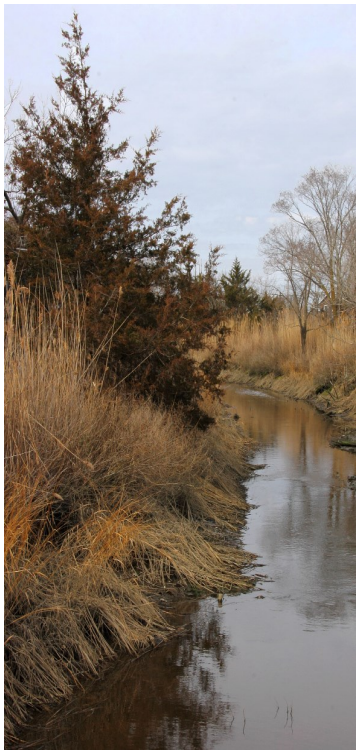
Final May 2018



Environmental Resource Inventory

for

West Cape May Borough

Cape May County, NJ

Prepared for:

West Cape May Borough

Kratzer Environmental Services

ENVIRONMENTAL RESOURCE INVENTORY

The Borough of West Cape May

Cape May County

New Jersey

Prepared By

Kratzer Environmental Services

For

The Borough of West Cape May

May 2018

Kratzer Environmental Services

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"We should act like this is the only planet we have because it is." (Honachevsky, 2000)

ACKNOWLEDGEMENTS

This report was authored by Deborah J. Kratzer, Jill S. Dodds and Elizabeth A. Johnson. Funding for this report was provided by the Borough of West Cape May.

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Table 7.10 (pages 130 to 134): Chuck Bargeron, Univ. of Georgia, Bugwood.org; Ted Bodner at USDA-NRCS PLANTS Database; Britton and Brown, 1913; John D. Byrd, Mississippi State University, Bugwood.org; Steve Dewey, Utah State University, Bugwood.org; Tom Heutte, USDA Forest Service, Bugwood.org; James H. Miller, USDA Forest Service, Bugwood.org; Mohlenbrock , 1995; Jan Samanek, State Phytosanitary Administration, Bugwood.org; Jil M. Swearingen, USDI National Park Service, Bugwood.org; USDA PLANTS Database, Bugwood.org ; Richard Webb, Self-employed horticulurist, Bugwood.org

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1: INTRODUCTION

A. About This Report

Ecologically Based Planning

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 Borough of West Cape May, both affecting and being affected by many physical and biological factors. With West Cape May's population of 1,024[1] (US Census, 2010), the cumulative effects of many individual decisions have altered and have the potential to impact the environment and human health.

> "The scientific community needs to articulate more clearly for local decision makers the underlying ecological processes and the consequences resulting from interference or truncation of those processes." (Honachefsky, 2000, p. 32)

Assembling an inventory of the Borough'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 land planners create and maintain an ecologically healthy community.

Goal of the Environmental Resource Inventory

The goal of the *Environmental Resource Inventory (ERI)* is to provide objective, reliable environmental data in one document. This enables Borough officials (the Mayor, Borough Council, Planning Board, Environmental Commission, Shade Tree Commission and Historical Preservation Commission) and the Lower Township Construction Office to make more informed decisions. By taking numerous variables into consideration, they will better protect the Borough's natural resources and the overall health and welfare of the community. Similarly, it is a tool for the public to use.

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).

[1] The population of Cape May County as a whole is estimated to be 94,727 persons and for the entire State of New Jersey, the population estimate is 8,958,013 persons (US Census, July 1, 2015 estimate).

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.

The Association of New Jersey Environmental Commissions (ANJEC) defines "Environmental Resource Inventory" in its Resource Paper, The Environmental Resource Inventory: ERI, as follows:

> "The Environmental Resource Inventory (ERI), or Index of Natural Resources, is a compilation of text, tables, maps and other visual information about the natural resource characteristics and environmentally significant features of an area. Traditionally called "Natural Resources Inventory," the title "Environmental Resources Inventory" is now commonly used, reflecting the addition of manmade features to the inventory, such as historic sites, brownfields and contaminated sites. An ERI provides baseline documentation for measuring and evaluating resource protection issues. It is an objective index and description of features and their functions, rather than an interpretation or recommendation. Identifying significant environmental resources is the first step in their protection and preservation and in assuring that future development or redevelopment protects public health, safety and welfare." (ANJEC, no date).

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 Borough of West Cape May. This objective information may facilitate resource-sensitive development decisions. In addition, familiarity with environmental concerns enables residents to appreciate and to learn how to maintain our valuable natural resources. Areas of specific concern may emerge which require additional protection strategies, such as further research and monitoring, public outreach and education, habitat restoration, easements, volunteer projects, and/or revised or new ordinances.

Methods

Funding for this project was provided by the Borough of West Cape May Environmental Commission.

An inventory of what is currently known about the physical and biological environment and the human influence on the environment of West Cape May 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 83 GIS data layers from 30 sources were used for this report's 45 maps.

What is GIS?

"A geographic information system (GIS) integrates hardware, software, and data for capturing, managing, analyzing, and displaying all forms of geographically referenced information.

GIS allows us to view, understand, question, interpret, and visualize data in many ways that reveal relationships, patterns, and trends in the form of maps, globes, reports, and charts." (GIS.com, 2013)

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 West Cape May 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).

When viewing the digital document (as opposed to a printed copy) maps in PDF[2], 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[3].

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 the Borough of West Cape May's natural resources, including climate, geology, soils, water, floodplains, wetlands, and forests, and cultural resources such as infrastructure and open space. Environmental concerns in West Cape May include air and water pollution, rare, threatened and endangered species and invasive species.

Limitations of the NRI

It should be noted that the NRI is not meant to replace the primary data sources upon which it is based. Details about each data layer, including the date, scale and methods of developing the data, are provided in **Appendix B**. The NRI is intended for preliminary assessments of projects and *cannot substitute for on-site testing and evaluations*. Most maps are presented at a scale of 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 $\pm$ 40 feet). Data mapped at 1:100,000, such as the geology data layer, have an accuracy of $\pm$ 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.*

Following the guidelines provided by ANJEC, management recommendations are not included in the ERI.

[2] PDF stands for "Portable Document Format," a digital format which allows the document to appear the same to everyone, requiring only the download of the free Adobe® Reader® at http://www.adobe.com/products/acrobat/readstep2.html.

[3] A few maps are so large in this format that they are included as a simple graphic in the report, but are available separately in PDF.

B. General Description of the Borough of West Cape May

West Cape May is located in Cape May County, NJ (see **Figure 1a**) and is bordered by Lower Township to the north, west, and south and the Cape May City to the east. West Cape May is one of four municipalities that are found south of the Cape May canal, the fourth being Cape May Point.

The Borough was incorporated in 1884. West Cape May encompasses 1.175 square miles (752 acres)[4] with a population of 1,024 living in 1,043 housing units (US Census, 2010).

C. Land Use and Land Use Change

Figures 1b through 1e show aerial photographs of West Cape May and the surrounding areas. In **Figure 1b**, aerial photography taken in 1930, although not very high resolution, and not georeferenced[5], illustrates the prevalence of agriculture and far less development at that time. Aerial photographs taken in 1995, 2002, 2007, 2012 and 2015 are shown in **Figures 1c, 1d, 1e, 1f and 1g** respectively.[6] These aerial photographs are georeferenced. Other options for viewing aerial photos online are listed in **Internet Resources**, at the end of this section.

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 West Cape May 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.

[4] The total acres determined by the ArcGIS coverage differs slightly from the acres provided on tax maps.
[5] Georeferencing involves defining the location of something in physical space using map coordinates and assigning a coordinate system. This is the strength of GIS, because features can be defined in relation to other features.
[6] The 2002, 2007, 2012 and 2015 aerial photography data are high resolution, with pixels of 1 square foot. This is much more detail than can be shown in this report. See NJ-GeoWeb in **Internet Resources**, at the end of this section.

Data Sources: NJDEP, NJDOT
Note: Map accuracy is limited to the accuracy and scale of the original data sets.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Figure 1a: West Cape May Location

The Borough of West Cape May is located at the southern end of Cape May County. The inset indicates its position relative to the rest of New Jersey.

Data Sources: NJDEP, NJDOT
Note: Map accuracy is limited to the accuracy and scale of the original data sets.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Figure 1b: West Cape May 1930 Aerial Photography

Prepared by Kratzer Environmental Services

Data Sources: NJDEP, NJDOT
Note: Map accuracy is limited to the accuracy and scale of the original data sets.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Figure 1c: West Cape May 1995 Aerial Photography

Prepared by Kratzer Environmental Services

Data Sources: NJDEP, NJDOT
Note: Map accuracy is limited to the accuracy and scale of the original data sets.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Figure 1d: West Cape May 2002 Aerial Photography

Figure 1e: West Cape May 2007 Aerial Photography

Prepared by Kratzer Environmental Services

Data Sources: NJDEP, NJDOT
Note: Map accuracy is limited to the accuracy and scale of the original data sets.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Figure 1f: West Cape May 2012 Aerial Photography

Prepared by Kratzer Environmental Services

Data Sources: NJDEP, NJDOT
Note: Map accuracy is limited to the accuracy and scale of the original data sets.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Figure 1g: West Cape May 2015 Aerial Photography

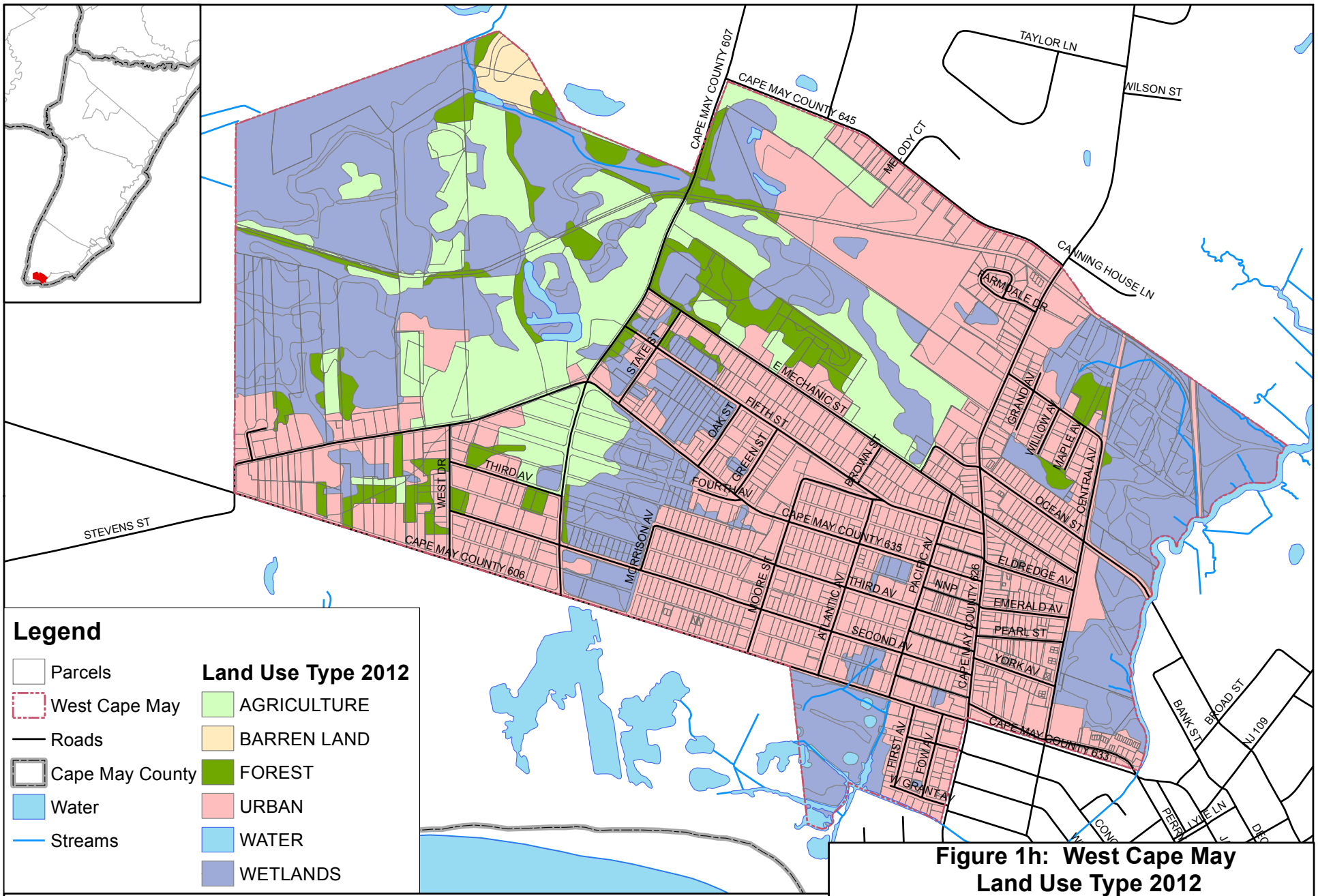
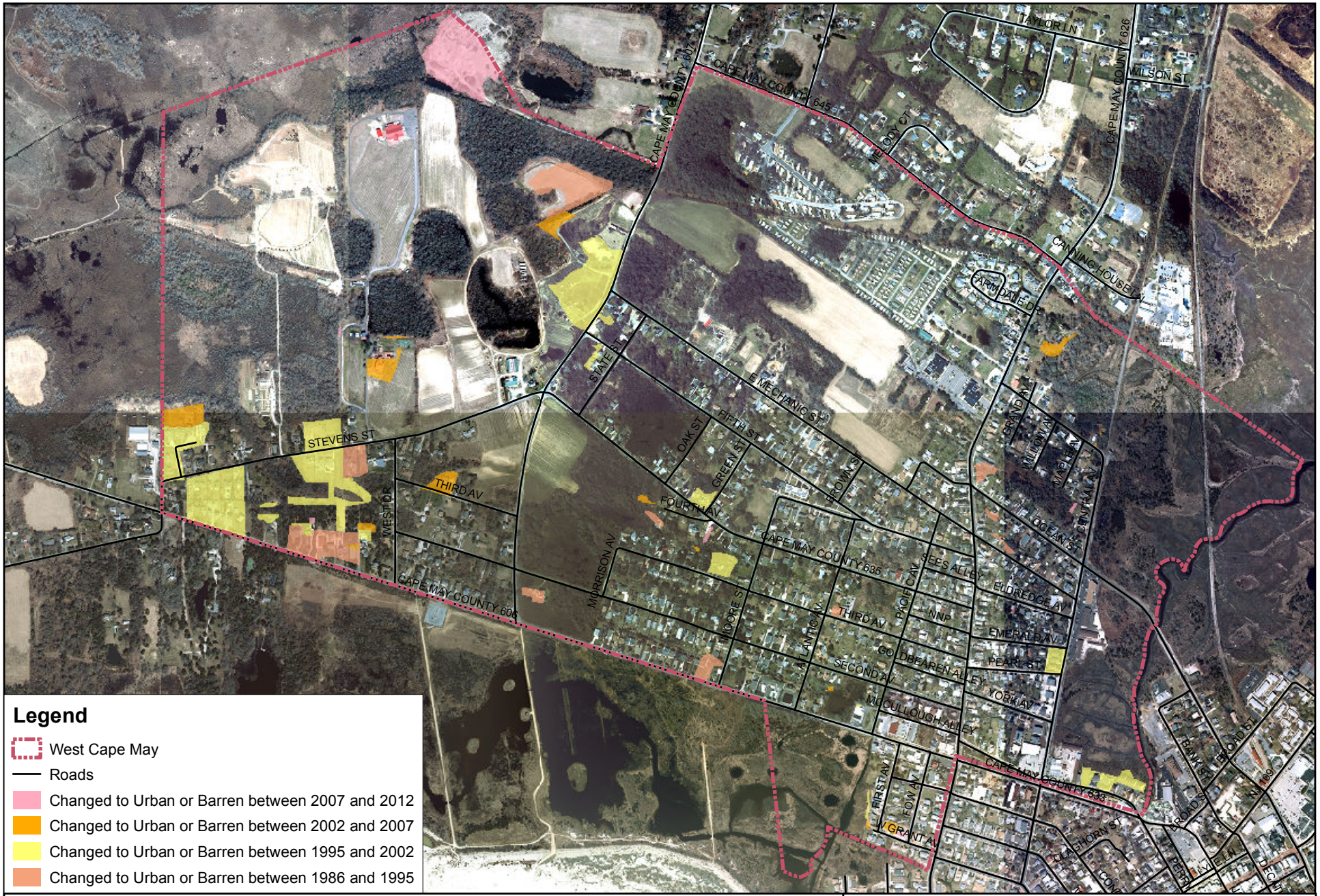


Figure 1h: West Cape May Land Use Type 2012

The predominant land use categories in West Cape May are urban, wetlands and agriculture. Scattered areas of forest are also present, and the remainder is made up of open water or barren land.



Prepared by Kratzer Environmental Services

Data Sources: NJDEP, NJDOT
Note: Map accuracy is limited to the accuracy and scale of the original data sets.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Figure 1i: West Cape May Land Use Change to Urban or Barren

Changes in land use between 1986 and 2012 where the type changed to urban or barren are highighted.

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 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 6C** of this report.

Table 1.1: 2012 Land Use Type

Land Use Type	Acres*	Percent
AGRICULTURE	104.75	13.88
BARREN LAND	5.06	0.67
FOREST	42.47	5.63
URBAN	329.90	43.72
WATER	6.02	0.80
WETLANDS	266.43	35.31
Total Acres	**754.63**	**100.00**

*Area calculated with GIS differs from area from other sources, such as tax maps.

Source: NJDEP, 2015

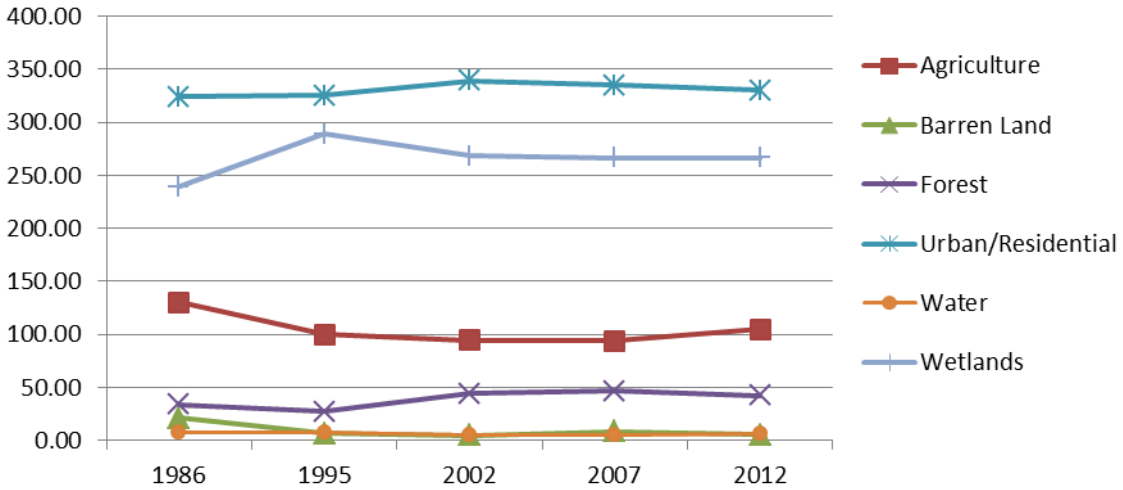
Barren Land includes areas being developed or cleared at the time the photos were taken.

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 Borough of West Cape May are illustrated in **Figure 1h**, and summarized in **Table 1.1**. West Cape May is approximately 44% urban and about 6% forested. Detailed categories of land use/land cover are shown in **Section 7** of this report.

Table 1.2: Change in Land Use Type*

Land Use Type	1986 Percent	1995 Percent	2002 Percent	2007 Percent	2012 Percent	26 year change Acres	26 year change Percent
Agriculture	17%	13%	12%	12%	14%	-25.4	-3%
Barren Land	3%	1%	1%	1%	1%	-15.7	-2%
Forest	4%	4%	6%	6%	6%	8.8	1%
Urban/Residential	43%	43%	45%	44%	44%	5.8	1%
Water	1%	1%	1%	1%	1%	-1.0	0%
Wetlands	32%	38%	36%	35%	35%	27.4	4%
Total:	100%	100%	100%	100%	100%		



*Some changes may be artifacts rather than actual changes, such as due to the increase in resolution in 1995 and 2002 or changes in definitions.

Source: NJDEP, 2015; NJDEP, 2010; NJDEP, 2007; NJDEP, 2000; NJDEP, 1998

Table 1.2 shows the percentages of West Cape May in each land use type in 1986, 1995, 2002, 2007, and 2012 and the changes in percent cover. **Figure 1i** highlights the areas that have changed to urban or barren land from another type (such as agriculture) over this time period. Some land changed within the urban type, such as changing from *other urban or built-up land* to *residential, single unit, low density*; while other areas changed from the urban type to another type, for example changing from *other urban or built-up land* to *cropland and pastureland* and these are not highlighted.

References: Introduction

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NJDEP, Bureau of Geographic Information Systems (BGIS). February 17, 2015. Land Use/Land Cover 2012 Update, Edition 20150217 Subbasin 02040302 - Great Egg Harbor, Subbasin 02040303 - Chincoteague 1:2,400. GIS Data. http://www.nj.gov/dep/gis/listall.html

US Census 2010. http://factfinder2.census.gov/faces/nav/jsf/pages/community_facts.xhtml; http://quickfacts.census.gov/qfd/states/34/3453850.html https://www.census.gov/quickfacts/table/PST045216/34009,34

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 and:

Google Earth[7]: http://www.google.com/earth/index.html (free download)

HistoricAerials.com[8]: http://historicaerials.com (free to use, but maps have watermark unless purchased)

Free online mapping:

NJ-GeoWeb (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/

[7] Users of Google Earth may also view several years of historic imagery of West Cape May from 1995 through 2012. On the menu bar, click View, then click Historical Imagery and use the slider bar to choose the year.

[8] HistoricAerials.com allows viewing of historic aerial photography between 1931 and 2007.

Cape May County's Official Home Page: http://capemaycountynj.gov/

Environmental Education

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

Free GIS Software

ArcExplorer (free GIS software): http://www.esri.com/software/arcexplorer/explorer.html

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
Download GIS data: http://www.state.nj.us/dep/gis/downloadintra.html
NJ Geographic Information Network: https://njgin.state.nj.us/NJ_NJGINExplorer/index.jsp

West Cape May's Official Home Page: http://www.westcapemay.us/

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

2: LOCAL & REGIONAL CONDITIONS

A. Climate & Meteorology

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 West Cape May that was evaluated for this climate study was Belleplain State Forest[9], which was monitored from April 1922 through January 2008 (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 coastal New Jersey is +0.3°F per decade, and the precipitation trend is -0.19 inches per decade (for the period of record 1895 to 2016) (NOAA, February 28, 2017). NOAA summarizes New Jersey's climate as follows:

- 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

[9] The Belleplain State Forest weather monitoring station was located about 25 miles north of West Cape May Borough, in Dennis (39'15", 74' 51" 30') Township, Cape May County. See **Figure 2a.**

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).

Figure 2a illustrates changing shorelines from 1837 to 2007. Online sea level rise and flood mapping tools are listed in **Internet Resources**.

Precipitation and Temperature

As the prevailing westerlies 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. West Cape May 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. Of these stations, the Cape May station is nearest long-running station to West Cape May Borough. The Cape May weather station has collected data from 1894 to present, but with gaps in data from 1898-1903, 1914-1925, and 1933-1938. **Table 2.1** displays monthly average highs and lows and mean temperature, average monthly precipitation, and record highs and lows (and the year it occurred in parentheses). In 2008, a weather station was activated at the Rea Farm in West Cape May. Current local conditions and forecasts for the Borough area are available at http://www.njweather.org/station/261.

Measurable precipitation falls in New Jersey on approximately 120 days per year. At the Cape May weather station, annual precipitation has averaged 40.70 inches (for the period 1894-2016), which is at the low end of the range of 40 to 51 inches in New Jersey (see **Table 2.1**) (ONJSC, No Date; ONJSC, February 2017).

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, February 2017). The portion of Cape May County that includes West Cape May Borough averages 10-12 day per year with precipitation one inch or greater, while precipitation levels exceeding two inches are only likely to occur once or twice a year (ONJSC, 2017).

Table 2.1: Temperature & Precipitation at Cape May, NJ

Month	*Based on data from 1894-2016*		*Based on data from 1894-2016*	*Based on data from 1894-2010*		*Based on data from 1894-2016*
	Temperature (°F)					Mean Precipitation
	Avg. High	Avg. Low	Mean	Record High	Record Low	
January	42.0	28.0	35.1	73°F (2002)	-2°F (1982)	3.19 in.
February	43.0	28.5	35.8	74°F (1930)	-1°F (1979)	2.90 in.
March	50.1	35.1	42.6	82°F (1990)	7°F (2007)	3.73 in.
April	59.5	43.4	51.4	91°F (2009)	22°F (1982)	3.29 in.
May	69.0	52.9	60.9	95°F (1991)	33°F (1992)	3.30 in.
June	77.9	62.0	70.0	99°F (1963)	42°F (1956)	3.19 in.
July	82.9	67.4	75.2	106°F (1966)	51°F (1962)	3.46 in.
August	82.1	66.8	74.5	98°F (1912, 2006&7)	45°F (1986)	4.14 in.
September	77.0	61.6	69.3	96°F (1953)	32°F (1967)	3.27 in.
October	66.7	50.9	58.8	89°F (2007)	26°F (1950)	3.38 in.
November	56.2	41.4	48.8	83°F (1950)	14°F (1947)	3.15 in.
December	46.2	32.2	39.3	76°F (1998)	5°F (1942)	3.38 in.
					Average Annual Precipitation:	40.70 in.
Sources: ONJSC, February 2017 (averages) and ONJSC, 1893-2010 (extremes).						

Snow typically contributes little to the total precipitation in West Cape May (about 10" of snow equals 1" of rain). During the average winter, southern Cape May County experiences only four to six days of snowfall greater than or equal to a half inch, while snowfall greater than one inch is likely to occur less than four times per winter (ONJSC, 2017). As measured at the Cape May station, the earliest snow on record was on November 10 (in 1987, with 0.1 inch), and the latest was April 9 (in 1907, with 3.0 inches). Record snowfall for the region was 20 inches on January 24, 1908 (ONJSC, 1893-2010).

The growing season within Cape May County averages about 196 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 17th, and the first frost of fall occurs around November 3rd; however, the frost-free season is typically 60 days longer on the southern peninsula than it is in the northern part of the county. find and cite county soil survey (Dunlap, D.V. as cited in Markley 1977). Extreme dates for temperatures below freezing recorded in at the Cape May station were October 14 (31°F in 1988) and April 23 (29°F in 1989) (ONJSC, 1893-2010). During the winter, temperatures do not remain low for long periods, and soils do not freeze to a depth of more than six to twelve inches (Dunlap, D.V. as cited in Markley 1977).

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, No Date). Eight tornadoes have been recorded in Cape May County since 1950 (occurring in 1952, 1956, 1971, 1979, 1985, 1986, 1989 and 2003) and three funnel clouds have also been documented (in 2006, 2008 and 2012) (NOAA, 1950-2016). During the same period, 18 hail events were recorded in Cape May County. Hail which fell in the immediate vicinity of West Cape May occurred on June 12, 2007 (penny to nickel size hail), June 27, 2008 (nickel size hail), and June 29, 2012 (penny size hail) (NOAA, 1950-2016).

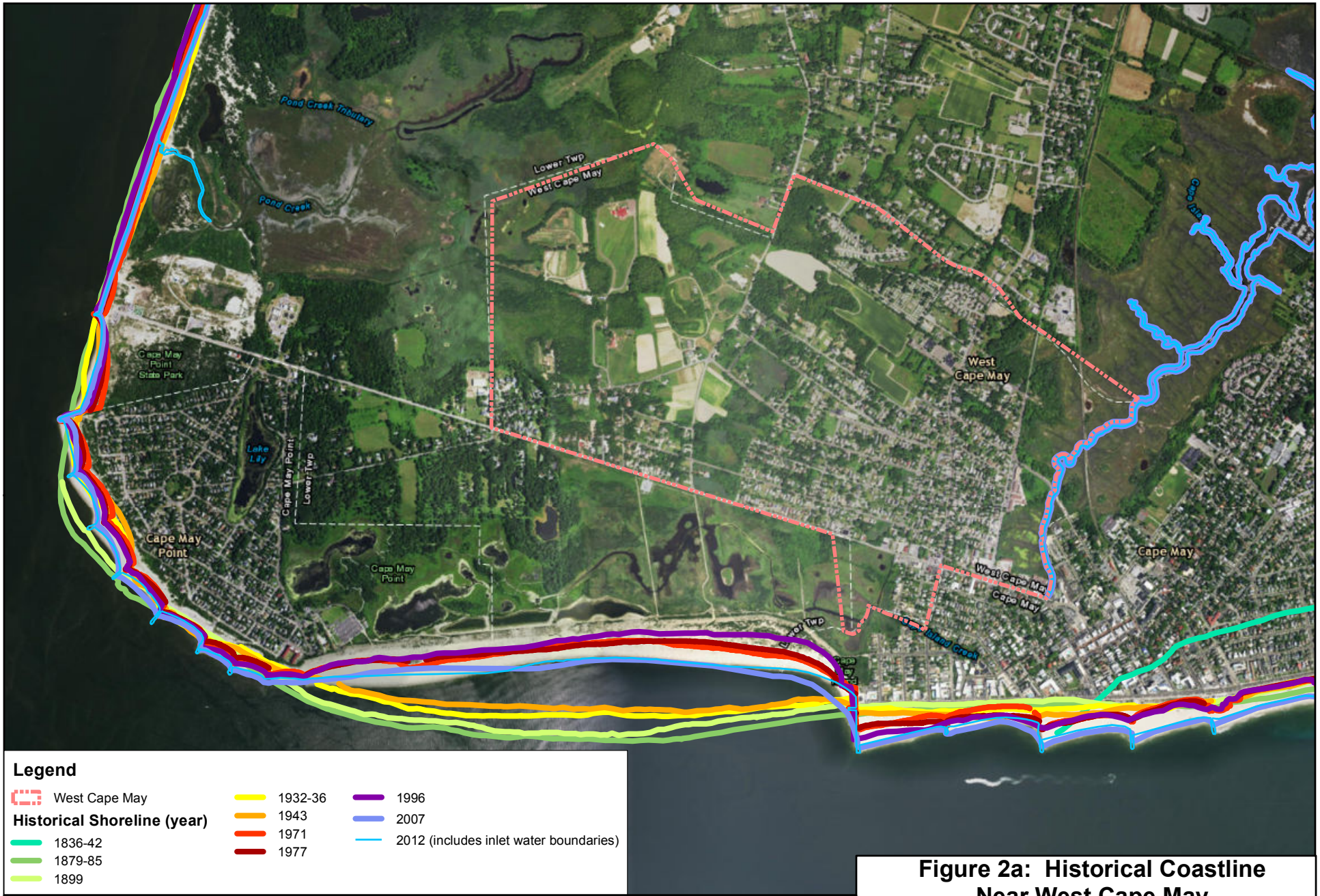


Figure 2a: Historical Coastline Near West Cape May

Selected data from the past 180 years shows a pattern of shifting shorelines at the outer tip of Cape May County.

Table 2.2 lists some of the highest snow and rainfall received in one day at the Cape May weather station (*although multiple day storms can have higher totals*), for the period 1893 to 2010 (the most recent data available on the Internet) (ONJSC, 1893-2010).

Table 2.2: Highest Daily Precipitation Measured at Cape May

Rank	Greatest one-day snowfall		Greatest one-day rainfall	
	Amount	Date	Amount	Date
1st	20.0 in.	Jan. 24, 1908	8.15 in.	Aug. 14, 1953
2nd	18.8 in.	Feb. 16, 2003	6.35 in.	Sep. 12, 1960
3rd	17.5 in.	Feb. 6, 2010	4.89 in.	Jun. 19, 1967
4th	16.8 in.	Feb. 19, 1979	4.60 in.	Aug. 4, 1967
5th	16.0 in.	Jan. 25, 1905	4.31 in.	May 21, 1894
6th	14.4 in.	Feb. 24, 1989	4.30 in.	Aug. 25, 1958
Source: ONJSC, 1893-2010				

Tropical storms and hurricanes can contribute significant rainfall and can cause flooding. Some of the major storms that have affected West Cape May are described here. Hurricane Floyd battered New Jersey on September 16, 1999, although the toll was greatest in the northern and central regions of the state. Damage in the Cape May area was limited to back bay flooding and minor beach erosion. Other noteworthy tropical storms affecting Cape May since 1950 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 nearly every municipality in Cape May County experienced widespread damage (NOAA 1950-2016). Precipitation levels were highest in Cape May County, and the storm delivered 8.97 inches of rain to West Cape May (Robinson, 2012).

Cape May County is also susceptible to non-tropical coastal flooding, which occur fairly frequently in the region. In addition to Superstorm Sandy, 62 coastal flooding events have been recorded in the region from 1996-2016 (NOAA, 1950-2016). Seven of these events resulted in extensive property damage within the county (**Table 2.3**).

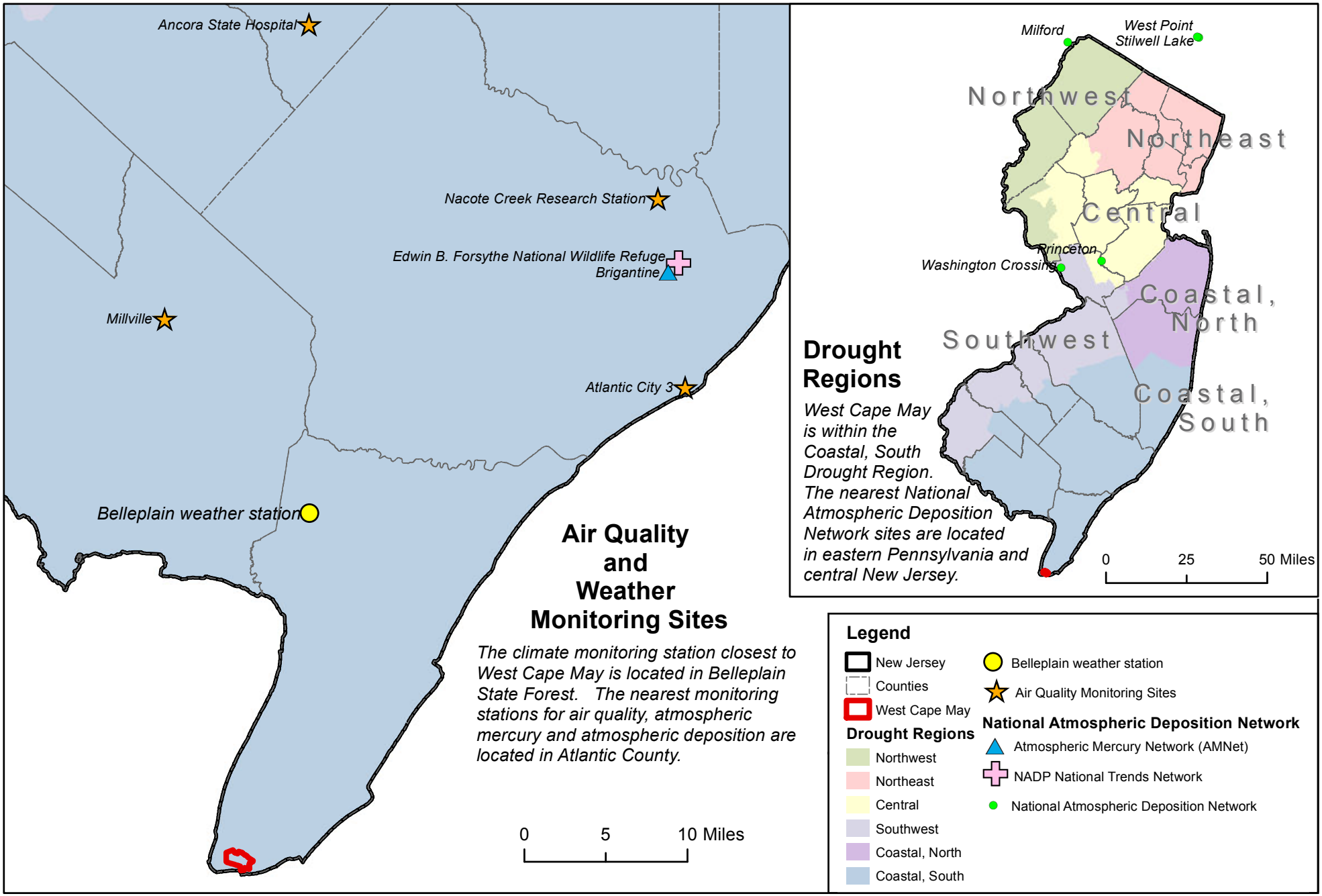
At the other extreme, extended periods of time with less than normal amounts of precipitation result in drought; agriculture suffers, wells can fail, reservoir levels fall and water supplies can be threatened.

NJDEP provides information about droughts according to Drought Region, using indicators of 90-day precipitation, 90-day stream flow, reservoir levels and ground water levels for each region. West Cape May lies within the Coastal South Drought Region (see **Figure 2b** and **Internet Resources**).

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 worst drought occurred in the 1960s, and included three consecutive years (1963-1965) that were among the four driest years since record-keeping began in 1985 (NJDEP, 2012). The full span of the drought ranged from June 1961 through August

Table 2.3: Cape May County Losses from Recent Coastal Flooding Events

Date	Estimated Cost	Cause
October 28, 2012	$ 175,000,000	Sandy
November 13, 2009	$ 122,000,000	northeaster
January 28, 1998	$ 14,500,000	northeaster
January 7, 1996	$ 3,900,000	coastal flood
February 4, 1998	$ 3,630,000	northeaster
October 2, 2015	$ 2,000,000	persistent onshore flow
February 12, 2006	$ 200,000	winter storm
March 7, 2013	$ 20,000	northeaster
Source: NOAA, 1950-2016.		



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Data Sources: NJDEP, NJDOT, NADP
Note: Map accuracy is limited to the accuracy and scale of the original data sets.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Prepared by Kratzer Environmental Services

Figure 2b: Air Quality and Weather Monitoring Sites and Drought Regions

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 but extended into March 2003 in the southern part of the state (NJDEP, 2017). The five years with lowest precipitation, based on long-term data from Cape May, New Jersey, are shown in **Table 2.4**.

Table 2.4: Lowest Annual Precipitation*

Rank	Year	Amount (inches)	Deviation from Mean
1st	1930	26.12	-14.58
2nd	1943	27.10	-13.60
3rd	1947	29.35	-11.35
4th	1929	29.85	-10.85
5th	1931	31.64	-9.06
*Cape May 1894-2016; mean = 40.70 inches			
Source: ONJSC, February 2017			

B. 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[10], 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 (USEPA, July 24, 2012; USEPA, February 14, 2012). 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 2c**). All of Cape May County is currently in attainment of the standard for CO. Thirteen New Jersey counties are presently designated as nonattainment areas for both the particulate matter ($PM_{2.5}$) annual

[10] Radon is discussed in **Section 3D** and Radon in ground water is discussed in **Section 5F**.

standard of 15 μg/m^3, [11,12] and for the 24-hour 35 μg/m^3 standard (see **Figure 2c**). Cape May County is in attainment with this standard, as are the two adjacent counties. However, Cape May County is part of the Southern New Jersey-Philadelphia-Delaware nonattainment area for the Ozone standard (1997 8-hour ozone standard of 0.08 ppm; revised in 2008 to 0.075 ppm (see **Figure 2c**) (NJDEP Bureau of Air Quality Planning, January 25, 2013).

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[13] 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).

NJDEP developed the Air Quality Index (AQI) to provide a descriptive rating and a color code (e.g. green=good) in real-time on the internet for many sites. The closest station to West Cape May that monitors Ozone (O_3) is located northeast of Millville in Cumberland County. Particulate matter ($PM_{2.5}$) and Nitrogen Dioxide/Nitric Oxide (NO_x) are also monitored at the site (NJDEP Bureau of Air Monitoring, February 13, 2013). See **Internet Resources** for a link to current air quality at the site; see **Figure 2b** for the location). The following paragraphs provide more information about ground-level ozone, particulates, air toxics and atmospheric deposition.

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 because the USEPA determined that the 1997 standard was inadequate to protect public health. The standard of 0.075 ppm is calculated as an average over 3 years of the annual fourth-highest daily maximum 8-hour concentration. The 1-hour ozone standard was revoked June 15, 2005 (USEPA, December 14, 2012).

During 2016, monitoring data for the Millville site indicated that the 8-hour ozone standard of 0.075 ppm was exceeded once, on the 25th of May. The 2013-2015 average of 4th-Highest Daily Maximum was 0.065 ppm at Millville, which is below the standard.

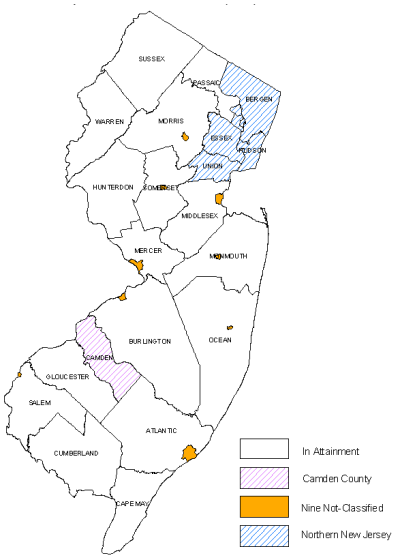
The Clean Air Act requires that all areas of the country be evaluated and then classified as attainment or non-attainment areas for each of the National Ambient Air Quality Standards. Using the most recent data throughout the state, the USEPA has classified northern New Jersey as being "moderate" and southern New Jersey as "marginal" for non-attainment of the 8-hour ozone NAAQS, as illustrated in **Figure 2c**. A "marginal" area has a design value of 0.076 up to but not including 0.086 ppm. New Jersey's 2012 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 (US EPA, May 3, 2013; US EPA, September 30, 2017; NJDEP Bureau of Air Monitoring, 2015; NJDEP Bureau of Air Monitoring, 2012).

[11] m^3= cubic meters
[12] μg/m^3 = micrograms per cubic meter of air (a microgram is one millionth (10^{-6}) of a gram).
[13] See Particulates, below in this section, for more information.

12 **Figure 2c: National Ambient Air Quality Standards Nonattainment**

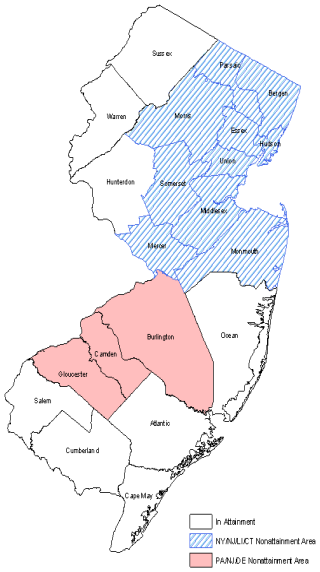
Cape May County is currently in attainment of the standards for carbon monoxide emissions and particulate matter. All of southern New Jersey is classified as marginally unhealthy for non-attainment of ground-level ozone standards.

New Jersey Carbon Monoxide (CO) Maintenance Areas



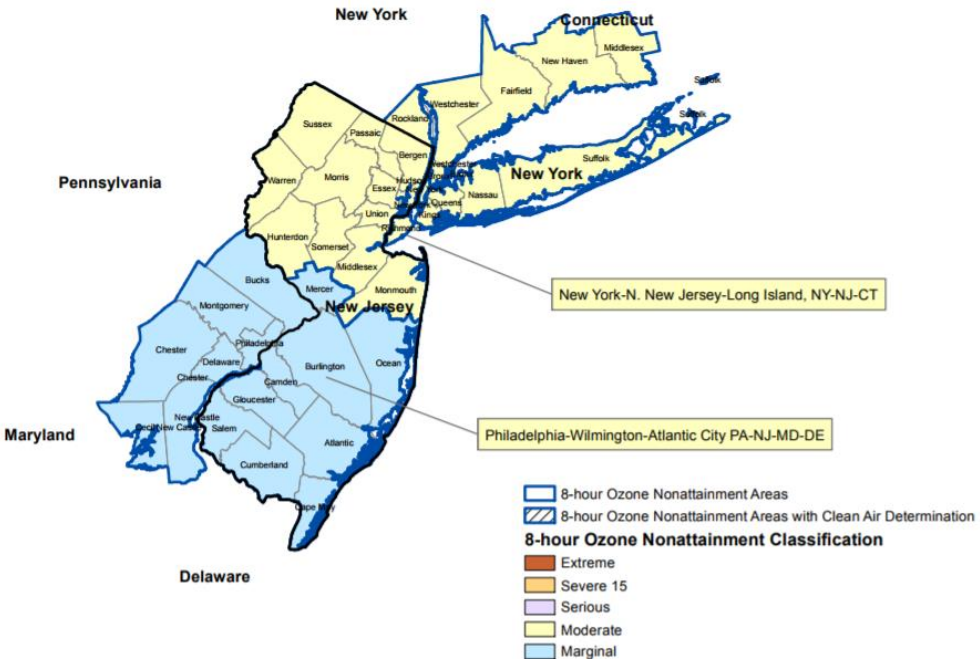
Carbon Monoxide [76 FR 54294, Aug 31, 2011]
Primary Standard:
8-hour average = 9 ppm not to be exceeded more than once per year.
1-hour standard = 35 ppm not to be exceeded more than once per year.

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(2008 standard)



Ozone*, *8-hour [73 FR 16436, Mar 27, 2008]
Primary & secondary:
Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years = 0.075 ppm

Sources: NJDEP Bureau of Air Quality Planning, January 25, 2013; USEPA, September 30, 2017

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 $\mu g/m^3$ (US EPA, December 14, 2012).

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, July 24, 2012). 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

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 updated in 1999, 2002 and 2005. 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%.

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 Air Toxics in NJ, 2005).

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 Edwin B. Forsythe National Wildlife Refuge, which has been monitored since 1998. Results for 2016 show a mean pH value of 5.12 (normal rainfall has a pH of about 5.6). This is acidic, but is an

improvement from 1999, when pH averaged 4.35 at this site. Trends show decreasing concentrations of SO_4 and NO_3; but no improvement in NH_4, Ca, Mg, K, Na, Cl and N (NADP, 2017a).

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. 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 6.I for Fish Consumption Advisories**) (NJDEP New Jersey Mercury Task Force, December 2001; NADP, 2017b).

In New Jersey, three sites are monitored as part of the Atmospheric Mercury Network (AMNet) for mercury: NJ54 Elizabeth Lab, NJ30 New Brunswick and NJ05 Brigantine The Brigantine site was initiated in 2015, replacing the Chester site. The data from this program is not publicly available (NADP, 2017c).

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 2d**). Standard procedures include automated weekly collection modified to preserve mercury. Ten years of data show a gradually decreasing trend in mercury deposition at the New Brunswick site (NADP, 2017b).

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).

C. Existing Infrastructure

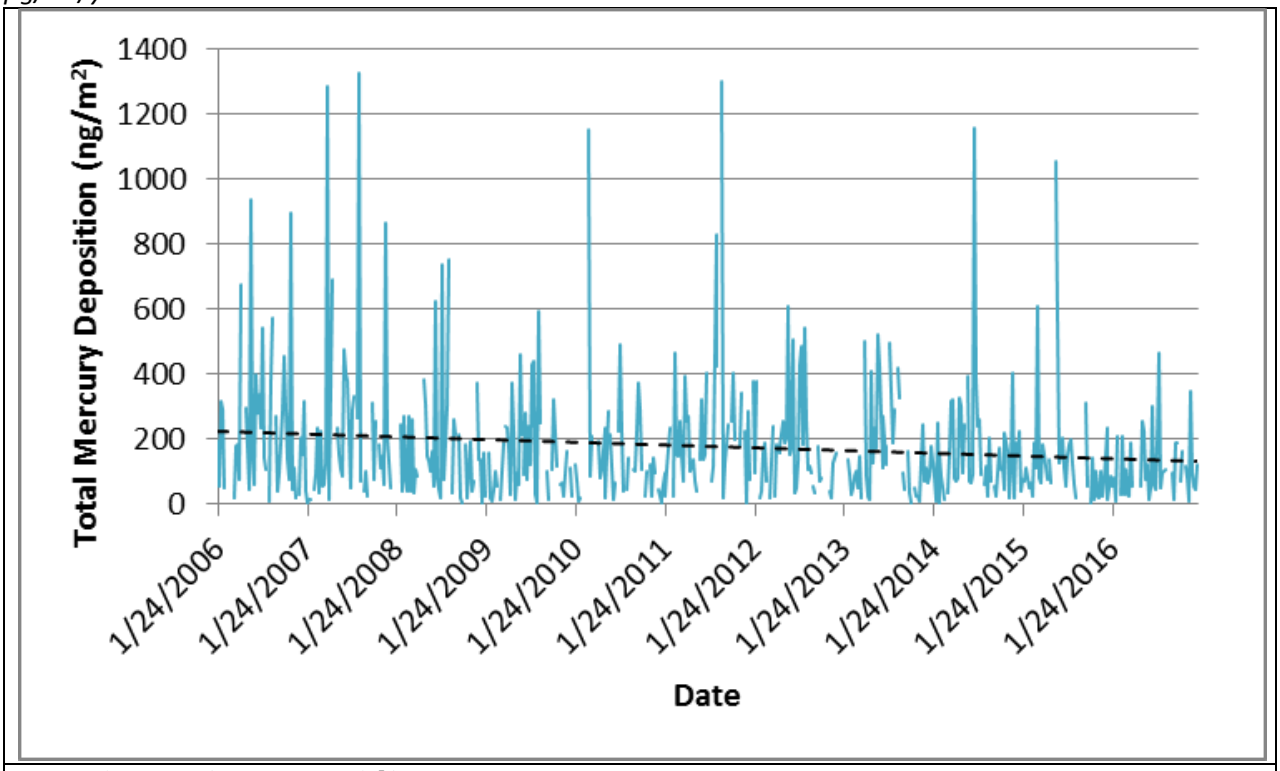
Public Water

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. *Public Community Water Supply* (PCWS) wells are wells that supply potable water to public communities, and serve at least 15 connections used by year-round residents or which serve at least 25 year-round residents.

The West Cape May Water Department obtains the borough's water from Cape May City Water Department from the wells shown in **Figure 2e,** which draw from the Atlantic City 800-foot sand aquifer and the 560-foot-deep Cohansey aquifer, and blended with the clean water from the desalination plant. The water purveyor areas are shown on **Figure 2e.** Roughly the northwestern quadrant of the borough (east of route 607 and south of Stevens Street) relies on private wells (NJDEP Bureau of Environmental Assessment, 2004). A discussion of the aquifers that these wells draw from is found in **Section 5C** while **Section 5.E** addresses water quality.

13 **Figure 2d: Mercury Deposition Network (MDN) at New Brunswick (2006 to 2016)**

Mercury levels in New Jersey show a decreasing trend, but still greatly exceed the national average of 10 µg/m²/year.



MDN Site NJ30 (New Brunswick)
Latitude: 40.4728 Longitude: -74.4226
Date Range Displayed: 01/17/2006 to present
Average (mean) = 178.2 ng/m2
Median (middle value) = 115.43
Minimum = 2.48 collected on 10/20/2015
Maximum = 1326.41 collected on 8/14/2007

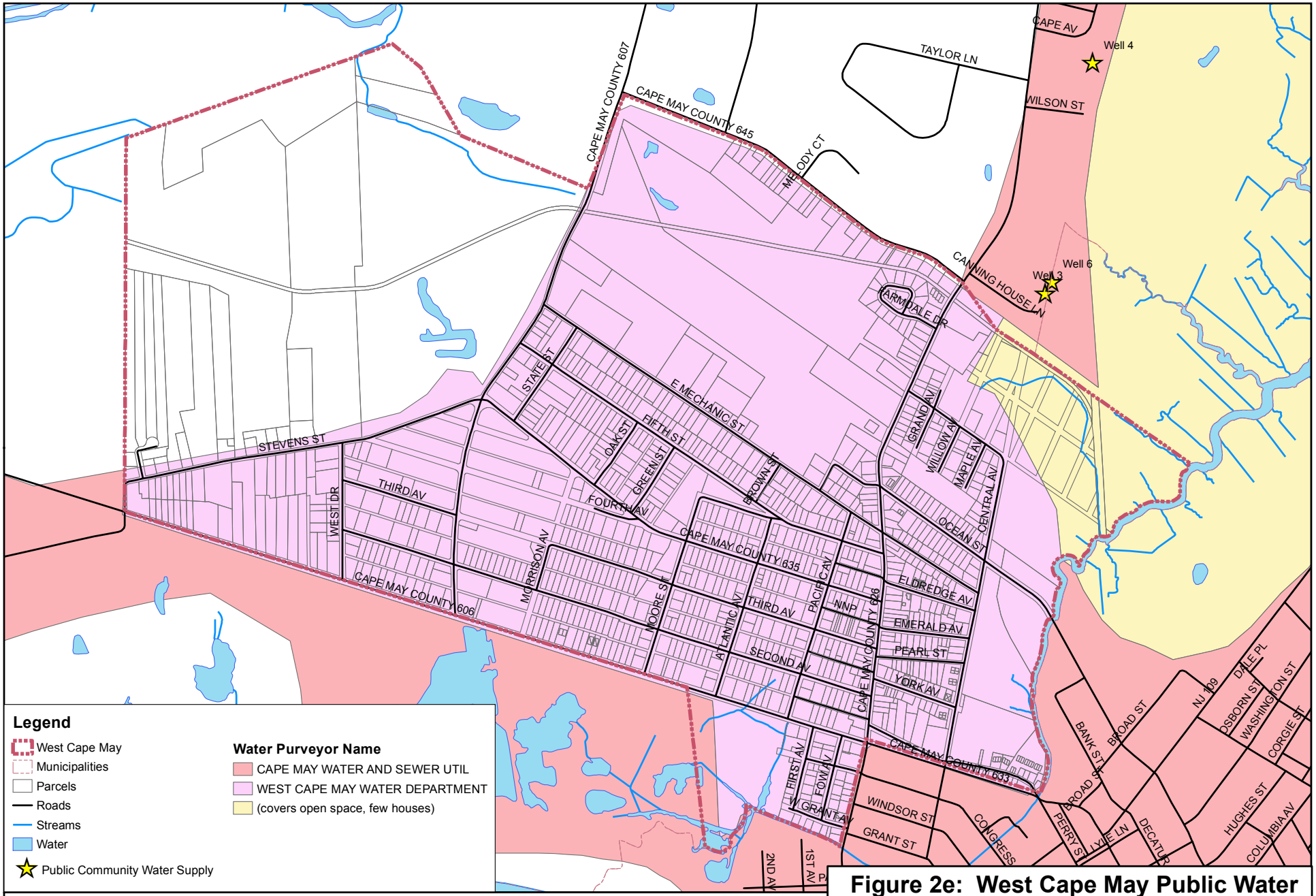
Source: NADP, 2017b

Sewer Service Areas

The NJDEP administers the Statewide *Water Quality Management (WQM)* Planning rules found in N.J.A.C. 7:15. The rules establish a mechanism for determining whether proposed projects or activities are consistent with the statewide WQM Plan (see **Internet Resources and Section 10C**). This process includes development and adoption of a *Wastewater Management Plan (WMP)*, a document that provides 20 year planning (or to build-out for non-urban communities) for wastewater and certain other water quality concerns.

Cape May County is the responsible agency for WMPs in the area including the borough of West Cape May (NJDEP Office of Water Resources Management Coordination, November 14, 2017).

The public *Sewer Service Areas* (SSA) mapped on **Figure 2f** show the areas served by the Cape May Regional Wastewater Treatment Plant. A separate SSA covers Westwood Mobile Estates Depot Travel Park. Areas not designated as SSAs are planned for service by individual subsurface disposal system (septic systems) discharging less than 2,000 gallons per day (gpd) (where the site conditions and existing regulations allow) (NJDEP, January 24, 2017).



