipper	Leonard's Skipper
Cobweb Skipper	Peck's Skipper	Tawny-Edged Skipper	Crossline Skipper
Whirlabout	Northern Broken Dash	Little Glassywing	Sachem
Delaware Skipper	Rare Skipper	Mulberry Wing	Zabulon Skipper
Aaron's Skipper	Broad-Winged Skipper	Dion Skipper	Black Dash
Two-Spotted Skipper	Dun Skipper	Dusted Skipper	Common Roadside Skipper
Eufala Skipper	Brazilian Skipper	Salt Marsh Skipper	Ocola Skipper
Giant Swallowtail	Southern Dogface	Orange-Barred Sulphur	Edward's Hairstreak
Hoary Elfin	Golden-Banded Skipper	Confused Cloudywing	Dotted Skipper
Indian Skipper	Arogos Skipper	Hobomok Skipper	

4.3 RARE SPECIES AND SPECIES OF SPECIAL CONCERN

A search of State and Federal maps and databases was made to determine if records exist for occurrences of threatened and endangered wildlife species, rare plants or natural communities, or critical wildlife habitat on or in the Township. This search identified numerous areas of critical habitat and the presence of rare, threatened and endangered species. Specifically, a search of the New Jersey Department of Environmental Protection Natural Heritage Program (NHP) Database was performed and the New Jersey Landscape Mapping Project was reviewed. Several threatened and endangered animals and habitat associated with them are known to occur within Dennis Township.

Foraging habitat for Bald Eagle, Black Skimmer, Least Tern, Black-crowned Night Heron, and other colonial waterbirds are present in the NHP database. Nest Buffers for Bald Eagle also exist in the Township. Nesting habitat for Black-crowned Night Heron and colonial waterbirds are also present in the NHP database, as well as a coastal heron rookery. Rare vertebrates are listed below. There are a number of rare, threatened or endangered invertebrates that were identified within the Township limits by the NHP.

Table 32: Rare Wildlife of Dennis Township (Lord 2007)

Common Name	Scientific Name	Status	Common Name	Scientific Name	Status
Bald eagle	<i>Haliaeetus leucocephalus</i>	E (LT)	Barred owl	<i>Strix varia</i>	T/T
Black rail	<i>Laterallus jamaicensis</i>	T/T	Black skimmer	<i>Rynchops niger</i>	E
Black-crowned night heron	<i>Nycticorax nycticorax</i>	T/S	Bobcat	<i>Lynx rufus</i>	E
Broad-winged hawk	<i>Buteo platypterus</i>	SC	Carpenter frog	<i>Rana virgatipes</i>	SC
Cattle egret	<i>Bubulcus ibis</i>	INC/INC	Comet darter	<i>Anax longipes</i>	
Common tern	<i>Sterna hirundo</i>	D/S	Cooper's hawk	<i>Accipiter cooperii</i>	T/T
Cope's gray treefrog	<i>Hyla chrysoscelis</i>	E	Eastern box turtle	<i>Terrapene carolina</i>	SC
Eastern kingsnake	<i>Lampropeltis g. getula</i>	U	Eastern tiger salamander	<i>Ambystoma t. tigrinum</i>	E
Forster's tern	<i>Sterna forsteri</i>	INC/S	Fowler's toad	<i>Bufo woodhousii fowleri</i>	SC
Frosted elfin	<i>Callophrys irus</i>	T	Glossy ibis	<i>Plegadis falcinellus</i>	D/S
Great blue heron	<i>Ardea herodias</i>	S/S	Great egret	<i>Casmerodius albus</i>	S/S
Least tern	<i>Sterna antillarum</i>	E	Little blue heron	<i>Egretta caerulea</i>	S/S
Marbled salamander	<i>Ambystoma opacum</i>	D	Martha's pennant	<i>Celithemis Martha</i>	
Northern diamondback terrapin	<i>Malaclemys t. terrapin</i>	SC	Northern harrier	<i>Circus cyaneus</i>	E/U
Osprey	<i>Pandion haliaetus</i>	T/T	Peregrine falcon	<i>Falco peregrinus</i>	E
Pine barrens treefrog	<i>Hyla andersonii</i>	T	Piping plover	<i>Charadrius melodus</i>	E (LT)
Rare skipper	<i>Problema bulenta</i>		Red knot	<i>Calidris canutus</i>	T
Red-headed woodpecker	<i>Melanerpes erythrocephalus</i>	T/T	Red-shouldered hawk	<i>Buteo lineatus</i>	E/T
Snowy egret	<i>Egretta thula</i>	S/S	Spotted turtle	<i>Clemmys guttata</i>	SC
Tricolored heron	<i>Egretta tricolor</i>	INC/S	Yellow-breasted chat	<i>Icteria virens</i>	SC
Yellow-crowned night heron	<i>Nyctanassa violacea</i>	T/T			

E – Endangered T – Threatened S – Stable SC – Special Concern INC - Increasing
E/T, T/T, T/S – Dual Status, letter before the slash is status of breeding population, letter after the slash is for the migratory population
(LT) – Federal Status, formally listed as threatened

The list includes avian species, reptiles and amphibians, and mammalian species that are very familiar to a great deal of people who are interested in nature. Less known are the invertebrates on the list. It contains five lepidopterans (in this case two species of butterflies and three moths), and seven species of odonates (five species of dragonflies and two species of damselflies). These species of invertebrates are interesting in that they require specific relationships with other organisms in order to go through their life cycles. For many species, humans still do not have the knowledge of the ecology of these species. In the case of the butterflies, they require specific types of host plants in order to raise their young and also require nectar plants in order to feed as adults (if they feed as adults).

Of these species of invertebrates, the Frosted Elfin (*Callophrys irus*) is the rarest and is considered to be a threatened species in New Jersey. It is known from Massachusetts to northern Florida and from Texas and Louisiana. In New Jersey, it is a much localized and rarely common species with colonies in open areas such as clearings, burns, woodland edges and power line easements. The adults fly in the spring into early summer. The host plant in New Jersey is Yellow Wild Indigo (*Baptisia tinctoria*). It is also known to use Wild Lupine (*Lupinus perennis*). This species of butterfly has disappeared from some of its known locations. However, a new location has recently been found in southern New Jersey along a power line easement.

The Rare Skipper (*Problema bulenta*) can be locally common in brackish coastal marshes, but habitat is limited and many colonies are inaccessible. It is found from New Jersey south to Georgia with some gaps in the range in North Carolina and Virginia. It flies in summer and the host plant is Wild Rice (*Zizania aquatica*) and other unknown grass species.

The odonates (dragonflies and damselflies) on the list are the Bar-winged Skimmer (*Libellula axilena*), the Blue-faced Meadowhawk (*Sympetrum ambiguum*), the Comet Darner (*Anax longipes*), the Double-ringed Pennant (*Celithemis verna*), the Martha's Pennant (*Celithemis martha*), the Pine Barrens Bluet (*Enallagma recurvatum*) and The Scarlet Bluet (*Enallagma pictum*). These odonate species are all rare species and ranked as S2 or S3 species which means as S2 species, they only occur in 6 to 20 locations in the State. S3 species occur in 21 to 50 locations in the State. The Bar-winged Skimmer is a S2 species in NJ and is found in 14 of the 21 counties. Many of the records are single records for particular counties. Also, many of the records are historical with no recent specimens observed. The



Bar-winged Skimmer is likely to be seen on the Coastal Plain of New Jersey in wooded swamps and around ponds (both permanent and intermittent). It is active in NJ from mid-May to the end of September. Similar to most dragonflies, it eats numerous types of flying insects. The Blue-faced Meadowhawk (pictured to the left) is considered to be imperiled in NJ. It is reported locally on the Coastal Plain of NJ. Its preferred habitat is temporary woodland ponds and swamps. It is only found in 8 of the 21 counties in the State and is active from mid-August to the end of September. It is ranked as a S2 species in NJ which indicates only 6 to 20 occurrences in the State.

The Comet Darner is a rare species that can be found throughout the State (13 out of 21 counties), but is more likely to be seen in coastal areas. It is active from early May to mid-September with the most seen during July flying over lakes and ponds. Its status in NJ is still to be determined. It is considered to be either a S2 or S3 species.

The Double-ringed Pennant is mainly a Pinelands species and inhabits lakes and ponds with emergent vegetation. It is only found in 5 of 21 counties in NJ and is active from the end of May to mid-July. It is considered to be a S2 species with 6 to 20 occurrences in NJ.

Martha's Pennant is a species of special concern and is most likely secure as far as conservation is concerned, but should be watched. It is a southern New Jersey species that is found around marshy edges of ponds and lakes. It is active from July to October with most flights seen in July and occurs in 8 of 21 counties in NJ.

The Pine Barrens Bluet is a type of damselflies and is part of the Pond Damsels group. As its name states, it is found in the pine barrens or pinelands of southern NJ. It is active from early May to the end of June and is found in 8 of 21 counties in NJ. It is a S3 species in the State.

The Scarlet Bluet is also a S3 species. It is active from mid-May to mid-September and is found in 9 of 21 counties in the State. It is also a pinelands species that can be found along the wet of waterways, ponds and cranberry reservoirs.

The Chain Fern Borer Moth (*Papaipema stenocelis*) is one of the owlet moths. The adults borrow into the stems of only Chain Fern. They are sedentary species and usually spend their entire lives within 10 meters of the host plant. This moth is a S3 species in NJ.

The Precious Underwing Moth (*Catocala pretiosa pretiosa*) is one of the underwing moths in the Noctuidae group. It has disappeared from its entire historical range from Maine to Virginia and only occurs in New Jersey and Massachusetts. Historically, it may not have occurred in NJ. The first records were for 1968. Overgrazing by deer and rabbits may have had an effect on its decline. The host plant is Chokeberry (*Aronia spp.*), but it is also been observed on Serviceberry (*Amelanchier spp.*) and Apples (*Malus spp.*). Restricted to mature swamp forests, forest edges, bog edges, coastal thickets and other habitats with thickets or very large bushes of foodplant exceeding 1.5 meters in height and usually taller. Of the three foodplant genera *Aronia* is by far the most important and does not grow that tall in most situations; therefore, the combination of shade, wet soils, lack of fire etc. are critical.

