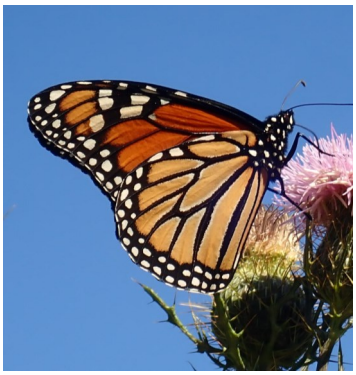
July 2019





Environmental Resource Inventory

for

Ocean Township

Monmouth County, NJ




Prepared for:

Township of Ocean
Monmouth County NJ

Kratzer Environmental Services

ENVIRONMENTAL RESOURCE INVENTORY

Township of Ocean
Monmouth County
New Jersey

Prepared By
Kratzer Environmental Services

For
The Township of Ocean, Monmouth County

July 2019

This plan was prepared with the assistance of a grant from the PSEG Foundation & Sustainable Jersey Grants Programs

Kratzer Environmental Services

Deborah J. Kratzer
19 Hill Road
Frenchtown, NJ 08825
908-996-2576
kratzerenv@gmail.com

This report was written by Deborah J. Kratzer, Jill S. Dodds and Elizabeth A. Johnson.

Photo Credits

Carnegie Museum of Natural History, page 87; Sandy Cook - cover (deer) and page 112; Michael Davenport - cover (turtle) and pages 83, 107, 127 and 138; Jill S. Dodds - pages 89, 90, 93, 94, 104, 106; Carolyn Gulick - cover (top right) and pages 5, 80 and 114; Deborah Kratzer - pages 1, 10, 54, 57, 124, 126, 137; Kate Maloney - page 64; Doug Manning, Invasive.org - page 95; Ken Schaefer - page 105; Ocean Township, http://www.oceantwp.org/content/5931/14165/default.aspx - page 145.

Table 3.6.3 (pages 90 to 94): Ted Bodner at USDA-NRCS PLANTS Database; Britton and Brown, 1913, Vol. 2: 614; John D. Byrd, Mississippi State University, Bugwood.org; Steve Dewey, Utah State University, Bugwood.org; Jill S. Dodds; Chris Evans, University of Illinois, Bugwood.org; Deborah J. Kratzer; Mike Davenport; Tom Heutte, USDA Forest Service, Bugwood.org; Stacy Leicht, University of Connecticut, Bugwood.org; Leslie R. Mehrhoff, University of Connecticut, Bugwood.org; James H. Miller, USDA Forest Service, Bugwood.org; Mohlenbrock , 1995; Rob Routledge, Sault College, Bugwood.org; Jan Samanek, Phytosanitary Admin., Bugwood.org; Forest and Kim Starr, Starr Environmental, Bugwood.org; Jil M. Swearingen, USDI National Park Service, Bugwood.org; Richard Webb, Bugwood.org.

Kratzer Environmental Services DATA DISCLAIMER

These data are provided “as is” and in no event shall the provider be liable for any damages, including, without limitation damages resulting from lost data or lost profits or revenue, the costs of recovering such data, the costs of substitute data, claims by third parties or for other similar costs, or any special, incidental, or consequential damages, arising out of the use of the data. The accuracy or reliability of the data is not guaranteed or warranted in any way and the providers disclaim liability of any kind whatsoever, including, without limitation, liability for quality, performance, merchantability and fitness for a particular purpose arising out of the use, or inability to use the data. The information in this report is intended for preliminary review and *cannot substitute for on-site testing and evaluations*.

Printed on 100% recycled paper

ACKNOWLEDGEMENTS

Funding for this report was provided by a grant from the PSEG Foundation and the Sustainable Jersey Grants Program. Special appreciation is extended for the input, review and support from the Township of Ocean Environmental Commission and from former Commission members Renee Amellio and Ray Pogwist who facilitated the planning for this project.

2019 Township of Ocean Mayor and Council Members

Christopher P. Siciliano, Mayor
John P. Napolitani, Sr., Deputy Mayor
Robert V. Acerra, Sr.
Margie Donlon
David J. Fisher

2019 Township of Ocean Environmental Commission Members

Fred Brody, Chairperson & Planning Board Rep.
Andrew Brannen
Norman Colten
Michael Davenport
Stephen Gaudette
Mary Johnson
Kenneth Lutz
Jack Mamiye, Alternate
Michele Crosta, Associate
Ed DiFiglia, Associate
Dallas Grove, Associate
Carolyn Gulick, Associate
Marc Rogoff, Associate
Kate Maloney, Secretary

Table of Contents

Figures

1. INTRODUCTION

1.1 PURPOSE

The Stucile Farm water tower c. 1920 housed the pumps that provided water for the working Haupt farm.

The Environmental Resource Inventory (ERI) is a compilation of information about the natural resources and environmentally significant features of the Township of Ocean. It also covers the addition of man-made features, such as residential areas, recreational areas, commercial and industrial sites, historic sites, brownfields, and contaminated sites. The ERI is an objective description of features and their functions, but not an interpretation or recommendation. It provides baseline documentation for measuring, evaluating, and protecting natural resources. Creating an ERI is an important step in protecting and preserving our natural resources and in ensuring that future development or redevelopment projects will protect public health, safety, and welfare (ANJEC, 2013).

By providing objective and reliable environmental data in one comprehensive document, the ERI will enable Township officials (the Mayor, Township Council, Planning and Zoning Boards, Environmental Commission, and Shade Tree Commission) and the Township Department of Community Development to make more informed decisions. By considering environmental factors, these officials will better be able to protect the Township's natural resources and the overall health and welfare of the community. The ERI is also a tool for the public to use in considering how changes might affect the environment of the Township.

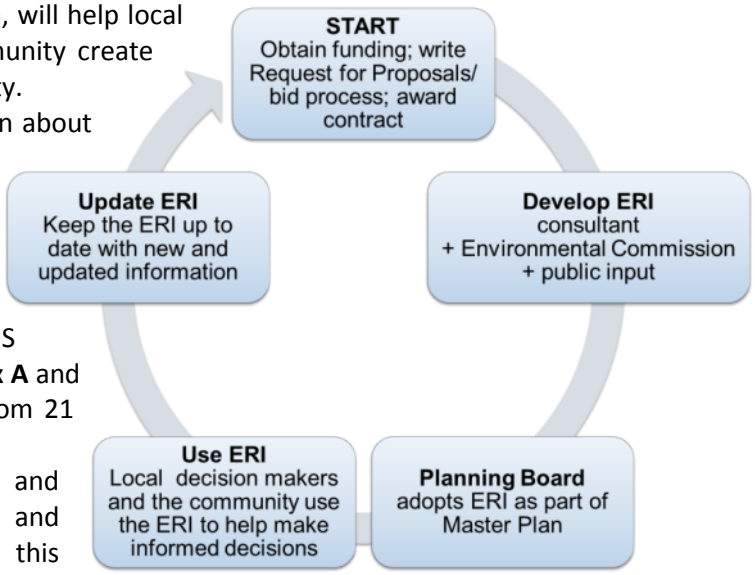
The Municipal Land Use Law requires municipalities' Master Plans to have a land use plan including topography, soil conditions, water supply, flood plains, wetlands, and woodlands. The Environmental Commission has the authority to conduct such research for inclusion in the Master Plan, and then to use this information to help evaluate development applications. The ERI will help support this requirement.

The ERI will principally be used by the Planning Board and Environmental Commission, but will provide valuable information to anyone interested in the natural resources of the Township of Ocean. This objective information should be used to inform resource-sensitive development decisions. In addition, familiarity with environmental concerns enables residents and officials to appreciate and learn how to maintain our valuable natural resources. Areas of specific concern may require additional protection strategies, including further research, monitoring, public outreach and education, habitat restoration, easements, volunteer projects, and revised or new ordinances.

1.2 METHODS

Ecology is defined as the science of the relationships between organisms and their environments. The relationships between and among the physical factors of the environment, including the air, geology, topography, soils, and water, and the biotic environment, including plants, animals and decomposers, are a complex web. Humans are a significant part of the ecosystem of the Township of Ocean, both affecting and being affected by many physical and biological factors. The cumulative effects of many individual decisions have altered and have the potential to impact the environment and human health.

Assembling an inventory of the Township's environmental and biological infrastructure is the first step in a proactive and ecological approach to protecting and preserving human and ecological health. Analyzing the data, gaining an understanding of the ecological processes involved, and considering the consequences of ignoring them, will help local decision makers, land planners and the community create and maintain an ecologically healthy municipality.



An inventory of what is currently known about the physical and biological environment and the human influence on the environment of Ocean Township has been compiled for this document. The most current GIS data have been obtained from the New Jersey Department of Environmental Protection GIS Data Web Site and other sources (see **Appendix A** and **Appendix B)**. A total of 82 GIS data layers from 21 sources were used for this report's 39 maps.

Further sources include the internet, and federal, state, county and local databases and contacts. All digital inventory data used in this report will be provided to the Ocean Township Environmental Commission. The public can also use GIS data by using either the New Jersey Department of Environmental Protection's NJ-GeoWeb website or obtain relevant data layers (most are free on the internet), and download the free software, ArcExplorer to view the data (see **Internet Resources**, at the end of this section).

What is GIS?
"A geographic information system (GIS) is a framework for gathering, managing, and analyzing data.... GIS technology applies geographic science with tools for understanding and collaboration. It helps people reach a common goal: to gain actionable intelligence from all types of data." (ESRI, 2019)

When viewing the digital document (as opposed to a printed copy) maps in PDF, clicking on the tab "Layers" at the left side of the screen will allow users to turn on or off the various data layers. Viewing the separate layers in this way is often helpful, especially for complex maps.

References and related Internet resources (with links) are listed at the end of each section, so that readers may find more information and updates. Please note that Internet sites may change or be temporarily out of service. If an Internet link doesn't work, try using an Internet search engine.

The following chapters present objective information about Ocean Township's natural resources, including climate, geology, soils, water, floodplains, wetlands, and forests, and cultural resources such as infrastructure and open space. Environmental concerns in Ocean Township include air and water pollution, rare, threatened and endangered species and invasive species.

1.3 LIMITATIONS OF THE ERI

It should be noted that the ERI is not meant to replace the primary data sources upon which it is based. Information about GIS data sources is provided in **Appendix B**. The ERI is intended for preliminary assessments of projects and *cannot substitute for on-site testing and evaluations*. Most maps are presented at a scale of about 1:36,000 in order to fit on 8.5 x 11 inch paper. "Zooming in" to better view individual lots is possible, but should not exceed the scale at which the data was created. Most data layers used for this report were created at 1:24,000 scale (with an accuracy of ± 40 feet). Data mapped at 1:100,000, such as the geology data layer, have an accuracy of ± 166.7 feet (Garie, 1998).

Sometimes mapped features don't line up exactly, since different data producers may have used different methods of acquiring and analyzing the data, used different scales or coordinate systems, and because of differences or errors in the base data.

GIS data layers from NJDEP are used with permission (see the Terms of Agreement in **Appendix A**), with the required "disclaimer" printed on each map that uses their data.

Some components of the environment may have been studied or presented in detail, while other important factors may have been minimally addressed. When new or updated information becomes available, or new issues emerge, *updates should be appended to the ERI*.

References: Introduction

Association of New Jersey Environmental Commissions (ANJEC). 2013. The Environmental Resource Inventory: ERI. ANJEC; Mendham, NJ. 12 pages. http://anjec.org/pdfs/ERI2013.pdf

Garie, Henry L. and Lawrence L. Thornton. September 1998. New Jersey State Agency Partnership GIS Technical Mapping Standards: Enhancing GIS Technology for Multi-Agency Cooperation. Standards Subcommittee State Mapping Advisory Committee: Trenton, NJ.

ESRI. 2019. What is GIS? https://www.esri.com/en-us/what-is-gis/overview

Honachefsky, William B. 2000. Ecologically Based Municipal Land Use Planning. Lewis Publishers: New York. 255 pages.

Kratzer, Deborah. 2018. Creating or Updating Your ERI, presented at ANJEC 2018 Environmental Congress. http://anjec.org/pdfs/ERIs-DKratzer-CreatingUpdatingERI.pdf

Municipal Land Use Law Chapter 291 Laws of N.J. 1975. NJ Statutes Annotated compiled as 40:55D-1 et. seq. with amendments through the 209th State Legislature, January 2002. http://njpo.org

NJDEP, Bureau of Geographic Information Systems (BGIS). February 17, 2015. Land Use/Land Cover 2012 Update, Edition 20150217 Subbasin 02040301 - Mullica-Toms (Land_lu_2012_hu02040301). GIS Data. http://www.state.nj.us/dep/gis/lulc12.html

US Geological Survey (USGS). 2010. Edited by NJDEP, Bureau of Geographic Information Systems (BGIS) 1998, 2000, 2001, 2002, 2005, 2007, 2010. NJDEP MODIFIED ANDERSON SYSTEM 2007 derived from: A Land Use and Land Cover Classification System for Use with Remote Sensor Data, USGS Professional Paper 964, 1976. 35 pages. http://www.state.nj.us/dep/gis/digidownload/metadata/lulc07/anderson2007.html

Internet Resources: Introduction

Aerial photography:

Google Earth[1]: http://www.google.com/earth/index.html (free download)

HistoricAerials.com[2]: http://historicaerials.com (free to use, but maps have watermark unless purchased)

[1] Users of Google Earth may also view several years of historic imagery of Ocean Township from 1995 through 2019. On the menu bar, click View, then click Historical Imagery and use the slider bar to choose the year.

[2] HistoricAerials.com allows viewing of historic aerial photography between 1931 and 2015.

Environmental Education

NJDEP SEEDS: The State Environmental Education Directory Website: http://www.state.nj.us/dep/seeds/index.html

Free online mapping:

NJ-GeoWeb 3.0 (NJDEP): http://www.state.nj.us/dep/gis/geowebsplash.htm

NJ Map: An Interactive Atlas for Ecological Resources, Environmental Education, and Sustainable Communities: http://www.njmap2.com/

GIS Data from New Jersey Department of Environmental Protection

For a complete list of data sources used in this report, see **Appendix B**

NJ GIS Home Page: http://www.state.nj.us/dep/gis/index.html

NJDEP Open Data: https://gisdata-njdep.opendata.arcgis.com/

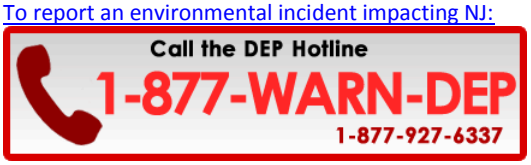
NJ Geographic Information Network: https://njgin.state.nj.us/NJ_NJGINExplorer/index.jsp

Monmouth County: https://co.monmouth.nj.us/

NJDEP Rules and Regulations (current and proposed): http://www.nj.gov/dep/rules/

Ocean Township: http://www.oceantwp.org/

To report an environmental incident impacting NJ:



2. BACKGROUND

2.1 GEOGRAPHY

The Township of Ocean is located in the eastern section of Monmouth County, New Jersey between the greater New York/New Jersey metropolitan area and the Jersey Shore (**Figure 2.1.1**). The township shares its borders with nine different municipalities, including Tinton Falls Borough to the west, the Boroughs of Eatontown and West Long Branch to the north, Long Branch City, Deal Borough, Allenhurst Borough, Interlaken Borough and Asbury Park City to the east and Neptune Township to the south. The township spans two USGS quadrangles, with the northern half located in the Long Branch Quadrangle and the southern half in the Asbury Park Quadrangle. Ocean Township encompasses a number of smaller named places including Cold Indian Springs, Colonial Terrace, Deal Park, Dogs Corners, Elberon Park, Green Grove, Oakhurst, Oakhurst Manor, Shadow Lawn Manor, Wanamassa, Wayside, Werthein's Corner, West Allenhurst and West Deal (NJDOT, 2004; NJ Geo-Web, 2019). The approximate locations are shown in **Figure 2.1.2**.

Weltz Park main path.

Ocean Township was formed from a part of Shrewsbury Township in 1849 and was initially larger, extending to the Atlantic Ocean. Between 1867 and 1967, parts of the original township spun off to create other municipalities including Long Branch, Eatontown, Asbury Park, Neptune, Sea Bright, Allenhurst, Deal, Monmouth Beach, Interlaken and Loch Arbour Village (Snyder, 1969). The township currently encompasses 10.88 square miles (6,963.2 acres)[3].

2.2 DEMOGRAPHY

The 2010 census documented a population of 27,291, which is 2,508 persons per square mile. A 2017 estimate places the populations slightly lower, at 26,988 (US Census Bureau, 2018). The township has 11,562 housing units; 70 percent are single-unit dwellings and the balance (30%) is multi-unit dwellings. Recent estimates put the number of households (10,675) at slightly lower than the number of dwellings, resulting in an eight percent vacancy rate (U.S. Census Bureau, 2017). According to the Monmouth County Division of Planning (2018), the average residential property tax in Ocean Township for 2016 was $9,065 and the township's net real estate valuation for 2017 was $4.8 billion. **Figure 2.2.1** illustrates the population and housing density in the various sections of the township.

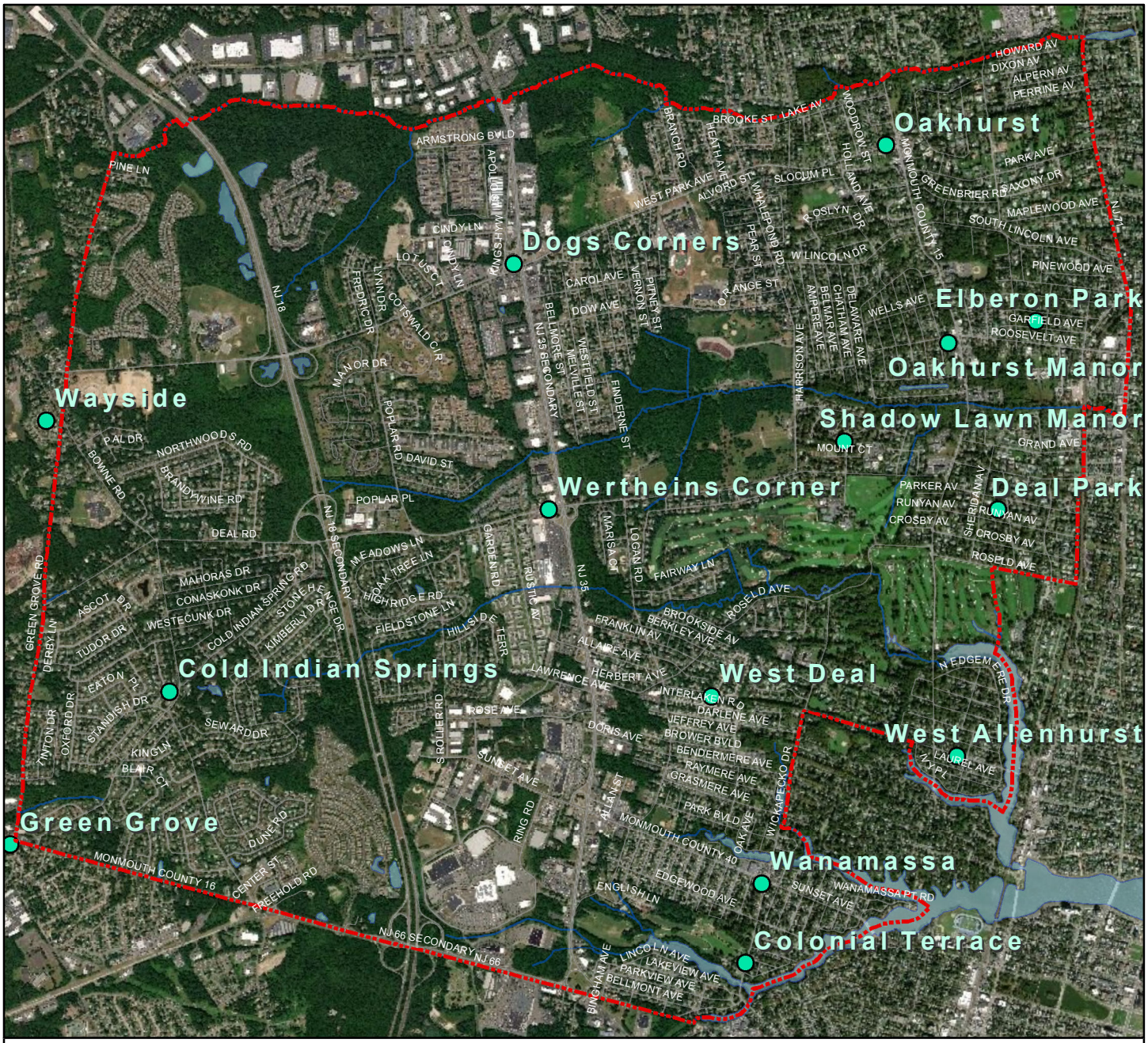
[3] The total acres determined by the ArcGIS coverage differs slightly from the acres provided on tax maps.

Data Sources: NJDEP, NJDOT
Disclaimer required for NJDEP Data: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Kratzer Environmental Services
Ocean Township ERI 2019

N

Figure 2.1.1. Location of Ocean Township in the New York Metropolitan Area



Legend

- Ocean Township
- Place Names
- Roads
- Waterbodies

N

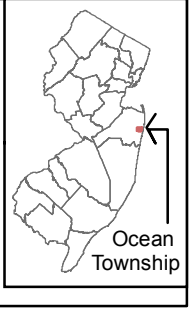
0 0.25 0.5 1 Miles

Data Sources: NJDEP, NJDOT
Disclaimer required for NJDEP Data: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Kratzer Environmental Services
Ocean Township ERI 2019

Figure 2.1.2. Areas of Ocean Township, Monmouth County

This map shows the locations of township areas, including Colonial Terrace, Deal Park, Oakhurst, Shadow Lawn Manor, Wanamassa, Wayside, West Allenhurst, and West Deal.



Legend

- Ocean Township
- Roads
- Parcels
- Streams

2010 Population per Census Tract

- 2105.0 - 2676.0
- 2676.1 - 3722.0
- 3722.1 - 4374.0
- 4374.1 - 5747.0
- 5747.1 - 9918.0

- Residential, high density or multiple dwelling
- Residential, single unit, medium density

N

0 0.25 0.5 1 Miles

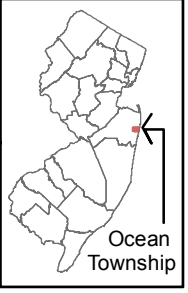
Data Sources: NJDEP, NJDOT

Disclaimer required for NJDEP Data: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Kratzer Environmental Services
Ocean Township ERI 2019

Figure 2.2.1. Population Density Ocean Township, Monmouth County

This map displays the population density distrubution of Ocean Township by showing 2010 census by census tract, and displaying parcel outlines. Areas identified by the 2012 Land Use data as high density residential use are shaded dark grey, and medium density residential areas are shaded medium grey.



2.3 HISTORY

2.3.1 Prehistoric

The eastern part of Monmouth County is located in New Jersey's outer coastal plain region, which was submerged beneath the ocean multiple times during the Tertiary Period of the Cenozoic Era (Collins and Anderson, 1994). A series of repeated invasions and withdrawals by the sea formed the characteristic soils of the region (see **Section 3.3**) and left behind a rich record of marine life in the form of fossils. Mollusk shells, shark teeth and the bones of prehistoric whales are abundant in Monmouth County, and fossil records of *Cimoliasaurus*, a short-necked sea reptile, have also been found in the region. Prior to that series of inundations the area was inhabited by dinosaurs, and Monmouth County has also produced the fossilized remains of late Cretaceous Period inhabitants such as *Hadrosaurus*, *Ankylosaurus* and *Coelosaurus* (Gallagher, 1997).

During the last glacial period when most of northern New Jersey was covered by an ice sheet, the lower part of the state was "a wind-swept tundra where great prehistoric beasts roamed" (Gallagher, 1997). Gallagher (1997) mentions an assortment of early vertebrate records from Monmouth County, including giant beaver teeth, giant ground sloth claws, elk-moose bones and antlers, and mastadon remains. A nearly complete skeleton of a mastodon was discovered in the marl deposits along Poplar Brook in what is now Joe Palaia Park in 1824 (Dekay, Van Rensselaer, and Cooper, 1824).

2.3.2 Native American

There is evidence that the area now known as Monmouth County has been inhabited by humans for thousands of years. Stone implements with fluted points characteristic of Paleo-American cultures were recovered at an archeological excavation site near Freehold, and radiocarbon dating indicated that the tools originated during the period from 7,041 B.C. through 5,939 B.C. Similar artifacts have been found at other locations in the county, including Farmingdale and Squankum (Marshall, 1982).

The earliest documented native inhabitants called the area Lenapehoking, which means land of the Lenape. Lenapehoking encompassed all of what is now New Jersey, eastern Pennsylvania, southeastern New York State, northern Delaware and a small section of southeastern Connecticut (Lenape Lifeways, 2002). The original residents traveled with the seasons, moving to the shore areas for shellfish and cooler weather in the summers but maintaining permanent settlements inland for the rest of the year (Ocean Township, 1949). Shells, arrowheads and artifacts found at Cold Indian Springs suggest this was once the location of a Lenape summer campsite (Dellinger and Dellinger, 1994).

The people in the southern half of Lenapehoking, below the Raritan River and the Delaware Water Gap, spoke the Unami dialect of the Eastern Algonquin Delaware language (Lenape Lifeways, 2002). Native place names and their derivations are still in use for numerous communities, waterways and roads in Monmouth County, including Assunpink, Chingarora, Conaskonk, Crosswicks, Hockhockson, Hominy, Lahaway, Lenape, Luppatatong, Mahoras, Manalapan, Manasquan, Matawan, Matchaponix, Metedeconk, Mingamahone, Mohingson, Narraticon, Navesink, Poricy, Port-au-Peck, Ramanessin, Ramapo, Raritan, Rumson, Shoppen, Squankum, Takanassee, Tepehemus, Tioga, Waackaack, Weamaconk, Wemrock, Wickapecko and Wickatunk. The community of Wanamassa in Ocean Township was named for one of the three sachems who signed over land at the head of Deal Lake in 1687 (Grumen, 2014).

2.3.3 Early Settlement

The first record of Europeans in Monmouth County was when Captain Henry Hudson's ship, the Half Moon, landed inside Sandy Hook on September 2, 1609. During the next half century, the area was settled by the Dutch until their claims were surrendered to England in 1664. Early settlers founded their homesteads on the banks of rivers and creeks, using the waterways for transportation. Because Deal Lake was originally accessible from the ocean, small boats could enter and travel to the upper branches.

Early mail was delivered to the area by small sloops, and also by post riders who followed the old Native American trails while eventually developed into the area's earliest roads (Ocean Township, 1949).

The division of New Jersey into East and West Jersey in 1676 was soon followed by the 1683 subdivision of East Jersey into four counties, one of which was Monmouth County. Ten years later, Monmouth County was divided into Freehold, Middletown and Shrewsbury Townships, the last of which included the current Township of Ocean (Ocean Township, 1949). The first village in what is now Ocean Township was at Oakhurst, which was previously known as Bennet Town (Dellinger and Dellinger, 1994). Some of the earliest commercial enterprises documented in the area were mills. A sawmill was located on Hog Swamp Creek, while a grist mill on the south side of Whale Pond Brook produced feed and flour. Other early industries in the township included the mining of marl for fertilizer and the slow burning of wood for charcoal production (Edelson, 1974).

By 1769 Monmouth County had six principal roads. The first school house in what later became Ocean Township was built in the Poplar School District in 1784, and the second was completed sometime before 1818 in the Deal School District. Schoolhouses for other districts to the south were situated outside of the current township (Ocean Township, 1949). The early 1800s also marked the establishment of a general store, a tavern and a wheelwright shop in the vicinity (Dellinger and Dellinger, 1994).

Eden Woolley House c. 1750, Home of the Township of Ocean Historical Museum.

2.3.4 Recent History

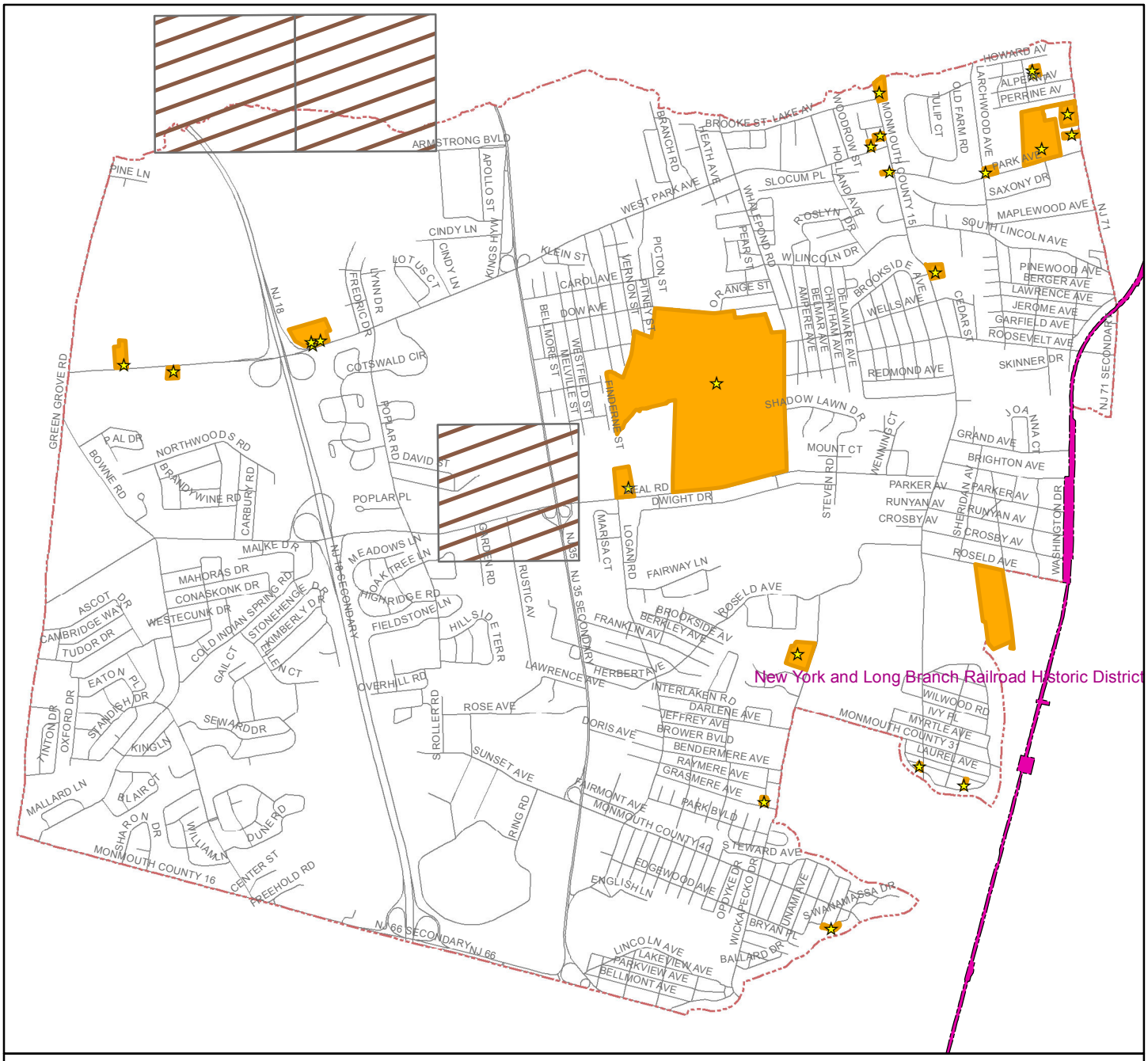
The Township of Ocean was established in 1849 when Shrewsbury Township was divided into two parts. At that time the two main villages in the township were Long Branch and Eatontown (Edelson, 1974). Ocean Township's first post office was established in 1860 and its first church was built in 1882 (Dellinger and Dellinger, 1994; Ocean Township, 1949). The area continued to develop: Several railroads were built to serve the vicinity in the late 1800s as well as a trolley route along what is presently Norwood Avenue, and poles with gas lamps were added to light the public roads. Ongoing regional growth resulted in the formation of independent municipalities from portions of the original Township of Ocean, the last of which was Loch Arbour in 1957 (Edelson, 1974).

2.3.5 Archeological Site Grid

The New Jersey Historic Preservation Office (HPS) catalogues locations of prehistoric or historic occupation or activity possessing archaeological value. The archeological site grid dataset indicates the presence of archeological sites on a ½ mile grid for informational purposes only, and does not preclude the existence of other archaeological districts or sites as yet unidentified, unrecorded, or undocumented. The archeological site grids within Ocean Township are shown in **Figure 2.3.1** (NJDEP HPO, January 29, 2019a).

2.3.6 Historic Districts

The NJDEP Historic Preservation Office (HPO) defines Historic Districts as areas that possess a significant concentration, linkage, or continuity of buildings, sites, structures, or objects united historically or aesthetically by plan or physical development. Historic Districts include National Historic Landmarks; areas on the New Jersey or National Registers of Historic Places; areas determined eligible for inclusion in the registers; districts designated as Local Historic Districts by a local government; or areas that have been identified through a cultural resource survey or other documentation on file at the HPO.



Legend

Ocean Township
Roads
Property Features
Historic Properties
Historic District
Archeological Grid

N
0 0.25 0.5 1 Miles

Data Sources: NJDEP, NJDOT
Disclaimer required for NJDEP Data: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Kratzer Environmental Services
Ocean Township ERI 2019

Figure 2.3.1. Historic and Archeological Resources Ocean Township, Monmouth County

Ocean Township

A portion of the New York and Long Branch Railroad Historic District passes through the eastern side of Ocean Township, as shown in **Figure 2.3.1.** The period of significance for the feature was from 1872 through 1954, and the site was deemed eligible for the National Register on August 20, 2004 (NJDEP HPO, January 29, 2019b).

2.3.7 Historic Properties

According to the NJDEP HPO, Historic Properties are buildings, sites, structures or objects that are evaluated as historically significant. These include properties that are on the National Historic Landmarks; included in the state or National Registers of Historic Places; determined Eligible for inclusion in the registers through the state or federal HPO processes; designated as Local Landmarks by local government; or identified through cultural resource survey or other documentation on file at the HPO. Properties on the current HPO inventory are listed in **Table 2.3.1** and shown on **Figure 2.3.1** (NJDEP HPO, January 29, 2019c; NJDEP, January 29, 2019d).

Table 2.3.1. Ocean Township Historic Properties and Features

Historic Property & Location	Historic Feature	Type	Intact
Deal Test Site Joe Palaia Park on Poplar Brook	Deal Test Site	Site	Yes
Neander Montgomery Woods House 1400 South Wanamassa Drive	Neander Montgomery Woods House	Bldg	Yes
Whyte House 26 Lake Drive	Whyte House	Bldg	Yes
515 South Edgemere Avenue (1337-2)	515 South. Edgemere Avenue (1337-2)	Bldg	Yes
703 South Edgemere Avenue	703 South Edgemere Avenue	Bldg	Yes
Harper House, *aka Search Day program, formerly known as Ivy Hedge* 73 Wickapecko Drive	Harper House	Bldg	Yes
Eden Wooley House 715 Deal Road	Eden Wooley House	Bldg	Yes
365 West Park Avenue	365 West Park Avenue	Bldg	No
Wooley Farm 1033 West Park Avenue	Wagon shed	Bldg	No
	Barn	Bldg	No
	House	Bldg	No
1136 West Park Avenue	1136 West Park Avenue	Bldg	Yes
Centerville M. E. Church *aka Wayside U. Methodist Church* 1229 West Park Avenue	Centerville M. E. Church	Bldg	Yes
231 Park Avenue	231 Park Avenue	Bldg	Yes
275 Park Avenue	275 Park Avenue	Bldg	Yes
7 Monmouth Road (1337-5)	7 Monmouth Road (1337-5)	Bldg	Yes
44 Monmouth Road (1337-6)	44 Monmouth Road (1337-6)	Bldg	Yes
76 Monmouth Road *aka Jersey Groove Mobile Detailing*	76 Monmouth Road	Bldg	Yes
Oakhurst School 163 Monmouth Road	Oakhurst School	Bldg	Yes
62 Norwood Avenue	62 Norwood Avenue	Bldg	Yes
76 Norwood Avenue	76 Norwood Avenue	Bldg	Yes
Jeffery House 3 Helen Court	House	Bldg	Yes
	Barn	Bldg	Yes
Source: NJDEP HPO, January 29, 2019c; NJDEP, January 29, 2019d			

2.4 LAND USE AND LAND USE CHANGE

The current zoning of Ocean Township is shown in **Figure 2.4.1** (Leon S. Avakian Consulting Engineers, 2014).

The New Jersey Department of Environmental Protection (NJDEP) used aerial photography taken in 1986, 1995, 2002, 2007 and 2012 to determine land use and land use change. The Land Use Type is the generalized category of six land uses: agriculture, barren, forest, urban, water and wetlands. Definitions are as follows (USGS, 2010):

Agriculture includes all lands used primarily for the production of food and fiber and associated farm structures. In Ocean Township this consists of close to 105 acres, which are primarily pastureland or cropland, with other uses such as orchards, vineyards, nurseries or horticulture.

Forest land is covered by woody vegetation (excluding wooded wetlands, which are included in the wetlands category) and includes overgrown shrubby fields. These areas are capable of producing timber and other wood products, and of supporting many kinds of outdoor recreation. Forests are important environmentally, because they affect air quality, water quality, wildlife habitat and climate.

Any areas periodically covered with water are included in the *water* land use type.

Wetlands are those areas that are inundated or saturated by surface or ground waters at a frequency and duration sufficient to support vegetation adapted for life in saturated soil conditions. Included in this category are naturally vegetated swamps, marshes, bogs, etc., as well as formerly natural wetlands that have been altered (sometimes filled) and are now part of a managed recreational area, but which still show signs of soil saturation on the aerial imagery. These altered wetland areas do not currently support typical wetland vegetation, but are vegetated primarily by grasses and other planted vegetation that may be routinely mowed. Wetlands are further discussed in **Section 3.5** of this report.

Barren Land includes areas being developed or cleared at the time the photos were taken.

The *Urban Land* type is characterized by intensive land use where the landscape has been altered by human activities. It encompasses various categories of residential, commercial, educational and industrial land.

The 2012 land use types within the Township of Ocean are illustrated in **Figure 2.4.2**, and summarized in **Table 2.4.1**. Ocean Township is approximately 75% urban, 16% water and wetlands, and 8% forested. Detailed categories of land use/land cover are shown in **Section 3.6** of this report.

Table 2.4.1. 2012 Land Use Types

Land Use Type (2012)	Acres*	Percent of Ocean Township
AGRICULTURE	26.77	0.38%
BARREN LAND	25.89	0.37%
FOREST	560.43	7.97%
URBAN	5,306.11	75.47%
WATER	87.25	1.24%
WETLANDS**	1,023.99	14.57%
Total:	7,030.43	100%
* Acreage from the GIS data may vary from acreage calculated based on tax maps.		
Note: Only an official determination from NJDEP, called a "Letter of Interpretation" (LOI) can verify the presence, absence or boundaries of freshwater wetlands. See **Section 3.5** for more information about wetlands.		
Source: NJDEP, 2015; USGS, 2010.		

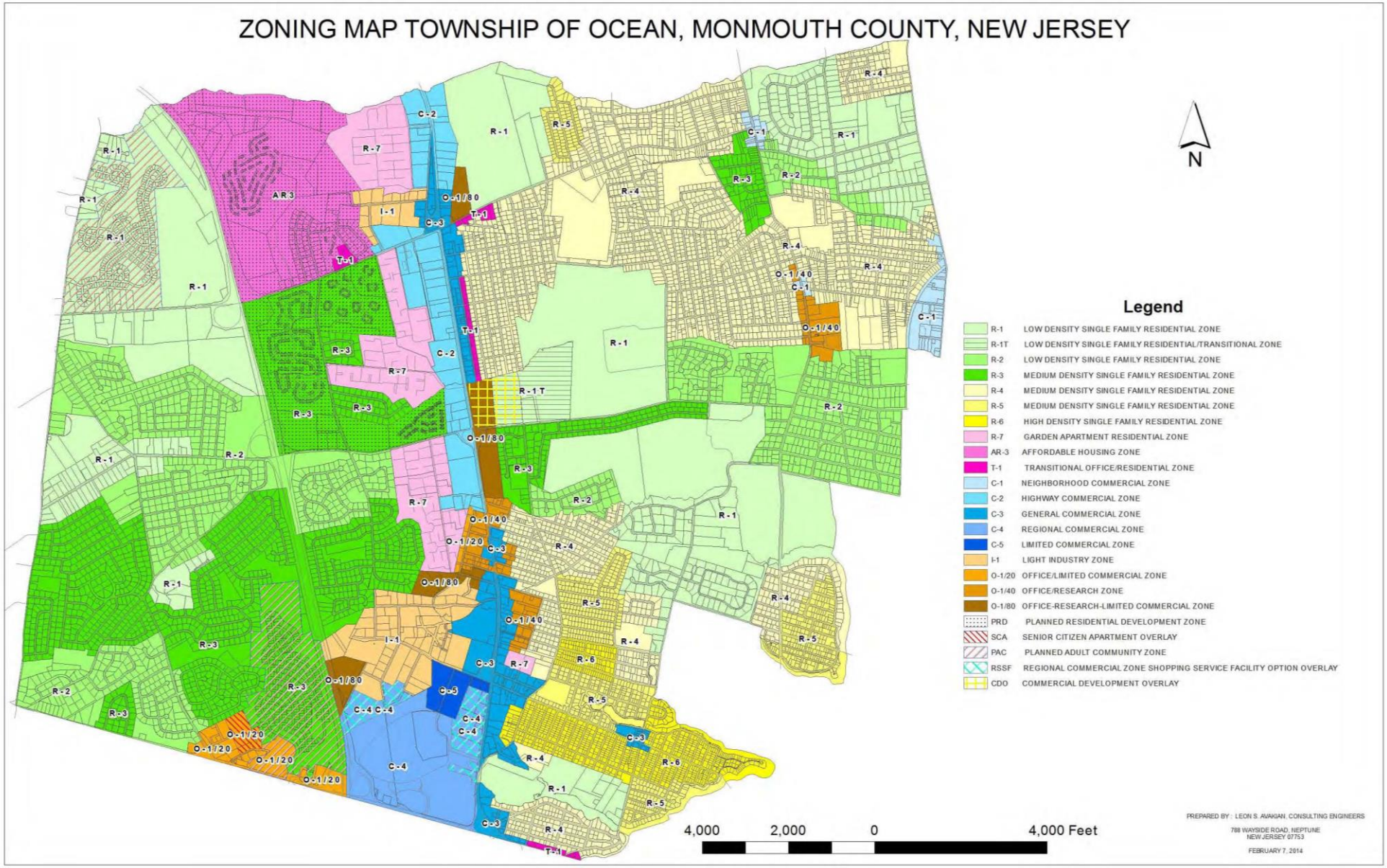
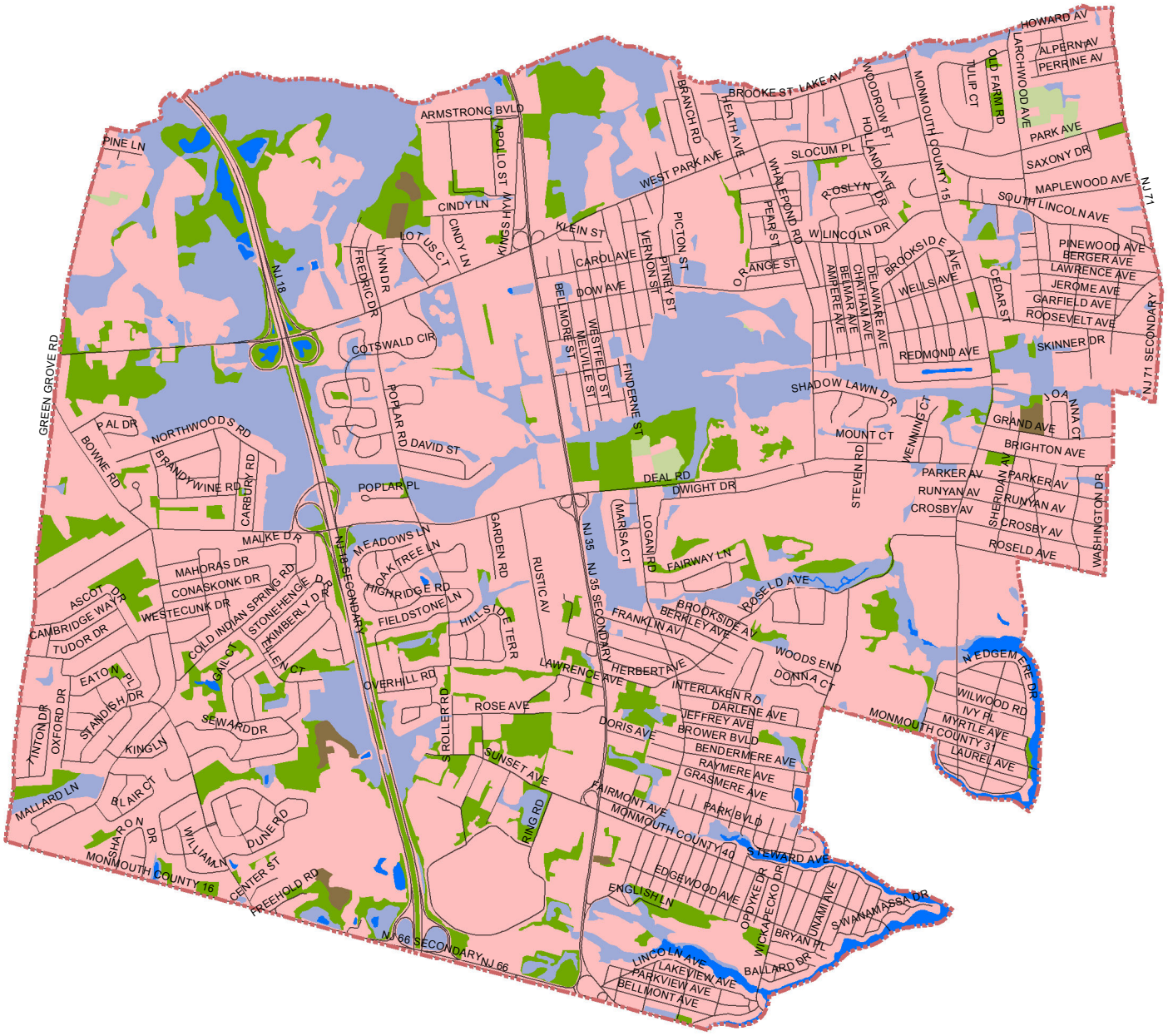


Figure 2.4.1. Zoning

Table 2.4.2 shows the shifting acreage in each land use type from 1972 through and 2012 as well as the total change in percent cover during that time period. **Figure 2.4.3** highlights the areas that have changed from one land use type to another over this time period. Both the table and the graph illustrate a trend in which agricultural lands, forests and wetlands have been replaced with urban land.

Table 2.4.2. Changes in Land Use Type

Land Use Type	1972 Acres	1986 Acres	1995 Acres	2002 Acres	2007 Acres	2012 Acres	40 Year Change in Acres	40 Year Change in % of Township
AGRICULTURE	666.2	134.9	65.5	25.7	24.4	26.8	-639.4	-9.10%
BARREN LAND	24.0	206.2	79.3	187.0	76.0	25.9	1.9	+0.03%
FOREST	1,294.0	721.2	731.2	647.9	554.0	560.4	-733.5	-10.44%
URBAN	3,293.1	4,590.7	4,866.4	4,966.6	5,296.8	5,306.1	2,013.0	+28.61%
WATER	37.4	55.9	78.3	72.5	78.5	87.2	49.8	+0.71%
WETLANDS	1,712.4	1,321.5	1,209.8	1,130.7	1,000.7	1,024.0	-688.4	-9.80%
Total:	7,027.1	7,030.4	7,030.4	7,030.4	7,030.4	7,030.4		
Sources: MCPD, August 15, 2017a; MCPD, August 15, 2017b; MCPD, August 15, 2017c; MCPD, August 15, 2017d; NJDEP, NJDEP, July 12, 2010; February 17, 2015.								



Legend

- Ocean Township
- Roads

Land Use Type (2012)

- AGRICULTURE
- BARREN LAND
- FOREST
- URBAN
- WATER
- WETLANDS

Land Use Type (2012)	Acres	Percent
AGRICULTURE	26.77	0.38%
BARREN LAND	25.89	0.37%
FOREST	560.43	7.97%
URBAN	5,306.11	75.47%
WATER	87.25	1.24%
WETLANDS	1,023.99	14.57%
Total:	7,030.43	100%

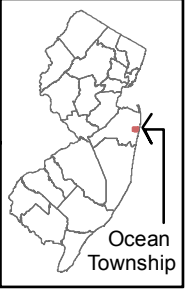
N

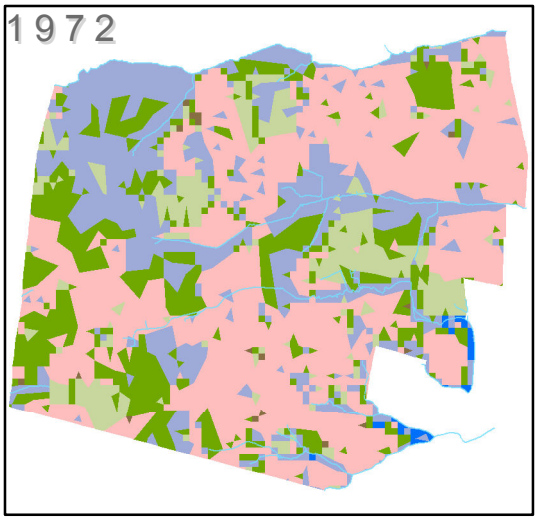
0 0.25 0.5 1 Miles

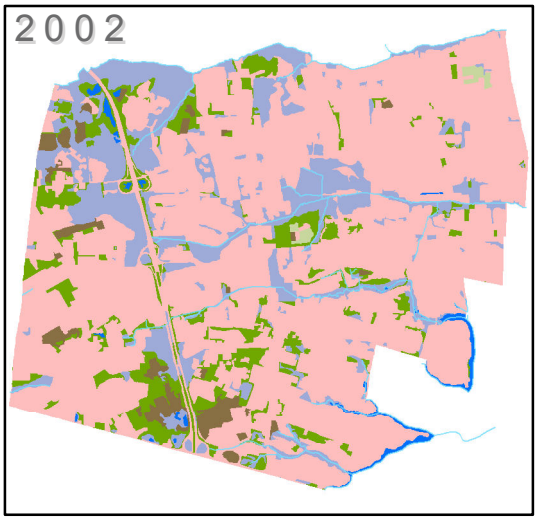
Data Sources: NJDEP, NJDOT
Disclaimer required for NJDEP Data: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Kratzer Environmental Services
Ocean Township ERI 2019

Figure 2.4.2. Land Use Type 2012
Ocean Township, Monmouth County



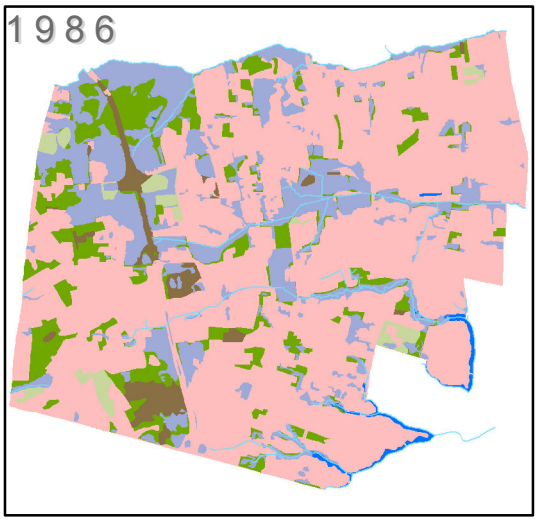


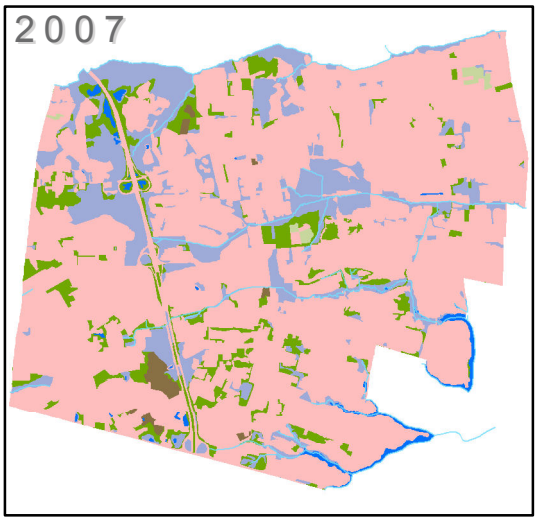


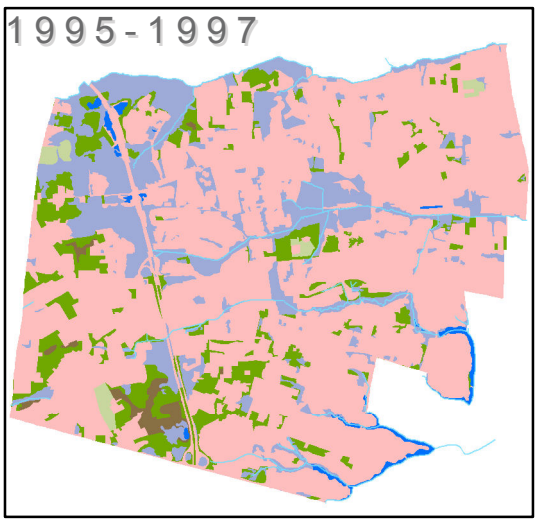
Legend

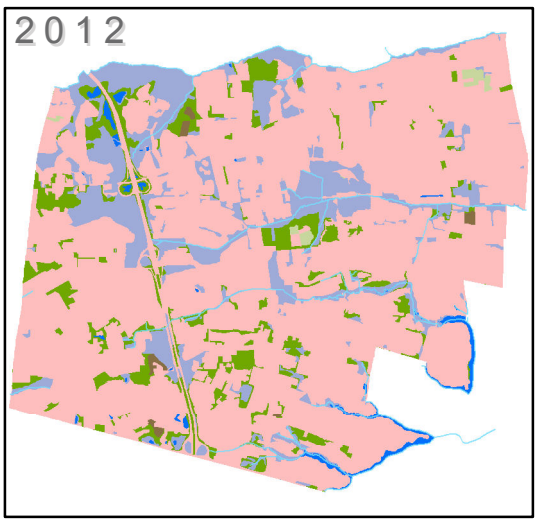
Land Use Type

- AGRICULTURE
- BARREN LAND
- FOREST
- URBAN
- WATER
- WETLANDS
- Streams (2002)









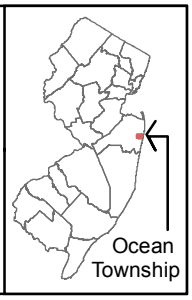
N

0 0.5 1 2 Miles

Data Sources: NJDEP, NJDOT
Disclaimer required for NJDEP Data: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Kratzer Environmental Services
Ocean Township ERI 2019

Figure 2.4.3. Land Use Change 1972 to 2012
Ocean Township, Monmouth County



References: Background

Geography

Leon S. Avakian Consulting Engineers. 2014. Ocean Township Zoning.

New Jersey Department of Transportation (NJDOT). 2004. Local Names. Available online: http://www.newjersey.gov/transportation/publicat/localnames2004.pdf

NJ-GeoWeb. 2019. An interactive web mapping application developed by the New Jersey Department of Environmental Protection, Bureau of GIS. Available online at https://www.state.nj.us/dep/gis/geowebsplash.htm. Accessed February 8, 2019.

Snyder, John F. 1969. The Story of New Jersey's Civil Boundaries: 1606-1968. First Edition. Bureau of Geology and Topography, Trenton, New Jersey.

Demography

Monmouth County Division of Planning. 2018. Monmouth County At-A-Glance. Report Prepared for the Monmouth County Board of Chosen Freeholders.

U.S. Census Bureau. 2017. American Community Survey 5-year estimates. Retrieved from Census Reporter Profile page for Ocean Township, Monmouth County, NJ. http://censusreporter.org/profiles/06000US3402554270-ocean-township-monmouth-county-nj/ Accessed February 8, 2019.

U.S. Census Bureau. 2018. Quick Facts: Ocean Township, Monmouth County, New Jersey. Available online: https://www.census.gov/quickfacts/oceantownshipmonmouthcountynewjersey?

History

Collins, B.R. and K.H. Anderson. 1994. Plant Communities of New Jersey. Rutgers University Press, New Brunswick, New Jersey.

Dekay, Van Rensselaer, and Cooper, "Account of the discovery of a Skeleton of the Mastodon Giganteum," Annals of the Lyceum of Natural History of New York, Volume 1, Issue 1, September, 1824, pp. 143-147.

Dellinger, T. and P. Dellinger (eds.). 1994. Township of Ocean: Landmarks and Lore. Published by the Township of Ocean Historical Museum.

Edelson, Marjorie. 1974. An Historic Perspective of the Township of Ocean. Published by the Township of Ocean on its 125th Anniversary.

Gallagher, William B. 1997. When Dinosaurs Roamed New Jersey. Rutgers University Press, New Brunswick, New Jersey.

Native People of New Jersey: http://www.usgennet.org/usa/nj/state/Lenape.htm. Accessed February 8, 2019.

Grumet, Robert S. 2014. Beyond Manhattan: A Gazeteer of Delaware Indian History Reflected in Modern-Day Place Names. Munsee and Northern Unami Interpretations by Ray Whritenour. New York State Museum Record 5. New York State Education Department, Office of Cultural Education.

Lenape Lifeways. 2002. About the Lenapes. http://www.lenapelifeways.org/lenape1.htm. Accessed February 8, 2019.

Marshall, Sydne B. 1982. Aboriginal Settlement in New Jersey During the Paleoindian Cultural Period CA. 10,000 B.C. - 6000 B.C. In Chesler O., S. Marshall, H.C. Kraft, R.A. Mounier, L.E. Williams, R.A.Thomas and S. Kardas (eds). New Jersey's Archeological Resources from the Paleoindian Period To the Present: a Review of Research Problems and Survey Priorities. Pages 10-51. Office of New Jersey Heritage, 1982.

NJDEP Historic Preservation Office (HPO). January 29, 2019a. Archaeological Site Grid of New Jersey, Edition 20190129 (Land_use_HPO_arch_grid). GIS data. https://njogis-newjersey.opendata.arcgis.com/datasets/njdep::archaeological-site-grid-of-new-jersey

NJDEP Historic Preservation Office (HPO). January 29, 2019b. Historic Districts of New Jersey, Edition 20190129 (Land_use_HPO_district). GIS data. https://njogis-newjersey.opendata.arcgis.com/datasets/njdep::historic-districts-of-new-jersey

NJDEP Historic Preservation Office (HPO). January 29, 2019c. Historic Properties of New Jersey, Edition 20190129 (Land_use_HPO_property). GIS data. https://njogis-newjersey.opendata.arcgis.com/datasets/njdep::historic-properties-of-new-jersey

NJDEP Historic Preservation Office (HPO). January 29, 2019d. Historic Property Features of New Jersey, Edition 20190129 (Land_use_HPO_property_feature). GIS data. https://njogis-newjersey.opendata.arcgis.com/datasets/njdep::historic-property-features-of-new-jersey

Ocean Township. 1949. The Township of Ocean: 1849-1949. Commemorative Book Published for the Centennial Celebration.

Land Use

Monmouth County Planning Department (MCPD). August 15,2017a. NJDEP 2002 Land Use for Ocean Township. GIS data.

Monmouth County Planning Department (MCPD). August 15,2017b. NJDEP 1995/1997 Land Use for Ocean Township. GIS data.

Monmouth County Planning Department (MCPD). August 15,2017c. NJDEP 1986 Land Use for Ocean Township. GIS data.

Monmouth County Planning Department (MCPD). August 15,2017d. NJDEP 1972 Land Use for Ocean Township. GIS data.

NJDEP. February 17, 2015. Land Use/Land Cover 2012 Update, Edition 20150217 Subbasin 02040301 - Mullica-Toms (Land_lu_2012_hu02040301). GIS data. http://www.state.nj.us/dep/gis/lulc12.html

NJDEP. July 12, 2010. NJDEP 2007 Land use/Land Cover Update, Monmouth Watershed Management Area, WMA12. GIS data. https://www.nj.gov/dep/gis/lulc07shp.html

US Geological Survey (USGS). 2010. Edited by NJDEP, Bureau of Geographic Information Systems (BGIS) 1998, 2000, 2001, 2002, 2005, 2007, 2010. NJDEP MODIFIED ANDERSON SYSTEM 2007 derived from: A Land Use and Land Cover Classification System for Use with Remote Sensor Data, USGS Professional Paper 964, 1976. 35 pages. http://www.state.nj.us/dep/gis/digidownload/metadata/lulc07/anderson2007.html

Internet Resources: Background

Demography

Recent Census Data:
https://www.census.gov/quickfacts/fact/table/oceantownshipmonmouthcountynewjersey,monmouthcountynewjersey/PST045218

History

Ancient America: Learning Lenape: http://www.njskylands.com/hs_lenape_083.htm

Lenape Lifeways. 2002. About the Lenapes. http://www.lenapelifeways.org/lenape1.htm

Native People of New Jersey: http://www.usgennet.org/usa/nj/state/Lenape.htm

New Jersey Comprehensive Statewide Historic Preservation Plan, 2013-2019:
http://www.nj.gov/dep/hpo/Index_HomePage_images_links/hpo_plan%202013_2019/hpoplan2014.pdf

Land Use

Land Use Chapter from 2016 Monmouth County Master Plan: http://co.monmouth.nj.us/documents/24/MP%20-%20Chapter%202.pdf

3. NATURAL RESOURCES

3.1 CLIMATE & METEOROLOGY

3.1.1 Climate

The American Meteorological Society defines weather as atmospheric variations on the short-term (minutes to days), including characteristics such as temperature, precipitation and wind. In contrast, *climate* is defined as the meteorological conditions in terms of long-term averages (a month or more) (American Meteorological Society, 2015).

Climate is a major factor in determining the kinds of plants and animals found in an ecosystem. New Jersey has a temperate climate because it has mild average temperatures, four seasons, and rainfall distributed throughout the year. The dominant atmospheric circulation is the prevailing westerlies, the broad, undulating flow of air from west to east across the middle latitudes of North America. Prevailing winds are from the southwest in summer and from the northwest in winter (ONJSC, No Date).

The NJ State Climatologist has collected and evaluated more than a century of data from 19 stations within NJ in order to chart weather variables over the past century (e.g. min. and max. temperature, precipitation). The weather station nearest to Ocean Township that was evaluated for this climate study was the Long Branch Station[4], which was monitored from October 1, 1907 through January 4, 2007 (Robinson, 2010; Hartman, 2002). According to the NJ State Climatologist, a "Preponderance of evidence suggests climate change is occurring and humans are responsible for a significant portion of recent changes." (Robinson, September 30, 2016).

According to the National Oceanic and Atmospheric Administration's (NOAA) National Climatic Data Center (NCDC), the temperature trend (annual average) in Monmouth County is +0.3°F per decade, and the precipitation trend is +0.23 inches per decade (for the period of record 1895 to 2018) (NOAA, March 24, 2019), illustrated in **Figure 3.1.1**.

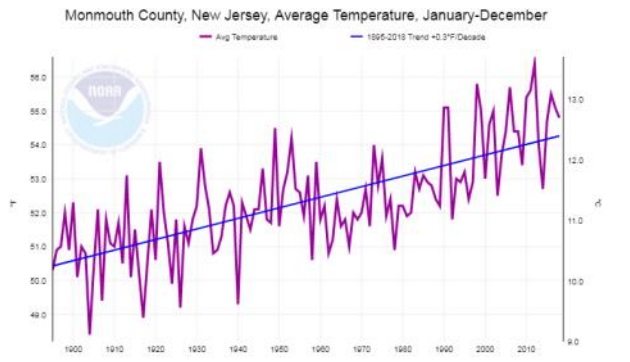


Figure 3.1.1. Monmouth County Average Temperature and Average Precipitation Trends

Source: NOAA National Centers for Environmental information, Climate at a Glance: County Time Series, published March 2019, retrieved on March 24, 2019 from https://www.ncdc.noaa.gov/cag/

NOAA summarizes New Jersey's climate as follows:

[4] The Long Branch weather monitoring station was located about a half mile northeast of Ocean Township, in Long Branch City (Lat 40'17" Lon 74'00" and 30' above sea level), Monmouth County.

- Average annual temperatures have increased by 3°F over the past century.
- Precipitation has been variable, with wetter than average conditions over the past decade.
- Sea level along the New Jersey coast has risen by more than 16 inches over the past century (Runkle et. al., 2017)

In addition, the NCDC calculates state *normals* (three-decade averages) of climatological variables, including temperature and precipitation. The normal maximum temperature for New Jersey has increased between 0.5 to 0.7°F for 1981-2010 compared to the 1971-2000 period. Normal minimum temperature for the state has increased 0.3 to 0.5°F (NOAA, May 16, 2011).

The impacts of climate change in New Jersey may include increasing temperature, changing precipitation patterns (more intense river flooding during winter and spring, and drought during summer and fall), rising sea levels, retreating shores, saltwater intrusion, infrastructure damage, challenges for agriculture and fishing, and increased risks to human health (such as increasing respiratory ailments and diseases such as Lyme disease) (USEPA, August, 2016).

Online sea level rise and flood mapping tools are listed in **Internet Resources**.

3.1.2 Precipitation and Temperature

As the prevailing westerly winds shift north and south and vary in strength, they bring wet, dry, hot, and cold airstreams. These influence the weather throughout New Jersey, resulting in highly variable daily weather. The Office of the New Jersey State Climatologist (ONJSC) divides New Jersey into five distinct climate regions. Ocean Township is included in the Coastal Zone, which includes the coastal portions of Monmouth, Ocean, Burlington and Atlantic Counties and nearly all of Cape May County (ONJSC, No Date).

Weather in the coastal zone is determined by both continental and oceanic influences. Proximity to the Atlantic Ocean has a moderating effect on air temperatures, resulting in more gradual changes and less extreme fluctuations than elsewhere in the state. Between October and April, the coastal zone is especially prone to storms that track along the coastal plain or offshore, bringing strong winds and heavy rains to the region. The coastal zone is particularly vulnerable to tropical storms and hurricanes, which may account for a significant amount of the regional precipitation in a given year. In addition to rain and wind, damage from high tides is often associated with severe coastal storms (ONJSC, No Date).

The ONJSC's New Jersey Weather and Climate Network maintains weather stations which transmit real-time data and weather forecasts on the Internet. One hundred years of data from the Long Branch/Oakhurst weather station (1908-2017) is summarized in **Table 3.x** which displays monthly average high, low and mean temperatures, record highs and lows, and average monthly precipitation. Presently, the nearest active station to Ocean Township is the Oceanport Station at Monmouth Park Racetrack, which has been running since December 15, 2011. Current local conditions and forecasts for the area are available at http://www.njweather.org/station/3481.

Measurable precipitation falls in New Jersey on approximately 120 days per year. At the Long Branch weather station, annual precipitation averaged 48.66 inches (for the period 1908-2017), which is near the higher end of the range of 40 to 51 inches in New Jersey (see **Table 3.1.1**) (ONJSC, Undated; ONJSC, 2018a).

Rainfall is distributed fairly evenly throughout the year, with February being the driest month. On average, August has the highest precipitation, but conditions may appear drier because evapotranspiration exceeds precipitation (ONJSC, 2018b). The portion of Monmouth County that includes Ocean Township averages more than 14 days per year with precipitation one inch or greater, while precipitation levels exceeding two inches are only likely to occur two to three days per year (ONJSC, 2019).

Table 3.1.1. Temperature & Precipitation Records from Long Branch, NJ, 1908-2017

Month	Temperature (°F)					Cumulative Average Precipitation
	Avg. High	Avg. Low	Mean	Record High	Record Low	
January	41.2	24.1	32.7	76°F (1950)	-8°F (1984)	4.21 in.
February	43.3	26.3	34.8	78°F (1985)	-12°F (1934)	3.04 in.
March	49.5	32.7	41.1	87°F (1945)	5°F (1943)	4.16 in.
April	58.7	41.4	50.1	92°F (1929)	12°F (1923)	4.39 in.
May	68.1	50.5	59.3	97°F (1925)	29°F (1978)	4.05 in.
June	77.8	60.7	69.3	99°F (1925/34/52/88)	37°F (1938)	3.48 in.
July	82.8	65.9	74.3	106°F (1936)	45°F (1984)	4.77 in.
August	81.3	65.2	73.2	101°F (1948, 2001)	43°F (1976)	5.02 in.
September	75.7	58.0	66.8	98°F (1983)	32°F (1983)	3.62 in.
October	65.6	46.4	56.0	95°F (1941)	24°F (1983)	4.42 in.
November	56.1	38.3	47.2	83°F (1950)	13°F (1929/30)	3.61 in.
December	46.4	29.2	37.8	74°F (1984)	-10°F (1942)	3.89 in.
Average Annual Precipitation:						48.66 in
Source: ONJSC, 2018a http://climate.rutgers.edu/stateclim_v1/dailynormalsextremes.html						

Snow typically contributes relatively little to the total precipitation in Ocean Township (about 10" of snow equals 1" of rain). Records from a nearby weather station where snowfall is recorded (Freehold/Marlboro) show an average seasonal total of 21-25 inches. However, the annual snowfall totals are highly variable, ranging from 1.5 inches during the winter of 1999-2000 to 66.9 inches during the winter of 1957-1958 (ONJSC, 2018c).

The Monmouth County growing season averages about 181 days, although the season is highly variable within the county due to coastal influences. The average date for the last killing spring frost is April 20th, and the first frost of fall occurs around October 19th (USDA, 1989).

3.1.3 Extreme Weather

Most areas of New Jersey receive 25 to 30 thunderstorms per year, with fewer storms near the coast than farther inland. In addition, each year between 1 and 10 nor'easters bring strong winds and heavy rains to the state, particularly in the coastal zone. Approximately five tornadoes appear each year in New Jersey (usually relatively weak ones) (ONJSC, Undated). Eleven tornadoes have been recorded in Monmouth County since 1950, occurring in 1952, 1955, 1960, 1964(2), 1994, 1997, 2001, 2011 and 2017 (2) and two funnel clouds have also been documented (in 2000 and 2006). During the same period, 47 hail events were recorded throughout the County (NOAA, 2018).

Table 3.1.2 lists some of the highest snow and rainfall received in one month at the Freehold weather station for the period 1893 to 2018 (the most recent data available on the Internet) (ONJSC, 2018c).

Tropical storms and hurricanes can contribute significant rainfall and can cause flooding, with the added dynamic of high wind. Some of the major storms that have affected eastern Monmouth County are described here. Hurricane Floyd battered New Jersey on September 16, 1999, and the toll was greatest in the northern and central regions of the state. Other noteworthy tropical storms in recent years include Bertha (July 13, 1996), Isabel September 18-19, 2003), Hanna (September 6, 2008) and Irene (August 27, 2011). Although post-tropical, Superstorm Sandy (October 28-30, 2012) was the costliest natural disaster in New Jersey, and the hardest hit areas were the coastal regions of Monmouth and Ocean Counties (NOAA 1950-2016). Ten days prior to the storm, Ocean Township had received over two inches of rain in a 24-hour period. Sandy then delivered heavy rain, a record coastal storm surge and hurricane-force wind gusts. Some of the highest wind speeds recorded during that event were in Monmouth County (Robinson, 2012).

Table 3.1.2. Highest Monthly Precipitation Measured at Freehold, NJ

Rank	Greatest monthly snowfall		Greatest monthly rainfall	
	Amount	Date	Amount	Date
1st	32.6"	February 1899	19.94"	August 2011
2nd	31.5"	February 2010	13.55"	July 1897
3rd	31.0"	February 1934	13.20"	October 2005
4th	26.0"	December 1957	12.22"	August 1955
5th	25.3"	February 1967	11.49"	July 1945
6th	23.6"	February 1979	11.43"	August 1971
Source: ONJSC, 2018c				

Monmouth County is also susceptible to non-tropical coastal flooding, which occurs fairly frequently in the region. In addition to Superstorm Sandy, 78 coastal flooding events have been recorded from 1996-2016 (NOAA, 1950-2016). Seven of these events resulted in extensive property damage within the eastern part of the Monmouth County (**Table 3.1.3**).

Table 3.1.3. Monmouth County (Eastern Zone) Losses from Recent Coastal Flooding Events

Date	Estimated Cost	Cause
October 28, 2012	$ 5,000,000,000	Sandy
January 7, 1996	$ 2,800,000	coastal flood
March 13, 2010	$ 1,000,000	coastal flood
November 13, 2009	$ 1,000,000	northeaster
February 4, 1998	$ 500,000	northeaster
February 12, 2006	$ 100,000	winter storm
March 7, 2013	$ 75,000	northeaster
Source: NOAA, 1950-2016.		

At the other extreme, extended periods of time with less than normal amounts of precipitation result in drought; agriculture suffers, wells can fail, reservoir levels fall and water supplies can be threatened. NJDEP (2019a) has divided the state into six regions for the purpose of water supply monitoring, and provides information about droughts for each region using indicators of 90-day precipitation, 90-day stream flow, reservoir levels and ground water levels for each region. Ocean Township lies within the Coastal North Drought Region.

During a *drought watch*, voluntary water conservation measures are encouraged. During a *drought warning*, measures are taken to manage water supplies in order to avert a *drought emergency*. A water supply emergency results in mandatory restrictions on water use in order to curtail water demand. New Jersey's longest and most severe drought occurred in the 1960s, extending from June 1961 through August 1966 (Bauersfeld et. al., 1989), and resulted in a major disaster declaration for the state (FEMA, 2017). FEMA (2017) also lists an emergency declaration for the state during the drought of June 1980 to April 1981. The most recent long-term drought of significance began in October 2001, was declared an emergency in March 2002 and ended in January 2003 for north and central New Jersey, while recent drought watches were implemented during 2010 and 2016 (NJDEP, 2019b). Local rainfall records from the weather monitoring station in Freehold indicate that average annual precipitation in the area is 46.51 inches (ONJSC, 2018c). The five years with lowest precipitation, based on long-term data from the Freehold site, are shown in **Table 3.1.4**.

Table 3.1.4. Lowest Annual Precipitation*

Rank	Year	Amount (inches)	Deviation from Mean
1st	1965	31.75"	-14.76"
2nd	1963	33.89"	-12.62"
3rd	1981	36.43"	-10.08"
4th	1957	37.05"	- 9.46"
5th	1943	37.29"	- 9.22"
*Recorded at Freehold, NJ 1894-2018; mean = 46.51 inches			
Source: ONJSC, 2018c			

References: Climate and Meteorology

American Meteorological Society. 2015. "Weather" and "Climate" in Glossary of Meteorology. http://glossary.ametsoc.org. Accessed September 25, 2017.

Bauersfeld, W.R., R.D. Schopp and M.D. Schulman. 1989. U.S. Geological Survey Water Supply Paper 2375. National Water Summary 1988-89--Floods and Droughts. Pages 401-408. https://md.water.usgs.gov/publications/wsp-2375/nj/

FEMA (Federal Emergency Management Agency). 2017. https://www.fema.gov/disasters/grid/state-tribal-government/37?field_disaster_type_term_tid_1=6857

Hartman, Richard V. 2002. Selected New Jersey Station Histories. Project Completed for Independent Study. Under Direction of Paul J. Croft, Ph.D. with Assistance from Dave A. Robinson, Ph.D. Updated by Mathieu Gerbush (4/2007). http://climate.rutgers.edu/stateclim_v1/hist.html

NOAA (National Oceanic and Atmospheric Administration). 2018. Storm Events Database 1950-2018. http://www.ncdc.noaa.gov/stormevents/

NOAA National Centers for Environmental information, Climate at a Glance: Global Mapping, published March 2019, retrieved on March 24, 2019 from https://www.ncdc.noaa.gov/cag/

NOAA (National Oceanic and Atmospheric Administration) National Centers for Environmental Information. May 16, 2011. NOAA's 1981-2010 Climate Normals. https://www.ncdc.noaa.gov/news/noaa%E2%80%99s-1981%E2%80%932010-us-climate-normals-overview

NJDEP. 2019a. NJ Drought Information - Current Conditions. https://www.nj.gov/dep/drought/current.html

NJDEP. 2019b. NJ Drought Information - Previous News and Announcements. https://www.nj.gov/dep/drought/news-archives.html

ONJSC (Office of the New Jersey State Climatologist). Undated. Climate Overview. http://climate.rutgers.edu/stateclim/?section=uscp&target=NJCoverview

ONJSC (Office of the New Jersey State Climatologist). 2019. Climate Maps. http://climate.rutgers.edu/stateclim/?section=menu& target=clim_maps

ONJSC (Office of the New Jersey State Climatologist). 2018a. Daily Station Averages & Extremes. http://climate.rutgers.edu/stateclim_v1/dailynormalsextremes.html

ONJSC (Office of the New Jersey State Climatologist). 2018b. Historical Monthly Station Data:Long Branch/Oakhurst. http://climate.rutgers.edu/stateclim_v1/monthlydata/index.php?stn=284987&elem=pcpn

ONJSC (Office of the New Jersey State Climatologist). 2018c. Historical Monthly Station Data: Freehold/Marlboro. http://climate.rutgers.edu/stateclim_v1/monthlydata/index.php?stn=283181&elem=snow

Robinson, David A., PhD. September 30, 2016. Exploring NJ Climate Variability and Change. Presentation to the Association of NJ Environmental Commissions. Outline available at http://www.anjec.org/pdfs/Congress16-PresentationKeynote.pdf

Robinson, David A., PhD. November 7, 2012. Sandy Strikes: October 2012 Report. Office of the New Jersey State Climatologist (ONJSC). http://climate.rutgers.edu/stateclim/?section=menu& target=oct12

Robinson, David A., PhD. 2010. NJ Climate Report Card. A Report Prepared by Dr. David A. Robinson, NJ State Climatologist for the NJ Department of Environmental Protection. http://climate.rutgers.edu/stateclim_v1/climreportcard/climate_report_card.html

Runkle, J., K. Kunkel, S. Champion, R. Frankson, B. Stewart, and W. Sweet. 2017. New Jersey State Summary. NOAA Technical Report NESDIS 149-NJ, 4 pp. https://statesummaries.ncics.org/nj

USDA (United States Department of Agriculture, Soil Conservation Service). April, 1989. Soil Survey of Monmouth County. https://www.nrcs.usda.gov/Internet/FSE_MANUSCRIPTS/new_jersey/monmouthNJ1989/monmouth.pdf

USEPA (United States Environmental Protection Agency). August 2016. What Climate Change Means for New Jersey. EPA 430-F-16-032. https://www.epa.gov/sites/production/files/2016-09/documents/climate-change-nj.pdf

Internet Resources: Climate and Meteorology

NJ Weather and Climate Network: Current local conditions and forecasts are available at Oceanport, NJ:
https://www.njweather.org/station/3481

Office of the New Jersey State Climatologist (ONJSC)
ONJSC Home Page: http://climate.rutgers.edu/stateclim/
NJ Drought Watch: http://www.njdrought.org/
Regional Drought Information: https://www.nj.gov/dep/drought/current.html
Weather and Climate Network Index: https://www.njweather.org/

National Weather Service Forecast Ocean, NJ:
https://forecast.weather.gov/MapClick.php?lat=40.2539&lon=-74.0123

National Weather Service National Hurricane Center: https://www.nhc.noaa.gov/

Sea Level Rise
Climate Central Surging Seas Risk Finder: https://riskfinder.climatecentral.org/
Directly to Ocean Township:
https://riskfinder.climatecentral.org/place/wanamassa.nj.us?comparisonType=place&forecastType=NOAA2017_int_p50&level=6&unit=ft&zillowPlaceType=place
NJ Coastal Communities Initiative: http://www.prepareyourcommunitynj.org/
NJ Flood Mapper (an interactive mapping website to visualize coastal flooding hazards and sea level rise):
http://www.njfloodmapper.org/slr/
National Storm Surge Hazard Maps (map application, not real-time)
https://noaa.maps.arcgis.com/apps/MapSeries/index.html?appid=d9ed7904dbec441a9c4dd7b277935fad

3.2 AIR QUALITY

3.2.1 Introduction to Air Quality

The New Jersey Comparative Risk Project (March 2003), funded by the United States Environmental Protection Agency (USEPA) and the NJDEP, combined the efforts of 73 experts to analyze and rank 88 chemical, physical and biological factors ("stressors") according to their relative negative impacts on human health, ecological quality, and socioeconomic conditions (monetary cost). The study ranked several air pollutants among the highest risks to human health, including ground-level ozone, particulate matter, radon[5], secondhand tobacco smoke, and volatile organic compounds (VOCs). Air pollution is estimated to have medium to medium-high socioeconomic impact, and lesser impacts to ecological quality (Steering Committee of the NJ Comparative Risk Project, 2003).

Exposure to air pollution is a widespread problem that occurs throughout the entire state. Airborne pollutants come from a wide variety of sources, including industry, utilities, manufacturing and commercial sources, vehicles and residential activities (such as oil burning for home heating, and painting houses). On hot summer days, when pollutant levels are worst, winds in New Jersey are usually blowing from the southwest, carrying air pollution from the Washington, Baltimore and Philadelphia metropolitan areas to New Jersey. In turn, these winds carry the pollution created here to New York, Connecticut and further to the northeast.

After the passage of the Clean Air Act in 1970, the USEPA set National Ambient Air Quality Standards (NAAQS) for six pollutants, known as the *Criteria Pollutants:* nitrogen dioxide, lead, sulfur dioxide, ozone, carbon monoxide, and particulate matter. These pollutants are addressed throughout the country through a planning process and the concentrations of these pollutants in air have been monitored for compliance with the air quality standards. Since 1970, concentrations of these six pollutants have been significantly reduced throughout the country, although there has been a slight increase in particulate matter since 2016 (USEPA, 2019a and 2019b). Areas of the country where air pollution levels persistently exceed the NAAQS are designated *nonattainment*.

New Jersey has never exceeded the NAAQS for nitrogen dioxide (NO_2), and has not exceeded the standard for lead since the early 1970s. As of 2014, Warren County was the only county to exceed the sulfur dioxide (SO_2) standard, but since Pennsylvania's Portland Power Plant shut down its coal-fired units all of New Jersey is in attainment of the SO_2 standard. Five New Jersey counties, and selected urban areas in ten additional counties, are included in the state's three 8-hour carbon monoxide (CO) maintenance plan areas (see **Figure 3.2.1**). With the exception of the Borough of Freehold, all of Monmouth County is currently in attainment of the standard for CO. Thirteen New Jersey counties, including Monmouth, shown in **Figure 3.2.1,** are presently designated as nonattainment areas for both the particulate matter ($PM_{2.5}$)[6] annual standard of 15 $\mu g/m^3$,[7] and for the 24-hour 35 $\mu g/m^3$ standard (see **Figure 3.2.1**). Monmouth County is also part of the Northern New Jersey-New York-Connecticut nonattainment area for the Ozone standard (revised in 2015 to 0.071 ppm (see **Figure 3.2.1**) (NJDEP Bureau of Air Quality Planning, January 28, 2019).

The USEPA requires New Jersey to report the emissions from major sources annually. To accomplish this, the Emission Statement Rule (N.J.A.C. 7:27-21) requires the annual reporting of emissions from stationary sources for the following air contaminants; carbon monoxide (CO), sulfur dioxide (SO_2), ammonia (NH_3), total suspended particulate matter (TSP), respirable particulate[6] matter (PM_{10} and $PM_{2.5}$), lead (Pb), volatile organic compounds (VOC), oxides of nitrogen (NO_x), carbon dioxide (CO_2), methane (CH_4) and the 36 toxic air pollutants (TAPs).

[5] Radon is discussed in **Section 5.5.1**.

[6] Particulate air pollution is covered in **Section 3.2.3.**

[7] $\mu g/m^3$ = micrograms per cubic meter of air (a microgram is one millionth (10^{-6}) of a gram).

A real-time Air Quality Index (AQI) provides a descriptive rating and a color code (e.g. green=good) for levels of $PM_{2.5}$, O_3, NO_2, SO_2 and CO at twelve sites around the state (https://aqicn.org/map/newjersey/). The station closest to Ocean Township is located at Rutgers University in New Brunswick. Another real-time monitoring resource was developed by the U.S. Environmental Protection Agency, National Oceanic and Atmospheric Administration, National Park Service, tribal, state, and local agencies in order to provide the public with easy access to national air quality information. The nearest station to Ocean Township is located at Monmouth University in West Long Branch, and monitors O_3 and $PM_{2.5}$ (AirNow, 2016). (See **Internet Resources** for links to current air quality at the sites). The following paragraphs provide more information about ground-level ozone, particulates, air toxics and atmospheric deposition.

3.2.2 Ground-level Ozone

Ground-level ozone (O_3) causes serious adverse health and environmental effects. It forms in the air from volatile organic compounds (VOCs) and nitrogen oxides (NO_x) under conditions of high temperature and bright sunlight. Sources include vehicles, power plants and factories. The hottest days of summer can yield unhealthy levels of ozone.

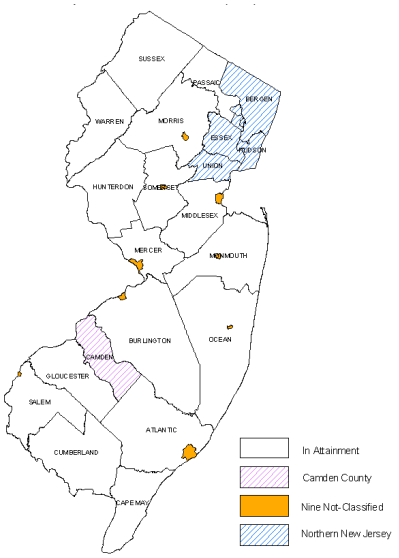
The National Ambient Air Quality Standards (NAAQS) for ozone were revised in 2008 and again in 2015 because the USEPA determined that the previous standards were inadequate to protect public health. The standard of 0.071 ppm is calculated as an average over 3 years of the annual fourth-highest daily maximum 8-hour concentration (USEPA, January 31, 2019a).

The Clean Air Act requires that all areas of the country be evaluated and then classified as attainment or non-attainment areas for each of the National Ambient Air Quality Standards. Using the most recent data throughout the state, the USEPA has classified northern New Jersey as being "moderate" and southern New Jersey as "marginal" for non-attainment of the 8-hour ozone NAAQS, as illustrated in **Figure 3.2.1**. A "marginal" area has a design value of 0.071 up to but not including 0.081 ppm. New Jersey's 2015 Ozone Summary states that significant further improvements will require reductions in both VOCs and NOx, which will have to be achieved over a large region because levels in New Jersey are impacted by emissions from upwind sources (USEPA, May 3, 2013; USEPA, January 31, 2019; NJDEP Bureau of Air Monitoring, 2015).

3.2.3 Particulates

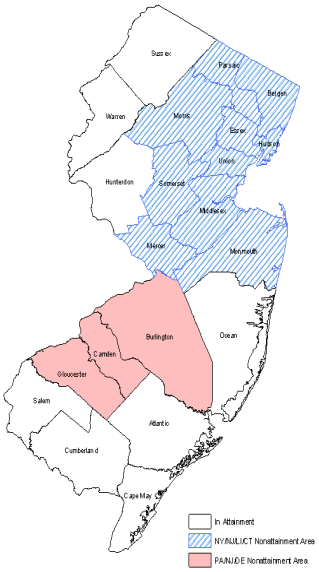
Particulate air pollution consists of both solid particles and liquid droplets suspended in the atmosphere, usually less than 70 microns in diameter. In addition to human health and environmental effects, particulate matter is a major cause of reduced visibility. Particulate matter smaller than 2.5µ (µ=microns, equal to 0.001 millimeter) diameter ($PM_{2.5}$) are considered *Fine Particulates*, while larger particles are considered *Coarse Particulates*. Coarse Particulates are made up of Total Suspended Particulates (TSP) and Inhalable Particulates (PM_{10}). All sizes are harmful to the environment, but coarse particles smaller than 10 microns (PM_{10}) are inhalable, therefore are considered harmful to human health, while fine particles less than 2.5 microns ($PM_{2.5}$) are even more detrimental to human health. Coarse particle sources include windblown dust and industrial sources, while fine particles come from combustion sources or are formed in the atmosphere from gaseous emissions. In December 2012, the EPA revised the standard from 15.0 $\mu g/m^3$ to 12.0 $\mu g/m^3$. An area will meet the standard if the three-year average of its annual average $PM_{2.5}$ concentration (at each monitoring site in the area) is less than or equal to 12.0 $\mu g/m^3$ (USEPA, November 12, 2018 and December 20, 2016).

New Jersey Carbon Monoxide (CO) Maintenance Areas



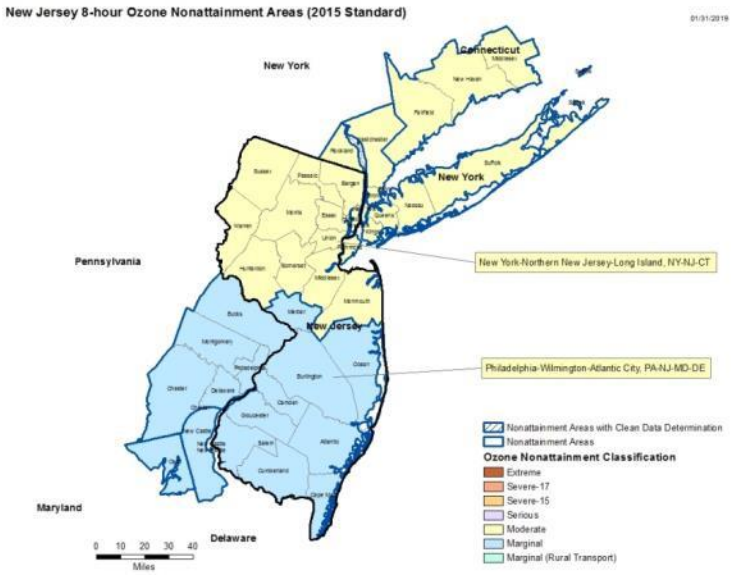
Carbon Monoxide [76 FR 54294, Aug 31, 2011]
Primary Standard:
8-hour average = 9 ppm not to be exceeded more than once per year.
1-hour standard = 35 ppm not to be exceeded more than once per year.

New Jersey Annual Fine Particulate Matter ($PM_{2.5}$) Nonattainment Areas



Particle Pollution, $PM_{2.5}$ [as of Dec 14, 2012]
Primary:
Annual mean, averaged over 3 years=12 µg/m^3;
Secondary:
Annual mean, averaged over 3 years=15 µg/m^3;
Primary & Secondary:
24-hour 98th percentile, averaged over 3 years=35 µg/m^3

New Jersey 8-Hour Ozone Nonattainment Areas(2015 standard)



Ozone, 8-hour [83 FR 25776, June 4, 2018]
Primary & secondary:
Annual fourth-highest daily maximum 8-hour concentration averaged over 3 years = 0.075 ppm

Figure 3.2.1. National Ambient Air Quality Standards Nonattainment

Sources: NJDEP Bureau of Air Quality Planning, January 28, 2019; USEPA, January 31, 2019b.

3.2.4 Air Toxics

In 1979, NJDEP adopted a regulation that specifically addressed air toxics emissions. This rule (Control and Prohibition of Air Pollution by Toxic Substances, N.J.A.C. 7:27-17) listed 11 Toxic Volatile Organic Substances (TVOS) and required that sources emitting those TVOS to the air should register with the Department and demonstrate that they were using state-of-the-art controls to limit their emissions (NJDEP Air Toxics in NJ, January 8, 2019). Under the Clean Air Act Amendments of 1990, USEPA is required to begin to address a list of 188 of these air toxics (known as Hazardous Air Pollutants, or HAPs). NJDEP works with USEPA to implement these various strategies to reduce air toxics throughout the state. Human health issues related to air toxics are addressed in **Section 5.1.1**.

3.2.5 Atmospheric Deposition

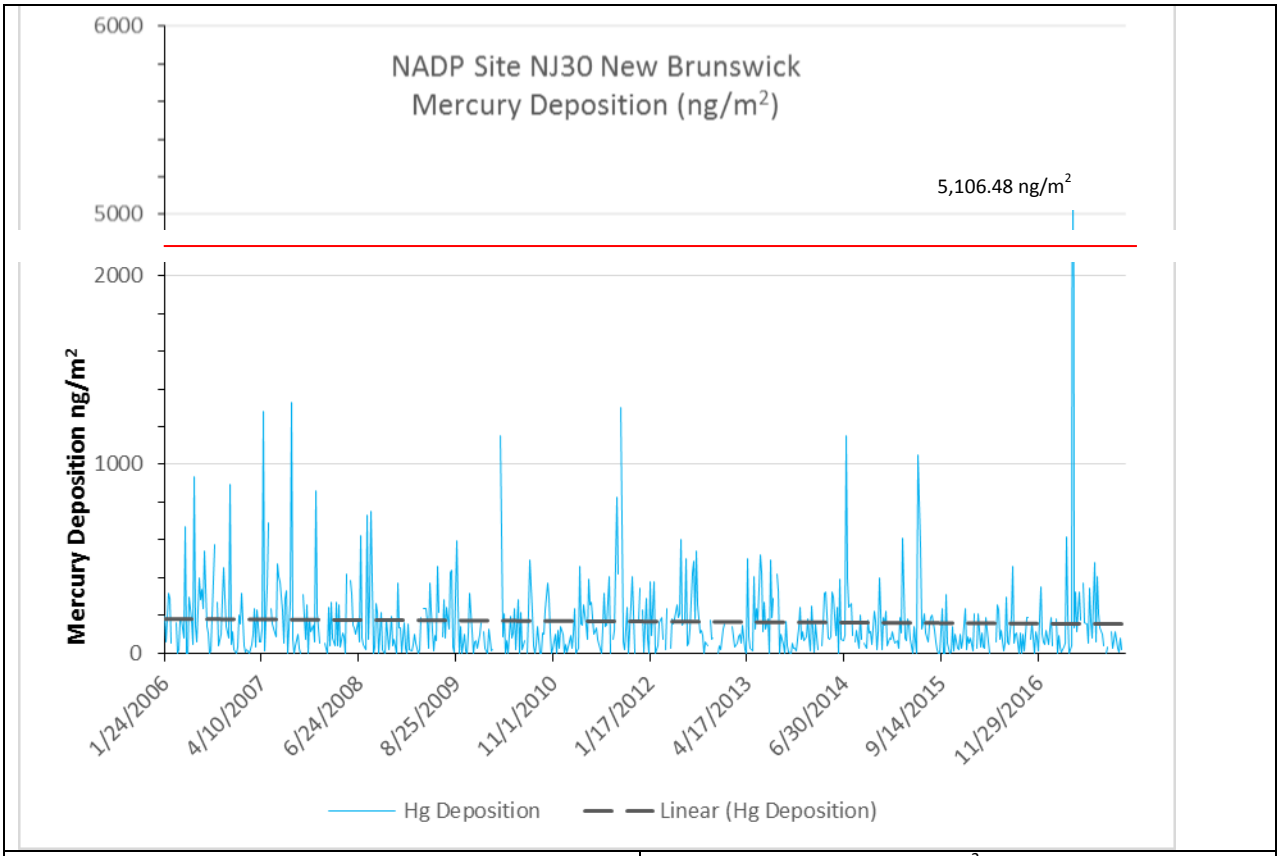
Pollution that is deposited on land or water from the air is called *atmospheric deposition.* Wet deposition is washed from the air by precipitation, while dry deposition refers to particulates that settle out of the atmosphere during dry weather. Sources include motor vehicles, power plants, and incinerators. The major pollutants of concern are sulfur dioxide (SO_2), nitrogen oxides (NO_x), mercury (Hg), and volatile organic compounds (VOCs). In addition, the presence of these pollutants changes the pH of the precipitation which can harm plants and aquatic life (trout are particularly sensitive) and deplete nutrients from soils.

