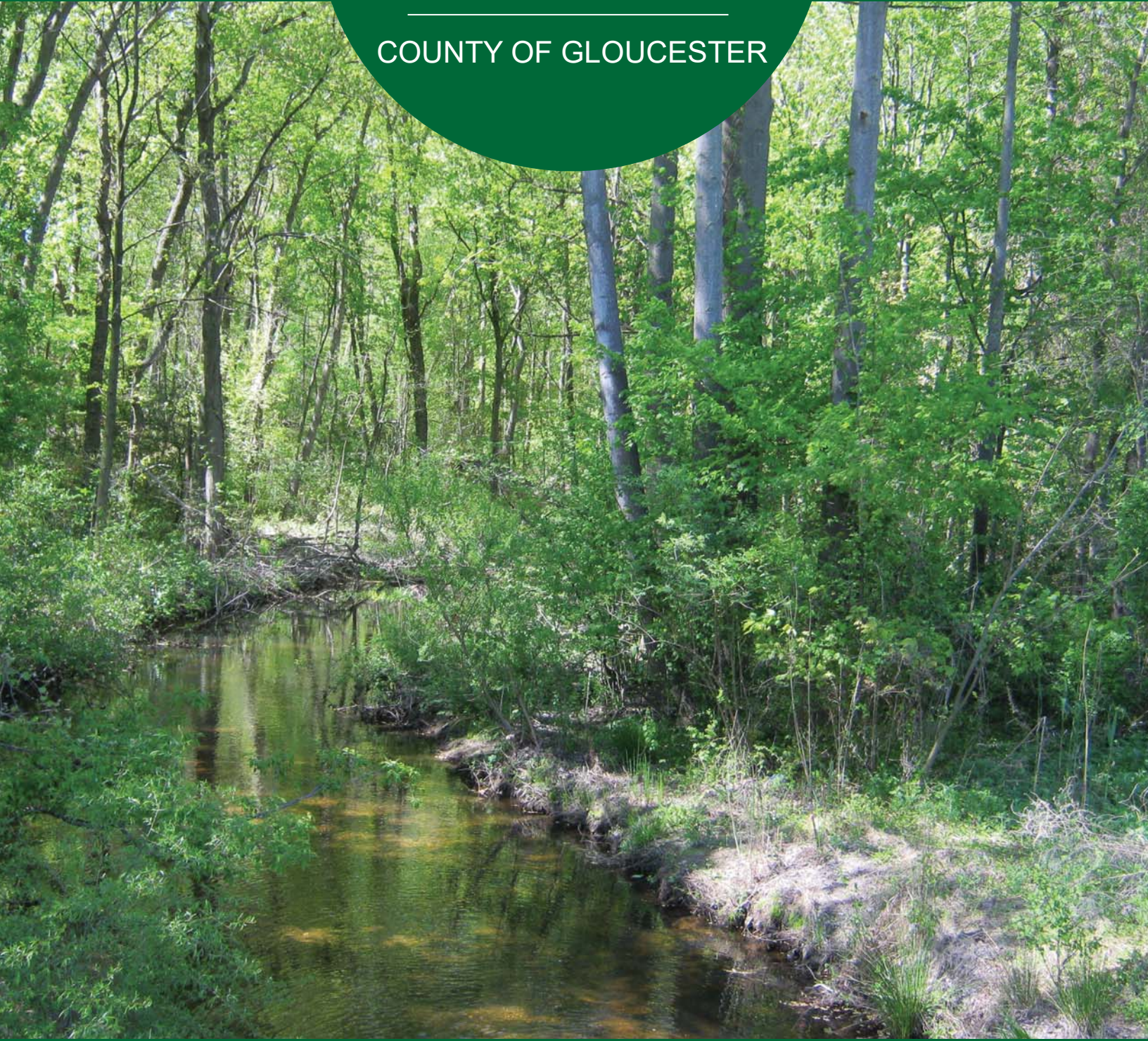


Township of Washington

ENVIRONMENTAL RESOURCE INVENTORY UPDATE

COUNTY OF GLOUCESTER



FINAL
August 1, 2017



ENVIRONMENTAL RESOURCE INVENTORY- 2017 UPDATE

for

Township of Washington County of Gloucester

Prepared August 1, 2017 by:

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**The original document was appropriately signed and sealed
in accordance with Chapter 41, Title 13 of the State Board of Professional Planners.**

ENVIRONMENTAL RESOURCE INVENTORY - 2017 UPDATE

for

Township of Washington County of Gloucester

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The information and maps presented in this report are intended for preliminary review and cannot substitute for on-site testing and evaluations. The maps for the Environmental Resource Inventory were developed using NJDEP Geographic Information System digital data

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EXECUTIVE SUMMARY

Located in the northeastern portion of Gloucester County, Washington Township is approximately 22 square miles, encompassing 14,455 acres. Mantua borders the Township to the west, Monroe and Glassboro to the south, Deptford to the north, and Camden County to the north and east. (*Map I*) Dating back to the pre-Revolutionary War era, Washington Township was settled as an agricultural community. Grenloch Terrace, once a thriving Lenni-Lenape village called Tetamekon, dates back to the 1600s.¹ Following World War II, and especially since the early 1960's, the Township's population has grown, changing from a rural-based economy to a residential suburb. The Township is committed to the preservation and protection of its environmental resources through the preservation of land and the protection of its environmentally sensitive areas². As a first step in this effort, the Township completed their initial *Environmental Resource Inventory* 1991 documenting the Township's natural resources.

The Township completed its *Environmental Resource Inventory* (ERI) in 1991. Between 1991 and 2010, the population grew by 6,599 people. Following completion of the 1991 ERI, the Township's *Master Plan* in 2004 and the approval of their *Open Space and Recreation Plan* (OSRP) in 2001 and 2009, supported the objectives of the 1991 ERI. As reported in its *2004 Master Plan*, Washington Township is a community with a strong desire to preserve and improve the quality of life that the citizens have come to expect. This report identifies the following goals for the Township:

- Open space protection
- Enhanced recreational and cultural opportunities
- Redevelopment of existing areas that have declined or that remain static
- Creation of a Town Center to further define a sense of place/a sense of community

The Township's *Open Space and Recreation Plan* provided a guide for the Township to identify and protect lands for recreation and natural resource conservation. The *ERI Update* and *OSRP* documents work together to assure the comprehensive knowledge and protection of the Township's environmental resources.

In 2014, Washington Township registered with the Sustainable Jersey program. New Jersey is the first state in the nation to have a comprehensive sustainability program for communities that links certification with strong state and private financial incentives, and a fully resourced program of technical support and training.³ The submittal of this *Environmental Resource Inventory (ERI) Update* is a priority certification action with Sustainable Jersey. The ERI provides baseline documentation for measuring and evaluating resource protection issues. Comprehensive knowledge of the natural resources allows Washington Township's officials and citizens to make informed decisions as they preserve the character of the Township and work to create a sustainable community within its landscape.

The *2017 Environmental Resource Inventory Update* (ERI) is based on available data from federal and state resources, as well as municipal resources. Mapping and tables detail the extent of Washington Township's natural resources highlighting its geology, hydrology, air quality and climate, wetlands, wildlife habitat, historic resources, public lands, land use and land cover, known contaminated sites, and transportation.

GEOLOGY AND GEOGRAPHY

Physiographic Provinces

New Jersey's landscape is divided into four distinctive regions, each characterized by unique geologic processes and landforms, known as physiographic provinces. Physiographic provinces classify landscapes based on terrain texture, rock type, and geologic structure and history. These attributes play an important role in determining the natural resources of an area. In New Jersey, beginning in the northwest and proceeding to the southeast, these provinces are identified as the Valley and Ridge, Highlands, Piedmont, and Coastal Plain Provinces. The Township of Washington is located within the Coastal Plain province.

The Coastal Plain is the largest physiographic province in New Jersey, covering an area of 4,667 square miles and occupying about 60% of the state. It extends from the southernmost tip of the state and includes all of Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, Monmouth, Ocean, and Salem Counties, as well as portions of Mercer and Middlesex Counties. The Coastal Plain is characterized by relatively flat terrain, underlain by unconsolidated deposits of sand with clay, silt, and gravel formations that range in age from the Upper Lower Cretaceous to the Miocene (90 to 10 million years old). The Atlantic Coastal Plain was formed by the movement of large glaciers during the Pleistocene Epoch. Streams flowing northwest to the Delaware River have narrow valleys, are shorter, and have steeper gradients than the streams that flow southeast to the Atlantic Ocean.⁴ In general, the Coastal Plain is characterized by wet, moist soil and is dotted with swamplands, marshes and rivers. Washington Township is part of the Inner Coastal Plain, consisting of a larger proportion of clay in its soils which allow the area to be distinguished as an important agricultural area. Nearby to the east, pine forests dominate the landscape.

Geology

The geology of Washington Township, consistent with that of southern New Jersey, is largely devoid of what is typically considered bedrock in most other regions, and instead is a system of surficial geology, consisting of unconsolidated sedimentary materials and unconsolidated marine deposits. It is convention in New Jersey geology that "bedrock also includes unconsolidated and semi-consolidated Coastal Plain formations consisting of sand, silt and clay." These surficial deposits have not been mapped by the New Jersey Department of Environmental Protection (NJDEP) and are not easily characterized by age or name (NJGS, Information Circular- Geologic Mapping in New Jersey). The properties of these layers "determine the physical extent of aquifers and the chemical quality of the water they yield. They also control how groundwater recharges and moves through the aquifers, how contaminants seep into and move through soil and groundwater, and where natural hazards like radon, sinkholes, and seismic instability may occur. Finally, these properties establish where geologic resources such as sand, gravel, peat, clay, quarry rock, and mineral ores are located. Geologic properties also determine the suitability of an area for the use of septic systems, the management of stormwater and surface runoff, and the stability of foundations for buildings, bridges, tunnels, and other structures."⁵

The *Geologic Formations Map* (Map 2 in the *Maps* section) depicts the distribution of formations within Washington Township and *Table 1. Bedrock Geology* shows their frequency of occurrence. The most predominant type is the Cohansey Formation (Tch), which covers 56.2% of the Township covering the southern portion of the Township. The second most predominant type is the Lower Member of Kirkwood Formation (Tkl), which covers 42.09% of the Township, and is located throughout the majority of the northern section of the Township. The Cohansey Formation consists of Quartz sand that is medium to coarse grained while the Lower Member of Kirkwood Formation consists of Quartz sand and clay.

Table 1. Bedrock Geology				
Abbrev.	Geologic Name	Lithology	Acres	Percent
Kml	Mt. Laurel Formation	Quartz sand, fine to coarse-grained, slightly glauconitic	8.37	0.06%
Kns	Navesink Formation	Glauconite sand, clayey	10.33	0.07%
Tch	Cohansey Formation	Quartz sand, medium to coarse grained	7749.44	56.20%
Tkl	Lower Member of Kirkwood Formation	Quartz sand and clay	5803.61	42.09%
Tht	Homerstown Formation	Glauconite sand, fine to medium grained	166.96	1.21%
Tvt	Vincentown Formation	Quartz sand, medium grained, clayey; and glauconitic near base; locally a calcarenite or coquina	50.08	0.36
Total:			13,788.78	100%

Surficial Geology

Surficial geology is the unconsolidated material overlaying bedrock formations. In the Coastal Plain, as it gradually changed height, the existing bedrock was eventually covered in an intervening layer of deposited materials that were spread very thinly across a broad surface and then slowly eroded, creating a new layer of varied composition. *Table 2* details the surficial geology in Washington Township. The most predominant type of surficial geology in Washington Township is the Weathered Coastal Plain Formation, which makes up 43.52% of the Township. It consists of exposed sand and clay of Coastal Plain bedrock formations. It includes thin, patchy alluvium and colluvium, and pebbles left from erosion of surficial deposits. This formation makes up the majority of the southern section of the Township. The second most predominant surficial geology type is the Bridgetown Formation, which makes up 40.24% of Washington Township. The Bridgetown Formation consists of sand, clayey sand, pebble gravel, minor silt, and cobble gravel. It is reddish-yellow, red, yellow, white, or very pale brown. The sand commonly includes weathered feldspar and can be as much as 40 feet thick. This formation covers a large portion of the northern section of the Township and also continues down into the southern section.

Table 2. Surficial Geology

Abbrev.	Formation	Lithology	GeoAge	Description	Acres	Percent
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.	155.49	1.13%
Tb	Bridgetown Formation	Sand, clayey sand, pebble gravel, minor silt and cobble gravel; reddish-yellow, red, yellow, white, very pale brown. Sand commonly includes weathered feldspar. As much as 40 feet thick.	Late Miocene	Occurs as erosional remnants of a former fluvial plain, capping the highest hills and uplands south of the Berlin area. Elevation of the base of the deposit grades from 180 feet near Berlin to 40 feet along the Atlantic coast.	5526.55	40.24%
Qtu	Upper Stream Terrace Deposits	Sand and pebble gravel, minor silt and cobble gravel; yellow, reddish yellow, yellowish brown. As much as 20 feet thick.	Middle to late Pleistocene	Form nonglacial stream terraces 20 to 50 feet above the modern floodplain. Topographic position and weathering characteristics are similar to Illinoian glaciofluvial deposits. Terraces grade to, or are overlapped by Cape May Formation, unit 2.	1561.50	11.37%
Tg	Upland Gravel	Sand, clayey sand, pebble gravel, minor cobble gravel; yellow to reddish yellow. Locally iron-cemented. As much as 20 feet thick.	Pliocene-early Pleistocene	Includes fluvial and minor colluvial deposits in erosional remnants capping hilltops and interfluves. On grade, in places, to the Pensauken Formation.	260.58	1.90%
Qwcp	Weathered Coastal Plain Formations	Exposed sand and clay of Coastal Plain bedrock formations. Includes thin, patchy alluvium and colluvium, and pebbles left from erosion of surficial deposits.	Chiefly Pleistocene, locally Miocene and Pliocene.		5977.62	43.52%

Table 2. Surficial Geology

Abbrev.	Formation	Lithology	GeoAge	Description	Acres	Percent
Qal	Alluvium	Sand, gravel, silt, minor clay and peat; reddish brown, yellowish brown, brown, gray. As much as 20 feet thick.	Holocene and late Pleistocene	Contains variable amounts of organic matter. Deposited in modern floodplains and channels.	216.68	1.58%
Qtl	Lower Stream Terrace Deposits	Sand, pebble gravel, minor silt and cobble gravel; reddish brown, yellowish brown, reddish yellow. As much as 30 feet thick.	Late Pleistocene, late Wisconsinan	Forms nonglacial stream terraces with surfaces 5 to 20 feet above modern floodplains. Terraces grade to late Wisconsinan glaciofluvial deposits in the Delaware, Millstone, and Raritan valleys.	36.72	0.27%
				Totals:	13,788.78	100%

SOILS

Soils Overview

Soils play a critical role in the environment. They support an area's vegetation, absorb rainwater, and provide habitat. The physical and chemical properties of soils reflect a large number of variables, including the parent material (bedrock), climate, vegetative cover, animal activities, slopes and drainage patterns, and time. New Jersey's fairly complex bedrock geology, history of glaciations, abundant precipitation, and patterns of human use has led to complex patterns of soil distribution.⁶

Soil Classifications

The official Soil Survey for Gloucester County was updated in 2015 by the Natural Resources Conservation Service (NRCS), an agency of the United States Department of Agriculture (USDA). The soils maps and tables in this *Environmental Resource Inventory Update* are based on the data from that official survey.

The NRCS Soil Survey plots soils by map units.⁷ The Soil Survey names each map unit based on the characteristics of the dominant soils within that unit. These *map unit names* identify the soils by their *soil series* classification(s).

Each map unit name has an associated abbreviation that offers a shorthand version of the naming/classification system. This abbreviation system identifies the soil types by steepness, stoniness, and frequency of flooding as follows:

- Capital letters at the end of the abbreviation indicate the slope
“A” being less steep and “E” being steeper
An example is the Aura series, which includes AucB, AugA, and AugB
- Small letters following these capital letters indicate stoniness
“a” “b” or “c” indicate the degree of stoniness: stony, very stony, and extremely stony
Although Washington Township does not have any soils with this classification, an example for reference is the Hibernia series: HhmCa
- Small letter “t” at the end of an abbreviation indicates “frequently flooded”
An example is Manahawkin muck (MakAt)

The Soil Survey also categorizes each map unit as one of four *map unit types*: consociations, complexes, associations, and undifferentiated groups. The soils in Washington Township fall into these three groups: consociation, complexes, or undifferentiated groups.

Consociations (Cn) are named for the *dominant soil*. In a consociation, delineated areas use a single name from the dominant component in the map unit. Dissimilar components are minor in extent. Consociations represent 49% of Washington Township's total area. An example of this soil type in Washington Township is the Freehold loam.

Complexes (Cx) consist of two or more *dissimilar* components that occur in a regularly repeating pattern. The total amount of other dissimilar components is minor in extent. Complexes represent

50% of Washington Township's total area. An example of this soil type in Washington Township is the Buddtown-Deptford complex

Undifferentiated groups (Un) “consist of two or more components that are not consistently associated geographically and do not always occur together in the same map delineation. They are included as the same named map unit because use and management are the same or very similar for common uses.”⁸ Undifferentiated groups represent less than 1% of Washington Township's total area. The Berryland and Mullica soil group is the only undifferentiated group in Washington Township. See *Appendix A. Soils* for the complete list of soils in Washington Township.

Major Soil Series

The three most prevalent soil types in Washington Township are Westphalia-Urban, Aura-Urban, and Westphalia. They account for 44.8% of the total land area. Water and Urban Land are not considered soil series and are excluded. See *Map 3. Soil Series*.

Westphalia-Urban accounts for 15.84% of the Township, or approximately 2,178 acres of land.

Aura-Urban accounts for 15.15% of the Township, or approximately 2,084 acres of land.

Westphalia accounts for 13.81% of the Township, or approximately 1,899 acres of land.

Westphalia- Urban - The Westphalia- Urban series consists of well drained sandy loam on the North Atlantic Coastal Plain. Slopes range between 0 to 10 percent

Aura-Urban - The Aura- Urban series consists of well drained sandy loam on the North Atlantic Coastal Plain. Slopes range between 0 to 10 percent

Westphalia – The Westphalia series consists of very deep, well drained soils on upland Coastal Plain terraces. They formed in unconsolidated Coastal Plain sediments containing fine and very fine sands. Slope ranges from 0 to 50 percent. Permeability is moderate.

Table 3 details the major soil series in Washington Township, including their farmland and erodibility ratings. The three major soil series within Washington Township are dispersed throughout the Township. The Westphalia-Urban series is concentrated mostly in the northern half, while the Aura-Urban soil series is located within the southern half where the Cohansey Formation is dominant. (see *Map 2. Geologic Formations*). Complete soil series descriptions can be found on the NRCS website.⁹

Table 3. Major Soil Series						
<i>Abbrv</i>	<i>Map Unit Name</i>	<i>Type</i>	<i>Farmland Type</i>	<i>Erodibility</i>	<i>Acres^a</i>	<i>% Township</i>
<i>Westphalia-Urban Series</i>						
WehB	Westphalia-Urban land complex, 0 to 5 percent slopes	Cx	Not prime farmland	Moderate	1719.31	12.5%
WehC	Westphalia-Urban land complex, 5 to 10 percent slopes	Cx	Not prime farmland	Moderate	458.23	3.33%
<i>Aura-Urban Series</i>						
AvuB	Aura-Urban land complex, 0 to 5 percent slopes, eroded	Cx	Not Prime Farmland	Moderate	1927.38	14.02%
AvuC	Aura-Urban land complex, 5 to 10 percent slopes	Cx	Nor Prime Farmland	Moderate	156.29	1.14%
<i>Westphalia Series</i>						
FmhAt	Fluvaquents, loamy, 0 to 3 percent slopes, frequently flooded	Cn	Not prime farmland	Moderate	992.59	7.22%
WeeB	Westphalia fine sandy loam, 2 to 5 percent slopes	Cn	All areas are prime farmland	Low	1334.43	9.70%
WeeC	Westphalia fine sandy loam, 5 to 10 percent slopes	Cn	Farmland of statewide importance	Low	242.45	1.98%
WeeD	Westphalia fine sandy loam, 10 to 15 percent slopes	Cn	Not Prime Farmland	Moderate	151.48	1.10%
WeeD2	Westphalia fine sandy loam, 10 to 15 slopes, eroded	Cn	Not Prime Farmland	Moderate	5.12	0.04%
WeeF	Westphalia fine sandy loam, 15 to 40 percent slopes	Cn	Not prime farmland	Moderate	135.52	0.98
Total					6130.21	44.8%
<i>Source: NRCS Soil Survey (Accessed March 2017)</i>						

Soil Characteristics

Agricultural Soils

Prime Farmland is defined by the United States Department of Agriculture (USDA) as land that has the best combination of physical and chemical characteristics for producing food, feed, fiber, forage, and oilseed crops.¹⁰ This classification of soil accounts for 28.62% of the land in Washington Township. Areas of Prime Farmland in Washington Township include gravel loam, silty loam, and sandy loam soils with slopes of 8% or less. (*Map 4. Agricultural Soils*).

^a Acres were measured using the ArcGIS 10.5 mapping digital mapping software

Farmland soils of Statewide Importance contain soils that are also highly productive under the right circumstances but not considered Prime Farmland and account for 9.61% of Washington’s land. The soil types classified under this tend to have a slope between 8 to 15% and are made up mainly of Sassafras.

Farmland of Local Importance can be used to produce high value food, fiber, or horticultural crops.¹¹ Evesboro sand and Freehold sandy loam make up this category. These soils are frequently flooded and have a slope between 0 to 3%. These soils account for 2.26% of Washington Township’s land.

Farmland of Unique Importance can be used for the production of specific high value food and fiber crops (for example: cranberries, fruits, and vegetables) but are not considered Prime Farmland. Manahawkin muck, Berryland and Mullica soils form this category. These soils have a slope between 0 to 2%. These soils account for 3.06% of Washington’s land. Over half (55.58%) of Washington’s land and soils are considered Not Prime Farmland. The soil types classified under this tend to be frequently flooded, stony, and have a higher slope (between 8 to 45%). A majority of this land is composed of the Westphalia series.

Table 4 details the agricultural potential of soils in Washington Township.

Table 4. Soil Rated for Agricultural Use		
<i>Arability Potential</i>	<i>Acres</i>	<i>Percent</i>
Prime farmland	3,970.35	28.62%
Farmland of statewide importance	1,333.88	9.61%
Farmland of local importance	313.93	2.26%
Farmland of unique importance	423.88	3.06%
Not prime farmland	7709.17	55.58%
Water	120.23	0.87%
Total	13,871.44	100%
<i>Source: NRCS Soil Survey</i>		

Erodibility

Soils can be categorized by their susceptibility to *erosion*, the natural process by which wind, moving water, ice, and gravitational forces cause soil and particulate materials to be displaced. While erosion of exposed bedrock occurs over an extended time scale, soil erosion can occur more acutely with more immediate consequences. The consistency of the soil is one factor determining its erodibility potential, with dense, compact, clayey soils being less susceptible and looser loamy soils, with varying levels of clay and sand, being more susceptible. A measure of this susceptibility is the K-factor. The K-factor looks at the soil texture and composition as well as the permeability to determine a number between 0.02 (less susceptible) and 0.69 (more susceptible) that demonstrates the erosion potential for a particular soil. The K-factor is shown in *Table 5. Soil Erodibility*. According to the NRCS, Erosion Hazard for Road/ Trail Soils measures the soil loss from unsurfaced roads and trails. It is determined using K-factor, slope, and content of rock fragments. The rating of the Erosion Hazard is described as Slight, Moderate, or Severe. In Washington Township, the soil K-factors range from 0.02 to 0.32 which represent slight risks of erosion. With these factors taken into account, Washington Township does face a moderate risk of

erosion on 49.4% of land. However no lands fall under severe risk of erosion (not including urban land and water).

<i>Erosion Hazard Road/Trail Rating</i>	<i>Acres</i>	<i>% of Land</i>
Low	6,264.4	50.6%
Moderate	6,112.2	49.4%
Severe	0	0%
Total Rated Area	12,376.6	100%
<i>Rated Area does not include water(120.2275 acres) and urban land (660.2935 acres)</i>		
<i>Source: NRCS Web Soil Survey</i>		

Topographic Protection (Wind)

According to the Natural Resource Conservation Service (NRCS), the soils of Washington Township are subjected to erosion by wind. Wind erosion most often affects soil on bare lands, where sheer force of wind detaches particles protruding from the soil surface. A conservation measure that can minimize damage due to wind erosion is maintaining a surface cover.

Hydric Soils

According to the NRCS, “A hydric soil is a soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part.” Hydric soils are an important element of wetland areas and naturally support wetland vegetation. If a soil is classified as “hydric,” Federal/State Wetlands Law may restrict land use due to the relationship of hydric soils to wetlands and wetland preservation.¹²

The NRCS Soil Survey for Washington Township identifies that 7.01% of the Township’s soils as hydric, and nearly 35% of these hydric soils are Manahawkin muck. These soils represent floodplains, river valleys, lake terraces, flood and outwash plains, depressions, and bogs. The hydric soils, their acreages, and typical locations are shown in *Table 6*.

Abbrev.	Typical Landform	Acres	% Hydric Soils	% of All Soils*
FamA	Swales, flats, drainageways, depressions	158.83	16.65%	1.16%
JdrA	Flats, depressions	256.82	26.93%	1.88%
AtsAr	Flats	2.82	0.29%	0.02%
BEXAS	Depressions, flats, drainageways	83.512	8.75%	0.61%
CoeAs	Flats, depressions, drainageways	0.12	0.01%	<0.1%
FapA	Swales, flats, drainageways, depressions	10.79	1.13%	0.08%

Abbrev.	Typical Landform	Acres	% Hydric Soils	% of All Soils*
FauB	Flats, depressions	24.44	2.56%	0.18%
JduA	Flats, depressions	69.37	7.27%	0.51%
MakAt	Swamps, flood plains	337.55	35.38%	2.47%
Total Hydric Soils		953.8	100%	7.01%
Total Soils Excluding Water		13,630.97		
<i>*Percentage of all soils excluding water</i>				
<i>Source: NRCS Web Soil Survey</i>				

Other Soil Characteristics and Limitations for Use

Other characteristics of soil that determine suitability for development, including its capacity to support foundations without corrosion, limits for septic systems, and hydrological characteristics such as tendency towards ponding and flooding, a shallow water table or potential for frost heave, can contraindicate development. The NRCS Soil Survey states, “Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes soil poorly suited to basements or underground installations.” The *Soil Limitations Table (Appendix B)* explores the following characteristics:

Depth to restrictive layer is the vertical distance from the soil surface to the upper boundary of the restrictive layer. The restrictive layer is a nearly continuous layer that has one or more physical, chemical, or thermal properties that significantly impede the movement of water and air through the soil or restrict roots or otherwise provide an unfavorable root environment. Examples are bedrock, cemented layers, dense layers, and frozen layers. Though not shown in this table, information on the hardness and thickness of the restrictive layer, both of which significantly affect the ease of excavation, can be obtained for specific soil types.

Drainage refers to the relative wetness of the soil under natural conditions as it pertains to wetness due to a water table. Drainage classes refer to the frequency and duration of wet periods under conditions similar to those under which the soil developed. Drainage classes range from excessively drained (water is removed very rapidly and the soils are commonly coarse-textured or shallow) to very poorly drained (water is removed from the soil so slowly that free water remains at or very near the ground surface during much of the growing season and unless artificially drained, most crops cannot be grown).

Capacity [of most limiting layer] to transmit water refers to the ease with which pores in a saturated soil transmit water. This capacity is considered in the design of soil drainage systems and septic tank absorption fields.

Depth to water table indicates a range of expected depth to a saturated zone in the soil, known as a “water table,” that occurs during several months in most years. A saturated zone that lasts for less than a month is not considered a water table.

Flooding is the temporary inundation of an area caused by overflowing streams or by runoff from adjacent slopes. Water standing for short periods after rainfall or snowmelt is not considered

flooding, and water standing in swamps and marshes is considered ponding rather than flooding. Frequency is expressed as none, very rare, rare, occasional, frequent, and very frequent.

- “None” means that flooding is not probable. The chance of flooding is nearly 0% in any year. Flooding occurs less than once in 500 years.
- “Very rare” means that flooding is very unlikely but possible under extremely unusual weather conditions. The chance of flooding is less than 1% in any year.
- “Rare” means that flooding is unlikely but possible under unusual weather conditions. The chance of flooding is 1-5% in any year.
- “Occasional” means that flooding occurs infrequently under normal weather conditions. The chance of flooding is 5-50% in any year.
- “Frequent” means that flooding is likely to occur often under normal weather conditions. The chance of flooding is more than 50% in any year but is less than 50% in all months in any year.
- “Very frequent” means that flooding is likely to occur often under normal weather conditions. The chance of flooding is more than 50% in all months of any year.

Ponding is standing water in a closed depression. Unless a drainage system is installed, the water is removed only by percolation, transpiration, or evaporation. Frequency is expressed as none, rare, occasional, and frequent.

- “None” means that ponding is not probable;
- “Rare” that it is unlikely but possible under unusual weather conditions (the chance of ponding is nearly 0 to 5% in any year);
- “Occasional” that it occurs, on the average, once or less in two years (the chance of ponding is 5-50% in any year); and
- “Frequent” that it occurs, on the average, more than once in two years (the chance of ponding is more than 50% in any year).