4.4 CRITICAL HABITATS AND SPECIAL ECOLOGICAL COMMUNITIES

4.4.1 FEDERAL HABITAT COMPLEXES

The US Fish and Wildlife Service (USFWS) has identified regionally significant habitats and species populations in the New York Bight Watershed. The USFWS recognizes the importance of delineating the larger habitat complexes that link local habitat patches and species populations, forming regional ecological assemblages. This landscape level perspective is critical to establishing uniform and effective management practices to replace site-by-site, uncoordinated practices that do not take into account real ecological complexity. For instance, species may utilize different habitat types at different life stages. Interbreeding between populations of a species promotes genetic health. Habitat patches that lose species can be recolonized from populations in other patches, if connectivity is preserved. In identifying these habitat complexes, the USFWS was particularly interested in locations of naturally occurring populations of federally and state-listed endangered and threatened species and candidates for listing, and those areas that contain significant concentrations of, or are otherwise important to critical life-history stages of, other indigenous species. The following use categories were prioritized:

- breeding, nesting, or spawning sites;
- migration pathways and stopover areas, including areas of open space in urban areas;
- roosting sites;
- nursery areas;
- staging areas;
- dispersal corridors;
- core concentration areas;
- overwintering areas;
- major feeding or foraging areas (USFWS, SNE-NYB Coastal Program 1997).

Dennis Township lies within the Cape May Peninsula Habitat Complex and New Jersey Pinelands Habitat Complex. The Cape May Peninsula habitat complex includes the entire Cape May Peninsula, encompassing marine, estuarine, wetland and upland habitats within this boundary. Developed barrier island and inland sites are not included. Within Dennis Township the habitat complex includes the backbarrier lagoon system on the Atlantic side, coastal plain intermittent ponds, hardwood and Atlantic white cedar swamps, upland forests and agricultural areas. Significant habitat for migratory landbirds, raptors, migratory shorebirds, colonial nesting waterbirds and regionally rare wetland and upland communities and plants can be found within this complex. The complex includes the Delaware Bayshore and near shore waters as well (USFWS, SNE-NYB Coastal Program 1997).

The New Jersey Pinelands Habitat Complex is a combination of contiguous upland forest and wetland habitats on the Outer Atlantic Coastal Plain of New Jersey, overlaying the Cohansey-Kirkwood Aquifer. The Pinelands are a widespread area of dry pine, oak and heath communities that result from the success of low-nutrient, fire-adapted species. Upland areas typically consist of pine-oak forest and oak-pine forest. Lowlands include Atlantic white cedar swamps, hardwood swamps, pitch pine lowlands, marshes, shrub swamps, and pine barren savannas. Coastal plain intermittent ponds (vernal pools) are important habitat components in this ecosystem for a variety of plants and amphibians. The New Jersey Pinelands are the largest pine barrens complex in the world, with 223 species of special emphasis located here (Atlantic Coastal Ventures 2005).

Within Dennis Township are portions of the South Coast Atlantic and Delaware Bayshores Focus Areas of the Atlantic Coast Venture New Jersey Waterfowl Focus Areas. The South Atlantic Coast, New Jersey Focus Area extends from Point Pleasant to Cape May. It encompasses important saltwater habitats, like saltmarshes, as well as freshwater emergent wetlands and open water. Numerous species of waterfowl use this focus area for migration and wintering. The focus area is habitat for the most significant American black duck (more than 80,000 individuals) and Atlantic brant (nearly 100,000 individuals) wintering populations in the Atlantic Flyway. The Delaware Bayshores Focus Area is an important migratory bird habitat, as a stopover between breeding and wintering grounds. Wetlands

in this area are a combination of emergent marshes and creeks, and contain several rare species of plants. More than 55,000 ducks and 250,000 other waterfowl use the Bayshores for breeding, migration, or wintering (Atlantic Coastal Ventures 2005).

4.4.2 STATE OF NEW JERSEY CRITICAL HABITAT MAPPING

The NJDEP's Division of Fish and Wildlife has developed maps identifying critical areas for threatened and endangered species based on land-use classifications and species locations. This effort was coordinated through a study known as the Landscape Project. The project focuses on large areas throughout the State that are ecologically similar in regard to plant and animal communities referred to as Landscape Regions. Cape May County is situated within three Landscape Regions, the Atlantic Coast, Delaware Bay and the Pinelands Landscape Regions. The Atlantic Coast Region is identified as one of the most productive coastal habitats in the country. The low-lying marsh and beaches of the barrier island communities support some of the state's most important colonies of nesting birds. The Delaware Bay Landscape Region encompasses most of the County and features populations of bald eagles, gray tree frogs and over thirty other endangered species in its vast woodlands. The extensive salt-water marshes support a vital shorebird migration habitat. The Pinelands Landscape Region is a unique ecosystem that supports diverse reptile, amphibian and invertebrate populations. The extensive cedar swamps and wetlands systems support large populations of insects, birds and aquatic communities.

The Landscape Project delineates the State into five habitat classes; forest, grassland, forested wetland, emergent wetland and beaches. These classes are based on information extracted from the NJDEP's Land Use/Land Cover data. Habitat patches within these areas are classified by a ranking system based on the status of the species present in each.

The prioritized ranking system is as follows:

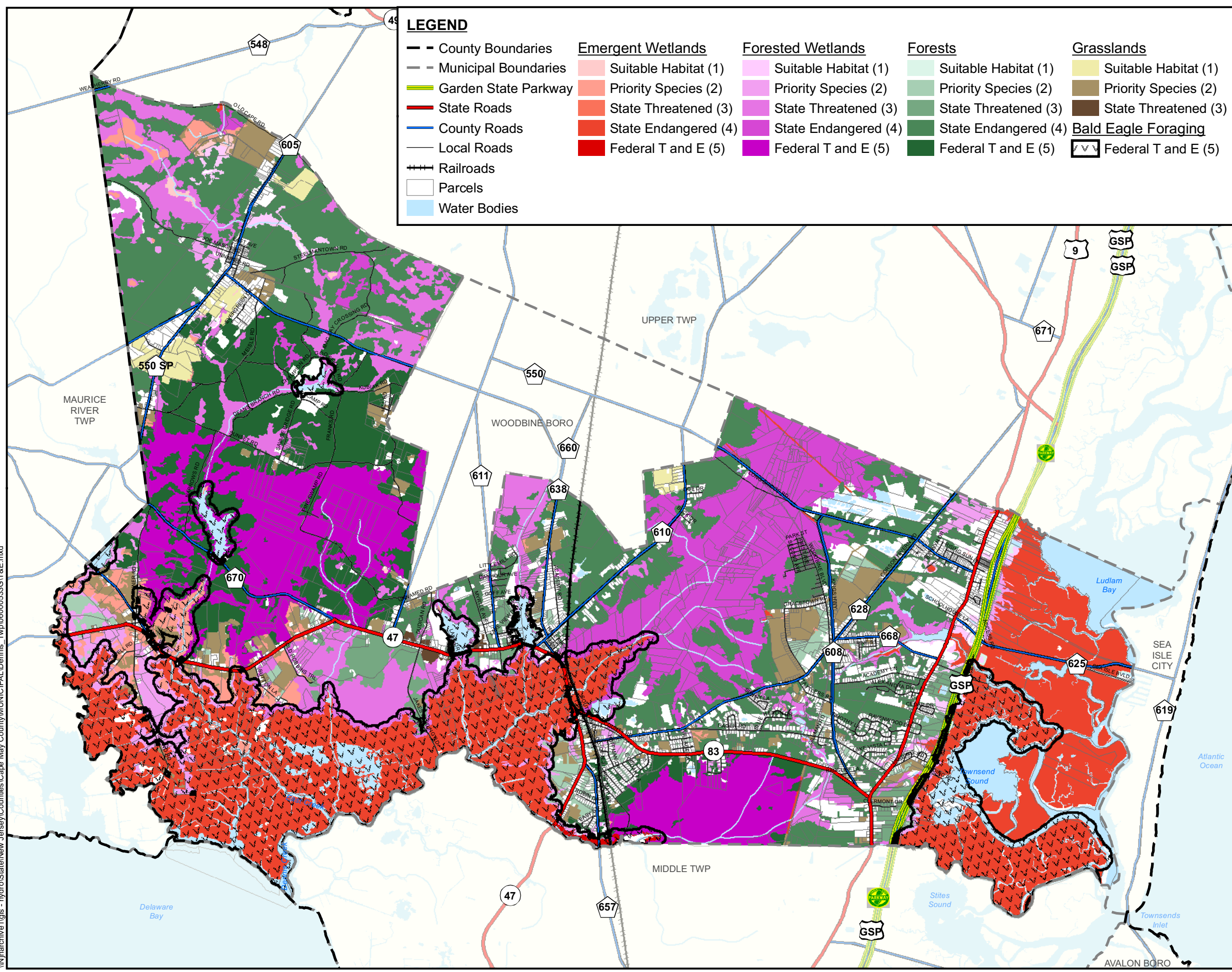
- **Rank 5** is assigned to areas containing one or more occurrences of at least one wildlife species listed as endangered or threatened on the Federal list of endangered and threatened species.
- **Rank 4** is assigned to areas containing one or more occurrences of at least one State endangered species.
- **Rank 3** is assigned to areas containing one or more occurrences of at least one State threatened species.
- **Rank 2** is assigned to areas containing one or more occurrences of at least one non-listed State priority species.
- **Rank 1** is assigned to areas that meet habitat-specific suitability requirements such as minimum size criteria for endangered, threatened or priority wildlife species, but do not intersect with any confirmed occurrences of such species.