Legend

- West Cape May
- Municipalities
- Parcels
- Roads
- Streams
- Water
- Public Community Water Supply

Water Purveyor Name

- CAPE MAY WATER AND SEWER UTIL
- WEST CAPE MAY WATER DEPARTMENT
- (covers open space, few houses)

0 0.1 0.2 Miles

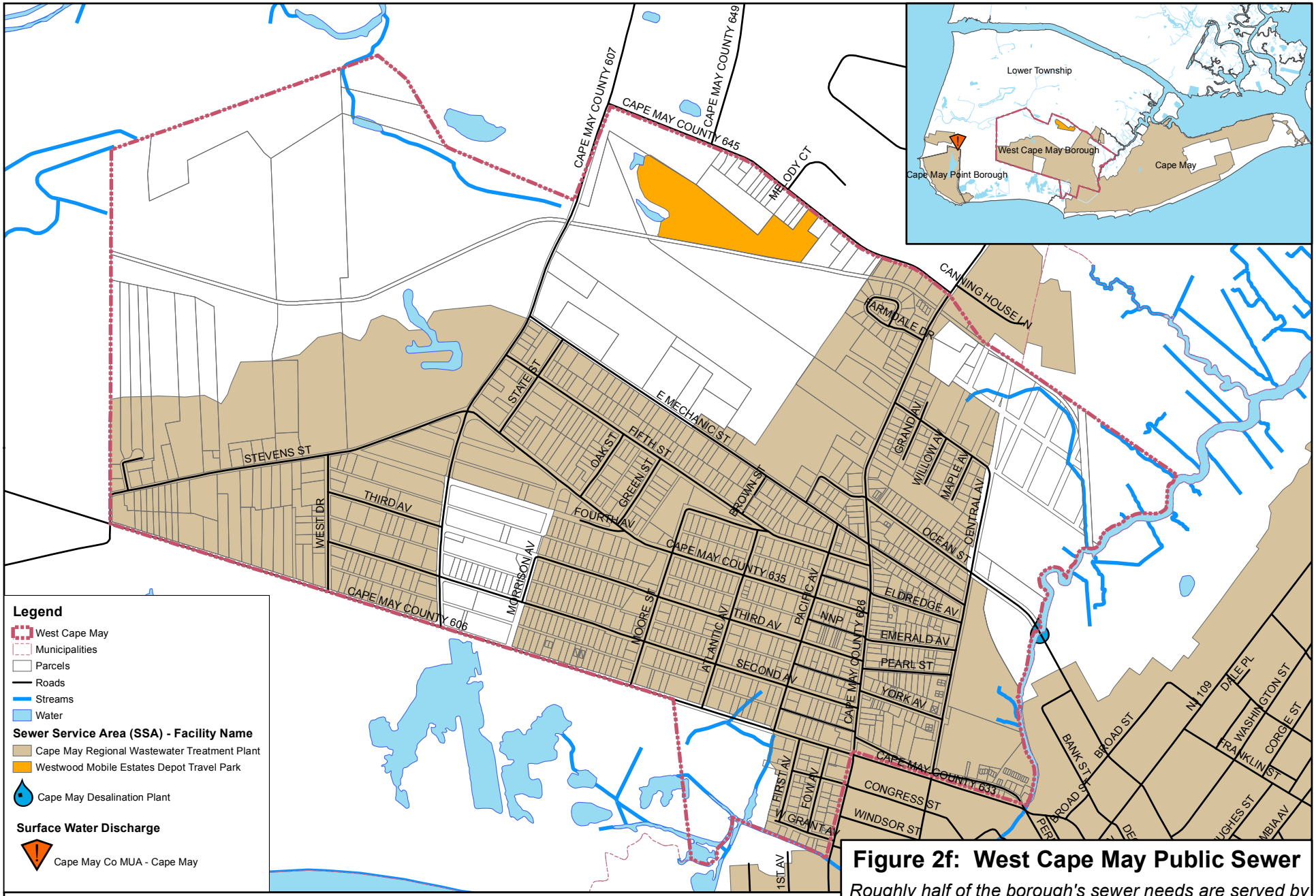
N

Prepared by Kratzer Environmental Services

Data Sources: NJDEP, NJDOT
Note: Map accuracy is limited to the accuracy and scale of the original data sets.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized

Figure 2e: West Cape May Public Water

The West Cape May Water Department obtains much of the borough's water from wells managed by the Cape May City Water Department. Water in the northwestern section of the borough is provided via private wells.



Prepared by Kratzer Environmental Services

Data Sources: NJDEP, NJDOT
Note: Map accuracy is limited to the accuracy and scale of the original data sets.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Figure 2f: West Cape May Public Sewer

Roughly half of the borough's sewer needs are served by the Cape May Regional Wastewater Treatment Plant. A separate Sewer Service Area covers Westwood Mobile Estates Depot Travel Park. The remaining areas are planned for service by individual septic systems.

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Internet Resources: Local & Regional Conditions

Climate and Meteorology

NJ Weather and Climate Network: West Cape May, NJ, Rea Farm. Current local conditions and forecasts for the Borough area are available at http://www.njweather.org/station/261

Office of the New Jersey State Climatologist (ONJSC)
- ONJSC Home Page: http://climate.rutgers.edu/stateclim/
- NJ Drought Watch: http://www.njdrought.org/
- Drought Status of Northwest Region: http://www.njdrought.org/current.html#coastalsouth
- Weather and Climate Network Index: http://climate.rutgers.edu/njwxnet

National Weather Service Advanced (NOAA) Hydrologic Prediction Service (flood predictions):
Delaware Bay at Cape May: http://water.weather.gov/ahps2/hydrograph.php?wfo=phi&gage=cman4
Cape May Harbor at Cape May Harbor: http://water.weather.gov/ahps2/hydrograph.php?wfo=phi&gage=capn4

National Weather Service Forecast West Cape May, NJ:
http://forecast.weather.gov/MapClick.php?CityName=Cape+May&state=NJ&site=PHI&textField1=38.9401&textField2=-74.9055&e=1#.WfZAaluPLb0

Sea Level Rise
- Climate Central Surging Seas Risk Finder: https://riskfinder.climatecentral.org/
  - Directly to West Cape May https://riskfinder.climatecentral.org/place/west-cape-may.nj.us
- 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/

Air Quality

Current Air Quality: http://www.njaqinow.net/

Daily Air Quality Index Forecast: http://www.airnow.gov/index.cfm?action=airnow.local_state&stateid=31&tab=0

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

NJDEP Radon Information: http://njradon.org or call 1-800-648-0394 609-984-5425

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

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

3: PHYSIOGRAPHY, TOPOGRAPHY & GEOLOGY

A. 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 3a**). The geologic history of New Jersey is summarized in **Table 3.1**.

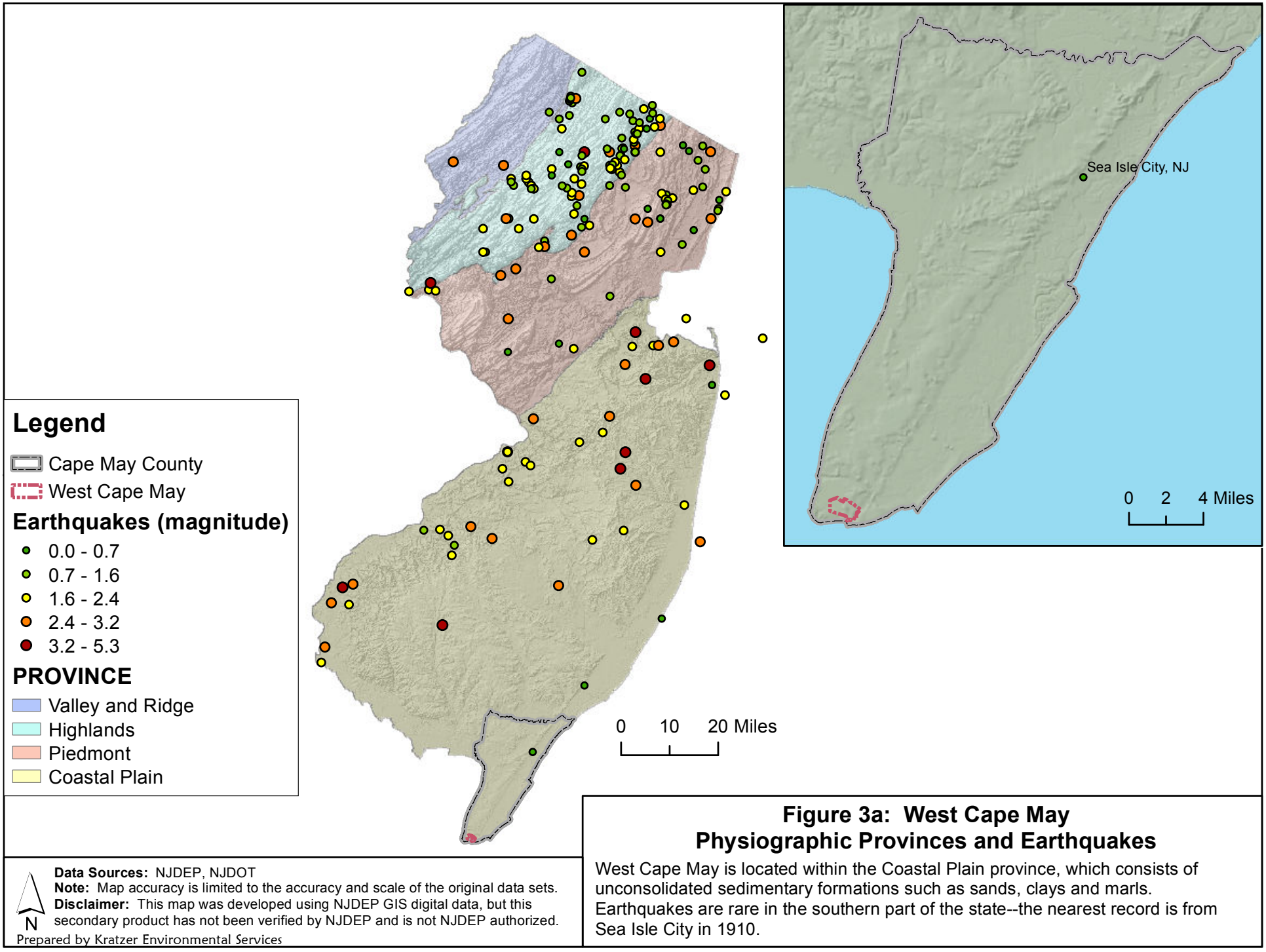
During the Precambrian and Paleozoic Eras, the land that is now New Jersey was at the bottom of the sea, close to the equator. About 400 million years ago, the continents Europe and North America collided; forming the Appalachian Mountains, which at that time reached far higher and were more rugged than 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, 2006).

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, 2006).

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, 2006).

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).



Data Sources: NJDEP, NJDOT
Note: Map accuracy is limited to the accuracy and scale of the original data sets.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.
Prepared by Kratzer Environmental Services

Figure 3a: West Cape May Physiographic Provinces and Earthquakes

West Cape May is located within the Coastal Plain province, which consists of unconsolidated sedimentary formations such as sands, clays and marls. Earthquakes are rare in the southern part of the state--the nearest record is from Sea Isle City in 1910.

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, 2006). The Coastal Plain Province is sometimes divided into the Inner and Outer Coastal Plains with West Cape May 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).

Table 3.1: Summary of New Jersey's Geologic History

Period	Million Years Ago	Description of Climate and Fossils Found in Corresponding Bedrock
Precambrian Era		
	Up to 544	**Climate:** New Jersey was under the sea. **Fossils:** stromatolites; most life forms were soft bodied and left no fossils
Paleozoic Era		
Cambrian Period	544 – 505	**Climate:** New Jersey was close to the equator, covered by warm tropical seas. **Fossils:** trilobites, brachiopods, stromatolites, worm burrows
Ordovician Period	505 – 440	**Climate:** New Jersey continued to be underwater, as the sea above deepened to oceanic depths. **Fossils:** trilobites, brachiopods, coral, nautiloids, clams, crinoids, and snails
Silurian Period	440 – 410	**Climate:** The sea level rose and fell, with New Jersey remaining at the sea floor. **Fossils:** coral, brachiopods, clams, brine shrimp, primitive fish, eurypterids (sea scorpions), arthrophycus (fossilized feeding burrow made by a worm-like animal)
Devonian Period	410 – 360	**Climate:** Europe collided with North America, forming the mountains which are now the Ridge and Valley and Highlands provinces of New Jersey. The fossils found continued to be aquatic life forms. **Fossils:** brachiopods, clams, trilobites, nautiloids, crinoids, coral, snails, stromatoporoids, ostracodes, bryozoa
Mississippian, Pennsylvanian & Permian Periods	360-248	**Climate:** No geologic record of these time periods is present in New Jersey. At some point, the sea subsided, and New Jersey became dry land, at least in part. **Fossils:** none
Mesozoic Era		
Triassic Period	248 – 200	**Climate:** New Jersey was next to Morocco, part of the supercontinent Pangaea. In the dry interior of the continent, the area experienced greater daily and seasonal fluctuations than the coasts. The rugged landscape consisted of high young mountains and deep valleys formed by faults. The brief rainy seasons' flashfloods dropped mud and silt in low areas, where playa lakes formed. In the end of the Triassic the climate became desert-like. The lakes began to dry up and became salty, resulting in an environment where brine shrimp flourished. When a lake went dry, some fish and other aquatic life became fossils. **Fossils:** dinosaur footprints, thecodonts, fish (including coelacanths), phytosaurs, amphibians, insects, plants
Jurassic Period	200 – 145	**Climate:** The breakup of Pangaea resulted in the beginning of the Atlantic Ocean. Igneous intrusions (molten rock forced into earlier rock formations) formed diabase and basalt bedrock. Because the terrain was mountainous, the net geologic action was erosion, not deposition. **Fossils:** There are no late Jurassic deposits in New Jersey; therefore no fossils exist from this period. However, the fauna probably consisted of the same dinosaurs as the American West, including sauropods, armored dinosaurs,

Period	Million Years Ago	Description of Climate and Fossils Found in Corresponding Bedrock
		ornithopods (forerunner of hadrosaurus), tenontosaurus (relative of the iguanadon). True flowering plants (angiosperms) appeared at this time.
Cretaceous Period	145 – 65	**Climate:** Northern New Jersey was above sea level, while southern New Jersey experienced flooding and ebbing. The sea level changed cyclically from deeper to shallower water in this tropical environment. During flooding, greensand marl (glauconite) was formed. During ebbing, clay and sand were deposited. **Fossils:** Fossil phytoplankton, clams, snails, crustaceans, ammonites, oysters, reptiles, sharks, burrows, worm tubes and vertebrates such as mosasaurs have been found in New Jersey's coastal plain. The fossil dinosaurs found include hadrosaurus (which probably washed downstream during a flood), ornithomimus, *Dryptosaurus aquilunguis* (a 17' predator with a great hand claw), *Hadrosaurus foulkii*, and *Hadrosaurus minor*.
Cenozoic Era		
Tertiary Period	65 – 1.8	**Climate:** The climate was warm, and the sea level was higher, covering the much of the Coastal Plain (see **Figure 3a**). **Fossils:** Fossils of land animals include birds, such as the diatryma (a giant flightless bird), tillodont (an extinct mammal the size of a bear, but with rodent-like teeth) and possibly others similar to those found in the South Dakota badlands, such as brontotherium, ancestral horses, entelodonts (resembled giant warthogs), diceratherium (semi-aquatic rhinoceros), peccary, prosynthetoceras (a camal), anchitherium (horse), and a primitive doglike carnivore. Fossils found in the Outer Coastal Plain include brachiopods, corals, sponges, clams, sharks, mollusks, crinoids, mammals (probably washed to the sea in floods), crocodiles, snakes, and early whales.
Quaternary Period	1.8 - present	**Climate:** The climate alternated between cool and warm, resulting in four intervals of glaciation. The glaciers covered northern New Jersey, reaching as far south as Belvidere on the Delaware River. South of the glacial ice, treeless, frozen tundra existed. When water was frozen in glaciers, the sea level was lower, resulting in a shoreline over a hundred miles east of the present coast. **Fossils:** Fossils of many familiar and some extinct animals have been found in nearby areas. There were insects, turtles, and snakes. Herbivores included squirrels, groundhogs, porcupines, beaver, muskrats, voles, mice, eastern cottontail rabbits, white-tailed deer, peccaries, tapirs, giant ground sloth, the elk-moose, giant beaver, American mastodon, and mammoth. Carnivores included otters, skunks, bobcats, foxes, black bears, coyotes, jaguars, jaguarundi, short-faced bear and a saber-toothed cat.
Sources: Gallagher, 1997; University of California Museum of Paleontology et al., 2003; USGS, 2002		

B. Topography

Topography depicts the relief features of an area. More than half of West Cape May's land area is less than ten feet above the ocean at mid-tide. The elevation in West Cape May ranges from about sea level at Cape Island Creek and Pond Creek to 20 feet above sea level east of S. Bayshore Rd. and north of Sixth Avenue, with the average elevation being 9.843 feet (NJGS, 1999a) (see **Figure 3b**). **Figure 3b** uses shaded colors to illustrate elevation in West Cape May (NJGS, 1999b).

Although steep slopes are of concern in many localities in New Jersey, there are no steep slopes present in West Cape May.

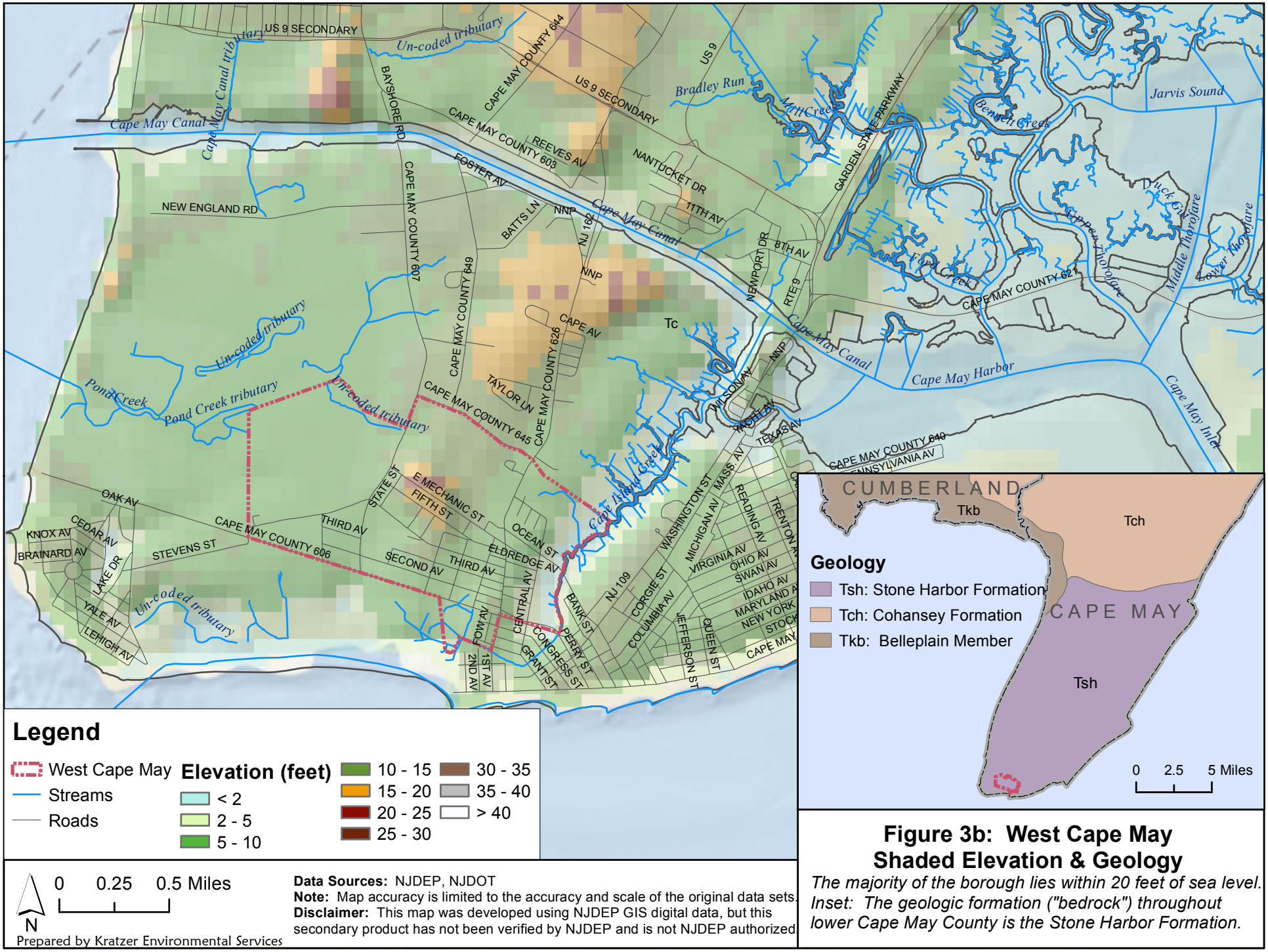


Figure 3b: West Cape May Shaded Elevation & Geology

The majority of the borough lies within 20 feet of sea level. Inset: The geologic formation ("bedrock") throughout lower Cape May County is the Stone Harbor Formation.

C. Geology of West Cape May

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). The geologic formation that outcrops at the surface for the entire peninsula, including West Cape May, is mapped as the recently named Stone Harbor Formation (see **Table 3.2**) (Dalton et al., 2014).

Solid crystalline bedrock of Middle Proterozoic to Mesozoic age can be found approximately 6,300 feet below the land surface, covered with layers of sands and gravels deposited by repeated inundations of the sea (Volkert et al., 1996). These beds of deposited sediments gently slope from northwest to southeast, being thicker at the eastern edge (Cape May).

Table 3.2: Characteristics of Geologic Formation Found in West Cape May

Geologic Formation	Lithology (physical character of the rocks)		Percent of West Cape May
	General	Age	
Tsh Stone Harbor Formation	Interbedded gravel, sand, and clay	upper Miocene	100 %
Source: Sugarman et al. 2016			

Tsh – The entire Cape May peninsula is covered by the newly named Stone Harbor Formation. In the southern part of the peninsula, it consists predominantly of sand, with layers of medium/coarse sand with organically rich materials, fine micaceous sand, and thinly laminated clay to sandy clay and silty sandy clay, clayey silt, and clay. Lignite[14] is generally common and there are scattered granuliferous and pebbly beds. At the well cores, it is overlain by the Cape May formation (see surficial geology) and underlain by the Cohansey Formation. The maximum thickness is 180 feet (Sugarman et al., 2016).

D. Earthquakes

The likelihood of an earthquake occurring in West Cape May is very low. The nearest reported quake occurred in Sea Isle City on April 23, 1910 (NJGS, November 7, 2016).

E. The Surficial Geology of West Cape May

Surficial materials are the recent unconsolidated sediments that overlie bedrock formations, and that are the parent material for soils. Surficial geology deposits in West Cape May consist of materials deposited by oceans over many millions of years. The characteristics of surficial geology types found in West Cape May are provided in **Table 3.3** and illustrated in **Figure 3c.** In West Cape May, 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.

[14] Lignite is a soft coal, also called brown coal, in which vegetable matter has altered more than in peat but not as far as in bituminous coal.

Table: 3.3: Characteristics of Surficial Geology Found in West Cape May

Geologic Abbreviation & Name	LITHOLOGY	GEOAGE	GEONOTES	AREA (acres)	Percent
Qcm2 CAPE MAY FORMATION, UNIT 2	Sand, pebble gravel, minor silt, clay, peat, and cobble gravel; very pale brown, yellow, reddish yellow, white, olive yellow, gray. As much as 200 feet thick on the Cape May peninsula, generally less than 50 feet thick elsewhere.	late Pleistocene (Sangamonian stage)	Silt and clay are thicker and more continuous in subsurface parts of the formation on the Cape May peninsula and along the Delaware bayshore. Forms a marine terrace with surface altitude up to 40 feet.	340.8	45.2%
Qcm3 CAPE MAY FORMATION, UNIT 3	Sand, pebble gravel, minor silt, clay, and peat; yellow, reddish yellow, white, gray. As much as 20 feet thick.	late Pleistocene (Late Sangamonian or middle Wisconsinan stages) age	Forms a marine terrace with surface altitude up to 15 feet. Equivalent to Cape May Formation, unit 1 of Newell and others (2000).	333.5	44.2%
Qmm SALT-MARSH AND ESTUARINE DEPOSITS	Silt, sand, peat, clay, minor pebble gravel; brown, dark-brown, gray, black. 100 feet thick	Holocene	Contain abundant organic matter. Deposited in salt marshes, estuaries, and tidal channels during Holocene sea-level rise.	38.7	5.1%
Qs SWAMP AND MARSH DEPOSITS	Peat and organic clay, silt, and minor sand; gray, brown, black. As much as 40 feet thick.	late Pleistocene and Holocene	Deposited in modern freshwater wetlands.	41.6	5.5%
Total				754.6	100.0%
*Note on Geologic time periods: Pleistocene: 2.6 million years ago – 117,000 years ago Holocene: 117,000 years ago – present Wisconsinan glaciation: 21,000 years ago (Wikipedia, 2013) http://en.wikipedia.org/wiki/Pleistocene					
Sources: NJGS, 2006; Newell and others, 1995; O'Neal and Dunn, 2003					

Qm - Salt-marsh deposits (Holocene)

Organic muck and peat, silt, clay, and sand. Black, brown, and gray organic muck includes remains of salt-tolerant grasses, especially *Spartina* (sp.). Silt and sand occur as levee and crevasse splay deposits along tidal creek margins. Transported largely as suspended sediments in turbid bays or rivers during high tides. Generally 1 to 2 m thick; up to 6 m thick along shorelines.

Qcm3 - Cape May Formation Unit 3 (early Sangamonian)

Sand, clayey silt, pebble gravel, and peat; wide variety of oxidized colors including gray and brownish gray. Primarily consists of quartz-rich estuarine and fluvial deposits with variable amounts of heavy minerals and chert. Thickness is highly variable, ranging from 1 to 47 m; thicker deposits fill deep channels cut as much as 55 m below present sea level by paleorivers, including a proto-Delaware River channel described by Knebel and Circe (1988) and Knebel (1992). Channels formed when sea level dropped as much as 60 m below present sea level.

Paleochannel shown in cross section C-C' on southern sheet has been informally known as the Rio Grande paleochannel (Gill, 1959; Gill, 1962).

Qcm2 - Cape May Formation Unit 2 (late Sangamonian)

Sand, pebble gravel, clayey silt, peat, silty sand, and cobble gravel. Variety of oxidized colors including gray, greenish gray, and brownish gray. Deposits include facies of several depositional environments. Beach facies consists of quartz-rich sand to pebble gravel with variable mix of heavy minerals and chert; characterized by well rounded, disc- and rod-shaped pebbles scattered in well-sorted, low-angle, planar beds which dip seaward and are interleaved with sets of lunate megaripples and trough crossbeds; axes of troughs parallel beach; locally includes leached, oxidized molds and casts of surf clams **(***Spisula***,** sp.); burrows common; top 1 to 2 m is deeply weathered and locally includes frost wedges and blanket of windblown sand; thickness varies from one to several meters; unconformably overlies open-bay to inner-shelf facies and largely is restricted to top 3 to 5 m of Cape May Peninsula south of Swainton in southern New Jersey. Shallow marine facies consists of fine to medium sand and silty sand; includes scattered thin, shelly sand beds; patchy distribution, thin layers, and lack of good subsurface data makes separation of this facies from estuarine-fluvial facies difficult. Estuarine-fluvial facies consists of sand, pebble to cobble gravel, silt and clay, and peat; deposits localized along tributary rivers entrenched primarily into Cohansey and Kirkwood Formations in southern New Jersey.

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, 2009)**.** Areas of historic fill in West Cape May are shown on **Figure 3c** (NJGS, 2009).

Mining & Quarrying

According to the New Jersey Geological Survey, there are no current sand and gravel quarrying operations and no records of mining within West Cape May (NJGS, 2005). Sand, gravel, and topsoil have been excavated out of local "borrow pits" (open mines) in past years. These mined areas are shown on County Soil survey maps. Small fresh water ponds were sometimes created in the process of mining. Most of these have been taken over by reed grass (Phragmites) or have become swamp forest (West Cape May ERI, 2003)

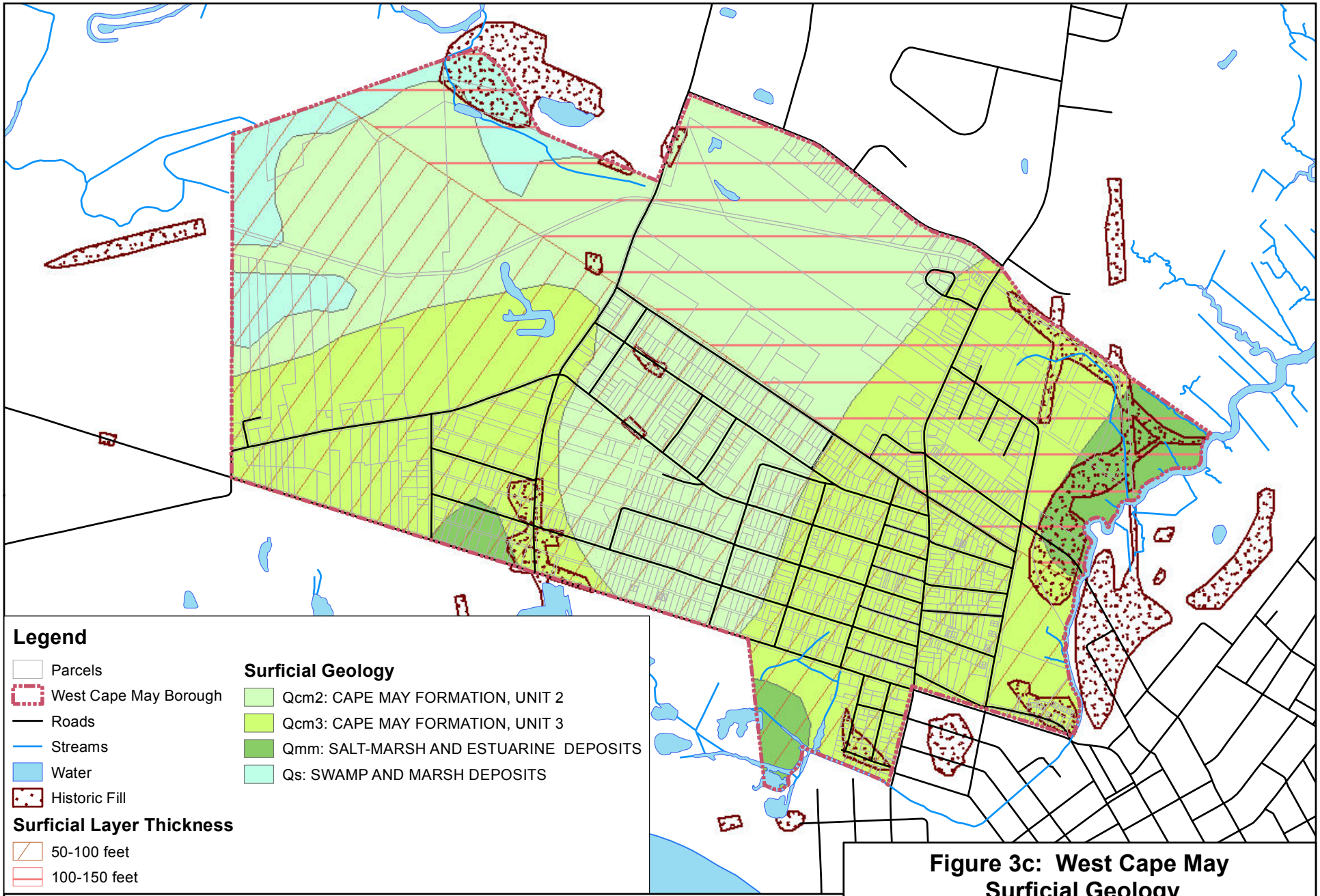


Figure 3c: West Cape May Surficial Geology

Prevalent surface materials are from the Cape May Formation Units 2 and 3, with sand and pebble gravel dominating the mix. Nonindigenous materials are mapped as Historic Fill.

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4: SOILS

A. 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, 2017). 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, February 10, 2011).

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 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).

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, February 17, 2012).

Beginning in 2005, the NRCS made its soil surveys available online (USDA NRCS, February 17, 2012). This provides the means for keeping the information current and available to the public. Users specify a geographic "area of interest" (must be less than 10,000 acres) and then may view a wide variety of tables of soil properties and soil interpretations. For this report,

the entire SSURGO (Soil Survey Geographic Database) spatial data and tabular data for Cape May County were downloaded for use in the GIS (USDA NRCS, September 28, 2016)[15].

B. 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.

There are 17 soil map units found in the Borough of West Cape May (**Figure 4a**), 15 of which are soil types (80% of land cover in the borough). The remaining units indicate locations where soils have either been removed (PHG) or covered by impervious materials (UR) (collectively 20% of the borough). The map units are described below, and the total acreage for each unit is provided. **Table 4.1** also summarizes some important properties of each soil type.

Map Unit Descriptions and Acreage

Sources: US Department of Agriculture, Natural Resource Conservation Service (2002 and August 2008).

Appoquinimink-Transquaking-Mispillion complex, 0 to 1 percent slopes, very frequently flooded (AptAv - 29 acres)
Very poorly drained soil with a high water capacity and a moderate to high organic content in the surface layer. Moderately to strongly saline within 30 inches of surface. Tidal marshes, tidal flats and drainageways.

Berryland and Mullica soils, 0 to 2 percent slopes, occasionally flooded (BEXAS - 160 acres)
Very poorly drained soil with a moderate water capacity and moderate organic content in the surface layer. Freshwater flats, floodplains, drainageways and depressions.

Dennisville sandy loam, 0 to 2 percent slopes (DenA - 10 acres)
Well drained soil with a low water capacity and low organic content in the surface layer.
Broad ridges, summits and side slopes.

Downer sandy loam, 0 to 2 percent slopes, Northern Tidewater Area (DoeAO - 9 acres)
Well drained soil with a moderate water capacity and low organic content in the surface layer.
Broad ridges, summits and side slopes.

Fort Mott sand, 0 to 5 percent slopes (FobB - 5 acres)
Well drained soil with a low or moderate water capacity and low organic content in the surface layer.
Ridges, terraces, summits and side slopes.

[15] The maps in this report use the most recent data available (Cape May County, NJ; Tabular Data US Department of Agriculture, Natural Resources Conservation Service (NRCS). September 28, 2016. Survey Area Version: 12. Survey Area Version Date: 09/28/2016.

Galloway loamy sand, 0 to 5 percent slopes (GamB - 23 acres)
Moderately well drained soil with a low water capacity and low organic content in the surface layer. Terraces, flats, side slopes and depressions.

Hammonton loamy sand, 0 to 5 percent slopes (HbmB - 92 acres)
Moderately well drained soil with a moderate water capacity and low organic content in the surface layer. Terraces, flats, depressions, side slopes and foot slopes.

Hammonton sandy loam, 0 to 2 percent slopes (HboA - 21 acres)
Moderately well drained soil with a moderate water capacity and low organic content in the surface layer. Terraces, flats, depressions, side slopes and foot slopes.

Ingleside loamy sand, 0 to 5 percent slopes (IngB - 50 acres)
Well drained soil with a moderate water capacity and low organic content in the surface layer. Flats, terraces, summits and side slopes.

Ingleside sandy loam, 0 to 2 percent slopes (InnA - 113 acres)
Well drained soil with a moderate water capacity and low organic content in the surface layer. Flats, terraces, summits and side slopes.

Pawcatuck-Transquaking complex, 0 to 1 percent slopes, very frequently flooded (PdwAv - 51 acres)
Very poorly drained soil with a very high water capacity and very high organic content in the surface layer. Strongly saline within 30 inches of surface. Tidal marshes, tidal flats and drainageways.

Pits, sand and gravel (PHG - 37 acres)
Not a soil type. Pits, sand and gravel are open areas from which soil material has been removed by human activity. They often have steep, unstable slope faces.

Psammaquents, sulfidic substratum, 0 to 3 percent slopes, frequently flooded (PstAt - 8 acres)
Fill material in tidal marshes, ranging from 2 to 4 feet in thickness, with fine materials in the upper part and silty organic materials in the lower part.

Psamments, wet substratum, 0 to 3 percent slopes, rarely flooded (PsvAr - 30 acres)
Fill material in floodplains, flats and swamps, ranging from 2 to 4 feet in thickness, with fine materials in the upper part and typically more loamy or mucky organic materials in the lower part.

Udorthents, refuse substratum, 0 to 8 percent slopes (UdrB - 5 acres)
Sanitary landfills on convex summits, side slopes or broad flats; typically a clay surface above a sandy or loamy material mixed with household or industrial refuse.

***Urban land** (UR - 110 acres)*
Not a soil type. Urban land is land where most of the soil surface is covered by asphalt, concrete, buildings, or other impervious material.

Urban land-Psamments, wet substratum complex, 0 to 8 percent slopes, rarely flooded (USPSBR - less than an acre)
Urban land developed over floodplains, flats, swamps or barrier islands that have been altered or filled. Generally sandy material of variable characteristics that has been placed on top of wet soils.

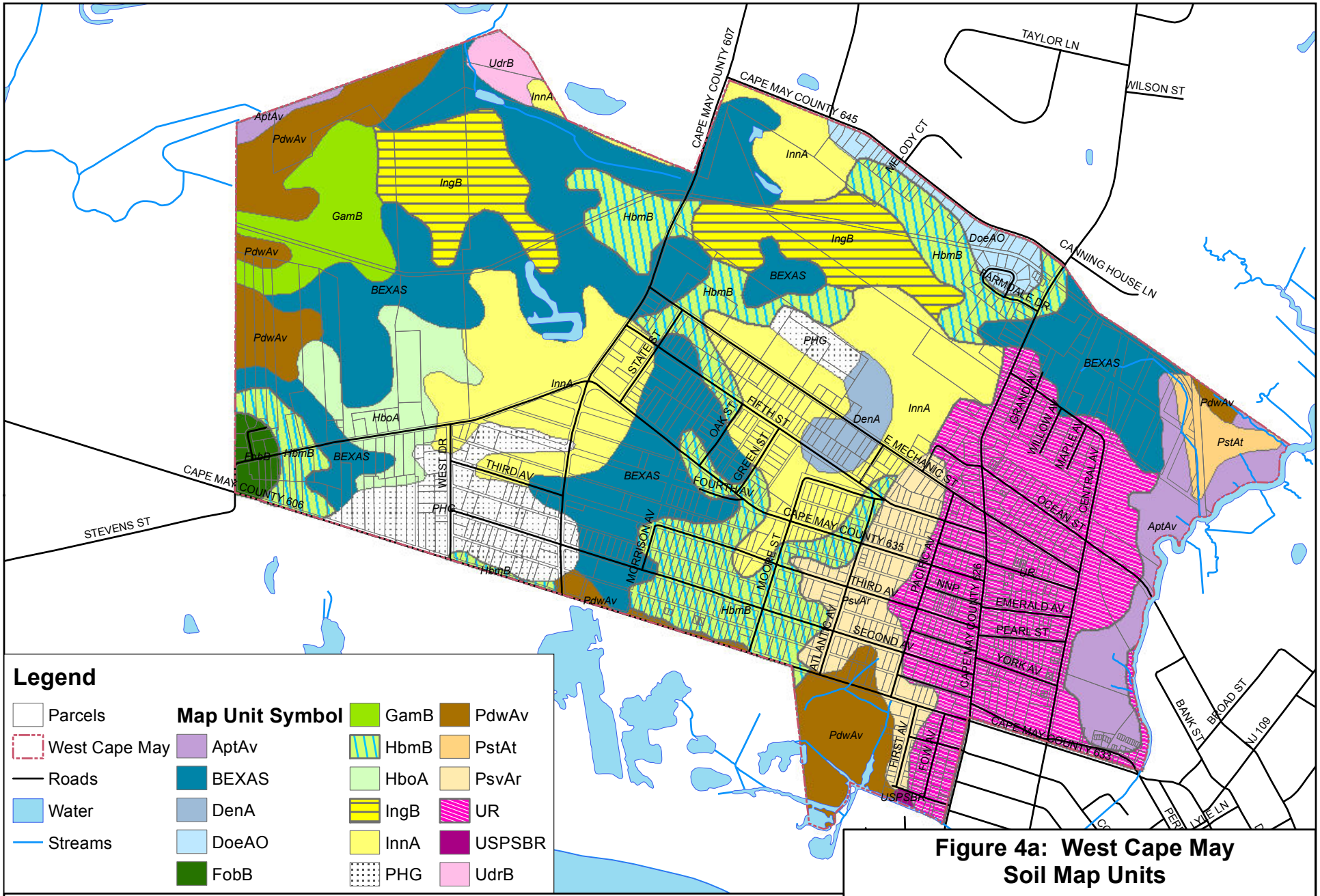


Figure 4a: West Cape May Soil Map Units

There are 17 soil map units found in the borough, 15 of which are soil types. The remaining units indicate locations where soils have either been removed (PHG) or covered by impervious materials (UR).

Table 4.1: Key Characteristics of Soil Types Found in West Cape May

Map unit symbol	Map unit name	Depth to root-restrictive layer (inches)	Depth to seasonal high water table (feet)	Flooding	Ponding	Potential frost action	Hydrologic group (defined in Table 4.2)	Natural drainage class	Hydric soil?	Farmland rating class	Septic disposal field rating class (NJ)	Septic limiting features (NJ)*
AptAv	Appoquinimink-Transquaking-Mispillion complex, 0 to 1 percent slopes, very frequently flooded	>60	0	very frequent	frequent	high	B/C/D	very poorly drained	Yes	Unique	very limited	DAZS, NPF, NPHS
BEXAS	Berryland and Mullica soils, 0 to 2 percent slopes, occasionally flooded	>60	0.0-0.5	occasional	occasional	high/ moderate	A/D	very poorly drained	Yes	Unique	very limited	DAZS, NPF, NPHS
DenA	Dennisville sandy loam, 0 to 2 percent slopes	>60	3.5-4.5	none	none	moderate	A	well drained	No	Prime	somewhat limited	DAZS
DoeAO	Downer sandy loam, 0 to 2 percent slopes, Northern Tidewater Area	>60	> 6	none	none	moderate	A	well drained	No	Prime	not limited	-
FobB	Fort Mott sand, 0 to 5 percent slopes	>60	4.0->6	none	none	low	A	well drained	No	Statewide	not limited	-
GamB	Galloway loamy sand, 0 to 5 percent slopes	>60	1.0-1.5	none	none	low	A/D	somewhat poorly drained	No	Statewide	very limited	DAZS
HbmB	Hammonton loamy sand, 0 to 5 percent slopes	>60	1.5-3.5	none	none	moderate	B	moderately well drained	No	Statewide	somewhat limited	DAZS
HboA	Hammonton sandy loam, 0 to 2 percent slopes	>60	1.5-3.5	none	none	moderate	B	moderately well drained	No	Prime	somewhat limited	DAZS
IngB	Ingleside loamy sand, 0 to 5 percent slopes	>60	3.5-4.5	none	none	moderate	A	well drained	No	Prime	somewhat limited	DAZS
InnA	Ingleside sandy loam, 0 to 2 percent slopes	>60	3.5-4.5	none	none	moderate	A	well drained	No	Prime	somewhat limited	DAZS
PdwAv	Pawcatuck-Transquaking complex, 0 to 1 percent slopes, very frequently flooded	>60	0	very frequent	frequent	high	A/D	very poorly drained	Yes	Unique	very limited	DAZS, NPF, NPHS,
PHG	Pits, sand and gravel	areas where soil has been removed										
PstAt	Psammaquents, sulfidic substratum, 0 to 3 percent slopes, frequently flooded	>60	0	frequent	frequent	moderate	A/D	very poorly drained	Yes	Prime	very limited	DAZS, NPF, NPHS

Map unit symbol	Map unit name	Depth to root-restrictive layer (inches)	Depth to seasonal high water table (feet)	Flooding	Ponding	Potential frost action	Hydrologic group (defined in Table 4.2)	Natural drainage class	Hydric soil?	Farmland rating class	Septic disposal field rating class (NJ)	Septic limiting features (NJ)*
PsvAr	Psamments, wet substratum, 0 to 3 percent slopes, rarely flooded	>60	1.5-3.5	rare	none	low	A	moderately well drained	No	Prime	very limited	DAZS, NPF
UdrB	Udorthents, refuse substratum, 0 to 8 percent slopes	>60	> 6	none	none	high	B	well drained	No	Prime	not limited	-
UR	Urban land	areas where soil has been covered by impervious materials										
USPSBR	Urban land-Psamments, wet substratum complex, 0 to 8 percent slopes, rarely flooded	>60	1.0-2.0	rare	none	low	A/D	excessively drained	No	Prime	not rated to very limited	DAZS, NPF
***** Septic System Limiting Factors: DAZS = Depth to apparent zone of saturation; NPF = Not Permitted - Flooding; NPHS = Not Permitted - Hydric Soil												
Sources: USDA NRCS, August 2008 and September 2016												

C. 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, November 2010).

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, November 2010).

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. The remedy is either prevention or washing the salt from the profile with excess water. Sodium salts are especially damaging because sodium causes the clays to disperse. Calcium chloride is relatively harmless to plants and soil (Muldowney, 2011; Wikepedia, May 30, 2013).

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).

D. Characteristics of West Cape May Soils

Soil properties contained in the NRCS soil survey and mapped in **Figures 4b through 4g** 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.

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. Each soil map unit is characterized by a range of depths to bedrock that is typical for the majority of that soil type. Depth to bedrock is

an important factor when determining the suitability of land for building roads, foundations and septic systems. Bedrock outcrops (depth to bedrock equals zero inches) are absent in West Cape May. All of the soil units mapped in the Borough have a depth to the root-restrictive layer exceeding five feet (see **Table 4.1**).

Depth to Seasonal High Water Table (Figure 4b)

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. 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.

Four of the soil units in West Cape May fall into the first category, with SHWTs of less than a foot. Those include the Appoquinimink-Transquaking-Mispillion complex (AptAv), the Berryland and Mullica soils (BEXAS), the Pawcatuck-Transquaking complex (PdwAv), and the Psammaquents sulfidic substratum (PstAt). Together they comprise 41% of the soil cover in the borough. Another five units, which collectively comprise 24% of the borough's total soil cover, have SHWTs that range between1.0-3.5 feet: Galloway loamy sand (GamB), Hammonton loamy sand and sandy loam (HbmB, HboA), Psamments wet substratum (PsvAr), and Urban land psamments - wet substratum complex (USPSBR). The remaining 35% of the soil cover in West Cape May has a minimum depth to seasonal high water table exceeding three feet (see **Table 4.1** and **Figure 4b**). Non-soil units were excluded from the percentage calculations in this section.

Hydrologic Soil Group (Figure 4c)

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 4.2**.

Table 4.2: 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, 2008	

Six of the soil units in West Cape May fall into Class A, and three others into Class B (**Table 4.1**). The remaining six 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, 2007) (**see Figure 4c**).

Soil Drainage Class (Figure 4d)

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. West Cape May has six soil types that are well drained, three that are moderately well drained, one that is somewhat poorly drained and three that are very poorly drained (see **Table 4.1**). The Urban land Psamments wet substratum complex, where wetlands have been filled in, is classified as excessively drained. Non-soil map units are also included in the figure in accordance with their runoff potential: Pit, sand and gravel (PHG) areas are very poorly drained and urban land (UR) is excessively drained. In total, 38% of the land in West Cape May is very poorly drained, 3% is poorly drained, 19% is moderately well drained, 25% is well drained and 15% is excessively drained (**Figure 4d**).

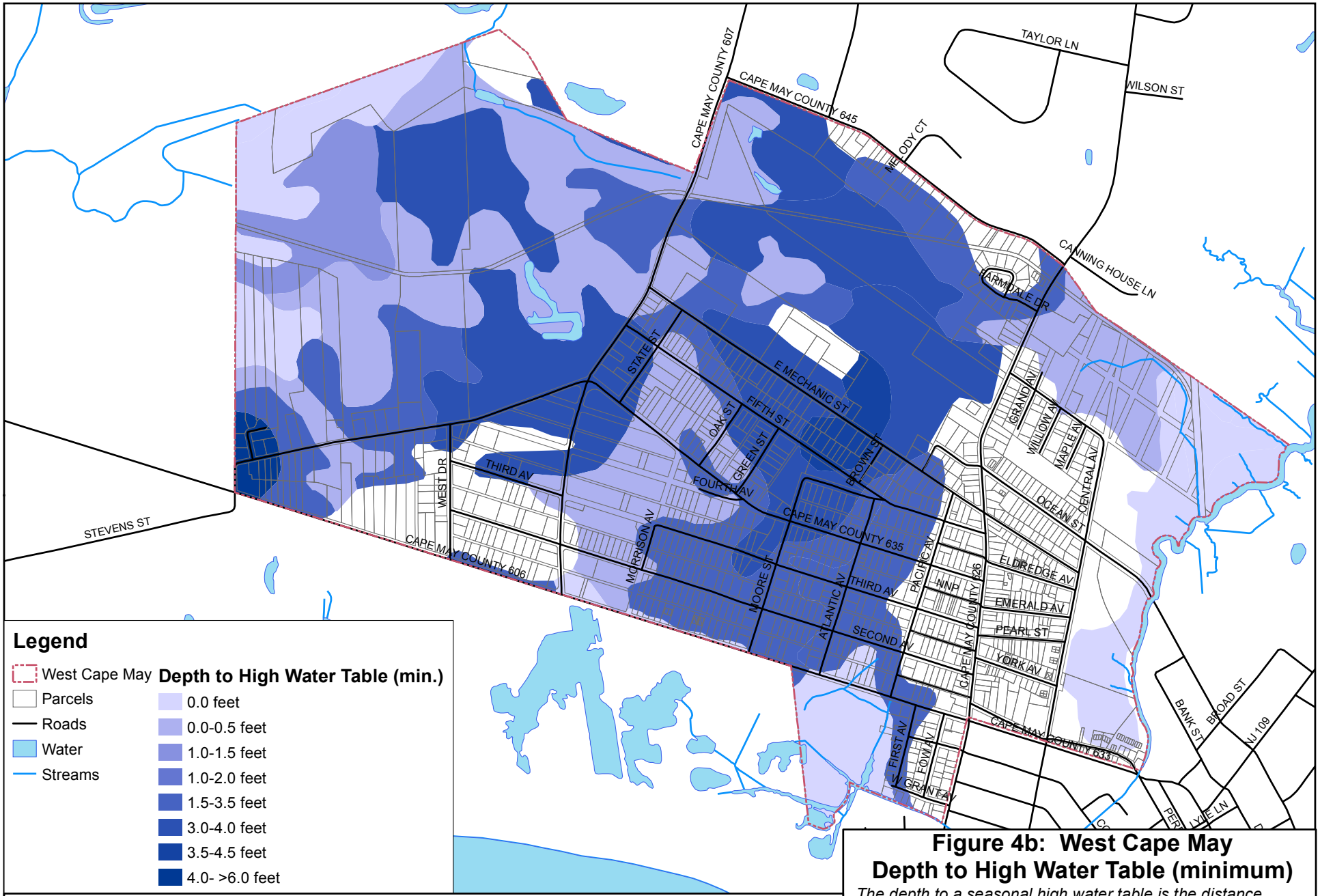
Hydric and Flooded Soils

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 four hydric soils found within West Cape May are the Appoquinimink-Transquaking-Mispillion complex (AptAv), the Berryland and Mullica soils (BEXAS), the Pawcatuck-Transquaking complex (PdwAv), and the Psammaquents sulfidic substratum (PstAt) (see **Table 4.1**). Collectively these map units comprise 33% of the borough. **Figure 6d** shows wetlands and hydric soils.

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 West Cape May, the hydric soils listed in the preceding paragraph are those most likely to experience flooding or ponding (see **Table 4.1**). **Figure 6c** shows floodplains, which encompass the frequently flooded soils.

Potential Frost Action (Figure 4e)

Potential Frost Action is an interpretational rating of the susceptibility of the soil to frost heaving. About half of the soil units mapped within West Cape May have moderate potential frost action, and those units account for 50% of the soil cover in the borough (**Table 4.1**). High potential for frost action is found in the Appoquinimink-Transquaking-Mispillion complex (AptAv), the Pawcatuck-Transquaking complex (PdwAv), and the Urdothents refuse substratum (UdrB), which together comprise 14% of the borough's soil cover. Berryland and Mullica soils (BEXAS), the most extensive map unit in West Cape May accounting for about a quarter of the borough's soil cover (26%), has a high/moderate potential for frost action. Conversely, the lowest potential for frost heave is found in the 10% of the borough's soil cover which includes Fort Mott sand (FobB), Galloway loamy sand (GamB), Psammets wet substratum (PsvAr) and Urban land Psamments wet substratum complex (USPSBR) (see **Figure 4e)**. Non-soil units were excluded from the percentage calculations in this section.



Prepared by Kratzer Environmental Services

Data Sources: NJDEP, NJDOT
Note: Map accuracy is limited to the accuracy and scale of the original data sets.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Figure 4b: West Cape May Depth to High Water Table (minimum)

The depth to a seasonal high water table is the distance between the ground surface and the top of the water surface in the saturated zone. A depth of less than one foot severely constrains development, and a depth between one and three feet also provides obstacles to development.