The closest National Atmospheric Deposition Program (NADP) site is located in Cattus Island Park in Ocean County, which has been monitored since December 2012. Results for 2016 and show mean pH values of 5.17 (normal rainfall has a pH of about 5.6). This is acidic, but is an improvement from 2013, when pH averaged 5.04 at this site. Trends show an increase in the concentrations of a number of elements that were relatively stable from 2013-2015, including sulfate ($SO_{4)}$, calcium (Ca), Magnesium (Mg), Potassium (K), sodium (Na), and chloride (Cl^-) (NADP, 2019a).

Mercury (Hg) is a highly toxic heavy metal. Human health concerns of mercury are discussed in **Section 5.1.1**. The exposure to mercury is not from ambient air, but from deposition of airborne mercury onto surface water, vegetation and soil, which can then enter the food and water supply. On the basis of preliminary data from the New Jersey Air Deposition Network, the deposition of mercury from the air is higher than the national average of 10 $\mu g/m^2$/year. In NJ, the major sources of mercury are steel and iron manufacturing, coal combustion, products (such as broken fluorescent tubes), and municipal and sludge incineration. Mercury persists in the atmosphere up to two years and reaches the surface through atmospheric deposition, where it may persist as methyl mercury in the soil for decades. Mercury is never removed from the environment but accumulates in biological tissue (bioaccumulation) (see **Section 5.1.2 for Fish Consumption Advisories**) (NJDEP New Jersey Mercury Task Force, December 2001).

The NADP has monitoring programs for both atmospheric mercury and mercury deposition. In New Jersey, two sites are currently monitored for mercury as part of the Atmospheric Mercury Network (AMNet): NJ54 Elizabeth Lab and NJ30 New Brunswick. A former site at Brigantine was inactivated in 2015 when the other two sites started up (NADP, 2019b). The Mercury Deposition Network (MDN) provides a long-term record of total mercury (Hg) deposition in precipitation throughout the United States and Canada, including one site in New Jersey (see **Figure 3.2.2**). Twelve years of data show almost no change in mercury deposition at the New Brunswick site from 2006-2017 (NADP, 2019c).

In addition to directly measuring mercury in precipitation, a study of mercury in lake sediment cores can be representative of atmospheric deposition over long periods of time. A 2003 study by the NJDEP Division of Science, Research and Technology, with sites throughout New Jersey, demonstrated that, while mercury levels have decreased, they are still present at levels far higher than natural levels (Kroenke et al, 2003; Schuster et al, 2004).



MDN Site NJ30 (New Brunswick) Latitude: 40.4728 Longitude: -74.4226 Date Range Displayed: weekly data collected from 01/17/2006 to 1/2/2018	Average: 184.8 ng/m^2 Maximum: 5,106.48 ng/m^2 on 5/2/2017 Minimum: 2.48 ng/m^2 on 10/27/2015

Figure 3.2.2. Mercury Deposition Network (MDN) at New Brunswick (2006 to 2018)

Source: NADP, 2019c

References: Air Quality

AirNow. 2016. Real Time Air Quality Index. https://airnow.gov/index.cfm?action=airnow.local_state&stateid=31

Kroenke, Amy E., Edward L. Shuster, Richard F. Bopp, and Mary Downes Gastrich. February 2003. Assessment of Historical and Current Trends in Mercury Deposition to New Jersey Aquatic Systems through Analysis of Sediment/Soil Cores. NJDEP Division of Science, Research and Technology. 6 pages.
http://www.state.nj.us/dep/dsr/air/mercury-deposition-aquatic.pdf

National Atmospheric Deposition Program (NADP). 2019a. National Trends Network (NTN): Cattus Island County Park (NJ39). http://nadp.slh.wisc.edu/data/sites/siteDetails.aspx?net=NTN&id=NJ39 Accessed February 1, 2019.

National Atmospheric Deposition Program (NADP). 2019b. Atmospheric Mercury Network (AMNet). NADP Program Office, Wisconsin State Laboratory of Hygiene, 465 Henry Mall, Madison, WI 53706.
http://nadp.slh.wisc.edu/AMNet/

National Atmospheric Deposition Program (NADP). 2019c. Mercury Deposition Network (MDN). NADP Program Office, Wisconsin State Laboratory of Hygiene, 465 Henry Mall, Madison, WI 53706. http://nadp.slh.wisc.edu/data/mdn/
NJ Data: http://nadp.slh.wisc.edu/data/sites/siteDetails.aspx?net=MDN&id=NJ30. Accessed March 30, 2019.

NJDEP Air Toxics in NJ. January 8, 2019. NJDEP Air Toxics Program. http://www.state.nj.us/dep/airmon/airtoxics/njatp.htm

NJDEP, Bureau of Air Monitoring. 2015. 2015 Ozone Summary .
http://njaqinow.net/App_Files/2015/Ozone%202015.pdf

NJDEP Bureau of Air Quality Planning. January 28, 2019. Attainment Areas Status. http://www.nj.gov/dep/baqp/aas.html.
Maps: http://www.state.nj.us/dep/baqp/images/comap.gif; http://www.state.nj.us/dep/baqp/images/8hro3map.gif;
http://www.state.nj.us/dep/baqp/images/annpmmap.gif

NJDEP New Jersey Mercury Task Force. December 2001. New Jersey Mercury Task Force Report.
Volume 1: https://www.nj.gov/dep/dsr/mercury/Mercury%20Task%20Force_Volume%20One.PDF
Volume 2: https://www.nj.gov/dep/dsr/mercury/Mercury%20Task%20Force_Volume%20Two.pdf
Volume 3: https://www.nj.gov/dep/dsr/mercury/Mercury%20Task%20Force_Volume%20Three.pdf

Shuster, Edward L., Richard F. Bopp, Amy E. Kroenke. and Mary Downes Gastrich. August 2004. Assessment of Historical and Current Trends in Mercury Deposition to New Jersey Aquatic Systems through Analysis of Sediment/Soil Cores -YEAR 2. 4 pages. http://www.state.nj.us/dep/dsr/research/mercury-deposition-yr2.pdf

Steering Committee of the New Jersey Comparative Risk Project. March 2003. Final Report of the New Jersey Comparative Risk Project. 213 pages. http://www.nj.gov/dep/dsr/njcrp/

US Environmental Protection Agency (EPA). May 3, 2013. Air Data Reports.
http://www.epa.gov/airdata/ad_reports.html.

US Environmental Protection Agency (EPA). 2019a. Air Trends. https://www.epa.gov/air-trends Accessed February 1, 2019

US Environmental Protection Agency (EPA). 2019b. Our Nation's Air - Status and Trends through 2017.
https://gispub.epa.gov/air/trendsreport/2018/

US Environmental Protection Agency (EPA). January 31, 2019a. National Ambient Air Quality Standards (NAAQS).
https://www.epa.gov/green-book

US Environmental Protection Agency (EPA). January 31, 2019b. New Jersey 8-Hour Ozone Nonattainment Areas (2015 standard). https://www3.epa.gov/airquality/greenbook/map/nj8_2015.pdf

US Environmental Protection Agency (EPA). November 12, 2018. Particulate Matter Pollution. https://www.epa.gov/pm-pollution

US Environmental Protection Agency (EPA). December 20, 2016. National Ambient Air Quality Standards (NAAQS).
https://www.epa.gov/criteria-air-pollutants/naaqs-table

Internet Resources: Air Quality

Current Air Quality: http://aqicn.org/city/usa/newjersey/rutgers-university/
https://airnow.gov/index.cfm?action=airnow.local_city&mapcenter=0&cityid=380

NJDEP Rules and Regulations (current and proposed): http://www.nj.gov/dep/rules/

Real-time Air Quality Index (AQI): https://aqicn.org/map/newjersey/

United States Environmental Protection Agency Air Topics: http://www.epa.gov/agriculture/air.html

What you can do to reduce air toxics? http://www.state.nj.us/dep/airmon/airtoxics/youcan.htm

3.3 GEOLOGY AND SOILS

3.3.1 Physiography

New Jersey can be divided into four regions, known as *physiographic provinces*, which are areas with a common geologic history and similar sequences of rock types and geologic structures (see **Figure 3.3a**).

During the Precambrian and Paleozoic Eras, the land that is now New Jersey was at the bottom of the sea, close to the equator. About 400 million years ago, the continents Europe and North America collided; forming the Appalachian Mountains, which at that time reached far higher and were more rugged than the Rocky Mountains are now (Gallagher, 1997).

In New Jersey, the Appalachian Mountains are known as the *Valley and Ridge Province.* This Province is characterized by long, parallel ridges and valleys, and encompasses the northwestern section of New Jersey. High Point, with an elevation of 1,803 feet and the highest point in New Jersey, is located in this Province (NJGS, 2006a).

Bordering the Valley and Ridge Province to the southeast, the *Highlands Province* consists of a series of ridges. Metamorphic granite and gneiss rocks 1.2 billion to 900 million years old (the oldest rocks in the state) are resistant to erosion and create a hilly upland. Wawayanda Mountain is the highest point (1,496 feet) in the Highlands. Elevations decrease to the southeast and southwest. The Highlands Province is also characterized by deep, steep-sided valleys carved by streams (NJGS, 2006a).

The Highlands Province is separated from the *Piedmont Province* by a series of major faults, where the crystalline rocks of the Highlands touch the much younger sedimentary and igneous rocks of the Piedmont. The Piedmont Province is characterized by gently rolling hills. The rocks of the Piedmont are of Late Triassic and Early Jurassic age, 240 to 140 million years old (NJGS, 2006a).

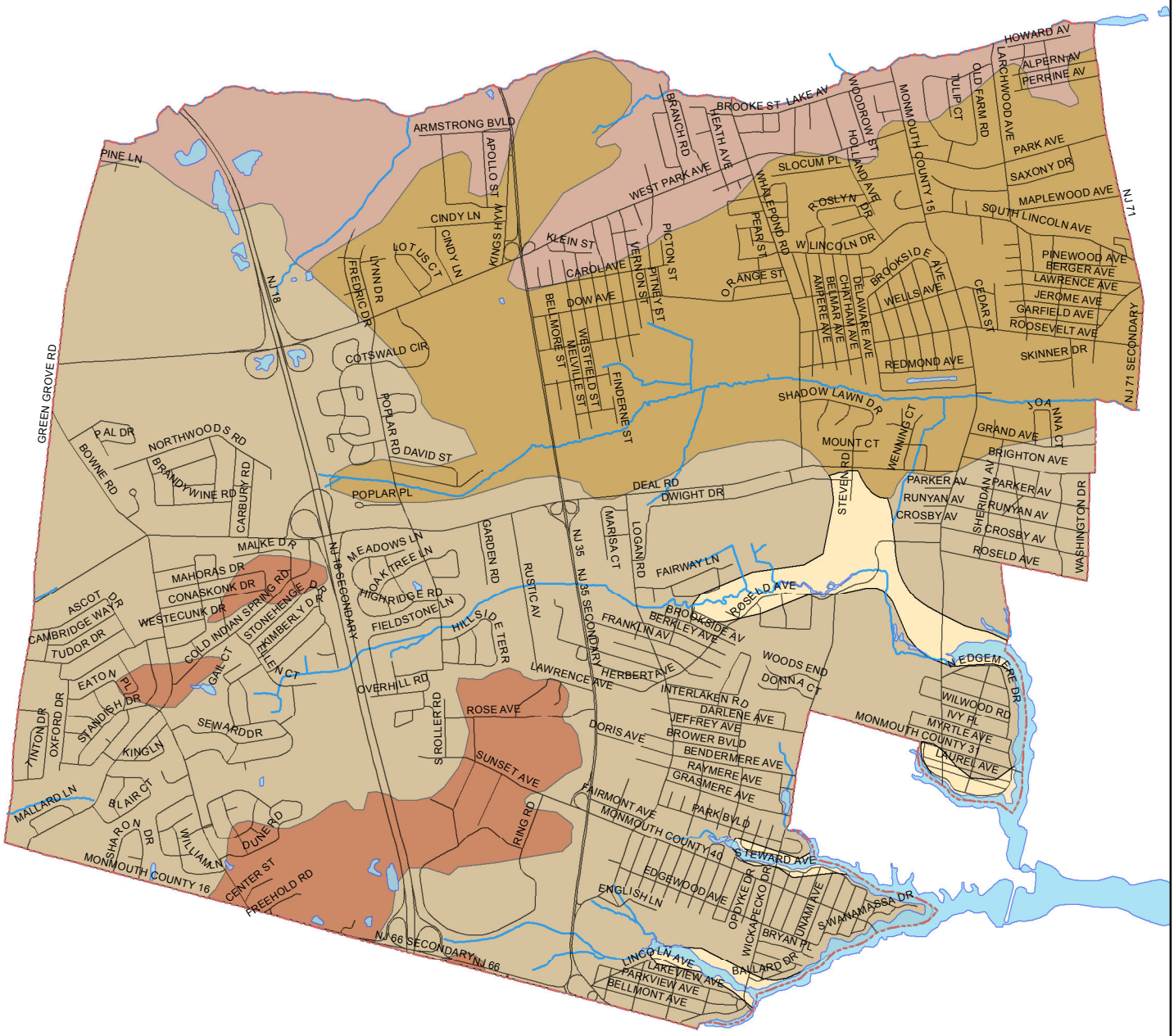
Sediments that eroded from adjacent uplands were deposited along rivers and lakes within the basin, and they became compacted and cemented to form conglomerate, sandstone, siltstone and shale bedrock. Roughly 200 million years ago, the supercontinent Pangaea broke apart, and the Atlantic Ocean was born. This was accompanied by volcanic activity, which resulted in magma flowing at the surface (forming basalt) or near the surface (forming diabase) (Lucey, 1971).

Overlapping the Piedmont Province, the relatively flat terrain of the *Coastal Plain Province* consists of unconsolidated sedimentary formations, such as sands, clays, and marls. These range in age from 90 to 10 million years old (NJGS, 2006a). The Coastal Plain Province is sometimes divided into the Inner and Outer Coastal Plains with Ocean Township located in the latter.

Within the past two million years, the climate alternated between cool and warm. During periods of glaciation, the glaciers covered northern New Jersey and extended as far south as Perth Amboy, NJ, while the area below that became cold tundra. At times, the Coastal Plain was under the Atlantic Ocean, although at other times, the shore may have extended a hundred miles beyond the present shore (White, 1998).

3.3.2 Elevation

Topography depicts the relief features of an area. The median elevation of Ocean Township's land area is 82 feet above the ocean at mid-tide. The elevation in Ocean Township ranges from about sea level along the eastern boundary of the Township (2.14 feet near the wetlands edge at Garvin Ave.) to 179 feet above sea level on the upland ridge at the end of Northland S. Rd. at Bownlard. The areas bordering Deal Lake are less than 10 feet elevation (NJDEP New Jersey Geological Survey (NJGS). June 30, 2002) (see **Figure 3.3.2**).



Legend

- Ocean Township
- Roads
- Water

Geologic Formation

- Tch: Cohansey Formation
- Tkl: Lower Member of Kirkwood Formation
- Tmq: Manasquan Formation
- Tsr: Shark River Formation
- Tvt: Vincentown Formation

N

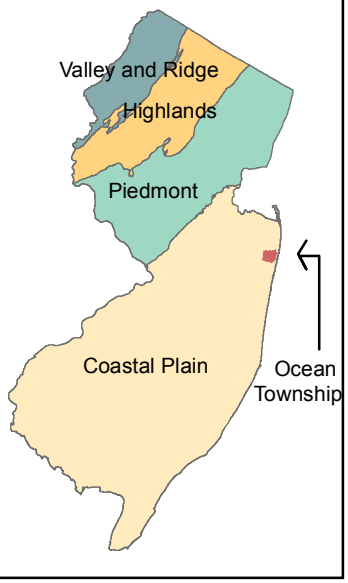
0 0.25 0.5 1 Miles

Data Sources: NJDEP, NJDOT

Disclaimer required for NJDEP Data: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Kratzer Environmental Services
Ocean Township ERI 2019

Figure 3.3.1. Geology Ocean Township, Monmouth County



3.3.3 Slope

Steep slopes are of concern in many localities in New Jersey, and do occur in Ocean Township. In particular, steep slopes greater than 25% are concentrated along the headwater uplands of the following streams; Hollow, Harvey, Poplar, and Whale Brooks. They also occur along the southern boundary between Freehold Rd. and Route 18, in the center of the Township between Sunset Ave and Hillside Terrace, and along Route 18 and Stonehenge Rd. Areas of lesser slope are found scattered across a north/south band/ridge along both sides of Route 18 (see **Figure 3.3.3**).

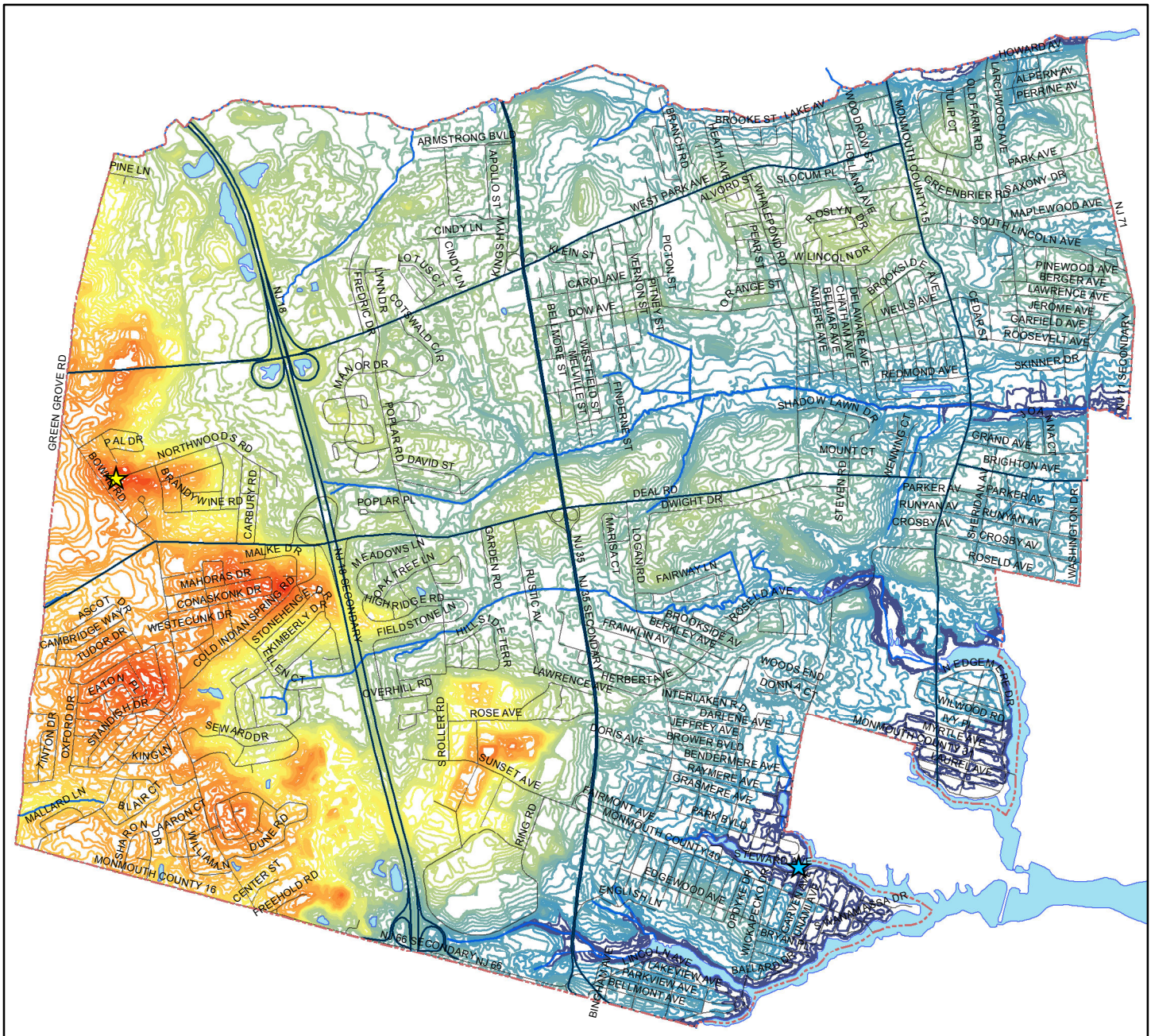
3.3.4 Geology

Bedrock is the solid rock beneath the soil and surficial rock. However, per convention by the USGS, coastal plain bedrock in New Jersey is considered to be unconsolidated sediments deposited from roughly the time of Cohansey Formation deposition and older (Scott Stanford, personal communication, March 7, 2017; see also Stanford and Sugarman, 2010). Solid crystalline basement rock is found beneath the New Jersey Outer Coastal Plain but it is difficult to study as it is deep below the surface. Information from scattered well samples taken from Monmouth County indicate that basement rock under the county is predominantly metamorphic schist. The average depth to basement rock in these wells ranged from 600 feet – 1390 feet (Volkert et al. 1996). The formations considered bedrock geology in Ocean Township are listed and described in **Table 3.3.1** and illustrated in **Figure 3.3.1.**

The sand hills at the western end of Sunset Avenue are composed of higher elevations of the Cohansey Formation, and contribute sand to the tributaries of Deal Lake (Kenneth Lutz, personal communication, May 12, 2019; Jablonski, 1968).

Table 3.3.1. Characteristics of Geologic Formations Found in Ocean Township

Abbreviation	Age	Geologic Formation	Lithology (physical character of the rocks)	Area	Percent of Ocean Township
Tch	Middle Miocene	Cohansey Formation	quartz sand, medium- to coarse grained	415.3	5.9
Tkl	Lower Miocene	Lower Member of Kirkwood Formation	quartz sand and clay	3750.8	53.4
Tsr	Upper and Middle Eocene	Shark River Formation	silt and clay; glauconite sand to a lesser extent	206.3	2.9
Tmg	Lower Eocene	Manasquan Formation	quartz-glauconite sand, clayey; and fine grained quartz sand or silt	1943.1	27.6
Tvt	Upper Paleocene	Vincentown Formation	quartz sand, medium-grained, clayey; and glauconitic near base; locally a calcarenite or coquina	715.02	10.17
			Total	**7030.4**	**100.0**
Source: Stanford and Sugarman, 2010					



Legend

Measured Elevation Points

- Lowest (2.14 feet)
- Highest (179 feet)
- Ocean Township
- Roads
- Major Roads
- Waterbodies

Elevation (2 foot intervals)

- 2.0 - 20.3
- 20.3 - 28.6
- 28.6 - 36.9
- 36.9 - 45.2
- 45.2 - 53.5
- 53.5 - 61.8
- 61.8 - 70.1
- 70. - 78.4
- 78.4 - 86.7
- 86.7 - 95.0
- 95.0 - 103.3
- 103.3 - 111.6
- 111.6 - 119.9
- 119.9 - 128.2
- 128.2 - 136.5
- 136.5 - 144.8
- 144.8 - 153.1
- 153.1 - 161.4
- 161.4 - 169.7
- 169.7 - 178.0

N

0 0.25 0.5 1 Miles

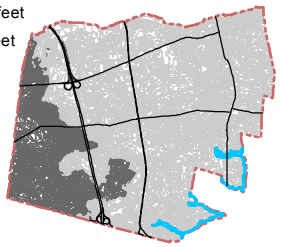
Data Sources: NJDEP, NJDOT and Monmouth County
Disclaimer required for NJDEP Data: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

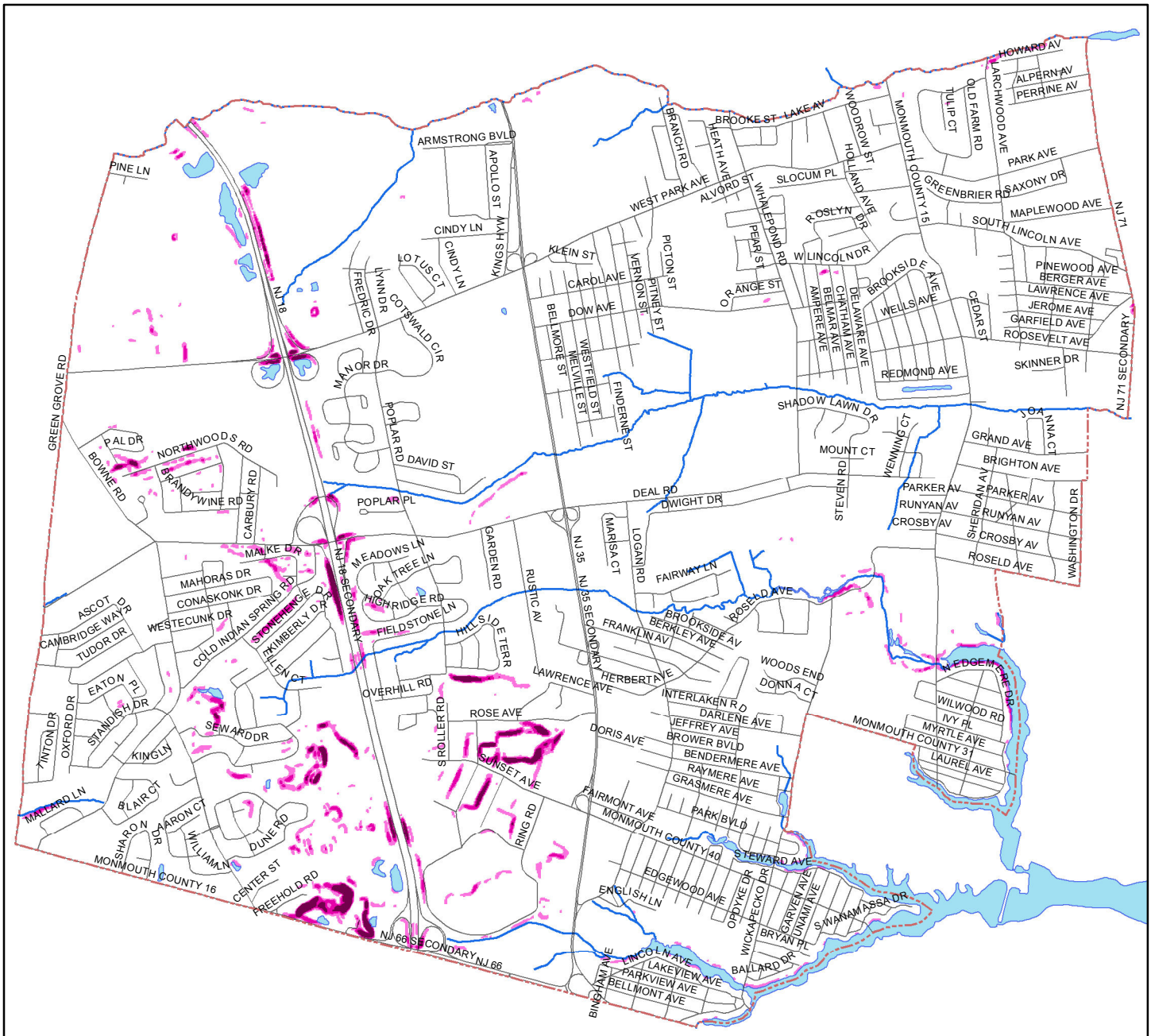
Kratzer Environmental Services
Ocean Township ERI 2019

Figure 3.3.2. Elevation of Ocean Township, Monmouth County

Elevation

- 82 to 178 feet
- 10 to 82 feet
- < 10 feet





Legend

- Ocean Township
- Roads
- Waterbodies
- Steep Slopes over 25%
- Steep Slopes 20 to 25%
- Steep Slopes 15 to 20%

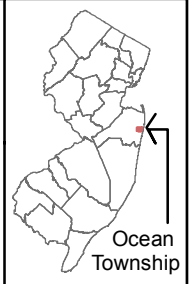
N

0 0.25 0.5 1 Miles

Data Sources: NJDEP, NJDOT and Monmought County
Disclaimer required for NJDEP Data: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Kratzer Environmental Services
Ocean Township ERI 2019

Figure 3.3.3. Steep Slopes of Ocean Township, Monmouth County



3.3.5 Surficial Geology

Surficial materials are the recent unconsolidated sediments that overlie bedrock formations, and that are the parent material for soils. Surficial geology deposits in Ocean Township consist of materials deposited by oceans over many millions of years, and are considered to be deposits laid down since the Cohansey Formation. The characteristics of surficial geology types found in Ocean Township are provided in **Table 3.3.2** and illustrated in **Figure 3.3.4**. In Ocean Township, sea level fluctuations over "recent" millennia were caused by the cycle of glacial/interglacial periods. However, there are no glacial deposits evident in this part of the coastal plain.

Table: 3.3.2. Characteristics of Surficial Geology Found in Ocean Township

Abbreviation Name	Lithology (physical character)	Geologic Age	Notes	Acres	Percent of Ocean Twp.
Qal ALLUVIUM	Sand, silt, clay, peat; yellowish brown, dark brown, gray; and pebble gravel. Abundant organic matter. Sand is chiefly quartz, with some glauconite and mica. Gravel is quartz and quartzite with minor ironstone. As much as 15 feet thick.	Holocene and late Pleistocene	Contains variable amounts of organic matter. Deposited in floodplains, channels, and ground-water seepage areas.	107.7	1.53
Qs SWAMP AND MARSH DEPOSITS	Freshwater peat and organic silt, sand, and clay; dark brown to black. As much as 10 feet thick.	late Pleistocene and Holocene	Deposited in modern freshwater wetlands.	67.8	0.96
Qe EOLIAN DEPOSITS	Windblown fine-to-medium sand, very pale brown to reddish yellow. Sand is chiefly quartz with minor glauconite and mica in places. As much as 20 feet thick.	late Pleistocene and Holocene	Form sand sheets and, locally, dunes.	37.2	0.53
Qtl LOWER STREAM TERRACE DEPOSITS	Sand and minor silt; yellow, yellowish brown, reddish yellow; and pebble gravel. Sand is chiefly quartz with some glauconite and mica. Gravel is quartz and quartzite with minor ironstone. As much as 30 feet thick.	late Pleistocene	Forms stream terraces with surfaces 5 to 20 feet above the modern floodplain	2,259.9	32.14
Qcl LOWER COLLUVIUM	Sand, silt, minor clay; yellow, yellowish brown, reddish yellow, light gray; some quartz and ironstone pebbles. As much as 20 feet thick, generally less than 10 feet thick.	late Pleistocene	Forms aprons at the base of slopes on Coastal Plain formations. Graded to lower stream terraces or the modern floodplain.	898.0	12.77

Abbreviation Name	Lithology (physical character)	Geologic Age	Notes	Acres	Percent of Ocean Twp.
Qcm2 CAPE MAY FORMATION, UNIT 2	Sand, minor silt and clay; very pale brown, yellow, white, olive yellow; and pebble gravel. Sand is chiefly quartz with minor glauconite and mica; gravel is quartz and quartzite. As much as 50 feet thick.	late Pleistocene [late Sangamonian]	Forms a shore-facing terrace with surface elevation between 15 and 40 feet. Deposited in beach and estuarine settings during the Sangamon highstand (interval when sea-levels were at their highest) and between 120,000 and 130,000 years ago	63.0	0.90
Qcm1 CAPE MAY FORMATION, UNIT 1	Sand, minor silt and clay; very pale brown, yellow, reddish yellow; and pebble gravel. Sand is chiefly quartz, with minor glauconite and mica; gravel is quartz and quartzite. As much as 30 feet thick.	Middle Pleistocene	Forms a shore-fronting marine terrace with surface elevation between 50 and 75 feet. Deposited in beach and estuarine settings during a middle? Pleistocene highstand (interval when sea-levels were at their highest)	2,222.9	31.62
Qtu UPPER STREAM TERRACE DEPOSITS	Sand, minor silt; yellow, reddish yellow; and pebble gravel. Sand is chiefly quartz; glauconite and mica are generally less abundant than in the lower terrace deposits and alluvium. Gravel is quartz, quartzite, and minor ironstone. As much as 20 feet thick.	middle Pleistocene	Forms terraces with surfaces 20 to 50 feet above the modern floodplain	18.4	0.26
Qcu UPPER COLLUVIUM	Sand, silt, minor clay; pale brown, yellow, reddish yellow; some quartz, quartzite and ironstone pebbles. As much as 20 feet thick.	middle Pleistocene	Forms aprons graded to upper terraces	16.4	0.23
TQg UPLAND GRAVEL, LOWER PHASE	Sand, minor silt; yellow to reddish yellow; and pebble gravel. Sand is chiefly quartz with minor glauconite and mica; gravel is quartz and quartzite. As much as 20 feet thick.	late Pliocene-middle Pleistocene	Caps lower uplands and interfluves	36.6	0.52

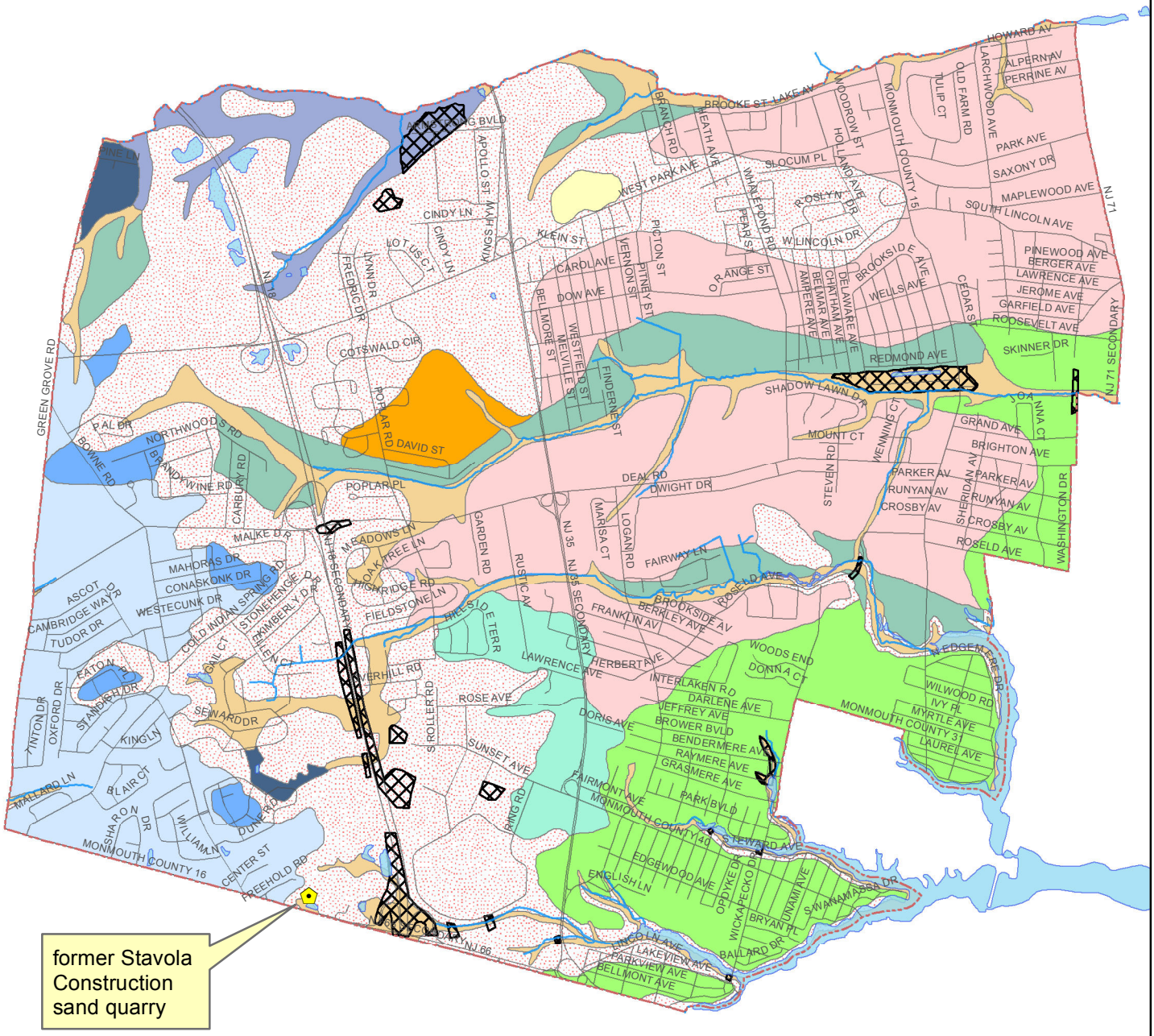
Abbreviation Name	Lithology (physical character)	Geologic Age	Notes	Acres	Percent of Ocean Twp.
Tg UPLAND GRAVEL	Sand, yellow to reddish yellow, and pebble gravel; minor fine-cobble gravel. Sand is chiefly quartz, with minor glauconite in places; gravel is quartz and quartzite with minor weathered chert. Locally iron-cemented. As much as 20 feet thick.	Pliocene-early Pleistocene	In erosional remnants on hilltops and interfluves	105.6	1.50
Qwcp WEATHERED COASTAL PLAIN FORMATIONS	Exposed sand and clay of Coastal Plain bedrock formations. May be overlain by thin, patchy alluvium and colluvium. Quartz and ironstone pebbles left from erosion of surficial deposits may be present on the surface and in the upper several feet of the formation.	Chiefly Pleistocene, locally Miocene and Pliocene.	Exposed sand and clay	1,197.9	17.02
			Total:	7,030.4	100.00
*Note on Geologic time periods: Pliocene: 3.6 to 2.6 million years ago Pleistocene: 2.6 million years ago – 117,000 years ago Holocene: 117,000 years ago – present Wisconsinan glaciation: 21,000 years ago (Wikipedia, 2019)					
Sources: NJGS, September 11, 2013 ; Stanford, 2000a and b					

Historic Fill

Historic fill is defined by NJDEP as non-indigenous material placed on a site in order to raise the topographic elevation of the site. Large areas (over 5 acres) of historic fill have been mapped by NJDEP, as required by the Brownfield and Contaminated Site Remediation Act (N.J.S.A. 58:10B-1 et seq.). Some areas of fill are inferred by comparing the extent of swamps and alluvial deposits shown on historical geologic and topographic maps to current maps. Small areas of fill are not mapped. While most urban and suburban areas are underlain by an irregular layer of excavated indigenous soil mixed with various amounts of non-indigenous material, this material generally does not meet the definition of historic fill. Also, there may be historic fill areas that were not detectable on aerial photography or by archival map interpretation, particularly along streams in urban and suburban areas (NJGS, January 26, 2016). Areas of historic fill in Ocean Township are shown on **Figure 3.3.4**.

Mining & Quarrying

According to the New Jersey Geological Survey, Stavola Construction formerly quarried sand in Ocean Township near Route 66 (shown on **Figure 3.3.4**). There are no current sand and gravel quarrying operations and no records of mining within Ocean Township (NJGS, December 12, 2006).



Legend

- Ocean Township
- Roads
- Water
- Historic Fill
- Sand Surficial Quarrying Operation

Surficial Geologic Formation

- Qal: ALLUVIUM
- Qcl: LOWER COLLUVIUM
- Qcm1: CAPE MAY FORMATION, UNIT 1
- Qcm2: CAPE MAY FORMATION, UNIT 2
- Qcu: UPPER COLLUVIUM
- Qe: EOLIAN DEPOSITS
- Qs: SWAMP AND MARSH DEPOSITS
- Qtl: LOWER STREAM TERRACE DEPOSITS
- Qtu: UPPER STREAM TERRACE DEPOSITS
- Qwcp: WEATHERED COASTAL PLAIN FORMATIONS
- TQg: UPLAND GRAVEL, LOWER PHASE
- Tg: UPLAND GRAVEL

N

0 0.25 0.5 1 Miles

Data Sources: NJDEP, NJDOT

Disclaimer required for NJDEP Data: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Kratzer Environmental Services
Ocean Township ERI 2019

Figure 3.3.4. Surficial Geology
Ocean Township, Monmouth County

Ocean Township

3.3.6 Soils

Soil Survey Maps

The *soil* is the unconsolidated mineral material on the immediate surface of the earth which serves as the medium for growth of land plants. The characteristics of each soil type have developed over time (usually many thousands of years) under the influence of the parent material (the bedrock that has broken down into small fragments to form the soil), climate (including moisture and temperature regimes), macro- and microorganisms, and topography. Soil is a basic resource for food production, in addition to its essential role in collecting and purifying water before it enters the ground water (Soil Science Society of America, 2019). However, soil itself can be a pollutant as dust in the air or as sediment in water.

The US Department of Agriculture Natural Resources Conservation Service (USDA NRCS) is the science-based agency which provides technical assistance regarding the conservation and management of soil, water, and other natural resources to private land owners, local, state, and federal agencies, and policy-makers (USDA NRCS, 2019a).

One of these technical services is the soil survey. A *soil survey* is an inventory of the country's soil resources to determine soil characteristics and capabilities and to provide interpretations to help people understand soils and their uses. Soil surveys help to identify the best ways to protect soil and water quality through the use of conservation practices, and to identify which sites are suitable (and the degree of suitability) for various land uses (e.g. septic systems, roads, agriculture) (USDA NRCS, 2019a).

The objective of soil mapping is to separate the landscape into segments that have similar use and management requirements. Therefore, this data set is not designed for use as a primary regulatory or management tool, but may be used as a broad scale reference source. According to the Soil Survey Geographic Database (also known as SSURGO) information, field investigations and data collection were carried out in sufficient detail to name map units and to identify accurately and consistently areas of about 5 acres. As with other GIS data sets, enlargement of the maps to a scale greater than the accuracy of the data can cause misinterpretation of the data. Onsite sampling, testing, and detailed study of specific sites is essential for determining intensive uses, and for managing farms and wetlands (USDA NRCS, August 21, 2017).

Soil Series and Map Units

Soil characteristics vary from place to place in slope, depth, drainage, erodibility and other characteristics that affect management. A *soil series* is a basic unit of soil classification consisting of soils that are essentially alike, except that they may differ in surface texture, stoniness, slope or some other attribute. A *map unit* is the area delineated on a soil map, representing an area dominated by one major kind of soil, and is named according to the classification of the dominant soil or soils. However, soils are natural systems, with natural variability, and the range of some observed properties may extend beyond the limits defined for the class. In addition, small areas of contrasting soils may not be visible on the maps. The databases included with the soils data describe the characteristics of each soil map unit. The NRCS has included both estimated and measured data on the physical and chemical soil properties and soil interpretations for engineering, water management, recreation, agronomic, woodland, range and wildlife uses of the soil (USDA NRCS, August 21, 2017).

There are 34 soil map units found in the Township of Ocean (**Figure 3.3.5**). The map unit descriptions and the total area for each unit are summarized in **Table 3.3.3** and briefly described in **Appendix C** using the most recent SSURGO available (USDA NRCS, October 6, 2017).

Soil Quality

Soil is arranged in horizontal layers called horizons. These horizons have technical designations largely useful for soil scientists to distinguish one soil series from another. The descriptions in the NRCS soil survey are done using soil in its native state where possible, so a soil profile which has been

disturbed may not match the written description for the series. This is the way the degree of disturbance is assessed—by comparing the soil in its native condition to the profile observed at a specific site. For example, the upper horizon is often an *A horizon*, commonly known as "*topsoil*." An A horizon typically exhibits increased organic matter, reduced clay percentage, a more granular structure of the soil aggregates, and a lower bulk density than the *B horizon* below it. If the A horizon is removed (a common practice in construction), this is evident to a trained observer and the soil would be described as having the A horizon missing. The material on the new surface does not automatically become an A horizon merely as a result of its position. It is possible over time for the newly exposed surface to acquire the characteristics of an A horizon, however this is not automatic and is highly management dependent. In technical writing, particularly in guidance documents intended for post-construction remediation, the use of the term "topsoil" should be used with caution if at all because there is no legal definition of topsoil and the materials available in commerce are highly variable in quality (Muldowney, 2011).

Soils vary naturally in their capacity to function. *Soil quality* is defined as the capacity of a specific kind of soil to function to sustain plant and animal productivity, maintain or enhance water and air quality, and support human health and habitation. *Inherent* or *intrinsic soil qualities* or characteristics of the soil are determined by factors of soil formation (climate, parent material, topography, time and biota). These are properties which cannot be altered by management except by actually replacing the present material with a different material altogether. An example of an inherent property is the percentage of sand in the soil's composition. Inherent soil quality is used to evaluate the suitability of soils for specific uses (buildings, roads, agriculture, septic systems, etc.). One measure of quality is soil particle size: A loamy soil will have higher water holding capacity than a sandy soil, and therefore will have a higher inherent quality for storing water (USDA NRCS, 2019b).

Contrasting with intrinsic soil properties are management-dependent soil properties, also known as *dynamic soil qualities*. As the term suggests, these can be altered significantly (for better or for worse) by the management of a specific parcel of land, and changes can have significant consequences for overall environmental quality. Dynamic quality is determined by soil characteristics that are affected by human use and management practices, including physical, chemical and biological properties. Soil quality or health may be evaluated by either comparison to a reference condition that represents full capacity of a soil for a specific function, or to a baseline for the management-dependent soils properties (such as before and after a land use change) (USDA NRCS, 2019b).

Degradation of soil quality occurs in many forms. Significant issues are cutting and filling, compaction, excess salt content and organic matter content. *Cutting and filling* operations actually remove, bury, or invert existing horizons such that they no longer behave in a hydrologically coherent way, with precipitation and gases readily able to enter the soil surface and transmit to horizons lower in the profile. *Compaction*, the increase of bulk density as a result of compression from the surface, is another common form of soil degradation. Compaction can be avoided by not working soil at too high a moisture content. Even foot traffic on a near saturated soil can result in lasting damage which does not resolve itself naturally. A compacted soil can have runoff characteristics more similar to pavement than to the soil in good condition (Muldowney, 2011).

Excess salt content often results from deicing salts but sometimes from fertilizer preparations. It is especially common on roadside verges. Sodium salts are especially damaging to soils because sodium causes the clays to disperse. The remedy is either prevention or washing the salt from the profile with excess water or prevention, by using less road salt or by using alternatives. Calcium chloride, for example, is relatively harmless to plants and soil (Muldowney, 2011; Wikipedia, March 25, 2019).

Table 3.3.3. Soils: Key Characteristics of Soil Types Found in Ocean Township

Map Unit Symbol	Map Unit Name	Farmland*	Urban Soil?	Water Table Depth (Min.)	Flooding	Ponding	Natural drainage class	Hyd. Group**	Hydric?	Landform	Off-road/trail erosion♦	Erosion on roads/trails♦♦	Surface runoff♦♦	Acres	Percent
AtsA	Atsion sand, 0 to 2 percent slopes	U		5”	None	5	Poorly	A/D	yes	flats	s	s	--	567.3	8.07
CoeAs	Colemantown loam, 0 to 2 percent slopes, occasionally flooded	No		15”	Occa-sional	90	Poorly	C/D	yes	Depressions, Drainageways, Flats	s	s	N	79.7	1.13
DocB	Downer loamy sand, 0 to 5 percent slopes	SI		0	None	5	Well	B	no	low hills	s	s	--	86.4	1.23
DocC	Downer loamy sand, 5 to 10 percent slopes	SI		0	None	0	Well	B	no	low hills	s	M	--	7.44	0.11
DoeB	Downer sandy loam, 2 to 5 percent slopes	P		0	None	0	Well	B	no	Fluviomarine terraces	s	s	--	102.9	1.46
DouB	Downer-Urban land complex, 0 to 5 percent slopes	no	Yes	0	None	0	Well	B	no	Knolls, Low hills	s	s	VL-VH	264.6	3.76
EkaAr	Elkton loam, 0 to 2 percent slopes, rarely flooded	SI_D		15”	Rare	85	Poorly	C/D	yes	Marine terraces	s	s	N	85.8	1.22
EveB	Evesboro sand, 0 to 5 percent slopes	no		0	None	5	Excessively	A	no	low hills	s	s	VL	817.4	11.63
EveC	Evesboro sand, 5 to 10 percent slopes	no		0	None	0	Excessively	A	no	low hills	s	M	L	328.7	4.68
EveD	Evesboro sand, 10 to 15 percent slopes	no		0	None	0	Excessively	A	no	Dunes, Low hills	s	M	L	88.6	1.26
EveE	Evesboro sand, 15 to 25 percent slopes	no		0	None	0	Excessively	A	no	low hills	M	Sev	M	18.6	0.26
EvuB	Evesboro-Urban land complex, 0 to 5 percent slopes	no	Yes	0	None	0	Excessively	A	no	Low hills	s	s	VL-VH	1,518.3	21.60
FapA	Fallsington loam, 0 to 2 percent slopes	SI_D		15”	None	5	Poorly	B/D	yes	flats	s	s	--	0.00	0.00
FrkB	Freehold sandy loam, 2 to 5 percent slopes	P		0	None	0	Well	B	no	Knolls, Low hills	s	s	L	149.3	2.12

Table 3.3.3. Soils: Key Characteristics of Soil Types Found in Ocean Township

Map Unit Symbol	Map Unit Name	Farmland*	Urban Soil?	Water Table Depth (Min.)	Flooding	Ponding	Natural drainage class	Hyd. Group**	Hydric?	Landform	Off-road/trail erosion♦	Erosion on roads/trails♦♦	Surface runoff♦♦	Acres	Percent
FrkC	Freehold sandy loam, 5 to 10 percent slopes	SI		0	None	0	Well drained	B	no	Hillslopes, Knolls	s	M	M	15.4	0.22
HboB	Hammonton sandy loam, 2 to 5 percent slopes	P		76”	None	0	Moderately well	B	no	Depressions, Flats	s	s	VH	7.0	0.10
HbrB	Hammonton-Urban land complex, 0 to 5 percent slopes	No	Yes	76”	None	0	Moderately well	B	no	Depressions, Flats	s	s	VH	105.9	1.51
HocA	Holmdel sandy loam, 0 to 2 percent slopes	P		69”	None	0	Moderately well	C	no	flats	s	s	L	186.1	2.65
HofB	Holmdel-Urban land complex, 0 to 5 percent slopes	No	Yes	69”	None	0	Moderately well	C	no	Flats, Low hills	s	M	L-VH	145.3	2.07
HumAt	Humaquepts, 0 to 3 percent slopes, frequently flooded	No		15”	Freq-uent	100	Poorly	D	yes	Flood plains	s	s	N	243.7	3.47
KemA	Keyport sandy loam, 0 to 2 percent slopes	P		61”	None	0	Moderately well	C	no	Knolls	s	s	M	130.8	1.86
KemB	Keyport sandy loam, 2 to 5 percent slopes	P		76”	None	0	Moderately well	C	no	Depressions, Flats	s	M	VH	67.5	0.96
KemC	Keyport sandy loam, 5 to 10 percent slopes	SI		61”	None	0	Moderately well	C	no	Knolls	s	M	H	3.8	0.05
KemD	Keyport sandy loam, 10 to 15 percent slopes	No		61”	None	0	Moderately well	C	no	Knolls	s	M	H	7.2	0.10
KeuC	Keyport-Urban land complex, 0 to 10 percent slopes	No	Yes	61”	None	0	Moderately well	C	no	Knolls	s	M	H-VH	192.5	2.74
KkgB	Klej loamy sand, 0 to 5 percent slopes	SI		46”	None	5	Somewhat poorly	B	no	dunes	s	s	VH	419.4	5.97
KkgkB	Klej loamy sand, clayey substratum, 0 to 5 percent slopes	SI		54”	None	0	Somewhat poorly	B	no	dunes	s	s	VL	43.5	0.62
KkhB	Klej loamy sand-Urban land complex, 0 to 5 percent	No	Yes	46”	None	0	Somewhat poorly	B	no	dunes	s	s	VH	271.2	3.86

Table 3.3.3. Soils: Key Characteristics of Soil Types Found in Ocean Township

Map Unit Symbol	Map Unit Name	Farmland*	Urban Soil?	Water Table Depth (Min.)	Flooding	Ponding	Natural drainage class	Hyd. Group**	Hydric?	Landform	Off-road/trail erosion◆	Erosion on roads/trails◆◆	Surface runoff◆◆◆	Acres	Percent
	slopes														
KrhB	Kresson loam, 2 to 5 percent slopes	SI_D		31”	None	0	Somewhat poorly	C	no	Depressions, Flats	s	M	VH	137.6	1.96
LasB	Lakewood sand, 0 to 5 percent slopes	No		0	None	0	Excessively	A	no	Flats, Knolls	s	s	VL	137.7	1.96
MakAt	Manahawkin muck, 0 to 2 percent slopes, frequently flooded	U		0	Freq-uent	100	Very poorly	D	yes	Flood plains, Swamps	s	s	N	15.8	0.22
PegB	Pemberton loamy sand, 0 to 5 percent slopes	SI		76”	None	0	Moderately well	B	no	Flats, Low hills	s	s	VL	82.7	1.18
ShrA	Shrewsbury sandy loam, 0 to 2 percent slopes	SI_D		15”	None	0	Poorly	C/D	yes	flats	s	s	VH	196.2	2.79
UdaB	Udorthents, 0 to 8 percent slopes	No		0	None	0	Well	D	no	low hills	s	M	VL	419.2	5.96
WATER	Water	--	--	0	--	0	--	--	--	--	--	--	--	68.3	0.97
WogA	Woodstown loam, 0 to 2 percent slopes	P		77”	None	5	Moderately well	C	no	flats	s	s	--	18.6	0.26
													Total	**7,030**	**100**

*Farmland: U=Unique; P=Prime; SI=Statewide Importance; SI-D=Statewide Importance, if Drained. Definitions in **Table 3.3.5**.

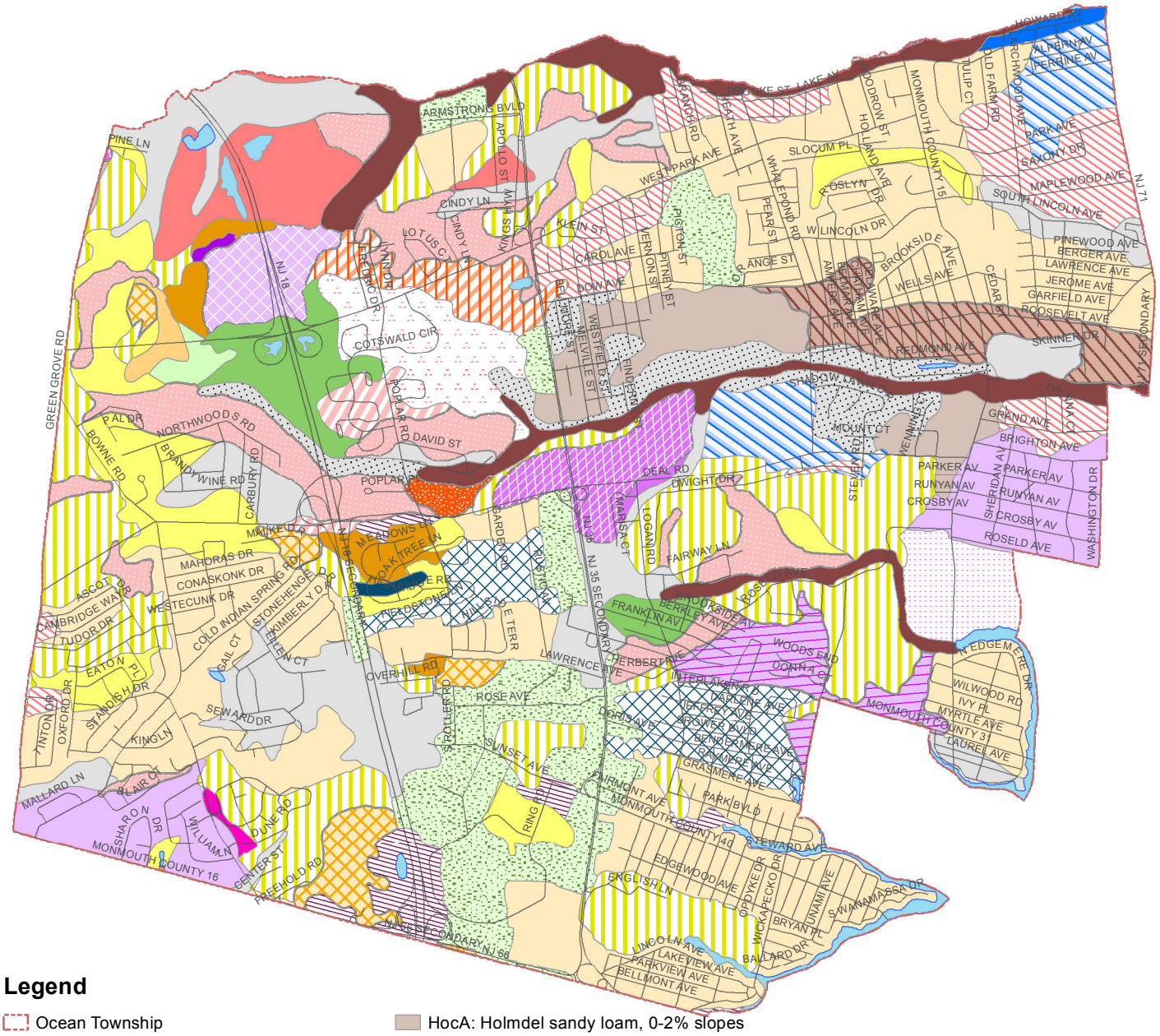
** Hydrologic Group definitions in **Table 3.3.4**.

◆Hazard of off-road or off-trail erosion: s= slight; M=Moderate (Slope/erodibility)

◆◆Hazard of erosion on roads and trails: : s= slight; M=Moderate (Slope/erodibility); Sev=Severe (Slope/erodibility)

◆◆◆Surface runoff: N=negligible; VL=very low; VL-VH=very low to very high; L-low; L-VH=Low-very high; M=medium; H-VH= High to very high; VH=very high

Source: USDA, NRCS, October 6, 2017



Legend

- Ocean Township
- Roads

Soil Map Unit

- AtsA: Atsion sand, 0-2% slopes
- CoeAs: Colemantown loam, 0-2% slopes, OF
- DocB: Downer loamy sand, 0-5% slopes
- DocC: Downer loamy sand, 5-10% slopes
- DoeB: Downer sandy loam, 2-5% slopes
- DouB: Downer-Urban land, 0-5% slopes
- EkaAr: Elkton loam, 0-2% slopes, RF
- EveB: Evesboro sand, 0-5% slopes
- EveC: Evesboro sand, 5-10% slopes
- EveD: Evesboro sand, 10-15% slopes
- EveE: Evesboro sand, 15-25% slopes
- EvuB: Evesboro-Urban land, 0-5% slopes
- FrkB: Freehold sandy loam, 2-5% slopes
- FrkC: Freehold sandy loam, 5-10% slopes
- HboB: Hammonton sandy loam, 2-5% slopes
- HbrB: Hammonton-Urban land, 0-5% slopes
- HocA: Holmdel sandy loam, 0-2% slopes
- HofB: Holmdel-Urban land, 0-5% slopes
- HumAt: Humaquepts, 0-3% slopes, FF
- KemA: Keyport sandy loam, 0-2% slopes
- KemB: Keyport sandy loam, 2-5% slopes
- KemC: Keyport sandy loam, 5-10% slopes
- KemD: Keyport sandy loam, 10-15% slopes
- KeuC: Keyport-Urban land, 0-10% slopes
- KkgB: Klej loamy sand, 0-5% slopes
- KkgkB: Klej loamy sand, clay sub., 0-5% slopes
- KkhB: Klej loamy sand-Urban land, 0-5% slopes
- KrhB: Klej loamy sand-Urban land, 0-5% slopes
- LasB: Lakewood sand, 0-5% slopes
- MakAt: Manahawkin muck, 0-2% slopes, FF
- PegB: Pemberton loamy sand, 0-5% slopes
- ShrA: Shrewsbury sandy loam, 0-2% slopes
- UdaB: Udorthents, 0-8% slopes
- WogA: Woodstown loam, 0-2% slopes
- WATER

RF=Rarely Flooded; OF=Occasionally Flooded; FF=Frequently Flooded

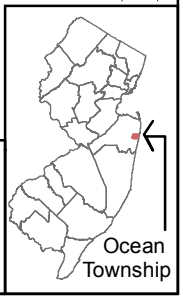
Figure 3.3.5. Soil Map Units Ocean Township, Monmouth County

0 0.25 0.5 Miles

N

Data Sources: NJDEP, NJDOT, NRCS
Disclaimer required for NJDEP Data: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Kratzer Environmental Services 2019
Ocean Township ERI



Organic matter content is another dynamic soil property. Rutgers New Jersey Agricultural Experiment Station (see **Internet Resources**) provides a chart for interpretation of organic matter percentages in New Jersey soils. Soils with a high organic content are better able to resist other forms of degradation than soils with depleted organic matter. The amount of organic matter in the upper horizons of a soil is a measure of carbon storage. Soil is the largest terrestrial reservoir of carbon and has the greatest potential for long term storage if degraded soils are managed in a way that builds up carbon. Silt loams, like the Preakness, are able to store more carbon in the form of organic matter than sandier soil. Keeping soil in good condition reduces runoff, produces cleaner runoff, requires less irrigation, grows more robust plantings, and sequesters more atmospheric carbon than a damaged soil (Muldowney, 2011).

3.3.7 Characteristics of Ocean Township's Soils

Soil properties contained in the NRCS soil survey and listed in **Table 3.3.3** are *intrinsic* soil properties. These are properties which cannot be altered by management except by actually replacing the present material with a different material altogether. Most of the following characteristics are interpretations based on measured soil properties, which are periodically updated. In addition the general rating class is presented for each map unit, but smaller areas with contracting characteristics may be present. Onsite investigation may be needed to validate these interpretations and to confirm the identity and qualities of the soil on a given site.

Depth to Bedrock

According to NJDEP (1999), *bedrock* is defined as "any solid body of rock, with or without fractures, which is not underlain by soil or unconsolidated rock material." The *depth to bedrock* is the distance from the land surface to bedrock. Depth to bedrock is an important factor when determining the suitability of land for building roads, foundations and septic systems. Crystallline bedrock outcrops (depth to bedrock equals zero inches) are absent in Ocean Township (as discussed previously, pre-Mesozoic basement rock is found deep under the ground). The soils in Ocean Township have a depth to the root-restrictive layer exceeding five feet.

Depth to Seasonal High Water Table

The *depth to seasonal high water table* (SHWT) is the distance between the ground surface and the top of the water surface in the saturated part of a water bearing zone. A SHWT of less than one foot severely constrains development, and a SHWT between 1 and 3 feet also provides obstacles to development. This is sometimes caused by a clay layer that impedes infiltration, resulting in a perched water table. On-site investigation will often reveal that these areas are actually wetlands or floodplains. High water tables impact the effectiveness of septic systems, and the freeze/thaw cycles cause frost heaving, which damages structures and roads.

Fifteen of the soil units in Ocean Township fall into the first category, with SHWTs of less than a foot. Those include the Evesboro sands, Eveboro-urban land complex, Atsion sand and Udorthents, among others. Together they comprise 65% of the soil cover in the township. Another five units, which collectively comprise 11% of the township's total soil cover, have SHWTs that range between 1.2 and 2.6 feet). The remaining 24% of the soil cover in Ocean Township has a minimum depth to seasonal high water table exceeding three feet (see **Table 3.3.3**).

Hydrologic Soil Group

The *hydrologic soil grouping* describes a group of soils having similar runoff potential under similar storm and cover conditions (how much water would runoff compared to the rate that water would infiltrate into the ground). The definitions of the hydrologic soil groups are shown in **Table 3.3.4**.

Six of the soil units in Ocean Township fall into Class A, and twelve others into Class B, nine fall into Class C and three fall into Class D (**Table 3.3.3**). The remaining four units have been assigned to multiple hydrologic soil groups. Dual ranks are indicative of soils that respond differently under varying

hydrological conditions. In those cases, the first letter applies to the soil when it is in a drained condition (seasonal high water table at least two feet below the soil surface), and the last letter shows how the soil functions when the water table is higher (USDA - NRCS, May 2008).

Table 3.3.4. Hydrologic Soil Grouping

Class	Definition
A	High infiltration rates. Soils are deep, well to excessively drained sands and gravels.
B	Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils that have moderately course textures.
C	Slow infiltration rates. Soils with layers impeding downward movement of water, or soils that have moderately fine or fine textures.
D	Very slow infiltration rates. Soils are clayey, have a high water table, or are shallow to an impervious layer.
Source: USDA NRCS, May 2007	

Soil Drainage Class

Soil Drainage Class is a code identifying the natural drainage condition of the soil and refers to the frequency and duration of periods when the soil is free of saturation or partial saturation during soil formation. It does not refer to saturation due to recently altered drainage (manmade or natural). The categories are as follows: well drained, moderately well drained, excessively drained, somewhat excessively drained, poorly drained, and somewhat poorly drained. Ocean Township has six soil types that are excessively well drained, seven soil types that are well drained, eleven that are moderately well drained, four that are somewhat poorly drained, five that are poorly drained and one that is very poorly drained (see **Table 3.3.3).** In total, less than 1% of the land in Ocean Township is very poorly drained, 12% is somewhat poorly drained, 17% is poorly drained, 13% is moderately well drained, 15% is well drained and 42% is excessively drained.

Hydric and Flooded Soils

Hydric soils are those soils that are wet long enough to periodically produce anaerobic conditions, thereby influencing the growth of plants. For delineation of hydric soils the ponding event must last longer than seven days. The six hydric soils found within Ocean Township are Atsion sand (AtsA), Colemantown Loam (CoeAs), Elkton Loam (EkaAr), Humaquepts (HumAt), Manahawkin Muck (MakAt), and Shrewsbury Sandy Loam (ShrA) (see **Table 3.3.3**). Collectively these map units comprise 16.9% of the township. **Figure 3.5.1** shows wetlands.

Annual flood frequency is a descriptive term used to describe the frequency of flooding that is likely to occur in a year. **Frequent** is > 50% chance of flooding in a given year; **occasional** is 5 to 50%; **rare** is 0 to 5% chance of flooding. In Ocean Township, the hydric soils listed in the preceding paragraph are those most likely to experience flooding or ponding (see **Table 3.3.3**). **Figure 3.4.4** shows floodplains, which encompass the frequently flooded soils.

Farmland Suitability

New Jersey uses standard categories of soil quality developed by the USDA to rank the relative value of land for farming purposes, as described in **Table 3.3.5** (NJ SADC/CADB, 2003). Although less than 0.4% of Ocean Township is used for farmland, 1/3 of the township falls into one of the farmland soils categories, as defined in **Table 3.3.3**. Seven of the soil units in Ocean Township are classified as Prime Farmland (9% of the township), and 12 others are ranked as being of Statewide Importance (15%). In the Unique category (8% of soil cover) are two of the six hydric soil types mapped in the township: the Atsion sand (AtsA) and the Manahawkin Muck (MakAT). None of the soils in Ocean Township are classified as locally important.

Legend

- Ocean Township
- Roads
- Water

Potential Erosion Hazard - Road / Trail

- Severe
- Moderate
- Slight

N

0 0.25 0.5 1 Miles

Data Sources: NJDEP, NJDOT

Disclaimer required for NJDEP Data: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Kratzer Environmental Services
Ocean Township ERI 2019

Figure 3.3.6. Soils - Potential Erosion Hazard - Road / Trail Ocean Township, Monmouth County

Ocean Township

Table 3.3.5. Farmland Rating Classes

Classification	Description
Prime	This land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber and oilseed crops and is also available for these uses. It has the soil quality, growing season, and moisture supply needed to economically produce sustained high yields of crops when treated and managed according to acceptable farming methods. Soils are not excessively erodible or saturated with water for a long period of time, and they either do not flood frequently or are protected from flooding.
Statewide	Soils of Statewide Importance are nearly Prime, and economically produce high yields of crops when treated and managed according to acceptable farming methods. Some may produce yields as high as Prime Farmland if conditions are favorable.
Local	Farmland of Local Importance includes those soils that are not prime or of statewide importance and are used for the production of high value food, fiber or horticultural crops.
Unique	These are soils with severe limitations which are used to produce special crops (e.g., cranberry bogs)
Source: NJ SADC/CADB, 2003	

Surface Runoff

The portion of precipitation or irrigation that is lost without entering the soil is called *surface runoff*, while the portion that enters the soil before reaching a stream channel is called seepage flow (Soil Science Society of America, 2019). The SSURGO provides a runoff class interpretation based on the soil saturated hydraulic conductivity (K_{Sat}) and the percent slope of the site. These calculations have been assigned to simplified classes: NEGLIGIBLE, VERY LOW, LOW, MEDIUM, HIGH, and VERY HIGH. Some soils have been assigned a range, such as VERY LOW to VERY HIGH.

The soils in Ocean Township have high or very high surface runoff characteristics in 48% of the township, medium to low on 13%, and very low to negligible on 27%. Surface runoff is not rated on the remaining 12% of land area (see **Table 3.3.3**).

Hazard of Erosion

Erosion hazard is accelerated erosion in excess of natural rates, usually as a result of anthropogenic activities, including roads, trails, and other actions that expose the soil surface (Soil Science Society of America, 2019).

The ratings in the "Potential Erosion Hazard - Road / Trail" interpretations indicate the hazard of soil loss from unsurfaced roads and trails. The ratings are based on soil erosion factor K, slope, and content of rock fragments. A hazard rating of SLIGHT indicates that little or no erosion is likely; MODERATE indicates that some erosion is likely; and SEVERE indicates that significant erosion is expected. Roads and trails with MODERATE erosion hazard may require occasional maintenance, and simple erosion control measures are needed. Significant erosion is expected on soils with SEVERE erosion hazard, and roads or trails on these soils require frequent maintenance and costly erosion-control measures (USDA NRCS, No Date(a)). Only 0.26% of Ocean Township's soils is rated SEVERE; 20% has MODERATE hazard of soil erosion (roads and trails); and 79% is rated SLIGHT (see **Table 3.3.3** and **Figure 3.6.1**).

The ratings for the "Erosion Hazard (Off-Road, Off-Trail)" interpretations indicate the hazard of soil loss from off-road and off-trail areas after disturbance activities where 50 to 75% of the soil surface has been exposed by construction, logging, grazing, mining, or other kinds of disturbance soil surface. The ratings are based on slope and soil erosion factor K. A rating of SLIGHT indicates that erosion is unlikely under ordinary climatic conditions; MODERATE indicates that some erosion is likely and that erosion control measures may be needed; SEVERE indicates that erosion is very likely and that erosion control measures, including revegetation of bare areas, are advised; and VERY SEVERE indicates that significant erosion is expected, loss of soil productivity and off-site damage are likely, and erosion control measures are costly and generally impractical (USDA NRCS, No Date(B)). All the soils in Ocean

Township are rated SLIGHT, except EveE (Evesboro sand, 15 to 25 percent slopes), which is rated MODERATE and makes up only 0.26% of the township (see **Table 3.3.3**).

References: Geology and Soils

Physiography

Gallagher, William B. 1997. When Dinosaurs Roamed New Jersey. Rutgers University Press. New Brunswick, NJ. 176 pages.

Lucey, C.S. 1971. Geology of Bergen County in brief. Bureau of Geology and Topography, New Jersey Geological Survey.

NJDEP New Jersey Geological Survey (NJGS). 2006a. Physiographic Provinces of NJ. New Jersey Geologic Survey Information Circular. http://www.state.nj.us/dep/njgs/enviroed/infocirc/provinces.pdf

NJDEP New Jersey Geological Survey (NJGS). June 30, 2002. DGS02-7: Physiographic Provinces of New Jersey. GIS data. http://www.state.nj.us/dep/njgs/geodata/dgs02-7.htm

Topography

Monmouth County Division of Planning, Office of GIS. 2017. Monmouth County Contour Database. GIS data.

Geology

Jablonski, Leo A. 1968. Ground-Water Resources of Monmouth County, New Jersey. U. S. Geological Survey SPECIAL REPORT NO. 23. https://pubs.er.usgs.gov/publication/70114619

NJDEP, New Jersey Geological Survey (NJGS). 2016. Bedrock Geologic Map of New Jersey. The Geology of New Jersey. 2 pages. http://www.state.nj.us/dep/njgs/enviroed/freedwn/psnjmap.pdf

NJDEP, New Jersey Geological Survey (NJGS). 2009. Bedrock Geology for New Jersey. DGS04-6. GIS data. http://www.state.nj.us/dep/njgs/geodata/

NJDEP, New Jersey Geological Survey (NJGS). December 12, 2006. Selected Sand, Gravel and Rock Surficial Mining Operations in New Jersey. Digital Geodata Series DGS05-1. GIS Data: http://www.state.nj.us/dep/njgs/geodata/dgs05-1.htm.

Stanford, S. 2000a. Surficial geology of the Long Branch Quadrangle, Monmouth County, New Jersey. Open File Map OFM 38, Department of Environmental Protection, Division of Science, Research and Technology, New Jersey Geological Survey. https://www.nj.gov/dep/njgs/pricelst/ofmap/ofm38.pdf

Stanford, S. 2000b. Surficial geology of the Asbury Park Quadrangle, Monmouth and Ocean Counties, New Jersey. Open File Map OFM 40. Department of Environmental Protection, Division of Science, Research and Technology, New Jersey Geological Survey. https://www.state.nj.us/dep/njgs/pricelst/ofmap/ofm40.pdf

Stanford, S.D. and P.J. Sugarman. 2010. Bedrock geology of the Long Branch Quadrangle, Monmouth County, New Jersey. Department of Environmental Protection, Land Use Management, New Jersey Geological Survey. https://www.njgeology.org/pricelst/ofmap/ofm78.pdf

Volkert, R.A., A.A. Drake, and P.J. Sugarman. 1996. Geology, Geochemistry, and Tectonostratigraphic Relations of the Crystalline Basement Beneath the Coastal Plain of New Jersey and Contiguous Areas. US Geological Survey Professional Paper 1565-B. US Government Printing Office. https://pubs.er.usgs.gov/publication/pp1565B

Surficial Geology

NJDEP New Jersey Geological Survey (NJGS). September 11, 2013 DGS07-2: Surficial Geology of New Jersey Geologic compilation by Scott D. Stanford and Ron W. Witte. GIS data. https://www.state.nj.us/dep/njgs/geodata/dgs07-2.htm

NJDEP New Jersey Geological and Water Survey (NJG&WS), January 26, 2016. DGS04-7: Historic Fill For New Jersey as of January 2016. GIS data. http://www.state.nj.us/dep/njgs/geodata/dgs04-7.htm

White, Ron W. 1998. Glacial Sediment and the Ice Age in New Jersey. NJGS Information Circular. http://www.state.nj.us/dep/njgs/enviroed/infocirc/glacial.pdf

Wikipedia. March 30, 2019 . Pleistocene. http://en.wikipedia.org/wiki/Pleistocene; Wisconsin glaciation: http://en.wikipedia.org/wiki/Wisconsin_glaciation.

William M. Kwalick Associates. January 1975. Poplar Brook Watershed Study Report, Township of Ocean Monmouth County, New Jersey.

Soils
Muldowney, Loren S. November 2011. Personal Communication. Soil Testing Laboratory, Department of Plant Biology and Pathology Rutgers School of Environmental and Biological Sciences Rutgers University.

NJ SADC/CADB. 2003. NJ State Agriculture Development Committee/ NJ County Agriculture Development Boards Farmland Preservation Program. Strategic Targeting Project Preliminary Report, March 2003. http://www.nj.gov/agriculture/sadc/farmpreserve/resources/stp2003report.pdf

Soil Science Society of America. 2019. Internet Glossary of Soil Science Terms. https://www.soils.org/publications/soils-glossary. Accessed March 30. 2019.

US Department of Agriculture, Natural Resources Conservation Service (NRCS). No Date(a). Potential Erosion Hazard - Road / Trail. https://www.nrcs.usda.gov/wps/PA_NRCSConsumption/download?cid=nrcseprd1295781&ext=pdf. Accessed March 30, 2019.

US Department of Agriculture, Natural Resources Conservation Service (NRCS). No Date(b). Erosion Hazard (Off-Road, Off-Trail). https://www.nrcs.usda.gov/wps/PA_NRCSConsumption/download?cid=nrcseprd1295780&ext=pdf. Accessed March 30, 2019.

US Department of Agriculture, Natural Resources Conservation Service (NRCS). 2019a. NRCS Soils Website. http://soils.usda.gov/ . Accessed March 30, 2019.

US Department of Agriculture, Natural Resources Conservation Service (NRCS). 2019b. Technical Soil Services Handbook (TSSH), Part 624 Soil Quality. https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/ref/?cid=nrcs142p2_053400. Accessed March 30, 2019.

US Department of Agriculture, Natural Resources Conservation Service (NRCS). October 6, 2017. USDA Soil Survey Geographic (SSURGO) database for Monmouth County, New Jersey. Survey Area Version: 12. Survey Area Version Date: 09/15/2018. Template database version: 36. Online_Linkage: https://websoilsurvey.sc.egov.usda.gov/

US Department of Agriculture, Natural Resources Conservation Service (NRCS). August 21, 2017. The Web Soil Survey Site. http://websoilsurvey.nrcs.usda.gov/app/

US Department of Agriculture, Natural Resources Conservation Service (NRCS). May 2007. Part 630 Hydrology National Engineering Handbook . Chapter 7 - Hydrologic Soil Groups. https://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba

Wikipedia. Accessed March 25, 2019. Calcium chloride. http://en.wikipedia.org/wiki/Calcium_chloride

Internet Resources: Geology and Soils

Geology
USGS programs in NJ: http://water.usgs.gov/pubs/FS/FS-030-96/

The Geology of New Jersey (NJ Geological Survey): http://www.state.nj.us/dep/njgs/index.html

The Paleontology Portal: http://www.paleoportal.org

The Physiographic Provinces of NJ (NJ Geological Survey): http://www.state.nj.us/dep/njgs/enviroed/infocirc/provinces.pdf

Soils
NRCS New Jersey Office: http://www.nj.nrcs.usda.gov/

NRCS Soils Website: Helping People Understand Soils: http://soils.usda.gov/
https://www.nrcs.usda.gov/wps/portal/nrcs/site/soils/home/

NRCS Soil Data Mart (download soils data for GIS): http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx

NRCS Soils Online Study Guide: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/nj/home/?cid=nrcs141p2_018928

Rutgers New Jersey Agricultural Experiment Station Soil Testing Laboratory Interpretation of Organic Matter Levels in New Jersey Soils: https://njaes.rutgers.edu/soil-testing-lab/organic-matter-levels.php

Web Soil Survey (online soils mapping): http://websoilsurvey.nrcs.usda.gov/app/

3.4 HYDROLOGY

3.4.1 Watersheds and Surface Waterways

Surface water is water that is visible above the ground surface, including creeks, rivers, ponds, lakes, and wetlands. Surface water is generally hydraulically connected to ground water, although the interactions are difficult to observe and are affected by variations in weather and human activities. Streams connect with ground water in in three basic ways: Streams can gain water from ground water through the streambed, lose water to ground water through the streambed, or have both gaining and losing reaches (Winter et. al., 1998).

Hollow Brook, a tributary of Deal Lake, as seen from South Ditmar Street (by Dollar General).

Watersheds and Subwatersheds

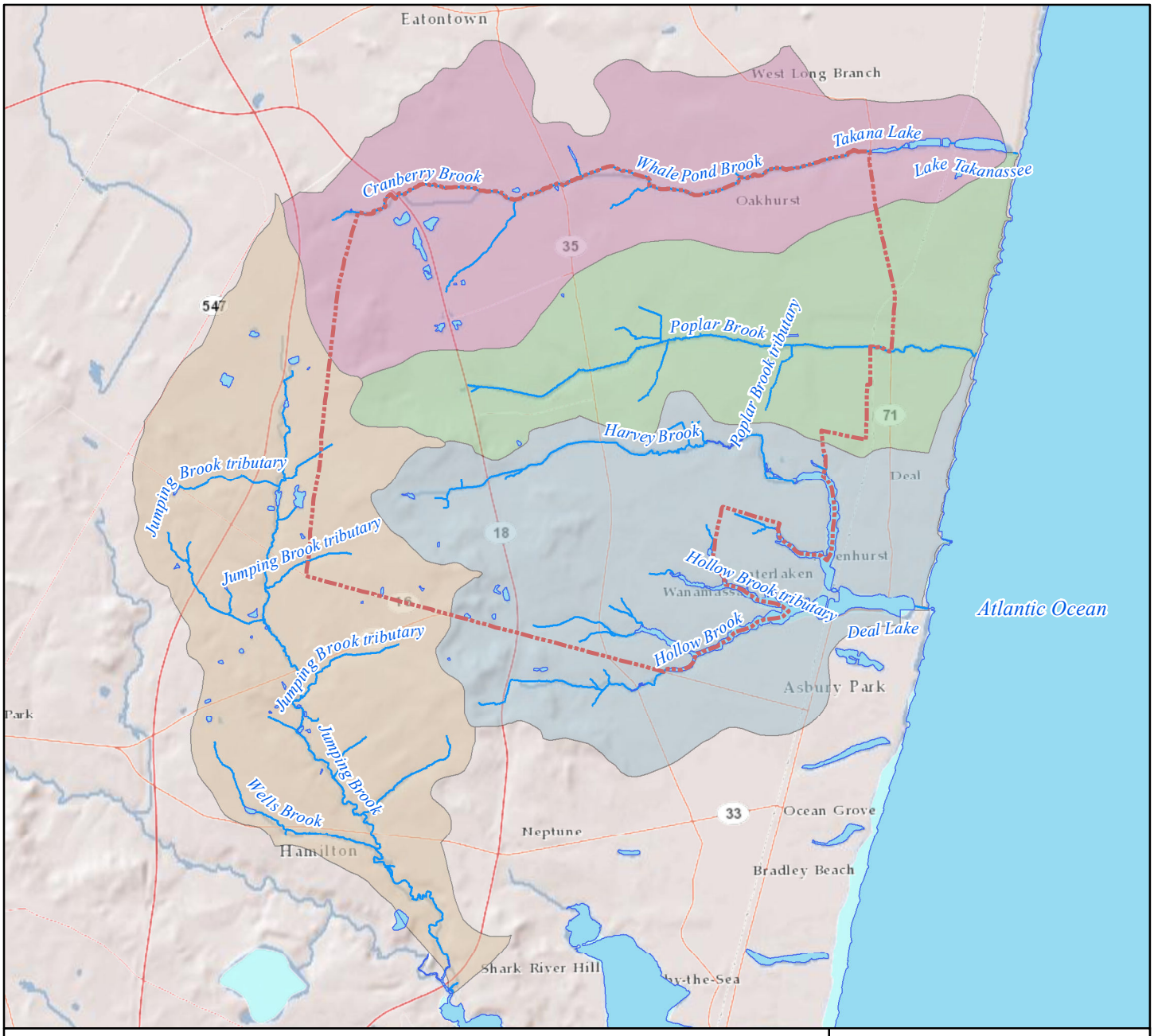
A *watershed* (or basin) is the land area within the confines of a drainage divide in which all surface runoff will drain into a river, river system, or body of water. The Township of Ocean is within the Atlantic coastal watershed. Watersheds can be divided in smaller subwatersheds. The land area of Ocean Township contributes surface runoff to four subwatersheds, illustrated in **Figure 3.4.1**.

Hydrologic Unit Codes (HUC)

The U.S. Geological Survey created a hierarchical numbering system of *Hydrologic Unit Codes* which divides the United States into successively smaller nested watersheds. The first 2 digits of the code refer to the USGS Water Resources Region and a HUC beginning with "02" is in the Mid-Atlantic Region. The first 4 digits (also known as a HUC4) refer to the major drainage basin, or sub-region, and a HUC4 of "0203" is the Lower Hudson-Long Island sub-region. In areas with a HUC8 of "02030104" the water flows generally towards Sandy Hook, NJ and Staten Island, NY (USGS, 2016). The land area of Ocean Township drains four separate HUC14 subwatersheds towards the Atlantic Ocean. HUC14 sub-watersheds encompassing the Township of Ocean are shown in **Figure 3.4.1** and listed in **Table 3.4.1** (NJDEP March 8, 2016).

Table 3.4.1. Hydrologic Unit Codes for Ocean Township's Sub-watersheds

HUC4	HUC8	14-Digit Hydrologic Unit Code (HUC14)	Sub-watershed Name
0203 -- Lower Hudson-Long Island	02030104 -- Sandy Hook-Staten Island NJ, NY	02030104090010	Whale Pond Brook
		02030104090020	Poplar Brook
		02030104090030	Deal Lake
		02030104090050	Jumping Brook (Monmouth County)*
*Note that the full name that NJDEP uses is "Jumping Brook (Monmouth Co)," which is different from the subwatershed named "Jumping Brook (Ocean Co)."			
Source: USGS, 2016; NJDEP March 8, 2016			



Legend

- Ocean Township
- Waterbodies
- Streams and rivers

HUC14 Subwatersheds

- 02030104090010: Whale Pond Brook
- 02030104090020: Poplar Brook
- 02030104090030: Deal Lake
- 02030104090050: Jumping Brook (Ocean Co)

N

0 0.45 0.9 1.8 Miles

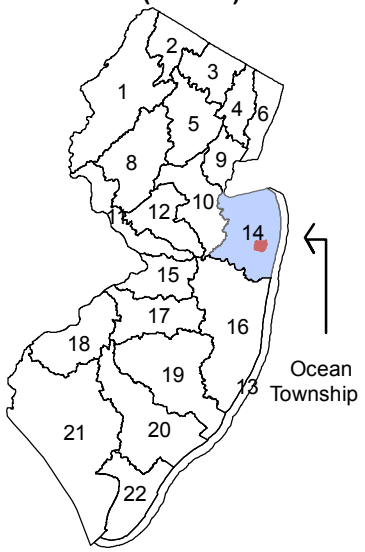
Data Sources: NJDEP, NJDOT, ESRI
Disclaimer required for NJDEP Data: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Kratzer Environmental Services
Ocean Township ERI 2019

Figure 3.4.1. Hydrography Ocean Township, Monmouth County

Inset shows New Jersey's 20 Watershed Management Areas (WMA). Ocean Township is in WMA 14, Monmouth.

Watershed Management Areas (WMAs)



Watershed Management Areas

Watershed management is the process of managing and protecting all of the water resources within the area of a watershed, rather than on a site-specific basis. The NJDEP recognizes that watersheds are "nature's boundaries" (NJDEP, January 1997). A watershed management approach is based on three key components: 1) a geographic focus; 2) continuous improvement based on sound science; and 3) partnerships/stakeholder involvement. NJDEP has divided the state's watersheds into 20 *Watershed Management Areas (WMAs)*. Ocean Township falls within *WMA 12: Monmouth* (see bottom right inset in **Figure 3.4.1**).

3.4.2 Surface Water Quality Standards

"Water is vital to life and comprises an invaluable natural resource which is not to be abused by any segment of the State's population or economy" (NJAC 7:9B, October 17, 2016).

Surface Water Quality Standards (SWQS) are the rules in chapter N.J.A.C. 7:9B that set forth designated uses, use classifications, and water quality criteria for the State's waters based upon the uses, and the NJDEP's policies concerning these uses, classifications and criteria, which are necessary to protect the State's waters. The SWQS operate in conformance with the Federal Water Pollution Control Act (33 U.S.C. 1313(c)), commonly known as the Clean Water Act (CWA), and the Federal Water Quality Standards Regulation at 40 CFR 131.

According to the Surface Water Quality Standards N.J.A.C. 7:9B,

> "Water is vital to life and comprises an invaluable natural resource which is not to be abused by any segment of the State's population or economy. It is the policy of the State to restore, maintain and enhance the chemical, physical and biological integrity of its waters, to protect the public health, to safeguard the aquatic biota, protect scenic and ecological values, and to enhance the domestic, municipal, recreational, industrial, agricultural and other reasonable uses of the State's waters.
>
> "The restoration, maintenance and preservation of the quality of the waters of the State for the protection and preservation of public water supplies is a paramount interest of the citizens of New Jersey.... Toxic substances in waters of the State shall not be at levels that are toxic to humans or the aquatic biota, or that bioaccumulate in the aquatic biota so as to render them unfit for human consumption.... Human health-based ambient criteria have been established in freshwaters due to consumption of fish and water, and in saline water due to consumption of fish. For carcinogens, the criteria have been established at levels which would result in no greater than a one-in-one-million lifetime excess cancer risk. For non-carcinogens, the criteria have been established which would result in no appreciable risk of deleterious effect." (NJDEP, October 17, 2016).

NJDEP assigns *surface water classifications* to each stream in order to group waters and assign water quality criteria. The *criteria* are numerical targets for constituent concentrations (such as toxic pollutants) or narratives that describe in-stream conditions to be attained, maintained or avoided, so that the specified uses are protected for the different use classifications. All of the surface waters within Ocean Township are categorized as general freshwater-non-trout/saline estuarine waters (FW2-NT/SE1), which is defined by N.J.A.C. 7:9B(f) as follows:

> "FW2-NT/SE1 (or a similar designation that combines two classifications) means a waterway in which there may be a salt water/fresh water interface. The exact point of demarcation between the fresh and saline waters must be determined by salinity measurements and is that point where the salinity reaches 3.5 parts per thousand at mean high tide. The stream is classified as FW2-NT in the fresh portions (salinity less than or equal to 3.5 parts per thousand at mean high tide) and SE1 in the saline portions." (NJDEP, October 17, 2016)

In all FW2 waters the designated uses are:

- Maintenance, migration and propagation of the natural and established biota;
- Primary contact recreation;
- Industrial and agricultural water supply;
- Public potable water supply after conventional treatment; and
- Any other reasonable uses.

In all SE1 waters the designated uses are:

- Shellfish harvesting in accordance with N.J.A.C. 7:12;
- Maintenance, migration and propagation of the natural and established biota;
- Primary contact recreation; and
- Any other reasonable uses.

Whale Pond Brook in Weltz Park.

The SWQS are used by several NJDEP programs, including the New Jersey Pollutant Discharge Elimination System program, Site Remediation program, Stream Encroachment, Land Use Regulation Program and Total Maximum Daily Loads (TMDLs, see **Section 3.4.6**).

3.4.3 Surface Water Quality Monitoring

A 1975 study of the Poplar Brook watershed concluded that surface water quality was good, but that there were few fish and macroinvertebrates, possibly due to the shallow depth the stream, with the exception of one pool below the dam. In addition, test borings revealed that the stream substrate is composed of a 2-foot layer of sand and this was "a slowly moving stream of sand and gravel." Several secci disk observations showed that the stream was clear to the bottom, indicating the absence of man-made siltation (William M. Kwalick Associates, January 1975). More recently, however, Poplar Brook is orange in appearance, although the reason is unknown (Kenneth Lutz, personal communication, May 12, 2019), which may be due to the naturally high levels of iron in the ground water (Jablonski, 1968).

Whale Pond Brook was found to support 11 fish species and had acceptable dissolved oxygen levels. However, upstream erosion of stream banks was found to contribute to siltation problems downstream. A narrow concrete flume prevents the natural mixing of salt and fresh water and prevents the natural flushing of silt from Lake Takanassee (Environmental Assessment Council, Inc., 1977). Similarly, erosion is causing siltation in Deal Lake, particularly from the sandy hills that form the headwaters of Harvey Brook (Rutgers University, 1977).

More recently, the NJDEP collects samples from surface waters and analyzes them for parameters such as salinity, dissolved oxygen, suspended solids and to assess the ecological health of New Jersey's coastal waters. There are three NJDEP surface water quality monitoring sites within Ocean Township. See **Internet Resources** for a link.

Table 3.4.2. Water Quality Monitoring Stations

HUC14	HUC14 Name	Station	Station Name	Municipality
02030104090010	Whale Pond Brook	1407617	Whale Pond Brook at Larchwood Ave at Oakhurst	Ocean
02030104090030	Deal Lake	1407636	Harvey Brook at West Allenhurst NJ	Ocean
02030104090050	Jumping Brook (Monmouth County)	1407720	Jumping Brook at Green Grove	Tinton Falls
02030104090020	Poplar Brook	1407630	Poplar Brook at Deal	Deal
Source: NJDEP, November 19, 2018				

3.4.4 Biomonitoring

Macroinvertebrates are larger-than-microscopic fauna, which are found in freshwater and estuarine environments, and are an essential part of the aquatic food web. These include insects (primarily immature forms), worms, mollusks (snails, clams) and crustaceans (scuds, shrimp, crayfish, etc.), most of which are bottom-dwelling (benthic). They are more easily collected and quantified than other biological indicators (fish or periphyton communities). Assessments of benthic macroinvertebrates provide a good indication of localized conditions of water quality. Due to the creatures' limited mobility, they are suitable for the evaluation of site-specific pollution impacts. Different species differ in their sensitivity to pollutants and environmental impacts from both point and non-point sources of pollution. Combined with relevant chemical/physical parameters, benthic macroinvertebrate communities can be used to identify sources of impairment (NJDEP. June 5, 2017).

The Ambient Biomonitoring Network (AMNET) is the NJDEP's ongoing macroinvertebrate monitoring program. From 1992 to 2004, the *New Jersey Impairment Score (NJIS)* was used to assign a rating of non-impaired, moderately impaired, or severely impaired. Beginning in 2004, an improved index has been used, which takes into account the different ecoregions in the state. The streams in Ocean Township are assessed using the *Coastal Plain Macroinvertebrate Index (CPMI)* which uses genus-level instead of family level identification, which provide four assessment rating levels; excellent, good, fair and poor. NJDEP uses this information in assessing progress toward the goals of the Clean Water Act through the Integrated Water Quality Monitoring and Assessment Report (see **Section 3.4.5**) (NJDEP, June 5, 2017). Locations of monitoring sites are shown on **Figure 3.4.2,** and results are shown in **Table 3.4.3**.