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in centimeters of water per centimeter of soil for each soil layer. The capacity varies, depending on soil properties that affect retention of water. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Potential for frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, saturated hydraulic conductivity (Ksat), content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential

for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained.

Silty and highly structured, clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that corrodes or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. The steel or concrete in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than the steel or concrete in installations that are entirely within one kind of soil or within one soil layer.

Septic limitations refer to effectiveness of a soil type to manage a septic tank absorption field. Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tile or perforated pipe. Only that part of the soil between depths of 24 and 60 inches is evaluated. The ratings are based on the soil properties that affect absorption of the effluent, construction and maintenance of the system, and public health. The most important soil properties that determine septic limitations are saturated hydraulic conductivity (Ksat), depth to a water table, ponding, depth to bedrock or a cemented pan, and flooding. Stones and boulders, ice, and bedrock or cemented pan interfere with installation. Subsidence interferes with installation and maintenance. Excessive slope may cause lateral seepage and surfacing of the effluent in downslope areas. All of the rated soils in Washington Township are classified by the NRCS as “very limited,” which indicates that the soil has at least one feature that is unfavorable for such use, with the expectation of poor performance and high maintenance¹³ (***Appendix B. Soil Limitations***).

Soil Limitations for Building Site Development

Washington Township has several soils that are rated by the NRCS Web Soil Survey as having no limits or some limits on their ability to support dwellings with or without basements and small commercial buildings.

For the purpose of these ratings, dwellings are defined as single-family houses of three stories or less and small commercial buildings are structures that are less than three stories high and do not have basements. For dwellings without basements and small commercial buildings, the foundation is “assumed to consist of spread footing of reinforced concrete built on undisturbed soil at a depth of 2 feet or at a depth of maximum frost penetration, whichever is deeper.” For dwellings with basements, the foundation is “assumed to consist of spread footings of reinforced concrete built in undisturbed soil at a depth of about 7 feet.” The ratings for dwellings are based on the soil properties that affect excavation and construction costs. The properties that affect the load-supporting capacity include depth to a water table, ponding and flooding, subsidence, linear extensibility (shrink-swell potential), and compressibility. Properties that affect excavation and

construction costs are depth to a water table, ponding and flooding, slope, depth to bedrock or cemented pan, hardness of bedrock or cemented pan, and the amount and size of rock fragments.

The ratings are as follows:

- Not limited*: indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected.
- Somewhat limited*: indicates that the soil has features that are moderately favorable for specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected.
- Very limited*: indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

See *Appendix C. Soil Limitations for Building Site Development* for the breakdown of these ratings for each soil type and their total acreage found throughout the Township.

HYDROLOGY

Watersheds

“A watershed is a topographic area within which apparent surface water runoff drains into a specific point on a stream or to a water body such as a lake.”¹⁴ The NJDEP has divided the state into Watershed Management Areas (WMAs). A watershed-based approach to natural resource management is considered by state and national agencies to be the most appropriate unit for managing complex environmental problems.

Washington Township falls within three Watershed Management Areas. The majority of Washington Township is part of WMA 18 which comprises the basins of the Lower Delaware River, and covers over 90% of the Township. The rest of Washington Township falls within WMAs 15 and 17, which include the Great Egg Harbor and Maurice, Salem, and Cohansey Rivers. WMA areas 15 and 17 are located along the Southern border of the Township.

Every WMA is composed of multiple watersheds and sub-watersheds. The United States Geological Survey (USGS) has mapped and identified watersheds using hierarchical numbering systems. This system identifies watersheds using hydrological unit code (HUC) consisting of up to 14 digits for the smallest watersheds. The HUC11 watersheds for Washington Township are identified on the *Watersheds map* (Map 5. *Watersheds* in the *Maps* section) and listed in Table 7. *HUC11 Watersheds*.

Table 7. HUC11 Watersheds

<i>WMA</i>	<i>WMA name</i>	<i>Sub-Watersheds</i>	<i>Acres</i>	<i>Percent</i>
15	Great Egg Harbor	Four Mile Branch (GEHR)	0.03	>0%
17	Maurice, Salem, and Cohansey	Scotland Run (above Fries Mill)	1,054.23	7.65%
17	Maurice, Salem, and Cohansey	Little Ease Run (above Academy Rd)	257.57	1.87%
18	Lower Delaware	Big Timber Creek SB (below Bull Run)	0.05	>0%
18	Lower Delaware	Big Timber Creek SB (includes Bull Run to Lakeland Rd)	1,739.85	12.62%
18	Lower Delaware	Mantua Creek (Edwards Run to Road to Sewell)	49.72	0.36%
18	Lower Delaware	Big Timber Creek SB (above Lakeland Rd)	4,366.81	31.67%
18	Lower Delaware	Mantua Creek (road to Sewell to Rt 47)	3,813.87	27.66%
18	Lower Delaware	Mantua Creek (above Rt 47)	2,506.63	18.18%
Total:			13,788.78	100%

Source: NJDEP

Surface Water

Surface water is water that collects on the ground or in a stream, river, lake, wetland, or ocean. Major water bodies in Washington Township include Mantua Creek, which delineates the western border of the Township, South Branch of Big Timber Creek at the eastern boundary, tributaries.

Bells Lake is the largest lake within the Township; however there are multiple smaller water bodies scattered throughout, these include Washington Lake (*Figure 1*), Grenloch Lake (*Figure 2*), Cedar Lake, Irvin Lake, Spring Lake, and Lake Kandle All of the lakes within Washington Township are artificially created by constructing dams on streams within the Township. The dam on Duffield's Run has been removed and due to this, Kressey and Stirling Lakes no longer exist.



Figure 1. Washington Lake

Photo credit: Vicky Binetti- Environmental Commission



Figure 2. Grenloch Lake

Photo credit: Leon Lakritz- Environmental Commission

New Jersey's Surface Water Quality Standards (SWQS) (N.J.A.C. 7:9) classify Fresh Water 1 (FW1) as the highest level of classification, which is defined as:

“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 prosperity) and not subjected to any manmade wastewater discharges or increase in runoff from anthropogenic activities. These waters are set aside for prosperity because of their clarity, color, scenic setting, other characteristics of aesthetic value, unique ecological significance, exceptional recreational significance, exceptional water supply significance, or exceptional fisheries resource(s).”¹⁵

The general classification for other freshwater in the State is Fresh Water 2 (FW2). The presence of trout in a stream means that the waters are relatively free of chemicals or biological contaminants, and is used to further define designated uses. A stream can be classified as Trout Production (TP), Trout Maintenance (TM), or Non-Trout (NT). Trout Production waters are designated “for the use by trout spawning or nursery purposes during their first summer.” Trout Maintenance waters support trout throughout the year. Waters classified as Non-Trout do not support trout, either because their physical nature or due to biological or chemical characteristics. ((SWQS) (N. J. A. C.7:9B)). The waterbodies of Washington Township are all classified as Category 2 FW2-NT (Fresh Water 2 Non-Trout). *Map 6. Surface Water Use Classifications* depicts the specific water quality designations.

Surface water quality is affected by point sources and non-point sources of pollution, as well as erosion and sedimentation. Point source means any 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, or vessel or other floating craft from which pollutants are or may be discharged.¹⁶ This includes discharges from sewage treatment plants and factories, storm water runoff, illegal dumping, and malfunctioning underground storage tanks and septic systems. This term does not include agricultural storm water discharges and return flows from irrigated agriculture.

In contrast to point source pollution, non-point source pollution comes from many different sources. As rainfall or snowmelt moves over and through the ground, it picks up and carries natural and human-made pollutants (such as fertilizers, herbicides and motor oil) and deposits them into surface and groundwater. The effects of pollutants on specific waterways can vary, but eventually all are manifested in negative outcomes for drinking water supplies, recreation, fisheries, and wildlife. One of these effects is eutrophication, which, in freshwater systems, is the addition of substances, either man-made or natural, to a water body affecting the primary productivity of that body of water. Nitrates and phosphates promote excessive algae growth. These “blooms” can have negative effects on the ecosystem. These can include clouding of the water, which limits sunlight penetration; this stops the growth of plants deeper in the water. Additionally, eutrophication can lead to anoxia, a condition where a water body has depleted levels of oxygen- a result of the decomposition of dead phytoplankton.

Water quality can also be negatively impacted by sedimentation, which is the transportation and deposition of eroded materials. A primary cause of sedimentation is development near streams and on steep slopes that reduce vegetative cover and results in exposed soil. The vegetative cover can typically absorb the impact of raindrops, but when it is removed, the exposed soil easily becomes eroded. The eroded soil can then be transported to surface waters where it could contaminate and increase the turbidity of the water, effectively blocking sunlight to plant species and negatively affecting the health of the aquatic ecosystem.

The *2012 New Jersey Integrated Water Quality Monitoring and Assessment Report*¹⁷ analyzes water quality monitoring data for the 952 watersheds within the State and assesses their quality for compliance with New Jersey’s water quality standards.^b Appendix A of the 2012 report assesses water quality data for stream usage, impairment, and causes¹⁸. Nearly all (98%) of the surface water within Washington Township falls within five sub-watersheds: Big Timber Creek South Branch (SB) (above Lakeland Road), Mantua Creek (road to Sewel to Route 47), Mantua Creek (above Route 47), Big Timber Creek SB (includes Bull Run to Lakeland Road), and Scotland Run (above Fries Mill). The majority of these sub-watersheds have water quality impairments:

- *Big Timber Creek SB (above Lakeland Road)*: Supports agricultural water supply, industrial water supply, and public water supply. It is not supporting of aquatic life due to total phosphorus levels and carries a total maximum daily load (TMDL) at medium priority, fish consumption due to mercury in fish tissue, and primary contact recreation due

^b The *Draft 2014 Integrated Water Quality Monitoring and Assessment Report* documents the same results as the *2012 Report*, but as it is in draft form was not used as a reference for the *ERI Update*.

to fecal coliform. These pollutants are from urban runoff and storm sewers, atmospheric deposition-toxics and agriculture.

- *Big Timber Creek (including Bull Run to Lakeland Road)*: Supports agricultural water supply and industrial water supply. It is not supporting of aquatic life due to total phosphorus levels, fish consumption due to mercury in fish tissue, primary contact recreation due to fecal coliform, and public water supply due to arsenic which contains a TMDL at low priority. These pollutants are from agriculture, urban runoff/storm sewers, and atmospheric deposition-toxics.
- *Mantua Creek (above Route 47)*: This sub-watershed does not support aquatic life. Data was not assessed for other water quality data categories.
- *Mantua Creek (road to Sewell to Route 47)* -This sub-watershed does not support aquatic life due to total phosphorus levels. Data was not assessed for other water quality data categories.
- *Scotland Run (above Fries Mill)* -This water body fully supports aquatic life but does not support fish consumption due to mercury in fish tissue caused from atmospheric deposition-toxics. Data was not assessed for other water quality data categories.

Groundwater Recharge Areas

Groundwater is the primary drinking and agricultural water source for the residents of New Jersey, and is the exclusive source of drinking water for residents of Washington Township. In Washington Township, the water is supplied from three main aquifers: the Potomac-Raritan-Magothy, the Mount Laurel-Wenonah, and the Kirkwood-Cohansey. The Kirkwood-Cohansey aquifer encompasses approximately 3,000 square miles of southern New Jersey¹⁹, including the entirety of the Pinelands National Preserve. It is an extremely productive aquifer, with an estimated 17 trillion-gallon capacity²⁰.

Groundwater recharge is the process in which surface water from lakes, streams, or rainwater runoff, flows or seeps downwards beneath ground surface, saturating soil or rock. Groundwater is contained in porous rocks and sediments. An area where such water-holding rocks or unconsolidated materials yield a usable quantity of water is called an aquifer, the source from which drinking water is drawn through wells. Protecting the land's capacity to recharge its aquifers, and limiting development to stay within the capacity of local water resources, is critical to maintaining our water supply.

Aquifer-recharge potential was calculated through the combination of a standardized statewide aquifer ranking system and the particular groundwater recharge coverage in the area of interest. Aquifer recharge or recharge to water-bearing geologic units is defined as the groundwater that reached the water table in the uppermost geologic unit with a thickness of 50 feet or greater. Groundwater recharge potential is ranked by average annual infiltration. The composite aquifer/groundwater recharge potential rank highlights the multiple relationships between the groundwater-recharge area ranks (indicative of infiltration rate) and the underlying water table aquifer ranks (indicative of the aquifer's capacity to absorb, transmit and supply water), and

provides a guide to how well the system in any given area allows groundwater to reach and recharge the aquifer. *Table 8* depicts the ranking system.

The Kirkwood-Cohansey aquifer has an aquifer Rank B meaning that it has a median well yield of >250-500 gallons per minute and a groundwater Rank A meaning it has an average annual infiltration of 13-15 inches per year.

<i>Aquifer Rank</i>	<i>Median Well Yield (Gallons/Minute)</i>	<i>Groundwater Rank</i>	<i>Avg. Annual Infiltration (In/Yr)</i>
A	>500	A	13-15
B	>250-500	B	9-12
C	>100-250	C	7-8
D	25-100	D	1-6
E	<25	0	0

There are also hydric soils (L/L), wetlands and open water (W/W) and instances where no recharge is calculated (X/X).
Source: NJGS

The *Aquifer Recharge Potential* map (*Map 7*) shows the distribution of rankings for Washington Township. This map shows the potential for an aquifer to recharge in a given area. The area with the highest potential for recharge would be ranked A/A (>500gpm/20-23 in/yr).

None of Washington Township is ranked A/A; 13.66 acres are ranked B/B (>250-500gpm/ 9-12 in/yr). The majority of the Township, 61% covering 8,350 acres, is ranked D/B (25-100 gpm/ 9-12 in/yr). The aquifer/groundwater recharge rankings in Washington Township are shown in *Table 9*.

<i>Alpha Rank</i>	<i>Numeric Rank</i>	<i>Acres</i>	<i>% of Township</i>
B/B	22	13.66	0.10%
B/C	23	1.15	0.01%
B/D	24	0.07	0.001%
D/A	41	162.59	1.18%
D/B	42	8,350.21	60.72%
D/C	43	1,638.14	11.91%
D/D	44	1,302.09	9.47%
E/A	51	3.67	0.03%
E/B	52	117.99	0.86%
E/D	54	7.29	0.05%
L/L	97	655.89	4.77%
W/W	98	1498.22	10.90%
Total		13,750.99	100%

Source: NJDEP

Aquifer Identification

An aquifer is an underground formation of permeable rock or unconsolidated materials that can yield significant quantities of water to wells or springs. The rate or recharge is not the same for all aquifers, and that must be considered when pumping water from a well. Pumping too much water too fast draws down the water in the aquifer and eventually causes a well to yield less and less water and even run dry.

Aquifers are typically equated to the type of geologic formation in which they exist. Aquifers in New Jersey are classified as either bedrock or surficial. Bedrock aquifers consist of rock formations while surficial aquifers are formed from unconsolidated materials such as sand, gravel, or glacial sediment. Bedrock aquifers contain water in fractures within the rock while surficial aquifers contain water primarily in the spaces between sand and gravel particles.

The Kirkwood-Cohansey Aquifer is an unconfined (or surficial/water table) aquifer. It is composed primarily of permeable sand, silts, and clay, and extends throughout the New Jersey coastal plain. Located at the surface, the Kirkwood-Cohansey Aquifer varies in thickness, depending on the depth of the underlying confined aquifers and confining units that slope from the northwest to the southeast. It provides the majority of streamflow to the watershed of southern New Jersey. Well usage and withdrawal of water from this aquifer reduces surface stream flow.²¹

The water supply within Washington Township falls within Water Supply Critical Area 2 which puts restrictions of groundwater withdrawal to allow the groundwater to replenish²². The Mt. Laurel-Wenonah and Potomac-Raritan Magothy aquifers lie below the Kirkwood-Cohansey Aquifer but do not outcrop in the Township (see *Figure 3. New Jersey Aquifers*).

The Kirkwood-Cohansey Aquifer is mapped in 98.3% of the Township (13,554 acres) and has a rank of B-A. The remaining 1.7% (or 234 acres) of Washington is composed primarily of composite confining unit with a lower rank for both the aquifer and groundwater infiltration rate. The aquifers in Washington Township are shown on the *Aquifer Ranking* map (*Map 8 in the Maps section*).

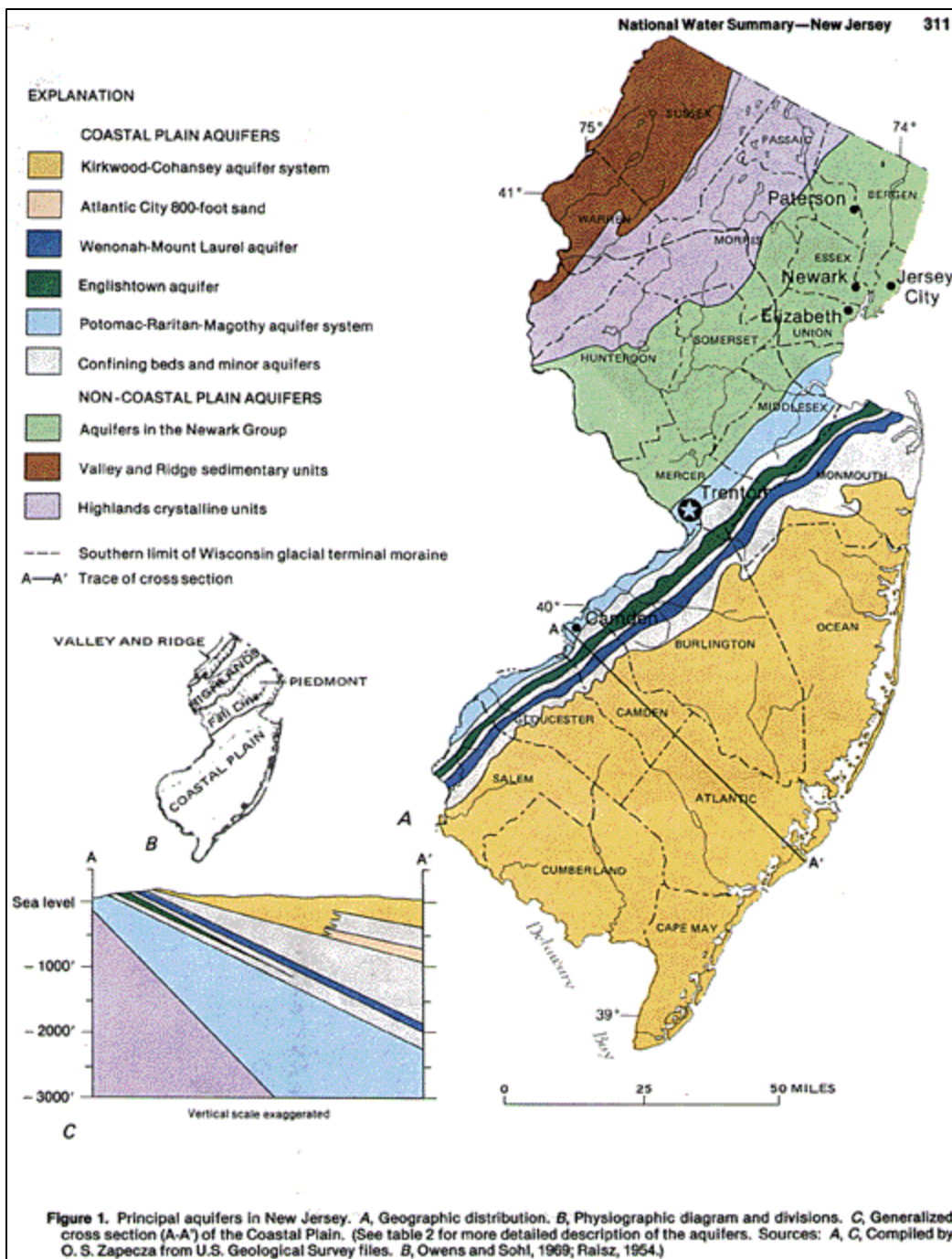


Figure 3. New Jersey Aquifers

Source: USGS https://nj.usgs.gov/infodata/aquifers/figure_1.html

Public Water Supply and Wellhead Protection

The 1986 Federal Safe Drinking Water Act Amendments directed all states to develop Well Head Protection Program (WHPP) Plans for both public community (CWS) and public non-community (NCWS) water supply wells.²³ A component of the WHPP is the delineation of Well Head Protection Areas. This delineation is the first step in defining the sources of water to a public water supply in order to prevent and clean up groundwater contamination.

Wellhead Protection Areas (WHPAs) are delineated for both public community and non-community wells. The delineations for these wells are the two, five, and twelve year tiers. Each tier represents the horizontal extent of groundwater captured by a well pumping at a specific rate over those periods of time.²⁴ In 2002, the Township adopted a Wellhead Protection Ordinance which designated 26 regulated land uses prohibited or allowed only as Approved Conditional Uses in WHPA Tiers 1, 2, or 3.²⁵ The Township also has a Well-Head Protection Overlay Zone, where development must conform to the requirements set forth in the Township's Wellhead Protection Ordinance.²⁶ There are 16 community wells in Washington Township. These are depicted in the *Public Wellhead Protection Map (Map 9 in the Maps section)*.

The Coastal Plain aquifer system is designated by the United States Environmental Protection Agency (USEPA) as a Sole Source Aquifer. These aquifers “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”²⁷ Groundwater in the Kirkwood Cohansey is typically fresh, acidic, highly corrosive, and low in dissolved solids. Natural compounds such as mercury, radium, iron, and manganese levels are recorded and vary locally. It is likely that mercury has been released due to human activity and is not naturally occurring in the aquifer. Radium is naturally occurring in the aquifer, however the application of agricultural chemicals could have facilitated its release into groundwater.²⁸ Since the Kirkwood Cohansey is a surficial/water table aquifer, it is vulnerable to pollution at the surface level.²⁹

Riparian Zones

In order to better protect the public from the hazards of flooding, preserve the quality of surface waters, and protect wildlife and vegetation, the NJDEP has adopted Flood Hazard Area Control Act rules (N.J.A.C. 7:13) in order to incorporate more stringent standards for development in flood hazard areas and riparian zones.³⁰ A riparian zone is land and vegetation within land adjacent to surface waters.

Activity within the regulated areas of the flood hazardous area and the riparian zone may be restricted if it includes or results in one or more of the following:

1. The alteration of topography through excavation, grading and/or placement of fill;
2. The clearing, cutting, and/or removal of vegetation in a riparian zone;
3. The creation of impervious surface;
4. The storage of unsecured material;
5. The construction, reconstruction, and/or enlargement of a structure; and
6. The conversion of a building into a private residence or a public building

In most areas of New Jersey, Category 1 waters require a 300-foot buffer, while other surface waters, such as those classified as FW2-NT (including those in Washington Township) are subjected only to a regulated 50-foot riparian zone, measured from the top of the bank.

WETLANDS

Wetlands are important natural resources that contribute significantly to an area's social, economic, and environmental health. Among the services they provide are filtration of chemicals, pollutants, and sediment from water; flood control; critical habitat for wildlife; recreation and tourism. The NJDEP defines a freshwater wetland as "an area that is inundated or saturated by surface water or ground water at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions, commonly known as hydrophytic vegetation; provided, however, that the Department, in designating a wetland, shall use the three-parameter approach (that is, hydrology, soils, and vegetation) enumerated in the 1989 Federal Manual."³¹ (N.J.A.C. 7:7A) NJDEP has adopted this manual as the technical basis for identifying and delineating wetlands. Washington Township is home to many wetland areas, typically following the major stream corridors throughout the town.

The NJDEP regulates virtually all activities in a wetland, including removing vegetation, filling, and placing obstructions. Depending on the environmental value of a particular wetland, there may also be a transition area, or buffer, around the wetland that will require a waiver issued by the NJDEP for any activity within that zone. A wetland containing endangered species habitat would require a 150-foot wide transition area, whereas a small wetland in a ditch might not require any transition area at all. Most freshwater wetlands require a 50-foot transition area. Wetlands in New Jersey are classified into three different values: exceptional resource value, ordinary resource value, or intermediate resource value:

Exceptional Resource Value Wetland

- Discharges into FW-1 water and FW-2 trout producing waters and their tributaries;
- Is a present habitat for threatened or endangered species; or
- Is a documented habitat for threatened or endangered species, and remains suitable for breeding, resting, or feeding by the species during the normal period these species would use the habitat.

Ordinary Resource Value Wetland

- A freshwater wetland which does not exhibit any of the characteristics of an Exceptional Resource Value Wetland which is:
 - An isolated wetland, as defined at *N.J.A.C. 7:7A-1.4*, which:
 - Is smaller than 5,000 square feet; and
 - Has the uses listed below covering more than 50% of the area within 50 feet of the wetland boundary. In calculating the area covered by a use, NJDEP will only consider a use that was legally existing in that location prior to July 1, 1988, or was permitted under this chapter since that date:
 - Lawns
 - Maintained landscaping
 - Impervious surfaces
 - Active railroad right-of-way
 - Graveled or stoned parking/storage areas and roads

- A drainage ditch
- A swale or
- A detention facility that was uplands at the time it was created regardless of the wetland resource classification of the wetlands under these rules, or classification of the body of water, as FW-1 or FW-2 trout production, to which it discharges.

Intermediate Resource Value Wetland

- A freshwater wetland of intermediate resource value is any wetland not defined as exceptional or ordinary

According to the NJDEP 2012 Land Use/Land cover data, there are 1,123 acres of wetlands within Washington Township occupying approximately 8% of the Township. The *Wetlands* map (*Map 10*) shows the locations of wetlands in Washington Township. *Table 10. Wetlands Classifications* presents a summary of wetlands by type. Deciduous Wooded Wetlands is the dominate type of wetlands in Washington Township, accounting for 82% of wetlands and covering approximately 6.7% (920 acres) of the Township. The majority of the deciduous wooded wetlands are found in the northern half of the Township along the major streams and waterways including Big Timber Creek, Bees Branch, Bethel Run, Porch Branch and other unnamed tributaries. The other wetland types within the Township are found scattered along these waterways and lakes throughout the Township.

Table 10. Wetlands Classifications

<i>Classifications</i>	<i>Acreage</i>	<i>% of Wetlands</i>	<i>% of Washington Twp</i>
Agricultural Wetlands (Modified)	11.26	1.00%	0.08%
Atlantic White Cedar Wetlands	6.27	0.56%	0.05%
Coniferous Scrub/Shrub Wetlands	2.93	0.26%	0.02%
Deciduous Scrub/Shrub Wetlands	34.60	3.08%	0.25%
Deciduous Wooded Wetlands	920.07	81.90%	6.67%
Disturbed Wetlands (Modified)	6.50	0.58%	0.05%
Former Agricultural Wetland (Becoming Shrubby, Not Built-Up)	4.12	0.37%	0.03%
Herbaceous Wetlands	9.32	0.83%	0.07%
Managed Wetland In Built-Up Maintained Rec Area	13.04	1.16%	0.09%
Managed Wetland In Maintained Lawn Greenspace	10.41	0.93%	0.08%
Mixed Scrub/Shrub Wetlands (Deciduous Dom.)	12.59	1.12%	0.09%
Mixed Wooded Wetlands (Coniferous Dom.)	18.91	1.68%	0.14%
Mixed Wooded Wetlands (Deciduous Dom.)	65.96	5.87%	0.48%
Phragmites Dominate Interior Wetlands	1.40	0.12%	0.01%
Phragmites Dominate Urban Area	1.96	0.17%	0.01%
Wetland Rights-Of-Way	4.07	0.36%	0.03%
Total	1,123.42	100%	8.15%

Source: NJDEP

Though this information is based on NJDEP mapped wetlands, unmapped wetlands, which are still subject to NJDEP regulations, may exist in Washington Township. Wetlands require a professional delineation before regulated activity could occur in or around them.

VEGETATION

Since 1986, the NJDEP has mapped land use within the state through their Land Use/Land Cover (LU/LC) data sets. Areas are delineated using color infrared images. The latest update of this data occurred in 2012. The NJDEP also maps critical habitat for imperiled and priority species through the Landscape Project, which is a proactive, ecosystem-level approach to the long-term protection of these habitats, rare plant species, and ecological communities through the Natural Heritage Database.

Land Cover

The NJDEP identifies six LU/LC categories: agriculture, barren land, forest, urban, water, and wetlands. Forested area represents approximately 14.5% of Washington Township’s land cover, providing critical habitat for wildlife. Wetlands account for approximately 8% and urban land represents 69% of Washington Township’s land cover. Together, wetlands and streams provide riparian corridors providing a different type of habitat for wildlife species.

Table 11 shows the percentage of acreage covered by each land cover type and *Map 11. Land Use/Land Cover* shows their distribution in the Township.

Table 11. Land Cover		
<i>Land Use Type</i>	<i>Acres</i>	<i>% of Washington Township</i>
Agriculture	868.52	6.30%
Barren Land	130.22	0.94%
Forest	2,000.30	14.51%
Urban	9,493.53	68.85%
Water	172.80	1.25%
Wetlands	1,123.42	8.15%
Total	13,788.78	100%
<i>Source: NJDEP</i>		

Forest Types

According to the 2012 LU/LC data, approximately 2,000 acres, or 14.5% of Washington Township is classified as forested, with 48% of the forests classified as Deciduous Forest with a >50% Crown Closure. The second most prevalent category is Mixed Forest containing >50% Deciduous with a >50% Crown Closure, followed by Mixed Deciduous/Coniferous Brush/Shrubland. *Table 12* below displays the complete breakdown.