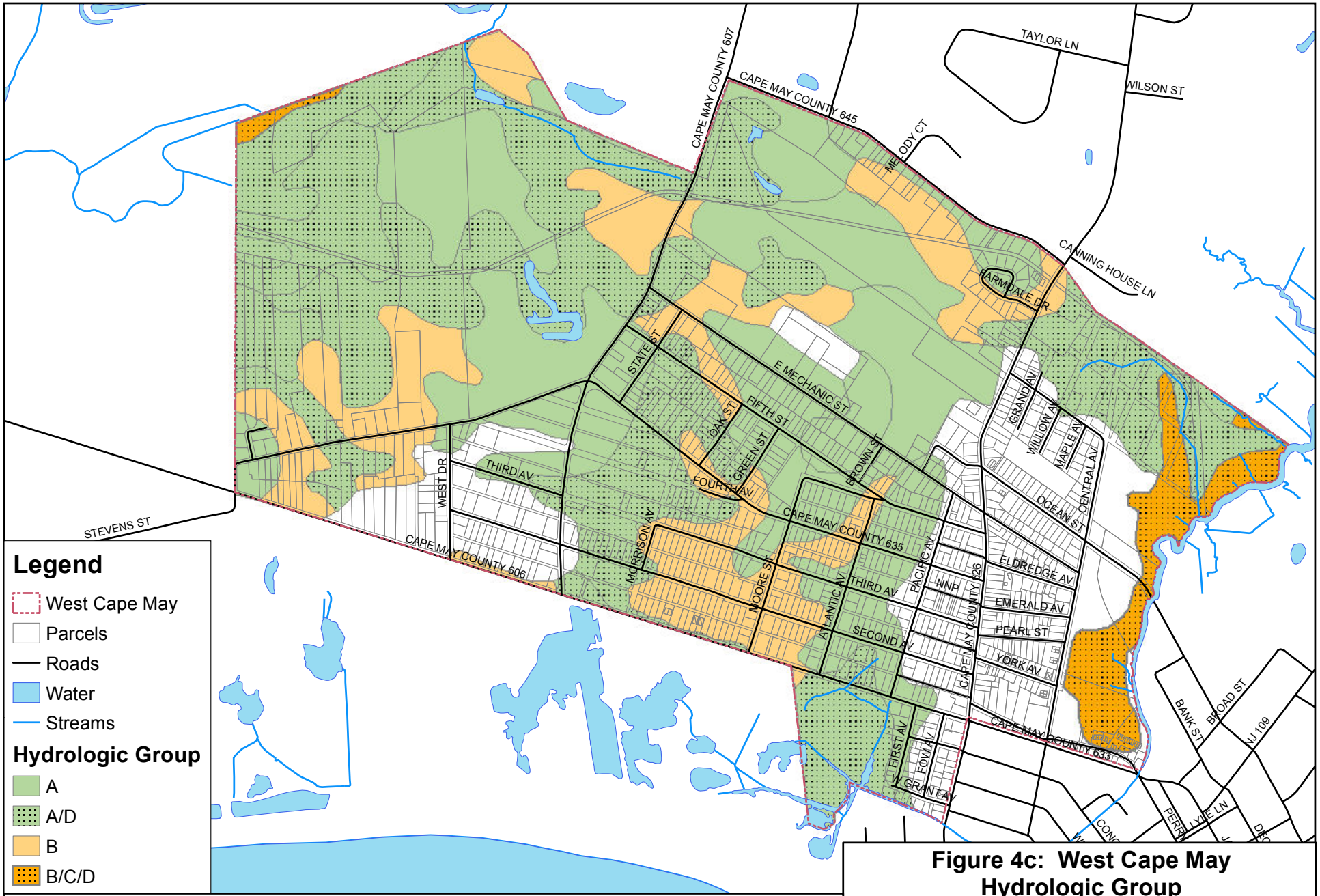
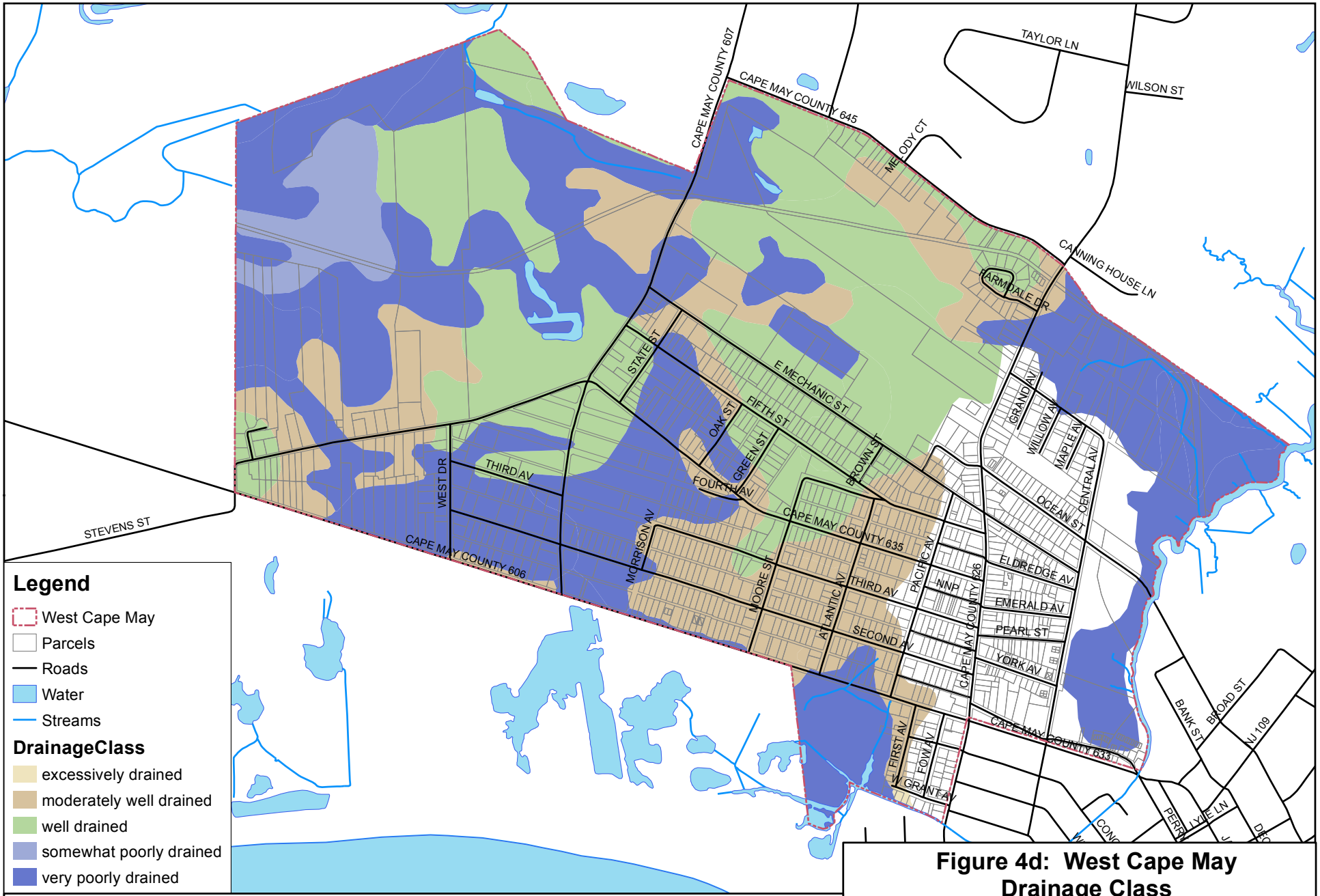


Figure 4c: West Cape May Hydrologic Group

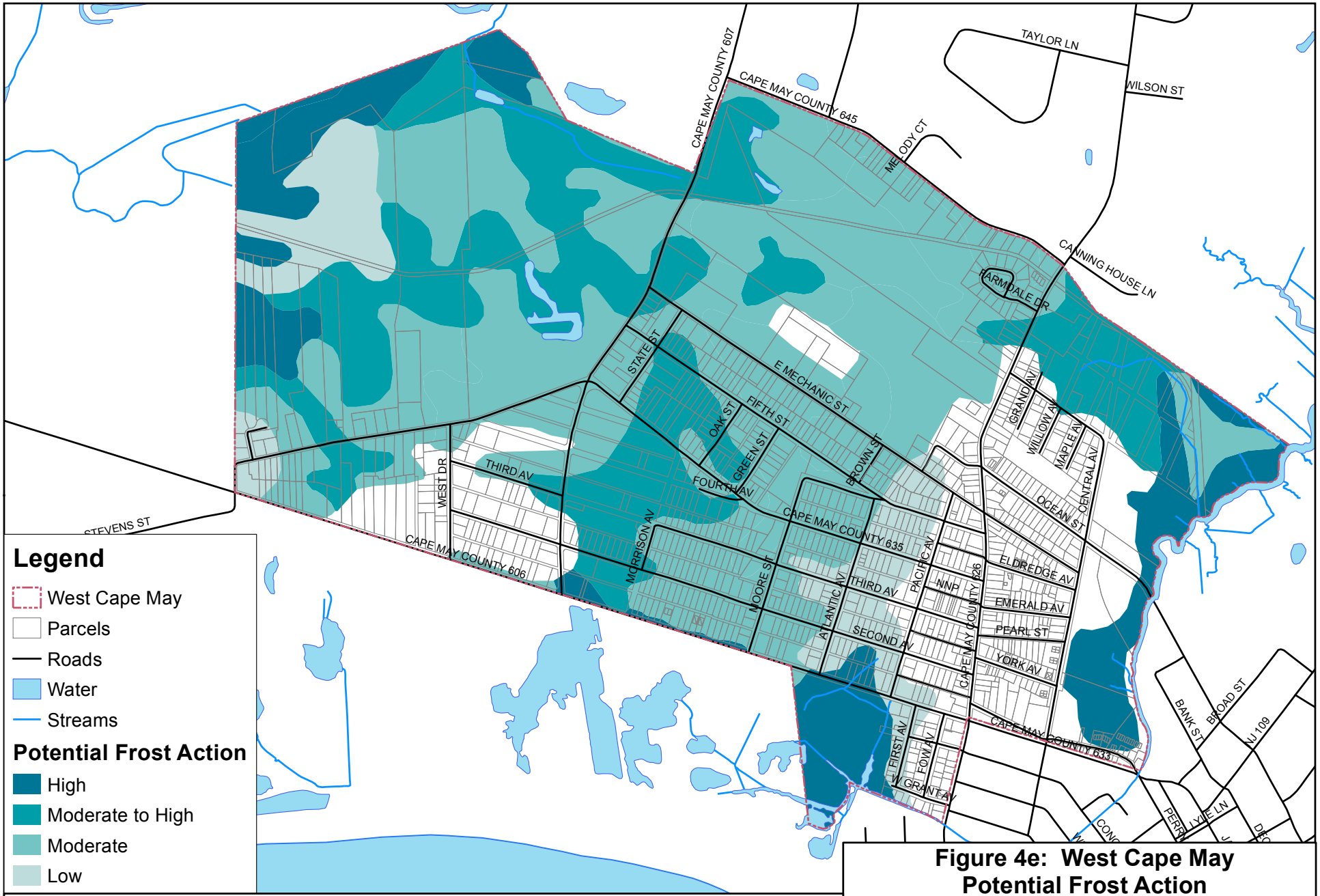
Hydrologic soil groupings indicate the infiltration rates and runoff potential for various soil groups. Class A soils have the highest rates of infiltration, while Class D soils have the slowest.



Data Sources: NJDEP, NJDOT
Note: Map accuracy is limited to the accuracy and scale of the original data sets.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Figure 4d: West Cape May Drainage Class

Soils in West Cape May range from well-drained to very poorly drained. Soils mapped as Excessively Drained indicate locations where wetlands have been filled in.



Data Sources: NJDEP, NJDOT
Note: Map accuracy is limited to the accuracy and scale of the original data sets.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Figure 4e: West Cape May Potential Frost Action

Potential Frost Action is an interpretational rating of the susceptibility of the soil to frost heaving. About half of the soil units mapped within West Cape May have a moderate ranking.

Farmland Suitability (Figure 4f)

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 4.3** (NJ SADC/CADB, 2003). Nine of the soil units in West Cape May are classified as Prime Farmland (40% of soil cover), and three others are ranked as being of Statewide Importance (20% of soil cover) (see **Table 4.1**). In the Unique category (40% of soil cover) are three of the four hydric soil types mapped in the borough: the Appoquinimink-Transquaking-Mispillion complex (AptAv), the Berryland and Mullica soils (BEXAS), and the Pawcatuck-Transquaking complex (PdwAv). None of the soils in West Cape May are classified as locally important (**Figure 4f**). Non-soil units were excluded from the percentage calculations in this section.

Table 4.3: 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: USDA - NRCS, 2007.	

Septic Suitability (Figure 4g)

The NRCS SSURGO database provides an interpretation of limitations of each soil for *septic suitability*. The interpretation shown in **Figure 4g** is based on the N.J.A.C. 7:9A Standards for Individual Subsurface Sewage Disposal Systems, Subchapter 10 Disposal Fields. Factors which may affect the functioning of the system, and therefore limit septic suitability, are excessively coarse substratum or excessively coarse horizon (which allow effluent to percolate to ground water too rapidly); presence of water (including depth to perched zone of saturation, depth to apparent zone of saturation, flooding, and hydric soils); depth to restrictive layer (bedrock, restrictive horizon or restrictive substratum); and steep grades over 25%. N.J.A.C 7:9A prohibits septic systems in soils subject to flooding. In addition, septic disposal fields are prohibited in locations with the combination of slope greater than 10% and less than 50 feet upslope of any bedrock outcrop where signs of ground water seepage can be detected (NJDEP, 1999).

Three of the soil types in West Cape May do not have limited suitability for septic systems, and together they make up only three percent of the borough's soil cover. Those include the Downer sandy loam (DoeAO), the Fort Mott sand (FobB), and the Urdothents refuse substratum (UdrB). The remainder are classified as having either somewhat limited (47%) or very limited (50%) capacity for septic disposal (**Table 4.1**). Non-soil units were excluded from the percentage calculations in this section.

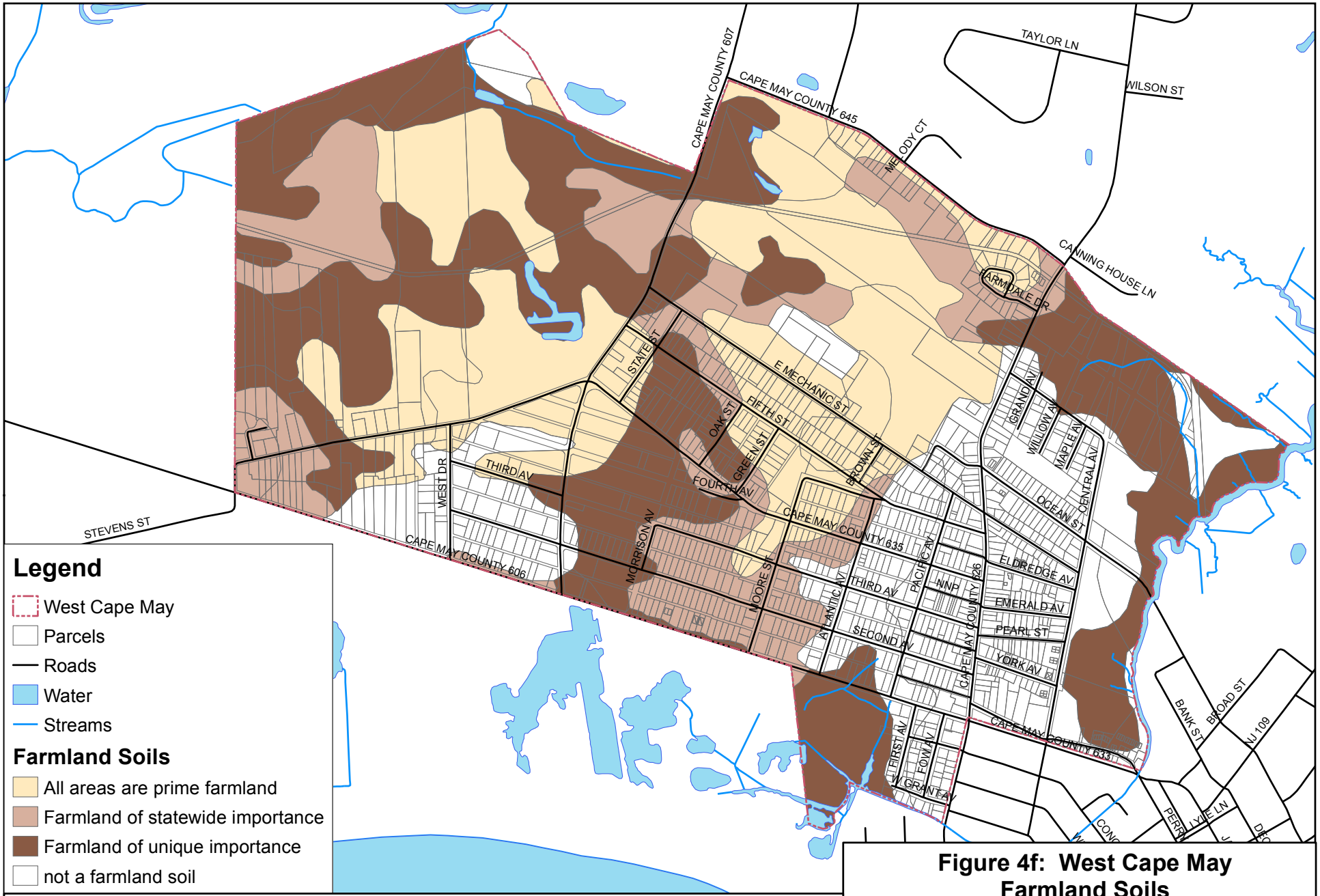
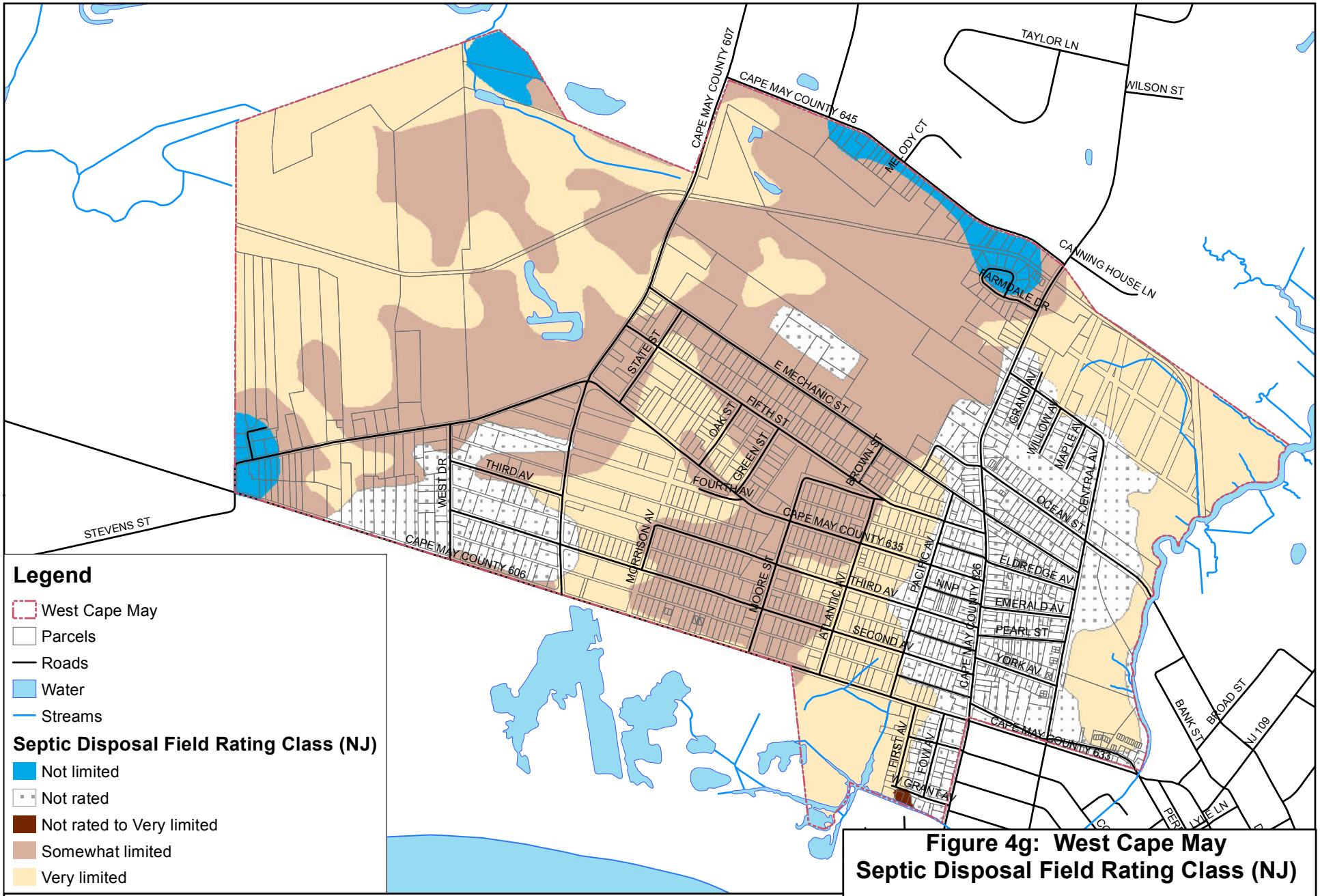


Figure 4f: West Cape May Farmland Soils

Soils ranked as Prime or of Statewide Importance are suitable for growing a wide variety of crops. Soils ranked as Unique are primarily wetlands, but may be suitable for certain specialty crops.



Legend

- West Cape May
- Parcels
- Roads
- Water
- Streams

Septic Disposal Field Rating Class (NJ)

- Not limited
- Not rated
- Not rated to Very limited
- Somewhat limited
- Very limited

0 0.125 0.25 Miles

N

Prepared by Kratzer Environmental Services

Data Sources: NJDEP, NJDOT
Note: Map accuracy is limited to the accuracy and scale of the original data sets.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Figure 4g: West Cape May Septic Disposal Field Rating Class (NJ)

The majority of soil types in West Cape May have either somewhat limited or very limited suitability for the development of septic fields. Suitability is typically limited by excessively coarse soils, the presence of water, shallow depth to bedrock, or steep gradients.

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Internet Resources: Soils

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

NRCS Soils Website: Helping People Understand Soils: http://soils.usda.gov/

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: http://njaes.rutgers.edu/soiltestinglab/pdfs/nj-om-interpret.pdf

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

5: GROUND WATER & DRINKING WATER

A. Water Cycle/Ground Water Background

Even though the quantity of water on the earth is great, only a small portion can be used for drinking water and other human needs. Ninety-seven percent of the world's water supply is saltwater stored in the oceans. The remaining 3% is fresh water. However, most of this is unavailable for human use because it is frozen in the polar ice caps, glaciers, and icebergs; too difficult to tap (below 1.6 miles depth); or too polluted. This leaves 0.003% of water that is available as fresh surface or ground water that humans can use (Miller, 1988).

Surface water is water that is visible above the ground surface, such as creeks, rivers, ponds, lakes, and wetlands. *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* (see **Figure 5a**). 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.

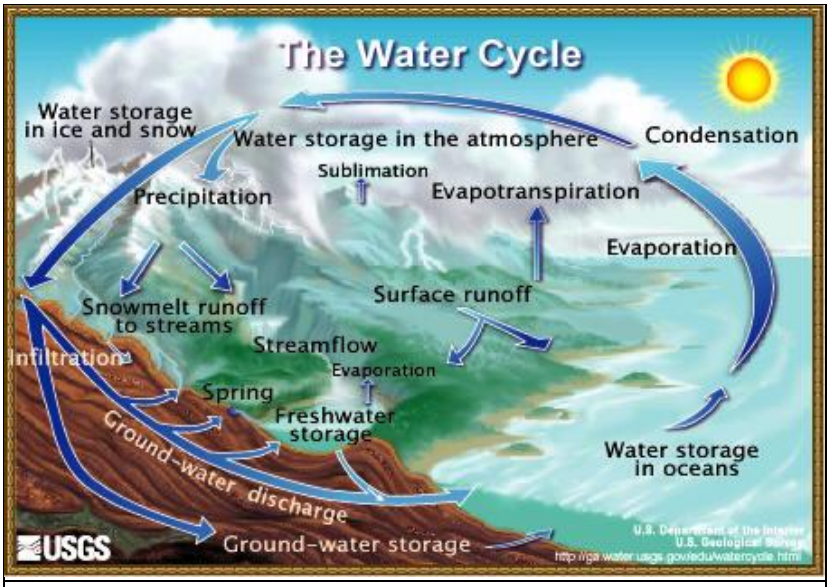


Figure 5a: The Water Cycle
Source: USGS, no date

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).

An understanding of the water cycle emphasizes the connections between surface and ground water. While the Borough of West Cape May relies primarily on water from public wells (not individual wells) fed by ground water, the water is no less part of the natural water cycle, and is susceptible to human impacts and the influence of climate and geology.

B. The Aquifers in West Cape May

West Cape May's drinking water comes predominantly from ground water (as does almost half of New Jersey's drinking water), and originates as local or regional precipitation. The ground water moves through the aquifers, eventually discharging into streams or directly into the aquifer systems and is distributed by wells (USEPA, August 1992).

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 (see **Section 5D**). 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 Borough of West Cape May is underlain by five main aquifers, described in the paragraphs below and summarized in **Table 5.1. Figure 5b** illustrates the unconfined (water table) aquifer (the Holly Beach water-bearing zone) that outcrops as the upper aquifer throughout most of Cape May County. **Figure 5c** presents a cross-sectional view of the unconfined and confined aquifers that occur beneath the county. These include Holly Beach water-bearing zone, estuarine sands, the Cohansey, Rio Grande water-bearing zone, and the Atlantic City 800-foot sand.

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. In the case of the Atlantic City 800-foot sand aquifer, the outcrop area is well to the west of Cape May County where the confining layer thins and the 800-foot sand joins the Kirkwood –Cohansey aquifer system (McAuley et al., 2001). Confined aquifers can also receive additional recharge from "leaking" from overlying aquifers.

West Cape May relies on groundwater from an aquifer system that is interconnected among all Atlantic coast counties such that withdrawals in lower Cape May County may affect water levels and water quality in Atlantic or Ocean County municipalities, and vice versa. 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).

The following are the main aquifers of lower Cape May County, as described by French and Silvestri, 1999; Herman et al., 1998; Lacombe and Carleton, 2002; and Sugarman et al., 2016.

Holly Beach Water-Bearing Zone

The Holly Beach water-bearing zone is a water table (surficial) aquifer that is recharged directly from local precipitation. It is composed of orange and yellow gravels and sands (coarse to fine-grained) with minor silt and clay deposits. It includes alluvium, beach, dune, deltaic, and marine sands. Although present at the ground surface in wetland areas, it can be found more than 10 feet deep in upland regions. The aquifer thickness of the freshwater portion ranges from 10-80 feet in the southern part of the county. There are high iron and manganese concentrations locally, with elevated salinity near coastal areas. Well yields range from 3 – 300 gallons/minute (Gill, 1962 as cited in Lacombe and Carleton, 2002).

Estuarine Sand Aquifer

The estuarine sand aquifer is composed of poorly sorted gravel and medium- to fine-grained sand, with some lignite, and ranges from 25 – 160 feet thick. Well yields range from 3 – 230 gallons/minute, although one test well generated 700 gallons/minute (Sugarman et al., 2016). High salinity levels are found in Cape May City and Villas, some areas of Middle Township, as well as along barrier islands.

Cohansey Aquifer

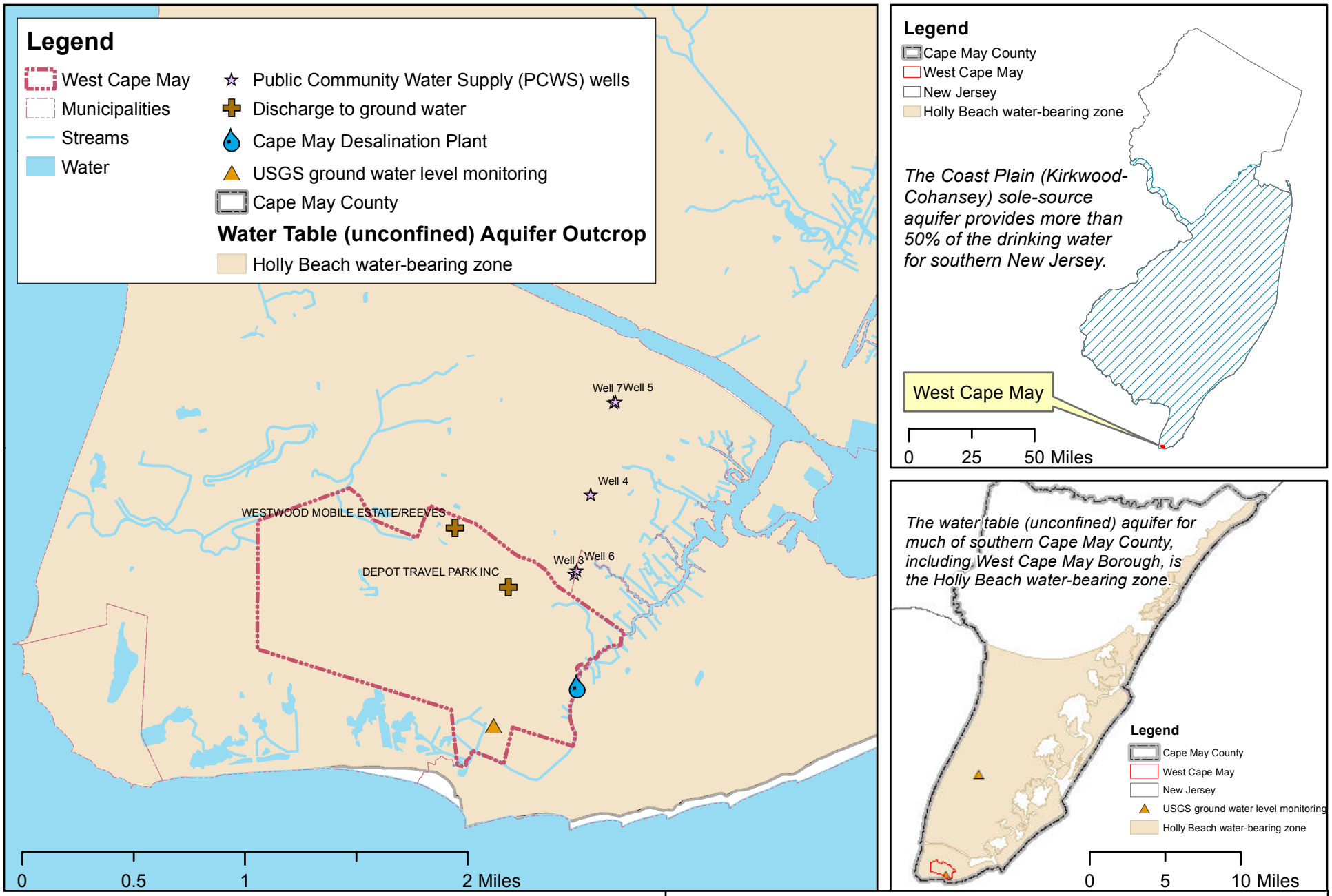
The Cohansey aquifer is the deepest of the peninsula's shallow water aquifers and is confined in Cape May County. It is made up of fine- to medium-grained sand, with lenses of silt and clay. The aquifer is 60 – 180 feet thick, with well yields ranging from 5 – 700 gallons/minute, though can go as high as 1,500 gallons/minute. It is predominantly fresh water in the mainland sections of the county, but has elevated chloride levels near the coast and barrier island.

Rio Grande water-bearing zone

The Rio Grande water-bearing zone underlays the Cohansey aquifer and is comprised of fine- to medium-grained sand. It is typically 50 – 100 feet thick, being thicker in the southern part of the county. High chloride levels are found south of Middle Township and east, beneath barrier islands.

Atlantic City 800-foot sand

This aquifer is the deepest of the Cape May aquifers and consists of fine- to medium-grained sand, with silt and clay. There are high levels of chloride in the lower part of the Cape May peninsula and southern Lower Township. The aquifer averages 150 – 200 feet thick and is found 400 – 950 feet below the surface. It yields large quantities of water from Stone Harbor to Ocean City and on mainland from Middle to Upper Township, typically 500 – 1000 gallons/minute.



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Prepared by Kratzer Environmental Services

Data Sources: NJDEP
Note: Map accuracy is limited to the accuracy and scale of the original data.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Figure 5b: West Cape May Aquifer & Sole-source Aquifer

The water table (unconfined) aquifer for much of southern Cape May County, including West Cape May Borough, is the Holly Beach water-bearing zone. The location of ground water wells, discharge sites and monitoring stations serving West Cape May are also pinpointed on this map. See Figure 5c for an illustration of the aquifers in cross section.

***28* Figure 5c: Hydrostratigraphy in Cape May County**

Relative positions of the five aquifers in lower Cape May County. The top image shows the location of the cross section of hydrostratigraphy pictured in the bottom figure.

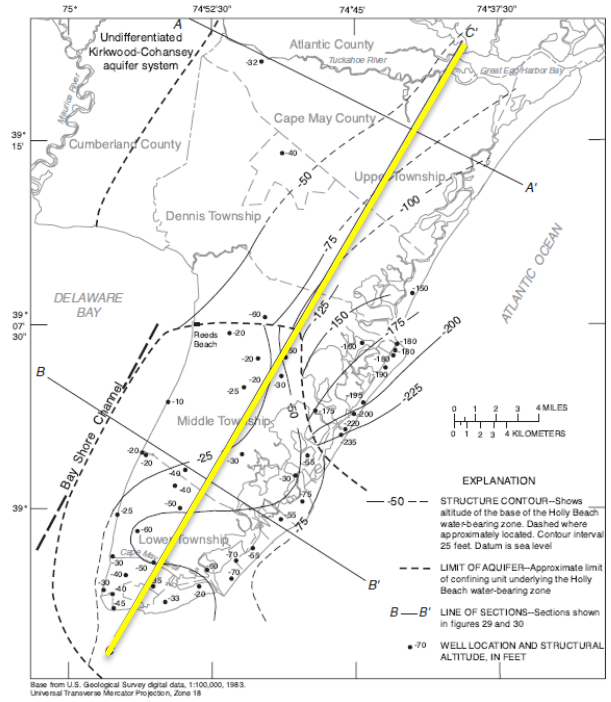


Figure 14. Altitude of the base of the Holly Beach water-bearing zone, Cape May County, New Jersey.

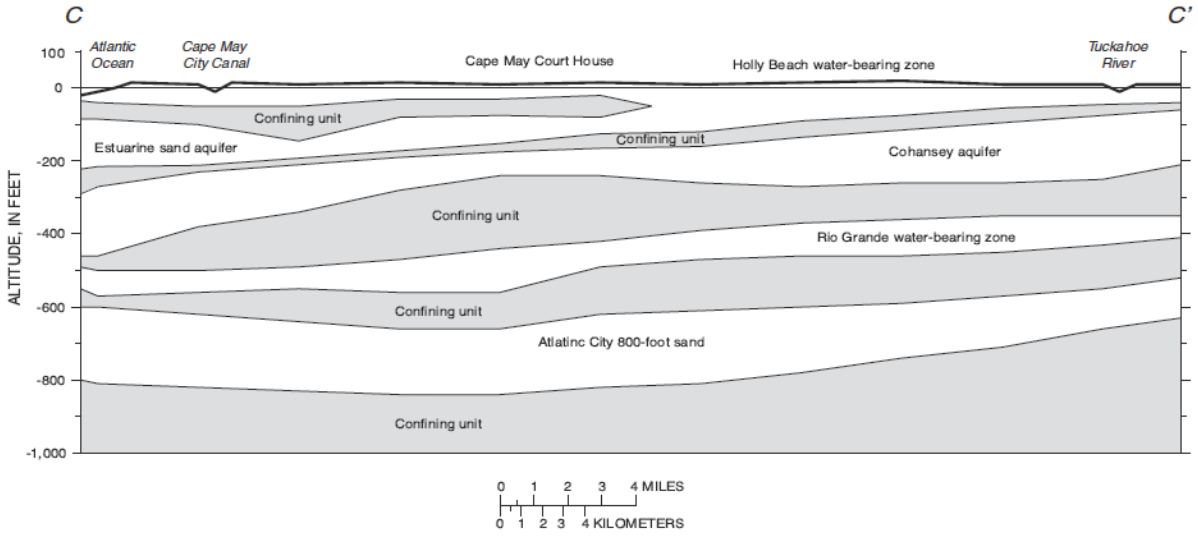


Figure 30. Section *C-C'* showing the hydrostratigraphy in Cape May County, New Jersey. (Lines of section are shown in figures 14 to 18.)

Source:
Lacombe, Pierre J. and Glen B. Carleton. 2002. Hydrogeologic Framework, Availability of Water Supplies, and Saltwater Intrusion, Cape May County, New Jersey. U.S. Geological Survey Water-Resources Investigations Report 01-4246. Prepared in Cooperation with the NJDEP.

Table 5.1: Characteristics of West Cape May Aquifers

Aquifer Unit	Aquifer Rank▪	Characteristics	Common Range*		
			Depth (ft)	Yield (gpm)	Thickness
UNCONSOLIDATED AQUIFERS					
Holly Beach water-bearing zone	C	Surficial aquifer of Quaternary age, orange and yellow sand and gravel, with thin clay and silt lenses and shell layers. It includes alluvium, beach, dune, deltaic, and marine sands. 20'-100 feet thick. Locally may be contaminated by human activities, and may be locally high in nitrate and iron with elevated salinity near coastal areas.	2 wells are <100' [S]	250-350 [S]	20-100 [S]
				Avg. = 110 Median = 100 [F]	
				3-300 [Gill 1962, as cited in L]	10 – 80 [L]
CONFINING UNIT					
Estuarine Sand	C	Fine to medium sands with some gravel and lignite. Variable thickness 20 – 150+ feet. High chlorides and sodium levels in Cape May City and barrier islands and parts of Lower Township. High iron in most areas.	80-225 [S]	700 from one well [S]	3-100 [S]
				Avg. = 360 Median = 250 [F]	
				3-230 [L]	25 -165 [L]
CONFINING UNIT					
Cohansey	A	Composed of medium- to coarse-grained sand with lenses of silty clay. High chloride levels beneath barrier islands and Cape May City. It can be thin, may be connections between confining units. 60-180 feet thick. Yields large quantities of water on the mainland.	200-300 in southern part of county [S]	Up to 1500 [S]	50-200 [S]
				Avg. = 514 Median = 500 [F]	
				5-700 [L]	60-180 [L]
CONFINING UNIT					
Rio Grande water-bearing zone	B	Fine to medium-grained sand. Typically 50-100 feet thick, being thicker in the southern part of the county. High chloride levels south of Middle Township. Upper layer within the Kirkwood Formation.		One well 1000 [S]	50-100 [S]
				Avg. = 460 Median = 300 [F]	
				1100 [L, one well]	30-170 [L]
CONFINING UNIT					
Atlantic City 800-foot sand	A	Fine to medium-grained sand, with silt and clay. High levels of chloride in the lower part of the Cape May peninsula and southern Lower Township. Averages 150 – 200' thick. Yields large quantities of water from Stone Harbor to Ocean City and on mainland from Middle to Upper Township.	400-950 [S]	500-1000 [S]	150-200 [S]
				Avg. = 579 Median = 700 [F]	
				600-900, or even > 1000 [L]	125-150 [L]

▪**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

Sources: Herman et al., 1998; USGS, January 14, 2013; except as noted below.

* Various studies list differing results for the range of depth, yield and thickness of the units, and the sources are noted in brackets. Note that these characteristics vary from location to location.

[F] French and Silvestri, 1999

[L] Lacombe and Carleton, 2002

[S] Sugarman et al., 2016

C. 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 5b** (upper right inset) and includes water-bearing units that supply West Cape May's water (NJDEP, May 19, 1998).

D. Recharge

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[16] coincide with, or are slightly offset from surface water divides (Lewis-Brown and Jacobsen, 1995) (watersheds are described in **Section 6A** and shown in **Figure 6a**). 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 5d). New Jersey receives an average of about 40 to 51 inches of precipitation per year (lowest along the southeast coast, including West Cape May, 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.

[16] 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. http://www.srh.noaa.gov/jetstream/append/glossary_g.htm

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 (see **Section 2A**), 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).

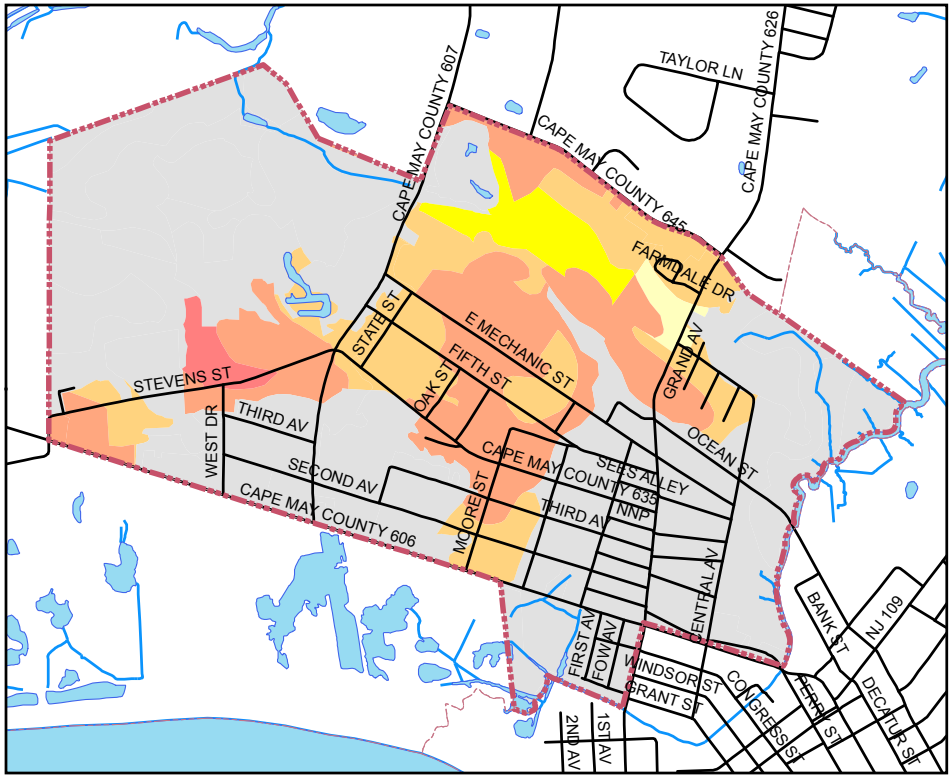
In view of the importance of not exceeding the aquifers' safe yield, the New Jersey Geological Survey has completed studies quantifying recharge, as discussed in the following sections.

New Jersey Geological Survey Recharge Method GSR-32

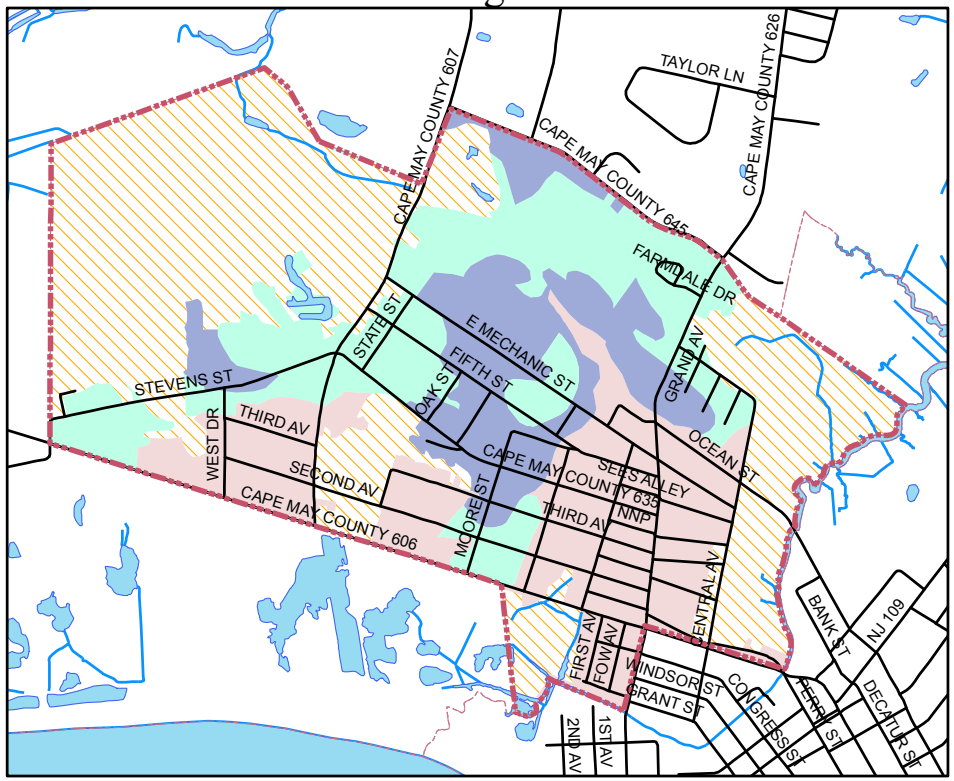
N.J.S.A. 58:11A, 12-16 required the NJDEP to publish a methodology to map and rank aquifer-recharge areas. In addition, the legislation required the development of ground water protection practices designed to encourage ecologically sound development in aquifer-recharge areas (Charles et. al., 1993). 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, recharge was calculated based on data for precipitation, soil, land-use/land-cover17, surface runoff, and evapotranspiration. This method was then applied by NJGS to create a GIS coverage (see Figure 5d). 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 (NJ Water Supply Authority, 2002).

[17] 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 5d**, because this involves complex calculations, and NJGS has not updated this GIS data layer.

Drought Recharge



Aquifer Rank/Ground Water Recharge Rank



Legend

- West Cape May
- Municipalities
- Roads
- Streams
- Water

Estimated Drought
Recharge Value (in/yr)

- 0
- 5
- 6
- 7
- 8
- 9

Aquifer Rank	High Yield Wells	Ground water recharge rank	Recharge
A	> 500 gpm	A	18 to 23 in/yr
B	250 to 500 gpm	B	10 to 17 in/yr
C	100 to 250 gpm	C	8 to 9 in/yr
D	25 to 100 gpm	D	1 to 7 in/yr
E	< 25 gpm	E	0 in/yr
L: hydric soils-no recharge calculated			
W: wetlands and open water--no recharge calculated			

N

0 0.25 0.5 Miles

Prepared by Kratzer Environmental Services

Data Sources: NJDEP, NJDOT
Note: Map accuracy is limited to the accuracy and scale of the original data sets.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Figure 5d: West Cape May Recharge and Aquifer Potential

Left: Drought recharge values are estimated in inches per year of subsurface recharge. Right: Recharge ranks range from A (highest) to E (lowest). The two ranks are combined in the format "ground water recharge rank/aquifer recharge rank". Higher ranks are positively correlated with higher yields.

Applying the GSR-32 method to West Cape May, the estimated average annual subsurface recharge rates range from 0 to 10 inches per year (excluding surface water, wetlands and hydric soils) and 0 to 9 inches per year during drought (shown on **Figure 5d**). Applying the 20% consumptive use limit to these figures results in usable recharge from 0 to 2 inches per year. As previously mentioned, only a portion of water entering the ground actually recharges the aquifer, but since GSR-32 did not attempt to quantify this amount, this method would be better described as *soil recharge*.

New Jersey Geological Survey Ground Water Potential

In 2005, also in response to N.J.S.A. 58:11A, 12-16, the NJ Geological Survey developed a qualitative representation of the potential for aquifer recharge. This was created by combining ground water recharge rankings and aquifer rankings.

NJGS assigned a relative rank based on the inches of ground-water recharge per year (mapped in **Figure 5d**), from A (highest recharge) to E (lowest recharge). Relative values of aquifer yield (based on high yield industrial wells and described in **Table 5.1**) were assigned to each aquifer, from A (highest yield) to E (lowest yield). For both data sets, areas of wetlands, open water and hydric soils were not ranked, since individual areas differ in whether they increase or decrease recharge, which varies seasonally. These two ranks are combined in the format "ground water recharge rank/aquifer recharge rank" and illustrated in **Figure 5d**. For example, A/A would be an area with the highest relative recharge and highest yield, and an area designated E/E would have the lowest recharge and lowest yield, while other combinations would lie somewhere in between (French, 2004). The State Ranks for the aquifers underlying West Cape May are C/D, D/D and E/D.

E. Ground Water Quality

Pollution, such as nitrates, bacteria, metals, pesticides and antibiotics, can enter ground water via non-point sources (including septic systems and runoff from fields and roads), point sources, and rain. 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, August 17, 2017), radon, arsenic, MTBE (methyl-t-butyl ether, which is a fuel oxygenate), nitrates, and waterborne pathogens.

In addition, 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 (no data was found specific to West Cape May, but background information may be found in **Internet Resources**).

Saltwater Intrusion

Saltwater intrusion is a major concern in coastal regions and is the predominant threat to the Cape May County water supply (Lacombe and Carleton, 2002). It occurs when excessive drawdown of the water table through freshwater withdrawals allows saltwater to enter supply wells. The rates of aquifer recharge and discharge determine the extent of saltwater intrusion (Dunne and Leopold, 1978).

Possible actions to halt or mitigate saltwater intrusion include; limiting water withdrawals, protecting aquifer recharge areas locally and regionally, enhancing groundwater recharge with the use of constructed recharge basins or artificially by injecting storm water or treated sewage effluent into aquifer(s), Aquifer Storage and Recovery (ASR), constructing saltwater desalinization plants, or any combination of the above. Each of these methods has costs

and benefits, with a goal of not exceeding the carrying capacity of the groundwater supply. See Lacombe and Carleton, 2002; and Lacombe et al., 2009 for a discussion of sustainable potable water-supply alternatives to meet current and future water supply demands in Cape May County.

Public Water Wells

The Cape May City Water Department serves the City and surrounding municipalities, including West Cape May, from the wells shown in **Figure 5b**. The two main wells in use today are located in the Atlantic City 800-foot sand aquifer. Due to their higher salt content, water from these wells is treated by the City's reverse osmosis water treatment facility constructed in 1998. In addition, some water from Well No. 5, drawn from the 560-foot-deep Cohansey aquifer, is blended with the clean water from the desalination plant. As saltwater intrusion continues to threaten the Cohansey wells in this region, other options are under consideration, such as recharging existing wells (e.g., No. 4) with clean water so that it could be used at future times (i.e. Aquifer Storage and Recovery (ASR)) (Degener, August 24, 2011) (see also Lacombe and Carleton, 2002; and Lacombe et al., 2009).

In addition to the reverse osmosis process, lime is used for pH adjustment and sodium hypo-chlorite is used for disinfection (West Cape May Water Department, 2016).

In the 2016 annual report (based on 2015 and some earlier water quality data), the West Cape May Water Department reported one positive Total Coliform Bacteria sample and follow-up sampling was negative. Coliform bacteria are naturally present in the environment and are monitored as an indicator that other, potentially-harmful, bacteria could be present. One water sample out of 10 in 2014 exceeded the lead action level. All other measured water quality parameters were below the Maximum Contaminant Levels (MCLs) for drinking water (West Cape May Water Department, 2016).

In 2016 to 2017, West Cape May Water Department has had 4 violations of type 27 (Monitoring and Reporting) for chlorine and 2 for trihalomethanes (TTHM) and one for type 71, violation of the Consumer Confidence Rule for submitting results late (NJ Drinking Water Watch, 2017). Water quality testing results are available online (see **Internet Resources**).

Private Wells

The New Jersey Private Well Testing Act (N.J.S.A. 58:12A-26 et seq.) became effective in September 2002, mandating 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. Private wells in Cape May County are required to be tested for total coliform (plus fecal coliform or E.coli if total coliform is positive), nitrate, iron, manganese, pH, VOCs, lead, mercury, and gross alpha particle activity. Since West Cape May is served primarily by public water systems, just 28 private wells have been tested pursuant to this regulation from September 2002 to April 2014. Of these 28 wells tested, one well exceeded the standard for bacteria; 18 exceeded the manganese standard; 17 exceeded the pH standards; and 13 exceeded the iron MCL,(see **Table 5.2**) (NJDEP Division of Water Supply and Geoscience, August 17, 2017; NJDEP Division of Water Supply and Geoscience, January 19, 2017).

Table 5.2: NJ Private Well Testing Act Data Summary (September 2002 to April 2014) in West Cape May Borough

Parameter	Number of Wells Sampled	% of Wells Exceeding MCL	MCL
Nitrate	28	0.0%	10 mg/l
Arsenic	Testing is not required under PWTA in Cape May Co.		5 µg/l
Iron	28	46.4%	0.3 mg/l
Manganese	28	64.3%	0.05 mg/l
Gross Alpha	26	0.0%	(initial)[18] 5 pCi/L
Mercury	28	0.0%	2 µg/l
VOC	28	0.0%	*
Fecal coliform or E. coli	28	3.6%	0 colonies
pH	28	60.7%	6.5-8.5
* MCLs vary for the 26 Volatile Organic Compounds (VOCs) required by the PWTA.			
Source: NJDEP Division of Water Supply and Geoscience, January 19, 2017; Atherholt et. al., 2008			

F. Ground Water Quality Standards

The New Jersey Ground Water Quality Standards (GWQS; N.J.A.C. 7:9C) (last amended July 22, 2010) 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 5H**), 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 (see **section 6D** for surface water classifications), 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 *Bureau of Environmental Analysis, Restoration and Standards*, September 15, 2017).

West Cape May'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.

G. Ground Water Discharges

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

[18] Results greater than 5 pCi/L requires a second gross alpha count. The MCL for gross alpha is 15 pCi/L.

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 2 ground water discharges within West Cape May, described below in **Table 5.3** and shown on **Figure 5.b** (NJDEP DWQ BNPC, July 18, 2007).

Table 5.3: NJPDESGW in West Cape May

FACILITY	PI #	NJPDES #	DISCHARGE TYPE*
DEPOT TRAVEL PARK INC	49849	NJG0135402	T1
WESTWOOD MOBILE ESTATE/REEVES	47400	NJG0089265	T1
* T1 stands for Sanitary Subsurface Disposal and authorizes the discharge of sanitary sewage from facilities to a subsurface disposal (septic) system with a design volume in excess of 2,000 GPD			
Source: NJDEP, Division of Water Quality (DWQ), Bureau of Nonpoint Pollution Control (BNPC), July 18, 2007			

H. 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, September 15, 2017).

The LSRP program does not apply to unregulated underground storage tanks (i.e. residential tanks) (see **Internet Resources**).

Known Contaminated Sites List (KCSL)

The NJDEP Site Remediation Program compiles a list of Known Contaminated Sites (KCS). The Known Contaminated Sites List 19 (non-homeowner) for New Jersey (as required

[19] The GIS data is updated periodically (the most recent data currently available is from April 27, 2017. The tabular data is updated more frequently (see **Internet Resources)**.

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. 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, February 14, 2017).

There are no active, pending, or closed contaminated sites within the Borough of West Cape May. Nor are there sites in West Cape May currently on the National Priorities (Superfund) List.

Homeowner sites are not included because they generally involve small heating oil discharges from leaking underground storage tanks (USTs) that are resolved relatively quickly (see Internet Resources for a link to NJDEP's grant program for removal and cleanup of USTs) (NJDEP SRP, April 25, 2017).

Classification Exception Area (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 (NJGWQS) 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, March 29, 2016). There are no CEAs in West Cape May.

Deed Notice

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. August 28, 2017). There are no Deed Notices delineated within the Borough of West Cape May.

Remediated Sites

A current Data Miner search revealed that there are currently no sites undergoing remediation in West Cape May (NJDEP SRP, June 13, 2017).

I. Ground Water Level Monitoring

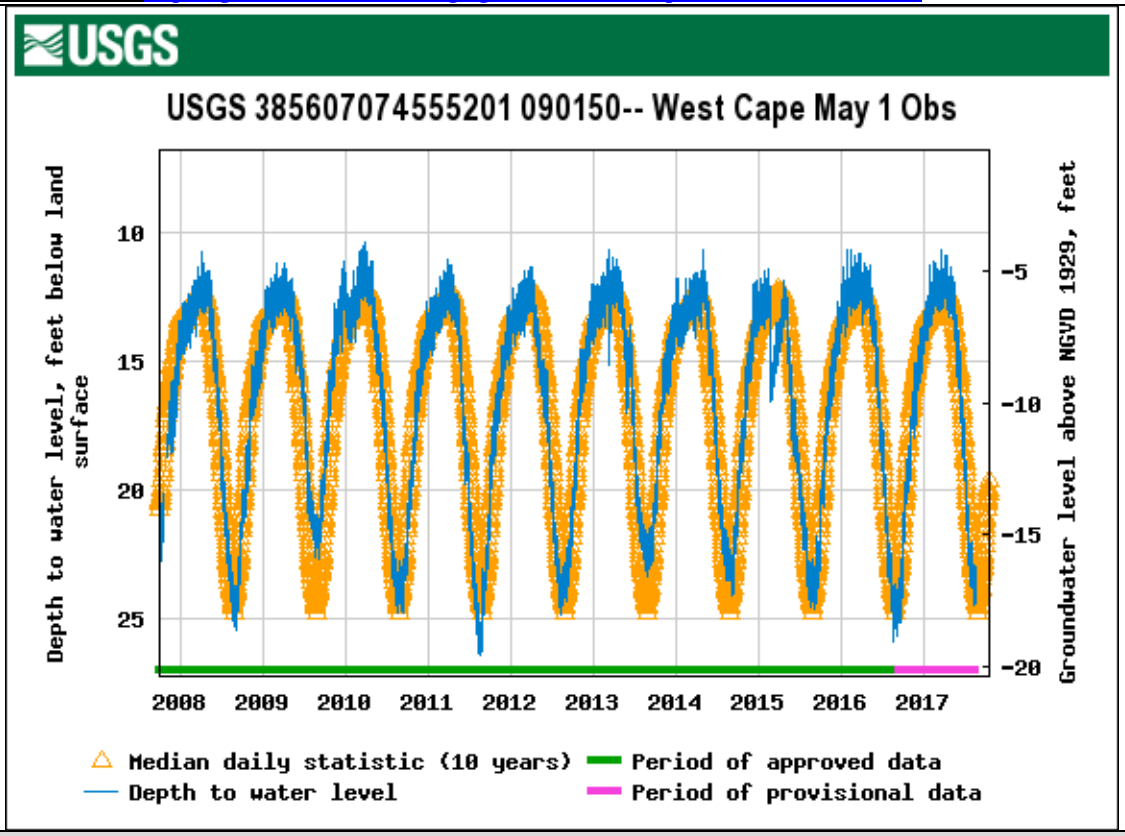
The *ground water level* is the distance from the land surface to the water in a well. Ground water level monitoring is critical for determining the current state of the ground water, identifying trends and predicting ground water drought. In addition to drought, over-withdrawal of ground water can occur in areas where more ground water is being pumped out of the aquifer than is replenished through recharge. This could lead to a drop in the ground water level, affecting well performance, sometimes causing wells to go dry, in addition to causing a decrease

in the baseflows of adjacent streams. In coastal areas like West Cape May, over-withdrawal of ground water also leads to saltwater intrusion into freshwater wells, a major concern.

The USGS maintains a nation-wide network of wells to monitor the effects of droughts and other climate variability on ground water levels. Data from these wells (among other factors) are used by the NJDEP to determine drought status (see **Internet Resources**). In West Cape May, the USGS has monitored a 293 foot deep well since 1957. A description of this site and a graph of ground water level for 2016-2017 is shown in **Table 5.4**. Its location is shown in **Figure 5b**. On average, the lowest groundwater levels occur during June-September, while highest levels occur January-March (USGS, 2017a; USGS 2017b).