Table 3.4.3. Macroinvertebrate and Habitat Scores

Site ID	Site	Date of Sampling	Macroinvertebrate Rating - NJIS or CPMI*	Habitat Analysis
The following sites are in Ocean Township				
AN0477	Whale Pond Brook at Larchwood Ave at Oakhurst	Round 1 -8/4/1994	NJIS: Moderately (9)	-
		Round 2 - 8/8/2000	NJIS: Severely (6)	Marginal (108)
		Round 3 - 5/3/2005	CPMI: Fair (8)	Suboptimal (146)
		Round 4 - 5/17/2010	CPMI: Poor (4)	Suboptimal (121)
		Round 5	CPMI: Poor (16.52)	Suboptimal (144)
1407636	Harvey Brook at Monmouth Rd (CR 15)	Round 5	CPMI: Fair (29.92)	Suboptimal (153)
The following sites are downstream of Ocean Township				
AN0478	Poplar Brook at Almyr Ave (in Deal Borough)	Round 1 -8/4/1994	NJIS: Moderately (9)	-
		Round 2 - 8/12/1999	NJIS: Moderately (12)	Suboptimal (140)
		Round 5	CPMI: Poor (16.13)	Suboptimal (131)
AN0479	Jumping Brook at Green Grove (in Tinton Falls)	Round 1 - 8/4/1994	NJIS: Moderately (15)	-
		Round 2 - 8/17/1999	NJIS: Moderately (12)	Suboptimal (153)
		Round 3 - 4/28/2005	CPMI: Fair (8)	Suboptimal (150)
		Round 4 - 5/13/2010	CPMI: Fair (10)	Suboptimal (158)

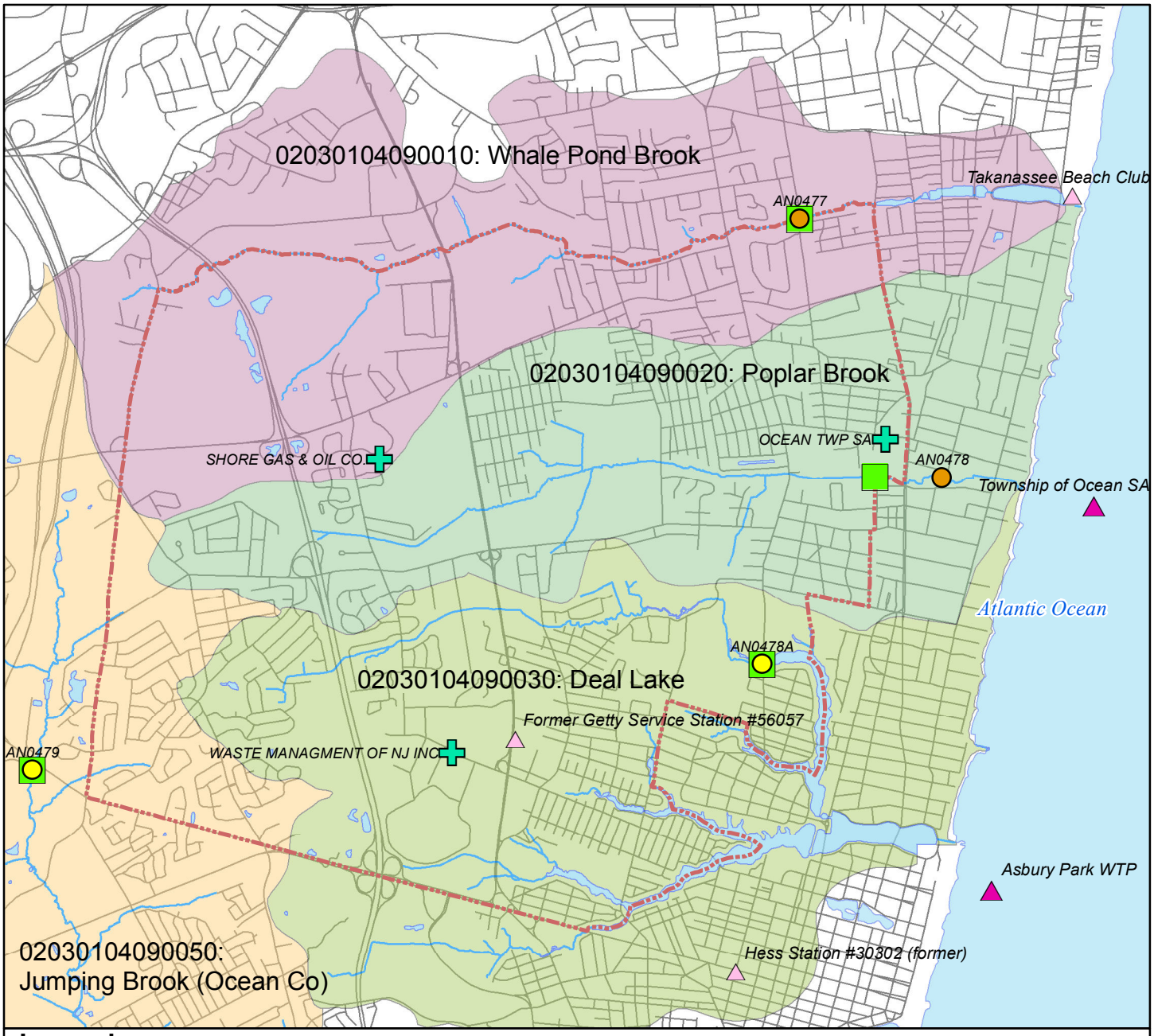
* Parameter:

CPMI (Coastal Plain Macroinvertebrate Index): **Excellent** 22 - 30 Full Attainment; **Good** 20-12 Full Attainment; **Fair** 10-6 Non-Attainment; **Poor** < 6 Non-Attainment

NJIS (New Jersey Impairment Score): A composite of 5 scores based on family level taxonomy. **N=Non-impaired**: score of 24 to 30. **M=Moderately Impaired**: score of 9 to 21; **S= Severely Impaired**: score of 0 to 9.

HABITAT SCORES: **OPTIMAL**= 160 – 200; **SUB-OPTIMAL**=110 – 159; **MARGINAL**= 60 – 109; **POOR**= < 60. Parameters evaluated included in-stream substrate, channel morphology, bank structural features, and riparian vegetation for the sample site and its immediate surroundings (usually 100-200 foot radius).

Source: NJDEP, June 5, 2017; NJDEP BFBM https://www.state.nj.us/dep/wms/bfbm/downloads.html#atl



Legend

- Ocean Township
- Roads
- Streams
- Waterbodies

Biomonitoring Score

- Fair
- Poor

- Ambient Water Monitoring Sites

Surface Water Discharges (NJPDES)

- Existing
- Revoked
- Regulated Facilities (NJPDES)

HUC14 Subwatersheds

- 02030104090010: Whale Pond Brook
- 02030104090020: Poplar Brook
- 02030104090030: Deal Lake
- 02030104090050: Jumping Brook (Ocean Co)

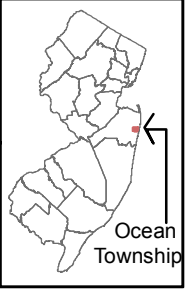
N

0 0.25 0.5 1 Miles

Data Sources: NJDEP, NJDOT, ESRI
Disclaimer required for NJDEP Data: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Kratzer Environmental Services
Ocean Township ERI 2019

Figure 3.4.2. Water Quality
Ocean Township, Monmouth County



3.4.5 Water Quality Impairments

States are required by the Federal Clean Water Act (US Federal Water Pollution Control Act, November 27, 2002) to develop a biennial Water Quality Inventory Report (required under Section 305(b) of the act) and a List of Water Quality Limited Segments (required under Section 303(d)). Since 2001, the USEPA has recommended that states integrate these two, producing the *Integrated List.* The goal is to provide an effective tool for maintaining high quality waters where designated uses (designated by the SWQS, discussed above in **Section 3.4.3**) are attained, and improving the quality of surface waters that do not attain their designated uses (NJDEP, May 2017).

The Integrated List is subject to regulatory requirements, which include public participation and submission to the USEPA for approval and adoption. The Integrated List identifies the status of all applicable designated uses for every assessment unit (usually by HUC14[8] sub-watershed) by labeling the results of each designated use assessment as *Fully Supporting, Not Supporting*, or *Insufficient Information* (see **Table 3.4.4**).

The NJDEP is required to use all existing and readily available data to assess water quality for the Integrated List. A methods document summarizes each step in the assessment process; to evaluate stations and data quality, combine stations to evaluate an assessment unit, assess designated uses, rank and prioritize assessment units that do not attain designated uses, develop a monitoring and assessment plan and provide for public participation (NJDEP, February 2015).

The 2014 Integrated List, which summarizes whether or not the surface water quality of Ocean Township's four subwatersheds meet the SWQS, is shown in **Table 3.4.4**. The water quality supports the water supply use of waters, while other uses are either not supported or there is insufficient information to assess them. **Table 3.4.5** displays more information about the impaired waters within Ocean Township.

Table 3.4.4. 2014 Integrated List (Overview)

Assessment Unit (HUC14)	Sub-watershed	Designated Use★					
		Aquatic Life General	Aquatic Life Trout	Recreation	Water Supply	Shellfish	Fish Consumption
02030104090010	Whale Pond Brook	Not Supporting	N/A	Not Supporting	Fully Supporting	N/A	Insufficient Data
02030104090020	Poplar Brook	Not Supporting	N/A	Not Supporting	Fully Supporting	Insuffi-cient Data	Insufficient Data
02030104090030	Deal Lake	Not Supporting	N/A	Not Supporting	Fully Supporting	N/A	Not Supporting
02030104090050	Jumping Brook (Monmouth County)	Not Supporting	N/A	Not Supporting	Fully Supporting	N/A	Insufficient Data

Minimum Suite of Parameters Needed to Determine if Water Quality is "Fully Supporting" a Use:

General Aquatic Life - Biological data
Aquatic Life - Trout Biological data and Temperature and DO
Recreation - Pathogenic Indicator Bacteria
Shellfish Harvest for Consumption - Total Coliform
Public Water Supply - Nitrate
Fish Consumption - Fish tissue data

For a full list of parameters for each designated use, see Appendix A of the 2014 methods document (NJDEP, February 2015)

Source: NJDEP, May 2017; NJDEP, February 2015

[8] HUC14 = 14-digit Hydrologic Unit Code (see **Section 3.4.1** for definition)

When surface waters do not meet the SWQS, *Total Maximum Daily Loads* (TMDLs) must be developed, as specified under Section 303(d) of the Federal Clean Water Act (US Federal Water Pollution Control Act, November 27, 2002). A TMDL identifies all the contributors to surface water quality impacts and sets goals for load[9] reductions for specific pollutants in order to meet the SWQS. Regulations concerning TMDLs are contained in EPA's Water Quality Planning and Management Regulations (USEPA, 2019).

Table 3.4.5 Impaired Waters Parameters and Sources

Use	Cause	First on 303(d) List	TMDL Completed or Priority*	Source
02030104090010 Whale Pond Brook				
Aquatic Life	Cause Unknown	2008	Low	Cause Unknown
Recreation	Fecal Coliform E. Coli	2006	TMDL completed #11002	Urban Runoff/Storm Sewers
02030104090020 Poplar Brook				
Aquatic Life	Phosphorus (Total)	2002	Medium	Urban Runoff/Storm Sewers
Recreation	Fecal Coliform E. Coli	2006	TMDL completed #10997	Urban Runoff/Storm Sewers
02030104090030 Deal Lake				
Aquatic Life	pH	2008	Medium	Urban Runoff/Storm Sewers
Aquatic Life	Phosphorus (Total)	2006	TMDL completed #9920	Urban Runoff/Storm Sewers
Recreation	Fecal Coliform E.Coli	2008	TMDL completed #11010	Urban Runoff/Storm Sewers
Fish Consumption	Mercury in Fish Tissue	2010	TMDL completed #37909	Atmospheric Deposition - Toxics
Fish Consumption	Chlordane in Fish Tissue	2010	Low	Source Unknown
Fish Consumption	DDT and its metabolites in Fish Tissue	2010	Low	Contaminated Sediments/source unknown
Fish Consumption	PCB in Fish Tissue	2010	Low	Contaminated Sediments/source unknown
02030104090050 Jumping Brook (Monmouth County)				
Aquatic Life	Cause Unknown	2012	Low	Source Unknown
Recreation	Fecal Coliform E. Coli	2006	TMDL completed #11097	Urban Runoff/Storm Sewers
*__Medium__ priority = NJDEP expects to complete TMDL in the near future, but not within the next two years. __Low__ priority = NJDEP does not expect to complete TMDL in the immediate or near future.				
Source: NJDEP, May 2017				

TMDLs represent the assimilative capacity of surface water for a given parameter of concern. The development of TMDLs includes balancing the impacts from point sources, nonpoint sources and natural background levels of a specific pollutant. The TMDL then quantifies the amount of a pollutant a water body can assimilate without violating a state's water quality standards and allocates that load capacity to known point and nonpoint sources in the form of waste load allocations (WLAs) for point sources, load allocations (LAs) for nonpoint sources, plus a margin of safety (MOS). Load allocations (for nonpoint source pollution) consist of identifying categories of nonpoint sources that contribute to the parameters of concern, followed by recommendations for implementation measures for specific load

[9] Load is the total amount of material (pollutants) entering the system from one or multiple sources; measured as a rate in weight per unit time (USEPA, 2019).

reductions. Examples include best management practices (BMPs), including structural (stormwater runoff controls) and non-structural (local ordinances for stormwater management and nonpoint source pollution control) mechanisms for addressing the water quality parameter(s) of concern (NJDEP Division of Watershed Management, February 21, 2019).

Waters requiring TMDLs are identified and prioritized in the Integrated Water Quality Assessment. After the Integrated List is approved, the NJDEP writes a TMDL report, which is a proposed Water Quality Management Plan Amendment. When this is published in the NJ Register for public review and comment, the TMDL is considered *proposed*. NJDEP then considers comments received during public comment and finalizes the TMDL report, and the TMDL is considered *established* when it is formally submitted to the US EPA Region 2 for thirty-day review. The TMDL is considered *approved* when the US EPA Region 2 approves it. Next, the TMDL is referred to as *adopted* when the EPA-approved TMDL is adopted by NJDEP as a water quality management plan amendment and the adoption notice is published in the NJ Register (NJDEP BEARS, February 21, 2019). **Table 3.4.6** lists adopted TMDLs for waters in Ocean Township.

Table 3.4.6 TMDLs for Waters in Ocean Township

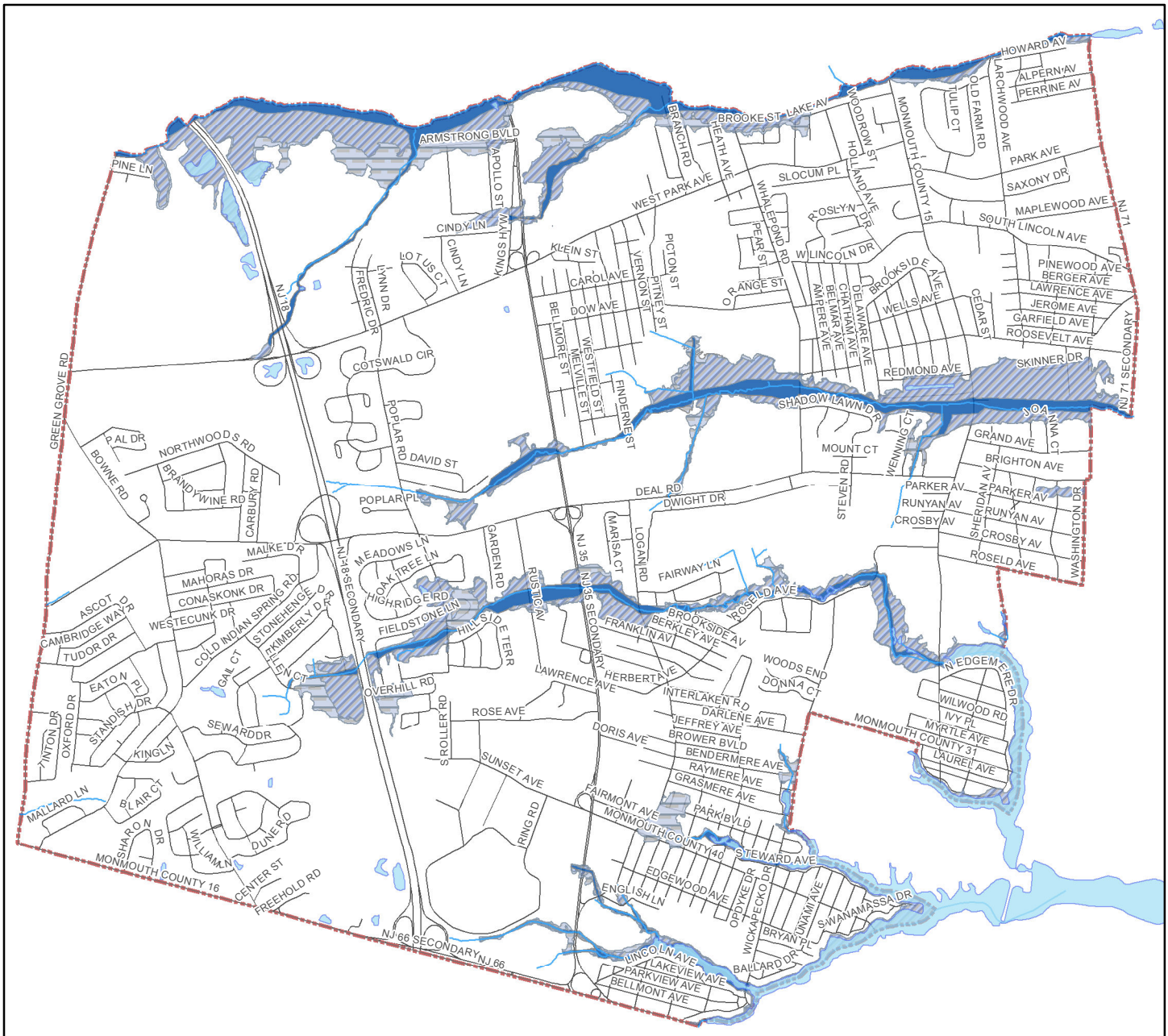
Waterbody	Parameter	Year	Title of TMDL Document	Link to TMDL Document
Hollow Brook Poplar Brook Whale Pond Brook	Fecal Coliform	2003	Total Maximum Daily Loads for Fecal Coliform to Address 31 Streams in the Atlantic Water Region Fecal Coliform	https://www.nj.gov/dep/wms/bears/docs/Atlantic%20FC.pdf
Deal Lake	Total Phosphorus	2003	Total Maximum Daily Loads for Phosphorus to Address Nine Eutrophic Lakes in the Atlantic Coastal Water Region	https://www.nj.gov/dep/wms/bears/docs/Atlantic%20Lakes.pdf
Shark River	Total coliform	2006	Five Total Maximum Daily Loads for Total Coliform to Address Shellfish-Impaired Waters in Watershed Management Area 12	https://www.nj.gov/dep/wms/bears/docs/coastal_pathogen_tmdls_wma12%20for%20adoption.pdf
Deal Lake Lake Takanassee	Fecal Coliform	2007	Total Maximum Daily Loads for Pathogens to Address 18 Lakes in the Atlantic Coastal Water Region	https://www.nj.gov/dep/wms/bears/docs/adopted_atlantic_fecal_lake.pdf
Deal Lake	Mercury	2010	Total Maximum Daily Load for Mercury Impairments Based on Concentration in Fish Tissue Caused Mainly by Air Deposition to Address 122 HUC 14s Statewide	https://www.nj.gov/dep/wms/bears/docs/TMDL%20HG%20document%20final%20version%209-8-09_formated%20for%20web%20posting%20js.pdf
Source: NJDEP Division of Watershed Management, February 21, 2019				

3.4.6 Flood Risk

A *floodplain* is the land along a river or stream that is subject to periodic flooding when the river or stream overflows its banks. As required by the Flood Disaster Protection Act of 1973, the Federal Emergency Management Administration (FEMA) is responsible for delineating floodplains.

According to FEMA, "Everyone lives in some type of flood zone." (FEMA, June 21, 2007). FEMA defines these geographic areas based on studies of flood risk.

FEMA provides flood hazard and risk data to states and communities to guide mitigation actions. The National Flood Insurance Program (NFIP) is the basis of the NFIP regulations and flood insurance requirements. Flood hazard mapping is an important part of the NFIP. FEMA uses the best available technical data, such as statistical information on river flows, to create the *Flood Insurance Rate Maps* (FIRMs) that show the flood zone boundaries (FEMA, September 19, 2018).



Legend

- Ocean Township
- Roads
- Water

FEMA Flood Subzone (2018)

- Floodway
- 1% annual chance of flood hazard
- 0.2 % annual chance of flooding hazard
- Zone X - area of minimal flood hazard

N

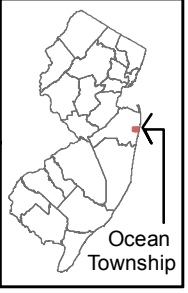
0 0.25 0.5 1 Miles

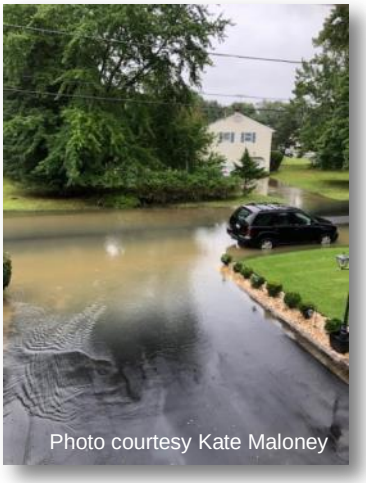
Data Sources: NJDEP, NJDOT, Monmouth County, FEMA
Disclaimer required for NJDEP Data: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Kratzer Environmental Services
Ocean Township ERI 2019

Figure 3.4.3. Flood Zones
Ocean Township, Monmouth County

According to FEMA flood zone maps, approximately 8.8% of Ocean Township is within the 1% annual chance of flooding, while another 1.9% has a 0.2% annual chance of flooding. Approximately 89.3% of the township is in an area defined as minimal flood hazard.





Whale Pond Brook Flooding.

The flood zone boundaries shown in **Figure 3.4.3** are produced using FEMA's National Flood Hazard Layer (Monmouth County Planning, September 25, 2009). Special Flood Hazard Areas (SFHAs) are defined as areas subject to inundation by a flood having, on average, about 1 in 100 chance in any given year, also referred to as the 1% annual chance flood, while in a "500-year flood zone," the probability goes down to 0.2% in any one year[10] (FEMA, March 18, 2019). Because FEMA maps are based on historical data, some scientists warn that rapid urbanization and changing climate conditions (for example, warmer air holds more moisture and sea levels are rising) will increase the likelihood and severity of future floods (Popovich and O'Neill, August 28, 2017) (climate is addressed in **Section 3.1.1**).

Below are brief definitions of the FEMA flood zones that occur within Ocean Township.

Zones with a high-risk of flooding, or SFHAs, include *Zone A* and *Zone AE*. *Zone A* corresponds to the 1% annual chance floodplains that are determined by approximate methods of analysis (i.e., not with Base Flood Elevations).

Zone AE corresponds to the 1% annual chance floodplains that are determined by detailed methods of analysis, which includes detailed hydraulic analyses to determine Base Flood Elevations. In communities such as Ocean Township that participate in the NFIP, all homeowners in Zones A and AE are required to get flood insurance in order to get a loan from a federally regulated lender (FEMA, March 18, 2019; FEMA, August 6, 2017).

The term "100-year flood" does not mean a flood that happens once every 100 years. It is a statistical designation that there is a 1% chance that a flood of a given size will be equaled or exceeded during any one year.

3.4.7 Flood Zones

Areas in *Zone X*, which includes approximately 32% of Ocean Township, have low to moderate risk of flooding and are not in the SFHAs. They correspond to areas outside the 1% annual chance floodplain, areas of 1% annual chance sheet flow[11] flooding where average depths are less than 1 foot, areas of 1% annual chance stream flooding or where the contributing drainage area is less than 1 square mile. No Base Flood Elevations or depths are shown within this zone. Areas with a 0.2% annual chance of flooding (typically referred to as the 500 year flood) are not considered high risk. The zone includes

[10] Flood designations are based on statistical averages, not the number of years between big floods. The term "100-year flood" does not mean a flood that happens once every 100 years. It is a statistical designation that there is a 1 in 100 chance that a flood of any given size will be equaled or exceeded during any year. Changes and variability in climate and land use over time can change flood frequency (Dinicola, 2005).

[11] Sheet flow, or overland flow, is flow that occurs overland in places where there are no defined channels, so the flood water spreads out over a large area at a uniform depth.

areas of little hazard, such as those with average depths of less than 1 foot and minimal hazard, such as ponding and local drainage problems. Insurance purchase is not required in this zone (FEMA, March 18, 2019).

Flood zones in Ocean Township are shown in **Figure 3.4.3**, based on FEMA determinations (Monmouth County Planning, September 25, 2009). Approximately 8.8% of the township is within the 1% annual chance of flooding, while another 1.9% has a 0.2% annual chance of flooding.

Floodplain management is the operation of a community program of corrective and preventative measures for reducing flood damage. Community involvement is an important element in making flood insurance available to home and business owners. These measures may include zoning, subdivision, or building requirements, and special-purpose floodplain ordinances. Riparian buffer and wetlands protection regulations and ordinances can also reduce flood damage by protecting those areas most susceptible to flooding and providing natural flood control.

Flood Facts

• Floods and flash floods happen in all 50 states.
• Hurricanes, winter storms and snowmelt are common (but often overlooked) causes of flooding.
• New land development can increase flood risk, especially if the construction changes natural runoff paths.
• Federal disaster assistance is usually a loan that must be paid back with interest.
• If you live in a Special Flood Hazard Area (SFHA) or high-risk area and have a Federally backed mortgage, your mortgage lender requires you to have flood insurance
• 20 to 25% of all flood claims are filed in low to moderate flood risk areas.
(FEMA, July 25, 2017; FEMA, June 21, 2007)

3.4.8 Ground Water

Ground water is that portion of water beneath the land surface that is within the zone of saturation (below the water table) where pore spaces are filled with water. An *aquifer* is a water-bearing rock or geologic formation (including sediments such as unconsolidated sands) where water is present in usable quantities. Water is constantly recycled through the *hydrologic cycle*, also known as the *water cycle.* Precipitation falls on the ground and some travels on the surface of the land (called *surface runoff*), entering streams (where it can be seen as high flows after rain events), and eventually making its way back to the ocean. Some of the water from precipitation enters the ground but remains in the shallow layers where it is available for use by plants, and returns to the atmosphere through *transpiration* by plants, while some water re-enters the atmosphere directly through *evaporation* from surface water. Evaporation and transpiration combined are known as *evapotranspiration*. The water that migrates below the root zone travels underground and exits the system as stream flow, known as *ground water baseflow* or *ground water recharge*. Ground-water baseflow can be calculated by measuring stream flow during dry weather conditions. A smaller portion of the water penetrates deeper into the ground and enters (or recharges) the saturated zone of the fractured bedrock or other geologic formation, called the *aquifer,* where most wells obtain their water.

Pollutants can enter water as it travels the water cycle. Surface runoff can pick up chemicals and sediment on its way, depositing these pollutants in waterways. This is especially true of "uncontrolled runoff" on soils that are vulnerable to erosion. Water seeping into the soil can be cleansed of many pollutants by natural soil processes. However, if the pollutant is one that is resistant to break-down, or if the pollutant doesn't get exposed to the soil long enough (such as by entering a bedrock fracture or by entering the ground water through sub-surface disposal), pollutants can spread underground and pollute sources of drinking water.

Movement of ground water is usually quite slow, on average, ranging from about one foot per day to perhaps ½ inch per month. Therefore, in some areas, it might take days for water to travel from the point where it enters the ground, to a point of discharge into a stream, or it might take millennia (Heath, 1983). Movement of water through an aquifer of unconsolidated sediment depends in part on the pore size between particles as well as the size and uniformity of the actual particles. Water is stored in and moves through connected pore spaces and larger particles of uniform size can more readily transmit water. Because hydraulic conductivity can be high, surficial (water table) aquifer systems of unconsolidated sediments may be susceptible to contamination (USGS, 2016).

Aquifers

An understanding of the water cycle emphasizes the connections between surface and ground water. The Township of Ocean relies on a combination of water from surface waters and from public wells (and some individual wells) fed by ground water. The water is part of the natural water cycle, and is susceptible to human impacts and the influence of climate and geology.

The density of housing and impervious surfaces can impact aquifers and may result in reduced recharge, lowered yields, increased interference (wells interfering with each other), and degradation of ground water quality. In any aquifer, if the rate of water use exceeds the recharge rate, well yields will decrease. Furthermore, these changes can alter stream flow dynamics resulting in higher flows after storm events and lowered flows between events. In coastal areas, increased rates of water use may also result in saltwater intrusion into freshwater aquifers and wells.

Aquifers are typically described as being unconfined or confined. *Unconfined* aquifers are those aquifers where the ground water is directly connected to the atmosphere through the pores of the aquifer. *Confined* aquifers are water-bearing formations that are separated from the surface by a layer of rock or soil through which water cannot move (Dunne and Leopold, 1978).

The Kirkwood Cohansey outcrops as the upper aquifer in Ocean Township, described below and summarized in **Table 3.4.9. Figure 3.4.4** illustrates the confining layers and the unconfined (water table) aquifer. The Potomac-Raritan-Magothy is also described below because wells supplying the township's public water are generally located in that aquifer.

The recharge area (where precipitation or snowmelt enters the ground) for unconfined (surficial) aquifers is local, usually above the aquifer. In contrast, the recharge area for confined aquifers can be a distance away, wherever that aquifer eventually intersects with the surface of the ground. Due to the interconnected nature of the coastal plain groundwater supply, the New Jersey Department of Environmental Protection (NJDEP) has recently completed a water supply plan for the confined aquifers of the coastal plain that explores options for ensuring adequate freshwater supply as demand continues to increase in the coming years (NJDEP, 2017).

Kirkwood-Cohansey Aquifer System

The Kirkwood-Cohansey aquifer is composed of sand and gravel with lenses of silt and clay and generally occurs under water-table conditions. This aquifer system extends from Monmouth County to the Delaware Bay and from the Delaware River to the Atlantic Ocean. The aquifer is 60 – 180 feet thick, and is underlain by confined Kirkwood aquifers. Water occurs in primary intergranular porosity and permeability with well yields ranging from 5 – 700 gallons/minute, though yields can go as high as 1,500 gallons/minute. Leakage from unconfined to confined parts provides water. Water quality is fresh, acidic, highly corrosive, and low in dissolved solids. Confined aquifers commonly have less corrosive water. Iron and manganese levels can be elevated and brackish and salty water may occur in coastal areas (USGS, January 14, 2013; Herman, et al., 1998).

Potomac-Raritan-Magothy

The Potomac-Raritan-Magothy confined aquifer is composed of interbedded sand, gravel, silt, and clay separated into lower, middle and upper aquifers. The P-R-M is highly productive and is the most used confined aquifer in the coastal plain. It extends throughout the coastal plain and attains a maximum thickness of 4,100 ft. Water occurs in primary intergranular porosity and permeability. Water quality is fresh, moderately hard, near-neutral pH, and commonly has elevated iron and manganese levels. Salinity increases with depth and towards the coastline. Calcium and magnesium levels decrease and sodium and potassium levels generally increase to the southeast. Calcium-bicarbonate type waters dominate (USGS, January 14, 2013; Herman, et al., 1998).

Composite Confining Unit (ccu and ccua)

Composite confining units are composed of silt and clay with localized confining sand lenses. Confining units include the Shark River, Manasquan, Hornerstown, and Tinton Formations, and the lower part (Sandy Hook Member) of the Red Bank Formation. Localized water-table aquifers (ccua) composed of massive quartz sand outcrop as the Vincentown Formation and the upper part (Shrewsbury Member) of the Red Bank Formation. These aquifers grade into confining units southeastward in the subsurface where the quartz sands become more glauconitic and silty. Water quality is generally good, but iron and manganese levels may be locally elevated. Calcium-bicarbonate type waters dominate (Herman, et al., 1998).

Table 3.4.9. Aquifer Characteristics

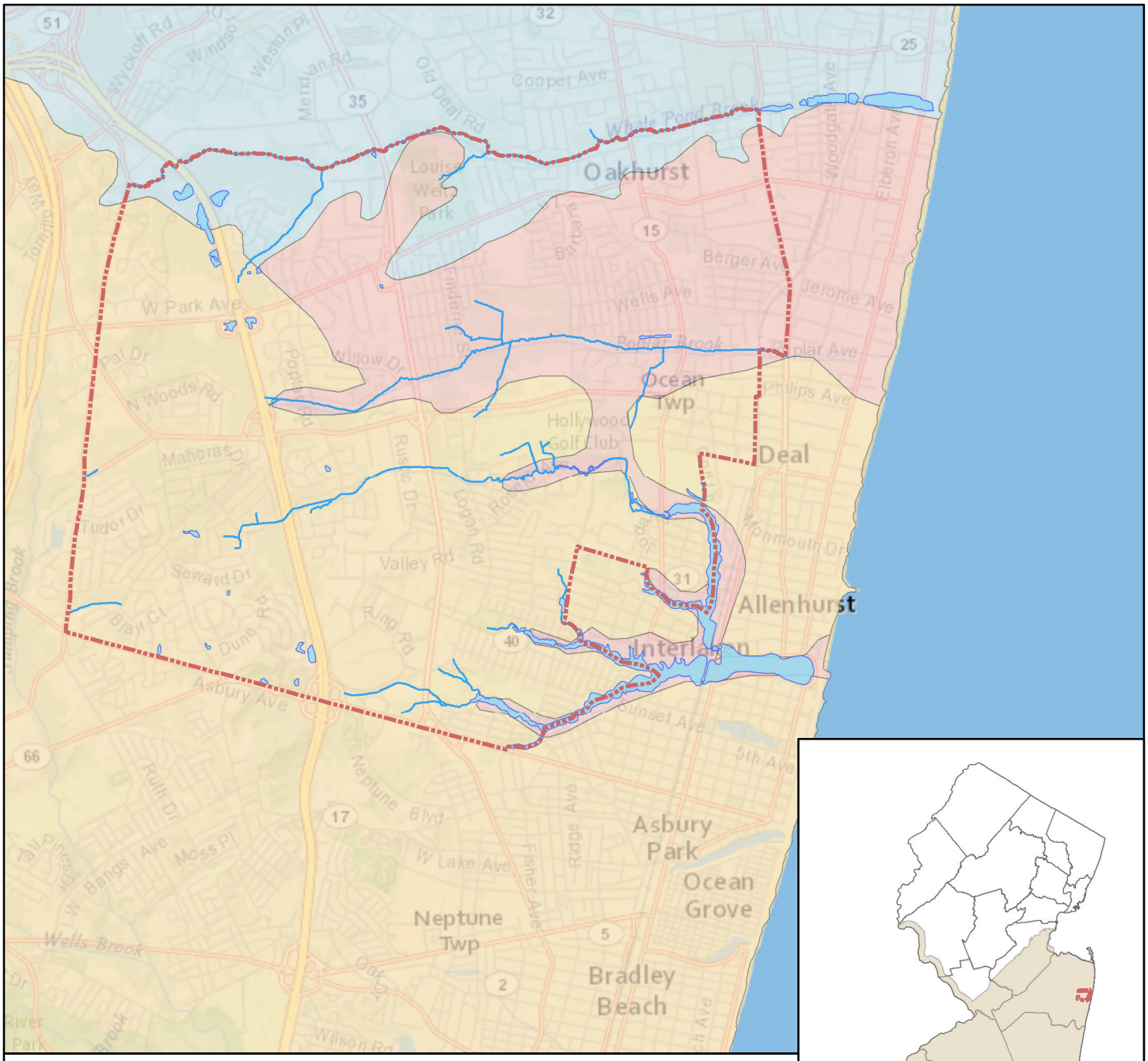
Abbreviation	Geologic Formation Name	Aquifer Rank	Acres at surface in Ocean Twp.	Percent of Ocean Twp.
ccu	Composite confining unit	E-D	2,152	31%
ccua	Composite confining unit aquifer	C-B	715	10%
kcas	Kirkwood-Cohansey aquifer system	B-A	4,164	59%
		Total:	7,030	100%
▪**Aquifer Rank** is from NJGS GIS data. It is based on High Capacity Wells (such as water-supply, irrigation, and industrial-supply wells sited and tested for maximum yield. Many of the wells have boreholes exceeding the standard six-inch diameter for domestic wells. State Rank is best viewed on a relative basis, with "A" yielding the most water, and "E" the least. Median High Capacity Wells Yield (in gpm): [A] > 500; [B] 251 to 500; [C] 101 to 250; [D] 25 to 100; [E] <25				
Source: NJGS, May 21, 1998				

Sole-Source Aquifer

The Safe Drinking Water Act (SDWA) of 1974 contains a provision in Section 1424(e) that provides for designating an aquifer that is the sole or principal drinking water source for an area and that, if contaminated, would create significant hazard to public health. As defined by the U.S. Environmental Protection Agency (EPA), s*ole-source aquifers* (SSA) are those aquifers that contribute more than 50% of the drinking water to a specific area and the water would be impossible to replace if the aquifer were contaminated. Once designated, no Federal financial assistance may be approved for any project that may contaminate the aquifer through a

recharge zone so as to create a significant hazard to public health (US EPA, August 1992). Therefore, the EPA must review any federally-funded project in an area that could affect ground water in a sole-source aquifer, including the *aquifer's recharge zone* (the area through which water recharges the aquifer) and its *stream-flow source zone* (the upstream area that contributes recharge water to the aquifer).

The Kirkwood-Cohansey Aquifer System met the technical requirements for SSA designation, and Notice of approval was published in the Federal Register 57 FR 39201, August 28, 1992. It covers much of the Inner and Outer coastal plain. The Kirkwood-Cohansey SSA in New Jersey is shown in **Figure 3.4.4** (lower right inset) and includes water-bearing units that supply Ocean Township's water (NJDEP, May 19, 1998).



Legend

- Ocean Township
- Water

Geologic Formation Name

- ccu - Composite confining unit
- ccua - Composite confining unit aquifer
- kcas - Kirkwood-Cohansey aquifer system

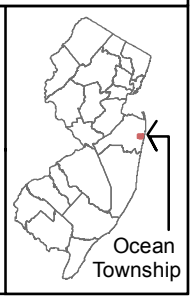
N

0 0.25 0.5 1 1.5 Miles

Data Sources: NJDEP, NJDOT, ESRI
Disclaimer required for NJDEP Data: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Kratzer Environmental Services
Ocean Township ERI 2019

Figure 3.4.4. Ground Water
Ocean Township, Monmouth County



3.4.9 Ground Water Recharge Areas

Ground water recharge is defined as water added to an aquifer (for example, precipitation that seeps into the ground deep enough to enter the saturated zone of the fractured bedrock). A g*round water recharge area* is the land area that allows precipitation to seep into the saturated zone. These areas are generally at topographically high areas with discharge areas at lower elevations, commonly at streams or other water bodies (i.e. the ground water returns to surface water). In general, ground water divides[12] coincide with, or are slightly offset from surface water divides (Lewis-Brown and Jacobsen, 1995) (watersheds are described in **Section 3.4.1** and shown in **Figure 3.4.1**). Most ground water flows through the shallow layers of soil and weathered bedrock to the nearest stream. A smaller percentage penetrates deeper and recharges the aquifer

Recharge rates are expressed in terms of the amount of precipitation that reaches the aquifer per unit of time (e.g. inches/year during a drought year is used in **Figure 3.4.5**). New Jersey receives an average of about 40 to 51 inches of precipitation per year (lowest along the southeast coast and highest in the north-central parts of the state) (ONJSC, no date). Many factors affect the amount of recharge that will occur in a given area, including climate (e.g. the amount, intensity, and form of precipitation, and the effect of wind, humidity and air temperature on evapotranspiration), soil, surficial geology, and vegetation factors. In addition, recharge of ground water varies seasonally. During the growing season, precipitation is intercepted by plants and returned to the atmosphere through transpiration (part of the hydrologic cycle, see Section 5A). Likewise, evaporation is higher during the warmer months. Together, these are known as evapotranspiration. Therefore, most recharge occurs during late fall, winter, and early spring, when plants are dormant and evaporation rates are minimal (Heath, 1983). Relative to land use, recharge rates in forests are much higher than those in urban areas (Heath, 1983). This is because urban areas have large areas covered with impermeable surfaces, hastening runoff to surface water, instead of allowing precipitation to percolate into the ground.

To ensure that water is available during all weather conditions for human consumption as well as ecosystems dependent on water, the NJDEP established the Planning Threshold, or *dependable yield,* to be used for planning purposes. *Dependable yield* is defined as "the water yield maintainable by a ground-water system during projected future conditions, including both a repetition of the most severe drought of record and long-term withdrawal rates without creating undesirable effects." The most severe drought on record was in the early 1960's, and this is used in the Statewide Water Supply Plan. However, the Plan acknowledges that there is insufficient long-term precipitation data to prove that this is the worst drought that could occur in the future, in duration or severity, and recommends re-evaluation of safe-yield estimates and development of optimal strategies for severe droughts (NJDEP OEP, 1996). Robert Canace, formerly of the NJ Geological Survey, suggested that 20% of the estimated recharge should be used for planning purposes, representing the portion of recharge actually available for use during drought conditions (Canace, 1995).

In view of the importance of not exceeding the aquifers' safe yield, the New Jersey Geological Survey has completed studies quantifying recharge, as discussed in the following sections.

New Jersey Geological Survey Recharge Method GSR-32

N.J.S.A. 58:11A, 12-16 required the NJDEP to publish a methodology to map and rank aquifer-recharge areas. In addition, the legislation required the development of ground water protection practices designed to encourage ecologically sound development in aquifer-recharge areas (Charles et. al., 1993). To fulfill the requirements of this legislation, the NJ Geological Survey developed GSR-32, which estimates ground water recharge (but not aquifer recharge), and is useful for evaluating the relative effect of present and future land uses on recharge areas (Charles et. al., 1993). For this method,

[12] A ground water divide is a line on a water table where on either side of which the water table slopes downward. It is analogous to a drainage divide between two drainage basins on a land surface.

recharge was calculated based on data for precipitation, soil, land-use/land-cover13, surface runoff, and evapotranspiration. This method was then applied by NJGS to create a GIS coverage (see Figure **3.4.5**). There were a number of assumptions made for the calculations and model inputs that limit the accuracy of the method: 1) the calculated ground water recharge includes any water entering the ground (in actuality, lesser amounts actually enter the aquifer); 2) assumes that all water that migrates below the root zone recharges the aquifer (which does not happen); 3) addresses only natural ground water recharge, and does not include artificial recharge, withdrawals or natural discharge; 4) wetlands and water bodies were eliminated from analysis, because the direction of flow between ground water and surface water is site-specific and also varies seasonally, and this level of detail was beyond the scope of the study (these areas were assumed to provide no recharge or discharge); 5) stream baseflows used may not be representative of local streams (Charles et. al., 1993) and 6) does not consider topography, depth to bedrock, presence of impervious surfaces, and/or type of bedrock underlying soils. An additional limitation of the data is that they estimate long-term average annual recharge, which does not represent the reduced recharge during critical summertime conditions.

Applying the GSR-32 method to Ocean Township, the estimated average annual subsurface recharge rates range from 0 to 17 inches per year (excluding surface water, wetlands and hydric soils) and 0 to 14 inches per year during drought (shown on **Figure 3.4.5**). Applying the 20% consumptive use limit to these figures results in usable recharge from 0 to 3 inches per year.

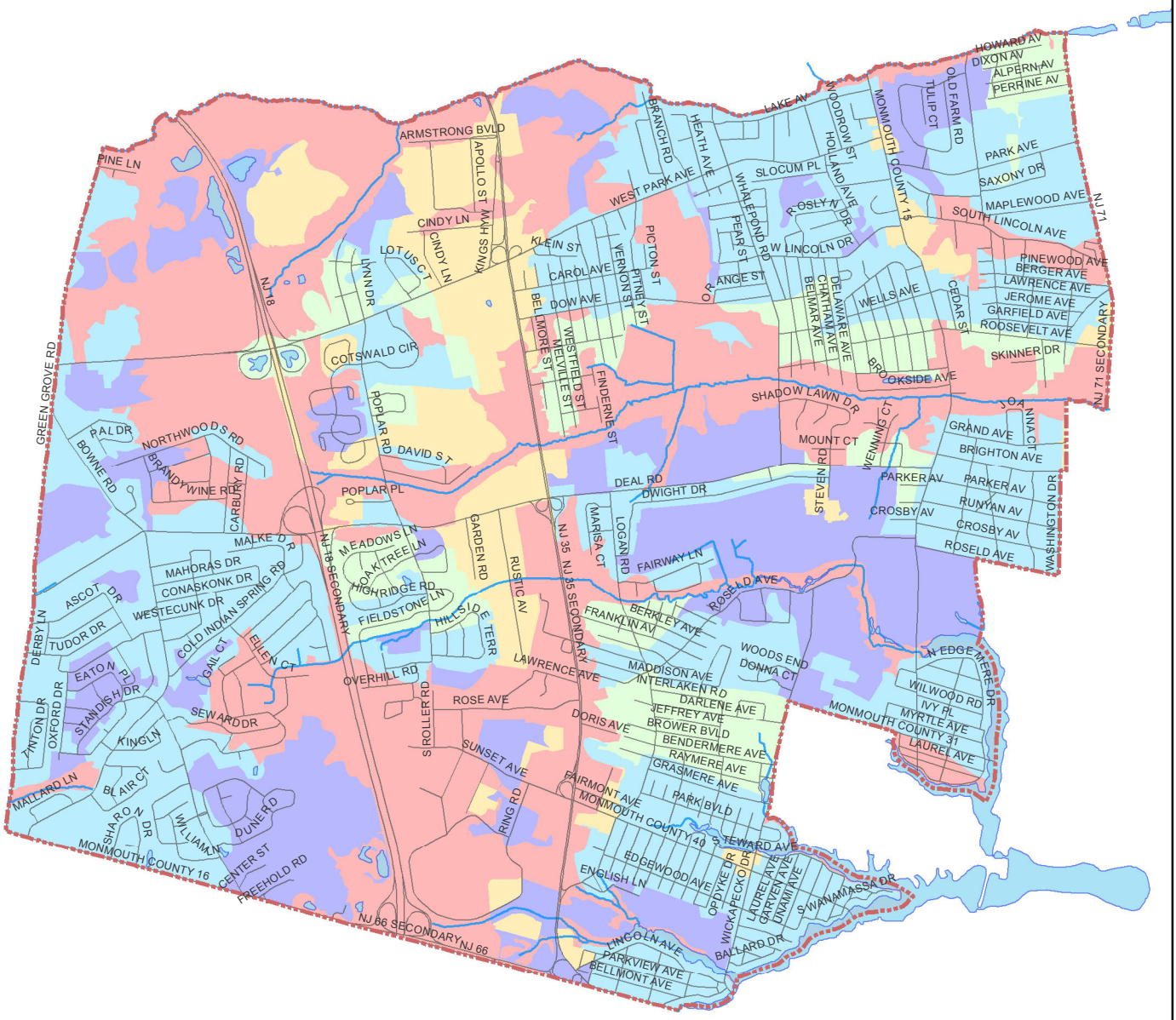
3.4.10 Ground Water Quality Standards

The New Jersey Ground Water Quality Standards (GWQS; N.J.A.C. 7:9C) (last amended August 9, 2018) specify the quality criteria and designated uses for ground water, and serve as the basis for setting ground water discharge standards under the New Jersey Pollutant Discharge Elimination System program (see **Section 5.5**), as well as for establishing standards for ground water cleanups and other relevant laws. The criteria are numerical values assigned to each constituent (pollutant). The GWQS also contain technical and general policies to ensure that the designated uses can be adequately protected.

Ground water within watersheds of FW1 surface waters, state-owned Natural Areas, and the major aquifers of the Pinelands Area are designated *Class I*. The designated use for Class I ground water is the maintenance of special ecological resources, with secondary uses being potable, agricultural and industrial water. *Class II* waters are those not specifically designated Class I or Class III. The designated use of Class II ground waters is to provide potable water using conventional treatment. Class II criteria specify the levels of constituents above which the water would pose an unacceptable risk for drinking water. *Class III* ground waters can be used for anything other than for potable water (NJDEP, March 13, 2019).

Ocean Township's waters are designated Class II (to provide potable water with conventional treatment). It should not be assumed that ground water quality everywhere meets the criteria for each classification area in view of natural variability and the possibility of localized pollution.

[13] Land use/land cover data from 1995-1997 were used for this study. Changes in land use/land cover and impervious surfaces affect recharge, but are not shown on **Figure 3.4.5**, because this involves complex calculations, and NJGS has not updated this GIS data layer.



Legend

- Ocean Township
- Roads
- Water

Aquifer Recharge (drought)

- 0 - 1 inches
- 2 - 5 inches
- 6 - 9 inches
- 10 - 11 inches
- 12 - 15 inches

N

0 0.25 0.5 1 Miles

Data Sources: NJDEP, NJDOT, ESRI
Disclaimer required for NJDEP Data: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Kratzer Environmental Services
Ocean Township ERI 2019

Figure 3.4.5. Ground Water Recharge (Drought, inches) Ocean Township, Monmouth County

Ocean Township

References: Hydrology

Watersheds

NJDEP Land Use Management, Water Monitoring and Standards. October 17, 2016. N.J.A.C. 7:9B Surface Water Quality Standards. http://www.nj.gov/dep/rules/rules/njac7_9b.pdf

NJDEP Office of Environmental Planning. January 1997. Draft Statewide Watershed Management Framework Document for the State of New Jersey. http://www.nj.gov/dep/watershedrestoration/docs/frame97fixed.pdf

NJDEP. March 8, 2016. 14 Digit Hydrologic Unit Code Delineations for New Jersey, Edition 20160309 (Hydr_HUC14_bnd). GIS data. https://gisdata-njdep.opendata.arcgis.com/datasets/8de4c55bcf6540bcbe173df2b0552eb2_22

USGS. 2016. Boundary Descriptions and Names of Regions, Subregions, Accounting Units and Cataloging Units. http://water.usgs.gov/GIS/huc.html https://water.usgs.gov/GIS/huc_name.html#Region02 Accessed March 20, 2019.

Winter, T.C., J.W. Harvey, O.L. Franke, and W.M. Alley. 1998. "Natural Processes of Ground-Water and Surface-Water Interaction" in *Ground Water and Surface Water A Single Resource--USGS Circular 1139*. https://pubs.usgs.gov/circ/circ1139/htdocs/natural_processes_of_ground.htm. Accessed March 20, 2019.

Surface Water Quality Standards

NJDEP. October 17, 2016. N.J.A.C. 7:9B Surface Water Quality Standards. http://www.nj.gov/dep/rules/rules/njac7_9b.pdf

NJDEP. December 2010. NJDEP Surface Water Quality Standards of New Jersey (Version 201012). GIS data. https://gisdata-njdep.opendata.arcgis.com/datasets/surface-water-quality-classification-of-new-jersey/data

Surface Water Monitoring and Biomonitoring

Environmental Assessment Council, Inc. 1977. Natural Resource Inventory for the Whale Pond Brook Watershed, Monmouth County, New Jersey.

Jablonski, Leo A. 1968. Ground-Water Resources of Monmouth County, New Jersey. U. S. Geological Survey SPECIAL REPORT NO. 23. https://pubs.er.usgs.gov/publication/70114619

NJDEP. June 5, 2017. Ambient Biomonitoring Network (AMNET) of New Jersey. GIS data. https://gisdata-njdep.opendata.arcgis.com/datasets/d8937d8a49064467876d80e0c58a0d6a_13

NJDEP. November 19, 2018. Ambient Stream Quality Monitoring Sites of New Jersey. GIS data. https://gisdata-njdep.opendata.arcgis.com/datasets/29d555f36c0a4960b0a5dfbc732f0d61_25

NJDEP. January 9, 2019. NJPDES Surface Water Discharges in New Jersey, (1:12,000). GIS data. https://gisdata-njdep.opendata.arcgis.com/datasets/2ee12c0ddd344380bcc1f5cfdd5f8128_0

NJDEP BFBM. Downloadable Reports. https://www.state.nj.us/dep/wms/bfbm/downloads.html#atl. Site accessed March 20, 2019.

Rutgers University Department of Landscape Architecture. 1977. Deal Lake Watershed Natural Resource Inventory.

William M. Kwalick Associates. January 1975. Poplar Brook Watershed Study Report, Township of Ocean Monmouth County, New Jersey.

Surface Water Quality Impairments

NJDEP. October 17, 2016. N.J.A.C. 7:9B Surface Water Quality Standards. http://www.nj.gov/dep/rules/rules/njac7_9b.pdf

NJDEP Division of Water Monitoring and Standards, Bureau of Environmental Analysis, Restoration and Standards. February 21, 2019. Total Maximum Daily Loads home page. https://www.nj.gov/dep/wms/bears/tmdls.html. Accessed March 20, 2019.

NJDEP Division of Water Monitoring and Standards, Bureau of Environmental Analysis, Restoration and Standards. May 2017. 2014 New Jersey Integrated Water Quality Assessment Report. http://www.nj.gov/dep/wms/bears/docs/2014_final_integrated_report.pdf

NJDEP Division of Water Monitoring and Standards, Bureau of Environmental Analysis, Restoration and Standards. February 2015. 2014 Integrated Water Quality Monitoring and Assessment Methods. http://www.nj.gov/dep/wms/bears/docs/2014_final_methods_document_and_response_to_comments.pdf

USEPA. 2019. Clean Water Act Section 303(d): Impaired Waters and Total Maximum Daily Loads (TMDLs). https://www.epa.gov/tmdl. Accessed March 20, 2019.

US. November 27, 2002. Federal Water Pollution Control Act [As Amended Through P.L. 107–303, November 27, 2002]. https://www.epa.gov/sites/production/files/2017-08/documents/federal-water-pollution-control-act-508full.pdf

Flood Risk and Flood Zones

Dinicola, Karen. 2005. The "100-Year Flood." US Geological Survey Fact Sheet 229-96. http://pubs.usgs.gov/fs/FS-229-96/

Federal Emergency Management Agency (FEMA). No date. Community Status Book Report: New Jersey Communities Participating in the National Flood Program. https://www.fema.gov/cis/NJ.html. Accessed March 20, 2019.

Federal Emergency Management Agency (FEMA). July 25, 2017. FLOODSMART: The National Flood Insurance Program. https://www.floodsmart.gov/Learn

Federal Emergency Management Agency (FEMA). September 19, 2018. National Flood Insurance Program: Flood Hazard Mapping. https://www.fema.gov/national-flood-insurance-program-flood-hazard-mapping. Accessed March 20, 2019.

Federal Emergency Management Agency (FEMA). March 18, 2019. Flood Zones. https://www.fema.gov/flood-zones. Accessed March 20, 2019.

Monmouth County Planning . September 25, 2009. FEMA's National Flood Hazard Layer for Ocean Township, Monmouth County, NJ (1:12,000). GIS data.

Popovich, Nadja and Claire O'Neill. August 28, 2017. "A '500-Year Flood' Could Happen Again Sooner Than You Think. Here's Why" In The New York Times. https://www.nytimes.com/interactive/2017/08/28/climate/500-year-flood-hurricane-harvey-houston.html?em_pos=medium&emc=edit_sc_20170904&nl=science-times&nl_art=8&nlid=719323&ref=headline&te=1.

Federal Emergency Management Agency (FEMA). June 21, 2007. Everyone Lives In A Flood Zone. Release Number: 1691/93-Floodsmart02. https://www.fema.gov/news-release/2007/06/21/everyone-lives-flood-zone

Ground Water Background

Heath, Ralph C. 1983. Basic Ground-Water Hydrology. U.S. Geological Survey Water-Supply Paper 2220. U.S. Geological Survey in cooperation with the North Carolina Department of Natural Resources and Community Development, 84 pages. https://pubs.er.usgs.gov/publication/wsp2220

US Geological Survey. 2016. Aquifer basics: Unconsolidated and semiconsolidated sand and gravel aquifers. https://water.usgs.gov/ogw/aquiferbasics/uncon.html. Accessed October 25, 2017.

Aquifers

Dunne, Thomas and Luna B. Leopold. 1978. Water in Environmental Planning. W. H. Freeman and Company: New York, New York. 818 pages.

Herman, Gregory C., Robert J. Canace, Scott D. Sanford, Ronald S. Pristas, Peter J. Sugarman, Mark A. French, Jeffrey L. Hoffman, Michael S. Serfes, and William J. Mennel. 1998. Aquifers of New Jersey. Open-File Map OFM 24. http://www.state.nj.us/dep/njgs/pricelst/ofmap/ofm24.pdf.

Lewis-Brown, Jean C. and Eric Jacobsen. 1995. Hydrogeology and Ground-water flow, Fractured Mesozoic Structural-Basin Rocks, Stony Brook, Beden Brook, and Jacobs Creek Drainage Basins, West-Central New Jersey. US Geological Survey Water-Resources Investigations Report 94-4147. West Trenton, New Jersey, 89 pages. http://pubs.usgs.gov/wri/1994/4147/report.pdf

NJGS. October 21, 2004. DGS02-3-Ground-Water Recharge for Monmouth County, NJ. GIS data. https://www.state.nj.us/dep/njgs/geodata/dgs02-3.htm

NJGS. October 8, 2004. DGS07-01 Aquifer Recharge Potential for NJ Watershed Management Area 12 (Monmouth Coastal Watersheds). GIS data. https://www.state.nj.us/dep/njgs/geodata/dgs07-1.htm

NJGS. May 21, 1998. DGS98-5 Aquifers of New Jersey. GIS data. http://www.state.nj.us/dep/njgs/geodata/dgs98-5.htm

NJDEP. 2017. Appendix B- Water supply options, confined aquifers of the New Jersey Coastal Plain in New Jersey Water Supply Plan 2017-2022. http://www.nj.gov/dep/watersupply/wsp.html

U.S. Geological Survey (USGS). January 14, 2013. Aquifer and Well Characteristics in NJ. https://www.nrc.gov/docs/ML0720/ML072050058.pdf

Sole Source Aquifers
NJDEP, New Jersey Geological Survey (NJGS), Jeffrey L. Hoffman (ed.). May 19, 1998. NJDEP Sole-Source Aquifers in New Jersey. http://www.state.nj.us/dep/njgs/geodata/dgs98-6.htm

U.S. Environmental Protection Agency (US EPA) Region 2. August 1992. Ramapo Aquifer Systems. Support Document. http://www.epa.gov/region02/water/aquifer/ramapo/ramapo.htm

Recharge
Canace, Robert. 1995. New Jersey Geological Survey, Department of Environmental Protection, Division of Science and Research. Critique of the Franklin Township ground water resources.

Charles, Emmanuel G., Cyrus Behroozi, Jack Schooley, and Jeffrey L. Hoffman. 1993. A Method for Evaluating Ground-Water-Recharge Areas in New Jersey. NJ Geological Survey Report GSR-32. NJDEP Geological Survey. 95 pages. http://www.state.nj.us/dep/njgs/pricelst/gsreport/gsr32.pdf

Heath, Ralph C. 1983. Basic Ground-Water Hydrology. U.S. Geological Survey Water-Supply Paper 2220. U.S. Geological Survey in cooperation with the North Carolina Department of Natural Resources and Community Development. 91 pages. http://pubs.er.usgs.gov/publication/wsp2220

NJDEP, Office of Environmental Planning (OEP). June 1996. Water for the 21st Century: The Vital Resource, New Jersey Statewide Water Supply Plan. 205 pages. http://rucore.libraries.rutgers.edu/rutgers-lib/32328/

NJGS. October 21, 2004. DGS02-3-Ground-Water Recharge for Monmouth County, NJ 1:24,000. GIS data. https://www.state.nj.us/dep/njgs/geodata/dgs02-3.htm

NJGS. October 8, 2004. DGS07-01 Aquifer Recharge Potential for NJ Watershed Management Area 12 (Monmouth Coastal Watersheds). GIS data. https://www.state.nj.us/dep/njgs/geodata/dgs07-1.htm

Office of the New Jersey State Climatologist (ONJSC). No Date. Climate Overview. http://climate.rutgers.edu/stateclim/?section=uscp&target=NJCoverview

Ground Water Quality Standards
N.J.A.C. 7:9C Ground Water Quality Standards. Date Last Amended: August 9, 2018. http://www.nj.gov/dep/rules/rules/njac7_9c.pdf

NJDEP Bureau of Environmental Analysis, Restoration and Standards. March 13, 2019. Ground Water Quality Standards N.J.A.C 7:9C. http://www.nj.gov/dep/wms/bears/gwqs.htm. Accessed March 20, 2019.

Internet Resources: Hydrology

General Water Resources Protection
Natural Processes of Ground-Water and Surface-Water Interaction (USGS): https://pubs.usgs.gov/circ/circ1139/htdocs/natural_processes_of_ground.htm

SEEDS: The NJ Environmental Education Directory Website: https://www.state.nj.us/dep/seeds/index.html

Basic Watershed Information (Watershed Restoration Section): http://www.nj.gov/dep/watershedrestoration/info.html

The Clean Water Book: Choices for Watershed Protection: http://www.nj.gov/dep/watershedrestoration/waterbook_tble.html

New Jersey Laws & Rules: http://www.nj.gov/dep/landuse/lawsregs.html
NJDEP Current and Proposed Rules https://www.nj.gov/dep/rules/

Water Quality Fact Sheets and Bulletins (NJ Agricultural Experiment Station Rutgers Cooperative Research & Extension): http://njaes.rutgers.edu/pubs/subcategory.asp?cat=6&sub=50&order=LastRevised

Floodplains & Floods
FEMA Flood Map Service Center: http://msc.fema.gov/portal

Flood Hazard Area Program (NJDEP Land Use Regulation): https://www.nj.gov/dep/landuse/fha_main.html

FloodSmart: The Official Site of the National Flood Insurance Program: http://www.floodsmart.gov

Integrated List & TMDL
NJDEP Integrated WQ monitoring and Assessment Report: http://www.nj.gov/dep/wms/bears/generalinfo.htm

NJDEP Total Maximum Daily Load (TMDL): http://www.nj.gov/dep/wms/bears/tmdls.html

USEPA Laws and Regulations: http://www2.epa.gov/laws-regulations

Surface Water Quality and Flow
Clean Shores: https://www.nj.gov/dep/wms/cleanshores.html

Cooperative Coastal Monitoring Program (Includes beach closings/advisories): https://www.njbeaches.org/

NJ Geological and Water Survey: http://www.state.nj.us/dep/njgs/index.html

USGS Real-time flow data index of NJ sites: http://waterdata.usgs.gov/nj/nwis/current/?type=flow

Water Quality Data Portal: https://www.waterqualitydata.us/

USGS - Water Resources of NJ: https://nj.usgs.gov/

3.5 WETLANDS

3.5.1 Wetland Classification

A *wetland* is a transitional area between aquatic and terrestrial ecosystems. Wetlands are those areas that are inundated (for example in a floodplain) or saturated by surface water or ground water (such as a perched water table) 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, commonly known as hydrophytic vegetation. To determine if an area is a wetland, the vegetation (plants that like wet conditions), soils (wetland, or hydric, soil types often show mottling) and hydrology (low spots or evidence of water) are evaluated. A *transition area*, or buffer, is an area of land adjacent to a freshwater wetland that minimizes adverse impacts on the wetland or serves as an integral component of the wetlands ecosystem (N.J.S.A. 13:9B-3 in NJDEP Division of Land Use Management, July 16, 1998).

In the past, wetlands were often regarded as wastelands – only useful when drained and filled. In contrast, a 1978 Tufts University study showed that one acre of wetland provides at least $153,000 (1978 dollars) of public value, considering proven monetary benefits of flood protection, pollution reduction, water supply, recreation and aesthetics (Fair, 2004). Some of the benefits of wetlands include:

- Wetlands protect drinking water by filtering out pollutants and sediments that would otherwise obstruct and contaminate our waters.
- Wetlands soak up runoff from heavy rains and snow melts, providing natural flood control.
- Wetlands release stored waters during droughts.
- Wetlands provide critical habitats for a major proportion of the state's fish and wildlife, including many endangered, commercial and recreational species.
- Wetlands provide high quality open space for recreation and tourism (NJDEP Land Use Regulation, August 16, 2017).

The value of wetlands was not broadly accepted until at least the 1970s and 1980s. By then, more than half of the country's wetlands had been destroyed (NJDEP Land Use Regulation, August 16, 2017). Loss of wetlands has resulted in erosion, flooding, sedimentation, and decreased populations of many types of wildlife. Structures built in wetlands suffer from frost heaving and other structural problems.

3.5.2 Regulations Related to Wetlands

New Jersey protects wetlands under the 1987 New Jersey Freshwater Wetlands Protection Act (N.J.S.A. 13:9B) and Rules (N.J.A.C. 7:7A) (NJDEP Division of Land Use Management, July 16, 1998 and April 16, 2018). Under these, NJDEP regulates virtually all activities proposed within wetlands and transition areas or buffers around freshwater wetlands, including cutting of vegetation, dredging, excavation or removal of soil, drainage or disturbance of the water level, and filling or discharge of any materials. Development that would impair the wetland's ability to provide the values listed above (filtration, flood control, etc.) is prohibited. There are limited exemptions for existing farming, ranching, or forestry operations.

On-site inspection (direct testing and observation of soils, hydrology and vegetation) by a qualified professional is needed prior to making any disturbance within a wetland or transition area. Only an official determination from NJDEP, called a *Letter of Interpretation* (LOI) can verify the presence, absence, or boundaries of freshwater wetlands and transition areas on a site. Copies of these maps are

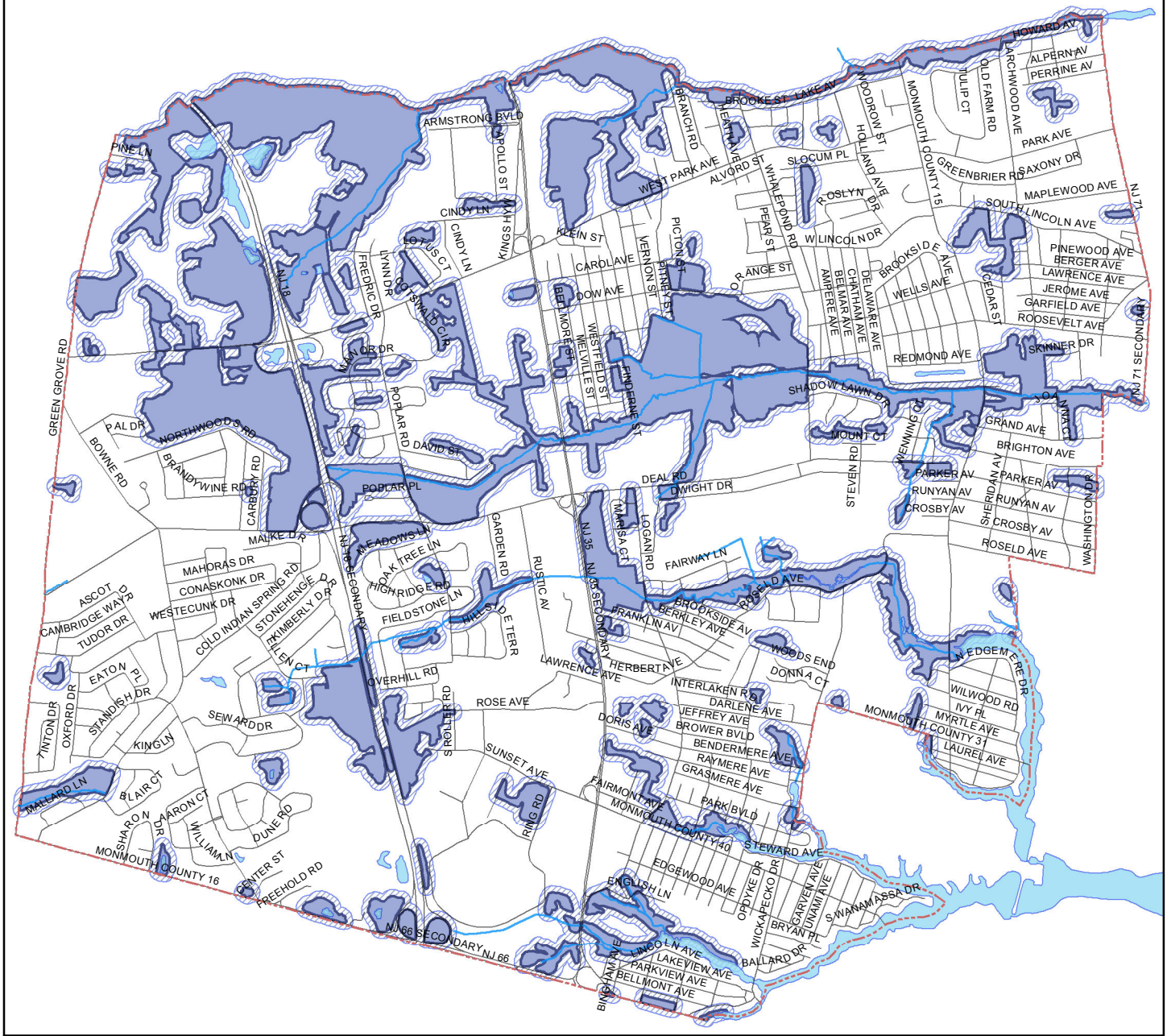
filed at the NJDEP and the township building, but unfortunately, NJDEP does not digitize these determinations into a GIS layer[14].

In addition to defining the boundary of the wetland, the LOI establishes the value of the wetland, which will determine the width of the regulated transition area. *Ordinary Value* wetlands, such as man-made drainage ditches and swales, have a 0 foot buffer. *Intermediate Value* wetlands have a 50 foot buffer, which includes those wetlands not included in the definitions of Ordinary or Exceptional value. *Exceptional Value* wetlands have a 150 foot buffer width. Exceptional Value wetlands include wetlands that provide habitat for endangered and threatened species. A determination of threatened and endangered species habitat is provided by using the Landscape Project data (see **Section 3.7.2**).

There are 1,024 acres of wetlands within Ocean Township, covering 14.57% of the township (NJDEP, February 17, 2015). The wetlands shown in **Figure 3.5.1** were determined by selecting all wetlands land use types from NJDEP's 2012 Land Use GIS data. **Figure 3.5.1** provides guidance on where wetlands are found in Ocean Township and is intended to serve as a resource for analysis rather than regulatory delineations because it is derived from aerial photos rather than on-site surveys. A transition area (buffer) width of 150 feet is mapped in **Figure 3.5.1** because the GIS data does not determine the value of each wetland. The actual transition area width (0, 50 or 150') required by the NJDEP is determined in the LOI.

Three-quarters of Ocean Township's wetland acreage consists of deciduous wooded wetlands. There are several other types of natural freshwater wetlands in the township including deciduous and coniferous scrub/shrub wetlands, mixed wooded wetlands and herbaceous wetlands (see **Section 3.6.1** and **Table 3.6.1**). Nearly thirteen percent of the township's wetlands have classifications that indicate alterations by human activity, including 'Managed Wetland in Built-up Maintained Recreational Area' (9.58%), 'Managed Wetland in Maintained Lawn Greenspace' (2.53%) and 'Disturbed Wetlands' (0.72%).

[14] Digitizing involves giving latitude and longitude coordinates to areas and lines to depict mapped features.



Legend

- Ocean Township
- Roads
- Water
- Wetlands (2012 Land Use)
- 50 foot transition area (buffer) applies to some wetlands
- 150 foot transition area (buffer) applies to some wetlands

N

0 0.25 0.5 1 Miles

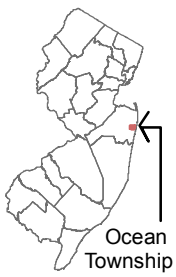
Data Sources: NJDEP, NJDOT

Disclaimer required for NJDEP Data: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Kratzer Environmental Services
Ocean Township ERI 2019

Figure 3.5.1. Wetlands Land Use 2012 Ocean Township, Monmouth County

Note: Only an official determination from NJDEP, called a "Letter of Interpretation" (LOI) can verify the presence, absence or boundaries of freshwater wetlands and transition areas (buffers).



References: Wetlands

Fair, Abigail. 2004. Freshwater Wetlands Protection in New Jersey: A Manual for Local Officials. Third Edition. Association of New Jersey Environmental Commissions. 52 pages. http://www.anjec.org/WaterFreshwaterWetlands.htm

NJDEP Division of Land Use Management. July 16, 1998. Freshwater Wetlands Protection Act N.J.S.A. 13:9B (last amended July 1998) 22 pages. http://www.nj.gov/dep/landuse/download/13_9b.pdf

NJDEP Division of Land Use Management. April 16, 2018. Freshwater Wetlands Protection Act Rules N.J.A.C 7:7A (last amended April 2018). 239 pages. http://www.nj.gov/dep/rules/rules/njac7_7a.pdf

NJDEP Land Use Regulation Program. August 16, 2017. Freshwater Wetlands Program Home Page. http://www.nj.gov/dep/landuse/fww/fww_main.html. Accessed October 22, 2017.

NJDEP, Bureau of Geographic Information Systems (BGIS). February 17, 2015. Land Use/Land Cover 2012 Update, Edition 20150217 Land Use/Land Cover 2012 Update, Edition 20150217 Subbasin 02040301 - Mullica-Toms (Land_lu_2012_hu02040301). 1:2,400. GIS Data. http://www.state.nj.us/dep/gis/lulc12.html

Internet Resources: Wetlands

Wetlands
Freshwater Wetlands Program (NJDEP Land Use Regulation): http://www.nj.gov/dep/landuse/fww/fww_main.html

Freshwater Wetlands Program: Before You Buy – Before You Build: http://www.nj.gov/dep/landuse/bybob.html

NJDEP Regulations:
NJDEP Laws & Rules: http://www.nj.gov/dep/landuse/lawsregs.html

NJDEP Rules & Regulations, current and proposed: http://www.state.nj.us/dep/rules

Phone Contacts:
NJ Drought Hotline: 1-800-4-ITS DRY (1-800-448-7379) or http://www.njdrought.org/

NJ Environmental Incident Hotline (hazardous spill, fire, explosion, illegal dumping, wildlife problem):
1-877-WARNDEP / 1-877-927-6337 (toll-free, 24 hours) or http://www.nj.gov/dep/warndep.htm

NJDEP Bureau of Coastal & Land Use Compliance & Enforcement: 1-609-292-1240

NJDEP Division of Land Use Regulation (Wetlands, Streams/Rivers, Flood Hazard Areas):
Technical Support Center: (609) 777-0454 or http://www.nj.gov/dep/landuse/contact.html
Forms: http://www.nj.gov/dep/landuse/forms.html

3.6 VEGETATION

3.6.1 Native Vegetation Types/Species

What are current threats?

The New Jersey Comparative Risk Project (March 2003) listed habitat fragmentation and habitat loss as the highest ranking stressors of Statewide ecological quality. Certain species that require large expanses of intact habitat are becoming less common. Other factors that impact ecological health include invasive non-native species and diseases, overpopulations of deer and geese, and pollution.

Deciduous trees and shrubs display fall colors in Weltz Park.

Dominant Vegetation (Land Cover)

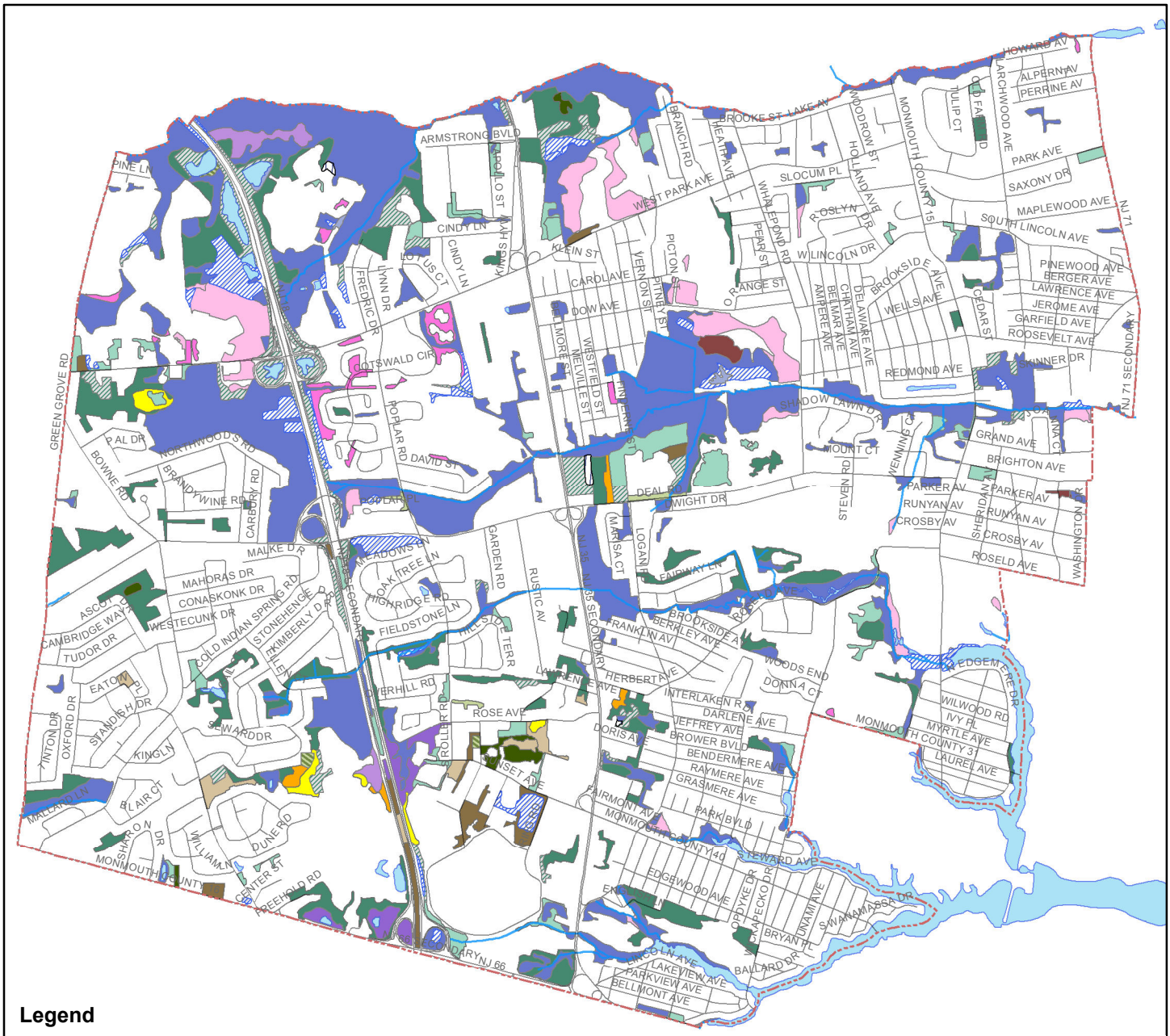
The 2012 Land Use/Land Cover (LU/LC) data layer was created by a consultant to NJDEP by comparing the 2007 LU/LC layer to 2012 color infrared imagery and delineating and coding areas of change with a 1 foot pixel resolution. The classification system used was a modified Anderson Classification System (USGS, 2010) that provided the parameters for proper and consistent coding of the LU/LC feature classes and subclasses. It should be noted that 1) changes since 2012 are not shown, and 2) the method is not 100% accurate. In addition, since it is based on interpretation of aerial photographs, the data layer cannot provide information about the particular species found in an area. The land cover classifications are shown in **Figure 3.6.1**, and the relative proportion of each within Ocean Township is provided in the acreage totals in a table embedded in the figure (NJDEP, 2015). The categories are broken down into a greater level of detail in **Table 3.6.1**.

Three-quarters of the land in Ocean Township is classified as Urban (75.47%). Most of the remaining acreage consists of forest (7.97%), wetlands (14.57%) or open water (1.24%), together accounting for 23.78% of the township. Less than 1% of the township land is utilized for agriculture (0.38%), and a small portion of the acreage is classified as barren land (0.37%) (NJDEP, 2015).

Table 3.6.1. Land Use Classifications in Ocean Township

Land Cover Code	Land Cover Name	Acres*	Percent
AGRICULTURE LAND USE TYPE			
2100	CROPLAND AND PASTURELAND	8.89	0.13
2400	OTHER AGRICULTURE	17.88	0.25
	Total AGRICULTURE:	**26.77**	**0.38**
BARREN LAND USE TYPE			
7400	ALTERED LANDS	8.06	0.11
7500	TRANSITIONAL AREAS	17.83	0.25
	Total BARREN LAND:	**25.89**	**0.37**
FOREST LAND USE TYPE			
4110	DECIDUOUS FOREST (10-50% CROWN CLOSURE)	98.18	1.40
4120	DECIDUOUS FOREST (>50% CROWN CLOSURE)	285.03	4.05
4210	CONIFEROUS FOREST (10-50% CROWN CLOSURE)	4.64	0.07
4220	CONIFEROUS FOREST (>50% CROWN CLOSURE)	11.59	0.16
4312	MIXED FOREST (>50% CONIFEROUS WITH >50% CROWN	8.01	0.11

Land Cover Code	Land Cover Name	Acres*	Percent
	CLOSURE)		
4322	MIXED FOREST (>50% DECIDUOUS WITH >50% CROWN CLOSURE)	12.36	0.18
4410	OLD FIELD (< 25% BRUSH COVERED)	16.98	0.24
4420	DECIDUOUS BRUSH/SHRUBLAND	93.40	1.33
4430	CONIFEROUS BRUSH/SHRUBLAND	2.91	0.04
4440	MIXED DECIDUOUS/CONIFEROUS BRUSH/SHRUBLAND	27.33	0.39
	Total FOREST:	**560.43**	**7.97**
URBAN LAND USE TYPE			
1110	RESIDENTIAL, HIGH DENSITY OR MULTIPLE DWELLING	398.94	5.67
1120	RESIDENTIAL, SINGLE UNIT, MEDIUM DENSITY	2121.43	30.17
1130	RESIDENTIAL, SINGLE UNIT, LOW DENSITY	780.41	11.10
1140	RESIDENTIAL, RURAL, SINGLE UNIT	342.50	4.87
1200	COMMERCIAL/SERVICES	592.96	8.43
1300	INDUSTRIAL	92.36	1.31
1400	TRANSPORTATION/COMMUNICATION/UTILITIES	27.41	0.39
1410	MAJOR ROADWAY	131.88	1.88
1420	RAILROADS	3.85	0.05
1499	STORMWATER BASIN	42.89	0.61
1500	INDUSTRIAL AND COMMERCIAL COMPLEXES	6.67	0.09
1600	MIXED URBAN OR BUILT-UP LAND	4.28	0.06
1700	OTHER URBAN OR BUILT-UP LAND	266.92	3.80
1710	CEMETERY	3.09	0.04
1800	RECREATIONAL LAND	434.09	6.17
1804	ATHLETIC FIELDS (SCHOOLS)	56.43	0.80
	Total URBAN:	**5306.11**	**75.47**
WATER LAND USE TYPE			
1419	BRIDGE OVER WATER	0.49	0.01
5100	STREAMS AND CANALS	1.32	0.02
5200	NATURAL LAKES	50.37	0.72
5300	ARTIFICIAL LAKES	35.06	0.50
	Total WATER:	**87.25**	**1.24**
WETLANDS LAND USE TYPE			
1750	MANAGED WETLAND IN MAINTAINED LAWN GREENSPACE	25.95	0.37
1850	MANAGED WETLAND IN BUILT-UP MAINTAINED REC AREA	98.15	1.40
2140	AGRICULTURAL WETLANDS (MODIFIED)	0.05	0.00
6210	DECIDUOUS WOODED WETLANDS	778.81	11.08
6231	DECIDUOUS SCRUB/SHRUB WETLANDS	70.22	1.00
6232	CONIFEROUS SCRUB/SHRUB WETLANDS	2.76	0.04
6240	HERBACEOUS WETLANDS	3.10	0.04
6251	MIXED WOODED WETLANDS (DECIDUOUS DOM.)	21.57	0.31
6252	MIXED WOODED WETLANDS (CONIFEROUS DOM.)	15.98	0.23
7430	DISTURBED WETLANDS (MODIFIED)	7.41	0.11
	Total WETLANDS:	**1023.99**	**14.57**
	Ocean Township Total:	**7030.43**	**100.00**
* Acreage from the GIS data may vary from acreage calculated based on tax maps.			
Source: NJDEP, 2015; USGS, 2010.			



Legend

- Ocean Township
- Roads
- Water

Forest Land Use/Land Cover

- 4110-DECIDUOUS FOREST (10-50% CROWN CLOSURE)
- 4120-DECIDUOUS FOREST (>50% CROWN CLOSURE)
- 4210-CONIFEROUS FOREST (>50% CROWN CLOSURE)
- 4220-CONIFEROUS FOREST (10-50% CROWN CLOSURE)
- 4312-MIXED FOREST (>50% CONIFEROUS WITH >50% CROWN CLOSURE)
- 4322-MIXED FOREST (>50% DECIDUOUS WITH >50% CROWN CLOSURE)
- 4410-OLD FIELD (< 25% BRUSH COVERED)
- 4420-DECIDUOUS BRUSH/SHRUBLAND
- 4430-CONIFEROUS BRUSH/SHRUBLAND
- 4440-MIXED DECIDUOUS/CONIFEROUS BRUSH/SHRUBLAND

Wetland Land Use/Land Cover

- 1750-MANAGED WETLAND IN MAINTAINED LAWN GREENSPACE
- 1850-MANAGED WETLAND IN BUILT-UP MAINTAINED REC AREA
- 2140-AGRICULTURAL WETLANDS (MODIFIED)
- 6210-DECIDUOUS WOODED WETLANDS
- 6231-DECIDUOUS SCRUB/SHRUB WETLANDS
- 6232-CONIFEROUS SCRUB/SHRUB WETLANDS
- 6240-HERBACEOUS WETLANDS
- 6251-MIXED WOODED WETLANDS (DECIDUOUS DOM.)
- 6252-MIXED WOODED WETLANDS (CONIFEROUS DOM.)
- 7430-DISTURBED WETLANDS (MODIFIED)

N

0 0.25 0.5 1 Miles

Kratzer Environmental Services
Ocean Township ERI 2019

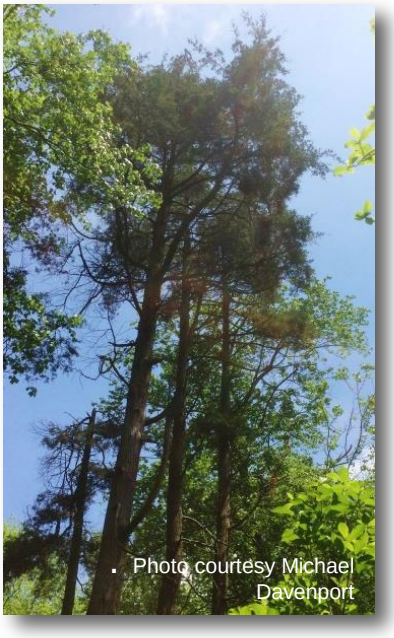
Figure 3.6.1. Vegetation (Land Cover) Ocean Township, Monmouth County

Data Sources: NJDEP, NJDOT
Disclaimer required for NJDEP Data: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Significant Ecological Communities

A pitch pine (*Pinus rigida*) swamp located in Ocean Township has been designated as a critical area by the county (Monmouth County Environmental Council, 1978). In addition to being both biologically and geologically unique in the region, the swamp has an important role as a natural flood control mechanism. Other noteworthy features reported in the swamp include 200-300 year old pine trees and a large stand of pink ladyslipper orchids (*Cypripedium acaule*). The special wetland is located west of Route 18 in the Poplar Brook Watershed (Township of Ocean, 1975).

The Whale Pond Brook is also noted as one of Monmouth County's significant waterways. The brook originates in Ocean Township and approximates the township's northern border, flowing east into Long Branch City where it eventually empties into Lake Takanassee. Whale Pond Brook was designated as important due to its wildlife habitat, watershed and floodplain characteristics, along with a locally significant stand of Atlantic white cedar (*Chamaecyparis thyoides*) (Monmouth County Environmental Council, 1975). An assessment of the watershed (Environmental Assessment Council, January 1977) determined that the headwaters of the Whale Pond Brook were "a valuable natural resource and ecologically sensitive area vital to the preservation of downstream quality" and recommended the site as a high priority for preservation. Although the headwaters area was later disturbed by the extension of Route 18 from Deal Road north to the Garden State Parkway in the late 1980s (Larsen, 2018), the construction resulted in the preservation of a 91-acre section of the watershed (NJNLT, 2013). Another section of the Whale Pond Brook watershed is preserved as part of Weltz Park. The Whale Pond Brook/Takanassee Lake Watershed Association, incorporated in 2011, is leading a campaign to restore the remainder of the watershed and has formal resolutions of support from all five towns in which it is located (Word on the Shore, 2012).

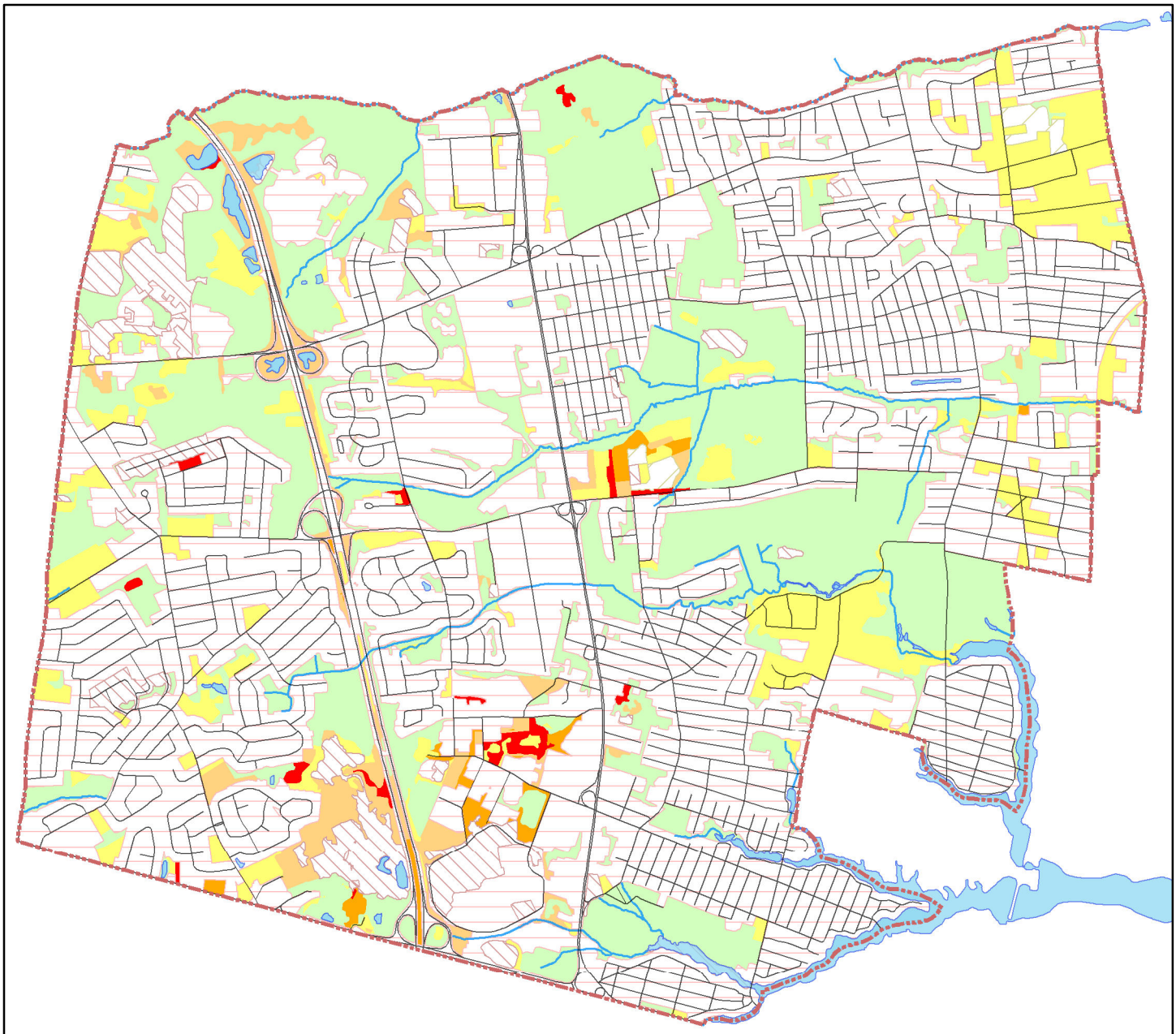


Atlantic White Cedar in Whale Pond Brook.

Wildfire Fuel Hazard

The New Jersey Forest Fire Service (NJFFS), a division of NJDEP, assessed *Wildfire Fuel Hazard* (WFH) throughout New Jersey (see **Figure 3.6.2**). The purpose is to provide information for NJ Forest Fire Service personnel, government agencies, and others interested in assessing the risk of wildfires throughout New Jersey. Modified Anderson Land Use/Land Cover Classifications from the 2002 Land Use/Land Cover dataset were assigned Wildfire Fuel Hazard Rankings (0 = Water, 1 = Low, 2 = Moderate, 3 = High, 4 = Very High, 5 = Extreme, 6 = Urban, 7 = Agriculture, 8 = Barren Land). Areas with 30% or greater slope and Wildfire Fuel Hazard 1 to 4 were increased by 1 (e.g. Low became Moderate, etc.) (NJDEP, 2018).

The majority of Ocean Township is either not rated or rated low wildfire fuel hazard. Just over ten percent of the township falls into the categories of moderate (7.93%) or high (2.57%) fuel hazard. Only about one percent of the township land is rated either very high (0.58%) or extreme (0.45%).



Legend

- Ocean Township
- Roads
- Water

Wildfire Fuel Hazard

- URBAN
- AGRICULTURE
- BARREN LAND
- WATER
- LOW (1)
- MODERATE (2)
- HIGH (3)
- VERY HIGH (4)
- EXTREME (5)

Wildfire Fuel Hazard	Description	Acres	%
0	WATER	72.03	1.02
1	LOW	1759.13	25.02
2	MODERATE	557.71	7.93
3	HIGH	180.67	2.57
4	VERY HIGH	41.12	0.58
5	EXTREME	31.42	0.45
6	URBAN	4111.66	58.49
7	AGRICULTURE	25.69	0.37
8	BARREN LAND	251.00	3.57
	TOTAL	7030.43	100.01

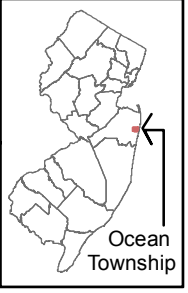
N

0 0.25 0.5 1 Miles

Data Sources: NJDEP, NJDOT
Disclaimer required for NJDEP Data: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Kratzer Environmental Services
Ocean Township ERI 2019

Figure 3.6.2 Wildfire Fuel Hazard Ocean Township, Monmouth County



3.6.2 Rare Plant Species

What are current threats?

