



ENVIRONMENTAL RESOURCE INVENTORY

TOWNSHIP OF BERKELEY

OCEAN COUNTY, NEW JERSEY

January 2012

Approved by the Berkeley Township Environmental Commission on June 19, 2012

Adopted as a Subelement of the Master Plan by the Berkeley Township Planning Board on ____ 2012



Berkeley Township Planning Board

Anthony G. DePaola, *Chairperson*

Jack Wiegartner, *Vice Chairperson*

Councilwoman Frances Siddons, *Secretary*

Carmen F. Amato, Jr., *Mayor*

Dominick Lorelli

Robert W. Winward

Brian Gingrich

Paul Kaywork, *Alternate*

Catherine Demand, *Alternate*



Melissa Kazmac, *Planning Board Secretary*

Gregory P. McGuckin, Esq., *Planning Board Attorney*

Alan B. Dittenhofer, PE, PP, CME, *Board Engineer*

James Oris, PE, PP, CME, CPWM, *Board Planner*

This document was prepared with funding assistance provided by Sustainable Jersey,
sponsored by WalMart, Inc.



Project Team:

David G. Roberts, PP, AICP, LLA, LEED AP ND, Project Manager

Wayne R. Ferren, Jr., Environmental Scientist

Daniel Bloch, PP, AICP, GIS Mapping

Darlene A. Jay, PP, AICP, Project Planner

Prepared by:



2317 Highway 34

Suite 1A

Manasquan, NJ 08736

The original of this document was signed and sealed in

accordance with N.J.S.A. 45:14A-12.

A handwritten signature in black ink that reads 'David G. Roberts'.

David G. Roberts, AICP/PP, LLA, RLA
License Number 03081

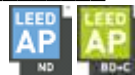


TABLE OF CONTENTS

1. EXECUTIVE SUMMARY	6
2. INTRODUCTION	7
3. LOCATION.....	8
3.1 REGULATORY JURISDICTIONS	8
4. EXISTING LAND USE AND LAND COVER	14
4.2 LAND USE/LAND COVER.....	14
4.2 LAND USE BY PROPERTY TAX CLASSIFICATION.....	15
5. CONTAMINATED SITES	21
6. PHYSICAL RESOURCES AND CONDITIONS.....	25
6.1 CLIMATE	25
6.2 AIR RESOURCES.....	27
6.3 PHYSIOGRAPHIC PROVINCES	30
6.4 GEOLOGY.....	30
6.5 TOPOGRAPHY, SLOPES AND SUBWATERSHEDS.....	37
6.6 SOILS.....	41
7. WATER RESOURCES AND CONDITIONS	47
7.1 GROUNDWATER RESOURCES.....	47
7.2 SURFACE WATER RESOURCES.....	60
7.3 WATERSHEDS	69
7.4 SURFACE WATER QUALITY.....	75
7.5 FLOODWAYS AND FLOODPLAINS	80
8. BIOLOGICAL RESOURCES.....	90
8.1 BOTANICAL RESOURCES.....	90
8.2 ZOOLOGICAL RESOURCES.....	124
8.3 RARE SPECIES AND SPECIES OF SPECIAL CONCERN	130
8.4 SPECIAL STATUS PLANT SPECIES.....	132
8.5 CRITICAL HABITATS AND SPECIAL ECOLOGICAL COMMUNITIES.....	137
9. AGRICULTURAL RESOURCES.....	141
9.1 PRESERVED FARMLAND	141
9.2 AGRICULTURAL PRODUCTION	141
9.3 IMPORTANT FARMLAND SOILS	146
10. HISTORIC & CULTURAL RESOURCES	147
10.1 INVENTORIED HISTORIC RESOURCES.....	147
10.2 INVENTORIED CULTURAL RESOURCES.....	151
11. OPEN SPACE & PUBLIC LAND RESOURCES	153
11.1 OPEN SPACE	156

11.2 PARKS AND RECREATION AREAS	162
12. REFERENCES.....	167
13. APPENDIX.....	172
13.1 NATURAL HERITAGE PRIORITY SITE DATA.....	172
13.2 NATURAL HERITAGE PROGRAM DATA.....	176

MAPS

Regional Location Map	9
Regional Jurisdictions Map.....	11
Land Use/Land Cover Map.....	16
Land Use Map	18
Known Contamination Map	22
Wind Energy Suitability Map	28
Bedrock Geology Map	32
Surficial Geology Map	34
Topography	38
Soils Map	42
Soil Limitations for Septic Systems Map.....	48
Soil Limitations for Dwellings with Basements.....	50
Soil Limitations for Dwellings.....	52
Groundwater Recharge Potential Map.....	54
Wellhead Protection Map.....	58
Wetlands Map.....	64
Watershed Management Map.....	70
Surface Water Quality Standards Map.....	78
Stormwater Management Map	82
Barnegat Bay Stormwater Management Map.....	84
Shellfish Classifications Map	86
Flood Hazard Areas Map	88
Natural Heritage Priority Sites Map	92
Vegetation Map	96
Submerged Aquatic Vegetation Types Map	110
Submerged Aquatic Vegetation Growth Map.....	112
Habitat for Threatened and Endangered Species Map.....	138
Farmland Soils Map.....	142
Agricultural Production Map	144
Historic Resources Map	148
Parks and Open Space Map.....	154

FIGURES

Figure 1: NJDEP Land Use/Land Cover Comparison	15
Figure 2: 2010 Land Use by Property Tax Classification	20
Figure 3: NJDEP Active Known Contaminated Sites.....	24
Figure 4: Temperatures Measured at Toms River	26
Figure 5: Precipitation Measured at Toms River and Tuckerton.....	27
Figure 6: Wind Energy Suitability.....	27
Figure 7: Subsurface Geology	31
Figure 8: Surficial Geology.....	37
Figure 9: Development Limitation of Soils	46
Figure 10: Groundwater Recharge Rates.....	47
Figure 11: Public Non-Community Wells	56
Figure 12: Public Community Wells.....	57
Figure 13: Township of Berkeley Wetlands	63
Figure 14: Double Trouble State Park – Historic District Trails and Cranberry Bogs	67
Figure 15: Watershed and Subwatersheds.....	72
Figure 16: Surface Water Quality Standards (SWQS) Data.....	76
Figure 17: Flood Hazard Areas.....	90
Figure 18: Forest Vegetation	95
Figure 19: Wetland Vegetation.....	105
Figure 20: New Jersey Mammals	125
Figure 21: New Jersey Mammals, continued	126
Figure 22: New Jersey Reptiles	127
Figure 23: New Jersey Amphibians	128
Figure 24: New Jersey Marine Mammals.....	130
Figure 25: Rare Vertebrate Animals in the Vicinity of the Barrier Island	131
Figure 26: Rare Vertebrate Animals in the Vicinity of the Mainland, East of the Parkway	132
Figure 27: Rare Vertebrate Animals in the Vicinity of the Mainland, West of the Parkway	132
Figure 28: Rare Plants Possibly on the Barrier Island	133
Figure 29: Rare Plants Possibly on or in Immediate Vicinity of Mainland, East of the Parkway	134
Figure 30: Rare Plants Possibly on or in Immediate Vicinity of Mainland, West of the Parkway	135
Figure 31: Habitat for Threatened and Endangered Species	140
Figure 32: Rare Terrestrial Communities on or in Immediate Vicinity of the Township of Berkeley	140
Figure 33: Agricultural Production	146
Figure 34: Farmland Soils	147
Figure 35: SHPO Historic Listed Properties.....	150
Figure 36: SHPO Historic Eligible Properties.....	151
Figure 37: Birds Eye View of Dover Forge, Courtesy of www.bing.com	152
Figure 38: Former Royal Pines Hotel, Courtesy of www.bing.com	153
Figure 39: Open Space, Parks and Recreation Areas	156
Figure 40: Edwin B. Forsythe National Wildlife Refuge Map	157
Figure 41: Hovnanian Sanctuary Map.....	159
Figure 42: Township-Owned Open Space	161
Figure 43: Township-Owned Parks and Recreation Areas	165

1. EXECUTIVE SUMMARY

The Township of Berkeley has been working with the State of New Jersey since 2003 towards controlling sprawl development and protecting the Township's delicate remaining woodlands and Barnegat Bay shorelines. As part of a comprehensive planning effort to achieve Plan Endorsement by the New Jersey State Planning Commission and implement an innovative Transfer of Development Rights (hereinafter "TDR") Program, the Mayor and Council and the Township of Berkeley Environmental Commission (hereinafter "BTEC") made an application to the 2011 Sustainable Jersey Small Grants Program for purposes of creating a new, Geographic Information Systems (hereinafter "GIS") -based Environmental Resource Inventory. The BTEC participated in the preparation and adoption of an ERI in 1996, which predated GIS technology and consisted of hand drawn maps compiled into a binder. There are only a few remaining copies, one of which is in the BTEC file, but is rarely referred to anymore. Because the Environmental Resource Inventory is essentially obsolete and difficult to access and use, it has not been an effective tool for the Township's boards or generally available to the public. Meanwhile, the Township has been compiling GIS mapping in its efforts to update its Master Plan in 2008 and pursue statewide planning initiatives such as Plan Endorsement and Transfer of Development Rights, which, combined with the rising tide of concern regarding the environmental sustainability of the Barnegat Bay, made the development of a GIS-based Environmental Resource Inventory timely and prudent.

The advanced state of GIS mapping data as compared to the sources available in 1996 have provided a rich information resource that enables this Environmental Resource Inventory to provide a much deeper understanding of the Township's varied ecological profile. Extensive field work by the project team has yielded detailed photographic documentation of a variety of environmental systems and influences within the Township, ranging from the estuarine marsh and mixed hardwood and pine wooded areas along the bayshore to the changing plant communities along Cedar Creek between the lagoons and Double Trouble State Park to the pure pine forests of the Pinelands. Island Beach State Park, which lies entirely within Berkeley Township and forms a unique double shoreline of the Barnegat Bay with the mainland portion of the Township, has its own well documented dune systems.

This Environmental Resource Inventory, as was proposed in the Township's grant application to Sustainable Jersey, was also an opportunity for the Township to explore the potential for altering past practices for managing stormwater in light of heightened concerns about its degradation of the fragile Barnegat Bay ecosystem. One of the indicators of the health of the Bay is the type and abundance of "submerged aquatic vegetation" (hereinafter "SAV"). Maps that focus on the opposing shorelines of Barnegat Bay within the Township between Island Beach State Park and the mainland show the location of SAV, but a composite map adds the layers for wetlands, vegetation, outfall pipe locations and stormwater basins with the intention of suggesting opportunities to divert stormwater from pipes into managed stormwater wetlands for the biofiltration of nutrients, especially nitrogen, before it reaches the bay. We believe that this map will advance the cause of reforming engineering practices for stormwater management along the Bay and support ongoing efforts by the New Jersey Department of Environmental Protection and Ocean County's departments of planning and engineering to convert traditional stormwater basins into biofiltration basins. It will also reinforce the Township's recent efforts to incorporate requirements for more sustainable stormwater management Best Management

Practices into its development regulations based on standards found in the Leadership in Energy and Environmental Design (hereinafter “LEED”) rating systems of the U.S. Green Building Council.

Finally, the discovery of historic and cultural sites within the State parklands through the field work was a bonus for the Environmental Resource Inventory and enabled the mapping to be more informative about the Township’s past and tell the stories of how the first settlers of the Township used the bogs to first extract iron from the mud to smelt into bars in forges and transport with mules (hence the name “Mule” Road) and then to harvest cranberries.

2. INTRODUCTION

An Environmental Resource Inventory (hereinafter “ERI”) is a compilation of all of the environmental features and characteristics in a municipality. It integrates a variety of data from multiple sources to give the most complete description of natural and cultural resources, critical areas and other environmental features. A detailed natural resources inventory serves to inform the planning process by providing a factual basis for land use decision-making. The mapping and description of sensitive areas facilitates their proper use and protection, the appropriate development of the few remaining vacant, privately-owned land parcels and the redevelopment of developed lands. It can serve in the refinement of zoning regulations and land use ordinances. The identification and understanding of natural systems and their inherent and regulatory limitations enhances effective management. The inventory can identify possibilities for regional partnerships and planning activities that can improve environmental conditions and quality of life in the Township of Berkeley.

In November 2011, the Township of Berkeley was awarded a \$10,000 Small Grant from Sustainable Jersey to develop a new GIS-based ERI. The Township partnered with Sustainable Jersey to fund the ERI.

The benefits of preparing an ERI are many. Once prepared, an ERI can be used as a:

- Factual basis for municipal land use planning;
- Resource in the preparation of the land use element of the Township’s Master Plan;
- Guide in the site plan review process;
- Tool in determining zoning regulations and municipal ordinances;
- Basis for a land capability analysis and for determining the intensity and location of development;
- Indicator of sensitive areas and areas suitable for development;
- Tool to increase understanding of natural systems;
- Long-term planning tool to identify potential land use and natural resource problems and
- Educational tool for residents to learn more about their community (Sustainable Jersey, Accessed 2012).

The Sustainable Jersey grant requires that the Township incorporate the ERI into its land use decision making process. If the Township Planning Board elects to adopt the ERI as part of the Master Plan, the justification and foundation is in place for the implementation of ordinances for resource

protection, conservation and preservation. Finally, it should be noted that the Township of Berkeley will earn 20 points towards its Sustainable Jersey certification upon completion of the ERI.

The primary source of information for the ERI is Ocean County, New Jersey Department of Environmental Protection (hereinafter “NJDEP”), United States Geological Survey (hereinafter “USGS”) and Township GIS data. The scope of the ERI includes:

- Location and regulatory jurisdictions in Chapter 3,
- Land use and land cover in Chapter 4,
- Contaminated sites in Chapter 5,
- Physical resources and conditions in Chapter 6,
- Water resources and conditions in Chapter 7,
- Biological resources in Chapter 8,
- Agricultural resources in Chapter 9,
- Historic and cultural resources in Chapter 10 and
- Open space and parkland resources in Chapter 11

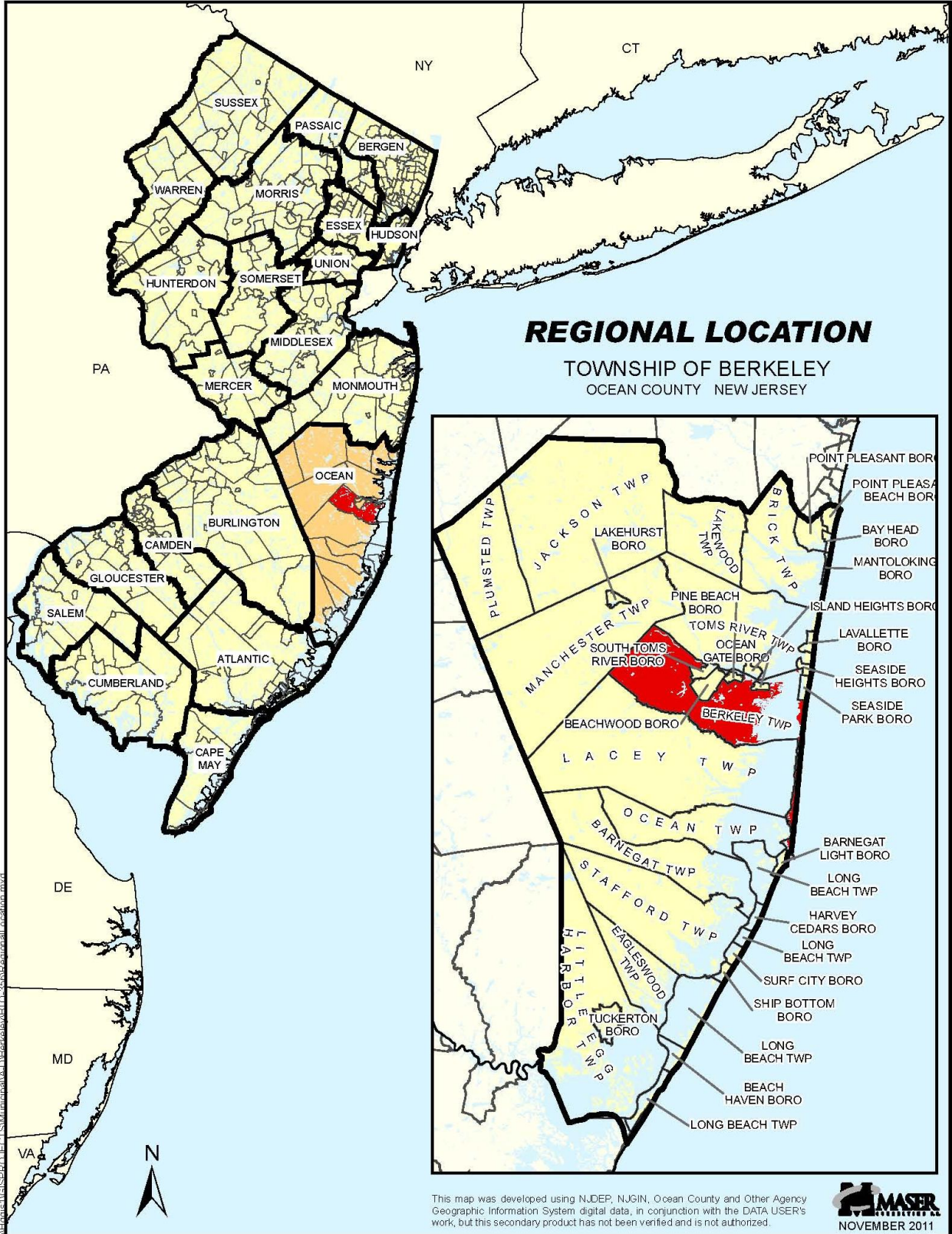
3. LOCATION

The Township of Berkeley is located in the eastern portion of Ocean County. It is bordered to the north by Toms River Township, South Toms River Borough, Beachwood Borough, Ocean Gate Borough, Pine Beach Borough, Island Heights Borough and Seaside Park Borough. It is bordered to the south by Lacey Township and to the west by Manchester Township. To the east is the Atlantic Ocean (see Regional Location Map on page 9). Regional access to the Township is gained by the Garden State Parkway (hereinafter “Parkway”) via Exit 77 as well as County Routes 530, 619, 618 and 621 and State Route 9 (hereinafter “Route 9”).

According to the 2010 tax records, the Township of Berkeley covers 41.4 square miles or roughly 26,500 acres. The Township can be divided into three sections. First, there is the barrier island that encompasses approximately 2,200 acres, which contains Island Beach State Park. Then there is the eastern mainland, lands east of the Parkway. Finally, there is the western mainland, which includes lands west of the Parkway. Most of these lands are under the Pinelands regulations. Berkeley has a wealth of water resources with “35 miles of shoreline comprised of roughly ten miles of oceanfront, 18 miles of bay frontage and seven miles of creek, stream and river frontage” (Maski 2009).

3.1 Regulatory Jurisdictions

The State of New Jersey has established several areas and designated certain natural resources within the State for extra protection. A number of these areas and environmental resources occur within the Township of Berkeley. This includes coastal wetlands, freshwater wetlands and their associated upland transition areas, tidelands, streams and their associated riparian corridors. Rules and regulations have been adopted by the State of New Jersey to regulate development in these areas.



The Township falls into five main regulatory jurisdictions – Coastal Area Facility Review Act, Flood Hazard Control Act, Wetlands Act of 1970, New Jersey Freshwater Wetlands Protection Act and Pinelands Protection Act (see Regional Jurisdictions Map on page 11).

3.1.1 Coastal Area Facility Review Act

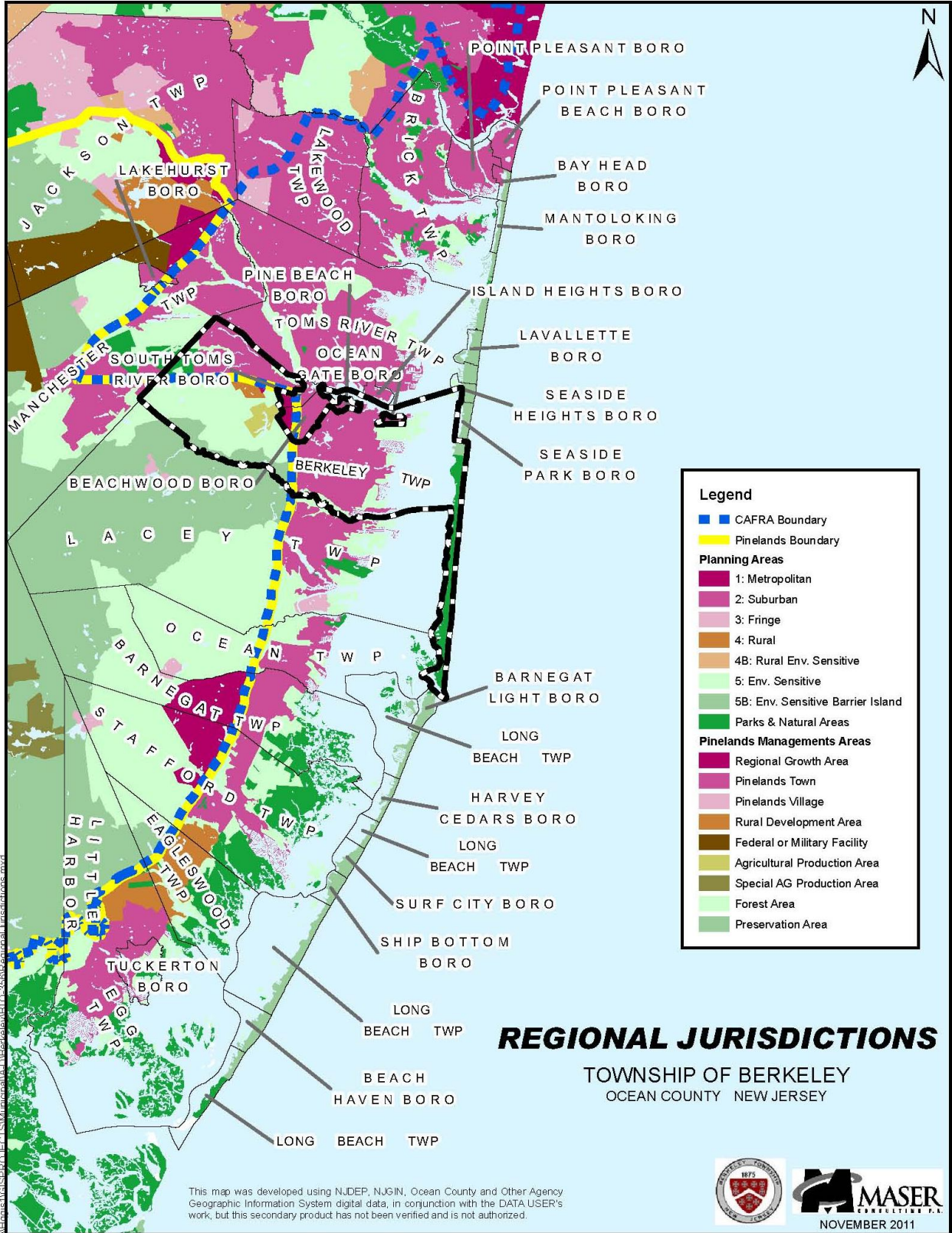
Approximately 16,000 acres (62%) of the Township of Berkeley is under the jurisdiction of the Coastal Area Facility Review Act (hereinafter “CAFRA”). The CAFRA area begins where the Cheesequake Creek enters Raritan Bay in Old Bridge, Middlesex County. The boundary then extends south along the coast around Cape May and then north along the Delaware Bay ending at the Kilcohook National Wildlife Refuge in Salem County. The inland limit of the CAFRA area follows an irregular line drawn along public roads, railroad tracks and other features. The CAFRA area varies in width from a few thousand feet to 24 miles, measured straight inland from the shoreline.

Beginning at the southern boundary of the Township with Lacey Township, the CAFRA boundary follows the Parkway north, cuts through Beachwood Borough and South Toms River Borough, then turns west and follows the former Penn Central railroad line to the western edge of the Township.

The law divides the CAFRA area into zones and regulates different types of development in each zone. CAFRA regulates almost all development activities, including construction, relocation, enlargement of buildings, excavation, grading and site preparation (NJDEP, Division of Land Use Regulation, Accessed 2012).

While the NJDEP has controlled the expansion of sewer infrastructure of the Berkeley Township Sewerage Authority through a specific general CAFRA permit, all other known CAFRA permits issued to the Township have been individual permits for specific engineering projects such as shoreline protection, dredging of navigable lagoon inlets, roads and bridges and stormwater management. All private development projects within the CAFRA area, which meet the CAFRA thresholds, must submit an individual CAFRA permit application to NJDEP.

The Township of Berkeley has been navigating through State Plan Endorsement since 2003. When the Transfer of Development Rights Act became law in March of 2004, Berkeley became one of the pilot communities using funding from the State TDR Bank and the Office of Smart Growth to begin planning for a TDR program in 2005. In September of 2009, the Township’s Action Plan for Plan Endorsement was approved by the State Planning Commission, with the principal remaining Action Items being the completion and adoption of the TDR documents and finalization of the Township’s “chapter” of the Draft Ocean County Water Quality Management Plan. Once the Township’s Petition for Plan Endorsement is approved by the State Planning Commission, NJDEP will publish a CAFRA Notice to recognize the endorsed Centers and Light Industrial Node within its CAFRA regulations. Developers within these areas will be permitted up to 70% impervious coverage where they are currently limited to 30% impervious surface coverage. The Township has already adopted zoning provisions requiring the purchase of Development Credits to gain the use of the additional 40% of property. The Development Credits would be purchased from hundreds of owners of approximately 2,000 vacant, undersized “newspaper subscription” lots consolidated with similar Township-owned lots into five Sending Areas within the remaining wooded areas of the Pinewald section of the Township. Currently such lots had been previously combined with auctioned Township lots into



buildable lots that contributed to a haphazard sprawl of road extensions into wooded areas to reach one or two homes.

3.1.2 Flood Hazard Control Act

Unless properly controlled, development within flood hazard areas can increase the intensity and frequency of flooding by reducing flood storage, increasing stormwater runoff and obstructing the movement of floodwaters. In addition, structures that are improperly built in flood hazard areas are subject to flood damage and threaten the health, safety and welfare of those who use them. Furthermore, healthy vegetation adjacent to surface waters is essential for retaining bank stability and water quality. The haphazard disturbance of such vegetation can destabilize channels, leading to increased erosion and sedimentation that exacerbates the intensity and occurrence of flooding. The loss of vegetation adjacent to surface waters also reduces filtration of stormwater runoff and thus degrades the quality of these waters.

The Flood Hazard Area Control Act rules regulate activities in flood hazard areas (floodways and floodplains) as well as in riparian corridors. NJDEP has adopted these new rules in order to better protect the public from the hazards of flooding, preserve the quality of surface waters and protect the wildlife and vegetation that exist within and depend upon such areas for sustenance and habitat. The rules incorporate stringent standards for development in flood hazard areas and adjacent to surface waters in order to mitigate the adverse impacts to the environment that can be caused by such development.

The required riparian zone width depends on the environmental resources being protected, with the most protective 300 foot riparian zone applicable to waters designated as Category One and certain upstream tributaries. Certain waters supporting trout, habitats of threatened or endangered species critically dependant on the watercourse to survive or watercourses that flow through areas that contain acid-producing soil deposits, receive a 150 foot riparian buffer.

Within the Township of Berkeley, these rules would apply to Potter Creek, Clamming Creek, Maple Creek and Sloop Creek as well as the riparian corridors adjacent to these waterways.

3.1.3 Wetlands Act of 1970

The land immediately adjacent to tidal water often contains coastal wetlands. These wetland areas are a vital coastal resource serving as habitat for many animals and plants. The wetlands also serve as buffers that protect upland areas from the flooding and damage caused by storms.

The Wetlands Act of 1970 requires NJDEP to regulate development in coastal wetlands. Any time land is located near tidal water; there is a good possibility of coastal wetlands on the property. Signs that may indicate the presence of wetlands are tall reeds and grasses or ground that is often soggy. The regulated coastal wetlands are shown on maps prepared by NJDEP. Unlike NJDEP's freshwater wetlands maps, the coastal wetlands maps are used to determine jurisdiction representing the regulatory limits of the State's authority under the Wetlands Act of 1970. One must have a Coastal Wetlands Permit to excavate, dredge, fill or place a structure on any coastal wetland shown on NJDEP's coastal wetlands maps.

3.1.4 New Jersey Freshwater Wetlands Protection Act

Unmapped coastal wetlands and freshwater wetlands are regulated by NJDEP under the Freshwater Wetlands Protection Act. The Freshwater Wetlands Protection Act regulates all activities in freshwater wetlands and their adjacent upland areas referred to as “transition areas”. Freshwater wetlands are commonly referred to as swamps, marshes or bogs. However, many freshwater wetlands in New Jersey are forested and do not fit the classic picture of a swamp or marsh. Previously misunderstood as wastelands, wetlands are now being recognized for their vital ecological and socioeconomic contributions.

Freshwater wetlands contribute to the social, economic and environmental health of our State in many ways:

- Wetlands protect drinking water by filtering out chemicals, pollutants and sediments that would otherwise clog and contaminate our waters.
- Wetlands soak up runoff from heavy rains and snow melts, providing natural flood control.
- Wetlands release stored flood waters during droughts.
- Wetlands provide critical habitats for a major portion of the State's fish and wildlife, including endangered, commercial and recreational species.
- Wetlands provide high quality open space for recreation and tourism.

Many of these values were not widely appreciated until the 1970s and 1980s. By then, more than half of the nation's wetlands were destroyed. The New Jersey freshwater wetlands program protects freshwater wetlands and upland areas within 150 feet of wetlands (called transition areas or "buffers"), from development, aiding the wetlands' ability to provide the values listed above.

If a property contains freshwater wetlands, it is limited in what can be done within the wetlands. The Freshwater Wetlands Protection Act requires NJDEP to regulate virtually all activities proposed in freshwater wetlands, including cutting of vegetation, dredging, excavation or removal of soil, drainage or disturbance of the water level, filling or discharge of any materials, driving of pilings and placing of obstructions. The most common type of freshwater wetlands permit is a general permit. General permits cover a limited number of very minor activities, such as:

- Repair of existing structures
- Short roads or driveways
- Docks
- Utility lines
- Stream bank stabilization
- Septic system repair

If an activity is not eligible for authorization under a general permit, NJDEP may, in very limited circumstances, issue an individual freshwater wetlands permit. Individual permits require an extensive alternatives analysis and are therefore much less common than general permits. When the Freshwater Wetland Protection Act was adopted it was structured such that the State of New Jersey would assume jurisdiction over freshwater wetlands regulated by the Federal Government under

Section 404 of the Clean Water Act. The State of New Jersey is only one of two states (the other being Michigan) which have assumed Section 404 authority from the Federal Government.

3.1.5 Pinelands Protection Act

Established by Congress in 1978, the Pinelands area was the country's first National Reserve. The Pinelands National Reserve includes portions of seven southern New Jersey counties and parts of 56 municipalities, covering roughly 1.1 million acres. In 1979, the New Jersey Legislature passed the Pinelands Protection Act, which contains regulations and standards designed to promote the orderly development of the Pinelands so as to preserve and protect the significant and unique natural, ecological, archaeological, historical and cultural resources of the Pinelands.

Approximately 10,000 acres (38%) of Berkeley Township is under Pinelands Commission jurisdiction (see Regional Jurisdictions Map on page 11). The Township falls within the Preservation Area, Forest Area, Agricultural Production Area, Rural Development Area and Regional Growth Area of the Pinelands. Berkeley's Master Plan and Zoning Ordinance have both been approved by the Pinelands Commission.

4. EXISTING LAND USE AND LAND COVER

The Township of Berkeley has a land area of 41.4 square miles. According to the 2010 Census, the Township has a population of 41,255, which translates to a density of 966 persons per square mile.

4.2 Land Use/Land Cover

The distribution of land use/land cover is summarized in Figure 1 and shown on the Land Use/Land Cover Map on page 16. Figure 1 shows the change of land use/land cover within the municipality between 2002 and 2007. In 2007, the majority of the Township was forest comprising 10,994.03 acres (31.75%) of Berkeley's total land area. Water was the second largest land use/land cover, with 7,572.78 acres (21.85%). The third largest land use/land cover category was wetlands, with 6,865.55 acres (19.81%). These three categories, which are environmentally sensitive features, comprise more than 73% of the Township's total land area.

Residential land use/land cover for 2007 totals 6,151.22 (17.75%) acres when the four residential land use categories are added together. Berkeley Township consists of 450.94 acres (1.30%) of commercial/service uses. Finally, there were 605.38 acres (1.75%) of industrial land use/land cover within the municipality in 2007.



Photo 1: View across preserved salt marsh toward Berkeley Shores residential development (12/1/2011).

Figure 1: NJDEP Land Use/Land Cover Comparison

Land Use/Land Cover	2007		2002	
	Acres	% of Twp.	Acres	% of Twp.
High Density Residential	2,711.04	7.82%	2,699.93	7.79%
Medium Density Residential	2,948.46	8.51%	2,803.34	8.09%
Low Density Residential	380.86	1.10%	325.00	0.94%
Rural Density Residential	110.86	0.32%	102.03	0.29%
Commercial / Services	450.94	1.30%	407.80	1.18%
Industrial	49.96	0.14%	41.61	0.12%
Airport Facilities	111.57	0.32%	109.15	0.31%
Athletic Fields (School)	66.22	0.19%	67.47	0.19%
Cemetery	3.57	0.01%	3.57	0.01%
Infrastructure	605.38	1.75%	575.69	1.66%
Recreational Land	385.96	1.11%	384.65	1.11%
Phragmites Dominate Urban Area	0.41	0.00%	0.41	0.00%
Other Urban Or Built-Up Land	546.11	1.58%	450.91	1.30%
Agriculture	44.97	0.13%	47.36	0.14%
Beaches	211.31	0.61%	313.42	0.90%
Water	7,572.78	21.85%	7,441.36	21.47%
Forest	10,994.03	31.72%	11,251.37	32.47%
Forested Wetlands	2,939.49	8.48%	3,003.82	8.67%
Wetlands	6,865.55	19.81%	6,905.32	19.93%
Extractive Mining	542.59	1.57%	662.26	1.91%
Barren Lands	53.38	0.15%	63.29	0.18%
Total	34,655.97	100.00%	34,655.97	100.00%
Source: New Jersey Department of Environmental Protection (NJDEP) Geographic Information Systems (GIS) Data				

4.2 Land Use by Property Tax Classification

Data on land use by property tax classification was available through Ocean County’s GIS data base. This data is from 2010 and provides insight on the distribution of land uses within Berkeley Township. In 2010 there were a total of 26,394 properties within the Township of Berkeley that had a value of \$5,172,590,600 (DCA, Division of Local Government Service, Accessed 2012). These properties are divided into eleven tax code classifications. These eleven codes are:

- Commercial
- Industrial
- Residential
- Apartment
- Farm
- Vacant
- School

INSERT LAND USE/LAND COVER MAP

Map 3: Land Use/Land Cover Map

PAGE INTENTIONALLY LEFT BLANK

INSERT LAND USE MAP

Map 4: Land Use Map

PAGE INTENTIONALLY LEFT BLANK

- Public property
- Church
- Church
- Cemetery
- Other tax exempt

The Land Use Map on page 18 shows the eleven tax codes as well as the classification of “unknown”, which is due to missing GIS data for some of the Township’s parcels. As shown by the Land Use Map, the majority of the Township west of the Parkway is colored blue, which reflects the large amount of public property located within the Pinelands portion of the municipality. This map illustrates the concentration of commercial properties along Route 9 and the location of the Township’s various schools.



Photo 2: Double Trouble State Park, one of Berkeley Township’s many public properties (12/1/2011).

The total acreage of each tax code classifications is shown in Figure 2. Public properties are the largest land use by property tax classification, encompassing 15,398.14 acres (58.08%) of Berkeley. Double Trouble State Park, Island Beach State Park, Crossley Preserve and Hovnanian Preserve are all included in this property tax classification. In fact, the majority of the Township’s environmentally sensitive areas fall into this category. Residential properties compose 4,621.68 acres of the municipality (17.43%). Vacant land is the third largest tax code classification with 3,683.69 acres (13.90%). The Land Use Map shows that many of the vacant parcels have streams following through them, such as Jakes Branch, Davenport Branch and Wrangel Brook.

Figure 2: 2010 Land Use by Property Tax Classification

Tax Classification	Land Use	Acres	% of Twp.
15C	Public Property	15,398.14	58.08%
2	Residential	4,621.68	17.43%
1	Vacant	3,683.69	13.90%
4B	Industrial	721.17	2.72%
4A	Commercial	665.90	2.51%
15F	Other Tax Exempt	566.11	2.14%
	Unknown Classification	529.58	2.00%
15A	School	153.94	0.58%
15D	Church	62.33	0.24%
4C	Apartment	52.13	0.20%
3A / 3B	Farm (Qualified)	52.99	0.20%
15E	Cemetery	2.13	0.01%
Total		26,509.79	100.00%

Source: Ocean County GIS Data

5. CONTAMINATED SITES

There are a total of 24 active contaminated sites within the Township of Berkeley. The Known Contamination Map shows the location of 23 of the 24 sites. The Western Boulevard contaminated site did not have any GIS coordinates; therefore, it was unable to be mapped. Five sites are within the Pinelands, while the remaining 18 are east of the Parkway. The map also shows well restriction areas and, where known, currently known extent of groundwater contamination areas. Two well restriction areas are shown, south of Robert J. Miller Airpark and north of Denzer and Schafer X-Ray Company. There is also a well restriction area associated with the Ocean County Airpark Hangar site, but no GIS coordinates were provided, therefore the well restriction area was unable to be mapped.

Two groundwater contamination areas are also shown on the Known Contamination Map. The Harborage Avenue and Dockage Road site has a small area northeast of it, while the Butler Boulevard site has a large known extent of groundwater contamination that has leached east of the site to Barnegat Bay.

Figure 3 provides the name, address, remediation level required and category of each active known contaminated site. Seven of the 24 sites in Berkeley have a remediation level of C₁, which means potential groundwater contamination. There are 11 C₂ sites in the Township; this represents sites with a known groundwater contamination. Five C₃ sites exist within Berkeley; these properties have a unknown or uncontrolled discharge to soil or groundwater. Lastly, there is one D remediation level contaminated site (Holiday City at Berkeley), which has multiple sources of contamination or multiple releases of contamination to multi-media including groundwater.

It is important for the Township to know where these sites are and to monitor their cleanup progress. Active known contaminated sites can harm sensitive environmental features and the flora and fauna that reside within these unique habitats. These types of sites also have the potential to impair groundwater quality, which should be a concern with the number of water supply wells in Berkeley Township.

INSERT KNOWN CONTAMINATION MAP

Map 5: Known Contamination Map

PAGE INTENTIONALLY LEFT BLANK

Figure 3: NJDEP Active Known Contaminated Sites

Site Name	Address	Remediation Level ¹	Category ²
Coastal	941 Rt. 9	C2	A
A. Kurnel & Sons	821 Rt. 9	C2	A
Butler Blvd.	Butler Blvd.	C3	B
Double Trouble State Park	Pinewalk Keswick Rd.	C1	A
15 Keats Drive	15 Keats Dr.	C1	A
Denzer & Schafer X-Ray Company	186 Hickory Ln.	C3	A
Bayville Russo	399 Rt. 9	C2	A
Harborage Ave. & Dockage Rd.	Harborage Ave. & Dockage Rd.	C3	B
Berkeley Twp. Water Co. Bay Well 2	Sherman Ave. & Bell St.	C3	B
Princess Laundromat & Dry Cleaning	Rt. 9 S	C1	A
293 Grand Central Parkway	293 Grand Central Pkwy.	C1	A
Delta	385 Rt. 9	C2	A
620 Riverside Drive	620 Riverside Dr.	C2	A
Robert J. Miller Airport	901 Rt. 530 West	C2	A
South Brunswick Asphalt Company	Gladney Ave.	C1	-
Hess Station 30307	125 Rt. 7 & JFK Blvd.	C2	B
70 Veeder Lane	70 Veeder Ln.	C2	A
Morweb Inc.	75 Rt. 9	C2	C
Cumberland Golf 126467	10 Atlantic City Blvd.	C1	A
Holiday City at Berkeley	730 Jamaica Blvd.	D	C
Anchor Outboards Sales & Service Inc.	856 Rt. 9	C1	A
Green Acres Auto Recycling Center	23 Double Trouble Rd.	C2	A
Ocean County Airpark Hangar	Rt. 530 & Mule Rd.	C2	A
Western Boulevard (not mapped)	Western Blvd. & Hoover Ave.	C3	B
Source: NJDEP GIS Data			
¹ Remediation Level Code Description:			
C1: No Formal Design - Source Known or Identified-Potential GW Contamination			
C2: Formal Design - Known Source or Release with GW Contamination			
C3: Multi-Phased RA - Unknown or Uncontrolled Discharge to Soil or GW			
D: Multi-Phased RA - Multiple Source/Release to Multi-Media Including GW			
² Category Code Description:			
A: Sites with On-Site Sources of Contamination			
B: Sites with Unknown Sources of Contamination			
C: Closed Sites with Restrictions			

6. PHYSICAL RESOURCES AND CONDITIONS

In this chapter, a regional description of the climate and physiographic setting of the Township of Berkeley is presented, along with a description of the topography, soils and geology. These factors are important, as they determine and influence the type of biological resources likely to be present within the Township and constrain human uses of the environment.

6.1 Climate

According to the Koppen climate classification, the portion of New Jersey where Berkeley is situated, experiences humid mesothermal (i.e., moderate) climate (Strahler and Strahler 1992). The rising and falling flow of air masses, generally moving from west to east across the United States controls the climate of New Jersey. This pattern of air mass movement is called the westerlies. As these streams of air vary in intensity and can be wet or dry, cold or warm, New Jersey weather is extremely variable on a day to day basis. 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. The Office of the New Jersey State Climatologist (hereinafter “ONJSC”) defines these five regions as Northern, Central, Pine Barrens, Southwest and Coastal (ONJSC, Accessed 2011).