The largest portion of Dennis Township's critical habitat is identified as the forested classification, most of which is recognized as containing one or more State endangered species (Rank 4) or Federally listed species (Rank 5). This forested habitat is dispersed throughout much of the Township, with the exception of the coastal areas along the Delaware Bayshore and the Atlantic Coast. Forested wetlands and emergent wetlands combined cover more area than the forested classification. Within the emergent wetland classification, most of these areas are documented as containing Rank 4 habitat, an area of one or more occurrences of a State endangered species. These emergent wetlands extend from the Delaware Bay northward and include the backbarrier lagoons and marshes along the Atlantic coast. Grassland habitat is dispersed throughout, with a concentration of grassland areas in the area of Belleplain in the northwest portion of the Township and South Seaville. The NJDEP has also mapped Natural Heritage Priority Sites which include habitats for threatened and endangered species.

Rank 5 habitat mapped in Dennis Township is associated with Bald eagle foraging areas and nest buffers, since the Bald eagle is a Federally threatened and State-endangered species. Rank 4 habitat consists of critical habitat for Black skimmer, Bobcat, Southern (Cope's) gray treefrog, Eastern tiger salamander, Least tern, breeding Northern harriers, Peregrine falcon and breeding Red-shouldered hawks. All of these species are State-endangered. Habitat

mapped as Rank 3, for State-threatened species, includes habitat for Barred owl, breeding Black-crowned night heron, Cooper's hawk, Frosted elfin, Northern pine snake, Osprey, Pine barrens treefrog, Red knot, Red-headed woodpecker, and non-breeding Red-shouldered hawks. Large areas within Dennis Township are mapped as habitat for threatened and endangered species. Much of this habitat occurs on publicly-owned land. Where it occurs on private land, special measures may be needed to preserve valuable wildlife habitat, while allowing necessary economic development and redevelopment in the Township (see the Threatened and Endangered Species map).

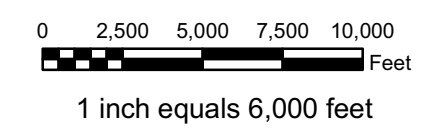
\\njarchive\lgis - hydro\State\New Jersey\Counties\Cape May County\MUNICIPAL\Dennis_Twp\060005333\GT&E.mxd



THREATENED & ENDANGERED SPECIES

TOWNSHIP OF DENNIS

CAPE MAY COUNTY
NEW JERSEY



DIGITAL SPATIAL DATA SOURCES:
- CAPE MAY COUNTY GEOGRAPHIC INFORMATION SYSTEM
- NEW JERSEY DEPARTMENT OF COMMUNITY AFFAIRS, OFFICE OF SMART GROWTH
- NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF GEOGRAPHIC INFORMATION
- UNITED STATES DEPARTMENT OF AGRICULTURE, NATURAL RESOURCES CONSERVATION SERVICES
- NEW JERSEY OFFICE OF INFORMATION TECHNOLOGY, OFFICE OF GIS



MAY 2007

4.4.3 NEW JERSEY NATURAL HERITAGE PROGRAM PRIORITY SITES

The NJDEP's Natural Heritage Program identifies sites within the state of New Jersey that exhibit exceptional natural diversity or comprise prime habitat for threatened and endangered plant and animal species and ecological communities. These sites are called Natural Heritage Priority Sites, and are assigned a biodiversity rank based on a scale developed by the Nature Conservancy and a network of Natural Heritage Programs. The scale indicates the significance of the diversity of the site on a local versus global level.

The global biodiversity ranks are defined as follows:

- **B1** is assigned to those sites that are of outstanding significance on a global level, which may contain the only known occurrence of an element such as a species or ecological community.
- **B2** is assigned to those sites that are of very high significance on a global level, such as the most outstanding occurrence of an ecological community.
- **B3** is assigned to those sites that are of high significance on a global level, with the occurrence of an element that is imperiled globally, or with a concentration of elements that are critically imperiled within the State of New Jersey.
- **B4** is assigned to those sites that are of moderate significance on a global level, with the only viable state occurrence of an element critically imperiled in the State of New Jersey, or excellent occurrences of elements that are rare in the State.
- **B5** is assigned to those sites that are of general biodiversity interest on a global level.

The state biodiversity ranks are defined as follows (not all sites are assigned a state biodiversity rank):

- **V1** is assigned to those sites that are of outstanding significance on a state level, such as a site containing the only known occurrence of an element in the State.
- **V2** is assigned to those sites that are of very high significance on a state level, and may include sites containing elements that are critically imperiled in the State of New Jersey, or a concentration of imperiled or rare elements.
- **V3** is assigned to those sites that are of high significance on a state level, such as those sites containing the best occurrence in the State of an imperiled element.
- **V4** is assigned to those sites that are of moderate significance on a state level, such as those containing an excellent occurrence of a state rare element.
- **V5** is assigned to those sites with any other occurrence of a state rare element.

The Natural Heritage Program has mapped several of these ecological communities within Dennis Township, as shown on the Natural Heritage Program Priority Sites map. Approximately 2,884 acres, or 7 percent of Dennis Township, is contained within mapped Natural Heritage Priority Sites. In March 2007, the Natural Heritage Program released a new version of priority site mapping that focuses on rare plants and natural communities, as opposed to animals. As a result, some of the previous priority sites were removed from the NHPS mapping, including the Avalon-Stone Harbor Marsh Macrosite, Belleplain Gravel Pit Site, Cape May Corridor Macrosite, Delaware Bayshore Macrosite, Dennis Creek Marsh Macrosite, Great Cedar Swamp Macrosite, Pickle Factory Pond, and South Dennis Site. The five remaining sites are named and described below.

Belleplain Pond South

Located in Belleplain State Forest in both Cape May and Cumberland Counties, Belleplain Pond South consists of a coastal plain intermittent pond in an upland oak-pine forest. The site is assigned a biodiversity rank of B2, as it contains a good occurrence of a globally rare wetland natural community and an excellent population of a globally rare plant species (NJDEP, NHP 2001a).

Clermont Bog Site

The Clermont Bog Site is located entirely within Dennis Township. It lies on the outer coastal plain of the Cape May peninsula and contains a series of hydrologically connected open bogs and open water ponds at the headwaters of Sluice Creek. Hardwood swamp and mesic coastal plain mixed oak forest form a fringe around the ponds. Adjacent uplands are dominated by dry oak-pine forests and successional pine-oak forests. The Clermont Bog Site is assigned a biodiversity rank of B4, as it contains several plant Species of Special Concern and a State-listed endangered animal species.

Magnolia Lake Site

At the headwaters of Mill Creek upstream from the Magnolia Lake dam at Route 9, the Magnolia Lake Site consists of two tributaries feeding the lake. The site is found on the outer coastal plain and wetlands within the site's boundaries include the open waters of Magnolia Lake, Atlantic white cedar swamps, and hardwood swamps dominated by Red maple (*Acer rubrum*), Black gum (*Nyssa sylvatica*), and Magnolia (*Magnolia virginiana*). A mesic coastal plain mixed oak forest occurs in a narrow band along most of the wetlands. The remaining upland portions of the site consist of dry oak-pine forest and successional pine-oak forest. The Magnolia Lake Site is assigned a biodiversity rank of B3, because there are two separate occurrences of a Federally threatened plant species.

Woodbine Bogs

In Dennis Township, much of the Woodbine Bogs site is contained within Belleplain State Forest. It includes contiguous wetland habitat for rare plant and animal species and upland areas that drain toward the wetlands. Woodbine Bogs are assigned a biodiversity rank of B3 because they contain one globally imperiled plant, one globally rare plant, and one State imperiled animal.

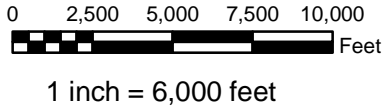
Woodbine Pond

A portion of the Woodbine Pond site extends into Dennis Township. The site is comprised of a grassy open intermittent pond in a pitch pine lowland. The site is assigned a biodiversity rank of B2, as it has an excellent occurrence of a globally rare plant species.

NATURAL HERITAGE PRIORITY SITES

TOWNSHIP OF DENNIS

CAPE MAY COUNTY
NEW JERSEY



DIGITAL SPATIAL DATA SOURCES:
- CAPE MAY COUNTY GEOGRAPHIC INFORMATION SYSTEM
- NEW JERSEY DEPARTMENT OF COMMUNITY AFFAIRS, OFFICE OF SMART GROWTH
- NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF GEOGRAPHIC INFORMATION
- UNITED STATES DEPARTMENT OF AGRICULTURE, NATURAL RESOURCES CONSERVATION SERVICES
- NEW JERSEY OFFICE OF INFORMATION TECHNOLOGY, OFFICE OF GIS