New Jersey has great floral diversity for a small, densely populated state and is home to more than 2,100 native plant species (NJDEP, 2006). However, at least a third of the state's native plants (794 vascular plants) are currently listed as extirpated, historical, endangered or species of concern (NJDEP, 2016). NJDEP's 2006 report on the status of rare plants identified 37 causes of extirpation, the most common of which were identified as development, urbanization, succession, transportation, dams, bulkheads or fill, mines and agriculture.

The report also examined threats to extant populations of endangered plants. The most common anthropogenic threats were road construction and maintenance, habitat disturbance, development, pollution and recreation. Additional human activities listed as threats included agriculture, dams, dredging, land clearing, mining, railroads, right-of-ways, and overcollection. Native plants are also threatened by herbivory, invasive species, competition and succession (NJDEP, 2006).

Inventory

The Endangered Plant Species List Act (N.J.S.A. 13:1B-15.151) was enacted in 1989, defining endangered plants as "any native plant species whose survival in the State or the nation is in jeopardy... and any species having five or fewer extant populations within the State." The Division of Parks and Forestry has the responsibility of creating the list of NJ endangered plant species (N.J.A.C. 7:5C–1.1). While the rule does not provide any protection for officially listed species, several regulatory agencies within NJDEP responsible for protecting plant habitat have incorporated the Endangered Plant Species List into their criteria for review of permits (NJDEP Division of Parks and Forestry, January 4, 2007). The Department of Environmental Protection, through its Natural Heritage Database, is responsible for monitoring the status of many additional plant species that are not included on the official Endangered Plant Species List. The List of Endangered Plant Species and Plant Species of Concern includes all plant species that are considered to be of conservation concern in the state.

Table 3.6.2 presents the definitions used by NJDEP in describing the status of rare plants. In order to better document the status or change in status of species, the New Jersey Natural Heritage Program solicits information from the general public concerning sightings of rare plant species. People should use the appropriate reporting forms (see **Internet Resources** and **Appendix D.1)**.

Table 3.6.2 Definitions of Special Plant Species Status

STATE STATUS	STATE STATUS DEFINITION
E	Native New Jersey plant species whose survival in the State or nation is in jeopardy.
REGIONAL STATUS CODES FOR PLANTS AND ECOLOGICAL COMMUNITIES	
LP	Taxa listed by the Pinelands Commission as endangered or threatened within their legal jurisdiction. Not all species currently tracked by the Pinelands Commission are tracked by the Natural Heritage Program. A complete list of endangered and threatened Pineland species is included in the New Jersey Pinelands Comprehensive Management Plan.
HL	Taxa or ecological communities protected by the Highlands Water Protection and Planning Act within the jurisdiction of the Highlands Preservation Area.
ELEMENT RANKS	The Nature Conservancy developed a ranking system for use in identifying elements (rare species and ecological communities) of natural diversity most endangered with extinction. Each element is ranked according to its global, national, and state (or subnational in other countries) rarity. These ranks are used to prioritize conservation work so that the most endangered elements receive atten-tion first. Definitions for element ranks are after The Nature Conservancy (1982: Chapter 4, 4.1-1 through 4.4.1.3-3).
GLOBAL RANK	**GLOBAL ELEMENT RANK DEFINITION**
G1	Critically imperiled globally because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extinction.
G2	Imperiled globally because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extinction throughout its range.

STATE STATUS	STATE STATUS DEFINITION
G3	Either very rare and local throughout its range or found locally (even abundantly at some of its locations) in a restricted range (e.g., a single western state, a physiographic region in the East) or because of other factors making it vulnerable to extinction throughout its range; with the number of occurrences in the range of 21 to 100.
G4	Apparently secure globally; although it may be quite rare in parts of its range, especially at the periphery.
G5	Demonstrably secure globally; although it may be quite rare in parts of its range, especially at the periphery.
GH	Of historical occurrence throughout its range i.e., formerly part of the established biota, with the expectation that it may be rediscovered.
G?	Species has not yet been ranked.
STATE RANK	**STATE ELEMENT RANK DEFINITION**
S1	Critically imperiled in New Jersey because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres). Elements so ranked are often restricted to very specialized conditions or habitats and/or restricted to an extremely small geographical area of the state. Also included are elements which were formerly more abundant, but because of habitat destruction or some other critical factor of its biology, they have been demonstrably reduced in abundance. In essence, these are elements for which, even with intensive searching, sizable additional occurrences are unlikely to be discovered.
S2	Imperiled in New Jersey because of rarity (6 to 20 occurrences). Historically many of these elements may have been more frequent but are now known from very few extant occurrences, primarily because of habitat destruction. Diligent searching may yield additional occurrences.
S3	Rare in state with 21 to 100 occurrences (plant species and ecological communities in this category have only 21 to 50 occurrences). Includes elements which are widely distributed in the state but with small populations/acreage or elements with restricted distribution, but locally abundant. Not yet imperiled in state but may soon be if current trends continue. Searching often yields additional occurrences.
SH	Elements of historical occurrence in New Jersey. Despite some searching of historical occurrences and/or potential habitat, no extant occurrences are known. Since not all of the historical occurrences have been field surveyed, and unsearched potential habitat remains, historically ranked taxa are considered possibly extant, and remain a conservation priority for continued field work with the expectation they may be rediscovered.
SX	Elements that have been determined or are presumed to be extirpated from New Jersey. All historical occurrences have been searched and a reasonable search of potential habitat has been completed. Extirpated taxa are not a current conservation priority.
SU	Elements believed to be in peril but the degree of rarity uncertain. Also included are rare taxa of uncertain taxonomical standing. More information is needed to resolve rank.
T	Element ranks containing a "T" indicate that the infraspecific taxon is being ranked differently than the full species. For example Stachys palustris var. homotricha is ranked "G5T? SH" meaning the full species is globally secure but the global rarity of the var. homotricha has not been determined; in New Jersey the variety is ranked historic.
Q	Elements containing a "Q" in the global portion of its rank indicates that the taxon is of questionable, or uncertain taxonomical standing, e.g., some authors regard it as a full species, while others treat it at the subspecific level.
.1	Elements only ever documented from a single location.
Source: NJDEP Division of Parks and Forestry, March 22, 2010	

Information on the rare plants and natural communities throughout the state is tracked in the *New Jersey Natural Heritage Database* by the NJDEP Office of Natural Lands Management (ONLM). A search of the Natural Heritage Database in October 2018 revealed no records of special concern plants in Ocean Township (NJDEP ONLM, October 2018). A single rare plant species - Davis' dewberry (*Rubus pervarius*) - was listed as having been documented in the immediate vicinity of the township.

The sole New Jersey record of this rare dewberry dates back to 1955, when it was found somewhere between Green Grove and Wayside. Although currently known from a few locations in West Virginia and Vermont, the species is now listed as Historical in New Jersey (Kartesz, 2013). Davis's

dewberry was originally named *Rubus davisiorum*, accounting for its common name. An alternate common name utilized in contemporary literature is Westminster dewberry. The rare plant closely resembles the common swamp dewberry (*Rubus hispidus*), which is widespread throughout the northeast. Some authors consider *R. pervarius* to be a morphological variant of the swamp dewberry and include it in that species (Flora of North America, 1993).

Appendix D.2 provides a list of all rare plant species known from Monmouth County. The single species known from the immediate vicinity of Ocean Township is highlighted on the list. Rare plants that have been documented at other locations in the county could be present in Ocean Township if suitable habitat is present within the township.

Mapping (Natural Heritage Grid and Priority Sites)

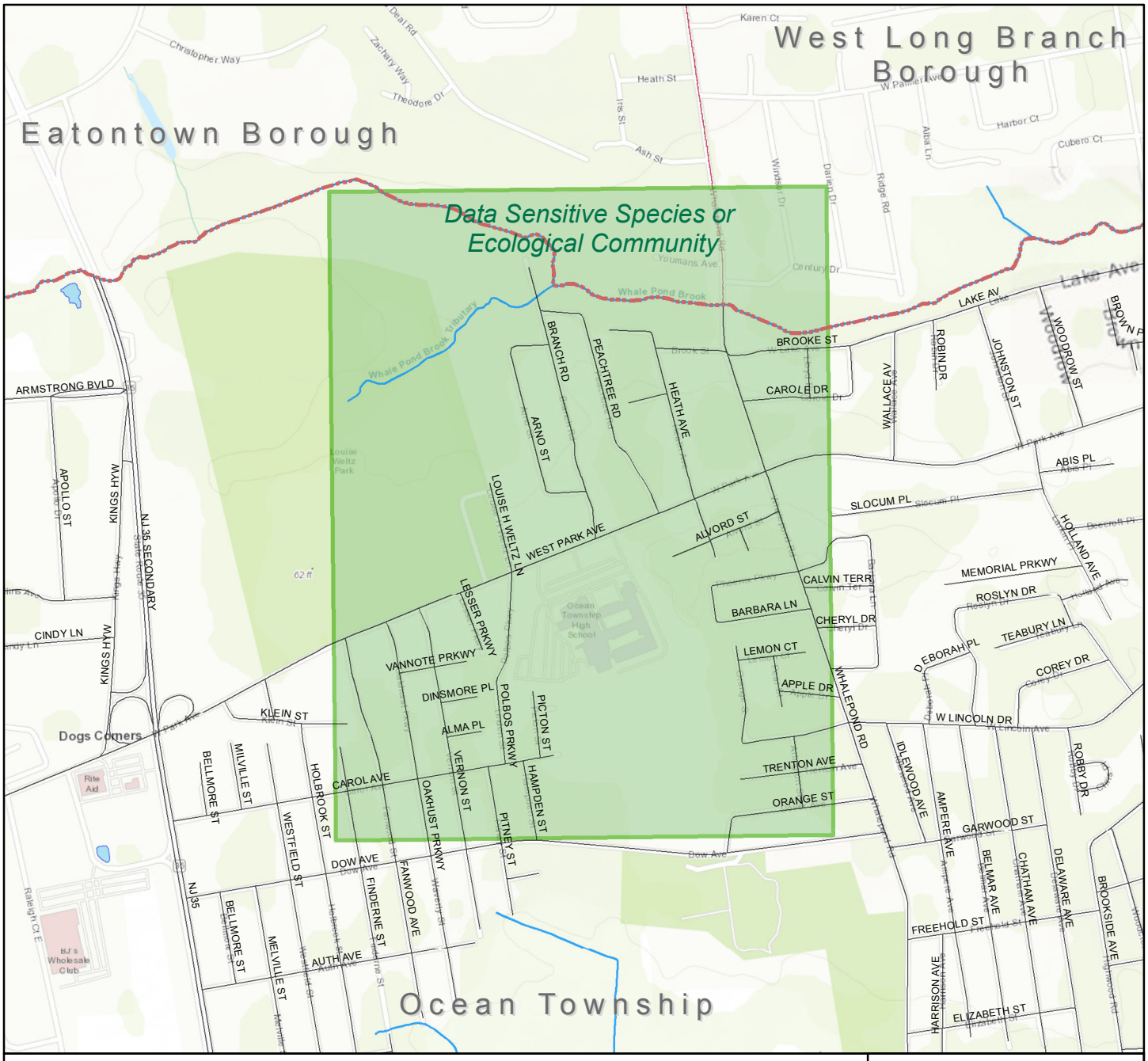
The NJDEP Office of Natural Lands Management (ONLM) has developed the Natural Heritage Grid Map (see **Figure 3.6.3** [15]), which provides a general representation of the locations of rare plant species and natural communities, including both historically and recently documented habitat. The purpose of the Grid Map is to document rare plant species and natural community habitats to inform decision-makers who need to address the conservation of natural resources. The map identifies potentially sensitive areas, and indicates where custom database searches are needed for land use decision-making. One quadrangle on the grid map is located primarily within Ocean Township, extending upward into portions of Eatontown and West Long Branch Boroughs. The quadrangle marks the possible location of a data-sensitive rare plant species with a state ranking of S2 (Imperiled) (NJ-GeoWeb, 2017), but that species was not listed in the Natural Heritage Program report for Ocean Township (NJDEP ONLM, October 2018). The custom search of the Natural Heritage Program Database revealed no rare plant records within Ocean Township, and only a single rare plant species in the immediate vicinity of the township with a state ranking of SH.1 (Historical from one location in the state). The Grid Map does not include habitat for animal species, and not all areas have been surveyed (NJDEP ONLM, November 2009).

In addition, the Natural Heritage Program makes lists of New Jersey rare plant species and ecological communities by county (see **Appendix D.2**). If suitable habitat exists in the township, it is possible that some of those species could be found in Ocean Township (NJDEP ONLM NHP, July 30, 2008).

Natural Heritage Priority Sites have been identified by the ONLM as areas critically important for preservation of New Jersey's biological diversity. These are considered some of the best and most viable occurrences of endangered and threatened plant species and natural communities, but other occurrences of endangered and threatened plant species may exist. No Natural Heritage Priority Sites have been identified in Ocean Township (NJDEP ONLM, October 2018).

Herbarium specimen of Davis' Dewberry. Image courtesy of the Carnegie Museum of Natural History. 1945.

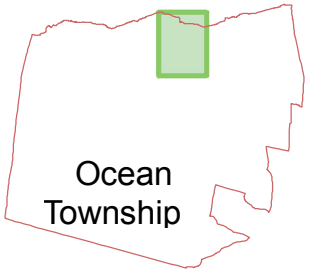
[15] The Natural Heritage Database search results (2013) differed from the most recent GIS data (2009) for the Natural Heritage Grid, therefore the search information (more recent) is shown.



Legend

- Ocean Township
- Municipalities
- Roads
- Water

Natural Heritage Grid Map
November 2009 Version
Generalized Locations of Rare Plant Species
S - Documented Location Known Precisely

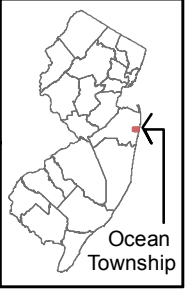


N
0 0.1 0.2 Miles

Data Sources: NJDEP, NJDOT. Topographic base map from ESRI.
Disclaimer required for NJDEP Data: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Kratzer Environmental Services
Ocean Township ERI 2019

Figure 3.6.3 Rare Plant Species (Natural Heritage Grid) Ocean Township, Monmouth County



3.6.3 Invasive and Non-native Vegetation

Non-native species (also called alien, exotic or introduced species) are those species that have been introduced outside their natural geographic range as a result of human actions, whether intentionally (e.g. as sources of food, for landscaping purposes or the release of unwanted pets) or unintentionally (e.g. in the ballast of a ship or in a load of lumber). Executive Order 13112 defines an *invasive species* as a species that is non-native to the ecosystem and whose introduction causes or is likely to cause economic or environmental harm or harm to human health (USDA, February 3, 1999). The most problematic of these displace native species, contribute to local elimination of species or even extinctions, alter the community structure, and may eventually disrupt ecosystem processes (Snyder et al, 2004). Preliminary research in NJ has documented over 1,200 species of nonindigenous plant species, or as much as 62% of the state's total vascular flora (Snyder et al, 2004).

Native plants can be susceptible to introduced diseases, which they have not evolved resistance to. The chestnut blight fungus was an accidental introduction that destroyed all mature American chestnut (*Castanea dentata*) trees, once one of the dominant trees in the New Jersey landscape. Another introduced fungus, Dutch elm disease, destroyed the American elm (*Ulmus americana*).

In addition, native plants may have little resistance to certain introduced insects, and/or these insects may have no natural enemies in their new surroundings, allowing them to rapidly reach pest proportions. Introduced insects which may be impacting Ocean Township's trees include the southern pine beetle, the gypsy moth, and the emerald ash borer (NJ Forest Service, 2018). The pests weaken their host trees, which often succumb to successive years of infestation, to diseases carried by the insects, or other environmental stresses.

For these reasons, the Final Report of the New Jersey Comparative Risk Project, which evaluated the relative risks of environmental problems to the people and ecosystems of New Jersey identified invasive species (including plants, insects, and other organisms) as one of the state's top environmental problems (Steering Committee of the New Jersey Comparative Risk Project, 2003).

In 2016, Ocean Township revised the ordinance entitled "Property Maintenance and Housing" to address invasive plant species in order to, "protect and promote the public health through the control of the growth of invasive plant species." Invasive plants are defined as, "all native and non-native vines and vegetation that grow out of place and are competitive, persistent, and pernicious. These plants may damage trees, vegetation, or structures. Examples include but are not limited to bamboo (spreading or running type), ragweed, multi flora rose, kudzu-vine and poison ivy or oak." Within the township, "All persons must control the growth of invasive plants. Failure to control the spread of such vegetation beyond the boundaries of a resident's property is a violation of this chapter" (Ocean Townshp, December 8, 2016).

While there is no official invasive species list for New Jersey, An Overview of Nonidigenous Plant Species in New Jersey (Snyder et al, 2004) profiled 27 nonindigenous plant species that aggressively invade natural plant communities in New Jersey. Subsequently, a statewide management plan for invasive species was developed, ranking non-native plants according to their abundance and level of threat to natural communities (VanClef, 2009). The 29 species in the highest-ranking category are summarized in **Table 3.6.3**.

Common reed (*Phragmites australis ssp. australis*) has sometimes been excluded from invasive species lists due to its strong resemblance to a native subspecies (*Phragmites australis ssp. americanus*). The two subspecies have recently been found to be morphologically distinguishable (Sarver et. al., 2008). While the invasive subspecies is widely established throughout New Jersey, the native subspecies is only known from Atlantic County (Kartesz, 2013). Because the large grass forms large, monotypic stands that completely exclude other wetland vegetation it is considered highly threatening to native communities.

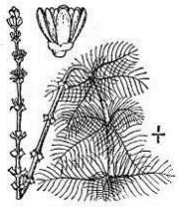
Common Reed

Table 3.6.3. New Jersey's Most Invasive Nonindigenous Plants

Scientific Name	Common Name	Problems Caused	Illustration	Illus. Source
Acer platanoides	Norway maple	Dispersed seeds easily sprout in shade, crowding out native plants. Canopy produces deep shade and roots produce a toxic substance preventing growth of wildflowers and other trees under its canopy.		Jan Samanek, State Phytosanitary Admin., Bugwood.org
Ailanthus altissima	tree of heaven	Aggressive in disturbed areas, crowding out native plants.		Jill S. Dodds
Alliaria petiolata	garlic mustard	Aggressive in shady habitats, crowding out native plants.		Deborah J. Kratzer
Ampelopsis glandulosa var. brevipedunculata	porcelain berry	Forms thick mats, blanketing the ground and trees and shrubs on forest edges		Michael Davenport
Berberis thunbergii	Japanese barberry	Can grow so thick in the understory of open forests that it shades out indigenous understory plants. Affects soil properties, particularly pH, which can affect plant establishment. Can form nearly impenetrable thorny thickets that impact the recreational value of natural lands.		Deborah J. Kratzer
Carex kobomugi	Japanese sedge	Forms dense mats and crowds out native species on beaches and dunes		Leslie R. Mehrhoff, University of Connecticut, Bugwood.org

Scientific Name	Common Name	Problems Caused	Illustration	Illus. Source
Celastrus orbiculatus	oriental bittersweet	The vine twines around surrounding plants, impeding sap flow. Also makes host plants too heavy, increasing wind, snow & ice damage.		Deborah J. Kratzer
Centaurea biebersteinii (C. stoebe, C. maculata)	spotted knapweed	Forms dense stands that replace native plants and alter community structure. Also produces leachate that inhibits the germination of grasses and conifer seeds.		Rob Routledge, Sault College, Bugwood.org
Cirsium arvense	Canada thistle	Competes with crops and degrades pastures (inedible to livestock).		Deborah J. Kratzer
Clematis terniflora	Japanese clematis	Spreads prolifically, invading forest edges, right-of-ways and urban green space		Richard Webb, Bugwood.org
Dipsacus fullonum	wild teasel	Highway mowing equipment and discarded dried teasel heads from flower arrangements can lead to the establishment of new colonies, often forming a monoculture that displaces native communities.		Steve Dewey, Utah State University, Bugwood.org
Elaeagnus umbellata	autumn olive	Sprouts vigorously in disturbed areas, produces shade, preventing sprouting of native trees.		Deborah J. Kratzer

Scientific Name	Common Name	Problems Caused	Illustration	Illus. Source
Eragrostis curvula	weeping lovegrass	Establishes in disturbed areas and then persists, replacing native species		Forest and Kim Starr, Starr Environmental, Bugwood.org
Euonymus alatus	burning bush	Grows well in many sites, especially upland forests and pastures, crowding out native plants.		James H. Miller, USDA Forest Service, Bugwood.org
Hedera helix	English ivy	Grows vigorously in deep shade, inhibiting growth of native woodland plants. Vines up tree trunks, adding to weight, and increasing likelihood of wind damage.		Deborah J. Kratzer
Lespedeza cuneata	sericea lespedeza	Forms dense stands in meadows, open woodlands and wetland borders, disrupting successional patterns and replacing native species		Chris Evans, University of Illinois, Bugwood.org
Lonicera japonica	Japanese honey-suckle	Spreads aggressively in disturbed habitats, crowding out native plants. Aggressive roots can decrease the growth of native trees and vines. Vines engulf small trees and shrubs, causing them to collapse. Leafs out very early in spring, which could inhibit flowering by spring ephemerals.		Deborah J. Kratzer
Lonicera morrowii	Morrow honeysuckle	Forms a dense shrub layer that deprives native understory plants of light, moisture and nutrients.		Stacy Leicht, University of Connecticut, Bugwood.org

Scientific Name	Common Name	Problems Caused	Illustration	Illus. Source
Lythrum salicaria	purple loosestrife	Spreads aggressively in wetlands, eliminating open water habitats and crowding out native plants. Contributes to the loss of wildlife that depend on native wetland plants.		John D. Byrd, Mississippi State University, Bugwood.org
Microstegium vimenium	Japanese stiltgrass	Spreads aggressively in disturbed, moist, shady areas, crowding out native plants. May raise pH and reduce organic soil horizon.		Deborah J. Kratzer
Myriophyllum spicatum L.	Eurasian water-milfoil	An aquatic plant that begins growing earlier in spring than most indigenous aquatic plants, it quickly overtops, outshades, and outcompetes surrounding vegetation.		Britton and Brown, 1913, Vol. 2: 614.
Polygonum cuspidatum (Fallopia japonica)	Japanese knotweed	Spreads aggressively in disturbed, sunny areas, especially river banks and wetlands, crowding out native plants.		Tom Heutte, USDA Forest Service, Bugwood.org
Polygonum perfoliatum	mile-a-minute vine	Grows very rapidly, blanketing the landscape and overtaking native vegetation, smothering seedlings and outcompeting mature plants.		Jill S. Dodds
Potamogeton crispus L.	curly leaf pondweed	An aquatic plant that begins growing earlier in spring than most indigenous aquatic plants, it quickly overtops, outshades, and outcompetes surrounding vegetation. Can form dense mats that disrupt boating, swimming, and fishing.		Mohlenbrock , 1995

Scientific Name	Common Name	Problems Caused	Illustration	Illus. Source
Ranunculus ficaria (Ficaria verna)	lesser celandine	Forms extensive monocultures in floodplains and other moist areas early in the season, threatening native spring ephemerals.		Jill S. Dodds
Robinia pseudoacacia	black locust	Forms dense stands in open habitats, altering sucessional processes and replacing native species. May also alter natural soil chemistry.		Jan Samanek, Phytosanitary Admin., Bugwood.org
Rosa multiflora	multiflora rose	Spreads everywhere, except standing water, crowding out native plants and degrading pastures.		James H. Miller, USDA Forest Service, Bugwood.org
Rubus phoenicolasius	wineberry	Forms an extensive, nearly impenetrable understory layer in favorable locations such as moist soils in forests over dolomite, marble, shale, diabase, and traprock, crowding out native plants.		Jil M. Swearingen, USDI National Park Service, Bugwood.org
Wisteria floribunda	Japanese wisteria	Aggressive climbing vines that girdle tree trunks and branches. Dense canopies weigh down branches and shade underlying areas.		Ted Bodner at USDA-NRCS PLANTS Database

Sources: Van Clef, 2009; Snyder & Kaufman, 2004; Center for Invasive Species and Ecosystem Health (Invasive.org), 2018; Courtney, 1997; Britton & Brown, 1913; Mohlenbrock, 1995; Bodner at USDA-NRCS PLANTS Database

Photo sources: Ted Bodner at USDA-NRCS PLANTS Database; Britton and Brown, 1913, Vol. 2: 614; John D. Byrd, Mississippi State University, Bugwood.org; Steve Dewey, Utah State University, Bugwood.org; Jill S. Dodds; Chris Evans, University of Illinois, Bugwood.org; Deborah J. Kratzer; Michael Davenport; Tom Heutte, USDA Forest Service, Bugwood.org; Stacy Leicht, University of Connecticut, Bugwood.org; Leslie R. Mehrhoff, University of Connecticut, Bugwood.org; James H. Miller, USDA Forest Service, Bugwood.org; Mohlenbrock , 1995; Rob Routledge, Sault College, Bugwood.org; Jan Samanek, Phytosanitary Admin., Bugwood.org; Forest and Kim Starr, Starr Environmental, Bugwood.org; Jil M. Swearingen, USDI National Park Service, Bugwood.org; Richard Webb, Bugwood.org.

The Invasive Species Strike Team focuses on preventing the spread of newer invasive species throughout the state (FoHVOS, 2018). The strike team page offers links to fact sheets which provide information regarding identification, threat levels and control measures for each species tracked in their system. Although their focus is on eradicating newly introduced species before they can establish and spread, fact sheets are also available for many of the widespread invasives.

Linden viburnum is among the most problematic invasive species observed in Monmouth County.

The team is tracking 39 invasive species in Monmouth County, 37 of which are plants (**Appendix D.3**). Some of the most problematic exotic species observed in Monmouth County include porcelain-berry, linden viburnum and English ivy. Taken together, these three species account for 65 percent of invasive species complaints in the county.

Linden viburnum (*Viburnum dilatatum*) does not appear in **Table 3.6.2** because it was not ranked in the top category on the 2009 list of New Jersey's invasive plants. The shrub forms dense thickets that shade out native herbs and woody seedlings, and young plants may blanket the forest floor (Center for Invasive Species and Ecosystem Health, 2018).

3.6.4 Trees and Canopy Closure

Nearly a quarter of the township (22.54%) is classified as either a wetlands (14.57%) or forest (7.97%), land use types typically dominated by trees (see Land Use Map, **Figure 3.6.1**). **Figure 3.6.4** illustrates the various forest types located within portions of the township that have been mapped as forest. In recognition of the many values of trees, the Township of Ocean has taken steps to evaluate and protect this resource for the benefit of the community.

Municipal regulations regarding tree removal

Township of Ocean Ordinance No. 2202, adopted in 2013, regulates the removal of trees in order to maintain the aesthetic character of the township, control drainage and prevent erosion, and reduce hazards to citizens and their property. A permit is required for the removal of five or more trees with a diameter of nine inches or greater at breast height (dbh>9"). Removal of significant specimen trees is also prohibited in the absence of compelling circumstances. Permit applications and approvals must be obtained from the Department of Community Development. Information regarding definitions, prohibitions, permit requirements and procedures, fees, exceptions, penalties and appeals is provided in the ordinance (Clerkbase, 2018).

Urban Tree Canopy Assessment

An Urban Tree Canopy Assessment was completed for Ocean Township's Shade Tree Commission early in 2013. The study looked at changes in tree cover throughout the township between 2002 and 2010 using high resolution land cover imagery. Land cover in the images was classified as water, open space, impervious surfaces, trees or barren land. From 2002 to 2010, the relative proportions of water (1%) and open space (33%) remained the same. A one percent decrease in trees (36% to 35%) and a two percent decrease in barren land (3% to 1%) was offset by a three percent increase in impervious surfaces (27% to 30%). It was noted that some of the land classified as barren in 2002 was due to sites that had recently been cleared for residential construction, and that tree cover may have been higher prior to the starting point of the study. Although tree cover was reduced by only one percent, the authors stated that the combined loss of trees and increase in impervious cover produced significant ecological changes, resulting in increasing stormwater management costs and declining air and water quality. One example provided to quantify the decline calculated that the tree canopy removed 299,077 pounds of pollutants in 2002 versus 296,265 pounds in 2010. Based on specific characteristics of Ocean Township, the report recommended increasing the total tree cover by 5 percent over the next 7 to 10 years. Suggested strategies for reaching the goal of 40 percent tree cover throughout the township (*50% in residential zones, 25% in industrial zones and 15% in central business*

zones) included planting new trees, extending the life of existing trees, and protecting existing stands of trees during development (Global Ecosystem Center, 2013).

Shortly after the study period on which the Canopy Assessment was based, New Jersey experienced extensive tree loss as a result of Hurricane Sandy in 2012. The state's Department of Environmental Protection assessed damage to various ecosystems including wetlands, riparian habitats and floodplains, forests, and open water (NJDEP Office of Science, 2015). Forest impact data was collected at multiple locations around the state: The sites nearest to Ocean Township included Allaire State Park, Monmouth Battlefield State Park and Turkey Swamp Wildlife Management Area. Allaire and Battlefield State Parks showed the highest losses recorded in the study, with total acres damaged at 25% and 20% respectively. Turkey Swamp was closer to statewide averages with 7% acres damaged. A limited study of blowdown conducted at three parks resulted in an average loss of 53 trees per acre, and the highest damage level (273 trees per acre) was recorded at Monmouth Battlefield State Park (NJDEP Office of Science, 2015). Significant storm damage within the township was also noted by the Shade Tree Commission in the Community Forestry Management Plan, which has a stated objective of planting 114 trees annually on public land in order to help reach the goal of 40 percent cover township-wide and 50 percent cover in residential areas (Township of Ocean Shade Tree Commission, 2014).

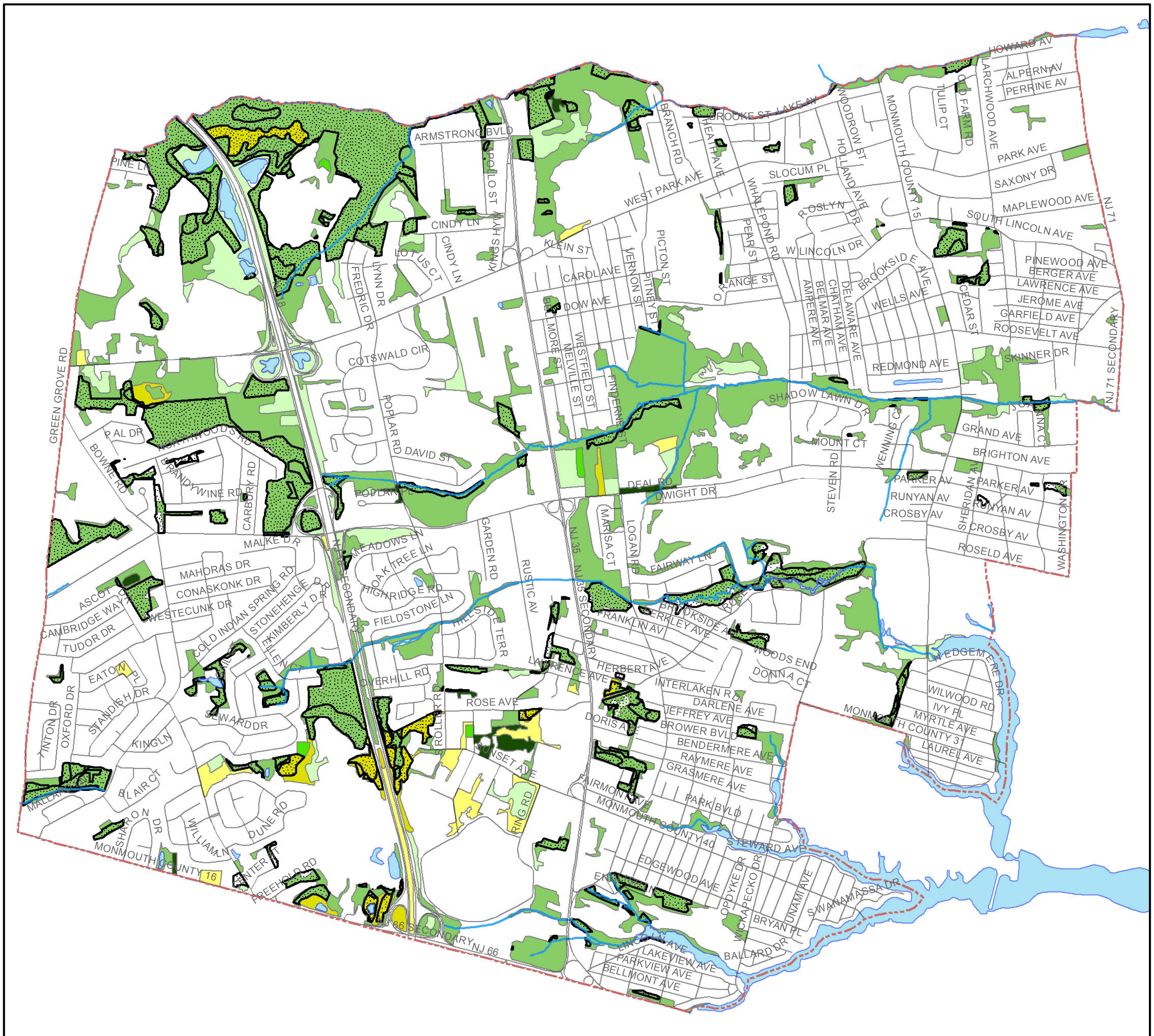
Specimen trees and century forests

The State of New Jersey maintains a list of record trees but, although a number of champions and runners-up are listed for Monmouth County, none are currently known from the Township of Ocean (NJ Forest Service, December 2018). Instructions for measuring and nominating trees for the list are available on the registry website.

Two-thirds of the forests in New Jersey are less than 60 years old, and only about five percent exceed 100 years of age (Widmann, 2005). The pitch pine swamp at the headwaters of Poplar Brook would therefore be exceptional in containing trees that are 200-300 years of age (Monmouth County Environmental Council, 1978). However, after the construction of Route 18, the township has not been able to verify if these trees still exist since they're located on private property (Michael Davenport, personal communication, March 25, 2019).

Insect and disease threats specific to trees

A number of tree pests are established or incipient in New Jersey, as summarized in **Table 3.6.4**. Some, like the gypsy moth, are well-established throughout the northeast. Others are more recent invaders that are rapidly spreading throughout the state. The southern pine beetle had expanded its northern limits to south Jersey by 2010, but it was detected in eastern Long Island (NY) in 2014 and was well established there within two years (NYDOC, 2016). The emerald ash borer was initially found in New Jersey in 2014, but is rapidly spreading throughout the state (NJ Department of Agriculture, 2018). Similarly, the spotted lanternfly was an accidental introduction to Berks County, Pennsylvania in 2014 and proliferated rapidly, crossing into New Jersey in 2018 (Rutgers, 2019). Although some of the pests included in the table are currently limited in scope, they may potentially become more problematic under the right circumstances. The NJ Forest Service (February 2018 and Undated) provides links with identification and management information for many of the tree-specific pests.



Legend

- Ocean Township
- Roads
- Water
- Forests estimated to be at least 100 years old

Generalized Forest

- Coniferous Forest
- Coniferous Shrubland
- Deciduous Forest
- Deciduous Shrubland
- Mixed Forest
- Mixed Shrubland

Generalized Forest*	Acres	Percent of Ocean Twp
Coniferous Forest	16.2	0.2%
Coniferous Shrubland	5.7	0.1%
Deciduous Forest	1162.0	16.5%
Deciduous Shrubland	163.6	2.3%
Mixed Forest	57.9	0.8%
Mixed Shrubland	44.3	0.6%
Total Forest Area	1449.8	20.6%
Century Forests**	527.7	7.5%

*Generalized Forest is based on 2012 Land Use (Source: NJDEP)

**Century Forests layer was created by examining 1930 and subsequent aerial datasets (not ground truthed) (Soucre: Monmouth County Park Sytem & GIS)

N

0 0.25 0.5 Miles

Data Sources: NJDEP, NJDOT, Monmouth County Park System and Monmouth County GIS

Disclaimer required for NJDEP Data: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Kratzer Environmental Services
Ocean Township ERI 2019

Figure 3.6.4. Century Forests & Tree Canopy Ocean Township, Monmouth County

Based on 2012 Land Use, 1,450 acres (20.6%) of Ocean Township is forested (including both upland and wetland types). According to the Monmouth County Century Forests data, more than 1/3 of the township's forests (approximately 528 acres) may have been continuously forested for 100 or more years.

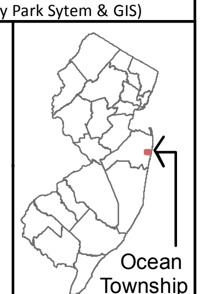


Table 3.6.4. Insect and Disease Threats to New Jersey Trees

Pests		Susceptible species	Affected areas in NJ
Insects			
gypsy moth	*Lymantria dispar*	oaks and other deciduous species	statewide
hemlock wooly adelgid	*Adelges tsugae*	eastern hemlock	statewide
emerald ash borer	*Agrilus planipennis*	ash species	northern and central NJ
scarlet oak sawfly	*Caliroa quercuscoccineae*	oak species	northern counties
southern Pine beetle	*Dendroctonus frontalis*	pine species	southern counties
Asian longhorned beetle	*Anoplophora glabripennis*	maples, willows, poplars, ash, horse chestnuts, elm, and buckeye trees	Union Co. and Middlesex Co.
eastern pine looper	*Lambdina pellucidaria*	pine species	Ocean Co. and Burlington Co.
spotted lanternfly	*Lycorma deliculata*	tree-of-heaven and other deciduous and commercial species	recently detected in western counties
gouty oak gall wasp	*Callirhytis quercuspunctata*	oak species, generally not fatal	undefined
Pathogens			
beech bark disease	*Nectria coccinea*	beeches	northern counties
bacterial leaf scorch	*Xylella fastidiosa*	oaks, sycamore, elms	southwestern counties
oak wilt	*Ceratocystis fagacearum*	oak species	yes, undefined
sudden oak death	*Phytophthora ramorum*	oaks and other deciduous species	not yet detected in NJ
thousand cankers disease	*Geosmithia sp.*	affects black walnut when the walnut twig beetle is present	not yet detected in NJ
Sources: NJ Forest Service (February 2018), NJ Forest Service (undated), Rutgers (2019).			

Issues with overhead utility wires

Trees are the most common cause of electric utility outages. The U.S. Department of Energy requires electric companies to develop vegetation management programs, and in New Jersey, the responsibility for overseeing the implementation of those programs lies with the Board of Public Utilities (NJ Board of Public Utilities, 2019). The most recent state legislation concerning the role of utility companies in vegetation management (N.J.A.C. 14:5-9) was updated in 2014, and the newest rules are still in draft form. The rules address issues including maintenance cycles, technical standards, and public notice.

When landscaping in the vicinity of utility wires, maintenance issues may be reduced or avoided by planting appropriate species. The Arbor Day Foundation (2019) offers guidelines for planting near powerlines in the form of a graphic as shown in **Figure 3.6.5**. A number of utility companies offer additional guidelines for determining tree height and distance from wires, and even offer a list of suggested species to be used (e.g. PECO, 2019; PSE&G, 2018). Although many of the suggested plantings are exotic species, some native plants on the list include redbud (*Cercis canadensis*), flowering dogwood (*Cornus florida*), fringe tree (*Chionanthus virginicus*), American hornbeam (*Carpinus caroliniana*), Washington hawthorne (*Crataegus phaenopyrum*), chokecherry (*Prunus virginiana*), and a variety of serviceberries (*Amelanchier spp*.).

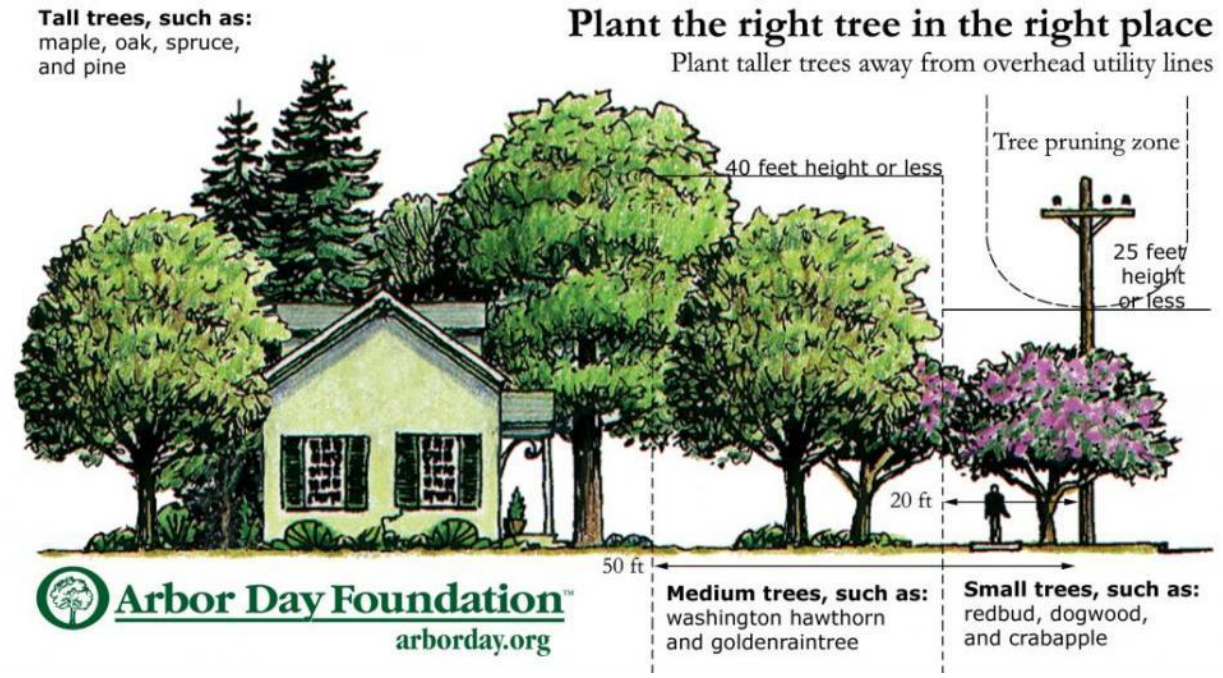


Figure 3.6.5. Guidelines for planting near overhead utility lines. Image courtesy of the Arbor Day Foundation (2019) https://www.arborday.org/programs/treelineusa/

3.6.5 Economic Value

New Jersey's natural ecosystems provide a wide array of benefits to the state's residents, including some which cannot be quantified but others which may be measured in terms of goods and services. A report on natural resource values in New Jersey assigned dollar values to the following ecosystem services (listed from highest to lowest $/year value): Nutrient cycling, disturbance regulation, water regulation, habitat/refugia, aesthetic/recreational, waste treatment, water supply, cultural/spiritual, gas/climate regulation, pollination, biological control and soil formation. By looking at the multiple values provided by various ecosystems around the state, the authors then projected a value in dollars per acre per year for each system. Projected annual values per acre for some land cover types in Ocean Township ware $11,568 for freshwater wetlands, $3,382 for riparian buffer, $1,476 for forested uplands, $765 for open water, $283 for urban land and $0 for barren land. Ecotourism was not included in the calculation of values (NJDEP, 2007).

The Urban Tree Canopy Assessment took a similar approach utilizing different models to put a value on forested acres in Ocean Township. It was estimated that the 2,504 acres of trees present in 2002 removed 299,077 pounds of air pollution that year at a value of $810,848 ($323.82/acre), and prevented 26,298,120 cubic feet of stormwater runoff during the same period saving $2,596,240 ($21,004.89/acre) in stormwater management costs (Global Ecosystem Center, 2103).

The estimation of ecosystem values is not an exact science, and different calculation methodologies may yield widely varying dollar amounts. Nevertheless, the examples clearly demonstrate that maintaining natural ecological zones can have significant consequences for a community, both in terms of economic benefits and quality of life.

References: Vegetation

Dominant Vegetation (Land Cover)

Environmental Assessment Council. January 1977. Natural Resource Inventory for Whale Pond Brook Watershed, Monmouth County, New Jersey. Report prepared for the Ocean Township Environmental Commission.

Larsen, Erik. April 21, 2018. Route 18: The Road to Nowhere. https://www.app.com/story/news/history/erik-larsen/2018/04/21/route-18-road-nowhere/539190002/

Monmouth County Environmental Council. December 1978. Monmouth County Unique Areas Study.

NJDEP, Bureau of Geographic Information Systems (BGIS). February 17, 2015. Land Use/Land Cover 2012 Update, Edition 20150217 Subbasin 02040301 - Mullica-Toms (Land_lu_2012_hu02040301). 1:2,400. GIS Data. http://www.nj.gov/dep/gis/listall.html

NJNLT (New Jersey Natural Lands Trust). 2013. Whale Pond Brook Preserve, Ocean Township, Monmouth County. http://njnlt.mgfx.com/whalepondbrook.htm

Steering Committee of the New Jersey Comparative Risk Project. March 2003. Final Report of the New Jersey Comparative Risk Project. 213 pages. http://www.state.nj.us/dep/dsr/njcrp/njcrp-final.pdf

Township of Ocean. January 1975. Poplar Brook Watershed Study Report. Report prepared for the Ocean Township Environmental Commission.

US Geological Survey (USGS). 2010. Edited by NJDEP, Bureau of Geographic Information Systems (BGIS) 1998, 2000, 2001, 2002, 2005, 2007, 2010. NJDEP MODIFIED ANDERSON SYSTEM 2007 derived from: A Land Use and Land Cover Classification System for Use with Remote Sensor Data, USGS Professional Paper 964, 1976. 35 pages. http://www.state.nj.us/dep/gis/digidownload/metadata/lulc07/anderson2007.html

Word on the Shore. May 14, 2012. Whale Pond Brook Watershed Announces Partnership. https://www.wordontheshore.com/whale-pond-brook-watershed-announces-partnership-cms-1397

Wildfire Fuel Hazard

NJDEP, New Jersey Forest Fire Service (NJFFS). Updated June 18, 2018. 2002 NJFFS Wildfire Fuel Hazard for Monmouth County, New Jersey. GIS Data. http://www.state.nj.us/dep/gis/njfh.html#CAP

Rare Plant Species

Carnegie Museum of Natural History Herbarium. 1945 (collection date). *Rubus davisiorum*: Catalog #: CM130899. Available to public domain via Creative Commons: http://intermountainbiota.org/portal/collections/individual/index.php?occid=11906689 Accessed January 2019.

Flora of North America Editorial Committee, eds. 1993+. Flora of North America North of Mexico. 20+ vols. New York and Oxford. Available online at http://floranorthamerica.org/

Kartesz, J.T. 2013. The Biota of North America Program (BONAP). North American Plant Atlas. Chapel Hill, N.C. [maps generated from Kartesz, J.T. 2013. Floristic Synthesis of North America, Version 1.0. Biota of North America Program (BONAP). (in press)]. Available online at http://bonap.net/tdc

NJDEP Division of Parks and Forestry. January 4, 2007. Endangered Plant Species Program. http://www.state.nj.us/dep/parksandforests/natural/endplants.html

NJDEP Division of Science and Research. 2006. Endangered Plant Species Populations in New Jersey: Health and Threats. https://www.state.nj.us/dep/dsr/plant/

NJDEP Office of Natural Lands Management (ONLM) Natural Heritage Program (NHP). 2016. List of Endangered Plant Species and Species of Concern. https://www.nj.gov/dep/parksandforests/natural/heritage/njplantlist.pdf

NJDEP Office of Natural Lands Management (ONLM) Natural Heritage Program. October 17, 2018. Letter Re: Ocean Township Natural Resource Inventory. Natural Heritage Database and the Landscape Project habitat mapping search results.

NJDEP Office of Natural Lands Management (ONLM) Natural Heritage Program (NHP). 2009. Natural Heritage Grid Map for New Jersey, Edition 200911. GIS data. https://gisdata-njdep.opendata.arcgis.com/datasets/b00b22666a44445c90e73af6fd39f152_1

NJDEP Office of Natural Lands Management (ONLM) Natural Heritage Program (NHP). July 30, 2008. New Jersey Rare Plant Species and Ecological Community Lists By County. http://www.state.nj.us/dep/parksandforests/natural/heritage/countylist.html

NJ-GeoWeb. 2017. NJDEP Bureau of GIS. Interactive Mapping Application. http://www.state.nj.us/dep/gis/geowebsplash.htm Accessed January 2019.

Invasive and Non-native Vegetation
Bodner, Ted. 2005. USDA-NRCS PLANTS Database / James H. Miller and Karl V. Miller. Forest plants of the southeast and their wildlife uses. University of Georgia Press., Athens.

Britton, N.L., and A. Brown at USDA-NRCS PLANTS Database. 1913. An illustrated flora of the northern United States, Canada and the British Possessions. 3 vols. Charles Scribner's Sons, New York. http://plants.usda.gov

Center for Invasive Species and Ecosystem Health. 2018. Invasive and Exotic Species of North America. University of Georgia. Images by Chuck Bargeron, Univ. of Georgia; John D. Byrd, Mississippi State University; Steve Dewey, Utah State University; Chris Evans, University of Illinois; Tom Heutte, USDA Forest Service; Stacy Leicht, University of Connecticut; Doug Manning, National Park Service; Leslie R. Mehrhoff, University of Connecticut; James H. Miller, USDA Forest Service; Rob Routledge, Sault College; Jan Samanek, State Phytosanitary Administration; Forest and Kim Starr, Starr Environmental; Jill M. Swearingen, National Park Service; and Richard Webb, Self-employed horticulturist. http://www.invasive.org and http://bugwood.org

Courtney, John Mark. 1997. Fact Sheets: Invasive Exotics. Bowman's Hill Wildflower Preserve, New Hope, PA. http://www.bhwp.org/resources/Invasive-Plants.htm

Kartesz, J.T. 2013. The Biota of North America Program (BONAP). North American Plant Atlas. Chapel Hill, N.C. [maps generated from Kartesz, J.T. 2013. Floristic Synthesis of North America, Version 1.0. Biota of North America Program (BONAP). (in press)]. http://bonap.net/tdc

Mohlenbrock, Robert H. at USDA-NRCS PLANTS Database / USDA NRCS. 1995. Northeast wetland flora: Field office guide to plant species. Northeast National Technical Center, Chester. http://plants.usda.gov

NJ Forest Service. 2018. Forest Health. http://www.state.nj.us/dep/parksandforests/forest/njfs_forest_health.html

Ocean Township. December 8, 2016. Regular Meeting Minutes Township Council – Township of Ocean. Chapter VII of the "Revised General Ordinances of the Township of Ocean." http://www.oceantwp.org/filestorage/5931/6843/6845/120/2477/10084/10088/19_December_8P.pdf.

FoHVOS (Friends of Hopewell Valley - Invasive Species Strike Team Team). 2018. Searchable Invasive Species Map and Invasive Species Fact Sheets. https://www.fohvos.info/invasive-species-strike-team/info-center/ Accessed January 2019.

Sarver, M., A. Treher, L. Wilson, R. Naczi and F.B. Kuehn. 2008. Mistaken Identity? Invasive plants and their native look-alikes: an identification guide for the Mid-Atlantic. Delaware Department of Agriculture. http://www.nybg.org/files/scientists/rnaczi/Mistaken_Identity_Final.pdf

Snyder, David and Sylvan R. Kaufman. 2004. An overview of nonindigenous plant species in New Jersey. New Jersey Department of Environmental Protection, Division of Parks and Forestry, Office of Natural Lands Management, Natural Heritage Program: Trenton, NJ. 107 pages. http://www.state.nj.us/dep/parksandforests/natural/heritage/InvasiveReport.pdf

Steering Committee of the New Jersey Comparative Risk Project. 2003. Final Report of the New Jersey Comparative Risk Project. 213 pages. http://www.state.nj.us/dep/dsr/njcrp/

Swearingen, J., K. Reshetiloff, B. Slattery, and S. Zwicker. 2010. Plant Invaders of Mid-Atlantic Natural Areas. National Park Service and U.S. Fish & Wildlife Service, Washington, D.C. https://www.invasive.org/alien/pubs/midatlantic/midatlantic.pdf

USDA. February 3, 1999. Executive Order 13112 of February 3, 1999 - Invasive Species. Federal Register: Feb 8, 1999 (Volume 64, Number 25) http://www.invasivespeciesinfo.gov/laws/execorder.shtml

Van Clef, M. 2009. New Jersey Strategic Management Plan for Invasive Species: The Recommendations of the New Jersey Invasive Species Council to Governor Jon S. Corzine, Pursuant to New Jersey Executive Order #97. http://www.nj.gov/dep/njisc/docs/Final%20NJ%20Strategic%20Management%20Plan%20for%20Invasive%20Species%2011.09.pdf.

Trees and Canopy Closure
Arbor Day Foundation. 2019. The Right Tree in the Right Place. https://www.arborday.org/programs/treelineusa/

Clerkbase, 2018. Online publication of Ocean Township Ordinance 2202. Chapter IX: Soil and Tree Removal. Follow links under Land Use at https://clerkshq.com/OceanTownship-nj

Global Ecosystem Center, LLC. January 24, 2103. Urban Tree Canopy Assessment: Township of Ocean, New Jersey 2002 and 2010. Report prepared for Ocean Township and available on township website http://www.oceantwp.org/filestorage/6368/7379/7535/Urban_Tree_Canopy_Assessment.pdf

Monmouth County Environmental Council. December 1978. Monmouth County Unique Areas Study. https://rucore.libraries.rutgers.edu/rutgers-lib/31644/

NJ Board of Public Utilities. 2019. Vegetation Management Rules. https://www.state.nj.us/bpu/about/divisions/energy/veg.html

NJ Department of Agriculture. November 13, 2018. Emerald Ash Borer. Online fact sheet: https://www.nj.gov/agriculture/divisions/pi/prog/emeraldashborer.html

NJDEP Office of Science. May 2015. Damage Assessment Report on the Effects of Hurricane Sandy on the State of New Jersey's Natural Resources - Final Report. Report Prepared for the Hurricane Sandy Natural & Cultural Resource Workgroup. https://www.nj.gov/dep/dsr/publications/hurricane-sandy-assessment.pdf

NJ Forest Service. February 12, 2018. Forest Health. http://www.state.nj.us/dep/parksandforests/forest/njfs_forest_health.html

NJ Forest Service. December 18, 2018. 2018 Champion Big Tree Register. https://www.state.nj.us/dep/parksandforests/forest/community/bigtree_registry.html

NJ Forest Service. Undated. Pests and Diseases in New Jersey. https://www.nj.gov/dep/parksandforests/forest/community/Pests_and_Diseases.htm

NYDEC (New York Department of Environmental Conservation). 2016. Southern Pine Beetle (*Dendroctonus frontalis*). Fact sheet published by the NY Division of Lands and Forests. https://www.dec.ny.gov/docs/lands_forests_pdf/spbactsheet.pdf

PECO. 2019. Plant the Right Tree in the Right Place. https://www.peco.com/SafetyCommunity/Safety/Pages/TPPlantingTrees.aspx

PSE&G. 2018. Right Tree, Right Place. https://nj.pseg.com/safetyandreliability/reliability/treetrimming/righttreerightplace

Rutgers, The State University of New Jersey. 2019. Spotted Lanternfly. New Jersey Agricultural Experiment Station. https://njaes.rutgers.edu/spotted-lanternfly/

Township of Ocean Shade Tree Commission. 2014. Township of Ocean Community Forestry Management Plan: An Action Plan for Community Forestry 2014-2019. Report prepared in cooperation with New Jersey Forest Service - Community Forestry.

Widmann, Richard H. 2005. Forests of the Garden State. United States Department of Agriculture, Forest Service Research Bulletin NE-163. https://www.fs.fed.us/ne/newtown_square/publications/resource_bulletins/pdfs/2005/ne_rb163.pdf

Economic Value

Global Ecosystem Center, LLC. January 24, 2103. Urban Tree Canopy Assessment: Township of Ocean, New Jersey 2002 and 2010. Report prepared for Ocean Township and available on township website http://www.oceantwp.org/filestorage/6368/7379/7535/Urban_Tree_Canopy_Assessment.pdf

NJDEP. 2007. Valuing New Jersey's Capital: An Assessment of the Economic Value of the State's Natural Resources. https://www.nj.gov/dep/dsr/naturalcap/nat-cap-1.pdf

Internet Resources: Vegetation

Local Watersheds

Whale Pond Brook Watershed Association: http://restorethewatershed.org/A/Welcome.html
Deal Lake Watershed Alliance: http://www.dlwanj.org/

Backyard Habitats & Conservation

Deer Tolerant/Resistant Native Plants:
https://bhwp.org/wp-content/uploads/Deer-Tolerant_Resistant-Plants.pdf
Gardening for Butterflies: https://www.naba.org/chapters/nabanj/gardening.html
National Audubon Society: http://www.audubon.org/bird/at_home/
New Jersey Audubon Society: http://www.njaudubon.org/SectionBackyardHabitat/Welcome.aspx
NJDEP Outdoor Classroom links: http://www.state.nj.us/dep/seeds/syhart/outclass.htm
USDA NRCS: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/newsroom/features/?cid=nrcs143_023574

Native Plants

Bowman's Hill Wildflower Preserve: http://www.bhwp.org
Native Plant Society of NJ: http://www.npsnj.org/
USDA Plants Database: http://plants.usda.gov

NJDEP

Environmental Rules: http://www.nj.gov/dep/rules/nj_env_law.html
Rare Plants & Communities: http://www.state.nj.us/dep/parksandforests/natural/index.html
Rare Plant Report Form:
http://www.state.nj.us/dep/parksandforests/natural/heritage/natherrareplantspeciesreportform1_2008.doc

Invasive Species

Invasive Species – New Jersey: http://www.invasivespeciesinfo.gov/unitedstates/nj.shtml
Native Plant Society of New Jersey – Invasive Species:
http://www.npsnj.org/pages/nativeplants_Plant_Lists.html
Invasive Species Strike Team (NJISST): https://www.fohvos.info/invasive-species-strike-team/
Forest Health: http://www.state.nj.us/dep/parksandforests/forest/njfs_forest_health.html

3.7 WILDLIFE & WILDLIFE HABITAT

3.7.1 Native Wildlife Types/Species

Background

New Jersey hosts approximately 450 species of vertebrate wildlife (NJDEP 2004a, 2004b, 2014, 2016). This high diversity in such a small state is partly due to New Jersey's geographic position where northern ecosystems reach their southern limit and where southern ecosystems reach their northern limit. In addition, the state provides a wide variety of habitats including mountains, valleys, rolling hills, wetlands, pinelands, beaches, estuaries and rivers (NJDEP, January 19, 2012). The NJDEP website offers checklists for the birds, mammals, reptiles and amphibians of New Jersey; with notes on the status of each (e.g. common or rare) (see **Internet Resources**). A variety of plant and animal species enjoy Ocean Township's diverse habitat types.

Birds

To date, 387 species of birds have been documented in Monmouth County (Sullivan et. al., 2009), but the list may be revised with additional sightings and surveys (see **Appendix E.4**). Thirteen percent of those species are only rare visitors to New Jersey, and are not included on the NJDEP list of state birds. Endangered, threatened and special concern birds are discussed in **Section 3.7.2,** and non-indigenous birds in **Section 3.7.3**. The Canada goose, a native species which may disproportionately affect the environment, is discussed below.

Canada Goose

The Canada goose (*Branta canadensis*) is one of New Jersey's most easily recognized birds, with its black head and neck, white check patch and undersides, brown back and large size (2'-3' tall, 10-12 lbs.). There are two distinct populations in NJ, migratory geese that visit the state in the winter and non-migratory geese, that nest in the state. New Jersey's resident population of resident Canada geese was recently estimated at 76,190 (APHIS, 2011).

Canada Goose.

While many people enjoy the sight of a few geese, this high population of non-migrating geese can cause the following problems:

- overgrazing of parks, lawns and athletic fields, causing erosion and impacting aesthetics
- reduction in water quality caused by introduction of sediments and particulates from eroded shorelines as well as deposition of excessive nutrients in fecal matter
- degradation of natural habitats by reducing the diversity of native vegetation
- displacement of native waterfowl due to reduced availability of food, shelter and nesting sites
- damage to agricultural lands, increasing erosion and decreasing crop yields
- accumulations of feces on land, creating a health risk from disease-causing organisms
- hazards to aircraft at airports
- aggression and attacks on humans (APHIS, 2011; Rutgers, 2019).

As migratory game species, Canada geese are afforded federal and state protection. Therefore, any management techniques involving handling nests, eggs or birds require a permit (NJDEP Division of Fish and Wildlife, undated-a).

Mammals

Twenty-eight of the 89 mammals listed on the NJDEP checklist are restricted to marine environments, leaving 61 species that may be observed at various locations around the state (**Appendix E.2**). Some of the listed mammals are limited to specific regions within the state, while others enjoy a wide range. A mammal list is not available specifically for either Monmouth County or the Township of Ocean. Endangered mammals are discussed in **Section 3.7.2,** and non-indigenous mammals in **Section 3.7.3**. One large native mammal that frequently clashes with the human population is discussed below.

White-tailed Deer

The white-tailed deer (*Odocoileus virginianus*), the largest herbivore living wild in New Jersey, is seen throughout all but the most urbanized areas of the state. Although the deer is a large animal, individuals tend to stay in a one square mile or less home range, one of the smallest ranges among wild ruminants (Burnett, 2004).

White-tailed Deer in Palaia Park.

Biologists have estimated that before the arrival of European settlers, there were about 8-11 white-tailed deer per square mile. By the early 1900's, New Jersey's deer herd was reduced to a handful by unregulated hunting. However, efforts to protect the deer herd were so successful that deer were considered over-populous by the 1920's (Latham et al, 2005). In addition, deer have been able to adapt to human-altered habitats. Studies have shown that deer densities above 10-15 per square mile have negative impacts on the diversity of understory vegetation and on the native songbird and wildflower populations that depend on a diverse understory, while deer populations in excess of 20 per square mile prevent tree regeneration (Latham et al, 2005). As of 2010, deer density in some parts of the state were estimated to be as high as 114 deer/mile^2 (NRCS, undated).

The state is divided into 70 Deer Management Zones (DMZs), with differing deer hunting regulations applied to different DMZs. Ocean Township falls within DMZ 51, which includes the eastern portions of Monmouth and Ocean Counties and utilizes Regulation Set 8 (NJDEP, 2017). In the 1999 Governor's Report on Deer Management, Zone 15 was identified as one of five zones where deer 'must be eliminated or maintained at low levels', and was also noted as a zone with 'intolerable' levels of deer damage to agricultural areas (NJDEP, 1999).

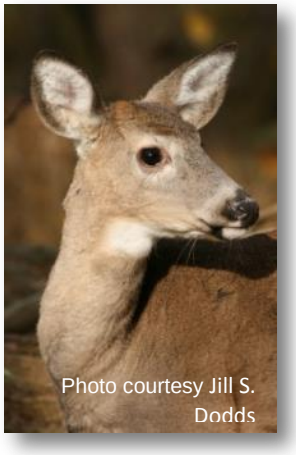
Documentation of deer population numbers is not available for Monmouth County or Ocean Township. Some inferences about local deer abundance may be made by looking at data from auto collisions, hunt harvests and local studies. Monmouth County had 827 deer picked up along state roadways in 2018, a total surpassed only by Somerset and Hunterdon Counties. During the previous two years, Monmouth had the highest rates of carcass collection in the state: 1,026 in 2017 and 999 in 2016 (Gallo, 2019). Countywide harvest data for the three most recent hunting seasons was 5004 (2017-18), 4995 (2016-17) and 4004 (2015-16) (NJDEP Division of Fish and Wildlife, January 17, 2019). Monmouth County has 468.8 square miles of land area (U.S. Census Bureau, 2010), so these records alone equate to approximately 12 deer per square mile.

Between 2003 and 2016, Monmouth County Park System conducted a series of helicopter and spotlight surveys in an attempt to quantify deer density in selected county parks. A total of 57

helicopter surveys were carried out at 15 locations from 2003 to 2010. Results varied widely, ranging from a high of 329/mile^2 on the Durand Tract in 2003 to 0 on the Ramanessin section of Holmdel Park on February 8 of 2010. The Ramanessin survey was repeated ten days later, yielding a result of 54 deer/mile^2. Spotlight surveys, carried out at seven locations from 2007 through 2016, also showed a great deal of variation between sites and years. In that dataset, Holmdel Park Ramanessin had the highest density at 248 deer/mile^2 in 2012, while the lowest result was 4/mile^2 at Hartshorne Woods the same year (Monmouth County Park System, 2017). Nevertheless, the cumulative data for each site provides an overview of deer abundance at that location. **Table 3.7.1** shows some data excerpted from their report, only including data from the last survey date at those parks where both methods were utilized. The table illustrates the difficulty in getting an accurate count, but also that regional deer densities are well above the ideal levels.

Table 3.7.1. Some examples of results from deer counts in Monmouth County Parks

County Park	Helicopter		Spotlight	
	Last Survey Date	deer/mile^2	Last Survey Date	deer/mile^2
Big Brook	2010	71	2015	87
Hartshorne Woods	2009	13	2016	13
Holmdel North	2010	30	2016	117
Holmdel Ramanessin	2010	54	2016	140
Huber	2009	30	2016	18
Tatum	2010	26	2014	36
Thompson	2010	6	2016	84
Selected data from Monmouth County Park System, 2017.				



White-tailed Deer.

Where deer are overabundant, this results in excessive damage to agricultural crops, gardens and residential landscaping; an increased incidence of deer/vehicle collisions; prevention of forest regeneration (which impacts plants and animals dependent on the forest); and the potential for reduced deer health due to inadequate nutrition and the spread of disease (Honachefsky, 2000; Latham et al, 2005; Sauer, 1998). In an effort to address the township's increasing deer population, residents were asked to participate in a 2018 survey on "Living with Deer in the Township of Ocean" to identify the issues of greatest impact and concern. Roughly three-quarters of the 793 respondents reported an increase in deer-related problems during their time of residence in the community, and 70% said the size of township's deer population was a problem. The top three concerns identified were driving safety (86.5% of respondents), gardening/landscaping damage (84.55%) and resident health (51.87%). Environmental and ecological health were also concerns for more than 40% of respondents (Ocean Township, 2018). Stine (2018) reports that 32 to 35 deer are hit by vehicles annually in Ocean Township.

Despite these impacts, deer remain a natural part of the ecosystem, and are not solely responsible for diversity loss and habitat degradation. A management program should seek to balance the well-being and health of natural communities with the safety and economic well-being of its residents. Guidelines for developing a plan to both reduce the impacts of an existing deer population and manage herd size may be found in An Overview of White-Tailed Deer Status and Management in New Jersey (Rutgers, 2013) and the Community Based Deer Management Manual for Municipalities (NJDEP Division of Fish and Wildlife, undated-b).

Reptiles and Amphibians

Of the 39 non-marine reptile species recorded in New Jersey, 31 have ranges which include Monmouth County, although five species of those are limited to the southern end of the county (**Appendix E.3**). Similarly, there are 34 species of amphibians in the state, 22 of which range into Monmouth County (**Appendix E.4**). Although lists of reptiles and amphibians (collectively known as herptiles) are not maintained by county, their potential presence in the Monmouth area can be extrapolated from the species range maps provided by the state's Division of Fish and Wildlife (NJDEP, Division of Fish & Wildlife, June 6, 2016). Endangered, threatened and special concern herptiles are discussed in **Section 3.7.2,** and the non-indigenous species are covered in **Section 3.7.3**.

Box Turtle.

Wildlife of Vernal Pools

Vernal pools are defined as confined depressions, either natural or man-made, that maintain ponded water for part of the year, have no permanent outflow, and are devoid of breeding fish populations. These temporary wetlands provide habitat to many species of amphibians, several of which breed exclusively in vernal pools, as well as a multitude of insects, reptiles, plants, and other wildlife. Certification of a vernal pool may be achieved by documenting breeding activity of obligate vernal pool species (such as wood frogs or spotted salamanders; (see **Table 3.7.2**) or by documenting both the presence of facultative species and photographic evidence that the pool goes dry or demonstrating the absence of fish (Tesauro, no date).

Table 3.7.2 Obligate And Facultative Fauna Species Found In Vernal Habitats.

Obligate Vernal Pool Breeding Species	Facultative Vernal Pool Breeding Amphibians	Reptiles that Inhabit Vernal Pools on a Seasonal Basis
eastern tiger salamander - *ENDANGERED* marbled salamander *Special Concern* spotted salamander Jefferson salamander *Special Concern* blue-spotted salamander - *ENDANGERED* wood frog eastern spadefoot toad *WAP-FS* fairy shrimp (order Anostraca)	green frog bullfrog pickerel frog southern leopard frog carpenter frog *Special Concern* spring peeper eastern cricket frog New Jersey chorus frog *WAP-FS* upland chorus frog northern gray treefrog Cope's gray treefrog *ENDANGERED* pine barrens treefrog *ENDANGERED* four-toed salamander long-tailed salamander *THREATENED*	wood turtle *THREATENED* spotted turtle *Special Concern* southeastern mud turtle eastern painted turtle snapping turtle (These reptiles visit vernal pools primarily to eat the eggs and larvae of amphibians.)
Note: Species in black are either known to occur in Ocean Township or their ranges include Monmouth County; species in gray have ranges that do not include Monmouth County, therefore it would be unlikely to find them in Ocean Township. Species labeled *WAP-FS* have not been formally listed in NJ, but have been identified as Focal Species for conservation in the state's Wildlife Action Plan (NJDEP, 2017).		
Sources: Kenney et al, no date; Gessner and Stiles, February 2001; N.J.A.C 7:7A, **Appendix E.3 & E.4**.		

Legend

- Ocean Township
- Roads
- Potential vernal pool location
- Potential vernal habitat
- Water

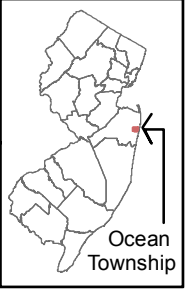
N

0 0.125 0.25 0.5 Miles

Data Sources: NJDEP, NJDOT
Disclaimer required for NJDEP Data: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Kratzer Environmental Services
Ocean Township ERI 2019

Figure 3.7.2. Vernal Pool Habitats Landscape Project version 3.3 Ocean Township, Monmouth County



There are currently eight sites identified as potential vernal pool habitats within Ocean Township, and two more along the borders which are only partially included in the township. All of the potential vernal ponds are situated in the western side of the township, and all but one are located west of Route 18 (see **Figure 3.7.1**). No vernal sites in the township are currently certified (NJDEP ONLM, October 2018 and NJDEP ENSP, May 9, 2017).

Fish

The New Jersey Division of Fish and Wildlife (2016) currently reports a total of 90 freshwater fish species in the state (**Appendix E.5**), although one of those (the longnose gar) is considered extirpated. Roughly two-thirds of those species are native to the state, while the others have been introduced either accidentally or deliberately. Some species introduced as game fish have become naturalized, while others do not readily reproduce and are repeatedly stocked for recreational purposes (NJ Division of Fish & Wildlife, 2016). Endangered fish species are discussed in **Section 3.7.2,** and non-indigenous fish in **Section 3.7.3**.

Deal Lake is the top site in Ocean Township for recreational freshwater fishing. No additional lakes, streams or rivers within the township are listed for public fishing, although there are many choices at other locations in the county (NJDEP, October 3, 2018). The nearest trout stocked waters are located at Shark River to the south and Franklin Lake to the north, but no waterways are stocked with trout in the Township of Ocean, though Deal Lake may be stocked with pike and "warmwater" species such as catfish, black crappie, bluegill sunfish and brown bullheads (NJDEP Division of Fish and Wildlife, June 13, 2018 and January 2019).

3.7.2 Endangered, Threatened, or Special Concern wildlife

Background

The health of an area's animal and plant populations can be an indicator of the health and sustainability of the environment for people. The decline or disappearance of one (or more) species may signal the deterioration of the habitat. Other species, and human health and welfare, may soon follow. Preserving the future of endangered and threatened species helps preserve our own species, benefiting human health and quality of life by protecting watersheds, preserving land in its natural state, and restoring wildlife habitat. Many people also place an intrinsic value on all species (Conserve Wildlife Foundation, 2002).

Many species are naturally rare in parts of their range, especially at the periphery. New Jersey often lies at the southern periphery of the range for many "northern" species and at the northern edge of the range of many "southern" species. Therefore, a species considered rare or imperiled within the state of New Jersey is not necessarily in danger of extinction worldwide. In addition, many rare species depend on large tracts of continuous undisturbed habitat to survive. If these habitats are interrupted by developed areas, the patches may become too small to support certain species.

The NJ Endangered Species Conservation Act was signed into law on December 14, 1973 (N.J.S.A. 23:2A-1 - 15), preceding the federal Endangered Species Act by two weeks. This milestone legislation established laws to protect and restore the state's endangered and threatened wildlife whose survival in New Jersey is imperiled by loss of habitat, over-exploitation, pollution, or other impacts (NJDEP, October 6, 2004). In February 2012, NJDEP updated the Endangered and Nongame Species rules (N.J.A.C. 7:25), revising the species list based on science, upgrading the status of some recovering species and adding some declining species to the list (NJDEP Division of Fish and Wildlife, April 2, 2012 and January 18, 2011).

Table 3.7.3 presents the definitions used by NJDEP in describing the status of rare animal species. In order to better document the status or change in status of species, NJDEP solicits information from the general public concerning sightings of endangered, threatened and special

concern species. People should use the appropriate reporting forms (see **Internet Resources** and **Appendix E.6)**.

Table 3.7.3 Definitions of Animal Species Status

STATE STATUS	STATE STATUS DEFINITION
Animals: Two animal lists provide state status codes after the Endangered and Nongame Species Conservation Act of 1973 (N.J.S.A. 23:2A-13 et. seq.): the list of endangered species (N.J.A.C. 7:25-4.13) and the list defining status of indigenous, nongame wildlife species of New Jersey (N.J.A.C. 7:25-4.17(a)). The status of animal species is determined by the Endangered and Nongame Species Program (ENSP), with the review and approval of the Endangered and Nongame Species Advisory Committee. Status for animals separated by a slash(/) indicate a dual status. First status refers to the state breeding population, and the second status refers to the migratory or winter population.	
E	An **endangered species** is one whose prospects for survival within the state are in immediate danger due to one or many factors - a loss of habitat, over exploitation, predation, competition, disease. An endangered species requires immediate assistance or extinction will probably follow.
T	A **threatened species** is a species that may become endangered if conditions surrounding the species begin to or continue to deteriorate.
SC	The term **Special Concern** applies to animal species that warrant special attention because of some evidence of decline, inherent vulnerability to environmental deterioration, or habitat modification that would result in their becoming a Threatened species. This category would also be applied to species that meet the foregoing criteria and for which there is little understanding of their current population status in the state.
S	A **stable species** is one whose population is not undergoing any long-term increase/decrease within its natural cycle.
U	An **undetermined species** is one about which there is not enough information available to determine the status.
ELEMENT RANKS	The Nature Conservancy developed a ranking system for use in identifying elements (rare species and ecological communities) of natural diversity most endangered with extinction. Each element is ranked according to its global, national, and state (or subnational in other countries) rarity. These ranks are used to prioritize conservation work so that the most endangered elements receive attention first. Definitions for element ranks are after The Nature Conservancy (1982: Chapter 4, 4.1-1 through 4.4.1.3-3).
GLOBAL RANK	**GLOBAL ELEMENT RANK DEFINITION**
G1	**Critically imperiled globally** because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extinction.
G2	**Imperiled globally** because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extinction throughout its range.
G3	Either **very rare and local throughout its range or found locally** (even abundantly at some of its locations) in a restricted range (e.g., a single western state, a physiographic region in the East) or because of other factors making it vulnerable to extinction throughout its range; with the number of occurrences in the range of 21 to 100.
G4	**Apparently secure globally**; although it may be quite rare in parts of its range, especially at the periphery.
G5	**Demonstrably secure globally**; although it may be quite rare in parts of its range, especially at the periphery.
GH	Of **historical occurrence** throughout its range i.e., formerly part of the established biota, with the expectation that it may be rediscovered.
STATE RANK	**STATE ELEMENT RANK DEFINITION**

B	Refers to the **breeding** population of the element in the state.
N	Refers to the **non-breeding** population of the element in the state.
Note: To express *uncertainty*, the most likely rank is assigned and a question mark added (e.g., G2?). A range is indicated by combining two ranks (e.g., G1G2, S1S3).	
Source: NJDEP Division of Fish and Wildlife, March 22, 2010	

Inventory

The NJDEP Division of Fish and Wildlife, Endangered and Nongame Species Program's (ENSP) mission is: "To actively conserve New Jersey's biological diversity by maintaining and enhancing endangered and nongame wildlife populations within healthy functioning ecosystems." The program is responsible for the protection and management of New Jersey's wildlife, including 50 endangered, 36 threatened and 100 species currently listed as special concern (NJDEP Division of Fish and Wildlife, April 2, 2012 and February 21, 2012). For state-wide species lists, see **Internet Resources**.

A search of NJDEP Division of Parks and Forestry *Natural Heritage Database* in October 2018 revealed the documented presence of eight imperiled animal species in the Township of Ocean (see **Table 3.7.3** for code definitions and **Table 3.7.4** for list)**.** Special Concern animal species, which warrant concern due to evidence of decline or vulnerability, include one reptile and three birds. State Threatened species include two birds, and a single State Endangered bird species is also documented in the township. The sole insect listed for the township is a moth that has not yet been assigned a protection status, but is currently tracked by the Natural Heritage Program. No rare amphibians, mammals or fish have been documented in Ocean Township.

Table 3.7.4 Natural Heritage Database Animal Species in Ocean Township

Class	Common Name	Scientific Name	Feature Type	LP Rank	Protection Status	Global Rank	State Rank
Species documented in Ocean Township							
Reptilia	eastern box turtle	*Terrapene c. carolina*	Occupied habitat	2	Special Concern	G5T5	S3
Aves	black-crowned night-heron	*Nycticorax nycticorax*	Foraging	3	State Threatened	G5	S2B, S3N
	common tern	*Sterna hirundo*	Foraging	2	Special Concern	G5	S3B, S4N
	great blue heron	*Ardea herodias*	Foraging	2	Special Concern	G5	S3B, S4N
	least tern	*Sternula antillarum*	Foraging	4	State Endangered	G4	S1B, S1N
	osprey	*Pandion haliaetus*	Foraging	3	State Threatened	G5	S2B, S4N
	osprey	*Pandion haliaetus*	Nest	3	State Threatened	G5	S2B, S4N
	wood thrush	*Hylocichla mustelina*	Breeding sighting	2	Special Concern	G4	S3B, S4N
Insecta	coastal bog metarranthis	*Metarranthis pilosaria*				G3G4	S3S4
Additional species documented in the vicinity of Ocean Township							
Aves	brown thrasher	*Toxostoma rufum*	Breeding sighting	2	Special Concern	G5	S3B, S4N
Note: See **Table 3.7.3** for Global and State Rank definitions, and **Table 3.7.6** for Landscape Project Rank definitions.							
Source: Natural Heritage Program, October 17, 2018							

Great Blue Heron in Palaia Park.

One additional bird species tracked through the Natural Heritage Program is known from the immediate vicinity of Ocean Township, but has not been documented in the state database as occurring within the township. However, that species (Brown thrasher) has been reported from two locations in the township on eBird (Sullivan et.al., 2019).

In fact, examination of eBird records from three locations in Ocean Township shows thirty noteworthy bird species in addition to those documented through the Natural Heritage Program (**Table 3.7.5**). Three species with a state status label of WAP in the table are not presently listed, but have been identified as Focal Species of Greatest Conservation Need in the recently updated state Wildlife Action Plan (NJDEP, 2017). The plan is discussed further below.

In 2018, NJDEP has documented a new nesting pair of bald eagles (known as the Harvey Brook nest/pair) in the Deal Lake area (NJDEP, 2018).

Table 3.7.5 Bird Species reported on eBird from sites in Ocean Township.
Species with an asterisk (*) are also included in **Table 3.7.4** above.

State Status	Common name	*Scientific name*	Date of most recent record through 1/19/19		
			Joe Palaia Park	Weltz Park	Deal Lake
Ebr, Tnb	bald eagle	*Haliaeetus leucocephalus*	17-Oct-18		15-Jan-19
Ebr, SCnb	northern harrier	*Circus cyaneus*	28-Apr-14		
Ebr, SCnb	peregrine falcon	*Falco peregrines*	19-Oct-18		21-Jan-18
Ebr, SCnb	pied-billed grebe	*Podilymbus podiceps*			11-Feb-17
Ebr, SCnb	red-shouldered hawk	*Buteo lineatus*	22-Oct-18		
T	American kestrel	*Falco sparverius*	17-Oct-18	11-Nov-18	
Tbr, SCnb	black-crowned night-heron *	*Nycticorax nycticorax*			6-Jun-18
Tbr	osprey *	*Pandion haliaetus*	25-Aug-18	31-Jul-18	5-Jun-18
Tbr	savannah sparrow	*Passerculus sandwichensis*	17-May-16	16-May-18	30-Mar-15
SC	common nighthawk	*Chordeiles minor*	16-May-16		
SC	sharp-shinned hawk	*Accipiter striatus*	30-Oct-18	23-Apr-18	26-Apr-18
SCbr	blackburnian warbler	*Setophaga fusca*	16-Sep-15	10-May-10	
SCbr	black-throated blue warbler	*Setophaga caerulescens*	12-May-18	16-May-18	
SCbr	black-throated green warbler	*Setophaga virens*	11-May-18	11-May-18	
SCbr	blue-headed vireo	*Vireo solitarius*	12-May-18	11-May-18	1-May-15
SCbr	broad-winged hawk	*Buteo platypterus*	6-May-14		
SCbr	brown thrasher	*Toxostoma rufum*	10-Jun-14	16-May-18	
SCbr	Canada warbler	*Cardellina canadensis*	13-May-18	15-May-18	
SCbr	cliff swallow	*Petrochelidon pyrrhonota*			30-May-18
SCbr	common tern *	*Sterna hirundo*		13-May-15	
SCbr	Cooper's hawk	*Accipiter cooperii*	23-Oct-18	31-Jul-18	30-May-18

State Status	Common name	*Scientific name*	Date of most recent record through 1/19/19		
			Joe Palaia Park	**Weltz Park**	**Deal Lake**
SCbr	great blue heron *	*Ardea herodias*	19-Apr-16	6-May-18	19-Jan-19
SCbr	hooded warbler	*Setophaga citrina*		11-May-18	
SCbr	least flycatcher	*Empidonax minimus*	9-May-16		
SCbr	Nashville warbler	*Oreothlypis ruficapilla*	21-Sep-15	11-May-18	
SCbr	northern parula	*Setophaga americana*	21-May-18	18-May-18	
SCbr	spotted sandpiper	*Actitis macularius*	17-May-16		30-Jul-14
SCbr	veery	*Catharus fuscescens*	21-May-18	16-May-18	
SCbr	winter wren	*Troglodytes hiemalis*		19-Feb-17	
SCbr	wood thrush *	*Hylocichla mustelina*	21-May-18	28-Jun-18	
SCbr	worm-eating warbler	*Helmitheros vermivorum*		19-May-16	
SCnb	gray-cheeked thrush	*Catharus minimus*	20-May-15		
WAP-FS	American woodcock	*Scolopax minor*		27-Mar-13	
WAP-FS	blue-winged warbler	*Vermivora cyanoptera*	20-May-16	11-May-18	
WAP-FS	scarlet tanager	*Piranga olivacea*	11-May-16	11-May-18	
WAP-FS indicates a species that has not yet been formally listed in NJ, but has been identified as a Focal Species for conservation in the state's Wildlife Action Plan (NJDEP, 2017).					
Source: Sullivan et.al., 2009. Site accessed January 20, 2019.					

A number of species included in **Table 3.7.5** above are only listed as Special Concern when they are breeding in the state, but may be routinely observed during spring and fall months as they travel between their breeding grounds and wintering sites. Nevertheless, if they are seen in the township during migration it indicates that habitat in Ocean Township can offer food and/or temporary shelter as they make their long journey. A summary of the habitat requirements for each rare species documented in Ocean Township is provided in **Appendix E.7**.

In addition to the rare bird species currently listed on eBird from Ocean Township, another 44 Endangered, Threatened or Special Concern birds have been reported at other locations in Monmouth County (**Appendix E.8**). It is likely that some additional rare birds also utilize habitat within Ocean Township.

State Wildlife Action Plan

NJDEP Division Fish and Wildlife prepared its first Wildlife Action Plan (WAP) in 2006, in response to the creation of a federal State Wildlife Grants program. The program was established by Congress in 2000 in order to help states develop a blueprint for the protection of species that are endangered, threatened, or have special conservation needs. In addition to making states eligible for conservation grants, the plans are designed to provide a planning tool for landowners and land managers. New Jersey's WAP was revised and updated in November of 2017 (NJDEP, 2017).

The emphasis of the updated Wildlife Action Plan was on the species of greatest conservation need (SGCN) in the state. A list of 3,700 vertebrate and invertebrate species was prioritized and reduced to a Focal SGCN list of 107 species most likely to benefit from concerted conservation action. The plan provided individual profiles for each of the 107 focal species. The Focal SGCN list includes 5 mammals, 29 birds, 15 reptiles, 7 amphibians, 12 fish, 33 insects and 6 freshwater mussels. Based on shared life history characteristics and habitat requirements, 77 of the focal species were consolidated into 18 groups or guilds and the remaining 30 species were ungrouped. For each guild or ungrouped species, specific threats were identified and conservation goals were developed (NJDEP, 2017).

Mapping (The Landscape Project)

The state's *Landscape Project* (see **Figure 3.7.2**) is a pro-active, ecosystem-level approach to the long-term protection of rare species and their important habitats in New Jersey. Its goal is to protect New Jersey's biological diversity by maintaining and enhancing rare wildlife populations within healthy, functioning ecosystems. It provides users with peer reviewed, scientifically sound wildlife data that is easily accessible and can be used by state, county, and local governments, as well as nongovernmental conservation organizations and private land owners for planning, open space acquisition, and land-use regulation (NJDEP Division of Fish and Wildlife, 2017).

The NJDEP, Division of Fish and Wildlife, Endangered and Nongame Species Program is responsible for the Landscape Project. Version 3.3 was released in 2017. The dataset was created by intersecting endangered, threatened and priority species data with the 2012 Land Use/Land Cover GIS layer, which was derived from aerial photography. The resulting data layer identifies, delineates and ranks (based on the conservation status of species present) critical habitat statewide. **Table 3.7.6** lists rank definitions. Each habitat patch is coded for the number of special concern, state threatened, state endangered and federally listed species present.

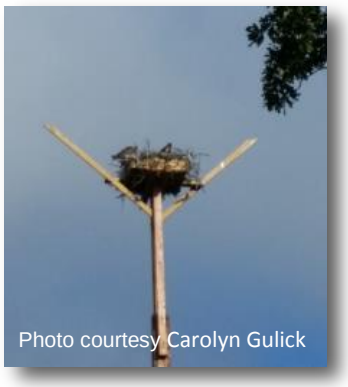
Table 3.7.6 Landscape Project Habitat Rank Definitions

Rank	Definition
0	**No Suitable Habitat**
1	**Suitable Habitat** – Rank 1 is assigned to patches that meet habitat-specific suitability requirements such as minimum size criteria for endangered, threatened or priority wildlife species, but that do not intersect with any confirmed occurrences of such species.
2	**Special Concern** – Rank 2 is assigned to patches containing one or more occurrences of species considered to be species of special concern.
3	**State Threatened** – Rank 3 is assigned to patches containing one or more occurrences of State threatened species.
4	**State Endangered** – Rank 4 is assigned to patches with one or more occurrences of State endangered species.
5	**Federally Listed** – Rank 5 is assigned to patches containing one or more occurrences of wildlife listed as endangered and threatened pursuant to the Federal Endangered Species Act of 1973.
Source: NJDEP Division of Fish and Wildlife, May 9, 2017	

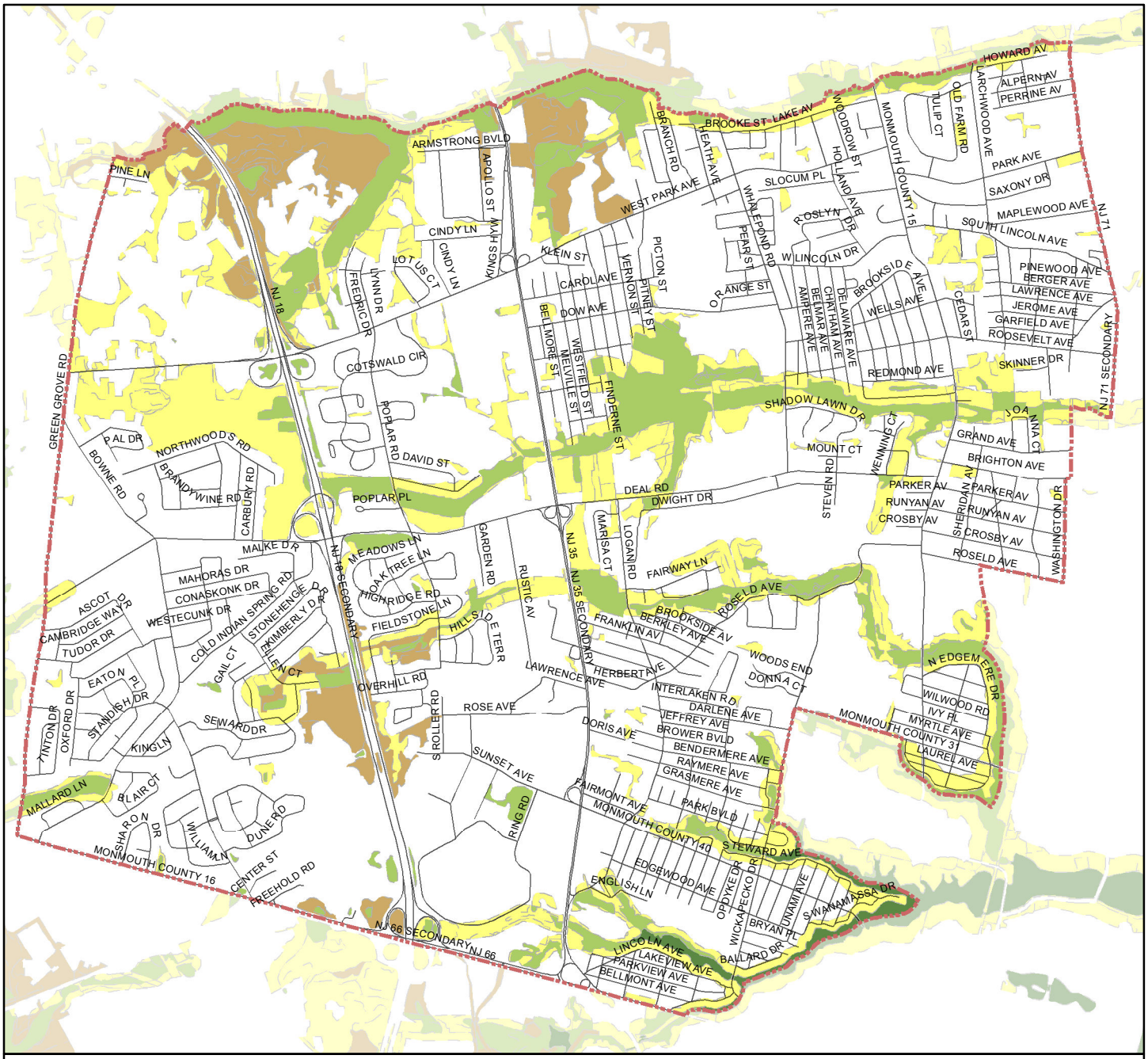
Over a tenth of Ocean Township (11.11%) is ranked as habitat for known occurrences of Endangered (0.44%), Threatened (7.09%) or Special Concern (3.58%) species according to the Landscape Project Version 3.3, and another 13.22% is ranked as potential habitat for priority species (see **Table 3.7.7** and **Figure 3.7.2)**.

Table 3.7.7 Landscape Project version 3.3

Land Use Type	Acres	Percent
No suitable habitat	5,319.82	75.67
Rank 1	929.12	13.22
Rank 2	251.93	3.58
Rank 3	498.16	7.09
Rank 4	30.97	0.44
Rank 5	0.00	0.00
Total Ranked Acres	**1,710.18**	**24.33**
Source: NJDEP Division of Fish and Wildlife, May 9, 2017		



Hwy 35 Osprey Nest.



Legend

Ocean Township

Roads

Landscape Project v.3.3 Rank

Rank 1 - Habitat specific requirements

Rank 2 - Special Concern

Rank 3 - State Threatened

Rank 4 - State Endangered

Rank 5 - Federal Listed (none in Ocean)

N

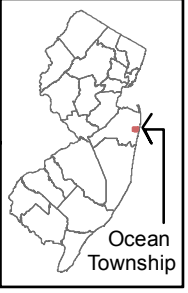
0 0.25 0.5 1 Miles

Data Sources: NJDEP, NJDOT

Disclaimer required for NJDEP Data: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Kratzer Environmental Services
Ocean Township ERI 2019

Figure 3.7.2. Landscape Project version 3.3 Ocean Township, Monmouth County



Current Threats

Habitat loss, fragmentation and degradation are the most serious threats to the state's wildlife populations (NJDEP, 2017). Habitat loss results from permanent or long-term alterations of the landscape, typically due to development or change in the vegetative cover. Fragmentation refers to the breaking up of large patches of natural habitat into smaller parcels, which increases edge habitat while disproportionately reducing interior habitat. Fragmentation also results in the loss of essential wildlife travel corridors. Examples of degradation include pollution, stream channel alterations, changes in characteristic hydrology or temperature, erosion, dredging, and off-road vehicular traffic. **Figure 3.7.3** illustrates the fragmentation of natural habitats that has occurred in Ocean Township.

A NJDEP effort called Connecting Habitat Across New Jersey (CHANJ), is an effort to improve habitat connectivity for terrestrial wildlife across the state. The CHANJ mapping and guidance document help prioritize land protection, inform habitat restoration and management, and guide mitigation of road barrier effects on wildlife and their habitats. The CHANJ project identified no potential cores or corridors in Ocean Township (NJDEP, April 12, 2019; NJDEP, May 7, 2019).