The eastern portion of the Township of Berkeley is located in the Coastal Zone 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 deviation (ONJSC, Accessed 2011). The sea breeze produces local changes in temperature, humidity, wind speed, wind direction, cloud cover and sometimes precipitation. Weather forecasts for near-shore locales must consider its modifying effects of sea breezes on weather conditions for the general public, as well as for boaters (Dunk 2005).

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, Accessed 2011). The distribution of sea surface temperature 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°C colder than the surrounding ocean. These cold pockets of upwelling assist in the creation of sea breezes (Dunk 2005).

ONJSC provides data on weather stations located in New Jersey. There is a weather station in Toms River just northwest of the mouth of Toms River. The weather station has been in operation since 1892 until the present (with a hiatus from 1908 to 1939) for which data is available on ONJSC’s website. The mean monthly temperatures at the Toms River weather station range from 20.5°F in January 1977 to 77.6°F in July of 1994 (ONJSC, Accessed 2012). The lowest monthly mean minimum temperature was observed in December 1989, 8.5°F, while the highest monthly mean maximum temperature was recorded in July of 1894 at 90.1°F (ONJSC, Accessed 2012). Annual mean temperatures, annual mean maximum temperatures and annual mean minimum temperatures from 1980 through 2009 are depicted in Figure 4.

Figure 4: Temperatures Measured at Toms River

Year	Annual Mean Maximum (°F)	Annual Mean Minimum (°F)	Annual Mean (°F)
1980	64.1	39.5	51.8
1981	-	-	-
1982	66.6	40.1	54.1
1983	65.3	41.8	53.6
1984	64.7	41.5	53.1
1985	65.2	41.5	53.4
1986	64.9	41.4	53.2
1987	64.5	42.2	53.6
1988	-	41.3	-
1989	64.3	37.4	50.8
1990	-	-	-
1991	-	-	-
1992	62.8	40.6	51.7
1993	65.1	41.2	53.2
1994	66.2	40.6	53.4
1995	65.4	41.6	53.5
1996	62.9	41.7	52.3
1997	63.8	42.3	53.1
1998	66.9	44.7	55.8
1999	65.5	43.9	54.7
2000	62.6	42.6	52.6
2001	65.4	42.0	53.7
2002	65.6	42.7	54.1
2003	61.6	42.1	51.8
2004	62.9	43.2	53.1
2005	63.3	42.7	53.0
2006	65.3	43.8	54.5
2007	63.9	43.0	53.5
2008	64.2	43.2	53.7
2009	31.3	-	51.8

Source: Office of the NJ State Climatologist
http://climate.rutgers.edu/stateclim_v1/monthlydata/index.html

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 the strong winds and storm surges can be extremely damaging to the natural and built environments. While the region has been spared a “direct hit” for many years, the potential catastrophic impact of Hurricane Irene in September of 2011 was only averted when she veered landward in Virginia and slowed to a tropical storm by the time she passed over the Township. Any nor’easter causes significant beach erosion and local flooding. Figure 5 shows the average monthly precipitation amounts recorded at the Toms River (for rainfall) and Tuckerton (for snowfall) weather

stations. Snowstorms in Ocean County produce an average of 19.0 inches of snowfall per year (ONJSC, Accessed 2012).

The monthly mean temperatures in coastal New Jersey, which includes portions of Atlantic, Cape May, Monmouth and Ocean counties within ten miles of the coast measured from 1895 to 2010 has been rising. Between 1895 and 1970 the mean of monthly temperatures was 53.0°F, between 1971 and 2000 the mean was 54.1°F and between 2001 and 2009 the mean of monthly temperatures was 55.5°F (ONJSC, Accessed 2011).

As a coastal municipality, the Township of Berkeley could experience significant impacts from global warming. Storm frequency and intensity could increase. The frequency of storm-associated floods would result, with the likelihood that events such as a 100-year storm and its associated flooding could occur at intervals much less than every 100 years. Storm surges and coastal erosion can be expected to occur in conjunction with stronger and more frequent storms. Other hazards include saltwater intrusion into aquifers and surface waters, which would cause the salinization of drinking water supplies and altering freshwater aquatic and wetland ecosystems (Gournich, Couch & Hartiq 2002).

Figure 5: Precipitation Measured at Toms River and Tuckerton

Month	Monthly Mean Rainfall ¹	Monthly Mean Snowfall (inches) ²
January	3.74	5.2
February	3.37	6.1
March	4.38	2.9
April	3.80	0.5
May	3.93	0.0
June	3.61	0.0
July	4.80	0.0
August	5.07	0.0
September	3.86	0.0
October	3.87	0.0
November	3.87	0.4
December	4.24	3.1
Annual	48.51	19.0

Source: Office of the NJ State Climatologist
http://climate.rutgers.edu/stateclim_v1/monthlydata/index.html

¹Precipitation was measured at Toms River weather station.

²Snowfall data was unavailable for Toms River, therefore Tuckerton data was utilized.

6.2 Air Resources

This ERI includes a Wind Energy Suitability Map, which depicts average winds speeds for the Township of Berkeley (also shown in Figure 6). The map shows the Pinelands area of the municipality (highlighted in blue) within an area with wind speeds of 0.0 to 12.5 miles per hour (hereinafter “mph”) at 50 meters of altitude. More than 62% of the Township has a wind speed of 0.0 to 12.5 mph at 50 meters of

Figure 6: Wind Energy Suitability

Wind Speed at 50 meters	Acres	% of Twp.
0.00 - 12.5 mph	21,784.54	62.86%
12.5 - 14.3 mph	5,481.82	15.82%
14.3 - 15.7 mph	7,226.25	20.85%
15.7 - 16.8 mph	163.31	0.47%
Off-limits to large scale wind development	1,964.10	5.67%

Source:
http://www.nrel.gov/gis/cfm/data/GIS_Data_Technology_Specific/United_States/Wind/metadata/midatlantic_50_m_metadata.htm and
<http://www.nj.gov/dep/gis/digidownload/metadata/stat>

INSERT WIND ENERGY SUITABILITY MAP

Map 6: Wind Energy Suitability Map

PAGE INTENTIONALLY LEFT BLANK

altitude. Approximately 16% of the lands within Berkeley have a wind speed of 12.5 to 14.3 mph; these areas are highlighted in green on the Wind Energy Suitability Map. Almost the entirety of Island Beach State Park is indicated as having wind speeds of 14.3 to 15.7 mph; however, the Park is off-limits to large scale wind development. Finally, there are 163.31 acres (0.47%) of the Township that have an average wind speed of 15.7 to 16.8 mph. These lands are located at the southern tip of Island Beach State Park and are off-limits to large scale wind development.

6.3 Physiographic Provinces

Areas that have similar rock types, geologic structures, landforms and geologic histories are organized into regions called physiographic provinces. There are five Physiographic Provinces within the State of New Jersey, which make it a complex State for its small size. From northwest to southeast across the State, the provinces are known as the Valley and Ridge, Highlands, Piedmont, Inner Coastal Plain and Outer Coastal Plain. Each name refers to the rock belt that underlies the area. The Township of Berkeley is located within the Outer Coastal Plain and Coastal District Provinces.

The Coastal Plain is the largest physiographic province in New Jersey, covering 4,667 square miles, including all of Ocean County in which Berkeley is located (Dalton 2003). 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 thick in southern Cape May County. The Coastal Plain Physiographic Province extends 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, influence the nature of sediments throughout the Coastal Plain. In general, the Atlantic Coastal Plain, including Berkeley, is flat and slopes gently seaward.

The Outer Coastal Plain consists of unconsolidated Tertiary deposits of sands, silt and gravels, which are sandy with less clay than the inner coastal plain and are more acidic and dry. The lack of fertility makes much of the region unsuitable for agriculture and large areas remain undeveloped. The sandy Pine Barrens, an area that is agriculturally poor but species rich, occupy the center of the province. Blueberries and cranberries have been cultivated in lowland bogs that have accumulated depths of organic matter (Wikipedia, Accessed 2012).

The Coastal District of New Jersey includes the barrier islands, headlands, estuaries and low-lying areas along the western margin of the bays. The climate is heavily influenced by proximity to the Atlantic Ocean and hence is buffered from some of the more extreme conditions experienced in central and western portions of the State. Island Beach State Park, South Seaside Heights, Barnegat Bay and the coast of the mainland are located within the Coastal District.

6.4 Geology

6.4.1 Subsurface Geologic Formations

The Coastal Plain deposits underlying the Township of Berkeley are tilted southeastward from their contact with the Piedmont Province (Dalton 2003). The Bedrock Geology Map and Figure 7 depict the three subsurface geologic formations within the Township.

The Cohansey Formation is middle Miocene in age and underlies the majority of the Township’s subsurface, essentially all lands west of Route 9. This formation encompasses 21,491.75 acres (62.09%) of the Township’s land area. It is composed of quartz sand, white to yellow, with local gravel and clay. It is locally stained red or orange by iron oxides or is cemented into large blocks of ironstone (Owens et al. 1998). The Cohansey commonly weathers white. Maximum thickness of the Cohansey Formation is approximately 197 feet; however, thickness is difficult to determine because of the irregular nature of the bottom contact and because of the post-glacial erosion of the deposits (Owens et al. 1998).

The Kirkwood Formation is middle to lower Miocene in age and consist of several members, two of which underlie portions of the Township (Owens et al. 1998). The Lower Member of the Kirkwood Formation is lower Miocene and underlies the lands west of Toms River, along Wrangel Brook. It composes 206.68 acres (0.60%) of the municipality. Locally it is composed of two facies including the upper fine to medium-grained, massively-bedded sands; and the lower, massive, dark clay and silt-clay facies that contain fossilized plant material. The Lower Member of the Kirkwood Formation ranges approximately 66 to 100 feet in thickness, but extends to almost 200 feet in the southeast beyond the Township.

The Wildwood Member is middle to lower Miocene in position and underlies the eastern portion of the Township. This formation encompasses 12,913.89 acres (37.31%) of Berkeley. It is composed of a massive to finely-bedded dark-gray to olive-gray silty clay. The upper beds are more sandy than the lower beds and commonly contain wood fragments (Owens et al. 1998). The maximum thickness of the Wildwood Member weathers to about 60 feet.

Figure 7: Subsurface Geology

Name	Lithology	Acres	% of Twp.
Cohansey Formation	quartz sand, medium- to coarse grained	21,491.75	62.09%
Lower Member Kirkwood Formation	quartz sand and clay	206.68	0.60%
Wildwood Member	clay, silty	12,913.89	37.31%

Source: NJDEP GIS Data

6.4.2 Surficial Geology

Surficial geology is the distribution of all the loose materials such as till, sand, gravel or clay, which overlie bedrock. Most surficial materials are deposits formed by glacial and deglacial processes during the last stage of continental glaciation, which began about 35,000 years ago. The remaining surficial deposits are the products of postglacial geologic processes, such as river flood plains or are attributed to human activity, such as development fill or other land-modifying features.

There are 13 types of surficial geology within the Township of Berkeley as shown on the Surficial Geology Map and in Figure 8. The following sections describe the various surficial geologies.

Salt-marsh and estuarine deposits (Qmm). Consists of silt, sand, peat, clay and minor pebble gravel. Ranges in color from brown to dark-brown to gray to black. These deposits contain abundant organic matter and were deposited in salt marshes, estuaries and tidal channels during Holocene sea-level rise.

INSERT BEDROCK GEOLOGY MAP

Map 7: Bedrock Geology Map

PAGE INTENTIONALLY LEFT BLANK

INSERT SURFICIAL GEOLOGY MAP

Map 8: Surficial Geology Map

PAGE INTENTIONALLY LEFT BLANK

Upper stream terrace deposits (Q_{tu}). Consists of sand and pebble gravel, minor silt and cobble gravel. Ranges in color from yellow to reddish yellow to yellowish brown. These deposits have weathering characteristics similar to Illinoian glaciofluvial deposits.

Weathered coastal plain formations (Q_{wcp}). Consists of exposed sand and clay and includes thin, patchy alluvium and colluvium and pebbles left from erosion of surficial deposits.

Upland gravel, lower phase (T_{Qg}). Consists of sand, clayey sand and pebble gravel. Ranges in color from yellow to reddish yellow. Can be up to 20 feet thick. It includes fluvial and minor colluvial deposits in erosional remnants capping lower uplands and interfluves.

Swamp and marsh deposits (Q_s). Composed of peat, organic clay, silt and minor sand. Ranges in color from gray to brown to black. It was deposited in modern freshwater wetlands.

Cape May formation, unit 1 (Q_{cm1}). Composed of sand, minor silt, clay and pebble gravel. Ranges in color from very pale brown to yellow to reddish yellow.

Cape May formation, unit 2 (Q_{cm2}). Consists of sand, pebble gravel, minor silt, clay, peat and cobble gravel. It ranges in color from very pale brown to yellow to reddish yellow to white to olive yellow to gray.

Beach and nearshore marine sand (Q_{bs}). Consists of sand and pebble gravel. It ranges from very pale brown to light gray. This deposit is generally less than 20 feet thick. These deposits were left during the Holocene sea-level rise.

Eolian deposits (Q_e). Composed of windblown fine sand and silt. It ranges in color from very pale brown to yellowish brown. Can be as much as 15 feet thick. Forms sand sheets and dunes.

Upland gravel (T_g). Composed of sand, clayey sand and pebble gravel. It ranges in color from yellow to reddish yellow. This deposit includes fluvial and minor colluvial deposits in erosional remnants capping hilltops and interfluves.

Alluvium (Q_{al}). Composed of sand, gravel, silt, minor clay and peat. It ranges in color from reddish brown to yellowish brown to brown to gray. Can be up to 20 feet thick. This deposit contains variable amounts of organic matter and has been deposited in modern floodplains and channels.

Upper Colluvium (Q_{cu}). Composed of sand, silt, minor clay and pebble gravel. It ranges in color from pale brown to yellow to reddish yellow. This deposit forms aprons as the base of slopes on Coastal Plain formations.

Lower stream terrace deposits (Q_{tl}). Composed of sand, pebble gravel, minor silt and cobble gravel. It ranges in color from reddish brown to yellowish brown to reddish yellow. Can be as much as 30 feet thick.

Figure 8: Surficial Geology

Name	Geogage	Acres
SALT-MARSH AND ESTUARINE DEPOSITS (Qmm)	Holocene	9,217.40
UPPER STREAM TERRACE DEPOSITS (Qtu)	middle to late Pleistocene	7,396.37
WEATHERED COASTAL PLAIN FORMATIONS (Qwcp)	Chiefly Pleistocene, locally Miocene and Pliocene.	7,220.35
UPLAND GRAVEL, LOWER PHASE (TQg)	late Pliocene-middle Pleistocene	2,868.40
SWAMP AND MARSH DEPOSITS (Qs)	late Pleistocene and Holocene	2,733.83
CAPE MAY FORMATION, UNIT 2 (Qcm2)	late Pleistocene	2,199.10
BEACH AND NEARSHORE MARINE SAND (Qbs)	Holocene	1,739.30
CAPE MAY FORMATION, UNIT 1 (Qcm1)	early to middle Pleistocene	594.41
EOLIAN DEPOSITS (Qe)	late Pleistocene, locally of early to middle Pleistocene and Pliocene age on uplands	232.24
UPLAND GRAVEL (Tg)	Pliocene-early Pleistocene	179.97
ALLUVIUM (Qal)	Holocene and late Pleistocene	149.44
UPPER COLLUVIUM (Qcu)	middle Pleistocene	17.77
LOWER STREAM TERRACE DEPOSITS (Qtl)	late Pleistocene, late Wisconsinan	16.78
Source: NJDEP GIS Data		

6.5 Topography, Slopes and Subwatersheds

The topography within the Township of Berkeley extends from sea level to a maximum height of approximately 80 feet above mean sea level, which is depicted on the Topography Map on page 38. The Bedrock Geology Map (page 32), Topography Map and Watershed Management Map on page 70 provide insight into the relationship among the various physical aspects of the landscape. For example, the Cape May and Cohansy Formations overlie the older Kirkwood Formation and weather into mostly undifferentiated sandy coastal plain surficial deposits that support Pinelands vegetation. The high topographic areas formed from the weathered Cohansy Formation provide the topographic divides among many of the subwatersheds. Streams such as Jakes Branch, a tributary of Toms River, have cut into the surficial material, forming low-lying floodplain wetlands between the divides. The older Kirkwood Formation along the immediate coast is covered with Aeolian deposits in uplands derived from windblown coastal sands and coastal wetlands along the tidally influenced Barnegat Bay. Beach and near-shore marine sands form the barrier-island or peninsula along the coast of the Atlantic Ocean. The riparian corridor formed by Cedar Creek provides the southern boundary of the Township, with floodplain wetlands and a distinctly different sequence of subwatersheds than the northward trending branches and subwatersheds related to the Toms River corridor forming portions of the northern boundary of the Township. The Barnegat central tributaries, a series of small streams that flow into Barnegat Bay, form the coastal subwatershed of the region.

The Township of Berkeley includes 17 subwatersheds (Watershed Management Map on page 70):

- Wrangel Brook (below Michaels Branch)
- Wrangel Brook (above Michaels Branch)

INSERT TOPOGRAPHY MAP

Map 9: Topography

PAGE INTENTIONALLY LEFT BLANK

- Michaels Branch (Wrangel Brook)
- Davenport Branch (above Pinewald Road)
- Davenport Branch (below Pinewald Road)
- Jakes Branch (Lower Toms River)
- Cedar Creek (74-16-38 to Chamberlain Brook)
- Toms River Lower (Route 166 to Oak Ridge Parkway)
- Cedar Creek (Parkway to 74d16m38s)
- Cedar Creek (below Parkway)
- Toms River Lower (below Route 166)
- Barnegat Control Tributaries (Route 37 to Cedar Creek)
- Barnegat Bay Control (Toms River – Cedar Creek)
- Barnegat Bay Control (Route 37 – Barnegat Inlet)
- Atlantic Coast (Route 37 to Barnegat Inlet)
- Barnegat Bay (Barnegat to Surf City)
- Barnegat Bay North (above Route 37 bridge)

The Wrangel Brook (below Michaels Branch) subwatershed is underlain by the Cohansey Formation and the Lower Member Kirkwood Formation, draining to Toms River. The Wrangel Brook (above Michaels Branch) subwatershed is underlain by the Cohansey Formation and drains northeast to Wrangel Brook. The Michaels Branch (Wrangel Brook) subwatershed is underlain by the Cohansey Formation. It drains northeast into Toms River. The Davenport Branch (above Pinewald Road) subwatershed is underlain by the Cohansey Formation, draining northeast to Toms River. The Davenport Branch (below Pinewald Road) subwatershed is underlain by the Cohansey Formation. This subwatershed drains northeast to Toms River. The Jakes Branch (Lower Toms River) subwatershed is underlain by the Cohansey Formation. It drains northeast, eventually draining into Toms River.

The Cedar Creek (74-16-38 to Chamberlain Brook) subwatershed is underlain by the Cohansey Formation. This subwatershed drains into Barnegat Bay. The Toms River Lower (Route 166 to Oak Ridge Parkway) subwatershed is underlain by the Lower Member Kirkwood Formation. It drains into Toms River. The Cedar Creek (Parkway to 74d16m38s) subwatershed is underlain by the Cohansey Formation. It drains into Barnegat Bay. The Cedar Creek (below Parkway) subwatershed is underlain by the Cohansey Formation and Wildwood Member. It drains into Barnegat Bay. The Toms River Lower (below Route 166) subwatershed is underlain by the Cohansey Formation and Wildwood Member. It drains into Toms River.

The Barnegat Control Tributaries (Route 37 to Cedar Creek) subwatershed is underlain by the Cohansey Formation and Wildwood Member, draining east to Barnegat Bay. The Barnegat Bay Control (Toms River – Cedar Creek) subwatershed is underlain by the Wildwood Member. This subwatershed drains into Barnegat Bay. The Barnegat Bay Control (Route 37 – Barnegat Inlet) subwatershed is underlain by Wildwood Member with elevations less than 20 feet and drains west into Barnegat Bay. The Atlantic Coast (Route 37 to Barnegat Inlet) subwatershed is underlain by Wildwood Member, has elevations less than 20 feet and drains east into the Atlantic Ocean. The Barnegat Bay (Barnegat to Surf City) subwatershed is underlain by the Wildwood Member. It has elevations less than 20 feet and drains west into Barnegat Bay. The Barnegat Bay North (above Route 37 bridge)

subwatershed is underlain by Wildwood Member and drains north into Barnegat Bay with elevations less than 20 feet.

6.6 Soils

Soil is composed of varying proportions of sand, silt and clay particles derived from underlying geologic parent material. These particles are the result of long term forces acting on mountains and rock to break down these large masses into small particles. The native soils of the Township of Berkeley were derived from sediments laid down in glacial outwash plains and near-shore marine deposits. Coastal Plain soils represent a “geologic-ecologic” blend. 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.

Today, we draw on a combination of factors to describe soils. The United States Department of Agriculture (hereinafter “USDA”) has taken the lead in describing the characteristics of soils in New Jersey through the Natural Resources Conservation Service (hereinafter “NRCS”). NRCS maintains a web-based Web Soil Survey, which provides soil data and information to the public.

6.6.1 Township Soils

The soil types found in the Township of Berkeley are depicted on the Soils Map and are described below (USDA, NRCS, Accessed 2012). Owing to the placement of fill and other land alternations associated with development in Berkeley, including the historic lands uses such as extraction of iron, clay and sand/gravel deposits, agricultural practices and alternation of wetlands, the native surficial soils in some areas of the Township have been extensively altered.

Appoquinimink-Transquaking-Misphillion complex, 0 to 1% slopes (AptAv). The soil complex consists of mucky silt loam, silt loam and mucky peat, and is very frequently flooded and frequently ponded. It is associated with tidal marshes. This soil is very poorly drained and annual ponding is frequent. The parent material consists of loamy stream sediments over herbaceous material. This soil type is considered hydric and as such is an indicator of the potential presence of wetlands.

Atsion sand, 0 to 2% slopes (AtsA). This soil consists of sand with a top layer of peat and has no flooding or ponding. It occurs on flats and is poorly drained. The parent material is sandy fluviomarine deposits.

Atsion sand, 0 to 2% slopes (AtsAt). This soil consists of sand to loamy sand and has frequent flooding and ponding. It is associated with tidal marshes and is poorly drained. The parent material consists of sandy fluviomarine deposits.

Aura sandy loam, 2 to 5% slopes (AugB). This soil consists of sandy loam to coarse sandy loam to gravelly coarse sandy loam to gravelly sandy clay loam. It has no frequency of flooding or ponding. Occurring on low hills, this soil is well drained. The parent material is old loamy alluvium and/or old gravelly alluvium.

Berryland sand, 0 to 2% slopes (BerAr). This soil consists of sand and is very poorly drained. It is associated with flats, depressions and drainage ways. Frequency of flooding and ponding is rare. The parent material is sandy fluviomarine deposits.

INSERT SOILS MAP

Map 10: Soils Map

PAGE INTENTIONALLY LEFT BLANK

Berryland sand, 0 to 2% slopes (BerAt). This soil consists of sand to loamy sand and is very poorly drained. It occurs on flats and in depressions and has frequent ponding and flooding. The parent material is sandy fluviomarine deposits.

Downer loamy sand, 0 to 5% slopes (DocB). This soil consists of loamy sand to sandy loam and has no flooding or ponding. It occurs on knolls and low hills and is well drained. The parent material is loamy fluviomarine deposits and/or gravelly fluviomarine deposits.

Evesboro sand, 0 to 5% slopes (EveB). This soil consists of sand to stratified loamy sand and has no flooding or ponding issues. It is found on low hills and is excessively drained. The parent material is sandy eolian deposits and/or sandy fluviomarine deposits.

Evesboro sand, 5 to 10% slopes (EveC). This soil consists of sand to loamy sand and has no flooding or ponding. It occurs on low hills and is excessively drained. The parent material is sandy aeolian deposits and/or sandy fluviomarine deposits.

Galloway loamy sand, 0 to 5% slopes (GamB). This soil consists of loamy sand to sand and has no flooding or ponding. It occurs in flats and dunes and is somewhat poorly drained. The parent material is unconsolidated sandy marine deposits.

Hammonton loamy sand, 0 to 5% slopes (HbmB). This soil consists of loamy sand to sandy loam to sand. It has no frequency of flooding or ponding. Found in flats and depressions, this soil is moderately well drained. The parent material consists of coarse-loamy fluviomarine deposits.

Hammonton sandy loam, 2 to 10% slopes (HboA). This soil consists of sandy loam to sand and has no occurrence of flooding or ponding. It occurs in flats and depressions and is moderately well drained. The parent material is coarse-loamy fluviomarine deposits.

Hooksan fine sand, 2 to 10% slopes (HorsC). This soil consists of fine sand and has no flooding or ponding. Found in dunes and barrier islands, this soil is excessively drained. The parent material consists of sandy beach sand.

Keyport sandy loam, 0 to 2% slopes (KemA). This soil consists of sandy loam to silty clay loam and has no frequency of flooding or ponding. It occurs on knolls and is moderately well drained. The parent material consists of silty and clayey eolian deposits and/or silty and clayey fluviomarine deposits.

Lakehurst sand, 0 to 5% slopes (LakB). This soil consists of slightly decomposed plant material to sand and has no occurrence of flooding or ponding. It occurs on flats and dunes and is moderately well drained. The parent material is sandy fluviomarine deposits.

Lakehurst sand, thick surface, 0 to 5% slopes (LakkB). This soil consists of moderately decomposed plant material to sand to loamy sand and has no flooding or ponding issues. It occurs in flats and dunes and is moderately well drained. The parent material is sandy fluviomarine deposits over clayey estuarine deposits.

Lakewood sand, 0 to 5% slopes (LasB). This soil consists of sand to loamy sand and has no flooding or ponding issues. Occurring on flats and knolls, this soil is excessively drained. The parent material is sandy fluviomarine deposits.

Lakewood sand, 0 to 5% slopes (LasC). This soil consists of sand to loamy sand and has no flooding or ponding. Found on marine terraces, this soil is excessively drained. The parent material is sandy fluviomarine deposits.

Manahawkin muck, 0 to 2% slopes (MakAt). This soil consists of muck to sand and suffers from frequent flooding and ponding. It occurs in swamps and flood plains and is very poorly drained. The parent material is organic, woody material over sandy alluvium.

Mullica sandy loam, 0 to 2% slopes (MumA). This soil consists of mucky peat to sandy loam to loamy sand and has no flooding or ponding. Found in flood plains, depressions and drainage ways, this soil is very poorly drained. The parent material is loamy and sandy fluviomarine deposits.

Phalanx loamy sand, 2 to 5% slopes (PhbC). This soil consists of loamy sand to channery sandy loam to very flaggy loamy sand. It has no frequency of flooding or ponding. Occurring on hills, this soil is well drained. The parent material consists of sandy and/or loamy fluviomarine deposits.

Psamments, 0 to 3% slopes (PssA). This soil consists of fine sand to sand and has no frequency of flooding or ponding. It occurs in depressions and is well drained. The parent material is sandy lateral spread deposits.

Psammaquents, sulfidic substratum, 0 to 3% slopes (PstAt). This soil consists of coarse sand to gravelly sand to mucky peat and is subject to frequent flooding and ponding. Found in flats, this soil is very poorly drained. The parent material is sandy lateral spread deposits over organic material.

Psammequents, sulfidic substratum, 0 to 3% slopes (PsuB). This soil consists of sand and has no flooding or ponding. It occurs on hills. The parent material is sandy lateral spread deposits.

Urban land – Hooksan complex, 2 to 10% slopes (USHOOB). This soil consists of fine sand to sand and has no flooding or ponding issues. It occurs on dunes and barrier islands and is excessively drained. The parent material is beach sand.

Woodmansie sand, 0 to 5% slopes (WobB). This soil consists of sand and has no flooding or ponding issues. It occurs on ridges and interfluves and is well drained. The parent material is siliceous loamy marine deposits.

Woodmansie sand, 5 to 10% slopes (WobC). This soil consists of sand to sandy loam and has no flooding or ponding issues. It occurs on hill slopes and ridges and is well drained. The parent material is siliceous loamy marine deposits.

The Soils Map (page 42) shows the soil survey mapping units. Excluding water, Lakehurst sand (LakB) is the most predominant type of soil within Berkeley Township; it covers 6,351.69 acres (18.33%) of the municipality. Lakewood sand (LasB) is the second largest soil type, with 4,796.14 acres (13.84%).

6.6.2 Soils Limitations

Figure 9 shows the limitations of the Township of Berkeley soils for certain types of development. The Soils Limitations for Septic Systems Map on page 48 depicts soil limitations for septic systems, the Soil Limitations for Dwellings with Basements Map on page 50 illustrates soil limitations for dwellings with basements and lastly, the Soil Limitations for Dwellings Map on page 52 depicts soil limitation for dwellings. As Figure 9 shows, many of the soils (e.g., Atsion, Berryland, Downer, Evesboro, Hammonton, Lakehurst and Manahawkin) have seasonally high water tables resulting in severe limitations for a variety of development activities including location of septic absorption fields and building foundations with basements. Several soil types, however, have slight to moderate limitations, including Aura, Lakewood, Phalanx and Woodmansie soils (Figure 9).

Figure 9: Development Limitation of Soils

Soil Name	Depth to Seasonal High Water Table (feet)	Septic Limitations: Absorption Fields	Limitations for Building Foundations (with basements)
Appoquinimink-Transquaking-Mispillion complex	tidal salt marshes		
Atsion sand	0 - 1.0	severe: wetness, floods	severe: wetness, floods
Aura sandy loam	> 6.0	moderate: percs slowly	slight
Berryland sand	0 - 0.5	severe: wetness, floods	severe: wetness, floods
Downer loamy sand	> 6.0	severe: seepage	slight
Evesboro sand	> 6.0	severe: slope, seepage	slight to moderate
Galloway loamy sand	-	-	-
Hammonton loamy sand	1.5 - 4.0	severe: wetness, seepage	severe: wetness
Hooksan fine sand	-	-	-
Keyport sandy loam	1.5 - 4.0	severe: percs slowly	moderate: wetness
Lakehurst sand	1.5 - 3.5	moderate to severe: wetness, percs slowly	severe: wetness
Lakewood sand	> 6.0	slight: rapid permeability, may cause pollution	slight
Manahawkin muck	+1.0 - 0	severe: wetness, floods	severe: wetness, floods, low strength
Mullica sandy loam	0 - 0.5	severe: wetness	severe: wetness
Phalanx loamy sand	> 6.0	moderate: large stones	moderate: large stones
Psamments	altered soils and fill needing individual site evaluation		
Psammaquents, sulfidic substratum	+1.0 - 0	severe: ponding, flooding	severe: ponding, flooding
Urban land-Hooksan complex	covered with 80% development, impervious surfaces		
Woodmansie sand	> 6.0	slight	slight

Source: Hole and Smith 1980

7. WATER RESOURCES AND CONDITIONS

Water is a critical resource for life. It provides sustenance and acts as a habitat for many animal and plant species. Water can be divided into two categories – groundwater and surface water.

Groundwater provides wells with drinking water and contributes to the base flow of streams and water bodies. Groundwater is found below the ground surface in the spaces between soil and sediment particles and in the cracks and pore spaces within bedrock and subsurface formations. Surface water, in contrast to groundwater, is water flowing in natural channels carved into the surface of the earth, which is commonly referred to as streams, rivers or creeks. Surface water has many uses, including drinking water and recreational activities. It provides habitat for fish and other aquatic life. The groundwater and surface water resources of the Township of Berkeley are described in the following sections.

7.1 Groundwater Resources

7.1.1 Aquifers

An aquifer is a water-bearing bed or stratum of permeable rock, sand or gravel through which subsurface water can move to supply springs and wells. Groundwater, contained primarily in subsurface formations, is one of our most important resources. Sources of groundwater recharge include direct precipitation and discharge from wetlands and surface water bodies; groundwater may also discourage or replenish wetlands and surface water bodies. Since the Township of Berkeley contains a vast amount of open space and parkland, there is enormous potential for groundwater recharge throughout the municipality. The

Groundwater Recharge Potential Map on page 54 and Figure 10 illustrate the six groundwater recharge rates within Berkeley. Dark green areas have the highest recharge, a rate of 13 to 14 inches per year. More than 11,000 acres (40.80%) have a groundwater recharge rate of 13 to 14 inches per year. A total of roughly 6,150 acres (22.19%) have a recharge rate of 11 to 12 inches per year. Wetlands and open waters, which have no recharge calculation, compose approximately 7,646 acres (27.59%) of the Township. Only 1,082 acres (3.90%) of land within the municipality have a groundwater recharge rate of zero inches per year.

Figure 10: Groundwater Recharge Rates

Ground Water Recharge Rank	Acres
Rank A: 13 - 14 in/yr	11,306.42
Rank B: 11 - 12 in/yr	6,149.60
Rank C: 8 - 10 in/yr	579.63
Rank D: 1 - 7 in/yr	948.54
Rank E: 0 in/yr	1,081.75
Rank W: Wetlands & Open Water - No Recharge Calculated	7,646.19
Source: NJDEP GIS Data	

The Kirkwood-Cohansey Aquifer System, typical of much of the outer Coastal Plain, extends throughout the Township of Berkeley (Herman et al. 1998), which is underlain by the Cohansey Formation and the Lower Member and Wildwood Member of the Kirkwood Formation. The Kirkwood-Cohansey Aquifer System is a water-table aquifer composed of sand and gravel with lenses of silt and clay (Herman et al. 1998). It is characterized primarily by inter-granular porosity and permeability. Water is fresh, acidic, highly corrosive and low in dissolved solids, but may be less corrosive in confined areas of the aquifer, which also may have elevated salinity near the coast (Herman et al. 1998). This aquifer is rank as A/B based on its ability to yield groundwater to high-

INSERT SOIL LIMITATIONS FOR SEPTIC SYSTEMS MAP

Map 11: Soil Limitations for Septic Systems Map

PAGE INTENTIONALLY LEFT BLANK

INSERT SOIL LIMITATIONS FOR DWELLINGS WITH BASEMENT MAP

Map 12: Soil Limitations for Dwellings with Basements

PAGE INTENTIONALLY LEFT BLANK

INSERT SOIL LIMITATIONS FOR DWELLINGS MAP

Map 13: Soil Limitations for Dwellings

PAGE INTENTIONALLY LEFT BLANK

INSERT GROUNDWATER RECHARGE POTENTIAL MAP

Map 14: Groundwater Recharge Potential Map

PAGE INTENTIONALLY LEFT BLANK

capacity wells, indicating wells are capable of yielding from greater than 250 gallons per minute to greater than 500 gallons per minute (Herman et al. 1998).

Berkeley Township Municipal Utilities Authority (hereinafter “MUA”) is the purveyor of potable water for the Township. The Township’s water supply is derived from three wells that draw water from Shark River Aquifer/ Piney Point Formation, which are over 500 feet deep (Berkeley Township MUA, Accessed 2012).

7.1.2 Wells and Well Head Protection Areas

Wellhead protection areas are mapped areas around a public water supply well that delineate the horizontal extent of groundwater captured by a public water supply well. Wellhead protection areas have three tiers, which serve to mark the boundaries for the protection of groundwater quality. Tier 1 is a two-year time of travel (e.g., the groundwater within this tier flows to the well within a two-year time frame), Tier 2 is a five-year time of travel and Tier 3 is equivalent to a 12-year time of travel.

There are two categories of public water supply wells – public community water supply wells and public non-community water supply wells. Public community systems have at least 15 service connections used by year-round residents, a municipal system is an example of a public community system. Public non-community systems are used by individuals other than year-round residents, such as hospitals or restaurants, for at least 60 days a year.

The Wellhead Protection Map on page 58 illustrates the public community and public non-community wells within Berkeley Township. There are a total of 14 public community wells and 27 public non-community wells in the municipality (refer to Figures 11 and 12). As the map shows, there are numerous wells outside of the Township that have

Figure 11: Public Non-Community Wells

Owner	Well Name
Downe's Bait & Tackle Shop	Well
Ocean County Utilities Authority	Well 2
Ocean County Utilities Authority	Well 1
Air Park Emergency Service	Well 1
Ocean County Airport Hanger	Well 1
Air Terminal Building #56	Well 1
Lanoka Harbor Marine - Dock	Well
JCPL	Well 1
Island Beach State Park	Area A7 Well
Crystal Lake Health Care	Well 1
Berkeley Township Municipal	Well 1
Public Works Building	Well 1
Cedar Creek Campground	Nellie's Deli Well
Cedar Creek GC	Club House Well
Cedar Creek GC	Well 2 (Maintenance Bldg)
Berkeley Island Park	Well
VFW Post #9503	Well
Cedar Creek Municipal Building	Well
Central Reg. Board of Education	Well 3
Central Reg. Board of Education	Well 4
Waters Edge Restaurant	Well
Hilltop II Nursery School	Well 1
Ryan's Funeral Home	Well
Lacey Garage	Well Building 47
Goodluck Point Marina, Inc.	Well
Getty Station #56157	Well
Hilltop II Nursery School	Well 2
Island Beach State Park	Well
Headstart	Well

Source: NJEDP GIS Data

wellhead protection areas that cross municipal boundaries into Berkeley. This includes one public community well in Pine Beach Borough, three public community wells in Beachwood Borough, two public community wells in South Toms River Borough, four public community wells in Seaside Heights Borough, two public non-community wells in Lacey Township and three public community wells in Toms River Township.

Figure 12: Public Community Wells

Owner	System	Address	Municipality	Completion Date
Beachwood Water Dept		Birch St & Halliard Ave	Beachwood	4/4/1985
Beachwood Water Dept		Beachwood Blvd	Beachwood	4/11/1975
Beachwood Water Dept		Birch St & Halliard Ave	Beachwood	3/7/2003
Crystal Lake Health Care		Lakeside Blvd	Berkeley	03/00/1979
Shore Water Co		23rd St & Central Ave	Berkeley	6/22/1954
Aqua New Jersey Inc	Berkeley Water Co	Rte 9 (Pinewald)	Berkeley	10/23/1961
Shore Water Co		23rd Ave	Berkeley	02/00/1973
Aqua New Jersey Inc	Berkeley Water Co	Rte 9	Berkeley	5/21/1997
United Water New Jersey	Toms River	Santiago Ave	Berkeley	10/15/1984
Aqua New Jersey Inc	Berkeley Water Co	Rte 9 & North Ash Ave	Berkeley	5/29/1986
Shore Water Co		Barnegat Ave	Berkeley	1/7/1988
United Water New Jersey	Toms River	Mule Rd, Holiday City	Berkeley	11/6/1987
United Water New Jersey	Toms River	Mule Rd	Berkeley	6/8/1988
Berkeley Township MUA		Station Rd	Berkeley	3/3/1992
Berkeley Township MUA		Station Rd	Berkeley	2/22/1992
Crystal Lake Health Care		Lakeside Blvd	Berkeley	1928
Berkeley Township MUA		Station Rd	Berkeley	9/18/1999
United Water New Jersey	Toms River	Waterline Rd	Toms River	5/10/1968
United Water New Jersey	Toms River	Waterline Rd	Toms River	5/28/1981
United Water New Jersey	Toms River	Waterline Rd	Toms River	12/29/1987
Pine Beach Water Dept		Station & Cedar Aves	Pine Beach	10/19/1989
Seaside Heights Borough	Water Dept	Sampson Ave & Bay Blvd	Seaside Heights	11/00/1976
Seaside Heights Borough	Water Dept	Hancock Ave & Bay Blvd	Seaside Heights	3/21/1986
Seaside Heights Borough	Water Dept	Grant Ave & Bay Blvd	Seaside Heights	12/23/1998
Seaside Heights Borough	Water Dept	Grant Ave	Seaside Heights	1942
United Water New Jersey	Toms River	Double Trouble Rd	South Toms River	3/7/1979
United Water New Jersey	Toms River	Double Trouble Rd	South Toms River	6/8/1988

Source: NJDEP GIS Data

Many of the wells shown on the Wellhead Protection Map are located in close proximity to developed areas, which poses a risk of contamination from existing and past development patterns. Potential contamination sources include agricultural land uses, contaminated soils, highway runoff, known contaminated sites, industrial and commercial point sources, leaking sewer lines, septic systems and leaking underground storage tanks.

NJDEP conducts an annual drinking water quality report, which reviews potential contamination sources near the MUA's wells. The report analyzes the susceptibility for seven contaminant categories

INSERT WELLHEAD PROTECTION MAP

Map 15: Wellhead Protection Map

PAGE INTENTIONALLY LEFT BLANK

and ranks them high, medium or low. For pathogens (e.g., bacteria and viruses), nutrients (e.g., nitrogen and phosphorus), pesticides (e.g., herbicides and insecticides) and volatile organic compounds (e.g., solvents, degreasers and gasoline components) all three of the MUA's well ranked low. Two wells ranked low and one well ranked medium for inorganics (e.g., arsenic, asbestos copper, lead and nitrate). One well ranked low and two wells ranked medium for radionuclide (e.g., radium and uranium). All three wells ranked high for disinfection byproduct precursors (e.g., when disinfectants react with dissolved organic material) (Berkeley Township MUA, Accessed 2012).

7.2 Surface Water Resources

This section reviews the various types of surface water resources within Berkeley Township – wetlands, vernal pools, streams, lakes, ponds and reservoirs.

7.2.1 Wetlands

According to the U.S. Army Corps of Engineers and U.S. Environmental Protection Agency regulations described in Section 404 of the Clean Water Act (33 CFR Section 328.3 and 40 CFR Section 230.3) respectively, wetlands are "... areas that are inundated or saturated with surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions".