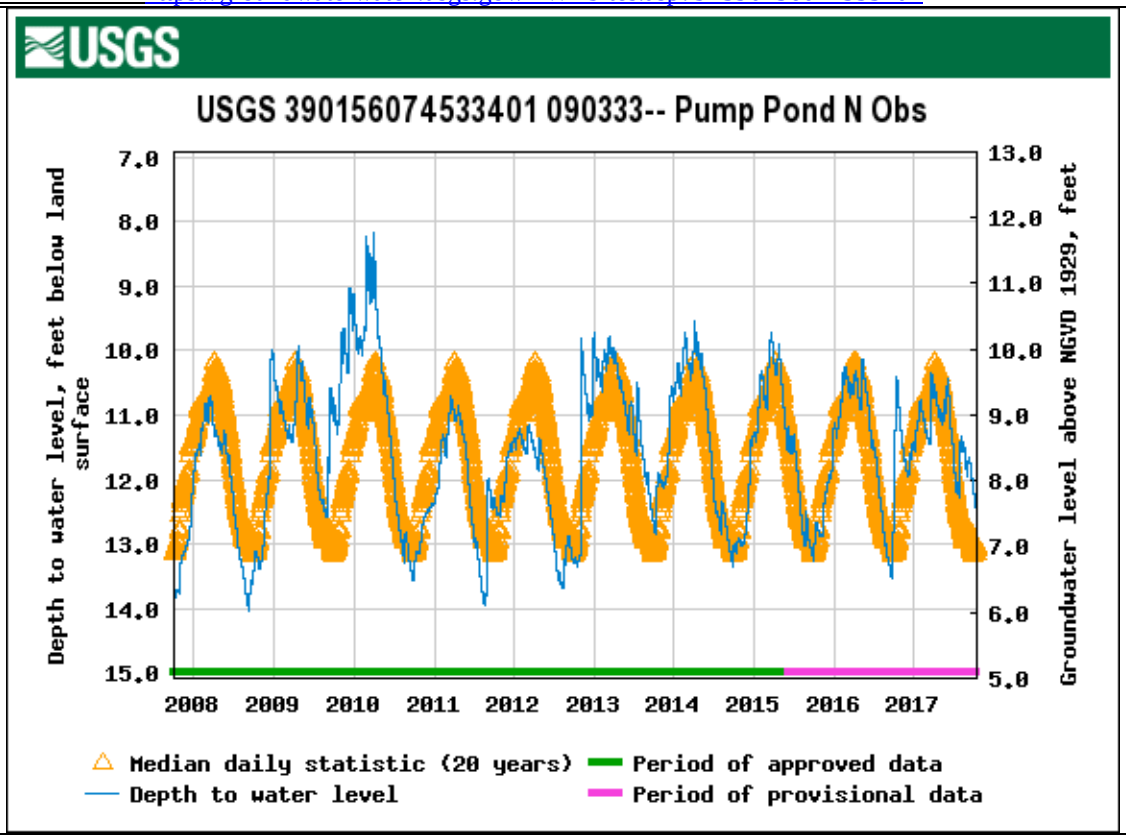
Table 5.4: USGS Real-Time Ground Water Level Network

Site Number:	**385607074555201 - 090150-- West Cape May 1 Obs**
Location:	Latitude 38°56'07", Longitude -74°55'56" NAD27 West Cape May Borough, Cape May County, New Jersey , Hydrologic Unit 02040302
Well Characteristics:	**Depth:** Well depth: 293 feet **Land surface altitude:** 6.60 feet above NGVD29.
Aquifer:	Well completed in "Northern Atlantic Coastal Plain aquifer system" national aquifer Well completed in "Cohansey Sand" local aquifer
Begin date (periodic record):	07/27/19**57**
Extremes for Period of Record:	*Highest Water Level*: 17.69' *Median*: 19.58' *Lowest Water Level*: 21.50'
Website:	https://waterdata.usgs.gov/nwis/inventory/?site_no=385607074555201&agency_cd=USGS https://groundwaterwatch.usgs.gov/AWLSites.asp?S=385607074555201



Site Number:	**USGS 390156074533401 090333-- Pump Pond N Obs**
Location:	Latitude 39°01'56", Longitude 74°53'34" NAD27 Middle Township, Cape May County, New Jersey , Hydrologic Unit 02040206
Well Characteristics:	**Well depth:** 43 feet **Hole Depth:** 69 feet **Land surface altitude**: 20 feet above NGVD29. Well completed in "Northern Atlantic Coastal Plain aquifer system" (S100NATLCP) national aquifer. Well completed in "Holly Beach Water-Bearing Zone" (112HLBC) local aquifer Cape May County, New Jersey , Hydrologic Unit 02040302
Begin date (periodic record):	07/15/1992

Extremes for Period of Record: *Highest Water Level*: 10.80' *Median*: 13.02' *Lowest Water Level*: 13.83'
Website: https://waterdata.usgs.gov/nwis/inventory?agency_code=USGS&site_no=390156074533401
https://groundwaterwatch.usgs.gov/AWLSites.asp?S=390156074533401



Note: These sites are maintained by USGS New Jersey Water Science Center.
Sources: USGS, 2017a & b

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Internet Resources: Ground Water

Drinking Water

West Cape May Water Department –

Annual Drinking Water Report:
http://www.westcapemay.us/borough-departments/annual-drinking-water-report.aspx

NJ Drinking Water Watch:
https://www9.state.nj.us/DEP_WaterWatch_public/JSP/WSDetail.jsp?tinwsys=265

Your Utility and Its Water Quality: http://www.nj.gov/dep/watersupply/dwc_systems.html

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: http://www.nj.gov/dep/watersupply/pdf/dw_standards_2_2005.pdf

NJDEP 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

Drought and Ground Water Level

NJDEP Drought Information: www.njdrought.org

USGS New Jersey Real-Time Groundwater Level Network
NJ: https://groundwaterwatch.usgs.gov/NetMapT1L2.asp?ncd=rtn&sc=34
Canal 5 Obs https://groundwaterwatch.usgs.gov/AWLSites.asp?S=385748074553301&ncd=NJN
West Cape May 1 https://groundwaterwatch.usgs.gov/AWLSites.asp?mt=g&S=385607074555201&ncd=awl

Ground Water Quality
NJDEP Ground Water Monitoring: http://www.state.nj.us/dep/wmm/bfbm/groundwater.html

Comparative Risk Project: http://www.state.nj.us/dep/dsr/njcrp/

NJDEP grants for Underground Storage Tank removal & remediation: http://www.nj.gov/dep/srp/finance/ustfund/

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Aquifer and Well Characteristics in New Jersey (USGS): http://wwwnj.er.usgs.gov/gw/table_1.html

NJGS Hydrogeologic Data (horizontal hydraulic conductivity values, transmissivity values, and vertical hydraulic conductivity values): http://www.state.nj.us/dep/njgs/geodata/dgs02-1.htm

Radioactivity in Ground Water
NJDEP: A South Jersey Homeowner's Guide to Radioactivity in Drinking Water:
http://www.state.nj.us/dep/rpp/rms/agreedown/radwater.pdf
US EPA: Basic Information about the Radionuclides Rule.
http://water.epa.gov/lawsregs/rulesregs/sdwa/radionuclides/basicinformation.cfm

Other
NJDEP Data Miner: https://www13.state.nj.us/DataMiner

NJDEP Laws & Rules: http://www.nj.gov/dep/landuse/lawsregs.html
NJDEP Rules & Regulations (current & proposed): http://www.nj.gov/dep/rules/
Site Remediation Reform Act, N.J.S.A. 58:10C.: http://www.nj.gov/dep/srp/regs/statutes/srra.pdf
Brownfield & Contaminated Sites Act, N.J.S.A. 58:10B: http://www.nj.gov/dep/srp/regs/statutes/bcsra.pdf
Spill Compensation and Control Act: http://www.nj.gov/dep/srp/regs/statutes/spill_act.pdf
Industrial Site Recovery Act: http://www.nj.gov/dep/srp/regs/statutes/isra.pdf
Underground Storage Tanks: http://www.nj.gov/dep/rules/rules/njac7_14b.pdf
Ground Water Quality Standards: http://www.nj.gov/dep/rules/rules/njac7_9c.pdf

NJDEP Division of Water Monitoring and Standards: http://www.nj.gov/dep/wms/bears/index.html

NJ Geological Survey Home Page: http://www.state.nj.us/dep/njgs/index.html

Underground Storage Tanks: http://www.nj.gov/dep/srp/bust/

USEPA Ground Water and Drinking Water: https://www.epa.gov/ground-water-and-drinking-water

USGS - New Jersey District - Ground Water Information (USGS): https://waterdata.usgs.gov/nj/nwis/gw

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

6: SURFACE WATER

A. Introduction

Surface Water

As described in **Section 5A**'s overview of the water cycle, *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).

Watersheds

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 Borough of West Cape May is within the Delaware Bay and Atlantic coastal watersheds, which covers the Cape May peninsula of New Jersey.

Watershed Management Areas

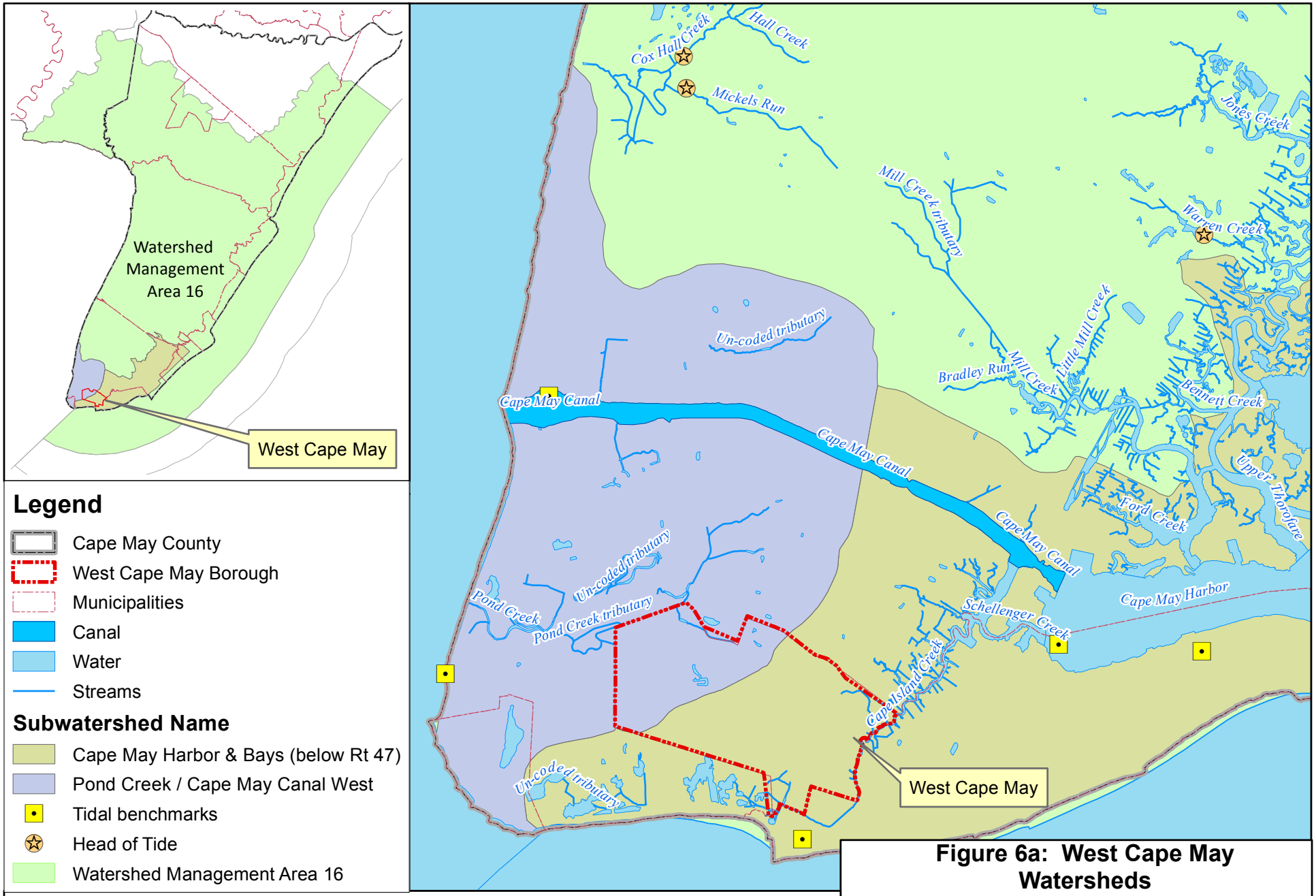
Watershed management is the process of managing and protecting all of the water resources within the area of a watershed, rather than on a site-specific basis. The NJDEP recognizes that watersheds are "nature's boundaries," and has established a watershed management approach (NJDEP, January 1997). A 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. More information concerning watershed management is presented in **Section 10D**. NJDEP has divided the state's watersheds into 20 *Watershed Management Areas (WMAs)*. West Cape May falls within *WMA 16: Cape May* (see top left inset in **Figure 6a**).

Hydrologic Unit Codes (HUC)

The classification system used by the NJDEP assigns each sub-watershed a *14-digit Hydrologic Unit Code (HUC14[20])*. The HUC14 is a hierarchical system where the first 2 digits refer to the USGS Water Resources Region and the first 4 digits (also known as a HUC4) refer to the major

"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."
(NJDEP NJAC 7:9B, April 4, 2011)

[20] The HUC14s have a minimum size of 3,000 acres, although some basins are defined with smaller areas. At other times, small subwatershed units are combined. Note, however, that the current HUC12 numbers are not consistent with this system.



Data Sources: NJDEP, NJDOT
Note: Map accuracy is limited to the accuracy and scale of the original data sets.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Figure 6a: West Cape May Watersheds

The eastern and western sides of the borough fall into two different sub-watersheds. Inset: The entire Cape May peninsula is included in Watershed Management Area 16.

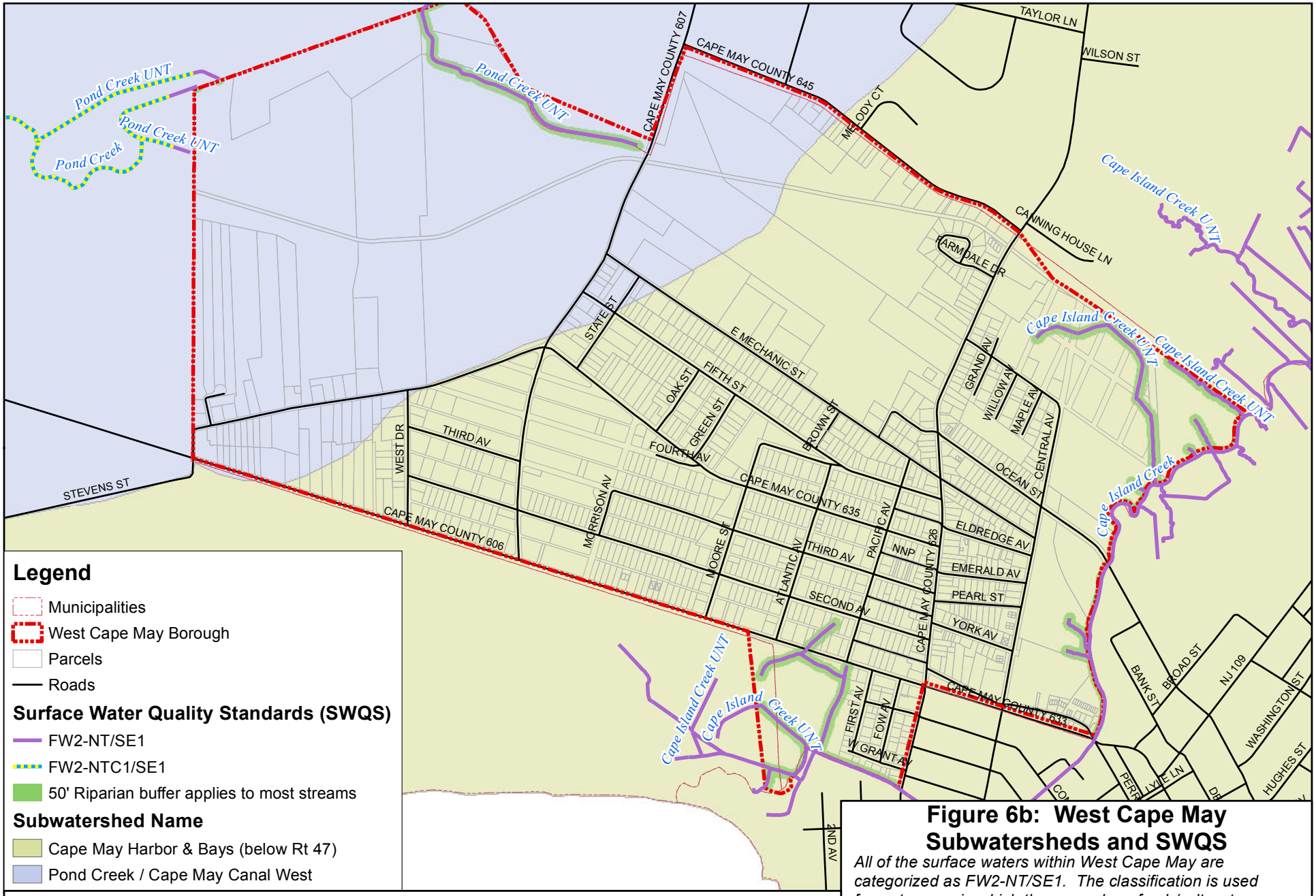


Figure 6b: West Cape May Subwatersheds and SWQS

All of the surface waters within West Cape May are categorized as FW2-NT/SE1. The classification is used for waterways in which there may be a fresh/salt water interface. Some Pond Creek tributaries just west of the borough have a C1 designation, which indicates exceptional significance and provides additional protections for those streams.

drainage basin, or sub-region. Therefore, a HUC2 of "02" is in the Mid-Atlantic Region, and a HUC4 of "0204" is in the Delaware-Mid Atlantic Coastal major drainage basin (USGS, June 23, 2017).

The area of land where water flows generally west towards the Delaware Bay is assigned a HUC8 of "02040206," and every sub-watershed within this basin has a HUC that starts with "02040206." The western half of West Cape May is in this area. Land that drains east to the Atlantic Ocean (Great Egg Harbor to Cape May) is assigned a HUC8 of "02040302," including the eastern half of West Cape May. HUC14 sub-watersheds encompassing the Borough of West Cape May are shown in **Figure 6a** and listed in **Table 6.1**.

Table 6.1: Hydrologic Unit Codes for West Cape May's Sub-watersheds

HUC4	HUC8	14-Digit Hydrologic Unit Code (HUC14)	Sub-watershed Name
0204	02040206	02040206230070	Pond Creek / Cape May Canal West
0204	02040302	02040302080090	Cape May Harbor & Bays (below Rt 47)
Source: NJDEP NJGS, February 25, 2011			

B. Floodplains

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.

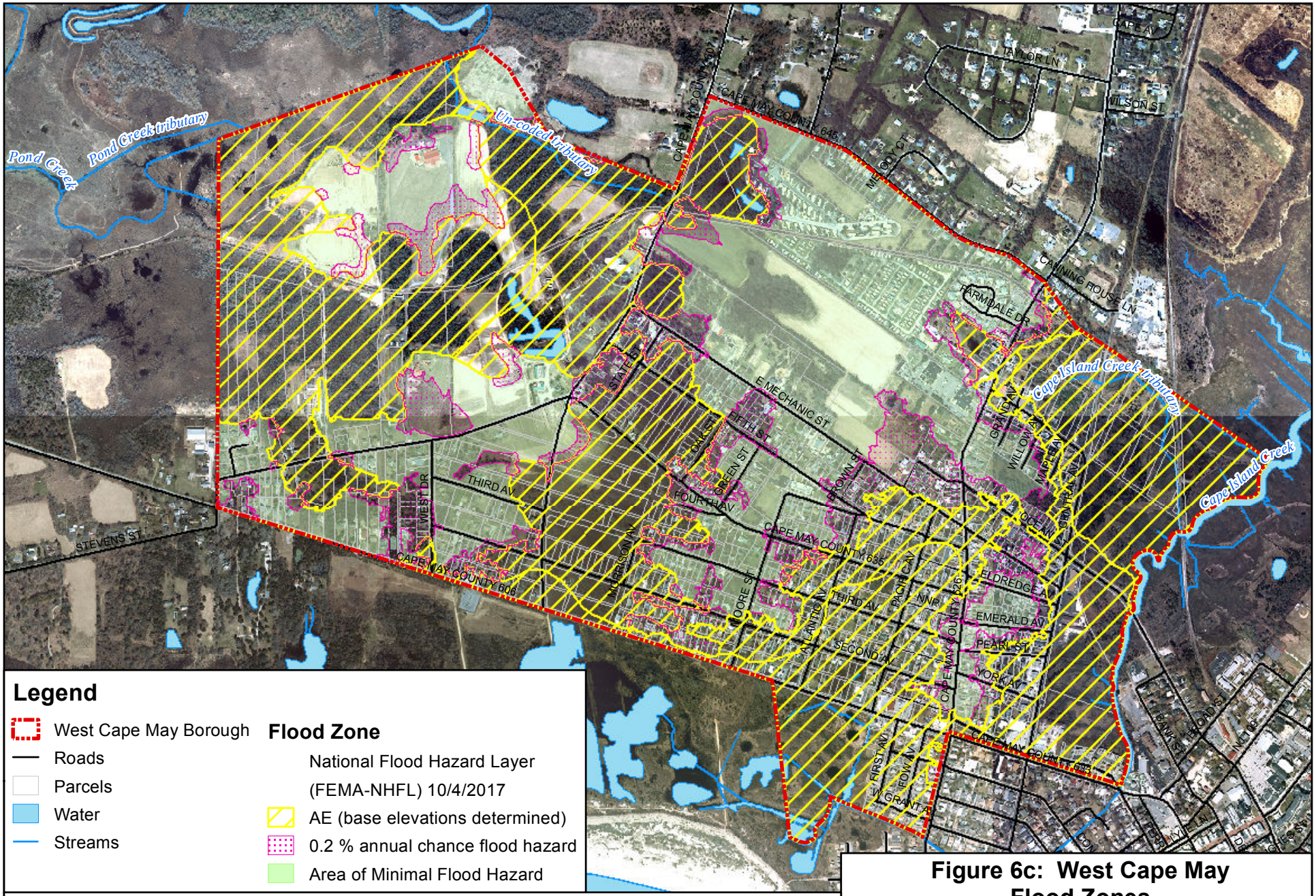
According to FEMA, "Everyone lives in some type of flood zone." (FEMA, June 21, 2007). FEMA defines these geographic areas based on studies of flood risk.

FEMA provides accurate 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, June 29, 2017).

The flood zone boundaries shown in **Figure 6c** are produced using FEMA's National Flood Hazard Layer (FEMA, October 4, 2017). 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[21] (FEMA, March 7, 2017). Below are brief definitions of the FEMA flood zones that occur within West Cape May.

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 West Cape May 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 7, 2017; FEMA, August 6, 2017).

[21] 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).



Data Sources: NJDEP, NJDOT
Note: Map accuracy is limited to the accuracy and scale of the original data sets.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Figure 6c: West Cape May Flood Zones

According to FEMA, approximately 56% of the borough is within the AE Zone (1% annual chance of flooding), while another 13% has a 0.2% annual chance of flooding.

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)

Areas in *Zone X*, which includes approximately 32% of West Cape May, 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[22] 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 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 7, 2017).

Floodplains in West Cape May are shown in **Figure 6c**, based on FEMA determinations (FEMA, October 4, 2017). Approximately 56% of the borough is within the 1% annual chance of flooding, while another 13% 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. These efforts benefit downstream areas, as well.

West Cape May has a flood hazard protection ordinance (Chapter XXIII of the Borough Code) and plan (see **Internet Resources**).

Tidal monitoring and flood forecast gages near West Cape May are shown in **Table 6.2**. Floods are covered in **Section 2.**

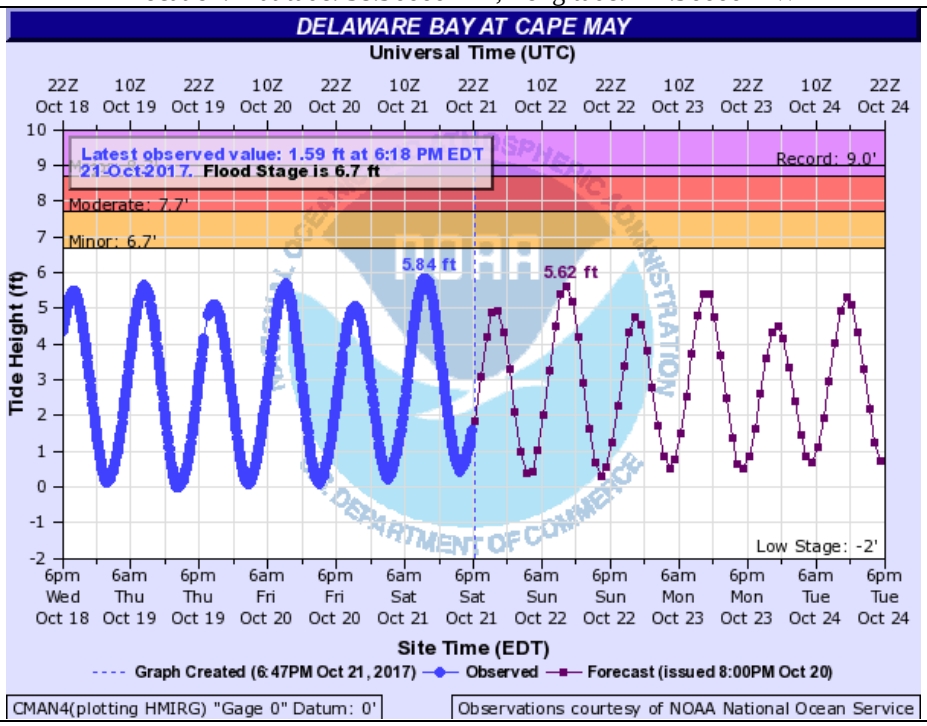
[22] Sheet flow, or overland flow, is flow that occurs overland in places where there are no defined channels, so the flood water spreads out over a large area at a uniform depth.

Table 6.2: National Weather Service Advanced (NOAA) Hydrologic Prediction Service (flood predictions)

Delaware Bay at Cape May

Website: http://water.weather.gov/ahps2/hydrograph.php?wfo=phi&gage=cman4

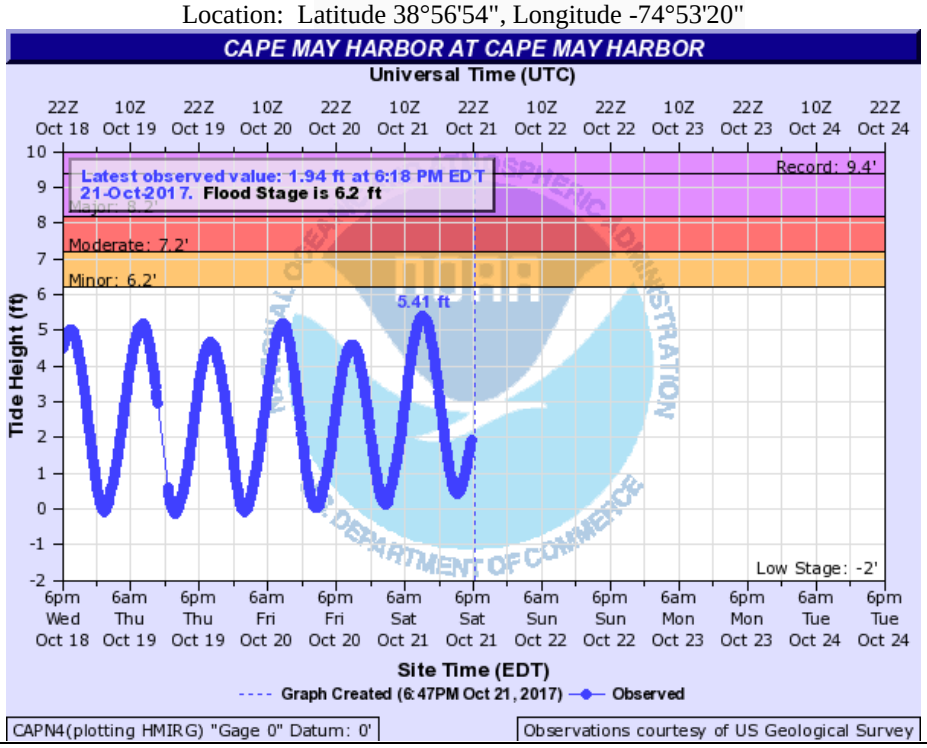
Location: Latitude: 38.966667° N, Longitude: -74.966667° W



Cape May Harbor at Cape May Harbor

Website: http://water.weather.gov/ahps2/hydrograph.php?wfo=phi&gage=capn4

Location: Latitude 38°56'54", Longitude -74°53'20"



C. Wetlands

A *wetland* is a transitional area between aquatic and terrestrial ecosystems. Wetlands are those areas that are inundated or saturated by surface water or ground water 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 types, which 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.

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 July 17, 2017). 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[23].

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 and those contiguous with FW-1, FW-2 Trout Production waters and their tributaries, and Category 1 classified streams (see **Section 6D** for descriptions of stream classifications, below). A determination of threatened and endangered species habitat is provided by using the Landscape Project data (see **Section 7F**).

There are approximately 266 acres of wetlands within West Cape May, or 35% of the borough (NJDEP, February 17, 2015). The wetlands shown in **Figure 6d** were determined by selecting all wetlands land use types from NJDEP's 2012 Land Use GIS data. **Figure 6d** provides guidance on where wetlands are found in West Cape May. This dataset 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 6d**, 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.

There are several types of freshwater wetlands in West Cape May, such as deciduous wooded wetlands, saline marsh (low and high), deciduous scrub/shrub wetlands, and agricultural wetlands (see **Section 7A** and **Figure 7a**).

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

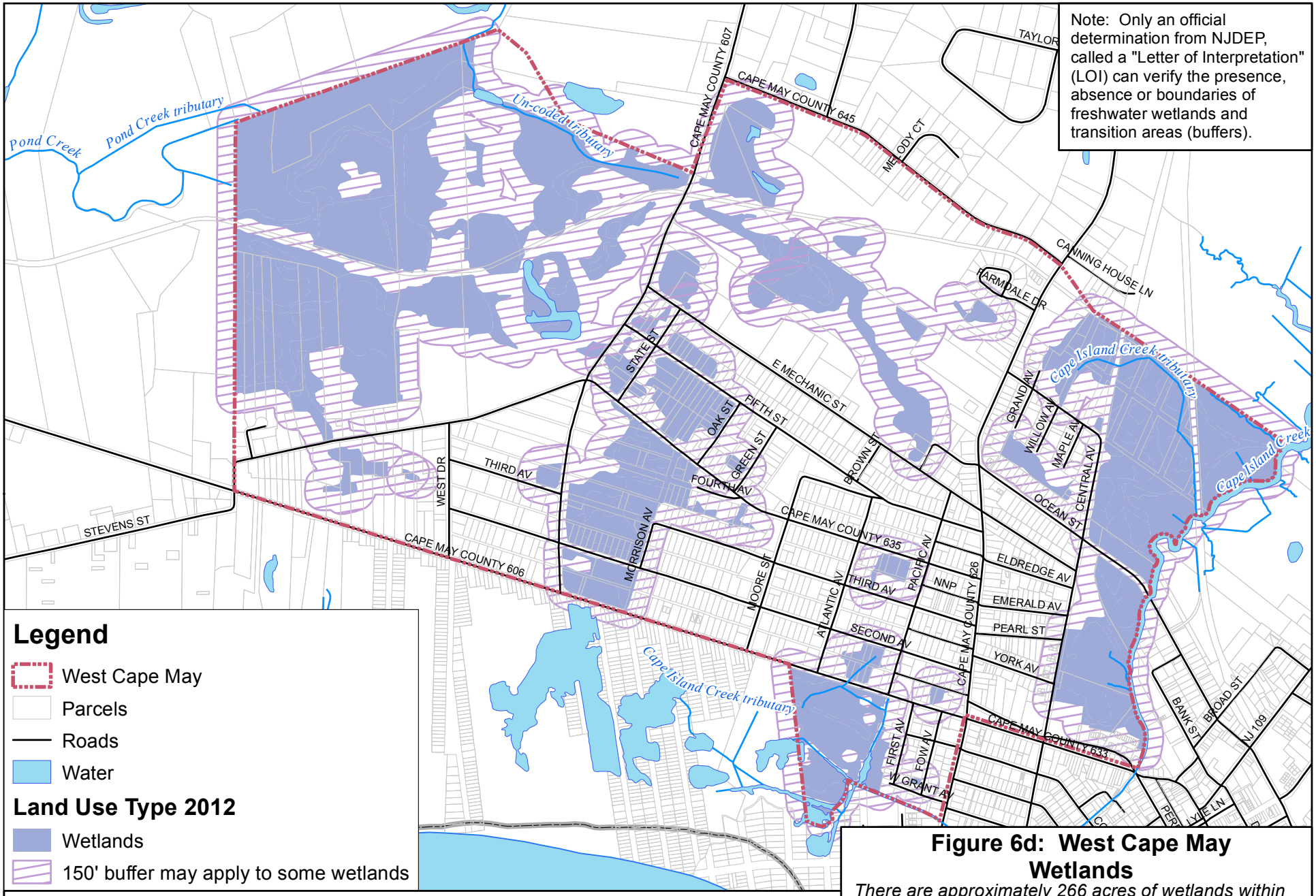


Figure 6d: West Cape May Wetlands

There are approximately 266 acres of wetlands within West Cape May, or 35% of the borough. Buffer areas indicated on the map are based on the maximum width of 150 feet. Actual buffer requirements may be less, depending on the values of individual wetlands.

D. Surface Water Quality Standards

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 Land Use Management, Water Monitoring and Standards, April 4, 2011).

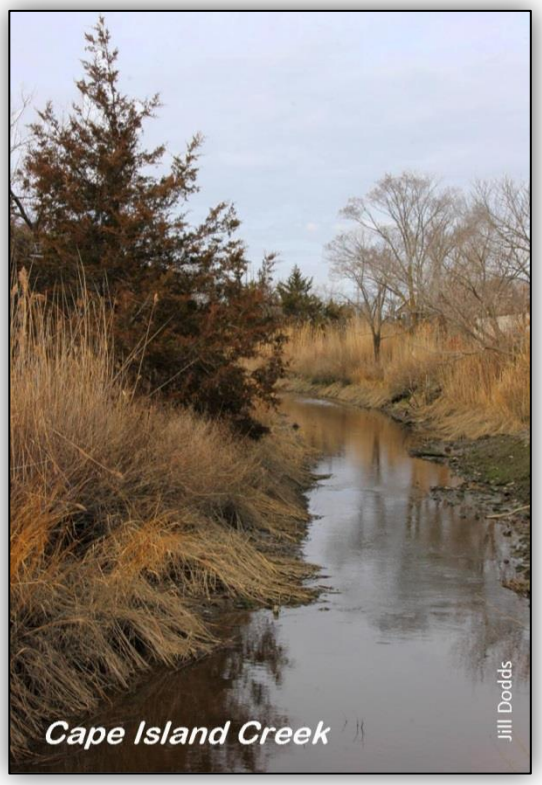
According to the designated uses under the SWQS, NJDEP assigns *surface water classifications* to each stream in order to group waters and assign water quality criteria. Designated uses include potable water, propagation of fish and wildlife, recreation, agricultural and industrial supplies, and navigation. 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.

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 6E**).

Table 6.3 describes the definitions of the surface water classifications. In **Figure 6b**, "category" is shown, which is a compendium of all surface water classification designations for a given water body. Category describes a stream's surface water classification in terms of its general surface water class (e.g. SE1), its trout water status (e.g. NT is non-trout) and its antidegradation status (e.g. C1). All of the surface waters within West Cape May are categorized as FW2-NT/SE1 (as defined by N.J.A.C. 7:9B(f):

> "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, April 4, 2011)

- **FW2-NT/SE1**
  - **Cape Island Creek** - Forms the eastern boundary of the borough



- **Cape Island Creek UNT** – Several small streams in the eastern portion of the borough are small unnamed tributaries of Cape Island Creek.
- **Pond Creek and Pond Creek UNT** – Approximately the western 40% of West Cape May drain to this watershed.

The *Category One (C1)* antidegradation designation provides streams with additional protections that help prevent water quality degradation and discourage development where it would impair or destroy natural resources and water quality. Waterways can be designated C1 because of exceptional ecological significance, exceptional water supply significance, exceptional recreational significance, exceptional shellfish resource, or exceptional fisheries resource (NJDEP Water Monitoring and Standards, June 15, 2017). There are no C1 streams within West Cape May, but Pond Creek and an unnamed tributary of Pond Creek, flowing from the western part of the borough are designated FW2-NTC1/SE1.

The antidegradation provisions of the SWQS are triggered when an applicant proposes an activity that has the potential to lower water quality. Previously approved wastewater discharges authorized through the NJPDES program as well as existing developments are not subject to the antidegradation policies unless a new or expanded activity is proposed. Under the Stormwater Management rules (N.J.A.C. 7:8) and the Flood Hazard Area Control Act rules (N.J.A.C. 7:13), for certain activities proposed adjacent to waters designated as C1, 300 foot buffers must be maintained in a natural state adjacent to all C1 waters and upstream tributaries of C1 waters (including named and unnamed tributaries), unless the disturbance is less than one acre and new impervious surface is less than 0.25 acres. However, where the buffer is already disturbed, the width may be reduced in the disturbed area, but will not be permitted to extend less than 150 feet from either bank. The buffer will not affect existing development. The buffer requirement can also be adjusted to reflect local conditions through the approval of a stream corridor protection plan as part of a regional stormwater management plan (NJDEP Water Monitoring and Standards, June 15, 2017).

Most of the state's Category One waters were designated in 1985 amendments to the SWQS, however no specific basis for these upgrades was documented. C1 upgrades after that were documented, based on their value as trout production (FW2-TP) waters or exceptional ecological significance or exceptional water supply significance.

Table 6.3: Surface Water Quality Standards Classification

Category	Definition
Freshwater General Surface Water Class	
FW1	**FW1** means those fresh waters, as designated in N.J.A.C. 7:9B-1.15(j), that are to be maintained in their natural state of quality (set aside for posterity) and not subjected to any man-made wastewater discharges or increases in runoff from anthropogenic activities. These waters are set aside for posterity because of their clarity, color, scenic setting, other characteristic of aesthetic value, unique ecological significance, exceptional recreational significance, exceptional water supply significance or exceptional fisheries resource(s).
FW2	**FW2** means the general surface water classification applied to those fresh waters that are not designated as FW1 or Pinelands Waters. In all FW2 waters the designated uses are: 1. Maintenance, migration and propagation of the natural and established biota; 2. Primary contact recreation; 3. Industrial and agricultural water supply; 4. Public potable water supply after conventional filtration treatment (a series of processes including filtration, flocculation, coagulation, and sedimentation, resulting in substantial particulate removal but no consistent removal of chemical constituents) and disinfection; and 5. Any other reasonable uses.
Saline Water General Surface Water Class	
SC	**Saline waters** means waters having salinities generally greater than 3.5 parts per thousand at mean high tide. **SC** means the general surface water classification applied to coastal saline waters.
SE	**SE** means the general surface water classification applied to saline waters of estuaries.
Trout Water Status - this is for information only and does not affect the water quality criteria for those waters.	
TP	***Trout production*** means waters designated at N.J.A.C. 7:9B-1.15I through (i) for use by trout for spawning or nursery purposes during their first summer.
TM	***Trout maintenance*** means waters designated at N.J.A.C. 7:9B-1.15I through (i) for the support of trout throughout the year.
NT	***Nontrout waters*** means fresh waters that have not been designated in N.J.A.C. 7:9B-1.15I through (h) as trout production or trout maintenance. These waters are generally not suitable for trout because of their physical, chemical, or biological characteristics, but are suitable for a wide variety of other fish species.
Antidegradation	
ONRW	***Outstanding National Resource Waters*** means high quality waters that constitute an outstanding national resource (for example, waters of National/State Parks and Wildlife Refuges and waters of exceptional recreational or ecological significance). Waters classified as FW1 waters and Pinelands waters are Outstanding National Resource Waters.
FW1/Non-degrada-tion	***Nondegradation waters*** means those waters set aside for posterity because of their clarity, color, scenic setting, other characteristic of aesthetic value, unique ecological significance, exceptional recreational significance, or exceptional water supply significance. These waters include all waters designated as FW1.
C1	***Category one waters*** means those waters designated in the tables in N.J.A.C. 7:9B-1.15(c) through (i), for purposes of implementing the antidegradation policies set forth at N.J.A.C. 7:9B-1.5(d), for protection from measurable changes in water quality based on exceptional ecological significance, exceptional recreational significance, exceptional water supply significance or exceptional fisheries resource(s) to protect their aesthetic value (color, clarity, scenic setting) and ecological integrity (habitat, water quality and biological functions).
C2	***Category two waters*** means those waters not designated as Outstanding National Resource Waters or Category One at N.J.A.C. 7:9B-1.15 for purposes of implementing the antidegradation policies set forth at N.J.A.C. 7:9B-1.5(d).
Source: NJDEP Land Use Management, Water Monitoring and Standards, April 4, 2011	

E. Integrated List and Total Maximum Daily Loads

States are required by the Federal Clean Water Act (US Federal Water Pollution Control Act, January 4, 2011) 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 6D**) are attained, and improving the quality of surface waters that do not attain their designated uses (NJDEP BEARS, May 2017 (final)).

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[24] sub-watershed) by labeling the results of each designated use assessment as *Fully Supporting*, *Not Supporting*, or *Insufficient Information* (see **Table 6.4**).

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, DWMS, BEARS, February 2015).

The 2014 Integrated List, which summarizes whether or not the surface water quality of West Cape May's two subwatersheds meet the SWQS, is shown in **Table 6.4** and **Figure 6e**. The water quality supports the recreational use of waters in the eastern portion of the borough, while other uses are either not supported or there is insufficient information to assess them. No changes were noted compared to the 2012 assessment. **Table 6.5** displays more information about the impaired waters within West Cape May.

Table 6.4: 2012 Integrated List (Overview)

Assessment Unit (HUC14)	Sub-watershed	Designated Use★					
		Aquatic Life General	Aquatic Life Trout	Recreation	Water Supply	Shellfish	Fish Consumption
02040302080090	Cape May Harbor & Bays (below Rt 47)	Not Supporting	N/A	Fully Supporting	N/A	Not Supporting	Insufficient Data
02040206230070	Pond Creek / Cape May Canal West	Not Supporting	N/A	Insufficient Data	N/A	Not Supporting	Not Supporting
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, DWMS, BEARS, February 2015)							
Source: NJDEP Water Monitoring and Standards, May 2017 (final); NJDEP, DWMS, BEARS, February 2015							

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, January 4, 2011). A TMDL identifies all the contributors to surface water quality impacts and sets goals for load[25] reductions for specific pollutants in

[24] HUC14 = 14-digit Hydrologic Unit Code (see **Section 6a** for definition)

[25] 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, 2017).

order to meet the SWQS. Regulations concerning TMDLs are contained in EPA's Water Quality Planning and Management Regulations (USEPA, 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 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, March 9, 2017).

Table 6.5: Integrated Water Quality Assessment (Details)

Use	Attain-ment	Cause	First on 303(d) List	TMDL Priority*	Source
02040302080090	**Cape May Harbor & Bays (below Rt 47)**				
Aquatic Life	**N**	Oxygen, Dissolved	2010	Medium	Urban Runoff/ Storm Sewers
Shellfish	**N**	Total Coliform	2006	Completed Sublist 4	
02040206230070	**Pond Creek / Cape May Canal West**				
Fish Consumption	**N**	PCB in Fish Tissue	2006	Low Sublist L	Contaminated Sediments
Aquatic Life	**N**	Phosphorus	2004	Completed Sublist 4	Urban Runoff/ Storm Sewers
Shellfish	**N**	Total Coliform	2014	Completed Sublist 4	Urban Runoff/ Storm Sewers

*__Designated Uses:__ **N** = Not Supporting
*__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 Water Monitoring and Standards, May 2017 (final)

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.

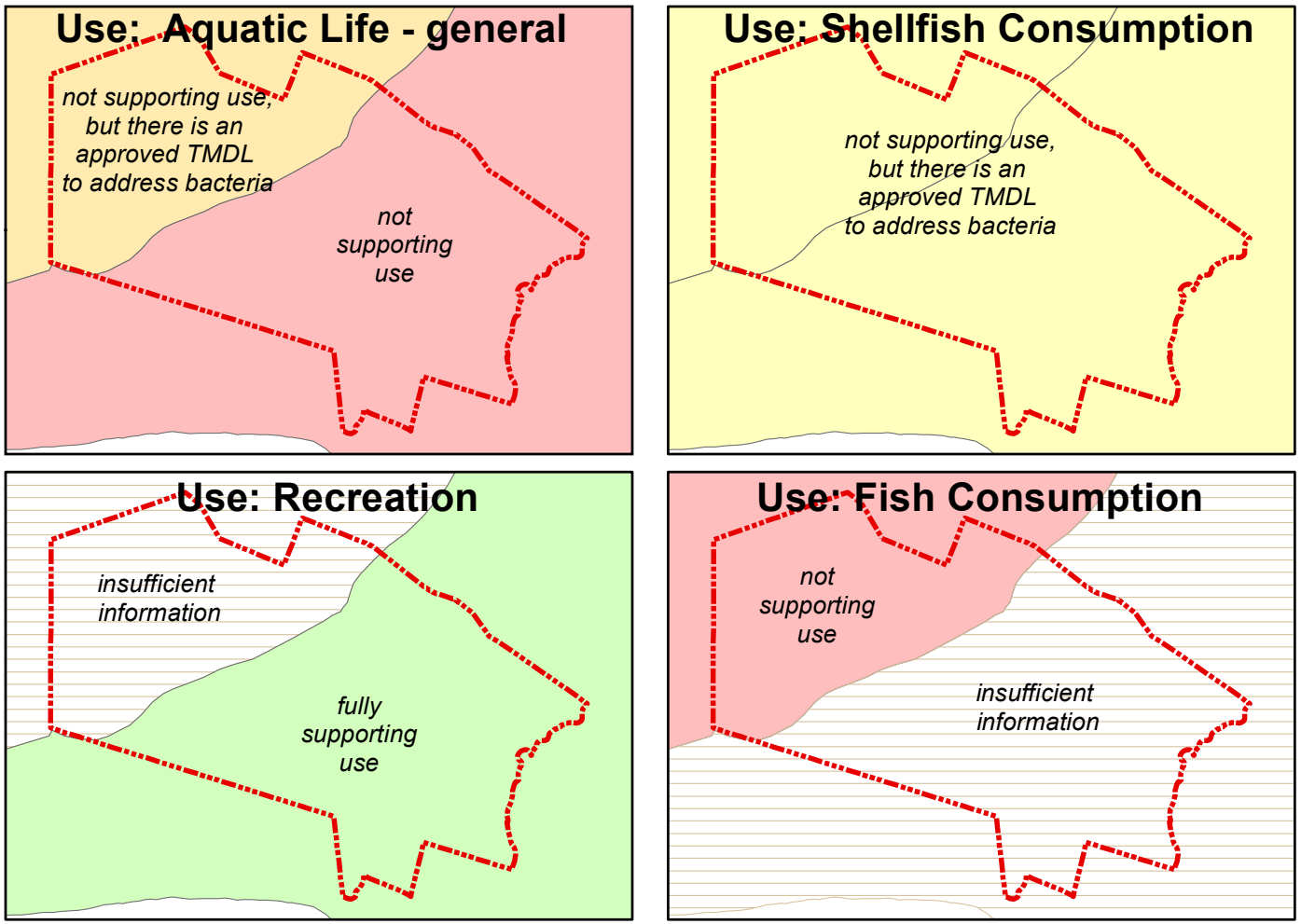


Figure 6e: West Cape May 2014 Integrated List

The Clean Water Act requires the NJDEP to assess the state's surface waters with respect to whether the water quality is good enough to support the designated uses. The surface waters in and around West Cape May are designated to be used for aquatic life (general, i.e. not trout), shellfish consumption, recreation and fish consumption. The assessments are done on a HUC14 level (see Section 6A and Figure 6a). Assessment details are presented in Table 6.4 and Table 6.5. The water quality of waters in the eastern portion of the borough support recreational use. Other uses are either not supported or there is insufficient information to assess them.

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, March 9, 2017).

The NJDEP developed a TMDL to address total coliform (bacterial) impairments based on the 2004 Integrated List of Waterbodies in twenty waterbodies in WMA 16. In that list, waterbodies that did not fully support shellfish harvest according with National Shellfish Sanitation Program (NSSP) criteria were determined to be impaired. New Jersey Surface Water Quality Standards (SWQS) specify that shellfish waters must meet the stringent guidelines of the NSSP to protect against the harvest of shellfish in waters where the sanitary quality could have health risks for consumers. The TMDL outlines actions such as source trackdown and installation of best management practices (BMPs) for stormwater to achieve load reduction targets (NJDEP and Tetra Tech, Inc. September 27, 2006).

No other TMDLs for either of West Cape May's subwatersheds are scheduled for completion within the next two years (NJDEP Water Monitoring and Standards, May 2017 (final).

Amendment to the Cape May County and Lower Delaware Water Quality Management Plans Ten Total Maximum Daily Loads for Total Coliform to Address Shellfish-Impaired Waters in Watershed Management Area 16 Atlantic Coastal Water Region. Approved: September 27, 2006. Prepared by: New Jersey Department of Environmental Protection And With assistance provided by: U.S. Environmental Protection Agency, Region 2

F. 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 Land Use Management, Water Monitoring and Standards, April 4, 2011).

Point source discharges are regulated by NJDEP under the New Jersey Pollutant Discharge Elimination System (NJPDES). There are 2 existing discharges within or on the border of West Cape May (see **Table 6.6** and **Figure 6f**) (NJDEP, Division of Water Quality, Bureau of Surface Water Permitting. June 14, 2017).

G. 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.

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.

Table 6.6: NJ Pollutant Discharge Elimination System Surface Water Discharges

PI #	NJPDES ID. #	Facility Name	Status*	Discharge Type*	Receiving Waters
47725	NJ0108341	Cape May Desalination Project	E	Industrial Category B	Cape Island Creek
744321	NJG0262498	Former Cape May MGP Site	E	B4B General Petroleum Product Cleanup	Cape Island Creek

***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: **B**=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**=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, Environmental Regulation, Division of Water Quality, June 14, 2017; NJDEP Bureau of Surface Water Permitting, January 6, 2016

An increase in impervious surface results in less water infiltrating to the soil and groundwater, 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).

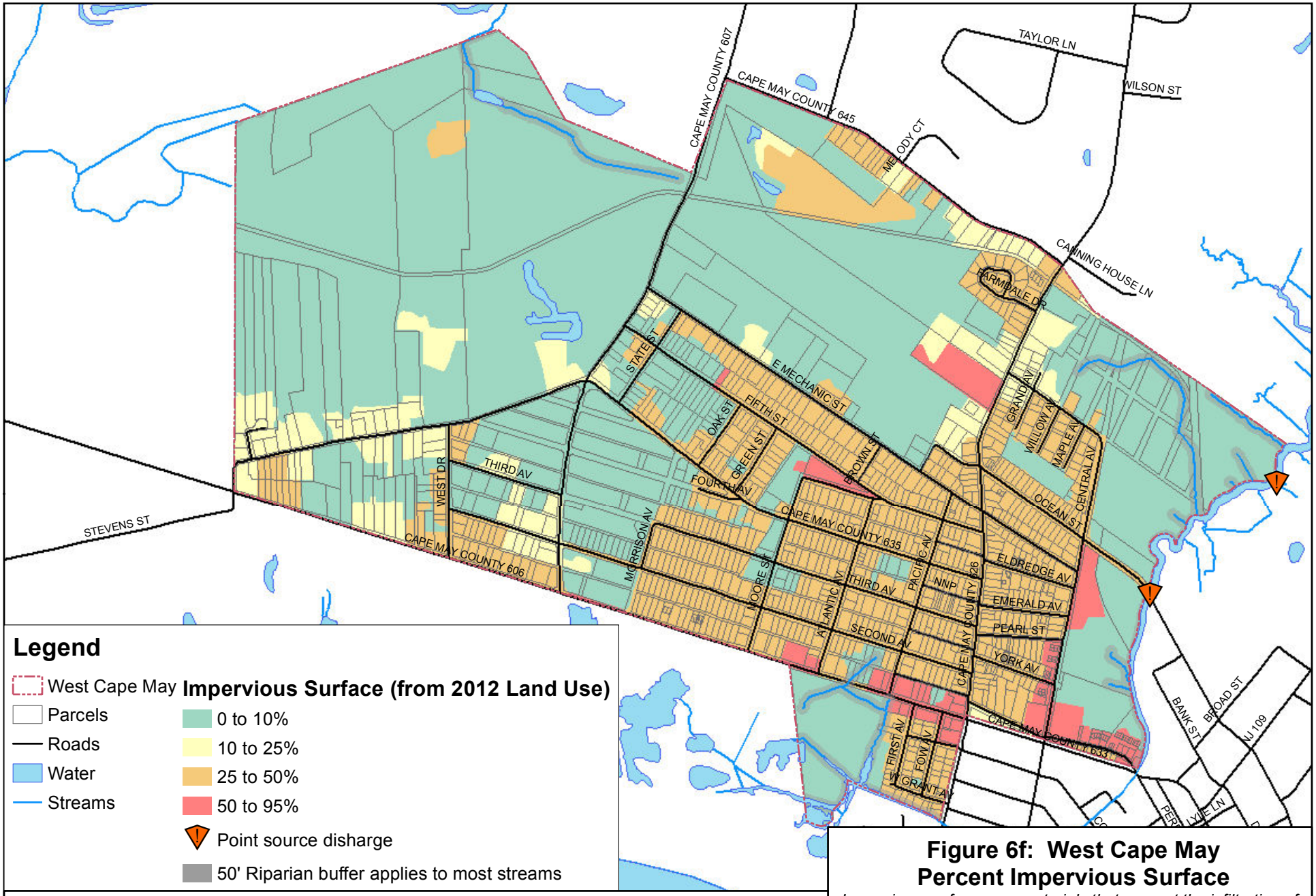
Studies have shown that the level where impacts begin to be seen is above 10% impervious surfaces, and that impacts become severe over 25 to 30% (Kaplan and Ayers, April 5, 2000).

NJDEP determined approximate percent impervious surface based on particular land uses. Using the approximation calculated using the 2012 land use data, West Cape May is 21% impervious (161 acres) (see **Figure 6f)** (NJDEP, February 17, 2015).

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).

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 West Cape May) or Tier B (less developed and non-coastal) (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, April 2004).



Data Sources: NJDEP, NJDOT
Note: Map accuracy is limited to the accuracy and scale of the original data sets.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Prepared by Kratzer Environmental Services

Figure 6f: West Cape May Percent Impervious Surface

Impervious surfaces are materials that prevent the infiltration of water into the soil such as parking lots, roads, buildings, sidewalks and compacted soil. Just over a fifth of West Cape May is impervious. Two point source pollution discharge sites are also located on the eastern border of the borough.

Chapter XXII Stormwater Control of the West Cape May Borough Code addresses stormwater management (see **Internet Resources**).

H. Surface Water Quality and Flow Monitoring

There are no routine NJDEP surface water quality monitoring sites within West Cape May. The NJDEP Bureau of Marine Water Monitoring collects samples from the coastal waters surrounding the Cape May Peninsula and analyzes them at its laboratory facilities at Leeds Point, NJ. Parameters such as salinity, dissolved oxygen, suspended solids and nutrients are measured to assess the ecological health of New Jersey's coastal waters See Internet Resources for a link to download the raw data for the Coastal Monitoring Network (BFBM, February 3, 2017).

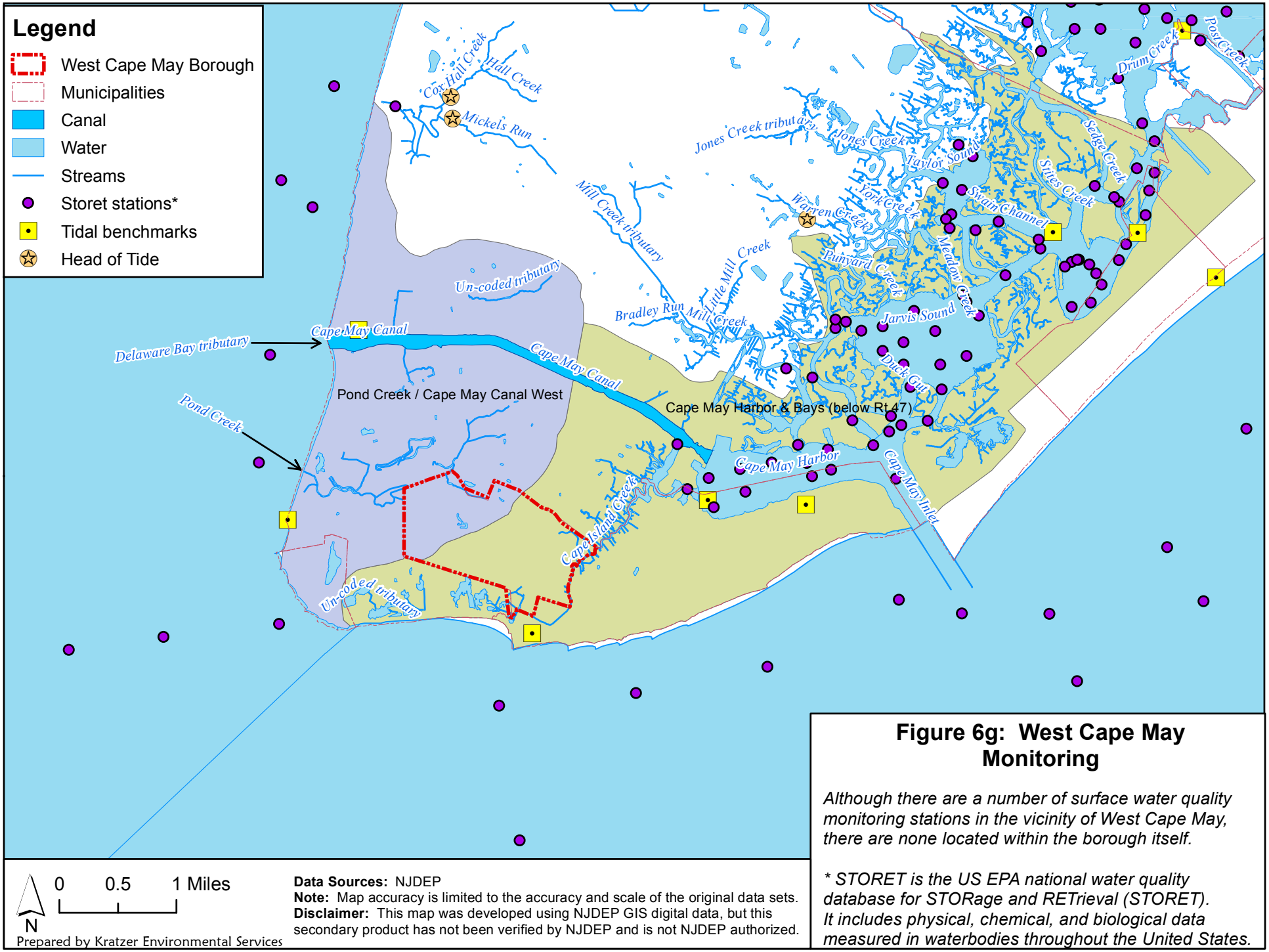
Data collected by some sampling programs and from certain sites are input into EPA's national STORET[26] water quality database. These sites are indicated on **Figure 6g**.