Table 12. Forest Classifications			
<i>Classification</i>	<i>Acres</i>	<i>% of Category</i>	<i>% of Washington Twp</i>
Coniferous Brush/Shrubland	10.3132	0.52%	0.07%
Coniferous Forest (>50% Crown Closure)	68.1864	3.41%	0.49%
Coniferous Forest (10-50% Crown Closure)	5.9205	0.30%	0.04%
Deciduous Brush/Shrubland	62.7031	3.13%	0.45%
Deciduous Forest (>50% Crown Closure)	967.0771	48.35%	7.01%
Deciduous Forest (10-50% Crown Closure)	160.7791	8.04%	1.17%
Mixed Deciduous/Coniferous Brush/Shrubland	194.6493	9.73%	1.41%
Mixed Forest (>50% Coniferous With >50% Crown Closure)	60.1885	3.01%	0.44%
Mixed Forest (>50% Coniferous With 10-50% Crown Closure)	2.83	0.14%	0.02%
Mixed Forest (>50% Deciduous With >50% Crown Closure)	301.5226	15.07%	2.19%
Mixed Forest (>50% Deciduous With 10-50% Crown Closure)	47.1447	2.36%	0.34%
Old Field (< 25% Brush Covered)	117.8538	5.89%	0.85%
Phragmites Dominate Old Field	1.1271	0.06%	0.01%
Total	2,000.30	100%	14.51%
<i>Source: NJDEP</i>			

The following definitions set the classification parameters:

Deciduous- This category includes forested lands that contain deciduous tree species. Deciduous trees are those which lose their leaves at the end of the growing season. These trees remain leafless throughout the winter and sprout new leaves the following spring. The average height of the stand is at least 20 feet. A forest stand must have at least 75% canopy coverage from deciduous tree species to be placed in this category.

Deciduous, >50% Crown Closure

This category contains deciduous stands with crown closure greater than 50%. Crown closure is the percentage of a forest area occupied by the vertical projections of tree crowns. Crown closure percentages provide a reasonable estimate of stand density. The majority of the deciduous forests in New Jersey are in this category.

Deciduous, 10-50% Crown Closure

This category contains deciduous forest stands that have crown closure greater than 10% but less than 50%.

Brush/Shrubland- When the vegetation is less than 20 feet high, the area is categorized as brush/shrubland. The following types have been identified in Washington Township:

Deciduous Brush/Shrubland

This category contains natural forested areas with deciduous species less than 20 feet in height. An area must have greater than 25% brush cover to be placed in this category. This category can also contain inactive agricultural areas that have grown over with brush.

Mixed Deciduous/Coniferous Brush/Shrubland

This category contains natural forested areas less than 20 feet high with a mixture of coniferous and deciduous trees.

Old Field

This category includes open areas that have less than 25% brush cover. The predominant cover types are grasses, herbaceous species, tree seedlings, and/or saplings. Old fields are distinguished from inactive farmland by the amount of brush cover. If a field contains few woody stems (<5%), it should be placed in the inactive farmland category. An area should be placed in the old field category if the amount of brush cover requires extensive brush removal before plowing. In some cases, it may not be established that the previous use was agricultural.

Coniferous- This category includes forested lands that contain coniferous tree species. Coniferous species are those trees commonly known as evergreens. They do not lose their leaves (needles) at the end of the growing season but retain them through the year. Conifers can easily be distinguished from deciduous trees on wintertime color infrared photography because of their high infrared reflectance due to their leaf retention. The stand must be 20 feet high and must be stocked by at least 75% conifers to be labeled as a coniferous stand.

Coniferous, >50% Crown Closure

This category contains coniferous stands with crown closure greater than 50%.

Coniferous, 10-50% Crown Closure

This category contains natural coniferous stands with crown closure >10%, but less than 50%.

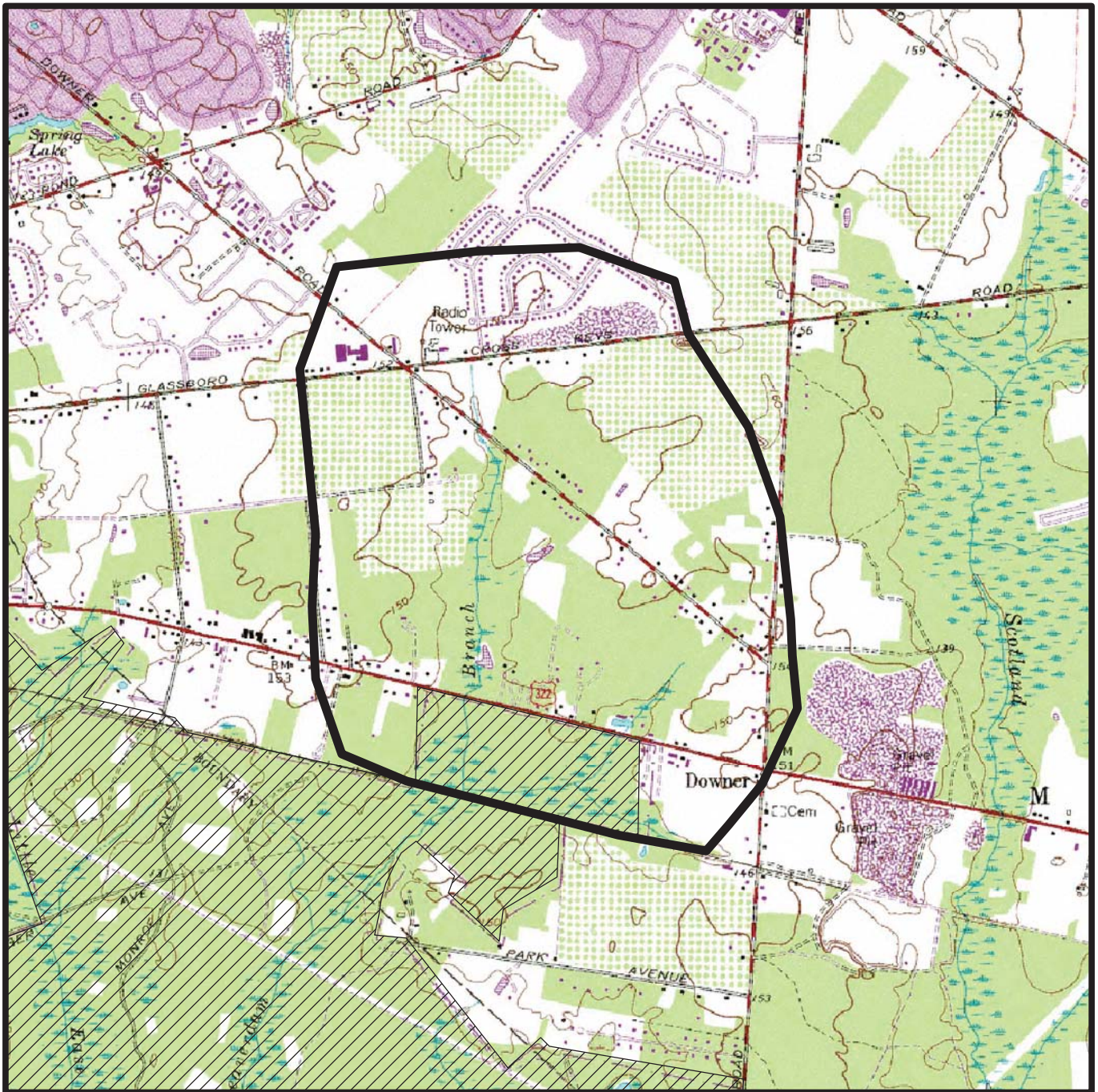
When neither coniferous nor deciduous trees represents 75% or more of the forested area, it is classified as Mixed Forest. This category is further broken down according to which type is 50% or greater in prevalence, conifers or deciduous trees, and the extent of crown closure. Mixed forests of all types represent a low percentage of Washington Township's land area, but one of the higher classifications of forest in the Township.

Vegetation

The State of New Jersey is home to a wide range of different ecosystems, some large and dominating, others less pronounced and more vulnerable to development. The NJDEP identifies and maps areas which are considered unique ecosystems and are known as the Natural Heritage Property sites (NHP). Washington Township has two Natural Heritage Priority sites: Downer and Lake Grenloch, *Figure 4* and *Figure 5* respectively.

The Downer site contains mostly red maple and Atlantic white cedar swamp and provides habitat for several rare State Endangered plant species. The Downer site has a biodiversity rank of B3 indicating that the site "contains a good population of a globally rare State Endangered plant species"³² Lake Grenloch is an artificially made lake within a wooded ravine that provides habitat to plant species of Special Concern. Lake Grenloch has a biodiversity rank of B5 indicating that the site "contains a Plant Species of Special Concern".³³ It is important to note that the Atlantic White Cedar (*Chamaecyparis thyoides*) is found not only at the Downer Natural Heritage Priority Site, but also near Washington Lake within the municipal park (*Figure 6*).

Figure 4. Downer Natural Heritage Priority Site



Natural Heritage Priority Site

Downer

Gloucester County



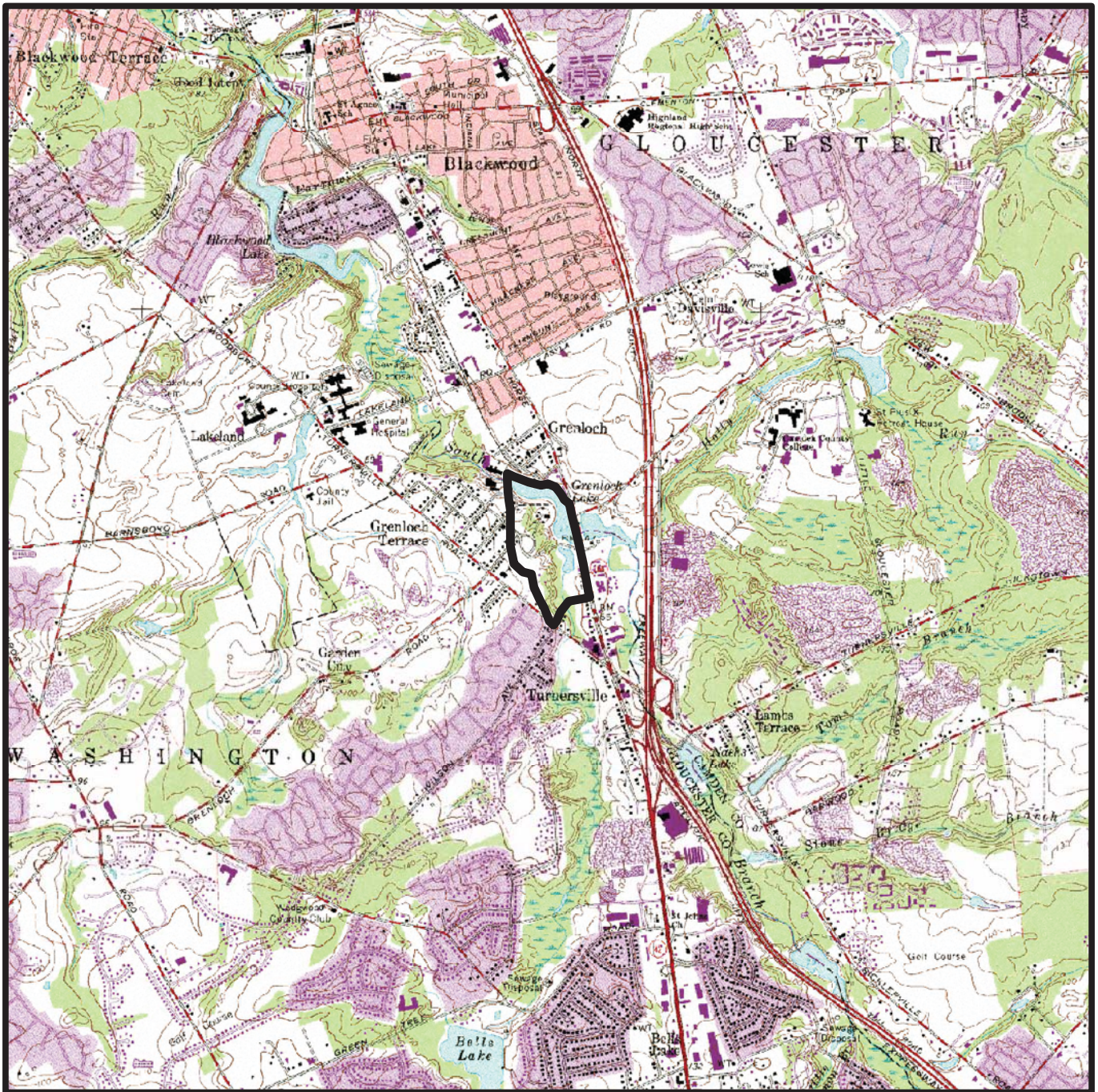
NJ Department of Environmental Protection
Division of Parks and Forestry

Natural Lands Management



 Priority Sites
 Public Land

Figure 5. Lake Grenloch Natural Heritage Priority Site



Natural Heritage Priority Site

Lake Grenloch

Camden and Gloucester Counties



Figure 6. Atlantic White Cedar, Washington Lake Park

Photo credit: Vicky Binetti- Environmental Commission

Rare Plant Species

According to the Natural Heritage Database, Washington Township is home to eight State Endangered vascular plant species and one Federally listed threatened vascular plant species, Swamp pink (*Helonias bullata*). *Table 13. Rare Plant Species* lists all threatened and endangered plant species identified in Washington Township and their rankings. See *Appendix D* for the complete NJDEP Natural Heritage Priority Site list of rare plant and animal species located on or in the immediate vicinity of the Township's two Natural Heritage Priority Sites (Downer and Lake Grenloch)

In New Jersey, species were listed under:

- **State Protection Status:** Notes if a species is listed as State Endangered, with its survival threatened at the state or national level.

Table 13. Rare Plant Species (Including the Immediate Vicinity (1/4 mile))			
Common Name	Scientific Name	Federal Protection Status	State Protection Status
Fly Poison	<i>Amianthium muscitoxicum</i>		
Puttyroot	<i>Aplectrum hyemale</i>		Endangered
White Milkweed	<i>Asclepias variegata</i>		
PawPaw	<i>Asimina triloba</i>		Endangered
Glomerate Sedge	<i>Carex aggregata</i>		
Scarlet Indian-paintbrush	<i>Castilleja coccinea</i>		
Cornel-leaf Aster	<i>Doellingeria infirma</i>		
Downey Willowherb	<i>Epilobium strictum</i>		
Swamp Pink	<i>Helonias bullata</i>	Threatened	Endangered
Hairy Wood-rush	<i>Luzula acuminata</i> var. <i>acuminata</i>		Endangered
Lance-leaf Loosestrife	<i>Lysimachia lanceolata</i>		Endangered
Virginia Bunchflower	<i>Melanthium virginicum</i>		Endangered
Wild Kidney Bean	<i>Phaseolus polystachios</i> var. <i>polystachios</i>		
Spotted Phlox	<i>Phlox maculata</i> var. <i>maculata</i>		
Swamp Oats	<i>Sphenopholis</i>		
Broad-leaf Ironweed	<i>Vernonia glauca</i>		Endangered
Death-camus	<i>Zigadenus leimanthoides</i>		Endangered

Source: NJDEP NHP Report

Swamp Pink (*Helonias bullata*) is listed as a Federally Threatened and State Endangered species. There is an extant population of Swamp Pink on municipal owned land in the southeast section of Washington Township along the Atlantic City Expressway (*Figure 7*).³⁴ Within this area there is an ongoing Swamp Pink protection project.³⁵ In 2013, the Township received grant funding from the United States Fish and Wildlife Service and the New Jersey Department of Environmental Protection to install a fence totaling 2100 linear feet to protect these endangered plants from animal foraging or human damage. The fence was completed in 2014. The South Jersey Land and Water Trust continues monitoring of this site.³⁶



Figure 7. Swamp Pink, Washington Township

Photo credit: hoganphoto.com

Ecological Communities

Washington Township is located in the Outer Coastal Plain Physiographic Province, close to the Inner Coastal Plain and is characterized by relatively flat terrain.³⁷ *Table 14* lists the ecological communities that are found here.

Table 14. Ecological Communities near Washington Township

<i>Outer Coastal Plain Ecological Communities</i>	<i>Inner Coastal Plain Ecological Communities</i>
<ul style="list-style-type: none"> • Southern mixed oak forest • Upland pine forest • Upland oak forest • Pine plains • Red maple-sweet gum forest • Virginia pine successional forest • Coastal white cedar swamp • Pitch pine lowland forest • Hardwood swamp • Pine barrens shrub swamp • Emergent marsh • Freshwater tidal marsh • Pine barrens savannah • Salt marsh • Coastal dune grassland • Coastal dune shrubland • Coastal dune forest • Successional communities 	<ul style="list-style-type: none"> • Southern mixed oak forest • Upland pine forest • Beech-oak forest • Red maple-sweet gum forest • Virginia pine successional forest • Coastal white cedar swamp • Hardwood swamp • Emergent marsh • Freshwater tidal marsh • Successional communities

Local Ordinances

In 2005 Washington Township passed a Tree Preservation and Maintenance Ordinance that establishes “protective regulations that will control the indiscriminate and excessive cutting and destruction of trees within Washington Township, to control problems of flooding, soil erosion, air and noise pollution, to abate the greenhouse effect and adverse atmospheric conditions, and to make Washington Township a healthier and safer place to live”.³⁸

WILDLIFE

Critical Habitat

Washington Township may have areas that are suitable to provide habitat for threatened or endangered species. The Landscape Project (Version 3.3 2017) ranks patches of habitat using a numeric system (0 through 5) for the purpose of identifying habitat which may be suitable for threatened and endangered species. Habitats identified as Ranks 3 through 5 are considered environmentally significant by the NJDEP. The following is a description of each rank:

Rank 5 is assigned to species-specific patches containing one or more occurrences of wildlife listed as endangered or threatened pursuant to the Federal Endangered Species Act of 1973.

Rank 4 is assigned to species-specific patches with one or more occurrences of State endangered species.

Rank 3 is assigned to species-specific patches containing one or more occurrences of State threatened species.

Rank 2 is assigned to species-specific patches containing one or more occurrences of species considered to be species of special concern (this rank represents “rare species” of wildlife as defined in the Highlands Water Protection and Planning Act rules).

Rank 1 is assigned to species-specific 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.

Rank 0 is assigned to species-specific patches that do not contain any species occurrences and do not meet any habitat-specific suitability requirements.

According to the NJDEP Landscape Project, Washington Township contains habitat patches Rank 0 through Rank 4 (State endangered species). The majority of critical species habitat is Rank 1 (14.5%), or patches that meet habitat-specific suitability requirements. Areas containing habitat of Ranks 1, 2, and 3 are dispersed throughout the Township, mostly found along waterways and streams. Together, these areas make up approximately 9% of the Township. About 3% of the Township is listed as rank 4, or patches where a state listed endangered species has been observed. These areas are found around Bells Lake and up through Big Timber Creek, Little Lebanon Branch, South Branch of Big Timber Creek, Mantua Creek and Duffield Run on the western border of the Township. The majority of the Township, covering 77% of the Township’s area, is given a Rank 0, denoting areas containing no species occurrences and not meeting any habitat-specific suitability requirements.

A summary of habitat patches within Washington Township is outlined in *Table 15* and their distribution within the Township is displayed in the *Endangered Species Map (Map 13)*.

Rank	Acres	Percent
0	10,594.66	76.84%
1	2,004.42	14.54%
2	244.88	1.78%
3	519.31	3.77%
4	425.51	3.09%
5	---	---
Total	13,788.78	100%

Source: The Landscape Project (Version 3.3 2017)

Threatened and Endangered Species

Washington Township is home to a wide array of wildlife including some endangered and threatened species listed on the state register. There are two state listed Endangered Species that inhabit Washington Township. In addition, there are three state listed Threatened Species and three state listed Species of Special Concern located in Washington Township. A full list of these species can be found in *Table 16*.

<i>Common Name</i>	<i>Scientific Name</i>	<i>Class</i>	<i>Landscape Project Rank</i>	<i>Federal Status</i>	<i>New Jersey Status</i>
Bald Eagle	<i>Haliaeetus leucocephalus</i>	<i>Aves</i>	4	NA	State Endangered
Cooper's Hawk	<i>Accipiter cooperii</i>	<i>Aves</i>	2	NA	Special Concern
Great Blue Heron	<i>Ardea Herodias</i>	<i>Aves</i>	2	NA	Special Concern
Red-headed Woodpecker	<i>Melanerpes erythrocephalus</i>	<i>Aves</i>	3	NA	State Threatened
Red-shouldered Hawk	<i>Buteo lineatus</i>	<i>Aves</i>	4	NA	State Endangered
Bobolink*	<i>Dolichonyx oryzivorus</i>	<i>Aves</i>	3	NA	State Threatened
Creeper	<i>Strophitus undulates</i>	<i>Bivalvia</i>	2	NA	Special Concern
Triangle Floater	<i>Alasmidonta undulata</i>	<i>Bivalvia</i>	3	NA	State Threatened

*within ¼ mile vicinity of project sites
Source: NJDEP NHP Report

Potential Vernal Habitat

Washington Township is home to many potential vernal habitats, also referred to as vernal pools. These natural wetland depressions fill with water during the rainy season in fall and remain ponded until the dry weather in early summer causes them to dry out. The vernal pools provide habitat for a wide array of amphibians, reptiles, invertebrates, and many species of wetland vegetation, but cannot support fish populations because of the pools' brief dry period. Certain wildlife species, referred to as "obligate" vernal pool breeders, have evolved with a reliance upon these fish-free breeding sites and cannot successfully reproduce elsewhere. Other wildlife species, referred to as "facultative" vernal pool species, also take advantage of vernal habitats for breeding and/or feeding purposes, but are not limited to performing these functions solely in vernal pools.

The New Jersey Departments of Environmental Protection defines a vernal habitat in the Freshwater Wetlands Protection Act Rules (see *N.J.A.C. 7:7A-1.4*) as a wetland that meets the following criteria:

1. The wetland must consist of or contain a confined basin or depression without a permanently flowing outlet;
2. The pool must feature evidence of breeding by at least one obligate or two facultative vernal habitat species (these species are identified in *N.J.A.C. 7:7A, Appendix 1*);
3. The area must maintain ponded water for at least two continuous months between March and September of a normal rainfall year, and;
4. The area must remain free of fish populations throughout the year, or it must dry up at some time during a normal rainfall year.

Wetland areas featuring a confined basin depression exhibiting the hydrologic and biological criteria established above are said to meet "certification" requirements, and may be referred to as "certified vernal habitats," or simply "vernal habitat areas." The NJDEP maps both certified "vernal habitat areas" and "potential vernal habitat areas" using New Jersey's Landscape Project, which is available online on NJ GeoWeb at <http://www.nj.gov/dep/gis/geoweb splash.htm>. The mapping depicts a 300 meter radii circle over the estimated center of both "certified" and "potential" vernal habitats. The 300 meter buffer is intended to account for the varying sizes of individual pools, the likely presence of adjacent wetland areas and –significantly– the adjacent dispersal habitats typically utilized by many resident amphibian species. The Landscape Project defines its mapping of vernal habitats as follows:

Potential vernal habitat area – These are areas identified as possibly containing a vernal pool that meets the criteria of a "vernal habitat" pursuant to N.J.A.C. 7:7A-1.4. These sites include sites that have been field inspected and have been found to meet the physical characteristics of a vernal habitat, but for which biological criteria have not yet been measured, as well as sites that have not been checked by NJDEP staff.

Vernal habitat areas – These are areas that contain pools that have been field-verified by the NJDEP and have been determined to meet both the physical and biological characteristics of a vernal habitat in accordance with N.J.A.C. 7:7A-1.4. The Freshwater Wetlands Protection Act

Rules (N.J.A.C. 7:7A) protects vernal habitats as wetland areas requiring a 50 foot buffer, or a 150 foot buffer if the pool supports a State threatened or endangered species.

In Washington Township the Landscape Project mapping identified seven separate potential vernal habitat polygons. This equates to approximately 536.57 acres of potential vernal habitat. All potential vernal habitat areas in Washington Township are shown on the *Potential Vernal Habitat Map* (Map 14).

Table 17 lists obligate and facultative fauna species found in vernal habitats. Some of these species *may be* present, but none are *confirmed* to be present within Washington Township’s potential vernal habitat areas.

Table 17. Obligate and Facultative Fauna Species Found in Vernal Habitats in New Jersey		
<i>Obligate Species</i>	<i>Facultative Species</i>	
Marbled Salamander***	Snapping Turtle	Upland Chorus Frog
Blue-spotted Salamander*	Eastern Mud Turtle	Northern Cricket Frog
Jefferson Salamander***	Spotted Turtle***	New Jersey Chorus Frog
Eastern Tiger Salamander*	Eastern Painted Turtle	Bull Frog
Wood Frog	Red-spotted Newt	Green Frog
Eastern Spadefoot Toad	American Toad	Southern Leopard Frog
Fairy shrimp (order <i>Arnostraca</i>)	Fowler’s Toad***	Four-toed Salamander
	Pine Barrens	Northern Spring Peeper
	Treefrog**	Long-tailed Salamander**
	Northern Gray	Wood Turtle**
	Treefrog	
	Southern Gray	
	Treefrog*	
* <i>State Endangered</i> ; ** <i>State threatened</i> ; *** <i>Special concern</i>		
Source: NJDEP		

Descriptions of the 71 species of reptiles and amphibians found in New Jersey, including the obligate and facultative vernal pool species, can be found on the NJDEP Division of Fish and Wildlife website at: http://www.nj.gov/dep/fgw/ensp/fieldguide_herps.htm.

LAND USE

Washington Township is a 13,789 acres with 68.85% of its total land categorized as urban land (NJDEP Land Use/Land Cover mapping, 2012). Urban land is defined by the NJDEP as single-unit residential properties, commercial services, and recreational land. Another 14.51% of Washington Township’s land cover is forest comprised of deciduous, coniferous, and mixed forests. Table 18 presents a breakdown of the six different land use types found within Washington Township, and includes a comparison of the land use/land cover in 1986 and what is found in 2012. Agricultural land has dropped by 2,555 acres and forest has decreased by 538 acres. Urban land has correspondingly increased by 3,371 acres since 1986.

Type	1986		2012	
	Acres	Percent	Acres	Percent
Agriculture	3,423.36	24.90%	868.52	6.29%
Barren Land	371.68	2.70%	130.22	0.94%
Forest	2,538.05	18.46%	2,000.29	14.51%
Urban	6,122.94	44.53%	9,493.53	68.85%
Water	136.11	0.99%	172.79	1.25%
Wetlands	1,158.77	8.43%	1,123.42	8.15%
Total:	13,750.92	100%	13,788.77	100%

Source: NJDEP

Agriculture – includes all lands used primarily for the production of food and fiber and some of the structures associated with this production. About 6.29% of the land cover in Washington Township is agricultural. Nearly 79.42% of this is used for cropland and pastureland, while 9.14% is utilized for orchards, nurseries, and horticultural areas. The remaining 11.44% is utilized for other agricultural purposes. Between 1986 and 2012, agricultural lands within the Township has decreased by 19% (or 2,555 acres). Table 19 details a breakdown of the agricultural land classifications in Washington Township.

Classification	Acres	% of Category	% of Washington Township
Cropland and Pastureland	689.80	79.42%	5.00%
Orchards/Nurseries/Horticultural Areas	79.38	9.14%	0.57%
Other Agriculture	99.33	11.44%	0.72%
Total	868.51	100%	6.29%

Source: NJDEP

Barren Land – the sub categories of barren land identified in Washington Township includes altered lands, beaches, and transitional lands. Included are residential, commercial and industrial areas under construction, areas under construction for unknown use, and abandoned structures. Barren land represents 0.94% of the Township’s total area. Barren land has seen a 2% decrease since 1986. Table 20 details the classifications of barren land in Washington Township.

Classification	Acres	% of Category	% of Washington Township
Altered Lands	95.03	72.97%	0.69%
Beaches	1.13	0.86%	<0.01%
Transitional Areas	34.06	26.15%	0.25%
Total	130.22	100%	0.94%

Source: NJDEP

Forest – Forestland includes any lands covered by woody vegetation other than wetlands. These areas are capable of producing timber and other wood products, and of supporting many kinds of outdoor recreation. Forestland is an important category environmentally because it affects air quality, water quality, wildlife habitat, climate, and many other aspects of the ecology of the area. Approximately 14.5% of Washington Township is classified as forested, with 48% of the forest classified as Deciduous Forest with >50% Crown Closure. The second most prevalent category is Mixed Forest containing >50% Deciduous with a >50% Crown Closure at 15.07%, followed by Mixed Deciduous/Coniferous Brush/Shrubland at 9.73%. (see the Vegetation Section of this report). Overall, forested lands within the Township have seen a 4% reduction since 1986, however, from 2007 to 2012 forested lands have increased by 71 acres.