Identification and delineation of wetlands are based on a functional approach that is commonly called the three-parameter approach and is outlined in the Federal Manual for Identifying and Delineating Jurisdictional Wetlands, an Interagency Cooperative Publication issued in 1989. The three parameters defining jurisdictional wetlands are hydric soils, hydrophytic vegetation and wetland hydrology. Other types of non-jurisdictional wetlands can occur at a site based upon different definitions, such as that used for the U.S. Fish and Wildlife Service Classification of Wetlands and Deepwater Habitats of the United States (Cowardin et al. 1979), which also has broad acceptance and is used to classify wetlands in general. Wetlands can be classified into systems, subsystems, classes, subclasses and dominance, soil and habitat types and other hierarchical categories.

Cowardin et al. (1979) identified five systems of wetlands for the United States: Marine, Estuarine, Riverine, Lacustrine and Palustrine. Marine wetlands occur along the intertidal shorelines of oceans, as contrasted to the Marine subtidal deepwater habitats. Estuarine Wetlands occur in the intertidal zones of estuaries, as contrasted to the Estuarine subtidal deepwater habitats. Riverine Wetlands are characterized by non-persistent plants when vegetated and occur in shallow or intermittent river and stream channels and along shores affected by the energy of flowing water, as compared to subtidal deepwater habitats in channels. Lacustrine Wetlands are characterized by non-persistent plants when vegetated and occur in the littoral zones of lakes generally greater than 20 acres and with wave-formed shorelines, as contrasted to the limnetic deepwater habitats of lakes. Palustrine Wetlands include those types not classified in the other systems and are represented, for example, by freshwater marshes, floodplain forested, vernal pools, bogs, seeps and wetland types. There are no deepwater habitats in the Palustrine System.

In New Jersey, use of freshwater wetlands is regulated by the Freshwater Wetlands Protection Act, N.J.S.A 13:9B-1 et seq. as described in Chapter 3 of this document. Wetlands are recognized as

important features of the landscape and provide many functions that are also beneficial to people and wildlife.

Wetland Habitats, Functions and Values

Wetland habitats have been defined as “part of the physical environment in which plants and animals live” (Novitzki, Accessed 2011). Wetlands are among the most productive habitats in the world, providing food, water and shelter for fish, shellfish, birds, herpetofauna and mammals. They serve as breeding grounds for numerous species and many endangered plant and animal species are dependent on wetland habitats for survival (Mitsch & Gosselink 1986; National Academy of Sciences 2001).

Wetland habitat functions and values have been considered a vital aspect of wetlands for many years. A national workshop was convened in 1983 to address the topic (Sather and Smith 1984) and an overview of functions and values, also referenced as “functional values”, was published subsequently by the U.S. Fish and Wildlife Service (Sather and Smith 1984). Wetland “ecosystem functions” have been defined as a process or series of processes that take place within a wetland (Novitzki, Accessed 2011). They also have been identified as the normal or characteristic activities that take place in wetland ecosystems. These include, for example, the storage of water, transformation of nutrients, growth of living matter and diversity of wetland plants, which have value for the wetland itself, for the surrounding ecosystem and for people. Wetland “values” have been defined as attributes that are worthwhile, beneficial or desirable (Novitzki, Accessed 2011). The value of a wetland lies in the benefits it provides to the environment or to people, the latter of which also have been called “socioeconomic values”. Although there have been various approaches proposed to categorize functions and values, the approach to ecosystem functions designed for the U.S. Army Corps of Engineers (Smith et al. 1995) is adopted herein for the purpose this ERI:

Wetland Ecosystem Functions (Smith et al. 1995)

Functions related to hydrologic processes:

- Short-term storage of surface water
- Flood storage and conveyance
- Long-term storage of surface water
- Storage of subsurface water
- Moderation of groundwater flow or discharge
- Aquifer recharge and discharge
- Dissipation of energy
- Erosion control
- Shoreline stabilization

Functions related to biogeochemical processes:

- Cycling of nutrients
- Primary productivity of autotrophs
- Nutrient utilization
- Decomposition
- Denitrification

- Food-chain support of heterotrophs
- Export of organic carbon
- Removal of elements or compounds
- Toxicant removal
- Retention of particulates
- Sediment removal

Functions related to habitat:

- Maintenance of plant and animal communities
- Plant diversity
- Submersed aquatic plants
- General habitat suitability
- Threatened and endangered species habitat
- Aquatic invertebrate and shellfish habitat
- Wetland associated vertebrates (herps, fish, birds, mammals)

Wetland socioeconomic values (i.e., “ecosystem goods and services”) (Sather & Smith 1984)

Consumptive values:

- Harvesting (fish, shellfish, lumber, agriculture)
- Grazing

Non-consumptive values:

- Recreation
- Cultural
- Education and scientific
- Heritage sites (uniqueness)
- Aesthetic values

Township of Berkeley Wetlands

The Wetlands Map on page 64 shows wetlands as delineated by NJDEP within the Township. This includes both tidal and non-tidal (freshwater) wetlands. As illustrated in Figure 13, there are 6,865.55 acres of wetlands within Berkeley. Of that total 4,903.55 acres (71.42%) are non-tidal wetlands and 1,962.00 (28.58%) are tidal wetlands. As depicted on the Wetlands Map, vegetated dune community tidal wetlands are located on the barrier island along with saline marsh tidal wetlands and pockets of scrub/shrub non-tidal wetlands located on the Barnegat Bay side of the barrier island.

The majority of the 972.15 acres of saline marsh tidal wetlands are located on the mainland adjacent to Barnegat Bay. Moving inland (i.e., west) these tidal wetlands transform into non-tidal wetlands. Non-tidal Atlantic White Cedar wetlands are mostly located along the Township’s streams and compose 532.79 acres of the Township. Refer to the discussion of vegetated wetlands in Chapter 8 for more details.

Figure 13: Township of Berkeley Wetlands

Type	Acres
Non-Tidal (Freshwater) Wetlands	4,903.55
Herbaceous Wetlands	53.80
Scrub / Shrub Wetlands	1,061.57
Wooded Wetlands	2,939.49
Atlantic White Cedars	532.79
Managed / Modified / Disturbed Built-Up Wetlands	315.90
Tidal Wetlands	1,962.00
Freshwater / Brackish Tidal Wetlands	92.39
Saline Marsh	972.15
Vegetated Dune Community	897.47
Total	6,865.55
Source: NJDEP GIS Data	

7.2.2 Vernal Pools

NJDEP defines vernal pools as “confined wetland depressions, either natural or man-made, that hold water for at least two consecutive months out of the year and are devoid of breeding fish populations” (NJDEP, DF&W, Accessed 2012). Vernal pools take many shapes; they can be isolated depressions within upland forests, seasonally flooded meadows, floodplain swamps or even abandoned gravel pits and quarries. In the State of New Jersey portions of the Coastal Plain landscape provide a habitat for vernal pools.

Vernal pools are unique ecosystems that provide a habitat to amphibians, insects and reptiles. In New Jersey, there are seven amphibians that are dependent on vernal pools, two frogs and five salamanders. Of these, the eastern tiger salamander and blue-spotted salamander are both endangered species.

Within the Township of Berkeley there are a total of 37 vernal pools. There are 19 within Island Beach State Park, four between Route 9 and Barnegat Bay, five between the Parkway and Route 9 and nine west of the Parkway (see the Wetlands Map on page 64 for locations).

7.2.3 Streams

A stream is a surface water drainage channel with a definite bed and banks. Streams can be perennial, intermittent or ephemeral. Perennial streams have a permanent flow of water; these streams are shown as blue lines on USGS maps. Intermittent and ephemeral streams do not have a permanent flow of surface water. Water flow in an intermittent stream normally occurs for several weeks or months, due to seasonal precipitation. An ephemeral stream generally occurs subsequent to rain events and lasts a few hours to days following said rain event.

Streams provide key functional values including habitat for numerous plant and animal species, stormwater and flood water retention and filtration, water quality protection, temperature moderation and recreational usage. There are 11 streams that flow through Berkeley Township, with a total stream length of 110 miles.

INSERT WETLANDS MAP

Map 16: Wetlands Map

PAGE INTENTIONALLY LEFT BLANK

Sunken Branch is located in the northwestern corner of the Township and flows eastward from Manchester Township. Historically, Sunken Branch flowed through cranberry bogs and fed into Wrangel Brook. Today, Sunken Branch flows through the Silver Ridge active adult community and feeds into Wrangel Brook just east of Mule Road. Sunken Brook is a perennial stream. It is used for limited fishing, swimming and boating in spots, but mostly serves as receiving surface water body for stormwater outfalls from the surrounding senior community (see the Stormwater Management Map on page 70).

Michaels Run is located along the Township's western border with Manchester Township. It flows northeast, feeding into Wrangel Brook before Wrangel Brook reaches the Silver Ridge adult community north of Holiday Heights. The two water bodies intersect east of Kirkwood Court, but west of Bimini Drive. Michaels Run is a perennial stream. It is used for fishing in spots, as it does not have the same impact from stormwater outfalls as does Sunken Branch and Wrangel Brook.

Wrangel Brook runs easterly from Manchester Township towards its confluence with Davenport Branch just east of the Toms River. The two streams meet the Winding River and merge into the Toms River just west of the Parkway. Tributaries of Wrangel Brook include Sunken Branch and Michaels Run. Historically, Wrangel Brook flowed through cranberry bogs and Dover Forge. Today, almost the entire watercourse west of Holiday City lies within preserved County-, State- and non-profit-owned lands. Wrangel Brook is a perennial stream. It is used for fishing, but mostly west of Silver Ridge and Holiday Heights within the preserved lands.

Davenport Branch runs easterly from Lacey Township through the Pinelands portion of Berkeley Township, across Pinewald-Keswick Road above Miller Airpark and then through Holiday Heights. Davenport Branch meets Wrangel Branch just east of Southampton Road. Historically, Davenport Branch flowed through cranberry bogs, which were located just south of Pinewald Keswick Road, then north, crossing under the old Penn Central railroad line. Today, Davenport Branch is lined by a variety of non-tidal wetlands including wooded, scrub/shrub, Atlantic White Cedar and herbaceous wetlands. Davenport Branch is a perennial stream. It is used for limited fishing along undeveloped sections and is a receiver of numerous stormwater outfalls as it passes through Holiday Heights.

Located within the Pinelands area of Berkeley Township is Jakes Branch. This water body flows northeast along the municipal boundary between South Toms River Borough and Beachwood Borough and feeds into Toms River. The large majority

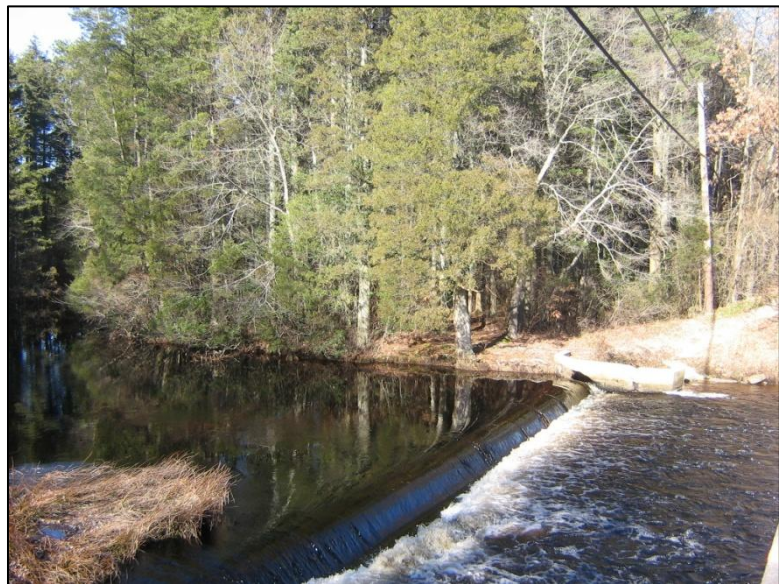
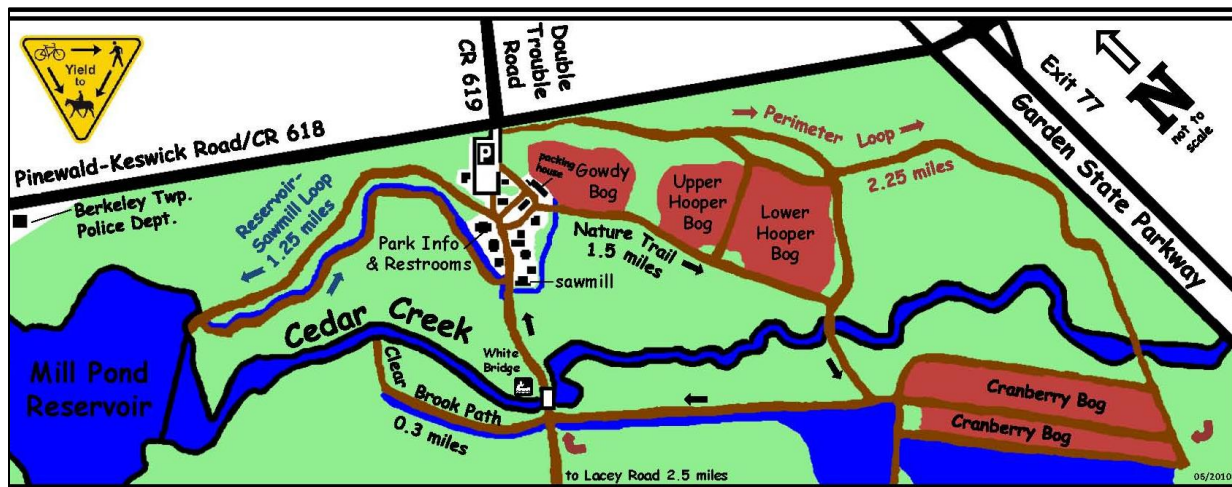


Photo 3: View from Route 9 of Cedar Creek (12/1/2011).

of Jakes Branch is within Double Trouble State Park, which flows into a network of cranberry bogs, located just south of the South Toms River Borough municipal boundary. The bogs have been maintained and harvested intermittently by leaseholders. However, in 2010 the cranberry farmer retired. Presently, there is no lease for the cranberry bogs (NJDEP, Division of Parks and Forestry, Accessed 2012). Jakes Branch also flows through Toms River Park. It is a perennial stream that is used for limited fishing along accessible sections.

Cedar Creek flows eastward along the southern portion of Berkeley Township and empties into Barnegat Bay. Portions of the stream are in Double Trouble State Park, Veterans Park, Berkeley Island Park and William J. Dudley Park. The headwaters of Cedar Creek is Bamber Lake in Lacey Township. Historically, Cedar Creek fed a number of cranberry bogs in Berkeley Township. There were bogs just south of Dover Road, which were called “Dover Cranberry Bogs” according to USGS mapping. These cranberry bogs abutted the municipal boundary with Lacey Township and are now wetlands. Additionally, there are bogs in Double Trouble Historic Village, which have been preserved. See Figure 14 for a map of these bogs (NJDEP, Division of Parks and Forestry, Accessed 2012). Cedar Creek is a perennial stream and its width varies greatly. The stream is used for kayaking, canoeing, swimming and fishing along most of its reach through Berkeley Township through Dudley Park. As it crosses Route 9 it mixes with lagoons and widens as it enters the Barnegat Bay at Berkeley Island Park to become a significant boating water body lined with several marinas.

Figure 14: Double Trouble State Park – Historic District Trails and Cranberry Bogs



Mill Creek is located in the eastern half of the Township. It begins just northwest of the Sylvan Lake and Sonata Bay neighborhoods and flows northeast into Toms River. Approximately half of the waterway is located in the Florence Allen Conservation Area and Mill Creek Park. The stream is bordered by a variety of non-tidal wetlands, including wooded, scrub/shrub and Atlantic White Cedar wetlands. Mill Creek is a perennial stream. It is used for limited fishing within Mill Creek Park and boating after it crosses Chelsea Avenue and enters Toms River.

Sloop Creek is located along the Township’s eastern edge, just south of the Berkeley Shores neighborhood. The stream begins just east of Elm Street and flows east into Barnegat Bay. Sloop Creek is classified by NJDEP as a Category One waterway, which will be further detailed in Section

7.4. Sloop Creek winds through tidal wetlands, including freshwater/brackish tidal wetlands and saline marsh. Sloop Creek is a perennial stream.

Potter Creek is located in the eastern half of the Township. It flows east into Barnegat Bay. The stream's source is just east of Timberline Road. Potter Creek is classified as a Category One waterway (see Section 7.4). The stream is a transitional ecosystem, traversing both tidal and non-tidal wetlands along its route to the Bay. The stream provides a unique habitat and is used for fishing, crabbing and boating.

Just south of the Holly Park neighborhood is Clamming Creek. The stream flows southeast into Barnegat Bay. NJDEP classifies the watercourse as a Category One stream (see Section 7.4). Clamming Creek is transitional in nature, with both tidal and non-tidal wetlands lining the waterway. It is largely inaccessible due to the surrounding wetlands.

Maple Creek is located in the southwestern portion of Berkeley Township. Its source is just east of Morris Boulevard. The stream flows northeast, crossing under Bayview Avenue, south of Glen Cove neighborhood and then empties into Barnegat Bay. Maple Creek is classified by NJDEP as a Category One waterway, which will be further detailed in Section 7.4. The stream is a transitional ecosystem with both tidal and non-tidal wetlands surrounding it.

7.2.4 Lakes, Ponds & Reservoirs

Lakes, ponds and reservoirs can be generally described as any impoundment of water, naturally occurring or shaped by the construction of structures for the retention of surface water. Overbuilt or poorly managed shore land areas can result in the degradation of water quality, harm the water body's ecosystem and decrease aesthetic values of lakes, ponds and reservoirs. These water bodies can be harmed by pollutants, which can easily contaminate the water. It is important to monitor the water quality of lakes, ponds and reservoirs to maintain their ecological and aesthetic value.

Within Berkeley Township there are three water bodies. Crystal Lake is located at the intersection of Western Boulevard and Veterans Boulevard. The manmade lake covers 18.44 acres, but is shallow and has low water quality due to siltation and stormwater runoff. Crystal Lake is privately owned.

Mill Pond Reservoir is located within Double Trouble State Park, just west of Double Trouble Historic Village. The reservoir was created to dam Cedar Creek and divert water to power the sawmill in the Village. The diverted water then runs into



Photo 4: View northward of Mill Pond Reservoir within Double Trouble State Park (12/22/2011).

Gowdy Bog. Mill Pond Reservoir covers 33.87 acres and has very good water quality.

Fisher Brothers Sand and Gravel Pond is located just east of the Beachwood Borough municipal boundary with access off of Railroad Avenue. The pond is a manmade pond resulting from extractive gravel mining that has occurred around the pond for many years. It is privately owned and covers 53.95 acres.

7.3 Watersheds

NJDEP defines a 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 by high points in the area 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, Accessed 2012). Watershed management areas are a designation used by NJDEP. The Township of Berkeley is located within the Barnegat Bay Watershed Management Area (#13). Area #13 lies mostly in Ocean County and includes a number of subwatersheds. The Watershed Management Map depicts the watersheds within the Township.

In addition to NJDEP’s watershed management area designation, the USGS uses watershed units for the purpose of surface water management. The USGS designates Hydrologic Unit Codes (HUC-11 and HUC-14) for watersheds. The HUC-14 area is displayed on the Watershed Management Map. At the HUC-14 level, the Township of Berkeley is divided between 17 different subwatersheds, which are discussed in the following sections and shown in Figure 15 on page 72.

INSERT WATERSHED MANAGEMENT MAP

Map 17: Watershed Management Map

PAGE INTENTIONALLY LEFT BLANK

Figure 15: Watershed and Subwatersheds

Watershed Name	HUC-14 Number	HUC-14 Subwatershed Name	Acres
Kettle Creek / Barnegat Bay North	02040301050050	Barnegat Bay North (above Rt 37 bridge)	14.74
Toms River (below Oak Ridge Parkway)	02040301080010	Wrangel Brook (above Michaels Branch)	36.25
	02040301080020	Michaels Branch (Wrangel Brook)	185.72
	02040301080030	Davenport Branch (above Pinewald Road)	696.77
	02040301080040	Davenport Branch (below Pinewald Road)	4,353.34
	02040301080050	Wrangel Brook (below Michaels Branch)	3,225.48
	02040301080060	Toms R Lwr (Rt 166 to Oak Ridge Pkwy)	3.20
	02040301080070	Jakes Branch (Lower Toms River)	4,705.78
Cedar Creek	02040301090030	Cedar Creek (74-16-38 to Chamberlain Br)	809.87
	02040301090050	Cedar Creek (GS Parkway to 74d16m38s)	1,269.63
	02040301090060	Cedar Creek (below GS Parkway)	2,013.28
Barnegat Bay Central & Tribs	02040301100010	Barnegat Cntrl tribs (Rt 37 to Cedar Ck)	5,245.97
	02040301100030	Barnegat Bay Cntrl (Rt 37- Brngt Inlet)	597.51
	02040301100040	Barnegat Bay Cntrl (Toms R-Cedar Crk)	428.28
Waretown Ck / Barnegat Bay South	02040301120040	Barnegat Bay (Barnegat to Surf City)	98.84
Atlantic Coast (Manasquan to Barnegat)	02040301910030	Atlantic Coast (Rt 37 to Barnegat Inlet)	1,049.66

Source: NJDEP GIS Data

7.3.1 Barnegat Bay North Subwatershed

The Barnegat Bay North subwatershed is located north of Route 37 between the mainland and barrier island and covers approximately 14 acres. This area is mostly urbanized with land cover including residential and other urban lands. It is underlain by the Wildwood Member Formation. Elevations range from a maximum of 20 feet to sea level. Characteristic soils include Psammaquents, sulfidic substratum. Adjacent portions of the subwatershed are located in Toms River Township to the west and Seaside Heights Borough to the east.

7.3.2 Wrangel Brook (above Michaels Branch) Subwatershed

The Wrangel Brook subwatershed covers approximately 36 acres and is located along the Township of Berkeley’s municipal line with Manchester Township. Land use types include, for example, forest, wetlands and forested wetlands. It is underlain by Cohansy Formation. The watershed lies between 40 and 60 feet in elevation, draining west to east. Adjacent portions of the subwatershed are located in Manchester Township to the west. Characteristic soils include Evesboro sand, Manahawkin muck and Lakehurst sand.

7.3.3 Michaels Branch Subwatershed

The Michaels Branch subwatershed covers roughly 186 acres of mostly forested land within the Township Limits. Located along the municipal boundary with Manchester Township, the

subwatershed is underlain by the Cohansey Formation. Elevations range from 40 to 60 feet. Characteristic soils include Lakehurst sand, Berryland sand and Atsion sand.

7.3.4 Davenport Branch (above Pinewald Road) Subwatershed

The Davenport Branch (below Pinewald Road) subwatershed is located in the southwestern corner of the municipality and covers approximately 697 acres of mostly forested land. Land use types include forest and forested wetlands. It is underlain by the Cohansey Formation. The subwatershed is located at one of the highest points in the municipality, with elevations above 80 feet. Adjacent portions of the subwatershed are located in Lacey Township and Manchester Township to the south. Characteristic soils include Lakehurst sand, Lakewood sand, Downer loamy sand and Manahawkin muck.

7.3.5 Davenport Branch (below Pinewald Road) Subwatershed

The Davenport Branch (below Pinewald Road) subwatershed is located within the Pinelands portion of the municipality and covers approximately 4,353 acres. It is the third largest subwatershed within Berkeley Township. Land uses include forest, forested wetlands, high density residential, low density residential and commercial/services. It is underlain by Cohansey Formation. The subwatershed ranges from more than 80 feet to less than 20 feet in elevation, draining northeast to Toms River. A small portion of this subwatershed lies in South Toms River Borough. Characteristic soils include Lakehurst sand, Lakewood sand, Atsion sand, Woodmansie sand, Psammets and Phalanx loamy sand.

7.3.6 Wrangel Brook (below Michaels Branch) Subwatershed

Covering approximately 3,225 acres of mostly residential and forested land is the Wrangel Brook (below Michaels Branch) subwatershed. It is underlain by Cohansey Formation. The subwatershed ranges from more than 80 feet to sea level elevation, draining east to Toms River. Adjacent portions of the subwatershed are located in Manchester Township to the west and Toms River Township to the north. Characteristic soils include Woodmansie sand, Downer loamy sand, Lakehurst sand, Lakewood sand, Atsion sand, Berryland sand and Mullica sandy loam. Portions of Double Trouble State Park and Crossley Preserve reside within this subwatershed.

7.3.7 Toms River Lower (Route 166 to Oak Ridge Parkway) Subwatershed

The Toms River Lower subwatershed covers approximately 3 acres of the municipality and is located at the mouth of Toms River. It is underlain by the Lower Member Kirkwood Formation. The subwatershed has an elevation that ranges from less than 20 feet to sea level. Adjacent portions of the subwatershed are located in Toms River Township. Characteristic soils include Manahawkin muck and Berryland sand.

7.3.8 Jakes Branch Subwatershed

Encompassing 4,706 acres is the second largest subwatershed in Berkeley Township, Jakes Branch. Land use types include, for example, forest, forested wetlands, wetlands and infrastructure. It is underlain by the Cohansey Formation. The subwatershed ranges from more than 80 feet to less than 40 feet in elevation and drains northeast towards Toms River. Adjacent portions of the subwatershed are located in Beachwood Borough and South Toms River Borough to the north. Characteristic soils include Manahawkin muck, Lakewood sand, Atsion sand, Woodmansie sand, Phalanx loamy sand,

Lakehurst sand and Berryland sand. A large majority of Double Trouble State Park is located within this subwatershed.

7.3.9 Toms River Lower (below Route 166) Subwatershed

The Toms River Lower (below Rt. 166) subwatershed is located west of the Parkway and covers approximately 2,902 acres. Land cover types include extractive mining, forest, residential, commercial/services, industrial and infrastructure. It is underlain by Cohansey and Wildwood Member Formation. Elevations range from 60 feet to sea level. Water drains northeast to Toms River. Characteristic soils include Downer loamy sand, Woodmansie sand, Galloway loamy sand, Evesboro sand, Lakewood sand and Hammonton sandy loam. Adjacent portions of the subwatershed are located in Beachwood Borough to the west and Pine Beach Borough to the north/northwest.

7.3.10 Cedar Creek (74-16-38 to Chamberlain Br.) Subwatershed

The Cedar Creek (74-16-38 to Chamberlain Br.) subwatershed covers approximately 810 acres of mostly forest and forested wetlands along the municipality's southern boundary with Lacey Township. It is underlain by the Cohansey Formation. The watershed drains east towards Barnegat Bay. Adjacent portions of the subwatershed are located in Lacey Township to the south. Characteristic soils include Berryland sand, Evesboro sand, Lakewood sand and Lakehurst sand.

7.3.11 Cedar Creek (Parkway to 74d16m38s) Subwatershed

Encompassing roughly 1,270 acres is the Cedar Creek (Parkway to 74d16m38s) subwatershed. Land use includes forest, forested wetlands, wetlands and limited commercial/services. It is underlain by the Cohansey Formation. The watershed ranges from more than 40 feet to 20 feet in elevation, draining east to Barnegat Bay. Adjacent portions of the subwatershed are located in Lacey Township. Characteristic soils include Lakehurst sand, Atsion sand, Manahawkin muck, Woodmansie sand and Psammequents, sulfidic substratum.

7.3.12 Cedar Creek (below Parkway) Subwatershed

The Cedar Creek (below Parkway) subwatershed covers approximately 2,013 acres. Land use types include, for example, forest, forested wetlands, residential, school athletic fields and commercial/services. It is underlain by Cohansey and Wildwood Member Formation. The watershed has an elevation that ranges from over 60 feet to sea level. Adjacent portions of the subwatershed are located in Lacey Township. Characteristic soils include Woodmansie sand, Manahawkin muck, Atsion sand, Downer loamy sand, Lakehurst sand and Psammments.

7.3.13 Barnegat Control Tributaries (Route 37 to Cedar Creek) Subwatershed

At approximately 5,246 acres, the Barnegat Control Tributaries subwatershed is the largest subwatershed within the Township. Land uses within this subwatershed include wetlands, forested wetlands, residential, recreational lands and commercial/services. It is underlain by Cohansey and Wildwood Member Formation. Drainage is eastward to Barnegat Bay. A portion of Ocean Gate Borough is also within this subwatershed. Characteristics soils include Hammonton loamy sand, Berryland sand, Atsion sand, Downer loamy sand, Woodmansie sand, Lakehurst sand and Evesboro sand.

7.3.14 Barnegat Bay Control (Route 37 to Barnegat Inlet) Subwatershed

The Barnegat Bay Control (Route 37 to Barnegat Inlet) subwatershed contains roughly 598 acres. It is located on the western half of Island Beach State Park. Land use types include, for example, wetlands and forested wetlands. It is underlain by Wildwood Member Formation. Elevations range from sea level to less than 20 feet. Drainage is westward to Barnegat Bay. Characteristic soils include Atsion sand, Appoquinimink-Transquaking-Mispillion and Hooksan fine sand.

7.3.15 Barnegat Bay Control (Toms River to Cedar Creek) Subwatershed

Barnegat Bay Control (Toms River to Cedar Creek) subwatershed contains roughly 428 acres. Land use types include, for example, residential, wetlands and forested wetlands. It is underlain by Wildwood Member Formation. Elevations are less than 20 feet to sea level. Drainage is westward to Barnegat Bay. Characteristic soils include Psammaquents, sulfidic substratum, Appoquinimink-Transquaking-Mispillion and Hooksan fine sand.

7.3.16 Barnegat Bay (Barnegat to Surf City) Subwatershed

Located at the southern tip of Island Beach State Park is the Barnegat Bay (Barnegat to Surf City) subwatershed. Consisting of roughly 99 acres, land uses include beaches, wetlands and forested wetlands. It is underlain by Wildwood Member Formation. The watershed lies at less than 20 feet in elevation. Adjacent portions of the subwatershed are located in Ocean Township, to the west. Characteristic soils include Appoquinimink-Transquaking-Mispillion and Hooksan fine sand.

7.3.17 Atlantic Coast (Route 37 to Barnegat Inlet) Subwatershed

Covering approximately 1,050 acres is the Atlantic Coast subwatershed, which is located on the eastern half of Island Beach Station Park. Land use includes, for example, wetlands, forested wetlands and beaches. It is underlain by Wildwood Member Formation. Elevations range from sea level to 20 feet. Characteristic soils include Hooksan fine sand, Atsion sand and Woodmansie sand.

7.4 Surface Water Quality

Surface Water Quality Standards have been established under NJDEP (N.J.A.C. 7:9-4.1), which delineate use designations for surface water. These designations are described briefly below.

- FW – signifies fresh waters and includes all non-tidal and tidal waters with a salinity of less than 3.5 parts per thousand.
- FW-1 – signifies 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.
- NT – non-trout waters.
- 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 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 2011, p. 3).

Waters that are classified by NJDEP as Category One waters receive extra protection under the State’s Stormwater Management Rules (N.J.A.C.7:8) and Flood Hazard Area Control Act Rules (N.J.A.C. 7:13). Under the Stormwater Management Rules, 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

are subject to a 300 foot special water resource protection areas (hereinafter “SWRPA”), which extends inland from the top of bank of the waterway. This includes perennial or intermittent streams that drain into or upstream of the Category One waters as shown on the USGS Quadrangle Maps or in the County Soil Surveys, within the associated HUC-14 drainage area. Also, under the Flood Hazard Area Control Act Rules, a 300 foot riparian zone is established along all Category One waters and their tributaries. This 300 foot riparian zone also extends inland from the top of bank of the waterway. Permits must be obtained from the NJDEP for any encroachments into the 300 foot SWRPA or 300 foot riparian zone.

As depicted on the Surface Water Quality Standards Map on page 78 and in Figure 16, Potter Creek, Clamming Creek, Sloop Creek and Maple Creek are classified as Category One waterways. All four streams are classified Category One from their sources to Barnegat Bay. This includes more than 40 miles of streams and their

Figure 16: Surface Water Quality Standards (SWQS) Data

SWQS Classification	Name	C1 Classification	Length in Miles
FW2-NT	Cedar Creek		3.32
FW2-NT	Cedar Creek UNT		2.58
FW2-NT	Davenport Branch		4.28
FW2-NT	Davenport Branch UNT		1.44
FW2-NT	Michaels Branch		0.49
FW2-NT	Michaels Branch UNT		0.23
FW2-NT	Sunken Branch		2.76
FW2-NT	Sunken Branch UNT		0.53
FW2-NT	Wrangel Brook		4.43
FW2-NT	Wrangel Brook UNT		3.58
FW2-NT/SE1	Cedar Creek		1.57
FW2-NT/SE1	Cedar Creek UNT	Tributary to C1	0.66
FW2-NT/SE1	Clamming Creek	Tributary to C1	1.27
FW2-NT/SE1	Maple Creek	Tributary to C1	1.02
FW2-NT/SE1	Mill Creek		1.94
FW2-NT/SE1	Potter Creek	Tributary to C1	2.60
FW2-NT/SE1	Sloop Creek	Tributary to C1	0.92
FW2-NT/SE1	Uncoded Tributary	Tributary to C1	20.53
FW2-NT/SE1	Wrangel Brook		1.24
FW2-NTC1	Cedar Creek		0.90
FW2-NTC1/SE1	Maple Creek	C1	0.52
FW2-NTC1/SE1	Uncoded Tributary	C1	13.08
PL	Cedar Creek		6.70
PL	Cedar Creek UNT		5.02
PL	Davenport Branch		3.27
PL	Davenport Branch UNT		5.71
PL	Jakes Branch		4.45
PL	Jakes Branch UNT		12.75
PL	Wrangel Brook UNT		2.35
FW2-NTC1/SE1	Toms River UNT	C1	0.37
Total			110.51

Source: NJDEP GIS Data

associated tributaries within the Township of Berkeley. The majority of land within the 300 foot SWRPA or 300 foot riparian zone is preserved, which includes Township-, County-, non-profit- and Federal-owned land.

All classifications have designated uses. For example, FW₂ waters are designated for maintenance, mitigation and proliferation 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 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. PL waters are designated for cranberry bog water supply and other agricultural uses, for maintenance, migration and proliferation of the natural and established biota indigenous to this unique ecological system, for public potable water supply after conventional filtration treatment, for primary contact recreation and for any other reasonable uses.

NJDEP classifies Wrangel Brook and its tributaries, Sunken Branch and Michaels Run, as FW₂-NT (fresh water, non-trout) to its confluence with Davenport Branch (see Map 78). Wrangel Brook between Davenport Branch and Toms River is classified as FW₂-NT/SE₁ (fresh water, non-trout, with salinity greater than 3.5 parts per thousand). Wrangel Brook south of the former Penn Central railroad tracks is classified as PL by NJDEP. Jakes Branch is classified as PL.

Davenport Branch is classified by NJDEP from its source to the former Penn Central railroad tracks as PL. Between the railroad tracks and its confluence with Wrangel Brook, Davenport Branch is classified as FW₂-NT (fresh water, non-trout).

Cedar Creek from its source to the Parkway is classified as PL. Between the Parkway and Route 9, except for portions of the stream within Edwin B. Forsythe National Wildlife Refuge, Cedar Creek is categorized as FW₂-NT (fresh water, non-trout). The sections of Cedar Creek within Edwin B. Forsythe National Wildlife Refuge are classified by NJDEP as FW₂-NT(C₁) (fresh water, non-trout, Category One). From Route 9 to Barnegat Bay, except for portions of the stream within Edwin B. Forsythe National Wildlife Refuge, Cedar

Creek is classified FW₂-NT/SE₁ (fresh water, non-trout, with salinity greater than 3.5 parts per thousand) (NJDEP 2011).



Photo 5: View westward of Cedar Creek within Pinelands in the vicinity of Dover Forge and Double Trouble State Park (12/22/2011).

INSERT SURFACE WATER QUALITY STANDARDS MAP

Map 18: Surface Water Quality Standards Map

PAGE INTENTIONALLY LEFT BLANK

Surface water resources have been identified as a vital link to the health of the Barnegat Bay. Much of the documented decline in the health of the Bay signaled by the reduction in submerged aquatic vegetation beds such as eel grass and the infestation by foreign sea nettle jellyfish has been attributed to increased levels of nitrogen and other nutrients and a decrease in salinity due to increased levels of stormwater runoff borne by streams and creeks draining into the Bay. Increased levels of development have increased runoff and removed natural vegetation and the impacts have spurred Ocean County and the NJDEP to initiate programs aimed at removing nitrogen from stormwater before it reaches the Bay. Several towns, such as Stafford Township, have adopted ordinances related to fertilizer use to reduce nitrogen levels and the NJDEP has funded projects in several towns to retrofit existing stormwater basins into biofiltration basins. The Stormwater Management Map and the Barnegat Bay Stormwater Management Map show the existing stormwater network of basins, pipes and outfalls and dramatically illustrate the impact on streams and creeks leading to the Barnegat Bay in Berkeley Township. The Barnegat Bay Stormwater Management Map adds the vegetation and wetland layers to the stormwater management system to inform a strategic solution that could potentially identify areas along the mainland bayshore where outfalls can be diverted into existing wetlands where there is room for these wetlands to expand, serving as natural bioretention to filter stormwater and remove nitrogen before it reaches Barnegat Bay.

7.4.1 Shellfish Harvest Areas

NJDEP's Bureau of Marine Monitoring periodically assesses water quality in the location of shellfish beds to determine the safety of ingesting shellfish growing in said beds. The transmission of shellfish borne infectious diseases begins with the contamination of growing waters with fecal matter. Contamination can reach shellfish growing waters through stormwater runoff from urban and agricultural areas and 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 humans ingesting contaminated shellfish.

The shellfish growing waters adjacent to Berkeley Township include the Atlantic Ocean, Barnegat Bay, Cedar Creek, Toms River and the manmade channels of the Glen Cove and Berkeley Shores neighborhoods. As the Shellfish Classifications Map on page 86 depicts, the manmade channels of the Glen Cove and Berkeley Shores neighborhoods, Toms River west of Island Heights Borough and a portion of the Atlantic Ocean at the northern edge of Berkeley Township are classified as prohibited areas for shellfish harvesting. The coastline of Berkeley Township, Cedar Creek and the mouth of Toms River are classified as special restricted areas. The designation indicates that further purification processing under a special permit is required for shellfish harvested in these waters. Barnegat Bay, north of Good Luck Drive, is classified seasonal from November to April. Barnegat Bay, south of Good Luck Drive, and the Atlantic Ocean are classified as approved harvest areas under any conditions.

7.5 Floodways and Floodplains

The Federal Emergency Management Agency (hereinafter "FEMA") provides GIS data on its website. The data for the Township of Berkeley is dated April of 2010. The Flood Hazard Areas Map depicts the FEMA data for Berkeley.

Applicable Flood Hazard Areas, shown on page 88, are as follows:

- A: Areas with a 1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage. No Base Flood Elevations (hereinafter “BFE”) have been determined.
- AE: An area inundated by 100 year flooding, for which BFEs have been determined.
- AO: River or stream flood hazard areas and areas with a 1% or greater chance of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage.
- VE: Coastal areas with a 1% or greater chance of flooding and an additional hazard associated with storm waves. These areas have a 26% chance of flooding over the life of a 30-year mortgage; BFEs have been determined.
- X-500: Area of moderate flood hazard, usually the area between the limits of the 100-year and 500-year floods. Are also used to designate base floodplains of lesser hazards, such as areas protected by levees from 100-year flood or shallow flooding areas with average depths of less than one foot.

Any construction within the A and V zones must meet certain construction standards which elevate habitable areas above the base flood elevation line. NJDEP regulates development in floodplains under the Flood Hazard Area Control Act Rules (N.J.A.C. 7:13).

Areas within the Township classified Zone A (i.e. 1% annual chance of flooding) by FEMA include the entire length of Jakes Branch and Mill Creek, Potters Creek west of Route 9, Cedar Creek west of Parkway and Michaels Run and Wrangel Brook west of Holiday City. Zone A covers approximately 1,768 acres of the municipality as shown in Figure 17.

Zone AE, which is shown as dark purple on the Flood Hazard Areas Map, covers roughly 5,989 acres of the Township. The entire length of Davenport Branch, the majority of Sunken Branch, a portion of Wrangel Brook and Cedar Creek east of the Parkway are all classified as Zone AE (i.e. 1% annual chance of flooding). The Barnegat Bay coastline of the mainland and Island Beach State Park are also classified Zone AE.

Areas within Berkeley Township that have been classified by FEMA as AO (i.e. 1% annual chance of flooding) cover only 45.90 acres. This area is on the barrier island, between Seaside Park Borough and Island Beach State Park.

Zone VE, which is shown as red on the Flood Hazard Areas Map, encompasses more than 2,000 acres of Berkeley. The Atlantic Ocean side of Island Beach State Park composes the majority of this classification. There are also select areas along the Barnegat Bay coast of the mainland classified as Zone VE.