Road mortality is another danger to wildlife in New Jersey. Many aquatic and terrestrial wildlife species are known to cross beneath roadways at bridge spans and through medium and large culverts. The CHANJ project's tool, which is part of the North Atlantic Aquatic Connectivity Collaborative Road-Stream Crossing Assessments, provides an inventory of road crossings (shown on **Figure 3.7.3**). The goal of this project is to use volunteers to collect a variety of data associated with culverts and bridges, including structure dimensions and the presence of barriers, to characterize these road-stream crossings to help identify opportunities to improve safe passage for wildlife (NJDEP, April 18, 2018).

Another significant threat to New Jersey's wildlife is invasive or overabundant species (NJDEP, 2017). Invasive and non-native species are discussed in **Section 3.7.3** below. Some examples of overabundant native species, white-tailed deer and non-migratory Canada geese, are discussed in **Section 3.7.1**. The unchecked spread of certain diseases can also cause an apparently stable species to rapidly decline. Populations of cave-roosting bats across the northeast were decimated by the introduction of a fungus that caused white-nose syndrome (Rutgers, 2019), and the effects of diseases such as ranavirus and snake fungal disease on the state's herptile populations are still being evaluated (NJDEP, 2017; Conserve Wildlife Foundation, 2015; Northeast Wildlife Disease Cooperative, 2017).

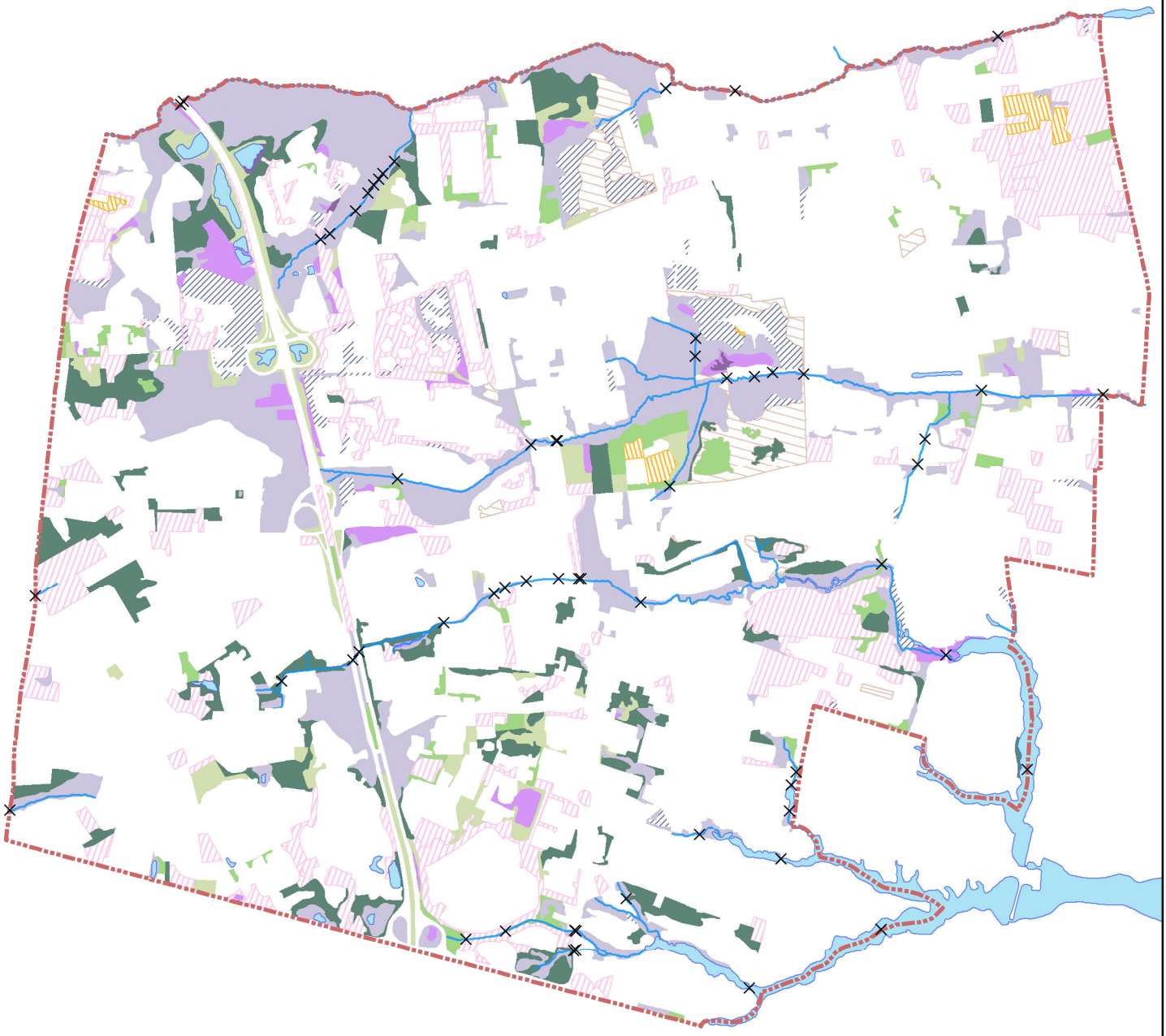
Litter, especially plastics, threatens wildlife directly through choking and entanglement and indirectly through the toxicity of the chemicals and biofilms associated with the breakdown of plastics. For example, osprey will add trash to their nesting material, which can entangle and even kill the young. About 267 marine animal species ingest plastic, which sometimes causes the animals' death. Researchers have found chemicals that result from the breakdown of plastics in the world's oceans, including bisphenol A (which has been shown to interfere with animals' reproductive systems) and styrene monomer (a suspected carcinogen) (Barry, August 20, 2009).

Beneficial insects, including pollintors, are vulnerable to threats from habitat loss and invasives species as well as the harmful effects of pesticides and herbicides. When these chemicals are used to target pests and weeds, they may drift beyond the intended area and jeopardize beneficial insects. Bees and butterflies are also vulnerable to the systemic neonicotinoid pesticides, which remain harmful throughout the life of the plant treated with them (NJDEP, 2017)

Wildlife populations are also threatened by illegal collecting (especially with regards to box turtles).

3.7.3 Invasive & Non-native Wildlife

As with exotic plant species, the introduction of non-native animal species can have a devastating effect on natural communities. This most often occurs due to competition with native animals for limited resources such as food and shelter, but it may also be due to predation on native species.



Legend

- Ocean Township
- Water
- × Road-Stream Crossing Assessments (not surveyed)

Habitat Types and Potential Habitat*

- Shrubs, brush and old fields
- Forest, 10-50% crown closure
- Forest, >50% crown closure
- Forested wetlands
- Scrub/shrub wetlands
- Herbaceous wetlands
- Potential habitat - modified wetlands
- Potential habitat - recreational Land
- Agricultural land
- Residential and other urban with possible natural areas

N

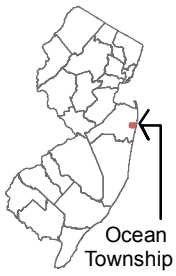
0 0.25 0.5 1 Miles

Data Sources: NJDEP, NJDOT, ESRI
Disclaimer required for NJDEP Data: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Kratzer Environmental Services
Ocean Township ERI 2019

Figure 3.7.3.Habitat Connectivity Ocean Township, Monmouth County

* Potential habitat includes areas identified by evaluating land use data and aerial photos to have potential natural habitat areas. Some may currently have natural habitat areas while others have the potential be restored to benefit habitat connectivity, such as through planting native plants and removing invasive species.



Feral Cats

An example of an introduced species that preys on native wildlife is the feral cat (*Felis domesticus*), which is the sole mammal tracked by the Invasive Species Strike Team likely to occur in Ocean Township. Feral cats are a widepread problem around the state, and are considered highly threatening to native communities (FoHVOS, 2018). Free-roaming domestic cats are visually and genetically indistinguishable from feral cats and pose the same threat to wildlife, but are protected by state statute (NJ Department of Health, 2016). A number of management options for the control of feral and free-roaming cats are reviewed by the Internet Center for Wildlife Damage Management (ICWDM, 2015). Some of their suggestions to repel or exclude cats are universally applicable, but others which focus on elimination of the animals are subject to state and local laws and may not be appropriate in many communities.

Recommendations specific to New Jersey include a combination of strong local ordinances, public education and the establishment of "Managed Cat Colonies". The concept of managed cat colonies is an alternative to the elimination of established feral cats, instead focusing on management of the population until it is eventually reduced by attrition. Components of managed cat colonies include spaying and neutering, designated caretakers, and public ordinances establishing local requirements for the program. In addition to laying out the guidelines for establishing and regulating managed cat colonies, local ordinances should address the implementation and enforcement of licensing and vaccinations for pets, prohibitions against the feeding of feral cats and abandonment, and effective animal control. Public education focuses on responsible pet ownership such as spaying and neutering, keeping cats indoors, and prevention of abandonment (NJ Department of Health, 2016).

On July 12, 2018, the governing body of Ocean Township passed a resolution which authorizes the execution of a Memorandum of Understanding between the Township and the Monmouth County S.P.C.A. to implement a Trap, Neuter and Release Program ("TNR"). The purpose is to humanely trap, neuter and vaccinate feral cats (Ocean Township, July 12, 2018).

Other Invasive Fauna

Of the eight non-native resident bird species in New Jersey, seven occur in Monmouth County and six have been reported in Ocean Township (**Table 3.7.8**).

Table 3.7.8. Non-native Resident Birds of Monmouth County

Common name	***Scientific name***	**Threat Level****
brown-headed cowbird *****	*Molothrus ater*	High
European starling *****	*Sturnus vulgaris*	Moderate
house finch *****	*Haemorhous mexicanus*	Mild
house sparrow *****	*Passer domesticus*	Mild
monk parakeet	*Myiopsitta monachus*	-
mute swan *****	*Cygnus olor*	High
rock pigeon *****	*Columba livia*	-
***** Species recorded in Ocean Township **Threat levels are ranked by the Invasive Species Strike Team (FoHVOS, 2018).		
Source: Sullivan et.al., 2009. Site accessed January 20, 2019.		

Both the house finch and the house sparrow are classified as mildly threatening to natural communities. The European starling, which poses a moderate threat to native species, is frequently seen in large flocks: the high count for this species in Monmouth County was estimated at 10,500 birds in 2012 (Sullivan et. al., 2009). The mute swan and brown-headed cowbird are both rated as highly threatening to native communities. In addition to competing with native birds for resources, the brown-headed cowbird is a brood parasite, laying its eggs in the nests of other bird species, which then raise the young cowbirds at the expense of their own offspring.

The sole invasive reptile likely to be encountered in Monmouth County is the red-eared slider, which is classified as highly threatening. This turtle is widespread in New Jersey, and may be found in ponds, lakes, swamps, streams, or slow-flowing rivers. No amphibians are currently tracked by the Invasive Species Strike Team.

The state Division of Fish and Wildlife (2016) lists nine species that pose a serious threat to freshwater resources, and which must be destroyed when encountered. Those invasive fish include the swamp eel, grass carp, bighead carp, silver carp, flathead catfish, brook stickleback, green sunfish, warmouth, and oriental weatherfish. The Invasive Species Strike Team tracks all of those species, and three additional freshwater fish. The northern snakehead (*Channa argus*) is not included on the state list of freshwater fish provided in **Appendix E.5**, although the Strike Team fact sheet states that it is widespread in New Jersey and lists its threat level as 'High'. The common carp is similarly ranked on the Strike Team list, but is not yet classified as a serious threat by Fish and Wildlife. The red-bellied pacu (*Piaractus brachypomus*) is a recent introduction into the state, and is ranked as a moderate threat.

The Invasive Species Strike Team additionally tracks a number of invertebrate species in the state, including 20 insects, 12 mollusks, 3 crabs, 7 worms, 4 crayfish, one arachnid and one jellyfish. Links to fact sheets with information about identification, threat levels and control measures for invasive animal species are also provided by the Strike Team (FoHVOS, 2018).

The annual Deal Lake Carp Contest as an effort to control the lake's invasive carp population (Deal Lake Commission, 2019).

References: Wildlife and Wildlife Habitat

Wildlife

APHIS (USDA Animal and Plant Health Inspection Service). January 2011. Fact Sheet: Managing Canada Goose Damage. 12 pages. https://www.nj.gov/agriculture/pdf/managingcanadagoosedamage.pdf

Burnett, Andrew. 2004. White-tailed Deer – Natural History and Autumn Behavior. NJDEP Division of Fish and Wildlife. 1 page. http://www.njfishandwildlife.com/deerart.htm

Gallo, Bill Jr. January 14, 2019. The 13 N.J. counties that cleaned up the most dead deer in 2018. Article on NJ.com https://www.nj.com/expo/news/g66l-2019/01/8055173e4c5291/the-13-nj-counties-that-cleane.html

Gessner, Jackie and Eric Stiles. February 2001. Field Guide to Reptiles and Amphibians of New Jersey. Funded By: Conserve Wildlife Funds And U.S. Fish & Wildlife Service's Partnerships For Wildlife. 1st Edition, Herp Atlas Field Guide. http://www.state.nj.us/dep/fgw/ensp/herpgide.htm

Honachefsky, William B. 2000. Ecologically Based Municipal Land Use Planning. Lewis Publishers: New York. 255 pages.

Kenney, Leo P., Matthew R. Burne, with adaptations and modifications for New Jersey by Jason Tesauro, Kris Schantz and Melissa Craddock. No date. Salamanders, Frogs and Turtles of New Jersey's Vernal Pools: A Field Guide. NJDEP Division of Fish and Wildllife, Endangered and Nongame Species Program. 54 pages.

Latham, Roger Earl and, Jan Beyea, Merlin Benner, Cindy Adams Dunn, Mary Ann Fajvan, Ronald R. Freed, Marrett Grund, Stephen B. Horsley, Ann Fowler Rhoads, and Bryon P. Shissler. January 2005. Managing White-tailed Deer in Forest Habitat From an Ecosystem Perspective. Pennsylvania Case Study Report of the Deer Management Forum convened by Audubon Pennsylvania and the Pennsylvania Habitat Alliance in Harrisburg, Pennsylvania. 340+ pages. http://pa.audubon.org/sites/g/files/amh821/f/pa-deermanagement--full--textoffullreport.pdf

Monmouth County Park System 2017. Deer Management Background Program Information. http://co.monmouth.nj.us/documents/127/2016_17_deer_background_report.pdf

NJDEP Division of Fish and Wildlife. Undated-a. Canada Goose Control Information. 4 pages. http://www.njfishandwildlife.com/pdf/goose_control_info.pdf

NJDEP Division of Fish and Wildlife. Undated-b. Community Based Deer Management Manual for Municipalities. 49 pages. https://www.state.nj.us/dep/fgw/pdf/cbdmp_manual.pdf

NJDEP Division of Fish and Wildlife. January 17, 2019. White-tailed Deer in New Jersey. https://www.state.nj.us/dep/fgw/deer.htm

NJDEP Division of Fish and Wildlife. January 2019. New Jersey Freshwater Fishing Digest. https://www.state.nj.us/dep/fgw/pdf/2019/digfsh19.pdf.

NJDEP Division of Fish and Wildlife. October 3, 2018. Places to Fish. http://www.state.nj.us/dep/fgw/fishplc.htm

NJDEP Division of Fish and Wildlife. June 13, 2018. Fishing Access Locations on Trout Waters - County Listing. http://www.state.nj.us/dep/fgw/accesscnty.htm

NJDEP Division of Fish and Wildlife. August 2017. NJ Deer Management Zone Descriptions. https://www.njfishandwildlife.com/derzones.htm

NJDEP Division of Fish and Wildlife. 2016. Checklist of NJ Fish. http://www.njfishandwildlife.com/chkfish.htm

NJDEP Division of Fish and Wildlife. June 6, 2014. Online Field Guide for Reptiles and Amphibians. http://www.state.nj.us/dep/fgw/ensp/fieldguide_herps.htm

NJDEP Division of Fish and Wildlife. January 19, 2012. Checklists of Wildlife. https://www.nj.gov/dep/fgw/chklists.htm

NJDEP Division of Fish and Wildlife. 2004a. Checklist of NJ Birds. http://www.state.nj.us/dep/fgw/chkbirds.htm

NJDEP Division of Fish and Wildlife. 2004b. Checklist of NJ Mammals. http://www.state.nj.us/dep/fgw/chkmamls.htm

NJDEP Division of Fish and Wildlife, Endangered and Nongame Species Program (ENSP). May 9, 2017. Species Based Habitat, Vernal Habitat, Version 3.3, 20170509 (Envr_hab_ls_v3_3_vernalhabitat). GIS data. http://www.nj.gov/dep/gis/landscape.html

NJDEP Division of Fish and Wildlife, Endangered and Nongame Species Program (ENSP). November 2014. The Leopard Frogs of New Jersey. http://www.njfishandwildlife.com/ensp/pdf/leopardfrog_guide.pdf

NJDEP Division of Fish, Game and Wildlife with the Department of Agriculture. 1999. The Governor's Report on Deer Management in New Jersey. 32 pages. http://www.state.nj.us/dep/fgw/pdf/govdrrpt.pdf

NRCS (USDA - Natural Resources Conservation Service). Undated. New Jersey Fact Sheet: White-tailed deer impacts and forest management. https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs141p2_017804.pdf

Ocean Township. 2018. "Living with Deer in the Township of Ocean." Survey Monkey survey by the Township of Ocean.

Rutgers, The State University of New Jersey. 2013. An Overview of White-Tailed Deer Status and Management in New Jersey. Cooperative Extension Fact Sheet FS12024, New Jersey Agricultural Experiment Station. https://njaes.rutgers.edu/fs1202/

Rutgers, The State University of New Jersey. 2019. Canada Goose Ecology and Impacts in New Jersey. Cooperative Extension Fact Sheet FS1214, New Jersey Agricultural Experiment Station. https://njaes.rutgers.edu/fs1214/

Sauer, Leslie Jones. 1998. The Once and Future Forest: A Guide to Forest Restoration Strategies. Island Press: Washington, D.C. 382 pages.

Stine, Don. May 9, 2018. Deer Survey in Ocean Township. The Coaster Online: https://thecoaster.net/wordpress/deer-survey-in-ocean-township/

Sullivan, B.L., C.L. Wood, M.J. Iliff, R.E. Bonney, D. Fink, and S. Kelling. 2009. eBird: a citizen-based bird observation network in the biological sciences. Biological Conservation 142: 2282-2292. http://ebird.org/ebird/nj/places. Accessed January 2019.

Tesauro, Jason. No date. New Jersey's Vernal Pools. NJDEP Division of Fish and Wildlife. http://www.state.nj.us/dep/fgw/vpoolart.htm

U.S. Census Bureau. 2010. https://www.census.gov/quickfacts/fact/table/monmouthcountynewjersey/LND110210#LND110210

Endangered, Threatened and Special Concern Species: Animals

Barry, Carolyn. August 20, 2009. "Plastic Breaks Down in Ocean, After All—and Fast" in National Geographic. https://news.nationalgeographic.com/news/2009/08/plastic-breaks-down-in-ocean-after-all-and-fast/. Accessed June 30, 2019.

Conserve Wildlife Foundation of New Jersey. March 20, 2015. Ranavirus Impacting New Jersey Amphibians. Conserve Wildlife Blog: http://www.conservewildlifenj.org/blog/2015/03/20/ranavirus-impacting-new-jersey-amphibians/

Conserve Wildlife Foundation of New Jersey and NJDEP Division of Fish and Wildlife. 2002. Endangered and Threatened Wildlife of New Jersey. 2 pages. http://www.state.nj.us/dep/fgw/ensp/pdf/e&tbroch.pdf

New Jersey Department of Environmental Protection Division of Fish and Wildlife. May 7, 2019. Connecting Habitat Across New Jersey (CHANJ). https://www.state.nj.us/dep/fgw/ensp/chanj.htm. Accessed July 13, 2019.

New Jersey Department of Environmental Protection Division of Fish and Wildlife. April 12, 2019. Connecting Habitat Across New Jersey (CHANJ). GIS data. https://njdep.maps.arcgis.com/apps/webappviewer/index.html?id=53339ff12f27488d8462e5e2c4c21b5c. Accessed June 30, 2019.

New Jersey Department of Environmental Protection Division of Fish and Wildlife. April 18, 2018. North Atlantic Aquatic Connectivity Collaborative (NAACC) Road-Stream Crossing Assessments in New Jersey, (Envr_CHANJ_pts). https://www.state.nj.us/dep/fgw/ensp/chanj_tools.htm

New Jersey Department of Environmental Protection. 2017. New Jersey Monarch Butterfly Conservation Guide. https://www.nj.gov/dep/docs/monarch-guide.pdf

NJDEP Division of Fish and Wildlife Endangered and Nongame Species Program. 2018. New Jersey Bald Eagle Project, 2018. https://www.state.nj.us/dep/fgw/ensp/pdf/eglrpt18.pdf

NJDEP Division of Fish and Wildlife. 2017. New Jersey's Wildlife Action Plan. https://www.state.nj.us/dep/fgw/ensp/wap/pdf/wap_plan17.pdf

NJDEP Division of Fish and Wildlife. May 9, 2017. NJDEP Species Based Habitat, Atlantic Coastal Region, Version 3.3 (Envr_hab_ls_v3_3_coastal) and NJDEP Species Based Habitat, Piedmont Plains Region, Version 3.3, 20170509 (Envr_hab_ls_v3_3_piedmont). GIS Data: http://www.state.nj.us/dep/gis/landscape.html#geodatabase

NJDEP Division of Fish and Wildlife. April 2, 2012. New Jersey's Endangered and Threatened Wildlife. http://www.njfishandwildlife.com/tandespp.htm

NJDEP Division of Fish and Wildlife. February 21, 2012. NJ Endangered and Nongame Species Program Special Concern – Species Status Listing. 4 pages. http://www.njfishandwildlife.com/ensp/pdf/spclspp.pdf

NJDEP Division of Fish and Wildlife. January 18, 2011. Notice of Readoption with Amendments: Division of Fish and Wildlife rules; Endangered Species List, Nongame Species List, N.J.A.C. 7:25-4.1, 4.13, 4.17 http://www.nj.gov/dep/rules/notices/011811b.html

NJDEP Division of Fish and Wildlife. March 22, 2010. Explanations of Codes Used in Natural Heritage Reports. http://www.nj.gov/dep/parksandforests/natural/heritage/spplant_ap1.html

NJDEP Division of Fish and Wildlife. October 6, 2004. Endangered Species Conservation Act: 30 Years of Protection. http://www.state.nj.us/dep/fgw/ensp/somhome.htm

NJDEP Office of Natural Lands Management (ONLM) Natural Heritage Program. October 17, 2018. Letter Re: Ocean Township Natural Resource Inventory. Natural Heritage Database and the Landscape Project habitat mapping search results.

Northeast Wildlife Disease Cooperative. 2017. Snake Fungal Disease. https://www.northeastwildlife.org/disease/snake-fungal-disease

Rutgers, The State University of New Jersey. 2019. The Facts About Bats in New Jersey. Cooperative Extension Fact Sheet FS1207, New Jersey Agricultural Experiment Station. https://njaes.rutgers.edu/fs1207/

Sullivan, B.L., C.L. Wood, M.J. Iliff, R.E. Bonney, D. Fink, and S. Kelling. 2009. eBird: a citizen-based bird observation network in the biological sciences. Biological Conservation 142: 2282-2292. http://ebird.org/ebird/nj/places. Accessed January 2019.

Invasive Species

Deal Lake Commission. 2019. Annual Deal Lake Carp Contest. http://www.deallake.org/annual-deal-lake-carp-contest/. Accessed June 30, 2019.

FoHVOS (Friends of Hopewell Valley - Invasive Species Strike Team Team). 2018. New Jersey Invasive Species List. https://www.fohvos.info/wp-content/uploads/2019/01/2018_NJISST_Species_List_and_Control_Recommendations_2018_04_30.pdf Accessed January 2019.

ICWDM (Internet Center for Wildlife Damage Management). 2015. House Cat Control. Site administered by the University of Wisconsin - Stevens Point and available at http://icwdm.org/wildlife/HouseCat.aspx

NJDEP Division of Fish and Wildlife. 2016. Checklist of NJ Fish. http://www.njfishandwildlife.com/chkfish.htm

New Jersey Department of Health. 2016. Veterinary Public Health: Animal Control - Free Roaming and Feral Cats. https://www.nj.gov/health/vph/animal-control/feral-cats/

Ocean Township. July 12, 2018. Resolution 18-136 "Authorize the Execution of a Memorandum of Understanding between the Township and the Monmouth County S.P.C.A. for a Trap, Neuter and Release Program." http://oceantwp.legistar.com/gateway.aspx?M=F&ID=2a6a2eb2-8ef1-4d37-bc1c-22ea2a7dea3c.doc

Sullivan, B.L., C.L. Wood, M.J. Iliff, R.E. Bonney, D. Fink, and S. Kelling. 2009. eBird: a citizen-based bird observation network in the biological sciences. Biological Conservation 142: 2282-2292. https://ebird.org/nj/explore Accessed January 2019.

Internet Resources: Wildlife

Backyard Habitats & Conservation

Conserve Wildlife Foundation: http://www.conservewildlifenj.org/protecting/backyard/
Deer Tolerant/Resistant Native Plants:
https://bhwp.org/wp-content/uploads/Deer-Tolerant_Resistant-Plants.pdf
Gardening for Butterflies: http://www.state.nj.us/dep/fgw/ensp/pdf/literature/butterfly_gardening.pdf
Jersey-Friendly Yards:
http://www.jerseyyards.org/create-a-jersey-friendly-yard/8-steps/step-7-create-wildlife-habitat/
National Audubon Society: http://www.audubon.org/bird/at_home/
NJDEP Outdoor Classroom links: http://www.state.nj.us/dep/seeds/syhart/outclass.htm
USDA NRCS: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/newsroom/features/?cid=nrcs143_023574

Checklists

Birds of NJ: http://www.state.nj.us/dep/fgw/chkbirds.htm
Butterflies of NJ: http://www.naba.org/chapters/nabanj/butterflies.html
Endangered & Threatened Wildlife of NJ: http://www.njfishandwildlife.com/tandespp.htm
Freshwater Fish Of NJ: http://www.njfishandwildlife.com/chkfish.htm
Mammals of NJ: http://www.state.nj.us/dep/fgw/chkmamls.htm
Reptiles and Amphibians of NJ: http://www.state.nj.us/dep/fgw/ensp/fieldguide_herps.htm
Species of Special Concern of NJ: http://www.njfishandwildlife.com/ensp/pdf/spclspp.pdf
Cornell Lab of Ornithology, All About Birds: http://www.birds.cornell.edu/AllAboutBirds/BirdGuide/

Deer Management

Community Based Deer Management Manual for Municipalities.
https://www.state.nj.us/dep/fgw/pdf/cbdmp_manual.pdf
An Overview of White-Tailed Deer Status and Management in New Jersey. https://njaes.rutgers.edu/fs1202/

Endangered Species

Conserve Wildlife Foundation of New Jersey: http://www.conservewildlifenj.org/
Disease Fact Sheets: https://sites.tufts.edu/nwdc/disease-fact-sheets/
Division of Fish and Wildlife Home Page: http://www.njfishandwildlife.com/wildlife.htm
Environmental Rules: http://www.nj.gov/dep/rules/nj_env_law.html
Endangered and Nongame Species Program Home Page: http://www.state.nj.us/dep/fgw/ensphome.htm
Landscape Project: http://www.state.nj.us/dep/fgw/ensp/landscape/
NJ Wildlife Action Plan: https://www.state.nj.us/dep/fgw/ensp/wap/pdf/wap_plan17.pdf
North American Butterfly Association, North Jersey Butterfly Club: http://www.naba.org/chapters/nabanj/
Rare Wildlife Sighting Form: http://www.njfishandwildlife.com/ensp/rprtform.htm

Invasive Species

Invasive Species – New Jersey: http://www.invasivespeciesinfo.gov/unitedstates/nj.shtml
Invasive Species Strike Team: https://www.fohvos.info/invasive-species-strike-team/
Forest Health: http://www.state.nj.us/dep/parksandforests/forest/njfs_forest_health.html

Feral Cat Management

Free Roaming and Feral Cats: https://www.nj.gov/health/vph/animal-control/feral-cats/
House Cat Control: http://icwdm.org/wildlife/HouseCat.aspx

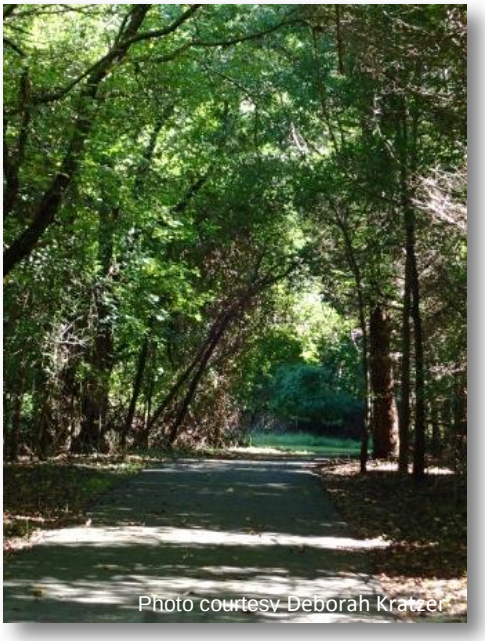
3.8 OPEN SPACE

3.8.1 Public Open Space and Recreation

Purposes & Funding

The purposes of open space preservation include:

- provide adequate active and passive recreation;
- provide recreational and open space opportunities on an equal and accessible basis for all citizens;
- protect the quantity and quality of surface and ground water;
- protect sensitive environmental features such as wetlands, steep slopes and critical habitats;
- link community resources and support the community's need for safe, multi-modal circulation through a system of greenways and trails;
- protect historic areas;
- maintain plant and animal biodiversity;
- minimize erosion or damage from flooding; and
- maintain rural character (ANJEC, 2011).



Palaia Park.

Funding for open space comes from a variety of sources, including municipal, county, state and federal sources and private land trusts. Private land trusts are non-profit organizations that "can often act faster and be more creative in their real estate transactions than established government agencies" according to Howe (1989). Landowners are able to reap tax benefits through charitable donations to a land trust. Many successful open space purchases combine a number of funding sources and strategies.

In 1987 Monmouth County voters approved a referendum question for an open space tax, making Monmouth the first county in New Jersey to establish an Open Space Trust Fund. Voters have approved increases to the Open Space Trust Fund in 1996, 2002, 2006 and 2017 to meet open space and recreation needs. The current rate is 2.75 cents per $100 of assessed property (Monmouth County Park System, September 5, 2017).

In 2017 a dedicated open space tax equal 1 cent for each $100 of assessed property value was approved by Ocean Township voters (Stine, November 8, 2017).

Private land trusts working to preserve land in southern New Jersey and the Association of New Jersey Environmental Commissions (ANJEC) are sources for in-depth information concerning open space preservation through various funding, planning, and zoning techniques (see **Internet Resources**).

Greenway Establishment & Maintenance

A *greenway* is a corridor of undeveloped land or open space, which often protects environmental features, such as a stream corridor, floodplain, forested ridgeline, or animal migration route, but which can also preserve a scenic view and provide recreational opportunities, such as parks or biking/hiking trails. Greenway corridors also have the potential for positive economic impacts, by creating jobs, enhancing property values, expanding local businesses, attracting new businesses, increasing local tax revenues, decreasing local government expenditures, and promoting a local community. The publication Economic Impacts of Protecting Rivers, Trails and Greenway Corridors outlines procedures for analyzing economic impacts of a greenway project, and provides examples. Decision makers can benefit from recognition of potential economic impacts as well as intrinsic values of

greenways in support of decisions that enhance the well-being of the community (National Park Service, 1995).

Garden State Greenways is an online planning tool designed for all those involved in conserving open space, farmland, and historic areas in New Jersey. It uses GIS to identify *hubs* **(**larger areas of undeveloped land with important natural resource values) and linear *connectors* between these hubs. The goal of the program is to help coordinate efforts of both private groups and government agencies (NJ Conservation Foundation, 2012).

Local governments often use a variety of planning and zoning techniques for establishing greenways, including creating a greenway map and adopting it as part of the Master Plan, creating a Greenway Overlay District, cluster zoning and Transfer of Development Rights. These strategies can be combined with land preservation, private land trusts, and conservation easements to meet the Township's open space and recreation goals (Howe, 1989).

Before a greenway is established, issues of maintenance, public access and monitoring of easements must be addressed to ensure long-term success of the project (Howe, 1989).

Inventory

An updated inventory of the preserved open space and recreation properties within the Township is presented in **Appendix G**, and the locations of the township's open spaces are shown in **Figure 3.8.1.** Using the acreage figures calculated by GIS, a total of 619.73 acres of Open Space have been established in Ocean Township (summarized in **Table 3.8.1**), which is approximately 8.8% of the Township's 7030.43 acres.

The majority of the total preserved open space in Ocean Township is managed by the township (65%). The remainder is managed by the county (20.6%) and the state (14.4%).

Table 3.8.1 Summary of Preserved Open Space and Recreation in Ocean Township

Managed By	Property Names	Primary Use	GIS Acres*
Ocean Township	Oakhurst First Aid and Firemens Memorial Park, Wanamassa Firemens Memorial Fields, David A Dahrouge Park, Rec Center Wayside Park, Memorial Park, Appleby Park, Ocean Community Pool and Tennis Facility	Athletic Facilities, recreation, playgrounds, swimming facility	59.60
Ocean Township	Colonial Terrace Golf Course	Golf Course	53.19
Ocean Township	Donna Lisa, Maple Ave., Wickepecko, other	Unknown	1.19
Ocean Township	Lake Drive Pond, North Edgemere, South Edgemere	Water Body	2.67
Ocean Township	Tilton Park, Marshall Park, Wayside Park (in part), Sally's Hole, Pond Out Fall, South Dittmar	Wooded Lot	32.94
Ocean Township	Joe Palaia Park	Active & Passive Recreation	243.40
Ocean Township	Blue Acres Program	Unknown	10.12
NJDEP, NJ Natural Lands Trust	Whale Pond Brook Preserve	Preserve	89.21
Monmouth County	Weltz Park	Passive Recreation/ Conservation	127.41
		Total:	619.73
*****Acreage calculated by GIS may vary from deed acreage.			

Municipal Open Space

At 243.4 acres, Joe Palaia Park is the largest preserved unit in Ocean Township, accounting for 60 percent of the municipally managed open space (**Figure 3.8.2**). The spacious park is centrally situated in the township, and its network of paved and unpaved trails is enjoyed by residents for a variety of recreational activities including hiking, jogging, biking, and birdwatching (Ocean Township, 2019). Sport fields, a disc golf course and a playground are also available in the park. Natural resources in undeveloped portions of the park include woodlands, forested wetlands and a portion of Poplar Brook and its tributaries. The mixture of habitat types is utilized by a wide variety of wildlife (Joe Palaia Park Adjunct Property NRI, undated), and a pollinator meadow has been established in the southwest corner of the park.

Native Plant Garden at the Ocean Township Library.

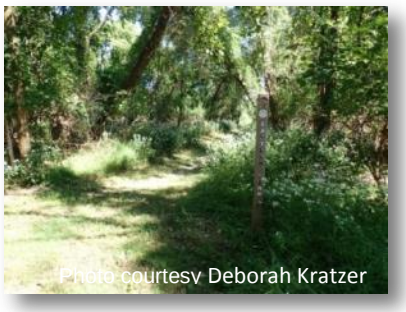
Colonial Terrace Golf Course is a nine acre public course located at the southern end of the township. Prior to 2007, a portion of the property was privately owned, but the township acquired it through a partnership with The Trust for Public Land, the New Jersey Green Acres Program and the Monmouth County Open Space fund (TPL, 2007). A number of the other properties managed by Ocean Township are designated for active recreational use including sports, picnicking and playgrounds (see **Table 3.8.1**).

Palaia Park Meadow.

Just over ten acres of township land includes tracts listed as 'Blue Acres'. Those are properties in the Poplar Brook watershed that have been acquired through a subsection of the state's Green Acres program which was designed to purchase flood-prone properties from willing sellers (NJDEP Green Acres Program, 2019). The remainder of township-managed open space consists of woodlots and open water.

County Open Space

Weltz Park encompasses 169 acres, the majority of which (127 acres) are located in Ocean Township (**Figure 3.8.3**). The park entrance is also situated in the township, with a small parking area available just off of West Park Avenue. Weltz Park is largely undeveloped, but it does contain nearly two miles of easy walking trails (Monmouth County Park System, undated). The park is designated for the quiet enjoyment of nature, and its environmental features include fields, forests and a portion of Whale Pond Brook. An interactive trail map App is available for Monmouth County parks (see **Internet Resources**).



Weltz Park.

State Open Space

The 89-acre Whale Pond Brook Preserve consists of two parcels in the northwestern section of the township that are separated by Route 18 (**Figure 3.8.4**). The preserve is managed by the New Jersey Natural Lands Trust, and is currently not open to hunting or other public uses (NJNLT, 2013). Management objectives for the preserve focus on natural resource protection, and key habitats found on the site include permanent and intermittent ponds as well as forested wetlands.

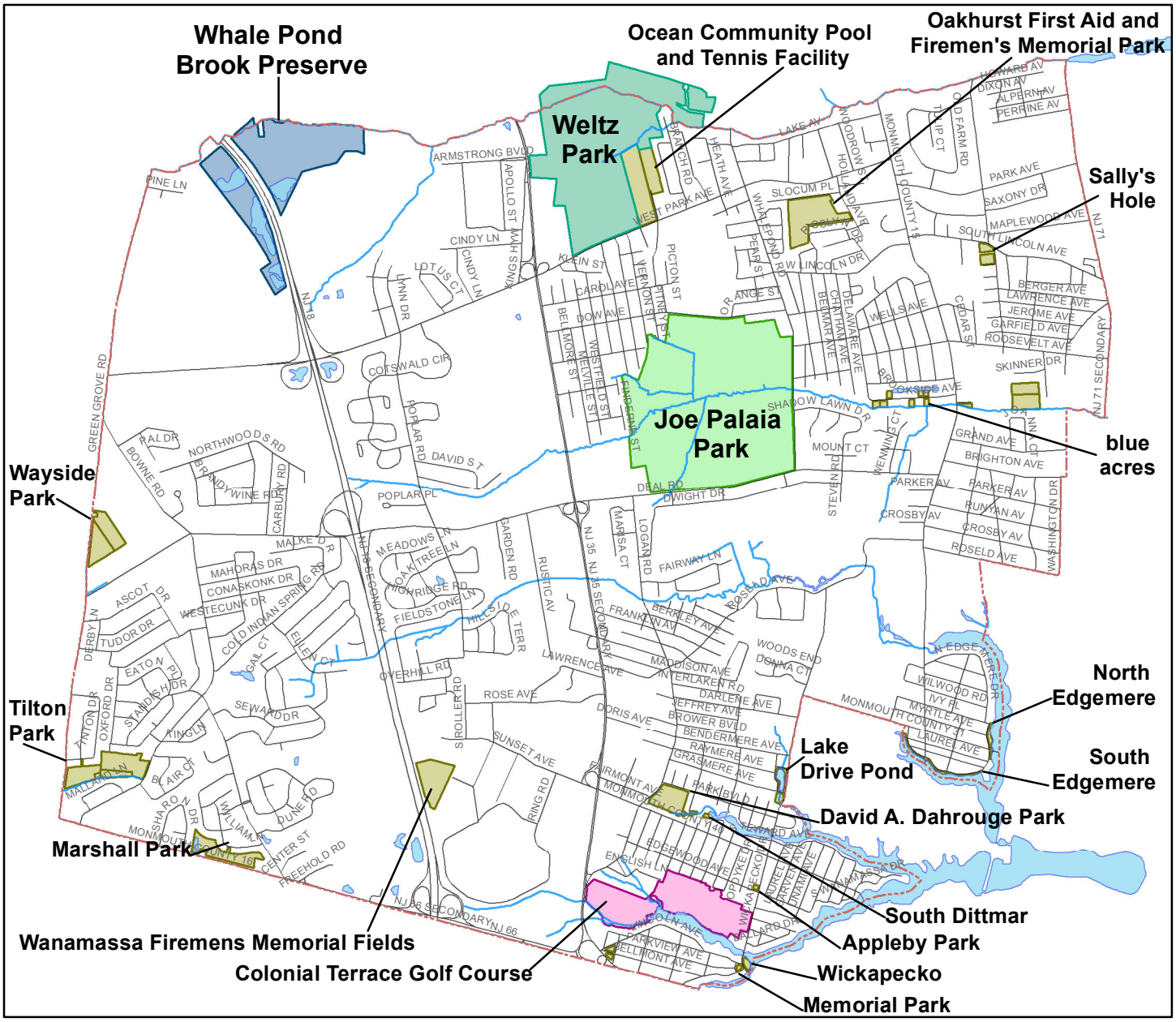
Whale Pond Brook Preserve.

3.8.2 Privately-owned Recreational Spaces

In addition to the public golf club discussed above, two large privately-owned golf clubs are situated in the southeastern section of Ocean Township. The Hollywood Golf Club is 163.4 acres, and its eastern boundary touches the western edge of the 112-acre Deal Golf and Country Club. Only 93.1 acres of the latter club are within Ocean Township, and the remaining acreage is located in Deal.

3.8.3 Privately-owned Green Spaces

A number of large, undeveloped tracts of land are present in Ocean Township. Some are currently township-owned, such as those associated with schools or highways, but others are privately held. Most of the larger privately-owned undeveloped lots in the township are associated with Poplar Brook, Whale Pond Brook, Harvey Brook, Hollow Brook, and their tributaries. Undeveloped and partially developed tracts offer potential sites for the township to develop additional open space and establish greenways and these are indicated on **Figure 3.8.5**. To create this map, aerial photography was examined and parcels which appear undeveloped, as well as some relatively large parcels that have some development but also appear to contain some natural/undeveloped areas were selected. A total of 801 acres fit these criteria. This map should not be interpreted to indicate landowner interest in preservation, township interest in preserving the tract, or other factors that must be considered in selecting and expending funds to preserve open space. Conversely, properties not indicated on this map may prove to be desirable for open space preservation or for easements for greenways. Therefore, this map merely presents a “first cut” which can be helpful in beginning the process of developing an open space preservation plan.



Legend

- Ocean Township
- Roads
- Water
- NJ Natural Lands Trust - Whale Pond Brook
- Monmouth County - Weltz Park
- Ocean Township - Joe Palaia Park
- Ocean Township - Colonial Golf Course
- Ocean Township - other

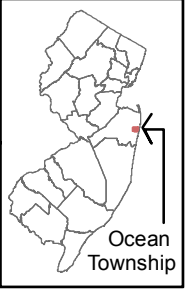
N

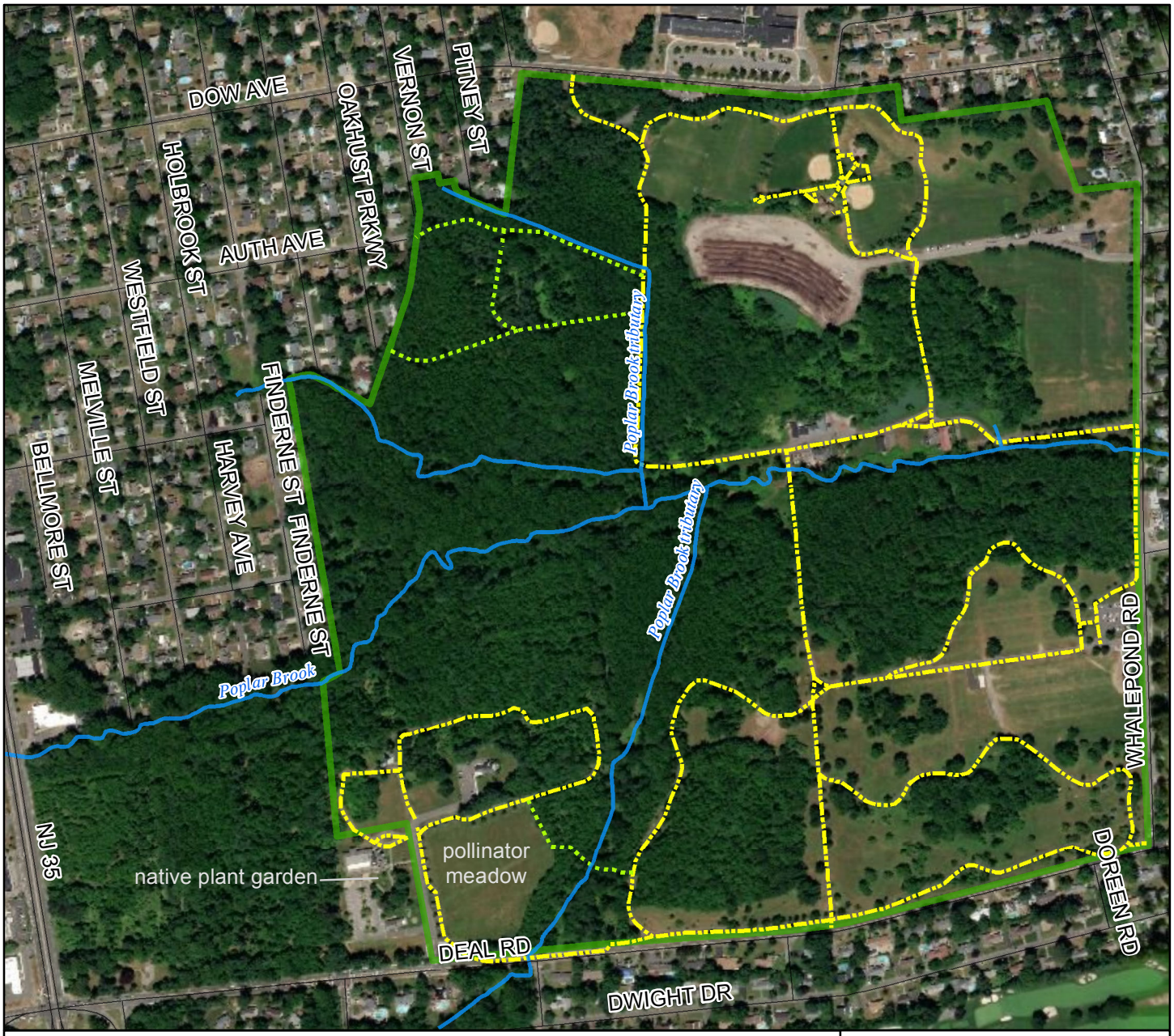
0 0.25 0.5 1 Miles

Data Sources: NJDEP, NJDOT
Disclaimer required for NJDEP Data: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Kratzer Environmental Services
Ocean Township ERI 2019

Figure 3.8.1
Preserved Open Space
Ocean Township, Monmouth County



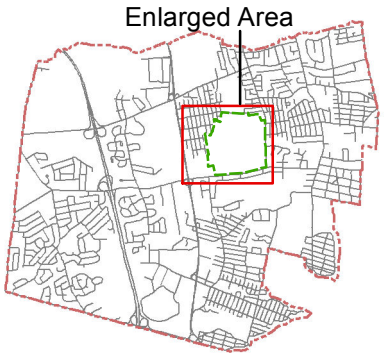


Legend

- Ocean Township
- Roads
- Streams
- Ocean Township - Joe Palaia Park

Trails

- Paved
- Soil/Grass



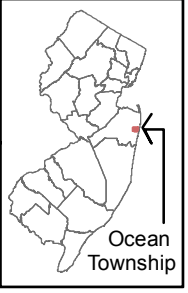
N

0 0.1 0.2 Miles

Data Sources: NJDEP, NJDOT and Monmouth County GIS
Disclaimer required for NJDEP Data: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Kratzer Environmental Services
Ocean Township ERI 2019

Figure 3.8.2
Preserved Open Space:
Palaia Park
Ocean Township, Monmouth County

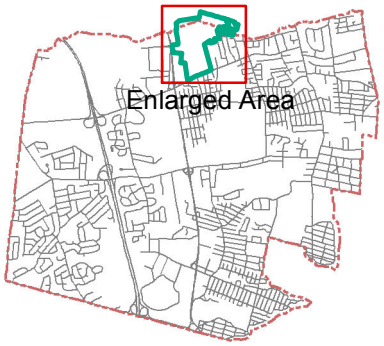


Legend

- Ocean Township
- Roads
- Streams
- County Open Space - Weltz Park

Trails (sand surface)

- Access Trail (200 feet)
- Eastern Loop (0.4 miles)
- North Trail (0.5 miles)
- Sophie's Shortcut (0.1 miles)
- Sweetbriar Trail (0.9 miles)



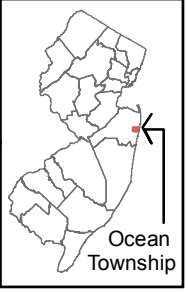
N

0 0.05 0.1 Miles

Data Sources: NJDEP, NJDOT
Disclaimer required for NJDEP Data: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Kratzer Environmental Services
Ocean Township ERI 2019

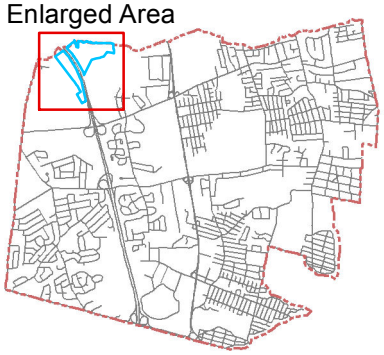
Figure 3.8.3
Preserved Open Space:
Weltz Park
Ocean Township, Monmouth County



Legend

- Ocean Township
- Roads
- Waterbodies
- Streams
- Wetlands in Whale Pond Brook Preserve
- State Open Space - Whale Pond Brook

Enlarged Area



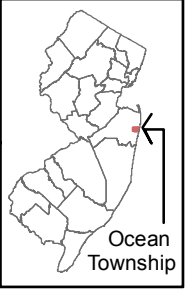
N

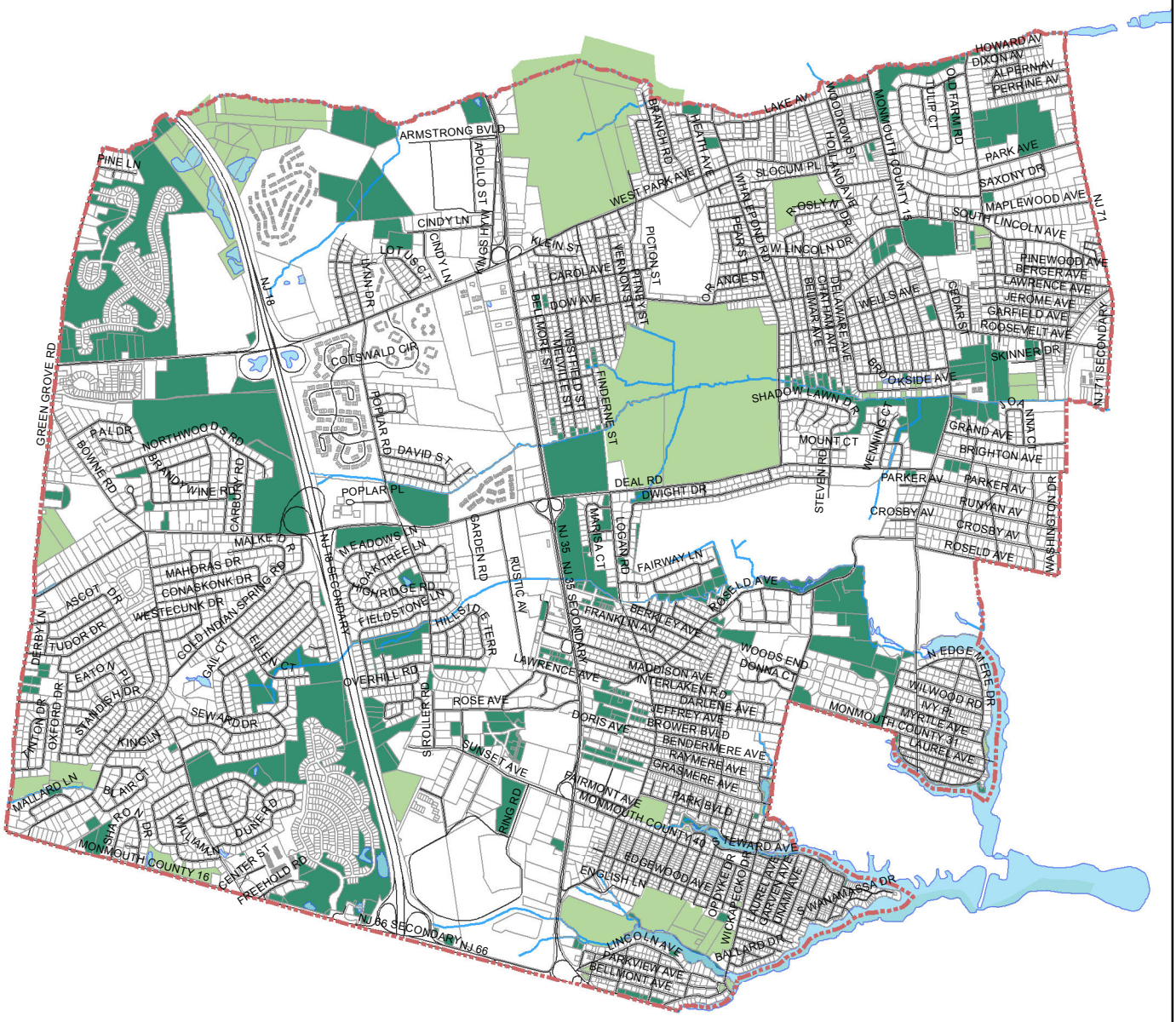
0 0.05 0.1 Miles

Data Sources: NJDEP, NJDOT
Disclaimer required for NJDEP Data: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Kratzer Environmental Services
Ocean Township ERI 2019

Figure 3.8.4
Preserved Open Space:
Whale Pond Brook Preserve
Ocean Township, Monmouth County





Legend

- Ocean Township
- Roads
- Parcels
- Water
- Existing Preserved Open Space
- Potential Open Space

To create this map, aerial photography was examined and parcels which appear undeveloped, as well as some relatively large parcels that have some development but also appear to contain some natural/undeveloped areas were selected. This map should not be interpreted to indicate landowner interest in preservation, township interest in preserving any of these parcels, or other factors that must be considered in selecting properies and expending funds to preserve open space. Conversely, properties not indicated on this map may prove to be desirable for open space preservation or for easements for greenways. Therefore, this map merely presents a "first cut" which can be helpful in beginning the process of developing an open space preservation plan.

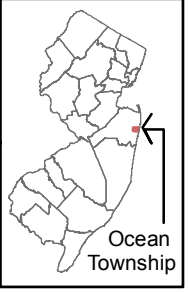
N

0 0.25 0.5 1 Miles

Data Sources: NJDEP, NJDOT, ESRI
Disclaimer required for NJDEP Data: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Kratzer Environmental Services
Ocean Township ERI 2019

Figure 3.8.5.Potential Open Space Parcels Ocean Township, Monmouth County



References: Open Space

ANJEC (Association of New Jersey Environmental Commissions). 2011. Resource Paper: Open Space Plan. 12 pages. http://anjec.org/pdfs/OpenSpacePlan2011.pdf

Howe, Linda. 1989. Keeping our Garden State Green: A Local Government Guide for Greenway and Open Space Planning. Association of New Jersey Environmental Commissions. 57 pages.

Monmouth County Park System. September 5, 2017. Monmouth County Open Space Trust Fund Fact Sheet. https://co.monmouth.nj.us/documents/127/Fact_Sheet_Open_Space_Trust_Fund_revised_9_5_2017.pdf

Monmouth County Park System. Undated. Weltz Park. https://www.monmouthcountyparks.com/page.aspx?ID=2542

National Park Service. 1995. Economic Impacts of Protecting Rivers, Trails, and Greenway Corridors: A Resource Book. Fourth Edition. 154 pages. https://www.railstotrails.org/resource-library/resources/economic-impacts-of-protecting-rivers-trails-and-greenway-corridors-a-resource-book/

Joe Palaia Park: Adjunct Property Natural Resource Inventory. Undated, no author listed. Report provided by Ocean Township.

NJ Conservation Foundation. 2012. Garden State Greenways. http://www.gardenstategreenways.org

NJDEP. January 30, 2019. State, Local and Nonprofit Open Space of New Jersey, Edition 20190130 (Land_owner_openspace) (Web Mercator ArcGIS Online Service). GIS Data. https://gisdata-njdep.opendata.arcgis.com/datasets/4a1f9d3075a04cd792a14f78b9697df3_65

NJDEP Green Acres Program. January 25, 2019. Blue Acres Floodplain Acquisitions. https://www.nj.gov/dep/greenacres/blue_flood_ac.html.

NJNLT (New Jersey Natural Lands Trust). 2013. NJNLT Preserves and Public Uses. https://nj.gov/dep/njnlt/njpreserves.htm

Ocean Township. 2019. Parks and Outdoor Facilities. http://oceantwp.org/content/5935/6681/6698.aspx

Stine, Don. November 8, 2017. "Ocean OKs Open Space Tax" in The Coaster. https://thecoaster.net/wordpress/ocean-oks-open-space-tax/

TPL (The Trust for Public Land). August 18, 2007. Public Golf Course Protected (NJ). https://www.tpl.org/media-room/public-golf-course-protected-nj

Internet Resources: Open Space

Association of New Jersey Environmental Commissions: http://anjec.org

Garden State Greenways: http://www.gardenstategreenways.org

Monmouth County Parks: https://www.monmouthcountyparks.com/
- Trails Web Map: http://mcps.maps.arcgis.com/apps/Viewer/index.html?appid=29e4c94fe4de4c16b6bde3fcc3d355cd#!
- Trails phone app (instructions): https://co.monmouth.nj.us/documents/130/lost_in_parks_app_instructions_updated_2_12_2018.pdf
- Weltz Park: https://www.monmouthcountyparks.com/page.aspx?ID=2542

Native Plant Society of New Jersey: http://www.npsnj.org

New Jersey Conservation Blueprint: https://www.njmap2.com/blueprint/

New Jersey Green Acres Program: http://www.nj.gov/dep/greenacres/index.html

New Jersey Natural Lands Trust: http://www.njnlt.org/

NJDEP Green Acres Program: https://www.nj.gov/dep/greenacres/pdf/osrpg_2019.pdf

Rain Garden Manual: http://www.npsnj.org/pages/nativeplants_Rain_Gardens.html

Rutgers NJ Agricultural Experiment Station – information for farmers, gardeners, & consumers: http://njaes.rutgers.edu/

4. UTILITIES, INFRASTRUCTURE, AND TRANSPORTATION

4.1 WATER SUPPLY

Public water purveyors may be government agencies, private companies, or quasi-government groups. Water purveyors are regulated by the NJDEP Bureau of Safe Drinking Water, under the Safe Drinking Water Act (N.J.S.A. 58:12A-1 et seq) and rules (N.J.A.C. 7:10). Currently, the NJDEP is proposing to amend the SDWA rules by establishing maximum contaminant levels (MCL) for perfluorooctanoic acid (PFOA) perfluorooctanesulfonic acid (PFOS). The proposal includes monitoring requirements for PFOA and PFOS for public community and public nontransient noncommunity water systems, and wells tested under the Private Well Testing Act (NJDEP, April 1, 2019).

Pollution, such as nitrates, bacteria, metals, pesticides, salt, microplastics and antibiotics, can enter water supplies via non-point sources (including septic systems and runoff from fields and roads), point sources, and rain.

Ocean Township's Water Supply

The majority of Ocean Township obtains water from New Jersey American Water's Coastal North System (PWS ID: NJ1345001). The system serving Ocean Township obtains water from a blend of sources that may include ground water from wells in the Potomac-Raritan-Magothy Aquifer (PRM) and surface water from Glendola Reservoir, Manasquan River/Reservoir, Shark River, and Swimming River/Reservoir (NJ American Water, 2019). **Figure 4.4.1** illustrates the general location of these sources. A discussion of the aquifers that the wells draw from is found in **Section 3.4.10**.

Since June 2012, NJ American Water has used chloramines to treat the water in its Coastal System to ensure that the drinking water complies with federal and state drinking water standards. Chloramines are an effective treatment to prevent the waterborne transmission of parasites. However, kidney dialysis patients and fish owners need to take special precautions (see **Internet Resources**).

No water quality violations were noted in the past four years for this water supply (NJ Drinking Water Watch, 2019). Water quality testing results are available online (see **Internet Resources**).

Private Wells

Relatively few homes are served by private wells in Ocean Township. The New Jersey Private Well Testing Act (N.J.S.A. 58:12A-26 et seq.) and rules (N.J.A.C. 7:9E) mandate private well testing upon the sale of a house. The number of wells tested in a municipality reflects the number of real estate transactions involving homes with private wells. In Monmouth County, the well water must be tested for Primary Contaminants[16] (bacteria, volatile organic compounds, arsenic, lead. nitrates, mercury and gross alpha) and Secondary Contaminants[17] (pH, iron and manganese) (NJDEP, March 26, 2019).

Since Ocean Township is served primarily by public water systems, just 11 private wells have been tested pursuant to this regulation (see **Table 4.2.1**).

[16] Primary contaminants are contaminants that may a cause potential health risk if consumed on a regular basis above the established maximum contaminant levels (MCLs).

[17] Secondary parameters are regulated by the State for aesthetic or other concerns (taste, odor, staining, scaling of home fixtures) rather than health effects. Whether or not these natural water quality parameters are a problem depends on the amount of the substance present.

Table 4.2.1 NJ Private Well Testing Act Data Summary (September 2002 to April 2014) in Ocean Township

Parameter	Number of Wells Exceeded/Sampled	% of Wells Exceeding MCL	MCL
Nitrate	0/11	0.0%	10 mg/l
Arsenic	Testing is not required under PWTA		5* µg/l
Iron	7/11	63.6%	0.3 mg/l
Manganese	3/11	27.3%	0.05 mg/l
Gross Alpha	0/10	0.0%	(initial)[18] 5 pCi/L (final) 15 pCi/L
Mercury	0/11	0.0%,	2 µg/l
VOC	0/11	0.0%	*
Fecal coliform or E. coli	0/11	0.0%	0 colonies
pH	3/11	27.3%	6.5-8.5
* MCLs vary for the 26 Volatile Organic Compounds (VOCs) required by the PWTA.			
Source: NJDEP, January 1, 2015; Atherholt et. al., April 2009			

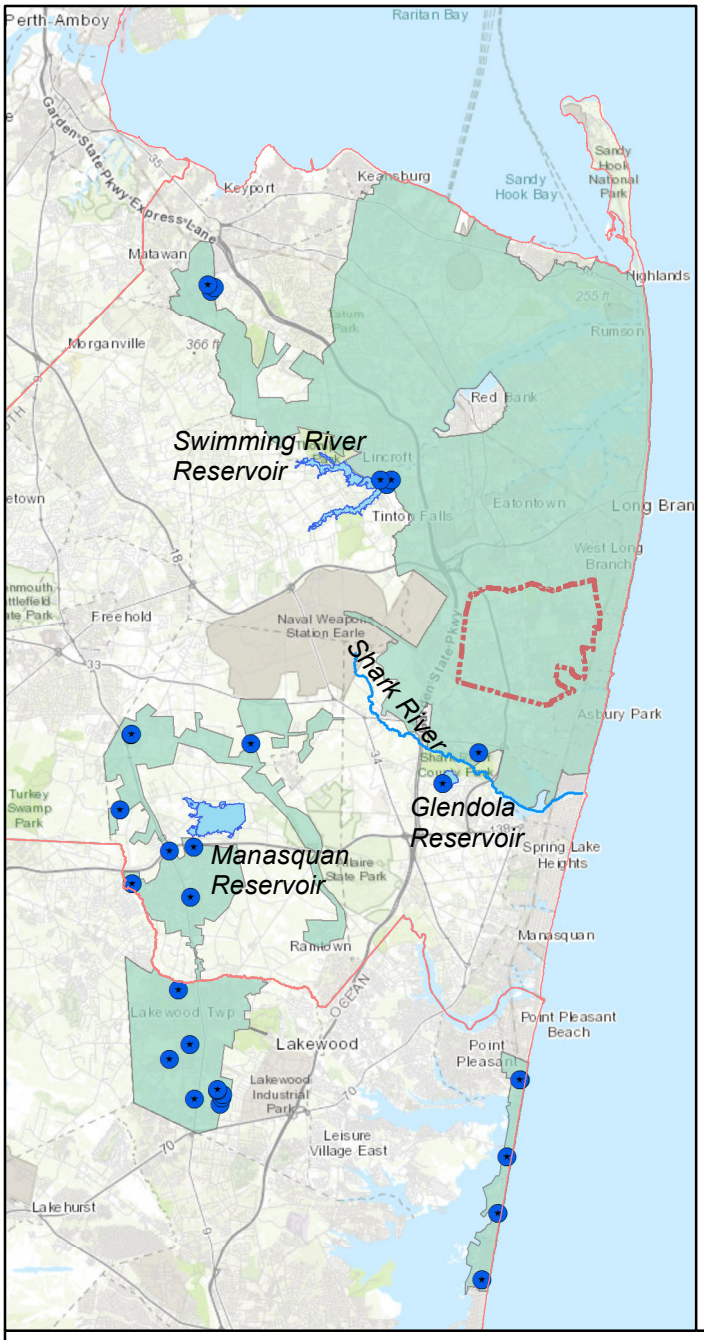
4.2 SEWER SERVICE AREAS

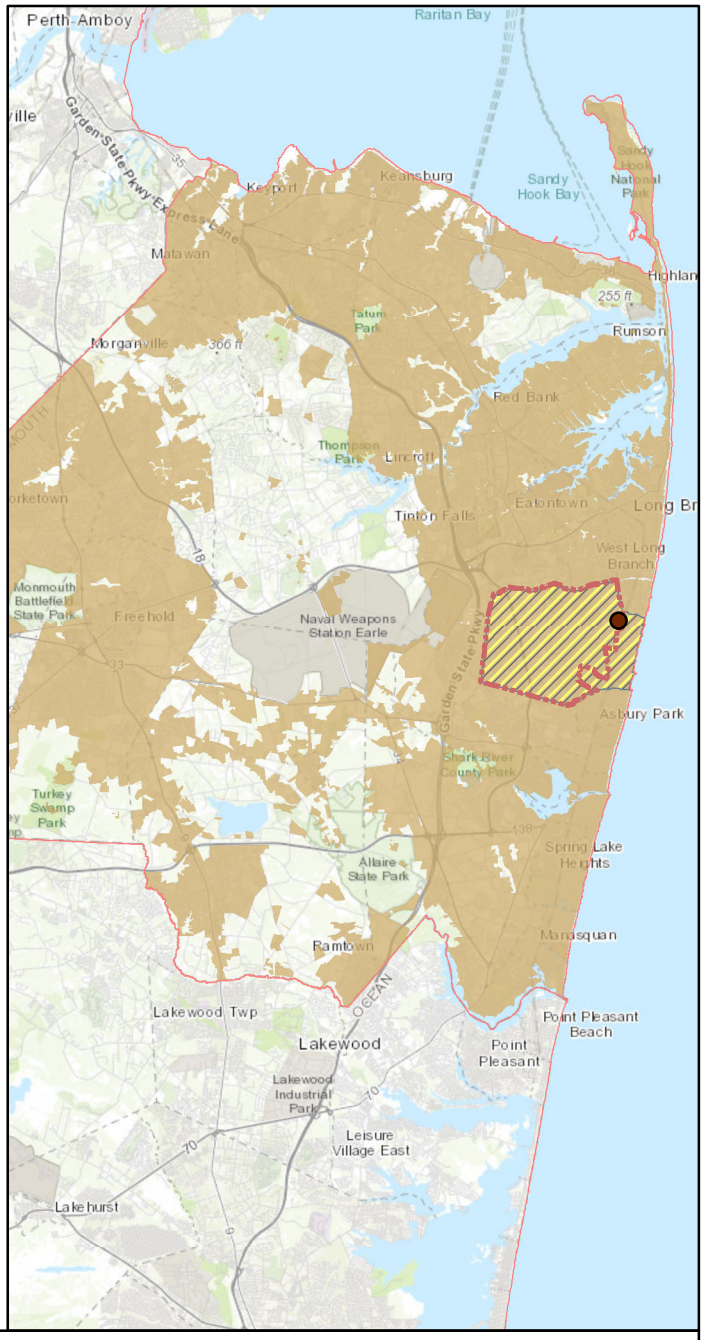
The *Township of Ocean Sewerage Authority* (TOSA) provides wastewater treatment for the Township of Ocean, as well as the neighboring communities of Deal, Allenhurst, Interlaken and Loch Arbour. TOSA provides sanitary sewerage service for approximately 30,000 people. TOSA is an autonomous governmental body of five members, appointed for staggered 5 year terms by the Township of Ocean's Mayor and Council (Township of Ocean, 2019). The permitted flow for this facility is 7.5 million gallons per day (MGD) with an average annual flow of 5.46 MGD (NJDEP, 2006).

The public *Sewer Service Area* (SSA) mapped on **Figure 4.1.1** shows the planned method of wastewater disposal for the township. The SSA shows that wastewater in all of Ocean Township will be collected and treated at a regional treatment facility, which is the Ocean Township Treatment Plant (NJDEP, January 24, 2017). There may, however, be buildings or areas that have not yet connected to the public sewer system.

The location of the Ocean Township sewage treatment plant discharge (NJPDES NJ0024520) is shown on **Figure 4.1.1**. The Wastewater Management Agency is Monmouth County BOCF, which is described in **Section 6.6**.

[18] Results greater than 5 pCi/L requires a second gross alpha count. The MCL for gross alpha is 15 pCi/L.





Legend

- Ocean Twp.
- Counties
- Public Community Water Supplies
- Shark River
- Reservoirs

Water Purveyor Service Area

- NJ American - Coastal North

Legend

- Ocean Twp. Sewage Authority

Wastewater Facility

- Area Served by Ocean Twp. SA STP

Wastewater Management Agency

- Monmouth County BOCF

N

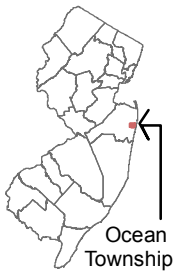
0 2 4 8 Miles

Data Sources: NJDEP, NJDOT,ESRI
Disclaimer required for NJDEP Data: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Kratzer Environmental Services
Ocean Township ERI 2019

Figure 4.1.1. Public Water Supply and Sewer Service Area Ocean Township, Monmouth County

Left: Public water is provided to Ocean Township by NJ American Water. The water sources for the "Shrewsbury area system" are ground water and surface water from several reservoirs and the Shark River.
Right: The Monmouth County Wastewater Service Area and the location of the Ocean Twp. Sewage Treatment Plant, and the area served.



4.3 STORMWATER

Water that flows off impervious surfaces is known as *stormwater*. Stormwater picks up and carries natural and human-made pollutants, depositing them into streams, rivers, lakes, wetlands, coastal waters, and even to ground water.

A stormwater infiltration basin by the Ocean Township Library.

The goals of New Jersey's Stormwater Management Rule (N.J.A.C. 7:8) include reducing runoff, flooding, erosion and non-point pollution for public safety as well as ecological and biological integrity. There are requirements for stormwater management measures and regional and municipal stormwater management planning (NJDEP, June 20, 2016). Revisions of the Stormwater Management Rule, including green infrastructure requirements, were recently proposed and are pending adoption (NJDEP, December 3, 2018).

The purpose of the Municipal Stormwater Regulation Program is to ensure a consistent approach to stormwater management statewide, reduce costs for regulated entities, and allow for a simple process for requesting authorization. All municipalities within the State are assigned either Tier A (more developed or coastal municipalities, including Ocean) or Tier B (less developed and non-coastal) for permitting their Municipal Separate Storm Sewer System (MS4s) (NJDEP Bureau of Nonpoint Pollution Control, 2009).

The permits address stormwater quality related issues to new and existing development and redevelopment by requiring the preparation of a stormwater program and implementation of specific permit requirements referred to as Statewide Basic Requirements (SBRs). The Tier B Permit concentrates on new development and redevelopment projects and public education. The Tier A Permit has additional requirements aimed at controlling stormwater pollutants from existing development, such as public education, disposal of waste, solids and floatable controls, maintenance yard operations and employee training (NJDEP Bureau of Nonpoint Pollution Control, March 18, 2019).

Ocean Township completed a Stormwater Management Plan in 2005, which was updated in 2007 and 2009 (Maser Consulting, Revised September 2009), as well as a Stormwater Prevention Plan (Revised January 3, 2019) which lists ordinances and other actions required by the MS4 permit (see **Internet Resources**).

An important component of the stormwater pollution prevention program is education that emphasizes that all storm drains discharge to surface waters, i.e. streams, lakes and coastal waters. The township's stormwater infrastructure has been mapped and these maps are available on the township's Storm Water Pollution Prevention Program website (http://www.oceantwp.org/content/5937/6802/default.aspx).

Each "outfall" shown on these maps is a location where stormwater that flows off roads, parking areas, yards, etc. discharges to surface water, carrying with it pollution and litter into the stream, lake or coastal waterway.

In order to comply with the MS4 requirements, the Township of Ocean has enacted ordinances to enforce the following;

Properly use and dispose of hazardous products. Hazardous products include some household or commercial cleaning products, lawn and garden care products, motor oil, antifreeze and paints. Do not pour any hazardous products down a storm drain because storm drains are usually connected to local water bodies and the water is not treated. If you have hazardous products in your home or workplace, make sure you store and dispose of them properly. Read the label for guidance. Use natural or less toxic alternatives when possible. Recycle used motor oil. Contact the Monmouth County Household Hazardous Waste Facility at 732-683-8686 for proper disposal.

Limit use of fertilizers and pesticides. Do a soil test to see if you need a fertilizer. Do not apply fertilizers if heavy rain is predicted. Look into alternatives for pesticides. Maintain your lawn and plant trees and other native vegetation that requires little or no fertilizer. If you use fertilizers and pesticides, follow the instructions on the label on how to correctly apply it.

Don't litter. Place trash in receptacles; recycle; recycle, recycle; participate in community clean-ups.

Don't feed wildlife. Do not feed wildlife, such as ducks or geese in public areas.

Keep pollution out of storm drains. The Township has labeled and marked all storm drain outlets. Labels remind residents that these storm drains are connected to local water ways. Do not let sewerage or other wastes flow into a stormwater system.

Clean up after your pet. Pet owners or their keepers must pick up and properly dispose of pet waste dropped on public lands or other people's property.
(Township of Ocean, http://www.oceantwp.org/content/5937/6802/default.aspx)

4.4 SOLID WASTE

Garbage in Whale Pond Brook

The most recent data available indicates that Monmouth County residents generated 1,590,094 tons of solid waste during 2016 (NJDEP, August 13, 2018). New Jersey describes solid waste in seven main categories, with two additional subclassifications under industrial waste (**Table 4.4.1**). Municipal Solid Waste, the category most readily manageable at the community level, accounts for 724,928.57 tons, or 46% of the Monmouth County total. Based on a county population estimate of 627,532, this translates into a per capita rate of 1.16 tons of municipal solid waste per resident. In 2016, slightly more than half of the county's municipal solid waste was recycled (52%) and the balance (48%) went to disposal facilities (NJDEP, August 13, 2018). During the same period, the overall county recycling rate for all types of waste combined was 62%.

Table 4.4.1. New Jersey Solid Waste Definitions.

Class	Type	Definition
10	Municipal (household, commercial and institutional)	Waste originating in the community consisting of household waste from private residences, commercial waste which originates in wholesale, retail or service establishments, such as, restaurants, stores, markets, theaters, hotels and warehouses, and institutional waste material originated in schools, hospitals, research institutions and public buildings.
12	Dry sewage sludge	Sludge from a sewage treatment plant which has been digested and dewatered and does not require liquid handling equipment.
13	Bulky waste	Large items of waste material, such as appliances and furniture. Discarded automobiles, trucks and trailers and large vehicle parts, and tires are included under this category.
13C	Construction and Demolition waste	Waste building material and rubble resulting from construction, remodeling, repair, and demolition operations on houses, commercial buildings, pavements and other structures. The following materials may be found in construction and demolition waste: treated and untreated wood scrap; tree parts, tree stumps and brush; concrete, asphalt, bricks, blocks and other masonry; plaster and wallboard; roofing materials; corrugated cardboard and miscellaneous paper; ferrous and nonferrous metal; non-asbestos building insulation; plastic scrap; dirt; carpets and padding; glass (window and door); and other miscellaneous materials; but shall not include other solid waste types.
23	Vegetative waste	Waste materials from farms, plant nurseries and greenhouses that are produced from the raising of plants. This waste includes such crop residues as plant stalks, hulls, leaves and tree wastes processed through a wood chipper. Also included are non-crop residues such as leaves, grass clippings, tree parts, shrubbery and garden wastes.
25	Animal and food processing wastes	Processing waste materials generated in canneries, slaughterhouses, packing plants or similar industries, including animal manure when intended for disposal and not reuse. Also included are dead animals. Animal manure, when intended for reuse or composting, is to be managed in accordance with the criteria and standards developed by the Department of Agriculture as set forth at N.J.S.A. 4:9-38
27	Dry industrial waste	Waste materials resulting from manufacturing, industrial and research and development processes and operations, and which are not hazardous in accordance with the standards and procedures set forth at N.J.A.C. 7:26G. Also included are nonhazardous oil spill cleanup waste, dry nonhazardous pesticides, dry nonhazardous chemical waste, and residue from the operations of a scrap metal shredding facility.
27A		Waste material consisting of asbestos or asbestos containing waste.
27I		Waste material consisting of incinerator ash or ash containing waste.
Source: NJDEP Division of Solid and Hazardous Waste, January 12, 2018.		

Although the state does not provide annual waste disposal data for individual municipalities, some information was available in the Monmouth County District Solid Waste Management Plan (Monmouth County, February 2009). **Table 4.4.2** shows the amounts of Municipal and Total Solid Waste generated in Ocean Township over a five-year period, and provides the township's recycling rates in comparison with countywide recycling rates for both categories. According to the data provided by Monmouth County (February 2009), Ocean Township's portion of the county's solid waste is approximately five percent for municipal waste and four percent overall.

Table 4.2.2. Recycling Rates in Ocean Township, 2002-2006

Year	Ocean Twp. Solid Waste (tons)		Ocean Twp. Share of County Waste (percentage)		Ocean Twp. Recycling Rates		Countywide Recycling Rates	
	MSW	Overall	MSW	Overall	MSW	Overall	MSW	Overall
2002	37,286	65,680	5%	4%	49.1%	62.6%	38.0%	56.1%
2003	44,528	73,130	6%	5%	57.6%	63.9%	33.9%	48.1%
2004	39,152	68,105	5%	4%	50.9%	57.5%	36.1%	49.9%
2005	40,165	68,953	5%	4%	51.6%	58.0%	40.1%	52.0%
2006	37,958	68,433	5%	4%	45.9%	55.5%	38.3%	51.9%
MSW = Municipal Solid Waste; Overall = All Waste Types								
Source: Monmouth County (February 2009).								

New Jersey has identified 30 categories of recyclable waste, as described in **Table 4.2.3**, and the state does track recycled materials by municipality. The volume of material recycled in Ocean Township during 2016 is also shown by category in the table below. In 2016, Ocean Township recycled 41,059 tons of solid waste, which is roughly four percent of the 988,804 tons recycled countywide.

Table 4.2.3. Ocean Township 2016 Recycling Totals (tons) by State Category

Class	Material	Description	Tons (2016)
1	Corrugated	Containers and similar paper items, usually used to transport supplies, equipment, parts, or other merchandise.	3,091.24
2	Mixed office paper	All computer paper, all high grade white paper (including letterhead, typing paper, copier paper, onionskin, tissue, and notepad). Also Items listed in computer printout/white ledger category when mixed with envelopes, manila folders and colored paper. Material is generated by commercial/institutional sources.	2,159.48
3	Newspaper	All paper marketed as newsprint or newspaper and containing at least 70% newsprint or newspaper (American Paper Institute grades #6, #7 and #8 news).	620.83
4	Other paper/mag/junk mail	All magazine stock, white and colored paper and envelopes. Also all paper that is not corrugated, office, magazines, white and colored bond paper, or newspaper, such as telephone directories, wrapping paper, chip board, books, papers coated with plastic, film or foil, paper contaminated with food, and grocery bags.	1,082.80
5	Glass containers	All glass containers used for packaging food or beverages.	446.02
6	Aluminum containers	Food and beverage containers made entirely of aluminum.	158.89
7	Steel containers	Rigid containers made exclusively or primarily of steel, tin-plated steel, and composite steel and aluminum cans used to store food, beverages, paint, and a variety of other household and consumer products.	162.01
8	Plastic containers	Containers such as polyethylene terephthalate (PETE - #1) soda bottles, high density polyethylene (HDPE - #2) milk, water or detergent bottles, low density polyethylene (LDPE - #4) containers, vinyl (V - #3) or polyvinyl chloride (PVC - #5) bottles and rigid and foam polystyrene (PS - #6).	421.96
9	Heavy iron	All structural steel or ferrous metal, cast iron components.	2,541.07

Class	Material	Description	Tons (2016)
10	Nonferrous/ aluminum scrap	All non-container aluminum including auto parts, siding, aircraft parts, lawn chairs, window and door frames, pots and pans, foils and pie plates. Non-ferrous scrap consists primarily of copper and zinc. Copper generally takes the form of cable (utility wires), plumbing, wiring harnesses, motors, house wiring and bulky items.	127.97
11	white good & light iron	All large appliances such as washers, dryers, refrigerators, etc., as well as products made from sheet iron, such as shelving, file cabinets, metal desks, recycled or reconditioned steel drums, stainless steel and other non-structural ferrous scrap.	2,347.24
12	Anti-freeze	An automotive engine coolant consisting of a mixture of ethylene glycol and water, or propylene glycol and water.	58.08
13	Batteries (auto)	Batteries from automobiles, trucks, other vehicles, machinery and equipment.	13.39
14	Automobile scrap	Crushed or shredded automobile or truck bodies, excluding auto shredder residue, or "fluff".	682.71
15	Tires	Rubber-based scrap automotive, truck, and specialty tires (e.g., forklift tires).	360.20
16	Used motor oil	A petroleum based or synthetic oil whose use includes, but is not limited to, lubrication of internal combustion engines, which through use, storage or handling has become unsuitable for its original purpose due to the presence of impurities or loss of original properties.	2,388.56
17	Brush/tree parts	Brush from homes, institutions, commercial or industrial sources.	2,950.70
18	Grass clippings	Grass clippings from homes, institutions, commercial or industrial sources.	0.00
19	Leaves	Leaves from homes, institutions, commercial or industrial sources.	2,492.79
20	Stumps	Unfinished wood from land clearing projects or storm damage	69.85
21	Consumer electronics	Batteries: Any type of button, coin, cylindrical, rectangular or other shaped, enclosed device or sealed container which is utilized as an energy source for commercial, industrial, medical, institutional or household use.	189.83
22	Concrete/asphalt/ brick/block	Asphalt, concrete, brick, cinder block, "patio blocks," ceramic materials, stones and other masonry and paving materials. Note that the regulations at N.J.A.C. 7:26A allow for asphalt to be handled in two ways: incorporated into the asphalt production process (milled asphalt) ; or asphalt is taken to a Class B recycling center and used to produce construction aggregate. Either form of the material is acceptable for reporting purposes.	16,448.91
23	Food waste	Food plate waste and food processing wastes. Food processing wastes include food processing vegetative waste (material generated in trimming and reject sorting operations from the processing of fruits and vegetables in canneries or similar industries, e.g., tomato skins, pepper cores, bean snips, cranberry hulls, etc.), food processing residuals and animal processing wastes. If the material is transported and processed as animal feed, it may be identified as such.	69.75

Class	Material	Description	Tons (2016)
24	Other material not listed	Furniture (plastic, wood, or items constructed of a combination of the above materials), wallboard, carpeting, padding, asphalt-based roofing scrap (including shingles, built up roofing, tarpaper, other roofing materials), and insulation. Also includes any other non-hazardous material which would otherwise be classified as a solid waste, and is not otherwise defined in this section and documented as recycled.	5.60
25	Other glass	All non-container glass such as plate glass, drinking glasses, and automotive glass.	0.00
26	Other plastic	Low density polyethylene (LDPE) film or bags, other film and plastic closures. Also Plastic Scrap: durable goods (appliances, furniture, automobile parts), and plastic pallets (provided they are melted down or chipped, and not simply reused).	38.34
27	Oil contaminated soil	Non-hazardous soils containing petroleum hydrocarbons resulting from spills, leaks or leaking underground storage tanks used for gasoline or any other commercial fuel, and which are recycled in accordance with the requirements of N.J.A.C 7:26A-1.1 et seq.	169.57
28	Process residue	Includes ferrous metals ash recovered from any form of incinerator power plant, and any other process residue which is non-hazardous and meets the definition of an ID-27 dry industrial waste. Not included in this definition is sludge.	0.00
29	Textiles	Cloth material such as cotton, linen, wool, nylon, polyester, etc., derived from clothing, cloth diapers, linens, etc.	0.65
30	Wood scraps	Finished and unfinished lumber from construction/demolition projects. Included in this category are telephone poles, railroad ties and wooden pallets.	1,960.55
		Ocean Township 2016 Recycling Total (tons)	41,058.99
Sources: NJDEP March 6, 2017 (definitions) and NJDEP January 24, 2019 (Municipal recycling totals)			

In Ocean Township, trash and selected recyclable materials are collected weekly by the Department of Public Works. Information regarding collection schedules and materials that may be included in waste and single-stream recycling bins is available on the Public Works page of the township website (see **Internet Resources**). Special collection dates and procedures are provided for brush, leaves, bulk trash, appliances and metal.

Class 10 trash collected by the township is transported to the Monmouth County Reclamation Center (Monmouth County, 2009), which is currently the only active landfill in the county (Stephens, 2009). According to Stephens (2009), two historic waste disposal sites were located in Ocean Township: One was developed as Seaview Square Shopping Mall in the mid-1970s and the other was at Deal Test Site and is now part of Joe Palaia Park.

The township also maintains a Class A Recycling facility operated by Recycle America, Inc. for certain recyclable materials as detailed on the website. Class A Recycling Centers handle source-separated recyclables including metal, glass, paper, plastic containers and cardboard and do not require a state permit in order to operate.

Residents are encouraged to compost their lawn clippings and other vegetative waste, but grass clippings may also be taken to the Class A recycling facility by homeowners. Commercial deposition of grass clippings by gardeners and landscapers requires a township permit.

Ocean Township picked up 11,503 cubic yards of leaves during 2018 (W. Bergeron, pers. comm.). Collected leaves are composted within the township at a Class C recycling facility operated by the municipal Department of Public Works (DEP Facility ID #132445). Class C Recycling Centers are state-permitted to handle source-separated compostable materials including yard trimmings, food

waste, and biodegradable paper or plastic bags (Monmouth County, 2009). Once the composting process is complete, the material is removed by a township-approved contractor for sifting and resale.

Household hazardous waste is not accepted by the township, but may be taken by residents to the county collection facility in Tinton Falls. Regulations and hours for use of the Monmouth County Reclamation Center are provided on its website at https://co.monmouth.nj.us/page.aspx?ID=186.

4.5 TRANSPORTATION

4.5.1 Mass Transit

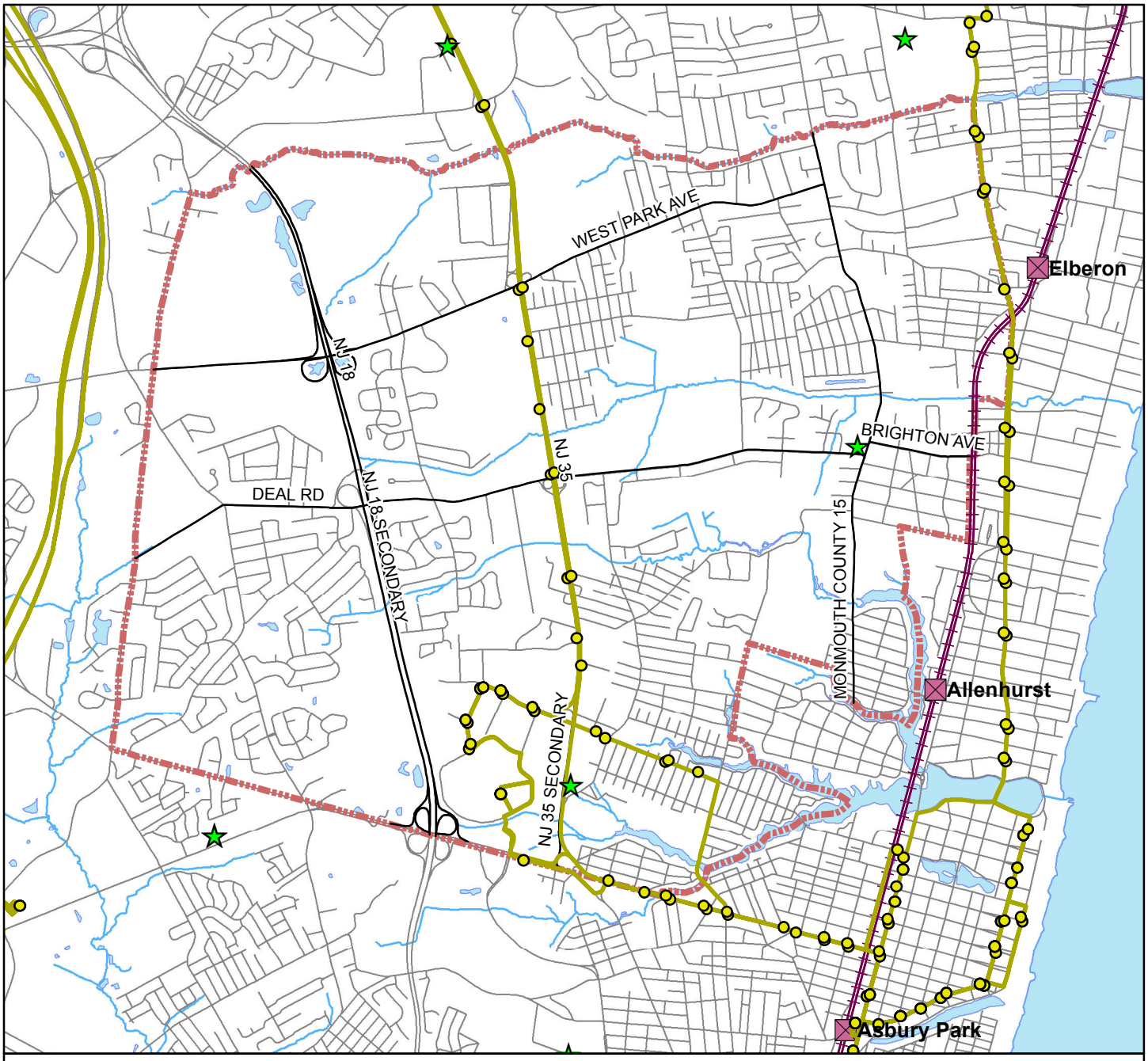
The nearest railway service to Ocean Township is the North Jersey Coast Line of New Jersey Transit, which runs between Bay Head and New York City with local stops at Long Branch, Elberon, Allenhurst and Asbury Park (New Jersey Transit, May 2016). New Jersey Transit has two bus routes with stops in Ocean Township: Route 832 includes stops along Route 35, the Ring Road area and Asbury Avenue, and Route 837 passes through Wanamassa with stops along Sunset Drive (New Jersey Transit, 2019). These routes are shown in **Figure 4.2.1**.

4.5.2 Automobiles/Traffic

Ocean Township is crisscrossed by approximately 149 miles of roads, consisting of about 22 miles of state roads, 5 miles of county roads and 122 miles of local roads. Major north-south routes are NJ-18, NJ-35 and County Route 15. Major east-west routes include West Park Avenue and Deal Road (NJDOT, December 1, 2014). These routes are illustrated in **Figure 4.2.1**.

4.5.3 Non-motorized Transportation

In 2010, Ocean Township commissioned the development of a Bicycle and Pedestrian Network Plan to encourage non-motorized modes of transportation in the community by improving access, connectivity and safety (Urban Engineers, 2010). The completed plan was approved by the Planning Board in December of 2011 (Ocean Township, December 12, 2011). Designed for implementation in stages over a 15-year period, the plan's recommendations include a 52-mile network of bicycle facilities, 33 miles of new sidewalk, 11 miles of off-road trails and the improvement of 72 road crossings. The bicycle network features shared lanes, bike lanes, buffered bike lanes, multi-use paths and parking options while the pedestrian network focuses on additional sidewalks, neighborhood school access and improved pedestrian crossings. The plan also incorporates sustainable drainage practices and the use of renewable energy as well as a public education component to encourage use and promote safety (Urban Engineers, 2010).



Legend

- Ocean Township
- Electric Vehicle Charging Station
- NJ Transit Bus Stops
- Streams
- Roads
- NJ Transit Bus Routes
- Waterbodies
- North Jersey Coast Line Railroad Stations
- North Jersey Coast Line

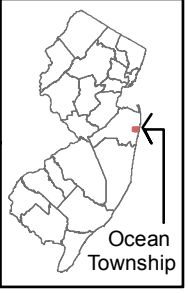
N

0 0.3 0.6 1.2 Miles

Data Sources: NJDEP, NJDOT, NJ TRANSIT, NJOIT OGIS
Disclaimer required for NJDEP Data: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Kratzer Environmental Services
Ocean Township ERI 2019

Figure 4.2.1. Transportation
Ocean Township, Monmouth County



4.6 RENEWABLE RESOURCES

On May 23, 2018, Governor Murphy signed Executive Order No. 28, which provides guidance for updating the state's Energy Master Plan, which, "shall provide a comprehensive blueprint for the total conversion of the State's energy production profile to 100% clean energy sources on or before January 1, 2050, and shall further provide specific proposals to be implemented over the next ten (10) years in order to achieve the January 1, 2050 goal" (EO 28, May 23, 2018).

4.6.1 Solar Energy

As of February 28, 2019, solar power installations totaling 2,777,404 kW (kilowatts) are installed in New Jersey, of which 8.2% (226,924 kW) is in Monmouth County. Another 592,344 kW are in the "solar project pipeline" in the state (NJBPU, February 28, 2019).

In addition to numerous private "behind the meter" solar photovoltaic installations in Ocean Township, there are two installations on public buildings. Both are installed on the roof of the Ocean Township Intermediate School, a 25.6 kW system was installed in 2009 and a 235.2 kW system was installed in 2015 (NJDEP, January 20, 2017). **Figure 4.6.1** shows the locations and other sources of information are listed in **Internet Resources**.