Urban – Urban land is categorized by landscape influenced by human activity. This category includes Residential, Commercial and Services, Transportation, Industrial complexes, and recreational. Urban land use is the most abundant land in Washington Township. It consists mainly of residential, multiple dwelling, single unit, low, medium, and high density subcategories making up for 68.75% of total urban land use. Commercial and industrial services also provide 13.81% of urban land use. Residential, single and multiple unit, areas encompass 47.33% of the total area in Washington Township. Urban land impacts the amount of impervious cover within the Township. In 1986, urban land (impervious surfaces) made up 45% of the Township’s total area. In 2012, urban land consisted of 69% of the total Township, a 24% increase. *Table 21* presents a breakdown of the urban classifications in Washington Township.

Classification	Acres	% of Category	% of Washington Township
Athletic Fields (Schools)	112.31	1.18%	0.81%
Cemetery	42.65	0.45%	0.31%
Commercial/Services	1170.73	12.34%	8.50%
Industrial	141.04	1.49%	1.02%
Major Roadway	68.38	0.72%	0.60%
Mixed Urban	1.39	0.01%	0.01%
Other Urban or Built-Up Land	585.86	6.18%	4.24%
Recreational Land	434.56	4.58%	3.15%
Residential, High Density or Multiple Dwelling	419.69	4.43%	3.04%

Classification	Acres	% of Category	% of Washington Township
Residential, Rural, Single Unit	800.50	8.44%	5.81%
Residential, Single Unit, Low Density	1437.75	15.16%	10.42%
Residential, Single Unit, Medium Density	3869.58	40.8%	28.06%
Stormwater Basin	265.16	2.80%	1.92%
Transportation/Communication/Utilities	114.64	1.21%	0.83%
Upland Rights-of-Way Developed	7.67	0.08%	0.06%
Upland Rights-of-Way Undeveloped	11.62	0.12%	0.12%
Total	9,483.53	100%	68.9%

Source: NJDEP

Water – All areas within the landmass of New Jersey that are periodically water covered are included in this category. All water bodies should be delineated as they exist at the time of data acquisition, except areas in an obvious state of flood. Water represents 1.25% of Washington Township’s total land area, with 1.23% identified as artificial lakes, as seen in *Table 22*. Water within the Township has seen an increase of 37 acres from 1986 to 2012.

Classification	Acres	% of Category	% of Washington Township
Artificial Lakes	169.89	98.32%	1.23%
Bridge Over Water	0.096	0.05%	<0.01%
Natural Lakes	1.33	0.77%	<0.01%
Streams and Canals	1.48	0.85%	<0.01%
Total	172.79	100%	1.25%

Source: NJDEP

Wetlands – Wetlands are defined as areas saturated by ground and surface waters at a frequency and duration sufficient to support vegetation adapted for life in saturated soil conditions. The wetlands of New Jersey are located around the numerous interior stream systems, and along coastal rivers and bays. New Jersey supports diverse wetlands habitats dependent upon physiographic and geological variables. According to the 2012 land use cover data, wetlands in Washington Township occupy 1123.42 acres, or 8.15% of the total area. The sub-classification of deciduous wooded wetlands amounts to 81.9% of the wetlands land use and 6.67% of the total land use in Washington Township. This sub-classification covers 920.07 acres of the total 13788.768 acres in Washington Township (see *Table 23*). Deciduous wooded wetlands are defined as “closed canopy swamps dominated by deciduous trees normally associated with watercourses, edges of marshes, and isolated wetlands.”³⁹ Wetlands within the Township have decreased 35 acres since 1986.

Table 23. Wetlands Classifications			
Classification	Acres	% of Category	% of Washington Township
Agricultural Wetlands (Modified)	11.26	1.00%	0.08%
Atlantic White Cedar Wetlands	6.27	0.56%	0.05%
Coniferous Scrub/Shrub Wetlands	2.93	0.26%	0.02%
Deciduous Scrub/Shrub Wetlands	34.60	3.08%	0.25%
Deciduous Wooded Wetlands	920.07	81.90%	6.67%
Disturbed Wetlands (Modified)	6.50	0.58%	0.05%
Former Agricultural Wetland (Becoming Shrubby, Not Built-Up)	4.12	0.37%	0.03%
Herbaceous Wetlands	9.32	0.83%	0.07%
Managed Wetland In Built-Up Maintained Rec Area	13.04	1.16%	0.09%
Managed Wetland in Maintained Lawn Greenspace	10.41	0.93%	0.08%
Mixed Scrub/Shrub Wetlands (Deciduous Dom.)	12.59	1.12%	0.09%
Mixed Wooded Wetlands (Coniferous Dom.)	18.91	1.68%	0.14%
Mixed Wooded Wetlands (Deciduous Dom.)	65.96	5.87%	0.48%
Phragmites Dominate Interior Wetlands	1.40	0.12%	0.01%
Phragmites Dominate Urban Area	1.96	0.17%	0.01%
Wetland Rights-Of-Way	4.07	0.36%	0.03%
Total	1123.42	100%	8.15%
<i>Source: NJDEP</i>			

Preserved Open Space- Preserved open space represents approximately 12% of the Township’s land area with 9% permanently preserved on the Township’s Recreation and Open Space Inventory (ROSI) through the NJDEP Green Acres Program (see *Table 24*). *Map 12* illustrates these preserved open space parcels.

Table 24. Preserved Open Space			
Classification	Acres	% of Category	% of Washington Township
County Open Space	89	4.08%	0.65%
Municipal parkland (ROSI)	1,273	58.33%	9.23%
Preserved Farmland	302	13.83%	2.19%
Total	2,182	100%	12.07%
<i>Source: NJDEP</i>			

AIR

Air Quality

Air quality in the Township of Washington and New Jersey is carefully monitored by the New Jersey Department of Environmental Protection through various regional collection stations that ensure air quality standards are meeting the national standards set by the Clean Air Act. The pollutants measured in the air can vary greatly over the course of a year and even from day to day depending on weather conditions and traffic patterns. The local air testing stations in New Jersey measure maximum pollutant concentration, assess population exposure, determine the impact of major pollution sources, measure background levels, determine the extent of regional pollutant transport, or measure secondary impacts in rural areas. The information gathered is transmitted in real time and consolidated in yearly reports to ensure that both State and National Clean Air Standards are met.

National Clean Air Standards

In 1970, the federal government passed the Clean Air Act, setting standards to be met throughout the country. The Act was amended in 1990, with focus on four areas of pollution: acid rain, urban air pollution, toxic air emissions, and stratospheric ozone depletion. The amendment also introduced a permits program and strengthened enforcement.⁴⁰

Under the Act, it is the responsibility of the US Environmental Protection Agency (EPA) to set National Ambient Air Quality Standards (NAAQS) for six common pollutants (ozone, carbon monoxide, sulfur dioxide, nitrogen dioxide, fine particulates, and lead) and the responsibility of each state to develop State Implementation Plans (SIPs) to attain and maintain these standards. In New Jersey, that role is assigned to the New Jersey Department of Environmental Protection (NJDEP) Division of Air Quality (DAQ) and its Bureau of Air Monitoring (BAM), which monitors the State's ambient air monitoring network.

Regional/ Local Statistics

The State uses the air quality data from its air monitoring network to determine which areas are in compliance with NAAQS as well as overall trends in air pollution levels. The NJDEP produces yearly reports but also provides real-time reporting through its Air Quality Index website.⁴¹ Although there are monitoring sites throughout the state, each site measures a limited set of pollutants; no one site tracks them all.

The six pollutants for which standards have been set by the EPA - ozone, sulfur dioxide, carbon monoxide, nitrogen dioxide, particulate matter, and lead, are known as *criteria pollutants*. Over the period of 1990-2010, total emissions of these air pollutants have decreased by more than 41% nationally.⁴²

In New Jersey, according to the NJDEP DAQ website⁴³, air quality has improved significantly over the last 40+ years since the first Earth Day, in 1970, but exceeds the current NAAQS standards for ozone throughout the state and for fine particulates in urban areas (13 counties). New Jersey has attained sulfur dioxide (with the exception of a portion of Warren County), lead, carbon

monoxide, and nitrogen dioxide standards. Additional air pollutants that may cause adverse health effects but are not criteria pollutants are referred to as Hazardous Air Pollutants (HAPs) or air toxics. The NJDEP DAQ also regulates emissions of these HAPs. For many toxins the State has set its own standards, with stricter requirements than the EPA.

Ozone

Ozone (O₃) is defined by the NJDEP *2015 Ozone Summary*⁴⁴ as a gas that consists of three oxygen atoms. Ozone occurs naturally in the upper atmosphere where it offers protection from harmful ultraviolet rays. However, when found at ground level, ozone can have serious adverse health effects. Ground-level ozone is formed through a chemical reaction that requires nitrous oxides (NO_x), volatile organic compounds (VOCs), and the presence of heat and sunlight. Therefore, as a result of the sunlight and heat necessary for ground-level ozone production, measurements are taken between April 1 and October 31.

The EPA revised National Ambient Air Quality Standards (NAAQS) for ozone in 2008, having determined that the previous standard of 0.08 parts per million (ppm) maximum daily 8-hour averages did not sufficiently protect public health and was lowered to 0.075 ppm. In October 2015, the 8-hour standard was lowered further to 0.070 ppm and went into effect in 2016. Attainment of the NAAQS is determined by taking the average of the fourth highest daily maximum 8-hour average concentrations that are recorded each year for three years.

New Jersey standards are based on 1-hour averaging, with primary standards set at 0.12 ppm and secondary standards set at 0.075 ppm^c. They are not as stringent as the revised NAAQS. To date, the effort to lower ozone concentrations has focused on reducing emissions of VOCs. However, improvements have leveled off in recent years, especially with respect to maximum 8-hour average concentrations. According to the NJDEP report, significant further improvements will require reductions in both VOCs and NO_x. Levels of NO_x in New Jersey are largely affected by emissions from regional upwind sources outside of New Jersey.

Statewide, New Jersey is classified as a “marginal” ozone non-attainment area for NAAQS, with an overall score between 0.062 and 0.073 ppm for the three year average. The highest 8-hour daily maximum reached 0.092 at the Bayonne Monitoring Station (approximately 80 miles from Washington Township). The ozone monitoring stations closest to Washington Township reported levels close to NAAQS for the period 2013-2015. Millville was the only station that met NAAQ standard of 0.075 for the highest daily maximum in 2015. However, all stations met the standards for the three year average (2013-2015). (See *Table 25*). The highest daily maximum in 2015 in the state was at Bayonne at 0.092.

^c Although the standards have reduced to 0.070 in 2016, the data collected is from 2015 and is based off the 2015 standard

Monitoring Site	1-Hour Average Concentration New Jersey Standards: Primary: 0.12ppm; Secondary: 0.08	8- hour Average Concentrations NAAQS Standard: 0.075 ppm		
	Maximum	Highest Daily Maximum (2015)	4 th – Highest Daily Maximum (2015)	2013-2015 Average of 4 th –Highest Daily Max.
Camden Spruce Street (c. 12.75 mi)	0.103	0.090	0.079	0.070
Millville (c. 24 mi)	0.078	0.073	0.068	0.065
Brigantine (c. 44 mi)	0.086	0.077	0.064	0.065

Source: NJDEP 2015 Ozone Summary <http://www.njaginow.net/>

Sulfur Dioxide

NJDEP’s *2015 Sulfur Dioxide Summary*⁴⁵ defines sulfur dioxide (SO₂) as “a heavy, colorless gas with a suffocating odor that easily dissolves in water to form sulfuric acid. SO₂ gases can be formed when fuels containing sulfur are burned, or when gasoline is extracted from oil.” Most of the sulfur dioxide released into the air comes from electric utilities, followed by fossil fuel combustion, industrial processes, non-road equipment, and on-road vehicles. Sulfur dioxide can be harmful to people (primarily children, the elderly and asthmatics) and the environment when it reacts with other gases and particulates in the air to form sulfates. These sulfates are a primary cause of reduced visibility in the eastern United States. Sulfur dioxide can also combine with other substances in the atmosphere to form acid rain, which damages forests, crops, aquatic environments, and decays building materials. There are several standards for monitoring SO₂, ranging from 1-hour to annual averaging. The State has both primary and secondary standards. The primary standard is a 12-month standard based on any twelve-month average recorded during consecutive years. The state’s secondary standards are 12-month, 24-hour, and 3-hour averages. New Jersey’s standards differ slightly from national standards, as shown in *Table 26*.

Averaging Period	Standard Type	New Jersey	National ^a
12-month average	Primary	80 µg/m ³ (0.03 ppm)	---
12-month average	Secondary	60 µg/m ³ (0.02 ppm)	---
24-hour average	Primary	365 µg/m ³ (0.14 ppm)	---
24-hour average	Secondary	260 µg/m ³ (0.10 ppm)	---
3-hour average	Secondary	1300 µg/m ³ (0.5 ppm)	0.5 ppm
1-hour average ^b	Primary	---	75 ppb

a-National standards are block averages rather than moving averages
b-To attain this standard, the 3-year average of the 99th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 75 ppm

Source: NJDEP 2015 Sulfur Dioxide Summary

Regulations requiring the use of low sulfur fuels in New Jersey have been effective in lowering SO₂ concentrations. No monitoring sites in New Jersey exceeded primary or secondary SO₂ standards in 2015. The last year an exceedance of the national 3-hour, 24-hour, or 12-month SO₂ standards was recorded in the state was 1980. *Table 27. Sulfur Dioxide 2015* shows data for the SO₂ monitoring sites closest to Washington Township.

Table 27. Sulfur Dioxide 2015 <i>parts per billion (ppb); parts per million(ppm)</i>				
Monitoring Site	3-year Avg. 99 th %-ile of Daily Max 1-Hour Avg (ppb)	3-hour Avg Max (ppm)	24-hour Avg Max (ppm)	12-Month Avg Max (ppm)
Camden Spruce Street (c. 12.75mi)	*	0.012	0.003	0.000
Brigantine (c. 44 mi)	6.2	0.0060	0.0032	0.0004
<i>Source: NJDEP 2015 Sulfur Dioxide Summary</i>				
*no data available				

Carbon Monoxide

According to the NJDEP *2015 Carbon Monoxide Summary*⁴⁶, carbon monoxide (CO) is a colorless, odorless, poisonous gas formed when carbon in fuels are not entirely burned. The primary creators of carbon monoxide emissions are on-road and off-road vehicles, with boilers, incinerators, and forest fires also contributing. The symptoms of exposure are headaches and nausea, with those who have cardiovascular disease being the most affected.

Although there are no national secondary standards, New Jersey has set its secondary standards at the same level as its primary standards and uses a different measuring metric than national standards (see *Table 28*). In addition, New Jersey standards are not to be exceeded more than once in any 12-month period.

Table 28. National and New Jersey Ambient Air Quality Standards of Carbon Monoxide <i>milligrams per cubic meter (mg/m³); parts per million(ppm)</i>			
Averaging Period	Type	New Jersey	National
1-Hour	Primary	40 mg/m ³ (35 ppm)	35 ppm
1-Hour	Secondary	40 mg/m ³ (35 ppm)	----
8-Hour	Primary	10 mg/m ³ (9 ppm)	9 ppm
8-Hour	Secondary	10 mg/m ³ (9 ppm)	----
<i>Source: NJDEP 2015 Carbon Monoxide Summary</i>			

According to the 2015 NJDEP report,

“carbon monoxide levels have improved dramatically over the past 39 years. The last time the CO standard was exceeded in New Jersey was in January of 1995. The entire state was

officially declared as having attained the CO standard on August 23, 2002.” (NJDEP 2015 CO report)

Because on-road vehicle emissions are a major contributor of CO levels, there is a variation throughout the day, with the highest peaks around 7 to 8 am, and another, lower but more extended rise between 4 and 8 pm.

In 2015, of the CO monitoring stations in New Jersey, the Camden Spruce Street station is the only one within close proximity to Washington Township (12.75 miles). All concentrations were well below the national and state standards (See *Table 29. Carbon Monoxide 2015*).

Table 29. Carbon Monoxide 2015				
1-Hour and 8-Hour Averages in Parts per million (ppm) 1-hour standard (35 ppm); 8 hour standard (9 ppm)				
Monitoring Site	Maximum 1-hr Avg.	2 nd Highest 1-hr Avg.	Maximum 8-hr Avg.	2 nd Highest 8-hr Avg.
Camden Spruce Street (c. 12.75 mi)	2	1.9	1.7	1.5
<i>Source: NJDEP 2015 Carbon Monoxide Summary</i>				

Nitrogen Dioxide

According to the NJDEP *2015 Nitrogen Dioxide Summary*⁴⁷, nitrogen dioxide (NO₂) is a reddish-brown, highly reactive gas that is formed in the air through the oxidation of nitric oxide (NO). When it reacts with other chemicals, it can form ozone, particulate matter and other contributors to acid rain and haze. Oxides of nitrogen (NO_x) are combinations of gases comprising mostly of NO₂ and NO. They are emitted from fuel-related sources, which include vehicle exhaust, the burning of coal, natural gas and oil, industrial processes such as welding, and household gas stoves and heaters. NO is released into the atmosphere as NO_x but easily converts to NO₂.

NO₂ can aggravate or cause respiratory illness and prolonged exposure can permanently damage the lungs. Along with NO, NO₂ can irritate the eyes, nose, throat and lungs and cause nausea and tiredness. The environmental effects of nitrogen oxides can include changes in the composition of the flora in wetland and terrestrial ecosystems, acidification of freshwater bodies, eutrophication of estuarine and coastal waters, increases in levels of toxins harmful to fish and other aquatic life, and decreased visibility.

The levels for the national and state standards are the same; however, national standards are based on calendar year averages, while state standards apply to any 12-month period (See *Table 30. National and New Jersey Ambient Air Quality Standards for Nitrogen Dioxide (NO₂)*). The majority of NO₂ emissions come from vehicle exhaust, therefore, the highest levels occur during the morning and afternoon rush hours. Levels are also higher in winter than in summer.

Averaging Period	Type	New Jersey	National
12-month average	Primary	100 µg/m ³ (0.053 ppm)	
Annual average	Primary		0.053 ppm (100 µg/m ³)
12-month average	Secondary	100 µg/m ³ (0.053 ppm)	
Annual average	Secondary		0.053 ppm (100 µg/m ³)
1-hour average	Primary		0.100 ppm (190 µg/m ³)

Source: NJDEP 2015 Nitrogen Dioxide Summary

NO₂ concentrations in New Jersey have fallen steadily since 1975 when the average concentration was 0.040 ppm. Neither the statewide nor the individual station averages have exceeded the health standard of 0.053 ppm, although the highest reporting stations in 1975 came close. The Fort Lee Near Road, Elizabeth Lab, and Bayonne stations all have exceeded the State or National Standards for 1-hour concentrations, however they do not violate the NAAQS which is based off of the 98th percentile. Of the ten reporting stations in 2015, Camden Spruce Street and Millville are the closest to Washington Township. Millville reported the lowest levels of NO₂ for these two stations (*Table 31. Nitrogen Dioxide (NO₂) 2015*). Although NO₂ concentrations score well within the NAAQS, oxides of nitrogen continue to be of concern because of their role in the formation of other pollutants, particularly ozone and fine particles.

Monitoring Station	1-Hour Average (ppm)		12-Month Average (ppm)	
	2015 98 th %-ile	2013-2015 98 th %-ile 3-year Avg	Maximum (Running 12 Month)	Calendar Year
Camden Spruce Street (12.75 mi)	0.051	0.049	0.013	0.013
Millville (c. 24 mi)	0.033	--- ^a	0.007	0.006

^a Millville temporarily shut down for site renovations December 2012 to March 2013
Source: NJDEP 2015 Nitrogen Dioxide Summary

Particulate Matter

Particulate matter⁴⁸ can be any manmade or natural particles found in the air, such as dust, dirt, smoke, sea salt, and liquid droplets. At any size, these particles can affect the environment. The total of all particles, of whatever size, is referred to as “Total Suspended Particulates” (TSPs). Particles less than 10 micrometers in diameter (PM₁₀) are called “Inhalable Particulates” because they can be inhaled into and accumulate in the respiratory system. Particles less than 2.5 micrometers (PM_{2.5}), called “Fine Particulates,” are believed to pose the greatest health risk. NAAQs for both Inhalable Particulates (PM₁₀) and Fine Particulates (PM_{2.5}) are set at the same level for both primary (health) and secondary (environmental welfare) standards. At greatest risk are children, the elderly, and individuals with heart and lung diseases, such as asthma.

The EPA abandoned standards for TSPs in favor of the smaller PM₁₀ and PM_{2.5} particulates, however New Jersey still maintains TSP standards, as shown in (Table 32). For PM_{2.5} standards, an annual concentration for a given site is calculated by averaging the annual mean concentrations for the three most recent consecutive calendar years, in this case 2013-2015. Similarly, the 24-hour concentration for a given site is calculated by averaging the 98th percentile 24-hour concentrations for each year for the same 3-year period. For PM₁₀, standards, the concentrations are simply calculated as the annual mean and the highest 24-hour average PM₁₀ concentrations. (see Table 32).

Table 32. Particulate Matter – 2015 National and New Jersey NAAQs			
<i>micrograms per cubic meter (µg/m³)</i>			
Pollutant	Averaging Time	Type	Level
Fine Particulate (PM _{2.5})	Annual	Primary	12.0 µg/m ³
	Annual	Secondary	15.0 µg/m ³
	24-Hour Average	Primary & Secondary	35 µg/m ³
Inhalable Particulate (PM ₁₀)	24-Hour Average	Primary & Secondary	150 µg/m ³

Source: NJDEP 2015 Particulate Summary

In 2015, three New Jersey air monitoring stations measured PM₁₀, twenty-three measured PM_{2.5}, and one monitored what is known as smoke shade or the coefficient of haze (COH), for which no standard is set. Several stations use the EPA sanctioned Federal Reference Method (FRM) sampling, based on a 24-hour period, but New Jersey also has additional monitors that continuously measure particulate concentrations (TEOMs), providing the real-time data that the FRM cannot. TEOM data are made available to the public via the Air Quality Index.

In 2015, all areas of the State were in attainment for Inhalable Particulates, PM₁₀. The closer of the two PM₁₀ monitoring stations to Washington Township is the Camden RRF, where the highest daily concentration was 114µg/m³, versus the national standard of 150µg/m³.

All sites met the annual and 24-hour standard for Fine Particulates, PM_{2.5}. The sites closest to Washington Township include Camden Spruce Street and Gibbstown which had a 10.2 µg/m³ and 8.6 µg/m³ annual mean concentration respectively, both falling below the National Standard of 15.0 µg/m³.

Further breaking down the fine particulate contribution to air pollution, five stations, including Camden Spruce Street, measure 39 components. The five highest contributors are organic carbon, sulfate, nitrate, elemental carbon, and sulfur. The Camden Spruce Street station reported the highest concentration for organic carbon, sulfate, and sulfur. Both organic and elemental carbon is sourced primarily from motor vehicles, and the Camden Spruce Street station is located in a high traffic area.

“Smoke shade” is an indirect measurement of particles in the atmosphere and is used for daily reporting in the Air Quality Index. Smoke shade is measured as a Coefficient of Haze (COH), with a benchmark set at 2.0. Readings above this level are deemed “Unhealthy for Sensitive Groups.” The closest station is Elizabeth Lab and the levels reported were well below the benchmark (Table

33). However, it should be noted that although Elizabeth Lab is the closest station to Washington Township monitoring smoke shade, the station is approximately 79 miles away and may not accurately reflect air quality conditions.

Table 33. Particulate Material 2015						
	PM _{2.5} Data		PM ₁₀ Data		Smoke Shade Coefficient of Haze	
	Measured in micrograms per cubic meter (µg/m ³)				Annual Mean Conc.	Highest 24-hr Average
Station	Annual Mean Conc.	Highest 24-hr Conc.	Annual Mean Conc.	Highest 24-hr Conc.		
Camden RRF (c. 11.5 mi)	---	---	37	114	---	---
Camden Spruce Street (c. 12.75 mi)	10.2	30.2	---	---	---	---
Gibbstown (c. 12.75 mi)	8.6	25.8	---	---	---	---
Elizabeth Lab (c. 79 mi)	10.2	33.4	---	---	0.14	1.03

Source: NJDEP 2015 Particulate Summary

Lead

Lead is a hazard to the health of humans and the environment, whether the source is lead in the air, in paint on walls, in our water, or in our soils. When taken into the body, lead circulates via the blood and accumulates in the bones. It affects the oxygen carrying capacity of the blood and can negatively affect the nervous system, kidneys, immune system, reproductive, developmental and cardiovascular systems. It most commonly causes neurological effects in children and cardiovascular effects in adults. On a secondary level, lead from the air or water bodies may accumulate in soils and sediments, adversely affecting biodiversity.

According to the EPA, taking lead out of on-road motor vehicle gasoline has been the primary reason for a decline in lead in the air. Between 1980 and 2010 the EPA reported an 89% decrease in national average. Contributors to lead in the air today include ore and metals processing and leaded aviation fuel. In 2008 the NAAQS level was set at 0.15µg/m³ for a rolling 3 month average. As of 2013, in accordance with the new 2008 standard there are 21 areas nationwide that are in non-attainment with the closest locations being in central Pennsylvania.⁴⁹

The NJDEP has data for New Jersey stations monitoring lead in the air from 1990 to 1995-1996. Although some stations exceeded NAAQS levels in the early 1990's, all were below the standards by 1996.

Air Toxics

Almost 200 air toxics have been identified on the list of Hazardous Air Pollutants (HAPs) maintained by the EPA. The EPA issues a National-Scale Air Toxics Assessment (NATA), which the NJDEP adapts to evaluate the types and amounts of air toxics people are exposed to in New

Jersey. NJDEP compares the estimated NATA air concentrations to their chemical-specific health benchmarks and divides the modeled air concentration by the health benchmark to get a risk ratio. If the risk ratio for a specific chemical is greater than one, it may be of concern, increasing the risk for cancer or other negative health effects. In general, higher population densities result in greater emissions of, and exposure to, air toxics.⁵⁰

In 2015, 10 air toxics measured in Camden exceeded the health benchmarks set by the EPA. These results can be seen in *Table 34*. Although the Camden station is the closest monitoring station, it is not reflective of conditions in Washington Township.

Pollutant	Annual Mean ($\mu\text{g}/\text{m}^3$)	Health Benchmark ($\mu\text{g}/\text{m}^3$)	Annual Mean Risk Ratio
Acetaldehyde	1.880	0.45	4
Acrolein ^a	0.924	0.02	---
Benzene	0.857	0.13	7
1,3-Butadiene	0.089	0.033	3
Carbon Tetrachloride	0.623	0.17	4
Chloroform	0.148	0.043	3
Chloromethane	1.253	0.56	2.2
1,2-Dibromoethane	0.005	0.0017	3
Ethylbenzene	0.422	0.4	1.1
Formaldehyde	2.667	0.077	35
Styrene	3.078	1.8	1.7

^aAcrolein concentrations are highly uncertain because of problems with collection and analysis methods
Source: NJDEP 2015 Air Toxics Summary

The three chemicals with the highest risk ratios reported at the Camden site are Formaldehyde (35), Benzene (7), and Carbon Tetrachloride (4).

Formaldehyde. Formaldehyde is used mainly to produce resins used in particleboard products and as an intermediate in the synthesis of other chemicals. The major sources of emissions to the air are forest and wildfires, stationary internal combustion engines and turbines, pulp and paper plants, petroleum refineries, power plants, manufacturing facilities, incinerators, and automobile exhaust emissions.

Benzene. Benzene is a natural part of gasoline, crude oil, and cigarette smoke and is formed both through natural processes and human activities⁵¹.

Carbon Tetrachloride. Carbon Tetrachloride was widely used as a household cleaner, propellant, degreaser, refrigerant, and fumigant. Because of its toxicity and ability to deplete stratospheric ozone it has been phased out of production and use. Despite this, approximately 100 tons are annually emitted by industry in the United States. There have been no emissions reported in New Jersey, however because it degrades slowly in the environment, air levels remain fixed.

Sources

The source of air toxics varies for each pollutant. On-road mobile sources of air toxics emissions are vehicles; non-road mobile sources include aircraft, trains, lawnmowers and leaf blowers, boats, dirt bikes, and construction vehicles. Nonpoint sources of air toxics emissions include heating, fuel and pesticide use, dry cleaners, and consumer products, such as adhesives, sealants, paint, personal care, and other household products. Point sources are identified by the NJDEP as “large facilities that emit a significant amount of air pollution during manufacturing, power generation, heating, incineration, or other such activity” as well as “smaller facilities including those that are required to report their emissions under the federal Toxic Release Inventory program and the state’s Community Right-To-Know program” (see *Contaminated Sites* chapter).