May 2010

LEGEND

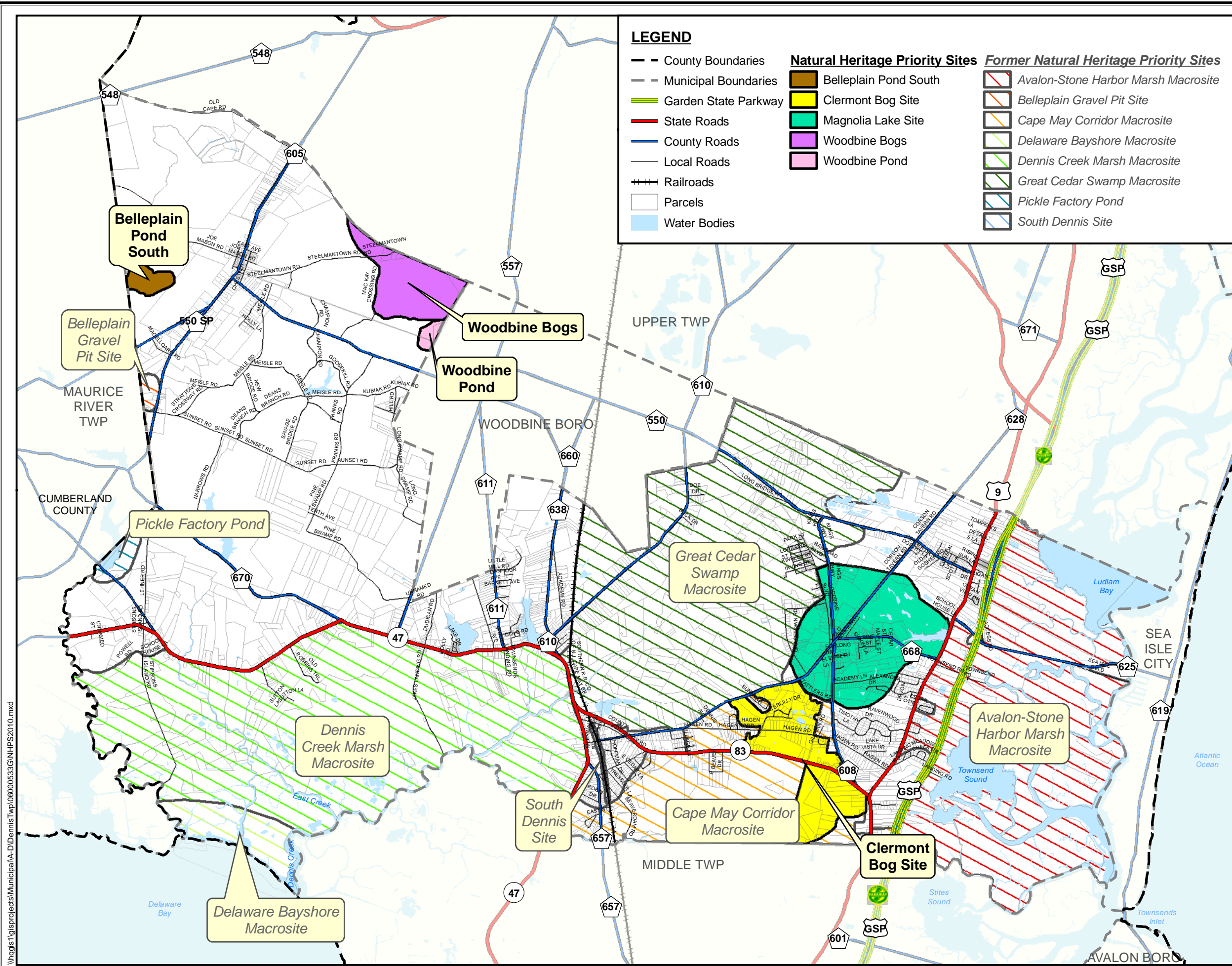
- County Boundaries
- Municipal Boundaries
- Garden State Parkway
- State Roads
- County Roads
- Local Roads
- Railroads
- Parcels
- Water Bodies

Natural Heritage Priority Sites

- Belleplain Pond South
- Clermont Bog Site
- Magnolia Lake Site
- Woodbine Bogs
- Woodbine Pond

Former Natural Heritage Priority Sites

- Avalon-Stone Harbor Marsh Macrosite
- Belleplain Gravel Pit Site
- Cape May Corridor Macrosite
- Delaware Bayshore Macrosite
- Dennis Creek Marsh Macrosite
- Great Cedar Swamp Macrosite
- Pickle Factory Pond
- South Dennis Site



\\hgis1\gisprojects\Municipal\A-DennisTwp\06000533\G\NHPS2010.mxd

5.0 CULTURAL RESOURCES

5.1 PREHISTORIC CONTEXT

The Paleo-Indian period coincides climatologically with the Early Holocene. For New Jersey, the environment was probably much like that of the modern Eastern Sub-Arctic with boreal forests of fir, spruce, and sporadic stands of pine, birch, and maple predominant (Webb 1987). Geologically, the New Jersey coastline lay some sixty to eighty miles east of its present-day location. The lower sea levels that resulted from glacial expansion exposed a broad, flat continental shelf of marshes and meadows cut by deep river channels and branching streams (Kraft 1977; Chesler 1982; Cavallo 1981). Early human populations inhabiting the upper Mid-Atlantic were most likely organized as small hunter-gatherer bands characterized by low population density and high mobility that occupied caves and rockshelters as well as short-term open air camps. Custer (1996) suggests that these populations could have ranged over broad areas during the course of a year exploiting a wide range of food resources. The following discussion of human prehistoric cultures will be discussed by subperiod. The following table shows the time periods associated with the archaeological subperiods.

Table 33: Archaeological Subperiods		
Time Period	Begins	Ends
	Yrs. Before present	Yrs. Before present
Paleo-Indian	14,000	10,000
Early Archaic	10,000	8,500
Middle Archaic	8,500	6,000
Late Archaic	4,000	3,800
Terminal Archaic	3,800	3,000
Early Woodland	3,000	2,000
Middle Woodland	2,000	1,900
Late Woodland	1,900	350
Initial Colonization	350	280

5.1.1 EARLY ARCHAIC

The Early Archaic subperiod is associated with a continuing expansion of forest habitats. Spruce forests covered large areas of the region affording few edible resources to human populations. Floodplains and river islands were attractive locations for hunter-gatherer camps as upland areas continue to be predominated by boreal forest. However, during this period limited use of upland lakes and bogs is evidenced by a small number of archaeological sites adjacent to these locales. Sinkhole complexes may have supported complexes of natural ponds throughout the Late Pleistocene and Early Holocene that would have been attractive locations for migratory wildlife and the human populations that exploited them. Such freshwater wetlands added to the diversity of resources available in the periods immediately following the last glaciation making broad-spectrum foraging a successful subsistence strategy for human populations (Custer 1996; Meltzer and Smith 1986; Cavallo and Mounier 1980; Pagoulatos 1991).

5.1.2 MIDDLE ARCHAIC

At approximately 6500 B.C. technological and settlement pattern shifts, as well as climatological changes, signal the beginning of a new phase of human settlement. Decline in boreal species and an increase in oak and hemlock favored the influx of new plant and animal communities. However, the distribution of these resources differed markedly from that of contemporary communities. The increase in temperature and rainfall (known as the Atlantic Episode) also favored the expansion of wetlands throughout the region. Archaeological remains suggest a greater reliance on plant resources many of which were certainly localized, short-term, seasonal food sources. An increased use of nut-bearing tree species is evident in technological innovations. Caches of tools, suggesting more predictable and regularized movements of population over an annual cycle, appear in the archaeological record for the first time. Likewise, site distribution reveals the utilization of a wider variety of habitats as well as much more intensive utilization of riverine and wetland settings (Custer 1996; Chesler 1982; Meltzer and Smith 1986; Pagoulatos 1991).

5.1.3 LATE ARCHAIC

The Late Archaic period represents a stabilization of cultural and environmental changes onset in the previous time period. More repeated and intensive use of estuarine/riverine settings is indicated. Moreover, use of more productively marginal resource areas increases and regional exchange networks appear for the first time. Tools specialized for plant processing, and also for fishing and fish processing, appear in quantity. These technological developments, coupled with continued caching of tools and the development of storage pits, suggest a greater emphasis on base camp settlement patterns (Carbone 1982; Custer 1984; Custer 1996). Also, important to local resource distribution were changes in marine environments occurring at this time. Slowing sea level rise favored a stabilization of coastal environments leading in turn to the development of shellbeds and estuarine marshes (Carbone 1982; Custer 1984; Custer 1996).

Overall, climatic changes during the Late Archaic would have significantly enhanced the productivity of some habitats, such as coastal marshes and mixed interior forests, while diminishing the output of traditional resource rich areas (Carbone 1982; Custer 1996; Pagoulatos 1991). Settlement patterns and subsistence strategies appear to have been radically altered to accommodate local populations in the face of changing resource availability. Significant increases in population density are noted in some areas as is a general decrease in mobility. Especially in proximity to riverine settings, large sites characterized by dense scatters of artifacts begin to appear. Use of swamp and marsh habitats intensifies during this period (Custer 1996: 188).

5.1.4 EARLY AND MIDDLE WOODLAND

The Early Woodland period marks the shift to modern climatological and environmental regimes in the Eastern United States. Vast deciduous forests dominant the landscape and temperature and rainfall patterns take on marked seasonal fluctuations. Mixed Oak-Chestnut forests characterized by a rich variety of tree species develop adding to the resource abundance of the region (Shelford 1963; Custer, 1996). Culturally, the environmental changes of the Early Woodland favor the continued development of trends initiated during the Late Archaic. Intensification in the use of plant foods as well as a trend toward increasing degrees of sedentism mark the transition from the Archaic to Woodland eras. Floodplains and their surroundings continue to attract base camp settlement in an even more focused manner than the previous period. Coupled with these cultural trends is the development of a crude ceramics technology most likely influenced by groups to the south and west.

5.1.5 LATE WOODLAND

The Late Woodland period for the northeastern United States is the last period commonly classified as prehistoric.



Environmental and climatic characteristics have assumed fully modern form by this point in time. Increasing population density throughout the Late Woodland led to the development of fully sedentary villages throughout the region. At the beginning of the Late Woodland, settlement patterns exhibit a shift away from estuarine settings in favor of more exclusively floodplain locations. The introduction of the bow and arrow and maize agriculture from the south and west throughout the period aided the transformation to fully sedentary lifestyles and horticultural subsistence. Ceramics continued to develop during this period as vessel

walls became thinner and decorations more complex. Conversely, much of the Late Woodland also shows a marked decrease in exchange and mortuary ceremonialism in comparison to earlier periods (Kraft 1986a, 1986b; Kraft and Mounier 1982; Custer, 1996). Perhaps the result of population movements at the beginning of the period, exchange networks do not begin to re-assert themselves until nearly the end of the Late Woodland.

5.2 HISTORIC CONTEXT

5.2.1 CAPE MAY COUNTY

Cape May County was constituted in 1692 as one of the oldest counties in the state. The maritime tradition of the county was established early in the seventeenth century as a station for Dutch fishermen and whalers in the 1630s, fishermen from New England and Long Island, later, in mid-century and by late seventeenth and early eighteenth century pirates who combed the waters of the Atlantic coast and occasionally put into the shallow bays of the Cape May coastline. Throughout the eighteenth century the smuggling of illegal imports through Cape May's ports added to its sea-oriented economy. During the Revolutionary War, Cape May privateers attacked British shipping and captured cargo to support Colonial war efforts. Hindered by a lack of roads into the area and a deep cedar forest, population grew slowly in the county. In 1725, the population of Cape May County was less than 1000 inhabitants. However, by the end of the eighteenth century, urbanites from Philadelphia, Baltimore, and Washington were regular vacationers to Cape May.