4.6.2 Electric Automobiles and Charging Stations

In New Jersey, the transportation sector is the largest source of greenhouse gas (GHG) pollution, accounting for about 30% of the total air emissions of hydrocarbons and nitrogen oxides. This has been the case since 1990, despite a minor increase in the fuel efficiency, most likely due to a concurrent increase in vehicle miles traveled (NJDEP, October 2017; NJDEP, March 4, 2019).

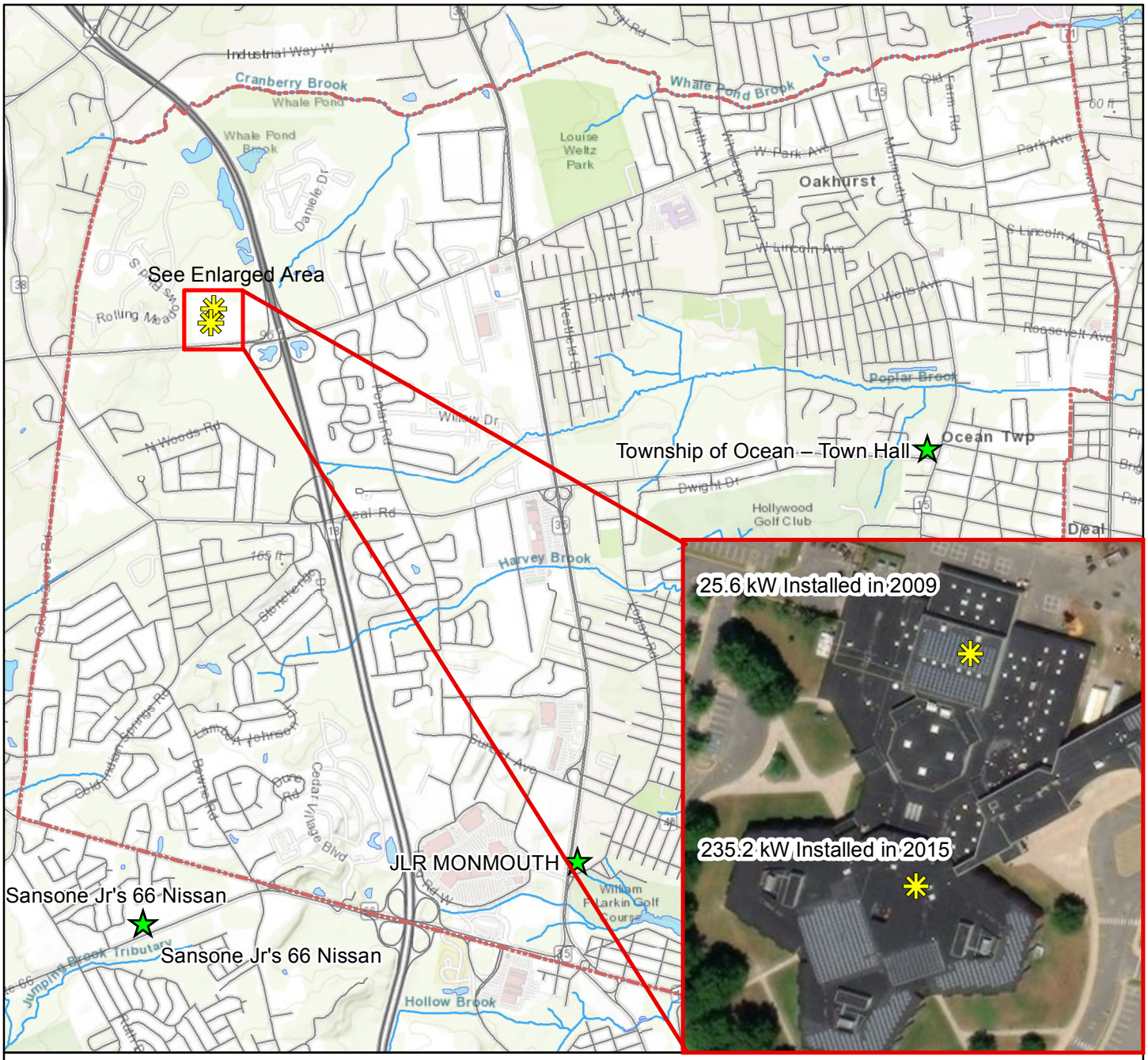
Plug-in electric vehicles (PEVs) have onboard rechargeable batteries which store energy to power one or more electric motors. PEVs that are powered only by electricity produce no tailpipe emissions. There are, however, upstream emissions associated with the production of that electricity, which can be produced from fossil fuels (including oil, coal and natural gas), nuclear energy, hydropower, wind, solar, and stored hydrogen. Fueling PEVs with electricity is currently cost effective compared to using gasoline, and incentives may offset the initial cost (U.S. Department of Energy, No Date).

Electric vehicle charging stations at the Ocean Township Municipal Office.

As part of our Township's green initiative, two electric vehicle charging stations are available for guests while they conduct business in Town Hall. There are two stations outside of Town Hall – one in the western parking lot along Deal Road and the other in the eastern parking lot along Monmouth Road and just outside the entrance to the Police Department (Ocean Township, 2019)(see **Figure 4.3.1** and **Table 4.6.1.).** Additional sources of information are listed in **Internet Resources**.

Table 4.6.1. Electric Vehicle Charging Stations

Station Name	Address	Description
Township of Ocean – Town Hall	399 Monmouth Rd, Oakhurst	Public, 24 hours daily, 732-531-5000, for visitors
Sansone Jr's 66 Nissan	3401 Route 66, Neptune	Public, call 732-922-1050, dealership business hours
Sansone Jr's 66 Nissan	3401 Route 66, Neptune	Private
JLR MONMOUTH	807 NJ-35, Wanamassa	Public, 24 hours daily, http://www.chargepoint.com/



Legend

- Ocean Township
- Roads
- Waterbodies
- Streams
- PV Solar Panels on Public Facilities
- Electric Vehicle Charging Station

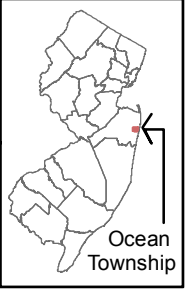
N

0 0.25 0.5 1 Miles

Data Sources: NJDEP, NJDOT
Disclaimer required for NJDEP Data: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Kratzer Environmental Services
Ocean Township ERI 2019

Figure 4.6.1. Renewable Resources Ocean Township, Monmouth County



References: Utilities, Infrastructure, and Transportation

Water Supply

Atherholt, Thomas B., Judith B. Louis, John Shevlin, Karen Fell, and Sandra Krietzman. April 2009. The New Jersey Private Well Testing Act: An Overview. NJDEP Division of Science, Research and Technology https://www.state.nj.us/dep/dsr/research/pwta-overview.pdf

New Jersey American Water. April 4, 2 019. https://amwater.com/njaw/ . Accessed April 4, 2019.

New Jersey American Water. 2017 Annual Water Quality Report: Coastal North System PWS ID: NJ1345001. http://www.amwater.com/ccr/coastalnorth.pdf

New Jersey American Water. No date. Coastal North Typical Water Quality Information PWSID Number: NJ1345001. http://www.amwater.com/twq/coastalnorth_twq.pdf Accessed March 24, 2019.

NJDEP. April 1, 2019. Notice of Rule Proposal New Jersey Register dated April 1, 2019. https://www.nj.gov/dep/rules/notices/20190401a.html

NJDEP. January 1, 2015. NJ Private Well Testing Act Summary Results by County September 2002 - March 2014 (Envr_mon_PWTA_co). GIS data. https://gisdata-njdep.opendata.arcgis.com/datasets/b4451e1a015c496fa52ec2536a911f0d_103

NJDEP. 2004. NJDEP Public Community Water Purveyor Service Areas. GIS data. No longer available online.

NJDEP Bureau of Safe Drinking Water. Safe Drinking Water Act N.J.S.A. 58:12A-1 et seq.

NJDEP Division of Water Supply and Geoscience. March 26, 2019. Private Well Testing Act (PWTA). http://www.nj.gov/dep/watersupply/pw_pwta.html

NJDEP Division of Water Supply and Geoscience. August 17, 2017. Lead in Drinking Water. http://www.nj.gov/dep/watersupply/dwc-lead.html. Accessed August 26, 2017.

NJDEP. Monmouth System Source Water Assessment Summary A State Review of Potential Contamination Sources Near Your Drinking Water https://www.nj.gov/dep/swap/reports/sumdoc_1345001.pdf

NJDEP Bureau of Environmental Analysis, Restoration and Standards. March 13, 2019. Ground Water Quality Standards N.J.A.C 7:9C. http://www.nj.gov/dep/wms/bears/gwqs.htm. Accessed March 20, 2019.

NJDEP Division of Water Supply and Geoscience. Community Water System Source Water Assessment Reports and Summaries. https://www.nj.gov/cgi-bin/dep/swap/swapdata2.pl?psid=1345001

NJDEP Drinking Water Watch. https://www9.state.nj.us/DEP_WaterWatch_public/JSP/WSDetail.jsp?tinwsys=384. Accessed April 4, 2019.

Steering Committee of the New Jersey Comparative Risk Project. March 2003. Final Report of the New Jersey Comparative Risk Project. 213 pages. http://www.state.nj.us/dep/dsr/njcrp/lacombe

Sewer Service

NJDEP. January 24, 2017. Statewide Sewer Service Area for New Jersey, Edition 20170124 (Util_wastewater_servicearea). GIS data. http://njogis-newjersey.opendata.arcgis.com/datasets/2ceba1ef852b4940afc3e0d94fb5d327_6

NJDEP. 2006. Mun_Flow_Data_Summary_06.xls. https://www.state.nj.us/dep/dwq/pdf/Mun_Flow_Data_Summary_06.xls. Accessed April 4, 2019.

Township of Ocean. 2019. Sewerage Authority. http://www.oceantwp.org/content/10184/default.aspx. Accessed April 4, 2019.

Stormwater

Maser Consulting. Revised September 2009. Stormwater Management Plan for Township of Ocean, Monmouth County, New Jersey. http://www.oceantwp.org/filestorage/5931/14019/STORMWATER_MANAGEMENT.pdf

NJDEP Bureau of Nonpoint Pollution Control. March 18, 2019. Municipal Stormwater Regulation Program. https://www.nj.gov/dep/dwq/msrp_home.htm. Accessed March 20, 2019.

NJDEP Bureau of Nonpoint Pollution Control. 2009. Municipal Tier Assignments 2009 Under the NJPDES Municipal Stormwater Regulation Program. http://www.nj.gov/dep/dwq/images/mun-tierA-assignments1.jpg

NJDEP. Proposed December 3, 2018. Stormwater Management rules, N.J.A.C. 7:8, Green Infrastructure https://www.nj.gov/dep/rules/notices.html. Accessed April 4, 2019.

NJDEP. June 20, 2016. N.J.A.C. 7:8 Stormwater Management Rule. Date last amended: Date last amended: June 20, 2016. http://www.nj.gov/dep/rules/rules/njac7_8.pdf

Township of Ocean Storm Water Pollution Prevention Program: http://www.oceantwp.org/content/5937/6802/default.aspx
Maps: http://www.oceantwp.org/filestorage/5937/6802/Stormwater_Infrastructure_NW.pdf
http://www.oceantwp.org/filestorage/5937/6802/Stormwater_Infrastructure_SE.pdf
http://www.oceantwp.org/filestorage/5937/6802/Stormwater_Infrastructure_SW.pdf
http://www.oceantwp.org/filestorage/5937/6802/Stormwater_Infrastucture_NE.pdf

Solid Waste

Bergeron, William. Personal communication, 2019. William Bergeron is the Roads Division Foreman for the Township of Ocean and can be reached at wbergeron@oceantwp.org

Monmouth County. February 2009. Monmouth County District Solid Waste Management Plan. http://co.monmouth.nj.us/documents/24%5CSolid%20Waste%20Management%20Plan%202009.pdf

NJDEP. March 6, 2017. Category/Definition of Recyclable Materials. https://www.nj.gov/dep/dshw/recycling/material.htm

NJDEP. August 13, 2018. 2016 Generation, Disposal and Recycling Rates in New Jersey. https://www.nj.gov/dep/dshw/recycling/stat_links/2016disposalrates.pdf
NJGS. 2015. New Jersey Radon Potential Map, https://www.state.nj.us/dep/rpp/radon/radonin.htm. Accessed April 4, 2019.

NJDEP. January 24, 2019. 2016 Final Recycling Report. https://www.nj.gov/dep/dshw/recycling/stat_links/2016finalreport.pdf

NJDEP Division of Solid and Hazardous Waste. January 12, 2018. Solid Waste Types. https://www.nj.gov/dep/dshw/lrm/type.htm

Stephens, Mike. June 4, 2009. Waste Disposal Sites in Monmouth County (map). Monmouth County Health Department. Available online at http://co.monmouth.nj.us/documents%5C121%5CWasteDisposalSites.pdf

Transportation

New Jersey Department of Transportation (NJDOT). December 1, 2014. New Jersey Department of Transportation Statewide Public Road Network (1:2400). GIS data. http://www.state.nj.us/transportation/gis/data.shtm

New Jersey Transit. 2019. Bus Route Planning Map. http://mybusnow.njtransit.com/bustime/map/displaymap.jsp

New Jersey Transit. May 2016. Rail Service System Map. Available at https://www.njtransit.com/pdf/rail/Rail_System_Map.pdf

Ocean Township. December 12, 2011. Planning Board meeting minutes. http://www.oceantwp.org/filestorage/5931/6843/6845/120/2475/4576/11_December_12,_2011.pdf

Urban Engineers. 2010. Ocean Township Bicycle and Pedestrian Network Plan. Report prepared for Ocean Township and the New Jersey Department of Transportation.

Renewable Resources

EXECUTIVE ORDER NO. 28. May 23, 2018. By Governor Philip D. Murphy. https://nj.gov/infobank/eo/056murphy/pdf/EO-28.pdf

NJ Board of Public Utilities (BPU). Solar Activity Reports. February 28, 2019. http://www.njcleanenergy.com/renewable-energy/project-activity-reports/project-activity-reports. Accessed March 30, 2019.

NJDEP. January 20, 2017. Public Solar Facilities of New Jersey, Edition 20170120 (Util_solar_public). Data obtained from AEG & NJBPU on 20160826. GIS data. https://njogis-newjersey.opendata.arcgis.com/datasets/public-solar-facilities-in-new-jersey

NJDEP, Division of Science, Research, and Environmental Health. October 2017. Greenhouse Gas Emissions in New Jersey Environmental Trends Report. https://www.nj.gov/dep/dsr/trends/ghg.pdf

NJDEP Bureau of Mobile Sources. March 4, 2019. Drive Green NJ. https://www.drivegreen.nj.gov/index.html. Accessed March 30, 2019.

Ocean Township. 2019. Electric vehicle charging stations. http://www.oceantwp.org/content/5931/14165/default.aspx. Accessed March 30, 2019.
U.S. Department of Energy, Energy Efficiency and Renewable Energy. No Date. Electricity Basics. https://afdc.energy.gov/fuels/electricity_basics.html. Accessed March 30, 2019.

Internet Resources: Utilities, Infrastructure, and Transportation

Water Supply
Ground Water and Drinking Water (US EPA): https://www.epa.gov/ground-water-and-drinking-water

Lead in Drinking Water: http://www.nj.gov/dep/watersupply/dwc-lead.html

NJ and Federal Drinking Water Standards (2018): https://www.nj.gov/dep/standards/drinking%20water.pdf

New Jersey American Water:
- Home Page: https://amwater.com/njaw/
- Annual Drinking Water Report: http://amwater.com/njaw/water-quality/water-quality-reports/coastal-north

NJDEP
- Annual Compliance Report on Public Water: https://www.state.nj.us/dep/watersupply/pdf/violations2017.pdf
- Drinking Water Watch: https://www9.state.nj.us/DEP_WaterWatch_public/JSP/WSDetail.jsp?tinwsys=384
- Your Utility and Its Water Quality (violations by year): http://www.nj.gov/dep/watersupply/dwc_systems.html
- Source Water Assessment: https://www.nj.gov/cgi-bin/dep/swap/swapdata2.pl?psid=1345001
- Private Well Testing Act: http://www.nj.gov/dep/watersupply/pw_pwta.html
- Story Map: NJ Private Well Testing Act Data Summary (Sep. 2002 to Apr. 2014)
  http://njdep.maps.arcgis.com/apps/MapSeries/index.html?appid=826ec9fae77543caa582a787d5f088e7
- Ground Water Monitoring: http://www.state.nj.us/dep/wmm/bfbm/groundwater.html
- NJDEP Laws & Rules: http://www.nj.gov/dep/landuse/lawsregs.html
- NJDEP Rules & Regulations (current & proposed): http://www.nj.gov/dep/rules/

USGS - New Jersey District - Ground Water Information (USGS): https://waterdata.usgs.gov/nj/nwis/gw

Stormwater
New Jersey's Stormwater Index: http://www.nj.gov/dep/dwq/fd.htm
- NJDEP Municipal Stormwater Regulation Program: http://www.state.nj.us/dep/dwq/msrp_home.htm
- Stormwater Best Management Practices Manual: http://www.njstormwater.org/bmp_manual2.htm
- Clean Water NJ: http://www.cleanwaternj.org/index.htm
- Multimedia Resources: http://www.cleanwaternj.org/multimedia.html
- Green Infrastructure: http://www.nj.gov/dep/gi/

Maser Consulting. Revised September 2009. Stormwater Management Plan for Township of Ocean, Monmouth County, New Jersey. http://www.oceantwp.org/filestorage/5931/14019/STORMWATER_MANAGEMENT.pdf

Township of Ocean's Storm Water Pollution Prevention Program: http://www.oceantwp.org/content/5937/6802/default.aspx

USEPA Nonpoint Source Pollution: http://water.epa.gov/polwaste/nps/index.cfm

Solid Waste
Monmouth County
- Reclamation Center (MCRC): https://co.monmouth.nj.us/page.aspx?ID=186
- Recycling Home Page: https://co.monmouth.nj.us/page.aspx?ID=4185
- Recycling and Solid Waste Planning: https://www.visitmonmouth.com/page.aspx?ID=4172

New Jersey Division of Solid and Hazardous Waste: https://www.nj.gov/dep/dshw/

New Jersey Recycling Information for Governments and Schools: https://www.nj.gov/dep/dshw/recycling/govschool.html

Ocean Township

Recycling webpage: http://www.oceantwp.org/content/5937/default.aspx
Recycling guide: http://www.oceantwp.org/filestorage/5937/Recycling_guide__2019.pdf

Transportation
NJDOT Park and Ride Locator map: https://www.state.nj.us/transportation/commuter/rideshare/prlocate.shtm

New Jersey Transit
Rail Service System Map: https://www.njtransit.com/pdf/rail/Rail_System_Map.pdf
Bus Route Planning Map: http://mybusnow.njtransit.com/bustime/map/displaymap.jsp

Renewable Resources
National Renewable Energy Laboratory PVWatts Calculator: https://pvwatts.nrel.gov/

New Jersey Clean Cities: https://www.njcleancities.com/

New Jersey Board of Public Utilities (BPU):
Home Page: https://www.state.nj.us/bpu/
A Basic Guide to Solar Electric Systems: http://www.njcleanenergy.com/whysolar

NJDEP
Air Quality, Energy and Sustainability: https://www.state.nj.us/dep/aqes/index.html
Bureau of Energy and Sustainability: https://www.state.nj.us/dep/aqes/bes.html
Clean Energy Technologies: https://www.state.nj.us/dep/aqes/osarit.html
Solar Siting Analysis: https://njdep.maps.arcgis.com/apps/Cascade/index.html?appid=f5838c39491d4df188fffe192c8531a5

Ocean Township Electric vehicle charging stations: http://www.oceantwp.org/content/5931/14165/default.aspx

Solar Estimator: How much will solar panels cost for your home? https://www.solar-estimate.org/solar-panels/new-jersey

U.S. Department of Energy
New Jersey Laws and Incentives: https://afdc.energy.gov/laws/state_summary?state=NJ
Plug-In Electric Vehicle Handbook for Public Charging Station Hosts: https://afdc.energy.gov/files/pdfs/51227.pdf
Vehicle Cost Calculator: https://afdc.energy.gov/calc/

5.1 HEALTH

5.1.1 Health Issues as Related to Air Quality

The New Jersey Comparative Risk Project (March 2003), funded by the United States Environmental Protection Agency (USEPA) and the NJDEP, combined the efforts of 73 experts to analyze and rank 88 chemical, physical and biological factors ("stressors") according to their relative negative impacts on human health, ecological quality, and socioeconomic conditions (monetary cost). The study ranked several air pollutants among the highest risks to human health, including ground-level ozone, particulate matter, radon, secondhand tobacco smoke, and volatile organic compounds (VOCs). Air pollution is estimated to have medium to medium-high socioeconomic impact, and lesser impacts to ecological quality (Steering Committee of the NJ Comparative Risk Project, 2003).

Ozone

Ground-level ozone (O_3) causes serious adverse health and environmental effects. Ozone levels are discussed in **Section 3.2.2.**

Particulates

All airborne particulate matter sizes are harmful to the environment. Coarse particles smaller than 10 microns (PM_{10}) are inhalable, therefore are considered harmful to human health. Fine particles less than 2.5 microns ($PM_{2.5}$) are even more detrimental to human health because they can travel deeper into the respiratory tract, harming the lungs. Particulate air pollution is covered in **Section 3.2.3.**

Radon

Radioactive substances (including uranium, thorium, radium, and radon) from natural sources (see **Section 3D)** are frequently found in ground water in New Jersey. Almost all rocks and soil contain at least some radioactive substances, which can sometimes exceed safe levels in drinking water. Based on frequency of radon found in homes, Ocean Township has *Low potential* for elevated radon concentrations, i.e. less than 5 percent of tested homes have radon concentrations greater than or equal to 4 pCi/L (NJGS, 2015).

Air Toxics

The USEPA prepared a comprehensive inventory of air toxics emissions for the entire country as part of the National-Scale Air Toxics Assessment (NATA) in 1996 and most recently updated NATA in 2014 (released in 2018). The 2005 study update determined that, in New Jersey, on-road mobile sources are responsible for 33% of the toxic emissions; nonpoint/area sources contribute 31% (residential, commercial, and small industrial sources); non-road mobile sources (airplanes, trains, construction equipment, lawnmowers, boats, dirt bikes, etc.) account for 29%; and point sources account for the remaining 7% (USEPA, 2014).

The NJDEP has established four comprehensive air toxics monitoring sites. They are located in Elizabeth, New Brunswick, Chester and Camden. Pollutant concentrations are trending downward, but many of them still exceed the NJDEP health benchmarks (NJDEP, April 4, 2019). A risk results analysis conducted in 2014 identified the chemicals of greatest concern both statewide and at the county level. Monmouth County results showed the highest risk ratios for Diesel particulate matter, Formaldehyde, Benzene, Carbon tetrachloride, Acetaldehyde, 1,3 Butadiene and Naphthalene (NJDEP Air Toxics in NJ, January 8, 2019). Additional information about toxics in air pollution is found in Section **3.2.4.**

Mercury

Mercury (Hg) is a highly toxic heavy metal. Human health concerns of mercury include neurotoxicity (low-level exposure is linked to learning disabilities in children) and interference in reproduction, while both methyl mercury and mercuric chloride are listed by EPA as possible human carcinogens. Environmental effects have not been adequately studied, but animals, especially fish-eaters, experience effects similar to humans. Levels of mercury from atmospheric deposition are covered in **Section 3.2.5**.

5.1.2 Health Issues as Related to Water Quality

The New Jersey Comparative Risk Project (2003) identified a number of possible human health risks from drinking water, including lead (which, when present, is usually from the plumbing) (NJDEP, March 26, 2019), radon, arsenic, MTBE (methyl-t-butyl ether, which is a fuel oxygenate), nitrates, and waterborne pathogens.

Source Water Assessment Program (SWAP)

The Federal Safe Drinking Water Act required states to establish a Source Water Assessment Program (SWAP) to provide for the protection of public water systems and to increase public knowledge of and participation in protecting the sources of public drinking water.

The NJDEP 1.) identified the area (known as the source water assessment area) that supplies water, 2.) inventoried any significant potential sources of contamination in the area; and 3.) Analyzed how susceptible the drinking water source is to the potential sources of contamination (low, medium or high). The susceptibility rating does not indicate if the water source is actually contaminated, but is meant to inform water testing schedules and treatment and other actions that would prevent human consumption of unsafe water (NJDEP, December 2004). The study concluded that surface water intakes for the NJ American Water Company - Monmouth System are highly susceptible to pathogens, disinfection by-products and nutrients; moderately susceptible to pesticides, VOCs and inorganics; and have low susceptibility to radionuclides and radon. The wells providing water to the Monmouth System are moderately susceptible to contamination by radionuclides, inorganics, and disinfection by-products and have low susceptibility to the other categories (NJDEP, December 2004).

Drinking Water Quality Report

The Federal and New Jersey State Safe Drinking Water Regulations require routine monitoring of public water supplies for a number of contaminant categories. The results are available through the Drinking Water Watch and the water purveyor's annual water quality report. The most recent Water Quality Report is provided in **Appendix H** (also see **Internet Resources** and **Section 4.1)**.

Lead in Drinking Water

Lead, even at low levels, can damage the nervous system, brain and kidneys, particularly in infants and children. Whether the drinking water is from surface or ground water sources, lead is not normally found in drinking water at the source. However, lead can contaminate drinking water from corrosion of the service lines, plumbing and fixtures that contain lead. When lead is present in plumbing, the amount of lead that leaches into the water depends on a number of factors, including lead content of pipes, fixtures, and solder, water temperature, chloride levels, pH and hardness. Actions to reduce possible exposure to lead include testing the water, testing children's blood levels, and running

Run your water to flush out lead.
Run water for 15-30 seconds or until it becomes cold or reaches a steady temperature before using it for drinking or cooking, if it hasn't been used for several hours. This flushes lead-containing water from the pipes.
(NJDEP, https://www.state.nj.us/dep/watersupply/dwc-lead.html)

water for 30 seconds before use (NJDEP Water Supply and Geoscience, March 26, 2019; NJDOH, No Date).

Fish Consumption Advisories

When toxic pollutants are present in surface water, they are consumed by the organisms that live in the water. The process of *bioaccumulation* is when there is an increase in concentration of certain fat-soluble chemicals, such as DDT and PCBs, in successively higher trophic levels of a food chain or web. For example, insects living in contaminated sediments may have accumulated a certain amount of a toxin. Fish, by eating many of these insects, then ingest the toxin into their own bodies. Anything that eats that contaminated fish, including humans and other predators, will absorb the toxin. When the concentration of toxin becomes high enough, the individual's health will be impacted.

Table 5.1.1. 2018 Fish Consumption Advisories

LOCATION	SPECIES	ADVISORY/PROHIBITION	
		Range of Recommended Meal Frequency (1)	
		General Population	High-Risk Individuals (2)
Deal Lake	Largemouth bass	One meal per week	One meal per week
	Bluegill Sunfish	No restrictions	No restrictions
	Brown Bullhead	No restrictions	No restrictions
	Common Carp	One meal per month	Do Not Eat
	White Perch	One meal per month	One meal per month
	American Eel	One meal per month	Do not eat
Statewide Freshwater – All water bodies except those listed separately	Trout - (Brown, Brook, Rainbow and Hybrid)	One meal per week	One meal per week
	Smallmouth bass	One meal per week	One meal per month
	Chain Pickerel	One meal per week	One meal per month
	Sunfish (bluegill, pumpkinseed and redbreast)	No restrictions	One meal per week
	Yellow Bullhead	No restrictions	One meal per month
Atlantic Ocean: Sea Isle City to Cape May	Weakfish	One meal per week	One meal per month
Statewide Estuarine & Marine Waters – All coastal waterbodies except those under Waterbody Specific Advisories	Striped bass	One meal per month	Do Not Eat
	Bluefish (greater than 6 lbs/24 inches)	Six meals per year	Do Not Eat
	Bluefish (less than 6lbs/24 inches)	One meal per month	Do Not Eat
	American eel	Four meals per year	Do Not Eat
	American lobster	**Do Not Eat the Green Gland (a.k.a., Tomalley or Hepatopancreas)**	
Important Consumption Reminder: *Eat only the fillet portions of the fish. Use proper trimming techniques to remove fat, and cooking methods that allow juices to drain from the fish (e.g., baking broiling, frying or grilling, and steaming).*			
(1) One meal is defined as an eight-ounce serving. (2) High-Risk Individuals include infants, children, pregnant women, nursing mothers and women of childbearing age.			
Source: NJDEP Division of Science and Research, 2018: http://www.state.nj.us/dep/dsr/njmainfish.htm See interactive map for up to date fish advisories: http://njdep.maps.arcgis.com/apps/MapJournal/index.html?appid=922dff1885394cf19ccf1d9c8d52b4f0			

The NJDEP samples fish for certain toxic pollutants and, when necessary, issues state and regional *fish consumption advisories*, to reduce exposure to dioxin, PCBs and mercury. This information is intended to help individuals make an informed choice on the number of meals of fish to consume.

The 2018 fish consumption advisories for fish caught in the immediate region or anywhere in the state are listed in **Table 5.1.1.** See the **Internet References** for more information, such as fish preparation guidelines and annual updates.

Harmful Algal Blooms (HABs) in Surface Water

Certain environmental conditions, such as high nutrient concentrations, warm water temperatures and calm water can encourage a rapid increase and accumulation in the population of algae and algae-like bacteria in a waterbody. These *algal blooms* can form a thick coating or mat on the surface of the water, and can harm aquatic organisms by lowering the dissolved oxygen in the water column. "Nuisance blooms" may result in unattractive and unpleasant water and may have offensive odors, but are not dangerous to people.

However, some are *harmful algal blooms (HABs)* that can be dangerous to people, animals or the ecology. HABs are caused by blooms of cyanobacteria which can produce and release chemicals that can be toxic to humans and animals if ingested, inhaled, or if contacted by the skin or mucous membranes. In addition, these toxins can accumulate in fish and shellfish which can cause illness when consumed. HABs can occur in both the freshwater and marine water environments (NJDEP, January 7, 2019). Within Ocean Township, Deal Lake and Lake Takanassee may be particularly susceptible to HABs.

5.1.3 Insect and Tick-borne Disease

Mosquitoes and ticks are widespread in Ocean Township and some of them can be vectors of a number of diseases. The most common mosquito-borne diseases in New Jersey include Eastern Equine Encephalitis (EEE) and West Nile Virus (WNV). EEE is typically found along eastern coastal regions in the U.S. and is considered a rare disease in humans (NJ Department of Health, 2018). However, it is a serious disease in horses, with a number of cases reported from the County in 2018 (TAPinto Horses, 2018). WNV typically affects wild birds, although people and horses are also susceptible (NJ Department of Health, 2018; Monmouth County, 2019).

The most common vector-borne disease in Monmouth County is lyme disease, transmitted by the black legged (deer) tick (*Ixodes scapularis*). These ticks can also carry babesiosis, anaplasmosis, and the Powassin virus, although these diseases are less common. The Lone Star Tick (*Ambylomma americanum*) is a carrier of Ehrlichiosis, and the dog tick (*Dermacentor variabilis*), can transmit rocky mountain spotted fever (Monmouth County, 2019).

Recently, an exotic tick species new to the US, the longhorned tick (*Haemaphysalis longicornis*), was identified in Hunterdon County, New Jersey. It was confirmed in Monmouth County in August 2018. It is mainly known as a pest of livestock in its native range in East Asia (USDA, 2018), however, it is not yet known what impact it will have in the US as it continues to spread.

The Monmouth County Mosquito Control Division uses Integrated Pest Management (IPM) to control mosquito populations and minimize health risks to county residents. In addition, since 1998, the Division has also provided information about ticks and tick-borne diseases, including tick identification services and guidelines for tick management for homeowners (Monmouth County, 2019; Freehold Township, 2007).

5.2 NOISE

Noise pollution, defined as unwanted or excessive sound, is another undesirable by-product of modern life. It can be a nuisance, interfere with activities, and can cause physical damage. Transportation noise is among the most pervasive noise sources in our environment today, particularly for people who live within 500 feet of heavily traveled highways or within 100 to 200 feet of lightly traveled roads (Washington County Task Force, 2005).

Federal highway noise criteria (which apply only to federal highways) range from 57 to 72 decibels (depending on adjacent land use) (USDOT, FHA, 2006). New Jersey's Noise Control Act of 1971 authorized the NJDEP to develop regulations relating to the control and abatement of noise. While

these regulations do not specify noise criteria, a sample municipal ordinance is provided with sound level standards of 50 decibels during nighttime (10:00 p.m. to 7:00 a.m.) and 65 decibels during daytime (NJDEP, 2017).

Ocean Township is subjected to noise pollution, such as from cars and trucks on Route 18 or 35 and the Garden State Parkway and does have a noise control ordinance chapter 245.

5.2.1 Noise-sensitive Areas

No noise-sensitive areas are described in the current ordinance.

5.2.2 Significant Sources of Noise

The most significant sources of noise in the Township are the highways corridors (Rt. 18, Rt. 35, and along the Garden State Parkway just outside the Township boundary) as well as the NJ Transit railway corridor on the eastern boundary. The roads may be most problematic during the summer shore season.

5.2.3 Day/Night Permitted Sound Levels

The noise nuisance ordinance specifies hours during the day or night where noise-producing activities are permitted, typically between the hours of 8 AM – 6 PM, with differing time constraints depending on the activity. For example, with sufficient snowfall, snow blowers can be operated overnight; ice cream vendors can operate until 9 PM; the operation of powered model vehicles is restricted between 8 PM and 8 AM. Details about restricted activities and times of day can be found by reviewing the ordinance. Sound levels in decibels have not been specified in the ordinance, rather, just types of noise-producing activities that would create noise "of such level and duration as to be or tend to be injurious to human health or welfare …" Ordinance 3-3 (Township of Ocean, 2017).

5.3 LIGHTING

Light pollution is defined as excess or inappropriate use of artificial light. Light pollution obstructs views of stars and planets, disrupts ecosystems and impacts human health and safety. In fact, almost 99% of the sky in Europe and the United States is polluted by night lighting (International Dark Sky Association, 2016). Ecological impacts of light pollution range from contributing to algal blooms (by disrupting nocturnal foraging of zooplankton), disrupting feeding and mating of nocturnal animals such as frogs, bats, fireflies and moths, and killing migrating birds (Rich and Longcore, 2006). Most migrating birds navigate at night by the moon and stars, and artificial lighting short-circuits their ability to navigate, causing millions of fatalities from collisions annually (Gauthreaux Jr. and Belser, 2006). Links between artificial light and human health, such as cancers, have also been documented. Surprisingly, the use of reduced and non-glaring lighting has not been shown to increase crime rates and, in fact, may improve human safety (International Dark Sky Association, 2016).

5.3.1 Significant Sources of Light

Ocean Township is highly impacted by a number of sources of light pollution. First, the general glow from the New York metropolitan area is sometimes visible in the night sky. **Figure 5.3.1** shows a map of NASA's satellite data of average visible and infrared light (Visible Infrared Imaging Radiometer Suite (VIIRS) data). Local sources include light from the Seaview Square shopping center and other large stores, increasing business and residential development along the Route 35 corridor, and night glow from development in Long Branch to the north and Asbury Park area to the southeast. Transient traffic along both routes 18 and 35 provide a minimal source of light pollution. Additional sources include street lamps along the highways, exterior lights around schools, offices and municipal buildings, and

unshielded outdoor lights on residences in the Township. (Note: the Township does have a relatively strict lighting code, which may prevent such unshielded lighting at this time.)

Figure 5.3.1. Light Pollution

Sources: Visible Infrared Imaging Radiometer Suite (VIIRS) data mapped by https://www.lightpollutionmap.info; Ocean Township boundary is approximate.

5.3.2 Regulations Addressing Lighting

Ocean Township has a lighting ordinance # 2169 amending Chapter 21 of the Comprehensive Land Development Ordinance. Section 21-46A.1 states:

> "The purpose of this Chapter is to regulate outdoor lighting in a manner which encourages the conservation of energy, improves or maintains the nighttime visual environment, prevents and/or eliminates misdirected or excessive artificial light, light trespass and/or unnecessary sky glow and protects the health, safety, security and welfare of Township residents and the general public." (Ocean Township, 2014)

To this end, Ocean Township recommends specific illuminance levels for parking lots, residences, businesses etc., requires shields so that light fixtures are directly and downwardly focused and a downward directed position to reduce light spillage. Generally, to reduce the effects of night lighting, night lights should be placed close to the ground (within 10 feet) (Township of Ocean, 2014). The transition to LEDs has reduced energy use, especially when dimmers or timers are used to increase efficiency and minimize the negative effects of light. Drake (2019) recommends that warmer, longer wavelength LEDs be used instead of the bright white/blue LEDs, which studies have shown are more disruptive to both humans and other wildlife species.

5.4 CONTAMINATED SITES

On May 7, 2012, NJDEP adopted amendments, repeals, and new rules to implement site remediations through the *Site Remediation Reform Act (SRRA)*, N.J.S.A. 58:10C-1 et seq., and related amendments to the *Brownfield and Contaminated Sites Act (Brownfield Act)* N.J.S.A. 58:10B-1 et seq., the *Spill Compensation and Control Act (Spill Act),* N.J.S.A. 58:23-11 35 seq., the *Industrial Site Recovery Act (ISRA)*, N.J.S.A. 13:1K-6 et seq., and the *Underground Storage of Hazardous Substances Act (UST Act)*, N.J.S.A. 58:10A-21 et seq. This major shift requires remediations of contaminated sites to proceed under the supervision of a *Licensed Site Remediation Professional (LSRP)* (hired by the property owner) instead of NJDEP (NJDEP Site Remediation Program, May 7, 2012).

The goal of these changes is to increase the pace of remediation in order to decrease the threat of contamination to public health and safety and the environment, and to more quickly return properties to productive use that are underutilized due to contamination.

Some key provisions create a licensing board and a code of ethics (including penalties for violations) for LSRPs; establish obligations of each person responsible for conducting remediation; institute mandatory timeframes for the completion of key phases of site remediation; set forth the circumstances under which NJDEP would undertake direct oversight of a remediation; and require NJDEP to establish presumptive remedies for residential development, schools and childcare facilities to ensure that the remediation at these sites is protective of human health and safety and of the environment (NJDEP SRP, March 13, 2019).

5.4.1 Known Contaminated Sites

The NJDEP Site Remediation Program compiles a list of Known Contaminated Sites (KCS). The Known Contaminated Sites List (non-homeowner) for New Jersey (as required under N.J.S.A. 58:10-23.16-17 and also the New Residential Construction Off-Site Conditions Disclosure Act N.J.S.A 46:3C1 et seq.) contains sites defined as those sites and properties within the state where contamination of soil or ground water has been confirmed at levels equal to or greater than applicable standards. Sites identified in the Known Contaminated Sites list can undergo a variety of activities, ranging from relatively simple soil removals to highly complex remedial activities. This dataset is updated daily. It is important to note that the list may include sites where remediation is either currently under way, required but not yet initiated or has been completed (and no longer considered contaminated). In addition, new contaminated sites may have been identified since the creation of this list and are not included here (NJDEP SRP, April 2, 2019).

There are 48 active contaminated sites within the Township of Ocean. The sites are listed in **Table 5.4.1**, and their locations are shown on in **Figure 5.4.1**. The figure also includes several locations just outside of Ocean Township's borders in Neptune (3), Eatontown (2), Long Branch (1) and Deal (1) because they may be of interest to Ocean Township residents. Two pending contaminated sites are also listed within Ocean Township, only one of which is included in **Table 5.4.1** and **Figure 5.4.1**. A second site listed as pending is White Swan Laundry Cleaners at 3213 Sunset Avenue. The site is not yet included with the state GIS data for contaminated sites, but is listed on the searchable website (NJDEP SRP, April 2, 2019). The state also lists 425 closed contaminated sites in Ocean Township, which are not included in this report (NJDEP SRP, April 2, 2019). Seven of the closed sites are still listed as active in the GIS data and thus are included in **Table 5.4.1** and **Figures 5.4.1** and **5.4.2**. No sites in Ocean Township are currently on the National Priorities (Superfund) List (USEPA, April 2, 2019).

Homeowner sites are often not included because they generally involve small heating oil discharges from leaking underground storage tanks (USTs) that are resolved relatively quickly.

Table 5.4.1. Active and Pending Known Contaminated Sites in Ocean Township

Site ID	Place Name	Address	Status	Remedial Level
Known Contaminated Sites (KCS)				
615129	244 OVERBROOK AVE LAWN MOWER SHOP	244 OVERBROOK AVE	Active	B
205636	CINDY LANE FAMILY HOUSING	W CINDY LN & CLEARVIEW DR	Active	B
505011	JCP&L TRANSFORMER: 259 OVERBROOK AVE.	259 Overbrook Ave.	Active	B
577778	13 BLAIR COURT	13 BLAIR CT	Active	C1
624562	14 CHRISTY LANE	14 CHRISTY LN	Active	C1
90206	4 OAKWOOD AVE	4 OAKWOOD AVE	Active	C1
84894	402 LINCOLN DRIVE	402 LINCOLN DR	Active	C1
624846	57 MONMOUTH ROAD	57 MONMOUTH RD	Active	C1
15243	GULF	1418 RT 35	Active	C1

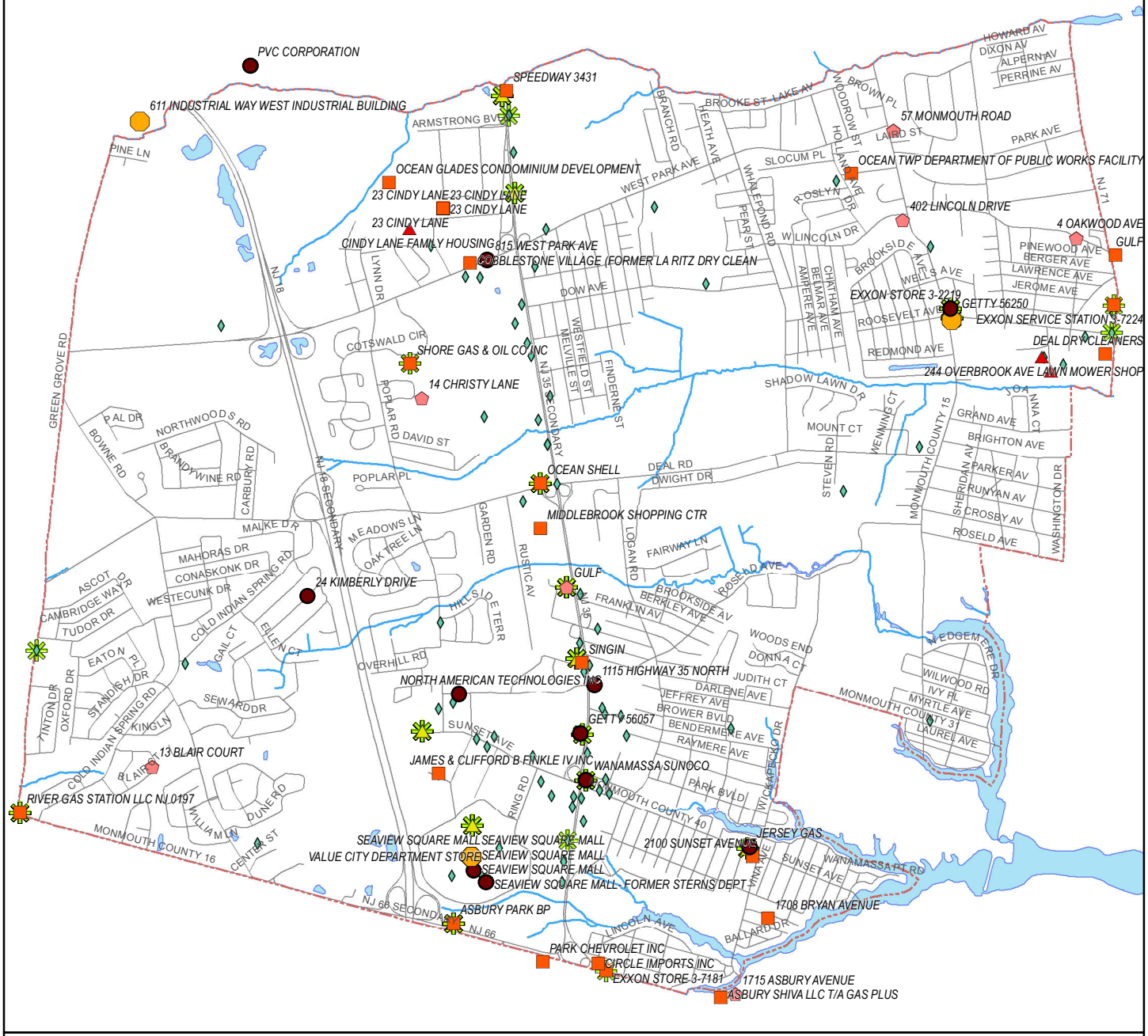
Site ID	Place Name	Address	Status	Remedial Level
455101	1708 BRYAN AVENUE	1708 BRYAN AVE	Active	C2
30462	23 CINDY LANE	23 CINDY LN	Active	C2
33262	23 CINDY LANE	23 CINDY LN	Active	C2
67680	23 CINDY LANE	23 CINDY LN	Active	C2
213972	23 CINDY LANE	23 CINDY LN	Active	C2
307318	23 CINDY LANE	23 CINDY LN	Active	C2
383952	23 CINDY LANE	23 CINDY LN	Active	C2
402787	23 CINDY LANE	23 CINDY LN	Active	C2
409282	23 CINDY LANE	23 CINDY LN	Active	C2
450037	23 CINDY LANE	23 CINDY LN	Active	C2
4195	ASBURY PARK BP	2415 ASBURY AVE RT 66	Active	C2
52230	CIRCLE IMPORTS INC	725 RTE 35	Active	C2
477247	JAMES & CLIFFORD B FINKLE IV INC	1001 HOPEWELL AVE	Active	C2
85192	MIDDLEBROOK SHOPPING CTR	816 DEAL RD	Active	C2
66923	OCEAN GLADES CONDOMINIUM DEVELOPMENT	WEST PARK AVE REAR	Active	C2
4203	OCEAN SHELL	805 DEAL RD & RT 35	Active	C2
17131	OCEAN TWP DEPARTMENT OF PUBLIC WORKS FACILITY	BEECROFT & LARKIN PLS	Active	C2
15624	SHORE GAS & OIL CO INC	1630 1636 POPLAR RD	Active	C2
4204	GETTY 56250	207 MONMOUTH RD	Active	D
51138	SEAVIEW SQUARE MALL	2301 RT 66	Active	D
59302	SEAVIEW SQUARE MALL	2301 RT 66	Active	D
93953	SEAVIEW SQUARE MALL	2301 RT 66	Active	D
185274	SEAVIEW SQUARE MALL	2301 RT 66	Active	D
59302	VALUE CITY DEPARTMENT STORE	2333 RT 66	Active	D
68021	24 KIMBERLY DRIVE	24 KIMBERLY DR	Pending	
Known Contaminated Sites which are Classification Exemption Areas (CEA)				
372483	2100 SUNSET AVENUE	2100 SUNSET AVE	Active	C2
4190	COBBLESTONE VILLAGE (FORMER LA RITZ DRY CLEAN	821 W PARK AVE	Active	C2
490789	EXXON SERVICE STATION 3-7224	236 NORWOOD AVE	Active	C2
4179	EXXON STORE 3-7181	RTE 35 & ASBURY CIR	Active	C2
4187	JERSEY GAS	2101 SUNSET AVE	Active	
4206	RIVER GAS STATION LLC NJ 0197	2901 ASBURY AVE AKA 1802	Active	C2
4197	SINGIN	1120 RT 35 S	Active	C2
4180	SPEEDWAY 3431	2137 HWY 35 N	Active	C2
519137	1115 HIGHWAY 35 NORTH	1115 HWY 35 N	Closed	
83456	815 WEST PARK AVE	815 W PARK AVE	Closed	
4174	EXXON STORE 3-2219	203 MONMOUTH RD	Closed	
4193	GETTY 56057	RT 35 & SUNSET AVE	Closed	
13598	NORTH AMERICAN TECHNOLOGIES INC	3504 ROSE AVE	Closed	
51138	SEAVIEW SQUARE MALL- FORMER STERNS DEPT	RTE 35 & 66	Closed	
4194	WANAMASSA SUNOCO	1001 RT 35	Closed	

Remedial Levels:	
B	Single-phase remedial action in response to a single contaminant category affecting only soils. May be a subsite of a more complex case. Does not include ground water investigation or remediation.
C1	A remedial action which does not involve formal design where the source is known/identified. May include the potential for (unconfirmed) ground water contamination.
C2	A remedial action which consists of a formal engineering design phase, and is in response to a known

Site ID	Place Name	Address	Status	Remedial Level
	source or release. Since the response is focused in scope and address a known, presumably quantifiable source, this remedial level is of relatively shorter duration than responses at sites of higher remedial levels. Usually involves cases where ground water contamination has been confirmed or is known to be present.			
D	A multi-phased remedial action in response to multiple, unknown and/or uncontrolled sources or releases affecting multiple medium which includes known contamination of ground water. In this remedial level, the contamination is unquantified and, therefore, no determinable timeframe for the conclusion of the remedial actions is known.			
Sources: Data - NJDEP SRP, February 14, 2019a; NJDEP SRP, March 17, 2019; Remedial Levels - NJDEP SRP. March 6, 2007				

5.4.2 Classification Exception Areas (CEA)

The Ground Water *Classification Exception Area* (CEA) dataset identifies those sites where ground water contamination has been identified and the NJDEP has established a Classification Exception Area (CEA). CEAs are institutional controls in geographically defined areas within which the New Jersey Ground Water Quality Standards (NJ GWQS) for specific contaminants have been exceeded. When a CEA is designated for an area, the constituent standards and designated aquifer uses are suspended for the term of the CEA. This data is intended to provide information to the public regarding areas of contaminated ground water to prevent inappropriate well placement, preventing potential health risks and can minimize unintended contaminant plume migration (NJDEP SRP, February 14, 2019a). Fifteen of the Known Contaminated Sites listed in **Table 5.4.1** are CEAs. Locations of the CEA sites are shown in **Figure 5.4.2**.



Legend

- Ocean Township
- Water
- Roads

Known Contaminated Sites (remedial level)

- not specified
- B
- C1
- C2
- D

Regulated UST Status (as of April 2019)

- Inspection Conducted
- Effective
- Terminated

N

0 0.25 0.5 1 Miles

Data Sources: NJDEP, NJDOT

Disclaimer required for NJDEP Data: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Kratzer Environmental Services
Ocean Township ERI 2019

Figure 5.4.1. Contaminated Sites and Regulated Underground Storage Tanks Ocean Township, Monmouth County

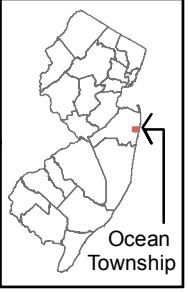
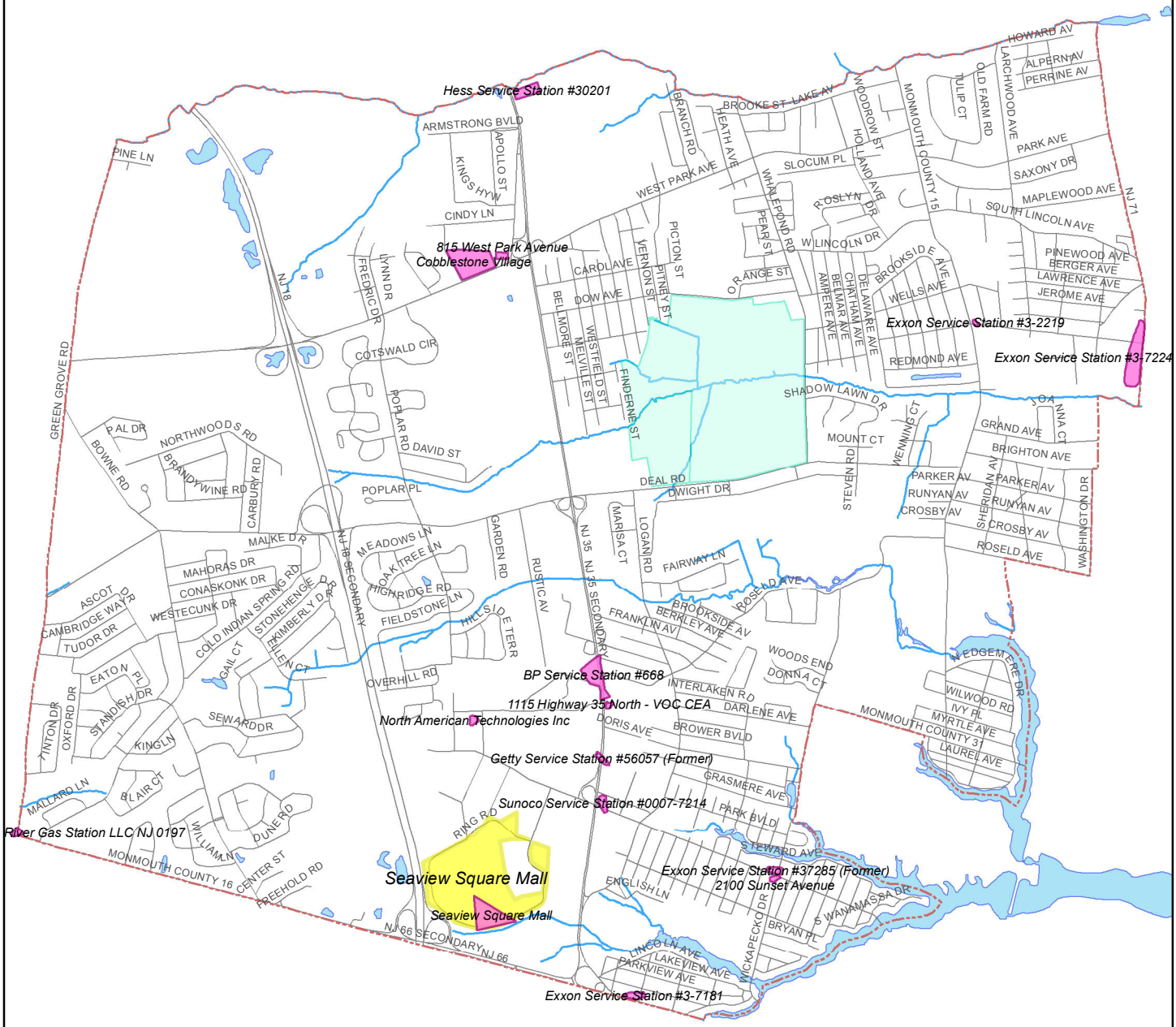


Table 5.4.2 Classification Exception Areas

Pref. ID	Name Address	Block Lot	Program	Established	Description	Formation	Contaminant of Concern
G00003 4917	815 West Park Ave	1.05-5	POST	2001-06-01	CEA encompasses 140 ft wide by 270 ft long area (0.66 acres); depth is 50'.	Vincentown	PCE
255956	Cobblestone Village (Former La Ritz Dry Clean) 821 W Park Ave	1.05-6	RAP	2016-10-04	Residual PCE remaining in two monitoring wells on-site, GW flow SE, depth is 15'; horizontal extent 7.5 acres	Cape May	PCE
461404	2100 Sunset Avenue	111-13	RAP	2016-09-27	A 0.568 acre CEA for Tetrachloroethene; depth is 25'; GW flow is NE	Cape May	PCE
007981	Exxon Service Station #3-7285 (Former) 2101 Sunset Ave	114-3; 99-5; 99-6	RAP	2003-07-02	The CEA is for VOC ground water contamination at the site. The horizontal extent of the CEA is approximately 0.76 acres and the vertical depth of the CEA is 9 ft bgs. Ground water flow is to the east.	Kirkwood	Benzene TBA TICS
011690	River Gas Station LLC NJ 0197 2901 Asbury Ave	123-53.01; 128.03 - 29.01; 318-20; 37-18	LSRP	2018-10-26	The CEA encompasses 0.58 acres and extends off-site to a depth of 35 feet bgs. GW flow is N-NW; The CEA extent is projected.	Kirkwood	Benzene TICS Ethylbenzene, Toluene, Xylenes (total)
014553	Wanamassa Sunoco Sunoco Service Station #0007-7214 1001 Route 35	137-28; 217-1; 217-2	RAP	2007-11-05	The CEA is for benzene ground water contamination that extends off-site under Sunset Ave, Block 217, Lot 2, & Block 137, Lot 4. The horizontal extent of the CEA is 0.84 acres. Depth is 20'; Ground water flow is SE.	Kirkwood	Benzene
007367	Exxon Service Station #3-7181 Route 35 & Asbury Cir	140.17 -1; 140.18 -5; 140.18 -6; 140.18 -7; 140.18 -8	LSRP	2007-03-06	0).95 acre site from pump islands northward and eastward, adjacent lot northward from pump islands to about 50 feet into lot and eastward to Overbrook Avenue, and roughly 40 feet of Overbrook Avenue right-of-way	Kirkwood	Benzene MTBE Ethylbenzene, Toluene, Xylenes (total)
015791	Seaview Square Mall Route 35 & Route 66	141-1	RAP	2013-03-07	CEA is for benzene. Horizontal extent is 240,000 square feet (5.8 acres). Vertical depth is 23.64 feet above msl. GW flow is SE	Kirkwood	Benzene
008381	Exxon Service Station #3-2219 203	18.01-1; 19-1; 19-2; 18.01-	RAP	1997-06-03	CEA for MTBE, TBA and total TICs extends from source in southeast direction across Roosevelt Ave to distance of	Manasquan	MTBE TBA TICS

Pref. ID	Name Address	Block Lot	Program	Established	Description	Formation	Contaminant of Concern
	Monmouth Rd	1; 19-1; 19-2			approximately 106 ft.; dept is 58'; GW flow is S.		
007757	North American Technologies Inc3504 Rose Ave	183-1; 183-3; 183-7	RAP	2011-08-09	The CEA consists of a 23,522.4 square foot area with a vertical depth of 30 feet. Flow is N-NE; Contaminants include Xylenes, Ethyl Benzene and Toluene.	Kirkwood	Ethylbenzene, Toluene, Xylenes (total)
001665	Getty Service Station #56057 (Former) Route 35 & Sunset Ave	187-1.01; 216-6; 216-7; 216-8	RAP	2017-01-03	The CEA is located on the Central and eastern portion of the site and extends beneath the right of way of Route 35 to two undeveloped parcels (Block 216, Lot 6 & 7) and onto a comercial propertry (L8); depth is 22 feet; flow is SE	Quaternary Age	Benzene
000964	BP Service Station #6681120 Route 35 S	190-4; 190-5; 191-7; 191-8; 191-9; 209-15	LSRP	1999-05-14	The CEA boundaries include the site and extend offsite to the north and northwest and also offsite to the south and southeast. Estimated area is 140,000 square feet. Depth is 50'; Flow is SE	Kirkwood	Benzene MTBE TBA TICS Ethylbenzene, Toluene, Xylenes (total)
652144	1115 Highway 35 North1115 Highway 35 North - VOC CEA	209-14	RAP	2018-05-30	The CEA covers approximately 13,202 square feet horizontally and does not extend off-site. The CEA follows variable ground water flow. Depth is 25 feet; flow direction is variable	Cape May	Benzene Dichloroethane (1,2-)
006680	Hess Service Station #302012137 Hwy 35 N	3-1.01	LSRP	2015-02-08	The Proposed CEA extends to the property boundary of the subject site to the north and west. To the east to the Ray Catena parking lot and Weltz Park Depth is 50'. Flow is variable. 2 acres.	Vincentown	Benzene MTBE Ethylbenzene, Toluene, Xylenes (total)
002066	Exxon Service Station #3-7224 236 Norwood Ave	See report	LSRP	1998-04-22	The aeral extent iis shown by the CEA/WRA locaton map. The CEA begins on-site and extends for approximately 1,200 feet to the south. Depth is 70'; GW flow is S. Area is 6.6 acres.	Vincentown	Benzene MTBE TBA Naphthalen Lead Ethylbenzene, Toluene, Xylenes (total)
Source: NJDEP SRP, February 14, 2019a							



Legend

- Ocean Township
- Roads
- Water
- Deed Notice Extent - Seaview Square Mall (2019)
- Classification Exception Areas (2019)
- Deal Test Site - somewhere in Palaia Park

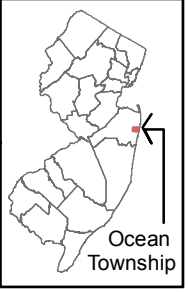
N

0 0.25 0.5 1 Miles

Data Sources: NJDEP, NJDOT
Disclaimer required for NJDEP Data: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Kratzer Environmental Services
Ocean Township ERI 2019

Figure 5.4.2. Deed Notice and Classification Exception Areas Ocean Township, Monmouth County



5.4.3 Deed Notice: Seaview Square Shopping Mall / Former M&T Delisa Landfill

A *Deed Notice* is defined by NJSA 58:10B-13a as a "...notice to inform prospective holders of an interest in the property that contamination exists on the property at a level that may statutorily restrict certain uses of, or access to, all or part of that property...." The purpose of the deed notice GIS layer is to minimize any chance of exposure to contaminants remaining on the property (NJDEP, February 14, 2019b). There is one Deed Notice delineated within the Township of Ocean, described below, in **Table 5.4.2** and shown on **Figure 5.4.2**.

Table 5.4.2. Deed Notice: Seaview Square Mall

Name and Location	Preferred ID Number	ACTIVITY	Date Filed	Contaminants of Concern	Acres
Seaview Square Mall 2301 Route 66 Block 141 Lot 1	781709	RAP (Soil Remedial Action Permit)	11/21/2007	Benzo[a]anthracene Benzo[a]pyrene Benzo[b]fluoranthene Polychlorinated Biphenyls (PCBs)	66.5
Source: NJDEP SRP, February 14, 2019b					

As noted in Chapter 4, the Seaview Square Shopping Mall was developed during the 1970s at the location of a historic waste disposal site (Stephens, 2009). The M&T Delisa Landfill operated from 1945 to 1975 and was only permitted to be utilized for municipal waste. Although the mall was built on clean fill in 1976, the parking lot sat on garbage and a leachate collection system and methane vents were installed during construction. Nevertheless, the Environmental Protection Agency (EPA) detected ground water, surface water and soil contamination by polynuclear aromatic hydrocarbons and metals in 1981, noting potential impacts to both private wells and Deal Lake (USEPA, September 8, 1983). The site was added to the National Priorities (Superfund) List in December 1982. A subsequent study of the extent of contamination did not find significant concentrations of hazardous contaminants, and the EPA recorded a decision of No Action (USEPA, 1990). In March 1991, the former landfill was deleted from the Superfund list, and turned over to New Jersey to be addressed under state regulations (USEPA, 2018).

5.4.4 Deal Test Site

The second historic waste disposal location at Deal Test Site reported by Stephens (2009) does not appear in the state databases of contaminated sites in Ocean Township. However, it is included in some documents related to cleanups at formerly used defense sites. The Deal Test Site was utilized by the U.S. Army Electronics command from the mid-1950s until June of 1973, serving as an important communications center for the monitoring of satellites and missiles (U.S. Army, 2010). The U.S. Army Corps of Engineers (September 30, 2015) categorizes the Deal Test Site as HTRW (Hazardous, Toxic and/or Radioactive Waste). Additional detail is provided by Groeger et al. (2017), who pinpoint Joe Palaia Park and the surrounding area as High Risk for contamination of groundwater, sediment, soil and surface water. Cleanup of the site is slated for completion by the Department of Defense in September of 2021 (Groeger et al., 2017).

5.4.5 Hazardous Substance Storage and Use

A *hazardous material/substance* is defined broadly by the Township of Ocean to include any material, solid, liquid or gas, listed as such under Federal statutes, hospital waste, and any material warranting removal or cleanup in the opinion of the Township of Ocean.

Ocean Township's ordinance, CHAPTER XXVII HAZARDOUS MATERIALS prohibits the discharge of hazardous substances. The ordinance requires that responsible parties must reimburse the township for all costs associated with "mitigating, controlling, or containing any incident in which a hazardous

material is involved in a fire, leak, release or spill, or where the potential thereof exists, or for the prevention of same."

This chapter also provides for penalties for violations such as committing a fire, leak, release or spill or for failure to report the same (Township of Ocean, 2014).

5.4.6 Underground Storage Tanks

Underground Storage Tanks (USTs) are regulated by NJDEP under N.J.A.C. 7:14B. This rule defines UST as a tank, or combination of tanks (and related equipment), used to contain an accumulation of hazardous substances, that is 10 percent or more beneath the surface of the ground (NJDEP, August 6, 2018). A GIS layer was developed to assist NJDEP Site Remediation and Enforcement programs in their efforts to manage UST facility registrations and inspections. Unregulated USTs (i.e. residential tanks) are not included in the map and the LSRP program does not apply to unregulated USTs (see **Internet Resources**).

The current GIS layer[19] lists 227 regulated USTs within Ocean Township (see **Figure 5.4.1)**. Of these, 81 have been terminated, which means that all regulated USTs at the facility are closed and/or abandoned in place. The 12 marked "Effective" are in compliance and are active. For the remaining 134 facilities, an UST compliance inspection has been conducted by NJDEP Water Quality Enforcement inspectors or by staff from the local county health agency (NJDEP SRP, December 28, 2018; NJDEP, March 20, 2019).

5.5 POLLUTION

5.5.1 Point Source Pollution

Point source pollution (as defined by N.J.A.C. 7:9B Surface Water Quality Standards) refers to discernible, confined, and discrete conveyance, including, but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, landfill leachate collection system, vessel, or other floating craft, from which pollutants are or may be discharged. This term does not include return flows from irrigated agriculture (NJDEP, October 17, 2016).

Point source discharges are regulated by NJDEP under the New Jersey Pollutant Discharge Elimination System (NJPDES). There are two existing discharges within or on the border of Ocean Township, as well as three former (revoked) discharges (see **Table 5.5.1** and **Figure 3.4.2**) (NJDEP, NJDEP, January 9, 2019).

New Jersey regulates the discharge of pollutants to ground water under the authority of the New Jersey Water Pollution Control Act (WPCA) N.J.S.A. 58:10A. The New Jersey Pollutant Discharge Elimination System (NJPDES) permit program regulations are contained in N.J.A.C. 7:14A (NJDEP, January 5, 2009).

NJPDES permits are required for discharges to ground water of both sanitary and industrial wastes. These permits, which limit the mass and/or concentration of pollutants discharged, are issued to sanitary and industrial facilities that have ongoing, operational discharges of wastewater to ground water. The purpose is to restrict the discharge of pollutants to the ground waters of the state and protect the public health and the environment. Discharges from past activities may continue to be regulated under the Site Remediation Program or the Division of Solid and Hazardous waste.

There are three regulated facility locations within Ocean Township, described below in **Table 5.5.2** and shown on **Figure 3.4.2** (NJDEP DWQ BNPC, July 18, 2007).

[19] The database is updated weekly, and was accessed April 4, 2019 for this report. Additional UST facilities may exist, that are not included in the map. Current information may be viewed using NJ-GeoWeb at https://www.nj.gov/dep/gis/geowebsplash.htm. Select "Site Remediation Program" from the list.

Table 5.5.1 NJ Pollution Discharge Elimination System (NJPDES) Surface Water Discharges

Status*	NJPDES ID	Facility Name	Discharge Type*	Discharge Class	Receiving Waters
Existing	NJ0025241.001A	Asbury Park WTP	A	Major	Atlantic Ocean
	NJ0024520.001A	Township of Ocean SA	A	Major	Atlantic Ocean
Revoked (no longer existing)	NJG0174173.001A	Former Getty Service Station #56057	B4B	Minor	Deal Lake via unnamed trib./storm sewer
	NJ0069477.001A	Takanassee Beach Club	B	Minor	Lake Takanassee
	NJG0173657.001A	Hess Station #30302 (former)	B4B	Minor	Deal Lake via storm sewer

***Notes for Above Codes** (NJDEP's codes and definitions were used):
Status: **E**=Existing in the Point Source Permitting Regions; **R**=Revoked/Terminated - Pipe no longer permitted for discharge
Discharge Type: **A**= Domestic Surface Water Discharge; **B**= Industrial/Commercial/Thermal Discharge This individual NJPDES DSW permit is issued to those facilities that discharge treated and non-treated wastewater derived from, but not limited to process and non-process wastewater, contact and non-contact cooling water and storm water run-off; **B4B**= GW Petroleum Products Cleanup GP, This general permit authorizes discharges of treated groundwater from petroleum leaks (i.e. fuel oil, diesel fuel, kerosene, aviation fuel, and gasoline) to select surface waterbodies.

Source: NJDEP, January 9, 2019; NJDEP Bureau of Surface Water Permitting, March 18, 2019

Table 5.5.2 NJ Pollution Discharge Elimination System (NJPDES) Regulated Facility Locations

Preferred ID	NJPDES	FACILITY Name	Discharge Type*
48423	NJG0117668	WASTE MANAGMENT OF NJ INC	5G2
46898	NJ0021849	SHORE GAS & OIL CO.	RF
46728	NJG0158020	OCEAN TWP SA	5G2

***Notes for Above Codes** (NJDEP's codes and definitions were used):
Discharge Type: **5G2**: This category includes industrial facilities, which have a regulated industrial activity or have materials onsite, which may degrade stormwater quality.
RF: This category includes facilities that cannot eliminate exposure of pollutants to stormwater.

NJDEP, July 18, 2007

5.5.2 Nonpoint Source Pollution

Nonpoint source or NPS pollution is any man-made or man-induced activity, factor, or condition, other than a point source, from which pollutants are or may be discharged. Nonpoint pollution may temporarily or permanently change any chemical, physical, biological, or radiological characteristic of water from what was or is the natural, pristine condition of such water.

Approximately 36% of Ocean Township is impervious surface (NJDEP, September 30, 2018).

Impervious surfaces are materials that prevent the infiltration of water into the soil (e.g. parking lots, roads, buildings, sidewalks and compacted soil). The construction of impervious surfaces disrupts the natural water cycle, and is one of the more significant landscape impacts attributable to urbanization (Hasse and Lathrop, December 2016). When water flows off impervious surfaces, it is known as *stormwater*. Nonpoint source pollution is directly associated with stormwater.

An increase in impervious surface results in less water infiltrating to the soil and ground water, which instead runs off the surface and gains velocity. As the velocity of water increases, the amount that can infiltrate into the soil and ground water is reduced and scouring and erosion increase. The

stormwater eventually discharges into streams and rivers, carrying pollutants that it has picked up along the way (e.g. trash, used motor oil, sediments, fertilizers, pesticides, pet droppings, etc.). The transport of these pollutants into local water bodies can result in the destruction of fish, wildlife, and habitats; threats to public health due to contaminated food and drinking water supplies; and losses of recreational and aesthetic values. In addition, increased stormwater results in greater frequency and magnitude of floods (Hasse, and Lathrop, December 2016; Kaplan and Ayers, April 5, 2000).

Studies have shown that the level where impacts begin to be seen is above 10% impervious surfaces, and that impacts become severe over 25 to 30% (Kaplan and Ayers, April 5, 2000). NJDEP determined approximate percent impervious surface based on particular land uses. Using the approximation calculated using the 2015 land use data, Ocean Township is 36% impervious (2,560 acres) (see **Figure 5.5.2)** (NJDEP, September 30, 2018). Stormwater management is covered in **Section 4.3**.

5.5.3 Landfill Odor

The Monmouth County Reclamation Center (MCRC) has been in operation since 1976 and is the disposal site serving all 53 municipalities in Monmouth County. This 900 acre landfill is located in Tinton Falls less than 2 miles west of Ocean Township. In addition to collecting household solid waste, recycling and household hazardous waste, MCRC has two Gas-to-Energy facilities that collect the methane landfill emissions and convert the gas to energy (MCRC, June 30, 2019).

Recent odor problems are the result of landfill gas (decomposing trash, and from the "fresh" trash being delivered), leachate seeps and the Phase 3 Slope Repair Project. For this project, 11 acres has been exposed, the landfill gas collection system has been disconnected and has been exacerbated by the above normal rainfall during 2018. Repairs, upgrades and mitigation are expected to alleviate the odor by summer 2019. According to the MCRC website,

> "Over $5,000,000 has been spent to date on landfill gas controls, but the nature of the landfill operation can, on occasion, lead to odor problems. The major sources of odors are gases from the decomposing trash, and from the "fresh" trash being delivered. A sophisticated gas collection system (collected gas is then used to create electricity) is added to each new disposal area as it is developed. Negative air flow and fabric/charcoal filters are used in the receiving building to capture and minimize odors from daily trash deliveries." (MCRC, June 30, 2019)

5.6 ENVIRONMENTALLY CRITICAL AREAS

Throughout this document, many environmental and natural features of the Township of Ocean have been documented, described and mapped. One of the greatest values of mapping with GIS is to easily combine features in new ways. To accomplish this, **Figure 5.6.1** combines some of the mapped layers from previous sections, displaying features that make an area environmentally critical together on one map.

A useful definition of an "environmentally critical area" is provided in the Stormwater Management regulations (N.J.A.C. 7:8):

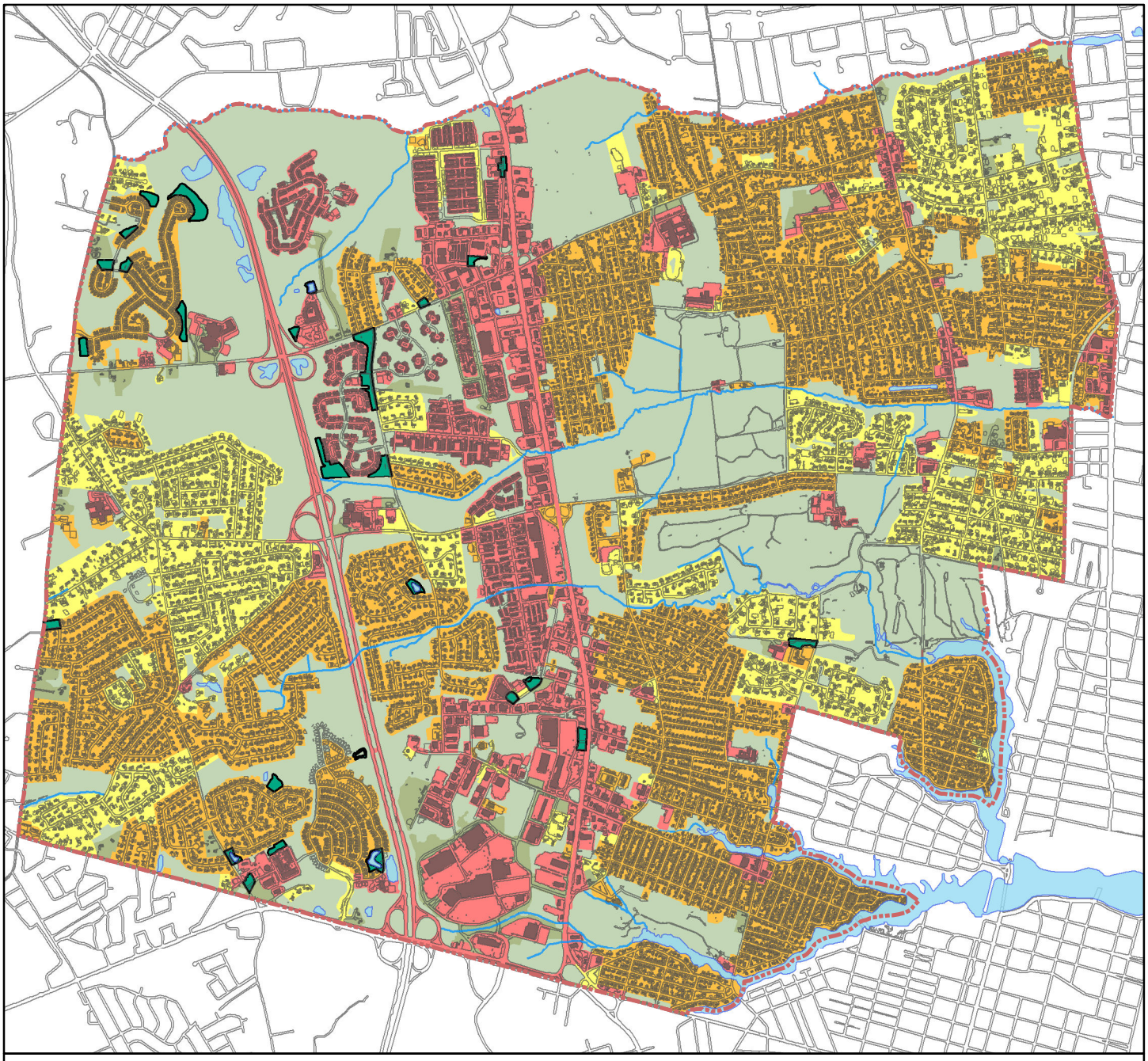
> " 'Environmentally critical area' means an area or feature which is of significant environmental value, including, but not limited to: stream corridors; natural heritage priority sites; habitats of endangered or threatened species; large areas of contiguous open space or upland forest; steep slopes; and well head protection and groundwater recharge areas. Habitats of endangered or threatened species are identified using the Department's Landscape Project as approved by the Department's Endangered and Nongame Species Program." (NJDEP, June 20, 2016)

Figure 5.6.1 combines the following:

- Steep Slopes > 15% (see S**ection 3.3.3**)
- Potential Erosion Hazard - Road / Trail (see **Section 3.3.6**)
- Streams and waterbodies (see S**ection 3.4.1**)
- Floodplains (see S**ection 3.4.4**)
- Wetlands[20] (see S**ection 3.5**)
- 50 foot wetlands buffers[20] (see S**ection 3.5**)
- Natural Heritage Grid – general location of a known rate plant species (see S**ection 3.6.2**)
- Potential Century Forests (see S**ection 3.6.4**)
- Rare, threatened and endangered animal habitat (Rank 3 and 4 habitats from Landscape Project version 3.3) (see S**ection 3.7.2**)
- Potential Vernal pools and habitat (Landscape Project version 3.3) (see S**ection 3.7.2**)
- Open space (see S**ection 3.8**)

Refer to the sections referenced above for more information about each individual layer and to **Appendix B** for the sources of GIS layers

[20] Wetlands and wetlands buffers are based on 2012 Land Use data, which is based on aerial photography. Note that an LOI from NJDEP is necessary to determine actual boundary of wetlands and wetland buffers.



Legend

- Ocean Township
- Water
- Buildings, impervious
- Road edges and other impervious
- STORMWATER BASIN

Impervious Surface

- 0 to 5%
- 5 to 10%
- 10 to 25%
- 25 to 50%
- 50 to 100%

Percent Impervious	Acres	Percent of Ocean Twp.
0 to 5%	2323	33%
5 to 10%	162	2%
10 to 25%	1131	16%
25 to 50%	2322	33%
50 to 100%	1093	16%
Total	7030	100%
Based on 2012 Land Use		

N

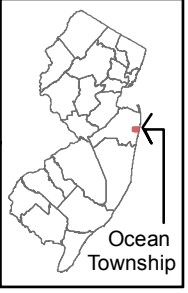
0 0.25 0.5 1 Miles

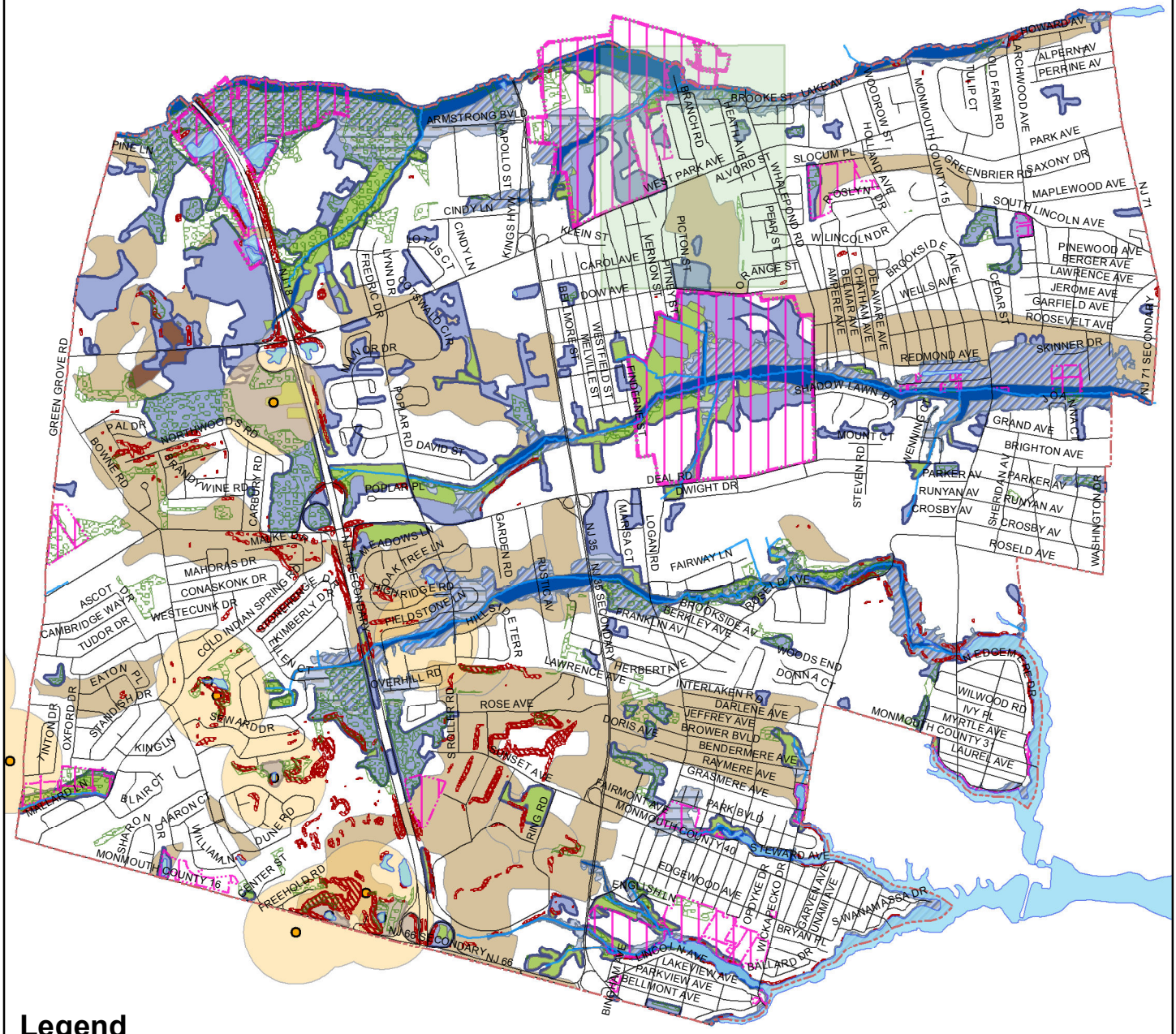
Data Sources: NJDEP, NJDOT, Monmouth County
Disclaimer required for NJDEP Data: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Kratzer Environmental Services
Ocean Township ERI 2019

Figure 5.5.2. Impervious Surface Ocean Township, Monmouth County

According to the NJDEP's impervious surface analysis of the 2015 Land Use data, Ocean Township has 2,560 acres of impervious surfaces, which is 36% of the township.





Legend

- Ocean Township
- Roads
- Water
- Preserved Open Space
- General Location of Rare Plant
- Potential Century Forests
- Steep slopes > 15%
- Potential vernal pool location
- Potential vernal habitat
- Erosion hazard - severe
- Erosion hazard - moderate
- Landscape Project Rank 3
- Landscape Project Rank 4
- Wetlands (2012 Land Use)
- 50' wetlands buffer may apply

FEMA Flood Hazard Subzone

- Floodway
- 1% annual chance
- 0.2 % annual chance

N

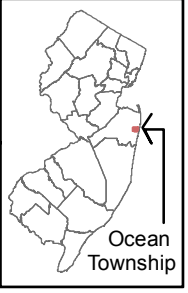
0 0.25 0.5 1 Miles

Data Sources: NJDEP, NJDOT, Monmouth County GIS
Disclaimer required for NJDEP Data: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Kratzer Environmental Services
Ocean Township ERI 2019

Figure 5.6.1. Environmentally Critical Areas
Ocean Township, Monmouth County

This Environmentally Critical Areas map is based on a combination of the following: steep slopes, flood zones, waterways, wetlands, century forests, rare plant or animal species, vernal pools.



5.7 DEVELOPMENT LIMITATIONS

In practical terms, physical characteristics of land, such as steep slopes, erodible soils and flood prone areas present challenges to development. Ignoring these environmental features and natural processes can cause or contribute to environmental damage that causes problems to property owners, residents and to surrounding or downstream areas.

"On America's first official "Earth Day" — April 22, 1970, the New Jersey Department of Environmental Protection was born."
(NJDEP, https://www.nj.gov/dep/about.html)

The New Jersey Department of Environmental Protection (NJDEP) is the state government agency responsible for administering environmental protection and conservation efforts, managing natural resources and solving pollution problems. Various NJDEP regulations and rules are touched on throughout this report as a starting point (see **Internet Resources**).

In the State of New Jersey, the Municipal Land-Use Law (MLUL) (Chapter 291, Laws of N.J. 1975 as amended) is the legislative foundation of municipal Planning Boards and Zoning Boards of Adjustment. The MLUL defines the powers and responsibilities of boards and is crucial to their functions and decisions.

References: Environmental Issues

Health - Air

NJDEP Air Toxics in NJ. April 4, 2019. Predicted Levels Compared To Monitor Data. https://www.state.nj.us/dep/airmon/airtoxics/Monitor.htm. Accessed April 4, 2019.

NJDEP Air Toxics in NJ. January 8, 2019. NJDEP Air Toxics Program. http://www.state.nj.us/dep/airmon/airtoxics/njatp.htm

NJGS. 2015. New Jersey Radon Potential Map. https://www.state.nj.us/dep/rpp/radon/radonin.htm. Accessed April 4, 2019.

Steering Committee of the New Jersey Comparative Risk Project. March 2003. Final Report of the New Jersey Comparative Risk Project. 213 pages. http://www.state.nj.us/dep/dsr/njcrp/lacombe

U.S. Environmental Protection Agency (USEPA). National Air Toxics Assessment 2014 NATA: Assessment Results. https://www.epa.gov/national-air-toxics-assessment/2014-nata-assessment-results. Accessed March 30, 2019.

Health – Water

NJDEP Geological and Water Survey. December 2004. Source Water Assessment Program (SWAP). https://www.state.nj.us/dep/watersupply/swap/index.html

NJDEP Division of Science and Research. 2018. Fish Smart, Eat Smart: A Guide to Health Advisories for Eating Fish and Crabs Caught in New Jersey Waters. https://www.state.nj.us/dep/dsr/njmainfish.htm and http://njdep.maps.arcgis.com/apps/MapJournal/index.html?appid=922dff1885394cf19ccf1d9c8d52b4f0

NJDEP Division of Water Monitoring and Standards. January 7, 2019. Harmful Algal Blooms. https://www.state.nj.us/dep/wms/HABS.html. Accessed April 4, 2019.

NJDEP Division of Water Supply and Geoscience. March 26, 2019. Private Well Testing Act (PWTA). http://www.nj.gov/dep/watersupply/pw_pwta.html. Accessed April 4, 2019.

NJDEP Water Supply and Geoscience. https://www.state.nj.us/dep/watersupply/dwc-lead.html. Accessed April 4, 2019.

NJ Department of Health (NJDOH). No Date. Drinking Water Facts: Lead. https://www.nj.gov/health/ceohs/documents/dw_lead_factsheet.pdf

Steering Committee of the New Jersey Comparative Risk Project. March 2003. Final Report of the New Jersey Comparative Risk Project. 213 pages. http://www.nj.gov/dep/dsr/njcrp/

Health – Ticks and Mosquitoes
Freehold Township. 2007. Tick-borne Disease and Ecology Control: Ticks of New Jersey. http://twp.freehold.nj.us/ticks/public/types_of_ticks_nj/blacklegged.html. Accessed April 4, 2019..

Monmouth County. 2019. Mosquito Control Division. https://co.monmouth.nj.us/page.aspx?ID=2858. Accessed April 4, 2019.

NJ Department of Health. 2018. Communicable Disease Service. https://www.nj.gov/health/cd/topics/eee.shtml. Accessed Accessed April 4, 2019.

Tapinto Horses. 2018. Equine health alert: Another Monmouth County N.J. Horse contracts EEE. 11 September 2018. https://www.tapinto.net/articles/equine-health-alert-another-monmouth-county-n-j-horse-contracts-eee. Accessed April 4, 2019.

U.S. Department of Agriculture (USDA). 2018. National *Haemaphysalis longicornis* (longhorned tick) Situation Report – August 29, 2018. https://www.state.nj.us/dep/fgw/pdf/2018/longhorntickupdate8-18usda.pdf

Noise
NJDEP. 2017. Noise Control Act of 1971. http://www.state.nj.us/dep//enforcement/noise-control.html. Accessed April 4, 2019.

Township of Ocean. 2017. Revised general ordinances of the Township of Ocean. Chapter 3 – General Police Regulations. 3-3 Regulation of Noise Nuisances Monmouth County, N.J. https://clerkshq.com/OceanTownship-nj. Accessed June 26, 2019.

U.S. Department of Transportation, Federal Highway Administration (USDOT, FHA). April 2006. Highway Traffic Noise in the United States Problem and Response. FHWA-HEP-06-020. https://www.fhwa.dot.gov/environment/noise/regulations_and_guidance/probresp.cfm

Washington County Noise Control Task Force (NCTF). July 2005. Report and Recommendations of the Washington County Noise Control Task Force (NCTF) Volume II Resource Documents. 71 pages. http://www.wcnctf.org/docs/Volume_II_Final_Report.pdf

Light
Drake, N. 2019. Our nights are getting brighter, and Earth is paying the price. National Geographic. April 3, 2019. https://www.nationalgeographic.com/science/2019/04/nights-are-getting-brighter-earth-paying-the-price-light-pollution-dark-skies/

Gauthreaux, Jr., S.A. and C.G. Belser. 2006. Effects of artificial night lighting on migrating birds. In Rich and Longcore, eds. Ecological consequences of artificial night lighting. Island Press, Washington, DC. https://ecfsapi.fcc.gov/file/6520212189.pdf

International Dark Sky Association. 2016. Light Pollution. Accessed: 3 April 2019. https://www.darksky.org/light-pollution/

Light Pollution Map. Visible Infrared Imaging Radiometer Suite (VIIRS) data mapped by https://www.lightpollutionmap.info. Accessed April 4, 2019.

Rich, C. and T. Longcore. 2006. Ecological consequences of artificial night lighting. Island Press, Washington, DC.

Township of Ocean. 2014. Revised general ordinances of the Township of Ocean. ARTICLE IV ZONING PROVISIONS. 21-46A Outdoor Lighting. Monmouth County, N.J. https://clerkshq.com/OceanTownship-nj or http://oceantwp.org/filestorage/5933/6019/2169_Ordinance_Lighting.pdf. Accessed April 4, 2019.

Contaminated Sites
Groeger, L., R.G. Jones and A. Lustgarten. December 5, 2017. Deal Test Site. From the ProPublica Bombs in our Backyard Series. https://projects.propublica.org/bombs/installation/NJ29799F0978009799

NJDEP. March 20, 2019. Underground Storage Tanks, New Jersey (Envr_NJEMS_site_ust). GIS data. https://gisdata-njdep.opendata.arcgis.com/datasets/underground-storage-tank-facilities-in-new-jersey

NJDEP. Date last amended August 6, 2018. N.J.A.C. 7:14B UNDERGROUND STORAGE TANKS. https://www.nj.gov/dep/rules/rules/njac7_14b.pdf

NJDEP Site Remediation Program (SRP). April 2, 2019. Contaminated Sites in New Jersey Reports. http://www.nj.gov/dep/srp/kcs-nj/. Accessed April 2, 2019.

NJDEP Site Remediation Program (SRP). March 17, 2019. Known Contaminated Site List for New Jersey (Envr_NJEMS_KCSL). GIS data. https://njogis-newjersey.opendata.arcgis.com/datasets/b167bb2ae09c43f8ab9e954700be45d9_0

NJDEP Site Remediation Program (SRP). March 13, 2019. Site Remediation Program. http://www.nj.gov/dep/srp/. Accessed April 1, 2019.

NJDEP Site Remediation Program (SRP). February 14, 2019a. Classification Exception Areas-Well Restriction Areas for New Jersey, Edition 20190214 (Envr_mon_gw_CEA). GIS Data. https://njogis-newjersey.opendata.arcgis.com/datasets/bfd549e193a947e9923492da13c24e4b_11

NJDEP Site Remediation Program (SRP). February 14, 2019b. Deed Notice Extent in New Jersey, Edition 20190214 (Envr_mon_soil_DNA). GIS data. https://njogis-newjersey.opendata.arcgis.com/datasets/njdep::deed-notice-extent-in-new-jersey

NJDEP Site Remediation Program (SRP). December 28, 2018. Underground Storage Tanks (USTs). http://www.nj.gov/dep/srp/bust/. Accessed April 2, 2019.

NJDEP Site Remediation Program (SRP). May 7, 2012. Administrative Requirements for the Remediation of Contaminated Sites and Technical Requirements for Site Remediation. Adopted Amendments, Adopted Repeals and Adopted New Rules. 687 pages. http://www.nj.gov/dep/rules/adoptions/adopt_20120507a.pdf

NJDEP Site Remediation Program (SRP). March 6, 2007. Site Remediation Program Reform Stakeholders Meeting Minutes. Available online: https://www.nj.gov/dep/srp/stakeholders/20070306minutes.pdf

Stephens, Mike. June 4, 2009. Waste Disposal Sites in Monmouth County (map). Monmouth County Health Department. Available online at http://co.monmouth.nj.us/documents%5C121%5CWasteDisposalSites.pdf

Township of Ocean. 2014. Revised general ordinances of the Township of Ocean. CHAPTER XXVII HAZARDOUS MATERIALS. Published by ClerkBase. Monmouth County, NJ. https://clerkshq.com/OceanTownship-nj. Accessed April 4, 2019.

U.S. Army (ed). 2010. A History of Army Communications and Electronics at Fort Monmouth, New Jersey: 1917-2007. U.S. Government Printing Office, Washington, D.C. 193 pages.

U.S. Army Corps of Engineers. September 30, 2015. Formerly Used Defense Sites (FUDS) per State: New Jersey. https://www.usace.army.mil/Portals/2/docs/Environmental/FUDS/FUDS_Inventory/FUDS_Inventory_NewJersey.pdf

USEPA (United States Environmental Protection Agency). April 2, 2019. Search for Superfund Sites Where You Live. https://www.epa.gov/superfund/search-superfund-sites-where-you-live. Accessed April 2, 2019.