According to a report summarizing 2005 data, Gloucester County’s air toxic emissions came from mostly mobile sources and non-point sources, with a minimal contribution coming from point sources (see *Figure 8*).⁵²

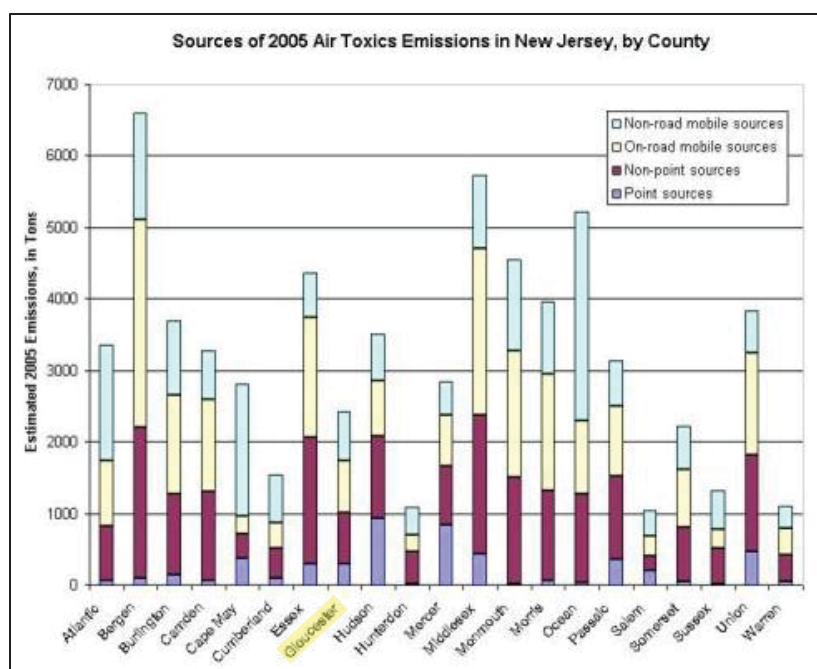


Figure 8. Source of 2005 Air Toxics Emissions in New Jersey, by County

Source: NJDEP

An additional category of contributions to emissions is background and secondary sources. Background concentrations generally cannot be sourced to current, local emissions. Secondary concentrations refer to chemicals that have been transformed in the air from an air pollutant into another chemical, which may have a different level of toxicity.⁵³

Radon

Radon is a naturally occurring radioactive gas. It is a byproduct of the decay of uranium and is found in soil at varying concentrations. Radon is a known health risk, causing lung cancer in smokers and non-smokers alike. Because it can accumulate in closed places such as houses,

homeowners in high risk areas are encouraged to have their properties tested. Radon can also work its way into the water supply. The greatest risk of radon from drinking water is that it may escape into indoor air. Testing of drinking water supplies for uranium has been a recent development. If levels exceed the maximum set by the EPA for extended periods of time, kidney damage can occur.

In New Jersey, there is a particularly uranium-rich geological formation, called the Reading Prong, which stretches from Pennsylvania through northwestern New Jersey into Southern New York State. Testing of homes built along this geologic formation has revealed high indoor levels of radon gas. Further testing in New Jersey, beyond the Reading Prong area, has shown additional areas where homes have elevated radon levels.⁵⁴ These include areas such as Gloucester County, which is considered a high risk county for radon presence. Most of the municipalities in Gloucester County rank as either Tier 1 (high radon potential) or Tier 2 (moderate radon potential). Washington Township is currently ranked Tier 2.⁵⁵ The ranking of municipalities in Gloucester County are listed in *Table 35*. For more information on radon, visit: <http://www.nj.gov/dep/rpp/radon/index.htm>.

Table 35. Tier Ranking of Radon Potential in Gloucester County

Municipality	Sample Size	Number of homes with ≥ 4 picocuries/ liter (pCi/L)	Percent of homes	Tier Assignment
Clayton Borough	262	62	24%	2
Deptford Borough	1225	330	27%	1
East Greenwich Township	790	199	25%	1
Elks Township	113	25	22%	2
Franklin Township	445	99	22%	2
Glassboro Borough	795	89	11%	2
Greenwich Township	217	32	15%	1
Harrison Township	1322	409	31%	1
Logan Township	236	43	18%	2
Mantua Township	2085	414	20%	2
Monroe Township	1001	147	15%	2
National Park Township	98	2	2%	3
Newfield Borough	95	17	18%	2
Paulsboro Borough	140	4	3%	3
Pitman Borough	498	49	10%	2
South Harrison Township	81	23	28%	1
Swedesboro Borough	654	183	28%	1
Washington Township	1411	133	9%	2
Wenonah Borough	472	175	37%	1
West Deptford Township	713	80	11%	2
Westville Borough	222	11	5%	2
Woodbury City	---	---	---	---
Woodbury Heights Borough	718	55	8%	2
Woolwich Township	700	258	37%	1

Source: <http://www.nj.gov/dep/rpp/radon/download/rtar2015.pdf>

Noise and Odors

Noise

The NJDEP, authorized by the Noise Control Act of 1971, N.J.A.C. 7:29, oversees noise control and abatement in New Jersey. The Office of Local Environmental Management (OLEM) works with County Health Departments and municipalities to monitor noise complaints and compliance. The NJDEP does not have a Noise Control Program, but the Noise Information website provides a list of contacts depending on the type of noise: aircraft, highway, commercial or industrial, or residential noise and nuisances. NJDEP has developed a model noise ordinance that can be adopted by local municipalities. The Noise Control Act allows municipalities to adopt noise control ordinances that are more stringent than the State code.⁵⁶ In 1995, the Washington Township Council adopted Ord. No. 26-1995 as their noise control ordinance.⁵⁷ Ordinance No. 2004-24, adopted in 2004, updated Washington Township's noise ordinance.

Odors

According to the NJDEP, "odor is an air contaminant and therefore may be considered air pollution if it is present in a way that unreasonably interferes with the enjoyment of life or property." Guidelines for odor control are set forth in The Air Pollution Control Act: N.J.S.A. 26:2C-1 et seq. and N.J.A.C. 7:27-1.1 et seq. Odor complaints can be reported to the NJDEP 24 hour toll-free environmental hotline at 877-927-6337.⁵⁸ At this time, Washington Township does not have any ordinances regarding odors.

Meteorology and Pollution

Meteorology plays an important role in the distribution of pollution throughout the troposphere, the layer of the atmosphere closest to the earth's surface. Atmospheric processes such as wind speed and wind direction affect the transport and dispersion of air pollution. Other weather phenomena, such as temperature, humidity, and barometric pressure influence chemical reactions and transformations in the atmosphere that affect air pollutants. By studying meteorological and air pollution data together, scientists and mathematicians have developed reasonably accurate models for predicting the fate of pollutants as they go through the stages of transport, dispersion, transformation, and removal. The Camden Spruce Street meteorological station monitors and measures temperature, relative humidity, wind speed and direction, and barometric pressure.⁵⁹

CLIMATE

Prevailing Air Currents in New Jersey

According to the Office of the New Jersey State Climatologist (ONJSC) at Rutgers University, a “broad, undulating flow from west to east” dominates atmospheric circulation in the middle latitudes of North America, including New Jersey. “These ‘prevailing westerlies’ shift north and south and vary in strength during the course of the year, exerting a major influence on the weather throughout the State.”⁶⁰

In general, most areas in New Jersey receive 25 to 30 thunderstorms per year, with fewer storms near the coast than farther inland. About 5 weak tornados occur each year throughout the state.

Climate Zone

New Jersey is divided into five distinct climate regions, or zones. Differences in geology, distance from the Atlantic Ocean, and prevailing atmospheric flow patterns produce distinct variations in the daily weather between each of these regions. According to the ONJSC publication, “The Climate of New Jersey,” Washington Township falls within the Southwest Zone. The Southwest Zone lies between sea level and approximately 100 feet above sea level, and due to the proximity to the Delaware Bay, a maritime influence on the climate is added to this region. This area has the highest average daily temperatures in the state, and tends to have higher nighttime minimum temperatures than the neighboring Pine Barrens Zone. The Southwest region receives less precipitation than the Northern and Central regions as there are no orographic features, and is also far enough inland to be away from the heavier rains experienced by the Coastal Zone. The prevailing winds generally come from the southwest, although in winter west to northwest winds tend to dominate.

Temperature and Precipitation

The ONJSC maintains temperature and precipitation data from monitoring stations throughout the state, with some records dating back to the 1890s. The state is divided into three divisions, with southern New Jersey falling under Division 2. Division 2 includes counties of Middlesex, Mercer, Burlington, Camden, Gloucester, Salem, Cumberland, and portions of Monmouth, Ocean, Atlantic, and Cape May. The ONJSC has compiled a statewide report, with values calculated from an average of monthly temperatures.

State Historic Averages

Data from 1895 through 2012 for New Jersey statewide mean annual temperatures and annual precipitation along with yearly cooling and heating day totals for New Jersey from 1890 to 2012 have been collected and graphically represented to show a comparison and historic trend for the state’s climate. This data is represented in *Figure 9*, *Figure 10*, *Figure 11*, and *Figure 12* which show an overall upward trend in mean temperature and precipitation for the state of New Jersey between 1895 and 2012, as well as an increase in yearly cooling degree days and a reduction in yearly heating degree days.

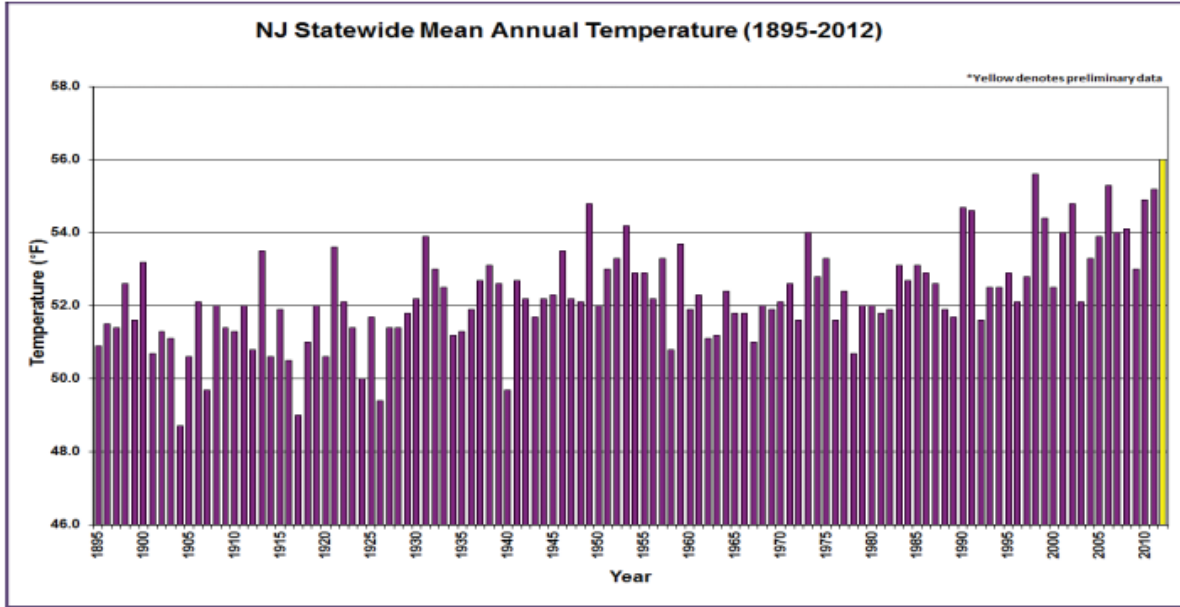


Figure 9. NJ Statewide Mean Annual Temperatures (1895-2012)

Source: <http://www.nj.gov/dep/dsr/trends/pdfs/climate-change.pdf>

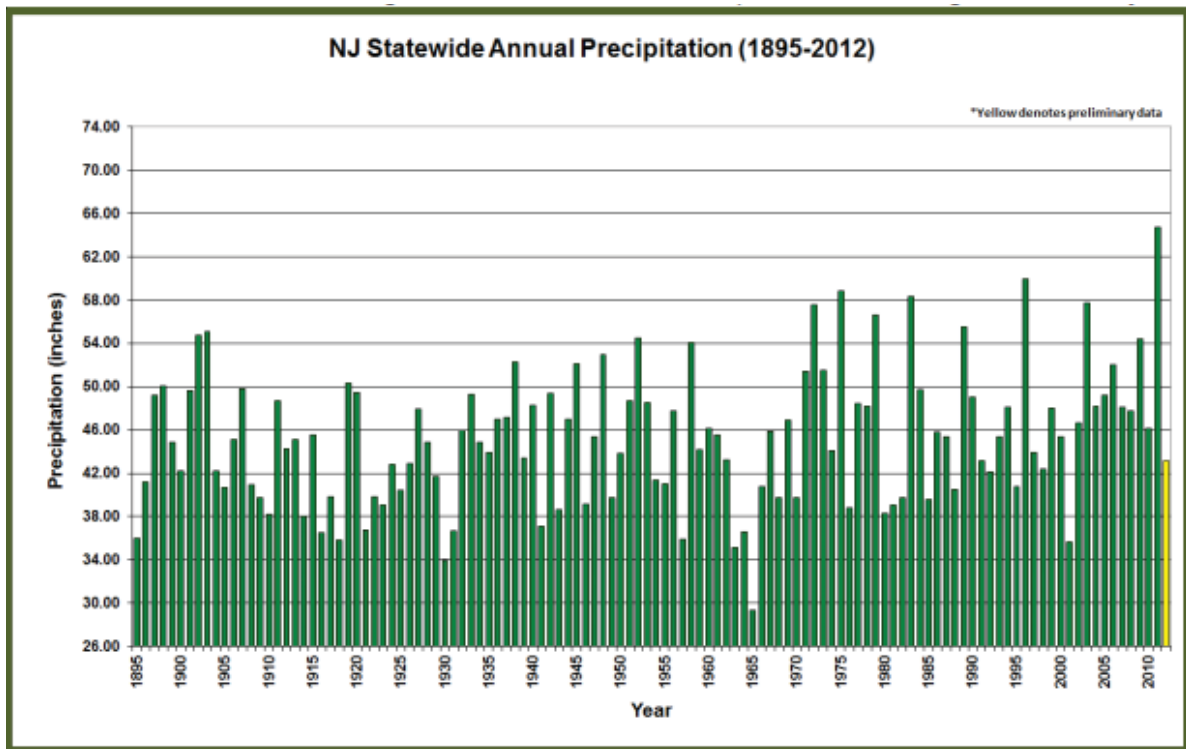


Figure 10. NJ Statewide Annual Precipitation (1895-2012)

Source: <http://www.nj.gov/dep/dsr/trends/pdfs/climate-change.pdf>

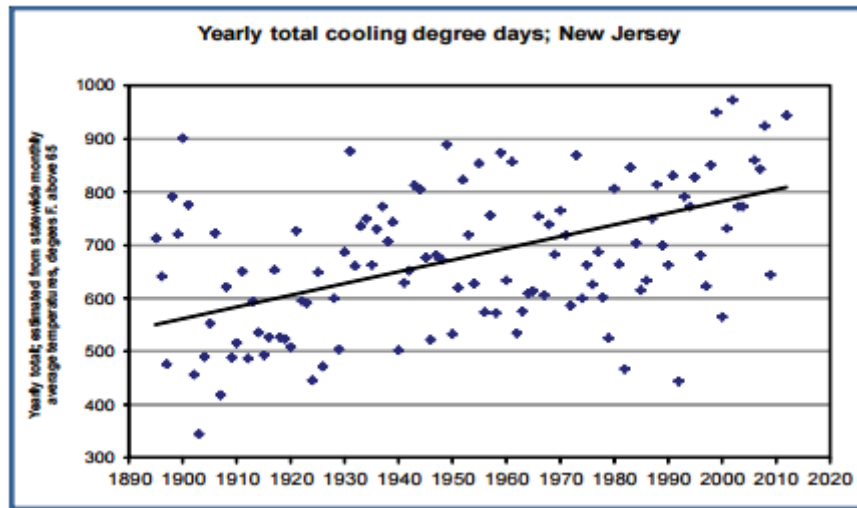


Figure 11. Yearly total cooling degree days; New Jersey

Source: <http://www.nj.gov/dep/dsr/trends/pdfs/climate-change.pdf>

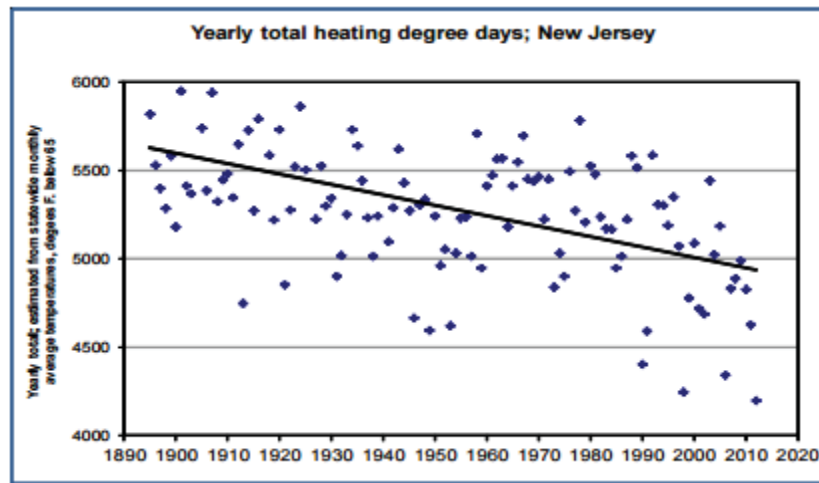


Figure 12. Yearly total heating degree days; New Jersey

Source: <http://www.nj.gov/dep/dsr/trends/pdfs/climate-change.pdf>

Local Historic Averages

The three ONJSC reporting stations closest to Washington Township are Woodstown (15 miles), Moorestown (16 miles), and Hammonton (17 miles). *Table 36. Monthly and Annual Mean Temperatures: Historic Averages for Woodstown, Moorestown, and Hammonton (°F)* shows the monthly and annual historic averages of mean, median, minimum, and maximum temperatures for these three stations. Each station has been gathering data for a different number of years as denoted in the table. *Note:* Some monitoring stations have gaps in recording temperature (such as Hammonton and Moorestown with gaps of 17 and 18 years, respectively). The historic average of

annual mean temperatures for Woodstown is 54.5°F, Moorestown is 53.4°F, and Hammonton is 54.0°F. All three locations display warmer temperatures than the 53.0°F computed for all of southern New Jersey for the time period of 1895-2016.

Table 36. Monthly and Annual Mean Temperatures: Historic Averages for Woodstown, Moorestown, and Hammonton (°F)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Woodstown Monitoring Station* (1901-2003)													
Mean	32.6	34.4	42.5	52.8	62.7	71.6	76.4	74.6	67.8	56.9	46.2	36.3	54.5
Median	32.4	34.4	42.3	52.8	62.2	71.8	76.3	74.3	68.0	56.9	46.2	37.0	54.3
Min	22.3	23.1	33.7	47.8	56.8	68.1	72.3	71.5	62.9	51.0	40.4	25.4	53.0
Max	41.9	42.5	48.3	58.5	69.4	76.0	80.1	78.2	73.3	63.2	51.2	44.0	57.1
Moorestown Monitoring Station (1893-2012)													
Mean	32.3	33.2	41.9	52.0	61.9	70.6	75.1	73.4	66.9	56.0	45.3	35.4	53.4
Median	32.5	32.9	41.7	52.0	61.7	70.6	74.7	73.4	66.7	56.2	45.2	35.7	53.4
Min	21.5	18.4	32.8	46.0	54.6	64.7	71.1	68.4	59.7	47.4	39.9	27.0	49.9
Max	42.6	42.9	52.6	58.5	69.9	76.4	81.3	78.2	73.6	62.8	52.5	44.8	57.4
Hammonton (1930-2016)													
Mean	32.0	33.8	42.0	52.0	62.4	71.3	76.1	74.4	67.6	56.3	46.6	36.4	54.0
Median	32.1	34.2	41.9	52.3	62.6	71.3	76.1	74.5	67.6	56.2	47.1	36.9	54.1
Min	20.3	22.5	32.1	46.1	56.6	66.7	72.7	68.1	62.8	49.2	40.1	28.4	51.8
Max	46.4	42.9	52.5	57.1	68.0	76.3	81.5	78.6	73.3	63.7	51.8	49.7	56.9
*Woodstown Station no longer active as of 2003													
Source: NJ State Climatologist, Rutgers University (Accessed March 1, 2017)													
http://climate.rutgers.edu/stateclim/													

Mean temperatures for the Woodstown, Hammonton, and Moorestown Monitoring Stations, by year are plotted in *Figure 13*, *Figure 14*, and *Figure 15*, along with the historic mean average. Extreme spikes and drops can be the result of incomplete data for the monitoring period. All of these figures show an upward trend in annual mean temperature.

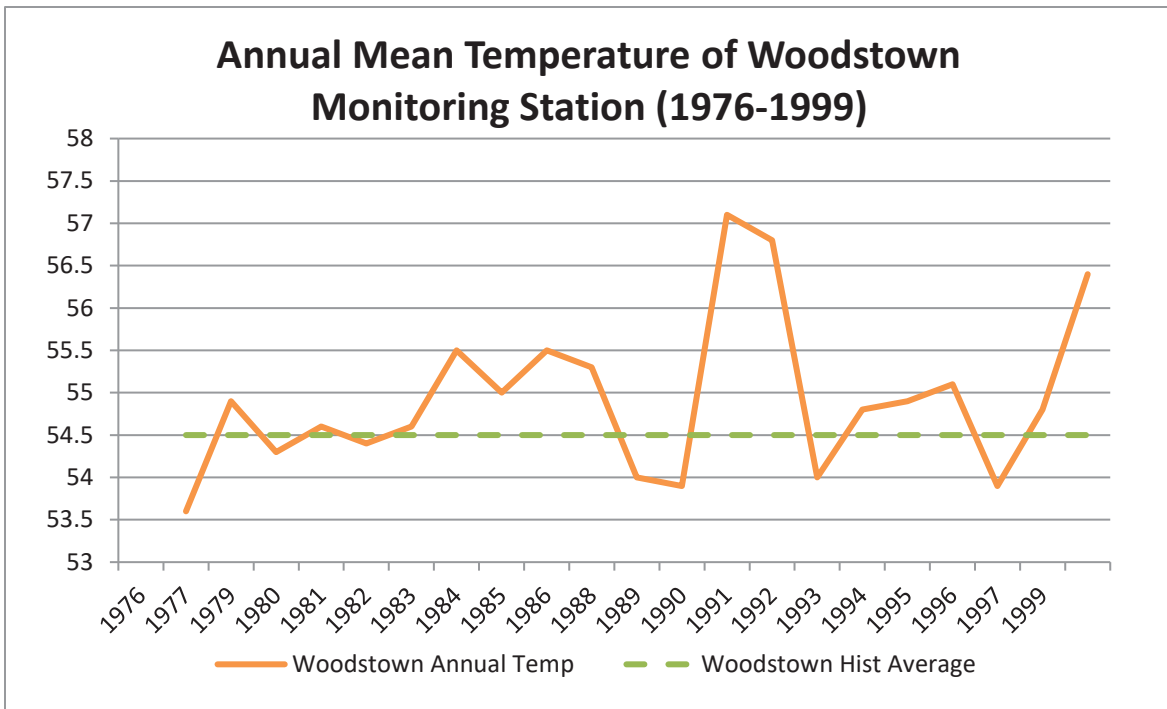


Figure 13. Annual Mean Temperatures of Woodstown Monitoring Station (1976-1999)

Source: http://climate.rutgers.edu/stateclim_y1/nclimdiv/

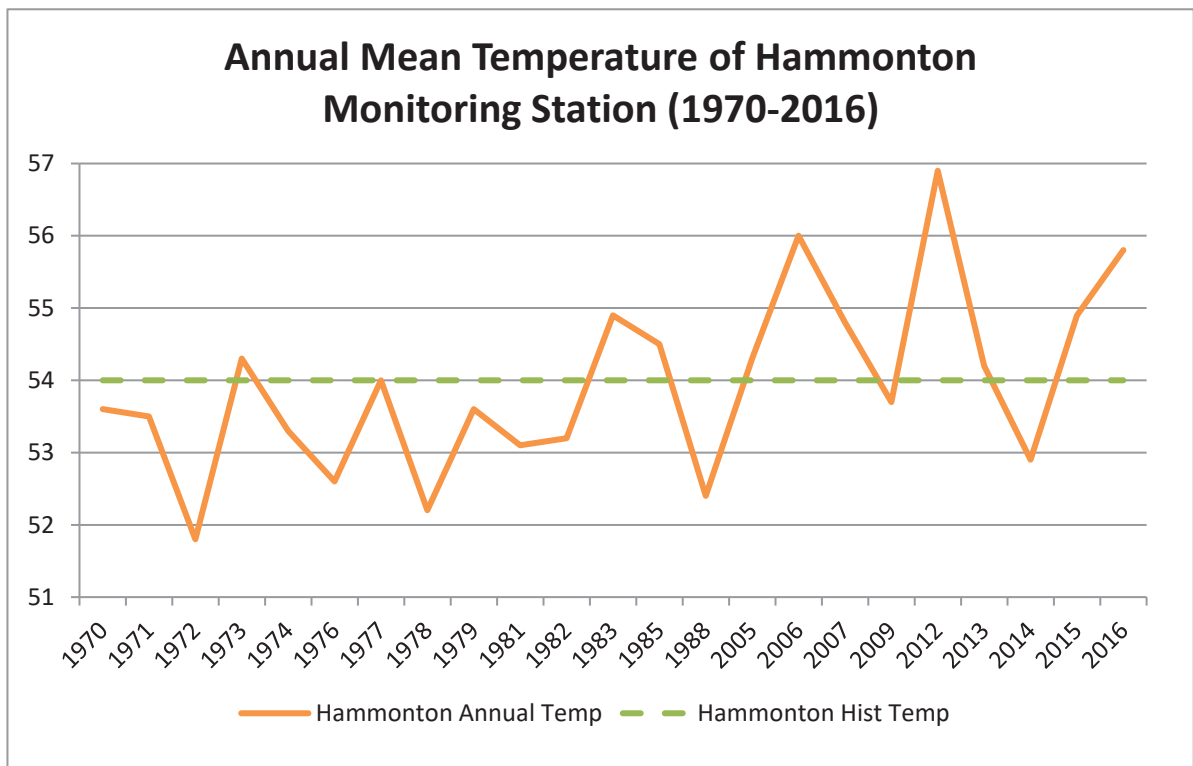


Figure 14. Annual Mean Temperature of Hammonton Monitoring Station (1970-2016)

Source: http://climate.rutgers.edu/stateclim_y1/nclimdiv/

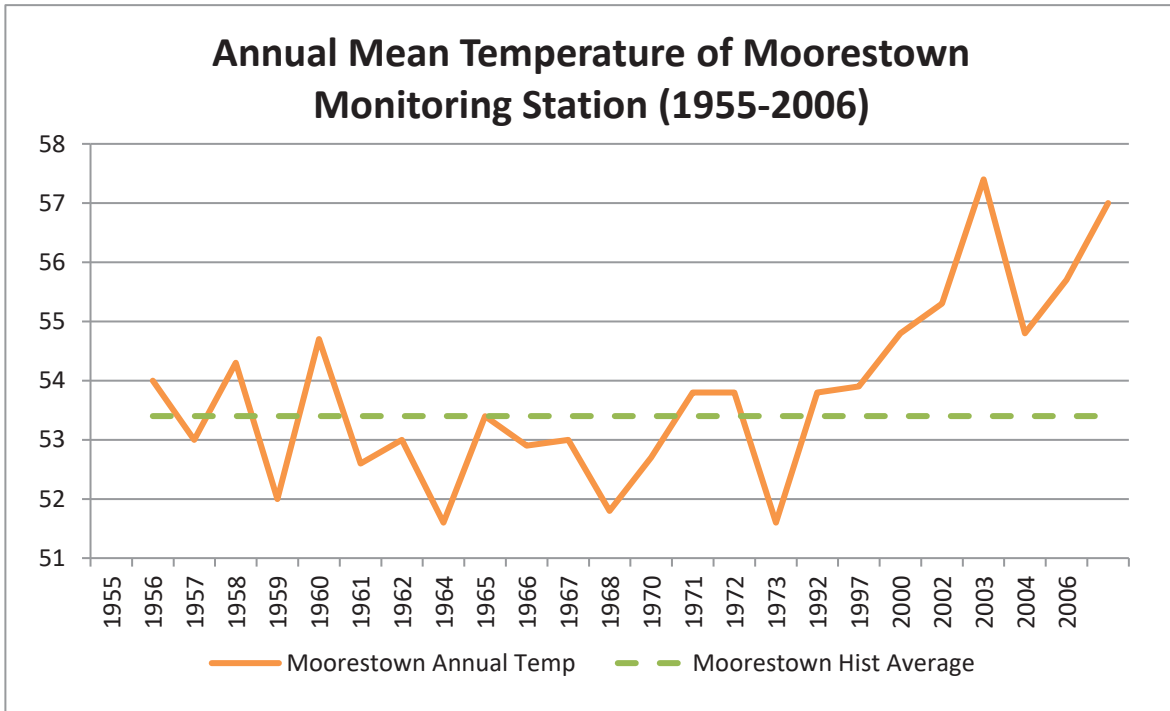


Figure 15. Annual Mean Temperature of Moorestown Monitoring Station (1955-2006)

Source: http://climate.rutgers.edu/stateclim_v1/nclimdiv/

Table 37. *Historic Precipitation for Woodstown, Moorestown, and Hammonton (inches)* details monthly and annual historic averages for all precipitation. Historic annual mean precipitation in Woodstown is 44.11 inches, which is just below the New Jersey average of 44.34 inches for southern New Jersey. Moorestown’s historic annual mean is 44.78 inches, while Hammonton is 45.82 inches, both above the state average for southern New Jersey.