As the population of Cape May County grew, some inhabitants turned to the exploitation of the county's natural resources including its southern hardwood forests, cedar swamps, and salt hay meadows. Coastal erosion has encroached upon some of these loci of early industry by as much as one mile. In filling of the marshes surrounding the sounds is also evident.

Prior to its inception as a county, Cape May was the landholding of Dr. Daniel Cox, one of the West Jersey proprietors. Cox held title to some 95,000 acres, but never sailed to America to develop his holdings. Instead, he sold his lands to the West Jersey Society in 1692. Throughout the 1690s, plantations developed throughout the county, held by a few principal families. In 1690, Shamgar Hand obtained 1,000 acres where Cape Court House is today. In 1691 the Leaming family and the Spicer family each took large land holdings that went from the ocean to the bay. Two roads cut in the early 1700s, provided north-south and east-west access routes for these early settlers. In 1723, Cape May County was divided into Upper, Middle, and Lower precincts, each of which became townships in 1798. Dennis Township was formed from portions of Upper Township in 1827.

Towns of eighteenth and nineteenth century Cape May County were associated principally with shipbuilding, mills, agriculture or fishing. However, two nineteenth century towns, Whitesboro and Woodbine, were developed as enclaves for African-Americans and Jewish immigrants, respectively. Whaling, shellfishing, timbering and cedar mining, grain cultivation, salt hay harvesting, shipbuilding, and a variety of milling enterprises constituted the economy of the county. Cape May Court House and Dennisville also supported glassmaking factories for a time in the nineteenth century.

5.2.2 DENNIS TOWNSHIP

Dennis Township was formed from portions of Upper Township in 1827. Growth of its communities had been slow during the eighteenth century. Villages developed around several mill seats including Clints Mills, Johnsons Mill, and Ludlams Mill on the bayside and Townsends Mill on the ocean side where Ocean View is today. During the nineteenth century, maritime enterprises such as shipbuilding and coastal trading brought economic growth and increasing settlement to the Dennis Creek area, particularly. Dennisville, the economic and social center of the township, boasted an extensive shipbuilding industry by 1870 that made use of hardwoods and cedar cut from the surrounding fast lands and swamps as well as cedar logs mined from the much along Dennis Creek and Sluice Creek. Routes 47 and 9, each colonial roads laid out in the mid eighteenth century, provided access to markets to the north and west.

Pioneer whaler/yeoman families such as the Ludlams developed mills, factories, and agricultural enterprises, such as meadows banking, which spurred early nineteenth century economic development of the township while securing their personal social and economic standing. The nineteenth century industrial center of Dennis Creek Landing grew into one of Delaware Bay's most important shipbuilding centers in the mid-1800's and instigated the growth of Dennisville and South Dennis villages as residential centers for the shipbuilders, lumberers and sea captain's who made use of Dennis Creek Landing's products and services. While Dennis Creek Landing declined during the early

twentieth century, the expansion of cedar lumbering and mining activities in Dennisville brought further prosperity to Dennis Township as Dennisville traded its cedar products throughout the Mid-Atlantic region. Dennisville, South Dennis, and the former village of Dennis Creek Landing represent important historic and archaeological districts for Dennis Township.

The community of Eldora likewise represents a community whose layout is strikingly true to its historic character. Except for minor changes to traffic patterns the transportation arteries through Eldora appear unchanged since circa 1842. Delsea Drive is one of the oldest active travel thoroughfares in the Pinelands, and has been described by the National Park Service as a nationally significant cultural landscape. Eldora has been designated as an historic district and is surrounded by many well preserved examples of eighteenth and nineteenth century farmsteads.

5.3 INVENTORIED CULTURAL RESOURCES

Over twenty-eight archaeological or cultural resources surveys have been conducted within Dennis Township. These investigations have resulted in the identification of eight registered prehistoric and historic archaeological sites (see Cultural Resources Map), and fourteen registered historic properties or historic districts, of which six are listed on the National Register of Historic Places (See Table of Historic Properties). Additionally, one multi-county historic district, the Garden State Parkway, traverses the eastern third of Dennis Township. Since the focus of previous cultural resources investigations has been the main traffic corridors through Dennis Township and their associated population centers, the majority of these identified cultural resources are clustered along Routes 9 and 47, Dennisville, South Dennis, Clermont, and Eldora.

Prehistoric archaeological sites exhibit a preference for fast land adjacent to marshes with access to sounds. Historic properties are typically sited on gently sloping, well-drained soils further from marsh edges or in proximity to water sources that could serve as suitable mill seats. Prehistoric archaeological sites and registered historic properties listed in this inventory constitute only those cultural resources documented as known to exist within Dennis Township based on a review of existing cultural resources records. The scope of the Natural Resource Inventory investigations precluded the identification of every potential cultural resource zone for all time periods as well as the development of a predictive model for prehistoric and historic cultural resources location. Cultural resources predictive models are complex functions built on multiple environmental, social, and economic factors.

This inventory does not provide a means to predict the location of undocumented cultural resources or to verify the current integrity of known cultural resources on file with New Jersey state agencies. Those areas not listed as sensitive may still contain isolated historic properties or archaeological sites as well as cultural resources that are atypical of the region and which, therefore, may yield significant information. The absence of inventoried historic properties or archaeological zones in some locations should not be interpreted to mean that development in those areas may proceed without a reasonable effort to demonstrate an absence of significant historical properties or archaeological materials.



A comparison of historic maps to cultural resources survey boundaries indicates that several high probability areas for cultural resources have not been adequately surveyed to date. These include interior road alignments some portions of which may be historic such as Hagen Road and Dennisville Road. Additionally, nineteenth century maps depict a series of early industrial and residential centers that have not been extensively surveyed such as West Creek, Belleplain, South Seaville, and Ocean View. These areas have not been surveyed for archaeological remains.

Table 34: State Registered Historic Properties				
Inventory No.	Property Name	Location	Date	Eligibility Status
3043	R.W. Bennett/Dr. C. Brook Worth House	NJ Route 47 North	1820	SHPO Opinion 5/9/1997
989	Calvary Baptist Church	Seaville Rd. & US Route 9	1850	NR: 11/25/1980 SR: 8/15/1980
990	Dennisville Historic District	Gatzmer and Hall Aves., Academy, Church, Fidler, and Petersburg Rds., Main St., NJ Route 47	1750-1899	NR: 11/24/1987 SR: 4/14/1987
3819	Dennis Creek Landing Archaeological Historic District (28-Cm-53)	protected	1790	SHPO Opinion 7/18/2001
991	East Creek Mill Site (28-Cm-20)	protected	1782	SHPO Opinion 8/20/1981
3044	Eldora Historic District	NJ Route 47, Lehner and Paper Mill Rds.	18th-19th centuries	SHPO Opinion 7/3/1996
992	Joseph Falkenburg House	922 Delsea Dr.	1805	NR: 10/3/1994 SR: 8/8/1994
993	189 Head of the River Road	189 Head of the River Road	1882	SHPO Opinion 12/1/1993
4076	James J. Ludlam House	913 NJ Route 47	1820	SHPO Opinion 7/18/2001
994	Henry Ludlam House	1336 NJ Route 47	1750	NR: 8/12/1993 SR: 7/7/1993
4614	Ludlam Schoolhouse	106 Myrtle Avenue	19th century	COE: 6/2/2006
3813	South Dennisville Historic District	NJ Route 47		SHPO Opinion 7/18/2001
4377	Thomas Ludlam Jr. House	707 NJ Route 47	1750	NR: 11/26/2004 SR: 8/28/2004
996	William S. Townsend House	96 Delsea Drive	1800	NR: 4/5/1984 SR: 3/1/1984
NR – National Register SR – State Register SHPO – State Historic Preservation Office				

Listing on the National Register of Historic Places (NR) contributes to an understanding of the historical and cultural foundations of the nation. Additionally, listing provides recognition of a property's significance to the nation, state, or community, eligibility for federal tax benefits, consideration of the property in the planning for a federal or federally assisted project, and qualifications for federal assistance for historic preservation. Listing on the New Jersey State Register of Historic Places (SR) mirrors the federal National Register program and provides the additional protection against undertakings by the state, counties, or municipalities. Listing on the State Register of Historic Places provides an avenue for the State to recommend the property for inclusion on the National Register. Properties formally evaluated by the State Historic Preservation Office (SHPO) as part of state regulatory procedures for public assisted development project may be issued a formal opinion on their eligibility for the State and National Registers.

An historic district is "a significant concentration, linkage, or continuity of sites, buildings, structures, or objects united historically or aesthetically by plan or physical development" (NJAC 7:4-1.3 R.2003 d.110 2003). This designation provides recognition of the collective significance of a locale in the cultural heritage of a community or region, even when individual properties within the historic district may not be historically significant in and of themselves. Listing of a locale as a historic district on the State or National Registers provides the same recognition and protection as those reserved for individual historic properties. Municipalities may develop historic preservation ordinances to create local historic preservation commissions and to regulate development within their historic districts pursuant to New Jersey Municipal Land Use Law (MLUL).

Finally, the Dennis Township Planning Board has designated several clusters of buildings as relevant examples of the historical and cultural heritage of the Township. These clusters have not been formally evaluated. (see Table 40).