I. 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.

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 2017 fish consumption advisories for fish caught anywhere in the state are listed in **Table 6.7**. See the **Internet References** for more information, such as fish preparation guidelines and annual updates.

[26] **STORET** is the U.S. Environmental Protection Agency (EPA) national water quality database for STORage and RETrieval (STORET). It includes physical, chemical, and biological data measured in waterbodies throughout the United States.



Data Sources: NJDEP
Note: Map accuracy is limited to the accuracy and scale of the original data sets.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Figure 6g: West Cape May Monitoring

Although there are a number of surface water quality monitoring stations in the vicinity of West Cape May, there are none located within the borough itself.

** STORET is the US EPA national water quality database for STORage and RETrieval (STORET). It includes physical, chemical, and biological data measured in waterbodies throughout the United States.*

Table 6.7: 2017 Fish Consumption Advisories

LOCATION	SPECIES	ADVISORY/PROHIBITION(1)	
		General Population Range of Recommended Meal Frequency(2)	**High-Risk Individuals** (3)
		DO NOT EAT MORE THAN:	**DO NOT EAT MORE THAN:**
Delaware Estuary & Delaware Bay – Chesapeake & Delaware (C&D) Canal out to the mouth of Delaware Bay	Striped Bass	One meal per year	Do Not Eat
	White Perch	One meal per year	Do Not Eat
	White Catfish	One meal per year	Do Not Eat
	Channel Catfish	One meal per year	Do Not Eat
	America Eel	One meal per year	Do Not Eat
	Bluefish	Do Not Eat fish larger than 6lbs or 24 inches— One meal per year of fish less than 6lbs or less than 24 inches	Do Not Eat
	Weakfish	One meal per week	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)**	
Statewide Freshwater – All water bodies except those listed separately	Trout - (Brown, Brook Rainbow and Hybrid)	One meal per week	One meal per week
	Chain Pickerel	One meal per week	One meal per month
	Sunfish (bluegill, pumpkinseed and redbreast)	No restrictions	One meal per week
	Brown Bullhead	No restrictions	One meal per month
	Yellow Bullhead	No restrictions	One meal per month
	Common Carp	One meal per week	One meal per month

**** Important Consumption Reminders ****

(1) 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). See text for full description.

(2) One meal is defined as an eight-ounce serving.

(3) High-Risk Individuals include infants, children, pregnant women, nursing mothers and women of childbearing age.

Source: NJDEP Division of Science and Research, 2017 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

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Internet Resources: Surface Water

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: http://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

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

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) http://www.nj.gov/dep/landuse/fha_main.html

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

National Weather Service Advanced (NOAA) Hydrologic Prediction Service (flood predictions):
Delaware Bay at Cape May: http://water.weather.gov/ahps2/hydrograph.php?wfo=phi&gage=cman4
Cape May Harbor at Cape May Harbor:
http://water.weather.gov/ahps2/hydrograph.php?wfo=phi&gage=capn4

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http://clerkshq.com/default.ashx?clientsite=westcapemay-nj

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

SWQS
Category One Waters: http://www.nj.gov/dep/wms/bears/c1waters.htm

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

Point Source Pollution
NJPDES Permitting: http://www.nj.gov/dep/dwq/database.htm

Non-Point Source Pollution / Stormwater:
NJDEP's Stormwater Website (includes links to all of the following, and more): http://www.njstormwater.org/ or 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/

USEPA Nonpoint Source Pollution: http://water.epa.gov/polwaste/nps/index.cfm

Surface Water Quality and Flow
Coastal water quality data: http://www.nj.gov/dep/bmw/delaware2.htm

National Weather Service Advanced (NOAA) Hydrologic Prediction Service (flood predictions):
Delaware Bay at Cape May: http://water.weather.gov/ahps2/hydrograph.php?wfo=phi&gage=cman4
Cape May Harbor at Cape May Harbor:
http://water.weather.gov/ahps2/hydrograph.php?wfo=phi&gage=capn4

NJDEP Drought Information: http://www.njdrought.org/

USEPA STORET Database: http://www.epa.gov/storet

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/

Fish Advisories & Guides
NJ Division of Science & Research Fish Advisories Home Page: http://www.state.nj.us/dep/dsr/njmainfish.htm

Fish Smart Eat Smart: http://www.state.nj.us/dep/dsr/fishsmart.pdf

NJDEP Regulations:
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

7: BIOLOGICAL RESOURCES

A. Dominant Vegetation (Land Cover)

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 exotic species and exotic diseases, overpopulations of deer and geese, and pollution.

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 (2007 and 2012 aerial photos are shown in **Figure 1d** and **Figure 1e**, respectively) 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, it cannot provide information about the particular species found in an area. The land cover classifications are shown in **Figures 7a, 7b, and 7c**. The relative proportion of each within West Cape May is provided in the acreage figures in **Table 7.1** (NJDEP, 2010).

The largest portion of land in West Cape May is classified as Urban (43.72%). Another 13.88% is utilized for agriculture, while 5.61% of the borough's wetlands have been modified for agricultural, residential or other purposes. Together, these categories account for about 63% of the borough. The remaining 37% of the land is primarily either unmodified wetlands (29.70%) or forested land (5.63%). Open water and barren land each account for less than one percent of the total land use (NJDEP, 2010).

Roughly seventeen percent of the borough is classified as either a wetland (13.57%) or a forest (3.76%) land use type that is dominated by trees. In recognition of the many benefits of trees, the Borough of West Cape May has adopted two ordinances (494-2015 and 515-2016) for the preservation and protection of trees that add special value to the community because of their size, rarity, historical, environmental or aesthetic importance (Borough of West Cape May, Chapter XXX).

Table 7.1: Land Use/Land Cover (Anderson Classification) in West Cape May

Land Cover Code	Land Cover Name	Acres*	Percent of Borough
URBAN LAND USE TYPE			
1110	RESIDENTIAL, HIGH DENSITY OR MULTIPLE DWELLING	34.23	4.54%
1120	RESIDENTIAL, SINGLE UNIT, MEDIUM DENSITY	185.95	24.64%
1130	RESIDENTIAL, SINGLE UNIT, LOW DENSITY	36.49	4.84%

Land Cover Code	Land Cover Name	Acres*	Percent of Borough
1140	RESIDENTIAL, RURAL, SINGLE UNIT	10.23	1.36%
1200	COMMERCIAL/SERVICES	26.83	3.56%
1400	TRANSPORTATION/COMMUNICATION/UTILITIES	3.77	0.50%
1420	RAILROADS	0.88	0.12%
1600	MIXED URBAN OR BUILT-UP LAND	1.82	0.24%
1700	OTHER URBAN OR BUILT-UP LAND	10.42	1.38%
1800	RECREATIONAL LAND	16.57	2.20%
1804	ATHLETIC FIELDS (SCHOOLS)	2.72	0.36%
	Total Acres of URBAN:	**329.91**	**43.72%**
AGRICULTURE LAND USE TYPE			
2100	CROPLAND AND PASTURELAND	77.15	10.22%
2200	ORCHARDS/VINEYARDS/NURSERIES/HORTICULTURAL AREAS	12.9	1.71%
2400	OTHER AGRICULTURE	14.7	1.95%
	Total Acres of AGRICULTURE:	**104.75**	**13.88%**
FOREST LAND USE TYPE			
4110	DECIDUOUS FOREST (10-50% CROWN CLOSURE)	5.64	0.75%
4120	DECIDUOUS FOREST (>50% CROWN CLOSURE)	14.36	1.90%
4210	CONIFEROUS FOREST (10-50% CROWN CLOSURE)	4.49	0.59%
4220	CONIFEROUS FOREST (>50% CROWN CLOSURE)	0.01	0.00%
4312	MIXED FOREST (>50% CONIFEROUS WITH >50% CROWN CLOSURE)	2.05	0.27%
4322	MIXED FOREST (>50% DECIDUOUS WITH >50% CROWN CLOSURE)	1.88	0.25%
4410	OLD FIELD (< 25% BRUSH COVERED)	2.89	0.38%
4420	DECIDUOUS BRUSH/SHRUBLAND	9.51	1.26%
4440	MIXED DECIDUOUS/CONIFEROUS BRUSH/SHRUBLAND	1.64	0.22%
	Total Acres of FOREST:	**42.47**	**5.63%**
WATER LAND USE TYPE			
5300	ARTIFICIAL LAKES	2.92	0.39%
5410	TIDAL RIVERS, INLAND BAYS, AND OTHER TIDAL WATERS	3.09	0.41%
	Total Acres of WATER:	**6.01**	**0.80%**
WETLANDS LAND USE TYPE			
1750	MANAGED WETLAND IN MAINTAINED LAWN GREENSPACE	1.23	0.16%
2140	AGRICULTURAL WETLANDS (MODIFIED)	39.02	5.17%
2150	FORMER AGRICULTURAL WETLAND (BECOMING SHRUBBY, NOT BUILT-UP)	2.99	0.40%
6111	SALINE MARSH (LOW MARSH)	27.44	3.64%
6112	SALINE MARSH (HIGH MARSH)	21.54	2.85%
6141	PHRAGMITES DOMINATE COASTAL WETLANDS	27.91	3.70%
6210	DECIDUOUS WOODED WETLANDS	90.89	12.04%
6231	DECIDUOUS SCRUB/SHRUB WETLANDS	13.46	1.78%
6232	CONIFEROUS SCRUB/SHRUB WETLANDS	1.89	0.25%
6233	MIXED SCRUB/SHRUB WETLANDS (DECIDUOUS DOM.)	7.2	0.95%
6234	MIXED SCRUB/SHRUB WETLANDS (CONIFEROUS DOM.)	0.75	0.10%

Land Cover Code	Land Cover Name	Acres*	Percent of Borough
6240	HERBACEOUS WETLANDS	0.72	0.10%
6241	PHRAGMITES DOMINATE INTERIOR WETLANDS	17.72	2.35%
6251	MIXED WOODED WETLANDS (DECIDUOUS DOM.)	11.53	1.53%
7430	DISTURBED WETLANDS (MODIFIED)	1.32	0.17%
7440	DISTURBED TIDAL WETLANDS	0.82	0.11%
	Total Acres of WETLANDS:	**266.43**	**35.31%**
BARREN LAND USE TYPE			
7500	TRANSITIONAL AREAS	5.06	0.67%
	Total Acres of BARREN LAND:	**5.06**	**0.67%**
	West Cape May Borough Totals:	**754.63**	**100.00%**
* Acreage from the GIS data may vary from acreage calculated based on tax maps.			
Source: NJDEP, 2010; USGS, 2010.			

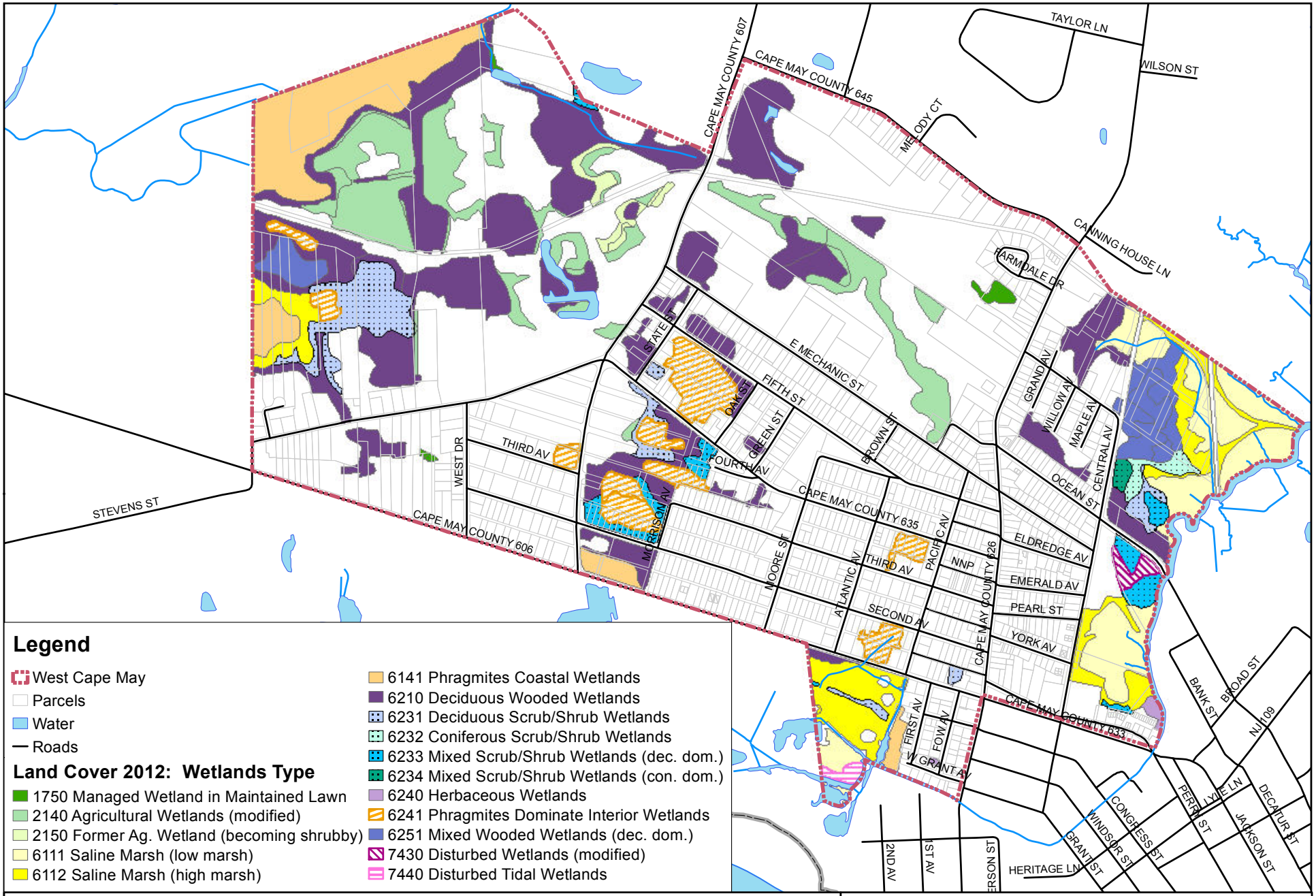
B. Wildfire Fuel Hazard

The New Jersey Forest Fire Service (NJFFS), a division of NJDEP, assessed *Wildfire Fuel Hazard* (WFH) throughout New Jersey (see **Figure 7d** and **Table 7.2**). 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, 2009).

The majority of West Cape May is either not rated or rated Low Wildfire Fuel Hazard. The highest wildfire risk areas in the borough are phragmites stands and high salt marsh.

Table 7.2: Wildfire Fuel Hazard

Fuel Hazard	Fire Description	Acres	Percent
0	water	4.6	1%
1	low	189.7	25%
2	moderate	61.1	8%
3	high	52.8	7%
4	very high	36.9	5%
5	extreme	3.9	1%
6	urban	303.7	40%
7	agriculture	94.2	12%
8	barren land	7.8	1%
	Total	**754.6**	**100%**



Legend

- West Cape May
- Parcels
- Water
- Roads

Land Cover 2012: Wetlands Type

- 1750 Managed Wetland in Maintained Lawn
- 2140 Agricultural Wetlands (modified)
- 2150 Former Ag. Wetland (becoming shrubby)
- 6111 Saline Marsh (low marsh)
- 6112 Saline Marsh (high marsh)
- 6141 Phragmites Coastal Wetlands
- 6210 Deciduous Wooded Wetlands
- 6231 Deciduous Scrub/Shrub Wetlands
- 6232 Coniferous Scrub/Shrub Wetlands
- 6233 Mixed Scrub/Shrub Wetlands (dec. dom.)
- 6234 Mixed Scrub/Shrub Wetlands (con. dom.)
- 6240 Herbaceous Wetlands
- 6241 Phragmites Dominate Interior Wetlands
- 6251 Mixed Wooded Wetlands (dec. dom.)
- 7430 Disturbed Wetlands (modified)
- 7440 Disturbed Tidal Wetlands

0 0.1 0.2 Miles

N

Prepared by Kratzer Environmental Services

Data Sources: NJDEP, NJDOT
Note: Map accuracy is limited to the accuracy and scale of the original data sets.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Figure 7a: West Cape May
Land Cover 2012: Wetlands Type
Wetlands account for approximately 35% of the land cover in West Cape May Borough.

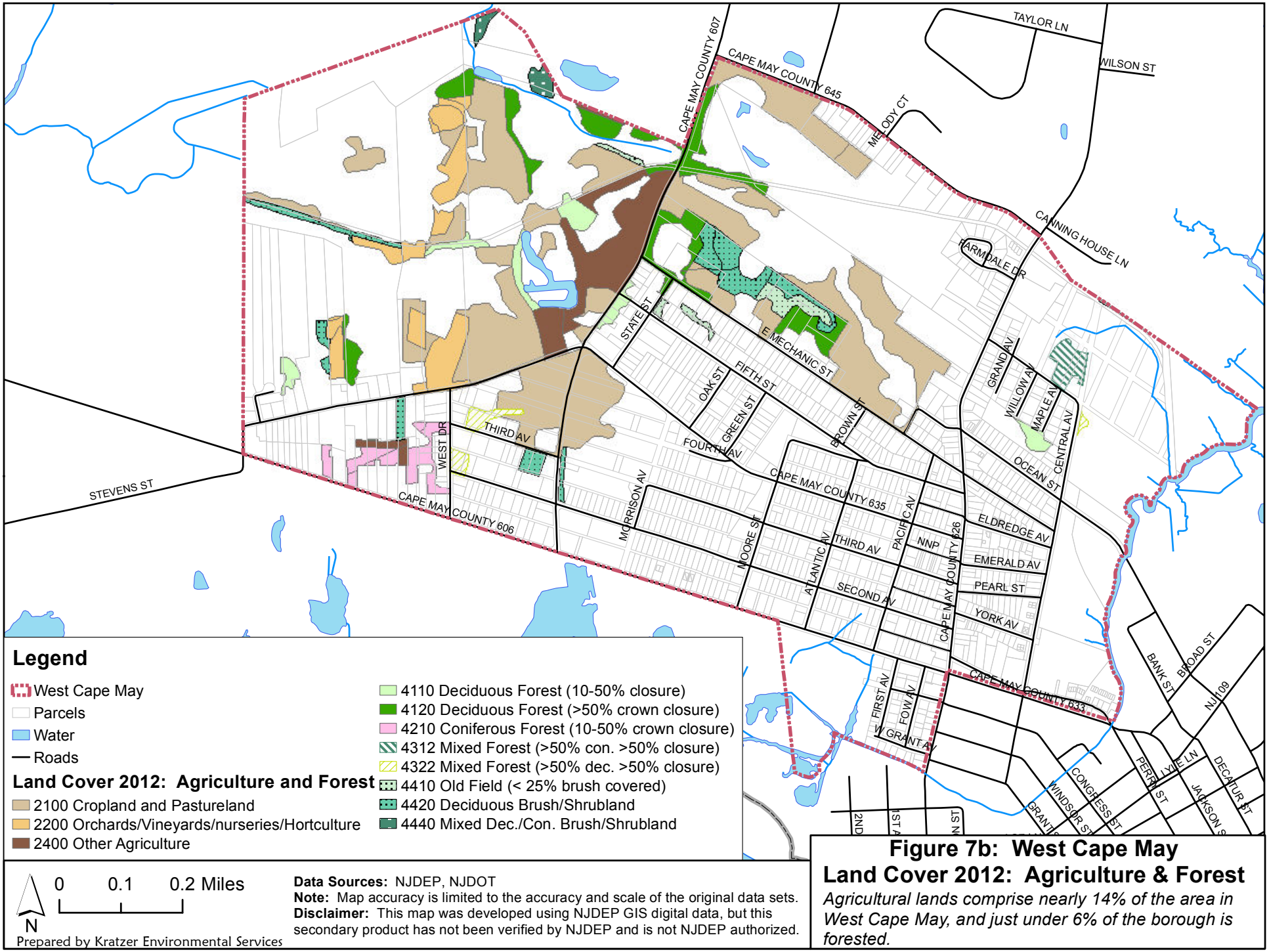
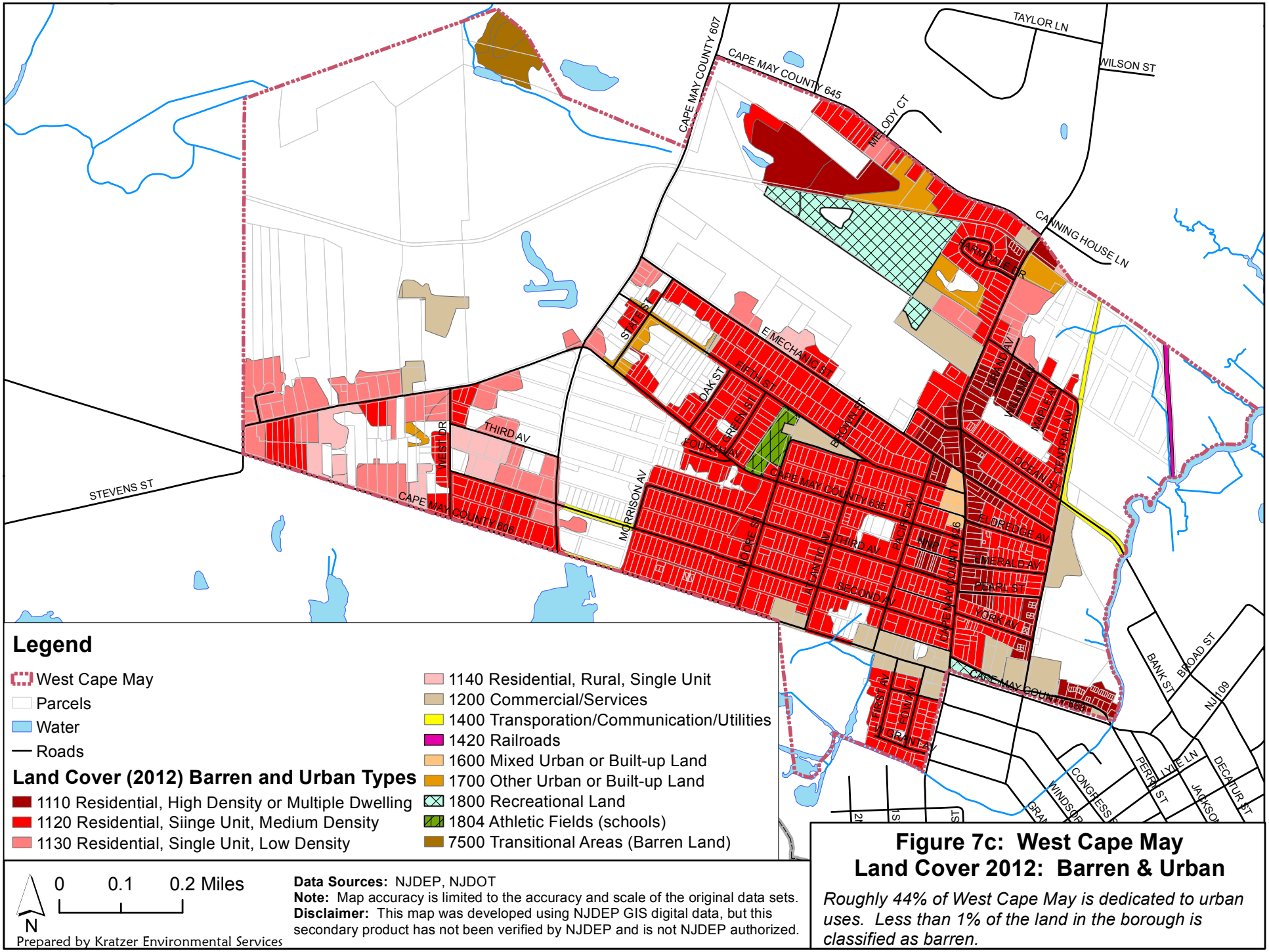


Figure 7b: West Cape May
Land Cover 2012: Agriculture & Forest

Agricultural lands comprise nearly 14% of the area in West Cape May, and just under 6% of the borough is forested.



Legend

- West Cape May
- Parcels
- Water
- Roads

Land Cover (2012) Barren and Urban Types

- 1110 Residential, High Density or Multiple Dwelling
- 1120 Residential, Siinge Unit, Medium Density
- 1130 Residential, Single Unit, Low Density
- 1140 Residential, Rural, Single Unit
- 1200 Commercial/Services
- 1400 Transporation/Communication/Utilities
- 1420 Railroads
- 1600 Mixed Urban or Built-up Land
- 1700 Other Urban or Built-up Land
- 1800 Recreational Land
- 1804 Athletic Fields (schools)
- 7500 Transitional Areas (Barren Land)

0 0.1 0.2 Miles

N

Prepared by Kratzer Environmental Services

Data Sources: NJDEP, NJDOT
Note: Map accuracy is limited to the accuracy and scale of the original data sets.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Figure 7c: West Cape May Land Cover 2012: Barren & Urban

Roughly 44% of West Cape May is dedicated to urban uses. Less than 1% of the land in the borough is classified as barren.

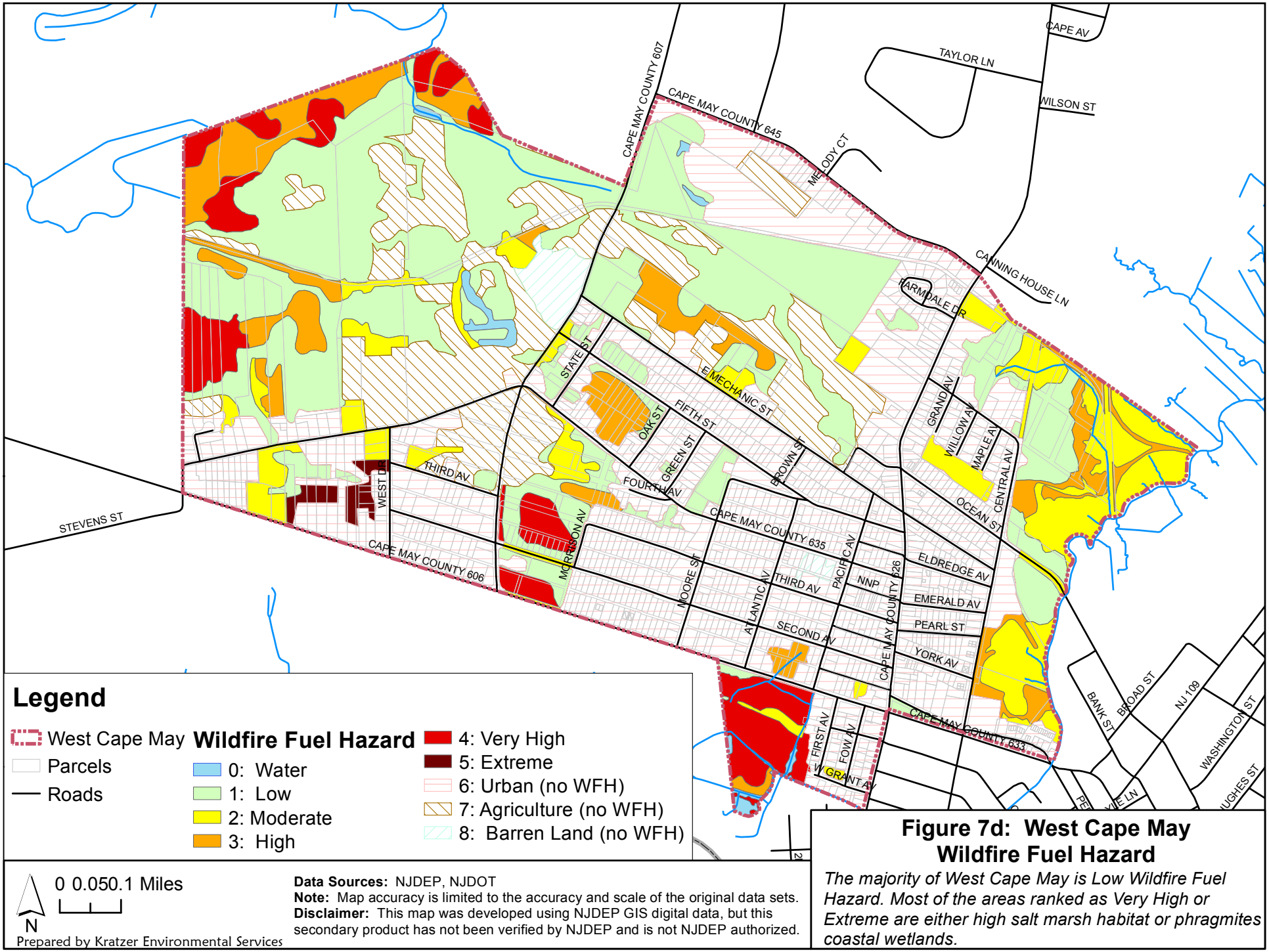


Figure 7d: West Cape May Wildfire Fuel Hazard

The majority of West Cape May is Low Wildfire Fuel Hazard. Most of the areas ranked as Very High or Extreme are either high salt marsh habitat or phragmites coastal wetlands.

C. Wildlife

New Jersey hosts 323 bird species, 89 mammal species, 44 reptile, 34 amphibian, 90 freshwater fish and over 300 marine finfish species (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 West Cape May's diverse habitat types.

Birds

Southern Cape May County has long been known as the premier birding site in New Jersey. Its position between the Atlantic Ocean and the Delaware Bay make it a significant stopover for migratory shorebirds, songbirds and raptors, and its diverse habitat components offer suitable sites for many year-round resident species as well (USFWS, 1997). Cape Island, defined as the region south of the canal and west of Cape Island Creek, is listed as an Important Bird Area of New Jersey (see **Figure 7e**), and the small woodlots and fallow fields of West Cape May are specifically mentioned as part of the local habitat matrix that makes this region special (Frank, 2010).

To date, 427 species of birds have been documented in Cape May County (Sullivan et. al., 2009), but the list may be revised with additional sightings and surveys (see **Appendix C.1**). Roughly a quarter 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 7E,** and non-indigenous birds in **Section 7G**. 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. Sources estimate the NJ population of resident Canada geese at approximately 83,000 to 96,800 (USDA, January 2003; NJDEP, March 2001).

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

- overgrazing of lawns and athletic fields, which impacts aesthetics and causes erosion
- damage to cropland, increasing erosion hazard and crop losses
- accumulations of feces on land, creating a health risk from disease-causing organisms
- degradation of water quality, from fecal bacteria, nitrogen and phosphorous
- hazards to aircraft at airports

- aggression and attacks on humans
- noise (USDA, January 2003; NJDEP, March 2001).

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, No date).

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 C.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 Cape May County or West Cape May Borough. Endangered mammals are discussed in **Section 7E,** and non-indigenous mammals in **Section 7G**. 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).

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 of over 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).

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). Despite these impacts, deer remain a natural part of the ecosystem, and are not solely responsible for diversity loss and habitat degradation.

Documentation of deer population numbers is not available for Cape May County or West Cape May Borough, therefore it is unknown whether the population exceeds either the number that can be sustained over an extended period (*ecological carrying capacity*) or the number that can coexist compatibly with local human populations (*cultural carrying capacity*) (NJDEP, 1999).

The state is divided into 70 Deer Management Zones (DMZs), with differing deer hunting regulations applied to different DMZs. West Cape May Borough falls within DMZ 34, which includes much of Cape May County and portions of Cumberland County and utilizes Regulation Set 0. Public lands open to deer hunting in Zone 34 include Beaver Swamp

Wildlife Management Area (WMA), Belleplain State Forest, Cape May National Wildlife Refuge, Cape May Wetlands WMA, Dennis Creek WMA, Heislerville WMA, Higbee Beach WMA, Lizard Tail Swamp Preserve, and Tuckahoe WMA. Data from the 2015-16 season indicate that 367 deer were harvested in Zone 34 (NJDEP Division of Fish and Wildlife, March 1, 2017).

Reptiles and Amphibians

Of the 39 non-marine reptile species recorded in New Jersey, 29 have ranges which include Cape May County (**Appendix C.3**). Similarly, there are 34 species of amphibians in the state, 21 of which range into Cape May County (**Appendix C.4**). Although lists of reptiles and amphibians (collectively known as herptiles) are not maintained by the county, their potential presence in the Cape May 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 7E,** and the non-indigenous species are covered in **Section 7G** (USGS January 26, 2017).

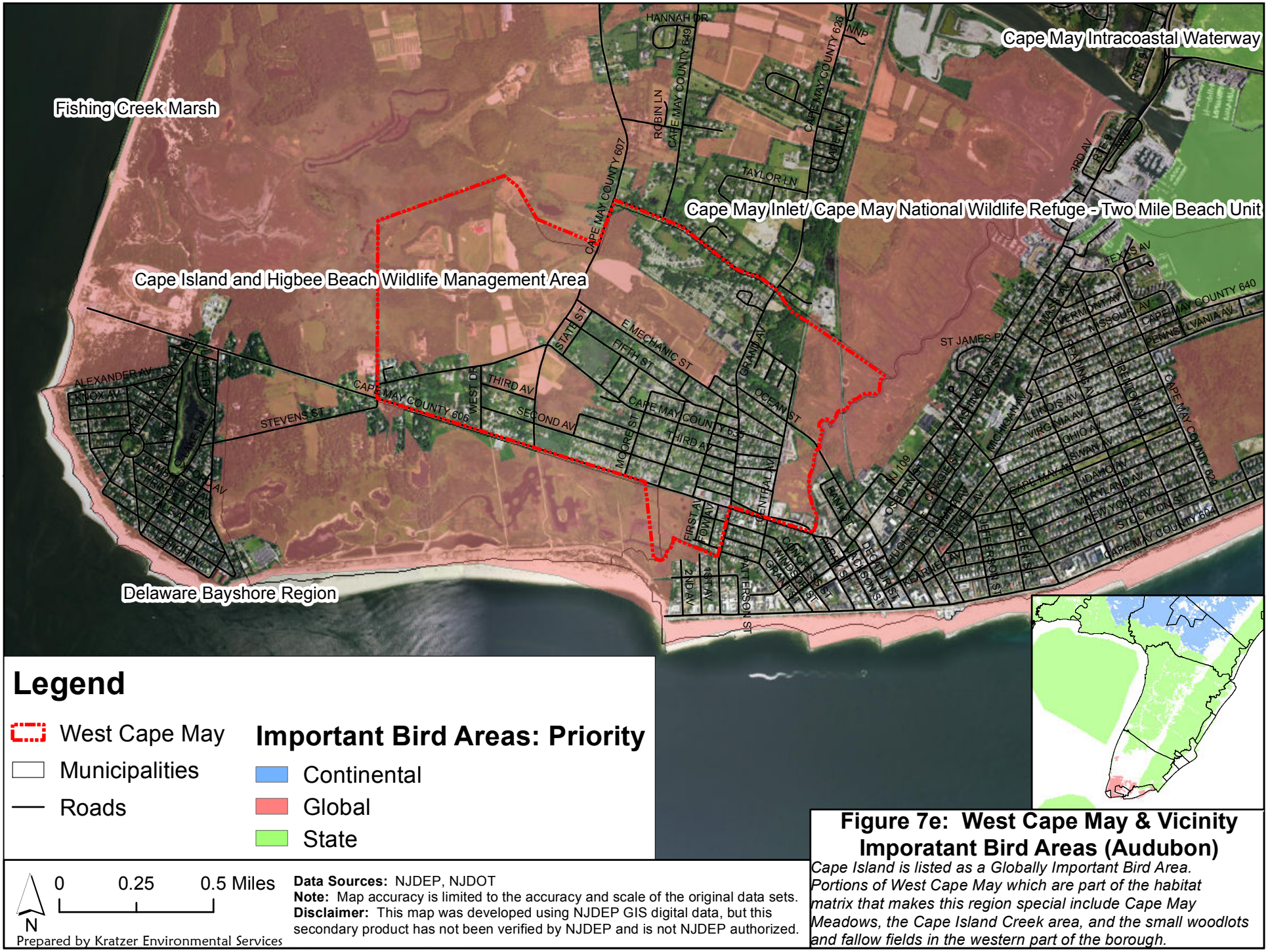
Wildlife of Vernal Pools

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 7.3**) 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 7.3: 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* Jefferson x Blue-spotted salamander *ENDANGERED* Wood frog Eastern spadefoot toad 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 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* Mud turtle Eastern painted turtle Common 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 West Cape May Borough or their ranges include Cape May County; species in gray have ranges that do not include Cape May County, therefore it would be unlikely to find them in West Cape May.		
Sources: Kenney et al, no date; Gessner and Stiles, February 2001; N.J.A.C 7:7A, Appendix 1.		

There are currently no documented vernal pool habitats within West Cape May. One site just east of the Borough has been identified as a potential vernal pool, and a portion of the associated habitat extends into West Cape May (see **Figure 7f**). Furthermore, vernal pools have



Legend

- West Cape May
- Municipalities
- Roads

Important Bird Areas: Priority

- Continental
- Global
- State

0 0.25 0.5 Miles

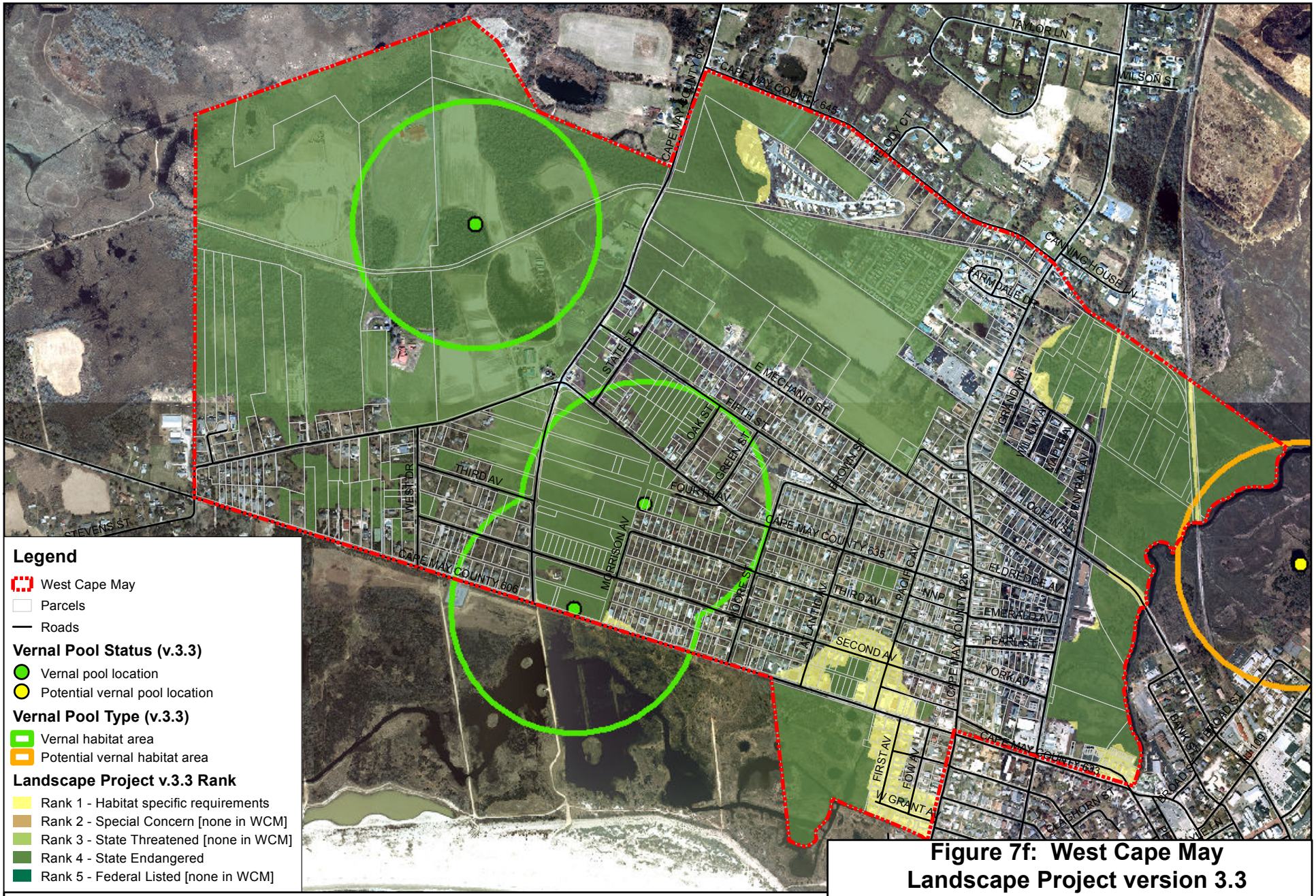
N

Prepared by Kratzer Environmental Services

Data Sources: NJDEP, NJDOT
Note: Map accuracy is limited to the accuracy and scale of the original data sets.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Figure 7e: West Cape May & Vicinity Imporatant Bird Areas (Audubon)

Cape Island is listed as a Globally Important Bird Area. Portions of West Cape May which are part of the habitat matrix that makes this region special include Cape May Meadows, the Cape Island Creek area, and the small woodlots and fallow fields in the western part of the borough.



Legend

- West Cape May
- Parcels
- Roads

Vernal Pool Status (v.3.3)

- Vernal pool location
- Potential vernal pool location

Vernal Pool Type (v.3.3)

- Vernal habitat area
- Potential vernal habitat area

Landscape Project v.3.3 Rank

- Rank 1 - Habitat specific requirements
- Rank 2 - Special Concern [none in WCM]
- Rank 3 - State Threatened [none in WCM]
- Rank 4 - State Endangered
- Rank 5 - Federal Listed [none in WCM]

N

0 0.1 0.2 Miles

Prepared by Kratzer Environmental Services

Data Sources: NJDEP, NJDOT
Note: Map accuracy is limited to the accuracy and scale of the original data sets.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized

Figure 7f: West Cape May Landscape Project version 3.3

The Landscape Project indicates that 91.6% of the borough is part of a habitat patch known to support endangered animal species. Smaller patches of land indicate the presence of suitable habitat for additional rare species. Two vernal pools and a portion of vernal habitat associated with an offsite pond are also found in the borough.

been reported within a complex of permanent and temporary ponds in the center of the borough that are utilized by breeding frogs (Remington, Vernick & Walberg, 2003).

Fish

The New Jersey Division of Fish and Wildlife (2016) currently reports a total of 90 freshwater fish species in the state (**Appendix C.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 7E,** and non-indigenous fish in **Section 7G**.

The location of West Cape May Borough does not lend itself to recreational freshwater fishing. In fact, no streams or rivers are listed as public fishing sites anywhere within Cape May County, and public fishing in ponds or lakes is only available north of the canal (NJDEP, July 22, 2016). Similarly, no trout stocked waters are located in the immediate vicinity of West Cape May (NJDEP Division of Fish and Wildlife, June 4, 2013).

D. Endangered, Threatened and Special Concern Species

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 7.4 presents the definitions used by NJDEP in describing the status of 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 D.1 and D.2)**.

Table 7.4: Definitions of Species Status

STATE STATUS	STATE STATUS DEFINITIONS
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.
Plants: Plant taxa listed as endangered are from New Jersey's official Endangered Plant Species List (N.J.A.C. 7:5C – 5.1).	
E	Native New Jersey plant species whose survival in the State or nation is in jeopardy.
FEDERAL STATUS	**FEDERAL STATUS DEFINITIONS**
LE	Taxa formally listed as **endangered.**
LT	Taxa formally listed as **threatened.**
REGIONAL STATUS	**REGIONAL STATUS CODES FOR PLANTS AND ECOLOGICAL COMMUNITIES**
LP	Indicates 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 NJ Pinelands Comprehensive Management Plan.
HL	Indicates taxa or ecological communities protected by the **Highlands Water Protection and Planning Act** within the jurisdiction of the Highlands Preservation Area.
GLOBAL & STATE CODE	The Nature Conservancy developed a ranking system for use in identifying elements (rare species and ecological com-munities) 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 CODE	**GLOBAL ELEMENT RANK DEFINITIONS**
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 CODE	**STATE ELEMENT RANK DEFINITIONS**
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.
S4	**Apparently secure** in the state, with many occurrences.
S5	**Demonstrably secure** in state and essentially ineradicable under present conditions.
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.
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	

Endangered, Threatened & Special Concern Animals

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 December 2016 revealed the documented presence of 19 special animal species in West Cape May (see **Tables 7.4** for code definitions and **Table 7.5** for list)**.** Special Concern animal species, which warrant concern due to evidence of decline or vulnerability, include six birds. State Threatened species include five birds. State Endangered species within West Cape May include two amphibians and four birds. Two insect species, one moth and one beetle, are being tracked by the Endangered and Nongame Species Program, but do not have any special designation. Also included on the special animal report is a Migratory Raptor Concentration Site, which

has been designated as Endangered due to its importance for the protection of rare species.

Three additional animal species tracked through the Natural Heritage Program are known from the immediate vicinity of West Cape May, but have not been documented within the Borough. Nesting areas for the Federally Threatened and State Endangered piping plover (*Charadrius melodus*) and the Special Concern American oystercatcher (*Haematopus palliatus*) occur within a quarter mile of the Borough. A State Endangered butterfly, the bronze copper (*Lycaena hyllus*) has also been recorded as a casual flyby in the area. A summary of the habitat requirements for each species discussed in this section is provided in **Appendix D.3**.

Table 7.5: Natural Heritage Database Animal Species in West Cape May

Class	Common Name	Scientific Name	Feature Type	LP Rank	Protection Status	Global Rank	State Rank
Amphibia	Cope's Gray Treefrog	*Hyla chrysocelis*	Occupied habitat	4	State Endangered	G5	S1
	Cope's Gray Treefrog	*Hyla chrysocelis*	Vernal pool breeding	4	State Endangered	G5	S1
	Eastern Tiger Salamander	*Ambystoma t. tigrinim*	Occupied habitat	4	State Endangered	G5T5	S1
Aves	Bald Eagle	*Haliaeetus leucocephalus*	Foraging	4	State Endangered	G5	S1B, S2N
	Bald Eagle	*Haliaeetus leucocephalus*	Nest	4	State Endangered	G5	S1B, S2N
	Barred Owl	*Strix varia*	Non-breeding sighting	3	State Threatened	G5	S2B, S2N
	Black Skimmer	*Rynchops niger*	Foraging	4	State Endangered	G5	S1B, S1N
	Black-crowned Night Heron	*Nycticorax nycticorax*	Foraging	3	State Threatened	G5	S2B, S3N
	Bobolink	*Dolichonyx oryzivorus*	Breeding sighting	3	State Threatened	G5	S2B, S3N
	Brown Thrasher	*Toxostoma rufum*	Breeding sighting	2	Special Concern	G5	S3B, S4N
	Cattle Egret	*Bubulcus ibis*	Foraging	3	State Threatened	G5	S2B, S3N
	Common Tern	*Sterna hirundo*	Foraging	2	Special Concern	G5	S3B, S4N
	Glossy Ibis	*Plegadis falcinellus*	Foraging	2	Special Concern	G5	S3B, S4N
	Least Tern	*Sternula antillarum*	Foraging	4	State Endangered	G4	S1B, S1N
	Little Blue Heron	*Egretta caerulea*	Foraging	2	Special Concern	G5	S3B, S3N
	Migratory Raptor Concentration Site	*Raptor Winter concentration Area*	Concentra-tion Site	4	State Endangered	GNR	SNR
	Osprey	*Pandion haliaetus*	Foraging	3	State Threatened	G5	S2B

Class	Common Name	Scientific Name	Feature Type	LP Rank	Protection Status	Global Rank	State Rank
	Osprey	*Pandion haliaetus*	Nest	3	State Threatened	G5	S2B
	Red-shouldered Hawk	*Buteo lineatus*	Breeding sighting	4	State Endangered	G5	S1B, S3N
	Snowy Egret	*Egretta thula*	Foraging	2	Special Concern	G5	S3B, S4N
	Tricolored Heron	*Egretta tricolor*	Foraging	2	Special Concern	G5	S3B, S3N
Insecta	Precious Underwing	*Catocala p. pretiosa*				G4T2	S2S3
	Southeastern Tiger Beetle	*Cicindela dorsalis media*				G4T3T4	S1S2

Note: See **Table 7.4** for Global and State Rank definitions and **Table 7.7** for Landscape Project Rank definitions.

Source: Natural Heritage Program, December 15, 2016

Of the 427 bird species that have been documented in Cape May County, 72 (about 17%) are listed as Endangered, Threatened or Special Concern (**Appendix D.4**). The location of West Cape May relative to the Cape May Migratory Bird Refuge Natural Heritage Priority Site (discussed in **Section 7F**) would make the Borough attractive to a variety of bird species. In addition to the fifteen rare bird species currently documented in the vicinity via the Natural Heritage Database, it is likely that a number of additional rare birds utilize habitat within West Cape May.

Endangered, Threatened & Special Concern Plants

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).

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 December 2016 revealed records of four special concern plants in West Cape May Borough (see **Table 7.4** for code definitions and **Table 7.6** for the species list) (NJDEP ONLM, December 2016). In addition to the plants described in the table below, the Natural Heritage Database listed 27 rare plants known from the immediate vicinity of the Borough.

Appendix D.4 provides a list of all rare plant species known from Cape May County. Species known from West Cape May, and those known from the immediate vicinity, are identified as subsets within the list. Rare plants that have been documented at other locations in the county could be present in West Cape May if suitable habitat is present within the Borough.

Table 7.6: Natural Heritage Database Plant Species recorded in West Cape May.

Scientific Name	Common Name	Federal Status	NJ Protection
Diodia virginiana var. virginiana	Larger Buttonweed	-	E
Regional Status	**Global Rank**	**State Rank**	**Last Observed**
LP, HL	G5T5	S1 (critically imperiled)	8/21/1991
Madder Family (Rubiaceae)			
Description: plant 2-8 dm high, leaves opposite, entire and narrow, flowers white or pink with 4 petals and 2 sepals			
Habitat: moist, open, low ground of watersides and ditches			
Description from Gleason & Cronquist (1991).			

Image credit to Robert H. Mohlenbrock, hosted by the USDA-NRCS PLANTS Database / USDA SCS. 1989. Midwest wetland flora: Field office illustrated guide to plant species. Midwest National Technical Center, Lincoln.

Scientific Name	Common Name	Federal Status	NJ Protection
Hydrocotyle verticillata var. verticillata	Whorled Marsh-pennywort	-	-
Regional Status	**Global Rank**	**State Rank**	**Last Observed**
HL	G5T5	S3 (rare)	2009
Parsley Family (Apiaceae)			
Description: stem creeping, leaves to 6 cm high, peltate, rounded and lobed; inflorescence a forking spike of tiny white flowers with five petals			
Habitat: wet or moist ground of bogs, swampy woods, watersides			
Description from Gleason & Cronquist (1991).			

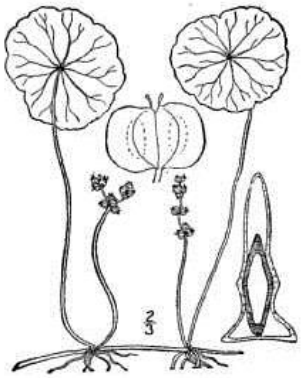


Image credit to USDA-NRCS PLANTS Database / Britton, N.L., and A. Brown. 1913. An illustrated flora of the northern United States, Canada and the British Possessions. 3 vols. Charles Scribner's Sons, New York. Vol. 2: 649.

Scientific Name	Common Name	Federal Status	NJ Protection
Malus angustifolia var. puberula	Spiny wild Crabapple	-	-
Regional Status	**Global Rank**	**State Rank**	**Last Observed**
HL	G5?T2T4	S2 (imperiled)	2010
Rose Family (Rosaceae)			
Description: tall shrub or low tree with thorny branches, leaves alternate, ovate and toothed, flowers pink to white with 5 petals. Variety distinguished by dense, felty look of twigs and pedicels.			
Habitat: woods and thickets			
Species description from Gleason & Cronquist (1991). Variety description from Virginia Botanical Associates (2017).			

Image (species only) credit to Eleanor, North Carolina State University/A&T State University Cooperative Extension, Plant Database: *Malus angustifolia*. Available online at https://plants.ces.ncsu.edu/plants/all/malus-angustifolia/

Scientific Name	Common Name	Federal Status	NJ Protection
Sesuvium maritimum	Seabeach purslane	-	-
Regional Status	**Global Rank**	**State Rank**	**Last Observed**
HL	G5	S2 (imperiled)	2010
Carpetweed Family (Aizoaceae)			
Description: plant succulent and sprawling, leaves opposite, oblanceolate and smooth, flowers lacking petals but with 5 sepals			
Habitat: sea beaches			
Description from Gleason & Cronquist (1991).			

Image credit to USDA-NRCS PLANTS Database / Britton, N.L., and A. Brown. 1913. An illustrated flora of the northern United States, Canada and the British Possessions. 3 vols. Charles Scribner's Sons, New York. Vol. 2: 34.

Note: For status and rank definitions, refer to **Table 7.4**.

Source: NJDEP ONLM, December 15, 2016

E. Protecting Endangered, Threatened and Special Concern Species

Wildlife Action Plan

NJDEP Division Fish and Wildlife prepared a Wildlife Action Plan (WAP) in 2008, required by the US Fish and Wildlife Service in order to qualify for future federal funds through the State Wildlife Grants program. This program provides federal funds to states for the conservation of species that are endangered, threatened, or have special conservation needs. A 25% match, provided by citizen contributions, is required. NJ has received approximately $1.2 million dollars of State Wildlife Grants funding each year (NJDEP, January 23, 2008).

The report states,

> "The greatest threats to NJ's natural resources include habitat loss, destruction, alteration, and fragmentation. This has been a recurring theme within NJ for years as it is the most densely populated state in our nation with an annually increasing population requiring additional homes, roads, commercial buildings, schools, etc. Additional threats include, but are not limited to, invasive species (flora and fauna, aquatic and terrestrial), pollution, and unsustainable land management practices." (NJDEP, January 23, 2008)

A Wildlife Action Plan specific to each region identifies habitats, wildlife of greatest conservation need, and threats. Conservation goals and actions are identified and prioritized, and potential partnerships are outlined with landowners, the public and conservation organizations, wildlife professionals and local, state and federal agencies. West Cape May is in the Peninsula conservation zone within the Delaware Bays landscape region.

The Landscape Project

The state's *Landscape Project* (see **Figure 7f**) 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, 2012).

The NJDEP, Division of Fish and Wildlife, Endangered and Nongame Species Program is responsible for the Landscape Project. Version 3.1 was released in 2012. The dataset was created by intersecting endangered, threatened and priority species data with the 2007 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 7.7** lists rank definitions. Each habitat patch is coded for the number of special concern, state threatened, state endangered and federally listed species present.

Table 7.7: 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, 2012	

Over 90% of West Cape May is ranked as habitat for priority species according to the Landscape Project Version 3.3, while 4.4% is Rank 1 for potential habitat (see **Table 7.8** and **Figure 7f)**.

Table 7.8: Landscape Project version 3.3

Land Use Type	Acres	Percent
No suitable habitat	30.26	4.0%
Rank 1	33.12	4.4%
Rank 2	0.00	0.0%
Rank 3	0.00	0.0%
Rank 4	691.25	91.6%
Rank 5	0.00	0.0%
Total Acres	**754.63**	**100.0%**
Source: NJDEP Division of Fish and Wildlife, May 9, 2017		

Natural Heritage Grid and Priority Sites

The NJDEP Office of Natural Lands Management (ONLM) has developed the Natural Heritage Grid Map (see **Figure 7g**[27]), which provides a general representation of the locations of rare plant species and natural communities, including both historically and recently documented

[27] 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.

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. Seven different quadrangles on the grid map include portions of West Cape May, and a total of 40 rare plants or communities are noted as occurring within those sections (NJ-GeoWeb, 2017). A custom search of the Natural Heritage Program Database conducted on December 15, 2016 revealed that four of those species records are from within West Cape May Borough (see **Table 7.6** for descriptions), and 27 other rare plant species have been recorded within a quarter mile of the borough (identified with green text in Appendix D.5). 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.5**). If suitable habitat exists in the borough, it is possible that some of those species could be found in West Cape May (NJDEP ONLM NHP, July 30, 2008).