USEPA (United States Environmental Protection Agency). October 23, 2018. Superfund Site: M&T Delisa Landfill Cleanup Activities. https://cumulis.epa.gov/supercpad/SiteProfiles/index.cfm?fuseaction=second.Cleanup&id=0200474#bkground

USEPA (United States Environmental Protection Agency). 1990. Superfund Record of Decision: M&T DeLisa Landfill, NJ. https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=9100SBJ7.TXT

USEPA (United States Environmental Protection Agency). September 8, 1983. NPL Site Narrative for M&T - Federal Register Notice. https://semspub.epa.gov/work/HQ/183638.pdf

Point Source Pollution

NJDEP. October 17, 2016. N.J.A.C. 7:9B Surface Water Quality Standards. http://www.nj.gov/dep/rules/rules/njac7_9b.pdf
NJDEP Bureau of Surface Water Permitting. March 18, 2019. Surface Water Permitting Information. http://www.nj.gov/dep/dwq/sw.htm. Accessed March 20, 2019.

NJDEP. January 9, 2019. NJPDES Surface Water Discharges in New Jersey, (1:12,000) Edition 20190110 (Strc_NJPDES_sw_pipe). GIS data. https://gisdata-njdep.opendata.arcgis.com/datasets/2ee12c0ddd344380bcc1f5cfdd5f8128_0

NJDEP. July 18, 2007. New Jersey Pollution Discharge Elimination System (NJPDES) Regulated Facility Locations, Edition 20070718 (Envr_NJEMS_NJPDES_all). GIS data. http://njogis-newjersey.opendata.arcgis.com/datasets/njdep::new-jersey-pollution-discharge-elimination-system-njpdes-regulated-facility-locations

Non-point Source Pollution

Hasse, John and Richard G. Lathrop. December 2016. Changing Landscapes in the Garden State: Land Use Change in New Jersey, 1986-2012.
https://crssa.rutgers.edu/projects/lc/download/NJ_Urb_Growth_III_executive_summary_2012_LathropHasse.pdf

Kaplan, Marjorie and Mark Ayers. April 5, 2000. Impervious Surface Cover Concepts and Thresholds. NJDEP and USGS. 10 pages. https://rucore.libraries.rutgers.edu/rutgers-lib/37000/PDF/1/play/

Maser Consulting. Revised September 2009. Stormwater Management Plan for Township of Ocean, Monmouth County, New Jersey. http://www.oceantwp.org/filestorage/5931/14019/STORMWATER_MANAGEMENT.pdf

NJDEP. September 30, 2018. Impervious Surfaces (2015) of New Jersey, Edition 20180930 (Land_lu_2015_is). GIS data. https://gisdata-njdep.opendata.arcgis.com/items/monmouth-county-impervious-surface-2015-of-new-jersey

NJDEP. February 13, 2017. NJPDES Surface Water Discharges in New Jersey, (1:12,000) Edition 20170213 (Strc_NJPDES_sw_pipe). GIS data. http://njogis-newjersey.opendata.arcgis.com/datasets/2ceba1ef852b4940afc3e0d94fb5d327_6

NJDEP. June 20, 2016. N.J.A.C. 7:8 Stormwater Management Rule. Date last amended: Date last amended: June 20, 2016. http://www.nj.gov/dep/rules/rules/njac7_8.pdf

NJDEP. July 18, 2007. New Jersey Pollution Discharge Elimination System (NJPDES) Regulated Facility Locations, Edition 20070718 (Envr_NJEMS_NJPDES_all). GIS data. http://njogis-newjersey.opendata.arcgis.com/datasets/njdep-non-point-wastewater-sites

NJDEP Bureau of Nonpoint Pollution Control. March 18, 2019. Municipal Stormwater Regulation Program. https://www.nj.gov/dep/dwq/msrp_home.htm. Accessed March 20, 2019.

NJDEP Bureau of Nonpoint Pollution Control. 2009. Municipal Tier Assignments 2009 Under the NJPDES Municipal Stormwater Regulation Program. http://www.nj.gov/dep/dwq/images/mun-tierA-assignments1.jpg

Landfill Odor
Monmouth County Reclamation Center (MCRC). June 30, 2019). Website. https://co.monmouth.nj.us/page.aspx?ID=186 Accessed June 30, 2019.

Critical Environmental Areas
See **Appendix B**.

Development Limitations
NJDEP. https://www.nj.gov/dep/ Accessed April 4, 2019.

NJ Planning Officials. http://njpo.org/NJPO_MLUL.html Accessed April 4, 2019.

Township of Ocean, Monmouth County. http://www.oceantwp.org Accessed April 4, 2019.

Township of Ocean, Monmouth County. Revised general ordinances. https://clerkshq.com/OceanTownship-nj. Accessed April 4, 2019.

Internet Resources: Environmental Issues

Health
Annual Drinking Water Report: http://amwater.com/njaw/water-quality/water-quality-reports/coastal-north

Current Air Quality Index for Monmouth County:
https://airnow.gov/index.cfm?action=airnow.local_city&zipcode=07755&submit=Go

Fish Advisories Home Page: http://www.state.nj.us/dep/dsr/njmainfish.htm

Fish Smart Eat Smart: https://www.state.nj.us/dep/dsr/Fish_Advisories_2018.pdf
https://njdep.maps.arcgis.com/apps/MapJournal/index.html?appid=922dff1885394cf19ccf1d9c8d52b4f0

Basic Information about the Radionuclides Rule.
http://water.epa.gov/lawsregs/rulesregs/sdwa/radionuclides/basicinformation.cfm

Harmful Algal Blooms (HABs): https://www.state.nj.us/dep/wms/HABS.html
Lead in Drinking Water: http://www.nj.gov/dep/watersupply/dwc-lead.html

NJ and Federal Drinking Water Standards (2018): https://www.nj.gov/dep/standards/drinking%20water.pdf

Light Pollution
Light Pollution Map (VIIRS) data: https://www.lightpollutionmap.info
Simple Scale for Evaluating sky darkness: https://www.skyandtelescope.com/astronomy-resources/light-pollution-and-astronomy-the-bortle-dark-sky-scale/

Underground Storage Tanks
NJDEP Guidelines for Homeowners: https://www.nj.gov/dep/watershedrestoration/waterbook_chp7.html
NJDEP Site Remediation Program: https://www.nj.gov/dep/srp/bust/

Pollution
Monmouth County Reclamation Center
Website: https://co.monmouth.nj.us/page.aspx?ID=186
Weekly Updates: https://co.monmouth.nj.us/page.aspx?ID=4879
Odor Complaint hotline: 732-922-2666

NJDEP Hotline: 1-877- WARN DEP (1-877-927-6337)
NJPDES Permitting: http://www.nj.gov/dep/dwq/database.htm

Development Limitations
Municipal Land Use Law: http://njpo.org/NJPO_MLUL.html

NJDEP
Home Page: https://www.nj.gov/dep/
Contact: https://www.nj.gov/cgi-bin/dep/contactdep.pl
Laws & Rules: http://www.nj.gov/dep/landuse/lawsregs.html
Rules & Regulations, current and proposed: http://www.state.nj.us/dep/rules
NJ Environmental Incident Hotline (hazardous spill, fire, explosion, illegal dumping, wildlife problem): 1-877-WARNDEP / 1-877-927-6337 (toll-free, 24 hours) or http://www.nj.gov/dep/warndep.htm

Township of Ocean
Home Page: http://www.oceantwp.org
Revised general ordinances: https://clerkshq.com/OceanTownship-nj
Department of Community Development: http://www.oceantwp.org/content/5933/default.aspx

6. REGIONAL RELATIONSHIPS

6.1 MONMOUTH COUNTY MASTER PLAN

The 2016 Monmouth County Master Plan Theme is "Redevelopment, Revitalization, and Rediscovery." This represents the third comprehensive *Master Plan* for Monmouth County since the establishment of the Monmouth County Planning Board in 1954. The plan states that the first two plans had emphasized "growth management in an era of mass suburbanization," and that the new focus is on the "redevelopment, revitalization, and rediscovery of communities throughout the county. The new *Plan* recognizes that most of our municipalities have successfully planned for and have already established their desired physical form and character. As such, many of them now seek to maintain and/or enhance their distinct identities through more sustainable approaches in a time characterized by limited growth and constrained public finance" (Monmouth County Division of Planning, 2016).

The Monmouth County Master Plan endeavors to inform and guide decision makers in their planning and implementation activities over the next 10 years. The goals of the Master Plan are:

1. Promote a comprehensive approach to planning and coordinate these efforts among all levels of government and with our community stakeholders.
2. Promote the protection and conservation of natural and cultural resources to help guarantee our long-term sustainability.
3. Promote beneficial development and redevelopment that continues to support Monmouth County as a highly desirable place to live, work, play, and stay (Monmouth County Division of Planning, 2016).

The report is divided to address the 12 Primary Elements:

- NATURAL RESOURCES
- OPEN SPACE
- FARMLAND PRESERVATION
- ARTS, HISTORIC, & CULTURAL RESOURCES
- UTILITIES
- TRANSPORTATION & MOBILITY
- AGRICULTURAL & ECONOMIC DEVELOPMENT
- COMMUNITY DEVELOPMENT & HOUSING
- HEALTHY COMMUNITIES
- COMMUNITY RESILIENCY
- SUSTAINABLE PLACES
- PLANNING SERVICES, OUTREACH, & COORDINATION

Chapters for each of the 12 primary elements contain an introduction, a review of existing conditions, a discussion about Emerging Issues and Long Range Challenges, highlights of stakeholder actions and efforts, as well as a section on resources and funding opportunities. Specific objectives, stakeholder strategies and recommendations are presented (Monmouth County Division of Planning, 2016).

6.2 MONMOUTH COUNTY AREAS OF SIGNIFICANT ENVIRONMENTAL QUALITY

Two key documents were prepared by the Monmouth County Environmental Council (MCEC) and used for describing and selecting the areas of significant environmental quality within the county. The initial *Natural Features Study for Monmouth County*, first published in 1975, was a county-wide inventory of natural features and resources intended to provide a sound environmental basis for future planning. In 1978, the *Monmouth County Unique Areas Study* expanded on a chapter of the Natural Features Study, producing a narrower list of sites with exceptional environmental or ecological significance in the county. A 1988 reprint of the Natural Features Study incorporated updated information from the 1978 document. Since 2007, the Unique Areas have been referred to as Areas of Significant Environmental Quality, although the reports were not formally reissued. An update to the countywide Natural Features Study is currently in the works (Monmouth County Division of Planning, 2016).

In the Unique Areas Study, a total of 42 areas were identified as significant. Areas were grouped into six categories and include five Bogs, Marshes and Swamps, twelve Waterways, six Coastal Wetlands, five Lakes, Ponds and Reservoirs, eight Meadows, Parks and Forests, and six Archeological and Geologic Sites (MCEC, 1978). Two of the areas occur in Ocean Township, as discussed in greater detail in **Section 3.6.1** (Significant Ecological Communities). A noteworthy Pitch Pine Swamp was documented in the Poplar Brook Watershed just west of Route 18, and the Whale Pond Brook waterway is partly contained within Ocean Township. Whale Pond Brook is also one of the 43 significant areas discussed in the updated Natural Features Study, where it is noted for its importance as a watershed, floodplain and wildlife habitat (MCEC, 1988).

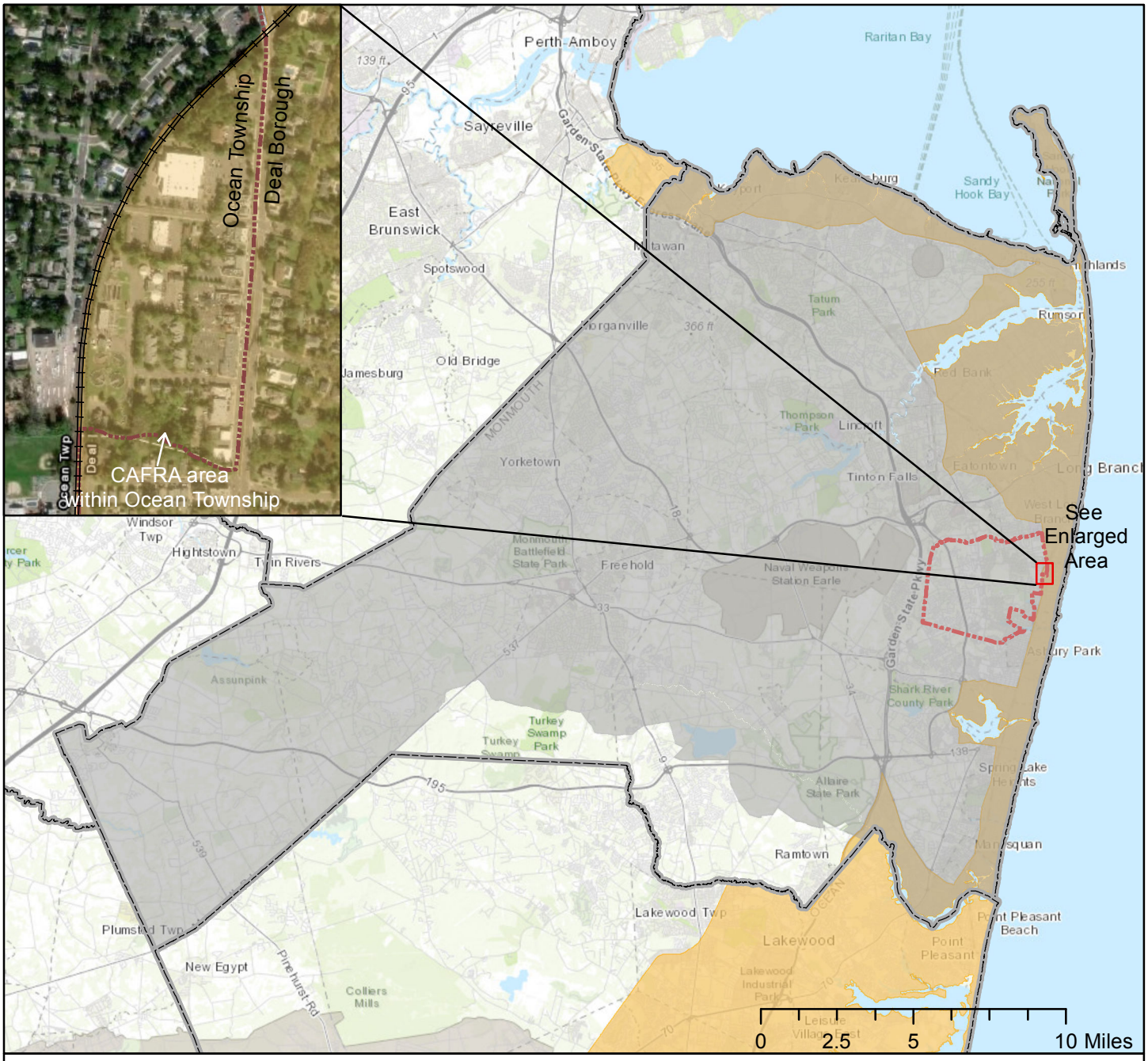
6.3 COASTAL AREA FACILITIES REVIEW ACT (CAFRA)

NJDEP's Division of Land Use Regulation regulates the use and development of coastal resources though the *Coastal Area Facility Review Act* (CAFRA), N.J.S.A. 13:19-1 et seq., the *Wetlands Act of 1970*, N.J.S.A. 13:9A-1 et seq., and the *Waterfront Development Law*, N.J.S.A. 12:5-1 et seq., and the *Coastal Zone Management Rules* at N.J.A.C. 7:7. Both the Coastal Management Program and the Coastal Zone Management Rules strive to attain:

1. Healthy coastal ecosystems
2. Effective management of ocean and estuarine resources
3. Meaningful public access to and use of tidal waterways and their shores
4. Sustained and revitalized water-dependent uses
5. Coastal open space
6. Safe, healthy and well-planned coastal communities and regions
7. Coordinated coastal decision-making, comprehensive planning and research
8. Coordinated public education and outreach (N.J.A.C. 7:7, March 6, 2019).

CAFRA established the CAFRA zone as the boundary of CAFRA regulation. The Division determines whether an activity is regulated based on the activity itself and its location within the coastal zone, as specified in the Coastal Zone Management rules at N.J.A.C. 7:7-2.2 (NJDEP, March 8, 2019).

Approximately 28 acres in Ocean Township fall within the CAFRA zone. The boundary coincides with the North Jersey Coast Line (see **Figure 6**) (NJDEP, July 20, 2007).



Legend

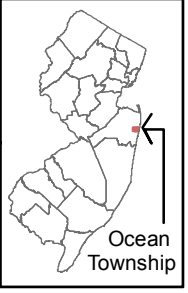
- Ocean Twp.
- Monmouth County Future Wastewater Service Area (FWSA)
- Coastal Area Facilities Review Act Boundary

N

Data Sources: NJDEP, NJDOT,ESRI
Disclaimer required for NJDEP Data: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Kratzer Environmental Services
Ocean Township ERI 2019

Figure 6. CAFRA and Wastewater Management Plan (WMP) Area Ocean Township, Monmouth County



6.4 SUSTAINABLE JERSEY

According to the organization's website, "Sustainable Jersey is a nonprofit organization that provides tools, training and financial incentives to support communities as they pursue sustainability programs. By supporting community efforts to reduce waste, cut greenhouse gas emissions, and improve environmental equity, Sustainable Jersey is empowering communities to build a better world for future generations" (Sustainable Jersey, 2017a).

The voluntary Sustainable Jersey certification is a significant achievement for municipal governments in New Jersey. Municipalities are awarded points for completing and documenting actions that increase sustainability. Nearly 80% of New Jersey's municipalities are listed as participating in the program, while 45% of these are currently certified at either the Bronze or Silver level.

Ocean Township received a *Sustainable Jersey Community Bronze Certification* on December 14, 2018 with 310 points (see **Table 6.4.1**) (Sustainable Jersey, 2017b). More information about several of the topics is located in other sections of this report.

Table 6.4.1. Sustainability Actions Implemented in Ocean Township for Bronze Certification

Category	Action	Points	Comment
Community Partnership and Outreach	Community Education and Outreach	10	
	Create Green Team	10	Bronze mandatory
Green Fairs	Hold a Green Fair	10	
Emergency Management & Resiliency	Climate Adaptation: Flooding Risk	20	Bronze Priority, Silver Priority
Municipal Energy Initiatives	Energy Efficiency for Municipal Facilities	15	Bronze Priority, Silver Priority
	Energy Tracking and Management	10	Bronze Priority, Silver Priority
Transportation Initiatives	Public Electric Vehicle Charging Infrastructure	15	
	Purchase Alternative Fuel Vehicles	10	
Green Design Municipal Buildings	Upgrade/Retrofit-Light Pollution	10	
Land Use & Transportation	Bicycle and or Pedestrian Plan	10	
Buy Local Programs	Buy Local Campaign	10	
Natural Resources	Environmental Commission	10	
Natural Resource Protection Ordinances	Tree Protection Ordinance	10	
Tree & Woodlands Management	Community Forestry Plan and Tree Cover Goal	20	
	Tree Maintenance Programs	10	
	Tree Planting Programs	10	
Grounds & Maintenance	Efficient Landscape Design	10	
	Green Grounds & Maintenance Policy	10	
	Minimize Water Consumption	10	
Access to Public Information	Digitizing Public Information	10	
Citizen Engagement	Improve Public Engagement in Municipal Government	10	
	Improve Public Engagement in Planning and Zoning	10	
	Online Municipal Public Service Systems	10	
Communications	Municipal Communications Strategy	10	
Waste Management	Prescription Drug Safety and Disposal	10	

Category	Action	Points	Comment
Recycling	Community Paper Shredding Day	5	
	Household Hazardous Waste	5	
	Non-Mandated Materials Recycling	5	
	Recycling Depot	10	
Waste Reduction	Grass - Cut It and Leave It Program	5	
	Total:	**310**	
Source: Sustainable Jersey, 2017b			

6.5 WATER SUPPLY PLANNING

The goal of statewide water supply planning, mandated by the Water Supply Management Act (N.J.S.A. 58:1A-1), is to improve the management and protection of the State's water supplies to ensure that the State's water supplies could withstand foreseeable drought and that aquifers are not depleted.

The first New Jersey Water Supply Plan (NJSWSP) was adopted in 1982, and was most recently updated in October 2017. The goal of this 5 year (2017-2022) NJSWSP is "to form the foundation of a 'living' resource able to be updated on a continuous basis as reliable new data becomes available and improved upon as new scientific methods are identified" (NJDEP, October 5, 2017).

Appendix B of the plan presents a discussion of the characteristics, status and trends, and potential availability of water from the confined aquifers of the state's Coastal Plain. The confined aquifers of the Coastal Plain provide approximately 40% of the ground water supply to the southern region of the state. According to the NJWSP, the future availability of this water supply is constrained by a number of factors, including:

- Regulations imposed in Water Supply Critical Areas 1 and 2 and any future revisions to those regulations
- The threat of saltwater intrusion in seaward and bayward margins of the aquifers
- Lack of stabilization of water levels within the aquifers
- The potential for impacts to wetlands and surface water in the outcrop areas of the aquifers
- Water-level interference with other users (NJDEP, October 5, 2017).

In the 1980s and 1990s, water level declines and saltwater intrusion in confined aquifers in the northern and central costal plain led to the state declaring two areas of "critical water supply concern." Ocean Township is within "Water Supply Critical Area 1." Within these two regions, the state mandated reductions in use, restricted future use, and developed surface water supplies to supplement ground water supply.

A ground water model was completed in 2005 as part of a review and reassesmment of the program. The studies conducted for the updated NJWSP lead to the following conclusions:

- Regional water-supply alternatives identified in the 1996 NJSWSP will continue to be endorsed.
- No additional water is available from the existing wells in the PRM, Englishtown and MLW aquifers.
- Wells in idealized locations in confined aquifers may yield a small amount (less than 1 MGD) of additional ground water.
- Aquifer storage and recovery methods may be able to provide the additional water needed to meet seasonal peak water demand.
- There is concern that aquifer withdrawals from confined aquifers between the boundaries of the Water Supply Critical Areas 1 and 2 could adversely impact other users, surface water, and known contaminated sites in the shallow hydrologic system (NJDEP, October 5, 2017).

6.6 WATER QUALITY MANAGEMENT PLANNING

In 2015, NJDEP released a new Continuing Planning Process (CPP) document, which was prepared pursuant to the federal Clean Water Act (CWA) and the New Jersey Water Pollution Control Act (WQPA), both of which require the NJDEP to formulate a continuing planning process (CPP) to achieve the water quality standards and maintain, improve, and protect water quality throughout the State. The CPP is intended to serve as an easily accessible planning tool, to be used not only as a listing of current NJDEP programs and rules relating to water quality, but as a resource for planning entities and members of the public on current policies and technical guidance on water quality issues, including:

- Establishing water quality standards and goals
- Assessing water quality and identify priority problems
- Water Quality Management Planning
- Identifying and controlling sources and causes of water quality impairment
- Intergovernmental Coordination (NJDEP Water Resources Management, November 6, 2015).

The *Water Quality Management Planning* rules at N.J.A.C 7:15 represent one component of the CPP. The current rules were adopted November 7, 2016, repealing and replacing the prior rules from 2008. These rules focus on procedures for adopting new or amended areawide water quality management (WQM) plans, including Wastewater Management Plans (WMPs); Lists of water quality limited (impaired) waters; and total maximum daily loads (TMDL) for impaired waters. The CPP describes how these processes, along with other Department programs, integrate and unify water quality management planning processes, establish and assess attainment of water quality goals and standards, and implement control measures necessary to maintain, improve, and protect water quality throughout the State (NJDEP Water Resources Management, November 6, 2015; NJDEP, November 7, 2016).

A *Wastewater management planning agency* or *WMP agency* is defined in the rule as a governmental entity that has wastewater management planning responsibility (NJDEP, July 12, 2018). Monmouth County Board of Chosen Freeholders is the responsible agency for WMPs in the area including the Township of Ocean (NJDEP Office of Water Resources Management Coordination, November 14, 2017).

One of the WQM agency's roles is to update the Wastewater Management Plan (WMP) at least once every 10 years for wastewater and certain other water quality concerns (NJDEP Office of Water Resources Management Coordination, November 14, 2017).

The rules establish a mechanism for determining whether proposed projects or activities are consistent with the statewide WQM Plan (see **Internet Resources**). The Wastewater Management Plan (WMP) for Monmouth County Future Wastewater Service Area (FWSA) Map (shown in **Figure 6**) was adopted in 2013. The 2016 WQMP rules require the DPAs to develop a new WMP for the county based on modeling and analysis for capacity of sewer service areas and septic areas in Monmouth County (Monmouth County Division of Planning, March 28, 2019)

References: Regional Relationships

Monmouth County

Monmouth County Division of Planning. 2016. Monmouth County Master Plan. Adopted October 17, 2016. http://co.monmouth.nj.us/documents/24/FINAL%20Master%20Plan%20Volume%20I.pdf

MCEC (Monmouth County Environmental Council). December 1978. Monmouth County Unique Areas Study. Report prepared for Monmouth County Planning Board.

MCEC (Monmouth County Environmental Council). 1988. Natural Features Study for Monmouth County. Report prepared for Monmouth County Planning Board.

CAFRA
N.J.A.C. 7:7 Coastal Zone Management Rules. Date last amended: March 6, 2019.
https://www.nj.gov/dep/rules/rules/njac7_7.pdf

NJDEP. July 20, 2007. Coastal Area Facilities Review Act Boundary for New Jersey (polygon). GIS data. https://njogis-newjersey.opendata.arcgis.com/datasets/6608f9feb7314ce7bfcb26aba82cf1be_0.

NJDEP Division of Land Use Regulation. March 8, 2019. https://www.nj.gov/dep/landuse/coastal/cp_main.html

Sustainable Jersey
NJDEP. January 20, 2017. Public Solar Facilities of New Jersey, Edition 20170120 (Util_solar_public). Data obtained from AEG & NJBPU on 20160826. GIS data. https://njogis-newjersey.opendata.arcgis.com/datasets/public-solar-facilities-in-new-jersey

Sustainable Jersey. 2017a. Sustainable Jersey. http://www.sustainablejersey.com/. Accessed March 26, 2019.

Sustainable Jersey. 2017b. Ocean [Township] Sustainable Jersey Community Certification Report. HTML Version: http://www.sustainablejersey.com/certification/participating-communities/certification-report/?tx_sjcert_certification%5Bcertification%5D%5B__identity%5D=721&tx_sjcert_certification%5Baction%5D=show&tx_sjcert_certification%5Bcontroller%5D=Certification&cHash=9b8f380bc730d670b58c1bec37b813e0
Accessed March 26, 2019

Water Supply Planning
NJDEP Division of Water Supply and Geoscience. October 5, 2017. New Jersey Water Supply Plan 2017-2022.
http://www.state.nj.us/dep/watersupply/wsp.html

Water Quality Management Planning
Monmouth County Division of Planning. March 28, 2019. Areawide Water Quality Management Program.
https://co.monmouth.nj.us/page.aspx?ID=4832. Accessed April 4, 2019.

Monmouth County. May 2, 2011. Wastewater Management Plan for Monmouth County. Areawide Water Quality Management Plan for Monmouth County Watershed Management Area 12 and portions of Watershed Management Areas 9, 10, 11, 13, 20.
http://co.monmouth.nj.us/documents/24/2011%20WMP%20Full%20Text%20Document%20.pdf

NJDEP. November 7, 2016. N.J.A.C. 7:15: Water Quality Management Planning. Date last amended: November 7, 2016.
http://www.nj.gov/dep/rules/rules/njac7_15.pdf

NJDEP. April 5, 2019. Water Quality Management Planning Program, Adopted Water Quality Management Plan Amendments and Revisions, Monmouth County https://www.nj.gov/dep/wqmp/wmpadopted.html#monmouth. Accessed April 7, 2019.

NJDEP Office of Water Resources Management Coordination. July 12, 2018 . The Water Quality Management Rules Home Page.
http://www.nj.gov/dep/wqmp/wqmps.html. Accessed March 30, 2019.

NJDEP Office of Water Resources Management Coordination. November 14, 2017. Water Quality Management Planning.
http://www.nj.gov/dep/wrm/index.html . Accessed April 4, 2019.

NJDEP Water Resources Management. November 6, 2015 (Appendix Update February 23, 2018). New Jersey's Continuing Planning Process. http://www.nj.gov/dep/wrm/docs/cpp.pdf.

Internet Resources: Regional Relationships

Monmouth County

Divison of Planning: https://co.monmouth.nj.us/page.aspx?Id=140
2016 Master Plan: http://co.monmouth.nj.us/documents/24/FINAL%20Master%20Plan%20Volume%20I.pdf

CAFRA

NJDEP Division of Land Use Regulation. March 8, 2019. https://www.nj.gov/dep/landuse/coastal/cp_main.html
Laws & Rules https://www.nj.gov/dep/landuse/lawsregs.html
Notice of Rule Proposals https://www.state.nj.us/dep/rules/notices.html

Sustainability

NJDEP Office of Sustainability: http://www.nj.gov/dep/aqes/sustainability.html
Rethink Energy NJ: http://rethinkenergynj.org/
Sustainable Jersey: http://www.sustainablejersey.com/
USEPA Greener Living: https://www.epa.gov/environmental-topics/greener-living

NJDEP Water Supply Plan: http://www.state.nj.us/dep/watersupply/wsp.html

NJDEP Water Quality Management Planning: http://www.nj.gov/dep/wrm/index.html

7. CONCLUSIONS AND RECOMMENDATIONS

- The Municipal Land Use Law requires municipalities' Master Plans to have a land use plan including, but not necessarily limited to, topography, soil conditions, water supply, flood plains, wetlands, and woodlands (Municipal Land Use Law, 2002 in ANJEC, 2013).
- The Environmental Commission Enabling Legislation gives environmental commissions the authority to conduct such research for inclusion in the Master Plan, and then to use this information to help evaluate development applications.
- This Ocean Township ERI provides this research and baseline documentation for measuring and evaluating resource protection issues and to help evaluate development applications.
- A municipal Planning Board reviews the ERI and holds a hearing and a vote to adopt the ERI as part of the Master Plan.
- The ERI can be used as an educational and reference document.
- The ERI may note areas or subjects in need of further research or investigation. For example Figure 3.8.5 (Open Space - potential preservation) may be used as a starting point for identifying parcels with potential for preservation.
- In order to keep the ERI up to date and maintain its usefulness, plans should be made to update the ERI at a minimum of every 10 years (Sustainable Jersey awards points only for ERIs less than 10 years old).

References: Conclusions and Recommendations

Association of New Jersey Environmental Commissions (ANJEC). 2013. The Environmental Resource Inventory: ERI. ANJEC; Mendham, NJ. 12 pages. http://anjec.org/pdfs/ERI2013.pdf

APPENDIX A.1. TERMS OF AGREEMENT FOR USE OF NJDEP GIS DATA

(Required by NJDEP Office of Information Management, Bureau of Geographic Information and Analysis.)

1. Digital data received from the NJDEP are to be used solely for internal purposes in the conduct of daily affairs.

2. The data are provided, as is, without warranty of any kind and the user is responsible for understanding the accuracy limitations of all digital data layers provided herein, as documented in the accompanying Data Dictionary and Readme files. Any reproduction or manipulation of the above data must ensure that the coordinate reference system remains intact.

3. Digital data received from the NJDEP may not be reproduced or redistributed for use by anyone without first obtaining written permission from the NJDEP. This clause is not intended to restrict distribution of printed mapped information produced from the digital data.

4. Any maps, publications, reports, or other documents produced as a result of this project that utilize NJDEP digital data will credit the NJDEP Geographic Information System (GIS) as the source of the data with the following credit/disclaimer:

> This (map/publication/report) was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.

5. Users shall require any independent contractor, hired to undertake work that will utilize digital data obtained from the NJDEP, to agree not to use, reproduce, or redistribute NJDEP GIS data for any purpose other than the specified contractual work. All copies of NJDEP GIS data utilized by an independent contractor will be required to be returned to the original user at the close of such contractual work. Users hereby agree to abide by the use and reproduction conditions specified above and agree to hold any independent contractor to the same terms. By using data provided herein, the user acknowledges that terms and conditions have been read and that the user is bound by these criteria.

APPENDIX A.2. CAUTIONS AND RESTRICTIONS ON USE OF NATURAL HERITAGE DATA

(Required by NJDEP Division of Parks and Forestry, Natural Lands Management.)

CAUTIONS AND RESTRICTIONS ON NATURAL HERITAGE DATA

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

This office cannot provide a letter of interpretation or a statement addressing the classification of wetlands as defined by the Freshwater Wetlands Act. Requests for such determination should be sent to the DEP Division of Land Use Regulation, P.O. Box 439, Trenton, NJ 08625-0439.

The Landscape Project was developed by the Division of Fish & Wildlife, Endangered and Nongame Species Program in order to map critical habitat for rare animal species. Natural Heritage Database response letters will also list all species (if any) found during a search of the Landscape Project. However, this office cannot answer any inquiries about the Landscape Project. All questions should be directed to the DEP Division of Fish and Wildlife, Endangered and Nongame Species Program, P.O. Box 400, Trenton, NJ 08625-0400.

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

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

APPENDIX B. GIS DATA LAYERS USED FOR THIS ERI

Data Disclaimers in **Appendix A** apply to the use of these data layers and the maps created from them. The user is responsible for understanding the accuracy limitations of the digital data layers, as documented in the accompanying report and metadata summaries, and the metadata files which accompany the data

Figure	Source of Data	Data Title	Date	Scale	Online Linkage
all	NJDEP BGIS	Municipalities of New Jersey (Clipped to Coast)	12/28/2012	1:2,400	http://www.state.nj.us/dep/gis/stateshp.html#MUNCOAST
many	NJDEP BGIS	State of New Jersey Composite of Parcels Data, New Jersey State Plane NAD83 and MOD-IV Tax List Search Database	07/29/2011	n/a	https://njgin.state.nj.us/NJ_NJGINExplorer/IW.jsp?DLayer=Parcels by County/Muni
most	NJDEP BGIS	National Hydrography Dataset (NHD) Streams 2002	11/1/2010	1:2,400	http://www.state.nj.us/dep/gis/digidownload/zips/statewide/nhdstreams2002shp.zip
most	NJDOT	New Jersey Department of Transportation Statewide Public Road Network (1:2400)	12/1/2014	1:2,400	http://www.state.nj.us/transportation/gis/data.shtm
most	NJDEP BGIS	NJDEP 2002 Waters of New Jersey (Lakes and Ponds)	5/1/2008	1:2,400	http://www.state.nj.us/dep/gis/digidownload/zips/statewide/njwaterbody.zip
2.1.1	NJDEP BGIS	Municipalities of New Jersey (Clipped to Coast)	12/28/2012	1:2,400	http://www.state.nj.us/dep/gis/stateshp.html#MUNCOAST
2.1.1	NJDEP BGIS	NJDEP County Boundaries for the State of New Jersey	7/20/2016	1:24,000	https://njogis-newjersey.opendata.arcgis.com/datasets/new-jersey-counties
2.1.1	NJDEP BGIS	NJDEP State Boundary of New Jersey	11/1/1998	1:24,000	http://www.state.nj.us/dep/gis/digidownload/zips/statewide/state.zip
2.1.1	ESRI, National Geo-graphic	NatGeo_World_Map			http://goto.arcgisonline.com/maps/NatGeo_World_Map
2.1.1	ESRI	World Boundaries and Places			http://goto.arcgisonline.com/maps/Reference/World_Boundaries_and_Places
2.1.1	ESRI	World Shaded Relief	1/1/2014		http://goto.arcgisonline.com/maps/World_Shaded_Relief
2.1.1	ESRI	Ocean Basemap			http://goto.arcgisonline.com/maps/Ocean_Basemap
2.1.1	ESRI, National Park Service	World Physical Map			http://goto.arcgisonline.com/maps/World_Physical_Map
2.1.1	ESRI	World Reference Overlay			http://goto.arcgisonline.com/maps/Reference/World_Reference_Overlay
2.1.2	NJDEP BGIS	NJDEP Place Name Locations in the State of New Jersey	1/1/2004	1:24,000	http://www.state.nj.us/dep/gis/digidownload/zips/statewide/placenam04.zip
2.1.2	ESRI	World Boundaries and Places			http://goto.arcgisonline.com/maps/Reference/World_Boundaries_and_Places
2.2.1	U.S. Census Bureau	TIGER/Line Shapefile, 2010, 2010 county, Monmouth County, NJ, 2010 Census Census Tract County-based	8/15/2017	n/a	http://www.census.gov/geo/www/tiger
2.3.1	NJDEP, NHR, HPO	Archaeological Site Grid of New Jersey, Edition 20190129	1/29/2019	n/a	https://njogis-newjersey.opendata.arcgis.com/datasets/njdep::archaeological-site-grid-of-new-jersey
2.3.1	NJDEP, NHR, HPO	Historic Districts of New Jersey, Edition 20190129	1/29/2019	n/a	https://njogis-newjersey.opendata.arcgis.com/datasets/njdep::historic-districts-of-new-jersey

Figure	Source of Data	Data Title	Date	Scale	Online Linkage
2.3.1	NJDEP, NHR, HPO	Historic Properties of New Jersey, Edition 20190129	1/29/2019	n/a	https://njogis-newjersey.opendata.arcgis.com/datasets/njdep::historic-properties-of-new-jersey
2.3.1	NJDEP, NHR, HPO	Historic Property Features of New Jersey, Edition 20190129	1/29/2019	n/a	https://njogis-newjersey.opendata.arcgis.com/datasets/njdep::historic-property-features-of-new-jersey
2.4.1	Leon S Avakian Consulting Engineers	Ocean Township ZONING MAP	2014		
2.4.2	NJDEP	Land Use/Land Cover 2012 Update, Edition 20150217 Subbasin 02040301 - Mullica-Toms	2/17/2015	1:2,400	http://www.state.nj.us/dep/gis/lulc12.html
2.4.3	NJDEP	Land Use/Land Cover 2012 Update, Edition 20150217 Subbasin 02040301 - Mullica-Toms	2/17/2015	1:2,400	http://www.state.nj.us/dep/gis/lulc12.html
2.4.3	Monmouth County GIS	NJDEP 1972 Land Use for Ocean Township	8/15/2017		----
2.4.3	Monmouth County GIS	NJDEP 1986 Land Use for Ocean Township	8/15/2017		----
2.4.3	Monmouth County GIS	NJDEP 1995/1997 Land Use for Ocean Township	8/15/2017		----
2.4.3	Monmouth County GIS	NJDEP 2002 Land Use for Ocean Township	8/15/2017		----
2.4.3	Monmouth County GIS	NJDEP 2007 Land Use for Ocean Township	8/15/2017		----
2.4.3	NJDEP	NJDEP 2007 Land use/Land Cover Update, Monmouth Watershed Management Area, WMA12	7/12/2010	1:2,400	https://www.nj.gov/dep/gis/lulc07shp.html
3.3.1	NJGS	DGS02-7: Physiographic Provinces of New Jersey	6/30/2002	1:100,000	http://www.state.nj.us/dep/njgs/geodata/dgs02-7.htm
3.3.1	NJGS	DGS04-6: Bedrock Geology for New Jersey 1:100,000 Scale	1/1/2009	1:100,000	https://www.state.nj.us/dep/njgs/geodata/dgs04-6.htm
3.3.2	Monmouth County GIS	Monmouth County Contour Database, 10' elevations	8/15/2017		----
3.3.2	Monmouth County GIS	Monmouth County Contour Database, 2' elevations	8/15/2017		----
3.3.2	Monmouth County GIS	Monmouth County Contour Database, Spot Elevations	2003		----
3.3.3	Monmouth County GIS	Monmouth County Contour Database, Slopes 15 To 20 Percent	2003		----
3.3.3	Monmouth County GIS	Monmouth County Contour Database, Slopes 20 To 25 Percent	2003		----
3.3.3	Monmouth County GIS	Monmouth County Contour Database, Slopes 25 Percent and Greater	2003		----
3.3.3	Monmouth County GIS	Monmouth County Contour Database, Steep Slopes 15% or Greater	2003		----
3.3.4	NJDEP NJG&WS	DGS04-7: Historic Fill For New Jersey as of January 2016	1/26/2016	1:100,000	http://www.state.nj.us/dep/njgs/geodata/dgs04-7.htm
3.3.4	NJGS	DGS05-1: Selected Sand, Gravel and Rock Surficial Mining Operations in NJ	12/12/2006		http://www.state.nj.us/dep/njgs/geodata/dgs05-1.htm
3.3.4	NJGS	DGS07-2: Surficial Geology of New Jersey	9/11/2013	1:100,000	https://www.state.nj.us/dep/njgs/geodata/dgs07-2.htm
3.3.5 and 3.3.6	NRCS	Soil Survey Geographic (SSURGO) database for Monmouth County, New Jersey	10/6/2017	1:24,000	http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx
3.4.1	NJDEP BGIS	14 Digit Hydrologic Unit Code Delineations for New Jersey	3/8/2016		https://gisdata-njdep.opendata.arcgis.com/datasets/8de4c55bcf6540bcbe173df2b0552eb2_22

Figure	Source of Data	Data Title	Date	Scale	Online Linkage
3.4.1	NJDEP BGIS	Watershed Management Areas in New Jersey	3/8/2016		https://gisdata-njdep.opendata.arcgis.com/datasets/de7aafe4a0604076a50f2a6885aff277_0
3.4.2	NJDEP BGIS	Ambient Biomonitoring Network (AMNET) of New Jersey	6/5/2017		https://gisdata-njdep.opendata.arcgis.com/datasets/d8937d8a49064467876d80e0c58a0d6a_13
3.4.2	NJDEP BGIS	Ambient Stream Quality Monitoring Sites of New Jersey	11/19/2018		https://gisdata-njdep.opendata.arcgis.com/datasets/29d555f36c0a4960b0a5dfbc732f0d61_25
3.4.2	NJDEP	New Jersey Environmental Management System (NJEMS) Sites (Envr_NJEMS_site)	3/21/2019	1:12,000	http://njogis-newjersey.opendata.arcgis.com/datasets/ce09dd0091f242edb2d4f8f7b3072215_2
3.4.2	NJDEP	New Jersey Pollution Discharge Elimination System (NJPDES) Regulated Facility Locations, Edition 20070718 (Envr_NJEMS_NJPDES_all)	7/18/2007	unknown	http://njogis-newjersey.opendata.arcgis.com/datasets/njdep-non-point-wastewater-sites
3.4.2	NJDEP	NJPDES Surface Water Discharges in New Jersey, (1:12,000) Edition 20190110 (Strc_NJPDES_sw_pipe)	1/9/2019	1:12,000	https://gisdata-njdep.opendata.arcgis.com/datasets/2ee12c0ddd344380bcc1f5cfdd5f8128_0
3.4.3	FEMA via Monmouth County GIS	FEMA Flood Zones	9/25/2009		https://msc.fema.gov
3.4.4	NJGS	DGS98-5 Aquifers of New Jersey	5/21/1998	1:100,000	http://www.state.nj.us/dep/njgs/geodata/dgs98-5.htm
3.4.4	NJGS	DGS98-6 NJDEP Sole-Source Aquifers in New Jersey	4/5/2000	1:24,000	http://www.state.nj.us/dep/njgs/geodata/dgs98-6.htm
3.4.5	NJGS	DGS02-3-Ground-Water Recharge for Monmouth County, NJ	10/21/2004	1:24,000	https://www.state.nj.us/dep/njgs/geodata/dgs02-3.htm
3.4.5	NJGS	DGS07-01 Aquifer Recharge Potential for NJ Watershed Management Area 12 (Monmouth Coastal Watersheds)	10/8/2004	1:24,000	https://www.state.nj.us/dep/njgs/geodata/dgs07-1.htm
3.5.1	NJDEP BGIS	Land Use/Land Cover 2012 Update, Edition 20150217 Subbasin 02040301 - Mullica-Toms (Land_lu_2012_hu02040301)	2/17/2015	1:2,400	http://www.state.nj.us/dep/gis/lulc12.html
3.6.1	Monmouth County Park System & Monmouth County GIS	Century Forests	10/18/2017		----
3.6.1	NJDEP	Land Use/Land Cover 2012 Update, Edition 20150217 Subbasin 02040301 - Mullica-Toms	2/17/2015	1:2,400	http://www.state.nj.us/dep/gis/lulc12.html
3.6.2	NJDEP NJFFS	Wildfire Fuel Hazard	3/22/2009	1:2,400	http://www.state.nj.us/dep/gis/njfh.html#CAP
3.6.3	NJDEP ONLM	Natural Heritage Grid Map for New Jersey, Edition 200911 (Grid_NHP) (Web Mercator ArcGIS Online Service)	12/1/2002	1:24,000	https://gisdata-njdep.opendata.arcgis.com/datasets/b00b22666a44445c90e73af6fd39f152_1
3.6.4	NJDEP BGIS	Land Use/Land Cover 2012 Update, Edition 20150217 Subbasin 02040301 - Mullica-Toms (Land_lu_2012_hu02040301)	2/17/2015	1:2,400	http://www.state.nj.us/dep/gis/lulc12.html
3.7.1	NJDEP DFW ENSP	NJDEP Species Based Habitat, Atlantic Coastal Region, Version 3.3, 20170509 (Envr_hab_ls_v3_3_coastal)	5/9/2017	1:12,000	http://www.nj.gov/dep/gis/listall.html

Figure	Source of Data	Data Title	Date	Scale	Online Linkage
3.7.1	NJDEP DFW ENSP	NJDEP Species Based Habitat, Piedmont Plains Region, Version 3.3, 20170509 (Envr_hab_ls_v3_3_piedmont)	5/9/2017	1:12,000	http://www.nj.gov/dep/gis/listall.html
3.7.2	NJDEP DFW ENSP	NJDEP Species Based Habitat, Vernal Habitat, Version 3.3, 20170509 (Envr_hab_ls_ v3_3_vernalhabitat)	5/9/2017	1:12,000	http://www.nj.gov/dep/gis/listall.html
3.7.2	NJDEP DFW ENSP	NJDEP Species Based Habitat, Vernal Pools, Version 3.3, 20170509 (Envr_hab_ls_ v3_3_vernalpools)	5/9/2017	1:12,000	http://www.nj.gov/dep/gis/listall.html
3.7.3	NJDEP DFW ENSP	North Atlantic Aquatic Connectivity Collaborative (NAACC) Road-Stream Crossing Assessments in New Jersey, (Envr_CHANJ_pts)	4/18/2018	na	https://gisdata-njdep.opendata.arcgis.com/datasets/eebe82c4a7dc4400b900a7bfbf9e4b25_0
3.7.3	NJDEP	Land Use/Land Cover 2012 Update, Edition 20150217 Subbasin 02040301 - Mullica-Toms	2/17/2015	1:2,400	http://www.state.nj.us/dep/gis/lulc12.html
3.8.1	NJDEP	State, Local and Nonprofit Open Space of New Jersey, Edition 20190130 (Land_owner_openspace) (Web Mercator ArcGIS Online Service)	1/30/2019	1:12,000	https://www.nj.gov/dep/gis/digidownload/zips/OpenData/Land_owner_openspace.zip
3.8.2	Monmouth County GIS	JoePalaiaPark_trails_Nov2018	11/1/2018	±5 meters	----
3.8.2	NJDEP	State, Local and Nonprofit Open Space of New Jersey, Edition 20190130	1/30/2019	1:12,000	https://www.nj.gov/dep/gis/digidownload/zips/OpenData/Land_owner_openspace.zip
3.8.3	Monmouth County GIS	MCPS Trails			----
3.8.3	NJDEP	State, Local and Nonprofit Open Space of New Jersey, Edition 20190130	1/30/2019	1:12,000	https://www.nj.gov/dep/gis/digidownload/zips/OpenData/Land_owner_openspace.zip
3.8.4	NJDEP	Land Use/Land Cover 2012 Update, Edition 20150217 Subbasin 02040301 - Mullica-Toms	2/17/2015	1:2,400	http://www.state.nj.us/dep/gis/lulc12.html
3.8.4	NJDEP	State, Local and Nonprofit Open Space of New Jersey, Edition 20190130	1/30/2019	1:12,000	https://www.nj.gov/dep/gis/digidownload/zips/OpenData/Land_owner_openspace.zip
4.1.1	NJDEP	Public Community Water Purveyor Service Areas, New Jersey, Edition 20190211	2/11/2019	na	https://gisdata-njdep.opendata.arcgis.com/datasets/00e7ff046ddb4302abe7b49b2ddee07e_13
4.1.1	NJDEP BGIS	Statewide Sewer Service Area for New Jersey, Edition 20190124	1/24/2019	na	https://njogis-newjersey.opendata.arcgis.com/datasets/7f614776818e4b8580a95efd30528ebe_8
4.2.1	NJ TRANSIT, GIS-Transportation & NJOIT, OGIS	NJ TRANSIT Bus Routes Currently Operating, 2016 (NAD83, NJSP feet)	2/10/2016	na	https://njgin.state.nj.us/oit/gis/download/NJ_Bus_shp.zip
4.2.1	NJDOT	New Jersey Department of Transportation Statewide Public Road Network (1:2400)	12/1/2014	1:2,400	http://www.state.nj.us/transportation/gis/data.shtm
4.2.1	NJ TRANSIT - GIS-Transportation	New Jersey Transit Rail, Light Rail, and Subway Currently Operated Right-of-Way lines, 2012 (NAD83, NJSP feet)	4/1/2012	na	https://njgin.state.nj.us/oit/gis/download/NJ_Rail_shp.zip
4.2.1	NJ TRANSIT, GIS-Transpor-tation & NJOIT, OGIS	NJ TRANSIT Bus Stop Locations 2016 (NAD83, NJSP feet)	2/10/2016	na	https://njgin.state.nj.us/oit/gis/download/NJ_Bus_shp.zip

Figure	Source of Data	Data Title	Date	Scale	Online Linkage
4.6.1	NJDEP BGIS	Alternative Fueled Vehicle Fueling Stations for New Jersey, (Continuously updated via script) (Strc_alt_fuel) (Web Mercator ArcGIS Online Service)	3/18/2019	na	https://gisdata-njdep.opendata.arcgis.com/datasets/aa2b3b026d534d2283ef2ef4ef06454c_1
4.6.1	NJDEP BGIS	Power Plants of New Jersey	9/19/2018	na	https://gisdata-njdep.opendata.arcgis.com/datasets/282eb9eb22cc40a99ed509a7aa9f7c90_20
4.6.1	NJOGIS	Public Solar Facilities in New Jersey	1/19/2017	na	https://njogis-newjersey.opendata.arcgis.com/datasets/public-solar-facilities-in-new-jersey
4.6.1	NJDEP BGIS	Solar Photovoltaic (PV) Installations by County in New Jersey		na	https://gisdata-njdep.opendata.arcgis.com/datasets/e3366d6efe9b4b3286db54d63c41ef6a_16
5.1.1	NJDEP	Deed Notice Extent in New Jersey, Edition 20190214 (Envr_mon_soil_DNA)	2/14/2019	1:24,000	https://njogis-newjersey.opendata.arcgis.com/datasets/njdep::deed-notice-extent-in-new-jersey
5.1.1	NJDEP	Known Contaminated Site List for New Jersey	3/17/2019	1:1,000	https://njogis-newjersey.opendata.arcgis.com/datasets/b167bb2ae09c43f8ab9e954700be45d9_0
5.1.1	NJDEP	Known Contaminated Site List for New Jersey	4/1/2019	1:24,000	https://njogis-newjersey.opendata.arcgis.com/datasets/b167bb2ae09c43f8ab9e954700be45d9_0
5.1.1	NJDEP	Underground Storage Tanks, New Jersey	3/20/2019	1:12,000	https://gisdata-njdep.opendata.arcgis.com/datasets/underground-storage-tank-facilities-in-new-jersey
5.1.2	NJDEP	Classification Exception Areas-Well Restriction Areas for New Jersey, Edition 20190214 (Envr_mon_gw_CEA	02/14/2019	1:1,000	https://njogis-newjersey.opendata.arcgis.com/datasets/bfd549e193a947e9923492da13c24e4b_11
5.4.3	NJDEP BGIS	Impervious Surfaces (2015) of New Jersey, Edition 20180930 (Land_lu_2015_is)	9/30/2018	na	https://gisdata-njdep.opendata.arcgis.com/items/monmouth-county-impervious-surface-2015-of-new-jersey
5.4.3	Monmouth County GIS	Impervious Surfaces (2015) of NJ, Edition 20180930	9/30/2018	na	----
5.4.3	NJDEP BGIS	Land Use/Land Cover 2012 Update, Edition 20150217 Subbasin 02040301 - Mullica-Toms	2/17/2015	1:2,400	http://www.state.nj.us/dep/gis/lulc12.html
6	NJDEP BGIS	Coastal Area Facilities Review Act Boundary for New Jersey (polygon)	7/20/2007	1:24,000	https://njogis-newjersey.opendata.arcgis.com/datasets/6608f9feb7314ce7bfcb26aba82cf1be_0

APPENDIX C. SOIL MAP UNIT DESCRIPTIONS

Map unit: AtsA - Atsion sand, 0 to 2 percent slopes, Northern Coastal Plain
The Atsion component makes up 90 percent of the map unit. Slopes are 0 to 2 percent. This component is on coastal plains, flats. The parent material consists of sandy eolian deposits and/or fluviomarine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 2 inches (depth from the mineral surface is 0 inches) during March, April. Organic matter content in the surface horizon is about 85 percent. Nonirrigated land capability classification is 5w. This soil meets hydric criteria. There are no saline horizons within 30 inches of the soil surface.

Map unit: CoeAs - Colemantown loam, 0 to 2 percent slopes, occasionally flooded
The Colemantown, occasionally flooded component makes up 90 percent of the map unit. Slopes are 0 to 2 percent. This component is on flats on North Atlantic coastal plains, depressions, drainageways. The parent material consists of glauconite bearing fluviomarine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches (or restricted depth) is very high. Shrink-swell potential is moderate. This soil is occasionally flooded. It is occasionally ponded. A seasonal zone of water saturation is at 6 inches during January, February, March, April, May. Organic matter content in the surface horizon is about 3 percent. Nonirrigated land capability classification is 3w. This soil meets hydric criteria.

Map unit: DocB - Downer loamy sand, 0 to 5 percent slopes, Northern Coastal Plain
The Downer component makes up 80 percent of the map unit. Slopes are 0 to 5 percent. This component is on low hills on coastal plains. The parent material consists of loamy fluviomarine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria. There are no saline horizons within 30 inches of the soil surface.

Map unit: DocC - Downer loamy sand, 5 to 10 percent slopes, Northern Coastal Plain
The Downer component makes up 85 percent of the map unit. Slopes are 5 to 10 percent. This component is on low hills, coastal plains. The parent material consists of loamy fluviomarine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 3e. Irrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map unit: DoeB - Downer sandy loam, 2 to 5 percent slopes, Northern Coastal Plain
The Downer component makes up 80 percent of the map unit. Slopes are 2 to 5 percent. This component is on fluviomarine terraces, coastal plains. The parent material consists of loamy fluviomarine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria. There are no saline horizons within 30 inches of the soil surface.

Map unit: DouB - Downer-Urban land complex, 0 to 5 percent slopes
The Downer component makes up 60 percent of the map unit. Slopes are 0 to 5 percent. This component is on knolls, low hills, coastal plains. The parent material consists of loamy fluviomarine deposits and/or gravelly fluviomarine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: EkaAr - Elkton loam, 0 to 2 percent slopes, rarely flooded
The Elkton component makes up 85 percent of the map unit. Slopes are 0 to 2 percent. This component is on marine terraces on coastal plains. The parent material consists of silty eolian deposits over loamy alluvium and/or loamy marine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is high. Shrink-swell potential is moderate. This soil is rarely flooded. It is rarely ponded. A seasonal zone of water saturation is at 6 inches during January, February, March, April, May, November, December. Organic matter content in the surface horizon is about 3 percent. Nonirrigated land capability classification is 3w. This soil meets hydric criteria.

Map unit: EveB - Evesboro sand, 0 to 5 percent slopes
The Evesboro component makes up 80 percent of the map unit. Slopes are 0 to 5 percent. This component is on low hills on North Atlantic coastal plains. The parent material consists of sandy eolian deposits and/or sandy fluviomarine deposits. Depth

to a root restrictive layer is greater than 60 inches. The natural drainage class is excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.

Map unit: EveC - Evesboro sand, 5 to 10 percent slopes
The Evesboro component makes up 95 percent of the map unit. Slopes are 5 to 10 percent. This component is on low hills on coastal plains. The parent material consists of sandy eolian deposits and/or sandy fluviomarine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.

Map unit: EveD - Evesboro sand, 10 to 15 percent slopes
The Evesboro component makes up 95 percent of the map unit. Slopes are 10 to 15 percent. This component is on dunes, low hills, coastal plains. The parent material consists of sandy eolian deposits and/or sandy fluviomarine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1percent. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.

Map unit: EveE - Evesboro s and, 15 to 25 percent slopes
The Evesboro component makes up 95 percent of the map unit. Slopes are 15 to 25 percent. This component is on low hills on coastal plains. The parent material consists of sandy eolian deposits and/or sandy fluviomarine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.

Map unit: EvuB - Evesboro-Urban land complex, 0 to 5 percent slopes
The Evesboro component makes up 60 percent of the map unit. Slopes are 0 to 5 percent. This component is on low hills on coastal plains. The parent material consists of sandy eolian deposits and/or sandy fluviomarine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.
Component: Urban land (30%)
Generated brief soil descriptions are created for major soil components. The Urban land is a miscellaneous area.

Map unit: FapA - Fallsington loams, 0 to 2 percent slopes, Northern Coastal Plain
The Fallsington, undrained component makes up 38 percent of the map unit. Slopes are 0 to 2 percent. This component is on flats on coastal plains. The parent material consists of loamy fluviomarine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is occasionally ponded. A seasonal zone of water saturation is at 5 inches (depth from the mineral surface is 3 inches) during January, February, March, April. Organic matter content in the surface horizon is about 68 percent. Nonirrigated land capability classification is 5w. This soil meets hydric criteria. There are no saline horizons within 30 inches of the soil surface. The Fallsington, drained component makes up 37%, and is similar but it is rarely ponded; seasonal zone of water saturation is at 14 inches during January, February, March, April. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 3w.

Map unit: FrkB - Freehold sandy loam, 2 to 5 percent slopes
The Freehold component makes up 85 percent of the map unit. Slopes are 2 to 5 percent. This component is on North Atlantic coastal plains, low hills, knolls. The parent material consists of glauconite bearing loamy eolian deposits and/or glauconite bearing loamy fluviomarine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: FrkC - Freehold sandy loam, 5 to 10 percent slopes
The Freehold component makes up 90 percent of the map unit. Slopes are 5 to 10 percent. This component is on North Atlantic coastal plains, hillslopes, knolls. The parent material consists of glauconite bearing loamy eolian deposits and/or glauconite bearing loamy fluviomarine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map unit: HboB - Hammonton sandy loam, 2 to 5 percent slopes

The Hammonton component makes up 85 percent of the map unit. Slopes are 2 to 5 percent. This component is on flats, depressions, coastal plains. The parent material consists of coarse-loamy fluviomarine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 30 inches during January, February, March, April. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 2w. This soil does not meet hydric criteria.

Map unit: HbrB - Hammonton-Urban land complex, 0 to 5 percent slopes
The Hammonton component makes up 70 percent of the map unit. Slopes are 0 to 5 percent. This component is on flats, depressions, coastal plains. The parent material consists of coarse-loamy fluviomarine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 30 inches during January, February, March, April. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 2w. This soil does not meet hydric criteria. Urban land component makes up 20% and is a miscellaneous area.

Map unit: HocA - Holmdel sandy loam, 0 to 2 percent slopes
The Holmdel component makes up 85 percent of the map unit. Slopes are 0 to 2 percent. This component is on flats on North Atlantic coastal plains. The parent material consists of glauconite bearing loamy marine deposits and/or fluviomarine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 27 inches during January, February, March, April, May, December. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 2w. This soil does not meet hydric criteria.

Map unit: HofB - Holmdel-Urban land complex, 0 to 5 percent slopes
The Holmdel component makes up 55 percent of the map unit. Slopes are 0 to 5 percent. This component is on North Atlantic coastal plains, flats, low hills. The parent material consists of glauconite bearing loamy marine deposits and/or fluviomarine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 27 inches during January, February, March, April, May, December. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 2w. This soil does not meet hydric criteria.

Map unit: HumAt - Humaquepts, 0 to 3 percent slopes, frequently flooded
The Humaquepts, frequently flooded component makes up 85 percent of the map unit. Slopes are 0 to 3 percent. This component is on flood plains, river valleys on North Atlantic coastal plains. The parent material consists of loamy alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is moderate. This soil is frequently flooded. It is frequently ponded. A seasonal zone of water saturation is at 6 inches during January, February, March, April, May, June, November, December. Organic matter content in the surface horizon is about 12 percent. Nonirrigated land capability classification is 5w. This soil meets hydric criteria.

Map unit: KemA - Keyport sandy loam, 0 to 2 percent slopes
The Keyport component makes up 85 percent of the map unit. Slopes are 0 to 2 percent. This component is on knolls on North Atlantic coastal plains. The parent material consists of silty and clayey eolian deposits and/or silty and clayey fluviomarine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is high. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 24 inches during January, February, March, April, May, November, December. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 2w. This soil does not meet hydric criteria.

Map unit: KemB - Keyport sandy loam, 2 to 5 percent slopes
The Keyport component makes up 85 percent of the map unit. Slopes are 2 to 5 percent. This component is on flats on North Atlantic coastal plains, depressions. The parent material consists of silty and clayey eolian deposits and/or silty and clayey fluviomarine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches (or restricted depth) is high. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 30 inches during January, February, March, April. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: KemC - Keyport sandy loam, 5 to 10 percent slopes
The Keyport component makes up 85 percent of the map unit. Slopes are 5 to 10 percent. This component is on knolls on North Atlantic coastal plains. The parent material consists of silty and clayey eolian deposits and/or silty and clayey fluviomarine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is high. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 24 inches during January, February, March, April, May, November, December. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map unit: KemD - Keyport sandy loam, 10 to 15 percent slopes
The Keyport component makes up 85 percent of the map unit. Slopes are 10 to 15 percent. This component is on knolls on North Atlantic coastal plains. The parent material consists of silty and clayey eolian deposits and/or silty and clayey fluviomarine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is high. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 24 inches during January, February, March, April, May, November, December. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map unit: KeuC - Keyport-Urban land complex, 0 to 10 percent slopes
The Keyport component makes up 55 percent of the map unit. Slopes are 0 to 10 percent. This component is on knolls on North Atlantic coastal plains. The parent material consists of silty and clayey eolian deposits and/or silty and clayey fluviomarine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is high. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 24 inches during January, February, March, April, May, November, December. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria. Urban land component makes up 30% and is a miscellaneous area.

Map unit: KkgB - Klej loamy sand, 0 to 5 percent slopes
The Klej component makes up 90 percent of the map unit. Slopes are 0 to 5 percent. This component is on dunes on North Atlantic coastal plains. The parent material consists of unconsolidated sandy marine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 18 inches (depth from the mineral surface is 14 inches) during January, February, March, April, December. Organic matter content in the surface horizon is about 85 percent. Below this thin organic horizon the organic matter content is about 2 percent. Nonirrigated land capability classification is 3w. This soil does not meet hydric criteria.

Map unit: KkgkB - Klej loamy sand, clayey substratum, 0 to 5 percent slopes
The Klej, clay substratum component makes up 90 percent of the map unit. Slopes are 0 to 5 percent. This component is on dunes on North Atlantic coastal plains. The parent material consists of unconsolidated sandy marine deposits over clayey estuarine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 21 inches (depth from the mineral surface is 17 inches) during January, February, March, April, December. Organic matter content in the surface horizon is about 85 percent. Below this thin organic horizon the organic matter content is about 2 percent. Nonirrigated land capability classification is 3w. This soil does not meet hydric criteria.

Map unit: KkhB - Klej loamy sand-Urban land complex, 0 to 5 percent slopes
The Klej component makes up 55 percent of the map unit. Slopes are 0 to 5 percent. This component is on dunes on North Atlantic coastal plains. The parent material consists of unconsolidated sandy marine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 18 inches (depth from the mineral surface is 14 inches) during January, February, March, April, December. Organic matter content in the surface horizon is about 85 percent. Below this thin organic horizon the organic matter content is about 2 percent. Nonirrigated land capability classification is 3w. This soil does not meet hydric criteria. Urban land component makes up 30% and is a miscellaneous area.

Map unit: KrhB - Kresson loam, 2 to 5 percent slopes
The Kresson component makes up 90 percent of the map unit. Slopes are 2 to 5 percent. This component is on depressions, flats on North Atlantic coastal plains. The parent material consists of glauconitic clayey marine deposits and/or glauconitic clayey fluviomarine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches (or restricted depth) is high. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 12 inches during January, February, March, April, May, December. Organic matter content in the surface horizon is about 3 percent. Nonirrigated land capability classification is 3w. This soil does not meet hydric criteria.

Map unit: LasB - Lakewood sand, 0 to 5 percent slopes
The Lakewood component makes up 85 percent of the map unit. Slopes are 0 to 5 percent. This component is on flats on North Atlantic coastal plains, knolls. The parent material consists of sandy fluviomarine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches (or restricted depth) is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.

Map unit: MakAt - Manahawkin muck, 0 to 2 percent slopes, frequently flooded
The Manahawkin, frequently flooded component makes up 85 percent of the map unit. Slopes are 0 to 2 percent. This component is on swamps on North Atlantic coastal plains, flood plains. The parent material consists of organic, woody material over sandy alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is very poorly drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches (or restricted depth) is very high.

Shrink-swell potential is low. This soil is frequently flooded. It is frequently ponded. A seasonal zone of water saturation is at 0 inches during January, February, March, April. Organic matter content in the surface horizon is about 55 percent. Nonirrigated land capability classification is 7w. This soil meets hydric criteria. There are no saline horizons within 30 inches of the soil surface.

Map unit: PegB - Pemberton loamy sand, 0 to 5 percent slopes
The Pemberton component makes up 85 percent of the map unit. Slopes are 0 to 5 percent. This component is on flats on North Atlantic coastal plains, low hills. The parent material consists of eolian sands over old alluvium and/or glauconitic bearing marine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 30 inches during January, February, March, April, May, June, November, December. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 3w. This soil does not meet hydric criteria.

Map unit: ShrA - Shrewsbury sandy loam, 0 to 2 percent slopes
The Shrewsbury component makes up 85 percent of the map unit. Slopes are 0 to 2 percent. This component is on flats on North Atlantic coastal plains. The parent material consists of fine-loamy marine deposits containing moderate amounts of glauconite. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 6 inches during January, February, March, April, May, June, October, November, December. Organic matter content in the surface horizon is about 4 percent. Nonirrigated land capability classification is 3w. This soil meets hydric criteria.

Map unit: UdaB - Udorthents, 0 to 8 percent slopes
The Udorthents component makes up 100 percent of the map unit. Slopes are 0 to 8 percent. This component is on low hills on uplands, fills, cuts (road, railroad, etc.). The parent material consists of fill and/or disturbed original soil material. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 3 percent. Nonirrigated land capability classification is 3w. This soil does not meet hydric criteria.

Map unit: WATER - Water
Generated brief soil descriptions are created for major soil components. The Water is a miscellaneous area.

Map unit: WogA - Woodstown loam, 0 to 2 percent slopes, Northern Coastal Plain
The Woodstown component makes up 81 percent of the map unit. Slopes are 0 to 2 percent. This component is on flats, coastal plains. The parent material consists of loamy fluviomarine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 24 inches during February. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 2w. This soil does not meet hydric criteria. There are no saline horizons within 30 inches of the soil surface.

APPENDIX D.1. RARE PLANT REPORTING FORM

Source: http://www.nj.gov/dep/parksandforests/natural/heritage/natherrareplantspeciesreportform1_2008.doc

Natural Heritage Rare Plant Species Reporting Form

This form is used to report a personal field sighting of a rare plant species tracked by the Natural Heritage Database. It may also be used to summarize locational information from a published or unpublished report. Plant species tracked include those appearing on the State Endangered Plant Species List or the Plant Species of Concern List (http://www.nj.gov/dep/parksandforests/natural/heritage/spplant.html). The Office of Natural Lands Management can provide copies of the lists upon request. In order for this form to be processed, the sections preceded by an asterisk (*) must be completed.

Send completed form to: DEP, Division of Parks and Forestry, Office of Natural Lands Management, Natural Heritage Program, P.O. Box 404, Trenton, NJ 08625-0404.

Today's Date: (date this form is being completed) _____

Common Name: _____ **Scientific Name:** _____

***Location Map:** *A mapped location of the occurrence must accompany this form.* The ideal format is to locate the site on a photocopied section of a U.S. Geological Survey 7.5 minute topographical map, and to also sketch a second map showing finer details. Be sure to provide the name of the USGS map.

GPS Coordinates (If available please provide the following):

Datum Used:	☐ NAD 1983	☐ NAD 1927	☐ WGS84	☐ Other _____
Lat/Long (if applicable):	_____ N (Latitude)		_____ W (Longitude)	
UTM (if applicable)	18 N/S: _____ Northing		_____ Easting	
Accuracy Level:	+/-____ ☐ feet or ☐ meters			

***Directions to Site:** Directions to the element occurrence using a readily locatable and relatively permanent landmark on or near the site (such as a road intersection, a prominent hill or cliff) as the starting point. Use clear, complete sentences so that someone who is unfamiliar with the area will be able to relocate the element occurrence using your written directions (e.g., "About 50 ft. N. of small stream draining Brindel Lake, 0.5 mi. SE of Brindeltown and 0.2 mi. WSW of jct. of Range Rd. and Rt. 539, Fort Dix").

***Date(s) of the Observation(s):** _____

Identification: How was the species identification made? Name the identification manuals used or the experts consulted. Were there identification problems?

***Number of Individuals Observed:**

☐ 1-10 ☐ 11-50 ☐ 101-1,000 ☐ 1,001-10,000 ☐ >10,000

If possible, provide the exact number of individuals and an estimated percentage of flowering/fruiting individuals. For rhizomatous plants such as grasses and sedges, what was counted as individual – separate culms or entire clumps or patches?

Life Stages Present: Check life stages observed or provide an estimate of the numbers of individuals for each life stage.

☐ vegetative ☐ in bud ☐ flower ☐ seed dispersing ☐ seedling ☐ dormant

Associated Species/Additional Biological Data: List any associated species and/or additional rare species observed at this site. What else was observed? Provide information on the general condition or vigor of the individuals and viability of the population(s).

Habitat Data: Describe the specific area where the occurrence is located. List natural community types, dominant vegetation and information on the physical environment such as substrate type, hydrology, moisture regime, slope and aspect. Also, describe the surrounding landscape.

Threats: Describe any current or potential threats to this occurrence. If invasive species are present, please list.

Ownership: If known, please provide landowner(s) name, address, phone #.

Information Source:
***Name, Address and Phone #** (of person filing report):

Name:	
Address:	
Phone Number:	

*Does this information come directly from ☐ a field visit or ☐ a published or unpublished report?

Citation: For information taken from a published or unpublished report, please provide a copy of the cover page and the pertinent portions of the report. If a copy can not be provided, list below the author, date, title, publisher, and page numbers.

Voucher: Was the observation vouchered with ☐ a photograph? ☐ a video/digital format? ☐ a specimen?
If possible, attach a copy of the photograph or tape. If specimen voucher, please provide the name of the repository:

Confirmation: Would you accompany a biologist to the site if needed? ☐ yes ☐ no.

Additional Comments: (use extra sheets if needed)

Note: Use the following address, not the one on the reporting form:

The New Jersey Natural Heritage Program
DEP - Office of Natural Lands Management
Mail Code 501-04
P.O. Box 420
Trenton, New Jersey 08625-0420

APPENDIX D.2. RARE PLANT SPECIES OF MONMOUTH COUNTY

The species shown in red is known from the immediate vicinity of Ocean Township.

Ferns & Allies		
Lygodium palmatum	climbing fern	moist open woods or thickets
Schizaea pusilla	curly grass fern	in sandy, acid soils of white cedar bog edges and hummocks, just above the water line
Graminoids		
Calamagrostis pickeringii	Pickering's reedgrass	bogs and wet shores
Carex cumulata	clustered sedge	dry, rocky or sandy soil
Carex polymorpha	variable sedge	dry open woods, mostly in acid soils
Carex silicea	seabeach sedge	sand or sandy soil near the coast
Carex utriculata	bottle-shaped sedge	wet soil or shallow water
Cyperus lancastriensis	Lancaster flat sedge	woods and fields
Cyperus polystachyos	coast flat sedge	wet soil
Eleocharis halophila	salt-marsh spike-rush	mainly of coastal salt marshes
Juncus articulatus	jointed rush	bogs, wet meadows and shores
Juncus caesariensis	New Jersey rush	sphagnum bogs in the pine barrens
Juncus greenei	Greene's rush	moist to dry, clay or sandy soil, sometimes on dunes
Leptochloa fascicularis var maritima	long-awn sprangletop	wet soil of watersides, fresh or usually brackish water of marshes
Luzula acuminata var acuminata	hairy wood-rush	moist woods, less often along roadsides or in other open places
Panicum dichotomum var yadkinense	spotted-sheath panic grass	moist soil in a variety of habitats, including rich woods, bottomlands, thickets, swamps
Panicum scabriusculum	sheathed panic grass	wet, low ground of swamps, woods, pondsides
Paspalum dissectum	mudbank crown grass	usually in wet, muddy soil or in shallow water of watersides, also in dried pond bottoms
Puccinellia fasciculata	saltmarsh alkali grass	wet soil or water of salt marsh borders, beaches
Rhynchospora knieskernii	Knieskern's beaked-rush	pine barren bogs
Rhynchospora pallida	pale beaked-rush	acid bogs along the coast
Rhynchospora recognita	coarse grass-like beaked-rush	low, wet to moist ground in swamps and bogs, sandy depressions
Schoenoplectus maritimus	saltmarsh bulrush	fresh, saline or alkaline swamps and marshes
Sphenopholis pensylvanica	swamp oats	swamps and wet woods
Terrestrial Herbs		
Agastache nepetoides	yellow giant-hyssop	open, rich soil of deciduous woods and shaded edges
Amaranthus pumilus	seabeach amaranth	sea-beaches
Arnoglossum atriplicifoliium	pale Indian plantain	dry, open ground of woods and shaded edges
Artemisia campestris ssp caudata	beach wormwood	dunes and other very sandy placer along the coast and irregularly inland
Asclepias lanceolata	smooth orange milkweed	swamps, bogs and brackish marshes on the coastal plain
Asclepias rubra	red milkweed	swamps, bogs and wet woods on or near the coastal plain
Asclepias variegata	white milkweed	upland woods and thickets
Aster concolor	eastern silvery aster	dry sandy places, often among pines

Aster radula	low rough aster	bogs, streambanks and other moist places
Atriplex subspicata	saline orache	sea beaches, also commonly inland in saline habitats
Chenopodium berlandieri var macrocalycium	large-calyx goosefoot	mainly coastal or coastal plain, often on sea beaches
Cuphea viscosissima	blue waxweed	dry soil
Desmodium cuspidatum var cuspidatum	toothed tick-trefoil	dry upland woods and thickets
Desmodium humifusum	trailing tick-trefoil	dry sandy woods
Desmodium pauciflorum	few-flower tick-trefoil	rich woods
Desmodium viridiflorum	velvety tick-trefoil	dry woods
Doellingeria infirma	cornel-leaf aster	dry ground of deciduous woods and shaded edges, rocky slopes
Draba reptans	Carolina whitlow-grass	dry, sterile or sandy soil
Epilobium angustifolium ssp circumvagum	narrow-leaf fireweed	many habitats, esp. moist soils rich in humus, often abundant after fires
Eryngium aquaticum var aquaticum	marsh rattlesnake-master	bogs and marshes near the coast
Eupatorium resinosum	Pine Barren boneset	pocosins, bogs and other wet places, often in pine barrens
Gentiana autumnalis	Pine Barren gentian	dry, commonly sandy soil, often in woods
Glaux maritima	sea-milkwort	moist or dry saline soil
Gnaphalium helleri var micradenium	small everlasting	dry, commonly sandy soil, often in woods
Helonias bullata	swamp-pink	swamps and bogs
Honckenya peploides var robusta	seabeach sandwort	sea beaches and sand dunes
Hydrocotyle verticillata var verticillata	whorled marsh-pennywort	wet or moist ground of bogs, swampy woods, watersides
Lespedeza stuevei	Stueve's downy bush-clover	dry upland woods and barrens
Liatris scariosa var novae-angliae	northern blazing star	prairies, open woods and other dry open places
Limosella australis	awl-leaf mudwort	muddy or sandy shores
Linum intercursum	sandplain flax	dry or moist, sandy, open ground of thin woods and shaded edges
Listera australis	southern twayblade	shaded bogs and wet woods, mainly on the coastal plain
Malaxis unifolia	green adder's-mouth	damp woods and bogs
Melanthium virginicum	Virginia bunchflower	wet woods and meadows
Mertensia virginica	Virginia bluebells	moist or wet woods
Obolaria virginica	Virginia pennywort	rich woods
Oenothera oakesiana	Oakes' evening-primrose	disturbed open places
Onosmodium virginianum	Virginia false-gromwell	well-drained, dry, open sandy ground of thin woods, barrens, rarely pinelands
Phaseolus polystachios var polystachios	wild kidney bean	moist woods and thickets
Phlox divaricata var divaricata	wild blue phlox	rich moist woods
Phlox maculata var maculata	spotted phlox	moist or wet, low ground of streamsides, meadows, floodplains
Plantago maritima var juncoides	seaside plantain	salt or brackish conditions, in water or wet soil of marshes, swamps, beaches, tidal streams, headlands

Plantago pusilla	dwarf plantain	dry, sandy open ground of woods edges, fields, dunes
Platanthera peramoena	purple fringeless orchid	open, swampy or vernally wet places, often in acid soil
Polygala polygama	racemed milkwort	dry, usually sandy soil
Polygonum glaucum	sea-beach knotweed	shallow water and wet ground of alluvial woods and edges, swamps, beaches, watersides
Porteranthus trifoliatus	Indian physic	dry or moist upland woods
Prenanthes autumnalis	Pine Barren rattlesnake-root	sandy, usually moist places, often among pines
Pycnanthemum torrei	Torrey's mountain-mint	dry or moist, open ground of thin woods and shaded edges, swamp edges
Pyrola chlorantha	greenish-flower wintergreen	dry woods
Ranunculus cymbalaria	seaside buttercup	in mud, especially in brackish or alkaline places
Rumex hastatulus	Engelmann's sorrel	sandy soil of the coastal plain
Sabatia dodecandra var dodecandra	large marsh-pink	salt or brackish marshes near the coast
Sagittaria australis	southern arrowhead	mostly in circumneutral water of lakes, ponds or swamps
Schwalbea americana	chaffseed	moist to dry, sandy ground of pine-oak woods and shaded edges, marshes
Sesuvium maritimum	seabeach purslane	sea beaches
Sisyrinchium fuscatum	sand plain blue-eyed grass	sandy areas, mainly near the coast
Stachys hyssopifolia	hyssop hedge-nettle	moist, usually sandy soil near the coast
Suaeda calceoliformis	American seablite	saline or alkaline soil
Triglochin maritima	seaside arrow-grass	brackish or fresh marshes and bogs
Trillium grandiflorum	large-flower trillium	forests, talus and rocky slopes
Uvularia puberula var nitida	Pine Barren bellwort	woods on the coastal plain
Verbena simplex	narrow-leaf vervain	dry, open, sandy or rocky non-acid ground of thin woods, fields, roadsides
Vicia americana var americana	American purple vetch	moist woods
Zigadenus leimanthoides	death-camus	bogs and wet woods on the coastal plain
Aquatic Herbs		
Ceratophyllum echinatum	spiny coontail	quiet water
Elatine minima	small waterwort	on mud
Eriocaulon parkeri	Parker's pipewort	tidal flats and muddy shores, oft submerged in fresh to slightly brackish water
Hottonia inflata	featherfoil	quiet shallow water or wet soil of swamps, slow streams, ditches
Myriophyllum tenellum	slender water milfoil	submersed in quiet water or rooting on muddy shores
Shrubs, Trees and Woody Vines		
Asimina triloba	pawpaw	rich, moist, alluvial soil of low woods, streamsides, river islands
Crataegus calpodendron	pear hawthorne	usually in dry or rocky ground
Crataegus succulenta	fleshy hawthorne	dry, rocky ground of woods, roadsides, streamsides
Dirca palustris	leatherwood	rich, moist woods
Fraxinus profunda	pumpkin ash	swamps and wet woods
Prunus angustifolia var angustifolia	Chickasaw plum	dry, open sandy or sterile ground of woods and shaded edges, dune sands
Rubus ostryifolius	highbush blackberry	cliffs, balds, or ledges, forest edges, forests, meadows and fields, woodlands

Rubus pervarius	Davis' dewberry	forest edges, meadows and fields, swamps, wetland margins, woodlands
Salix lucida ssp lucida	shining willow	moist, low ground of bogs, swamps, watersides
Smilax pulverulenta	downy carrion-flower	moist soil of open woods, roadsides and thickets

APPENDIX D.3. INVASIVE PLANTS TRACKED IN MONMOUTH COUNTY

Scientific name	Common name	Taxa
Acer ginnala	Amur maple	tree
Acer palmatum	Japanese maple	tree
Acer pseudoplatanus	Sycamore maple	tree
Aralia elata	Japanese angelica tree	tree
Pyrus calleryana	Callery pear (Bradford pear)	tree
Styrax japonicus	Japanese snowbell	tree
Rhamnus cathartica	European buckthorn	tree/shrub
Viburnum sieboldii	Siebold's arrowwood	tree/shrub
Elaeagnus angustifolia	Russian olive	shrub
Elaeagnus umbellata	autumn olive	shrub
Ligustrum obtusifolium	border privet	shrub
Rhodotypos scandens	jetbead	shrub
Robinia hispida	bristly locust	shrub
Viburnum dilatatum	linden viburnum	shrub
Viburnum setigerum	tea viburnum	shrub
Akebia quinata	chocolate vine	vine
Ampelopsis glandulosa var. brevipedunculata	porcelain-berry	vine
Celastrus orbiculatus	oriental bittersweet	vine
Clematis terniflora	sweet autumn virginsbower	vine
Cynanchum louiseae	black swallowwort	vine
Hedera helix	English ivy	vine
Persicaria perfoliata	mile-a-minute vine	vine
Pueraria montana var. lobata	kudzu	vine
Wisteria floribunda	Japanese wisteria	vine
Wisteria sinensis	Chinese wisteria	vine
Alliaria petiolata	garlic mustard	terrestrial herb
Lespedeza cuneata	sericea lespedeza	terrestrial herb
Reynoutria (Fallopia) sachalinensis	giant knotweed	terrestrial herb
Hydrilla verticillata	hydrilla	aquatic herb
Iris pseudacorus	yellow iris	aquatic herb
Marsilea quadrifolia	European water-clover	aquatic herb
Myriophyllum aquaticum	parrotfeather	aquatic herb
Trapa natans	European water chestnut	aquatic herb
Carex macrocephala	largehead sedge	graminoid
Microstegium vimineum	Japanese stiltgrass	graminoid
Miscanthus sinensis	Chinese silvergrass	graminoid
Phragmites australis ssp. australis	common reed	graminoid

Data from FoHVOS, 2018. https://www.fohvos.info/invasive-species-strike-team/interactive-map/

APPENDIX E.1. MONMOUTH COUNTY BIRDS

The list shows the high count for every species reported on E-bird as of mid-January, 2019. *Species with an asterisk have also been observed at locations in Ocean Township, including Joe Palaia Park, Weltz Park and Deal Lake.