Table 35: Planning Board Designated Historic Sites			
Municipality	Boundaries	Period of Significance	Number of Contributing Buildings
Eldora	Delsea Drive, Stipson Island Road, Paper Mill Road, Sutton Lane	1840-1910	15
Northwest Dennis	Delsea Drive, Petersburg Road	1740-1825	10
South Dennis	Delsea Drive	1720-1880	21
Clermont	Shore Road	1740-1830	7
Ocean View	Shore Road	1690-1910	19
South Seaville	Dennisville Road, Kings Highway, Main Street	1793-1890	17
Dennisville	Petersburg Road, Main Street	1750-1900	55

\\njarchive\lgis - hydro\State\New Jersey\Counties\Cape May County\MUNICIPAL\Dennis_Twp\06000533\G\CULTURAL_RESOURCES.mxd

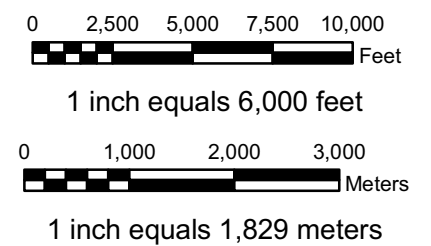
LEGEND

- County Boundaries
 - Municipal Boundaries
 - Garden State Parkway
 - State Roads
 - County Roads
 - Local Roads
 - Railroads
 - Parcels
 - Water Bodies
 - Registered Historic Properties
 - Registered Historic Districts
 - Planning Board Designated Historic Districts
 - Known Archaeological Zones
- NOTE: THE DISTRICT AND ZONE BOUNDARIES AND PROPERTY LOCATIONS PROVIDED IN THIS MAP ARE APPROXIMATE AND SUBJECT TO ON-SITE ASSESSMENTS.

CULTURAL RESOURCES

TOWNSHIP OF DENNIS

CAPE MAY COUNTY
NEW JERSEY



DIGITAL SPATIAL DATA SOURCES:
- CAPE MAY COUNTY GEOGRAPHIC INFORMATION SYSTEM
- NEW JERSEY DEPARTMENT OF COMMUNITY AFFAIRS, OFFICE OF SMART GROWTH
- NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF GEOGRAPHIC INFORMATION
- UNITED STATES DEPARTMENT OF AGRICULTURE, NATURAL RESOURCES CONSERVATION SERVICES
- NEW JERSEY OFFICE OF INFORMATION TECHNOLOGY, OFFICE OF GIS



MAY 2007

5.4 OPEN SPACE/PUBLIC LAND

5.4.1 OPEN SPACE

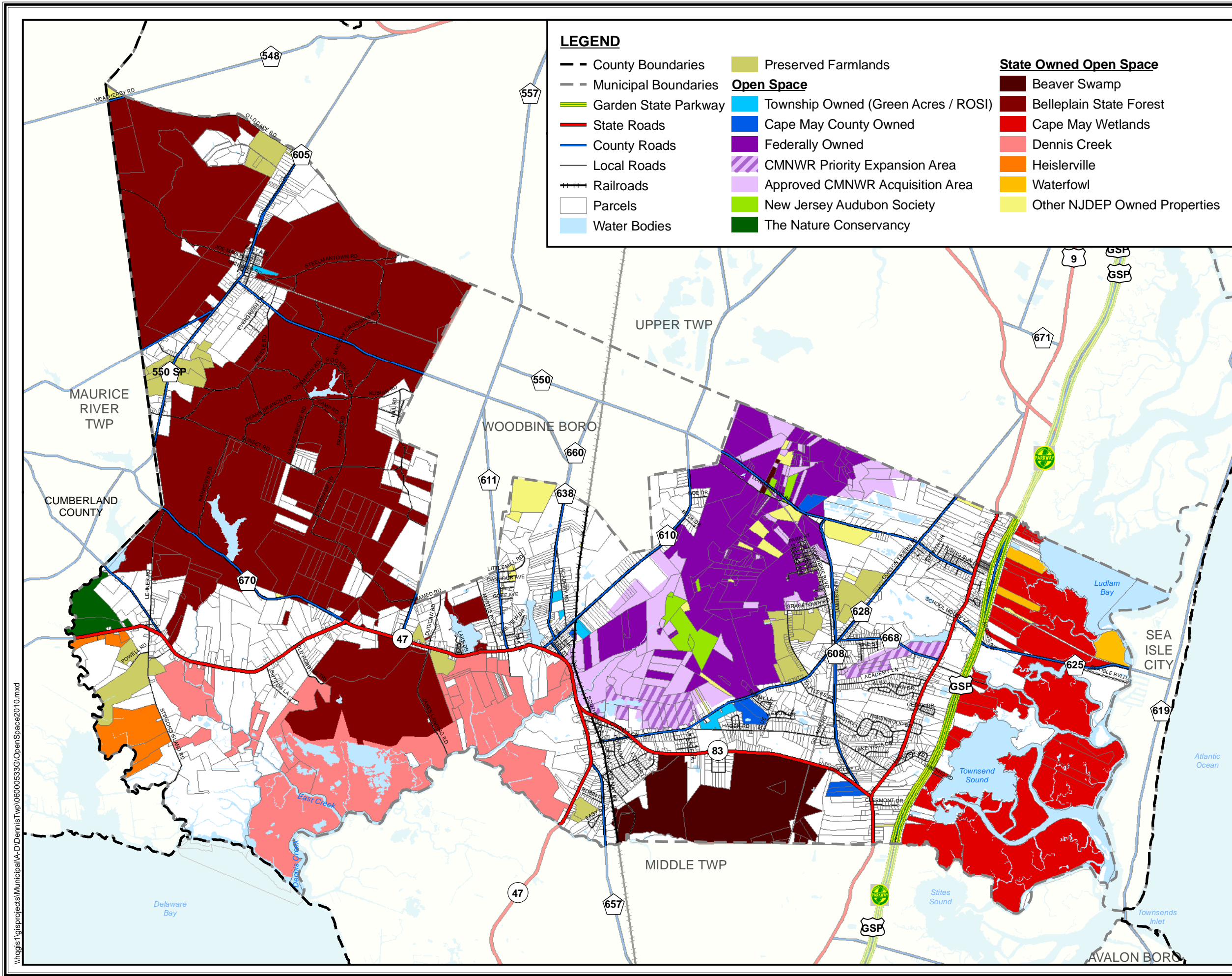
Open space, for the purpose of this inventory, is defined as undeveloped land which is permanently deed restricted. The presence of open space confers social, economic and ecological benefits to municipalities that preserve and protect it. Much of the tourist industry in coastal municipalities is based on the presence of public open space containing beaches, dunes and fishable waters. Extensive wetlands attract birds and birdwatchers and provide habitat for the juveniles of many commercial and sport fish species. These wetlands can act as a buffer and can mitigate impacts of storm events and floods by removing pollutants from stormwater from paved areas before it enters waterbodies (Kane, RP).

Cape May County has established a trust fund to preserve open space and agricultural lands. The trust fund is replenished with a County property tax of 1 cent per 100 dollars of assessed valuation and currently generates approximately 1.3 million dollars a year. Since its inception, the program has preserved approximately 3,000 acres of open space and farmland (almost 5 square miles) in the County. Approximately 985 acres of farmland have been preserved within Dennis Township.

The Cape May County Open Space and Farmland Preservation Department has a map showing existing areas of open space and preserved farmland throughout the county. According to this resource, Dennis Township has approximately 985 acres of preserved farmland. Additional areas are preserved within the Township for County Parks, Federal and State Open Space. In some cases, property owners may have only sold the development rights and not the land outright. Novasak's Sod Farm is an example of this.

The Open Space list that follows should be used as a supplement to the following Open Space map to distinguish between State owned land, which is the majority of the acreage, preserved farms, and Township owned parcels. The Open Space map \ should be reviewed in conjunction with the Natural Heritage Priority Sites map, which outlines a specific category of State owned land. The Natural Heritage Priority Sites map includes State Parks and Forests, Wildlife Management Areas, and Natural Lands Trust preserves.

A number of State and Federal-owned properties are present in Dennis Township.



OPEN SPACE

TOWNSHIP OF DENNIS

CAPE MAY COUNTY
NEW JERSEY



1 inch = 6,000 feet

DIGITAL SPATIAL DATA SOURCES:

- CAPE MAY COUNTY GEOGRAPHIC INFORMATION SYSTEM
- NEW JERSEY DEPARTMENT OF COMMUNITY AFFAIRS, OFFICE OF SMART GROWTH
- NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF GEOGRAPHIC INFORMATION
- UNITED STATES DEPARTMENT OF AGRICULTURE, NATURAL RESOURCES CONSERVATION SERVICES
- NEW JERSEY OFFICE OF INFORMATION TECHNOLOGY, OFFICE OF GIS



May 2010

\\hgis1\gis\projects\Municipal\A-DennisTwp\0600005330\OpenSpace2010.mxd

According to the NJDEP iMap, much of the State Open Space preserved in Dennis Township consists of protected watershed management areas, including the Cape May wetlands in the east, Heislerville and Dennis Creek in the southwest, Waterfowl in the northeast and Beaver Swamp in the south. Additional areas protected within the Township include the Belleplain State Forest, Cape May Wetlands State Park and other miscellaneous areas within the Cape May Wetlands. The following lands within Dennis Township are owned and managed by the State and Federal government:

Dennis Creek Fish and Wildlife Management Area

This protected management area consists of approximately 5,100 acres, 2,100 of which are located within the municipality. It encompasses most of the Delaware Bay wetlands from Route 47 to the Delaware Bay (Dennis Township Planning Board 1994).

Beaver Swamp Fish and Wildlife Management Area

Approximately 1,120 acres of the 2,770-acre management area are located within Dennis Township. It encompasses the headwaters of Sluice Creek and includes the Beaver Dam impoundment area to the Seashore Line railroad to the west and almost Route 83 to the north (Dennis Township Planning Board 1994).

Marmora Coastal Wetlands Wildlife Management Area

The management area consists of 3350 acres. Approximately 572 acres are located within the Dennis Township municipality. The area encompasses most of the wetlands north of Sea Isle Boulevard between Ludlam's Throrofare on the east and the Garden State Parkway on the west (Dennis Township Planning Board 1994).

Belleplain State Forest

This land also takes up a large portion of the northwestern region of the municipality. This State Forest is located in both Cape May and Cumberland County and consists of over 13,000 acres of forested land. It was established in 1928 by the State for public recreation, timber production, wildlife management and water conservation (<http://members.aol.com/famjustin/Belleplain1.html>).