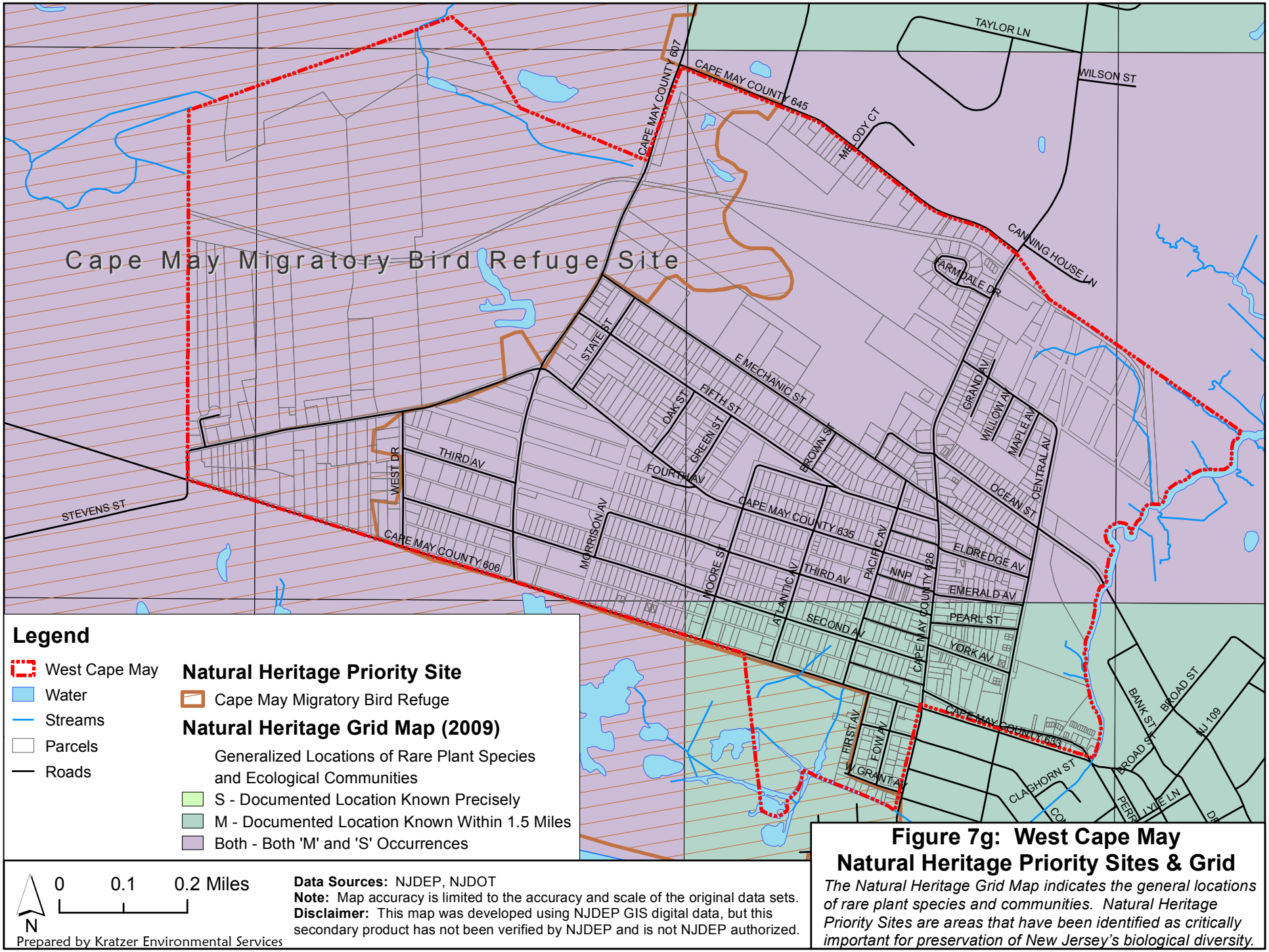
Natural Heritage Priority Sites have been identified by the ONLM as areas critically important for preservation of New Jersey's biological diversity. These are considered some of the best and most viable occurrences of endangered and threatened plant species and natural communities, but other occurrences of endangered and threatened plant species may exist. A large Natural Heritage Priority Site is located at the tip of the Cape May peninsula, and it includes portions of West Cape May Borough (**see Figure 7g and Appendix D.6**). Features that contribute to the importance of the site include a high concentration of migratory birds, state imperiled plant and animal species, globally imperiled animal species, high quality coastal plant communities, and vernal habitat.

F. Invasive Nonindigenous Species

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).

Flora

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*).



Legend

- West Cape May
- Water
- Streams
- Parcels
- Roads

Natural Heritage Priority Site

- Cape May Migratory Bird Refuge

Natural Heritage Grid Map (2009)

Generalized Locations of Rare Plant Species and Ecological Communities

- S - Documented Location Known Precisely
- M - Documented Location Known Within 1.5 Miles
- Both - Both 'M' and 'S' Occurrences

0 0.1 0.2 Miles

N

Prepared by Kratzer Environmental Services

Data Sources: NJDEP, NJDOT
Note: Map accuracy is limited to the accuracy and scale of the original data sets.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Figure 7g: West Cape May Natural Heritage Priority Sites & Grid

The Natural Heritage Grid Map indicates the general locations of rare plant species and communities. Natural Heritage Priority Sites are areas that have been identified as critically important for preservation of New Jersey's biological diversity.

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 West Cape May's trees include the southern pine beetle, the gypsy moth, and the emerald ash borer (NJ Forest Service, 2010). 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).

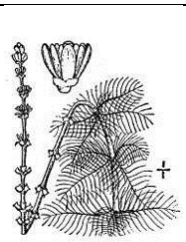
While there is no official invasive species list for New Jersey, An Overview of Nonidigenous Plant Species in New Jersey (Snyder et al, 2004) profiles 27 nonindigenous plant species that aggressively invade natural plant communities in New Jersey, which are summarized in **Table 7.9**. Some of the most problematic long-established invasive exotic species observed in West Cape May include English ivy, multiflora rose, Japanese honeysuckle, and common reed. The first three are illustrated in the table below, but the last is not.

Table 7.9: 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 Administration, Bugwood.org
Ailanthus altissima	tree of heaven	Aggressive in disturbed areas, crowding out native plants.		Britton and Brown, 1913, Vol. 2: 446.
Alliaria petiolata	garlic mustard	Aggressive in shady habitats, crowding out native plants.		Deborah J. Kratzer

Artemisia vulgaris	Mugwort or common wormwood	Aggressive, crowding out native plants.		Deborah J. Kratzer
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
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
Cirsium arvense	Canada thistle	Competes with crops and degrades pastures (inedible to livestock).		Deborah J. Kratzer
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

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
Ligustrum vulgare	common privet	Crowds out more desirable native plants.		USDA PLANTS Database, Bugwood.org
Lonicera japonica Thunberg	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
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.
Miscanthus sinensis	Chinese silver grass	Escapes from ornamental plantings and can form large clumps along disturbed areas, crowding out native vegetation. It is also extremely flammable and increases fire risks where it grows.		James H. Miller, USDA Forest Service, Bugwood.org
Phyllostachys aurea	Golden bamboo	Forms dense monocultural thickets that crowd out other plants. Difficult to eradicate once established.		Chuck Bargeron, Univ. of Georgia, Bugwood.org
Polygonum cuspidatum	Japanese knotweed	Spreads aggressively in disturbed, sunny areas, especially river banks and wetlands, crowding out native plants.		Tom Heutte, USDA Forest Service, Bugwood.org
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
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
Viburnum plicatum	Japanese viburnum	Shade tolerant shrub considered highly threatening to native plant communities.		Richard Webb, Self-employed horticulturist, Bugwood.org
Vinca minor	periwinkle	Spreads in shady forests, crowding out native plants.		Jil M. Swearingen, USDI National Park Service, Bugwood.org
Wisteria floribunda and W. sinensis	Japanese and Chinese 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: Snyder & Kaufman, 2004; Swearagain et al., 2002; Courtney, 1997; Center for Invasive Species and Ecosystem Health (bugwood.org), 2010; Britton and Brown, 1913; Mohlenbrock , 1995; Bodner at USDA-NRCS PLANTS Database

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.

The New Jersey Invasive Species Strike Team (NJISST) focuses on preventing the spread of newer invasive species throughout the state (NJISST, 2016). The team is tracking 35 invasive species in Cape May County, 34 of which are plants (**Appendix E**). The strike team provides links to fact sheets which provide information regarding identification, threat levels and control measures for each species tracked in their system (NJISST, 2016). 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. Four species that NJISST is currently tracking at multiple locations in West Cape May Borough are invasive vines (**Table 7.10**).

Table 7.10: Some Recent Invasives Tracked in West Cape May

Scientific Name	Common Name	Description	Threat
Pueraria montana var. lobata	Kudzu	climbing or trailing semi-woody vine with alternate compond leaves, long clusters of purple flowers, brown, hairy flattened seed pods	Highly threatening to native communities
Ampelopsis brevipedunculata	Porcelain-berry, amur peppervine	climbing woody vine with alternate, lobed and coarsely-toothed leaves, small greenish white flowers, mature fruits bright blue	Highly threatening to native communities
Clematis terniflora	Sweet autumn virginsbower, Japanese clematis, leatherleaf clematis	climbing woody vine with opposite compound leaves, small white flowers with 4 petals, fruit with long feathery plumes	Highly threatening to native communities
Persicaria perfoliata	Mile-a-minute	Climbing annual prickly vine grows up to 6" per day, alternate, toothless, triangular leaves with saucer-shaped leaf surrounds the stem at base of leaf stem and base of flower, small white flowers, small round fruit turns blue when mature	Widespread and highly threatening to native plant communities
Albizia julibrissin	mimosa, Persian silk tree, powder puff tree, silk tree, silky acacia, Japanese mimosa	small deciduous tree with bipinnate (double compound) leaves, flowers are showy, tight clusters of pink stamens with a white base, looking like silky threads, fruit is a flat brown pod	regionally common or abundant, moderately threatening to native communities
Source: NJISST, 2016			

Fauna

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. An example of the latter is the feral cat (*Felis domesticus*), which is the mammal tracked by the New Jersey Invasive Species Strike Team that is most likely to occur in West Cape May Borough. Feral cats are a widepread problem around the state, and are considered highly threatening to native communities (NJISST, 2016). The nutria (*Myocastor coypus*) has a more limited presence, but is occasionally seen in the southern part of the state (Van Clef, 2009).

Fact sheets with information about identification, threat levels and control measures for invasive animal species are also provided by the Strike Team (NJISST, 2016). All five of the invasive bird species tracked are commonly encountered throughout New Jersey, including Cape May County (see **Appendix C.1**), and are likely to be present in West Cape May. 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 Cape May County was estimated at 5,000 birds in 2013 (Sullivan et. al., 2009). Both the mute swan and brown-headed cowbird are 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 Cape May 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 NJISST. Although included on the DEP's list of New Jersey amphibians, the barking treefrog (*Hyla gratiosa*) is not considered native to the state. The species was at one time established and breeding in Cape May County southern New Jersey, but was thought to be introduced and is currently presumed extirpated (USGS 2017).

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 NJISST tracks all of those species, and one additional freshwater fish. The northern snakehead (*Channa argus*) is not included on the state list of freshwater fish provided in **Appendix C.5**, although the Strike Team fact sheet states that it is widespread in New Jersey. No threat level is given for the snakehead.

The Invasive Species Strike Team additionally tracks a number of invertebrate species in the state, including 18 insects, 12 mollusks, 4 crustaceans and 1 worm. Fact sheets are also available for the invasive invertebrates (NJISST, 2016).

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Internet Resources: Biological Resources

Wildlife and Plants

Backyard Habitats & Conservation:

- Deer Tolerant/Resistant Native Plants: http://www.bhwp.org/cms/files/file_ID96121.pdf
- Gardening for Butterflies: http://www.state.nj.us/dep/fgw/ensp/pdf/literature/butterfly_gardening.pdf
- 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

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

Cornel Lab of Ornithology, All About Birds: http://www.birds.cornell.edu/AllAboutBirds/BirdGuide/

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:

Conserve Wildlife Foundation of New Jersey: http://www.conservewildlifenj.org/
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: http://www.state.nj.us/dep/fgw/ensp/wap/wap_outline.htm
Rare Plants & Communities: http://www.state.nj.us/dep/parksandforests/natural/index.html

North American Butterfly Association, North Jersey Butterfly Club: http://www.naba.org/chapters/nabanj/
Long dash (*Polites mystic*): http://www.naba.org/chapters/nabanj/butterflies/long_dash.html

Rare Wildlife Sighting Form: http://www.njfishandwildlife.com/ensp/rprtform.htm

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

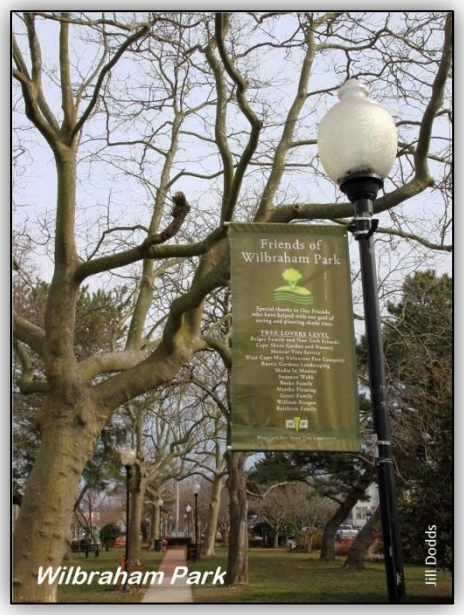
Native Plant Society of New Jersey – Invasive Species: http://www.npsnj.org/pages/nativeplants_Plant_Lists.html

New Jersey Invasive Species Strike Team (NJISST): http://www.njisst.org/

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

8: OPEN SPACE & RECREATION

A. 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;
- maintain water quality and groundwater recharge areas;
- protect sensitive environmental features;
- protect historic areas;
- maintain biodiversity;
- minimize erosion or damage from flooding;
- maintain rural character (ANJEC, no date).

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.

Cape May County assesses a tax which is designated for open space and agricultural land preservation, parks and recreation projects and historic preservation. The rate, not to exceed one cent per $100 of total County equalized real property valuation, provides approximately $1.3 million annually (Cape May County Department of Open Space and Farmland Preservation, 2017).

The Garden State Preservation Trust Act provides state funds for land acquisition and park development through the Green Acres program. West Cape May is one of three municipalities in Cape May County that has not yet utilized the program (NJDEP Green Acres Program, January 3, 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**).

B. 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, 2005).

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 Borough'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).

A significant portion of the Cape Island region at the tip of Cape May County is included in the Garden State Greenways. Large swaths of preserved open space are present adjacent to West Cape May Borough, including Higbee Beach Wildlife Management Area, Cape May Point State Park, and South Cape May Meadows (Garden State Greenways, 2004). A small portion of the Cape May Meadows Preserve falls within the Borough. West Cape May currently has roughly 130 acres of preserved farmland (West Cape May Sustainability Plan, 2009) that is associated with the greenway. In addition to the land already preserved, the western part of the Borough has a matrix of undeveloped emergent and forested wetland habitat that has not been permanently protected. The New Jersey Green Infrastructure Assessment (NJGIA) has identified a portion of those wetlands as conservation priorities in order to connect West Cape May's preserved farmlands to preserved open spaces within Cape May Point Borough (Garden State Greenways, 2004), and expansion of the greenway is included in West Cape Map's long-term plan (Remington, Vernick & Walberg Engineers, 2009).

C. Open Space and Recreation in West Cape May

An updated inventory of the preserved open space and recreation properties within the Borough is presented in **Figure 8a.** Using the acreage figures calculated by GIS, a total of 18.8 acres of Open Space have been established in West Cape May (**Table 8.1**), which is approximately 2.5% the Borough's 755 acres.

Combined totals of preserved open space and farmland yield a collective 151 acres that have been protected in West Cape May, which is 20% of the land in the borough. Plans for the preservation of additional borough lands for greenway expansion and for the development of an eco-park are outlined in West Cape May's Master Plan (Remington, Vernick & Walberg Engineers, 2009).

Table 8.1: Open Space in West Cape May

Block	Lot	Acres*	Owner
33	1	16.58	The Nature Conservancy
49	1.01, 1.02, 1.03	1.76	NJDEP
3	1	0.47	West Cape May
	Total:	18.80	
*Acreage calculated by GIS may vary from deed acreage.			

Municipal Open Space

Wilbraham Park and Arboretum is a narrow half acre lot donated to the Borough by John W. Wilbraham in 1921. The site, which is across the street from the historic Wilbraham Mansion, is presently maintained by the West Cape May Shade Tree Commission. The park serves as a small oasis in the downtown section of the borough, offering a beautifully landscaped setting with benches and picnic tables. The location of the park is depicted in **Figure 8b**.

Private Land Trust Open Space

South Cape May Meadows is a Nature Conservancy Preserve over 200 acres in size, and about 16.5 acres of the protected site fall within West Cape May Borough (**Figure 8c**). The land provides foraging and resting habitat for migrating birds, and the preserve's trail system provides hiking and wildlife viewing opportunities to an estimated 90,000 visitors per year (The Nature Conservancy, 2017).

State Open Space

Nearly two acres of state-owned land is located at the southwestern corner of 5th Avenue and State Street in West Cape May (**Figure 8d**). The site is managed as an ancillary parcel of the Higbee Beach Wildlife Management Area (MWA). The primary preserve is about 1,100 acres in size, providing critical habitat for threatened and endangered species and migrating birds. Visitors may enjoy wildlife from two viewing platforms and a network of nature trails (NJDEP Division of Fish & Wildlife, 2016). The remote parcel in West Cape May Borough is undeveloped.

Preserved Farmland

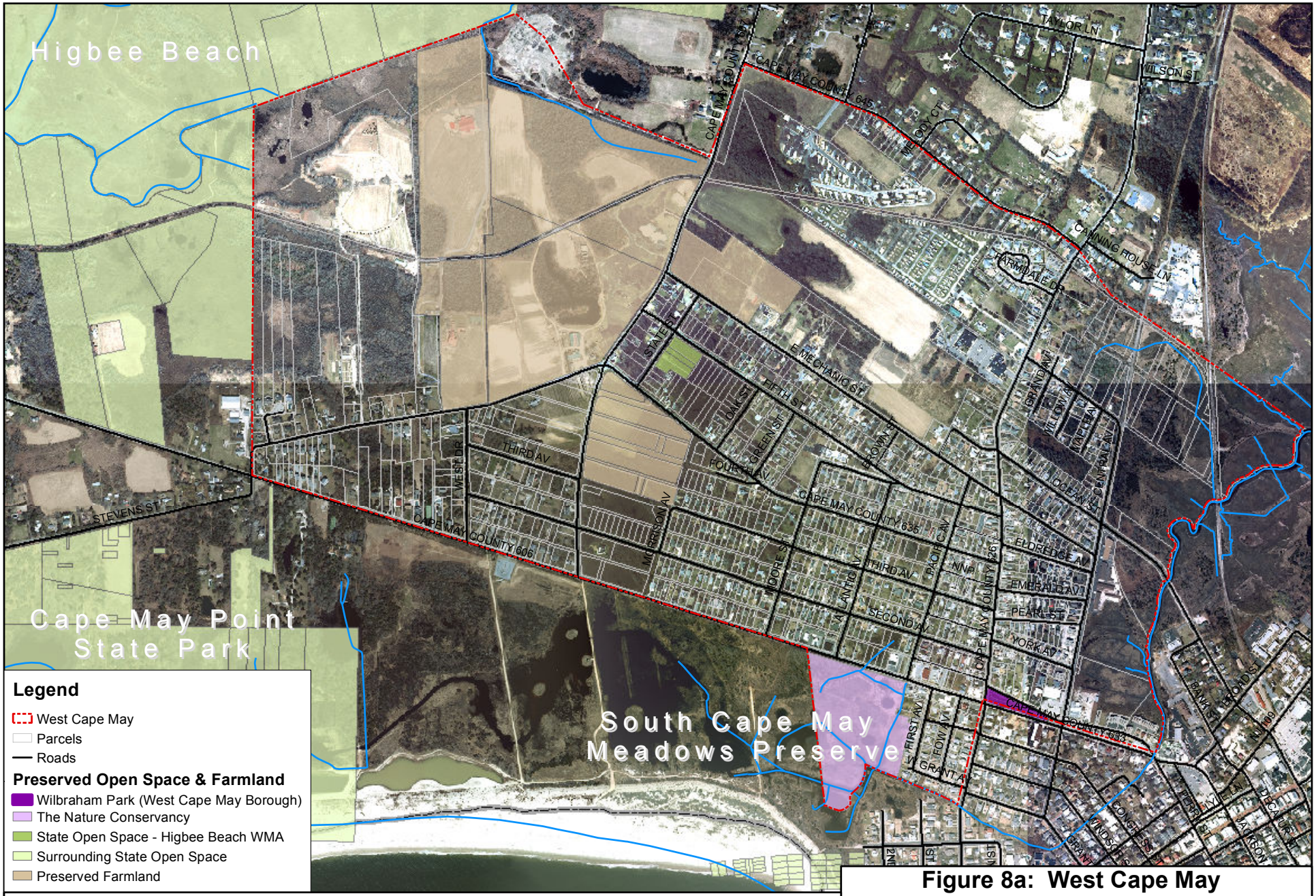
Farmland accounts for about 28% of the total land in West Cape May, with a total of 210.12 acres actively farmed (Cape May County Property Tax Records, 2017). More than half of the farmland in the borough has been preserved (**Table 8.2 and Figure 8a**). The 132 acres of preserved farmland accounts for 17.5% of the land in West Cape May.

Table 8.2: Preserved Farmland in West Cape May.

NJDA/ SADC Number	Preserved as BLOCK	Preserved as LOT	Current Tax ID	Acres*	Date Preserved	Listed Owner
9619	55	25	B 55 L 25	10.329	6/15/2009	Vasser
9630	64	1	B 64 L 1	2.917	4/25/2002	Rea
9632	64	2		1.658		
9633	64	3		0.182		
9634	64	4		1.053		
9624	65	1		2.526		
9626	65	2		1.9		
9628	65	3		0.164		
9629	65	4		0.654		
9622	66	1		0.971		
9631	Borough Hall Alley+			0.362		
9627	Fourth Avenue+			0.947		
9623	Seaview Drive+			0.699		
9625	Sees Alley+			0.385		
9621	73	9	B 73 L 9	12.507	6/6/2007	Bray Wilde
9620	73	10	B 73 L 10	31.28	4/25/2002	Rea
9618	73	10		3.462		
9615	74	2	B 74 L 2	23.739	6/6/2007	Bray Wilde
9616	74	3	B 74 L 3	27.565	4/25/2002	Rea
9617	74	3		9.074		
		Total:		**132.374**		

*Acreage calculated by GIS may vary from deed acreage

+ indicates undeveloped roadways



Prepared by Kratzer Environmental Services

Data Sources: NJDEP, NJDOT
Note: Map accuracy is limited to the accuracy and scale of the original data sets.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Figure 8a: West Cape May Preserved Open Space and Recreation

An overview of the 132 acres of Preserved Farmland and 19 acres of Preserved Open Space in West Cape May.

Data Sources: NJDEP, NJDOT
Note: Map accuracy is limited to the accuracy and scale of the original data sets.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Figure 8b: West Cape May Wilbraham Park

A detail map showing the location of the municipal park in the eastern section of the borough

Data Sources: NJDEP, NJDOT
Note: Map accuracy is limited to the accuracy and scale of the original data sets.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Prepared by Kratzer Environmental Services

Figure 8c: West Cape May South Cape May Meadows Preserve

A detail map showing the portion of the Nature Conservancy preserve that falls within the borough.

Legend

- Parcels
- Roads
- Water
- State Open Space - Higbee Beach WMA
- Preserved Farmland

0 125 250 Feet

N

Prepared by Kratzer Environmental Services

Data Sources: NJDEP, NJDOT
Note: Map accuracy is limited to the accuracy and scale of the original data sets.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Figure 8d: West Cape May Part of Higbee Beach WMA

A detail map showing the location of a parcel that is managed by the State of New Jersey in conjunction with a larger park west of the borough.

References: Open Space

Association of New Jersey Environmental Commissions. No Date. Resource Paper: Open Space Plan. 12 pages. http://anjec.org/pdfs/OpenSpacePlan.pdf

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NJDEP, Division of Fish and Wildlife. 2016. Higbee Beach Wildlife Management Area. http://www.state.nj.us/dep/fgw/ensp/higbee.htm

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NJDEP Green Acres Program. January 3, 2017. Recreational and Open Space Inventory (ROSI). http://www.nj.gov/dep/greenacres/openspace.html. Accessed March 10, 2017.

Regional Plan Association. 1996. A Region At Risk: A Summary of the Third Regional Plan for the New York-New Jersey-Connecticut Metropolitan Area. 22 pages. http://library.rpa.org/pdf/RPA-Plan3-A-Region-at-Risk-Summary.pdf

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The Nature Conservancy. 2017. Our Initiatives: New Jersey - South Cape May Meadows. http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/newjersey/placesweprotect/south-cape-may-meadows.xml

West Cape May Sustainability Plan. 2009. Prepared by West Cape May Comprehensive Planning Studio, Edward J. Bloustein School of Planning and Public Policy, Rutgers, The State University of New Jersey. http://www.westcapemay.us/LinkClick.aspx?fileticket=l5iRI2xnNfI%3D&tabid=2024

Internet Resources: Open Space

Association of New Jersey Environmental Commissions: http://anjec.org

Cape May County Open Space Program Guide: Updated 3/9/2017
http://capemaycountynj.gov/DocumentCenter/Home/View/3883

Garden State Greenways http://www.gardenstategreenways.org

Native Plant Society of New Jersey: http://www.npsnj.org

New Jersey Conservation Foundation: http://www.njconservation.org/

New Jersey Green Acres Program: http://www.nj.gov/dep/greenacres/index.html

New Jersey Natural Lands Trust: http://www.njnlt.org/

NJDEP, Division of Fish and Wildlife. 2016. Higbee Beach Wildlife Management Area.
http://www.state.nj.us/dep/fgw/ensp/higbee.htm

NY-NJ Trail Conference: http://www.nynjtc.org/

Open Space Institute: http://www.osiny.org/site/PageServer?pagename=Places_NewJersey

Rain Garden Manual: http://www.npsnj.org/pages/nativeplants_Rain_Gardens.html

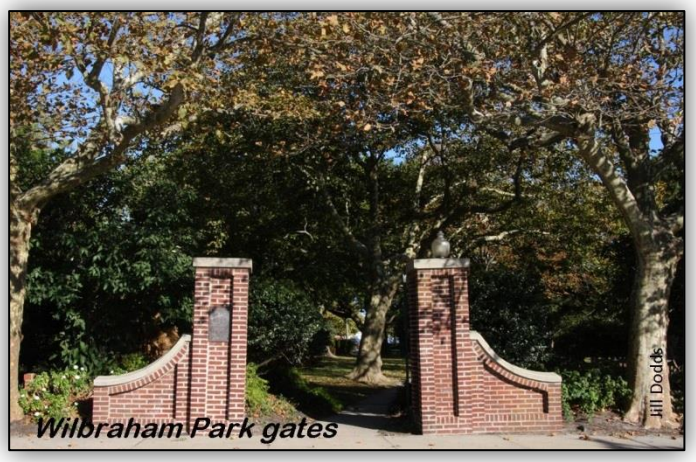
Rutgers New Jersey Agricultural Experiment Station (NJAES) – information & links for farmers, gardeners, & consumers: http://njaes.rutgers.edu/

South Jersey Land and Water Trust: http://sjlandwater.org/

The Nature Conservancy. 2017. Our Initiatives: New Jersey - South Cape May Meadows.
http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/newjersey/placesweprotect/south-cape-may-meadows.xml

9: HISTORIC RESOURCES

A. Resource Inventory – Historic Resources



The earliest known inhabitants of southern Cape May County were members of the Kechemeche Tribe of the Lenni-Lenape Nation (Stevens, 1897). It is generally believed that the native tribes spent much of the year in the Delaware Valley, utilizing the coastal areas seasonally for hunting and fishing (Skinner and Schrabish, 1913). An archaeological site in West Cape May reportedly produced a number of artifacts, including "A bead beaten from a nugget of native gold" (Skinner and Schrabish, 1913). There is currently a state archaeological grid site (Cell ID BP331) centered in the northeastern corner of West Cape May Borough (see **Figure 9a**) (NJDEP HPO, September 22, 2016a), and Native American artifacts are frequently discovered in neighboring towns on Cape Island (Newsworks, July 20, 2016).

According to Stevens (1897), Cape May was christened in 1623 by the Dutch explorer and Captain Cornelius Jacobsen Mey, who named it after himself. Cape May County was established in 1692 by an Act of the General Assembly of the Province of West New Jersey (Cape May County, 2017). In 1723, the County Court created three precincts that divided the county along both geographic and religious lines: the Upper Precinct (Quaker), Middle Precinct (Baptist) and Lower Precinct (Presbyterian) (Fulginiti, 2017). The three precincts became townships by an act of the New Jersey Legislature in 1798, and West Cape May Borough was formed out of Lower Township in 1884 (Fulginiti, 2017).

B. 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. Historic Districts in and adjacent to West Cape May are listed in **Table 9.1** and **Table 9.2** and shown in **Figure 9a** (NJDEP HPO, September 22, 2016b).

West Cape May has one region and one building that are listed on the National Register of Historic Places (State of NJ, 2017). The Cape May Historic District includes both the western end of Cape May City and the southeastern portion of West Cape May (see **Table 9.2** and **Figure 9a**). The district, which was added to both the state and national registers in 1970, is best known for its concentration of structures built during the late Victorian Period (1870-1901). The Whilldin-Miller House is located within the Cape May Historic District, but has also been

individually registered since 2002 in the state and 2003 nationally (NJDEP HPO, November 20, 2017) (see **Table 9.2** and **Figure 9a**). The original timber frame portion of the house was reputedly built by Joseph Whilldin around 1715, and the newer part constructed in 1860 (Wikipedia, 2017).

In addition to the registered sites, there is a 1977 opinion of eligibility record for a historic milestone on the south side of Sunset Boulevard in West Cape May. The milestone was a marker for the Cape Island Turnpike, circa 1848-1851. State Historic Preservation Officer (SHOP) opinions are issued in response to federally funded activities that would have an effect on historic properties not listed on the National Register (NJDEP HPO, November 20, 2017).

Table 9.1: Historic Districts In and Adjacent to West Cape May

ID	Name	Status[1]	Date of Status Update	NHL	List Date[2]	Period of Significance	Survey Name[3]	Survey Date[4]
474	Cape May Historic District (NR/SR)	LISTED	1970-12-29	NO	NR: 1970-12-29 SR: 1970-12-10	1850-1910		
475	Cape May Historic District (NHL)	NHL	1976-05-11	YES	NR: 1970-12-29 SR: 1970-12-10			
476	West Cape May Historic District	ELIGIBLE	2006-10-26	NO				
643	Cape May Historic District [proposed NR/SR boundary revision, 2013]	LISTED	1970-12-29	NO	NR: 1970-12-29 SR: 1970-12-10	1850-1910	Phase I Archaeological Investigation and Structure Inventory[5]	2013-01-01
780	Cape May Local Historic District	Locally Designated		NO				
788	Atlantic City Railroad Cape May Division Historic District	ELIGIBLE	2005-06-23	NO			Historic District Management Study[6]	2010-05-07

Notes:

[1] NHL = National Historic Landmark; LISTED = Listed in the NJ and/or National Registers of Historic Places; ELIGIBLE = Formally determined eligible for listing in the NJ and/or National Registers of Historic Places (SHPO Opinion, COE, DOE); LOCALLY_DESIGNATED = Designated as an historic district by municipal ordinance.

[2] Title of most recent cultural resource survey report

[3] NR = National Register; SR = State Register

[4] Date of inclusion in most recent cultural resource survey; Either the report date or the individual survey date recorded on the survey form for the resource

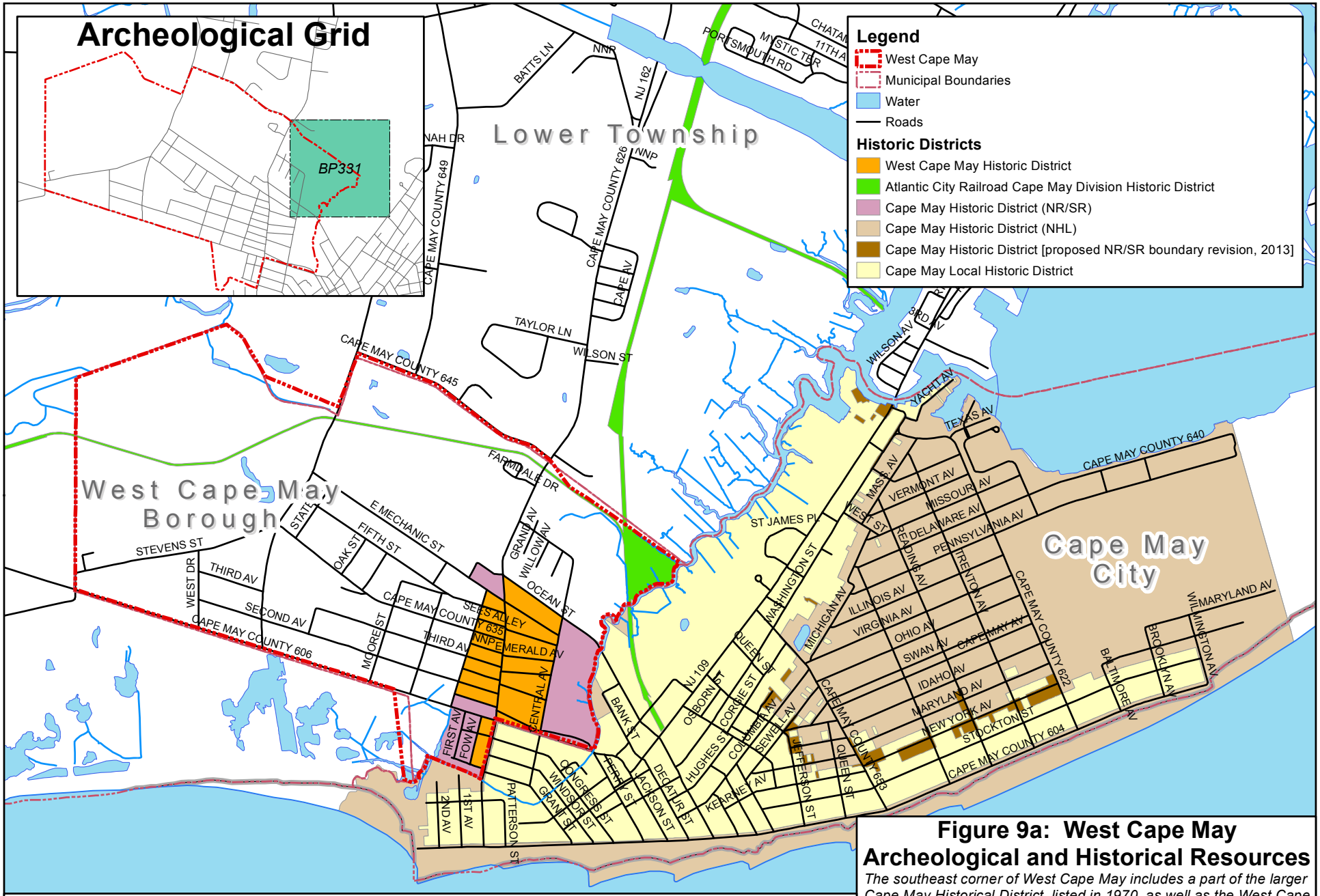
[5] Phase I Archaeological Investigation and Structure Inventory (Revised), Peckman River Flood Damage Reduction Project, Borough of Woodland Park (formerly West Paterson) and Townships of Little Falls and Cedar Grover, Pasasic and Essex Counties, New Jersey

[6] Historic District Management Study for the Atlantic City Railroad Cape May Division Historic District; Camden, Atlantic, and Cape May Counties, New Jersey

Source: NJDEP HPO, September 22, 2016b

Table 9.2 West Cape May Sites on the National Register of Historic Places.
Data from State of New Jersey (2017), Locations from NJ_GeoWeb (2017).

Cape May Historic District (added 1970 - #70000383		
Cape May City and Borough of West Cape May, Cape May		
	Historic Significance:	Event, Architecture/ Engineering
	Architect, builder or engineer:	Multiple
	Architectural Style:	Late Victorian
	Area of Significance:	Conservation, Entertainment/ Recreation, Architecture
	Period of Significance	1850-1875, 1875-1899, 1900-1924
	Owner:	Private, Local
	Historic Function:	Domestic, Health Care
	Historic Sub-function:	Camp, Hotel, Resort
	Current Function:	Domestic, Health Care
	Current Sub-function:	Camp, Hotel, Resort
Whilldin-Miller House, also known as **Fow House** (added 2003 - #03000012)		
416 South Broadway, Borough of West Cape May, Cape May		
	Historic Significance:	Architecture/ Engineering
	Architectural Style:	Mid 19th Century Revival, Italianate
	Area of Significance:	Architecture
	Period of Significance	1850-1874
	Owner:	Private
	Historic Function:	Domestic
	Historic Sub-function:	Single Dwelling
	Current Function:	Commerce/Trade
	Current Sub-function:	Restaurant
Source: NJDEP HPO, November 20, 2017		



Prepared by Kratzer Environmental Services

Data Sources: NJDEP, NJDOT
Note: Map accuracy is limited to the accuracy and scale of the original data sets.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Figure 9a: West Cape May Archeological and Historical Resources

The southeast corner of West Cape May includes a part of the larger Cape May Historical District, listed in 1970, as well as the West Cape May Historic District which was designated as Eligible for Listing in 2006. A part of the Atlantic City Railroad Cape May Division Historic District occupies the northeast corner of the borough.
Inset: The northeast end of West Cape May is also included in a state archaeological project grid.

C. 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 9.3** and shown on **Figure 9b** (NJDEP HPO, February 21, 2017a; NJDEP, February 21, 2017b).

Table 9.3: Historic Properties in West Cape May

ID	Name/Address	Status	Survey Name
Historic District: Atlantic City Railroad Cape May Division Historic District			
69113	Cape Island Creek Trestle Atlantic City Railroad, Cape May Division over Cape Island Creek; Atlantic City Railroad, Cape May Division over Cape Island Creek	ELIGIBLE_HD	Historic District Management Study for the Atlantic City Railroad Cape May Division Historic District; Camden, Atlantic, and Cape May Counties, New Jersey (2010-05-07)
90953	Cape Island Creek Trestle Atlantic City Railroad, Cape May Division over Cape Island Creek	ELIGIBLE_HD	Historic District Management Study for the Atlantic City Railroad Cape May Division Historic District; Camden, Atlantic, and Cape May Counties, New Jersey (2010-05-07)
Historic District: Cape May Historic District (NR/SR)			
511	Whilldin-Miller House 416 South Broadway	LISTED_INDV 2003-02-12	A Survey of the Heavy Timber Frame Buildings of Cape May County, New Jersey (2003-10-01)
77706	109 SECOND AVENUE	LISTED_HD	
77707	201 BROADWAY	LISTED_HD	
77708	141 PEARL AVENUE	LISTED_HD	
77709	105 W. GRANT ST.	LISTED_HD	
77710	196 SOUTH BROADWAY	LISTED_HD	
77711	100 GRANT STREET	LISTED_HD	
77712	110 ELDREDGE AVE	LISTED_HD	
77713	133 ELDREDGE AVE	LISTED_HD	
77714	402 BROADWAY	LISTED_HD	
77715	121 SIXTH AVENUE	LISTED_HD	
77716	4 1/2 E. MECHANIC ST.	LISTED_HD	
77717	156 LEAMING AVENUE	LISTED_HD	
77718	SUNSET BLVD.&1ST AVE	LISTED_HD	
77719	FIRST AVENUE	LISTED_HD	
77720	222 BROADWAY	LISTED_HD	
77721	113 PEARL AVE	LISTED_HD	
77722	301 BROADWAY	LISTED_HD	
77723	117 PEARL AVE	LISTED_HD	
77724	121 PEARL AVE	LISTED_HD	
77725	127 GOLDBEATEN ALLEY	LISTED_HD	
77726	125 PEARL AVE	LISTED_HD	
77727	129 PEARL AVE	LISTED_HD	
77728	135 PEARL AVE	LISTED_HD	
77729	220 BROADWAY	LISTED_HD	
79409	137 ELDREDGE AVE	LISTED_HD	
79410	129 ELDREDGE AVE	LISTED_HD	
79411	131 EMERALD AVE	LISTED_HD	
79412	117 EMERALD AVE	LISTED_HD	
79413	123 EMERALD AVE	LISTED_HD	
79414	135 EMERALD AVE	LISTED_HD	
79415	409 BROADWAY	LISTED_HD	
79416	131 THIRD AVENUE	LISTED_HD	
79417	EMERALD AVE	LISTED_HD	
79418	414 PARK BLVD	LISTED_HD	
79419	137 EMERALD AVE	LISTED_HD	

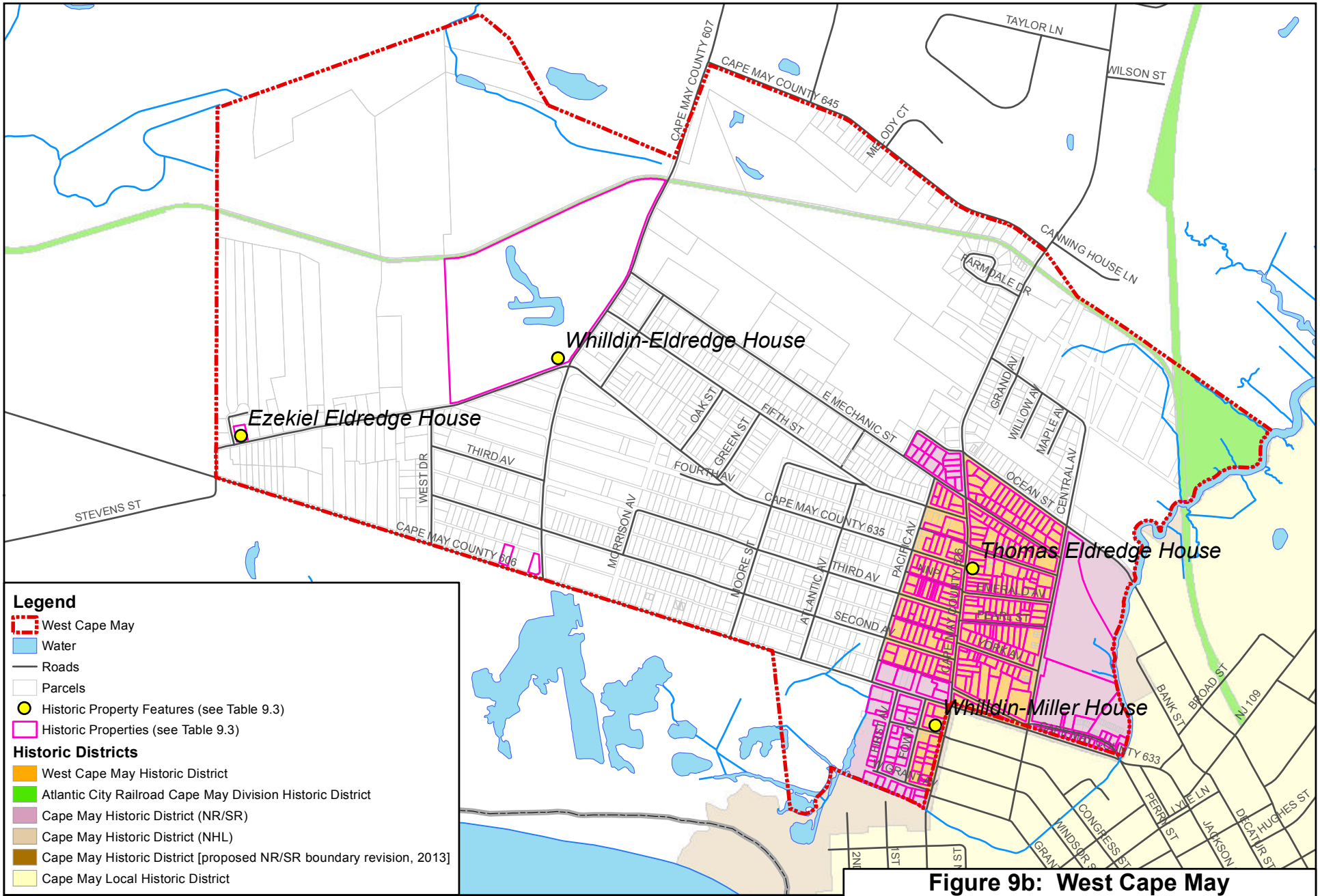
79420	124 THIRD AVENUE	LISTED_HD	
79421	605 PARK BLVD	LISTED_HD	
79422	9 E MECHANIC ST	LISTED_HD	
79423	409 PACIFIC AVE	LISTED_HD	
79424	16 E MECHANIC ST	LISTED_HD	
79425	112 PEARL AVE	LISTED_HD	
79426	114 PEARL AVE	LISTED_HD	
79427	116 PEARL AVE	LISTED_HD	
79428	120 PEARL AVE	LISTED_HD	
79429	122 PEARL AVE	LISTED_HD	
79430	124 PEARL AVE	LISTED_HD	
79431	128 PEARL AVE	LISTED_HD	
79432	111 SECOND AVENUE	LISTED_HD	
79433	132 PEARL AVE	LISTED_HD	
79434	136 PEARL AVE	LISTED_HD	
79435	140 PEARL AVE	LISTED_HD	
79585	114 SIXTH AVENUE	LISTED_HD	
79586	141 ELDREDGE AVE	LISTED_HD	
79587	126 LEAMING AVENUE	LISTED_HD	
79588	124 FOURTH AVENUE	LISTED_HD	
79589	122 ELDREDGE AVE	LISTED_HD	
79590	120 FOURTH AVENUE	LISTED_HD	
79591	423 BROADWAY	LISTED_HD	
79592	310 BROADWAY	LISTED_HD	
79593	420 PARK BLVD	LISTED_HD	
79594	411-413 BROADWAY	LISTED_HD	
79595	125 EMERALD AVE	LISTED_HD	
79596	310 PACIFIC AVE	LISTED_HD	
79597	316 BROADWAY	LISTED_HD	
79598	125 THIRD AVENUE	LISTED_HD	
79599	404 FOW AVE.	LISTED_HD	
79600	407 FIRST AVENUE	LISTED_HD	
79601	400 FIRST AVENUE	LISTED_HD	
79602	400 FOW AVENUE	LISTED_HD	
79603	217 MYRTLE AVE	LISTED_HD	
79604	324 FIRST AVENUE	LISTED_HD	
79605	325 FIRST AVENUE	LISTED_HD	
79606	6 CONGRESS ST	LISTED_HD	
79607	402, 404, 586-604 MYRTLE AVE	LISTED_HD	
79608	400 MYRTLE AVE	LISTED_HD	
79609	320 FIRST AVENUE	LISTED_HD	
79610	398 MYRTLE AVE	LISTED_HD	
79611	396 MYRTLE AVE	LISTED_HD	
79612	314 FOW AVE	LISTED_HD	
79613	318 FIRST AVENUE	LISTED_HD	
79614	317 FIRST AVENUE	LISTED_HD	
79615	316 FIRST AVENUE	LISTED_HD	
79616	313 FOW AVE	LISTED_HD	
79617	310 FIRST AVENUE	LISTED_HD	
79672	309 FIRST AVENUE	LISTED_HD	
79673	315 FOW AVENUE	LISTED_HD	
79674	312 FOW AVE	LISTED_HD	
79675	209 BROADWAY	LISTED_HD	
79676	216 BROADWAY	LISTED_HD	
79677	113 SECOND AVENUE	LISTED_HD	
79678	132 YORK AVE	LISTED_HD	
79679	111-117 SUNSET BLVD	LISTED_HD	
79680	119 SIXTH AVENUE	LISTED_HD	
79681	115 YORK AVE	LISTED_HD	
79682	103 SECOND AVENUE	LISTED_HD	

79683	204 BROADWAY	LISTED_HD	
79684	129 YORK AVE	LISTED_HD	
79685	116 SECOND AVENUE	LISTED_HD	
79686	133 YORK AVE	LISTED_HD	
79687	139 YORK AVE	LISTED_HD	
79688	112-114 SECOND AVENUE	LISTED_HD	
79689	139 BROADWAY	LISTED_HD	
79690	131 BROADWAY	LISTED_HD	
79691	110 SECOND AVE	LISTED_HD	
79692	123 PACIFIC AVE.	LISTED_HD	
79693	110 YORK AVE	LISTED_HD	
79694	108 SECOND AVENUE	LISTED_HD	
79695	112 YORK AVE	LISTED_HD	
79696	106 SECOND AVENUE	LISTED_HD	
79697	114 YORK AVE	LISTED_HD	
79698	116 YORK AVE	LISTED_HD	
79699	104 SECOND AVENUE	LISTED_HD	
79700	124 YORK AVE	LISTED_HD	
79701	114 FOURTH AVENUE	LISTED_HD	
79702	615 BROADWAY	LISTED_HD	
79703	122 BROADWAY	LISTED_HD	
79704	127 BROADWAY	LISTED_HD	
79705	MYRTLE AVE & PARK	LISTED_HD	
79782	128 YORK AVE	LISTED_HD	
79783	111 MYRTLE AVE	LISTED_HD	
79784	110 BROADWAY	LISTED_HD	
79785	126 SUNSET BLVD.	LISTED_HD	
79786	BROADWAY & SUNSET BLVD	LISTED_HD	
79787	MYRTLE AVE & PARK BLVD	LISTED_HD	
79788	118 SIXTH AVENUE	LISTED_HD	
79789	132 LEAMING AVE	LISTED_HD	
79790	605 BROADWAY	LISTED_HD	
79791	123 E MECHANIC STREET	LISTED_HD	
79792	308 PACIFIC AVENUE	LISTED_HD	
79793	312 PACIFIC AVENUE	LISTED_HD	
79794	608-616 MYRTLE AVENUE	LISTED_HD	
79795	15-17 PARK BLVD	LISTED_HD	
79796	121-125 YORK AVE	LISTED_HD	
79797	127 YORK AVE	LISTED_HD	
79798	151-153 YORK AVE	LISTED_HD	
79799	211-213 PARK BLVD	LISTED_HD	
79800	305 PARK BLVD	LISTED_HD	
79801	313 PARK BLVD	LISTED_HD	
79802	114 ELDREDGE AVE	LISTED_HD	
79803	115-117 ELDREDGE AVE	LISTED_HD	
79804	119-121 ELDREDGE AVENUE	LISTED_HD	
79805	EAST MECHANIC ST.	LISTED_HD	
79806	120 LEAMING AVE UNIT A & B	LISTED_HD	
79807	107 PARK BLVD	LISTED_HD	
79808	145 YORK AVE	LISTED_HD	
79809	SIXTH AVENUE	LISTED_HD	
79810	4 LANDIS AVE	LISTED_HD	
79811	620 BROADWAY	LISTED_HD	
79812	8 LANDIS AVE	LISTED_HD	
79813	6 LANDIS AVE	LISTED_HD	
79814	2 LANDIS AVE	LISTED_HD	
79895	616 BROADWAY	LISTED_HD	
79896	626 BROADWAY	LISTED_HD	
79897	135 SIXTH AVE	LISTED_HD	
79898	619 BROADWAY	LISTED_HD	

79899	133 SIXTH AVE	LISTED_HD	
79900	127 SIXTH AVENUE	LISTED_HD	
80633	105-107 SECOND AVENUE	LISTED_HD	
80634	102 GOLDBEATEN ALLEY	LISTED_HD	
80635	107 YORK AVE	LISTED_HD	
80636	212 BROADWAY	LISTED_HD	
80637	111 YORK AVE	LISTED_HD	
80638	304 FIRST AVENUE	LISTED_HD	
80639	422 BROADWAY	LISTED_HD	
80640	172 LEAMING AVE	LISTED_HD	
80641	5 E. MECHANIC ST	LISTED_HD	
80642	307 BROADWAY	LISTED_HD	
80643	120 THIRD AVENUE	LISTED_HD	
80644	145 ELDREDGE AVE	LISTED_HD	
80645	125 ELDREDGE AVE	LISTED_HD	
80646	129 THIRD AVENUE	LISTED_HD	
80647	127 THIRD AVENUE	LISTED_HD	
80648	136 LEAMING AVE	LISTED_HD	
80649	108-110 SIXTH AVENUE	LISTED_HD	
80650	140 LEAMING AVENUE	LISTED_HD	
80651	108 FOURTH AVENUE	LISTED_HD	
80652	Thomas Eldredge House 417 BROADWAY	LISTED_HD 1970-12-29	A survey of the Heavy Timber Frame Buildings of Cape May - Phase II (2006-11-01)
80726	324 BROADWAY	LISTED_HD	
80727	134 THIRD AVE	LISTED_HD	
80728	130 EMERALD AVE	LISTED_HD	
80729	170 LEAMING AVENUE	LISTED_HD	
80730	300 FIRST AVENUE	LISTED_HD	
80731	FOW AVE.	LISTED_HD	
80732	FIRST AVE & GRANT ST.	LISTED_HD	
80733	302 SOUTH BROADWAY	LISTED_HD	
80734	119 MYRTLE AVE	LISTED_HD	
80735	123 BROADWAY	LISTED_HD	
80736	136 YORK AVE	LISTED_HD	
80737	120 BROADWAY	LISTED_HD	
80738	140 YORK AVE	LISTED_HD	
80739	103-109 SUNSET BLVD	LISTED_HD	
80740	121 BROADWAY	LISTED_HD	
80741	116 BROADWAY	LISTED_HD	
80742	113 MYRTLE AVE	LISTED_HD	
80743	133 MYRTLE AVE	LISTED_HD	
80744	119 THIRD AVE	LISTED_HD	
80745	109 EMERALD AVE	LISTED_HD	
80746	117 THIRD AVE	LISTED_HD	
80747	135 THIRD AVENUE	LISTED_HD	
80748	115 EMERALD AVE	LISTED_HD	
80749	115 THIRD AVENUE	LISTED_HD	
80750	116 THIRD AVENUE	LISTED_HD	
80751	121 E MECHANIC ST	LISTED_HD	
80752	112 THIRD AVENUE	LISTED_HD	
80753	306 PARK BLVD	LISTED_HD	
80754	207 W. GRANT ST.	LISTED_HD	
80755	201 W GRANT ST	LISTED_HD	
80756	115 W GRANT STREET	LISTED_HD	
80757	136 EMERALD AVE	LISTED_HD	
80758	121 THIRD AVENUE	LISTED_HD	
80820	407 BROADWAY	LISTED_HD	
80821	162 LEAMING AVENUE	LISTED_HD	
80822	138 EMERALD AVE	LISTED_HD	
80823	126 THIRD AVE	LISTED_HD	

80824	144 EMERALD AVE	LISTED_HD	
80825	146 EMERALD AVE	LISTED_HD	
80826	309 PARK BLVD	LISTED_HD	
80827	515-517 BROADWAY	LISTED_HD	
80828	3 E MECHANIC ST	LISTED_HD	
80829	12 E MECHANIC ST	LISTED_HD	
80830	11 E. MECHANIC ST.	LISTED_HD	
80831	SIXTH AVENUE	LISTED_HD	
80832	109 SIXTH AVE	LISTED_HD	
80833	102 SECOND AVENUE	LISTED_HD	
80834	401 BROADWAY	LISTED_HD	
80835	149 EMERALD AVENUE	LISTED_HD	
80836	FIRST AVENUE	LISTED_HD	
80837	306 FOW AVE.	LISTED_HD	
80838	311 FOW AVE	LISTED_HD	
80839	301 FOW AVE	LISTED_HD	
80840	298 SOUTH BROADWAY	LISTED_HD	
80841	298 1/2 BROADWAY	LISTED_HD	
80842	296 SOUTH BROADWAY	LISTED_HD	
80843	109 W. GRANT ST.	LISTED_HD	
80844	107 W GRANT ST	LISTED_HD	
80845	113 ELDREDGE AVE	LISTED_HD	
80846	511 BROADWAY	LISTED_HD	
80847	603 PARK BLVD	LISTED_HD	
80848	201 PACIFIC AVE	LISTED_HD	
80849	107 GOLDBEATEN ALLEY	LISTED_HD	
80850	115 SECOND AVENUE	LISTED_HD	
80851	136-138 ELDREDGE AVE	LISTED_HD	
80852	142 ELDREDGE AVE	LISTED_HD	
80915	144 ELDREDGE AVE	LISTED_HD	
80916	154 LEAMING AVENUE	LISTED_HD	
80917	501-503 PACIFIC AVE.	LISTED_HD	
80918	106-108 SUNSET BLVD	LISTED_HD	
80919	409 FIRST AVENUE	LISTED_HD	
80920	6 E MECHANIC ST	LISTED_HD	
80921	523 BROADWAY	LISTED_HD	
80922	500-502 BROADWAY	LISTED_HD	
80923	158 LEAMING AVENUE	LISTED_HD	
80924	8 E MECHANIC ST	LISTED_HD	
80925	160 LEAMING AVE	LISTED_HD	
80926	10 E MECHANIC	LISTED_HD	
80927	521 BROADWAY	LISTED_HD	
80928	412 PARK BLVD	LISTED_HD	
80929	306 BROADWAY	LISTED_HD	
80930	147 EMERALD AVE	LISTED_HD	
80931	104 EMERALD AVENUE	LISTED_HD	
80932	302 BROADWAY	LISTED_HD	
80933	110 EMERALD AVE	LISTED_HD	
80934	116 EMERALD AVE	LISTED_HD	
80935	136 THIRD AVENUE	LISTED_HD	
80936	118 EMERALD AVE	LISTED_HD	
80937	122 EMERALD AVE	LISTED_HD	
80938	311 BROADWAY	LISTED_HD	
80939	126 EMERALD AVE	LISTED_HD	
80940	612 BROADWAY	LISTED_HD	
80941	115 BROADWAY	LISTED_HD	
80942	101 SUNSET BLVD	LISTED_HD	
80943	127 MYRTLE AVE	LISTED_HD	
80944	601 BROADWAY	LISTED_HD	
80945	506 BROADWAY	LISTED_HD	

80946	150 LEAMING AVE	LISTED_HD	
80947	2 E MECHANIC STREET	LISTED_HD	
80948	4 E MECHANIC ST	LISTED_HD	
81012	406 BROADWAY	LISTED_HD	
81013	503 BROADWAY	LISTED_HD	
81014	[Park] MYRTLE & PERRY AVE	LISTED_HD	
81015	304 SOUTH BROADWAY	LISTED_HD	
81016	306 SOUTH BROADWAY	LISTED_HD	
81017	102-104 SUNSET BLVD	LISTED_HD	
81018	479 W PERRY ST	LISTED_HD	
81019	435 W PERRY ST	LISTED_HD	
81020	433 W PERRY ST	LISTED_HD	
81021	431 W PERRY ST	LISTED_HD	
81022	429 W PERRY ST	LISTED_HD	
81023	427 W PERRY ST	LISTED_HD	
81024	310 SO. BROADWAY	LISTED_HD	
81025	392 MYRTLE AVE	LISTED_HD	
81026	425 W PERRY ST	LISTED_HD	
81027	423 W PERRY ST	LISTED_HD	
81028	421 W PERRY ST	LISTED_HD	
81029	419 W PERRY ST	LISTED_HD	
81030	405 W PERRY ST	LISTED_HD	
81031	394 MYRTLE AVE	LISTED_HD	
81032	308 SOUTH BROADWAY	LISTED_HD	
81033	116 FOURTH AVENUE	LISTED_HD	
81034	128 ELDREDGE AVE	LISTED_HD	
81035	185 E MECHANIC ST	LISTED_HD	
81036	414-416 BROADWAY	LISTED_HD	
81037	123 FOURTH AVENUE	LISTED_HD	
81038	PARK BLVD	LISTED_HD	
81039	507 BROADWAY	LISTED_HD	
81040	121 FOURTH AVENUE	LISTED_HD	
81041	17 E MECHANIC ST	LISTED_HD	
81042	119 FOURTH AVE	LISTED_HD	
81043	601 PARK BLVD	LISTED_HD	
81044	E MECHANIC ST	LISTED_HD	
Other/No District			
93209	609 Sunset Boulevard (demolished)	IDENTIFIED_INDV 1980-01-01	Historic Sites Survey, Cape May County, 1980: Lower Township (1980-01-01)
93350	601 SUNSET BLVD (demolished)	IDENTIFIED_INDV 1980-01-01	Historic Sites Survey, Cape May County, 1980: Lower Township (1980-01-01)
93905	Ezekiel Eldredge House (alternate name George Reeves House) 108 Stevens Street	IDENTIFIED_INDV 2006-11-01	A survey of the Heavy Timber Frame Buildings of Cape May - Phase II (2006-10-12)
93943	Whilldin-Eldredge House (alternate name Stillwell Stevens House) 213 STEVENS ST	IDENTIFIED_INDV 2006-11-01	A survey of the Heavy Timber Frame Buildings of Cape May - Phase II (2006-11-01)
Source: NJDEP HPO, February 21, 2017a; NJDEP, February 21, 2017b			



Prepared by Kratzer Environmental Services

Data Sources: NJDEP, NJDOT
Note: Map accuracy is limited to the accuracy and scale of the original data sets.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Figure 9b: West Cape May Historic Districts and Properties

The four homes highlighted on the map were featured in a 2006 survey of the Heavy Timber Frame Buildings of Cape May.