Table 37. Historic Precipitation for Woodstown, Moorestown, and Hammonton (inches)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Woodstown Monitoring Station* (1901-2003)													
Mean	3.25	2.80	3.95	3.56	3.58	3.57	4.23	4.31	3.84	3.17	3.47	3.59	44.11
Median	2.79	2.57	3.82	3.25	3.55	3.46	3.95	3.60	3.36	2.99	2.87	3.07	43.15
Min	0.38	0.37	1.20	0.92	0.62	0.31	0.90	0.70	0.50	0.24	0.25	0.18	32.99
Max	8.41	6.43	8.00	8.19	7.85	10.21	9.11	11.38	12.53	6.50	8.43	10.16	58.19
Moorestown Monitoring Station (1893-2012)													
Mean	3.33	2.88	3.85	3.63	3.84	3.76	4.64	5.01	3.83	3.53	3.34	3.56	44.78
Median	3.03	2.78	3.77	3.35	3.65	3.48	4.29	4.61	3.48	3.16	3.00	3.33	44.27
Min	0.17	0.33	0.46	0.60	0.44	0.30	0.80	0.47	0.30	0.05	0.32	0.18	29.23
Max	8.55	6.45	8.31	8.19	9.34	9.19	11.57	16.91	10.34	10.12	9.07	9.74	62.05
Hammonton (1893-2016)													
Mean	3.57	3.18	3.83	3.79	3.59	3.90	4.60	4.60	3.63	3.62	3.47	3.90	45.82
Median	3.41	3.10	3.59	3.42	3.28	3.49	4.43	4.34	3.56	3.40	3.17	3.54	45.91
Min	0.57	0.42	0.98	0.47	0.55	0.52	0.33	0.50	0.08	0.10	0.28	0.36	29.63
Max	8.41	6.75	9.24	8.20	9.41	12.22	14.01	12.06	12.05	11.89	9.17	10.21	68.34
*Woodstown Monitoring Station no longer active as of 2003 Source: NJ State Climatologist, Rutgers University (Accessed March 1, 2017) ⁶¹													

See Figure 16. Annual Mean Precipitation of Woodstown Monitoring Station (1975-2001), Figure 17. Annual Mean Precipitation of Moorestown Station (1984-2008), and Figure 18. Annual Mean Precipitation of Hammonton Station (1973-2016) for graphical presentations of this data.

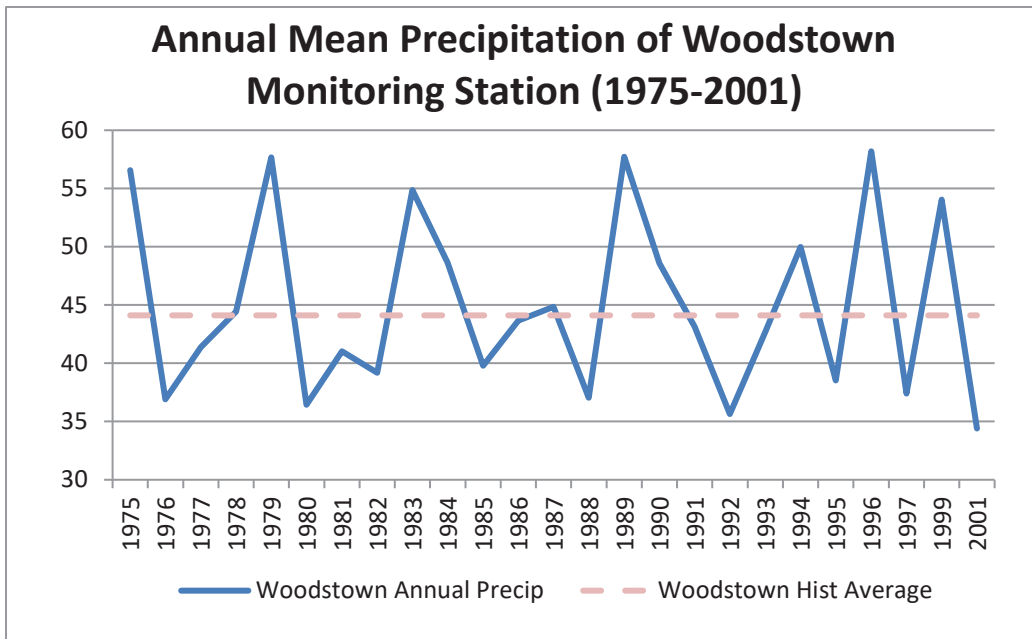


Figure 16. Annual Mean Precipitation of Woodstown Monitoring Station (1975-2001)

Source: http://climate.rutgers.edu/stateclim_v1/nclimdiv/

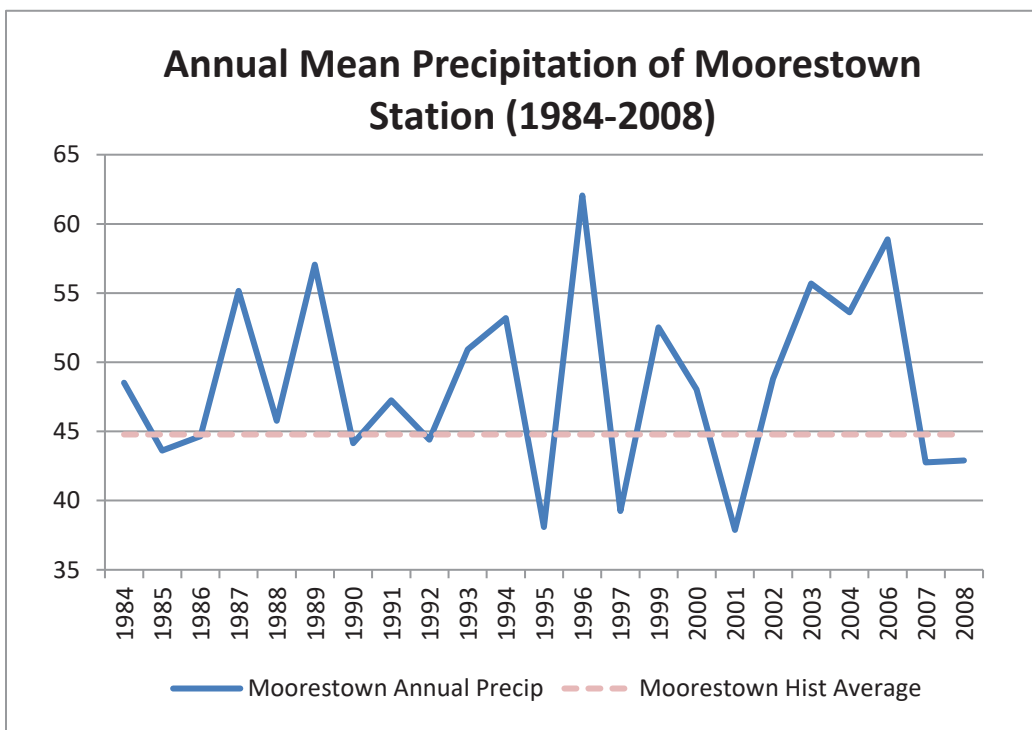


Figure 17. Annual Mean Precipitation of Moorestown Station (1984-2008)

Source: http://climate.rutgers.edu/stateclim_v1/nclimdiv/

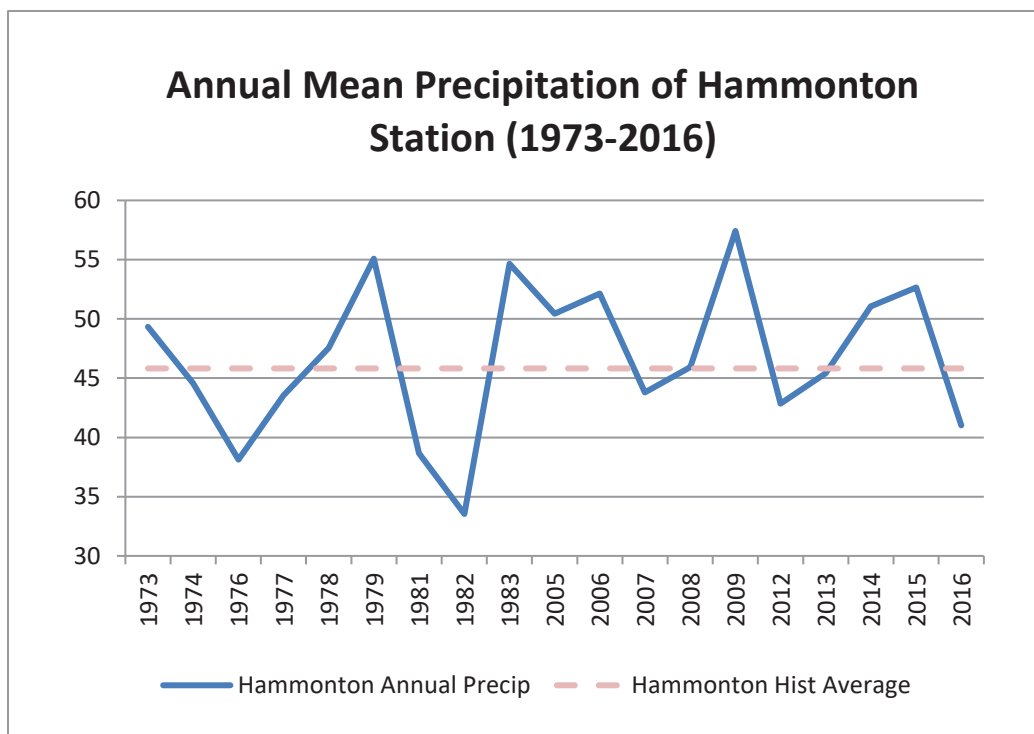


Figure 18. Annual Mean Precipitation of Hammonton Station (1973-2016)

Source: http://climate.rutgers.edu/stateclim_y1/nclimdiv/

Snowfall amounts are shown in *Table 38. Monthly and Annual Mean Snowfall: Historical Averages for Woodstown*. The table shows the Woodstown monitoring station receiving approximately 17 inches of snow annually from 1901 to 2003. Neither the Moorestown nor Hammonton monitoring stations measure snowfall.

Table 38. Monthly and Annual Mean Snowfall: Historical Averages for Woodstown													
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Annual
Woodstown Monitoring Station* (1901-2003)													
Mean	0.0	0.0	0.0	0.1	0.6	3.5	5.8	5.5	2.3	0.3	0.0	0.0	17.0
Median	0.0	0.0	0.0	0.0	0.0	1.9	4.5	3.3	0.5	0.0	0.0	0.0	14.5
Min	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3
Max	0.0	0.0	0.0	2.5	6.8	21.0	22.3	25.2	15.0	4.0	T	T	52.5
*Woodstown Monitoring Station no longer active as of 2003 T=trace (<0.1" for snow)													
Source: NJ State Climatologist, Rutgers University (Accessed March 1, 2017)													

Current Normals

Table 39. Monthly Station Normals Moorestown and Hammonton shows the temperature, and heating and cooling degree day normal, or averages, from 1981-2010. Heating degree days are the number of degrees the average daily temperature is below 65°F. Cooling degree days are the number of degrees the average daily temperature is above 65°F.

Table 39. Monthly Station Normals Moorestown and Hammonton													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Moorestown Monitoring Station													
Temperature Normals (° F)													
Mean	32.9	35.7	43.7	53.6	62.9	72.2	76.5	74.5	67.4	56.3	46.5	36.9	54.9
Max	42.8	46.8	56.0	67.1	76.7	85.3	89.1	87.0	80.1	69.0	57.6	46.8	67.0
Min	22.9	24.6	31.4	40.2	49.0	59.1	63.9	62.0	54.7	43.6	35.3	27.1	42.8
Heating Degree Days (the number of degrees the average daily temperature is below 65)													
Heating	997	820	662	355	138	16	1	3	53	287	558	869	4759
Cooling Degree Days (the number of degrees the average daily temperature is above 65)													
Cooling	0	0	1	14	71	232	357	297	125	17	1	0	1115
Hammonton Monitoring Station													
Temperature Normals (°F)													
Mean	32.1	34.2	41.7	52.2	61.6	71.7	76.4	74.5	66.7	55.3	45.0	36.1	54.0
Max	41.1	44.0	52.0	63.2	72.4	82.2	86.8	84.9	78.1	66.7	56.3	45.5	64.4
Min	23.0	24.3	31.4	41.2	50.9	61.1	66.0	64.1	55.3	43.8	35.7	26.8	43.6
Heating Degree Days (the number of degrees the average daily temperature is below 65)													
Heating	1021	864	723	393	162	22	1	2	64	318	571	894	5035
Cooling Degree Days (the number of degrees the average daily temperature is above 65)													
Cooling	0	0	1	9	58	221	354	296	115	16	1	~0**	1071
*Normal = 30 year average (1981-2010)													
**Values of ~0 represent a non-zero degree day that would round to zero													
Source: NJ State Climatologist, Rutgers University (Accessed March 1, 2017) ⁶²													

Comparison of Current Normals and Historic Averages

Table 40. *Historic Averages vs. Station Normals* compares the annual historic averages for the Moorestown and Hammonton monitoring stations against the current normal (i.e. the averages for the current 30-year period of 1981-2010) for temperature. Current normals show a mean increase in annual temperature of 1.5°F in Moorestown and no change in Hammonton.

Table 40. Historic Averages vs. Station Normals			
Annual Historic Averages 1893-2012 vs Station Normals 1981-2010: Moorestown			
	Historic Avg.	Current Normals*	Difference
Temperature (°F)			
Mean	53.4	54.9	+1.5
Max	57.4	67.0	+9.6
Min	49.9	42.8	-7.1
Annual Historic Averages 1930-2016 vs Station Normals 1981-2010: Hammonton			
	Historic Avg.	Current Normals*	Difference
Temperature (°F)			
Mean	54.0	54.0	0
Max	56.9	64.4	+7.5
Min	51.8	43.6	-8.2
*Normal = 30 year average (1981-2010)			
Source: NJ State Climatologist, Rutgers University (Accessed March 1, 2017)			
http://climate.rutgers.edu/stateclim/			

Figure 19. Woodstown Heating and Cooling Degree Days Trend (1985-1999) shows the annual heating degree days (HDD) and cooling degree days (CDD) by yearly intervals for the Woodstown Monitoring Station.

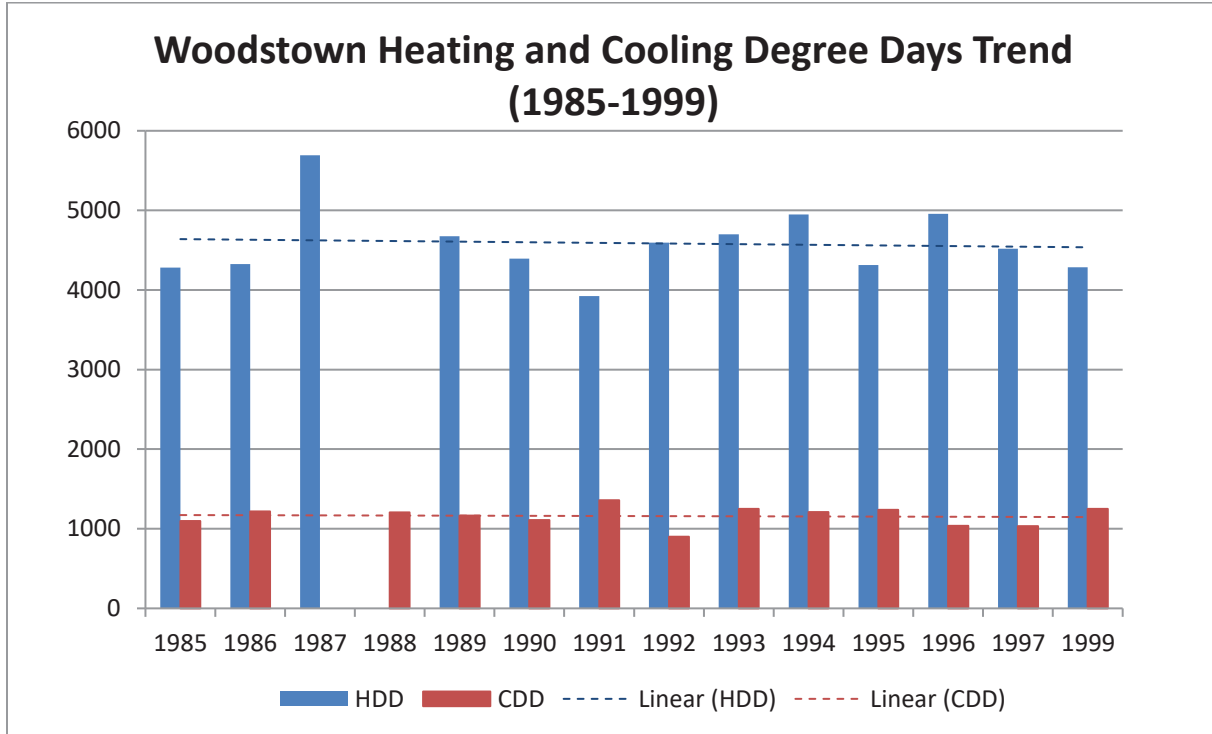


Figure 19. Woodstown Heating and Cooling Degree Days Trend (1985-1999)

Source: http://climate.rutgers.edu/stateclim_v1/nclimdiv/

Extreme Phenomena

Tropical Cyclones

According to the National Oceanic and Atmospheric Administration (NOAA), tropical cyclones are rotating, organized systems of clouds and thunderstorms that originate over tropical or subtropical waters.⁶³ Tropical cyclones have four major levels, increasing in severity: tropical depression, tropical storm, hurricane, and major hurricane. Storms may start out as major hurricanes and weaken in strength as they travel and make landfall. The season generally runs from spring through fall, with most activity for the Mid-Atlantic States occurring in August and September. Tropical cyclones tend to bypass New Jersey due to its protective location slightly to the west of coastal outcrops to the north and south. When they do affect New Jersey, they are more apt to affect coastal areas, although a few have traveled inland.

Notable recent tropical cyclones are Hurricane Floyd in September 1999, Hurricane Irene in August 2011, and Hurricane Sandy in October 2012. According to ONJSC, about 150 mm (approximately 6 inches) of rain fell in the areas near Washington Township during Hurricane Floyd. Similarly, about 5 inches of rain fell during Hurricane Irene.⁶⁴ During Hurricane Sandy in

2012, the Washington Township monitoring station calculated peak wind gusts at 53 mph. Rainfall was measured at 5.01 inches.⁶⁵ Although there were heavy rains and high winds during Hurricane Sandy, there was minimal damage to houses and other structures in the town. Power outages were sporadic and quickly restored.⁶⁶

Other recent tropical cyclones affecting New Jersey:

2010 – Tropical Storm Hanna took an inland track.

2004 – A number of tropical storms and depressions affected the East Coast but missed inland Northern New Jersey.

2000 – A tropical depression from Hurricane Gordon affected coastal NJ.

1999 – Hurricane Bret clipped the New Jersey coast in September at a Tropical Storm level.

1996 – Hurricane Josephine downgraded to a tropical storm hit inland NJ in October.

1994 – A tropical depression traveled west and north of New Jersey.

1992 – Tropical Storm Earl traveled south and west of New Jersey.

1988 – Tropical Storm Chris traveled west to east through Northern New Jersey.

1985 – Hurricane Gloria skirted the coast of New Jersey.

For 2016, the most recent summary data available, the frequency of tropical storms was above the 1981-2010 average of 12.1, with 15 named storms forming (7 of which were hurricanes, while 8 were tropical storms). The 2016 season had an Accumulated Cyclone Energy index (duration and strength) of about 40% above the 1981-2010 average, and the highest since 2012. The 2016 season also saw Hurricane Matthew become the first Category 5 storm to form since Hurricane Felix in 2007.⁶⁷

Macroburst

A macroburst, a convective downdraft with an affected outflow area of at least 2.5 miles wide and peak winds lasting between 5 and 20 minutes, occurred on June 23, 2015 throughout Washington Township. This resulted in downed trees, power outages, and damage to structures.⁶⁸

Landslides

Landslides in New Jersey have generally occurred in the northern and central parts of the state and include slumps, debris flows, rock falls, and rockslides. They are not as common in New Jersey as in other parts of the country. As of July 2015, there were 278 landslides in New Jersey as reported by the New Jersey Department of Environmental Protection (NJDEP).⁶⁹ Of the 278 landslides recorded in New Jersey from 1887 to 2015, nearly 14% (39) occurred during the heavy rains of Hurricane Irene in August 2011. No landslides have occurred in Washington Township, or in Gloucester County

Earthquakes

The NJDEP maintains a database of recorded earthquakes in New Jersey totaling 200 as of November 2016. They occur more frequently along the fault lines in north-central New Jersey than in other parts of the state. These earthquakes are generally minor in nature, often registering in the

category of micro-quakes. The strongest earthquake epicentered in New Jersey, with a magnitude of 5.3, occurred in 1783, just north of present-day Picatinny Arsenal in neighboring Rockaway Township. The strongest earthquakes *felt* in New Jersey had a magnitude of 8.0-8.8 and were epicentered in New Madrid, Missouri in 1811-1812. An earthquake epicentered in Virginia was felt in New Jersey in August 2011.⁷⁰

In New Jersey, damage from earthquakes is rare or minor. The baseline for the hazard ranking is the level of horizontal shaking that have a 2-in-100 chance of being exceeded in a 50-year period. Shaking is expressed as a percentage of the acceleration of a falling object due to gravity. Maps available from the USGS can “form the basis for seismic design provisions of building codes, insurance rate structures, earthquake loss studies, retrofit priorities, and land-use planning.”⁷¹

Earthquakes are measured by magnitude, intensity (level of shaking), and depth to hypocenter. Magnitude measures the relative size and energy released (when one block or rock, along a fault line, slips over another, causing the ground to vibrate).⁷² The magnitude scale begins at 0 and the highest magnitude ever recorded was 9.5. Of the 200 earthquakes recorded in the database, 61% had a magnitude of 2 or less and are considered “micro earthquakes.” *Table 41. Magnitude Summary for Earthquakes in New Jersey* shows the magnitude summary.

<i>Range</i>	<i>Count</i>	<i>% of Total</i>
<2.0	126	63%
2.1-3.0	61	30.5%
3.1-4.0	11	5.5%
4.1-5.0	1	0.5%
>5.1	1	0.5%
Total	200	100%

Source: NJDEP

Generally, the intensity of an earthquake relates to its magnitude, with a higher level of intensity occurring at or near the epicenter of a higher magnitude earthquake. The intensity scale ranges from I to VIII or higher. Intensities of VI (felt by all, frightening but damage is slight) or VII (damage negligible in buildings of good design and construction) are generally associated with a magnitude in the 5 range. Intensities of IV (felt by nearly everyone; some shaking, cracking of walls, standing cars rocked) or V (felt by everyone) are generally associated with magnitudes in the 4 range.

Another earthquake measurement is the depth below the surface at which the hypocenter occurs. The hypocenter is the point in the earth where the rupture starts, and the epicenter is the point at the earth’s surface directly above the hypocenter. Depth levels are grouped as shallow, 0-70 km deep; intermediate, 70-300 km deep; and deep, 300-700 km deep. All earthquakes in New Jersey have a shallow depth to hypocenter with the deepest recorded hypocenter at 25 km below the surface for an earthquake occurrence near Sussex in northwestern New Jersey in 1969. *Figure 20. Earthquakes in New Jersey* shows the frequency of earthquakes in New Jersey from 1983-2015. The highest annual count was 13 in 1984, and no earthquakes were reported in either 1985 or 2000.

Earthquakes epicentered around Washington Township are listed in *Table 42. Earthquakes Epicentered Around Washington Township (20 mile radius)*. The strongest earthquake recorded within 20 miles of Washington Township was a 3.5 magnitude earthquake centered near Wilmington, Delaware in 1973. By comparison, the strongest earthquake in all of New Jersey was along the Longwood Valley Fault in Morris County in 1783, with a magnitude of 5.3.

Table 42. Earthquakes Epicentered Around Washington Township (20 mile radius)							
ID	Date	Time	Lat_N	Long_W	Depth (km)	Magnitude	Location
20	11/15/1939	2:53	39.580	75.050	3.00	3.4	Salem County
31	2/28/1973	8:21	39.690	75.440	11.90	3.5	East of Wilmington, DE
32	7/10/1973	4:38	39.700	75.400	0.00	2.6	East of Wilmington, DE
55	8/30/1980	9:19	39.840	74.860	2.00	3.0	Medford Lakes, NJ
106	9/29/1991	12:21	39.848	75.031	5.00	2.2	Somerdale Boro, NJ
111	2/26/1993	21:13	39.876	74.942	5.00	2.5	Cherry Hill, NJ
143	3/22/2004	15:21	39.866	75.063	2.4	2.1	2km NE from Runnemede, NJ
144	12/17/2004	5:30	39.639	75.414	7.00	2.0	6km ESE from Pennsville, NJ
170	5/10/2011	8:19:59	40.011	74.796	5.00	1.9	2km N of Mt. Holly
178	11/23/2012	5:13:20	39.789	75.016	5.00	2.2	17km S of Ramblewood, NJ
181	5/19/2014	4:09:50	39.819	75.006	5.20	1.0	13km SW of Ramblewood, NJ
199	11/6/2016	10:11:15	39.865	75.125	5.00	1.5	2.6km W of Bellmawr, NJ

Source: NJDEP <http://www.state.nj.us/dep/njgs/geodata/dgsdown/njearthquakes.pdf> (Accessed March 2017)

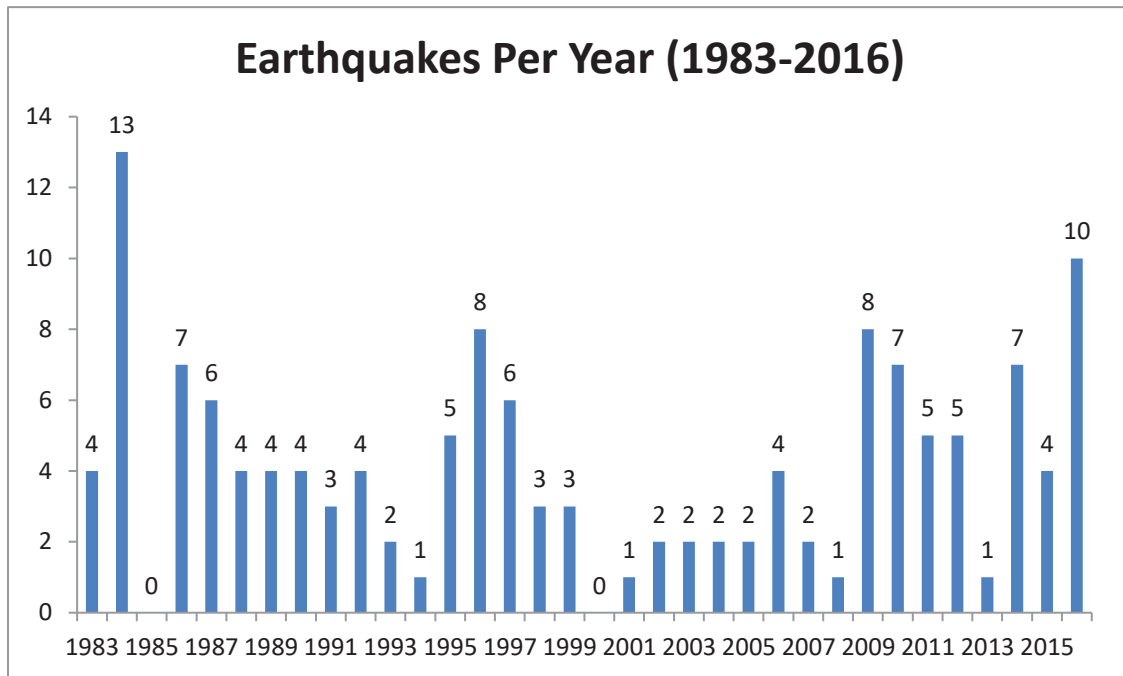


Figure 20. Earthquakes in New Jersey

Climate Change

In 2007, the Intergovernmental Panel on Climate Change (IPCC) reported that increasing carbon dioxide (CO₂) emissions into the atmosphere, as a result of human activity, has warmed the Earth’s surface by more than 1.3°F during the last century. The Union of Concerned Scientists has indicated that temperatures in the northeast are likely to rise in winter and summer over the next several decades. Without a reduction in CO₂ and other Greenhouse Gas (GHG) Emissions, average temperatures may rise by up to 14°F in the summer by 2100. Studies have predicted that by the end of the century the New York City region and cities such as Trenton could experience more than 20 days per summer with temperatures above 100°F.⁷³

This warming trend can have impacts on the health of humans and the environment. The predicted effects on humans include heat stress, increased particulates in the air we breathe, and increased occurrences of insect-spread diseases such as West Nile Virus in the winter season of northern climates. Ecosystem repercussions include changes to the water cycle, with the following potential consequences: loss of critical habitat, further stressing some already threatened and endangered species; impacts on water supply and agriculture; more intense rain events; more frequent periods of extended dryness; and increases in fires, pests, disease pathogens, and invasive weed species.⁷⁴

A Greenhouse Gas (GHG) is defined by the NJDEP as:

“an atmospheric gas that slows the rate at which heat radiates into space, thus having a warming effect on the atmosphere. GHGs include water vapor, carbon dioxide (CO₂), methane (CH₄), nitrous oxide, chlorofluorocarbons (CFCs), hydrofluorocarbons (HFCs), and some other halogenated gases.”⁷⁵

To address the effects of GHGs, New Jersey enacted the Global Warming Response Act in 2007. This law requires:

- Stabilization of statewide GHGs to 1990 levels by 2020, and
- A further reduction to 80% below 2006 levels by 2050

According to the NJDEP, New Jersey must meet these limits in order to avoid the most damaging impacts of climate change. In 2012, the latest year for which major sector estimates are available, total estimated emissions were 104.6 million metric tons of CO₂ equivalent (MMTCOe), below the 1990 baseline and 2020 target of 125.6 MMTCOe. The 2050 goal is much more ambitious: to be 80% below the 2006 level, or approximately 25.5 MMTCOe.