Cape May Wetlands Wildlife Management Area

This vast area, established by the United States Department of the Interior, contains a total of 12,702. It consists of two areas: The Delaware Bay Division and the Great Cedar Swamp Division. The Great Cedar Swamp Division consists of approximately 7,900 acres, of which 3,855 acres are located in Dennis Township (Dennis Township Planning Board 1994). This coastal wetland area is almost all salt marsh, less than 100 acres is upland-field habitat. The site is covered with tidal salt marsh of cordgrass and salt hay and the main vegetation of upland edges such as red cedar, wild cherry, sweet gum, bayberry, poison ivy and high tide bush. The intercoastal waterway flows through the entire length of the site. The marshes are heavily utilized by waterfowl during the fall and winter months and numerous shore birds nest in the area. Saltwater fishing and crabbing are excellent in all the coastal bays and estuaries (<http://www.state.nj.us/dep/fgw/wmaland.htm>).

Cape May National Wildlife Refuge

In response to the National Wildlife Refuge System Administration Act of 1966 and subsequent National Wildlife Refuge System Improvement Act of 1997, the U.S. Fish & Wildlife Service (USFWS) adopted the *Cape May National Wildlife Refuge (CMNWR) Comprehensive Master Plan (CMP)* on June 16, 2004 in order to establish priorities and to ensure consistent and integrated management for the CMNWR. The CMNWR was established in January 1989 when the U.S. Fish and Wildlife Service acquired the Refuge's first (90-acre) parcel from the Nature Conservancy. Since then, the Refuge has grown to more than 11,000 acres as the USFWS continues to buy land. Ultimately the Refuge will protect over 21,200 acres of precious wildlife habitat in New Jersey's Cape May Peninsula. CMNWR's key location in the Atlantic Flyway makes it an important link in the vast nationwide network of National Wildlife Refuges administered by the U.S. Fish & Wildlife Service. The Delaware Bay wetlands are one of only 17 designated Wetlands of International Importance in the United States.

The Great Cedar Swamp Division is partially located in Dennis Township near Dennisville Village and Woodbine Borough. Currently over 2,600 acres are within Dennis Township. An additional 1,930 acres of unpreserved land is within the approved CMNWR Federal Acquisition Area, including 380 acres within the CMNWR Priority Expansion Area. This area has the largest contiguous forest on the refuge and is part of the Pinelands National Reserve and the Great Egg Harbor National Scenic and Recreational River. This division protects mostly hardwood swamp, salt marsh and bog habitat along with some forested uplands and grassland areas. Unique viewing opportunities exist for Atlantic white cedar stands, a variety of warblers, including prothonotary and pine warblers, wood thrush, bald eagles, wintering short-eared, long-eared and northern saw-whet owls, and northern diamondback terrapin. The Great Cedar Swamp Division also supports large numbers of marsh and water birds, songbirds, raptors, reptiles and amphibians.

5.4.2 *PARKS AND RECREATION AREAS*

Opportunities for recreation are provided throughout Dennis Township. The main local park site, located at 565 Dennisville Road in South Dennis. The Dennis Township Recreational Park (www.dennistwp.org/reactiv.htm) contains a gymnasium, an outdoor picnic area, roller hockey rink, soccer fields, baseball fields, tennis courts, basketball court and playgrounds. Dennis Township also has the Chestnut Street Park, located on Chestnut Street in Belleplain, which contains athletic fields, picnic areas and playgrounds (Dennis Township Recreational webpage (www.dennistwp.org/reactiv.htm)).

Campgrounds are a major source of recreation within the municipality. Approximately 838 acres, or 2% of the total land area is used by campgrounds. Approximately 5,030 campsites were located throughout the municipality. An additional 188 campsites and 14 shelters are located at Lake Nummy in Belleplain State Forest.

The following is a list of the commercial campgrounds located in Dennis Township:

- Holly Lake Campground
- Dennisville Lake Campground
- Jersey Shore Airstream Haven
- Hidden Acres Campground
- Avalon Campground
- Driftwood Campground
- Little Oaks Campground
- Pine Haven Campground
- Tamerlane Campground
- Ocean View Resort Campground
- Sea Grove Campground
- Lake and Shore Resort
- Resort Campground Country Club

5.5 AESTHETIC RESOURCES

Both natural and constructed environmental are components of the aesthetic resources available in Dennis Township. Intact historical buildings, with their varied architectural styles provide a human historic context while the natural marshes and bays provide a striking natural setting of Dennis Township. These natural land areas, separating the inland with the barrier islands, provide protected land with special habitats and great natural diversity. Protected lands, including State- and Federally-owned lands, are located throughout the municipality, such as the Cape May Wetlands, which lie adjacent to Dennis Township, and the Pineland Preservation areas, which lie within the northwestern portion of Township. These nearby special places provide environments to be shared by residents and visitors alike.

Scenic resources are present at many scales. Long distance vistas encompass ocean, beaches and dunes or extensive saltmarsh and bay views present an individual with an unstructured opportunity for peace and relaxation. The natural plant and animal populations, natural ecosystems, as intermittent ponds and fens provide for a smaller scale appreciation of beauty. These resources are valuable in their own right, but also have value because they are beautiful and provide a unique sense of place.

References

Atlantic Coastal Ventures. 2005. Fact Sheet

Breden, T F. 1989. *Classification of Vegetation Communities of New Jersey*. Office of Natural Lands Management, Division of Parks and Forestry, NJDEP, Trenton, NJ.

Center for Remote Sensing and Spatial Analysis (CRSSA) and New Jersey Department of Environmental Protection, Division of Fish & Wildlife, Endangered & Nongame Species Program. (ENSP)
<http://www.dbcrssa.rutgers.edu/ims/vernal/viewer.htm>. Accessed 22 May 2007.

Cape May County Division of Market and Demographic Research. 2003. County Population and Labor Force Projections for New Jersey. 2000 to 2020. In: Cape May County Data Brook, January 2003.

Cape May Planning Commission. 2006. *Open Space Map*. (<http://www.capemaycountygov.net/Cit-e-Access/webpage.cfm?TID=5&TPID=458>)

Carbone, Victor A. 1982. Environment and Society in Archaic and Woodland Times. In, *Practicing Environmental Archaeology: Methods and Interpretations*. Roger Moeller, ed., pp. 32-52. Occasional Paper No. 3, American Indian Archaeological Institute, Washington, Conn.

Cavallo, John. 1981. Turkey Swamp: A Late Paleo-Indian Site in New Jersey's Coastal Plain. *Archaeology of Eastern North America* 9: 1-18.

Cavallo, John and R. Alan Mounier. 1980. Aboriginal Settlement Patterns in the New Jersey Pinelands. In *History, Culture and Archaeology of the Pine Barrens: Essays from the Third Pine Barrens Conference*, edited by Jon Sinton. Stockton College, Pomona.

Chesler, Olga (ed.). 1982. *New Jersey's Archaeological Resources from Paleo-Indian Period to the Present: A Review of the Research Problems and Survey Priorities*. New Jersey Department of Environmental Protection, Office of New Jersey Heritage, Trenton.

Collins, BR, & KH Anderson. 1994. *Plant Communities of New Jersey: A Study in Landscape Diversity*. Rutgers University Press. New Brunswick, NJ: 287 pp.

Cooper, MJP, MD Beevers & M Openheimer. 2005. *Future Sea Level Rise and the New Jersey Coast*. Science, Technology and Environmental Policy Program, Woodrow Wilson School of Public and International Affairs, Princeton University. Princeton, NJ

Custer, Jay F. 1996. Prehistoric Cultures of Eastern Pennsylvania. Anthropological Series No. 7, Commonwealth of Pennsylvania, Pennsylvania Historical and Museum Commission, Harrisburg.

Custer, Jay F. 1984. The Paleoecology of the Late Archaic: Exchange and Adaptation. *Pennsylvania Archaeologist*, 54 (3-4): 32-47.

Dennis Township Planning Board. 1994. Dennis Township Master Plan

Dunk, Richard. 2005. *Offshore Wind Analysis for New Jersey and Delaware*. Rutgers University Institute of Marine and Coastal Sciences (http://marine.rutgers.edu/coo/wind/weather/wind_analysis/phase2.pdf)

- Federal Interagency Committee for Wetland Delineation. 1989. Federal Manual for Identifying and Delineating Jurisdictional Wetlands. US Army Corps of Engineers, US Environmental Protection Agency, US Fish and Wildlife Service, and USDA Soil Conservation Service. Washington, DC Cooperative technical publication: 76 p. plus appendices
- Fetter, CW. 1994. *Applied Hydrogeology*. Macmillan, NY
- Foster, DM. 2006. *Cape May County 2006 Hurricane Conference Local Impacts Report*. (<http://www.capemaycountygov.net/FCpdf/DaleFosterPPS%2Epdf>)
- Gill, H.E., and Farlekas, G.M. 1976., Geohydrologic Map of the Potomac-Magothy-Raritan Aquifer System in the New Jersey Coastal Plain (HA-557}. NJ Geological Survey, Trenton, NJ
- Gournich, V, S. Couch and EK Hartig. 2002. Impacts of Sea Level Rise in the New York City Metropolitan Area. *Global and Planetary Changes* 32: 61-88
- Herman, GC, RJ Canace, SD Stanford, RS Pristas, PJ Sugarman, MA French, JL Hoffman, MS Serfes and WJ Mennel. 1998. Aquifers of New Jersey, NJ Geological Survey Open File Map No. 24. Trenton, NJ
- Kane, RP. *The Ecological and Biological Benefits of Open Space*. New Jersey Audubon Society. (<http://www.greatswamp.org/publications/kane.htm>)
- Kraft, Herbert C. and R. Alan Mounier. 1982. The Late Woodland Period in New Jersey. In New Jersey's Archaeological Resources from Paleo-Indian Period to the Present: A Review of the Research Problems and Survey Priorities, edited by Olga Chesler, pp.139-184. New Jersey Department of Environmental Protection, Office of New Jersey Heritage, Trenton.
- Kraft, John C. 1977. Late Quaternary Paleogeographic Changes in the Coastal Environments of Delaware, Middle Atlantic Bight, Related to Archaeological Setting. In, Amerinds and Their Paleo-Environments in Northeastern North America. W.S. Newman and Bert Salwen, eds. Annals of the New York Academy of Sciences, 288: 35-69.
- Lacombe, PJ. and GB. Carleton. 2002. *Hydrogeologic Framework, Availability of Water Supplies, and Saltwater Intrusion, Cape May County, New Jersey, Water-Resources Investigations Report 01-4246*. USGS and NJDEP. (pubs.usgs.gov/wri/wri014246/pdf/wrir01-4246.pdf)
- Lacombe, PJ., GB Carleton, DA, Pope, R Kecskes, R Grabowski. 2006. Sustainability of Potable and Ecological Water Supplies, Cape May, County, New Jersey. *Geological Society of America Abstracts with Programs*, Vol. 38, No. 7, p. 193
- Lively, JC. 1996. Uncertainty in Predictions of Hurricane Frequency and Intensity in Relation to the Greenhouse Effect. *J. Undergrad. Sci*, 3: 79-84
- Lord, H. 2007. Correspondence. New Jersey Natural Heritage Program Database Search Results
- Meltzer, David J. and Bruce D. Smith. 1986. Paleoindian and Early Archaic Subsistence Strategies in Eastern North America. In, *Foraging, Collecting, and Foraging: Archaic Subsistence and Settlement in the Eastern Woodlands*. Sarah W. Neusius ed., pp. 3-31. Center for Archaeological Investigations, Occasional Paper No. 6, Southern Illinois University at Carbondale.