INSERT STORMWATER MANAGEMENT MAP

Map 19: Stormwater Management Map

PAGE INTENTIONALLY LEFT BLANK

INSERT BARNEGAT BAY STORMWATER MANAGEMENT MAP

Map 20: Barnegat Bay Stormwater Management Map

PAGE INTENTIONALLY LEFT BLANK

INSERT SHELLFISH CLASSIFICATIONS MAP

Map 21: Shellfish Classifications Map

PAGE INTENTIONALLY LEFT BLANK

INSERT FLOOD HAZARD AREAS MAP

Map 22: Flood Hazard Areas Map

PAGE INTENTIONALLY LEFT BLANK

Figure 17: Flood Hazard Areas

FEMA Flood Zone	Description	Acres
Zone A: 1% Annual Flood Hazard (No BFE)	Areas subject to inundation by the 1%-annual-chance flood event generally determined using approximate methodologies. Because detailed hydraulic analyses have not been performed, no Base Flood Elevations (BFEs) or flood depths are shown.	1,768.01
Zone AE: 1% Annual Flood Hazard (BFE)	Areas subject to inundation by the 1%-annual-chance flood event determined by detailed methods. Base Flood Elevations (BFEs) are shown.	5,988.54
Zone AO: 1% Annual Flood Hazard (Shallow Flooding)	Areas subject to inundation by 1%-annual-chance shallow flooding (usually sheet flow on sloping terrain) where average depths are between one and three feet. Average flood depths derived from detailed hydraulic analyses are shown in this zone.	45.90
Zone VE: 1% Annual Flood Hazard with Velocity Hazard (Wave Action)	Areas subject to inundation by the 1%-annual-chance flood event with additional hazards due to storm-induced VELOCITY wave action. Base Flood Elevations (BFEs) derived from detailed hydraulic analyses are shown.	2,023.53
Zone X-500: 0.2% Annual Flood Hazard	Areas subject to inundation by the 0.2%-annual-chance flood event generally determined using approximate methodologies. Because detailed hydraulic analyses have not been performed, no Base Flood Elevations (BFEs) or flood depths are shown.	1,094.56
Source: NJDEP GIS Data		

There are a total of 14 flood structures within the Township of Berkeley. Sunken Branch, located in the northwest corner of the Township, has two culverts and three dams. Wrangel Brook has two footbridges, two dams and two culverts. Davenport Branch has two dams, which are south of Pinewald Keswick Road. Lastly, there is a culvert controlling Potter Creek, just north of Riverside Drive. These flood structures are depicted on the Flood Hazard Areas Map.

8. BIOLOGICAL RESOURCES

8.1 Botanical Resources

The “natural communities” of Berkeley Township include those vegetation types (e.g., wetlands) and specialized habitats (e.g., vernal pools) that characterize the undeveloped open spaces of the municipality. The physiographic location (i.e. Outer Coastal Plain), largely sandy acidic soils, marine influences and other environmental factors provide the foundation for the growth of pine and oak forests, acidic wetlands and coastal tidelands.

In addition to the factors, however, the land use history over the past two centuries has had a profound impact on the location and status of many of the natural communities. Historic villages such

as Double Trouble (Photo 6) included extensive alternation of the landscape for development of cranberry bogs and a lumber mill. Extraction of bog iron at Dover Forge (Photo 7) and clay at Crossley Preserve (Photo 8) resulted in the alteration of waterways and wetlands. The construction of roads and railroads to transport goods and serves provided by the early industries resulted in fragmentation of natural communities and corridors for potential invasion of exotic species into the pristine historic landscape. Construction of lagoons in coastal marshes for boat access, filling of wetlands and expansion of urbanization reduced the cover of natural communities contributing to the rarity of particular communities and the plants and animals they support.

In response to the long-term impacts to natural communities, various agencies and organizations have implemented programs to protect, enhance and restore large tracts of some of the remaining resources. At the Federal level, the U.S. Department of Interior has acquired coastal wetlands within the Barnegat Bay Ecosystem. At the State level, Double Trouble State Park including Dover Forge, Island Beach

State Park and Crossley Preserve of the New Jersey Natural Lands Trust, are examples of preserved natural communities and their associated historic

cultural resources. From a regulatory perspective, the Pinelands National Reserve and Comprehensive Management Plan and CAFRA have provided important context for management of resources and assessment of potential impacts (see the Regional Jurisdictions Map on page 11. As part of the State's Natural Heritage Program, designation of the "Crossley Natural Heritage Priority Site" within the Pinelands and the "Island Beach Natural Heritage Macrosite" within the CAFRA zone identified two particularly important areas for rare and endangered plants and animals (see Natural Heritage Priority Sites Map on page 92).



Photo 6: View within Double Trouble State Park toward cranberry packing house adjacent to cranberry bog (12/22/2011).



Photo 7: View northward toward a portion of the former site of historic Dover Forge within Double Trouble State Park (12/22/2011).

INSERT NATURAL HERITAGE PRIORITY SITES MAP

Map 23: Natural Heritage Priority Sites Map

PAGE INTENTIONALLY LEFT BLANK

From a local perspective, extensive coastal wetlands preserved by the Ocean County Natural Lands Trust (Photo 9) and municipal lands along Cedar Creek at William J. Dudley Park are examples of citizen efforts to preserve the natural heritage of Berkeley Township. Private nonprofit organizations such as the Audubon Society also have participated in preservation efforts including the Hovnanian Sanctuary on Davenport Road. Examples of the rich association of natural communities and resources in Berkeley Township have been preserved and protected at many levels. Access to the natural communities and resources for enjoyment through passive recreation is possible at many sites, as described and illustrated herein.

The following discussion of the natural communities is organized by major categories (Terrestrial and Wetland types), although the spatial distribution tends to be arranged according to types found along the immediate coast such as at Island Beach State Park and Barnegat Bay (e.g., marine, estuarine and dune communities); within the mainland coastal district east of the Parkway corridor (e.g., mixed oak and oak-pine woodlands and forests); and west of the corridor within the Pinelands.

8.1.1 Terrestrial Plant Communities

Terrestrial (i.e. “upland” or “dryland”) communities include those habitat types for which the dominant characteristics including plant communities are not influenced by environmental parameters representative of persistent shallow groundwater or surface water resulting in the formation of wetland communities. Dry or mesic grasslands, shrublands, woodlands and forests are examples of terrestrial communities. The following examples of anticipated or observed terrestrial communities in Berkeley Township are identified in part according to Breden (1989) and Cowardin et al. (1979). Mapped vegetation is illustrated on the Vegetation Map on page 96. Figure 18 shows the total acreage of each type of forest vegetation.



Photo 8: View southeast in Crossley Preserve toward ruins of platform possibly used for loading excavated clay into railroad cars from nearby pits (12/22/2011).



Photo 9: View eastward within County-preserved coastal lands adjacent to Berkeley Shores neighborhood, which includes salt marsh and coastal scrub habitats (12/2/2011).

Figure 18: Forest Vegetation

Type	Acres
Forest >50% Crown Closure	8,855.42
Coniferous Forest (>50% Crown Closure)	8,002.89
Deciduous Forest (>50% Crown Closure)	260.23
Mixed Forest (>50% Coniferous With >50% Crown Closure)	358.46
Mixed Forest (>50% Deciduous With >50% Crown Closure)	233.84
Forest 10-50% Crown Closure	1,310.37
Coniferous Forest (10-50% Crown Closure)	1,127.19
Deciduous Forest (10-50% Crown Closure)	74.21
Mixed Forest (>50% Coniferous With 10-50% Crown Closure)	77.72
Mixed Forest (>50% Deciduous With 10-50% Crown Closure)	31.26
Successional Brush / Shrubland	685.17
Coniferous Brush/Shrubland	359.64
Deciduous Brush/Shrubland	49.61
Mixed Deciduous/Coniferous Brush/Shrubland	275.91
< 25% Brush Covered	85.70
Plantation	54.85
Phragmites Dominant	2.52
Total Forest Vegetation	10,994.03
Source: NJDEP GIS Data	

Herbaceous Terrestrial Communities

Coastal Dune Grassland Community

Coastal dune grassland communities characterize Aeolian (wind-blown) sand habitats along the immediate coast landward of Marine intertidal wetlands (i.e., sandy beaches). Primary or foredunes (Photo 10) are dominated by *Ammophila breviligulata* (American Beachgrass) and can support a number of native species among the clumps of beachgrass including State-listed species such as *Oenothera humifusa* (Beach Evening Primrose), which is potential for the dunes at Island Beach State Park within Berkeley Township. Stabilized or secondary dunes also can support other



Photo 10: Terrestrial Communities. View northeast across primary dune habitat dominated by American Beachgrass at Island Beach State Park (12/22/2011).

INSERT VEGETATION MAP

Map 24: Vegetation Map

PAGE INTENTIONALLY LEFT BLANK

grassland or herbaceous-dominated vegetation inland from the primary dunes and also scattered among dune shrubland and woodland vegetation. These grasslands are typically characterized by *Andropogon virginicus* (Broomsedge) and *Schizachyrium scoparium* (Little Bluestem). Associated native species generally include common coastal species such as *Hudsonia tomentosa* (Woolly Beach-heather, Photo 11) and *Solidago sempervirens* (Seaside Goldenrod) as well as a number of specialized species such as the native cactus *Opuntia humifusa* (Prickly Pear) and a member of the Agave family, *Yucca filamentosa* (Adam's Needle).

Old Field Succession Community

Fallow fields generally undergo a successional sequence of change from native grassland species or weedy herbaceous to shrubland and woodland or forest as part of a predictable series of vegetation types. Characteristic plant species may differ among the vegetation types depending on soil and moisture regimes. For example the coastal and Pinelands old field sequences may be characterized by different species. Native species typical of old field sandy soils in Berkeley Township include by are not limited to several dominant grass species (Photo 12) such as *Andropogon virginicus* (Broomsedge), *Schizachyrium scoparium* (Little Bluestem) and *Panicum virgatum* (Switchgrass) as well as a number of “forb” species including *Eupatorium* spp. (Eupatorium species), *Euthamia* spp. (Flat-topped Goldenrod species), *Solidago* spp. (Goldenrod species), *Symphotrichum* spp. (Aster species) and others. Virtually all of the larger patches of grassland habitat are located at sites with an extensive land use history such as at Crossley Preserve (Photo 13), Dover Forge (Photo 14) and abandoned railroad corridors (Photo 15).



Photo 11: Terrestrial Communities. View across secondary or stabilized dune habitat dominated by Woolly Beach-heather toward Dune Scrub habitat at Island Beach State Park (12/22/2011).



Photo 12: Terrestrial Communities. View north from a historic railroad corridor into Crossley Preserve, characterized at this site by Grassland Habitat, dominated by Broomsedge (12/22/2011).

Photo 13: Terrestrial Communities. View of Grassland Habitat within Crossley Preserve (12/22/2011).



Photo 14: Terrestrial Communities. View northeast across Grassland Habitat dominated by Switchgrass at Dover Forge in Double Trouble State Park (12/22/2011).



Photo 15: View westward along historic railroad corridor and adjacent utility right-of-way, south of Crossley Preserve (12/22/2011).



Ruderal Herbaceous Community

Herbaceous ruderal communities are dominated by weedy or ruderal herbaceous species in a disturbed habitat setting. Examples include weedy roadsides, recently fallowed fields, utility and railroad rights-of-way, abandoned urban lots and others. Weedy species may include a mixture of native and introduced species depending on the environmental setting. Woody species are generally mixed with the herbaceous species, particularly if the ruderal habitat persists in an unmaintained state.

Shrubland Terrestrial Communities

Old Field Successional Scrub/Shrubland Community

As noted above, in temperate environments abandoned fields generally undergo a series of successional vegetation changes until a “climax” community is reached, which is often a woodland or forest community type. Intermediate between the herbaceous and woodland/forest types are a complex and rich association of native and introduced shrubs and scrub or sapling form of tree species as well as many herbaceous species. The various associations of shrubs and scrub-form of trees may differ depending on soil characteristics including moisture regimes. As with ruderal shrublands, many of the shrub species are bird-dispersed and in addition to those listed above often include the native species *Rhus copallinum* (Winged Sumac), *Rubus* spp. (Blackberry) and *Viburnum dentatum* (Arrow-wood), *Vaccinium corymbosum* (Highbush Blueberry) and *Elaeagnus umbellata* (Autumn Olive), an introduced species. Scrub or sapling forms of trees commonly include *Acer rubrum* (Red Maple), *Quercus palustris* (Pin Oak) and *Liquidambar styraciflua* (Sweet Gum), which are common native trees typical of early successional woodland and forest vegetation.



Photo 16: Terrestrial Communities. View of Pine Barren Scrub dominated by Highbush Blueberry and Pine Forest dominated by Pitch Pine in Double Trouble State Park (12/22/2011).



Photo 17: Terrestrial Communities. View of Successional Scrub (center) such as Highbush Blueberry, saplings such as Eastern Red Cedar and grasses in Double Trouble State Park (12/22/2011).

Within the Pinelands, historically disturbed, mesic sites can be dominated by Pine Barren Scrub, which often consists mostly of Highbush Blueberry (Photo 17). Other similar sites can illustrate future succession to woodland or forest vegetation (Photo 16) based upon the presence of tree saplings such as those of *Juniperus virginiana* (Eastern Red Cedar) and *Pinus rigida* (Pitch Pine).

Coastal Dune Shrubland Community

Coastal Dune Scrub is one of the natural communities characteristic of Island beach State Park (Photos 18 & 19). It grows in stabilized dune environments landward of the primary or foredune

habitats adjacent to marine wetlands. Deciduous Dune Scrub is often dominated by the shrub *Prunus maritima* (Beach Plum) and *Morella pensylvanica* (Bayberry), or the tree *Prunus serotina* (Black Cherry), the latter of which is usually smaller in stature due to natural pruning by wind and salt spray (Photo 19). *Rosa rugosa* (Rugose Rose) is a native shrub restricted to the dune environment. Evergreen Dune Scrub (Photo 18) forms seaward of woodland and forest types and generally is also the result of pruning by wind and salt.

Characteristic pruned or juvenile tree species include *Juniperus virginiana* (Eastern Red Cedar), *Pinus rigida* (Pitch Pine) and *Ilex opaca* (American Holly).

Ruderal Shrubland Community

Ruderal shrub and scrub communities are common in disturbed habitats in the coastal portion of mainland Berkeley Township. *Baccharis halimifolia* (Groundsel Bush), a wind-dispersed shrub and *Morella pensylvanica* (Barberry) and *Toxicodendron radicans* (Poison Ivy), two bird-dispersed shrubs, are common dominants. Introduced shrubs are often bird dispersed as a result of their fleshy-fruits and may include but are not limited to *Berberis vulgaris* (Common Barberry), *Ligustrum* spp. (Privet), *Lonicera morrowii* (Morrow's Honeysuckle) and *Lonicera japonica* (Japanese Honeysuckle, a vine).



Photo 18: Terrestrial Communities. View in stabilized dune habitat toward Dune Scrub dominated by Beach Plum (center) and Eastern Red Cedar (background) (12/22/2011).



Photo 19: Terrestrial Communities. View through salt-spray-pruned Dune Scrub vegetation composed of Black Cherry in stabilized dune habitat at Island Beach State Park (12/22/2011).

Woodland and Forest Terrestrial Communities

Coastal Dune Woodland and Maritime Forest

Coastal Dune Woodland is listed by NJDEP as an endangered (S1) plant community in New Jersey (see Appendix). Examples in Berkeley Township are located within Island Beach State Park (Photo 20), where *Pinus rigida* (Pitch Pine) is often a dominant due to the sandy, generally well-drained soils. Scrub oak (e.g., *Quercus ilicifolia*, Bear Oak) and tree oak species (e.g., *Quercus falcata*, Southern Red Oak; *Q. stellata*, Post Oak) are typical associates. At mesic sites with more soil moisture, the open canopy woodland is transitional to Maritime Forest vegetation.



Photo 20: Terrestrial Communities. View westward on Island Beach State Park along trail in Pine-Oak Woodland characterized by Pitch Pine, various scrub and tree oak species and American Holly (12/22/2011).

Pitch Pine Woodland

Pitch Pine Woodland is typical of previously disturbed, dry sandy soil sites within the Pinelands (Photo 21). The open canopy and sparse understory is typical, although some sites may also have an understory of various low-growing shrubs including blueberry and huckleberry species. Another form includes oak shrub species such as *Quercus ilicifolia* (Bear Oak) and *Q. marilandica* (Black-jack Oak) and is listed by NJDEP as a sensitive plant community in Berkeley Township (NJDEP, Natural Heritage Program 2011;). This community is transitional to the various pine-oak and oak-pine forest types described below.



Photo 21: Terrestrial Communities. View into Pitch Pine Woodland dominated by Pitch Pine within Crossley Preserve and Natural Heritage Priority Site (12/22/2011).

Successional Woodland Community

The Successional Woodland Community is part of the previously described seral vegetation that follows disturbance and abandonment. Grassland and scrubland communities typical of the earlier phases of succession are followed by woodland or forest communities, which are initially dominated

by pioneering tree species such as *Juniperus virginiana* (Eastern Red Cedar), *Betula populifolia* (Gray Birch) and *Acer rubrum* (Red Maple). In the Pinelands, Pitch Pine may also be a dominant.

Coastal Plain Mixed Oak Forest

Coastal Plain Mixed Oak Forest in Berkeley Township is located mostly in the coastal zone east of the Parkway corridor (Photo 22). It may occur in mesic sites along the coast (Photo 22) or somewhat more inland in mesic Pinelands sites not dominated by Pitch Pine. In either case, a number of oak tree species may be common including, for example, *Quercus alba* (White Oak), *Q. coccinea* (Scarlet Oak), *Q. rubra* (Red Oak) and *Q. velutina* (Black Oak). Other tree species associates may include, for example, *Ilex opaca* (American Holly), *Pinus rigida* (pitch Pine), *Liquidambar styraciflua* (Sweet Gum), *Nyssa sylvatica* (Black Gum), *Sassafras albidum* (Sassafras) and *Fagus grandifolia* (American Beech).

Maritime Forest

Maritime Forest is a relatively dense, closed-canopy coastal community mostly found growing on mesic soils on barrier islands and peninsulas (Photo 23). *Ilex opaca* (American Holly), a broad-leaf evergreen tree is frequently a dominant.

Other evergreen species include *Pinus rigida* (Pitch Pine) and *Juniperus virginiana* (Eastern Red Cedar).

Deciduous species such as *Quercus* spp.

(oak species) and *Sassafras albidum* (Sassafras) are common. Maritime Forest as a component of Coastal Dune Woodland is listed by NJDEP as an endangered (S₁) plant community in New Jersey (see Appendix).



Photo 22: Terrestrial Communities. View from Bayview Avenue across estuarine wetlands toward Mixed Oak Forest vegetation, dominated by deciduous oak tree species (12/1/2011).



Photo 23: Terrestrial Communities. View of Maritime Forest vegetation dominated by American Holly within Island Beach Start Park (12/22/2011).

Dry Pitch Pine, Oak-Pine, and Pine-Oak Forests

Dry forests dominated by oak species where *Pinus rigida* (Pitch Pine) covers less than 30% are included in the Dry Oak-Pine Forest community. Common oaks include *Quercus alba* (White Oak), *Q. coccinea* (Scarlet Oak), *Q. falcata* (Southern Red Oak), *Q. marilandica* (Black-jack Oak), *Q. prinus* (Chestnut Oak) and *Q. stellata* (Post oak). Scrub oaks including *Quercus ilicifolia* (Bear Oak) are also characteristic. Pine forests where Pitch Pine covers 30% or more and contributes about 50% of the tree stems and 50% or more of the basal area are included in the Dry Oak-Pine Forest community. For the purpose of this report, Pineland forests composed of virtually only Pitch Pine are included in the Dry Pitch Pine Forest community (Photos 24-25). A large portion of the undeveloped Township is composed of some combination of these forest types. The understory is generally represented by heath dominated shrub layers. “New Jersey Pitch Pine/Scrub Oak Barren” is a subtype listed as a sensitive natural community in Berkeley Township (NJDEP, Natural Heritage Program 2011).



Photo 24: Terrestrial Communities. View westward toward youthful stand of Pitch Pine at Crossley Preserve (12/22/2011).



Photo 25: Terrestrial Communities. View westward along Dover Road toward a stand of Pitch Pine Forest vegetation (12/22/2011).

8.1.2 Wetland /Deepwater Plant Communities

Generalized wetland communities are presented on the Wetlands Map on page 64, as provided by NJDEP. Figure 19 depicts the acreage of these generalized wetland communities within the Township of Berkeley. Freshwater wetlands are defined by the State of New Jersey as “...an area that is inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions, commonly known as hydrophytic vegetation; provided, however, that the Department, in designating a wetland, shall use the three-parameter approach (that is, hydrology, soils and vegetation) enumerated in the 1989 Federal Manual as defined in this section” (NJDEP 2009).

Wetland communities are organized herein according to the hierarchical system of the U.S. Department of Interior, Fish and Wildlife Service (Cowardin et al. 1979). Wetlands of New Jersey have been described by various authors including, for example, Robichaud and Buell (1973), Cowardin et al. (1979), Tiner (1984) and Breden (1989).

Figure 19: Wetland Vegetation

Type	Acres
Wooded Wetlands	3,472.28
Deciduous Wooded Wetlands	511.94
Coniferous Wooded Wetlands	1,203.56
Mixed Wooded Wetlands (Deciduous Dom.)	415.84
Mixed Wooded Wetlands (Coniferous Dom.)	808.14
Atlantic White Cedars	532.79
Successional Scrub / Shrub Wetlands	1,061.57
Deciduous Scrub/Shrub Wetlands	222.29
Coniferous Scrub/Shrub Wetlands	278.70
Mixed Scrub/Shrub Wetlands (Deciduous Dom.)	246.66
Mixed Scrub/Shrub Wetlands (Coniferous Dom.)	313.91
Herbaceous Wetlands	53.80
Herbaceous Wetlands	33.26
Phragmites Dominate Interior Wetlands	20.54
Total Wetland Vegetation	4,587.65
Source: NJDEP GIS Data	

Marine System

The Marine System includes two subsystems: (1) Subsystem Intertidal (wetlands); and, (2) Subsystem Subtidal (deepwater habitats). Cowardin et al. (1979) define the system as follows:

“The Marine System...consists of the open ocean overlying the continental shelf and its associated high-energy coastline. Marine habitats are exposed to the waves and currents of the open ocean and the water regimes are determined primarily by the ebb and flow of oceanic tides. Salinities exceed 30 ppt [parts per thousand], with little or no dilution except outside the mouths of estuaries. Shallow coastal indentations or bays without appreciable freshwater inflow, and coasts with exposed rocky islands that provide the mainland with little or no shelter from wind and waves are also considered part of the Marine System because they generally support typical marine biota”.

Marine Subtidal Deepwater Habitats

Although generally excluded from consideration as a municipal resource, but rather treated as a State or Federal resource, subtidal marine habitat certainly provides many services, goods and benefits to Berkeley Township including commercial and sport fishing and shell-fishing and beach-related recreational opportunities. Deepwater habitat also supports many rare wildlife species as noted on the

Natural Heritage Program (hereinafter “NHP”) report (see the Appendix), including but not limited to several marine turtles and whales.

Marine Intertidal Gravel/Sand Beach Community

The unconsolidated intertidal gravel/sand beach community is identified as wetland habitat within the Marine System, which occur for example along the coast of Island Beach State Park (Photos 26 & 27), a Natural Heritage Priority Macrosite (see the NHP report in Appendix X). It is listed as a State sensitive ecological community. The intertidal community supports abundant infauna such as crustaceans and during exposed conditions provides important foraging habitat for resident and migratory shorebirds including endangered species such as Piping Plovers and Least Terns. Upper beach areas also provide habitat for nesting shore birds including Piping Plovers and Least Terns. Rare and endangered plant species restricted to upper beach habitats (generally in the vicinity of wrack material) also are known from Island Beach State Park, as noted in the NHP reports provided in the Appendix. Examples include *Honkenia peploides* var. *robusta* (Seabeach Sandwort) and *Polygonum glaucum* (Seabeach Knotweed), two State-listed endangered species. Although not listed in the NHP reports for Berkeley Township, *Amaranthus pumilus* (Seabeach Amaranth), a Federally-listed endangered plant, is listed for Ocean County and may also occur at Island Beach State Park.



Photo 26: Marine Habitat. View northward along sandy lower-beach Intertidal Wetland Habitat (center), situated between Primary Dunes and upper-beach (left) and Subtidal Deepwater Habitat (upper right) (12/22/2011).



Photo 27: Marine Habitat. View northward along sandy upper-beach Intertidal Wetland Habitat (center), situated between Primary Dunes (center left) and lower beach wetlands (center right) and Subtidal Deepwater Habitat (right) (12/22/2011).

Estuarine System

The Estuarine System includes two subsystems: (1) Subsystem Subtidal, which includes deepwater habitats; and (2) Subsystem Intertidal, which includes wetlands. Cowardin et al. (1979) define the system as follows:

“The Estuarine System...consists of deepwater subtidal habitats and adjacent tidal wetlands that are usually semi-enclosed by land but have open, partly obstructed, or sporadic access to the open ocean, and in which ocean water is at least occasionally diluted by freshwater runoff from the land. The salinity may be periodically increased above that of the open ocean by evaporation. Along some low-energy coastlines there is appreciable dilution of sea water. Offshore areas with typical estuarine plants and animals, such as mangroves...and eastern oysters...are also included in the Estuarine System”.

Cowardin et al. also have provided a description of the limits of this system, including three main features: (1) the Estuarine System extends upstream or toward land to the area where salinity from ocean-derived salts (i.e., largely sodium chloride) is less than 0.5 ppt (parts per thousand) during the average annual low flow of freshwater input; (2) downstream to an imaginary line that closes the mouth of an estuary (e.g., a river, bay, or sound); and (3) extending to the seaward limit of estuarine vegetation dominated by emergents, shrubs, or trees and to the seaward limit of offshore areas continuously diluted by runoff to salinities less than those of the Marine System.

Estuarine Subtidal Deepwater Habitats

Estuarine deepwater habitats, which are located below Mean Lower Low Water (hereinafter “MLLW”), occur in Barnegat Bay, tidal brackish streams and rivers, and in channels in tidal salt and brackish marshes (Photo 28). They provide important habitat for commercial and recreational fish and shellfish.

Perhaps one of the most valuable and environmentally sensitive resources associated with Estuarine deepwater habitat in Ocean County are the many and extensive beds of SAV. Relevant SAV-oriented literature, some of which is cited herein, provides important context for the value of SAV resources. Some literature generalizes information regarding SAV habitats and “seagrasses” without distinguishing individual species, which makes detailed understanding of the important issues difficult in some situations. The cause of seagrass decline is of interest to the purpose of this ERI. Bologna et al. (2007) report that significant light reductions negatively impact seagrass growth and



Photo 28: Estuarine Habitat. View along shoreline of Barnegat Bay characterized by intertidal gravel/sand habitat at Allen Road Beach Park (12/1/2011).

productivity. This also may be a result of anthropogenic nutrient input, disease, and general coastal development. In Little Egg Harbor, New Jersey, a macroalgal bloom occurred that rapidly caused a decline in the distribution of Eelgrass, which recovered in some areas once favorable conditions returned. Bologna et al. emphasize that, “Reductions in the vitality and distribution of these vascular plants often signal a decline in aquatic ecosystem health”. Bologna et al. (2000) found during the 25 years prior to their study the total SAV cover (*Ruppia* and *Zostera*) in the Little Egg harbor declined by 62%.



Photo 29: Estuarine Habitat. View from Allen Road Beach Park along the west shore of Barnegat Bay toward subtidal deepwater habitat characterized by Unconsolidated Gravel Bottom and Aquatic Bed Vegetation dominated by a red alga (12/1/2011).

Widgeongrass (*Ruppia maritima*) is an annual or rarely a perennial herbaceous plant that grows submersed in shallow waters of brackish and saline habitats or in some alkaline freshwater habitats. Widgeongrass can tolerate large variability in salinity and desiccation. Widgeongrass can dominate shallow waters in some estuaries but has limited competitive abilities and can be replaced rapidly by other submersed species if conditions change (USGS 2007). Various algae are common associates of Widgeongrass, including *Ulva* and *Gracilaria* (as in Barnegat Bay, Photo 29), but some are “serious reducers” of this seagrass (USGS 2007). In some cases, however, declines in Eelgrass are not associated with declines of Widgeongrass, which remained unchanged (Lathrop et al. 2001).

Widgeongrass is a primary producer in some aquatic systems. Many invertebrates are associated with it and epiphytic diatoms can be abundant on the plants. Widgeongrass is an important source of food for waterfowl and food and shelter for many fish species (USGS 2007).

Eelgrass (*Zostera marina*) is a herbaceous perennial plant that grows in intertidal to subtidal marine and estuarine waters and flowers late spring through summer. It is found mostly in subtidal habitats, is rarely exposed at low tide and grows in more or less sheltered areas on soft mud or firm sand (FNA 2007). Eelgrass forms “meadows” that accumulate substrate and lower the velocity of current flow. When the rhizomes become too buried the stands dieback, which is often followed by erosion (FNA 2007). Eelgrass is important for its role as a primary producer, as an indirect source of food through detritus, as well as its role as a habitat for adult fish (Bologna et al. 2007).

In the Maryland coastal bays, a disease nearly eliminated Eelgrass in the 1930s, which led to a “drastic decline” in acreage covered by seagrasses in general in the bays (Wazniack et al. 2003). Historic losses of Eelgrass are attributed to disease, but increasingly issues for seagrasses in general include water quality (Wazniack et al. 2003), dredging (Stephan et al. 2005), commercial clamming and fishing (Stephan et al. 2005) and some recreational activities including the extensive use of jet skis are

reported (e.g., Schwaab 2007) to be associated with declines. Physical injury to plants can include leaf shearing, seed or flower shearing, uprooting, chopping of underground parts especially at low tide and burial (Stephan et al. 2005). In Little Egg Harbor, New Jersey, significant loss of Eelgrass density and biomass occurred in 1998 associated with an increase in macro-algae including *Ulva*, *Gracilaria* and *Conium* in Eelgrass beds, blanketing the bottom (Bologna et al. 2007).

Stephan et al. (2005) advises that if SAV species experience impacts from multiple sources, the stress of multiple impacts is expected to make the plants more susceptible to injury from any one or all of the impacts individually. Based on a review of the literature, impacts such as decreased water quality, increased turbidity, competition from other submersed species such as algae, extensive recreational and commercial activities and disease can have cumulative effects that may result in serious consequences to the density, cover, and distribution of SAV.

Reduction in SAV bed coverage within the Berkeley portion of Barnegat Bay is illustrated on the SAV maps provided herein (Submerged Aquatic Vegetation Types Map and Submerged Aquatic Vegetation Growth Map). Apparent loss of SAV beds is particularly evident along the mainland (western) shore of the Bay as illustrated from 1968 and 1979 compared to later mapping efforts (e.g., 2009). Reduction in the extent of SAV beds along the eastern shore of the Bay can also be seen in association with the barrier island containing Island Beach State Park.

Estuarine Intertidal Wetland Communities

Wetlands identified within the estuarine system of Berkeley Township are located in the brackish intertidal zones within Barnegat Bay and the tidal creeks entering into the Bay. Non-vegetated wetlands (i.e. an example of State open waters) include sand and gravel shores and mud flats. Vegetated wetlands include emergent wetlands dominated by herbaceous species (e.g., salt marsh and brackish marsh habitats) and scrub-shrub wetlands dominated by low-growing woody species.

Salt marsh habitat is a form of emergent wetland generally dominated by halophytic plants characteristic of the higher salinities (mixohaline-brackish to saline and hypersaline types) of the estuarine environment (Photo 30). In Berkeley Township, the mixohaline to saline marshes are dominated by *Spartina alterniflora* (Salt Marsh Cordgrass) in regularly inundated marshes and by *Spartina patens* (Meadow Cordgrass) and *Distichlis spicata* (Saltgrass) in higher elevation,



Photo 30: Estuarine Communities. View from Bayview Avenue toward tidal channel and Estuarine Emergent Wetland in the form of salt marsh dominated by Salt Marsh Cordgrass (12/1/2011).

INSERT SUBMERGED AQUATIC VEGETATION TYPES MAP

Map 25: Submerged Aquatic Vegetation Types Map

PAGE INTENTIONALLY LEFT BLANK

INSERT SUBMERGED AQUATIC VEGETATION GROWTH MAP

Map 26: Submerged Aquatic Vegetation Growth Map

PAGE INTENTIONALLY LEFT BLANK

less frequently inundated habitats often peripheral to Salt marsh Cordgrass dominated habitats and with seasonally higher salinities due to concentration of salt through evapotranspiration processes. Other halophytes also may be scattered in this peripheral vegetation including several species of seep-weed (*Suaeda americana*, American Seepweed; and *S. linearis*, Tall Seep-weed). *Suaeda maritima* (Low Seep-weed) generally grows in more regularly flooded habitats such as margins of channels. Salt pans, ponded depressions within the salt marsh supporting sparse vegetation, often dry during summer months at sites that don't receive regular inundation. Halophytes that can tolerate seasonally hypersaline conditions such as *Salicornia bigelovii* (Dwarf Glasswort), *S. depressa* (Slender Glasswort) and *Sarcocornia pacifica* (Perennial Glasswort or Pickleweed) usually characterize salt pans and similar areas with fluctuating salinities including hypersaline conditions and hydrology.



Photo 31: Estuarine Communities. View across estuarine habitats in the vicinity of Bayview Avenue, including intertidal mudflats and Estuarine Emergent Wetland represented by brackish marsh, which is characterized by American Three-square and other estuarine species (12/1/2011).

Brackish marsh habitat is a form of emergent wetland generally dominated by halophytic plants characteristic of somewhat lower salinities (mixohaline to oligohaline) than salt marsh habitats (Photo 31). In Berkeley Township, these marshes include various bulrushes mixed with Cordgrass species. *Schoenoplectus americanus* (American Three-square) is a bulrush characteristic of brackish marshes with freshwater influences from groundwater and surface flows. Additional species of cordgrass also characterize brackish marshes in Barnegat Bay including *Spartina cynosuroides* (*Big Cordgrass*) and *Spartina pectinata* (*Prairie Cordgrass*). Brackish marshes are often transitional between salt marshes and tidal riverine, tidal palustrine and non-tidal palustrine wetlands adjacent to terrestrial environments.

Scrub-shrub wetland in the estuarine system is generally restricted to marsh fringe habitats, islands in marsh habitat and margins of roads and berms. It is characterized by two species: *Iva frutescens* (Marsh Elder), which is often in slightly lower elevations and *Baccharis halimifolia* (Groundsel Bush), which is often in slightly higher elevations. Sites with reduced salinities, which are transitional to tidal freshwater habitats in the palustrine system, are characterized by a diverse group of shrub species including but not limited to *Amelanchier canadensis* (Service Berry), *Cephalanthus occidentalis* (Buttonbush), *Clethra alnifolia* (Sweet Pepperbush), *Ilex verticillata* (Winterberry), *Rosa palustris* (Swamp Rose) and *Vaccinium corymbosum* (Highbush Blueberry).

Riverine System

The Riverine System is characterized by unidirectional flow from upstream to downstream within a channel. Cowardin et al. (1979) define the system as follows:

“The Riverine System...includes all wetlands and deepwater habitats contained within a channel, with two exceptions: (1) wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens, and (2) habitats with water containing ocean-derived salts in excess of 0.5 ppt. A channel is “an open conduit either naturally or artificially created which periodically or continuously contains moving water, or which forms a connecting link between two bodies of standing water”.

Cowardin et al. (1979) also have provided a description of the limits of this system, including two major features: (1) the system terminates downstream where the concentration of ocean-derived salts in the water exceeds 0.5 ppt during the period of annual low flow (= Estuarine), or where the channel enters a lake (= Lacustrine); and (2) the system terminates upstream where tributary streams originate, or where the channel leaves a lake. On the landward side of the channel, the Riverine System is bounded by upland, or by wetland dominated trees, shrubs, persistent emergent species, emergent mosses, or lichens (= Palustrine).

Riverine Subtidal Deepwater Habitats

Riverine subtidal habitats are anticipated in the lower Cedar Creek system, where tidal influence extends upstream into Atlantic White Cedar Swamps habitat east of Route 9. Unconsolidated bottom dominates the habitat but areas of Submerged Aquatic Vegetation are anticipated. The slightly brackish to freshwater species known to occur in the Barnegat Bay system and potential in the tidal riverine portion or upper estuarine portion of Cedar Creek include but are not limited to *Ruppia maritima* (Widgeongrass), *Stuckenia pectinatus* (Sago Pondweed) and *Zannichellia palustris* (Horned Pondweed).

Riverine Intertidal Wetland Communities

Riverine wetland habitat is rare in Berkeley Township and mostly confined to the narrow intertidal shores of Cedar Creek (Photo 32). Although not explored as part of this inventory, the intertidal shores of Cedar Creek are similar to other central or southern New Jersey freshwater tidal shores that are known to support a number of restricted and rare or endangered plant species (Ferren & Schuyler 1980). The uncommon and threatened community is situated in an island like situation, surrounded by dissimilar potential hostile environments (non-tidal wetland, upland and saline environments) for plants and animals restricted to the freshwater and tidal



Photo 32: Tidal Riverine and Palustrine Communities. View eastward along freshwater tidal portion of Cedar Creek, which separates Berkeley (left) and Lacey Township (right), including tidal riverine habitats and Palustrine Tidal Swamp dominated by Atlantic White Cedar (12/1/2011).

environment. Example plant species characteristic of this environmental and potential for Berkeley Township include *Elatine americana* (American Waterwort), *Eleocharis olivacea* var. *reductiseta* (Pine Barren's Spikerush), *Eriocaulon parkeri* (Parker's Pipewort) and *Isoetes riparia* (Riverbank Quillwort).

Riverine Littoral Wetlands and Limnetic Deepwater Habitats

Riverine littoral wetlands occur along shores, in shallow water and on bars and benches of local streams and rivers upstream from tidal influence. They are dominated by non-persistent vegetation that is generally removed from the habitats during storms, winter

conditions, or other factors. Riverine aquatic bed vegetation is similar to estuarine SAV, sometimes composed of some of the same slightly brackish to freshwater species including *Potamogeton* spp. (Pondweed species), *Zannichellia palustris* (Horned Pondweed) and others (Photo 33). Stands of persistent emergent vegetation within the riverine environment are considered palustrine wetlands (Photo 34).

Riverine limnetic deepwater habitats occur in channels where the substrates are deep enough to prevent the growth of emergent species. Portions of Cedar Creek and Toms River support limnetic conditions.

Lacustrine System

The Lacustrine System as delimited by Cowardin et al. (1979) includes two subsystems: (1) Subsystem Limnetic, considered to be deepwater habitats and not covered by this study; and, (2) Subsystem Littoral, considered here to be wetland habitats. Cowardin et al. (1979) define this system as follows:



Photo 33: Riverine Aquatic Communities. View of submerged Riverine Aquatic Bed vegetation (upper left), characterized by Pondweed and Water Bulrush and Unconsolidated Bottom Habitat in Cedar Creek at William J. Dudley Park, adjacent to Route 9 (12/1/2011).



Photo 34: Riverine and Palustrine Wetland Communities. View toward Palustrine Emergent Wetland, dominated by Bayonet Rush (center of photo) within Riverine context of Cedar Creek at William J. Dudley Park (12/1/2011).

“The Lacustrine System...includes wetlands and deepwater habitats with all of the following characteristics: (1) situated in a topographic depressions or a dammed river channel; (2) lacking trees, shrubs, persistent emergent species, emergent mosses, or lichens with greater than 30% areal coverage; and (3) total area exceeds 8 ha (20 acres). Similar wetland and deepwater habitats totaling less than 8 ha are also included in the Lacustrine System if an active wave formed or bedrock shoreline feature makes up all or part of the boundary, or if the water depth in the deepest part of the basin exceeds 2 m (6.6 feet) at low water. Lacustrine waters may be tidal or non-tidal, but ocean- derived salinity is always less than 0.5 [ppt]”.

Cowardin et al. also have provided a description of the limits of the Lacustrine System, including: (1) landward boundaries at upland habitats or wetlands dominated by trees, shrubs, persistent emergent species, emergent mosses, or lichens; and, (2) the approximate contour of the "normal" spillway or pool elevation in dammed river channels, except where palustrine wetlands extend lake-ward into the lacustrine environment. The littoral or wetland habitats of the Lacustrine System extend from the shoreward boundary of the system to a depth of 2 meters (6.6 feet) below low water or to the maximum extent of non-persistent emergent species, if these grow at depths greater than 2 meters.



Photo 35: Lacustrine Communities. View westward of dam on Cedar Creek forming Mill Pond Reservoir (12/22/2011).

Lacustrine Littoral Wetlands and Limnetic Deepwater Habitats

No natural lacustrine environments (i.e., true lakes) are located in Berkeley Township. A gravel quarry within the lands of New Jersey Pulverizing is large and deep enough to support lacustrine environments. Mill Pond Reservoir formed from damming Cedar Creek (Photo 35) is large enough to likely fall within the lacustrine classification. Littoral wetland types include unconsolidated shores and non-persistent emergent wetlands that are shallow enough to support emergent vegetation. Persistent emergent vegetation within the lacustrine environment (e.g., stands of cattails and bulrushes) is classified as palustrine wetlands in a lacustrine context. Lacustrine limnetic habitats are located in lakes deep enough to preclude the growth of emergent vegetation.

Palustrine System

The Palustrine System contains no subsystems as considered by Cowardin et al. (1979) because there is no overwhelming physical features of the environment (e.g., oceanic tides and salinity, shoreline waves, flowing water) that influence the formation of habitats and the structure of biotic communities. All elements of this system are wetlands. Cowardin et al. define the Palustrine System as follows:

“The Palustrine System...includes all non-tidal wetlands dominated by trees, shrubs, persistent emergent species, emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5 ppt [parts per thousand]. It also includes wetlands lacking such vegetation, but with all of the following four characteristics: (1) area less than 8 ha (20 acres); (2) active wave-formed or bedrock shoreline features lacking; (3) water depth in the deepest part of basin less than 2 m at low water; and (4) salinity due to ocean-derived salts less than 0.5 ppt”.

There are many examples of palustrine wetlands in Berkeley Township including representatives from emergent, scrub-shrub and forested communities. The following examples of anticipated or observed moss-lichen, emergent, scrub/shrub and forested palustrine wetlands are identified according to Breden (1989) and Cowardin et al. (1979).