In December 2011, the state revised its *Energy Master Plan* and released an updated draft in December 2015, but it has not yet been approved. The state *Energy Master Plan* is the strategic vision for the use, management, and development of energy in New Jersey over the next decade. Because fossil fuels such as coal, oil, and natural gas are the largest source of GHGs in the state, the *Energy Master Plan* serves as the platform for discussions about how New Jersey can meet the Global Warming Response Act's 2050 greenhouse gas limit.⁷⁶

The transportation sector continues to be the major contributor to GHGs (44% in 2012) and vehicle miles traveled continue to increase while fuel efficiencies have leveled off. In 2012, electricity generation was the second largest contributor at approximately 20% followed by residential at 11%, commercial at approximately 10%, and industrial at approximately 10%, combining for 31% of gross statewide emission. Highly warming gases, waste management, and land clearing contributed approximately 12%, while terrestrial carbon sequestration (forests absorbing carbon) provided an offset of -7.9%.⁷⁷

The Sustainable Jersey program is a certification program that acknowledges communities that complete qualifying actions toward sustainability. Washington Township is a participating community. Among the qualifying actions are a number of Greenhouse Gas initiatives that can be undertaken by the municipality.

On an individual level, rebates on energy efficient alternatives for household appliances, heating, cooling, and alternative energy systems are available through New Jersey's Clean Energy Program (NJCEP), which are administered by the New Jersey Board of Public Utilities. Commercial, industrial, and local government programs are also available.⁷⁸

FLOOD HAZARD AREAS

Flood Zones

Federal, state, and municipal governments provide oversight regarding areas prone to flooding through various acts, laws, and ordinances. The intent is to minimize property damage and negative ecological effects by limiting development and protecting positive environmental influences in areas subject to frequent flooding.

At the federal level, the United States Geological Survey (USGS) maps flood prone areas and the Federal Emergency Management Agency (FEMA) evaluates and maps Special Flood Hazard Areas (SFHAs) that can be used in participating communities to determine flood insurance rates. On the state level, the NJDEP delineates Flood Hazard Areas along streams and regulated activities within these areas. In recent years, FEMA and the state have coordinated to integrate NJDEP flood hazard area parameters into FEMA updates. Municipal code may set standards that are stricter than either the state or FEMA.

FEMA Mapping and Flood Insurance Program

Special Flood Hazard, evaluated and mapped by FEMA, and other flood zones are used to create official Flood Insurance Rate Mapping (FIRM) that can be used in participating communities, such as Washington Township, to determine flood insurance rates. Communities can choose to participate in the National Flood Insurance Program (NFIP), which requires mandatory flood insurance in areas mapped as Special Flood Hazard Areas. A Special Flood Hazard Area is defined as “an area that would be inundated by the flood having one percent chance of being equaled or exceeded in any given year,” also known as the base flood or 100- year flood zone. NFIP mapping also includes information of 500-year flood zones and various sublevels within the 100-year zone.⁷⁹ *Map 15* illustrates both the 100-year and 500-year threshold for Washington Township. Areas along streams in Washington Township fall within the 100-year flood zone.

The majority of the Township is not located in a Flood Zone. 3% of the Township is located within the 100-year flood zone, while less than 1% of the Township is located in the 500-year flood zone. *Table 43* outlines the acres of mapped flood zones in Washington Township.

<i>Flood Hazard</i>	<i>Acres</i>	<i>% of Total Municipal Area</i>
100-year Flood (1% annual chance)	422.74	3.07%
500-year Flood (0.2% annual chance)	33.66	0.24%
Not in Flood Zone	13,294.62	96.68%
Total Township Acreage	13,751.02	100%

Source: FEMA DFIRM (2014)

NJDEP Regulated Water Ways

At the state level, New Jersey regulates flood prone areas through the New Jersey Flood Hazard Area Control Act, Act, *N.J.S.A. 58:16A-50 et. Seq.*, and its rule, adopted November 5, 2007. The Act recognizes the importance not only of avoiding building in unsafe places, but also preserving the vegetation that “is essential for maintaining bank stability and water quality.” The rules set standards for development in flood hazard areas and areas adjacent to surface waters “in order to mitigate the adverse impacts to flooding and the environment that can be caused by such development.” As defined by the rules, a flood hazard area exists along every regulated waterway that has a drainage area of 50 acres or more.

A Flood Hazard Area is defined as the area inundated by the flood hazard area design flood, which is equal to the 100-year flood plus a “factor of safety”. It includes both a floodway and a flood fringe. There are six measures for determining the flood hazard area under the FHCA rules. They include NJDEP delineation method (flood studies are undertaken); FEMA tidal, fluvial and hydraulic methods; and approximation and calculation methods.

NJDEP regulated activities in a flood hazard area or riparian zone include:

1. The alteration of topography through excavation, grading, and/or placement of fill;
2. The clearing, cutting, and/or removal of vegetation in a riparian zone;
3. The creation of impervious surface;
4. The storage of unsecured material;
5. The construction, reconstruction, and/or enlargement of a structure; and
6. The conversion of a building into a private residence or a public building.
(N.J.A.C. 7:13-2.4)

Flooding in Washington Township

Washington Township boundaries are delineated by two major creeks: Mantua Creek to the west and the South Branch of Big Timber Creek to the east. Within Washington Township, the 100-year flood zone “occurs along major streams and their tributaries; Mantua Creek, Big Timber Creek, portions of: Bethel Run, Porch Branch, and Duffield Run.”⁸⁰ However, “despite the numerous streams which traverse the township, flooding has been relatively minor. This is due to the fact that, until the late 1970’s, development within Washington has been minimal.”⁸¹ Development was very rapid in the late 1970’s and 1980’s, and into the early 1990’s. The 500-year flood zone within the Township is located along Duffield Run and the South Branch of Big Timber Creek.

On a local level, the Washington Township Municipal Code addresses flood hazard areas in Chapter 96, Flood Damage Prevention Code, which specifies strict standards for flood hazard reduction in those areas designated SFHAs as defined by FEMA.

Article 5, *Provisions for Flood Hazard Reduction*, provides the following general standards for building in flood areas:

- *Anchoring*; All new construction and substantial improvements shall be anchored to prevent flotation, collapse, or lateral movement of the structure.
- *Construction Materials and Methods*; All new construction and substantial improvements shall be constructed with materials and utility equipment resistant to flood damage.
- *Utilities*; All new and replacement water supply systems shall be designed to minimize or eliminate infiltration of flood waters into the system; new and replacement sanitary sewage systems shall be designed to minimize or eliminate infiltration of flood waters into the systems and discharge from the systems into flood waters; on-site waste disposal systems shall be located to avoid impairment to them, or contamination from them during flooding; electrical, heating, ventilation, plumbing, and air-conditioning equipment and other service facilities shall be designed and/or located so as to prevent water from entering or accumulating within the components during conditions of flooding.
- *Subdivision proposals*; All subdivision proposals and other proposed new development shall be consistent with the need to minimize flood damage; shall have public utilities and facilities to minimize flood damage; shall have adequate drainage provided to reduce exposure to flood damage; and base flood elevation data shall be provided.
- *Enclosure opening*; All new construction and substantial improvements have fully enclosed areas below the lowest floor that are usable solely for parking vehicles, building access, or storage in an area other than a basement and which are subject to flooding shall be designed to automatically equalize hydrostatic flood forces on exterior walls by allowing for the entry and exit of flood waters.

A full list of the Township's standards for building in flood hazard areas is available online at:
<http://ecode360.com/31448505>

TRANSPORTATION

Transportation has been a major factor in the role of development of Washington Township. The construction of railroad lines including the West Jersey Railroad and the Pennsylvania-Reading Seashore Lines that passed through Blackwood and Grenloch allowed for new transportation opportunities in Washington Township.⁸² The Blackwood station, built in 1891, specifically aided in bringing significant industry and tourism to the township.⁸³

Within Washington Township, easily accessible bus routes and highways enable residents to reach surrounding regional areas as well as other points of interest within the Township. Transportation for residents and visitors is available by car, bus, or nearby train. Washington Township is located approximately 15 miles (about 20 minutes) away from Philadelphia, a major metropolitan hub of the region. The Atlantic City Expressway, which runs from Camden to Atlantic City passes through a portion of Washington Township on its eastern border. The Township is also home to a section of Route 42, which passes through the Township from the north to the southeast. Route 55, accessible immediately outside the Township, provides access to Route 42 and interstate highways, as well as to the municipalities to the south. Interstate Routes 295, 95, 676, and the New Jersey Turnpike are all within ten minutes of the town.

Currently, Washington Township does not have an active railroad system for commuters. However, the New Jersey Transit Atlantic City Line is nearby and runs from Philadelphia to Atlantic City. The closest station, Lindenwold Train Station, is approximately 7 miles away from Washington Township.⁸⁴ In addition, the Township is about a half hour from a major Amtrak hub in Philadelphia, which has connecting lines running north to New York City and Boston, South to Washington D.C., and west to Pittsburgh.⁸⁵

One of the goals of the Township's *2004 Master Plan* is to "Create a pedestrian and bicycle friendly transportation infrastructure by planning, designing, constructing, and managing transportation and recreation facilities which will accommodate and encourage use by bicyclists and pedestrians, and be responsive to their needs."⁸⁶ In 2016, Gloucester County received a \$1.5 million grant from the Regional Transportation Alternatives Program for the Washington Township and Monroe Township Bikeway Project. The project will help link existing bike and multiuse trails in Gloucester County's James G. Atkinson Park to Washington Lake Park. It will also add new trails and crossing beacons in two locations to increase safety for cyclists and pedestrians. In addition, there will be a new trail at the Bunker Hill School and Fred Smith Tract properties, as well as new trail links at Washington Lake Park and the township firehouse to roadway connections at Greentree Road and Holly Dell Drive. The aim of the project is to increase safe transportation alternatives to cars and to improve the health and well-being of residents by enhancing recreational opportunities and promoting a healthy, active lifestyle within the community. The increase in multi-use trails in the region can help reduce the impact of noise and pollution that affects all residents. The project will take approximately two years to complete.⁸⁷

KNOWN CONTAMINATED SITES

Soil and groundwater contamination is tracked by the state and federal government. This includes the following type of sites and locations:

- ✓ Brownfields – Extensive, long-term remediation sites;
- ✓ Community Right to Know program locations – Point source facilities that require ongoing, continuous monitoring; and
- ✓ Known Contaminated Sites – Point source occurrences that are specific and limited.

The NJDEP Site Remediation Program currently maintains a list of more than 12,000 New Jersey Sites that have been confirmed contaminated and are undergoing remedial investigation, cleanup, or awaiting assignment of a Licensed Site Remediation Professional (LSRP). These sites include private residences, active/abandoned manufacturing/commercial properties, and gas stations. The list does not include sites that have been successfully remediated.

There are 31 active Known Contaminated Sites in Washington Township, and 27 are non-homeowner sites.

Brownfields

A brownfield is “any former or current commercial or industrial site, currently vacant or underutilized and on which there has been, or there is suspected to have been, a discharge of a contaminant.”⁸⁸ The State of New Jersey encourages municipalities and counties to redevelop their brownfields as part of Smart Growth initiatives. According to the State of New Jersey Brownfield Sitemart, there are 31 brownfield site locations in Washington Township.⁸⁹

Community Right to Know

The Community Right to Know (CRTK) program is responsible for collecting and disseminating data on hazardous substances produced, stored, or used at companies in New Jersey. Companies or organizations storing certain hazardous substances in levels above specific threshold amounts are required by state and federal law to file annual reports. The Release and Pollution Prevention Report (RPPR) is used to collect information for the NJDEP Community Right to Know and Pollution Prevention programs. The RPPR gathers data on toxic chemical throughput, multi-media environmental releases, on-site waste management, and off-site transfers, collectively known as material accounting. The Emergency Planning and Community Right-to-Know Act (EPCRA) is a federal regulation that “establishes requirements...regarding emergency planning and “Community Right-to-Know” reporting on hazardous toxic chemicals” to increase public knowledge and information about chemical uses.⁹⁰

In 2016 there were 6 (4 exempt eligibility^d)⁹¹ active sites in Washington Township that met the threshold for the State CRTK.⁹² These sites are listed in *Table 44* below.

^d Certain facilities are exempt from reporting a Community Right to Know Survey including facilities reported previously as non-user or user below threshold of NJ Community Right to Know Environmental Hazardous Substances

Table 44. Community Right to Know Locations

<i>Facility</i>	<i>Eligibility</i>	<i>Physical Address</i>	<i>Substance</i>
Kennedy Health	Exempt	300 Medical Center Dr	Diesel Fuel or #2 heating oil
Comcast of South Jersey, LL-CABL	EPCRAonly	1 Cable TV Lane	Diesel Fuel or #2 heating oil, Lead, Sulfuric Acid
Lowes Home Centers LLC	EPCRAonly	100 Watson Dr	Diesel Fuel or #2 heating oil
J.R. Group INC.	Exempt	4700 Black Horse Pk	---
Monro Muffler Brake & Service	Exempt	5300 Blackhorse Pke	Ethylene Glycol
Kennedy Surgical Center	Exempt	540 Egg Harbor Rd	Diesel Fuel or #2 heating oil

Source: NJDEP. Data Miner. <https://www13.state.nj.us/DataMiner> (Accessed March 2017)

Known Contaminated Sites

The Known Contaminated Sites List (KCSL) for New Jersey includes those sites and properties within the state where contamination of soil or groundwater has been confirmed at levels equal to or greater than applicable standards. Known Contaminated Sites may include:

- *Active Sites* with known contamination, having one or more active cases with any number of pending and closed cases.
- *Pending sites* with confirmed contamination having one or more pending cases, no active cases, and any number of closed cases
- *Closed sites* with remediated contamination, which are those sites having only closed cases, and no active or pending cases.

In Washington Township, there are 31 active sites (27 non-homeowner), 1 pending non-homeowner site, and 259 closed sites.⁹³

These lists are produced by the NJDEP in response to the Brownfield and Contaminated Site Remediation Act, N.J.S.A. 58:10-23.16-17, which required the preparation of a list of sites affected by hazardous substances. It also satisfies obligations under the New Jersey New Residential Construction Off-Site Conditions Disclosure Act (*N.J.S.A. 46:3C1 et seq.*). Sites included in the KCSL report can undergo a wide variety of remedial activities, ranging from relatively simple “cut and scrape” cleanups to highly complex cleanups. The sites with complex contamination issues can have several sources of contamination, which can affect both soil and groundwater at the same time.

The Site Remediation Reform Act, N.J.S.A. 58:10C-1 et seq. (SRRA), enacted in 2009, has helped to speed up the remediation process, “thus helping to decrease the threat of contamination to public health and safety of the environment, and to quickly return underutilized properties to productive use.” As of May 7, 2012, with limited exceptions, all remediation in the State of New Jersey, without regard to when remediation was initiated, proceeds under the supervision of a Licensed Remediation Professional (LSRP), without New Jersey Department of Environmental Protection (NJDEP) approval, following nine requirements set forth at N.J.S.A. 58:10B-1.3b(1) through (9).

The active sites are rated with B, C1, C2, C3, or D depending on the type of severity of the contamination defined as follows:

B - Remedial level associated with emergency response, simple removal activities of contaminants, usually no impact to soil or ground water

C1 - Remedial levels are associated with simple sites one or two contaminants localized to soil and the immediate spill or discharge area.

C2 - Remedial levels are associated with more complicated contaminant discharges such as multiple site spills and discharges, or more than one contaminant, with both soil and groundwater impacted or threatened.

C3 - Remedial levels are associated with highly complex and threatening sites. These sites can have multiple contaminants, some at high concentrations with unknown sources continuing to impact soils, groundwater, and possibly surface waters and potable water resources. These sites are dangerous for direct contact with contaminated soils.

D - Same conditions are C3 except that D levels are also usually designated Federal “Superfund Sites”.

The Classification Exception Area (CEA) Status explains an area where one or more standards and designated uses are suspended. (*N.J.A.C 7:9C -1.4*)⁹⁴ These sites are listed in *Table 45* and are shown in *Map 16. Known Contaminated Sites (Non-Homeowner)*.

Table 45. Active (Non-Homeowner) Contaminated Sites			
Site Name	Site Location	CEA Status	Category
Ace Transformer Release	220 Fish Pond Rd		B
Frimair USA Inc	350 Fries Mill Rd		C2
56088 Sewell Fuels	401 Egg Harbor Rd	Ongoing 5-11-1997	C2
Webb's Sunoco	246 Fries Mill Rd	Ongoing 7-16-2001	C2
Mill Pond Village Plaza	372 384 Egg Harbor Rd		C2
Pioneer Service Station	5150 Rt 42 - Black Horse Pk		B
Lukoil 57253	4800 Rt 42		C2
Meet Bani Llcgastro Plus	5440 Rt 42		C2
Gil Petroleum	5880 Rt 42	Ongoing 5-11-2000	C2
Turnersville Shell	6001 Blackhorse Pk	Ongoing 8-20-2013	C2
Five Points Gas Station	108 Delsea Dr		C2
Classic Automobile Group Inc	Black Horse Pk & Rt 555		C1
Turnersville Citgo Former	5321 Rt 42 S		C2
Washington Twp Garage	6000 Rt 42		C2
Lakeside Lk & Springlake Ave Gw Contamination	Lakeside Ln & Spring Lk Ave		C3
Fred Smith Orchards	Fish Pond Rd		B
Stratton Motors Inc	Rte 47 (Delsea Dr)		C2
PGSI - Pitman Extra	690 Delsea Dr		C1

Table 45. Active (Non-Homeowner) Contaminated Sites			
Site Name	Site Location	CEA Status	Category
Gloucester Cnty Mosquito Comm	Delsea Dr		C2
Greentree Shopping Center	117 Greentree Rd	Ongoing 5-18-2015	C2
Arnold Buick Incorporated	221 Delsea Dr		C2
H G Enderlein Company	301 Central Ave		C3
Colts Neck Estates	Egg Harbor Rd	Ongoing 7-22-1996	C2
Five Points Gas Stop	109 Delsea Dr @ Rt 47 & 41	Ongoing 4-30-2002	D
Marte Marsh	722 Black Horse Pk		C1
Exxon Store 3-2753	2700 Rt 42 Aka Blackhorse Pk		C2
3146 Crosskeys Glassboro Road	3146 Glassboro Cross Keys Rd		---
<i>Source: NJDEP(Accessed July 2017)</i>			

HISTORIC AND CULTURAL FEATURES

Washington Township’s earliest settlers were a thriving Lenni-Lenape Indian Village called Tetamekon. By the early 18th century, this area became home to European settlers as a part of the West Jersey land grant. Notable early settlers in the area include the Heritage family (1725), the Morgan family (1736), and the Collins family (1771). Others include the Turner family, for whom Turnersville was named, and the Hurff family of Hurffville. The plentiful water and arable land drew settlers looking for areas to farm, and by the mid-19th century, small farming communities began to appear. Over 200 farms existed at the Township’s peak of farming in the late 19th century. These communities, such as Turnersville, Hurffville, Creesville, and Dilksboro do not formally exist anymore, however they are still recognized as local geographic regions. The Township was originally part of Deptford Township in Gloucester County, and became incorporated into its own political entity in 1836. In 1844, the Township temporarily became part of Camden County, but was returned to Gloucester County in 1871. The Township grew in population with the settlement of various industries, notably General Mills, Inc. in 1899. Through the creation of railroads such as the West Jersey Railroad and the Pennsylvania-Reading Seashore Lines, industry and tourism were brought to Washington Township. Throughout the first half of the 20th century, the Township largely remained a farming community. However, after World War II, many people left the cities in search of more rural surroundings. This brought about the modern developments in the Township, leading to the disappearance of many farms and orchards. Soon afterwards, Washington Township grew into the thriving suburb it is today.⁹⁵

Historic and Cultural Sites

The historical sites of Washington Township identified by the NJDEP Historic Preservation Office (State Historic Preservation Office or SHPO) are identified in *Table 46*. Several other sites in the Township are of special historic interest and may be eligible for inclusion on the National or State Register but have yet to receive an opinion from the SHPO.

<i>Site Name</i>	<i>Address</i>	<i>SHPO Opinion</i>
Archaeological Site 28-GI-125		9/14/1982 (ID#1398)
Charcoal Kiln Site (28-GI-279)		7/17/1995 (ID#2849)
Davis Farm Prehistoric Site (28-GI-133)	Greentree Road	1/10/1985 (ID#3170)
George Morgan Stone House	Egg Harbor Road	6/20/1979 (ID#1418)
Hurff House and Outbuildings	Berlin Road and County Route 555	12/17/1981 (ID#1417)

The National Register of Historic Places, authorized by the National Historic Preservation Act of 1966, is a national program run by the National Park Service's National Register that aims to coordinate and support public and private efforts to identify, evaluate, and protect America's historic and archaeological resources. The George Morgan House is eligible for inclusion on the National Register and a grant requesting funds to complete the registration has been submitted.⁹⁶ At this time, there are no other sites within Washington Township are included or eligible for inclusion on the National Register. A full list of Historic Sites located in the Township is included in *Table 47*.

Sites explained

Olde Stone House Village

The Olde Stone House Village, located on Egg Harbor Road, features a collection of historic buildings representing the Township's 175 year history including the George Morgan House (*Figure 21*), a post office, a train station, and a church. Representing several distinct eras for the town, the village serves as a monument to the history of the area. Owned by George and Susanna Morgan, along with their six children, The George Morgan Stone House was built between 1730 and 1736 from locally quarried sandstone. It is a two-story brick and stone house, which has become the centerpiece of the Township's historical village. The Turnersville Post Office and Court House building was built in 1864 and served as a post office until 1903, when it was converted to a court room. It was moved to the village in 1988. Originally located on Church Road near Blackwood Lake, the Blackwood Railroad Station was built in 1891 and served as a stop along the Pennsylvania-Reading Seashore Line.



Figure 21. Old Stone House, Washington Township
Photo credit: Leon Lakritz- Environmental Commission

Bunker Hill Presbyterian Church

The Bunker Hill Presbyterian Church has been an active Church since the 1850's. The church itself was built in 1869 and was originally located on Hurffville-Crosskeys Road. It is the oldest church building in Gloucester County and was in constant use until 1984. It is now located at the Olde Stone Village on Egg Harbor Road. Although some features of the building have been replaced over the years, such as the stained glass windows in 1924, it still contains the original pews, pulpit, and chairs.⁹⁷

Quay House

Dating back to the late 18th century, the Quay House was a farmhouse previously owned by Charles Quay. The house holds one of the nation's largest private collections of antique farm machinery, assembled by the late Quay. Another notable resident of the house was John Turner, the founder of Turnersville. Several Indian sites have been found on the 80-acre tract where the house is located, and one of the oldest landmarks on the farm is a boundary marker dated 1731.

Hurff House

The Historic house of Thomas W. Hurff, the house still boasts the original hand blown glass windows and woodwork that was hewn by hand axes right on the spot. It is considered a fine example of early 1840's architecture.

Davis Farm Prehistoric Site

The Davis Farm Site is an example of a small base camp and procurement site representative of the somewhat transient lifestyle of the Late Archaic/Early-Middle Woodland Period.⁹⁸

Grenloch Terrace

Grenloch Terrace dates back to 1785, when it was the farm of John Wilkins. Grenloch Terrace was home to the Bateman Iron Age Implements, an international company which operated for many years in the area. The Grenloch Presbyterian Church was built in 1909. The church was built via subscription but largely at the incentive of the Bateman family, who owned the local factory. *Note:* The Wilkins homestead is located on Millburn Avenue in Grenloch and possibly dates from 1785. It has been restored and is a private residence.⁹⁹

Grenloch Lake was used by the employees of the Bateman Iron Age Implements for recreation and was opened for use by the public for boating and swimming as Grenloch Lake Park in 1888. With the arrival of the railroad, the park grew into a local amusement park with attractions, pavilion and a carousel carved by Charles Carmel whose "Carmel horses were known for their fine carving."¹⁰⁰

Table 47. Washington Township Historic Sites	
<i>Site Name</i>	<i>Location</i>
Bateman Homestead and Carriage House	
Bethel Cemetery	
Bethel United Methodist Church	Delsea Drive
Blacksmith Shop & House	Delsea Drive
Blackwood Railroad Station	Relocated to Olde Stone Village
Bradshaw Store and House	
Brown-Heggan-Federici House	Near the corner of Pitman-Downer Rd and Glassboro-Cross Keys Road
Brown-Hillman-Thomas House	Hurffville-Cross Keys Road
Bunker Hill Presbyterian Church	Hurffville-Cross Keys Road near Greentree Road
Bunkerhill Presbyterian Cemetery	Relocated to Olde Stone House Village- Egg Harbor Road
Bunkerhill School House	Hurffville-Cross Keys Road near Greentree Rd intersection
Chew General Store	Delsea Drive
David Duffield House	Chapel Heights Road
Davis-Haines Home	Hurffville-Cross Keys Road adjacent to Haines Dairy Homestead
Dilkes-Kincaid House	Delsea Drive
Duffield Farm House	Located adjacent to David Duffield home
Good-Intent Mill site	
Grenloch Park	
Haines Dairy Homestead	Hurffville-Cross Keys Road
Heritage Homestead	Salina Road
Hillcrest Memorial Park	
Hubert Read House	Black Horse Pike
Hurff General Store and Homestead	Corner of Delsea Drive and Hurffville-Cross Keys Rd (store was demolished in the 1980's)
Hurffville Grange Hall	
Joel Wood-Thron-Natale House	
Kandle Homestead	Chapel Heights Road
Kandle Mill House	Located adjacent to Duffield Run
Lloyd-Wharton House	
Locke-Davis House	Greentree Road adjacent to Washington Lake Park entrance
Methodist Episcopal Church	Chapel Heights Road
Nicholson Homestead	East Holly Avenue (was Nicholson Road)
Olde Stone House	Egg Harbor Road
Original Huffville School	Delsea Drive
Original Hurffville Grange Hall	
Quay House	Hurffville-Cross Keys Road
Reeves Mill House	Holly Ave just south of Pitman-Downer Road
Reeves Mill Site	Located adjacent to Reeves Mill House
Reid House	
Rowe-Hurff Homestead	Hurff Lane

Table 47. Washington Township Historic Sites	
<i>Site Name</i>	<i>Location</i>
Sears Kit Barn	
Silver Hill Graveyard	
St. John Methodist Cemetery	Corner of Black Horse Pike and Greentree Road
Tetamekon Lenni-Lenape Village	
Turner Farm	
Turner General Store & Post Office	Corner of County House Road and Black Horse Pike
Waters Edge-Senior's Lake – Clear Streams	Located along the Main Branch of the Mantua Creek between Greentree Road and Fish Pond Road
Williams-Bell Mill Site	Located adjacent to Bells Lake
Young-Kuhn House	
<i>Source: Washington Township Historical Preservation Commission¹⁰¹</i>	

APPENDIX

Appendix A. Soils

Appendix B. Soil Limitations

Appendix C. Soil Limitations for Building Site Development

Appendix D. Natural Heritage Priority Sites Species List

Appendix A. Soils

<i>Abbrv.</i>	<i>MU (Map Unit) Name</i>	<i>MU Type</i>	<i>Acres</i>	<i>% Twp.</i>
AtsAr	Atsion sand, 0 to 2 percent slopes, rarely flooded	Cn	2.82	0.02%
AucB	Aura loamy sand, 0 to 5 percent slopes	Cn	252.49	1.84%
AugA	Aura sandy loam, 0 to 2 percent slopes	Cn	1.75	0.01%
AugB	Aura sandy loam, 2 to 5 percent slopes	Cn	611.52	4.45%
AvsB	Aura-Sassafras loamy sands, 0 to 5 percent slopes	Cx	39.24	0.29%
AvsC	Aura-Sassafras loamy sands, 5 to 10 percent slopes	Cx	3.25	0.02%
AvtB	Aura-Sassafras sandy loams, 2 to 5 percent slopes	Cx	99.11	0.72%
AvtC	Aura-Sassafras sandy loams, 5 to 10 percent slopes	Cx	91.53	0.67%
AvtC2	Aura-Sassafras sandy loams, 5 to 10 percent slopes, eroded	Cx	64.25	0.47%
AvuB	Aura-Urban land complex, 0 to 5 percent slopes, eroded	Cx	1927.38	14.02%
AvuC	Aura-Urban land complex, 5 to 10 percent slopes	Cx	156.29	1.14%
BEXAS	Berryland and Mullica soils, 0 to 2 percent slopes, occasionally flooded	Un	83.51	0.61%
BumA	Buddtown-Deptford complex, 0 to 2 percent slopes	Cx	397.80	2.89%
BuuB	Buddtown-Urban land complex, 0 to 5 percent slopes	Cx	234.58	1.70%
CoeAs	Colemantown loam, 0 to 2 percent slopes, occasionally flooded	Cn	0.12	<0.01%
CokA	Collington sandy loam, 0 to 2 percent slopes	Cn	44.25	0.32%
CokC	Collington sandy loam, 5 to 10 percent slopes	Cn	5.48	0.04%
CopB	Collington-Urban land complex, 0 to 5 percent slopes	Cx	109.52	0.79%
DocB	Downer loamy sand, 0 to 5 percent slopes, Northern Coastal Plain	Cn	200.94	1.46%
DocC	Downer loamy sand, 5 to 10 percent slopes, Northern Coastal Plain	Cn	4.93	0.04%
DoeA	Downer sandy loam, 0 to 2 percent slopes, Northern Coastal Plain	Cn	26.05	0.18%
DoeB	Downer sandy loam, 2 to 5 percent slopes, Northern Coastal Plain	Cn	75.88	0.55%
DouB	Downer-Urban land complex, 0 to 5 percent slopes	Cx	276.35	2.0%
EveB	Evesboro sand, 0 to 5 percent slopes	Cn	161.97	1.17%
EveE	Evesboro sand, 15 to 25 percent slopes	Cn	1.92	0.01%
EvuB	Evesboro-Urban land complex, 0 to 5 percent slopes	Cx	22.595	0.16%
FamA	Fallsington sandy loams, 0 to 2 percent slopes, Northern Coastal Plain	Cn	158.83	1.15%