State Status		Common name	*Scientific name*	Monmouth High Count	Monmouth High Count Date
Ducks, Geese & Swans					
RV		black-bellied whistling duck	*Dendrocygna autumnalis*	10	6-Jul-18
RV		greater white-fronted Goose	*Anser albifrons*	5	6-Jan-17
RV		pink-footed goose	*Anser brachyrhynchus*	2	24-Dec-16
	*	snow Goose	*Chen caerulescens*	15000	5-Feb-17
RV		Ross's Goose	*Chen rossii*	1	9-Dec-18
	*	brant	*Branta bernicla*	10000	5-Mar-14
RV		cackling goose	*Branta hutchinsii*	7	16-Feb-18
	*	Canada goose	*Branta canadensis*	10000	2-Jan-17
RV		barnacle goose	*Branta leucopsis*	3	23-Feb-17
int	*	mute Swan	*Cygnus olor*	600	19-Jan-09
RV		trumpeter swan	*Cygnus buccinator*	9	27-Jan-18
		tundra swan	*Cygnus columbianus*	77	19-Jan-15
		muscovy duck	*Cairina moschata*	12	28-May-17
	*	wood duck	*Aix sponsa*	47	14-Mar-14
		gadwall	*Anas strepera*	534	9-Jan-14
		Eurasian wigeon	*Anas penelope*	3	2-Mar-14
	*	American wigeon	*Anas americana*	700	21-Jan-17
	*	American black duck	*Anas rubripes*	5000	14-Mar-65
	*	mallard	*Anas platyrhynchos*	500	3-Jan-15
	*	blue-winged teal	*Anas discors*	23	26-Apr-13
		northern shoveler	*Anas clypeata*	100	14-Mar-65
		northern pintail	*Anas acuta*	125	10-Oct-11
	*	green-winged teal	*Anas crecca*	55	1-Mar-09
	*	canvasback	*Aythya valisineria*	442	6-Dec-92
		redhead	*Aythya americana*	50	25-Jan-18
		ring-necked duck	*Aythya collaris*	400	16-Mar-14
	*	greater scaup	*Aythya marila*	50000	13-Feb-88
		lesser scaup	*Aythya affinis*	2000	2-Feb-08
		tufted duck	*Aythya fuligula*	3	1-Mar-95
		king eider	*Somateria spectabilis*	6	7-Dec-13
		common eider	*Somateria mollissima*	32	21-Nov-10
		harlequin duck	*Histrionicus histrionicus*	21	2-Jan-04
	*	surf scoter	*Melanitta perspicillata*	15000	19-Feb-15
		white-winged scoter	*Melanitta fusca*	500	27-Mar-17
	*	black scoter	*Melanitta americana*	55000	21-Feb-15

State Status		Common name	*Scientific name*	Monmouth High Count	Monmouth High Count Date
	*	long-tailed duck	*Clangula hyemalis*	5000	19-Feb-15
	*	bufflehead	*Bucephala albeola*	850	2-Feb-04
		common goldeneye	*Bucephala clangula*	1200	2-Feb-04
RV		Barrow's goldeneye	*Bucephala islandica*	3	10-Jan-05
	*	hooded merganser	*Lophodytes cucullatus*	400	19-Jan-09
	*	common merganser	*Mergus merganser*	2500	12-Jan-15
	*	red-breasted merganser	*Mergus serrator*	800	8-Jan-12
	*	ruddy duck	*Oxyura jamaicensis*	1100	17-Feb-12
Grouse, Quail & Allies					
WAP-FS		northern bobwhite	*Colinus virginianus*	30	14-Nov-91
		ring-necked pheasant	*Phasianus colchicus*	16	14-Mar-65
		ruffed grouse	*Bonasa umbellus*	1	16-Apr-06
		wild turkey	*Meleagris gallopavo*	40	1-Jan-19
Grebes					
Ebr, SCnb	*	pied-billed grebe	*Podilymbus podiceps*	29	18-Dec-15
		horned grebe	*Podiceps auritus*	165	1-Mar-15
		red-necked grebe	*Podiceps grisegena*	20	8-Mar-03
RV		eared grebe	*Podiceps nigricollis*	2	7-Jan-08
RV		western grebe	*Aechmorphorus occidentalis*	1	10-Apr-16
Pigeons & Doves					
int	*	rock pigeon	*Columba livia*	1000	5-Feb-05
RV		Eurasian collared-dove	*Streptopelia decaocto*	4	10-Jan-12
RV		white-winged dove	*Zenaida asiatica*	1	16-Nov-16
	*	mourning dove	*Zenaida macroura*	200	11-Jan-13
Cuckoos					
		groove-billed ani	*Crotophaga sulcirostris*	1	9-Oct-97
	*	yellow-billed cuckoo	*Coccyzus americanus*	13	22-May-18
SCbr		black-billed cuckoo	*Coccyzus erythropthalmus*	5	19-May-17
Nightjars					
SC	*	common nighthawk	*Chordeiles minor*	50	10-Aug-13
		chuck-will's-widow	*Antrostomus carolinensis*	4	12-May-16
SCbr, Unb		eastern whip-poor-will	*Antrostomus vociferous*	5	27-Jun-18
Swifts & Hummingbirds					
	*	chimney swift	*Chaetura pelagica*	220	19-May-18
	*	ruby-throated hummingbird	*Archilochus colubris*	41	20-May-18
RV		rufous hummingbird	*Selasphorus rufus*	1	7-Jan-14
RV		Mexican violetear	*Colibri thalassinus*	1	24-Aug-05

State Status		Common name	*Scientific name*	Monmouth High Count	Monmouth High Count Date
Cranes & Rails					
		yellow rail	*Coturnicops noveboracensis*	1	23-Dec-07
	*	clapper rail	*Rallus longirostris*	8	5-Jul-14
		king rail	*Rallus elegans*	1	1-Oct-91
		Virginia rail	*Rallus limicola*	6	23-Dec-07
		sora	*Porzana carolina*	3	14-Aug-16
		purple gallinule	*Poryphyrula martinica*	1	27-May-17
		common gallinule	*Gallinula galeata*	10	13-Oct-07
	*	American coot	*Fulica americana*	460	18-Dec-15
		Sandhill crane	*Grus canadensis*	2	24-Oct-18
Plovers, Sandpipers & Allies					
		black-bellied plover	*Pluvialis squatarola*	96	31-Aug-14
		American golden-plover	*Pluvialis dominica*	36	21-Oct-89
RV		Wilson's plover	*Charadrius wilsonia*	1	24-May-10
		semipalmated plover	*Charadrius semipalmatus*	500	19-Aug-06
E		piping plover	*Charadrius melodus*	37	26-Jun-11
	*	killdeer	*Charadrius vociferus*	150	22-Aug-14
SC		American oystercatcher	*Haematopus palliatus*	76	5-Aug-12
		black-necked stilt	*Himantopus mexicanus*	3	1-Jun-03
		American avocet	*Recurvirostra americana*	1	6-May-17
SCbr	*	spotted sandpiper	*Actitis macularius*	44	21-Jul-76
	*	solitary sandpiper	*Tringa solitaria*	40	21-May-03
		greater yellowlegs	*Tringa melanoleuca*	60	12-May-10
		willet	*Tringa semipalmata*	36	2-May-16
	*	lesser yellowlegs	*Tringa flavipes*	50	10-Aug-76
E		upland sandpiper	*Bartramia longicauda*	2	22-Aug-18
SCnb		whimbrel	*Numenius phaeopus*	29	31-Aug-14
		Hudsonian godwit	*Limosa haemastica*	22	6-Sep-79
		marbled godwit	*Limosa fedoa*	2	15-Jul-18
WAP-FS		ruddy turnstone	*Arenaria interpres*	150	24-May-83
Enb		red knot	*Calidris canutus*	33	30-May-12
SCnb		sanderling	*Calidris alba*	1000	12-Dec-14
SCnb		semipalmated sandpiper	*Calidris pusilla*	250	12-Aug-16
		western sandpiper	*Calidris mauri*	15	10-Aug-76
	*	least sandpiper	*Calidris minutilla*	110	7-Sep-15
		white-rumped sandpiper	*Calidris fuscicollis*	18	4-Jun-12
		Baird's sandpiper	*Calidris bairdii*	13	26-Sep-04
		pectoral sandpiper	*Calidris melanotos*	18	25-Sep-11
		purple sandpiper	*Calidris maritima*	85	14-Jan-13
		dunlin	*Calidris alpina*	350	24-May-13
		stilt sandpiper	*Calidris himantopus*	7	27-Aug-06
		ruff	*Calidris pugnax*	1	29-Apr-99
		buff-breasted sandpiper	*Tryngites subruficollis*	13	14-Sep-11

State Status		Common name	*Scientific name*	Monmouth High Count	Monmouth High Count Date
		short-billed dowitcher	*Limnodromus griseus*	350	9-May-09
		long-billed dowitcher	*Limnodromus scolopaceus*	2	5-Oct-02
		Wilson's snipe	*Gallinago delicata*	22	16-Apr-12
WAP-FS	*	American woodcock	*Scolopax minor*	28	25-Mar-17
		Wilson's phalarope	*Phalaropus tricolor*	2	6-Sep-17
		red-necked phalarope	*Phalaropus lobatus*	6	26-May-03
		red phalarope	*Phalaropus fulicarius*	4	3-Dec-06
		black-legged kittiwake	*Rissa tridactyla*	500	7-Dec-96
RV		Sabine's gull	*Xema sabini*	1	26-Aug-06
	*	Bonaparte's gull	*Chroicocephalus philadelphia*	3500	4-Dec-13
		black-headed gull	*Chroicocephalus ridibundus*	3	23-Apr-09
		little gull	*Hydrocoloeus minutus*	4	21-Apr-07
	*	laughing gull	*Leucophaeus atricilla*	5000	16-Nov-08
RV		Franklin's gull	*Leucophaeus pipixcan*	4	13-Nov-15
	*	ring-billed gull	*Larus delawarensis*	5000	29-Jan-05
	*	herring gull	*Larus argentatus*	10000	18-Feb-06
	*	Iceland gull	*Larus glaucoides*	5	31-Dec-13
	*	Lesser black-backed gull	*Larus fuscus*	42	16-Apr-18
	*	glaucous gull	*Larus hyperboreus*	5	29-Dec-07
	*	great black-backed gull	*Larus marinus*	2000	18-Feb-06
		bridled tern	*Onychoprion anaethetus*	1	2-Sep-06
RV		sooty tern	*Onychoprion fuscatus*	1	6-Sep-79
E		least tern	*Sternula antillarum*	256	21-Jun-18
SC		gull-billed tern	*Gelochelidon nilotica*	4	24-Aug-09
SCbr		Caspian tern	*Hydroprogne caspia*	6	20-Sep-16
		black tern	*Chlidonias niger*	48	3-Sep-12
RV		white-winged tern	*Chlidonias leucopterus*	1	12-May-16
E		roseate tern	*Sterna dougallii*	9	14-May-03
SCbr	*	common tern	*Sterna hirundo*	1800	3-Sep-12
RV		arctic tern	*Sterna paradisaea*	3	25-May-17
WAP-FS		Forster's tern	*Sterna forsteri*	320	30-Oct-15
		royal tern	*Thalasseus maximus*	136	2-Oct-12
		sandwich tern	*Thalasseus sandvicensis*	2	24-Sep-03
RV		elegant tern	*Thalasseus elegans*	1	14-Sep-12
E		black skimmer	*Rynchops niger*	310	3-Sep-10
RV		great skua	*Stercorarius skua*	1	14-Dec-91
RV		south polar skua	*Stercorarius maccormicki*	1	25-Aug-96
		pomarine jaeger	*Stercorarius pomarinus*	4	4-Dec-99
		parasitic jaeger	*Stercorarius parasiticus*	4	12-Nov-13
		long-tailed jaeger	*Stercorarius longicaudus*	1	24-Aug-08
		dovekie	*Alle alle*	40	15-Jan-12
		common murre	*Uria aalge*	33	22-Jan-11
		thick-billed murre	*Uria lomvia*	4	29-Jan-05

State Status		Common name	*Scientific name*	Monmouth High Count	Monmouth High Count Date
	*	tazorbill	*Alca torda*	698	31-Dec-18
RV		black guillemot	*Cepphus grylle*	1	31-Dec-18
		long-billed murrelet	*Brachyramphus perdix*	1	19-Jan-07
		Atlantic puffin	*Fratercula arctica*	2	7-Dec-96
Loons					
	*	red-throated loon	*Gavia stellata*	1298	5-Nov-18
	*	common loon	*Gavia immer*	202	3-Dec-06
RV		Pacific loon	*Gavia arctica*	1	16-Dec-17
Tubenoses					
		northern fulmar	*Fulmarus glacialis*	107	7-Dec-96
		Cory's shearwater	*Calonectris diomedea*	134	24-Aug-08
		great shearwater	*Puffinus gravis*	33	24-Aug-08
		sooty shearwater	*Puffinus griseus*	42	30-May-12
		manx shearwater	*Puffinus puffinus*	7	3-Dec-06
		Audubon's shearwater	*Puffinus lherminieri*	1	20-Aug-05
		Wilson's storm-petrel	*Oceanites oceanicus*	500	24-Aug-08
RV		white-faced storm-petrel	*Pelagodroma marina*	1	28-Aug-99
Storks					
RV		wood stork	*Mycteria americana*	1	19-Sep-17
Frigatebirds, Boobies, Cormorants, Darters & Allies					
RV		magnificent frigatebird	*Fregata magnificens*	1	18-May-06
RV		brown booby	*Sula leucogaster*	1	25-Feb-18
	*	northern gannet	*Morus bassanus*	18000	9-Apr-09
	*	double-crested cormorant	*Phalacrocorax auritus*	1000	28-Oct-10
		great cormorant	*Phalacrocorax carbo*	150	15-Mar-91
RV		anhinga	*Anhinga anhinga*	2	15-May-04
Pelicans, Herons, Ibises & Allies					
		American white pelican	*Pelecanus erythrorhynchos*	7	11-Dec-06
		brown Ppelican	*Pelecanus occidentalis*	7	9-Jul-02
Ebr, SCnb		American bittern	*Botaurus lentiginosus*	8	15-Apr-12
SC		least bittern	*Ixobrychus exilis*	6	2-Jul-14
SCbr	*	great blue heron	*Ardea herodias*	45	8-May-16
	*	great egret	*Ardea alba*	34	1-Apr-13
SCbr		snowy egret	*Egretta thula*	40	13-Aug-13
SC		little blue heron	*Egretta caerulea*	10	6-Aug-91
SC		tricolored heron	*Egretta tricolor*	3	26-Apr-18
Tbr, SCnb		cattle egret	*Bubulcus ibis*	1	2-May-17
	*	green heron	*Butorides virescens*	13	3-May-18
Tbr, SCnb	*	black-crowned night-heron	*Nycticorax nycticorax*	42	14-Aug-79

State Status		Common name	*Scientific name*	Monmouth High Count	Monmouth High Count Date
T		yellow-crowned night-heron	*Nyctanassa violacea*	9	24-Jul-16
RV		white ibis	*Eudocimus albus*	1	30-Apr-17
SCbr		glossy ibis	*Plegadis falcinellus*	83	8-May-16
New World Vultures					
	*	black vulture	*Coragyps atratus*	55	30-Dec-17
	*	turkey vulture	*Cathartes aura*	148	31-Mar-18
Hawks, Kites, Eagles & Allies					
Tbr	*	osprey	*Pandion haliaetus*	26	2-May-13
		swallow-tailed kite	*Elanoides forficatus*	2	16-Apr-17
	*	Mississippi kite	*Ictinia mississippiensis*	7	28-May-12
Ebr, Tnb	*	bald eagle	*Haliaeetus leucocephalus*	10	9-Mar-18
Ebr, SCnb	*	northern harrier	*Circus cyaneus*	40	4-Apr-09
SC	*	sharp-shinned hawk	*Accipiter striatus*	300	2-May-97
SCbr	*	Cooper's hawk	*Accipiter cooperii*	50	24-Apr-09
Ebr, SCnb		northern goshawk	*Accipiter gentilis*	2	7-Nov-04
Ebr, SCnb	*	red-shouldered hawk	*Buteo lineatus*	47	9-Apr-09
SCbr	*	broad-winged hawk	*Buteo platypterus*	100	2-May-97
	*	red-tailed hawk	*Buteo jamaicensis*	40	3-Nov-14
		rough-legged hawk	*Buteo lagopus*	1	27-Jan-16
		golden eagle	*Aquila chrysaetos*	1	13-Nov-13
Owls					
		barn owl	*Tyto alba*	3	25-Nov-00
		eastern screech-owl	*Megascops asio*	10	16-Dec-90
	*	great horned owl	*Bubo virginianus*	3	16-Jun-18
		snowy owl	*Bubo scandiacus*	3	1-Mar-18
T		barred owl	*Strix varia*	2	18-Jul-18
T		long-eared owl	*Asio otus*	3	30-Dec-12
Ebr, SCnb		short-eared owl	*Asio flammeus*	4	20-Mar-91
		northern saw-whet owl	*Aegolius acadicus*	12	17-Oct-12
Kingfishers & Allies					
	*	belted kingfisher	*Megaceryle alcyon*	13	26-Sep-04
Woodpeckers					
T		red-headed woodpecker	*Melanerpes erythrocephalus*	2	11-Oct-16
	*	red-bellied woodpecker	*Melanerpes carolinus*	26	17-Dec-17
	*	yellow-bellied sapsucker	*Sphyrapicus varius*	25	13-Oct-12
	*	downy woodpecker	*Picoides pubescens*	30	3-Apr-14
	*	hairy woodpecker	*Picoides villosus*	8	25-Oct-14
	*	northern flicker	*Colaptes auratus*	250	13-Oct-12
		pileated woodpecker	*Dryocopus pileatus*	3	14-Oct-18

State Status		Common name	*Scientific name*	Monmouth High Count	Monmouth High Count Date
Caracaras & Falcons					
RV		crested caracara	*Caracara cheriway*	1	7-Feb-16
T	*	American kestrel	*Falco sparverius*	250	11-Apr-15
	*	merlin	*Falco columbarius*	79	30-Apr-10
		gyrfalcon	*Falco rusticolus*	2	undated
Ebr, SCnb	*	peregrine falcon	*Falco peregrines*	8	4-May-12
Parrots					
int		monk parakeet	*Myiopsitta monachus*	1	15-Jun-03
Perching Birds					
	*	olive-sided flycatcher	*Contopus cooperi*	4	15-May-10
	*	eastern wood-pewee	*Contopus virens*	18	23-May-18
		yellow-bellied flycatcher	*Empidonax flaviventris*	10	21-May-03
	*	Acadian flycatcher	*Empidonax virescens*	4	28-Jun-14
		alder flycatcher	*Empidonax alnorum*	7	26-May-14
	*	willow flycatcher	*Empidonax traillii*	13	20-May-18
SCbr	*	least flycatcher	*Empidonax minimus*	30	21-May-03
	*	eastern phoebe	*Sayornis phoebe*	200	25-Sep-09
RV		Say's phoebe	*Sayornis saya*	1	1-Oct-18
RV		ash-throated flycatcher	*Myiarchus cinerascens*	1	2-Dec-17
	*	great crested flycatcher	*Myiarchus crinitus*	22	20-May-18
		western kingbird	*Tyrannus verticalis*	2	17-Dec-07
	*	eastern kingbird	*Tyrannus tyrannus*	150	22-Aug-16
RV		scissor-tailed flycatcher	*Tyrannus forficatus*	1	15-Sep-09
RV		fork-tailed flycatcher	*Tyrannus savana*	1	22-Oct-17
RV		gray kingbird	*Tyrannus dominicensis*	1	23-Sep-06
		northern shrike	*Lanius excubitor*	1	12-Nov-16
Enb		loggerhead shrike	*Lanius ludovicianus*	1	6-May-08
	*	white-eyed vireo	*Vireo griseus*	20	5-Sep-13
		yellow-throated vireo	*Vireo flavifrons*	11	4-May-12
SCbr	*	blue-headed vireo	*Vireo solitarius*	45	13-Oct-18
	*	warbling vireo	*Vireo gilvus*	18	25-May-09
	*	Philadelphia vireo	*Vireo philadelphicus*	3	24-Sep-16
	*	red-eyed vireo	*Vireo olivaceus*	85	20-May-18
	*	blue jJay	*Cyanocitta cristata*	1500	26-Apr-09
	*	American crow	*Corvus brachyrhynchos*	2000	13-Oct-17
	*	fish crow	*Corvus ossifragus*	270	31-Aug-12
	*	common raven	*Corvus corax*	7	30-Nov-18
Tbr, SCnb		horned lark	*Eremophila alpestris*	100	17-Jan-11
	*	purple martin	*Progne subis*	150	12-Aug-89
	*	tree swallow	*Tachycineta bicolor*	15000	5-Sep-10
	*	northern rough-winged swallow	*Stelgidopteryx serripennis*	50	1-May-12

State Status		Common name	*Scientific name*	Monmouth High Count	Monmouth High Count Date
		bank swallow	*Riparia riparia*	114	20-May-18
SCbr	*	cliff swallow	*Petrochelidon pyrrhonota*	20	5-Sep-10
		cave swallow	*Petrochelidon fulva*	14	12-Dec-15
	*	barn swallow	*Hirundo rustica*	2000	14-May-16
	*	Carolina chickadee	*Poecile carolinensis*	150	2-Jan-88
		black-capped chickadee	*Poecile atricapillus*	42	4-Oct-16
	*	tufted titmouse	*Baeolophus bicolor*	60	29-Mar-18
	*	red-breasted nuthatch	*Sitta canadensis*	147	30-Sep-18
	*	white-breasted nuthatch	*Sitta carolinensis*	25	18-Apr-11
	*	brown creeper	*Certhia americana*	35	11-Oct-16
	*	house wren	*Troglodytes aedon*	35	29-Apr-17
SCbr	*	winter wren	*Troglodytes hiemalis*	25	27-Oct-06
E		sedge wren	*Cistothorus platensis*	1	28-Sep-18
	*	marsh wren	*Cistothorus palustris*	25	28-Jul-17
	*	Carolina wren	*Thryothorus ludovicianus*	47	16-Feb-15
	*	blue-gray gnatcatcher	*Polioptila caerulea*	400	16-Apr-17
	*	golden-crowned kinglet	*Regulus satrapa*	1000	16-Oct-99
	*	ruby-crowned kinglet	*Regulus calendula*	500	13-Oct-12
	*	eastern bluebird	*Sialia sialis*	50	31-Dec-11
RV		Townsend's solitaire	*Myadestes townsendi*	1	19-Nov-18
SCbr	*	veery	*Catharus fuscescens*	22	11-May-16
SCnb	*	gray-cheeked thrush	*Catharus minimus*	14	26-May-16
		Bicknell's thrush	*Catharus bicknelli*	2	2-Jun-17
	*	Swainson's thrush	*Catharus ustulatus*	70	17-May-17
	*	hermit thrush	*Catharus guttatus*	200	14-Apr-12
SCbr	*	wood thrush	*Hylocichla mustelina*	30	1-Jun-14
	*	American robin	*Turdus migratorius*	2000	20-Feb-18
	*	gray catbird	*Dumetella carolinensis*	200	15-May-18
	*	northern mockingbird	*Mimus polyglottos*	36	23-Jun-07
		sage thrasher	*Oreoscoptes montanus*	1	21-Oct-09
SCbr	*	brown thrasher	*Toxostoma rufum*	15	22-Apr-01
int	*	European starling	*Sturnus vulgaris*	10500	29-Dec-12
		American pipit	*Anthus rubescens*	150	5-Nov-13
RV		Bohemian waxwing	*Bombycilla garrulus*	3	2-Feb-08
	*	cedar waxwing	*Bombycilla cedrorum*	700	25-Feb-16
		Lapland longspur	*Calcarius lapponicus*	12	13-Feb-78
RV		chestnut-collared longspur	*Calcarius ornatus*	1	22-Jan-84
		snow bunting	*Plectrophenax nivalis*	295	20-Dec-08
	*	ovenbird	*Seiurus aurocapilla*	60	11-May-18
SCbr	*	worm-eating warbler	*Helmitheros vermivorum*	4	11-May-16
	*	Louisiana waterthrush	*Parkesia motacilla*	3	5-Apr-77
	*	northern waterthrush	*Parkesia noveboracensis*	45	11-May-18
Ebr,SCnb		golden-winged warbler	*Vermivora chrysoptera*	1	12-Nov-17
WAP-FS	*	blue-winged warbler	*Vermivora cyanoptera*	15	4-May-12

State Status		Common name	*Scientific name*	Monmouth High Count	Monmouth High Count Date
	*	black-and-white warbler	*Mniotilta varia*	120	8-May-16
WAP-FS		prothonotary warbler	*Protonotaria citrea*	2	26-May-18
RV		Swainson's warbler	*Limnothlypis swainsonii*	1	2-Jun-17
	*	Tennessee warbler	*Oreothlypis peregrina*	17	9-Sep-17
		orange-crowned warbler	*Oreothlypis celata*	8	29-Nov-17
SCbr	*	Nashville warbler	*Oreothlypis ruficapilla*	25	4-May-12
		Connecticut warbler	*Oporornis agilis*	4	9-Sep-06
RV		MacGillivray's warbler	*Geothlypis tolmiei*	1	20-Dec-17
		mourning warbler	*Geothlypis philadelphia*	9	26-May-14
SC		Kentucky warbler	*Geothlypis formosa*	2	13-Jun-92
	*	common yellowthroat	*Geothlypis trichas*	300	17-May-16
SCbr	*	hooded warbler	*Setophaga citrina*	4	17-May-17
	*	American redstart	*Setophaga ruticilla*	455	9-Sep-17
	*	Cape May warbler	*Setophaga tigrina*	74	9-Sep-17
SCbr		cerulean warbler	*Setophaga cerulea*	3	15-May-84
SCbr	*	northern parula	*Setophaga americana*	100	8-May-16
	*	magnolia warbler	*Setophaga magnolia*	200	17-May-16
	*	bay-breasted warbler	*Setophaga castanea*	17	15-May-18
SCbr	*	blackburnian warbler	*Setophaga fusca*	20	14-May-10
	*	yellow warbler	*Setophaga petechia*	60	5-Aug-13
	*	chestnut-sided warbler	*Setophaga pensylvanica*	18	20-May-18
	*	blackpoll warbler	*Setophaga striata*	312	29-Sep-18
SCbr	*	black-throated blue warbler	*Setophaga caerulescens*	36	17-May-16
	*	palm warbler	*Setophaga palmarum*	200	16-Apr-17
	*	pine warbler	*Setophaga pinus*	36	12-Apr-15
	*	yellow-rumped warbler	*Setophaga coronata*	2000	13-Oct-12
		yellow-throated warbler	*Setophaga dominica*	2	10-Apr-15
	*	prairie warbler	*Setophaga discolor*	10	4-May-12
RV		Townsend's warbler	*Setophaga townsendi*	1	9-Sep-18
SCbr	*	black-throated green warbler	*Setophaga virens*	110	8-May-16
SCbr	*	Canada warbler	*Cardellina canadensis*	36	15-May-10
	*	Wilson's Warbler	*Cardellina pusilla*	32	17-May-16
SCbr		yellow-breasted chat	*Icteria virens*	13	26-Sep-04
	*	eastern towhee	*Pipilo erythrophthalmus*	169	28-Apr-18
		American tree sparrow	*Spizella arborea*	40	13-Feb-15
	*	chipping sparrow	*Spizella passerina*	80	26-Oct-18
		clay-colored sparrow	*Spizella pallida*	4	30-Sep-18
	*	field sparrow	*Spizella pusilla*	65	3-Jan-15
Ebr, SCnb		vesper sparrow	*Pooecetes gramineus*	4	21-Oct-17
	*	lark sparrow	*Chondestes grammacus*	4	12-Aug-15
RV		lark bunting	*Calamospiza malanocorys*	1	16-Sep-16
Tbr	*	savannah sparrow	*Passerculus sandwichensis*	125	14-Oct-04
Tbr, SCnb		grasshopper sparrow	*Ammodramus savannarum*	45	27-Jun-11
E		Henslow's sparrow	*Ammodramus henslowii*	1	1-Jan-12

State Status		Common name	*Scientific name*	Monmouth High Count	Monmouth High Count Date
RV		Le Conte's sparrow	*Ammodramus leconteii*	1	19-Mar-18
		Nelson's sparrow	*Ammodramus nelsoni*	19	24-Oct-07
SCbr		saltmarsh sparrow	*Ammodramus caudacutus*	25	12-Oct-14
		seaside sparrow	*Ammodramus maritimus*	15	1-Jul-11
	*	fox sparrow	*Passerella iliaca*	60	27-Mar-15
	*	song sparrow	*Melospiza melodia*	550	27-Mar-15
	*	Lincoln's sparrow	*Melospiza lincolnii*	21	14-Oct-04
	*	swamp sparrow	*Melospiza georgiana*	400	31-Oct-18
	*	white-throated sparrow	*Zonotrichia albicollis*	1250	31-Oct-18
RV		Harris's sparrow	*Zonotrichia querula*	1	3-Nov-13
	*	white-crowned sparrow	*Zonotrichia leucophrys*	55	22-Oct-18
RV		golden-crowned sparrow	*Zonotrichia atricapilla*	1	9-Jan-11
	*	dark-eyed junco	*Junco hyemalis*	1400	4-Nov-13
		summer tanager	*Piranga rubra*	3	12-May-07
WAP-FS	*	scarlet tanager	*Piranga olivacea*	55	4-May-12
RV		western tanager	*Piranga ludoviciana*	1	29-Jan-12
	*	northern cardinal	*Cardinalis cardinalis*	63	17-Dec-88
	*	rose-breasted grosbeak	*Pheucticus ludovicianus*	100	4-May-12
	*	blue grosbeak	*Passerina caerulea*	10	27-Jun-09
	*	indigo bunting	*Passerina cyanea*	45	14-May-16
RV		painted bunting	*Passerina ciris*	1	26-Nov-17
		dickcissel	*Spiza americana*	10	4-Sep-17
Tbr, SCnb		bobolink	*Dolichonyx oryzivorus*	300	21-May-03
	*	red-winged blackbird	*Agelaius phoeniceus*	25000	4-Mar-18
SCbr		eastern meadowlark	*Sturnella magna*	39	8-Nov-13
		yellow-headed blackbird	*Xanthocephalus xanthocephalus*	1	5-Oct-11
	*	rusty blackbird	*Euphagus carolinus*	20	31-Dec-11
RV		Brewer's blackbird	*Euphagus cyanocephalus*	2	24-Nov-93
	*	common grackle	*Quiscalus quiscula*	10000	15-Mar-07
	*	boat-tailed grackle	*Quiscalus major*	225	5-Nov-17
int	*	brown-headed cowbird	*Molothrus ater*	800	21-Feb-16
	*	orchard oriole	*Icterus spurius*	50	3-May-06
	*	Baltimore oriole	*Icterus galbula*	1000	10-May-06
	*	purple finch	*Haemorhous purpureus*	85	13-Oct-18
int	*	house Finch	*Haemorhous mexicanus*	250	19-Nov-16
		red crossbill	*Loxia curvirostra*	22	11-Nov-12
		white-winged crossbill	*Loxia leucoptera*	13	2-Dec-12
		common redpoll	*Acanthis flammea*	300	1-Feb-94
RV		European goldfinch	*Carduelis carduelis*	1	7-Oct-15
		pine siskin	*Spinus pinus*	252	13-Oct-12
	*	American goldfinch	*Spinus tristis*	300	3-May-17
		evening grosbeak	*Coccothraustes vespertinus*	30	30-Oct-01
int	*	house sparrow	*Passer domesticus*	346	3-Jan-09

State Status	Common name	*Scientific name*	Monmouth High Count	Monmouth High Count Date
RV indicates a species that is only a rare visitor to NJ. *WAP-FS* indicates a species that has not yet been formally listed in NJ, but has been identified as a Focal Species for conservation in the state's Wildlife Action Plan (NJDEP, 2017).				
Data from Sullivan, B.L., C.L. Wood, M.J. Iliff, R.E. Bonney, D. Fink, and S. Kelling. 2009. eBird: a citizen-based bird observation network in the biological sciences. Biological Conservation 142: 2282-2292. Available online: http://ebird.org/ebird/nj/places. Site Accessed January 2019.				

APPENDIX E.2. NEW JERSEY LAND MAMMALS

Mammals have not been inventoried by county.

Status	Common Name	*Scientific Name*
	opossum	*Didelphis marsupialis*
	masked shrew	*Sorex cinereus*
	Tuckahoe masked shrew	*Sorex cinereus nigriculus*
	water shrew	*Sorex palustris*
	smokey shrew	*Sorex fumeus*
	long-tailed shrew	*Sorex dispar*
	short-tailed shrew	*Blarina brevicauda*
	least shrew	*Cryptotis parva*
	pygmy shrew	*Sorex hoyii*
	hairy-tailed mole	*Parascalops breweri*
	eastern mole	*Scalopus aquaticus*
	star-nosed mole	*Condylura cristata*
WAP-FS	little brown bat	*Myotis lucifugus*
E	Indiana bat	*Myotis sodalis*
WAP-FS	northern myotis	*Myotis septentrionalis*
	small-footed myotis	*Myotis leibii*
	silver-haired bat	*Lasionycteris noctivagans*
	eastern pipistrel	*Pipistrellus subflavus*
	big brown bat	*Eptesicus fuscus*
	red bat	*Lasiurus borealis*
peripheral	northern yellow bat	*Lasiurus intermedius*
	hoary bat	*Lasiurus cinereus*
	eastern cottontail	*Sylvilagus floridanus*
	New England cottontail	*Sylvilagus transitionalis*
int	European hare	*Lepus capensis*
int	black-tailed jackrabbit	*Lepus californicus*
int	white-tailed jackrabbit	*Lepus townsendii*
	eastern chipmunk	*Tamias striatus*
	woodchuck	*Marmota monax*
	gray squirrel	*Sciurus carolinensis*
	red squirrel	*Tamiasciurus hudsonicus*
	southern flying squirrel	*Glaucomys volans*
	northern flying squirrel	*Glaucomys sabrinus*
	beaver	*Castor canadensis*
int	nutria	*Myocastor coypus*
	marsh rice rat	*Oryzomys palustris*
	white-footed mouse	*Peromyscus leucopus*
E	Allegheny woodrat	*Neotoma magister*
	red-backed mouse	*Clethrionomys gapperi*
	meadow vole	*Microtus pennsylvanicus*

Status	Common Name	*Scientific Name*
	woodland vole	*Microtus pinetorum*
	muskrat	*Ondatra zibethicus*
	southern bog lemming	*Synaptomys cooperi*
int	black rat	*Rattus rattus*
int	brown rat	*Rattus norvegicus*
int	house mouse	*Mus musculus*
	woodland jumping mouse	*Napaeozapus insignis*
	meadow jumping mouse	*Zapus hudsonius*
	porcupine	*Erethizon dorsatum*
	eastern coyote	*Canis latrans*, *var*
	red fox	*Vulpes vulpes*
	gray fox	*Urocyon cinereoargenteus*
	black bear	*Ursus americanus*
	raccoon	*Procyon lotor*
	ermine	*Mustela erminea*
	long-tailed weasel	*Mustela frenata*
	mink	*Mustela vison*
	striped skunk	*Mephitis mephitis*
	river otter	*Lutra canadensis*
E	bobcat	*Felis rufus*
	white-tailed deer	*Odocoileus virginianus*

WAP-FS indicates a species that has not yet been formally listed in NJ, but has been identified as a Focal Species for conservation in the state's Wildlife Action Plan (NJDEP, 2017).

Source: NJDEP Division of Fish and Wildlife, 2004b.

APPENDIX E.3. MONMOUTH COUNTY REPTILES

New Jersey reptile species that may occur in Monmouth County.

Status	Common Name	Scientific Name
Lizards		
	common five-lined skink	*Plestiodon fasciatus*
	eastern fence lizard	*Sceloporus undulatus*
	ground skink	*Scincella lateralis*
Snakes		
	eastern wormsnake	*Carphophis a. amoenus*
WAP-FS	northern black racer	*Coluber c. constrictor*
	northern ring-necked snake	*Diadophis punctatus edwardsi*
	southern ring-necked snake *	*Diadophis p. punctatus*
WAP-FS	eastern hog-nosed snake	*Heterodon platirhinos*
SC	eastern kingsnake *	*Lampropeltis getula*
	eastern milksnake	*Lampropeltis t. triangulum*
	coastal plain milksnake *	*Lampropeltis t. triangulum x L. t. elapsoides*
	northern watersnake	*Nerodia s. sipedon*
	rough greensnake *	*Opheodrys aestivus*
	eastern ratsnake	*Pantherophis alleghaniensis*
T	northern pinesnake *	*Pituophis m. melanoleucus*
	northern brownsnake	*Storeria d. dekayi*
	northern red-bellied snake	*Storeria o. occipitomaculata*
	eastern ribbonsnake	*Thamnophis s. sauritus*
	eastern gartersnake	*Thamnophis s. sirtalis*
	eastern smooth earthsnake	*Virginia v. valeriae*
Turtles		
	snapping turtle	*Chelydra serpentina*
	eastern painted turtle	*Chrysemys p. picta*
SC	spotted turtle	*Clemmys guttata*
T	wood turtle	*Glyptemys insculpta*
E	bog turtle	*Glyptemys muhlenbergii*
	southeastern mud turtle	*Kinosternon s. subrubrum*
WAP-FS	northern diamond-backed terrapin	*Malaclemys t. terrapin*
WAP-FS	northern red-bellied cooter	*Pseudemys rubiventris*
	eastern musk turtle	*Sternotherus odoratus*
SC	woodland box turtle	*Terrapene c. carolina*
int	red-eared slider	*Trachemys scripta*
* Range in Monmouth is limited to the southern end of the county.		
WAP-FS indicates a species that has not yet been formally listed in NJ, but has been identified as a Focal Species for conservation in the state's Wildlife Action Plan (NJDEP, 2017).		
Source: NJDEP Division of Fish and Wildlife, June 6, 2014.		

APPENDIX E.4. MONMOUTH COUNTY AMPHIBIANS

New Jersey amphibian species that may occur in Monmouth County.

Status	Common Name	*Scientific Name*
<u>Anurans</u>		
	eastern cricket frog	*Acris crepitans*
SC	Fowler's toad	*Anaxyrus fowleri*
	northern gray treefrog	*Hyla versicolor*
	bullfrog	*Lithobates catesbeianus*
	green frog	*Lithobates clamitans*
	Atlantic coast leopard frog *****	*Lithobates kauffeldi*
	pickerel frog	*Lithobates palustris*
	southern leopard frog	*Lithobates sphenocephalus*
	wood frog	*Lithobates sylvaticus*
SC	carpenter frog	*Lithobates virgatipes*
	spring peeper	*Pseudacris crucifer*
WAP-FS	New Jersey chorus frog	*Pseudacris kalmi*
WAP-FS	eastern spadefoot toad	*Scaphiopus h. holbrooki*
<u>Salamanders</u>		
	spotted salamander	*Ambystoma maculatum*
SC	marbled salamander	*Ambystoma opacum*
	northern dusky salamander	*Desmognathus fuscus*
	northern two-lined salamander	*Eurycea bislineata*
	four-toed salamander	*Hemidactylium scutatum*
	red-spotted newt	*Notophthalmus v. viridescens*
	red-backed salamander	*Plethodon cinereus*
	northern slimy salamander	*Plethodon glutinosus*
WAP-FS	northern red salamander	*Pseudotriton r. ruber*

***** Species range still under study.

WAP-FS indicates a species that has not yet been formally listed in NJ, but has been identified as a Focal Species for conservation in the state's Wildlife Action Plan (NJDEP, 2017).

Sources: NJDEP Division of Fish and Wildlife, June 6 2014; NJENSP November 2014.

APPENDIX E.5. FRESHWATER FISH OF NEW JERSEY

Fish have not been inventoried by county.

Status	Common Name	*Scientific Name*
Northern Lampreys		
	American brook lamprey	*Lampetra appendix*
	sea lamprey	*Petromyzon marinus*
Sturgeons		
E	Atlantic sturgeon	*Acipenser oxyrhynchus*
E	shortnose sturgeon	*Acipenser brevirostrum*
Gars		
X	longnose gar	*Lepisosteus osseus*
Bowfins		
	bowfin	*Amia calva*
Freshwater Eels		
	American eel	*Anguilla rostrata*
Swamp Eels		
int*	swamp eel	*Monopterus albus*
Herrings, Shads, Sardines, Menhadens		
WAP-FS	blueback herring	*Alosa aestivalis*
	hickory shad	*Alosa mediocris*
WAP-FS	alewife	*Alosa pseudoharengus*
	American shad	*Alosa sapidissima*
	gizzard shad	*Dorosoma cepedianum*
Salmonids		
int	rainbow trout	*Oncorhynchus mykiss*
int	brown trout	*Salmo trutta*
WAP-FS	brook trout	*Salvelinus fontinalis*
int	lake trout	*Salvelinus namaycush*
Smelts		
	rainbow smelt	*Osmerus mordax*
Mudminnows		
	eastern mudminnow	*Umbra pygmaea*
Pikes		
	redfin pickerel	*Esox americanus*
int	northern pike	*Esox lucius*
	chain pickerel	*Esox niger*
int	muskellunge	*Esox masquinongy*

Status	Common Name	*Scientific Name*
Carps, Minnows		
int	goldfish	*Carassius auratus*
int*	grass carp	*Ctenopharyngodon idella*
	satinfin shiner	*Cyprinella analostana*
	spotfin shiner	*Cyprinella spiloptera*
int	common carp	*Cyprinus carpio*
	cutlip minnow	*Exoglossum maxillingua*
	eastern silvery minnow	*Hybognathus regius*
int*	bighead carp	*Hypophthalmichthys nobilis*
	common shiner	*Luxilis cornutus*
int	Allegheny pearl dace	*Margariscus margarita*
	golden shiner	*Notemigonus crysoleucas*
WAP-FS	comely shiner	*Notropis amoenus*
WAP-FS	bridle shiner	*Notropis bifrenatus*
WAP-FS	ironcolor shiner	*Notropis chalybaeus*
	spottail shiner	*Notropis husdonius*
	swallowtail shiner	*Notropis procne*
int	fathead minnow	*Pimephales promelas*
int	bluntnose minnow	*Pimephales notatus*
	blacknose dace	*Rhinichthys atratulus*
	longnose dace	*Rhinichthys cataractae*
	creek chub	*Semotilus atromaculatus*
	fallfish	*Semotilus corporalis*
Suckers		
	quillback	*Carpiodes cyprinus*
	white sucker	*Catostomus commersoni*
	creek chubsucker	*Erimyzon oblongus*
	northern hog sucker	*Hypentelium nigricans*
Freshwater Catfishes		
	white catfish	*Ameiurus catus*
int	black bullhead	*Ameiurus melas*
	yellow bullhead	*Ameiurus natalis*
	brown bullhead	*Ameiurus nebulosus*
int	channel catfish	*Ictalurus punctatus*
	tadpole madtom	*Noturus gyrinus*
	margined madtom	*Noturus insignis*
int*	flathead catfish	*Pylodictis olivarus*
Pirate Perches		
	pirate perch	*Aphredoderus sayanus*
Killifishes		
	banded killifish	*Fundulus diaphanus*
	mummichog	*Fundulus heteroclitus*
Poeciliids		
	eastern mosquitofish	*Gambusia holbrooki*
int	mosquitofish	*Gambusia affinis*

Status	Common Name	*Scientific Name*
Gasterosteidae:		
	fourspine stickleback	*Apletes quadracus*
int*	brook stickleback	*Culaea inconstans*
	threespoine stickleback	*Gasterosteus aculeatus*
	ninespine stickleback	*Pungitius pungitius*
Moronidae:		
	white perch	*Morone americana*
	striped bass	*Morone saxatilis*
Sticklebacks, Tubesnouts		
WAP-FS	mud sunfish	*Acantharchus pomotis*
int	rock bass	*Ambloplites rupestris*
WAP-FS	blackbanded sunfish	*Enneacanthus chaetodon*
	bluespotted sunfish	*Enneacanthus gloriosus*
WAP-FS	banded sunfish	*Enneacanthus obesus*
int*	green sunfish	*Lepomis cyanellus*
	pumpkinseed	*Lepomis gibbosus*
int	bluegill	*Lepomis macrochirus*
	redbreast sunfish	*Lepomis auritus*
int*	warmouth	*Lepomis gulosus*
int	smallmouth bass	*Micropterus dolomieu*
int	largemouth bass	*Micropterus salmoides*
int	white crappie	*Pomoxis annularis*
int	black crappie	*Pomoxis nigromaculatus*
Perches		
WAP-FS	swamp darter	*Etheostoma fusiforme*
	tessellated darter	*Etheostoma olmstedi*
	yellow perch	*Perca flavescens*
	shield darter	*Percina peltata*
int	walleye	*Sander vitreus*
Sculpins		
	slimy sculpin	*Cottus cognatus*
Loaches		
int*	oriental weatherfish	*Misgurnus anguillicaudatus*
Soles		
	hogchoker	*Trinectes maculatus*

* indicates species that pose a serious threat to freshwater resources, and must be destroyed when encountered. An anticipated addition to this category, the silver carp (*Hypophthalmichthys molitrix*) has not yet been documented in NJ.

WAP-FS indicates a species that has not yet been formally listed in NJ, but has been identified as a Focal Species for conservation in the state's Wildlife Action Plan (NJDEP, 2017).

Source: NJDEP Division of Fish and Wildlife. 2016.

APPENDIX E.6. RARE WILDLIFE SIGHTING FORM

RARE WILDLIFE SIGHTING REPORT FORM

REPORT FORM MUST BE ACCOMPANIED BY AN AERIAL PHOTOGRAPH, SATELLITE IMAGE, OR TOPOGRAPHIC MAP WITH THE LOCATION PRECISELY MARKED. PLEASE PRINT LEGIBLY.
*The inclusion of a map is mandatory, please see other side for further information on obtaining a map.

General Information

Today's Date _____
Common Name _____ Scientific Name (If known) _____

Where did the sighting take place?

Municipality/ Township _____ County _____

Topographic quad (if known) _____ Coordinates in state plane feet (if known) _____ _____

Directions to location with landmarks, which will enable the future relocation of the site where the species was sighted:

_____

_____

_____

Land Owner (name, address and phone number, if known) _____
Describe habitat at the point of sighting and habitat in the general area of the sighting location.

_____

_____

Would you accompany a biologist to the site if needed? ☐ Yes ☐ No
Can you describe any immediate or future plans to develop or disturb the site? ☐ Yes ☐ No
If so, please describe. _____

_____

Locational Accuracy

1. Is your depiction of the sighting location on the topographic map or aerial photo within 6m (20ft) of the animals actual location on the ground? ☐ Yes ☐ No (if no, answer question 2 below)

2. Your mapping is accurate to within ___ meters ___ feet ___ miles of the actual location.

What was observed?

How was the species identification made? (ex. Sighting, Call, Road Kill, etc.) _____

Date and time of this sighting (ex. August 20, 2004, 10:30am) _____

How frequently has this species been sighted at this location and over how long a period of time? _____

_____

Number of individuals sighted: Adult ____ Immature ____ Larva ____ Unknown/Other ____

Describe sighting and activity observed (ex. Nesting, Perched, Flying, Sunning, etc.) _____

Describe physical features that identify the sighted animal as the species you are reporting. _____

_____

_____

Were photos taken? ☐ Yes ☐ No Was video recorded? ☐ Yes ☐ No Was audio recorded? ☐ Yes ☐ No
(PHOTOS/VIDEO/AUDIO ARE STRONGLY ENCOURAGED IN ORDER TO VERIFY THE ACCURACY OF A SIGHTING.
Items should be identified with the date taken, location, and observer signature. Items will not be returned.)

List manuals used or experts consulted to verify identification. _____

Provide a brief background on wildlife knowledge and/or experience, or additional information that would add to the validity of the sighting. _____

_____

Can this be verified by someone else or can anyone vouch for your identification skills? ☐ Yes ☐ No _____

Describe any additional information that may be useful in regards to the condition of the animal or location.

_____

_____

Your Contact information

Name _____
Street _____
City _____ State _____ ZIP _____
Daytime Phone ( ) - E-mail _____

Preferred method of contact _____

Signature _____

Conserve Wildlife
N.J. Division of Fish, Game & Wildlife
Endangered & Nongame Species Program

Return to:
Endangered and Nongame Species Program
NJ Division of Fish and Wildlife
PO Box 400
Trenton, NJ 08625-0400
(609) 292-9400

NEW JERSEY DIVISION OF
Fish and Wildlife

Instructions

1. Complete this form for first-hand field observations only.
2. DO NOT COMPLETE THIS FORM if the source of your information is a report, letter, conversation, or other document. Send us the documentation instead.
3. Attach a copy of a map.(*see below*)
4. Only report one species at each location per form and map.

***Mapping**

A map is necessary to help our biologists determine if suitable habitat is present at the location. Once the suitability of the area is determined the map provided aids in the delineation of land to be protected. Ideally the most accurate form of map is an aerial photo, which can be obtained from http://www.state.nj.us/dep/gis/newmapping.htm, if you are comfortable with your ability to identify the location of the sighting accurately on them. In addition, satellite-derived images are available at http://www.maps.google.com. These images can be printed and clearly marked with a pen. An alternative to an aerial photo or satellite image is a topographic map. You may also print copies of topographic maps from the internet at http://www.topozone.com. Please use 1:24,000 scale topographic maps only. Please provide either an image or a topographic map, but NOT both. Thank you.

Refer to the DFW website for further information: http://www.njfishandwildlife.com/ensp/rprtform.htm

APPENDIX E.7. HABITAT REQUIREMENTS FOR RARE WILDLIFE SPECIES RECORDED IN OCEAN TOWNSHIP

Habitat notes are generally direct quotes or loosely paraphrased excerpts from the cited sources.

Eastern Box Turtle, Special Concern
The box turtle is one of our terrestrial turtles, and is primarily a species of open woods and pastures. During hot, dry weather the turtles remain concealed beneath logs or rotting vegetation (Conant, 1975). Box turtles may also utilize shallow pools as a means of thermoregulation during the hottest weather (Ernst et al. 1994).

American Kestrel, Threatened, breeding and non-breeding
American Kestrels favor open areas with short ground vegetation and sparse trees. They may be found in meadows, grasslands, deserts, parks, farm fields, cities, and suburbs. When breeding, kestrels need access to at least a few trees or structures that provide appropriate nesting cavities. Kestrels are attracted to many habitats modified by humans, including pastures and parkland, and are often found near areas of human activity including golf courses, towns and cities (Cornell Lab of Ornithology, 2015-a; Elphick et. al., 2001).

American Woodcock, Wildlife Action Plan Focal Species
The American woodcock may be found in moist woodlands, mixed forests, wet meadows and thickets along boggy streams, abandoned fields and conifer plantations. Courtship diplays in early spring may be seen over fields, meadows or clearings, and nests are built on the ground beneath brush or shrubs or in the hollows of rocks or tree roots (Ehrlich et. al., 1988).

Bald Eagle, Endangered breeding, Threatened non-breeding
Eagles live near rivers, lakes, and marshes where they can find fish, their staple food. The eagles will also feed on waterfowl, turtles, rabbits, snakes, and other small animals and carrion. Bald eagles require a good food base, perching areas, and nesting sites. Their habitat includes estuaries, large lakes, reservoirs, rivers, and some seacoasts. In winter, the birds congregate near open water in tall trees for spotting prey and night roosts for sheltering (USFWS, 2015).

Blackburnian Warbler, Special Concern breeding, Stable non-breeding
This warbler requires mature coniferous forests for its nesting sites (Ehrlich et. al., 1988). In New Jersey, it is only known to breed in the northwestern part of the state (Walsh et.al., 1999).

Black-crowned Night-Heron, Threatened breeding, Special Concern non-breeding
Forests, scrub/shrubland, marshes and ponds serve as nesting, roosting and foraging habitats for black-crowned night-herons. The birds nest colonially, sometimes in mixed-species colonies, in wooded swamps, coastal dune forests, vegetated dredge spoil islands, scrub thickets or marshes. The herons forage in marshes, along the edges of ponds and creeks, and in saline habitats including shallow tide pools, tidal channels and mudflats (Beans and Niles, 2003).

Black-Throated Blue Warbler, Special Concern breeding, Stable non-breeding
The black-throated blue warbler nests in mixed deciduous woodlands with a dense understory of laurel or rhododendron. Breeding records in New Jersey are limited to the northwestern part of the state, although there is an unconfirmed report from Mercer County (Walsh et.al., 1999).

Black-throated Green Warbler, Special Concern breeding, Stable non-breeding

Breeding records for this warbler are widely distributed across the state. The species prefers coniferous and mixed woodlands, often near spruce or hemlock groves but also in cedar swamps (Walsh et.al., 1999).

Blue-headed Vireo, Special Concern breeding, Stable non-breeding
The blue-headed vireo nests in hemlock forests as well as other semi-open coniferous or mixed woods. Although most of the state breeding records for this species come from the northwestern counties, there is a confirmed record from Monmouth County (Walsh et.al., 1999).

Blue-winged Warbler, Wildlife Action Plan Focal Species
Blue-winged warblers may be found breeding in any county in New Jersey. Their preferred nesting habitat is open second-growth woodlands and along woodland edges. During the past century, the species has declined in urban areas but expanded its presence in less developed parts of the state (Walsh et.al., 1999).

Broad-winged Hawk, Special Concern breeding, Stable non-breeding
Breeding habitat for the broad-winged hawk is characterized by dense deciduous and mixed forest cover, although they occasionally utilize more open woodlands. The hawks often select nesting sites near water (Ehrlich et. al., 1988).

Brown Thrasher, Special Concern breeding, Stable non-breeding
In eastern North America, brown thrashers nest in thickets, hedgerows, forest edges, and overgrown clearings in deciduous forest. They're often found in woodlands with cottonwood, willow, dogwood, American plum, saltcedar, hawthorn, pitch pine, or scrub oak. On rare occasions they breed in backyards and gardens, although they are more likely to breed in suburban settings in the western part of their range. (Cornell Lab of Ornithology, 2015-b; Ehrlich et. al., 1988).

Canada Warbler, Special Concern breeding, Stable non-breeding
Moist or wet woodlands with a dense understory typify the preferred breeding habitat of the Canada warbler. Although the majority of the species' breeding records in New Jersey are limited to the northern part of the state, there is an unconfirmed record from Monmouth County as well as two probable records from Burlington and southern Hunterdon Counties (Walsh et.al., 1999).

Cliff Swallow, Special Concern breeding, Stable non-breeding
Formerly restricted to canyons, foothills, and river valleys with natural cliff faces and overhangs, cliff swallows have spread into a wide variety of habitats by nesting on buildings, bridges, and other human-made structures. They now live in grasslands, towns, broken forest, and river edges, but avoid heavy forest and deserts. In the south-central and northeastern states they are rare and localized breeders. Most colony sites are close to a water source, open fields or pastures for foraging, and a source of mud for nest building. Cliff Swallows spend the winter in grasslands, farmland, marshes, and the outskirts of towns in southern South America (Cornell Lab of Ornithology, 2015-c).

Common Nighthawk, Special Concern, breeding and non-breeding
The booming sound made by the common nighthawk during its aerial displays may be heard over a variety of open and semi-open habitats including savannas, grasslands, fields, cities and towns. The species does not make a nest but lays its eggs on sandy or gravelly surfaces, stumps, or old robins' nests (Ehrlich et. al., 1988).

Common Tern, Special Concern breeding
Common terns utilize a variety of coastal habitats, including sand and shell beaches, grassy uplands, or rocky island shores. In some areas, the birds have resorted to nesting on spoil banks. Availability of suitable nesting sites for this colonial species is a limiting factor to its success in the eastern United States (Harrison, 1975).

Cooper's Hawk, Special Concern breeding, Stable non-breeding
During the breeding season, Cooper's hawks may be found in a variety of deciduous and coniferous forest types. They often choose nesting sites in or adjacent to wetlands, preferring forests with a closed canopy, moderate to heavy shrub cover and trees at least 30 years old. Wintering hawks may hunt for smaller birds at backyard feeders, sheltering in dense stands of evergreens during harsh weather (Beans and Niles, 2003).

Gray-cheeked Thrush, Special Concern, non-breeding
The gray-cheeked thrush breeds well to the north of New Jersey and winters in South America. The species was historically a common migrant in the state, especially during the fall months. Recent records indicate that the thrush is encountered much less frequently (Walsh et.al., 1999).

Great Blue Heron, Special Concern breeding, Stable non-breeding
Great blue herons forage widely in both freshwater and saltwater habitats, and also in grasslands and agricultural fields, where they stalk frogs and mammals. Most breeding colonies are located within 2 to 4 miles of feeding areas, often in isolated swamps or on islands, and near lakes and ponds bordered by forests (Cornell Lab of Ornithology, 2015-d).

Hooded Warbler, Special Concern breeding, Stable non-breeding
Nesting records for the hooded warbler span the full length of New Jersey. The species nests in the dense understory of moist or wet deciduous woodlands, particularly favoring a laurel-dominated shrub layer (Walsh et.al., 1999).

Least Flycatcher, Special Concern breeding, Stable non-breeding
The least flycatcher may be found nesting in open deciduous woodlands, along forest edges or in clearings. The majority of breeding records for this species in New Jersey are from the northern counties. However, there are two confirmed records from southern Hunterdon County, and a smattering of unconfirmed records from other locations around the state including two in Monmouth County (Walsh et.al., 1999).

Least Tern, State Endangered
Least terns nest in colonies along barrier island beaches or mainland beach strands. They prefer bare or sparsely vegetated sandy areas just beyond the reach of normal spring tides. Sandy dredge disposal sites or sand piles near mining operations may also be utilized. The birds typically forage in bays, lagoons, estuaries, rivers and lakes along the coast (Beans and Niles, 2003).

Nashville Warbler, Special Concern breeding, Stable non-breeding
The Nashville warbler nests in riparian woodlands, brushy bogs, and open second-growth woodlands. There are a limited number of breeding records for this species in New Jersey, and all of those are limited to the northwestern part of the state (Walsh et.al., 1999).

Northern Harrier, Endangered breeding, Special Concern non-breeding
Harriers may be seen flying low over the landscape in a variety of open habitats including marshes, meadows, grasslands, agricultural fields, and airports. Vegetation in their foraging habitats is usually under two meters in height. The raptors nest on the ground in both salt and freshwater marshes, and also occasionally in agricultural fields with low levels of disturbance (Beans and Niles, 2003).

Northern Parula, Special Concern breeding, Stable non-breeding
The northern parula utilizes a variety of habitats for nesting, including deciduous or mixed woodlands and spruce plantations. Although widely distributed in the state, the species is most likely to be found in the northwestern areas and in the Pine Barrens (Walsh et.al., 1999).

Osprey, Threatened breeding, Stable non-breeding
As a piscivorous species, the osprey is strictly associated with bodies of water that support adequate fish populations. Consequently, ospreys inhabit coastal rivers, marshes, bays and inlets as well as inland rivers, lakes and reservoirs. Ospreys nest on live or dead trees, artificial nesting platforms, light poles, channel markers, abandoned duck blinds, or other artificial structures that are in close proximity to fishing areas and offer an unobstructed view of the surrounding landscape. Territories typically contain poles, snags, or structures near the nest on which the ospreys perch. (Beans and Niles, 2003).

Peregrine Falcon, Endangered breeding, Special Concern non-breeding
The natural nesting habitat of this large falcon is cliffs and large rock outcrops, but the species has adapted to human presence and will now utilize tall buildings or bridges. The birds also nest on large platforms that were constructed in coastal marshes to help the species recover following a severe population decline. Marshes, beaches and open water are favored as hunting grounds (Beans and Niles, 2003).

Pied-billed Grebe, Endangered breeding, Special Concern non-breeding
During the breeding season, pied-billed grebes primarily inhabit freshwater marshes associated with slow-moving rivers or open water such as ponds, lakes or reservoirs that offer a robust mixture of emergent and aquatic plants. A wider variety of open water habitats, both fresh and saline, may also be utilized during the winter months (Beans and Niles, 2003).

Red-shouldered Hawk, Endangered breeding, Special Concern non-breeding
Mature wet woods such as hardwood swamps and riparian forests typify red-shouldered hawk breeding habitat. Nesting territories, which occur in deciduous, coniferous, or mixed woodlands, are typically located within remote and extensive old growth forests containing standing water. Red-shouldered hawks select large deciduous and, to a lesser extent, coniferous trees for nesting. Forest characteristics include a closed canopy of tall trees, an open subcanopy, and variable amounts of understory cover. An-area sensitive species, the red-shouldered hawk typically nests away from residences, roads, and development. During the nonbreeding season, red-shouldered hawks are less restrictive in their habitat use. They inhabit the traditional wetland forests occupied during the breeding season as well as uplands, fragmented woods, smaller forests, open areas, and edges. (NJENSP, undated).

Savannah Sparrow, Threatened breeding, Stable non-breeding
Savannah sparrows breed in both open and early-successional habitats including grasslands, upland meadows, agricultural fields, pastures, airports and vegetated landfills. Suitable nesting locations offer a mixture of short and tall grasses, a thick litter layer, dense ground cover and scattered shrubs or forbs (Beans and Niles, 2003).

Scarlet Tanager, Wildlife Action Plan Focal Species
Scarlet tanagers breed in mature deciduous and mixed deciduous-coniferous forests. Breeding tanagers prefer large forest tracts with large trees. During spring and fall migration they use similar forest habitats as well as open spaces such as parks and gardens (Cornell Lab of Ornithology, 2015-e).

Sharp-shinned Hawk, Special Concern, breeding and non-breeding
Sharp-shinned hawks are birds of the forest and forest edge, and are only found where trees are scarce during migration. They require dense forest, ideally with a closed canopy, for breeding. In the winter season they may also be found in somewhat more open habitats, including forest edges and suburban areas with bird feeders where they hunt for smaller birds (Cornell Lab of Ornithology, 2015-f).

Spotted Sandpiper, Special Concern breeding
The spotted sandpiper breeds in a wide variety of habitats (Erlich et. al., 1988). The birds typically nest near fresh water including lakes, ponds, rivers and streams. The species breeds throughout New Jersey, but is less common in the southern part of the state (Walsh et.al., 1999).

Veery, Special Concern breeding
The spiraling musical song of the veery may be heard in moist deciduous woodlands and forested swamps during their breeding season. Veeries are most commonly encountered in the northern and central part of the state, but are generally absent in highly developed areas (Walsh et.al., 1999).

Winter Wren, Special Concern breeding
Breeding habitat favored by the winter wren is typified by moist coniferous woodlands with a thick understory, often located on talus slopes. New Jersey nesting records for the species are somewhat sparse and mainly limited to the northern counties. The southernmost breeding location documented in the state is in Somerset County (Walsh et.al., 1999).

Wood Thrush, Special Concern breeding, Stable non-breeding
Wood thrushes breed throughout mature deciduous and mixed forests in eastern North America. They nest somewhat less successfully in fragmented forests and even suburban parks where there are enough large trees for a territory. Ideal habitat includes trees over 50 feet tall, a moderate understory of saplings and shrubs, an open floor with moist soil and decaying leaf litter, and water nearby. In their winter range, they are most abundant in the interior of mature, shady, broad-leaved and palm tropical forests in lowlands. As in their temperate range, they will also inhabit forest edges and the denser understory of second-growth forests. (Cornell Lab of Ornithology, 2015-g).

Worm-eating Warbler, Special Concern breeding
There are breeding records for the worm-eating warbler throughout New Jersey, although the majority are from the northern part of the state where it may be found in the undergrowth in forested ravines and on other wooded slopes. Further to the south, the warbler nests in damp or wet deciduous wetlands (Walsh et.al., 1999).

Coastal Bog Metarranthis, Not listed, but tracked by Natural Heritage Program
Although moths are not yet included on New Jersey's lists of endangered, threatened and special concern species, this attractive moth is on a list of the state's rare imvertebrates (NJDEP, 2001). As its name suggests, the species inhabits bogs, boggy wetlands and acid swamps, often in the Pine Barrens. Habitats are characterized by larval foodplants such as cranberry (*Vaccinium macrocarpon*) and leatherleaf (*Chamaedaphne calyculata*) (NatureServe, 2018).

Citations:
Beans, B.E. and L. Niles. 2003. Endangered and Threatened Wildlife of New Jersey. Rutgers University Press, New Brunswick, New Jersey.

Conant, Roger. 1975. A Field Guide to Reptiles and Amphibians of Eastern/Central North America. Houghton Mifflin Company, Boston.

Cornell Lab of Ornithology. 2015-a. All About Birds: American Kestrel.
https://www.allaboutbirds.org/guide/American_Kestrel/lifehistory

Cornell Lab of Ornithology. 2015-b. All About Birds: Brown Thrasher.
https://www.allaboutbirds.org/guide/Brown_Thrasher/lifehistory

Cornell Lab of Ornithology. 2015-c. All About Birds: Cliff Swallow.
https://www.allaboutbirds.org/guide/Cliff_Swallow/lifehistory

Cornell Lab of Ornithology. 2015-d. All About Birds: Great Blue Heron.
https://www.allaboutbirds.org/guide/Great_Blue_Heron/lifehistory

Cornell Lab of Ornithology. 2015-e. All About Birds: Scarlet Tanager. https://www.allaboutbirds.org/guide/Scarlet_Tanager/lifehistory

Cornell Lab of Ornithology. 2015-f. All About Birds: Sharp-shinned hawk. https://www.allaboutbirds.org/guide/Sharp-shinned_Hawk/lifehistory

Cornell Lab of Ornithology. 2015-g. All About Birds: Wood Thrush. https://www.allaboutbirds.org/guide/Wood_Thrush/lifehistory

Ehrlich, P.R., D.S. Dobkin and D. Wheye. 1988. The Birder's Handbook: A Field Guide to the Natural History of North American Birds. Simon & Schuster Inc., New York, New York.

Ernst, Carl H., Jeffrey E. Lovich and Roger W. Barbour. 1994. Turtles of the United States and Canada. Smithsonian Institution Press, Washington.

Harrison, H.H. 1975. A Field Guide to Birds' Nests, United States East of the Mississippi River. Houghton Mifflin Company, New York, New York.

Natureserve. 2018. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available at http://explorer.natureserve.org. Site accessed January 2019.

NJDEP (New Jersey Department of Environmental Protection). 2001. Special Invertebrate Animals of New Jersey. Available at https://www.state.nj.us/dep/parksandforests/natural/heritage/textfiles/njinvert.txt. Site accessed January 2019.

NJENSP (Endangered and Nongame Species Program). Undated. Red-shouldered Hawk Fact Sheet. http://www.nj.gov/dep/fgw/ensp/pdf/end-thrtened/redshldhwk.pdf Site accessed February 2017.

USFWS (U.S. Fish and Wildlife Service). 2015. Bald and Golden Eagle Information. U.S. Fish & Wildlife Service, Migratory Bird Program. https://www.fws.gov/birds/management/managed-species/bald-and-golden-eagle-information.php Site updated September 25, 2015.

Walsh, J., V. Elia, R. Kane, and T. Halliwell. 1999. Birds of New Jersey. New Jersey Audubon Society, Bernardville, New Jersey.

APPENDIX E.8. ADDITIONAL BIRD SPECIES REPORTED ON EBIRD FROM SITES IN MONMOUTH COUNTY OUTSIDE OF OCEAN TOWNSHIP

State Status	Common name	*Scientific name*
E	black skimmer	*Rynchops niger*
E	Henslow's sparrow	*Ammodramus henslowii*
E	least tern	*Sternula antillarum*
E	piping plover	*Charadrius melodus*
E	roseate tern	*Sterna dougallii*
E	sedge wren	*Cistothorus platensis*
E	upland sandpiper	*Bartramia longicauda*
Ebr, SCnb	American bittern	*Botaurus lentiginosus*
Ebr, SCnb	northern goshawk	*Accipiter gentilis*
Ebr, SCnb	short-eared owl	*Asio flammeus*
Ebr, SCnb	vesper sparrow	*Pooecetes gramineus*
Ebr,SCnb	golden-winged warbler	*Vermivora chrysoptera*
Enb	loggerhead shrike	*Lanius ludovicianus*
Enb	red knot	*Calidris canutus*
T	barred owl	*Strix varia*
T	long-eared owl	*Asio otus*
T	red-headed woodpecker	*Melanerpes erythrocephalus*
T	yellow-crowned night-heron	*Nyctanassa violacea*
Tbr, SCnb	bobolink	*Dolichonyx oryzivorus*
Tbr, SCnb	cattle egret	*Bubulcus ibis*
Tbr, SCnb	grasshopper sparrow	*Ammodramus savannarum*
Tbr, SCnb	horned lark	*Eremophila alpestris*
SC	American oystercatcher	*Haematopus palliatus*
SC	gull-billed tern	*Gelochelidon nilotica*
SC	Kentucky warbler	*Geothlypis formosa*
SC	least bittern	*Ixobrychus exilis*
SC	little Blue heron	*Egretta caerulea*
SC	tricolored heron	*Egretta tricolor*
SCbr	black-billed cuckoo	*Coccyzus erythropthalmus*
SCbr	Caspian tern	*Hydroprogne caspia*
SCbr	cerulean warbler	*Setophaga cerulea*
SCbr	eastern meadowlark	*Sturnella magna*
SCbr	glossy ibis	*Plegadis falcinellus*
SCbr	saltmarsh sparrow	*Ammodramus caudacutus*
SCbr	snowy egret	*Egretta thula*
SCbr	yellow-breasted chat	*Icteria virens*
SCbr, Unb	eastern whip-poor-will	*Antrostomus vociferous*
SCnb	sanderling	*Calidris alba*
SCnb	semipalmated sandpiper	*Calidris pusilla*
SCnb	whimbrel	*Numenius phaeopus*
WAP-FS	Forster's tern	*Sterna forsteri*
WAP-FS	northern bobwhite	*Colinus virginianus*
WAP-FS	prothonotary warbler	*Protonotaria citrea*
WAP-FS	ruddy turnstone	*Arenaria interpres*

WAP-FS indicates a species that has not yet been formally listed in NJ, but has been identified as a Focal Species for conservation in the state's Wildlife Action Plan (NJDEP, 2017).

Source: Sullivan et.al., 2009. Site accessed January 20, 2019.

APPENDIX F. INVASIVE SPECIES

Species Tracked by the New Jersey Invasive Species Strike Team in Monmouth County

Common Name	Scientific Name	Taxa
	ANIMALS	
mute swan		bird
	PLANTS	
black locust	*Robinia pseudoacacia*	tree
callery pear (Bradford pear)	*Pyrus calleryana*	tree
mimosa	*Albizia julibrissin*	tree
Norway maple	*Acer platanoides*	tree
paper-mulberry	*Broussonetia papyrifera*	tree
tree-of-heaven	*Ailanthus altissima*	tree
Amur honeysuckle	*Lonicera mackii*	shrub
autumn olive	*Elaeagnus umbellata*	shrub
butterflybush	*Buddleja davidii*	shrub
European privet	*Ligustrum vulgare*	shrub
multiflora rose	*Rosa multiflora*	shrub
privet	*Ligustrum sp.*	shrub
seaside rose	*Rosa rugosa*	shrub
trifoliate orange	*Citrus trifoliata*	shrub
Chinese wisteria	*Wisteria sinensis*	vine
English ivy	*Hedera helix*	vine
Japanese honeysuckle	*Lonicera japonica*	vine
kudzu	*Pueraria montana var. lobata*	vine
mile-a-minute vine	*Persicaria perfoliata*	vine
oriental bittersweet	*Celastrus orbiculatus*	vine
porcelain-berry	*Ampelopsis brevipedunculata*	vine
sweet autumn virginsbower	*Clematis terniflora*	Vine
common reed	*Phragmites australis*	grass
weeping lovegrass	*Eragrostis curvula*	grass
Chinese bush clover	*Lespedeza cuneata*	herb
garlic mustard	*Alliaria petiolata*	herb
Japanese knotweed	*Fallopia japonica*	herb
lesser celandine, fig buttercup	*Ficaria verna*	herb
mugwort	*Artemesia vulgaris*	herb
purple loosestrife	*Lythrum salicaria*	herb
yellow iris	*Iris pseudacorus*	herb
spotted knapweed	*Centaurea stoebe ssp. micranthos*	plant
parrotfeather	*Myriophyllum aquaticum*	aquatic

Data from NJISST (undated). http://www.njisst.org/

APPENDIX G. OPEN SPACE INVENTORY

Owner	Managed By	Property Name	Block	Lot	GIS Acres	Primary Use*	Funding Type
Monmouth County	Monmouth County	Weltz Park	3	17.01	17.10		None
Monmouth County	Monmouth County	Weltz Park	3	4	103.75		None
Monmouth County	Monmouth County	Weltz Park	3	52	6.56		None
Ocean Township	Ocean Township	Appleby Park	111	1	0.22	Playground	None
Ocean Township	Ocean Township	Colonial Terrace Golf Course	140	69	34.34	Golf Course	None
Ocean Township	Ocean Township	Colonial Terrace Golf Course	140	71	3.59	Golf Course	GA
Ocean Township	Ocean Township	Colonial Terrace Golf Course	140	72	5.16	Golf Course	GA
Ocean Township	Ocean Township	Colonial Terrace Golf Course	140	74	1.99	Golf Course	GA
Ocean Township	Ocean Township	Colonial Terrace Golf Course	140	75	0.25	Golf Course	GA
Ocean Township	Ocean Township	Colonial Terrace Golf Course	140	76	3.84	Golf Course	GA
Ocean Township	Ocean Township	Colonial Terrace Golf Course	140	79	4.00	Golf Course	GA
Ocean Township	Ocean Township	David A Dahrouge Park	94	1	7.26	Athletic Facility	None
Ocean Township	Ocean Township	Donna Lisa	22	21	0.34	Unknown	None
Ocean Township	Ocean Township	Joe Palaia Park	33	1	205.47		GA
Ocean Township	Ocean Township	Joe Palaia Park	33	16.01	37.74		GA
Ocean Township	Ocean Township	Joe Palaia Park	33	97	0.19		None
Ocean Township	Ocean Township	Lake Drive Pond	81	1	0.53	Water Body	None
Ocean Township	Ocean Township	Maple Ave.	95	6	0.25	Unknown	None
Ocean Township	Ocean Township	Marshall Park	38	90	8.62	Wooded Lot	None
Ocean Township	Ocean Township	Memorial Park	136	1	0.28	Park for recreation	None
Ocean Township	Ocean Township	North Edgemere	59	26	0.74	Water Body	None
Board of Fire Commissioners District 1	Ocean Township	Oakhurst First Aid and Firemens Memorial Park	26	3	16.94	Athletic Facility	None
Ocean Township	Ocean Township	Ocean Community Pool and Tennis Facility	3	17	13.32	Swimming Facility	None
Ocean Township	Ocean Township	Open Space	140.07	1	0.35	Unknown	GA
Ocean Township	Ocean Township	Open Space	140.19	1	0.25	Unknown	GA
Ocean Township	Ocean Township	Pond Out Fall	87	11	0.67	Wooded Lot	None

Owner	Managed By	Property Name	Block	Lot	GIS Acres	Primary Use*	Funding Type
Ocean Township	Ocean Township	Rec Center	3	18	5.97	Athletic Facility	None
Ocean Township	Ocean Township	Sallys Hole	17	63	1.30	Wooded Lot	None
Ocean Township	Ocean Township	Sallys Hole	17	64	1.01	Wooded Lot	None
Ocean Township	Ocean Township	South Dittmar	96	1	0.20	Wooded Lot	None
Ocean Township	Ocean Township	South Edgemere	76.01	1	0.53	Water Body	None
Ocean Township	Ocean Township	South Edgemere	76	1	0.06	Water Body	None
Ocean Township	Ocean Township	South Edgemere	76	10	0.81	Water Body	None
Ocean Township	Ocean Township	Tilton Park	37	13	8.11	Wooded Lot	None
Ocean Township	Ocean Township	Tilton Park	37	14	2.03	Wooded Lot	None
Ocean Township	Ocean Township	Tilton Park	37	22	5.25	Wooded Lot	None
Board of Fire Commissioners District 2	Ocean Township	Wanamassa Firemens Memorial Fields	142	47	10.28	Athletic Facility	None
Ocean Township	Ocean Township	Wayside Park	36	17	5.34	Athletic Facility	None
Ocean Township	Ocean Township	Wayside Park	36	18	5.75	Wooded Lot	GA
Ocean Township	Ocean Township	Wickepecko	123.01	1	0.64	Unknown	None
Ocean Township	Ocean Township		22	32.02	3.96	Unknown	BA//FEMA
Ocean Township	Ocean Township		22	32.03	2.91	Unknown	BA//FEMA
NJDEP	NJ Natural Lands Trust	Whale Pond Brook Preserve	1.01	1	0.50	Preserve	
NJDEP	NJ Natural Lands Trust	Whale Pond Brook Preserve	1.01	2	1.20	Preserve	
NJDEP	NJ Natural Lands Trust	Whale Pond Brook Preserve	1.01	3	1.86	Preserve	
NJDEP	NJ Natural Lands Trust	Whale Pond Brook Preserve	1.01	4	1.36	Preserve	
NJDEP	NJ Natural Lands Trust	Whale Pond Brook Preserve	1.01	5	2.24	Preserve	
NJDEP	NJ Natural Lands Trust	Whale Pond Brook Preserve	1.01	6	0.07	Preserve	
NJDEP	NJ Natural Lands Trust	Whale Pond Brook Preserve	1.01	7	3.03	Preserve	
NJDEP	NJ Natural Lands Trust	Whale Pond Brook Preserve	1.02	10	7.07	Preserve	
NJDEP	NJ Natural Lands Trust	Whale Pond Brook Preserve	1.02	11	2.49	Preserve	
NJDEP	NJ Natural Lands Trust	Whale Pond Brook Preserve	1.02	12	0.48	Preserve	
NJDEP	NJ Natural Lands Trust	Whale Pond Brook Preserve	1.02	13	8.59	Preserve	
NJDEP	NJ Natural Lands Trust	Whale Pond Brook Preserve	1.02	15	7.78	Preserve	
NJDEP	NJ Natural Lands Trust	Whale Pond Brook Preserve	1.02	16	8.14	Preserve	

Owner	Managed By	Property Name	Block	Lot	GIS Acres	Primary Use*	Funding Type
NJDEP	NJ Natural Lands Trust	Whale Pond Brook Preserve	1.02	17	4.03	Preserve	
NJDEP	NJ Natural Lands Trust	Whale Pond Brook Preserve	1.02	18	1.97	Preserve	
NJDEP	NJ Natural Lands Trust	Whale Pond Brook Preserve	1.02	19	0.50	Preserve	
NJDEP	NJ Natural Lands Trust	Whale Pond Brook Preserve	1.02	2	2.38	Preserve	
NJDEP	NJ Natural Lands Trust	Whale Pond Brook Preserve	1.02	20	1.49	Preserve	
NJDEP	NJ Natural Lands Trust	Whale Pond Brook Preserve	1.02	3	1.35	Preserve	
NJDEP	NJ Natural Lands Trust	Whale Pond Brook Preserve	1.02	4	2.24	Preserve	
NJDEP	NJ Natural Lands Trust	Whale Pond Brook Preserve	1.02	5	0.01	Preserve	
NJDEP	NJ Natural Lands Trust	Whale Pond Brook Preserve	1.02	6	1.93	Preserve	
NJDEP	NJ Natural Lands Trust	Whale Pond Brook Preserve	1.02	7	0.59	Preserve	
NJDEP	NJ Natural Lands Trust	Whale Pond Brook Preserve	1.02	8	2.16	Preserve	
NJDEP	NJ Natural Lands Trust	Whale Pond Brook Preserve	1.02	9	3.78	Preserve	
NJDEP	NJ Natural Lands Trust	Whale Pond Brook Preserve	1	37	4.82	Preserve	
NJDEP	NJ Natural Lands Trust	Whale Pond Brook Preserve	ROW		17.12	Preserve	
NJDEP	Ocean Township		25.34	13	0.33	Unknown	Blue Acres Program
NJDEP	Ocean Township		25.34	6	0.33	Unknown	Blue Acres Program
NJDEP	Ocean Township		25.34	7	0.33	Unknown	Blue Acres Program
NJDEP	Ocean Township		25	138	0.46	Unknown	Blue Acres Program
NJDEP	Ocean Township		25	139	0.45	Unknown	Blue Acres Program
NJDEP	Ocean Township		25	145	0.35	Unknown	Blue Acres Program
NJDEP	Ocean Township		25	148	0.36	Unknown	Blue Acres Program

*Primary Use:

Park - Preserved area designated as park land for recreation
Playground - Designated playground with playground equipment
Preserve - Area maintained for the protection of wildlife or natural resources
Swimming Facility - Open space with a designated pool
Unknown - Primary use not currently known

NJDEP. January 30, 2019. State, Local and Nonprofit Open Space of New Jersey, Edition 20190130 (Land_owner_openspace).
GIS data. Online link: https://njogis-newjersey.opendata.arcgis.com/datasets/njdep::state-local-and-nonprofit-open-space-of-new-jersey

APPENDIX H. DRINKING WATER QUALITY REPORT

- Drinking water quality report

2017 Annual Water Quality Report

Coastal North System
PWS ID: NJ1345001

NEW JERSEY AMERICAN WATER

A Message from the New Jersey American Water President

To Our Valued Customers:

New Jersey American Water is proud to be your local water service provider, and I am pleased to share some very good news about the quality of your drinking water. As you read through our Annual Water Quality Report, you will see that we continue to supply water that meets or surpasses all state and federal water quality standards. Better yet, the price you pay for this high-quality water service remains a great value as one of the lowest household utility bills.

New Jersey American Water has experienced professionals, the right technologies in use, and a demonstrated commitment to replacing and upgrading our infrastructure so that you can be assured that your drinking water is of the highest standards.

Please take the time to review this report. It provides details about the source and quality of your drinking water using the data from water quality testing conducted for your local system between January and December 2017.

Sincerely,

Rob MacLean
President, New Jersey American Water
Sr. VP, Eastern Division, American Water

This report contains important information about your drinking water. If you do not understand it, please have someone translate it for you.

Este informe contiene información muy importante sobre su agua potable. Tradúzcalo o hable con alguien que lo entienda bien.

આ અહેવાલ માં તમારા પીવાના પાણી વિષે
અગત્ય ની જાણકારી આપવા માં આવી છે.
એનો અનુવાદ કરો અથવા જેને સમજણ પડતી
હોય તેની સાથે વાત કરો

本报告与您的饮用水有关。
如果您不了解其内容，应请别人为您翻译解说。

이 보고서에는 귀하께서 사용하고 계시는 식수에 관한 정보가 들어있습니다.
만약에 이해를 못하시면 누군가에게 번역을 의뢰하십시오.

Share This Report:

Landlords, businesses, schools, hospitals and other groups are encouraged to share this important water quality information with water users at their location who are not customers. Additional copies of this report are available by contacting customer service at 1-800-272-1325.

Partnership for Safe Drinking Water Program

New Jersey American Water is a member of the Environmental Protection Agency (EPA) Partnership for Safe Water Program (an association of water utilities and government) which is committed to voluntarily providing drinking water of a quality far better than required by federal regulations. The Partnership recognized New Jersey American Water for our commitment to provide the best water quality by presenting the prestigious “Director’s Award” for our surface water treatment plant in Tinton Falls (Monmouth County) and in Neptune (Monmouth County). These plants once again earned the “Director’s Award” in 2017 under the Partnership for Safe Water program administered by the U.S. EPA, New Jersey Department of Environmental Protection, and other water related organizations. The award honors water utilities for achieving operational excellence, by voluntarily optimizing their treatment facility operations and adopting more stringent performance goals than those required by federal and state drinking water standards.

About New Jersey American Water

New Jersey American Water, a subsidiary of American Water (NYSE: AWK), is the largest investor-owned water utility in the state, providing high- quality and reliable water and/or wastewater services to approximately 2.7 million people. For more information, visit www.newjerseyamwater.com and follow New Jersey American Water on Twitter and Facebook.

About American Water

With a history dating back to 1886, American Water is the largest and most geographically diverse U.S. publicly traded water and wastewater utility company. The company employs more than 6,900 dedicated professionals who provide regulated and market-based drinking water, wastewater and other related services to an estimated 15 million people in 46 states and Ontario, Canada. American Water provides safe, clean, affordable and reliable water services to our customers to make sure we keep their lives flowing. For more information, visit www.amwater.com.

How to Contact Us

Thank you… for allowing us to continue to provide your family with quality drinking water this year. We ask that all our customers protect our water sources. Please call our Customer Call Center toll-free at 1-800-272-1325 if you have questions:

New Jersey American Water

131 Woodcrest Road

P.O. Box 5079

Cherry Hill, NJ 08034

www.amwater.com

Water Information Sources

New Jersey Department of Environmental Protection,

Bureau of Safe Drinking Water:

(609) 292-5550 • www.state.nj.us/dep

New Jersey Board of Public Utilities:

(973) 648-2350 • Two Gateway Center, Newark, NJ 07102

Division of Customer Relations:

1-800-624-0241 • www.state.nj.us/bpu

US Environmental Protection Agency:
www.epa.gov/safewater

Safe Drinking Water Hotline: 1-800-426-4791

American Water Works Association: www.awwa.org

Centers for Disease Control and Prevention: www.cdc.gov

Public Participation

How You Can Get Involved

Customers can participate in decisions that may affect the quality of water by:

- Reading the information provided in bill inserts and special mailings
- Contacting the company directly with questions or to discuss issues
- Responding to company requests for participation in focus groups and roundtables
- Attending open houses conducted by the company
- Responding to survey requests

Where Your Water Comes From

Your drinking water comes from a blend of sources that may include:

Coastal North System – PWSID # NJ1345001
Shrewsbury area of system-Groundwater from the Potomac-Raritan-Magothy Aquifer (PRM) and surface water from the Glendola Reservoir, the Manasquan River/Reservoir, the Shark River, and the Swimming River/Reservoir.

Lakewood/Howell area of system-14 wells, 1 surface water supply. This system's source water comes from the Englishtown aquifer, Kirkwood-Cohansey aquifer, Mount Laurel-Wenonah aquifer, Potomac-Raritan-Magothy aquifer, upper Potomac-Raritan-Magothy aquifer, and Vincentown aquifer.

Ocean County area of system-5 wells and 1 purchased ground water source. This system's source water comes from the Englishtown aquifer system, Potomac-Raritan-Magothy aquifer, and upper Potomac-Raritan-Magothy aquifer. Also, bulk transfer of surface water from Jumping Brook Treatment Plant.

Ortley Beach/Pelican Island area of the system- This system can purchase water from the Lavallette Water Dept., and Seaside Heights Water Department. Also, bulk transfer of surface water from Jumping Brook Treatment Plant.

Protecting Your Water Source

What is S.W.A.P.

SWAP (Source Water Assessment Program) is a program of the New Jersey Department of Environmental Protection (NJDEP) to study existing and potential threats to the quality of public drinking water sources throughout the state. Sources are rated depending upon their contaminant susceptibility.

Susceptibility Ratings for New Jersey American Water — Coastal North

The table below illustrates the susceptibility ratings for the seven contaminant categories (and radon) for each source in the system. The table provides the number of wells and intakes that rated high (H), medium (M), or low (L) for each contaminant category. For susceptibility ratings of purchased water, refer to the specific water system's source water assessment report. Source Water Assessment Reports and Summaries are available for public water systems at www.state.nj.us/dep/swap/ or by contacting the NJDEP's Bureau of Safe Drinking Water at (609) 292-5550.

Contaminant Categories

DEP considered all surface water highly susceptible to pathogens, therefore all intakes received a high rating for the pathogen category. For the purpose of the Source Water Assessment Program, radionuclides are more of a concern for ground water than surface water. As a result, surface water intakes' susceptibility to radionuclides was not determined and a low rating was assigned.

If a system is rated highly susceptible for a contaminant category, it does not mean a customer is or will be consuming contaminated drinking water. The rating reflects the potential for contamination of source water, not the existence of contamination. Public water systems are required to monitor for regulated contaminants and to install treatment if any contaminants are detected at frequencies and concentrations above allowable levels.

As a result of the assessments, DEP may customize (change existing) monitoring schedules based on the susceptibility ratings.

Source water protection is a long-term dedication to clean and safe drinking water. It is more cost effective to prevent contamination than to address contamination after the fact. Every member of the community has an important role in source water protection. NJDEP recommends controlling activities and development around drinking water sources whether it is through land acquisition, conservation easements or hazardous waste collection programs. We will continue to keep you informed of SWAP's progress and developments.

Susceptibility Chart Definitions

- **Pathogens:** Disease-causing organisms such as bacteria and viruses. Common sources are animal and human fecal wastes.

- **Nutrients:** Compounds, minerals and elements that aid growth, that are both naturally occurring and man-made. Examples include nitrogen and phosphorus.
- **Volatile Organic Compounds:** Man-made chemicals used as solvents, degreasers, and gasoline components. Examples include benzene, methyl tertiary butyl ether (MTBE), and vinyl chloride.
- **Pesticides:** Man-made chemicals used to control pests, weeds and fungus. Common sources include land application and manufacturing centers of pesticides. Examples include herbicides such as atrazine, and insecticides such as chlordane.
- **Inorganics:** Mineral-based compounds that are both naturally occurring and man-made. Examples include arsenic, asbestos, copper, lead, and nitrate.
- **Radionuclides:** Radioactive substances that are both naturally occurring and man-made. Examples include radium and uranium.
- **Radon:** Colorless, odorless, cancer-causing gas that occurs naturally in the environment. For more information go to http://www.nj.gov/dep/rpp/radon/index.htm or call (800) 648-0394.
- **Disinfection By-product Precursors:** A common source is naturally occurring organic matter in surface water. Disinfection by-products are formed when the disinfectants (usually chlorine) used to kill pathogens react with dissolved organic material (for example leaves) present in surface water.

		Pathogens			Nutrients			Pesticides			Volatile Organic Compounds			Inorganics			Radionuclides			Radon			Disinfection By-product Precursors		
	Sources	H	M	L	H	M	L	H	M	L	H	M	L	H	M	L	H	M	L	H	M	L	H	M	L
Shrewsbury Area	Wells - 10			10			10			10			10		8	2		9	1			10		8	2
	GUDI - 0																								
	Surface water intakes - 5	5			1	4			2	3		5		3	2				5			5	5		
Lakewood Area	Wells - 14		1	13	4		10			14	4		10	4	6	4	1	6	7		5	9	1	13	
	GUDI- 0																								
	Surface water intakes - 1	1				1			1			1			1				1			1	1		
Ocean County Area	Wells - 5			5			5			5			5		4	1		3	2			5		5	
	GUDI - 0																								
	Surface water intakes - 0																								

Lead Education Statement

If present, elevated levels of lead can cause serious health problems, especially for pregnant women and young children. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing. New Jersey American Water is responsible for providing high quality drinking water, but cannot control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to 2 minutes before using water for drinking or cooking. If you are concerned about lead in your water, you may wish to have your water tested. Information on lead in drinking water, testing methods, and steps you can take to minimize exposure is available from the Safe Drinking Water Hotline or at http://www.epa.gov/safewater/lead.

Unregulated Contaminant Monitoring Rule 3 (UCMR3)

During 2013, 2014 and 2015 our Company participated in the Unregulated Contaminant Monitoring Rule. Unregulated contaminants are those for which the EPA has not established drinking water standards. The purpose of unregulated contaminant monitoring is to assist the EPA in determining the occurrence of unregulated contaminants in drinking water and whether regulation is warranted. For testing conducted, the substance found are listed in the table further below.

What's in the Source Water Before We Treat It?

In general, the sources of drinking water (both tap and bottled water) include rivers, lakes, streams, ponds, reservoirs, springs and wells. As water travels over the surface of the land or through the ground, it dissolves naturally occurring minerals and can pick up substances resulting from the presence of animals or from human activities.

Substances That May Be Present in Source Water Include:

Microbiological Contaminants: such as viruses and bacteria, which may come from sewage treatment plants, septic systems, agricultural livestock operations or wildlife.

Inorganic Contaminants: such as salts and metals which can be naturally occurring or may result from urban stormwater runoff, industrial or domestic wastewater discharges, oil and gas production, mining or farming.

Pesticides and Herbicides: which may come from a variety of sources such as agriculture, urban stormwater runoff and residential uses.

Organic Chemical Contaminants: including synthetic and volatile organic chemicals which are by-products of industrial processes and petroleum production, and may also come from gas stations, urban stormwater runoff and septic systems.

Radioactive Contaminants: which can be naturally occurring or may be the result of oil and gas production and mining activities.

For more information about contaminants and potential health effects, call the EPA's Safe Drinking Water Hotline at 1-800-426-4791.

What is Radon?

Radon is a radioactive gas that occurs naturally in some groundwater. It may pose a health risk when the gas is released from water into air, as occurs while showering, washing dishes and performing other household activities. Radon can move up through the ground and into a home through cracks in the foundation. Compared to radon entering the home through soil, radon entering through tap water is, in most cases, a small source of radon in indoor air. Inhalation of radon gas has been linked to lung cancer, however the effects of radon ingested in drinking water are not yet clear. If you are concerned about radon in your home, tests are available to determine the total exposure level.

The EPA is developing regulations to reduce radon in drinking water. Radon in the air is inexpensive to test and easy to correct. For additional information, call the EPA's Radon Hotline at 1-800-SOS-RADON.

Do I Need to Take Special Precautions?

To ensure that tap water is safe to drink, the U.S. EPA prescribes regulations limiting the amount of certain contaminants in water provided by public water systems. U.S. Food and Drug Administration regulations establish limits for contaminants in bottled water, which must provide the same protection for public health.

Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the EPA's Safe Drinking Water Hotline at 1-800-426-4791.

How Do I Read the Table of Detected Contaminants?

First, determine which table you should read by finding your town in the Towns Served by this System. Starting with the **Contaminant**, read across from left to right. A "**Yes**" under **Compliance Achieved** means the amount of the substance met government requirements. The column marked **MCLG, Maximum Contaminant Level Goal**, is the level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety. The shaded column marked **MCL, Maximum Contaminant Level**, is the highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLGs as feasible using the best available treatment technology. The column marked **Range Detected** shows the highest and lowest test results for the year. The column

marked **Highest Level Detected** shows the highest test results during the year. **Typical Source** shows where this substance usually originates. Compare the Range Detected values with the MCL column. To be in compliance, the Highest Level Detected must be lower than the MCL standard. Those substances not listed in the table were not found in the treated water supply.

As you can see from the table, our system had no MCL violations again this year. The footnotes and the definitions below will help you interpret the data presented in the Table of Detected Contaminants.

Table Definitions

90th Percentile Value: Of the samples taken, 90 percent of the values of the results were below the level indicated in the table.

Action Level: The concentration of a contaminant which, if exceeded, triggers treatment or other requirements which a water system must follow.

MRDL (Maximum Residual Disinfectant Level): The highest level of disinfectant allowed in drinking water. There is convincing evidence that addition of a disinfectant is necessary for control of microbial contaminants.

MRDLG (Maximum Residual Disinfectant Level Goal): The level of drinking water disinfectant below which there is no known or expected risk to health. MRDLGs do not reflect the benefits of the use of disinfectants to control microbial contamination.

NA: not applicable

NTU (Nephelometric Turbidity Units): Measurement of the clarity, or turbidity, of the water.

ND (None Detected): Laboratory analysis indicates that the constituent is not present.

ppb (parts per billion): Corresponds to one part substance in one billion parts of water.

ppm (parts per million): Corresponds to one part substance in one million parts of water.

pCi/L (picoCuries per Liter): A measure of the radioactivity in water.

RUL: Recommended Upper Limit

TT (Treatment Technique): A required process intended to reduce the level of a contaminant in drinking water.

Water Quality Statement

The data presented in the Table of Detected Contaminants is the same data collected to comply with U.S. Environmental Protection Agency and New Jersey state monitoring and testing requirements. We have learned through our testing that some contaminants have been detected, however, these contaminants were detected well below the levels set by the EPA to protect public health. To assure high quality water, individual water samples are taken each year for chemical, physical and microbiological tests. Tests are done on water taken at the source, from the distribution system after treatment and, for lead and copper monitoring, from the customer's tap. Testing can pinpoint a potential problem so that preventative action may be taken. The Safe Drinking Water Act regulations allow monitoring waivers to reduce or eliminate the monitoring requirements for asbestos, volatile organic chemicals, and synthetic organic chemicals. Our system has received monitoring waivers for synthetic organic chemicals

Vulnerable Populations Statement

Some people may be more vulnerable to contaminants in drinking water than the general population. Immuno-compromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. EPA/CDC guidelines on appropriate means to lessen the risk of infection by *Cryptosporidium* and other microbial pathogens are available from the Safe Drinking Water Hotline (1-800-426-4791).

Coastal North System – PWS ID# NJ1345001
Table of Detected Contaminants – 2017

Towns Served by this system: Shrewsbury area of system-Aberdeen | Allenhurst | Asbury Park | Bradley Beach | Colts Neck in part | Deal | Eatontown | Elberon | Fair Haven | Highlands Borough | Holmdel | Interlaken | Little Silver | Loch Arbor | Long Branch | Middletown | Monmouth Beach | Neptune | Neptune City | Ocean Grove | Oceanport | Ocean Township | Red Bank | Rumson | Sea Bright | Shrewsbury Borough | Shrewsbury Township | Tinton Falls | Wanamassa | West Long Branch | Lakewood/Howell area of system-Freehold in part | Howell Township | Lakewood | Ocean County area of system-Bay Head | Brick Township in part | Dover in part | Lavallette in part | Mantoloking | Ortley Beach | Pelican Island

Those substances not listed in this table were not found in the treated water supply.

Regulated Substances [1]

Contaminant	Units	MCL	MCLG	Range Detected	Highest Level Detected	Compliance Achieved	Typical Source
Inorganic Chemicals							
Total Coliform	cfu	Coliform detected no more than 5% of monthly samples	0	NA	0.09 % [14]	Yes	Naturally present in environment
Fluoride [2]	ppm	4	4	ND to 0.84	0.84	Yes	Erosion of natural deposits; Water additive which promotes strong teeth
Nitrate	ppm	10	10	ND to 1.52	1.52	Yes	Runoff from fertilizer use; Industrial or domestic wastewater discharges; Erosion of natural deposits
Cyanide	ppm	0.2	0.2	ND to 0.006	0.006	Yes	Discharge from steel/metal/ plastic/fertilizer factories
Chromium	ppb	100	100	ND to 0.1.4	1.4 [13]	Yes	Discharge from steel and pulp mills; Erosion of natural deposits
Treatment By-Products Stage-2							
Total Trihalomethanes [TTHMs]	ppb	80	NA	4.3 to 89.7	59.9[3]	Yes	By-product of drinking water disinfection
Total Haloacetic Acids [THAA5]	ppb	60	NA	0 to 41.0	24.0[3]	Yes	By-product of drinking water disinfection
Turbidity							
Turbidity [12]	ntu	TT	NA	0.06 to 0.28	0.28	Yes	Soil runoff
Treatment By-products Precursor Removal							
Total Organic Carbon	ppm	TT	NA	0.31 to 2.20	2.20	Yes	Naturally present in the environment
Disinfectants							
Chloramines	ppm	MRDL = 4	MRDLG = 4	0.06 to 2.85	1.40[4]	Yes	Water additive used to control microbes
Chlorite [10]	ppm	1	0.8	ND to 0.55	0.55	Yes	By-product of drinking water disinfection
Chlorine Dioxide [11]	ppb	MRDL = 800	MRDLG = 800	40 to 600	600	Yes	Water additive used to control microbes
Radiological Substances							
Alpha Emitters [9]	pCi/L	15	0	ND to 14.9	14.9	Yes	Erosion of natural deposits
Combined Radium 226 and 228	pCi/L	5[5]	0	ND to 2.8	2.8	Yes	Erosion of natural deposits
Organics							
Methyl Tert-Butyl Eather	ppb	5	0	ND to 0.6	0.6	Yes	Discharge from chemical plants and Other industrial activities

Tap water samples were collected for lead and copper analysis from homes in the service area

Contaminant	Units	Action Level	MCLG	Amount Detected (90th %tile)	Homes Above Action Level	Compliance Achieved	Typical Source
Copper 2017	ppm	1.3	1.3	0.125	none	Yes	Corrosion of household plumbing systems
Lead 2017	ppb	15	0	3	4	Yes	Corrosion of household plumbing systems

Secondary Contaminants

Contaminant	Units	RUL	Amount Detected
Iron [6]	ppm	0.3	ND to 0.33 [13]
Manganese [7]	ppm	0.05	ND to 0.045 [13]
Sodium [8]	ppm	50	3.8 to 48.6 [13]
Hardness	ppm	250	52 to 120 [13]
Aluminum	ppm	0.05	ND to 0.15

Unregulated Contaminant Monitoring [13]

Contaminant	Units	NJDEP Guidance Level	Range Detected	Highest Level Detected	Use or Environmental Source
Chlorate	ppb	NA	ND to 760	760	Agricultural defoliant or desiccant; disinfection byproduct; and used in production of chlorine dioxide.
Hexavalant Chromium	ppb	NA	ND to 0.53	0.53	Major sources of Hexavalent Chromium (Chromium-6) in drinking water are discharges from steel and pulp mills, and erosion of natural deposits of chromium-3. Hexavalent Chromium is not currently regulated as an individual substance. NJ American Water voluntarily performed this monitoring based on recommendations from USEPA. For more information on Hexavalent Chromium (Chromium-6), please visit our web site.
Strontium	ppb	NA	37.6 to 508.5	508.5	Naturally occurring element; commercial use of strontium has been in the faceplate glass of cathode-ray tube televisions to block x-ray emissions.
1,4-Dioxane	ppb	NA	ND to 0.50	0.50	Used as a solvent in manufacturing and processing of paper, cotton, textile products, automotive coolant, cosmetics and shampoos.

[1] Under a waiver granted by the State of New Jersey Department of Environmental Protection, our system does not have to monitor for synthetic organic chemicals/pesticides because several years of testing have indicated that these substances do not occur in our source water. The SDWA regulations allow monitoring waivers to reduce or eliminate the monitoring requirements for volatile organic chemicals and synthetic organic chemicals. Our system received monitoring waivers for synthetic organic chemicals.
[2] Fluoride is added to the water (Shrewsbury and Ocean County areas of Coastal North System).
[3] This level represents the highest annual quarterly Locational Running Average calculated from the data collected.
[4] This level represents the highest annual quarterly Average calculated from the data collected.
[5] Radium 226 and Radium 228 have a combined MCL of 5 pCi/L.
[6] The recommended upper limit for iron is based on unpleasant taste of the water and staining of laundry. Iron is an essential nutrient, but some people who drink water with iron levels well above the recommended upper limit could develop deposits of iron in a number of organs of the body.
[7] The recommended upper limit for manganese is based on staining of laundry. Manganese is an essential nutrient, and toxicity is not expected from high levels which would be encountered in drinking water.
[8] For healthy individuals, the sodium intake from water is not important, because a much greater intake of sodium takes place from salt in the diet. However, sodium levels above the recommended upper limit may be of concern to individuals on a sodium restricted diet.
[9] Certain minerals are radioactive and may emit a form of radiation known as alpha radiation. Some people who drink water containing alpha emitters in excess of the MCL over many years may have an increased risk of getting cancer.
[10] Some infants and young children who drink water containing chlorite in excess of the MRDL could experience nervous system effects. Similar effects may occur in fetuses of pregnant women who drink water containing chlorite in excess of the MCL. Some people may experience anemia.
[11] Some infants and young children who drink water containing chlorine dioxide in excess of the MRDL could experience nervous system effects. Similar effects may occur in fetuses of pregnant women who drink water containing chlorine dioxide in excess of the MRDL. Some people may experience anemia.
[12] Turbidity is a measure of the cloudiness of the water. 100% of the turbidity readings were below the treatment technique requirement of 0.3 ntu. We monitor it because it is a good indicator of the effectiveness of our filtration system.
[13] The state of New Jersey allows us to monitor for some substances less than once per year because the concentrations of these substances do not change frequently. Some of our data, though representative, is more than one year old.
[14] Maximum percentage of positive samples collected in any one month.

Our Water Research Efforts

Cryptosporidium is a protozoan found in surface water throughout the U.S. Although filtration removes *Cryptosporidium*, the most commonly used filtration methods cannot guarantee 100 percent removal. Ingestion of *Cryptosporidium* may cause cryptosporidiosis, an abdominal infection. Symptoms of infection include nausea, diarrhea, and abdominal cramps. Most healthy individuals can overcome the disease within a few weeks. However, people with severely weakened immune systems have a risk of developing a life threatening illness. We encourage such people to consult their doctors regarding appropriate precautions to take to avoid infection. *Cryptosporidium* must be ingested to cause disease. It can also be spread through means other than drinking water. For additional information regarding cryptosporidiosis and how it may impact those with weakened immune systems, please contact your personal health care provider.

The U.S. EPA issued a rule in January 2006 that requires systems with higher *Cryptosporidium* levels in their source water to provide additional treatment. To comply with this rule, New Jersey American Water once again began conducting 24 consecutive months of monitoring for *Cryptosporidium* in our raw water sources starting in in 2015. The monitoring to date indicates the presence of these organisms in the source water. The samples were collected from the source before the water was processed through our treatment plants. We continued monitoring until April 2017. The data collected is presented in the Source Water Monitoring table below.

Source Water Monitoring

Contaminant	Swimming River source water	Jumping Brook source water	Oak Glen source Water	
Cryptosporidium, Oocysts/L	ND – 0.100	ND	ND	Microbial pathogens found in surface waters throughout the United States.
Giardia, Cysts/L	0 – 0.558	0 – 0.089	0 – 0.558	

NJDEP Water Conservation Message...Because Remember, Every Drop Counts