Ponds

Coastal and Pinelands ponds that are generally flooded permanently due to artificial impoundments or excavations are too small to provide the environment necessary to be classified as true “lacustrine lakes”. Hence they are included together as “palustrine ponds”. Examples occur throughout the Township and can include those with aesthetic settings such as along Route 9 (Photo 36) and agricultural wetlands such as abandoned or actively-farmed cranberry “bogs” as at Double Trouble State Park (Photo 37).

Coastal Plain Intermittent Pond and Vernal Pool Habitat

Coastal Plain Intermittent Pond Herbaceous Vegetation in seasonal ponds and pools is considered rare in New Jersey and is reported by NJDEP from Ocean County (NHP report, see Appendix). *Eleocharis* spp. (Spikerush species) is a characteristic group of plants. Although perhaps not providing natural



Photo 36: Palustrine Communities. View eastward from Route 9 toward perennial pond along artificially impounded drainage, supporting various palustrine communities including Emergent and Forested Wetlands (12/22/2011).



Photo 37: Palustrine Communities. View across cranberry bog habitat supporting Palustrine Emergent Wetland vegetation at Double Trouble State Park (12/22/2011).

habitat for this listed dominance type, “artificial” intermittent pond habitat also occurs in Berkeley Township, as located along Davenport Road (Photo 38), which is listed as “potential vernal pool habitat” (No. 47030cp) on the Wetland Map provided herein. One of several potential vernal pools located within Crossley Preserve includes ground cover of various species of *Sphagnum* moss and *Lycopodium* spp. within an *Acer rubrum* (Red Maple) hardwood swamp context (Photo 39). Naturally occurring intermittent pond or vernal pool habitat in a Pinelands or coastal landscape is anticipated in Berkeley Township and is likely to support characteristic wetland species including several rare and endangered plants known to occur elsewhere in Ocean County such as several species of *Rhynchospora* (Beaked-rush). Additional “potential vernal habitat” (as many as 19 numbered sites) is identified on the included Wetlands Map. NJDEP “designated vernal pool” habitat meets several important criteria including breeding habitat for restricted (obligate and facultative) and often rare or special concern amphibian and reptile species identified for Berkeley Township (NJDEP NHP 2011).

Moss-Lichen Wetland

Moss-lichen wetland is represented primarily by the *Sphagnum* “bog” characteristic of the acidic wetlands and waters of the Pinelands in the State. Some of the wetlands with *Sphagnum* as a component perhaps are best treated as palustrine emergent wetlands dominated by herbaceous emergent hydrophytes, whereas others may have sufficient cover of shrubs or trees (> 30%) to be considered scrub-shrub or forested wetland types. Some species belonging to the genus *Sphagnum* are considered by the State to be rare or endangered species. In Berkeley Township, *Sphagnum*



Photo 38: Palustrine Wetland Communities. View toward an intermittent pond and potential vernal pool habitat, characterized by Palustrine Emergent Wetland including Woolgrass along Davenport Road in the Hovnanian Sanctuary, a New Jersey Audubon Society natural preserve (12/1/2011).



Photo 39: Palustrine Wetland Communities. View of deciduous Forested Wetland vegetation and an understory of scattered hydrophytic shrub and herbaceous vegetation in Crossley Preserve (12/22/2011).

portoricense is known from wetlands associated with Michael's Branch, and elsewhere in Ocean County *Sphagnum macrophyllum* has been documented (NJDEP NHP 2011).

Palustrine Emergent Wetland

Palustrine tidal marshes are anticipated to occur at locations inland from estuarine wetlands where freshwater conditions characterize the landscape. Examples may include large stands of persistent emergent vegetation in tidal creeks and rivers and freshwater tidal marshes located at seeps between estuarine wetlands and terrestrial habitats.

Emergent wetlands situated in a dune complex generally located in dune swales between dune crests are mostly fresh water in nature due to the shallow freshwater lenses located in the sandy soil. Salt spray or occasional wash-over may introduce sufficient salt to produce palustrine brackish marsh conditions. Typical dominants include representatives of *Juncus* spp. (rush species), *Scirpus* spp. (bulrush species), *Carex* spp. (sedge species), *Andropogon* (broom-sedge) and many others.

Robust Emergent Marsh (Breden 1989) includes a wide variety herbaceous wetland types. In Berkeley Township these wetlands often occur in a Pinelands setting at sites with a long land use history of excavation (e.g. bog iron excavation) and natural recovery (Photos 40 & 41). A rich association of hydrophytic emergent and sub-shrub plants characterizes the habitats, which usually reflects the acidic aquatic environment of Pineland's wetlands.



Photo 40: Palustrine Communities. View across various palustrine wetland communities including Emergent Wetland (foreground and center), possibly formed following the removal of bog iron during the operation of Dover Forge (12/22/2011).

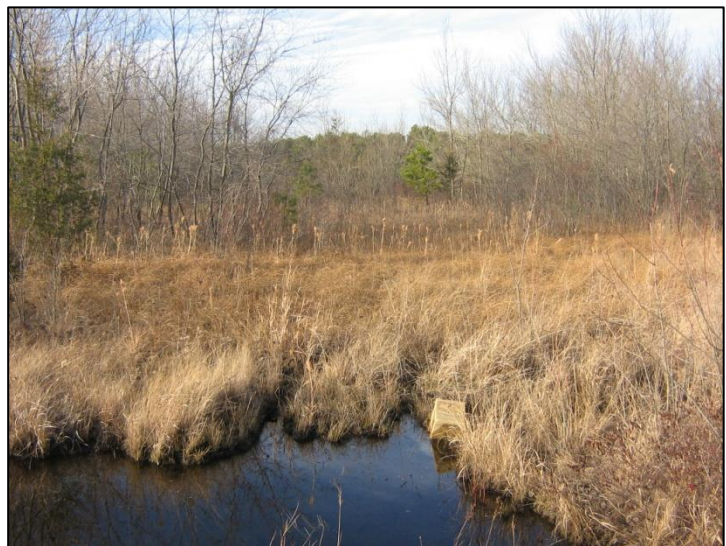


Photo 41: Palustrine Communities. View toward Palustrine Emergent Wetland (center) and Deciduous Scrub-shrub Wetland (center right and left) adjacent to Cedar Creek; possibly formed following the removal of bog iron during the operation of Dover Forge (12/22/2011).

River bars, benches, shores and shallow beds may support persistent emergent vegetation that represents a palustrine community within the riverine environment. A representative example is located in Cedar Creek dominated by *Juncus militaris* (Bayonet Rush).

Palustrine Scrub-shrub Wetland

Narrow shrub-dominated wetland is often characteristic of the margins of streams and ponds in the Township. A diverse assemblage of native shrubs can form the Palustrine Scrub-shrub Wetland community including but not limited to *Amelanchier canadensis* (Service Berry), *Chamaedaphne calyculata* (Leather-leaf), *Clethra alnifolia* (Sweet Pepperbush), *Eubotrys racemosa* (Fetterbush), *Ilex verticillata* (Winterberry), *Ilex glabra* (Inkberry), *Kalmia angustifolia* (Sheep Laurel), *Pyrus arbutifolia* (Red Chokeberry), *Rhododendron viscosum* (Swamp Azalea), *Vaccinium corymbosum* (Highbush Blueberry), *Vaccinium macrocarpon* (Cranberry) and others.

Basins, drainages and other wet or moist open areas of the Pinelands often are characterized by a mosaic of emergent and scrub-shrub wetland types. Many of the shrub species listed for stream and pond side wetlands also characterize this form of Palustrine Scrub-Shrub Wetland, but may be composed for few species such as patches of Sweet Pepperbush, Sheet Laurel, Leather-leaf, or Highbush Blueberry. As with examples of Palustrine Emergent Wetland, many of the sites have been impacted by historic land uses that have altered drainages and topographic features, resulting in the formation of altered landscapes and habitats now vegetated by native species.

Palustrine Forested Wetland

Palustrine Forested Wetlands in Berkeley Township can be grouped into broad-leaf deciduous types and narrow-leaf evergreen types of combinations of both. Various subgroups have been identified by authors (e.g., Robichaud & Buell 1973, Tiner 1985, and Breden 1989), some of which are described below.

Forested wetlands in freshwater tidal situations are an uncommon occurrence in New Jersey, due in part to natural environmental limitations and impacts from past land use activities such as logging and coastal development and landward migration of coastal wetlands due to sea level rise. In Berkeley Township, examples are located along the lower reaches of Cedar Creek, where the dominant tree species is *Chamaecyparis thyoides* (Atlantic White Cedar). Other tree species either associated with this vegetation or potentially dominant include *Acer rubrum* (Red Maple) and *Nyssa sylvatica* (Black Gum).



Photo 42: Palustrine Communities. View from vicinity of historic railroad corridor toward broadleaf-deciduous Forested Wetland dominated by Red Maple at Crossley Preserve (12/22/2011).

Deciduous Palustrine Forested Wetlands are widespread in occurrence but in the Township generally dominated by only a few species. They have been observed for the preparation of this inventory in dune swales at Island Beach State Park, coastal drainages and lowlands, and in Pinelands floodplains, seeps, historically excavated areas and poorly defined drainages (Photo 42). Most examples are dominated by *Acer rubrum* (Red Maple). Other characteristic species include but are not limited to *Nyssa sylvatica* (Black Gum), *Salix nigra* (Black Willow), *Magnolia virginiana* (Sweet Bay) and *Liquidambar styraciflua* (Sweet Gum). *Ilex opaca* (American Holly) a broad-leaf evergreen tree is a common associate among the deciduous species.

Atlantic White Cedar Swamp is a type of forested freshwater wetland where trees of the needle-leaf evergreen species *Chamaecyparis thyoides* (Atlantic White Cedar) dominate (Photo 43). The vegetation may occur in a number of ecological settings including, for example, along banks of streams in a riparian setting, in broad floodplain swamps and in tidal freshwater habitats as noted above. Atlantic White Cedar has been logged for many years in the Township and was an important component of the economic development of the historic village of Double Trouble.



Photo 43: Estuarine Communities. View from bridge over Cedar Creek towards a riparian form of narrow-leaf-evergreen Forested Wetland (Atlantic White Cedar Swamp), dominated by Atlantic White Cedar (12/1/2011).

Palustrine Forested Wetlands dominated by *Pinus rigida* (Pitch Pine) are a type of needle-leaf evergreen community characteristic of the Pinelands. Pine Barren Savanna and Pitch

Pine Lowlands are both listed by for the Township and are among those communities of special concern (NJDEP NHP 2011). The Pine Barren Savanna community is a mosaic of emergent, scrub-shrub wetlands with scattered Pitch Pines, whereas the Lowland Forest tends to have a denser stand of Pitch Pines in a somewhat less aquatic situation. Both communities provide habitat for a number of listed rare or endangered plant species (NJDEP NHP 2011).

8.1.3 Invasive Plant Species

Regarding wetlands, the most serious impact is from Common Reed (*Phragmites australis*), which dominates some of the Estuarine Emergent Wetlands along Barnegat Bay and other wetlands in the Township. The biodiversity of these wetlands have been diminished due to the overwhelming dominance of this invasive species.

Margins of wetlands and mesic woodlands have been colonized by several species including Multiflora Rose (*Rosa multiflora*) and Japanese Knotweed (*Polygonum cuspidatum*). Several woody vines also are becoming threats to native vegetation including English Ivy (*Hedera helix*), Oriental Bittersweet (*Celastrus orbiculatus*), Japanese Honeysuckle (*Lonicera japonica*) and Sweet Autumn Clematis (*Clematis paniculata*). Other invasive shrubs noted during reconnaissance field trips include Japanese

Lespedeza (*Lespedeza cuneata*) and Morrow's Honeysuckle (*Lonicera morrowii*). Occasional, potentially invasive exotic trees include Norway Maple (*Acer platanoides*) and Tree-of-Heaven (*Ailanthus altissima*).

Numerous herbaceous plant species not native to the region also have established at various sites throughout the Township. Although most of these exotic species are not necessarily invasive, most are indicative of the disturbed nature of the habitats. Some particularly problematic species include the following: Mugwort (*Artemisia vulgaris*) along roadside and at disturbed sites and Purple Loosestrife (*Lythrum salicaria*) in freshwater coastal wetlands.

8.1.4 The Urban Forest

An urban forest is a collection of trees that grow in a municipal setting. Care and management of urban forests is called urban forestry. Urban forests play important roles in the ecology of human habitats in many ways: they filter air, water and sunlight; provide shelter to animals and recreational areas for humans. They moderate local environments, help reduce noise and wind, help conserve energy by shading structures to conserve energy and are critical in cooling the urban heat island effect. Benefits of urban trees and shrubs include but are not limited to beautification; reduction of heat, erosion and stormwater runoff and air and noise pollution; contribute to carbon sequestration and active pollutant removal; enhance property values; improve wildlife habitat; and mitigate the overall urban environmental impact.

The Urban Forest Project is an environmental, public arts and educational initiative around the world resulting in a series of outdoor exhibitions in various cities including the creation of banners employing the form of a tree to make a visual statement through the communities. Funding associated with the project is used to support various local environmental and forestry initiatives.

In the Township of Berkeley, local urban forestry efforts can be enhanced by using trees native in the region, including those growing within the Township Limits. Examples of locally native trees include those known to occur at or in the vicinity of local parks. Representative native tree species from these sites include the following:

- American Beech (*Fagus grandifolia*): broad-leaf deciduous
- American Holly (*Ilex opaca*): broad-leaf evergreen
- Atlantic White Cedar (*Chamaecyparis thyoides*): needle-leaf evergreen
- Black Oak (*Quercus velutina*): broad-leaf deciduous
- Black Cherry (*Prunus serotina*): broad-leaf deciduous
- Black or Sour Gum (*Nyssa sylvatica*): broad-leaf deciduous
- Black-jack Oak (*Quercus marilandica*): broad-leaf deciduous
- Eastern Red Cedar (*Juniperus virginiana*): needle-leaf evergreen
- Gray Birch (*Betula populifolia*): broad-leaf deciduous
- Pitch Pine (*Pinus rigida*): needle-leaf evergreen
- Post Oak (*Quercus stellata*): broad-leaf deciduous
- Red Maple (*Acer rubrum*): broad-leaf evergreen
- Scarlet oak (*Quercus coccinea*): broad-leaf deciduous
- Smooth Alder (*Alnus serrulata*): broad-leaf deciduous

- Southern Red Oak (*Quercus falcata*): broad-leaf deciduous
- Swamp White Oak (*Quercus bicolor*): broad-leaf deciduous
- Sweet bay (*Magnolia virginiana*): broad-leaf deciduous
- Sweet Gum (*Liquidambar styraciflua*): broad-leaf deciduous
- Sycamore (*Platanus occidentalis*): broad-leaf deciduous
- Tulip Tree (*Liriodendron tulipifera*): broad-leaf deciduous
- Virginia Pine (*Pinus virginiana*): needle-leaf evergreen
- White Oak (*Quercus alba*): broad-leaf deciduous
- Chestnut Oak (*Quercus prinus*): broad-leaf deciduous

8.2 Zoological Resources

Urbanization affects aquatic habitats, due to contaminants and pollutants present in stormwater and the warming of runoff coming from impervious surfaces. These factors reduce the diversity of freshwater aquatic animals (Adams 1994). Urbanization also results in the loss of terrestrial habitats due to urban and suburban sprawl. In spite of the high level of development along Barnegat Bay, in Bayville and in Holiday City, the Township of Berkeley supports a wide variety of wildlife, including habitats for many threatened and endangered species, particularly those that find suitable habitats unique to a beach/dune ecosystem and to the Pinelands.

8.2.1 Terrestrial Animals

Dozens of species of terrestrial fauna are known to reside in New Jersey including mammals, herpetofauna (reptiles and amphibians) and birds. Because the Township of Berkeley contains an extensive open space network, necessary habitats for many terrestrial wildlife species, such as extensive forest, woodland or grassland habitats are readily present. Still, the varieties of wildlife present in a suburban setting, such as in Bayville or Holiday City, can



Photo 44: Inquisitive red fox at Island Beach State Park (12/22/2011).

be surprising. Species, which achieve the greatest numbers in such suburban settings will be small to medium-sized herbivores, which are habitat generalists. Residents of the Township of Berkeley can expect to see species such as Chipmunks, Gray squirrels, Raccoons, Opossums, House mouse and Eastern mole in their backyard. Landscaped yards provide cover, nesting and feeding habitats for local and migrating songbirds. Birds likely to visit backyard bird feeders include Juncos, House sparrow, House finch, Cardinal, Black-capped chickadee, Blue jay, Tufted titmouse, Goldfinch, Mourning dove and House wren. Great Blue herons and American egret are occasional in the coastal marshes, but fairly large groups of Snowy egrets scattered throughout the marshes along both sides of Bayview Avenue are a

fairly common sight. The ubiquitous Turkey vulture and various species of hawk, including Red-tail as well as various species of gull commonly grace the skies overhead. Osprey nests can be seen among the abandoned poles of Telegraph Park on Good Luck Point and elsewhere on manmade mounts and occasionally on top of navigational buoys in the Bay.

The smaller, disturbance-tolerant mammals have an easier time finding habitat than larger mammals, although one of New Jersey's larger mammals, the White-tailed deer frequently occurs in suburban settings. A deer sighting would be most likely in a wooded area.

Forested, scrub-shrub and palustrine emergent wetlands are found largely west of the Parkway. The shyer wildlife species, such as Shrews, Voles and Bats are more likely to be found in such areas. The American woodcock, flycatchers and various herons will seek the quieter parts of the Township. Eastern Coyote is on the increase. This species has been observed in suburban settings in New Jersey (Greenwire 2010). The black bear has even been observed in every county in New Jersey. Other shyer or uncommon species should occur, but would be less easily observed. A listing of New Jersey mammals is depicted in Figure 20 and 21, most of which could potentially occur, within the boundaries of the Township.

New Jersey is home to numerous reptiles. 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 geographical ranges, particularly southern Coastal Plain and northern species. Of particular interest is some of the special status reptile species reported from the Township including

Figure 20: New Jersey Mammals

Common Name	Scientific Name	Status*
Opossum	<i>Didelphis marsupialis</i>	S
Masked Shrew	<i>Sorex cinereus</i>	S
Short-tailed Shrew	<i>Blarina brevicauda</i>	S
Least Shrew	<i>Cryptotis parva</i>	U
Eastern Mole	<i>Scalopus aquaticus</i>	S
Star-nosed Mole	<i>Condylura cristata</i>	U
Little Brown Bat	<i>Myotis lucifugus</i>	S
Eastern Cottontail	<i>Sylvilagus floridanus</i>	S
Eastern Chipmunk	<i>Tamias striatus</i>	S
Woodchuck	<i>Marmota monax</i>	S
Gray Squirrel	<i>Sciurus carolinensis</i>	S
Raccoon	<i>Procyon lotor</i>	S
Striped Skunk	<i>Mephitis mephitis</i>	S
Beaver	<i>Castor canadensis</i>	INC
Keen Myotis	<i>Myotis septentrionalis</i>	U
Silver-haired Bat	<i>Lasionycteris noctivagans</i>	U
Eastern Pipistrel	<i>Pipistrellus subfalvus</i>	U
Big Brown Bat	<i>Eptesicus fuscus</i>	S
Red Bat	<i>Lasiurus borealis</i>	S
Hoary Bat	<i>Lasirus cinereus</i>	U
Meadow Jumping Mouse	<i>Zapus hudsonius</i>	U
Red Fox	<i>Vulpes vulpes</i>	S
Black Bear	<i>Ursus americanus</i>	INC
Marsh Rice Rat	<i>Oryzomys palustris</i>	S
White-footed Mouse	<i>Peromyscus leucopus</i>	S
Red-backed Mouse	<i>Clethrionomys gapperi</i>	S
Meadow Vole	<i>Microtus pennsylvanicus</i>	S
Pine Vole	<i>Microtus pinetroum</i>	S
Muskrat	<i>Ondatra zibethicus</i>	S
House Mouse	<i>Mus musculus</i>	I
White-tailed Deer	<i>Odocoileus virginianus</i>	D
Eastern Coyote	<i>Canis latrans</i>	INC
Tuckahoe Masked Shrew	<i>Sorex cinereus nigriculus</i>	U
Water Shrew	<i>Sorex palustris</i>	U
Smokey Shrew	<i>Sorex fumeus</i>	U
Long-tailed Shrew	<i>Sorex dispar</i>	U
Pygmy Shrew	<i>Sorex hoyii</i>	U
Hairy-tailed Mole	<i>Parascalops breweri</i>	U
Indiana Bat	<i>Myotis sodalis</i>	E
Small-footed Myotis	<i>Myotis leibii</i>	U

Timber rattlesnake, Northern pine snake and Northern diamondback terrapin, a turtle found in the estuarine waters of Barnegat Bay. Figure 22 lists the various reptiles found in New Jersey.

Amphibians are terrestrial animals in their adult life stage, but they require aquatic environments for breeding and early life stages. Degraded aquatic habitats subject to warmed and contaminated stormwater runoff will limit the ability of amphibians to breed within the Township of Berkeley. In addition, many individuals may be lost to road kill, attempting to move from aquatic breeding habitats to the terrestrial habitats suited to adult stages (Adams 1994). Small floodplain ponds could potentially provide breeding habitat for amphibians, if contamination or lack of adequate upland habitat is not an issue. Spring peepers and New Jersey chorus frogs and Bullfrogs may be heard singing their Spring breeding songs in these waters and in inundated wetlands. A listing of amphibians found in the State of New Jersey is depicted in Figure 23. The Wetlands Map on page 58 illustrates the location of potential vernal pools in which amphibians may breed.

The diversity of terrestrial fauna present even in a suburban environment is exemplified by the birds. The Township of Berkeley contains several important habitat types for avian species. This is evidenced by the procurement of two tracts within the Township by the U.S. Fish and Wildlife Service for inclusion in the Edwin B. Forsythe National Wildlife Refuge. The Refuge covers more than 47,000 acres of southern New Jersey's coastal habitats. It is located in one of the Atlantic Flyway's most active flight paths and provides a valuable habitat for a variety of birds (USF&WS, Accessed 2012). A list of the birds of New Jersey can be found at http://en.wikipedia.org/wiki/List_of_birds_of_New_Jersey.

The coastal wetlands and coves provide excellent habitat for waterfowl, both local and migrating species. A visit to one of these impoundments might provide sightings of the very common Mallard. You might also observe Canvasbacks, Blue-winged teals, Ring-necked ducks and Greater or Lesser scaups. A Great blue heron may be feeding in the shallows at the edge of the water. The coastal sand dunes and beaches, ocean and estuaries provide important shorebird habitat. Sandpipers dart back and forth between the waves at the beach and Herring gulls or Laughing gulls very likely tried to steal a lunch.

Figure 21: New Jersey Mammals, continued

Common Name	Scientific Name	Status*
Northern Yellow Bat	<i>Lasiurus intermedius</i>	P
New England Cottontail	<i>Sylvilagus transitionalis</i>	U
European Hare	<i>Lepus capensis</i>	I
Black-tailed Jackrabbit	<i>Lepus californicus</i>	I
White-tailed Jackrabbit	<i>Lepus townsendii</i>	I
Red Squirrel	<i>Tamiasciurus hudsonicus</i>	S
Southern Flying Squirrel	<i>Glaucomys volans</i>	U
Northern Flying Squirrel	<i>Glaucomys sabrinus</i>	U
Nutria	<i>Myocastor coypus</i>	I
Eastern Wood Rat	<i>Neotoma floridana</i>	E
Southern Bog Lemming	<i>Synaptomys cooperi</i>	U
Black Rat	<i>Rattus rattus</i>	I
Brown Rat	<i>Rattus norvegicus</i>	I
Woodland Jumping Mouse	<i>Napaeozapus insignis</i>	U
Porcupine	<i>Erethizon dorsatum</i>	INC
Gray Fox	<i>Urocyon cinereoargenteus</i>	S
Ermine	<i>Mustela erminea</i>	U
Long-tailed Weasel	<i>Mustela frenata</i>	S
Mink	<i>Mustela vison</i>	S
River Otter	<i>Lutra canadensis</i>	S
Bobcat	<i>Felis rufus</i>	E
*E = endangered; T = threatened; D = decreasing; INC = increasing; S = stable; U = undetermined; I = introduced and P = peripheral.		
Source: NJDEP Division of Fish and Wildlife 2005b.		

Figure 22: New Jersey Reptiles

Common Name	Scientific Name	Status*
Bog Turtle	<i>Clemmys muhlenbergii</i>	E
Common Map Turtle	<i>Graptemys geographica</i>	
Common Musk Turtle	<i>Sternotherus odoratus</i>	
Common Snapping Turtle	<i>Chelydra serpentina</i>	
Diamondback Terrapin	<i>Malaclemys t. terrapin</i>	
Eastern Box Turtle	<i>Terrapene c. carolina</i>	
Eastern Mud Turtle	<i>Kinosternon s. subrubrum</i>	
Eastern Painted Turtle	<i>Chrysemys p. picta</i>	
Eastern Spiny Softshell	<i>Apalone s. spinifera</i>	
Redbelly Turtle	<i>Pseudemys rubriventris</i>	
Red-eared Slider	<i>Trachemys scripta elegans</i>	
Spotted Turtle	<i>Clemmys guttata</i>	
Wood Turtle	<i>Clemmys insculpta</i>	T
Northern Fence Lizard	<i>Sceloporus undulatus hyacinthinus</i>	
Black Rat Snake	<i>Elaphe o. obsoleta</i>	
Corn Snake	<i>Elaphe g. guttata</i>	E
Coastal Plain Milk Snake	<i>L. t. triangulum X L. t. elapsoides</i>	
Eastern Garter Snake	<i>Thamnophis s. sirtalis</i>	
Eastern Hognose Snake	<i>Heterodon platyrhinos</i>	
Eastern Kingsnake	<i>Lampropeltis g. getula</i>	
Eastern Milk Snake	<i>Lampropeltis t. triangulum</i>	
Eastern Ribbon Snake	<i>Thamnophis s. sauritus</i>	
Eastern Smooth Earth Snake	<i>Virginia v. valeriae</i>	
Eastern Worm Snake	<i>Carphophis a. amoenus</i>	
Northern Black Racer	<i>Coluber c. constrictor</i>	
Northern Brown Snake	<i>Storeria d. dekayi</i>	
Northern Copperhead	<i>Agkistrodon contortrix mokasen</i>	
Northern Pine Snake	<i>Pituophis m. melanoleucus</i>	T
Northern Redbelly Snake	<i>Storeria o. occipitomaculata</i>	
Northern Ringneck Snake	<i>Diadophis punctatus edwardsii</i>	
Northern Scarlet Snake	<i>Cemophora coccinea copei</i>	
Northern Water Snake	<i>Nerodia s. sipedon</i>	
Queen Snake	<i>Regina septemvittata</i>	E
Rough Green Snake	<i>Opheodrys aestivus</i>	
Smooth Green Snake	<i>Opheodrys vernalis</i>	
Southern Ringneck Snake	<i>Diadophis p. punctatus</i>	
Timber Rattlesnake	<i>Crotalus horridus</i>	E
* T =State threatened and E = State endangered.		
Source: http://www.nj.gov/dep/fgw/ensp/fieldguide_herps.htm#turtles		

Figure 23: New Jersey Amphibians

Common Name	Scientific Name	Status*
Blue-spotted Salamander	<i>Ambystoma laterale</i>	E
Eastern Mud Salamander	<i>Pseudotriton m. montanus</i>	T
Eastern Tiger Salamander	<i>Ambystoma t. tigrinum</i>	E
Four-toed Salamander	<i>Hemidactylium scutatum</i>	
Jefferson Salamander	<i>Ambystoma jeffersonianum</i>	
Longtail Salamander	<i>Eurycea l. longicauda</i>	T
Marbled Salamander	<i>Ambystoma opacum</i>	
Mountain Dusky Salamander	<i>Desmognathus ochrophaeus</i>	
Northern Dusky Salamander	<i>Desmognathus f. fuscus</i>	
Northern Red Salamander	<i>Pseudotriton r. ruber</i>	
Northern Slimy Salamander	<i>Plethodon glutinosus</i>	
Northern Spring Salamander	<i>Gyrinophilus p. porphyriticus</i>	
Northern Two-lined Salamander	<i>Eurycea bislineata</i>	
Redback Salamander	<i>Plethodon cinereus</i>	
Red-spotted Newt	<i>Notophthalmus v. viridescens</i>	
Spotted Salamander	<i>Ambystoma maculatum</i>	
American Toad	<i>Bufo americanus</i>	
Bullfrog	<i>Rana catesbeiana</i>	
Carpenter Frog	<i>Rana virgatipes</i>	
Eastern Spadefoot (toad)	<i>Scaphiopus h. holbrookii</i>	
Fowler's Toad	<i>Bufo woodhousii fowleri</i>	
Green Frog	<i>Rana clamitans melanota</i>	
New Jersey Chorus Frog	<i>Pseudacris triseriata kalmi</i>	
Northern Cricket Frog	<i>Acris c. crepitans</i>	
Northern Gray Treefrog	<i>Hyla versicolor</i>	
Northern Spring Peeper	<i>Pseudacris c. crucifer</i>	
Pickerel Frog	<i>Rana palustris</i>	
Pine Barrens Treefrog	<i>Hyla andersonii</i>	T
Southern Gray Treefrog	<i>Hyla chrysoscelis</i>	E
Southern Leopard Frog	<i>Rana utricularia</i>	
Upland Chorus Frog	<i>Pseudacris triseriata feriarum</i>	
Wood Frog	<i>Rana sylvatica</i>	
* T =State threatened and E = State endangered.		
Source: http://www.nj.gov/dep/fgw/ensp/fieldguide_herps.htm#turtles		

8.2.2 Aquatic Animals

The aquatic fauna are found in the various aquatic habitats within the Township of Berkeley and include representative species of mammals, fish, invertebrates and amphibians. The surface waters of the Township of Berkeley are both tidal and non-tidal, freshwater, brackish water and saline providing a diverse ecosystem within the municipality.

The bays, estuaries and marine waters of New Jersey can be home to hundreds of marine finfish at some point during the year. The adults of the finfish species will occur in the waters of the Atlantic Ocean. Other life stages may occur in the estuaries within, and adjacent to, the Township of Berkeley. Anadromous fish, which spawn in freshwater, but live the bulk of their lives in salt water, such as American Eel, Herring or Shad, migrate upstream and breed, unless impediments such as dams prevent the movement upstream.

The estuarine waters of Barnegat Bay are teeming with pre-adult life stages of fishes. These estuaries are designated as essential fish habitat for spawning young life stages of Whiting, Red hake, Winter flounder, Yellowtail flounder, Windowpane flounder, Ocean pout, Atlantic sea herring, Monkfish, Bluefish, Atlantic butterfish, Summer flounder, Scup, Black sea bass, Surf clam, King mackerel, Spanish mackerel, Cobia, Dusky shark and Sandbar shark (NOAA, Accessed 2012).

Surf fisherman hope for a Bluefish or a Weakfish, while out in the boats, fishermen drift for Winter or Summer flounder, and maybe the occasional Windowpane (a type of flounder). The ocean waters of the shore of Island Beach State Park are also considered as essential fish habitat for fishes in their adult stages: Atlantic cod, Whiting, Winter flounder, Windowpane flounder, Ocean pout, Atlantic sea herring, Bluefish, Summer flounder, Scup, Black sea bass, Surf clam, King mackerel, Spanish mackerel, Cobia, Sandbar Shark (NOAA, Accessed 2012).

Invertebrate animals are numerous in the marine and estuarine waters associated with the Township. In the ocean, off of Island Beach State Park, there are Moon and Comb Jellies, Blue crab and the prehistoric strangeness of a Horseshoe crab. These waters are also essential fish habitat for the invertebrate Surf clam and Ocean quahog. Walking along the beach you'll find the exoskeletons or shells of the invertebrates living in the intertidal and subtidal ocean waters. In addition to Surf clam and Ocean quahog, shells of Ribbed mussel, Common oyster, Hard-shelled clam, Boatsnail and Moon snail may be found on the beaches of the Township of Berkeley.

Off the shore of New Jersey 28 marine mammals are known to occur, although few species are observed in the waters directly adjacent to the Township. Figure 24 lists the more common non-fish aquatic species.

Figure 24: New Jersey Marine Mammals

Common Name	Scientific Name	Status*
Harbor Seal	<i>Phoca vitulina</i>	S
Harp Seal	<i>Pagophilus groenlandica</i>	P
Gray Seal	<i>Halichoerus grypus</i>	P
Hooded Seal	<i>Cystophora cristata</i>	P
Goose-beaked Whale	<i>Ziphius cavirostris</i>	U
Dense Beaked Whale	<i>Mesoplodon densirostris</i>	U
Gervais Beaked Whale	<i>Mesoplodon europaeus</i>	U
True's Beaked Whale	<i>Mesoplodon mirus</i>	U
Sperm Whale	<i>Physeter macrocephalus</i>	E
Pygmy Sperm Whale	<i>Kogia breviceps</i>	U
Dwarf Sperm Whale	<i>Kogia simus</i>	U
Beluga Whale	<i>Delphinapterus leucas</i>	P
Bridled Spotted Dolphin	<i>Stenella frontalis</i>	U
Spotted Dolphin	<i>Stenella plagiodon</i>	U
Striped Dolphin	<i>Stenella coeruleoalba</i>	U
Saddle-backed Dolphin	<i>Delphinus delphis</i>	U
Bottle-nosed Dolphin	<i>Tursiops truncatus</i>	S
Atlantic Killer Whale	<i>Orcinus orca</i>	U
Risso's Dolphin	<i>Grampus griseus</i>	U
Long-finned Pilot Whale	<i>Globicephala melaena</i>	U
Short-finned Pilot Whale	<i>Globicephala macrorhynchus</i>	U
Harbor Porpoise	<i>Phocoena phocoena</i>	U
Fin Whale	<i>Balaenoptera physalus</i>	E
Sei Whale	<i>Balaenoptera borealis</i>	E
Minke Whale	<i>Balaenoptera acutorostrata</i>	U
Blue Whale	<i>Balaenoptera musculus</i>	E
Humpback Whale	<i>Megaptera novaeangliae</i>	E
Black Right Whale	<i>Balaena glacialis</i>	E
*E = endangered; T = threatened; D = decreasing; INC = increasing; S = stable; U = undetermined; I = introduced and P = peripheral.		
Source: http://www.nj.gov/dep/fgw/chkmamls.htm		

8.3 Rare Species and Species of Special Concern

The State of New Jersey maintains a database of records for occurrences of threatened and endangered wildlife species, rare plants or natural communities and critical wildlife habitat within the State. A search of the NJDEP NHP Database was performed (see the Appendix) and the New Jersey Landscape Mapping Project was reviewed for the Township of Berkeley. Several threatened and endangered animals are known to occur within Berkeley; however, no rare, threatened or endangered invertebrates were identified within the Township.

Three searches of the NHP databases were requested and received; Barrier Island, Mainland East of the Parkway and Mainland West of the Parkway. Three responses were received, which provided information regarding rare vertebrate animals. The following sections detail the findings.

8.3.1 Island Beach and Island Beach State Park

Figure 25 shows rare vertebrate animals found on the barrier island, which comprise a number of endangered species including Atlantic leatherback, Atlantic loggerhead, Black skimmer, Humpback whale, Kemp’s ridley, and Piping plover. It should be noted that almost the entirety of the barrier island is shown as a location for Federal threatened and endangered species or as a suitable habitat. According to the NHP database, the barrier island provides a habitat for seven Federally-designated endangered or threatened species, which includes: Atlantic green turtle, Atlantic leatherback, Atlantic loggerhead, Humpback whale, Kemp’s ridley, Piping plover and Roseate tern.

Figure 25: Rare Vertebrate Animals in the Vicinity of the Barrier Island

Common Name	Scientific Name	Status*
American Oystercatcher	<i>Heamatopus palliatus</i>	Special Concern/Special Concern
Atlantic Green Turtle	<i>Chelonia mydas</i>	Threatened
Atlantic Leatherback	<i>Dermochelys coriacea</i>	Endangered
Atlantic Loggerhead	<i>Caretta caretta</i>	Endangered
Black Skimmer	<i>Rynchops niger</i>	Endangered
Black-Crowned Night-Heron	<i>Nycticorax nycticorax</i>	Threatened/Special Concern
Cattle Egret	<i>Bubulcus ibis</i>	Special Concern/Special Concern
Common Tern	<i>Sterna hirundo</i>	Special Concern/Stable
Glossy Ibis	<i>Plegadis falcinellus</i>	Special Concern/Stable
Humpback Whale	<i>Megaptera novaeangliae</i>	Endangered
Kemp's or Atlantic Ridley	<i>Lepidochelys kempii</i>	Endangered
Least Tern	<i>Sterna antillarum</i>	Endangered
Little Blue Heron	<i>Egretta caerulea</i>	Special Concern/Special Concern
Northern Diamondback Terrapin	<i>Malaclemys terrapin terrapin</i>	Special Concern
Northern Harrier	<i>Circus cyaneus</i>	Endangered/Special Concern
Osprey	<i>Pandion halaetus</i>	Threatened/Stable
Peregrine Falcon	<i>Falco peregrinus</i>	Endangered
Piping Plover	<i>Cahradrius melodus</i>	Endangered
Roseate Tern	<i>Sterna dougallii dougallii</i>	Endangered
Snowy Egret	<i>Egretta thula</i>	Special Concern/Stable
Tricolored Heron	<i>Egretta tricolor</i>	Special Concern/Special Concern
Yellow-Crowned Night-Heron	<i>Nyctanassa violacea</i>	Threatened/Threatened
* "/" indicates dual status, letter before the slash is status of breeding population, letter after the slash is for the migratory population.		
Source: New Jersey Department of Environmental Protection, Division of Parks and Forestry, Natural Heritage Program, December 7, 2011		

8.3.2 Mainland Vertebrate Animals East of the Parkway

Figure 26 illustrates species of concern on the mainland, east of the Parkway within Berkeley Township. The bobcat - State endangered, Red-headed woodpecker – State threatened and Timber rattlesnake – State endangered occur within this area of the municipality.

Figure 26: Rare Vertebrate Animals in the Vicinity of the Mainland, East of the Parkway

Common Name	Scientific Name	Status*
Black-Billed Cuckoo	<i>Coccyzus erythrophthalmus</i>	Special Concern/Stable
Black-Throated Blue Warbler	<i>Dendroica caerulescens</i>	Special Concern/Stable
Black-Throated Green Warbler	<i>Dendroica virens</i>	Special Concern/Stable
Bob Cat	<i>Lynx rufus</i>	Endangered
Cerulean Warbler	<i>Dendroica cerulea</i>	Special Concern/Special Concern
Eastern King Snake	<i>Lampropeltis g. getula</i>	Special Concern
Northern Parula	<i>Parula americana</i>	Special Concern/Stable
Red-Headed Woodpecker	<i>Melanerpes erythrocephalus</i>	Threatened/Threatened
Timber Rattlesnake	<i>Crotalus horridus horridus</i>	Endangered
Veery	<i>Catharus fuscescens</i>	Special Concern/Stable
Wood Thrush	<i>Hylocichla mustelina</i>	Special Concern/Stable
Worm-Eating Warbler	<i>Hemitheros vermivorus</i>	Special Concern/Stable
* "/" indicates dual status, letter before the slash is status of breeding population, letter after the slash is for the migratory population.		
Source: New Jersey Department of Environmental Protection, Division of Parks and Forestry, Natural Heritage Program, December 7, 2011.		

8.3.3 Mainland Vertebrate Animals West of the Parkway

Figure 27 concerns the Township’s mainland, west of the Parkway. Only two species of concern reside in the western portion of Berkeley, the Black skimmer, which is State endangered and the Glossy ibis, which is State special concern.

Figure 27: Rare Vertebrate Animals in the Vicinity of the Mainland, West of the Parkway

Common Name	Scientific Name	Status*
Black Skimmer	<i>Rynchops niger</i>	Endangered
Glossy Ibis	<i>Plegadis falcinellus</i>	Special Concern/Stable
* "/" indicates dual status, letter before the slash is status of breeding population, letter after the slash is for the migratory population.		
Source: New Jersey Department of Environmental Protection, Division of Parks and Forestry, Natural Heritage Program, December 7, 2011.		

8.4 Special Status Plant Species

Three reports on rare plants, animals and communities were provided by the Natural Heritage Program for the Township of Berkeley based on the knowledge of these organisms or communities in the Township. One report is for Island Beach, a second is for the coastal portion of the Township to the Parkway and a third report is for the lands west of the Parkway (see the Appendix). The following

discussion of rare plants is based on this organization. A list of the *Rare Plants and Ecological Communities Presently Recorded in the New Jersey Natural Heritage Database for Ocean County* also is included in the Appendix and is relevant to the discussion.

8.4.1 Island Beach and Island Beach State Park

The coastal habitats on the barrier island/peninsula known as Island Beach, includes Island Beach State Park, a Natural Heritage Priority Site (i.e., Island Beach Macrosite); support populations of State-listed endangered and species of concern plant species. For example, Seabeach Sandwort (*Honckenia peploides* var. *robusta*) and Sea-beach Knotweed (*Polygonum glaucum*) are two endangered species reported from Island Beach State Park; and Seabeach Sedge (*Carex silicea*) and Sickle-leaf Golden-aster (*Pityopsis falcata*); two State species of special concern also are known. The latter is a Pinelands listed species not typical of sandy habitats of the immediate coast but more typical of dry, sandy habitats of the Pine Barrens habitats.