Miller, Raymond W. and Duane T. Gardiner. 1998. *Soils in Our Environment*, Eighth Edition. Upper Saddle River, NJ: Prentice Hall, Inc. p. 28.

Natural Resource Conservation Service (NRCS). 2006. *Web Soil Survey*. (<http://websoilsurvey.nrcs.usda.gov/app/>)

NRCS Accessed 2006. <ftp://ftp.wcc.nrcs.usda.gov/support/climate/soil-nar/nj/CAPEMAY.DOC>

NJDEP 2002 Land use/Land cover Update, Cape May Watershed Management Area, WMA-16, New Jersey Department of Environmental Protection (NJDEP), Office of Information Resources Management (OIRM), Bureau of Geographic Information and Analysis (BGIA), Published January 1, 2007, http://www.state.nj.us/dep/gis/digidownload/zips/lulc02/w16lu02_D.zip

NJDEP, DFW 2005b. Mammals of New Jersey. (<http://www.nj.gov/dep/fqw/chkmamls.htm>)

NJDEP, DFW 2005c. Birds of New Jersey. (<http://www.nj.gov/dep/fqw/chkbirds.htm>)

NJDEP, DFW 2005d. Reptiles of New Jersey. (<http://www.nj.gov/dep/fqw/chkrept.htm>)

NJDEP, DFW 2005e. Amphibians of New Jersey. (<http://www.nj.gov/dep/fqw/chkamph.htm>)

NJDEP, DFW 2005f. Saltwater Fish of New Jersey. (<http://www.nj.gov/dep/fqw/chkfishmarine.htm>)

NJDEP DLUR. 2007. Notices and Announcements: Flood Hazard Area Control Act Rules Adopted, 11/5/07. (<http://www.nj.gov/dep/landuse/announce.html#110507>)

NJDEP, Division of Watershed Management. 2005. *Basic Information*. (<http://www.state.nj.us/dep/watershedmgt/basicinfo.htm>)

NJDEP Green Acres 2006 the NJDEP Green Acres Program Open Space Database). (<http://www.nj.gov/cgi-bin/dep/greenacres/facproc.pl>)

NJDEP, Natural Heritage Program. 2001a. *Natural Heritage Priority Site – Avalon-Stone Harbor Marsh Macrosite (Description)*. (Site Code S.USNJHP1*53)

NJDEP, Natural Heritage Program. 2001b. *Natural Heritage Priority Site – Belleplain Pond South (Description)*. (Site Code S.USNJHP1*111)

NJDEP, Natural Heritage Program. 2001c. *Natural Heritage Priority Site –Clermont Bog Site (Description)*. (Site Code S.USNJHP1*174)

NJDEP, Natural Heritage Program. 2001d. *Natural Heritage Priority Site – Magnolia Lake Site (Description)*. (Site Code S.USNJHP1*337)

NJDEP, Natural Heritage Program. 2001d. *Natural Heritage Priority Site – Woodbine Bogs (Description)*. (Site Code S.USNJHP1*598)

NJDEP, Natural Heritage Program. 2001e. *Natural Heritage Priority Site – Woodbine Pond (Description)*. (Site Code S.USNJHP1*599)

- NJDEP. Office of Natural Lands Management. Accessed 2006. Endangered Plants of New Jersey Fact Sheet: Sea-Beach Amaranth. Trenton, NJ
- NJDEP. 2004. *Stormwater Management Rules* (N.J.A.C. 7:8)
- NJDEP. 2006. *Surface Water Quality Standards* (N. J. A. C. 7:9B). Trenton, NJ
- NJDEP, Division of Site Remediation and Waste Management. 2006. Known Contaminated Sites in NJ Report 7th Edition (Spring 2006). (<http://www.nj.gov/dep/srp/kcs-nj/capemay/#0504>)
- NJDEP, Site Remediation Program. "Classification Exception Areas" (CEA) (<http://www.state.nj.us/dep/srp/regs/guidance.htm#cea>)
- NJDEP Source Water Protection Program. 2005. Noncommunity Source Water Assessment Report for Dennis Twp, Cape May, County. (<http://www.nj.gov/cgi-bin/dep/swap/ncswapdatamuni.pl>)
- NJ Pinelands Commission. 2005. New Jersey Pinelands Land Capability Map. (http://www.state.nj.us/pinelands/cmp/lcm/200507_01_pma.pdf)
- Office of the New Jersey Climatologist (ONJSC). 2006a. *The Climate of New Jersey*. (<http://climate.rutgers.edu/stateclim/?section=njcp&target=NJCoverview>)
- Office of the New Jersey Climatologist. 2006b. *Historical Monthly Station Data*. (http://climate.rutgers.edu/stateclim_v1/monthlydata/index.html)
- Olsson, H. 1988. *Vegetation of the New Jersey Pine Barrens: A Phytosocial Classification*. In: RTT Forman (ed.) Pine Barrens: Ecosystem and Landscape. Rutgers University Press. New Brunswick, NJ
- Owens, JF, PJ Sugarman, NF Sohl, RA Parker, HF Houghton, RA Volkert, AA Drake, and RC Orndorff. 1998. Bedrock Geology Map of Central and Southern New Jersey. USGS and NJ Geological Survey. Series Map 1-2540-B.
- Pagoulatos, Peter. 1990. Native American Land Use Patterns of New Jersey. *Journal of Middle Atlantic Archaeology* 8: 57-77.
- Russell, RW, ML May, KL Spltesz, JW Fitzpatrick. 1998. Massive Swarms of Dragonflies in Eastern North America. (abs). *The American Midland Naturalist* 140(2)
- Shelford, Victor E. 1963. *The Ecology of North America*. University of Illinois Press. Urbana, Illinois.
- Shiffman, M. 2006. *Plan Endorsement Petition, Dennis Township, Cape May County, New Jersey*. Maser Consulting PA
- Spayd, SE and S W Johnson. 2003. *Guidelines for Delineation of Wellhead Protection Areas, NJGS Open File Report 03-1*. Trenton, NJ
- Tedrow, J.C.F. 1986. *Soils of New Jersey*. Robert E. Krieger Publishing Company, Inc., Malabar, Florida
- U.S. Fish and Wildlife Service (USFWS), Cape May National Wildlife Refuge Comprehensive Conservation Plan. June 2004.

- U.S. Fish and Wildlife Service (USFWS), Southern New England-New York Bight Coastal Ecosystems Program. 1997. *Significant Habitats and Habitat Complexes of the New York Bight Watershed – Cape May- Complex #1*. Charleston, Rhode Island. (http://training.fws.gov/library/pubs5/web_link/text/cmp_form.htm)
- U.S. Geological Survey (USGS). 1999. *Ground Water*. U.S. Geological Survey General Interest Publication Reston, Virginia (http://capp.water.usgs.gov/GIP/gw_gip/how_a.html)
- USGS. 2005. Aquifer Basics. (<http://capp.water.usgs.gov/aquiferBasics/>).
- USGS. 2005. *Major Aquifers in New Jersey*. (<http://nj.usgs.gov/gw/aquifer.html>)
- USGS. 1987. *Hydrologic units, Hydrologic unit codes and Hydrologic unit names*. (Modified from Slack and Landwehr, 1992 and Seaber, Kapinos, & Knapp <http://water.usgs.gov/nawqa/sparrow/wrr97/geograp/hucs.txt> ())
- USGS. 2006. *Bird Checklists of the United States: Birds of Cape May County*. Northern Prairie Wildlife Research Center Online. Jamestown, ND: (<http://www.npwrc.usgs.govcapemay.htm>)
- Watkins, D. 1998. Reappraisal: Shellfish Growing Area #SE-4 -Ludlams Bay & Townsends Sound (1993 – 1997). NJDEP Bureau of Marine Water Monitoring, Trenton, NJ (<http://www.nj.gov/dep/bmw/Reports/SE4-98.pdf>)
- Webb, Thompson.1987. The appearance and disappearance of major vegetational assemblages: Long-term vegetational dynamics in eastern North America. *Vegetation* 69: 177-187.
- Whittaker, R. 1988. *Vegetational Relationships in the New Jersey Pine Barrens*. In: RTT Forman (ed.) *Pine Barrens: Ecosystem and Landscape*. Rutgers University Press. New Brunswick, NJ
- Wright, D and P. Sutton. 1999. Checklist of Butterflies of Cape May County. (<http://www.njaudubon.org/NatureNotes/bflies.html>)