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Wikipedia. Accessed March 20, 2017. Whilldin-Miller House. https://en.wikipedia.org/wiki/Whilldin-Miller_House

Internet Resources: Historic Resources

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

Cape May County Library: Genealogy and Local History - http://www.cmclibrary.org/services/genealogy-local-history

Cape May County New Jersey: Historic Sites - http://capemaycountynj.gov/374/Historic-Sites

History of Cape May County: http://capemaycountynj.gov/982/History-of-Cape-May-County

New Jersey National Landmarks and Historic Sites: http://www.nationalregisterofhistoricplaces.com/nj/cape+may/state.html

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

The Museum of Cape May County - 504 North Route 9, Cape May Court House - http://www.cmcmuseum.org/

Revolutionary War Sites in Cape May County: http://www.revolutionarywarnewjersey.com/new_jersey_revolutionary_war_sites/counties/cape_may_county_revolutionary_war_sites.htm

10: REGIONAL RELATIONSHIPS

A. 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 44% of these are currently certified at either the Bronze or Silver level.

West Cape May Borough received a *Sustainable Jersey Community Bronze Certification* on October 12, 2016 with 185 points (see **Table 10.1**) (Sustainable Jersey, 2017b).

There are currently two solar photovoltaic installations on public buildings in West Cape May, including a 7.56 mw system on the Borough Hall (installed in 2008) and a 66.89 mw system on the elementary school (installed in 2012) (NJDEP, January 20, 2017).

Table 10.1: Sustainability Actions Implemented in West Cape May for Bronze Certification

Category	Action	Points	Comment
Community Partnership & Outreach	Community Education and Outreach	10	
Community Partnership & Outreach	Create Green Team	10	Bronze Mandatory
Support Local Food	Farmers Market	10	
Support Local Food	Making Farmers Markets Accessible	5	
Innovation & Demonstration Projects	Innovative Community Project (Arbor Day activities)	10	
Innovation & Demonstration Projects	Wind Ordinance	10	
Solar Actions	On-site solar system	10	
Land Use & Transportation	Sustainable Land Use Pledge	20	Bronze Priority Silver Priority
Natural Resources	Environmental Commission	10	
Natural Resources	Environmental Commission Site Plan Review	10	
Natural Resources Protection Ordinances	Tree Protection Ordinance	10	
Tree and Woodlands Management	Community Forestry Plan and Tree Cover Goal	20	
Tree and Woodlands Management	Tree Planting Programs	10	
Green Purchasing Program	Recycled paper	10	
Access to Public Information	Digitizing Public Information	10	
Waste Management	Prescription Drug Safety and Disposal	10	Bronze Priority Silver Priority
Recycling	Recycling Depot	10	
	Total:	**185**	
Source: Sustainable Jersey, 2017b.			

B. 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 has been periodically updated and revised. A new plan was released for public comment in June 2017 and finalized in October. 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 Division of Water Supply and Geoscience, October 5, 2017)

Appendix A of the plan presents a characterization of confined and unconfined ground water and surface water supplies on a HUC11 basis. DEP analyzed data available from 1998 through 2015 to determine a period of time representing peak consumptive demand in New Jersey. West Cape May is within two HUC11s; 02040206230 (Cape May Tribs West) and 02040302080 (Cape May Bays & Tribs East). The method calculated the quantity of water available for depletive/consumptive loss to be 4.2 million gallons per day (mgd) in these two HUC11s. The full allocation of depletive/consumptive water loss is calculated to be 1.9 mgd in Cape May Tribs West and -1.9 mgd (net gain) in Cape May Bays & Tribs East. Based on this information, one of the stated management options is that NJDEP will continue to monitor the Cape May Tribs West watershed as they approach the planning threshold for depletive/consumptive uses associated with unconfined groundwater or unregulated (non-safe yield) surface water (NJDEP Division of Water Supply and Geoscience, October 5, 2017).

D. 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, December 18, 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. The new rules streamline the wastewater planning process and eliminate the some of the requirements found previously in both wastewater planning and other permitting

programs. 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, December 18, 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, November 7, 2016). The Cape May County Board of Chosen Freeholders is the designated planning agency with approved plan amendment procedures for the Cape May County WQM planning area, which includes the Borough of West Cape May. One of the WQM agency's roles is to update the WMP at least once every 10 years (NJDEP Office of Water Resources Management Coordination, November 16, 2017).

There have been no recent changes to the West Cape May portion of the Cape May County WQM planning area (NJDEP Office of Water Resources Management Coordination, November 3, 2017). The last change was a 2006 revision in order to correct, clarify or update the boundaries using newer, more accurate mapping (NJDEP Division of Watershed Management, July 11, 2006; NJDEP, January 24, 2017) (see **Figure 2d**).

The wastewater from the Cape May Co MUA discharges into Atlantic Ocean via an outfall pipe in Cape May Point Borough (discharge id. number NJ0020371) (NJDEP, February 13, 2017) (see **Figure 2d**).

References: Regional Relationships

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.

Sustainable Jersey. 2017a. Sustainable Jersey. http://www.sustainablejersey.com/. Accessed September 4, 2017.

Sustainable Jersey. 2017b. West Cape May Sustainable Jersey Community Certification Report. HTML version of report or PDF version of report. Accessed October 26, 2017.

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

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. 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. 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 Division of Watershed Management. July 11, 2006. Public Notice: Revision to the Cape May County Water Quality Management Plan. http://www.nj.gov/dep/wqmp/docs/wqmp/capemay/20060711a.pdf

NJDEP Office of Water Resources Management Coordination. November 16, 2017. The Water Quality Management Rules Home Page. http://www.nj.gov/dep/wqmp/wqmps.html. Accessed November 19, 2017.

NJDEP Office of Water Resources Management Coordination. November 3, 2017. Water Quality Management Planning Program. http://www.nj.gov/dep/wqmp/wmpadopted.html#capemay. Accessed November 19, 2017.

NJDEP Water Resources Management. December 18, 2015. New Jersey's Continuing Planning Process. http://www.nj.gov/dep/wrm/docs/cpp.pdf.

Internet Resources: Regional Relationships

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

Water Quality Management Planning

NJDEP Water Quality Management Planning: http://www.nj.gov/dep/wrm/index.html

NJDEP Water Supply Planning: http://www.state.nj.us/dep/watersupply/wsp.html

11: COMPOSITE MAP OF ENVIRONMENTALLY CRITICAL AREAS

Throughout this document, many environmental and natural features of the Borough of West Cape May 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 11** 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 11 combines the following:

- Floodplains
- Wetlands (based on 2012 Land Use data; Note: an LOI is necessary to determine actual boundary of wetlands)
- 150 foot wetlands buffers (based on 2012 Land Use data; an LOI is necessary to determine actual buffer for wetlands – wetlands are given a 150', 50' or 0' buffer)
- Riparian buffers: 50 foot buffers are given for most streams)
- Landscape Project version 3.3: Rank 4 habitats
- Open space

References: Environmentally Critical Areas

NJDEP. June 20, 2016. N.J.A.C. 7:8 Stormwater Management Rule. Date last amended: Date last amended: June 20, 2016. 39 pages. http://www.nj.gov/dep/rules/rules/njac7_8.pdf

GIS data:

Floodplains: See Section 6B; Figure 6c
Wetlands & wetlands buffers: See Section 6C; Figure 6d
Riparian buffers: See Section 6D; Figure 6b
Landscape Project v3.3 Rank 3 or 4: See Section 7F; Figure 7d
Open Space: See Section 8C; Figure 8a

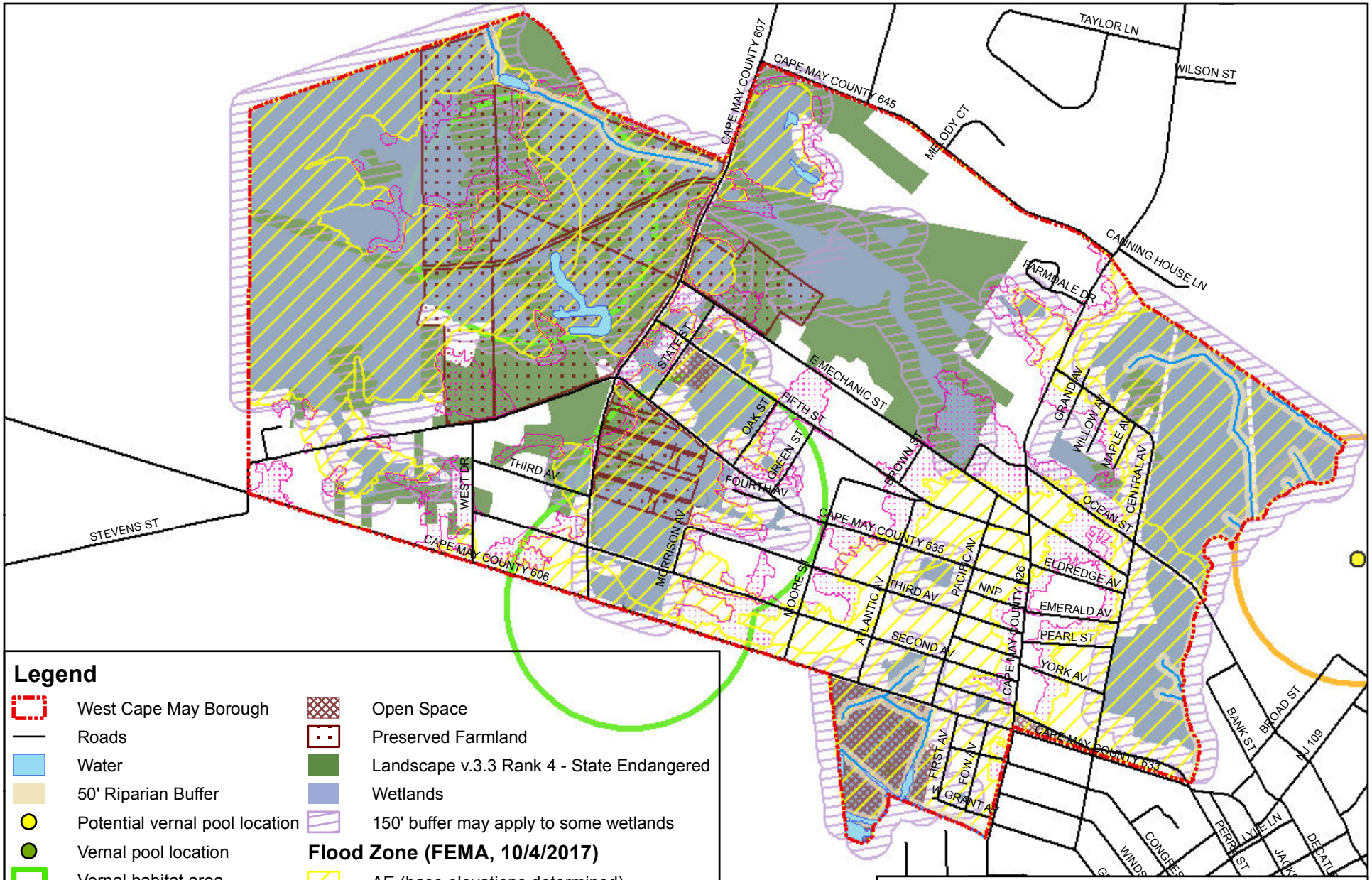

Figure 11: West Cape May Environmentally Critical Areas

"Environmentally critical area" means an area or feature which is of significant environmental value. This map combines some of the mapped layers from previous sections that make an area environmentally critical.

APPENDIX A: DATA USE AGREEMENTS

Contents

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.

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: METADATA FOR GIS DATA LAYERS USED FOR THIS REPORT

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.

APPENDIX B: GIS DATA LAYERS USED FOR THIS REPORT

Figure	Source of Data*	Data Title	Date	Scale	Online Linkage
Base Layers on many or most maps	NJDEP BGIS	Municipalities of New Jersey (Clipped to Coast), Edition 20121228 (Govt_admin_mun_coast_bnd)	12/28/2012	1:2,400	http://www.state.nj.us/dep/gis/stateshp.html#MUNCOAST
	NJDEP BGIS	NJDEP State Boundary of New Jersey	11/1/1998	1:24,000	http://www.state.nj.us/dep/gis/stateshp.html#STATE
	NJDEP BGIS	NJDEP County Boundaries for the State of New Jersey	1/23/2003	1:100,000	http://njogis-newjersey.opendata.arcgis.com/datasets/5f45e1ece6e14ef5866974a7b57d3b95_1
	NJDEP BGIS	National Hydrography Dataset (NHD) Waterbody 2002	11/1/2010	1:2,400	http://www.state.nj.us/dep/gis/digidownload/zips/statewide/nhdwaterbody2002shp.zip
	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
	Cape May County Planning Department	CMC_Parcels (20110923)	9/23/2011	1:400	https://njgin.state.nj.us/NJ_NJGINExplorer/DataDownloads.jsp
Figure 1a: Location of Municipality	NJDEP	Alternative Fueled Vehicle Fueling Stations for New Jersey, Edition 20160706 (Strc_alt_fuel)	7/6/2016	na	http://njogis-newjersey.opendata.arcgis.com/datasets/4b93a5c694f7413a9def60139a49ae1f_9
	NJDEP	Solar PV Grid Supply Installations of New Jersey, Edition 20170927 (Util_solar_supply)	1/20/2017	na	http://njogis-newjersey.opendata.arcgis.com/datasets/new-jersey-solar-pv-grid-supply-installations
	NJDOT	New Jersey Lighthouses	2/22/2017	na	http://njogis-newjersey.opendata.arcgis.com/datasets/new-jersey-lighthouses
Figure 1b: 1930 Aerial Photography	NJOIT OGIS	1930s Aerial Photography of New Jersey Web Map Service (WMS)	10/1/2009	na	WMS Server: http://geodata.state.nj.us/imagerywms/BlackWhite1930?
Figure 1c: 1995 Aerial Photography	USGS	1994/1995 Digital Orthophoto Quadrangles (DOQ)	6/21/1905	1:12,000	https://njgin.state.nj.us/NJ_NJGINExplorer/IW.jsp
Figure 1d: 2002 Aerial Photography	NJOIT OGIS	New Jersey 2002 High Resolution Orthophotography	7/31/2003	1:2,400	https://njgin.state.nj.us/NJ_NJGINExplorer/IW.jsp
Figure 1e: 2007 Aerial Photography	NJOIT OGIS	New Jersey 2007 - 2008 High Resolution Orthophotography, MrSID 5K Tiles	10/1/2008	1:19,200	https://njgin.state.nj.us/NJ_NJGINExplorer/IW.jsp
Figure 1f: 2012 Aerial Photography	NJOIT OGIS	New Jersey 2012 - 2013 High Resolution Orthophotography, NAD83 NJ State Plane Feet, MrSID Tiles	3/1/2013	1:2,400	https://njgin.state.nj.us/NJ_NJGINExplorer/IW.jsp
Figure 1g: 2015 Aerial Photography	NJOIT OGIS	New Jersey 2015 High Resolution Orthophotography, NAD83(2011) NJ State Plane Feet, MrSID Tiles	2/24/2016	1:2,400	https://njgin.state.nj.us/NJ_NJGINExplorer/IW.jsp
Figure 1h: Land Use Type (2012)	NJDEP BGIS	Land Use/Land Cover 2012 Update, Edition 20150217 Subbasin 02040204 - Delaware Bay, Subbasin 02040206 - Cohansey-Maurice (Land_lu_2012_hu02040204_206)	2/17/2015	1:2,400	http://www.nj.gov/dep/gis/listall.html
Figure 1h: Land Use Type (2012)	NJDEP BGIS	Land Use/Land Cover 2012 Update, Edition 20150217 Subbasin 02040302 - Great Egg Harbor, Subbasin 02040303 - Chincoteague (Land_lu_2012_hu02040302_303)	2/17/2015	1:2,400	http://www.nj.gov/dep/gis/listall.html
Figure 1i: Change in Land Use Type	NJDEP BGIS	NJDEP 1986 Land Use/Land Cover for Cape May County, New Jersey	11/1/1998	1:24,000	http://www.nj.gov/dep/gis/lulcshp.html#CAP
	NJDEP BGIS	NJDEP 1995/97 Land use/Land cover Update, Cape May Watershed Management Area, WMA-16	12/1/2000	1:12,000	http://www.nj.gov/dep/gis/lulc95shp.html

Figure	Source of Data*	Data Title	Date	Scale	Online Linkage
	NJDEP BGIS	NJDEP 2002 Land use/Land cover Update, Cape May Watershed Management Area, WMA-16, Edition 20080304	3/4/2008	1:2,400	http://www.nj.gov/dep/gis/lulc02cshp.html
	NJDEP BGIS	NJDEP 2007 Land use/Land Cover Update, Cape May Watershed Management Area, WMA16	7/12/2010	1:2,400	http://www.nj.gov/dep/gis/lulc07cshp.html
Figure 2a:: Historical Coastline	NJDEP BGIS	NJDEP Coastline of New Jersey, 1836-1977 (created 1991)	1/1/1991	unknown	http://www.state.nj.us/dep/gis/digidownload/zips/statewide/histshore.zip
	NJDEP BGIS	NJDEP Coastline of New Jersey (published in 1996 from 1986 aerials)	1/1/1996	1:24,000	http://www.state.nj.us/dep/gis/digidownload/zips/statewide/coast.zip
	NJDEP BGIS	Coastline of New Jersey, Edition 20150501 (Land_coastline_2007)	5/1/2015	1:2,400	http://www.state.nj.us/dep/gis/stateshp.html#NJCOAST07
	NJDEP BGIS	Coastline of New Jersey, Edition 20150501 (Land_coastline_2012)	5/1/2015	1:2,400	http://www.state.nj.us/dep/gis/stateshp.html#NJCOAST12
	ESRI	Imagery Basemap from ESRI		1:70,000	http://goto.arcgisonline.com/maps/World_Imagery
Figure 2b: Drought Regions & Air Quality	NADP	National Atmospheric Deposition Network	6/27/1905	na	http://nadp.sws.uiuc.edu/data/
	NJDEP NJGS	DGS00-1: Drought Regions of New Jersey	5/1/2004	1:24,000	http://www.state.nj.us/dep/njgs/geodata/dgs00-1.htm
	NJDEP BAM	NJDEP Ambient Air Quality Monitors	3/1/2006	1:1,600	http://njogis-newjersey.opendata.arcgis.com/datasets/new-jersey-air-quality-monitoring-stations
Figure 2c: Public Water	NJDEP DSRT BEA	NJDEP Public Community Water Purveyor Service Areas, 1998	7/12/2004	1:24,000	http://www.state.nj.us/dep/gis/digidownload/zips/statewide/watpurv1998.zip
	NJGS	DGS97-1 NJDEP Public-Community Water-Supply Wells of New Jersey	7/7/2011	1:24,000	http://www.state.nj.us/dep/njgs/geodata/dgs97-1.htm
Figure 2d: Public Sewer	NJDEP	Statewide Sewer Service Area for New Jersey, Edition 20170124 (Util_wastewater_servicearea)	1/24/2017	na	http://njogis-newjersey.opendata.arcgis.com/datasets/2ceba1ef852b4940afc3e0d94fb5d327_6
	NJDEP	NJPDES Surface Water Discharges in New Jersey, (1:12,000) Edition 20170213 (Strc_NJPDES_sw_pipe)	2/13/2017	1:12,000	http://njogis-newjersey.opendata.arcgis.com/datasets/2ceba1ef852b4940afc3e0d94fb5d327_6
Figure 3a: Physiographic Provinces	NJDEP BGIA	NJDEP Digital Elevation Grid for New Jersey (100 meter)	5/1/2002	1:24,000	http://www.state.nj.us/dep/gis/digidownload/zips/statewide/nj100mlat.zip
	NJDEP BGIA	NJDEP Hillshade Grid for New Jersey (100 meters)	5/1/2002	1:24,000	http://www.state.nj.us/dep/gis/digidownload/zips/statewide/nj100mhill.zip
	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
	NJGS	DGS04-1: Earthquakes Epicentered In New Jersey, Edition 20161107	11/7/2016	n/a	http://www.state.nj.us/dep/njgs/geodata/dgs04-1.htm
Figure 3b: Bedrock Geology	NJGS	DGS04-6: Bedrock Geology for New Jersey 1:100,000 Scale	6/30/1999	1:100,000	http://www.state.nj.us/dep/njgs/geodata/dgs04-6.htm
Figure 3c: Surficial Geology	NJGS	DGS07-2: Surficial Geology of New Jersey	9/11/2013	1:100,000	http://www.state.nj.us/dep/njgs/geodata/dgs07-2.htm
	NJGS	Thickness of Surficial Deposits in New Jersey	9/11/2013	1:100,000	http://njgeology.org/geodata/dgs07-2.htm
	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
Figure 3d: Shaded Elevation (Hillshade)	NJDEP BGIA	NJDEP Digital Elevation Grid for New Jersey (100 meter)	5/1/2002	1:24,000	http://www.state.nj.us/dep/gis/digidownload/zips/statewide/nj100mlat.zip
	NJDEP BGIA	NJDEP Hillshade Grid for New Jersey (100 meters)	5/1/2002	1:24,000	http://www.state.nj.us/dep/gis/digidownload/zips/statewide/nj100mhill.zip
Figure 4a-4g: Soil Maps	USDA	Soil Survey Geographic (SSURGO) database for Cape May County, New Jersey	9/28/2016	1:24,000	http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx
Figure 5b: Aquifer, GW Monitoring wells	NJGS	DGS98-5 Aquifers of New Jersey	5/21/1998	1:100,000	http://www.state.nj.us/dep/njgs/geodata/dgs98-5.htm
	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
	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
	NJGS	DGS97-1 NJDEP Public-Community Water-Supply Wells of New Jersey	7/7/2011	1:24,000	http://www.state.nj.us/dep/njgs/geodata/dgs97-1.htm; new message (noticed it on 10/8/17) sensitive nature so no longer available
	NJGS	DGS04-5 Well Head Protection Areas For Public Non-Community Water Supply Wells In New Jersey.	2/19/2015	1:24,000	http://www.state.nj.us/dep/njgs/geodata/dgs04-5.htm

Figure	Source of Data*	Data Title	Date	Scale	Online Linkage
	USGS	USGS ground water level monitoring	na	na	
Figure 5d: Ground Water Recharge & Aquifer Rank	NJGS	DGS02-3 Ground-Water Recharge for Cape May County, NJ	10/8/2004	1:24,000	http://www.state.nj.us/dep/njgs/geodata/dgs02-3.htm
	NJGS	DGS07-1: Aquifer-Recharge Potential for Cape May County, NJ	1/4/2005	1:24,000	http://www.state.nj.us/dep/njgs/geodata/dgs07-1.htm
Figure 6a: Watershed	NJDEP OEA CTD	NJDEP Head of Tide Points for Watercourses of New Jersey	1/1/1986	1:24,000	http://www.state.nj.us/dep/gis/digidownload/zips/statewide/hot.zip
	NJGS	DGS06-2 New Jersey Tidal Benchmark Network	3/1/2006	na	http://www.state.nj.us/dep/njgs/geodata/dgs06-2.htm
	NJGS	Canals and Water Raceways of New Jersey	10/1/2008	1:24,000	http://www.state.nj.us/dep/njgs/geodata/dgs08-1.htm#image
	NJDEP DWM	NJDEP Watershed Management Areas in New Jersey (Version 200901)	1/1/2009	1:24,000	http://www.nj.gov/dep/gis/stateshp.html#WMAS
	NJGS	14 Digit Hydrologic Unit Code Delineations for New Jersey (Version 20110225)	2/25/2011	1:24,000	http://www.nj.gov/dep/gis/stateshp.html#HUC14
Figure 6b: Subwatershed & SWQS	NJDEP WMS	NJDEP Surface Water Quality Standards of New Jersey (Version 201012)	12/1/2010	1:2,400	http://www.state.nj.us/dep/gis/stateshp.html#SWQS
Figure 6c: Floodplains	FEMA	National Flood Hazard Layer (NFHL) (Cape May, NJ)	10/4/2017	1:12,000	https://msc.fema.gov
Figure 6d: Wetlands	NJDEP BGIS	Land Use/Land Cover 2012 Update, Edition 20150217 Subbasin 02040204 - Delaware Bay, Subbasin 02040206 - Cohansey-Maurice (Land_lu_2012_hu02040204_206)	2/17/2015	1:2,400	http://www.nj.gov/dep/gis/listall.html
	NJDEP BGIS	Land Use/Land Cover 2012 Update, Edition 20150217 Subbasin 02040302 - Great Egg Harbor, Subbasin 02040303 - Chincoteague (Land_lu_2012_hu02040302_303)	2/17/2015	1:2,400	http://www.nj.gov/dep/gis/listall.html
Figure 6e: Integrated List	NJDEP WMS	Integrated List of Waters for New Jersey, 2014 (Integrated List), Edition 20170927 (Envr_mon_water_IR_2014_use	9/27/2017	1:24,000	http://njogis-newjersey.opendata.arcgis.com/datasets/2014-new-jersey-integrated-list-of-waters-integrated-list?geometry=-82.144,38.633,-61.237,41.573
Figure 6f: Percent Impervious Surface & Discharge	NJDEP BGIS	Land Use/Land Cover 2012 Update, Edition 20150217 Subbasin 02040204 - Delaware Bay, Subbasin 02040206 - Cohansey-Maurice (Land_lu_2012_hu02040204_206)	2/17/2015	1:2,400	http://www.nj.gov/dep/gis/listall.html
	NJDEP BGIS	Land Use/Land Cover 2012 Update, Edition 20150217 Subbasin 02040302 - Great Egg Harbor, Subbasin 02040303 - Chincoteague (Land_lu_2012_hu02040302_303)	2/17/2015	1:2,400	http://www.nj.gov/dep/gis/listall.html
	NJDEP	NJPDES Surface Water Discharges in New Jersey, (1:12,000) Edition 20170614 (Strc_NJPDES_sw_pipe)	6/14/2017	1:12,000	http://njogis-newjersey.opendata.arcgis.com/datasets/55e8b1a25706431490a8f3becf861f91_5
Figure 6g: Monitoring	NJDEP BFBM	STORET Water Quality Monitoring Stations	8/1/2005	unknown	http://www.state.nj.us/dep/gis/digidownload/zips/statewide/storet.zip
Figure 7a-7c: Land Cover (2012)	NJDEP BGIS	Land Use/Land Cover 2012 Update, Edition 20150217 Subbasin 02040204 - Delaware Bay, Subbasin 02040206 - Cohansey-Maurice (Land_lu_2012_hu02040204_206)	2/17/2015	1:2,400	http://www.nj.gov/dep/gis/listall.html
	NJDEP BGIS	Land Use/Land Cover 2012 Update, Edition 20150217 Subbasin 02040302 - Great Egg Harbor, Subbasin 02040303 - Chincoteague (Land_lu_2012_hu02040302_303)	2/17/2015	1:2,400	http://www.nj.gov/dep/gis/listall.html
Figure 7d: Wildfire Fuel Hazard	NJDEP NJFFS	2002 NJFFS Wildfire Fuel Hazard for Cape May County, New Jersey	4/17/2009	1:2,400	http://www.state.nj.us/dep/gis/njfh.html#CAP
Figure 7e: Important Bird Areas (Audubon)	State Audubon	Important Bird Areas	3/2/2016	1:50,000	ArcGIS Map Service or http://gis.audubon.org/arcgisweb/rest/services/NAS/ImportantBirdAreas_Poly/MapServer
Figure 7f: Landscape Project version 3.3	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.state.nj.us/dep/gis/landscape.html#geodatabase
	NJDEP DFW ENSP	NJDEP Species Based Habitat, Vernal Pools, Version 3.3, 20170509	5/9/2017	1:12,000	http://www.state.nj.us/dep/gis/landscape.html#geodatabase

Figure	Source of Data*	Data Title	Date	Scale	Online Linkage
		(Envr_hab_ls_v3_3_vernalpools)			
	NJDEP DFW ENSP	NJDEP Species Based Habitat, Delaware Bay Region, Version 3.3, 20170509 (Envr_hab_ls_v3_3_delbay)	5/9/2017	1:12,000	http://www.state.nj.us/dep/gis/landscape.html#geodatabase
	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.state.nj.us/dep/gis/landscape.html#geodatabase
Figure 7g: Natural Heritage Priority Sites and Grid	NJDEP ONLM	NJDEP Natural Heritage Priority Sites	3/1/2007	1:24,000	http://www.state.nj.us/dep/gis/stateshp.html#PRIORITY
	NJDEP ONLM	NJDEP Natural Heritage Grid Map, Version 200911	3/21/2013	1:24,000	http://www.state.nj.us/dep/gis/stateshp.html#NHPGRID
Figure 8a: Preserved Open Space & Recreation	NJDA SADC	NJFPP - New Jersey Farmland Preservation Program	1/8/2013	1:24,000	http://www.nj.gov/agriculture/sadc/farmpreserve/resources/njfpp.zip
	NJDEP	State Owned, Protected Open Space and Recreation Areas in New Jersey, Edition 20160527 (Land_owner_openspace_state)	5/27/2016	1:2,400	http://njogis-newjersey.opendata.arcgis.com/datasets/b75fe11ed90543c1b4ee87e66af63b8b_1
	KES	Open Space - Other (selected parcels from CMC_parcels)	3/16/2017	na	na
Figure 9a: Archeological & Historical	NJDEP NHR HPO	Historic Property Features of New Jersey, Edition 20160922 (Land_use_HPO_property_feature)	9/22/2016	NA	https://geodata.state.nj.us/arcgis/rest/services/Features/Land_Use_and_Land_Cover/MapServer/7
	NJDEP NHR HPO	Archaeological Site Grid of New Jersey, Edition 20160922 (Land_use_HPO_arch_grid)	9/22/2016	NA	https://geodata.state.nj.us/arcgis/rest/services/Features/Land_Use_and_Land_Cover/MapServer/8
Figure 9b: Historical Properties	NJDEP NHR HPO	Historic Districts of New Jersey, Edition 20160922 (Land_use_HPO_district)	9/22/2016	NA	https://geodata.state.nj.us/arcgis/rest/services/Features/Land_Use_and_Land_Cover/MapServer/9
	NJDEP NHR HPO	Historic Property Features of New Jersey, Edition 20111121 (Land_use_HPO_property_feature)	11/21/2017	NA	https://geodata.state.nj.us/arcgis/rest/services/Features/Land_Use_and_Land_Cover/MapServer/6
Figure 11: Composite Map of Environ-mentally Critical Areas	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
	NJDA SADC	NJFPP - New Jersey Farmland Preservation Program	1/8/2013	1:24,000	http://www.nj.gov/agriculture/sadc/farmpreserve/resources/njfpp.zip
	NJDEP BGIS	Land Use/Land Cover 2012 Update, Edition 20150217 Subbasin 02040204 - Delaware Bay, Subbasin 02040206 - Cohansey-Maurice (Land_lu_2012_hu02040204_206)	2/17/2015	1:2,400	http://www.nj.gov/dep/gis/listall.html
	NJDEP BGIS	Land Use/Land Cover 2012 Update, Edition 20150217 Subbasin 02040302 - Great Egg Harbor, Subbasin 02040303 - Chincoteague (Land_lu_2012_hu02040302_303)	2/17/2015	1:2,400	http://www.nj.gov/dep/gis/listall.html
	NJDEP	State Owned, Protected Open Space and Recreation Areas in New Jersey, Edition 20160527 (Land_owner_openspace_state)	5/27/2016	1:2,400	http://njogis-newjersey.opendata.arcgis.com/datasets/b75fe11ed90543c1b4ee87e66af63b8b_1
	KES	Open Space - Other (selected parcels from CMC_parcels)	3/16/2017	1:400	na
	FEMA	National Flood Hazard Layer (NFHL) (Cape May, NJ)	10/4/2017	1:12,000	https://msc.fema.gov

***Sources of GIS Data:**

Data Sources	Full Name of Data Source
Cape May County PD	Cape May County Planning Department
DRBC	Delaware River Basin Commission
ESRI	ESRI Inc.
FEMA	Federal Emergency Management Agency
KES	Kratzer Environmental Services
NADP	National Atmospheric Deposition Program
NJDA SADC	New Jersey Department of Agriculture (NJDA), State Agriculture Development Committee (SADC)
NJDEP	NJ Department of Environmental Protection
NJDEP BAM	NJDEP Dept of Environmental Regulation, Bureau of Air Monitoring
NJDEP BFBM	NJDEP Bureau of Freshwater Biological Monitoring
NJDEP BGIA	NJDEP Bureau of Geographic Information and Analysis
NJDEP BGIS	NJDEP Bureau of Geographic Information Services
NJDEP DFW ENSP	NJDEP Division of Fish & Wildlife, Endangered Nongame Species Program
NJDEP DSRT BEA	NJDEP Division of Science, Research, and Technology, Bureau of Environmental Assessment
NJDEP DWM	NJDEP Division of Watershed Management
NJDEP GA	NJDEP Green Acres
NJDEP NHR HPO	NJDEP Natural and Historic Resources, Historic Preservation Office
NJDEP NJFFS	NJDEP New Jersey Forest Fire Service
NJDEP NJG&WS	NJDEP New Jersey Geological and Water Survey
NJDEP OEA CTD	NJDEP Office of Environmental Analysis (OEA), Coast survey Limited (CTD)
NJDEP ONLM	NJDEP Office of Natural Lands Management
NJDEP WMS	NJDEP Division of Water Monitoring and Standards
NJDOT	New Jersey Department of Transportation
NJGIN	New Jersey Geographic Information Network
NJGS	New Jersey Geological Service
NJOIT OGIS	New Jersey Office of Information Technology, Office of GIS
PA DCNR	Pennsylvania Department of Conservation and Natural Resources
State Audubon	NJ State Audubon
USDA/NRCS	United States Department of Agriculture, Natural Resources Conservation Service
USGS	United States Geological Survey

APPENDIX C: REGIONAL FAUNA

Contents:

C.1 Cape May County Birds

State Status	Common name	*Scientific name*	Cape May High Count*	Cape May High Count Date*	Recorded in West Cape May**
Ducks, Geese & Swans					
RV	Greater White-fronted Goose	*Anser albifrons*	7	3/3/2014	✓
RV	Pink-footed goose	*Anser brachyrhynchus*	1	2/26/2017	
	Snow Goose	*Chen caerulescens*	15000	12/8/2008	✓
RV	Ross's Goose	*Chen rossii*	2	12/18/2014	✓
	Brant	*Branta bernicla*	3200	1/2/2014	✓
RV	Cackling Goose	*Branta hutchinsii*	7	12/6/2014	✓
	Canada Goose	*Branta canadensis*	20325	12/9/2010	✓
RV	Barnacle goose	*Branta leucopsis*	1	11/24/2013	
int	Mute Swan	*Cygnus olor*	135	1/10/2003	✓
RV	Trumpeter Swan	*Cygnus buccinator*	1	1/5/2006	
	Tundra Swan	*Cygnus columbianus*	102	11/18/2014	✓
	Fulvous whistling duck	*Dendrocygna bicolor*	2	10/5/1974	
RV	Black-bellied whistling duck	*Dendrocygna autumnalis*	12	7/14/2016	✓
	Wood Duck	*Aix sponsa*	428	10/21/2013	✓
	Gadwall	*Anas strepera*	450	11/7/2014	✓
	Eurasian Wigeon	*Anas penelope*	5	10/31/2014	✓
	American Wigeon	*Anas americana*	425	10/31/1998	✓
	American Black Duck	*Anas rubripes*	1100	2/10/1929	✓
	Mallard	*Anas platyrhynchos*	880	2/6/2014	✓
	Blue-winged Teal	*Anas discors*	120	9/15/2008	✓
	Northern Shoveler	*Anas clypeata*	200	11/10/2013	✓
	Northern Pintail	*Anas acuta*	1000	2/12/2012	✓
	Green-winged Teal	*Anas crecca*	2510	3/7/2008	✓
	Canvasback	*Aythya valisineria*	12	1/11/2015	
	Redhead	*Aythya americana*	60	12/14/2013	✓
	Ring-necked Duck	*Aythya collaris*	600	2/19/2017	✓
	Greater Scaup	*Aythya marila*	1075	1/1/2014	✓
	Lesser Scaup	*Aythya affinis*	300	11/2/2008	✓
	King Eider	*Somateria spectabilis*	3	12/2/2014	
	Common Eider	*Somateria mollissima*	227	11/27/2009	
	Harlequin Duck	*Histrionicus histrionicus*	8	3/14/2004	
	Surf Scoter	*Melanitta perspicillata*	66587	10/26/2007	✓
	White-winged Scoter	*Melanitta fusca*	424	11/29/2010	
	Black Scoter	*Melanitta americana*	74998	10/26/2007	✓
	Long-tailed Duck	*Clangula hyemalis*	1000	3/5/2000	✓
	Bufflehead	*Bucephala albeola*	1063	11/17/2007	✓
	Common Goldeneye	*Bucephala clangula*	51	1/7/2012	
RV	Barrow's Goldeneye	*Bucephala islandica*	1	11/28/2007	
	Hooded Merganser	*Lophodytes cucullatus*	405	12/17/2006	✓
	Common Merganser	*Mergus merganser*	59	3/7/2008	
	Red-breasted Merganser	*Mergus serrator*	523	11/19/2007	✓
	Ruddy Duck	*Oxyura jamaicensis*	2254	1/28/2016	✓

State Status	Common name	*Scientific name*	Cape May High Count*	Cape May High Count Date*	Recorded in West Cape May**
Grouse, Quail & Allies					
	Northern Bobwhite	*Colinus virginianus*	30	10/21/2008	✓
	Ring-necked Pheasant	*Phasianus colchicus*	1	4/1/2016	✓
	Ruffed Grouse	*Bonasa umbellus*	1	11/3/2014	✓
	Wild Turkey	*Meleagris gallopavo*	61	1/12/2012	✓
Grebes					
Ebr, SCnb	Pied-billed Grebe	*Podilymbus podiceps*	20	11/23/1998	✓
	Horned Grebe	*Podiceps auritus*	70	1/11/2015	
	Red-necked Grebe	*Podiceps grisegena*	13	3/2/2015	
RV	Eared Grebe	*Podiceps nigricollis*	1	9/30/2012	
RV	Western Grebe	*Aechmorphorus occidentalis*	1	12/1/2013	
Pigeons & Doves					
int	Rock Pigeon	*Columba livia*	389	12/18/2016	✓
RV	Band-tailed Pigeon	*Patagioenas leucocephala*	1	1/18/2007	✓
RV	Eurasian Collared-Dove	*Streptopelia decaocto*	5	9/6/2012	✓
RV	White-winged Dove	*Zenaida asiatica*	1	6/11/2016	✓
	Mourning Dove	*Zenaida macroura*	302	12/16/2012	✓
RV	Common Ground-Dove	*Columbina passerina*	1	10/29/2010	
Cuckoos					
	Yellow-billed Cuckoo	*Coccyzus americanus*	10	9/1/1983	✓
SCbr	Black-billed Cuckoo	*Coccyzus erythropthalmus*	3	8/13/2011	✓
Nightjars					
SC	Common Nighthawk	*Chordeiles minor*	1202	9/6/2012	✓
RV	Lesser Nighthawk	*Chordeiles acutipennis*	1	11/25/2007	
	Chuck-will's-widow	*Antrostomus carolinensis*	12	5/21/2015	✓
SCbr, Unb	Eastern Whip-poor-will	*Antrostomus vociferous*	18	5/11/2012	✓
Swifts & Hummingbirds					
	Chimney Swift	*Chaetura pelagica*	517	10/7/2012	✓
RV	Black Swift	*Cypseloides niger*	1	8/28/2011	
	Ruby-throated Hummingbird	*Archilochus colubris*	35	8/17/2014	✓
RV	Black-chinned Hummingbird	*Archilochus alexandri*	1	11/17/2016	
RV	Broad-tailed Hummingbird	*Selasphorus platycercus*	1	4/3/2012	
RV	Rufous Hummingbird	*Selasphorus rufus*	2	12/26/2008	✓
RV	Allen's Hummingbird	*Selasphorus sasin*	1	12/7/2004	
RV	Calliope Hummingbird	*Selasphorus calliope*	1	11/20/2015	
Cranes & Rails					
	Corn Crake	*Crex crex*	1	11/11/1905	
	Yellow rail	*Coturnicops*	1	10/26/2015	✓

State Status	Common name	*Scientific name*	Cape May High Count*	Cape May High Count Date*	Recorded in West Cape May**
		noveboracensis			
Ebr, Tnb	Black rail	*Laterallus jamaicensis*	3	5/5/2008	✓
	Clapper Rail	*Rallus longirostris*	113	6/20/2009	✓
	King Rail	*Rallus elegans*	3	5/8/2013	✓
	Virginia Rail	*Rallus limicola*	17	12/15/2013	✓
	Sora	*Porzana carolina*	11	9/29/1972	✓
	Purple gallinule	*Poryphyrula martinica*	1	10/26/2016	✓
	Common Gallinule	*Gallinula galeata*	10	9/22/1973	✓
	American Coot	*Fulica americana*	266	11/25/2011	✓
	Sandhill Crane	*Grus canadensis*	14	11/26/2016	✓
Plovers, Sandpipers & Allies					
RV	Northern Lapwing	*Vanellus vanellus*	1	1/3/1997	
	Black-bellied Plover	*Pluvialis squatarola*	1000	10/4/1986	✓
	American Golden-Plover	*Pluvialis dominica*	21	10/23/2007	✓
RV	Wilson's Plover	*Charadrius wilsonia*	1	6/6/2016	
	Semipalmated Plover	*Charadrius semipalmatus*	1795	8/13/2004	✓
E	Piping Plover	*Charadrius melodus*	30	9/6/2011	✓
	Killdeer	*Charadrius vociferus*	415	10/23/2014	✓
RV	Lesser Sand-Plover	*Charadrius mongolus*	1	7/13/1990	
SC	American Oystercatcher	*Haematopus palliatus*	500	9/26/2006	✓
	Black-necked Stilt	*Himantopus mexicanus*	6	5/13/1988	
	American Avocet	*Recurvirostra americana*	4	7/15/2016	
SCbr	Spotted Sandpiper	*Actitis macularius*	25	7/27/2013	✓
	Solitary Sandpiper	*Tringa solitaria*	31	5/2/2016	✓
	Greater Yellowlegs	*Tringa melanoleuca*	660	11/1/2011	✓
	Willet	*Tringa semipalmata*	472	4/22/2014	✓
	Lesser Yellowlegs	*Tringa flavipes*	854	9/12/2009	✓
E	Upland Sandpiper	*Bartramia longicauda*	4	8/23/1987	✓
SCnb	Whimbrel	*Numenius phaeopus*	1144	5/5/2012	✓
RV	Long-billed Curlew	*Numenius americanus*	1	7/18/2011	
	Hudsonian Godwit	*Limosa haemastica*	29	10/10/2015	
	Marbled Godwit	*Limosa fedoa*	20	10/8/2006	✓
	Ruddy Turnstone	*Arenaria interpres*	3300	5/27/2014	✓
Enb	Red Knot	*Calidris canutus*	95530	5/21/1982	✓
SCnb	Sanderling	*Calidris alba*	4629	8/27/2004	✓
SCnb	Semipalmated Sandpiper	*Calidris pusilla*	5000	5/29/2014	✓
	Western Sandpiper	*Calidris mauri*	800	8/5/2007	✓
	Least Sandpiper	*Calidris minutilla*	1200	7/26/2013	✓
	White-rumped Sandpiper	*Calidris fuscicollis*	295	10/4/2010	✓
	Baird's Sandpiper	*Calidris bairdii*	3	9/8/2008	
	Pectoral Sandpiper	*Calidris melanotos*	101	9/5/2012	✓
	Purple Sandpiper	*Calidris maritima*	84	12/14/2008	
	Dunlin	*Calidris alpina*	11000	2/26/2012	✓
	Stilt Sandpiper	*Calidris himantopus*	120	8/13/2014	✓
	Curlew sandpiper	*Calidris ferruginea*	2	5/16/2005	
RV	Little Stint	*Calidris minuta*	1	7/10/2003	

State Status	Common name	*Scientific name*	Cape May High Count*	Cape May High Count Date*	Recorded in West Cape May**
RV	Red-necked Stint	*Calidris ruficollis*	1	8/30/2008	
RV	Sharp-tailed Sandpiper	*Calidris acuminata*	1	10/8/2002	
	Ruff	*Calidris pugnax*	1	5/7/2016	
	Buff-breasted Sandpiper	*Tryngites subruficollis*	22	9/8/2007	✓
	Short-billed Dowitcher	*Limnodromus griseus*	2300	5/7/2009	✓
	Long-billed Dowitcher	*Limnodromus scolopaceus*	30	10/16/2011	✓
	Wilson's Snipe	*Gallinago delicata*	75	10/4/2010	✓
	American Woodcock	*Scolopax minor*	140	1/13/2011	✓
	Wilson's Phalarope	*Phalaropus tricolor*	3	9/19/1993	
	Red-necked Phalarope	*Phalaropus lobatus*	262	9/2/2006	
	Red Phalarope	*Phalaropus fulicarius*	235	11/8/2016	
	Black-legged Kittiwake	*Rissa tridactyla*	500	12/4/1982	
RV	Ivory Gull	*Pagophila eburnea*	1	12/9/2009	
RV	Sabine's Gull	*Xema sabini*	1	10/11/2009	
	Bonaparte's Gull	*Chroicocephalus philadelphia*	1900	12/20/2015	✓
	Black-headed Gull	*Chroicocephalus ridibundus*	5	3/11/2014	
	Little Gull	*Hydrocoloeus minutus*	3	2/10/2002	✓
	Laughing Gull	*Leucophaeus atricilla*	20000	5/13/2016	✓
RV	Franklin's Gull	*Leucophaeus pipixcan*	114	11/13/2015	✓
	Ring-billed Gull	*Larus delawarensis*	8000	11/24/2013	✓
RV	California Gull	*Larus californicus*	1	11/11/2011	
	Herring Gull	*Larus argentatus*	8000	12/14/2008	✓
RV	Thayer's Gull	*Larus thayeri*	1	2/19/2000	✓
	Iceland Gull	*Larus glaucoides*	2	2/4/2017	✓
	Lesser Black-backed Gull	*Larus fuscus*	32	7/20/2015	✓
	Glaucous Gull	*Larus hyperboreus*	2	12/21/2010	
	Great Black-backed Gull	*Larus marinus*	1200	12/14/2008	✓
RV	Black-tailed Gull	*Larus crassirostris*	1	12/10/1998	
	Bridled Tern	*Onychoprion anaethetus*	23	9/3/2000	
RV	Sooty Tern	*Onychoprion fuscatus*	25	9/16/1999	
E	Least Tern	*Sternula antillarum*	380	7/28/2016	✓
SC	Gull-billed Tern	*Gelochelidon nilotica*	15	7/5/2016	✓
SCbr	Caspian Tern	*Hydroprogne caspia*	250	9/13/2016	✓
	Black Tern	*Chlidonias niger*	125	9/3/2016	✓
RV	White-winged Tern	*Chlidonias leucopterus*	1	6/10/1989	
RV	Whiskered Tern	*Chlidonias hybrida*	1	9/20/2014	
E	Roseate Tern	*Sterna dougallii*	16	9/19/2003	
SCbr	Common Tern	*Sterna hirundo*	3000	5/18/2007	✓
RV	Arctic Tern	*Sterna paradisaea*	7	5/7/1993	
	Forster's Tern	*Sterna forsteri*	3788	11/4/2014	✓
	Royal Tern	*Thalasseus maximus*	1027	10/17/2006	✓
	Sandwich Tern	*Thalasseus sandvicensis*	34	9/19/2003	✓
E	Black Skimmer	*Rynchops niger*	2002	7/11/2008	✓
RV	Great Skua	*Stercorarius skua*	1	2/6/2016	

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RV	South Polar Skua	*Stercorarius maccormicki*	2	5/25/2015	
	Pomarine Jaeger	*Stercorarius pomarinus*	91	10/30/2012	
	Parasitic Jaeger	*Stercorarius parasiticus*	172	11/11/2013	✓
	Long-tailed Jaeger	*Stercorarius longicaudus*	3	9/2/2006	
	Dovekie	*Alle alle*	397	2/12/2013	
	Common Murre	*Uria aalge*	27	1/16/2011	
	Thick-billed murre	*Uria lomvia*	1	11/7/2008	
	Razorbill	*Alca torda*	131	1/11/2015	
RV	Black Guillemot	*Cepphus grylle*	1	12/22/2011	
	Atlantic Puffin	*Fratercula arctica*	17	2/6/2016	
Loons					
	Red-throated Loon	*Gavia stellata*	20000	11/14/1985	✓
	Common Loon	*Gavia immer*	376	10/24/2016	✓
RV	Pacific Loon	*Gavia arctica*	1	10/24/2015	
Tubenoses					
	Northern Fulmar	*Fulmarus glacialis*	10	3/14/2004	
	Cory's Shearwater	*Calonectris diomedea*	89	8/22/2008	
	Great Shearwater	*Puffinus gravis*	182	6/28/2015	
	Sooty Shearwater	*Puffinus griseus*	224	5/25/2002	
	Manx Shearwater	*Puffinus puffinus*	30	12/20/2016	
	Audubon's Shearwater	*Puffinus lherminieri*	12	9/18/2016	
RV	Black-capped Petrel	*Pterodroma hasitata*	8	7/13/1996	
	Wilson's Storm-Petrel	*Oceanites oceanicus*	419	5/20/2011	
	Leach's Storm-Petrel	*Oceanodroma leucorhoa*	16	5/20/2011	
RV	Band-rumped Storm-Petrel	*Oceanodroma castro*	11	7/13/1996	
RV	White-faced Storm-Petrel	*Pelagodroma marina*	1	9/18/2016	
RV	Black-browed Albatross	*Thalassarche melanophris*	1	5/12/1985	
RV	Yellow-nosed Albatross	*Thalassarche chlororhynchos*	1	5/23/2000	
Storks					
RV	Wood Stork	*Mycteria americana*	2	9/17/1983	✓
Frigatebirds, Boobies, Cormorants, Darters & Allies					
RV	Magnificent Frigatebird	*Fregata magnificens*	1	9/7/2012	✓
RV	Masked Booby	*Sula dactylatra*	1	10/15/2015	
RV	Brown Booby	*Sula leucogaster*	1	9/27/2016	
	Northern Gannet	*Morus bassanus*	16946	11/11/2008	✓
	Neotropic Cormorant	*Phalacrocorax brasilianus*	1	10/14/2015	
	Double-crested Cormorant	*Phalacrocorax auritus*	35500	10/17/2009	✓
	Great Cormorant	*Phalacrocorax carbo*	30	10/22/2012	✓
RV	Anhinga	*Anhinga anhinga*	1	5/1/2011	✓

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Tropicbirds					
RV	White-tailed Tropicbird	*Phaethon lepturus*	3	8/28/2011	
Pelicans, Herons, Ibises & Allies					
	American White Pelican	*Pelecanus erythrorhynchos*	11	11/29/2009	✓
	Brown Pelican	*Pelecanus occidentalis*	94	9/29/2010	
Ebr, SCnb	American Bittern	*Botaurus lentiginosus*	80	10/5/2008	✓
SC	Least Bittern	*Ixobrychus exilis*	6	6/18/2015	✓
SCbr	Great Blue Heron	*Ardea herodias*	3000	10/2/1994	✓
	Great Egret	*Ardea alba*	375	8/24/2014	✓
SCbr	Snowy Egret	*Egretta thula*	891	8/27/2014	✓
SC	Little Blue Heron	*Egretta caerulea*	100	4/4/1970	✓
SC	Tricolored Heron	*Egretta tricolor*	92	8/19/2014	✓
Tbr, SCnb	Cattle Egret	*Bubulcus ibis*	50	5/11/1986	✓
	Green Heron	*Butorides virescens*	310	9/13/2015	✓
Tbr, SCnb	Black-crowned Night-Heron	*Nycticorax nycticorax*	300	10/5/2008	✓
T	Yellow-crowned Night-Heron	*Nyctanassa violacea*	58	7/5/2015	✓
RV	White Ibis	*Eudocimus albus*	4	9/1/2015	✓
SCbr	Glossy Ibis	*Plegadis falcinellus*	400	4/28/2016	✓
RV	White-faced Ibis	*Plegadis chihi*	3	5/14/2005	✓
New World Vultures					
	Black Vulture	*Coragyps atratus*	100	11/6/2010	✓
	Turkey Vulture	*Cathartes aura*	657	11/19/2014	✓
Hawks, Kites, Eagles & Allies					
Tbr	Osprey	*Pandion haliaetus*	800	10/2/1986	✓
	Swallow-tailed Kite	*Elanoides forficatus*	3	5/3/2013	✓
	Mississippi Kite	*Ictinia mississippiensis*	17	6/13/2016	✓
Ebr, Tnb	Bald Eagle[28]	*Haliaeetus leucocephalus*	36	9/14/2013	✓
Ebr, SCnb	Northern Harrier	*Circus cyaneus*	266	10/2/1986	✓
SC	Sharp-shinned Hawk	*Accipiter striatus*	5025	10/2/1986	✓
SCbr	Cooper's Hawk	*Accipiter cooperii*	587	10/11/2009	✓
Ebr, SCnb	Northern Goshawk	*Accipiter gentilis*	11	10/23/1993	✓
Ebr, SCnb	Red-shouldered Hawk	*Buteo lineatus*	233	11/4/2012	✓
SCbr	Broad-winged Hawk	*Buteo platypterus*	2986	10/2/1986	✓
RV	Swainson's Hawk	*Buteo swainsoni*	2	10/31/1998	✓
RV	Zone-tailed Hawk	*Buteo albonotatus*	1	9/23/2015	✓
	Red-tailed Hawk	*Buteo jamaicensis*	428	11/4/2012	✓
	Rough-legged Hawk	*Buteo lagopus*	4	3/8/2015	✓
	Golden Eagle	*Aquila chrysaetos*	14	11/4/2012	✓

[28] There are no recent bald eagle nests in West Cape May (Michael O'Brien, personal communication, May 15, 2018).