Figure 28: Rare Plants Possibly on the Barrier Island

Common Name	Scientific Name	Federal Status	State Status*	Regional Status*
Seabeach Sedge	<i>Carex silicea</i>	-	-	HL
Seabeach Sandwrt	<i>Honckenya peploides</i> var. <i>robusta</i>	-	-	HL
Sickle-leaf Golden-aster	<i>Pityopsis falcata</i>	-	-	LP, HL
Seabeach Knotweed	<i>Polygonum glaucum</i>	-	E	LP, HL
<p>* HL = protected by the Highlands Act within the jurisdiction of the Highlands Preservation Area. LP = listed by the Pinelands Commission as endangered or threatened within their legal jurisdiction. E = endangered species.</p>				
<p>Source: New Jersey Department of Environmental Protection, Division of Parks and Forestry, Natural Heritage Program, December 7, 2011.</p>				

8.4.2 Mainland, East of the Parkway

Coastal habitats east of the Parkway include, for example, pinelands, oak woodlands and estuarine, riverine and palustrine wetlands. Plants listed specifically for this area of the Township and adjacent sites include Mudbank Crown Grass (*Paspalum dissectum*), a State species of special concern of shallow freshwater and muddy shores and wetlands and Crane-fly Orchid (*Tipularia discolor*), also a State species of special concern but from rich, damp woods. Other special status plant species are potential for this portion of the Coastal District, including some of those species listed for the Township west of the Parkway.

Figure 29: Rare Plants Possibly on or in Immediate Vicinity of Mainland, East of the Parkway

Common Name	Scientific Name	Federal Status	State Status	Regional Status*
Sickle-leaf Golden-aster	<i>Pityopsis falcata</i>	-	-	LP, HL
Curly Grass Fern	<i>Schizaea pusilla</i>	-	-	LP, HL
New Jersey Pitch Pine/Scrub Oak Barren	<i>Pinus rigida/Quercus/Pyxidantha barbulata</i> Woodland	-	-	HL
Southern Twayblade	<i>Listera australis</i>	-	-	LP, HL
Mudbank Crown Grass	<i>Paspalum dissectum</i>	-	-	HL
Crane-fly Orchid	<i>Tipularia discolor</i>	-	-	HL
* HL = protected by the Highlands Act within the jurisdiction of the Highlands Preservation Area. LP = listed by the Pinelands Commission as endangered or threatened within their legal jurisdiction.				
Source: New Jersey Department of Environmental Protection, Division of Parks and Forestry, Natural Heritage Program, December 7, 2011.				

8.4.3 Mainland, West of the Parkway

The extensive and relatively natural habitats west of the Parkway are known to support at least 12 special status plant species. Seven plants are State-listed endangered species including New Jersey Rush (*Juncus caesariensis*); Knieskern’s Beaked-rush (*Rhynchospora knieskernii*), which is also a Federal-listed threatened species; Pickering’s Morning-glory (*Stylisma pickeringii* var. *pickeringii*); Death-camus (*Zigadenus leimanthoides*); Pine Barren Boneset (*Eupatorium resinosum*); and Bog Asphodel (*Narthecium americanum*). Each of these is also a Pinelands-listed rare plant. State species of special concern also are listed for the region west of the Parkway including Pine barren Smoke Grass (*Muhlenbergia torreyana*), Sickle-leaf Golden-aster (*Pityopsis falcata*) and Curly Grass Fern (*Schizaea pusilla*). Both wetlands and dry Pinelands habitats are represented by the special status plant species.

Figure 30: Rare Plants Possibly on or in Immediate Vicinity of Mainland, West of the Parkway

Common Name	Scientific Name	Federal Status*	State Status*	Regional Status*
New Jersey Pitch Pine/Scrub Oak Barren	<i>Pinus rigida/Quercus/Pyxidantha barbulata Woodland</i>	-	-	HL
New Jersey Rush	<i>Juncus caesariensis</i>	-	E	LP, HL
Pine Barren Smoke Grass	<i>Muhlenbergia torreyana</i>	-	-	LP, HL
Sickle-leaf Golden-aster	<i>Pityopsis falcata</i>	-	-	LP, HL
Knieskern's Beaked-rush	<i>Rhynchospora knieskernii</i>	LT	E	LP, HL
Pickering's Morning-glory	<i>Stylisma pickeringii var. pickeringii</i>	-	E	LP, HL
Death-camus	<i>Zigadenus leimanthoides</i>	-	E	LP, HL
Curly Grass Fern	<i>Schizaea pusilla</i>	-	-	LP, HL
Sphagnum	<i>Sphagnum portoricense</i>	-	-	HL
Pine Barren Boneset	<i>Eupatorium resinsum</i>	-	E	LP, HL
Bog Asphodel	<i>Narthecium americanum</i>	C	E	LP, HL
Slender Horned-rush	<i>Rhynchospora inundata</i>	-	-	LP, HL
<p>* HL = protected by the Highlands Act within the jurisdiction of the Highlands Preservation Area. LP = listed by the Pinelands Commission as endangered or threatened within their legal jurisdiction. E = endangered species. LT = formally listed as threatened. C = proposed to be listed as endangered or threatened.</p>				
<p>Source: New Jersey Department of Environmental Protection, Division of Parks and Forestry, Natural Heritage Program, December 7, 2011.</p>				

8.4.4 Potential Occurrence of Additional Rare Plant Species

The list of the *Rare Plants and Ecological Communities Presently Recorded in the New Jersey Natural Heritage Database for Ocean County* includes many rare plant species potentially also occurring in the Township of Berkeley based on the presence of rare plant habitats. Some of these additional species are treated in the following discussion.

Seabeach Amaranth (*Amaranthus pumilus*): Seabeach Amaranth, which is Federally-listed as threatened and State-listed as endangered, is an annual plant species that generally occurs in the vicinity of the high tide wrack line along sandy ocean beaches, including those of Ocean County. Sparsely vegetated areas with limited wrack accumulation and lack of inundation during the flowering period of May to November are required for this plant to complete successfully in the coastal zone. The seeds are dispersed by the dynamic coastal processes including those affected by wind and water. It is likely to occur sporadically along the upper beach habitats of Island Beach State Park.

Additional rare plant species that are known from elsewhere in New Jersey and may potentially occur in the Township of Berkeley, including the following:

- Seabeach Evening Primrose (*Oenothera humifusa*): beach/ dune habitats; State endangered (reported from Ocean County).

- Sea-milkwort (*Glaux maritima*): beach and salt marsh habitats; State endangered (reported from Ocean County).
- Seabeach Purslane (*Sesuvium maritimum*): beach habitats; State species of concern.

Additional rare plant species, which are known from coastal ponds and freshwater to slightly brackish tidal wetlands in coastal central and southern New Jersey (NJDEP NHP 2011), some of which may potentially occur in coastal wetlands of the Township:

- Parker's Pipewort (*Eriocaulon parkeri*): freshwater tidal wetlands and tidal ponds; State species of concern (known from Ocean County).
- Whorled Marsh Pennywort (*Hydrocotyle verticillata* var. *verticillata*): freshwater and slightly brackish wetlands and ponds; State species of concern.
- Mudwort (*Limosella subulata*): freshwater tidal and slightly brackish wetlands and ponds; State endangered (known from Ocean County).
- Slender Water Milfoil (*Myriophyllum tenellum*): freshwater ponds; State endangered (known from Ocean County).
- Small Waterwort (*Elatine minima*): freshwater tidal wetlands and ponds; State species of concern (known from Ocean County).

Additional rare plant species that are known from coastal salt marshes and related environments in elsewhere in Ocean County (NJDEP NHP 2011), some of which may potentially occur in wetlands of the Township, including the following:

- Salt-marsh Spikerush (*Eleocharis halophila*): salt marshes; State species of concern.
- Salt-marsh Alkali Grass (*Puccinellia fasciculata*): salt marshes and shores; state species of concern.
- Seaside Plantain (*Plantago maritima* var. *juncooides*): salt marshes and shores; State species of concern.
- Seaside Buttercup (*Ranunculus cymbalaria*): mud in brackish marshes; State-listed endangered.
- Salt-marsh Bulrush (*Bolboschoenus (Scirpus) maritimus*): brackish and salt marshes; State-listed endangered.
- Seaside Arrow-grass (*Triglochin maritima*): brackish marshes; State-listed endangered.

Many additional rare plant species that are known from Pinelands habitats including wetlands and drylands elsewhere in Ocean County (NJDEP NHP 2011), some of which may potentially occur in the Township, including but not limited to the following State-listed endangered species:

- Butterfly-pea (*Clitoria mariana*): dry upland woods and barrens.
- Rough Cottongrass (*Eriophorum tenellum*): swamps and bogs.
- Swamp-pink (*Helonias bullata*), also Federal-listed threatened: swamps and bogs.
- Dwarf Azalea (*Rhododendron atlanticum*): moist, sandy Coastal Plain soils.
- Coarse Grass-like Beaked-rush (*Rhynchospora globularis*): swamps, bogs and wet soil.
- Slender Arrowhead (*Sagittaria teres*): shallow water.
- Long's Woolgrass (*Scirpus longii*): seasonally wet marshes, mostly following burns.
- Lace-lip Ladies'-tresses (*Spiranthes laciniata*): swamps, marshes, meadows and roadsides.

- Two-flowered Bladderwort (*Utricularia biflora*): shallow water on the Coastal Plain.

8.5 Critical Habitats and Special Ecological Communities

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 location. 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. The Township of Berkeley is located within the Atlantic Coast Region, identified as one of the most productive coastal habitats in the United States.

The Landscape Project divides the State into five habitat classes: emergent wetlands, forested wetlands, forest, grasslands and beach. These classes are based on information extracted from 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 (Federal T&E)** is assigned to areas containing one or more occurrences of at least one wildlife species listed on as endangered or threatened on the Federal list of endangered and threatened species.
- **Rank 4 (State Endangered)** is assigned to areas containing one or more occurrences of at least one State endangered species.
- **Rank 3 (State Threatened)** is assigned to areas containing one or more occurrences of at least one State threatened species.
- **Rank 2 (Priority Species)** is assigned to areas containing one or more occurrences of at least one non-listed State priority species.
- **Rank 1 (Suitable Habitat)** 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.

As shown on the Habitat for Threatened and Endangered Species Map, the Township of Berkeley has critical habitat in each of the five habitat classes. Figure 31 provides the acreage for each habitat class. Berkeley Township has approximately 286 acres of beach, 343 acres of grassland, 15,939 acres of forest, 4,071 acres of forested wetlands and 2,236 acres of emergent wetlands habitat. As shown on the map, forest habitat is the largest in the Township, the majority of which is located west of the Parkway in Double Trouble State Park, Crossley Preserve, Hovnanian Sanctuary and Greenwood Wildlife Management Area (hereinafter "WMA"). The map on page 138 illustrates a thin brown line of beach habitat on the east side of the barrier island and scattered grassland habitats in yellow.

The Township has more than 1,100 acres of habitat for Federal threatened and endangered species. These lands are located along the mainland shoreline with Barnegat Bay, on the eastern face of the barrier island and the cranberry bogs on Jakes Branch. Approximately 9,800 acres of the Township provides a home for State endangered species. Much of this habitat is located west of the Parkway. Lands along Cedar Creek and forested areas in Double Trouble State Park, Crossley Preserve, Greenwood WMA and Hovnanian Preserve provide a habitat for State endangered species. State threatened species have a habitat of roughly 6,400 acres within the Township. Approximately 2,100

INSERT HABITAT FOR THREATENED AND ENDANGERED SPECIES MAP

Map 27: Habitat for Threatened and Endangered Species Map

PAGE INTENTIONALLY LEFT BLANK

acres of Township land provide a habitat for priority species. Suitable habitat areas compose roughly 3,300 acres; these lands are located on the barrier island and for the most part, east of the Parkway.

Figure 31: Habitat for Threatened and Endangered Species

RANK	Emergent Wetland Acres	Forested Wetland Acres	Forest Acres	Grassland Acres	Beach Acres	Total Acres
Federal Threatened & Endangered	951.33				166.51	1,117.84
State Endangered	729.07	431.75	8,525.35	52.13	87.76	9,826.06
State Threatened	124.28	1,519.26	4,554.30	291.10		6,488.94
Priority Species	431.66	974.65	700.33		32.61	2,139.25
Suitable Habitat		1,145.77	2,159.61			3,305.38
Total	2,236.34	4,071.43	15,939.59	343.23	286.88	22,877.47

Source: NJDEP GIS Data

Specific Rare Ecological Communities, classified by international or State standards, have been identified for the Township of Berkeley, as noted in the NJDEP NHP (2008) reports for the three regions evaluated for the ERI. The following list of Rare Ecological Communities was identified for the Township.

- Coastal Dune Woodland (barrier island: Island Beach)
- Pitch Pine Lowlands (east of Parkway)
- Pine-oak-scrub Oak Woodland (east and west of Parkway)
- Pitch Pine –pinelands Reedgrass Savanna (east of Parkway)

Figure 32 below lists the specific rare ecological communities identified for Berkeley Township. All four communities are either globally impaired or globally rare.

Figure 32: Rare Terrestrial Communities on or in Immediate Vicinity of the Township of Berkeley

Common Name	Scientific Name	Global Rank*	State Rank*
Pitch Pine Lowlands	<i>Pinus rigida saturated woodland alliance</i>	G3	S3
Pine-oak-shrub Oak Woodland	<i>Pinus rigida-quercus spp./quercus woodland</i>	G3	S3
Pitch Pine-pinelands Reedgrass Savanna	<i>Pinus rigida-calamovilfa brevipilis savanna</i>	G1	S1
Coastal Dune Woodland	<i>Coastal dune woodland</i>	G2G3	S1

* **G1** = globally impaired because of extreme rarity or because of factors making it vulnerable to extinction.
G2 = imperiled globally because of rarity or because of factors making it very vulnerable to extinction.
G3 = very rare or found locally in a restricted range or because of factors making it vulnerable to extinction.
S1 = critically imperiled in New Jersey because of extreme rarity.
S3 = rare in state with 21 to 100 occurrences.

Source: New Jersey Department of Environmental Protection, Division of Parks and Forestry, Natural Heritage Program, December 7, 2011

Other Rare Ecological Communities reported from Ocean County and potential for the Township:

- Marine Intertidal Gravel/sand Beach Community
- Coastal Dune Scrub
- Dry Oak-pine Forest
- Northern Peatland Sedge Coastal Plain Pond (Internatl. Veg. Class.)
- Coastal Plain Muck Pondshore (Internatl. Veg. Class)
- Coastal Plain Intermittent Pond Herbaceous Vegetation
- Sphagnum Moss Coastal Plain Intermittent Pond Herbaceous Vegetation
- Pitch Pine Lowlands

9. AGRICULTURAL RESOURCES

Historically, agriculture was a vital component of the economy, culture and landscape of the State of New Jersey. Old Township maps show dozens of cranberry bogs west of the Parkway, which utilized the many streams in this portion of the municipality. But slowly, over time, many of these cranberry bogs were abandoned. The following sections cover the topics of preserved farmland, agricultural production and important farmland soils within the Township of Berkeley.

9.1 Preserved Farmland

The Township of Berkeley has no preserved farmland. However, in 2010 there were 52.99 acres of tax classified farmland properties within the Township. These lands composed 0.20% of the total land area of Berkeley Township. The three properties are shown on the Farmland Soils Map, page 142.

The first farmland assessed property is located at 60 Hickory Lane, west of Route 9. Approximately ten acres is farmland assessed, which is composed primarily of forest. The second parcel is located at 180 Mill Creek Road in Bayville and contains 5.74 acres. This parcel is also forested. The third and last farmland assess property has the address of “Dav Hgts”. The parcel is bisected by the municipal border with Manchester Township and is due west of the Costa Mesa Drive development in Silver Ridge. This property is owned by Heritage Minerals Incorporated and is composed of forest and wetlands (Ocean County Board of Taxation, Accessed 2012).

9.2 Agricultural Production

According to the NJDEP’s 2007 land use/land cover GIS data, Berkeley Township contains 44.97 acres of land in agricultural production. It should be noted that this is different from lands classified by the tax assessor as farmland. For example, there are cranberry bogs within Double Trouble State Park that are agricultural production lands, but the property is classified as public property under the tax records.

Lands within Berkeley Township considered by NJDEP as agricultural production lands are depicted on the Agricultural Production Map on page 144 and in Figure 33. There are a total of 14.41 acres of cropland/pastureland, 6.34 acres of orchards/nurseries and 24.22 acres of other agricultural lands. The other category includes cranberry bogs. As shown on the Agricultural Production Map, the farmland assessed property at 60 Hickory Lane is the only parcel in the Township classified by NJDEP as

INSERT FARMLAND SOILS MAP

Map 28: Farmland Soils Map

PAGE INTENTIONALLY LEFT BLANK

INSERT AGRICULTURAL PRODUCTION MAP

Map 29: Agricultural Production Map

PAGE INTENTIONALLY LEFT BLANK

orchards/nurseries. Four areas are classified cropland pasture land including a parcel located west of Robert J. Miller Airpark, two properties on the south side of Hickory Lane and a parcel on the south side of Butler Boulevard. Finally, there are four areas categorized by NJDEP as “other agriculture” production lands. This includes property west of Robert J. Miller Airpark, cranberry bogs within Double Trouble State Park located east of the intersection of Dover Road and Davenport Road, cranberry bogs within Double Trouble Historic District and lands on the south side of Hickory Lane.

Figure 33: Agricultural Production

Type	Acres	% of Twp
Cropland and Pastureland	14.41	0.04%
Orchards/Vineyards/Nurseries/Horticultural Areas	6.34	0.02%
Other Agriculture	24.22	0.07%
Total	44.97	0.13%
Source: NJDEP GIS Data		

9.3 Important Farmland Soils

There are three soil types that are considered farmland soils – Prime Farmland, Statewide Importance and Unique Importance. Prime Farmland soil has the best combination of physical and chemical characteristics for producing food, feed, forage and fiber crops. Prime farmland soils do not flood frequently or are protected from flooding. Statewide Importance soils are comparable to Prime Farmland soils and may produce crop yields as high as Prime Farmland, if conditions are favorable. Unique Importance soils are used for special crops, such as cranberries in the Pinelands. Unique Importance soils are established by the New Jersey Soil Conservation Committee.

Within the Township of Berkeley there is more than 400 acres of Prime Farmland soils as depicted on the Farmlands Soils Map, page 142 and in Figure 34. The majority of these soils are east of the Parkway. Soil types include Aura sandy loam, Hammonton sandy loam and Psammequents, sulfidic substratum.

Statewide Importance soils compose approximately 2,664 acres of Berkeley Township. These soils are shown in green on the Farmlands Soils Map. East of the Parkway is where the majority of Statewide Importance soils are located. Soil types within this category include Downer loamy sand, Mullica sandy loam, Galloway loamy sand and Hammonton loamy sand.

Finally, there are 6,199 acres of Unique Importance soils within the municipality. Depicted in purple on the Farmlands Soils Map, these soils are scattered throughout the municipality and can even be found within Island Beach State Park. Soil types include, Berryland sand, Manahawkin muck, Woodmansie sand, Atsion sand and Appoquinimink-Transquaking-Mispillion.

Figure 34: Farmland Soils

Symbol	Soil Name	Type	Acres
AptAv	Appoquinimink-Transquaking-Mispillion complex	Unique Importance	1,060.98
AtsA	Atsion sand	Unique Importance	1,925.54
AtsAt	Atsion sand	Unique Importance	293.91
AugB	Aura sandy loam	Prime Farmland	52.48
BerAr	Berryland sand	Unique Importance	324.09
BerAt	Berryland sand	Unique Importance	915.67
DocB	Downer loamy sand	Statewide Importance	1,956.35
Gamb	Galloway loamy sand	Statewide Importance	44.29
HbmB	Hammonton loamy sand	Statewide Importance	103.95
HboA	Hammonton sandy loam	Prime Farmland	257.70
KemA	Keyport sandy loam	Prime Farmland	5.27
MakAt	Manahawkin muck	Unique Importance	1,459.55
MumA	Mullica sandy loam	Statewide Importance	559.93
PsuB	Psammets, waste substratum	Prime Farmland	104.21
WobC	Woodmansie sand	Unique Importance	219.44
Total			9,283.35
Source: NJDEP GIS Data			

10. HISTORIC & CULTURAL RESOURCES

The Township of Berkeley has a rich history. Incorporated in 1875, Berkeley was formed from portions of Dover Township (now Toms River Township). “Sections of the Township were taken to form Seaside Park (March 3, 1898), Seaside Heights (February 6, 1913), Beachwood (March 22, 1917), Ocean Gate (February 28, 1918) Pine Beach (February 26, 1925), South Toms River (March 28, 1927)” (Wikipedia, Accessed 2012). In 1964 the estate of Henry Phipps, steel magnate and co-owner of Bethlehem Steel, was purchased by the State, establishing Island Beach State Park (Ocean County Historical Museums, Accessed 2012).

10.1 Inventoried Historic Resources

Historic resources in the Township of Berkeley can be placed in three categories: (1) those listed on the New Jersey and National Registers of Historic Places; (2) Properties eligible for listing as determined by the State Historic Preservation Office; and (3) Locally identified historic resources.

The National Register of Historic Places is the official list of the nation’s historic resources worthy of preservation and protection and the New Jersey Register is the official list of New Jersey’s historic resources of local, State and national interest. The New Jersey Register is maintained by the State Historic Preservation Office (hereinafter “SHPO”). There are three sites listed in Figure 35 and located on the Historic Resources Map (page 148) that are listed on the State and National Registers of Historic Places.

INSERT HISTORIC RESOURCES MAP

Map 30: Historic Resources Map

PAGE INTENTIONALLY LEFT BLANK

Figure 35: SHPO Historic Listed Properties

Site Name and Inventory Number	Location	Designation
U.S. Lifesaving Station Number 14 (ID#2322)	NJ Route 35	State Register: 3/7/1977 National Register: 1/30/1978 (Reference #78001789)
Manitou Park School House (ID#6)	167 Third Avenue	State Register: 12/6/2004 National Register: 3/15/2005 (Reference #05000177)
Double Trouble State Park Historic District (ID#3874)	Keswick Road at Drouble Trouble Road	State Register: 10/14/1977 National Register: 2/23/1978 (Reference #78001787)
Source: New Jersey State Historic Preservation Office http://www.state.nj.us/dep/hpo/1identify/nrsr_lists.htm		

The U.S. Lifesaving Station #14 is located within Island Beach State Park. The structure was placed on the New Jersey State Register in 1977 and less than a year later was placed on the National Register of Historic Places. Manitou Park School House is located in the western half of the Township, near the Borough of South Toms River. The School House was placed on the State Register and National Register in 2004 and 2005, respectively.

Double Trouble State Park encompasses a total of 8,495 acres in both Berkeley and Lacey Township. The Double Trouble State Park Historic District occupies over 200 acres and includes Double Trouble Village, a preserved company town with a saw mill, foreman’s house, picker’s cottage, communal house, cranberry sorting and packing house, general store, etc. (NJDEP, Division of Parks and Forestry, Accessed 2012). The Double Trouble State Park Historic District was placed on the State Register in 1977 and the National Register in 1978.

The Township of Berkeley has five properties that have either received a SHPO Opinion or a Certification of Eligibility (hereinafter “COE”). A SHPO Opinion is “an opinion of eligibility issued by the State Historic Preservation Officer. It is in response to a Federally funded activity that will have an effect on historic properties not listed on the National Register” (NJDEP, Historic Preservation Office, Accessed 2012). A COE is “issued by the New Jersey State Historic Preservation Officer. For properties not already listed on the New Jersey Register of Historic Places, a COE satisfies a prerequisite to apply for funds from the New Jersey Historic Trust, as well as several county preservation funding programs” (NJDEP, Historic Preservation Office, Accessed 2012). These five properties are listed in Figure 36 and located on the Historic Resources Map (page 148).

Figure 36: SHPO Historic Eligible Properties

Site Name and Inventory Number	Location	Designation
AT&T Transmitter Building and Antenna Field (ID#4723)	83 Bayview Avenue (Route 617)	Certification of Eligibility: 7/30/2007
Cedar Creek Trestle - Barnegat Branch Railroad (ID#4950)	Barnegat Branch Railroad over Cedar Creek	Certification of Eligibility: 9/10/2009
Coast Guard Station 112 (ID#3403)	NJ Route 35 on Island Beach State Park	SHPO Opinion: 5/9/1996
Garden State Parkway Historic District (ID#3874)	Garden State Parkway Right-of-Way	SHPO Opinion: 10/12/2001
Midway Campus Historic District (ID#4090)	South Seaside Park, Central, 13th, Ocean and 20th Avenues	SHPO Opinion: 10/15/2001
Source: New Jersey State Historic Preservation Office http://www.state.nj.us/dep/hpo/1identify/nrsr_lists.htm		

The AT&T Transmitter Building and Antenna Field is located along Bayview Avenue in the northeastern corner of the Township. The site received a COE in 2007. The Cedar Creek Trestle is located along the Township’s boundary with Lacey Township, just west of Route 9 and received a COE in 2009. Coast Guard Station 112 is located in the southern half of Island Beach State Park and received a SHPO Opinion in 1996. The Garden State Parkway Historic District runs along the entire Parkway. The District received a SHPO Opinion in 2001. The Midway Campus Historic District is located just north of Island Beach State Park and abuts the municipal border with Seaside Park Borough. The District received a SHPO Opinion in 2001.

10.2 Inventoried Cultural Resources

10.2.1 Dover Forge

Dover Forge was located on Dover Road south of Pinewald Keswick Road. Very little is known about the forge, except for a manuscript from the Monmouth County Historical Association. The manuscript states:

“Dover Forge was built by William L. Smith, William Scott and Daniel Hillman and opened in 1809. It was not until July 1810, however, that the land was deeded to them. It was located on Dover Forge Pond at the headwaters of the middle branch of Cedar Creek, about four miles from Ferrago Forge (later known as Bamber or Cedar Crest), in Berkley Township, Ocean County, New Jersey. According to Charles S. Boyer, this was one of the largest of the Ocean County forges, and in the 1830’s was one of the prominent places of the region” (Monmouth County Historical Association, Accessed 2012).

The original Dover Forge was destroyed by fire and operations ceased until 1828 when a second forge was built. Forge operations continued until 1868 when the current owner died. The new owner, Rubin Potter, operated the forge as a sawmill (Monmouth County Historical Association, Accessed 2012).

“According to John Austin, a son of Charles W. Austin, Sr. and grandson of Joseph, Jr., the Forge contained two hammers, four fires, and a stamping mill to reduce the ore and cinder mass to such a size that it could be readily melted by forge fire. The principle product of Dover Forge was bar iron, which was hauled to Philadelphia over a road through the woods known as “Mule Road”” (Monmouth County Historical Association, Accessed 2012).

Today all that remains of Dover Forge is a trail through the woods accessed from Dover Road. The original pond has silted in and only a depression remains, supporting new pine forest growth.

Figure 37: Birds Eye View of Dover Forge, Courtesy of www.bing.com



10.2.2 Double Trouble Historic Village

Located in Double Trouble State Park is Double Trouble Historic Village. Listed on both the State and National Register of historic places, the Village provides a glimpse into a Pine Barren company town.

“The natural environment of cedar forest and rapidly flowing stream provided both raw materials and water power for an extensive lumber industry from the 1700s to the 1900s. As timber was cut, the cleared swampland created bog habitat ideal for growing cranberries. A fruit native to North America, the cranberry was originally named the “crane-berry” because its blossom resembles the crooked neck of a sand crane. Cranberry culture began at Double Trouble Village in the 1860s. By the 20th century, the Double Trouble Company was one of the largest cranberry operations in the state. With technological advancements and the change from the back breaking “dry” harvest of cranberries by hand to the mechanized “wet” harvest still used today, the large seasonal labor force of migrant workers who lived in the village was no longer needed” (NJDEP Division of Parks and Forestry, Accessed 2012).

There are a total of 15 buildings remaining within the Village, which include a school, foreman home, garage and machine shop, cranberry sorting and packing house, general store, pickers’ cottage, sawmill and cook house. The Village contains cranberry bogs and has walking trails.

10.2.3 Pinewald

Prior to the resort community of Pinewald, was a place called Barnegat Park. An Army officer, Lt. Edward Farrow, bought woodland within Berkeley Township to construct a retirement community for veterans. Lt. Farrow built a railroad station at the corner of Central Boulevard and Wheaton Avenue. He also constructed a “resort hotel called The Pines with the idea of attracting people” (Wikipedia, Accessed 2012). Eventually Lt. Farrow went bankrupt and in the 1920s Benjamin Sangor purchased the

area. “Between 1928 and 1929, about 8,000 lots were sold in Pinewald, a new-type, residential, recreational city-of-the sea-and-pines” (Wikipedia, Accessed 2012). These 8,000 lots are the undersized “newspaper subscription” lots mentioned in the Executive Summary, which are a part of the Sending Areas component of the Township’s TDR program.

The developer built the Royal Pines Hotel facing Crystal Lake on Lakeside Boulevard, which was the focal point of the new community. Presently, the eight-story former hotel is the Crystal Lake Nursing and Rehabilitation Center. “In 1929, during the Great Depression, the resort community went bankrupt” (Wikipedia, Accessed 2012).

Figure 38: Former Royal Pines Hotel, Courtesy of www.bing.com



10.2.4 Manitou Park

The Manitou Park neighborhood is located in the western half of the Township, just northwest of South Toms River Borough. According to the New Jersey Historic Trust, Manitou Park was the largest African-American community in Ocean County outside of Lakewood, which existed in the early twentieth century. The only public building within the Manitou Park community is the Manitou Park School House, which was built in 1929. This one-room school house is on both the State and National Register of Historic Places.

11.OPEN SPACE & PUBLIC LAND RESOURCES

The Township of Berkeley contains more than 11,000 acres of open space, parks and recreation areas. This translates to 44.3% of the Township’s total land area (26,500 acres). The Parks and Open Space Map on page 154 shows all of the Federal, State, Non-Profit, County and Municipal-owned land within the Township of Berkeley. Figure 39 illustrates the breakdown of open space, parks and recreation areas by owner. The following sections divide open space and public land resources into two categories – 1) open space and 2) parks and recreation areas.

INSERT PARKS AND OPEN SPACE MAP

Map 31: Parks and Open Space Map

PAGE INTENTIONALLY LEFT BLANK

Figure 39: Open Space, Parks and Recreation Areas

Type	Acres
Federal	311.85
State	5,122.90
County	1,928.80
Non-Profit	2,569.00
Municipal	819.52
Homeowner's Association Dedicated Green Area	997.74
TOTAL	11,749.81

Source: NJDEP and Township of Berkeley GIS Data

11.1 Open Space

11.1.1 Federal

The Federal government owns a number of properties within Berkeley Township, which are a part of the greater Edwin B. Forsythe National Wildlife Refuge. The following section provides more detail on this national refuge.

Edwin B. Forsythe National Wildlife Refuge

The Edwin B. Forsythe National Wildlife Refuge encompasses over 47,000 acres of southern New Jersey coastal habitats, which work to protect the habitat for migratory birds (see Figure 40 for the southern New Jersey network) (USF&WS, Accessed 2012). The refuge is managed by the U.S. Fish and Wildlife Service and is located in one of the Atlantic Flyway’s most active flight paths, making it an extremely important preserved open space (USF&WS, Accessed 2012). The Federal government has purchased three areas within the Township for inclusion in the refuge, which total 311.85 acres.

However, the Federal government has approved roughly 2,041 acres for future Federal acquisition to enhance the refuge (see the map on page 157). As the map shows, many of the areas outline for future acquisition are already owned by the County, Township or a Non-Profit.

The first Federally-owned portion of the refuge consists of Block 1206, Lot 1, which is located west of Bayview Avenue in the northeastern corner of the Township.

The United States of America purchased the property, which consists of 50.5 acres, in 2003 (Ocean County Board of Taxation, Accessed 2012). Additionally, the Federal government owns the property where the AT&T Transmitter Building and Antenna



Photo 45: AT&T property (commonly known as “Telegraph Park” owned by the Federal government, which is a part of the Edwin B. Forsythe National Wildlife Refuge (12/11/2011).

Field historical site is located. This portion of the refuge contains saline marsh tidal wetlands, scrub/shrub non-tidal wetlands and wooded non-tidal wetlands.

The second set of parcels within the refuge surrounds Township-owned Bel Aire Park. The United States of America purchased Block 1601.01, Lot 11; Block 1606, Lot 9; and Block 1601.02, Lot 1 in 1997. The three properties total 106.86 acres (Ocean County Board of Taxation, Accessed 2012). Tidal and non-tidal wetlands are located on the property, which offers a transitional ecosystem.

The third portion of the refuge is located along Cedar Creek on the municipal boundary with Lacey Township. All of these properties are quite small, but work to preserve the habitat along Cedar Creek.

11.1.2 State

The State of New Jersey owns three open space areas within Berkeley Township – Greenwood Forest WMA, Double Trouble State Park and Island Beach State Park. While Double Trouble State Park and Island Beach State Park contain areas of open space, due to the existence of recreational facilities, they are discussed under Section 11.2 Parks and Recreation Areas.

Greenwood Forest Wildlife Management Area

The Greenwood Forest WMA is located in the southwestern corner of Berkeley Township. According to the County's tax records, the State purchased the entirety of Greenwood Forest WMA between 2001 and 2004 (Ocean County Board of Taxation, Accessed 2012). The Area encompasses 778.84 acres and contains forest cover with greater than 50% crown closure, forest cover with 10% to 50% crown closure and successional brush/shrubland. There are three streams that traverse the property – Davenport Branch and two tributaries of Wrangel Brook. These waterways are lined by wooded non-tidal wetlands, shrub/shrub wetlands and Atlantic white Cedar wetlands.

11.1.3 Non-Profit

The New Jersey Natural Lands Trust and New Jersey Audubon own properties within Berkeley Township. These two non-profit agencies have preserved more than 2,500 acres of open space.

Clamming Creek

Owned by the New Jersey Natural Lands Trust, Clamming Creek is located north of Bayview Park. The property is bisected by Bayview Avenue. Clamming Creek encompasses over 128 acres and contains a variety of environmental resources (Ocean County Planning Board, Accessed 2012). These resources include saline marsh tidal wetlands, freshwater/brackish tidal wetlands, and wooded non-tidal (freshwater) wetlands.

Crossley Preserve

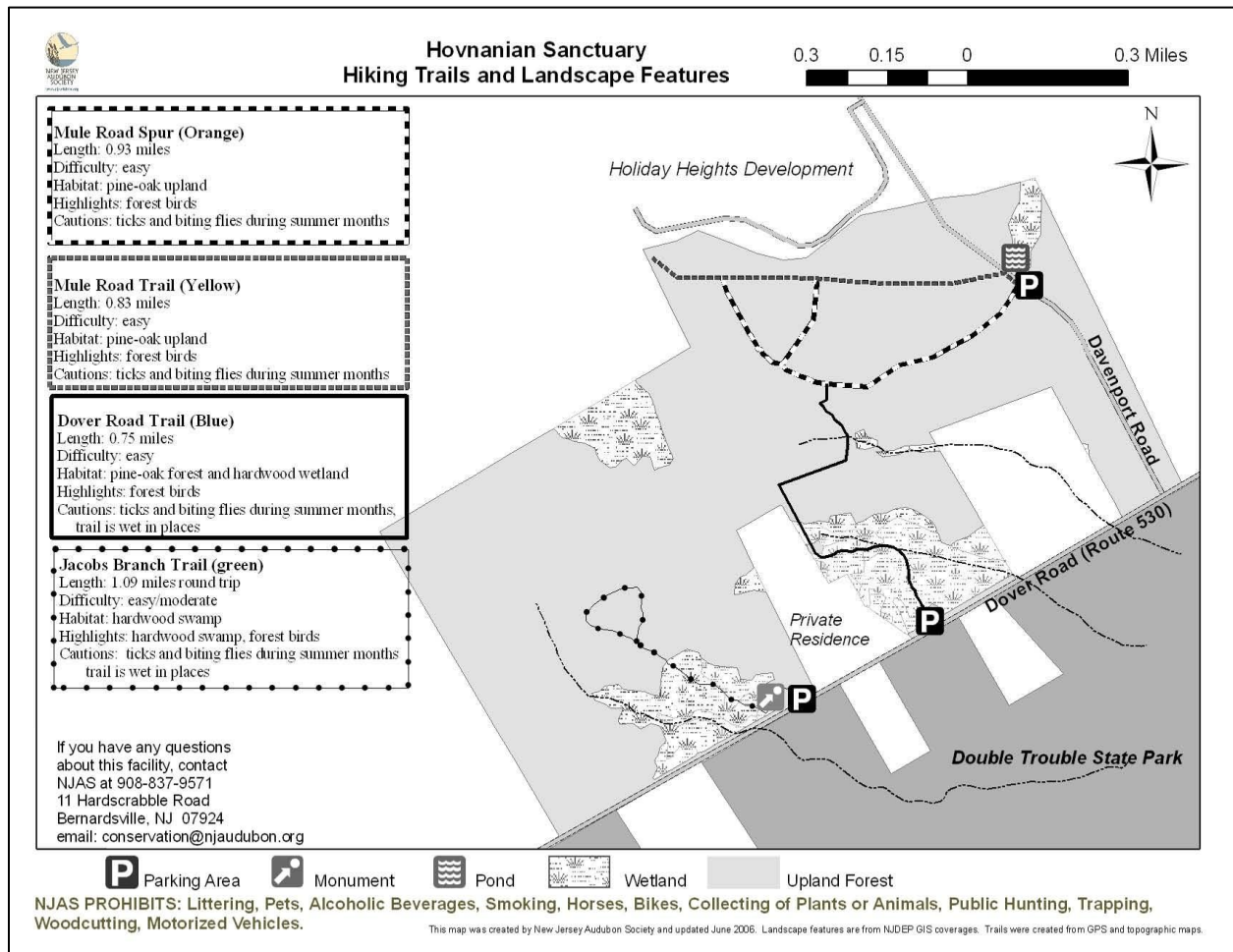
Crossley Preserve is located in both Berkeley Township and Manchester Township. Located within the Pinelands portion of the municipality, the Preserve is owned by the New Jersey Natural Lands Trust. The Preserve totals 1,929 acres, with portions purchased as recently as 2007. Environmental features include tributaries of Davenport Branch and Jakes Branch, forested areas and wooded wetlands.

Hovnanian Preserve

Owned by the New Jersey Audubon, Hovnanian Preserve contains 512 acres (New Jersey Audubon, Accessed 2012). This property is located in the Pinelands portion of the municipality and is contiguous

with Crossley Preserve and Double Trouble State Park. According to the Audubon’s website the property is “representative of upland forests and lowland wetlands found in the Pine Barrens. These habitats contain many unique Pine Barrens plants including the Pine Barrens sandwort, swamp azalea, sheep laurel and turkeybeard” (New Jersey Audubon, Accessed 2012). Hovnanian Preserve provides a habitat for “rare wildlife species including the Pine Barrens tree frog, Eastern box turtle, American Kestrel and Sharp-shinned Hawk” (New Jersey Audubon, Accessed 2012). The Preserve offers four walking trails that are easy to moderate in difficulty. The trails are shown in Figure 41 (New Jersey Audubon, Accessed 2012).

Figure 41: Hovnanian Sanctuary Map



11.1.4 County

Two Ocean County entities own open space within Berkeley Township – the Department of Parks and Recreation and the Ocean County Natural Lands Trust Fund. More than 1,800 acres have been preserved by these two entities.

Florence T. Allen Conservation Area

The Florence T. Allen Conservation Area is located just south of Pine Beach Borough, off of Chelsea Avenue. The Conservation Area encompasses 45 acres of swamp, wetlands and uplands that border Mill Creek (Ocean County, Department of Parks and Recreation, Accessed 2012).

Roberts Avenue Marsh

Located adjacent to the Township-owned Roberts Avenue Park on the barrier island is Roberts Avenue Marsh. The property totals 7.10 acres and is owned by the Ocean County Natural Lands Trust Fund (Ocean County Planning Board, Accessed 2012).

Good Luck Point & Good Luck Point Extension

Good Luck Point and Good Luck Point Extension are located south of Ocean Gate Borough and encompass over 572 acres (Ocean County Planning Board, Accessed 2012). Owned by the Ocean County Natural Lands Trust Fund, these properties contain both tidal and non-tidal wetlands, which provide a transitional ecosystem.

Toms River Divide

Owned by the Ocean County Natural Lands Trust Fund and containing more than 126 acres, this area is just west of the Parkway (Ocean County Planning Board, Accessed 2012). Wrangel Brook flows through the property, which has Atlantic White Cedar wetlands, wooded wetlands and modified/disturbed wetlands along it. The vast majority of the property is forested with a forest cover greater than 50%.

Berkeley Island West

Located adjacent to Berkeley Island Park is Berkeley Island West. This property contains 18.20 acres and is owned by the Ocean County Natural Lands Trust Fund (Ocean County Planning Board, Accessed 2012). The majority of this area is modified/disturbed wetlands with limited scrub/shrub non-tidal wetlands.

Potters Creek

Containing 118 acres, Potters Creek is located east of Route 9, just north of Potter Creek. Potters Creek is owned by the Ocean County Natural Lands Trust Fund (Ocean County Planning Board, Accessed 2012). The property contains both freshwater/brackish tidal wetlands and wooded non-tidal wetlands.

Miscellaneous Properties

The Ocean County Planning Board's 2011 Comprehensive Master Plan lists all of the properties owned by the Ocean County Natural Lands Trust Fund within the County. However, the document does not provide addresses for each of the properties listed; as a result, they cannot be mapped. Additionally, some of these properties are relatively small and therefore are unable to be shown on the Parks and Open Space Map (see page 154). Properties owned by the Ocean County Natural Lands Trust Fund, along with their total acreage are as follows:

- Lifetime Homes, Inc. 126.10 acres
- KGE 100.00 acres (located in both Berkeley and Lacey Township)
- Sloop Creek Donation 5.70 acres
- Haines 400.00 acres

- Lumley 284.34 acres
- Lifetime Homes – Myers 0.14 acres
- Lifetime Homes – Smith Donation 3.00 acres
- Hopkins 33.62 acres (Ocean County Planning Board, Accessed 2012)

11.1.5 Municipal

The Township of Berkeley owns ten open space properties and holds a conservation easement on one tract. The ten open space properties total more than 270 acres and the conservation easement property encompasses 43 acres (refer to Figure 42). The following sections summarize the Township’s open space properties.

Figure 42: Township-Owned Open Space

ROSI Key	Name	Status	Acres
3	Butler Beach	Unfunded	3.11
A	Ocean Gate	Unfunded	8.90
B	Barnegat Pier	Unfunded	1.47
C	Allen Road	Unfunded	12.53
D	Sandpiper Road	Unfunded	1.30
F	Cedar Creek Park	Funded	66.15
H	Cedar Creek	Funded	11.05
I	Bel Aire Park	Unfunded	4.51
K	Bayview Park	Funded	3.35
L	Sloop Creek	Funded	72.14
M	Southern Gibson Tract	Unfunded	88.08
N	Northern Gibson Tract	Unfunded	43.35
Total Township-Owned Open Space			315.94
Source: http://www.nj.gov/cgi-bin/dep/greenacres/facproc.pl			

Butler Beach

Butler Beach is located at the end of Butler Road on Barnegat Bay. The property has a parking lot and a pier that juts out into the Bay. Approximately half of the open space is wetlands.

Allen Road

The Allen Road preserve is located east of Bayview Avenue and encompasses over 12 acres of saline marsh tidal wetlands and scrub/shrub wetlands.

Ocean Gate

This municipal open space property is located off of Seabright Avenue and contains over eight acres of land. It is a waterfront property on Barnegat Bay, which provides water access for residents. Ocean Gate is mainly covered by successional brush/shrubland.

Barnegat Pier

Barnegat Pier is located east of Bayview Avenue on White Cap Way. The property contains 1.47 acres and provides access to a pier that juts out into Barnegat Bay.

Bayview Park

Bayview Park's 3.35 acres were purchased by the Township in 2000, one of Berkeley's more recent acquisitions. The property is located at the corner of Bayview Avenue and Butler Boulevard. Saline marsh tidal wetlands can be found on the property.

Sloop Creek

The Sloop Creek property encompasses over 70 acres. The property is bisected by Bayview Avenue and stretches into Barnegat Bay. Sloop Creek contains saline marsh tidal wetlands and wooded wetlands.

Cedar Creek Park

Encompassing over 70 acres, Cedar Creek Park stretches from Western Boulevard to the Barnegat Branch Trail. Cedar Creek flows through the preserve. Non-tidal (freshwater) wetlands included wooded wetlands, scrub/shrub wetlands and Atlantic white Cedar wetlands can be found on the property. Portions of the preserve include forest cover greater than 50% crown closure and successional brush/shrubland.

Sandpiper Road

This 1.3 acre property is located on the south side of Cedar Run Road.

Bel Aire Park

This preserve contains 4.51 acres and is located east of Jeanette Street. The property abuts Federally-owned open space. There are wooded non-tidal (freshwater) wetlands within Bel Aire Park.

Southern Gibson Tract

The Southern Gibson Tract is located south of Holiday Heights, east of Mule Road. The tract totals roughly 88 acres. Tributaries of the Davenport Branch and Jakes Branch pass through the property. Portions of the tract have forest cover of greater than 50% crown closure and forest cover of 10% to 50% crown closure.

Northern Gibson Tract

Immediately south of Holiday Heights and adjacent to the intersection of Mule Road and St. Maximilian Lane is the Northern Gibson Tract. This property includes just over 43 acres, on which Berkeley Township holds a conservation easement. The property is entirely composed of forest cover with greater than 50% crown closure.

11.2 Parks and Recreation Areas

11.2.1 Federal

There are no Federally-owned parks or recreation areas within the Township other than the Edwin B. Forsythe National Wildlife Refuge lands such as the former AT&T site referenced earlier.

11.2.2 State

The State of New Jersey owns two parks within Berkeley Township – Double Trouble State Park and Island Beach State Park. The following sections summarize each of the facilities.

Double Trouble State Park

Double Trouble State Park encompasses a total of 8,495 acres in both Berkeley and Lacey Township. According to the County's tax records, 2,144 acres of the Park are in Berkeley Township (Ocean County Board of Taxation, Accessed 2012).

"Double Trouble State Park offers an outstanding example of the Pine Barrens ecosystem and a window into the Pine Barrens history" with Double Trouble Historic Village (NJDEP, Division of Parks and Forestry, Accessed 2012). The Park includes two streams and their associated tributaries - Cedar Creek and Jakes Branch. These waterways have a variety of non-tidal wetlands associated with them including herbaceous wetlands, scrub/shrub wetlands, wooded wetlands, Atlantic White Cedar wetlands and modified/disturbed wetlands. The vast majority of the Park is forested with a forest cover of more than 50% crown closure. Moreover, Double Trouble State Park provides a habitat for State Endangered and State threatened species.

Facilities and activities in Double Trouble State Park include cranberry bogs, Double Trouble Historic Village, fishing, hunting, canoeing and hiking, horseback riding and biking trails (NJDEP, Division of Parks and Forestry, Accessed 2012).

Island Beach State Park

Located south of Seaside Park Borough is Island Beach State Park. The Park totals 2,200 acres (Ocean County Board of Taxation, Accessed 2012) and is divided into three sections. Island Beach Northern Natural Area totals 659 acres, Island Beach (central portion) totals 304 acres and Island Beach Southern Natural Area encompasses 1,237 acres. "Together, these two natural areas encompass one of the few remaining undeveloped barrier beaches in the northeast United States. Rolling sand dunes, salt-sculptured vegetation, lush green salt marshes, and nine plant communities including a nationally significant maritime forest characterize Island Beach" (NJDEP, Division of Parks and Forestry, Accessed 2012). Island Beach State Park is "one of New Jersey's last significant remnants of a barrier island ecosystem that once existed along much of the coast" (Ocean County Planning Board, Accessed 2012).

The central section of Island Beach State Park offers fishing, canoeing, swimming, scuba diving, biking and walking trails.

11.2.3 Non-Profit

There are no non-profit-owned parks or recreation areas within Berkeley Township.

11.2.4 County

Ocean County operates four parks within Berkeley Township. Totaling over 74 acres, these parks provide a variety of recreational opportunities for Township residents.

Barnegat Branch Trail

The Barnegat Branch Trail opened in 2007 as a multi-use rail to trail linear park utilizing the former bed of the Barnegat Branch Division of the Central Railroad of New Jersey. When finished, the trail will be 15.6 miles long and stretch from Barnegat Township to Toms River Township. The project has been divided into phases, with the section in Berkeley from the municipal border with Lacey Township

to Maryland Avenue complete. The section of the Trail from Maryland Avenue to the Borough of Beachwood is scheduled as a future phase (Ocean County Department of Planning, Accessed 2012).

Berkeley Island County Park

Located at the end of Brennan Concourse is Berkeley Island County Park. This County Park totals 25 acres and is a peninsula that extends into Barnegat Bay. The Park has a beach, fishing pier, picnic areas and playground (Ocean County, Department of Parks and Recreation, Accessed 2012).



Photo 46: Sign for Barnegat Branch Trail (12/1/2011).

Mill Creek County Park

Mill Creek County Park is located at the intersection of Chelsea Avenue and Mill Creek Road. The Park totals 14 acres and contains trails and a playground (Ocean County, Department of Parks and Recreation, Accessed 2012).

Robert J. Miller Airpark

The Robert J. Miller Airpark is located in the Pinelands portion of Berkeley Township, just west of Double Trouble State Park. The Park contains 35 acres and has a playground and an off-leash dog park (Ocean County, Department of Parks and Recreation, Accessed 2012).

11.2.5 Municipal

Berkeley Township has 15 parks and/or recreation areas. These properties total approximately 503 acres (see Figure 43). The following sections provide a synopsis of the Township's parks and recreational areas.

Bayville Park

Bayville Park is located in the eastern half of the Township. The Park contains just under four acres and has a playground, ball fields and basketball facilities (Maski 2009).

Berkeley Shores

Berkeley Shores is located on Barnegat Bay and provides a playground and picnic areas. Swimming and fishing opportunities also exist at the 1.38 acre facility (Maski 2009).

Centennial/Station Road

This municipal park encompasses approximately 25 acres and is located off of Station Road. The park contains ball fields (Maski 2009).

Figure 43: Township-Owned Parks and Recreation Areas

ROSI Key	Name	Status	Acres
1	William J. Dudley Park	Unfunded	40.00
2	Moorage Avenue Park	Unfunded	6.75
4	White Sands Beach	Funded	6.76
5	Forest Hills Soccer Fields	Unfunded	5.94
6	Mallard Park	Unfunded	5.19
7	Veterans Park	Funded	244.21
8	Manitou Park	Funded	2.15
9	Sylvan Lakes	Unfunded	3.14
10	Bayville Park	Unfunded	3.87
11	Recreation Center	Unfunded	2.59
12	Centennial (Station Road)	Unfunded	24.90
13	Berkeley Shores	Unfunded	1.38
14	Veterans Park (Football Field)	Funded	12.69
15	Veterans Park (Golf Range)	Funded	24.03
16	Veterans Park (Softball Field)	Funded	8.44
17	Eastern Blvd. Soccer Facility	Unfunded	11.45
E	Roberts Avenue	Unfunded	1.18
G	Cedar Creek Golf Course	Funded	8.40
J	Toms River Park	Funded	90.51
Total Township-Owned Parks & Recreation Areas			503.58
Source: http://www.nj.gov/cgi-bin/dep/greenacres/facproc.pl			

Eastern Boulevard Soccer Facility

This recreation facility is located at the end of Eastern Boulevard and contains roughly 11 acres. The park has a playground, picnic areas and ball fields (Maski 2009).

Forest Hill Soccer Fields

Forest Hill Soccer Fields is located along Forest Hills Parkway, across from Veterans Park in the southern portion of the Township, just east of the Parkway. The facility contains approximately six acres of recreation space.

Mallard Park

Mallard Park encompasses 5.19 acres and is located at the intersection of Mallard Road and Partridge Lane. The facility contains two baseball/softball fields, a basketball court and a playground.

Manitou Park

Manitou Park is located along Third Avenue in the western half of the Township. The Park contains just over two acres and has a playground and two basketball courts.

Moorage Avenue Park

This Park is located east of Route 9 at the intersection of Moorage Avenue and Red Bank Avenue. The facility contains 6.75 acres and four baseball/softball fields, a basketball court and a playground.

Recreation Center

The Township's Recreation Center sits on 2.59 acres of land just west of Route 9. There is a multi-purpose field, a playground and two basketball courts.

Roberts Avenue

Approximately one acre in size, the Roberts Avenue recreation facility provides fishing opportunities in Barnegat Bay (Maski 2009).

Sylvan Lakes

This recreation facility is located south of Mallard Park and encompasses roughly three acres. Sylvan Lakes provides a playground for residents' use (Maski 2009).

Toms River Park

Toms River Park is the second largest municipally-owned active recreation facility (approximately 90 acres). The Park is located west of Holiday Heights, at the end of Selkirk Avenue. There are two baseball/softball fields and a picnicking area. The vast majority of the facility is forested.

Veterans Park

The Veterans Park complex encompasses over 289 acres and is the largest active recreation property the Township owns. It is located east of the Parkway, which it abuts, along Forest Hills Parkway. Facilities at the Park include a playground, picnic areas, a track, a football field, baseball/softball fields, soccer fields, more than a dozen tennis courts and Cedar Creek Golf Course. Portions of the Park are forested, especially the area along Cedar Creek.

White Sands

White Sands is located on the barrier island, just south of Seaside Park Borough and north of Island Beach State Park. The park stretches from 20th Avenue to 23rd Avenue and encompasses roughly seven acres. Recreation activities include swimming, fishing, biking and ball fields (Maski 2009).

William J. Dudley Park

Located off of Route 9 and backing up to the Barnegat Branch Trail, the William J. Dudley Park encompasses 40 acres. The vast majority of the Park is forested with Cedar Creek cutting the property diagonally. Residents are able to swim at the Park, due to the small beach area along Cedar Creek. There is also a playground, picnic area, roller rink and bike trails (Maski 2009).

12. REFERENCES

- Adams, L.W. *Urban Wildlife Habitats: A Landscape Perspective of Wildlife Habitats*, Volume 3. U. Minnesota Press, Minneapolis, MN: 186 pp.
- Berkeley Township Municipal Utilities Authority (MUA). *Water Quality*. http://www.berkeleymua.org/water_quality_report.html Accessed 1/16/2012.
- Bologna, P., R. Lathrop, P. Bowers, and K. Able. 2000. *Assessment of submerged aquatic vegetation in Little Egg Harbor, New Jersey*. Technical Report 2000-11. Institute of Marine and Coastal Sciences, Rutgers • The State University of New Jersey, New Brunswick, NJ.
- Bologna, P., S. Gibbons-Ohr, and M. Downes-Gastrich. 2007. *Recovery of Eelgrass after a major disturbance event in Little Egg Harbor, New Jersey, USA*. Bull. N.J. Acad. Sci. 52(1): 1-6.
- Breden, T. F. 1989. *A preliminary Natural Community Classification for New Jersey*. In, E. F. Karlin (ed.), *New Jersey's Rare and Endangered Plants and Animals*. Institute for Environmental Studies, Ramapo College, Mahwah, NJ. 280 p.
- Cowardin, L. M., V. Carter, F. C. Golet, and E. T. LaRoe. 1979. *Classification of Wetlands and Deepwater Habitats of the United States*. U.S. Dept. of Interior, Fish and Wildlife Service, Biological Services Program. FWS/OBS-79-31.
- Dalton, R. 2003. *Physiographic Provinces of New Jersey*. New Jersey Geological Survey, Information Circular.
- DCA, Division of Local Government Services. 2011. *Property Tax Information*. <http://www.state.nj.us/dca/lgs/taxes/taxmenu.shtml> Accessed 1/13/2012.
- Dunk, Richard. 2005. *Offshore Wind Analysis for New Jersey and Delaware*. Rutgers University Institute of Marine and Coastal Sciences http://marine.rutgers.edu/cool/weather/wind_analysis/phase2.pdf Accessed 01/4/2011.
- Federal Interagency Committee for Wetland Delineation. 1989. *Federal Manual for Identifying and Delineating Jurisdictional Wetlands*. U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, and USDA Soil Conservation Service. Washington, DC Cooperative technical publication: 76 p. plus appendices.
- Ferren, W. R. Jr. and A. E. Schuyler. 1980. *Intertidal Vascular Plants of River Systems near Philadelphia*. Proceedings of the Academy of Natural Sciences of Philadelphia 132:86-120.
- FNA. 2007. *Zostera marina* Linnaeus, Sp. Pl. 2:968. 1753. *Zostera marina* in *Flora of North America* @ efloras.org, http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=200024703 Accessed 9/26/2007.
- Forman, T. T. (ed.). 1979. *Pine Barrens: Ecosystem and Landscape*. Rutgers University Press, New Brunswick, NJ. (Revised edition, 1998).
- Greenwire. 2010. *Wildlife: An urban jungle grows wild as it greens* <http://www.eenews.net/public/Greenwire/2010/08/09/2> Accessed 01/06/2011.

- 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.
- Harshberger, J. W. 1970. *The Vegetation of the New Jersey Pine-Barrens.* Dover Publications Inc. (republished in 1970).
- Herman, G. C., R. J. Canace, S. D. Stanford, R. S. Pristas, P. J. Sugarman, M. A. French, J. L. Hoffman, M. S. Serfes, and W. J. Mennel. 1998. *Aquifers of New Jersey.* Department of Environmental Protection, Division of Science & Research, New Jersey Geological Survey.
- Hole, T. J. F. and H. C. Smith. 1980. *Soil Survey of Ocean County, New Jersey.* USDA Soil Conservation Service; in cooperation with NJ Agricultural Experiment Station, Cook College, Rutgers, The State University; and the NJ Department of Agriculture, State Soil Conservation Committee. (Reissued February 1989)
- Kenney, L. P. and M. R. Burne. No Date. *Salamanders, Frogs and Turtles of New Jersey's Vernal Pools.* [with adaptations and modifications for New Jersey by J. Tesauro, K. Schantz, and M. Craddock]. NJDEP Endangered and Nongame Species Program. 54 p.
- Lathrop R., R. Styles, S. Seitzinger, and J. Bognar. 2001. *Use of GIS mapping and modeling approaches to examine the spatial distribution of seagrasses in Barnegat Bay, New Jersey.* *Estuaries.* 24:904-916.
- Maski, David. 2009. *2008 Land Use & Circulation Elements.* Prepared for the Township of Berkeley. <http://twp.berkeley.nj.us/docs/020609%20Final%20LU%20and%20Circ%20elements.pdf> Accessed 1/11/2012.
- McCormick, J. 1979. *The Vegetation of the New Jersey Pine Barrens.* In, Forman, T. T. (ed.), *Pine Barrens: Ecosystem and Landscape,* Rutgers University Press, New Brunswick, NJ. (Revised edition, 1998).
- Mitsch, W. J. and J. G. Gosselink. 1986. *Wetlands.* Von Nostrand Reinhold, New York. 537 p.
- Monmouth County Historical Association. 2012. *Manuscript Collections. Collection 8. Dover Forge Records, 1821-1850.* <http://www.monmouthhistory.org/index.php?mod=Sections&op=read&id=23> Accessed 1/23/2012.
- Montgomery, J. D. and D. E. Fairbrothers. 1992. *New Jersey Ferns and Fern Allies.* Rutgers University Press, New Brunswick, NJ. 293 p.
- National Academy of Sciences. 2001. *Compensating for Wetland Losses Under the Clean Water Act.* National Academy Press, Washington, DC. 322p.

- National Oceanic and Atmospheric Administration (NOAA), *Summary of Essential Fish Habitat (EFH) Designation*. http://www.nero.noaa.gov/hcd/STATES4/new_jersey/39507400.html Accessed 1/18/2012.
- New Jersey Audubon. 2012. *Hovnanian Sanctuary*. <http://www.njaudubon.org/SectionConservation/NJAUnstaffedWildlifeSanctuaries/HovnanianSanctuary.aspx> Accessed 1/12/2012.
- NJDEP, Division of Land Use Regulation. 2008. *Coastal Permitting*. <http://www.state.nj.us/dep/landuse/coast.html> Accessed on 1/ 9/ 2012.
- NJDEP, Division of Fish & Wildlife (DF&W). 2008. *New Jersey's Vernal Pools*. <http://www.state.nj.us/dep/fgw/ensp/vernalpool.htm> Accessed 1/16/2012.
- NJDEP, Division of Parks and Forestry. 2011. *Island Beach State Park*. <http://www.state.nj.us/dep/parksandforests/parks/double.html> Accessed 1/12/2012.
- NJDEP, Division of Parks and Forestry. 2012. *Double Trouble State Park*. <http://www.state.nj.us/dep/parksandforests/parks/double.html> Accessed 1/12/2012.
- NJDEP, Division of Watershed Management (DWM). 2010. *Basic Information*. <http://www.nj.gov/dep/watershedmgt/basicinfo.htm> Accessed 1/16/2012.
- NJDEP. 2009. *Freshwater Wetlands Protection Act Rules*. N.J.S.A. 13:9B-1 et seq.
- NJDEP, Historic Preservation Office. 2011. *New Jersey and National Registers of Historic Places*. http://www.state.nj.us/dep/hpo/identify/nrsr_lists.htm Accessed 1/12/2012.
- NJDEP Natural Heritage Program. 2008. *Rare Plant Species and Ecological Communities Presently Recorded in the NJ Natural Heritage Database – Ocean County, New Jersey*.
- NJDEP National Heritage Program. 2011. *Berkeley Township Environmental Resource Inventory – all barrier island*. Letter from R. J. Cartica, Administrator, December 7, 2011. [Rare species and communities information]
- NJDEP National Heritage Program. 2011. *Berkeley Township Environmental Resource Inventory – all on mainland east of Parkway*. Letter from R. J. Cartica, Administrator, December 7, 2011. [Rare species and communities information].
- NJDEP National Heritage Program. 2011. *Berkeley Township Environmental Resource Inventory – all on mainland west of Parkway*. Letter from R. J. Cartica, Administrator, December 7, 2011. [Rare species and communities information].
- NJDEP. 2011. *Surface Water Quality Standards (N. J. A. C. 7:9B)*. Trenton, NJ
- Novitzki, R. P, R. D. Smith, and J. D. Fretwell. 1997. *Restoration, Creation, and Recovery of Wetlands – Wetland Functions, Values, and Assessment*. USGS Water Supply Paper 2425. <http://water.usgs.gov/nwsun/WSP2425/functions.html> Accessed 1/6/2011.

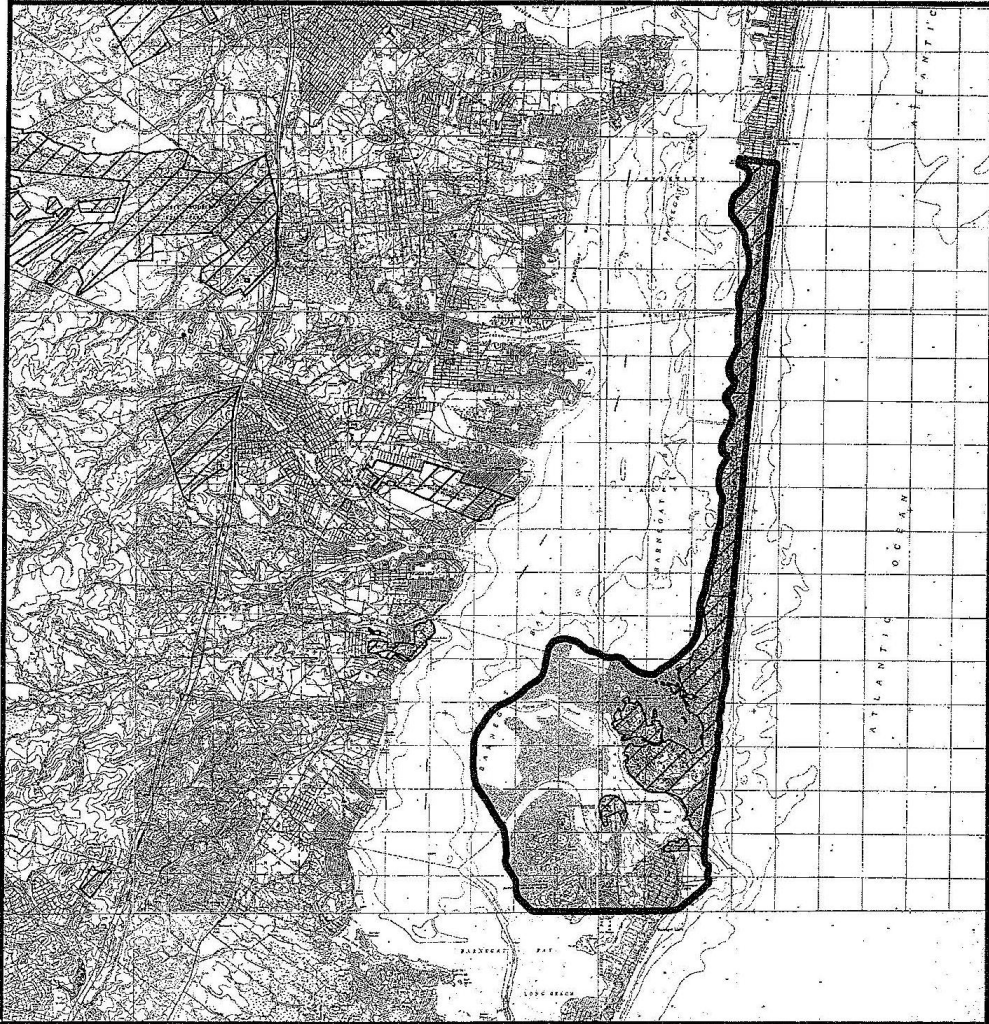
- Ocean County, Department of Parks and Recreation. 2008. *Ocean County Parks Listing*. <http://www.co.ocean.nj.us/OC Parks/ParkList.aspx> Accessed 1/12/2012.
- Ocean County Department of Planning. 2012. *Barnegat Branch Trail*. <http://www.planning.co.ocean.nj.us/bbt.htm#update> Accessed 1/12/2012.
- Ocean County Historical Museums. *History of Ocean County: Timeline*. <http://www.co.ocean.nj.us/museums/history2.htm#1900> Accessed 1/23/2012.
- Ocean County Planning Board. 2011. *Comprehensive Master Plan*. http://www.planning.co.ocean.nj.us/final_master_plan_2012.pdf Accessed 1/12/2012.
- Ocean County Board of Taxation. 2011. *Tax Records.com*. <http://www.tax.co.ocean.nj.us/> Accessed 1/19/2012.
- Office of the New Jersey Climatologist (ONJSC). 2006a. *The Climate of New Jersey*. <http://climate.rutgers.edu/stateclim/?section=njcp&target=NJCoverview> Accessed 1/4/2011.
- Office of the New Jersey Climatologist (ONJSC). 2012. *Monthly Station*. <http://climate.rutgers.edu/stateclim/> Accessed 1/13/2012.
- Robichaud, B. and M. L. Buell. 1973. *Vegetation of New Jersey*. Rutgers University Press, New Brunswick, NJ. 340 p.
- Sather, J. H. and R. D. Smith. 1984. *An Overview of Major Wetland Functions and Values*. Performed for Western Energy and Land Use Team, Division of Biological Services, Fish and Wildlife Service, U.S. Dept. of Interior. FWS/OBS-84-18. September 1984.
- Schwaab, E. 2007. Proceedings – DELMARVA Coastal Bays Conference III. Tri-state Approaches to Preserving Aquatic Resources. Development of a Maryland Coastal Bays Water-use Management Plan.
- Smith, R. D., A. Ammann, C. Bartoldus, and M. M. Brinson. 1995. *An Approach for Assessing Wetland Functions Using Hydrogeomorphic Classification, Reference Wetlands, and Functional Indices*. U.S. Army Corps of Engineers, Waterways Experiment Station. Wetlands Research Program Technical Report WRP-DE-9. October 1995- Final Report.
- Stephan, C. D., R. L. Peuser, and M. S. Fonseca. 2005. *Evaluating fishing gear impacts to submerged aquatic vegetation and determining mitigation strategies*. ASMFC Habitat Management Series # 5. Atlantic States Marine Fisheries Commission, Washington, DC.
- Strahler, Ah, AN Strahler. 1992. *Modern Physical Geography* (Fourth Edition). John Wiley and Sons, Inc. New York. 638 pp.
- Sustainable Jersey. *Natural Resource Inventory*. http://sustainablejersey.com/actiondesc.php?arr_num=80&id_num=113 Accessed 1/19/2012.

- Tiner Jr., R. W. 1985. *Wetlands of New Jersey*. U.S. Fish and Wildlife Service, National Wetlands Inventory, Newton, MA. 117 p.
- U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS). *Web Soil Survey*. <http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx> Accessed 1/16/2012.
- U.S. Fish and Wildlife Service (USF&WS). 2011. *Edwin B. Forsythe National Wildlife Refuge*. <http://www.fws.gov/northeast/forsythe/> Accessed 1/18/2012.
- U.S. Geological Survey. 2007. *Wigeongrass (Ruppia maritima L.): A Literature Review*. Biotic Communities and Associated Limiting factors. Northern Prairie Wildlife Research Center. <http://www.npwrc.usgs.gov/resource/plants/ruppia/biotic/htm> Accessed 9/26/2007.
- Wazniack, C., L. Karrh, T. Parham, M. Naylor, M. Hall, T. Carruthres, and R. Orth. 2003. *Seagrass abundance and habitat criteria in the Maryland Coastal Bays*. Chapter 6.1, In: Maryland's Coastal Bays: Ecosystem Health Assessment. Accessed 9/26/2007.
- Wikipedia. 2011. *Berkeley Township, New Jersey*. http://en.wikipedia.org/wiki/Berkeley_Township,_New_Jersey Accessed 1/23/2012.
- Wikipedia. 2012. *Geography of New Jersey*. http://en.wikipedia.org/wiki/Geography_of_New_Jersey Accessed 1/25/2012.

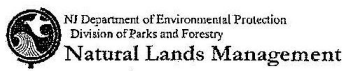
13. APPENDIX

13.1 Natural Heritage Priority Site Data

13.1.1 Barrier Island Macrosite



Natural Heritage Priority Site
Island Beach Macrosite
Ocean County



Natural Heritage Priority Site
Island Beach Macrosite

Locational Information

Quad Name: Barnegat Light ; Forked River ; Seaside Park

County: Ocean

Municipality: Berkeley Twp ; Barnegat Light Boro ; Lacey Twp ; Long Beach Twp ; Ocean Twp

Description of Site

Large expansive beaches, dunes and wetlands on and adjacent to Island Beach State Park and on the northern tip of Long Beach Island.

Boundary Justification

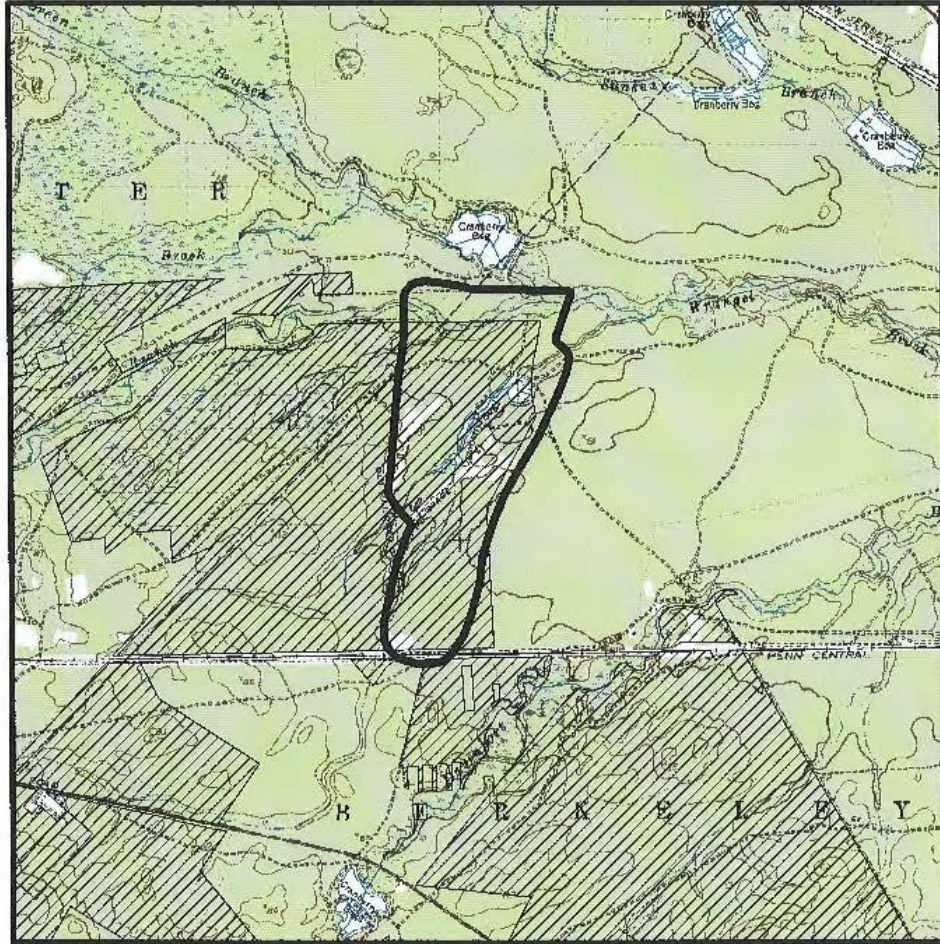
Boundaries include extensive beach, dune and marsh habitats for rare birds, plants and natural communities. Primary bounds should exclude developed portions of Barnegat Light.

Biodiversity Rank B2

The site contains populations of several globally rare and state rare endangered and threatened animals, plants, and natural communities.

March, 2007
Site Code: S.USNJHP1*65

13.1.2 Crossley



Natural Heritage Priority Site

Crossley

Ocean County



4

Natural Heritage Priority Site
Crossley

Locational Information

Quad Name: Keswick Grove
County: Ocean
Municipality: Berkeley Twp ; Manchester Twp

Description of Site

Pitch pine uplands and lowlands. Disturbed areas include gravel pits and abandoned RR ROW. Both these disturbed habitats important for rare species.

Boundary Justification

Includes extent of wetland and upland habitats for rare plants.

Biodiversity Rank B2

Two critically imperiled plants; plus globally rare plants and State significant animals.

March, 2007
Site Code: S.USNJHP1*191

13.2 Natural Heritage Program Data

13.2.1 Barrier Island



State of New Jersey

CHRIS CHRISTIE
Governor

DEPARTMENT OF ENVIRONMENTAL PROTECTION
Division of Parks and Forestry
Mail Code 501-04
ONLM -Natural Heritage Program
P.O. Box 420
Trenton, NJ 08625-0420
Tel. #609-984-1339
Fax. #609-984-1427

BOB MARTIN
Commissioner

KIM GUADAGNO
Lt. Governor

December 7, 2011

Wayne R. Ferren, Jr.
Maser Consulting P.A.
331 Newman Springs Road, Suite 203
Red Bank, NJ 07701

Re: Berkeley Township Environmental Resource Inventory - all on barrier island

Dear Mr. Ferren:

Thank you for your data request regarding rare species information for the above referenced project site in Berkeley Township, Ocean County.

Searches of the Natural Heritage Database and the Landscape Project (Version 3 for the highlands region, Version 2.1 elsewhere) are based on a representation of the boundaries of your project site in our Geographic Information System (GIS). We make every effort to accurately transfer your project bounds from the topographic map(s) submitted with the Request for Data into our Geographic Information System. We do not typically verify that your project bounds are accurate, or check them against other sources.

We have checked the Natural Heritage Database and the Landscape Project habitat mapping for occurrences of any rare wildlife species or wildlife habitat on the referenced site. Please see Table 1 for species list and conservation status.

Table 1 (on referenced site).

Common Name	Scientific Name	Federal Status	State Status	Grank	Strank
American oystercatcher	<i>Haematopus palliatus</i>		SC/SC	G5	S3B,S3N
Atlantic green turtle	<i>Chelonia mydas</i>	LT	T	G3	S1
Atlantic leatherback	<i>Dermochelys coriacea</i>	LE	E	G2	S1
Atlantic loggerhead	<i>Caretta caretta</i>	LT	E	G3	S1
black skimmer	<i>Rynchops niger</i>		E	G5	S1B,S1N
black-crowned night-heron	<i>Nycticorax nycticorax</i>		T/SC	G5	S2B,S3N
cattle egret	<i>Bubulcus ibis</i>		SC/SC	G5	S3B,S3N
common tern	<i>Sterna hirundo</i>		SC/S	G5	S3B,S4N
glossy ibis	<i>Plegadis falcinellus</i>		SC/S	G5	S3B,S4N
humpback whale	<i>Megaptera novaeangliae</i>	LE	E	G3	S1
Kemp's or Atlantic ridley	<i>Lepidochelys kempii</i>	LE	E	G1	S1
least tern	<i>Sterna antillarum</i>		E	G4	S1B,S1N
little blue heron	<i>Egretta caerulea</i>		SC/SC	G5	S3B,S3N
northern diamondback terrapin	<i>Malaclemys terrapin terrapin</i>		SC	G4T4	S3
northern harrier	<i>Circus cyaneus</i>		E/SC	G5	S1B,S3N
osprey	<i>Pandion haliaetus</i>		T/S	G5	S2B
peregrine falcon	<i>Falco peregrinus</i>		E	G4	S1B,S1N
pipit plover	<i>Charadrius melodus</i>	LT	E	G3	S1B,S1N
roseate tern	<i>Sterna dougallii dougallii</i>	LE	E	G4T3	S1B,S1N
snowy egret	<i>Egretta thula</i>		SC/S	G5	S3B,S4N
tricolored heron	<i>Egretta tricolor</i>		SC/SC	G5	S3B,S3N
yellow-crowned night-heron	<i>Nyctanassa violacea</i>		T/T	G5	S2B,S2N

Neither the Natural Heritage Database nor the Landscape Project has records for any additional rare wildlife species or wildlife habitat within 1 mile of the referenced site.

We have also checked the Natural Heritage Database for occurrences of rare plant species or ecological communities. The Natural Heritage Database has records for occurrences of *coastal dune woodland*, *Pityopsis falcata*, *Honckenya peploides* var. *robusta*, *Polygonum glaucum* and *Carex silicea* that may be on the site and for *Carex silicea* that may be on or in the immediate vicinity of the site and for *Carex silicea* and *Fimbristylis caroliniana* that may be in the immediate vicinity of the site. The attached lists provide more information about these occurrences. **Because some species are sensitive to disturbance or sought by collectors, this information is provided to you on the condition that no specific locational data are released to the general public. This is not intended to preclude your submission of this information to regulatory agencies from which you are seeking permits.**

A list of rare plant species and ecological communities that have been documented from Ocean County can be downloaded from <http://www.state.nj.us/dep/parksandforests/natural/heritage/countylist.html>. If suitable habitat is present at the project site, the species in that list have potential to be present.

Status and rank codes used in the tables and lists are defined in EXPLANATION OF CODES USED IN NATURAL HERITAGE REPORTS, which can be downloaded from http://www.state.nj.us/dep/parksandforests/natural/heritage/nhpcodes_2008.pdf.

The Natural Heritage Program reviews its data periodically to identify priority sites for natural diversity in the State. Included as priority sites are some of the State's best habitats for rare and endangered species and ecological communities. One of these sites is located within or near the areas you have outlined. Please refer to the enclosed Natural Heritage Priority Site Map for the location and boundary of this site. On the back of each Priority Site Map is a report describing the significance of the site.

If you have questions concerning the wildlife records or wildlife species mentioned in this response, we recommend that you visit the interactive I-Map-NJ website at the following URL, <http://www.state.nj.us/dep/gis/dep splash.htm> or contact the Division of Fish and Wildlife, Endangered and Nongame Species Program at (609) 292 9400.

PLEASE SEE 'CAUTIONS AND RESTRICTIONS ON NHP DATA', which can be downloaded from <http://www.state.nj.us/dep/parksandforests/natural/heritage/newcaution2008.pdf>.

Thank you for consulting the Natural Heritage Program. The attached invoice details the payment due for processing this data request. Feel free to contact us again regarding any future data requests.

Sincerely,



Robert J. Cartica
Administrator

c: NHP File No. 11-3907471-0379

December 05, 2011
Page: 1

**Immediate Vicinity of Project Site
Based on Search of Natural Heritage Database
Rare Plant Species and Ecological Communities Currently Recorded in
the New Jersey Natural Heritage Database**

Scientific Name	Common Name	Federal Status	State Status	Regional Status	G Rank	S Rank	Last Obs	Ident	Location
<i>Carex sifeca</i>	Seabeach Sedge			HL	G5	S2	1908-09-27	Y	Seaside Park.
<i>Fimbristylis caroliniana</i>	Carolina Fimbry			HL	G4	S2	2009-09-15	Y	Near terminus of Spizzle Creek Trail at point where trail forks and North branch leads to a bird blind and South branch leads towards a fishing shack. Ca. 0.8 mile South of Johnny Allen Cove, Island Beach State Park.

2 Records Selected

December 05, 2011
Page: 1

Possibly on Project Site
Based on Search of Natural Heritage Database
Rare Plant Species and Ecological Communities Currently Recorded in
the New Jersey Natural Heritage Database

Scientific Name	Common Name	Federal Status	State Status	Regional Status	G Rank	S Rank	Last Obs	Ident	Location
Terrestrial Community - Other Classification <i>Coastal dune woodland</i>	Coastal Dune Woodland				G2G3	S1	1987-??-??		ISLAND BEACH STATE PARK. CA. 9.5 MI. OF BARRIER ISLAND S. OF SEASIDE PARK.
Vascular Plant <i>Carex silicea</i>	Seabeach Sedge		HL	HL	G5	S2	2007-09-10	Y	0.05 miles East of Route 35 in Berkeley Township, Ocean County. Approximately 1 mile North of the southernmost end of the beach.
<i>Honckenya peploides</i> var. <i>robusta</i>	Seabeach Sandwort		HL	HL	G5T4	S1	1990-09-14	Y	1990. ISLAND BEACH STATE PARK NORTHERN NATURAL AREA. FROM APPROXIMATELY 0.5 MILES SOUTH OF THE GOVERNOR'S HOUSE TO GILLIKINS VEHICLE ACCESS POINT.
<i>Pityopsis fulcata</i>	Stickle-leaf Golden-aster		LP, HL	LP, HL	G3G4	S3	1994-10-24	Y	ALONG RIGHT SIDE OF LEFT FORK OF MAINTENANCE COMPLEX BEACH ACCESS (ACROSS FROM PARKING LOT F-1).
<i>Pityopsis fulcata</i>	Stickle-leaf Golden-aster		LP, HL	LP, HL	G3G4	S3	2008-08-13	Y	Island Beach State Park, roadside (east side) between maintenance complex and Aeolium Nature Center. Approximately 5 meters south of fisherman's path.
<i>Polygonum glaucum</i>	Sea-beach Knotweed	E	LP, HL	G3	G3	S1	1987-09-26	Y	CA. 1 MILE N. OF MAIN PARKING LOTS AT BATHING FACILITY, ISLAND BEACH NATURAL AREA.

6 Records Selected

December 05, 2011
Page: 1

**On or in Immediate Vicinity of Project Site
Based on Search of Natural Heritage Database
Rare Plant Species and Ecological Communities Currently Recorded in
the New Jersey Natural Heritage Database**

Scientific Name	Common Name	Federal Status	State Status	Regional Status	G Rank	S Rank	Last Obs	Ident	Location
Vascular Plant <i>Carex stilicea</i>	Seabeach Sedge			HL	G5	S2	1914-06-21	Y	1 mile below Seaside Park.