State Status	Common name	*Scientific name*	Cape May High Count*	Cape May High Count Date*	Recorded in West Cape May**
Owls					
	Barn Owl	*Tyto alba*	5	10/10/2010	✓
	Eastern Screech-Owl	*Megascops asio*	7	12/14/2014	✓
	Great Horned Owl	*Bubo virginianus*	9	12/18/2011	✓
	Snowy Owl	*Bubo scandiacus*	3	12/13/2013	✓
T	Barred Owl[29]	*Strix varia*	8	5/21/2015	✓
T	Long-eared Owl	*Asio otus*	13	10/29/1996	✓
Ebr, SCnb	Short-eared Owl	*Asio flammeus*	8	1/14/2017	✓
	Northern Saw-whet Owl	*Aegolius acadicus*	53	11/5/2012	✓
Kingfishers & Allies					
	Belted Kingfisher	*Megaceryle alcyon*	15	10/13/2013	✓
Woodpeckers					
	Red-headed Woodpecker	*Melanerpes erythrocephalus*	15	5/6/2015	✓
	Red-bellied Woodpecker	*Melanerpes carolinus*	50	10/5/2012	✓
	Yellow-bellied Sapsucker	*Sphyrapicus varius*	40	10/2/2010	✓
	Downy Woodpecker	*Picoides pubescens*	14	12/16/2012	✓
	Hairy Woodpecker	*Picoides villosus*	8	4/10/2011	✓
	Northern Flicker	*Colaptes auratus*	1350	9/30/2007	✓
	Pileated Woodpecker	*Dryocopus pileatus*	1	6/4/2016	✓
Caracaras & Falcons					
RV	Crested Caracara	*Caracara cheriway*	1	5/5/2014	✓
T	American Kestrel	*Falco sparverius*	2467	10/2/1986	✓
	Merlin	*Falco columbarius*	800	9/30/1999	✓
Ebr, SCnb	Peregrine Falcon	*Falco peregrines*	241	10/5/2005	✓
Perching Birds					
	Olive-sided Flycatcher	*Contopus cooperi*	3	9/10/2010	
	Eastern Wood-Pewee	*Contopus virens*	34	5/23/2009	✓
	Yellow-bellied Flycatcher	*Empidonax flaviventris*	4	9/5/2010	✓
	Acadian Flycatcher	*Empidonax virescens*	23	5/12/2016	✓
	Alder Flycatcher	*Empidonax alnorum*	4	9/15/2010	✓
	Willow Flycatcher	*Empidonax traillii*	8	5/25/2014	✓
SCbr	Least Flycatcher	*Empidonax minimus*	10	9/9/2009	✓
	Eastern Phoebe	*Sayornis phoebe*	150	10/19/2005	✓
RV	Say's Phoebe	*Sayornis saya*	1	9/3/2013	
RV	Vermilion Flycatcher	*Pyrocephalus rubinus*	1	10/14/2014	✓
RV	Ash-throated Flycatcher	*Myiarchus cinerascens*	1	12/20/2015	✓
	Great Crested Flycatcher	*Myiarchus crinitus*	26	8/28/2007	✓
	Western Kingbird	*Tyrannus verticalis*	3	10/21/2007	✓

[29] Barred owl nesting has been documented in West Cape May (Michael O'Brien, personal communication, May 15, 2018).

State Status	Common name	*Scientific name*	Cape May High Count*	Cape May High Count Date*	Recorded in West Cape May**
	Eastern Kingbird	*Tyrannus tyrannus*	908	8/30/2011	✓
RV	Scissor-tailed Flycatcher	*Tyrannus forficatus*	1	6/17/2015	✓
RV	Fork-tailed Flycatcher	*Tyrannus savana*	1	10/26/2014	✓
RV	Gray Kingbird	*Tyrannus dominicensis*	1	10/5/2011	✓
RV	Sulphur-bellied Flycatcher	*Myiodynastes luteiventris*	1	10/13/2006	
	Northern Shrike	*Lanius excubitor*	1	12/28/2012	✓
Enb	Loggerhead shrike	*Lanius ludovicianus*	2	9/11/1957	✓
	White-eyed Vireo	*Vireo griseus*	35	5/9/2009	✓
RV	Bell's Vireo	*Vireo bellii*	3	10/13/2015	✓
	Yellow-throated Vireo	*Vireo flavifrons*	7	5/2/2016	✓
SCbr	Blue-headed Vireo	*Vireo solitarius*	9	4/24/2010	✓
	Warbling Vireo	*Vireo gilvus*	4	9/8/2008	✓
	Philadelphia Vireo	*Vireo philadelphicus*	6	9/18/2008	✓
	Red-eyed Vireo	*Vireo olivaceus*	110	9/26/2011	✓
	Blue Jay	*Cyanocitta cristata*	1500	10/8/2010	✓
	American Crow	*Corvus brachyrhynchos*	1394	12/17/2006	✓
	Fish Crow	*Corvus ossifragus*	875	9/7/2011	✓
	Common Raven	*Corvus corax*	1	6/16/2016	✓
Tbr, SCnb	Horned Lark	*Eremophila alpestris*	65	12/28/1947	✓
	Purple Martin	*Progne subis*	3401	8/21/2015	✓
RV	Brown-chested Martin	*Progne tapera*	1	11/18/1997	✓
	Tree Swallow	*Tachycineta bicolor*	100000	9/26/2015	✓
RV	Violet-green Swallow	*Tachycineta thalassina*	1	9/19/2011	✓
	Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	175	10/17/2014	✓
	Bank Swallow	*Riparia riparia*	100	5/13/2007	✓
SCbr	Cliff Swallow	*Petrochelidon pyrrhonota*	1500	9/12/1993	✓
	Cave Swallow	*Petrochelidon fulva*	662	11/14/2015	✓
	Barn Swallow	*Hirundo rustica*	4500	9/3/2015	✓
	Carolina Chickadee	*Poecile carolinensis*	75	1/2/1950	✓
	Black-capped Chickadee	*Poecile atricapillus*	1	2/11/2017	
	Tufted Titmouse	*Baeolophus bicolor*	140	4/6/2010	✓
	Red-breasted Nuthatch	*Sitta canadensis*	427	10/5/2012	✓
	White-breasted Nuthatch	*Sitta carolinensis*	23	10/21/2012	✓
RV	Brown-headed Nuthatch	*Sitta pusilla*	1	6/30/2016	
	Brown Creeper	*Certhia americana*	36	10/15/2015	✓
RV	Rock Wren	*Salpinctes obsoletus*	1	3/8/1993	
	House Wren	*Troglodytes aedon*	28	5/10/2013	✓
SCbr	Winter Wren	*Troglodytes hiemalis*	13	12/18/2011	✓
E	Sedge Wren	*Cistothorus platensis*	5	8/8/1988	✓
	Marsh Wren	*Cistothorus palustris*	35	6/24/2011	✓
	Carolina Wren	*Thryothorus ludovicianus*	58	4/24/2008	✓
	Blue-gray Gnatcatcher	*Polioptila caerulea*	313	8/16/2012	✓
	Golden-crowned Kinglet	Regulus satrapa	232	10/15/2015	✓
	Ruby-crowned Kinglet	*Regulus calendula*	650	10/25/2014	✓
RV	Northern Wheatear	*Oenanthe oenanthe*	1	10/9/2012	
	Eastern Bluebird	*Sialia sialis*	1000	11/18/2008	✓

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RV	Mountain Bluebird	*Sialia currucoides*	1	11/12/1988	
RV	Townsend's Solitaire	*Myadestes townsendi*	1	10/31/2015	✓
SCbr	Veery	*Catharus fuscescens*	150	9/8/2009	✓
SCnb	Gray-cheeked Thrush	*Catharus minimus*	300	10/5/2008	✓
	Bicknell's Thrush	*Catharus bicknelli*	12	10/5/2008	✓
	Swainson's Thrush	*Catharus ustulatus*	475	10/5/2008	✓
	Hermit Thrush	*Catharus guttatus*	1000	10/30/2010	✓
SCbr	Wood Thrush	*Hylocichla mustelina*	50	5/3/2012	✓
	American Robin	*Turdus migratorius*	250000	11/3/2013	✓
RV	Varied Thrush	*Ixoreus naevius*	1	1/30/2016	
	Gray Catbird	*Dumetella carolinensis*	1053	10/5/2015	✓
	Northern Mockingbird	*Mimus polyglottos*	55	5/9/2009	✓
SCbr	Brown Thrasher	*Toxostoma rufum*	35	10/10/2008	✓
int	European Starling	*Sturnus vulgaris*	5000	11/25/2013	✓
	American Pipit	*Anthus rubescens*	410	11/14/2012	✓
RV	Bohemian Waxwing	*Bombycilla garrulus*	1	2/10/2004	
	Cedar Waxwing	*Bombycilla cedrorum*	5000	11/2/2012	✓
	Lapland Longspur	*Calcarius lapponicus*	5	2/1/2014	✓
RV	Smith's Longspur	*Calcarius pictus*	1	3/20/2014	
	Snow Bunting	*Plectrophenax nivalis*	140	12/14/2007	✓
	Ovenbird	*Seiurus aurocapilla*	186	4/24/2011	✓
SCbr	Worm-eating Warbler	*Helmitheros vermivorum*	51	5/1/2012	✓
	Louisiana Waterthrush	*Parkesia motacilla*	6	4/9/2005	✓
	Northern Waterthrush	*Parkesia noveboracensis*	200	9/4/2014	✓
Ebr,SCnb	Golden-winged Warbler	*Vermivora chrysoptera*	2	9/7/2014	✓
	Blue-winged Warbler	*Vermivora cyanoptera*	15	5/2/2007	✓
	Black-and-white Warbler	*Mniotilta varia*	676	9/15/2015	✓
	Prothonotary Warbler	*Protonotaria citrea*	6	5/4/2012	✓
RV	Swainson's Warbler	*Limnothlypis swainsonii*	1	5/5/2016	
	Tennessee Warbler	*Oreothlypis peregrina*	100	9/17/1997	✓
	Orange-crowned Warbler	*Oreothlypis celata*	6	12/21/2016	✓
SCbr	Nashville Warbler	*Oreothlypis ruficapilla*	30	9/14/1997	✓
	Connecticut Warbler	*Oporornis agilis*	8	9/13/2007	✓
RV	MacGillivray's Warbler	*Geothlypis tolmiei*	1	1/10/1998	✓
	Mourning Warbler	*Geothlypis philadelphia*	4	8/17/2012	✓
SC	Kentucky Warbler	*Geothlypis formosa*	4	5/13/2010	✓
	Common Yellowthroat	*Geothlypis trichas*	1200	10/5/2006	✓
SCbr	Hooded Warbler	*Setophaga citrina*	12	4/29/2007	✓
	American Redstart	*Setophaga ruticilla*	4065	9/15/2015	✓
	Cape May Warbler	*Setophaga tigrina*	150	9/30/1996	✓
SCbr	Cerulean Warbler	*Setophaga cerulea*	2	5/14/2016	✓
SCbr	Northern Parula	*Setophaga americana*	800	10/6/2006	✓
	Magnolia Warbler	*Setophaga magnolia*	73	9/29/2007	✓
	Bay-breasted Warbler	*Setophaga castanea*	17	9/24/2012	✓
SCbr	Blackburnian Warbler	*Setophaga fusca*	22	9/8/2008	✓
	Yellow Warbler	*Setophaga petechia*	365	8/14/2014	✓
	Chestnut-sided Warbler	*Setophaga pensylvanica*	30	8/27/2010	✓

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	Blackpoll Warbler	*Setophaga striata*	1068	9/29/2012	✓
SCbr	Black-throated Blue Warbler	*Setophaga caerulescens*	500	10/6/2006	✓
	Palm Warbler	*Setophaga palmarum*	1500	10/10/2014	✓
	Pine Warbler	*Setophaga pinus*	128	4/6/2010	✓
	Yellow-rumped Warbler	*Setophaga coronata*	63640	10/29/2010	✓
	Yellow-throated Warbler	*Setophaga dominica*	32	5/12/2016	✓
	Prairie Warbler	*Setophaga discolor*	20	5/6/2011	✓
RV	Black-throated Gray Warbler	*Setophaga nigrescens*	1	8/29/2014	
RV	Townsend's Warbler	*Setophaga townsendi*	1	3/7/2013	✓
SCbr	Black-throated Green Warbler	*Setophaga virens*	90	9/29/2007	✓
SCbr	Canada Warbler	*Cardellina canadensis*	9	5/12/2012	✓
	Wilson's Warbler	*Cardellina pusilla*	5	5/23/2015	✓
SCbr	Yellow-breasted Chat	*Icteria virens*	12	5/21/2015	✓
RV	Spotted Towhee	*Pipilo maculatus*	1	4/5/1995	
	Eastern Towhee	*Pipilo erythrophthalmus*	50	4/29/2007	✓
	American Tree Sparrow	*Spizella arborea*	100	12/26/1938	✓
	Chipping Sparrow	*Spizella passerina*	1422	10/21/2007	✓
	Clay-colored Sparrow	*Spizella pallida*	6	10/21/2007	✓
	Field Sparrow	*Spizella pusilla*	100	10/22/2005	✓
Ebr, SCnb	Vesper Sparrow	*Pooecetes gramineus*	35	12/26/1938	✓
	Lark Sparrow	*Chondestes grammacus*	3	9/11/1999	✓
RV	Lark Bunting	*Calamospiza melanocorys*	1	6/2/2008	
Tbr	Savannah Sparrow	*Passerculus sandwichensis*	600	10/5/2006	✓
Tbr, SCnb	Grasshopper Sparrow	*Ammodramus savannarum*	6	10/5/2008	✓
E	Henslow's sparrow	*Ammodramus henslowii*	10	7/28/1929	✓
RV	Le Conte's Sparrow	*Ammodramus leconteii*	1	1/10/2016	
	Nelson's Sparrow	*Ammodramus nelsoni*	20	10/21/2016	✓
SCbr	Saltmarsh Sparrow	*Ammodramus caudacutus*	37	7/13/2011	✓
	Seaside Sparrow	*Ammodramus maritimus*	60	7/13/2011	✓
	Fox Sparrow	*Passerella iliaca*	143	2/13/2010	✓
	Song Sparrow	*Melospiza melodia*	2000	10/30/2010	✓
	Lincoln's Sparrow	*Melospiza lincolnii*	9	10/12/2013	✓
	Swamp Sparrow	*Melospiza georgiana*	10000	10/30/2010	✓
	White-throated Sparrow	*Zonotrichia albicollis*	1500	10/30/2010	✓
RV	Harris's Sparrow	*Zonotrichia querula*	1	11/4/1998	
	White-crowned Sparrow	*Zonotrichia leucophrys*	60	11/19/2008	✓
RV	Golden-crowned Sparrow	*Zonotrichia atricapilla*	1	2/21/1998	
	Dark-eyed Junco	*Junco hyemalis*	3397	10/29/2010	✓
	Summer Tanager	*Piranga rubra*	7	5/10/2016	✓
	Scarlet Tanager	*Piranga olivacea*	50	9/30/1996	✓
RV	Western Tanager	*Piranga ludoviciana*	2	12/25/2012	✓
	Northern Cardinal	*Cardinalis cardinalis*	87	4/24/2008	✓
	Rose-breasted Grosbeak	*Pheucticus ludovicianus*	50	9/24/1983	✓
RV	Black-headed Grosbeak	*Pheucticus melanocephalus*	1	3/6/1999	✓

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	Blue Grosbeak	*Passerina caerulea*	60	5/12/2007	✓
	Indigo Bunting	*Passerina cyanea*	150	9/30/1996	✓
RV	Painted Bunting	*Passerina ciris*	1	9/15/2015	✓
	Dickcissel	*Spiza americana*	12	10/10/2015	✓
Tbr, SCnb	Bobolink[30]	*Dolichonyx oryzivorus*	7500	9/4/2014	✓
	Red-winged Blackbird	*Agelaius phoeniceus*	70000	11/19/2013	✓
SCbr	Eastern Meadowlark	*Sturnella magna*	145	10/22/2007	✓
	Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*	2	9/10/2011	✓
	Rusty Blackbird	*Euphagus carolinus*	250	11/19/2013	✓
RV	Brewer's Blackbird	*Euphagus cyanocephalus*	8	2/12/1990	✓
	Common Grackle	*Quiscalus quiscula*	17000	12/2/2016	✓
	Boat-tailed Grackle	*Quiscalus major*	700	10/15/2014	✓
int	Brown-headed Cowbird	*Molothrus ater*	5000	10/28/2007	✓
	Orchard Oriole	*Icterus spurius*	30	8/7/2015	✓
RV	Bullock's Oriole	*Icterus bullockii*	1	5/11/2016	✓
	Baltimore Oriole	*Icterus galbula*	420	9/4/1997	✓
	Purple Finch	*Haemorhous purpureus*	1000	11/3/2012	✓
int	House Finch	*Haemorhous mexicanus*	3000	10/31/2006	✓
	Red Crossbill	*Loxia curvirostra*	166	11/16/2012	✓
	White-winged Crossbill	*Loxia leucoptera*	360	11/3/2012	✓
	Common Redpoll	*Acanthis flammea*	30	12/29/2003	✓
RV	European Goldfinch	*Carduelis carduelis*	1	5/9/2007	
	Pine Siskin	*Spinus pinus*	4740	11/2/2012	
	American Goldfinch	*Spinus tristis*	9000	11/17/2008	✓
	Evening Grosbeak	*Coccothraustes vespertinus*	45	11/8/2012	✓
int	House Sparrow	*Passer domesticus*	394	12/18/2016	✓
RV	Eurasian Tree Sparrow	*Passer montanus*	1	4/9/2014	

*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. http://ebird.org/ebird/nj/places. Website accessed March 2017.

**Michael O'Brien, personal communication, May 15, 2018.

[30] Bobolink nesting has not been documented in West Cape May, but migrants use the borough extensively (Michael O'Brien, personal communication, May 15, 2018).

C.2 List of New Jersey Land Mammals

Mammals have not been inventoried specifically in West Cape May Borough or Cape May 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*
	Little brown bat	*Myotis lucifugus*
E	Indiana bat	*Myotis sodalis*
	Keen 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	Eastern woodrat	*Neotoma floridana*
	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*

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

C.3 Cape May County Reptiles

New Jersey reptile species that may occur in Cape May County.

Status	Common Name	*Scientific Name*
Lizards		
	Common five-lined skink	*Plestiodon fasciatus*
	Eastern fence lizard	*Sceloporus undulatus*
Snakes		
	Eastern wormsnake	*Carphophis a. amoenus*
	Northern black racer	*Coluber c. constrictor*
	Northern ring-necked snake	*Diadophis punctatus edwardsi*
	Southern ring-necked snake	*Diadophis p. punctatus*
	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*
E	Red cornsnake	*Pantherophis guttatus*
	Eastern ratsnake	*Pantherophis alleghaniensis*
	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*
E	Bog turtle	*Glyptemys muhlenbergii*
	Southeastern mud turtle	*Kinosternon s. subrubrum*
	Northern diamond-backed terrapin	*Malaclemys t. terrapin*
	Northern red-bellied cooter	*Pseudemys rubiventris*
	Eastern musk turtle	*Sternotherus odoratus*
SC	Woodland box turtle	*Terrapene c. carolina*
int	Red-eared slider	*Trachemys scripta elegans*

Source: NJDEP Division of Fish and Wildlife, June 6 2014.

C.4 Cape May County Amphibians

New Jersey amphibian species that may occur in Cape May County.

Status	Common Name	*Scientific Name*
Anurans		
	Eastern cricket frog	*Acris crepitans*
SC	Fowler's toad	*Anaxyrus fowleri*
E	Cope's gray treefrog	*Hyla chrysoscelis*
	Barking treefrog	*Hyla gratiosa*
	Northern gray treefrog	*Hyla versicolor*
	Bullfrog	*Lithobates catesbeianus*
	Green frog	*Lithobates clamitans*
	Pickerel frog	*Lithobates palustris*
	Southern leopard frog	*Lithobates sphenocephalus*
	Wood frog	*Lithobates sylvaticus*
SC	Carpenter frog	*Lithobates virgatipes*
	Spring peeper	*Pseudacris crucifer*
	New Jersey chorus frog	*Pseudacris kalmi*
	Eastern spadefoot toad	*Scaphiopus h. holbrooki*
Salamanders		
SC	Marbled salamander	*Ambystoma opacum*
E	Eastern tiger salamander	*Ambystoma tigrinum*
	Four-toed salamander	*Hemidactylium scutatum*
	Red-spotted newt	*Notophthalmus v. viridescens*
	Red-backed salamander	*Plethodon cinereus*
T	Eastern mud salamander	*Pseudotriton m. montanus*
	Northern red salamander	*Pseudotriton r. ruber*

Sources: NJDEP Division of Fish and Wildlife, June 6 2014; NJENSP November 2014.

C.5 Freshwater Fish of New Jersey

State 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		
	Blueback Herring	*Alosa aestivalis*
	Hickory Shad	*Alosa mediocris*
	Alewife	*Alosa pseudoharengus*
	American Shad	*Alosa sapidissima*
	Gizzard Shad	*Dorosoma cepedianum*
Salmonids		
int	Rainbow Trout	*Oncorhynchus mykiss*
int	Brown Trout	*Salmo trutta*
	Brook Trout	*Salvelinus fontinalis*
int	Lake Trout	*Salvelinus namaycush*
Smelts		
	Rainbow Smelt	*Osmerus mordax*
Mudminnows		
	Eastern Mudminnow	*Umbra pygmaea*
Pikes		
	Redfin Pickerel	*Esox americanus*

State Status	Common Name	*Scientific Name*
int	Northern Pike	*Esox lucius*
	Chain Pickerel	*Esox niger*
int	Muskellunge	*Esox masquinongy*
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*
	Comely Shiner	*Notropis amoenus*
	Bridle Shiner	*Notropis bifrenatus*
	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*

State Status	Common Name	*Scientific Name*
Pirate Perches		
	Pirate Perch	*Aphredoderus sayanus*
Killifishes		
	Banded Killifish	*Fundulus diaphanus*
	Mummichog	*Fundulus heteroclitus*
Poeciliids		
	Eastern Mosquitofish	*Gambusia holbrooki*
int	Mosquitofish	*Gambusia affinis*
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		
	Mud Sunfish	*Acantharchus pomotis*
int	Rock Bass	*Ambloplites rupestris*
	Blackbanded Sunfish	*Enneacanthus chaetodon*
	Bluespotted Sunfish	*Enneacanthus gloriosus*
	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		
	Swamp Darter	*Etheostoma fusiforme*
	Tessellated Darter	*Etheostoma olmstedi*
	Yellow Perch	*Perca flavescens*
	Shield Darter	*Percina peltata*

State Status	Common Name	*Scientific Name*
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.

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

APPENDIX D: ENDANGERED SPECIES

Contents:

D.1 Rare Plant Reporting Form

Source: http://www.nj.gov/dep/parksandforests/natural/heritage/natherrareplantspeciesreportform1_2008.doc

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

D.2 Rare Wildlife Reporting Form

Source: http://www.state.nj.us/dep/fgw/ensp/pdf/rptform.pdf

D.3. Habitat Requirements for Rare Wildlife Species Recorded in the Vicinity of West Cape May Borough

D.4. Rare Bird Species Documented in Cape May County

D.5 List of Rare Plant Species of Cape May County
Source: http://www.state.nj.us/dep/parksandforests/natural/heritage/textfiles/hunterdon.pdf

D.6 Cape May Migratory Bird Refuge Natural Heritage Priority Site

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)

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

D.3 Habitat Requirements for Rare Wildlife Species Recorded in the Immediate Vicinity of West Cape May Borough

Habitat notes are generally direct quotes, as excerpted from the cited sources.

Cope's Gray Treefrog
(State Endangered)
Cope's gray treefrogs require both aquatic and terrestrial habitats, relying on small freshwater ponds, old fields, and hardwood forests throughout their annual cycle. Accepting both natural and manmade basins, they breed in vernal ponds, gravel pits, retention basins, floodplain corridors, bogs, weedy lakes, marshes and farm ponds. Breeding pools must contain water long enough to ensure metamorphosis but often dry up by the end of summer, thereby prohibiting the establishment of predatory fish (Beans and Niles, 2003).

Eastern Tiger Salamander
(State Endangered)
Tiger salamanders require both upland and wetland habitats that contain suitable breeding ponds, forests, and soil types appropriate for burrowing (loamy sand and sandy loam). Ponds may have gravel, mud, sand or clay substrates and pH levels between 3.5 and 7.9, but they must contain clean, unpolluted water and be fish free. Terrestrial habitats utilized by the species include old fields and deciduous or mixed woods (Beans and Niles, 2003).

Bald Eagle
(Endangered breeding, Threatened non-breeding)
Bald Eagles live near rivers, lakes, and marshes where they can find fish, their staple food. Bald 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).

Barred Owl
(State Threatened)
Barred owls require mature, wet woods that contain large trees with cavities suitable for nesting. The lack of large nesting cavities is often the primary limiting factor for the birds. Their habitats typically have an open understory through which the owls can fly and hunt. Large, unbroken tracts that are remote from human habitation are preferred by the species (Beans and Niles, 2003).

Black Skimmer
(State Endangered)
Black skimmers nests on open, sandy beaches, inlets, sandbars, offshore islands and dredge disposal islands that are sparsely vegetated and contain shell fragments. Shallow tidal creeks, inlets and ponds are utilized for foraging. Similar coastal and estuarine habitats are used throughout the year (Beans and Niles, 2003).

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).

Bobolink
(Threatened breeding, Special Concern non-breeding)
Bobolinks inhabit low-intensity agricultural habitats, such as hayfields and pastures, during the breeding season. In addition, lush fallow fields and meadows of grasses, forbs, and wildflowers are occupied. Bobolink nests are often placed in areas of greatest vegetative height and density. Similar habitats are occupied by bobolinks throughout their annual cycle. During migration, bobolinks inhabit fallow and agricultural fields, as well as coastal and freshwater marshes. On their South American wintering grounds, they occur in grasslands, marshes, rice fields, and farm fields. (NJENSP, undated-a).

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-a; Ehrlich et. al., 1988).

Cattle Egret
(Threatened breeding, Special Concern non-breeding)
Cattle Egrets breed in coastal barrier islands, marshes, reservoirs, lakes, quarries, swamps, riverside woodlands, and upland forests. They usually nest in colonies already established by native herons and egrets, and forage in fields with grazing livestock. During spring and fall migration they stop along marine shorelines as well as in farm fields (Cornell Lab of Ornithology, 2015-b).

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).

Glossy Ibis
(Special Concern breeding)
The glossy ibis breeds in colonies along the coast, often associating with other species such as herons. A variety of habitat conditions by be utilized including fresh, brackish or saltwater settings. Rookeries may be found in swamps, marshes or on islands (Harrison, 1975).

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).

Little Blue Heron
(Special Concern)
Little Blue Herons nest and forage in many kinds of wetlands, including swamps, marshes, ponds, streams, lagoons, tidal flats, canals, ditches, fish hatcheries, and flooded fields. They nest mostly in shrubs and small trees in standing water or upland sites on islands, including artificial islands created from dredged material. Rarely, they seek prey in upland pasture sites. They usually forage in water 2–6 inches deep, often gravitating toward densely vegetated foraging sites. In wintertime, Little Blue Herons make especially frequent use of salt ponds, mudflats, and savannas (Cornell Lab of Ornithology, 2015-c).

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).

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-b).

Snowy Egret
(Special Concern breeding)
Snowy Egrets nest in colonies on thick vegetation in isolated places such as barrier islands, dredge-spoil islands, salt marsh islands, swamps, and marshes. They often change location from year to year. During the breeding season Snowy Egrets feed in estuaries, saltmarshes, tidal channels, and shallow bays. They winter in freshwater swamps, grassy ponds, and temporary pools, and forage on beaches, shallow reefs, and wet fields (Cornell Lab of Ornithology, 2015-d).

Tricolored Heron
(Special Concern)
Tricolored herons, also known as Louisiana herons, may breed in both inland freshwater and saltwater habitats, although it prefers the latter. Like other herons, it is a colonial nester and may be found in mixed-species colonies located on islands, in marshes, or adjacent to ponds, lakes and rivers (Ehrlich et. al, 1988; Harrison 1975).

Precious Underwing

(not currently listed but tracked by Endangered and Nongame Species Program)
The precious underwing is a moth that inhabits mesic to wet hardwood forests, including riparian and seepage swamps. Best habitats are usually headwaters swamps with an abundant supply of a preferred food plant in the understory. Larval host plants are members of the rose family including red chokeberry (*Aronia arbutifolia*), beach plum (*Prunus maritima*), serviceberry (*Amelanchier sp*.), and apple (*Malus sp*.) (Natureserve, 2015; BugGuide, 2017).

Southeastern Tiger Beetle
(not currently listed but tracked by Endangered and Nongame Species Program)
The southeastern tiger beetle may be found on open, pristine white sandy beaches along the Atlantic coast during the summer months. Adults run actively on sand to hunt, while larvae hide in burrows with only their jaws protruding to catch unwary prey. Therefore, larvae need a safe place for development above the high tide line, and both stages require a large enough expanse of naturally shifting ocean beach so that sufficient prey is available. (SCDNR, 2015; BugGuide, 2017).

Piping Plover
(Federally Threatened, State Endangered)
Piping plovers inhabit ocean-front beaches and barrier islands, typically nesting on the stretch of beach between dunes and the high-tide line. Nests are often located in sparsely vegetated areas with shell fragments. During the non-breeding season, the plovers inhabit coastal beaches, barrier islands, inlets, sand flats, mudflats and dredged material islands. Intertidal beaches, washover areas, exposed mud and sand flats, wracklines and shorelines are preferred foraging sites (Beans and Niles, 2003).

American Oystercatcher
(Special Concern)
During the breeding season, American Oystercatchers may be found in coastal habitats including sand or shell beaches, dunes, salt marshes, marsh islands, mudflats, and dredge spoil islands made of sand or gravel. During migration and winter, look for them feeding in mud or sand flats exposed by the tide, or on shellfish beds. Oystercatchers tend to roost on beaches, dunes, or marsh islands near their foraging sites, and rarely venture far inland (Cornell Lab of Ornithology, 2015-e).

Bronze Copper
(State Endangered)
The bronze copper is a butterfly that inhabits moist or wet areas including brackish and freshwater marshes, bogs, fens, seepages, wet sedge meadows, riparian zones, wet grasslands and drainage ditches. Various kinds of dock (*Rumex spp*.) are the preferred larval host plants, and adults nectar on an assortment of wildflowers (Beans and Niles, 2003).

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D.4 Rare Bird Species Documented in Cape May County

This is a subset of the full county list provided in Appendix C.1.

ENDANGERED		
E	Piping Plover	*Charadrius melodus*
E	Upland Sandpiper	*Bartramia longicauda*
E	Least Tern	*Sternula antillarum*
E	Roseate Tern	*Sterna dougallii*
E	Black Skimmer	*Rynchops niger*
E	Sedge Wren	*Cistothorus platensis*
E	Henslow's sparrow	*Ammodramus henslowii*
Ebr, SCnb	Pied-billed Grebe	*Podilymbus podiceps*
Ebr, SCnb	American Bittern	*Botaurus lentiginosus*
Ebr, SCnb	Northern Harrier	*Circus cyaneus*
Ebr, SCnb	Northern Goshawk	*Accipiter gentilis*
Ebr, SCnb	Red-shouldered Hawk	*Buteo lineatus*
Ebr, SCnb	Short-eared Owl	*Asio flammeus*
Ebr, SCnb	Peregrine Falcon	*Falco peregrines*
Ebr, SCnb	Vesper Sparrow	*Pooecetes gramineus*
Ebr, Tnb	Black rail	*Laterallus jamaicensis*
Ebr, Tnb	Bald Eagle	*Haliaeetus leucocephalus*
Ebr,SCnb	Golden-winged Warbler	*Vermivora chrysoptera*
Enb	Red Knot	*Calidris canutus*
Enb	Loggerhead shrike	*Lanius ludovicianus*
THREATENED		
T	Yellow-crowned Night-Heron	*Nyctanassa violacea*
T	Barred Owl	*Strix varia*
T	Long-eared Owl	*Asio otus*
T	American Kestrel	*Falco sparverius*
Tbr	Osprey	*Pandion haliaetus*
Tbr	Savannah Sparrow	*Passerculus sandwichensis*
Tbr, SCnb	Cattle Egret	*Bubulcus ibis*
Tbr, SCnb	Black-crowned Night-Heron	*Nycticorax nycticorax*
Tbr, SCnb	Horned Lark	*Eremophila alpestris*
Tbr, SCnb	Grasshopper Sparrow	*Ammodramus savannarum*
Tbr, SCnb	Bobolink	*Dolichonyx oryzivorus*
SPECIAL CONCERN		
SC	Common Nighthawk	*Chordeiles minor*
SC	American Oystercatcher	*Haematopus palliatus*
SC	Gull-billed Tern	*Gelochelidon nilotica*
SC	Least Bittern	*Ixobrychus exilis*
SC	Little Blue Heron	*Egretta caerulea*
SC	Tricolored Heron	*Egretta tricolor*

SC	Sharp-shinned Hawk	*Accipiter striatus*
SC	Kentucky Warbler	*Geothlypis formosa*
SCbr	Black-billed Cuckoo	*Coccyzus erythropthalmus*
SCbr	Spotted Sandpiper	*Actitis macularius*
SCbr	Caspian Tern	*Hydroprogne caspia*
SCbr	Common Tern	*Sterna hirundo*
SCbr	Great Blue Heron	*Ardea herodias*
SCbr	Snowy Egret	*Egretta thula*
SCbr	Glossy Ibis	*Plegadis falcinellus*
SCbr	Cooper's Hawk	*Accipiter cooperii*
SCbr	Broad-winged Hawk	*Buteo platypterus*
SCbr	Least Flycatcher	*Empidonax minimus*
SCbr	Blue-headed Vireo	*Vireo solitarius*
SCbr	Cliff Swallow	*Petrochelidon pyrrhonota*
SCbr	Winter Wren	*Troglodytes hiemalis*
SCbr	Veery	*Catharus fuscescens*
SCbr	Wood Thrush	*Hylocichla mustelina*
SCbr	Brown Thrasher	*Toxostoma rufum*
SCbr	Worm-eating Warbler	*Helmitheros vermivorum*
SCbr	Nashville Warbler	*Oreothlypis ruficapilla*
SCbr	Hooded Warbler	*Setophaga citrina*
SCbr	Cerulean Warbler	*Setophaga cerulea*
SCbr	Northern Parula	*Setophaga americana*
SCbr	Blackburnian Warbler	*Setophaga fusca*
SCbr	Black-throated Blue Warbler	*Setophaga caerulescens*
SCbr	Black-throated Green Warbler	*Setophaga virens*
SCbr	Canada Warbler	*Cardellina canadensis*
SCbr	Yellow-breasted Chat	*Icteria virens*
SCbr	Saltmarsh Sparrow	*Ammodramus caudacutus*
SCbr	Eastern Meadowlark	*Sturnella magna*
SCbr, Unb	Eastern Whip-poor-will	*Antrostomus vociferous*
SCnb	Whimbrel	*Numenius phaeopus*
SCnb	Sanderling	*Calidris alba*
SCnb	Semipalmated Sandpiper	*Calidris pusilla*
SCnb	Gray-cheeked Thrush	*Catharus minimus*

D.5 Rare Plant Species of Cape May County.

Species shown in red are known from West Cape May Borough, and those in green from the immediate vicinity.

Ferns & Allies		
Isoetes melanopoda	black-base quillwort	mostly in shallow, temporary ponds or nearly terrestrial
Ophioglossum pusillum	northern adder's tongue	grassy marsh edges and ditches
Ophioglossum vulgatum	southern adder's-tongue	low woods and floodplains
Schizaea pusilla	curly grass fern	in sandy, acid soils of white cedar bog edges and hummocks, just above the water line
Graminoids		
Carex joorii	cypress-swamp sedge	wet woods and swamps, mainly on the coastal plain
Carex mitchelliana	Mitchell's sedge	swamp forests and wet thickets and meadows
Carex silicea	seabeach sedge	sand or sandy soil near the coast
Cyperus lancastriensis	Lancaster flat sedge	woods and fields
Cyperus polystachyos	coast flat sedge	wet soil
Cyperus refractus	reflexed flat sedge	woods and fields
Cyperus retrofractus	rough flat sedge	pastures, roadsides and other disturbed places
Eleocharis brittonii	Britton's spike-rush	acid swamps near the coast
Eleocharis halophila	salt-marsh spike-rush	mainly of coastal salt marshes
Eleocharis melanocarpa	black-fruit spike-rush	wet sand and pine barrens, mostly near the coast
Eleocharis quadrangulata	angled spike-rush	shallow water
Eleocharis tortilis	twisted spike-rush	swamps and bogs, chiefly near the coast
Eriophorum tenellum	rough cotton-grass	bogs and swamps, often under conifers
Fimbristylis castanea	marsh fimbry	brackish coastal marshes, seldom in inland alkaline sites
Fuirena squarrosa	hairy umbrella-sedge	moist or wet, often sandy places
Rhynchospora cephalantha	large-headed beaked-rush	wet acid soil on the coastal plain
Rhynchospora filifolia	thread-leaf beaked-rush	pine-barren bogs on the coastal plain
Rhynchospora glomerata	clustered beaked-rush	bogs and wet sand
Rhynchospora inundata	slender horned-rush	swamps and pond margins
Rhynchospora nitens	short-beaked bald-rush	wet sandy soil and bogs
Rhynchospora pallida	pale beaked-rush	acid bogs along the coast
Rhynchospora rariflora	rare-flower beaked-rush	bogs and wet soil on the coastal plain
Rhynchospora recognita	coarse grass-like beaked-rush	low, wet to moist ground in swamps and bogs, sandy depressions
Rhynchospora scirpoides	long-beak bald-rush	wet sandy soil
Schoenoplectus novae-angliae	New England bulrush	brackish transitional zones of tidal river systems
Scirpus longii	Long's woolgrass	marshes near the coast
Scleria verticillata	whorled nut-rush	wet sandy soil
Juncus articulatus	jointed rush	bogs, wet meadows and shores
Juncus brachycarpus	short-fruit rush	damp or wet soil
Juncus caesariensis	New Jersey rush	sphagnum bogs in the pine barrens
Juncus coriaceus	awl-leaf rush	wet ground, swamps or brackish marshes
Juncus diffusissimus	slim-pod rush	wet soil and muddy shores

Juncus elliottii	Elliott's rush	damp or wet, sandy or peaty soil, especially in pine barrens
Juncus torreyi	Torrey's rush	wet sunny places or shallow standing water, especially on prairies
Andropogon glomeratus var hirsutior	hairy beardgrass	wet, open soil
Andropogon gyrans	Elliott's beardgrass	fields and open woods
Andropogon ternarius var ternarius	silvery beardgrass	open woods and dry fields
Aristida virgata	wand-like three-awn grass	dry sandy soil of the coastal plain
Coelorachis rugosa	wrinkled jointgrass	wet pine barrens
Gymnopogon brevifolius	short-leaf skeleton grass	sandy or peaty dry ground of bog margins, pinelands
Leptochloa fascicularis var maritima	long-awn sprangletop	wet soil of watersides, fresh or usually brackish water of marshes
Muhlenbergia torreyana	Pine Barren smoke grass	wet, open soil of bogs, sandy pinelands
Panicum aciculare	bristling panic grass	dry to moist sandy soil of the coastal pinelands
Panicum dichotomum var roanokense	bluish panic grass	marshes, swampy woods, esp in pinelands
Panicum hemitomon	maiden-cane	moist soil or shallow water of swamp edges, watersides, wet fields, ponds
Panicum leucothrix	rough panic grass	wet, sandy soil of coastal pinelands, bogs
Panicum longiligulatum	coastal-plain panic grass	moist or dry sites, opens woods, dunes, shores and prairies
Panicum tenue	white-edge panic grass	damp sandy soil of the coastal plain
Panicum wrightianum	Wright's panic grass	moist or wet, sandy or peaty soil of watersides, bogs, beaches
Paspalum dissectum	mudbank crown grass	usually in wet, muddy soil or in shallow water of watersides, also in dried pond bottoms
Paspalum floridanum	Florida crown grass	sandy, usually moist open ground, brackish marshes
Puccinellia fasciculata	saltmarsh alkali grass	wet soil or water of salt marsh borders, beaches
Sacciolepis striata	American cupscale	shallow water or muddy ground of swamps, ditches
Setaria magna	giant fox-tail	low, wet disturbed soil in fresh to brackish conditions, found in marshes and swamps
Sphenopholis pensylvanica	swamp oats	swamps and wet woods
Sporobolus clandestinus	rough rush-grass	dry, sandy to rocky ground of woods edges, meadows
Tridens flavus var chapmanii	Chapman's redtop	dry open woods and shaded edges, disturbed ground, fields
Vulpia elliotea	squirrel-tail six-weeks grass	dry sandy soils
Terrestrial Herbs		
Ruellia caroliniensis	Carolina petunia	moist or dry woods
Sesuvium maritimum	seabeach purslane	sea beaches
Sagittaria australis	southern arrowhead	mostly in circumneutral water of lakes, ponds or swamps
Sagittaria teres	slender arrowhead	sandy soil in shallow acid water
Amaranthus pumilus	seabeach amaranth	sea-beaches
Centella erecta	erect coinleaf	marshes and wet soil along the coast
Eryngium aquaticum var aquaticum	marsh rattlesnake-master	bogs and marshes near the coast
Hydrocotyle prolifera	Canby's marsh-pennywort	wet or moist ground of bogs, swampy woods, watersides

Hydrocotyle verticillata var verticillata	whorled marsh-pennywort	wet or moist ground of bogs, swampy woods, watersides
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
Asclepias verticillata	whorled milkweed	fields, roadsides, upland woods and prairies
Aster concolor	eastern silvery aster	dry sandy places, often among pines
Aster ericoides var ericoides	white heath aster	dry open places
Bidens mitis	small-fruit beggar-ticks	swamps and other wet places
Boltonia asteroides var glastifolia	southern boltonia	moist or wet places
Cirsium virginianum	Virginia thistle	savannas, bogs and wet pinelands
Eupatorium album var vaseyi	Vasey's boneset	dry open woods, especially in sandy pinelands
Eupatorium aromaticum var aromaticum	smaller white snakeroot	dry woods, especially in sandy soil
Eupatorium capillifolium	dog-fennel thoroughwort	open places, often in old fields and pastures
Eupatorium coelestinum	mist-flower	woods, streambanks, meadows and fields
Eupatorium resinosum	Pine Barren boneset	pocosins, bogs and other wet places, often in pine barrens
Gnaphalium helleri var micradenium	small everlasting	dry, commonly sandy soil, often in woods
Hieracium marianum	Maryland hawkweed	mostly in dry open woods
Krigia dandelion	potato dwarf-dandelion	low prairies, fields and other moist, chiefly open places
Pluchea foetida	stinking fleabane	permanently wet soil, often in meadows or swampy woods
Prenanthes autumnalis	Pine Barren rattlesnake-root	sandy, usually moist places, often among pines
Senecio tomentosus	wooly ragwort	dry open places and pine woods, especially in sandy soil
Smallanthus uvedalius	bear's-foot	woods and meadows
Solidago elliottii	Elliott's goldenrod	fresh or brackish swamps near the coast
Solidago uliginosa var uliginosa	bog goldenrod	bogs, acid swamps, meadows and moist to dryish thickets
Arabis drummondii	Drummond's rockcress	various habitats
Polypremum procumbens	juniper-leaf	dry sandy soil and waste places
Lobelia boykinii	Boykin's lobelia	ponds and swamps on the coastal plain
Lobelia canbyi	Canby's lobelia	swamps on the coastal plain
Honckenya peploides var robusta	seabeach sandwort	sea beaches and sand dunes
Chenopodium berlandieri var macrocalycium	large-calyx goosefoot	mainly coastal or coastal plain, often on sea beaches
Suaeda rolandii	Roland's seablite	saline or alkaline soil
Hypericum adpressum	Barton's St. John's-wort	marshes, shores and wet meadows
Triadenum walteri	Walter's St. John's-wort	swamps and marshes on the coastal plain
Cuscuta indecora	collared doddar	on a wide variety of hosts
Cuscuta polygonorum	smartweed dodder	on Polygonum and other hosts
Croton willdenowii	elliptical rushfoil	in sand, sandy soil or rocky barrens
Euphorbia purpurea	Darlington's glade spurge	dry or moist woods

Aeschynomene virginica	sensitive joint-vetch	sandy or muddy riverbanks and fresh to brackish tidal shores
Centrosema virginianum	spurred butterfly-pea	dry sandy woods and barrens
Clitoria mariana	butterfly-pea	dry upland woods and barrens
Desmodium strictum	pineland tick-trefoil	pine barrens on the coastal plain
Desmodium viridiflorum	velvety tick-trefoil	dry woods
Galactia volubilis	downy milk-pea	dry upland woods and barrens
Lespedeza stuevei	Stueve's downy bush-clover	dry upland woods and barrens
Lupinus perennis var perennis	sundial lupine	dry open woods and clearings
Phaseolus polystachios var polystachios	wild kidney bean	moist woods and thickets
Stylosanthes biflora	pencil-flower	dry or rocky woods and barrens
Gentiana autumnalis	Pine Barren gentian	wet, open sandy ground of pinelands and edges, roadsides
Sabatia dodecandra var dodecandra	large marsh-pink	salt or brackish marshes near the coast
Sisyrinchium fuscatum	sand plain blue-eyed grass	sandy areas, mainly near the coast
Lycopus rubellus	stalked water-hoarhound	low wet or moist ground of marshes, alluvial woods and edges
Trichostema setaceum	narrow-leaf bluecurls	dry, open sandy or rocky ground of thin woods fields or sterile disturbed soils
Helonias bullata	swamp-pink	swamps and bogs
Linum intercursum	sandplain flax	dry or moist, sandy, open ground of thin woods and shaded edges
Ammannia latifolia	Koehn's toothcup	wet ground on the coastal plain
Rotala ramosior	tooth-cup	wet, open muddy or sandy ground of watersides, depressions, swamps
Rhexia aristosa	awned meadow-beauty	local in sandy or peaty acid bogs on the coastal plain
Rhexia mariana var ventricosa	showy meadow-beauty	moist, open places, often in disturbed habitats
Epilobium angustifolium ssp circumvagum	narrow-leaf fireweed	many habitats, esp. moist soils rich in humus, often abundant after fires
Ludwigia hirtella	hairy primrose-willow	swamps on the coastal plain
Ludwigia linearis	narrow-leaf primrose-willow	wet soil, muddy shores or shallow waters
Oenothera humifusa	sea-beach evening-primrose	dry sand of upper sea beaches, dunes and hollows
Oenothera oakesiana	Oakes' evening-primrose	disturbed open places
Arethusa bulbosa	dragon mouth	sphagnum bogs and swampy meadows
Cleistes divaricata	spreading pogonia	swamps and wet woods, mostly on the coastal plain
Listera australis	southern twayblade	shaded bogs and wet woods, mainly on the coastal plain
Platanthera ciliaris	yellow fringed orchid	bogs, fields and woods
Platanthera cristata	crested yellow orchid	low moist meadows and damp pine woods, especially along the coastal plain
Platanthera flava var flava	southern rein orchid	boggy or swampy ground and floodplains
Platanthera integra	yellow fringeless orchid	open acid bogs and pine barrens on the coastal plain
Platanthera nivea	snowy orchid	open acid bogs on the coastal plain
Platanthera peramoena	purple fringeless orchid	open, swampy or vernally wet places, often in acid soil
Spiranthes laciniata	lace-lip ladies'-tresses	open wet places on the coastal plain

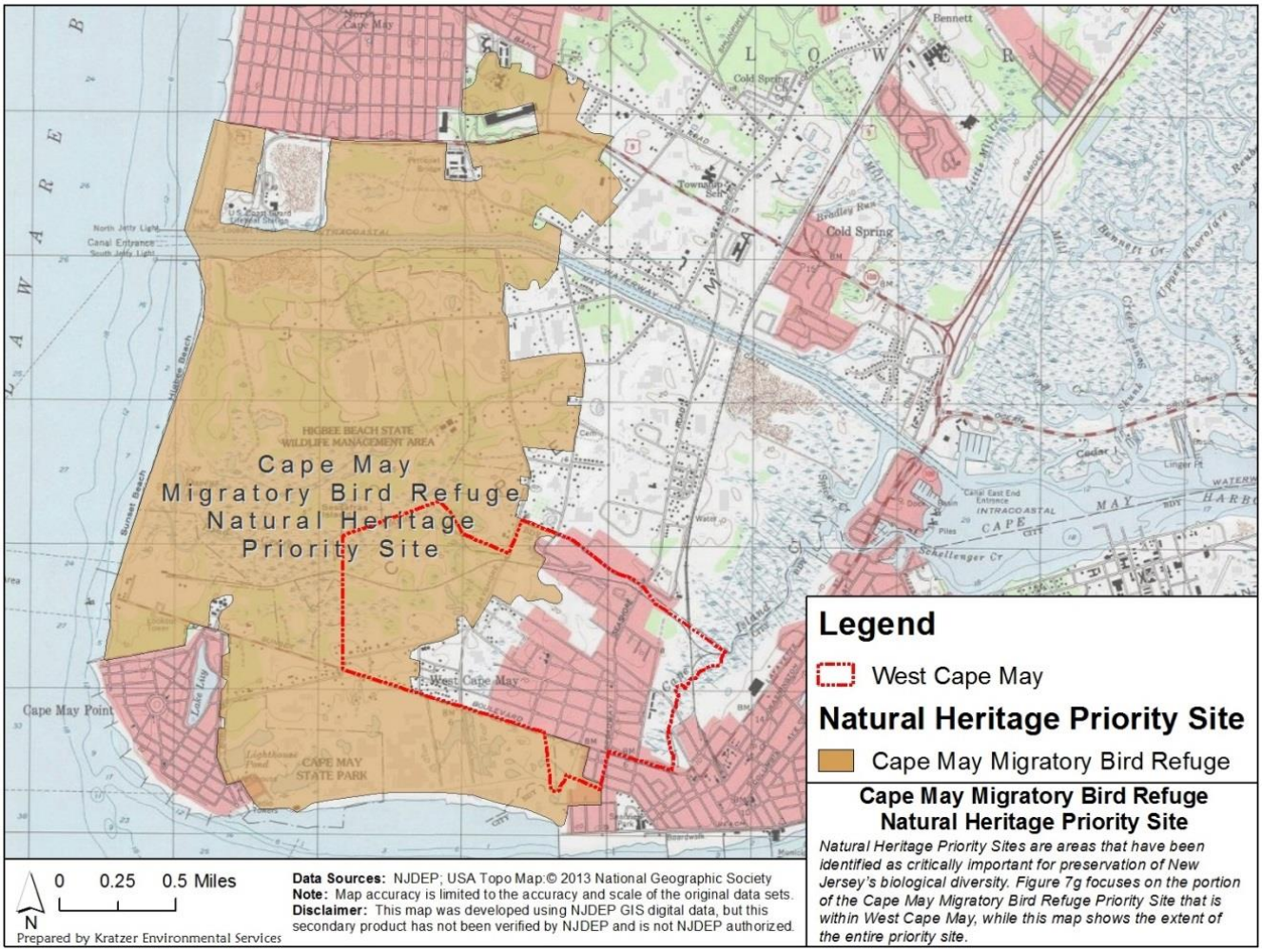
Spiranthes lucida	shining ladies'-tresses	damp woods, marshes and wet shores; calciphile
Spiranthes odorata	fragrant ladies'-tresses	open moist, often sandy places; mainly on the coastal plain, often in estuaries
Spiranthes tuberosa	little ladies'-tresses	acid, usually rather dry soil
Plantago maritima 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
Phlox maculata var maculata	spotted phlox	moist or wet, low ground of streamsides, meadows, floodplains
Polygala mariana	Maryland milkwort	dry, usually sandy ground but sometimes in clay or peat
Polygala ramosa	low Pine Barren milkwort	water of pineland swamps, wet fields
Polygonum densiflorum	dense-flower knotweed	shallow water or wet ground of shaded swamps, pool edges, woods edges
Polygonum glaucum	sea-beach knotweed	dry open sand of beaches, dune hollows, saline pond edges, fill dirt
Polygonum hydropiperoides var opelousanum	Opelousas water-pepper	shallow water and wet ground of alluvial woods and edges, swamps, beaches, watersides
Polygonum setaceum var setaceum	bristly smartweed	shallow water and wet ground of alluvial woods and edges, swamps, beaches, watersides
Ranunculus cymbalaria	seaside buttercup	in mud, especially in brackish or alkaline places
Diodia virginiana	larger buttonweed	moist, open low ground of watersides and ditches
Galium hispidulum	coast bedstraw	sandy soil, esp pineland on the coastal plain
Gratiola pilosa	hairy hedge-hyssop	sandy, usually moist ground of salt marsh edges, pinelands, open woods & shaded edges
Gratiola virginiana	round-fruit hedge-hyssop	wet woods
Schwalbea americana	chaffseed	moist to dry, sandy ground of pine-oak woods and shaded edges, marshes
Valerianella radiata	beaked cornsalad	moist ground of streamsides, fields, meadows, woods and edges
Phyla lanceolata	fogfruit	moist low ground and muddy flats, both coastal and inland
Verbena simplex	narrow-leaf vervain	dry, open, sandy or rocky non-acid ground of thin woods, fields, roadsides
Viola brittoniana var brittoniana	Britton's coast violet	low, wet or moist, sandy or peaty ground, oft in brackish conditions, in woods edges & meadows
Viola brittoniana var pectinata	cut-leaf coast violet	low, wet or moist, sandy or peaty ground, oft in brackish conditions, in woods edges & meadows
Xyris jupicai	Richard's yellow-eyed grass	wet, sunny disturbed sites, often weedy

Aquatic Herbs

Sclerolepis uniflora	bog buttons	shallow water on the coastal plain
Ceratophyllum echinatum	spiny coontail	quiet water
Elatine americana	American waterwort	muddy tidal shores
Elatine minima	small waterwort	on mud
Eriocaulon parkeri	Parker's pipewort	tidal flats and muddy shores, oft submerged in fresh to slightly brackish water
Myriophyllum pinnatum	cutleaf water-milfoil	submersed in quiet water or rooting on muddy shores
Lemna perpusilla	minute duckweed	floating on quiet waters of ponds, streams, springs, lakes
Utricularia gibba	humped bladderwort	shallow water

Utricularia minor	lesser bladderwort	shallow water
Utricularia purpurea	purple bladderwort	quiet shallow water of ponds, slow streams, ditches
Utricularia radiata	small swollen bladderwort	quiet shallow water of ponds, ditches
Utricularia resupinata	reversed bladderwort	very shallow water or wet mud of watersides
Nuphar microphyllum (lutea ssp. Pumila)	small yellow pond-lily	ponds
Potamogeton oakesianus	Oakes' pondweed	in quiet shallow waters of ponds; soils usually acid, sandy or rocky
Hottonia inflata	featherfoil	quiet shallow water or wet soil of swamps, slow streams, ditches
Shrubs		
Rhododendron atlanticum	dwarf azalea	sandy soil on the coastal plain
Malus angustifolia var puberula	spiny wild crabapple	woods and thickets
Prunus angustifolia var angustifolia	Chickasaw plum	dry, open sandy or sterile ground of woods and shaded edges, dune sands
Rubus gnarus	Pollock's mill blackberry	state historic from one occurrence
Rubus longii	Long's blackberry	dry sandy soil, chiefly on the coastal plain
Rubus novocaesarius	New Jersey dewberry	worldwide occurrence restricted to a single occurrence in Cape May County
Trees		
Quercus michauxii	basket oak	low or wet soil, especially alluvial flood plains, on the coastal plain
Quercus nigra	water oak	usually in damp or wet soil
Fraxinus profunda	pumpkin ash	swamps and wet woods
Pinus serotina	pond pine	swamps and wet soil
Pinus taeda	loblolly pine	moist, sandy soil
Populus heterophylla	swamp cottonwood	wet low woods and swamps

D.6 Cape May Migratory Bird Refuge Natural Heritage Priority Site



APPENDIX E: INVASIVE SPECIES

Species Tracked by the New Jersey Invasive Species Strike Team in Cape May 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/