1 Records Selected

13.2.2 Mainland, East of Parkway



State of New Jersey

DEPARTMENT OF ENVIRONMENTAL PROTECTION
 Division of Parks and Forestry
 Mail Code 501-04
 ONLM -Natural Heritage Program
 P.O. Box 420
 Trenton, NJ 08625-0420
 Tel. #609-984-1339
 Fax. #609-984-1427

CHRIS CHRISTIE
 Governor

KIM GUADAGNO
 Lt. Governor

BOB MARTIN
 Commissioner

December 7, 2011

Wayne R. Ferren, Jr.
 Maser Consulting P.A.
 331 Newman Springs Road, Suite 203
 Red Bank, NJ 07701

Re: Berkeley Township Environmental Resource Inventory - all on mainland east of Parkway

Dear Mr. Ferren:

Thank you for your data request regarding rare species information for the above referenced project site in Berkeley Township, Ocean County.

Searches of the Natural Heritage Database and the Landscape Project (Version 3 for the highlands region, Version 2.1 elsewhere) are based on a representation of the boundaries of your project site in our Geographic Information System (GIS). We make every effort to accurately transfer your project bounds from the topographic map(s) submitted with the Request for Data into our Geographic Information System. We do not typically verify that your project bounds are accurate, or check them against other sources.

We have checked the Natural Heritage Database and the Landscape Project habitat mapping for occurrences of any rare wildlife species or wildlife habitat on the referenced site. Please see Table 1, attached, for species list and conservation status.

We have also checked the Natural Heritage Database and the Landscape Project habitat mapping for occurrences of any rare wildlife species or wildlife habitat within 1 mile of the referenced site. Please see Table 2 for species list and conservation status. This table excludes any species listed in Table 1.

Table 2 (additional species within 1 mile of referenced site).

Common Name	Scientific Name	Federal Status	State Status	Grank	Strank
black-billed cuckoo	<i>Coccyzus erythrophthalmus</i>		SC/S	G5	S3B
black-throated blue warbler	<i>Dendroica caerulescens</i>		SC/S	G5	S3B
black-throated green warbler	<i>Dendroica virens</i>		SC/S	G5	S3B
bobcat	<i>Lynx rufus</i>		E	G5	S1
cerulean warbler	<i>Dendroica cerulea</i>		SC/SC	G4	S3B,S3N
eastern king snake	<i>Lampropeltis g. getula</i>		SC	G5T5	S3
northern parula	<i>Parula americana</i>		SC/S	G5	S3B
red-headed woodpecker	<i>Melanerpes erythrocephalus</i>		T/T	G5	S2B,S2N
timber rattlesnake	<i>Crotalus horridus horridus</i>		E	G4T4	S1
veery	<i>Catharus fuscescens</i>		SC/S	G5	S3B
wood thrush	<i>Hylocichla mustelina</i>		SC/S	G5	S3B
worm-eating warbler	<i>Helminthos vermivorus</i>		SC/S	G5	S3B

We have also checked the Natural Heritage Database for occurrences of rare plant species or ecological communities. The Natural Heritage Database has records for occurrences of *Tipularia discolor* and *Paspalum dissectum* that may be on the site and for *Pityopsis falcata* and *Schizaea pusilla* that may be on or in the immediate vicinity of the site and for *new jersey pitch pine / scrub oak barren*, *pine-oak-shrub oak woodland (pow)*, *pitch pine lowlands (undifferentiated)*, *pitch pine-pinelands reedgrass savanna* and *Listera australis* that may be in the immediate vicinity of the site. The attached lists

provide more information about these occurrences. **Because some species are sensitive to disturbance or sought by collectors, this information is provided to you on the condition that no specific locational data are released to the general public. This is not intended to preclude your submission of this information to regulatory agencies from which you are seeking permits.**

A list of rare plant species and ecological communities that have been documented from Ocean County can be downloaded from <http://www.state.nj.us/dep/parksandforests/natural/heritage/countylist.html>. If suitable habitat is present at the project site, the species in that list have potential to be present.

Status and rank codes used in the tables and lists are defined in EXPLANATION OF CODES USED IN NATURAL HERITAGE REPORTS, which can be downloaded from http://www.state.nj.us/dep/parksandforests/natural/heritage/nhp_codes_2008.pdf.

If you have questions concerning the wildlife records or wildlife species mentioned in this response, we recommend that you visit the interactive I-Map-NJ website at the following URL, http://www.state.nj.us/dep/gis/dep_splash.htm or contact the Division of Fish and Wildlife, Endangered and Nongame Species Program at (609) 292 9400.

PLEASE SEE 'CAUTIONS AND RESTRICTIONS ON NHP DATA', which can be downloaded from <http://www.state.nj.us/dep/parksandforests/natural/heritage/newcaution2008.pdf>.

Thank you for consulting the Natural Heritage Program. The attached invoice details the payment due for processing this data request. Feel free to contact us again regarding any future data requests.

Sincerely,



Robert J. Cartica
Administrator

c: NHP File No. 11-3907482-0380

Table 1 (on referenced site).

Common Name	Scientific Name	Federal Status	State Status	Grank	Srank
Atlantic green turtle	<i>Chelonia mydas</i>	LT	T	G3	S1
Atlantic loggerhead	<i>Caretta caretta</i>	LT	E	G3	S1
barred owl	<i>Strix varia</i>		T/T	G5	S2B,S2N
black skimmer	<i>Rynchops niger</i>		E	G5	S1B,S1N
black-crowned night-heron	<i>Nycticorax nycticorax</i>		T/SC	G5	S2B,S3N
brown thrasher	<i>Toxostoma rufum</i>		SC/S	G5	S3B,S4N
carpenter frog	<i>Rana virgatipes</i>		SC	G5	S3
cattle egret	<i>Bubulcus ibis</i>		SC/SC	G5	S3B,S3N
common tern	<i>Sterna hirundo</i>		SC/S	G5	S3B,S4N
Cooper's hawk	<i>Accipiter cooperii</i>		T/T	G5	S2B,S4N
dotted skipper	<i>Hesperia attalus slossonae</i>			G3G4T3	S3
eastern box turtle	<i>Terrapene carolina carolina</i>		SC	G5T5	S3
Fowler's toad	<i>Bufo woodhousii fowleri</i>		SC	G5	S3
glossy ibis	<i>Plegadis falcinellus</i>		SC/S	G5	S3B,S4N
great blue heron	<i>Ardea herodias</i>		SC/S	G5	S3B,S4N
Kemp's or Atlantic ridley	<i>Lepidochelys kempii</i>	LE	E	G1	S1
least tern	<i>Sterna antillarum</i>		E	G4	S1B,S1N
little blue heron	<i>Egretta caerulea</i>		SC/SC	G5	S3B,S3N
northern diamondback terrapin	<i>Malaclemys terrapin terrapin</i>		SC	G4T4	S3
northern pine snake	<i>Pituophis melanoleucus melanoleucus</i>		T	G4T4	S2
osprey	<i>Pandion haliaetus</i>		T/S	G5	S2B
peregrine falcon	<i>Falco peregrinus</i>		E	G4	S1B,S1N
pine barrens treefrog	<i>Hyla andersonii</i>		T	G4	S2
snowy egret	<i>Egretta thula</i>		SC/S	G5	S3B,S4N
spotted turtle	<i>Clemmys guttata</i>		SC	G5	S3
tricolored heron	<i>Egretta tricolor</i>		SC/SC	G5	S3B,S3N

**Immediate Vicinity of Project Site
Based on Search of Natural Heritage Database
Rare Plant Species and Ecological Communities Currently Recorded in
the New Jersey Natural Heritage Database**

Scientific Name	Common Name	Federal Status	State Status	Regional Status	G Rank	S Rank	Last Obs	Ident	Location
Internatl. Vegetation Classification <i>Pinus rigida</i> / <i>Quercus marilandica</i> , <i>iticefolia</i> / <i>Pyxidanthra barbulata</i> Woodland	New Jersey Pitch Pine / Scrub Oak Barren			HL	G2	S2	2002-10-15	Y	Two main patches are located south of Jakes Branch, north of Pinevald-Keswick Grove Road, east of JCPL powerline, and west of the Garden State Parkway. Patches are located 0.5 to 2.3 miles north of the Double Trouble State Park entrance, partly within Jakes Branch County Park in Beachwood Boro, and partly within Double Trouble State Park and private lands in Berkeley Twp.
Terrestrial Community - Other Classification <i>Pinus rigida</i> saturated woodland alliance	Pitch Pine Lowlands (Undifferentiated)				G3	S3	2003-01-25	Y	Several patches S of Jakes Branch, N of Pinevald-Keswick Grove Road, east of the JCPL powerline, and W of the Garden State Parkway.
<i>Pinus rigida</i> - <i>sp. echinata</i> - <i>quercus</i> <i>spp. quercus</i> (marilandica, iticefolia) woodland	Pine-oak-shrub Oak Woodland (Pow)				G3	S3	2003-01-25	Y	Twelve scattered patches located south of Jakes Branch, mostly north of Pinevald-Keswick Grove Road, mostly east of the JCPL powerline, and west of the Garden State Parkway.
<i>Pinus rigida-cattamoviflo</i> <i>brevipilis savanna</i> Savanna	Pitch Pine-pinelands Reedgrass Savanna				G1	S1	2003-01-25	Y	Four main patches are located 1.55 to 1.75 mi. NNE (bearing 5 deg) of the Double Trouble State Park entrance, and 0.3 mi. W of the Garden State Parkway at the Jakes Branch headwater crossing. Within Jakes Branch County Park (Beachwood Boro) from 0.05 to 0.25 mi. NE of the township line road.
Vascular Plant <i>Listera australis</i>	Southern Twyblade			LP, HL	G4	S2	1991-05-04	Y	CA. 0.7 MILE EAST OF MURRAY GROVE, LACEY TWP. REACHED FROM RT. 9 MURRAY GROVE VIA DIRT ROAD WHICH ORIGINATES AT PAVED BUT UNDEVELOPED ROAD.

5 Records Selected

Possibly on Project Site
Based on Search of Natural Heritage Database
Rare Plant Species and Ecological Communities Currently Recorded in
the New Jersey Natural Heritage Database

Scientific Name	Common Name	Federal Status	State Status	Regional Status	G Rank	S Rank	Last Obs	Ident	Location
Vascular Plant <i>Paspalum dissectum</i>	Mudbank Crown Grass		HL	HL	G4?	S2	1982-??-??	Y	Berkeley Township, ca. 1/8 mile east of intersection of Arverne Avenue and Narragansett Avenue in Ocean Gate. 3/4 mile west of Barnegat Bay, ca. 3/8 mile north of Bayview Avenue.
<i>Tipularia discolor</i>	Cranefly Orchid		HL	HL	G4G5	S3	1991-08-22	Y	Ca. 80 meters north of Veeder Lane and its intersection with Top Sail Court, ca. 1 mile east of Route 9.

2 Records Selected

December 07, 2011
Page: 1

On or in Immediate Vicinity of Project Site
 Based on Search of Natural Heritage Database
 Rare Plant Species and Ecological Communities Currently Recorded in
 the New Jersey Natural Heritage Database

Scientific Name	Common Name	Federal Status	State Status	Regional Status	G Rank	S Rank	Last Obs	Ident	Location
Vascular Plant <i>Ptyopsis falcata</i>	Sickle-leaf Golden-aster		LP, HL	LP, HL	G3G4	S3	1991-08-22	Y	Along a trail ca. 1/2 mile south of the Toms River and 3/4 mile east of Mill Creek Road.
<i>Schizaea pusilla</i>	Curly Grass Fern		LP, HL	LP, HL	G3G4	S3	1995-06-20	Y	Located within 1 mile of intersection of Route 9 and Harbor In Road, site is east and west of Bayview just west of Berkeley Island County Park, in Berkeley Township (Ocean County).

2 Records Selected

13.2.3 Mainland, West of Parkway



State of New Jersey

CHRIS CHRISTIE
Governor

DEPARTMENT OF ENVIRONMENTAL PROTECTION
Division of Parks and Forestry
Mail Code 501-04
ONLM -Natural Heritage Program
P.O. Box 420
Trenton, NJ 08625-0420
Tel. #609-984-1339
Fax. #609-984-1427

BOB MARTIN
Commissioner

KIM GUADAGNO
Lt. Governor

December 7, 2011

Wayne R. Ferren, Jr.
Maser Consulting P.A.
331 Newman Springs Road, Suite 203
Red Bank, NJ 07701

Re: Berkeley Township Environmental Resource Inventory - all on mainland west of Parkway

Dear Mr. Ferren:

Thank you for your data request regarding rare species information for the above referenced project site in Berkeley Township, Ocean County.

Searches of the Natural Heritage Database and the Landscape Project (Version 3 for the highlands region, Version 2.1 elsewhere) are based on a representation of the boundaries of your project site in our Geographic Information System (GIS). We make every effort to accurately transfer your project bounds from the topographic map(s) submitted with the Request for Data into our Geographic Information System. We do not typically verify that your project bounds are accurate, or check them against other sources.

We have checked the Natural Heritage Database and the Landscape Project habitat mapping for occurrences of any rare wildlife species or wildlife habitat on the referenced site. Please see Table 1, attached, for species list and conservation status.

We have also checked the Natural Heritage Database and the Landscape Project habitat mapping for occurrences of any rare wildlife species or wildlife habitat within 1 mile of the referenced site. Please see Table 2 for species list and conservation status. This table excludes any species listed in Table 1.

Table 2 (additional species within 1 mile of referenced site).

Common Name	Scientific Name	Federal Status	State Status	Grank	Srank
black skimmer	<i>Rynchops niger</i>		E	G5	S1B, S1N
glossy ibis	<i>Plegadis falcinellus</i>		SQS	G5	S3B, S4N

We have also checked the Natural Heritage Database for occurrences of rare plant species or ecological communities. The Natural Heritage Database has records for occurrences of *new jersey pitch pine / scrub oak barren*, *pitch pine lowlands (undifferentiated)*, *Pine-oak-shrub Oak Woodland*, *Rhynchospora knieskernii*, *Juncus caesariensis*, *Zigadenus leimanthoides*, *Pityopsis falcata*, *Stylisma pickeringii var. pickeringii* and *Muhlenbergia torreyana* that may be on the site and for *Schizaea pusilla* that may be on or in the immediate vicinity of the site and for *pitch pine-pinelands reedgrass savanna*, *Sphagnum portoricense*, *Eupatorium resinosum*, *Narthecium americanum*, *Rhynchospora inundata*, *Juncus caesariensis* and *Schizaea pusilla* that may be in the immediate vicinity of the site. The attached lists provide more information about these occurrences. **Because some species are sensitive to disturbance or sought by collectors, this information is provided to you on the condition that no specific locational data are released to the general public. This is not intended to preclude your submission of this information to regulatory agencies from which you are seeking permits.**

A list of rare plant species and ecological communities that have been documented from Ocean County can be downloaded from <http://www.state.nj.us/dep/parksandforests/natural/heritage/countylist.html>. If suitable habitat is present at the project site, the species in that list have potential to be present.

Status and rank codes used in the tables and lists are defined in EXPLANATION OF CODES USED IN NATURAL HERITAGE REPORTS, which can be downloaded from http://www.state.nj.us/dep/parksandforests/natural/heritage/nhpcodes_2008.pdf.

The Natural Heritage Program reviews its data periodically to identify priority sites for natural diversity in the State. Included as priority sites are some of the State's best habitats for rare and endangered species and ecological communities. One of these sites is located within or near the areas you have outlined. Please refer to the enclosed Natural Heritage Priority Site Map for the location and boundary of this site. On the back of each Priority Site Map is a report describing the significance of the site.

If you have questions concerning the wildlife records or wildlife species mentioned in this response, we recommend that you visit the interactive I-Map-NJ website at the following URL, <http://www.state.nj.us/dep/gis/depsplash.htm> or contact the Division of Fish and Wildlife, Endangered and Nongame Species Program at (609) 292 9400.

PLEASE SEE 'CAUTIONS AND RESTRICTIONS ON NHP DATA', which can be downloaded from <http://www.state.nj.us/dep/parksandforests/natural/heritage/newcaution2008.pdf>.

Thank you for consulting the Natural Heritage Program. The attached invoice details the payment due for processing this data request. Feel free to contact us again regarding any future data requests.

Sincerely,



Robert J. Cartica
Administrator

c: NHP File No. 11-3907482-0381

Table 1 (on referenced site).

Common Name	Scientific Name	Federal Status	State Status	Grank	Strank
barred owl	<i>Strix varia</i>		T/T	G5	S2B,S2N
black-billed cuckoo	<i>Coccyzus erythrophthalmus</i>		SC/S	G5	S3B
black-throated blue warbler	<i>Dendroica caerulescens</i>		SC/S	G5	S3B
black-throated green warbler	<i>Dendroica virens</i>		SC/S	G5	S3B
bobcat	<i>Lynx rufus</i>		E	G5	S1
brown thrasher	<i>Toxostoma rufum</i>		SC/S	G5	S3B,S4N
carpenter frog	<i>Rana virgatipes</i>		SC	G5	S3
cerulean warbler	<i>Dendroica cerulea</i>		SC/SC	G4	S3B,S3N
common tern	<i>Sterna hirundo</i>		SC/S	G5	S3B,S4N
Cooper's hawk	<i>Accipiter cooperii</i>		T/T	G5	S2B,S4N
corn snake	<i>Elaphe guttata guttata</i>		E	G5T5	S1
dotted skipper	<i>Hesperia attalus slossonae</i>			G3G4T3	S3
eastern box turtle	<i>Terrapene carolina carolina</i>		SC	G5T5	S3
eastern king snake	<i>Lampropeltis g. getula</i>		SC	G5T5	S3
Fowler's toad	<i>Bufo woodhousii fowleri</i>		SC	G5	S3
grasshopper sparrow	<i>Ammodramus savannarum</i>		T/SC	G5	S2B,S3N
great blue heron	<i>Ardea herodias</i>		SC/S	G5	S3B,S4N
least tern	<i>Sterna antillarum</i>		E	G4	S1B,S1N
little blue heron	<i>Egretta caerulea</i>		SC/SC	G5	S3B,S3N
northern parula	<i>Parula americana</i>		SC/S	G5	S3B
northern pine snake	<i>Pituophis melanoleucus melanoleucus</i>		T	G4T4	S2
pine barrens treefrog	<i>Hyla andersonii</i>		T	G4	S2
red-headed woodpecker	<i>Melanerpes erythrocephalus</i>		T/T	G5	S2B,S2N
savannah sparrow	<i>Passerculus sandwichensis</i>		T/T	G5	S2B,S4N
snowy egret	<i>Egretta thula</i>		SC/S	G5	S3B,S4N
spotted turtle	<i>Clemmys guttata</i>		SC	G5	S3
timber rattlesnake	<i>Crotalus horridus horridus</i>		E	G4T4	S1
veery	<i>Catharus fuscescens</i>		SC/S	G5	S3B
wood thrush	<i>Hylocichla mustelina</i>		SC/S	G5	S3B
worm-eating warbler	<i>Helmitheros vermivorus</i>		SC/S	G5	S3B

December 07, 2011
Page: 1

**Immediate Vicinity of Project Site
Based on Search of Natural Heritage Database
Rare Plant Species and Ecological Communities Currently Recorded in
the New Jersey Natural Heritage Database**

Scientific Name	Common Name	Federal Status	State Status	Regional Status	G Rank	S Rank	Last Obs	Ident	Location
<i>Sphagnum portoricense</i>	Sphagnum		HL	G5	S2	1996-08-29	Y		North side of Michaels Branch, about 1.2 miles east-northeast of its intersection with Congasia Road and approx. 2.25 miles northeast of Keswick Grove.
<i>Sphagnum portoricense</i>	Sphagnum		HL	G5	S2	1996-09-17	Y		Michaels Branch corridor both east and west of a breached dam that is located ca. 0.2 mi. east of the junction of Michaels Branch and Congasia Road, approx. 1 mile northeast of Keswick Grove.
Terrestrial Community - Other Classification <i>Pinus rigida-catanoviflora brevifolia savanna</i>	Pitch Pine-nielands Reedgrass Savanna		G1	S1	2003-01-25	Y			Four main patches are located 1.55 to 1.75 mi. NNE (bearing 5 deg) of the Double Troutle State Park entrance, and 0.3 mi. W of the Garden State Parkway at the Jakes Branch headwater crossing. Within Jakes Branch County Park (Beachwood Boro) from 0.05 to 0.25 mi. NE of the township line road.
Vascular Plant <i>Eupatorium resinatum</i>	Pine Barren Boneset	E	LP, HL	G3	S2	1985-07-30	Y		Wrangle Brook, east of Keswick Grove, (east side, north of railroad).
<i>Juncus caesariensis</i>	New Jersey Rush	E	LP, HL	G2	S2	1996-09-17	Y		Michaels Branch corridor both east and west of a breached dam that is located ca. 0.2 mile east of the junction of Michaels Branch and Congasia Road, approx. 1 mile northeast of Keswick Grove.
<i>Narthecium americanum</i>	Bog Asphodel	C	LP, HL	G2	S2	1995-07-22	Y		Wrangle Brook 0.5 mile east of Keswick Grove, east side of brook, south side of railroad.
<i>Rhynchospora inundata</i>	Slender Horned-rush		LP, HL	G4P	S2	1996-08-29	Y		Concealed, intermittent pond ca. 50 yards north of sand road (Wrangle Brook Road) between Wrangle Brook and Michaels Branch, ca. 0.5 mi. southwest of junction of Green Branch and Wrangle Brook, Manchester Township, Ocean County.
<i>Schizaea pusilla</i>	Curly Grass Fern		LP, HL	G3G4	S3	1985-07-30	Y		Wrangle Brook, 0.5 mile east of Keswick Grove, south side of railroad.
<i>Schizaea pusilla</i>	Curly Grass Fern		LP, HL	G3G4	S3	1996-09-17	Y		Michaels Branch corridor both west and east of a breached dam that is located ca. 0.2 miles east of junction of Michaels Branch and Congasia Road, approx. 1 mile northeast of Keswick Grove.

9 Records Selected

Possibly on Project Site
Based on Search of Natural Heritage Database
Rare Plant Species and Ecological Communities Currently Recorded in
the New Jersey Natural Heritage Database

Scientific Name	Common Name	Federal Status	State Status	Regional Status	G Rank	S Rank	Last Obs	Ident	Location
Interuatl. Vegetation Classification <i>Pinus rigida</i> / <i>Quercus marilandica</i> , <i>iticifolia</i> / <i>Pyxistanthera barbulata</i> Woodland	New Jersey Pitch Pine / Scrub Oak Barren		HL	G2	S2	2002-10-15	Y		Two main patches are located south of Jakes Branch, north of Pinewald-Keswick Grove Road, east of JCPL powerline, and west of the Garden State Parkway. Patches are located 0.5 to 2.3 miles north of the Double Trouble State Park entrance, partly within Jakes Branch County Park in Beachwood Boro, and partly within Double Trouble State Park and private lands in Berkeley Twp.
Terrestrial Community - Other Classification <i>Pinus rigida saturataed woodland alliance</i>	Pitch Pine Lowlands (Undifferentiated)			G3	S3	2003-01-25	Y		Several patches S of Jakes Branch, N of Pinewald-Keswick Grove Road, east of the JCPL powerline, and W of the Garden State Parkway.
<i>Pinus rigida</i> - <i>(p. echinata)</i> - <i>quercus</i> <i>spp./quercus marilandica, iticifolia</i> woodland	Pine-oak-strub Oak Woodland (Pow)			G3	S3	2003-01-25	Y		Twelve scattered patches located south of Jakes Branch, mostly north of Pinewald-Keswick Grove Road, mostly east of the JCPL powerline, and west of the Garden State Parkway.
Vascular Plant <i>Juncus caesariensis</i>	New Jersey Rush	E	LP, HL	G2	S2	1907-09-09	Y		DOVER FORGE, RD. SIDE E. SIDE OF MILL POND.
<i>Muhlenbergia torreyana</i>	Pine Barren Smoke Grass		LP, HL	G3	S3	1993-09-23	Y		SE OLD CLAY PIT, 0.5 MI. NNE OF CROSSLEY.
<i>Pityopsis falcata</i>	Sickle-leaf Golden-aster		LP, HL	G3G4	S3	1999-07-01	Y		Northwest corner of intersection of Garden State Parkway and Magnolia Avenue, Berkeley Township.
<i>Pityopsis falcata</i>	Sickle-leaf Golden-aster		LP, HL	G3G4	S3	2009-08-20	Y		Approximately 1.6 miles East of Keswick Grove. Approximately 300 Feet east of where Township Line Road intersects with the powerline right of way (ROW), Berkeley Township, Ocean County.
<i>Rhynchospora knieskernii</i>	Kniesken's Beaked-rush	LF	E	LP, HL	G2	1994-09-03	Y		OLD CLAY PITS 0.5 MI. NNE OF CROSSLEY.
<i>Syllisma pickeringii</i> var. <i>pickeringii</i>	Pickering's Morning-glory	E	LP, HL	G4T3	S1	2008-09-24	Y		Approximately 3 miles northeast of Keswick Grove, approximately 0.9 mile north of Penn Central railroad, approximately 0.1 mile west of cranberry bogs.
<i>Zizadems teimanthoides</i>	Death-camus	E	LP, HL	G4Q	S1	1993-06-25	Y		1993: Ca. 0.5 mile west of Route 9 in Toms River, between the Garden State Parkway and pipeline. 1926: Edge of ditch, by railroad 0.5 mile west of Tom's River, NJ. 1916: Tom's River, NJ. 1874: Toms River.

December 07, 2011

Page: 1

On or in Immediate Vicinity of Project Site
Based on Search of Natural Heritage Database
Rare Plant Species and Ecological Communities Currently Recorded in
the New Jersey Natural Heritage Database

Scientific Name	Common Name	Federal Status	State Status	Regional Status	G Rank	S Rank	Last Obs	Ident	Location
Vascular Plant <i>Schizaea pusilla</i>	Curly Grass Fern			LP, HL	G3G4	S3	1907-07-25	Y	LAKE INLET AT DOUBLE TROUBLE.

1 Records Selected

13.2.4 Ocean County Data

7/30/2008

Rare Plant Species and Ecological Communities Presently
Recorded in the NJ Natural Heritage Database

Scientific Name	Common Name	Federal Status	State Status	Regional Status	G Rank	S Rank
<i>County: Ocean</i>						
Internatl. Vegetation Classification						
<i>Carex striata</i> var. <i>brevis</i> Herbaceous Vegetation	Northern Peatland Sedge Coastal Plain Pond			HL	GNR	S1S3
<i>Pinus rigida</i> / <i>Quercus (marilandica, ilicifolia)</i> / <i>Pyxidantha barbulata</i> Woodland	New Jersey Pitch Pine / Scrub Oak Barren			HL	G2	S2
<i>Rhexia virginica</i> - <i>Panicum verrucosum</i> Herbaceous Vegetation	Coastal Plain Muck Pondshore			HL	G2G3	S1S3
Nonvascular Plant						
<i>Sphagnum macrophyllum</i>	Sphagnum			HL	G3	S2
<i>Sphagnum portoricense</i>	Sphagnum			HL	G5	S2
Terrestrial Community - Other Classification						
<i>Coastal dune shrubland</i>	Coastal Dune Shrubland				G4	S2?
<i>Coastal dune woodland</i>	Coastal Dune Woodland				G2G3	S1
<i>Dry oak-pine forest</i>	Dry Oak-pine Forest				G4G5	S4?
<i>Dwarf pinus rigida-quercus (marilandica, ilicifolia)/corema conradii shrubland</i>	Pine Plains (Pp4/5)				G1	S1
<i>Eleocharis (olivacea, microcarpa, robbinsii) - xyris (difformis var. difformis, smalliana) herbaceous vegetation</i>	Spikerush (Smallfruit, Bright Green, Robbin's) - Yelloweyed Grass (Bog, Small's) Coastal Plain Intermittent Pond Herbaceous Vegetation				G2	S2
<i>Marine intertidal gravel/sand beach community</i>	Marine Intertidal Gravel/sand Beach Community				GU	SU
<i>Panicum rigidulum</i> var. <i>pubescens</i> - <i>dichanthelium</i> sp. / <i>sphagnum</i> spp. herbaceous vegetation	Redtop Panicgrass - Rosette Grass / Sphagnum Moss Coastal Plain Intermittent Pond Herbaceous Vegetation				G2	S2
<i>Pinus rigida saturated woodland alliance</i>	Pitch Pine Lowlands (Undifferentiated)				G3	S3

County: **Ocean**

<i>Pinus rigida</i> -(p. <i>echinata</i>)- <i>quercus</i> <i>spp. quercus (marilandica, ilicifolia)</i> <i>woodland</i>	Pine-oak-shrub Oak Woodland (Pow)				G3	S3
<i>Pinus rigida-calamovilfa brevipilis savanna</i>	Pitch Pine-pinelands Reedgrass Savanna				G1	S1
Vascular Plant						
<i>Alopecurus aequalis var. aequalis</i>	Short-awn Meadow-foxtail				HL G5TNR	S2
<i>Amaranthus pumilus</i>	Seabeach Amaranth	LT	E		LP, HL G2	S1
<i>Amianthium muscitoxicum</i>	Fly Poison				HL G4G5	S2
<i>Arethusa bulbosa</i>	Dragon Mouth				HL G4	S2
<i>Aristida dichotoma var. curtissii</i>	Curtiss' Three-awn Grass				HL G5T5	S2
<i>Aristida virgata</i>	Wand-like Three-awn Grass				HL G5T4T5	S2
<i>Aristolochia serpentaria</i>	Virginia Snakeroot				HL G4	S3
<i>Artemisia campestris ssp. caudata</i>	Beach Wormwood				HL G5T5	S2
<i>Asclepias lanceolata</i>	Smooth Orange Milkweed				HL G5	S2
<i>Asclepias rubra</i>	Red Milkweed				LP, HL G4G5	S2
<i>Aster concolor</i>	Eastern Silvery Aster				LP, HL G4?	S2
<i>Aster radula</i>	Low Rough Aster		E		LP, HL G5	S1
<i>Buchnera americana</i>	Bluehearts				HL G5?	SX
<i>Cacalia atriplicifolia</i>	Pale Indian Plantain		E		LP, HL G4G5	S1
<i>Calamovilfa brevipilis</i>	Pine Barren Reedgrass				LP G4	S4
<i>Cardamine longii</i>	Long's Bittercress		E		LP, HL G3	SH
<i>Carex barrattii</i>	Barratt's Sedge				LP G4	S4
<i>Carex mitchelliana</i>	Mitchell's Sedge				HL G3G4	S2
<i>Carex pallescens</i>	Pale Sedge				HL G5	S2
<i>Carex willdenowii var. willdenowii</i>	Willdenow's Sedge				HL G5T5	S2
<i>Cirsium virginianum</i>	Virginia Thistle		E		LP, HL G3	S1

County: **Ocean**

<i>Clitoria mariana</i>	Butterfly-pea	E	LP, HL	G5	S1	
<i>Corema conradii</i>	Broom Crowberry	E	LP, HL	G4	S1	
<i>Coreopsis rosea</i>	Rose-color Coreopsis		LP, HL	G3	S2	
<i>Croton willdenowii</i>	Elliptical Rushfoil		LP, HL	G5	S2	
<i>Cyperus pseudovegetus</i>	Marsh Flat Sedge	E	LP, HL	G5	SH	
<i>Desmodium nuttallii</i>	Nuttall's Tick Trefoil		HL	G5	S3	
<i>Desmodium pauciflorum</i>	Few-flower Tick-trefoil	E	LP, HL	G5	SH	
<i>Desmodium viridiflorum</i>	Velvety Tick-trefoil		HL	G5?	S2	
<i>Elatine minima</i>	Small Waterwort		HL	G5	S3	
<i>Eleocharis halophila</i>	Salt-marsh Spike-rush		HL	G4	S2	
<i>Eleocharis tortilis</i>	Twisted Spike-rush	E	LP, HL	G5	S1	
<i>Epilobium angustifolium ssp. circumvagum</i>	Narrow-leaf Fireweed		HL	G5T5	S1	
<i>Eriocaulon parkeri</i>	Parker's Pipewort		HL	G3	S2	
<i>Eriophorum tenellum</i>	Rough Cotton-grass	E	LP, HL	G5	S1	
<i>Eryngium aquaticum var. aquaticum</i>	Marsh Rattlesnake-master		HL	G4T4	S3	
<i>Eupatorium resinosum</i>	Pine Barren Boneset	E	LP, HL	G3	S2	
<i>Fimbristylis caroliniana</i>	Carolina Fimbry		HL	G4	S2	
<i>Fraxinus profunda</i>	Pumpkin Ash	E	LP, HL	G4	S1	
<i>Fuirena squarrosa</i>	Hairy Umbrella-sedge		HL	G4G5	S3	
<i>Galactia volubilis</i>	Downy Milk-pea	E	LP, HL	G5	SH	
<i>Gentiana autumnalis</i>	Pine Barren Gentian		LP, HL	G3	S3	
<i>Glaux maritima</i>	Sea-milkwort	E	LP, HL	G5	SX.1	
<i>Gnaphalium helleri</i>	Small Everlasting	E	LP, HL	G4G5T3?	SH	
<i>Helonias bullata</i>	Swamp-pink	LT	E	LP, HL	G3	S3
<i>Honckenya peploides var. robusta</i>	Seabeach Sandwort		HL	G5T4	S1	

County: **Ocean**

<i>Hottonia inflata</i>	Featherfoil	E	LP, HL	G4	S1	
<i>Houstonia longifolia</i>	Long-leaf Summer Bluet		HL	G4G5	SX	
<i>Jeffersonia diphylla</i>	Twinleaf	E	LP, HL	G5	S1	
<i>Juncus articulatus</i>	Jointed Rush		HL	G5	S2	
<i>Juncus brevicaudatus</i>	Narrow-panicle Rush		HL	G5	S2	
<i>Juncus caesariensis</i>	New Jersey Rush	E	LP, HL	G2	S2	
<i>Juncus greenii</i>	Greene's Rush		HL	G5	S2	
<i>Juncus torreyi</i>	Torrey's Rush	E	LP, HL	G5	S1	
<i>Lespedeza stuevei</i>	Stueve's Downy Bush-clover		HL	G4?	S2	
<i>Limosella subulata</i>	Awl-leaf Mudwort	E	LP, HL	G4G5	S1	
<i>Linum intercursum</i>	Sandplain Flax	E	LP, HL	G4	S1	
<i>Listera australis</i>	Southern Twayblade		LP, HL	G4	S2	
<i>Lobelia canbyi</i>	Canby's Lobelia		LP, HL	G4	S3	
<i>Ludwigia brevipes</i>	Tucker's Island Primrose-willow		HL	G4G5	SX.1	
<i>Lupinus perennis</i>	Wild Lupine		HL	G5	S3	
<i>Luzula acuminata</i>	Hairy Wood-rush	E	LP, HL	G5T4T5	S2	
<i>Malaxis unifolia</i>	Green Adder's-mouth		HL	G5	S2	
<i>Melanthium virginicum</i>	Virginia Bunchflower	E	LP, HL	G5	S1	
<i>Muhlenbergia torreyana</i>	Pine Barren Smoke Grass		LP, HL	G3	S3	
<i>Myriophyllum tenellum</i>	Slender Water-milfoil	E	LP, HL	G5	S1	
<i>Myriophyllum verticillatum</i>	Whorled Water-milfoil	E	LP, HL	G5	SH	
<i>Narthecium americanum</i>	Bog Asphodel	C	E	LP, HL	G2	S2
<i>Nymphoides cordata</i>	Floatingheart		LP, HL	G5	S3	
<i>Obolaria virginica</i>	Virginia Pennywort		HL	G5	S2	
<i>Oenothera humifusa</i>	Sea-beach Evening-primrose	E	LP, HL	G5	S2	

County: **Ocean**

<i>Onosmodium virginianum</i>	Virginia False-gromwell	E	LP, HL	G4	S1	
<i>Panicum wrightianum</i>	Wright's Panic Grass		HL	G4	S2	
<i>Paspalum dissectum</i>	Mudbank Crown Grass		HL	G4?	S2	
<i>Phaseolus polystachios</i> var. <i>polystachios</i>	Wild Kidney Bean		HL	G4TNR	S2	
<i>Phoradendron leucarpum</i>	American Mistletoe		LP, HL	G5	S2	
<i>Pityopsis falcata</i>	Sickle-leaf Golden-aster		LP, HL	G3G4	S3	
<i>Plantago maritima</i> var. <i>juncooides</i>	Seaside Plantain		HL	G5T5	S2	
<i>Plantago pusilla</i>	Dwarf Plantain	E	LP, HL	G5	SH	
<i>Platanthera ciliaris</i>	Yellow Fringed Orchid		LP, HL	G5	S2	
<i>Platanthera cristata</i>	Crested Yellow Orchid		LP, HL	G5	S3	
<i>Polygala polygama</i>	Racemed Milkwort		HL	G5	S2	
<i>Polygonum glaucum</i>	Sea-beach Knotweed	E	LP, HL	G3	S1	
<i>Polygonum hydropiperoides</i> var. <i>opelusanum</i>	Opelousas Water-pepper		HL	G5TNRQ	S2	
<i>Potamogeton oakesianus</i>	Oakes' Pondweed		HL	G4	S2	
<i>Prenanthes autumnalis</i>	Pine Barren Rattlesnake-root		LP, HL	G4G5	S2	
<i>Prunus angustifolia</i>	Chickasaw Plum	E	LP, HL	G5T4T5	S2	
<i>Puccinellia fasciculata</i>	Saltmarsh Alkali Grass		HL	G3G5	S2	
<i>Pycnanthemum setosum</i>	Awmed Mountain-mint		HL	G3?	S3	
<i>Ranunculus cymbalaria</i>	Seaside Buttercup	E	LP, HL	G5	SH	
<i>Rhododendron atlanticum</i>	Dwarf Azalea	E	LP, HL	G4G5	S1	
<i>Rhynchospora cephalantha</i>	Large-head Beaked-rush		LP, HL	G5	S3	
<i>Rhynchospora globularis</i>	Coarse Grass-like Beaked-rush	E	LP, HL	G5?	S1	
<i>Rhynchospora inundata</i>	Slender Horned-rush		LP, HL	G3G4	S2	
<i>Rhynchospora knieskernii</i>	Knieskem's Beaked-rush	LT	E	LP, HL	G2	S2
<i>Rhynchospora microcephala</i>	Small-head Beaked-rush	E	LP, HL	G5T5	S1	

County: **Ocean**

<i>Rhynchospora nitens</i>	Short-beaked Bald-rush		HL	G4?	S2	
<i>Rhynchospora pallida</i>	Pale Beaked-rush		HL	G3	S3	
<i>Rubus recurvicaulis</i>	Blanchard's Dewberry		HL	G4?	S1.1	
<i>Rumex hastatulus</i>	Engelmann's Sorrel		HL	G5	SH	
<i>Sabatia campanulata</i>	Slender Marsh-pink		HL	G5	S3	
<i>Sabatia dodecandra</i> var. <i>dodecandra</i>	Large Marsh-pink		HL	G5?T4T5	S2	
<i>Sagittaria teres</i>	Slender Arrowhead	E	LP, HL	G3	S1	
<i>Schizaea pusilla</i>	Curly Grass Fern		LP, HL	G3	S3	
<i>Schwalbea americana</i>	Chaffseed	LE	E	LP, HL	G2	S1
<i>Scirpus longii</i>	Long's Woolgrass		E	LP, HL	G2	S2
<i>Scirpus maritimus</i>	Saltmarsh Bulrush		E	LP, HL	G5	SH
<i>Scleria minor</i>	Slender Nut-rush			LP	G4	S4
<i>Solidago stricta</i>	Wand-like Goldenrod			LP, HL	G5	S3
<i>Solidago tarda</i>	Late Goldenrod			HL	G4?Q	S3
<i>Spiranthes laciniata</i>	Lace-lip Ladies'-tresses	E		LP, HL	G4G5	S1
<i>Spiranthes odorata</i>	Fragrant Ladies'-tresses			HL	G5	S2
<i>Spiranthes tuberosa</i>	Little Ladies'-tresses			LP, HL	G5	S3
<i>Stachys tenuifolia</i>	Smooth Hedge-nettle			HL	G5	S3
<i>Stylisma pickeringii</i> var. <i>pickeringii</i>	Pickering's Morning-glory	E		LP, HL	G4T2T3	S1
<i>Tipularia discolor</i>	Cranefly Orchid			HL	G4G5	S3
<i>Tridens flavus</i> var. <i>chapmanii</i>	Chapman's Redtop	E		LP, HL	G5TNR	SH
<i>Triglochin maritima</i>	Seaside Arrow-grass	E		LP, HL	G5	S1
<i>Utricularia biflora</i>	Two-flower Bladderwort	E		LP, HL	G5	S1
<i>Utricularia minor</i>	Lesser Bladderwort	E		LP, HL	G5	S1
<i>Utricularia purpurea</i>	Purple Bladderwort			LP, HL	G5	S3

County: **Ocean**

<i>Utricularia resupinata</i>	Reversed Bladderwort	E	LP, HL	G4	S1
<i>Uvularia puberula</i> var. <i>nitida</i>	Pine Barren Bellwort	E	LP, HL	G5T3?	S2
<i>Valerianella radiata</i>	Beaked Comsalad	E	LP, HL	G5	S1
<i>Verbena simplex</i>	Narrow-leaf Vervain	E	LP, HL	G5	S1
<i>Viola brittoniana</i> var. <i>brittoniana</i>	Britton's Coast Violet		HL	G4G5T4T5	S3
<i>Xyris fimbriata</i>	Fringed Yellow-eyed-grass	E	LP, HL	G5	S1
<i>Zigadenus leimanthoides</i>	Death-camus	E	LP, HL	G4Q	S1