Appendix A. Soils

<i>Abbrev.</i>	<i>MU (Map Unit) Name</i>	<i>MU Type</i>	<i>Acres</i>	<i>% Twp.</i>
FapA	Fallsington loams, 0 to 2 percent slopes, Northern Coastal Plain	Cn	10.79	0.08%
FauB	Fallsington-Urban land complex, 0 to 5 percent slopes	Cx	24.44	0.18%
FmhAt	Fluvaquents, loamy, 0 to 3 percent slopes, frequently flooded	Cn	992.59	7.22%
FrFB	Freehold loamy sand, 0 to 5 percent slopes	Cn	60.11	0.43%
FrkA	Freehold sandy loam, 0 to 2 percent slopes	Cn	126.53	0.92%
FrkB	Freehold sandy loam, 2 to 5 percent slopes	Cn	19.31	0.14%
FrkC	Freehold sandy loam, 5 to 10 percent slopes	Cn	12.41	0.09%
FrkD	Freehold sandy loam, 10 to 15 percent slopes	Cn	0.47	<0.01%
FrkE	Freehold sandy loam, 15 to 25 percent slopes	Cn	32.90	0.24%
FrkF	Freehold sandy loam, 25 to 40 percent slopes	Cn	0.09	<0.01%
FrrB	Freehold-Urban land complex, 0 to 5 percent slopes	Cx	82.03	0.59%
HbmB	Hammonton loamy sand, 0 to 5 percent slopes	Cn	101.92	0.74%
JdrA	Jade Run fine sandy loam, 0 to 2 percent slopes	Cn	265.82	1.93%
JduA	Jade Run-Urban land complex, 0 to 2 percent slopes	Cx	69.37	0.50%
LasB	Lakewood sand, 0 to 5 percent slopes	Cn	4.90	0.04%
MakAt	Manahawkin muck, 0 to 2 percent slopes, frequently flooded	Cn	337.54	2.45%
MoaB	Marlton sandy loam, 2 to 5 percent slopes	Cn	7.67	0.05%
PHG	Pits, sand and gravel	Cn	96.34	0.07%
SabB	Sassafras loamy sand, 0 to 5 percent slopes	Cn	42.78	0.31%
SabC	Sassafras loamy sand, 5 to 10 percent slopes	Cn	57.85	0.42%
SabD	Sassafras loamy sand, 10 to 15 percent slopes	Cn	19.87	0.14%
SabF	Sassafras loamy sand, 15 to 40 percent slopes	Cn	126.58	0.92%
SacA	Sassafras sandy loam, 0 to 2 percent slopes, Northern Coastal Plain	Cn	461.75	3.36%
SacB	Sassafras sandy loam, 2 to 5 percent slopes, Northern Coastal Plain	Cn	34.21	0.25%
SacC	Sassafras sandy loam, 5 to 10 percent slopes	Cn	40.65	0.29%
SapB	Sassafras-Urban land complex, 0 to 5 percent slopes	Cx	176.82	1.28%
UdauB	Udorthents-Urban land complex, 0 to 8 percent slopes	Cx	41.152	0.29%
UR	Urban land	Cn	339.89	2.47%
USAURB	Urban land-Aura complex, 0 to 5 percent slopes	Cx	266.85	1.94%
USSASB	Urban land-Sassafras complex, 0 to 5 percent slopes	Cx	53.55	0.38%

Appendix A. Soils

<i>Abbrv.</i>	<i>MU (Map Unit) Name</i>	<i>MU Type</i>	<i>Acres</i>	<i>% Twp.</i>
Water	Water	Cn	120.23	0.87%
WeeB	Westphalia fine sandy loam, 2 to 5 percent slopes	Cn	1334.42	9.70%
WeeC	Westphalia fine sandy loam, 5 to 10 percent slopes	Cn	272.45	1.98%
WeeD	Westphalia fine sandy loam, 10 to 15 percent slopes	Cn	151.48	1.10%
WeeD2	Westphalia fine sandy loam, 10 to 15 percent slopes, eroded	Cn	5.12	0.04%
WeeF	Westphalia fine sandy loam, 15 to 40 percent slopes	Cn	135.52	0.98%
WehB	Westphalia-Urban land complex, 0 to 5 percent slopes	Cx	1719.31	12.5%
WehC	Westphalia-Urban land complex, 5 to 10 percent slopes	Cx	458.23	3.33%
WoeA	Woodstown sandy loam, 0 to 2 percent slopes, Northern Coastal Plain	Cn	21.66	0.16%
WokA	Woodstown-Glassboro complex, 0 to 2 percent slopes	Cx	356.59	2.59%
WooB	Woodstown-Urban land complex, 0 to 5 percent slopes	Cx	214.62	1.56%
Total			13,788.81¹	100.0%
<i>Source: NRCS Web Soil Survey (Accessed March 2017)</i>				

¹ Acres are calculated using ArcGIS 10.5 digital mapping software

Appendix B. Soil Limitations

Abbrev.	Depth to Restrictive Feature (cm)	Drainage	Depth to Water Table (cm)	Available Water Capacity (cm)	Flooding	Ponding	Frost Action Potential	Risk of Corrosion Steel	Risk of Corrosion Concrete	Septic Limitations
AucB	>56	Well drained	>200	0.09	None	None	Moderate	Low	High	Very Limited
AtsAr	>200	Poorly drained	15	0.06	Rare	Rare	Moderate	Low	High	Very Limited
AugA	56	Well drained	>200	0.10	None	None	Moderate	Low	High	Very Limited
AugB	56	Well drained	>200	0.10	None	None	Moderate	Low	High	Very Limited
AvsB	56	Well drained	>200	0.09	None	None	Moderate	Low	High	Very Limited
AvsC	56	Well drained	>200	0.09	None	None	Moderate	Low	High	Very Limited
AvtB	56	Well drained	>200	0.10	None	None	Moderate	Low	High	Very Limited
AvtC	56	Well drained	>200	0.10	None	None	Moderate	Low	High	Very Limited
AvtC2	51	Well drained	>200	0.10	None	None	Moderate	Low	High	Very Limited
AvuB	56	Well drained	>200	0.10	None	None	Moderate	Low	High	Very Limited
AvuC	56	Well drained	>200	0.10	None	None	Moderate	Low	High	Very Limited
BEXAS	>200	Very poorly drained	0	0.07	Occasional	Occasional	Moderate	Low	High	Very Limited
BumA	>200	Moderately well drained	76	0.11	None	None	Moderate	High	High	Very Limited
BuuB	>200	Moderately well drained	76	0.11	None	None	Moderate	High	High	Very Limited
CoeAs	>200	Poorly drained	15	0.20	Occasional	Occasional	High	High	Moderate	Very Limited
CokA	>200	Well drained	>200	0.12	None	None	Moderate	Moderate	High	Very Limited
CokC	>200	Well drained	>200	0.12	None	None	Moderate	Moderate	High	Very Limited
CopB	>200	Well drained	>200	0.12	None	None	Moderate	Moderate	High	Very Limited
DocB	>200	Well drained	>200	0.10	None	None	Moderate	Low	High	Very Limited
DocC	>200	Well drained	>200	0.10	None	None	Moderate	Low	High	Very Limited

Appendix B. Soil Limitations

Abbrv.	Depth to Restrictive Feature (cm)	Drainage	Depth to Water Table (cm)	Available Water Capacity (cm)	Flooding	Ponding	Frost Action Potential	Risk of Corrosion Steel	Risk of Corrosion Concrete	Septic Limitations
DoeA	>200	Well drained	>200	0.10	None	None	Moderate	Low	High	Very Limited
DoeB	>200	Well drained	>200	0.10	None	None	Moderate	Low	High	Very Limited
DouB	>200	Well drained	>200	0.11	None	None	Moderate	Low	High	Very Limited
EveB	>200	Excessively drained	>200	0.07	None	None	Low	Low	High	Very Limited
EveE	>200	Excessively drained	>200	0.07	None	None	Low	Low	High	Very Limited
EvuB	>200	Excessively drained	>200	0.07	None	None	Low	Low	High	Very Limited
FamA	>200	Poorly drained	13	0.12	None	Occasional	High	High	High	Very Limited
FapA	>200	Poorly drained	>13	0.12	None	Occasional	High	High	High	Very Limited
FauB	>200	Poorly drained	15	0.09	None	None	High	High	High	Very Limited
FmhAt	>200	Somewhat poorly drained	38	0.10	Frequent	Frequent	High	High	Moderate	Very Limited
FrFB	>200	Well drained	>200	0.12	None	None	Moderate	Moderate	High	Very Limited
FrkA	>200	Well drained	>200	0.13	None	None	Moderate	Moderate	High	Very Limited
FrkB	>200	Well drained	>200	0.13	None	None	Moderate	Moderate	High	Very Limited
FrkC	>200	Well drained	>200	0.13	None	None	Moderate	Moderate	High	Very Limited
FrkD	>200	Well drained	>200	0.12	None	None	Moderate	Moderate	High	Very Limited
FrkE	>200	Well drained	>200	0.13	None	None	Moderate	Moderate	High	Very Limited
FrkF	>200	Well drained	>200	0.13	None	None	Moderate	Moderate	High	Very Limited
FrrB	>200	Well drained	>200	0.13	None	None	Moderate	Moderate	High	Very Limited
HbmB	>200	Moderately well drained	76	0.11	None	None	Moderate	High	High	Very Limited
JdrA	>200	Poorly drained	15	0.12	None	None	High	High	High	Very Limited

Appendix B. Soil Limitations

Abbrv.	Depth to Restrictive Feature (cm)	Drainage	Depth to Water Table (cm)	Available Water Capacity (cm)	Flooding	Ponding	Frost Action Potential	Risk of Corrosion Steel	Risk of Corrosion Concrete	Septic Limitations
JduA	>200	Poorly drained	15	0.12	None	None	High	High	High	Very Limited
LasB	>200	Excessively drained	>200	0.02	None	None	Low	Low	High	Very Limited
MakAt	>200	Very poorly drained	0	0.23	Frequent	Frequent	High	High	High	Very Limited
MoaB	>200	Moderately well drained	76	0.14	None	None	Moderate	High	Moderate	Very Limited
PHG	>200	Well drained	>200	-	None	None	-	-	-	Not rated
PssA	>200	Well drained	122	0.07	None	None	Low	Low	High	Very Limited
SabB	>200	Well drained	>200	0.11	None	None	Moderate	Moderate	High	Very Limited
SabC	>200	Well drained	>200	0.11	None	None	Moderate	Moderate	High	Very Limited
SabD	>200	Well drained	>200	0.11	None	None	Moderate	Moderate	High	Very Limited
SabF	>200	Well drained	>200	0.11	None	None	Moderate	Moderate	High	Very Limited
SacA	>200	Well drained	>200	0.11	None	None	Moderate	Low	High	Very Limited
SacB	>200	Well drained	>200	0.11	None	None	Moderate	Low	High	Very Limited
SacC	>200	Well drained	>200	0.11	None	None	Moderate	Moderate	High	Very Limited
SapB	>200	Well drained	>200	0.11	None	None	Moderate	Moderate	High	Very Limited
UdauB	>200	Well drained	>200	0.12	None	None	Low	Low	High	Very Limited
UR	>200	-	>200	-	None	None	-	-	-	Not rated
USAURB	>200	-	>200	-	None	None	-	-	-	Not rated
USSASB	>200	-	>200	-	None	None	-	-	-	Not rated
Water	>200	-	>200	-	None	None	-	-	-	Not Rated
WebA	>200	Very poorly drained	15	0.12	None	None	None	High	High	Very Limited
WedB	>200	Well drained	>200	0.14	None	None	Moderate	Low	High	Very Limited

Appendix B. Soil Limitations

Abbrv.	Depth to Restrictive Feature (cm)	Drainage	Depth to Water Table (cm)	Available Water Capacity (cm)	Flooding	Ponding	Frost Action Potential	Risk of Corrosion Steel	Risk of Corrosion Concrete	Septic Limitations
WedC	>200	Well drained	>200	0.11	None	None	Moderate	Low	High	Very Limited
WeeB	>200	Well drained	>200	0.14	None	None	Moderate	Low		Very Limited
WeeC	>200	Well drained	>200	0.11	None	None	Moderate	Low	High	Very Limited
WeeD	>200	Well drained	>200	0.11	None	None	Moderate	Low	High	Very Limited
WeeD2	>200	Well drained	>200	0.10	None	None	Moderate	Low	High	Very Limited
WeeF	>200	Well drained	>200	0.11	None	None	Moderate	Low	High	Very Limited
WefB	>200	Well drained	>200	0.15	None	None	Moderate	Low	High	Very Limited
WehB	>200	Well drained	>200	0.11	None	None	Moderate	Low	High	Very Limited
WehC	>200	Well drained	>200	0.11	None	None	Moderate	Low	High	Very Limited
WoeA	>200	Moderately well drained	61	0.13	None	None	Moderate	Moderate	High	Very Limited
WokA	>200	Moderately well drained	76	0.09	None	None	Moderate	High	High	Very Limited
WooB	>200	Moderately well drained	76	0.10	None	None	Moderate	High	High	Very Limited

Appendix C. Soil Limitations for Building Site Development

<i>Rating</i>	<i>Dwellings with Basements</i>	<i>Dwellings without Basements</i>	<i>Small Commercial Buildings</i>
Not Rated	Water (120.23) PHG (96.34) UR (339.89) USAURB (266.85) USSASB (53.55) Total Acres: 876.86 % of Township: 6.37%	Water (120.23) PHG (96.34) UR (339.89) USAURB (266.85) USSASB (53.55) Total Acres: 876.87 % of Township: 6.37%	Water (120.23) PHG (96.34) UR (339.89) USAURB (266.85) USSASB (53.55) Total Acres: 876.87 % of Township: 6.37%
Not Limited	DocC (4.93) AucB (252.49) AugA (1.75) AugB (611.52) AvsB (39.24) AvsC (3.25) AvtB (99.12) AvtC (91.53) AvtC2 (64.25) AvuB (1,927.38) AvuC (156.29) CokA (44.25) CokC (5.48) CopB (109.52) DocB (200.94) DoeA (26.03) DoeB (75.88) DouB (276.35) EveB (161.97) EvuB (22.58) FrfB (60.11) FrkA (126.53) FrkB (19.31) FrkC (12.40) FrrB (82.03) LasB (4.89) SabB (42.78) SabC (57.85) SabD (19.87) SacA (461.74) SacB (34.21) SacC (40.65) SapB (176.82) UdauB (41.15) WeeB (1,334.42) WeeC (272.45) WehB (1,719.31) WehC (458.23) Total Acres: 9195.98 % of Township: 66.87%	DocC (4.93) BumA (397.79) BuuB (234.58) CokC (5.48) DocB (200.94) DocC (4.93) DoeA (26.05) DoeB (75.88) DouB (276.35) EveB (161.97) EvuB (22.60) FrfB (60.11) EvuB (22.60) FrkA (126.53) FrkB (19.31) FrkC (12.41) FrfB (60.11) HbmB (101.92) LasB (4.89) SabB (42.78) SabC (57.85) UdauB (41.15) WeeB (1,334.42) WeeC (272.45) WehB (1,719.32) WehC (458.23) Total Acres: 6436.42 % of Township: 46.8%	DocC (4.93) BumA (397.80) BuuB (234.58) DocB (200.94) DoeA (26.05) DoeB (75.88) DouB (276.35) EveB (161.97) EvuB (22.60) FrfB (60.11) FrkA (126.53) FrkB (19.31) FrrB (82.03) HbmB (101.92) LasB (4.90) SabB (42.78) SabC (57.85) SacA (461.74) SacB (34.21) SapB (176.82) WeeB (1,334.43) WehB (1,719.32) WokA (356.59) WooB (214.62) Total Acres: 6194.25 % of Township: 45.05%

Appendix C. Soil Limitations for Building Site Development

<i>Rating</i>	<i>Dwellings with Basements</i>	<i>Dwellings without Basements</i>	<i>Small Commercial Buildings</i>
Somewhat Limited	WeeD (151.48) WeeD2 (5.12) FrkD (0.47) Total Acres: 157.08 % of Township: 1.14%	WeeD (151.48) WeeD2 (5.12) AucB (252.49) AugA (1.75) AugB (611.52) AvsB (39.24) AvsC (3.25) AvtB (99.12) AvtC (91.53) AvtC2 (64.25) AvuB (1,927.38) AvuC (156.29) CokA (44.25) CopB (109.52) FrkD (0.47) MaoB (7.67) SabD (19.87) WeeD (151.48) WeeD2 (5.12) WoeA (21.66) Total Acres: 3763.48 % of Township: 27.37%	AucB (252.49) AugA (1.75) AugB (611.52) AvsB (39.24) AvsC (3.25) AvtB (99.12) AvtC (91.53) AvtC2 (64.25) AvuB (1,927.38) AvuC (156.29) CokA (44.25) CopB (109.52) DocC (4.93) FrkC (12.41) MaoB (7.67) SacC (40.65) UdauB (41.15) WeeC (272.45) WehC (458.23) WoeA (21.66) Total Acres: 4259.75 % of Township: 30.98%
Very Limited	BumA (397.797) EveE (1.9225) FamA (158.8307) FmhAt (992.5864) JdrA (265.8177) AtsAr (2.8202) BEXAS (83.51242) BuuB (234.5796) CoeAs (0.1165) FapA (10.78617) FauB (24.43578) EveE (1.9225) FrkE (32.90186) FrkF (0.0881) HbmB (101.9224) JduA (69.36561) MakAt (337.5492) MaoB (7.667356) SabF (126.5823) WeeF (135.5214) WoeA (21.66068) WokA (356.5883) WooB (214.6249) Total Acres: 3579.60 % of Township: 26.03%	EveE (1.92) AtsAr (2.82) BEXAS (83.51) CoeAs (0.12) EveE (1.92) FamA (158.83) FapA (10.79) FauB (24.44) FmhAt (992.59) FrkE (32.90) FrkF (0.09) JdrA (265.82) JduA (69.36) MakAt (337.55) SabF (126.58) WeeF (135.52) WokA (356.59) WooB (214.62) Total Acres: 2815.97 % of Township: 20.48%	AtsAr (2.82) BEXAS (83.51) CoeAs (0.12) CokC (5.48) EveE (2.0) FamA (158.83) FapA (10.79) FauB (24.44) FmhAt (992.59) FrkD (0.47) FrkE (32.90) FrkF (0.09) JdrA (265.81) JduA (69.36) MakAt (337.55) SabD (19.87) SabF (126.58) WeeD (151.48) WeeD2 (5.12) WeeF (135.52) Total Acres: 2425.35 % of Township: 17.64%



State of New Jersey

CHRIS CHRISTIE
Governor

DEPARTMENT OF ENVIRONMENTAL PROTECTION
Division of Parks & Forestry
State Forestry Service
Mail Code 501-04

BOB MARTIN
Commissioner

KIM GUADAGNO
Lt. Governor

Office of Natural Lands Management – Natural Heritage Program
P.O. Box 420
Trenton, NJ 08625-0420
Tel. (609) 984-1339 Fax. (609) 984-1427

February 13, 2017

Jason Gonter, Business Administrator
Township of Washington
523 Egg Harbor Road
Sewell, NJ 08080

Re: Washington Township Environmental Resource Inventory
Washington Township, Gloucester County

Dear Mr. Gonter:

Thank you for your data request regarding rare species information for the above referenced project site.

Searches of the Natural Heritage Database and the Landscape Project (Version 3.1) are based on a representation of the boundaries of your project site in our Geographic Information System (GIS). We make every effort to accurately transfer your project bounds from the topographic map(s) submitted with the Natural Heritage Data Request Form into our Geographic Information System. We do not typically verify that your project bounds are accurate, or check them against other sources.

We have checked the Landscape Project habitat mapping and the Biotics Database for occurrences of any rare wildlife species or wildlife habitat on the referenced site. The Natural Heritage Database was searched for occurrences of rare plant species or ecological communities that may be on the project site. Please refer to Table 1 (attached) to determine if any rare plant species, ecological communities, or rare wildlife species or wildlife habitat are documented on site. A detailed report is provided for each category coded as 'Yes' in Table 1.

This report does not include information concerning known Northern Long-eared Bat hibernacula and maternity roost trees protected under the provisions of the U.S. Fish & Wildlife Service's 4(d) Rule. You must contact the U.S. Fish & Wildlife Service, New Jersey Field Office, for additional information concerning the location of these features, or visit their website at: <http://www.fws.gov/northeast/njfieldoffice/endangered/consultation.html>.

We have also checked the Landscape Project habitat mapping and Biotics Database for occurrences of rare wildlife species or wildlife habitat in the immediate vicinity (within ¼ mile) of the referenced site. Additionally, the Natural Heritage Database was checked for occurrences of rare plant species or ecological communities within ¼ mile of the site. Please refer to Table 2 (attached) to determine if any rare plant species, ecological communities, or rare wildlife species or wildlife habitat are documented within the immediate vicinity of the site. Detailed reports are provided for all categories coded as 'Yes' in Table 2. These reports may include species that have also been documented on the project site.

The Natural Heritage Program reviews its data periodically to identify priority sites for natural diversity in the State. Included as priority sites are some of the State's best habitats for rare and endangered species and ecological communities. Please refer to Tables 1 and 2 (attached) to determine if any priority sites are located on or in the immediate vicinity of the site.

NHP File No. 17-3907571-11379

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

Status and rank codes used in the tables and lists are defined in EXPLANATION OF CODES USED IN NATURAL HERITAGE REPORTS, which can be downloaded from http://www.state.nj.us/dep/parksandforests/natural/heritage/nhpcodes_2010.pdf.

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

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

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

Sincerely,



Robert J. Cartica
Administrator

c: NHP File No. 17-3907571-11379

Table 1: On Site Data Request Search Results (6 Possible Reports)

<u>Report Name</u>	<u>Included</u>	<u>Number of Pages</u>
1. Possibly on Project Site Based on Search of Natural Heritage Database: Rare Plant Species and Ecological Communities Currently Recorded in the New Jersey Natural Heritage Database	Yes	2 page(s) included
2. Natural Heritage Priority Sites On Site	Yes	See emailed attachments
3. Rare Wildlife Species or Wildlife Habitat on the Project Site Based on Search of Landscape Project 3.1 Species Based Patches	Yes	1 page(s) included
4. Vernal Pool Habitat on the Project Site Based on Search of Landscape Project 3.1	Yes	1 page(s) included
5. Rare Wildlife Species or Wildlife Habitat on the Project Site Based on Search of Landscape Project 3.1 Stream Habitat File	Yes	1 page(s) included
6. Other Animal Species On the Project Site Based on Additional Species Tracked by Endangered and Nongame Species Program	No	0 pages included

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

Scientific Name	Common Name	Federal Protection Status	State Protection Status	Regional Status	Grank	Sranks	Identified	Last Observed	Location
<i>Vascular Plants</i>									
<i>Asimina triloba</i>	Pawpaw	E		LP, HL	G5	S1	Y - Yes	1992-08-04	Approximately 1 mile east-southeast of Sewell, along Mantua Creek.
<i>Carex mesochorea</i>	Midland Sedge			HL	G4G5	S2	Y - Yes	2008-08-18	Located 0.1 mile northwest of intersection of Bamsboro Road and Good Intent Lower Landing Road, 200 feet from South Branch, in locale of Good Intent within Washington Township (Gloucester County).
<i>Helonias bullata</i>	Swamp-pink	LT	E	LP, HL	G3	S3	Y - Yes	2010-09-09	1997: SOUTH BRANCH OF BIG TIMBER CREEK FROM JUST SOUTH OF THE ATLANTIC CITY EXPRESSWAY TO CA. 0.5 MILE NORTH-NORTHWEST OF JONES LAKE. 2010: Located 0.4 mile east-northeast of Whitman Square.
<i>Helonias bullata</i>	Swamp-pink	LT	E	LP, HL	G3	S3	Y - Yes	1997-08-19	AT SEVERAL LOCATIONS ALONG MANTUA CREEK AND ITS TRIBUTARIES BETWEEN GREEN TREE AND FISH POND ROADS.
<i>Helonias bullata</i>	Swamp-pink	LT	E	LP, HL	G3	S3	Y - Yes	2009-09-15	Located 0.9 mile east of intersection of Pitman Downer Road and Altair Drive, 500 feet west of where Duffield Run crosses Altair Drive, in Washington Township.
<i>Helonias bullata</i>	Swamp-pink	LT	E	LP, HL	G3	S3	Y - Yes	1997-05-31	JUST SE OF THE INTERSECTION OF GREEN TREE RD. & PITMAN-DOWNER RD. UPSTREAM OF SENIOR LAKES, MANTUA CREEK.
<i>Phaseolus polystachios</i> var. <i>polystachios</i>	Wild Kidney Bean			HL	G5T5?	S2	Y - Yes	1992-08-04	Approximately 0.8 mile east-southeast of Sewell.

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

Scientific Name	Common Name	Federal Protection Status	State Protection Status	Regional Status	Grank	Sranks	Identified	Last Observed	Location
<i>Prunus angustifolia</i> var. <i>angustifolia</i>	Chickasaw Plum			HL	G5T4T5	S2	Y - Yes	1988-08-10	N. OF GRENLOCH TERRACE SCHOOL AND CA. 0.2 MI. WEST OF RT. 168 & C.A. 0.1 MI. SW OF LAKE GRENLOCH.

Total number of records: 8

**Rare Wildlife Species or Wildlife Habitat on the
Project Site Based on Search of
Landscape Project 3.1 Species Based Patches**

Class	Common Name	Scientific Name	Feature Type	Rank	Federal Protection Status	State Protection Status	Grank	Strank
Aves	Bald Eagle	Haliaeetus leucocephalus	Foraging	4	NA	State Endangered	G5	S1B,S2N
	Cooper's Hawk	Accipiter cooperii	Nest	2	NA	Special Concern	G5	S3B,S4N
	Great Blue Heron	Ardea herodias	Foraging	2	NA	Special Concern	G5	S3B,S4N
	Red-headed Woodpecker	Melanerpes erythrocephalus	Breeding Sighting	3	NA	State Threatened	G5	S2B,S2N
	Red-shouldered Hawk	Buteo lineatus	Nest	4	NA	State Endangered	G5	S1B,S3N

**Vernal Pool Habitat on the
Project Site Based on Search of
Landscape Project 3.1**

Vernal Pool Habitat Type	Vernal Pool Habitat ID
Potential vernal habitat area	979
Potential vernal habitat area	993
Potential vernal habitat area	1036
Potential vernal habitat area	1047
Potential vernal habitat area	1069
Potential vernal habitat area	1073
Potential vernal habitat area	1100
Total number of records:	7

**Rare Wildlife Species or Wildlife Habitat
On the Project Site Based on Search of
Landscape Project 3.1 Stream Habitat File**

Link ID	Common Name	Scientific Name	Feature Type	Rank	Federal Protection Status	State Protection Status	Grank	Srank	Last Observed	Count
51952	Creeper	<i>Strophitus undulatus</i>	Occupied Habitat	2	NA	Special Concern	G5	S3	2003	2
51952	Triangle Floater	<i>Alasmidonta undulata</i>	Occupied Habitat	3	NA	State Threatened	G4	S2	2003	1

Total number of records: 2

Table 2: Vicinity Data Request Search Results (6 possible reports)

<u>Report Name</u>	<u>Included</u>	<u>Number of Pages</u>
1. Immediate Vicinity of the Project Site Based on Search of Natural Heritage Database: Rare Plant Species and Ecological Communities Currently Recorded in the New Jersey Natural Heritage Database	Yes	3 page(s) included
2. Natural Heritage Priority Sites within the Immediate Vicinity	Yes	See emailed attachments
3. Rare Wildlife Species or Wildlife Habitat Within the Immediate Vicinity of the Project Site Based on Search of Landscape Project 3.1 Species Based Patches	Yes	1 page(s) included
4. Vernal Pool Habitat In the Immediate Vicinity of Project Site Based on Search of Landscape Project 3.1	Yes	1 page(s) included
5. Rare Wildlife Species or Wildlife Habitat In the Immediate Vicinity of the Project Site Based on Search of Landscape Project 3.1 Stream Habitat File	Yes	1 page(s) included
6. Other Animal Species In the Immediate Vicinity of the Project Site Based on Additional Species Tracked by Endangered and Nongame Species Program	No	0 pages included

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

Scientific Name	Common Name	Federal Protection Status	State Protection Status	Regional Status	Grank	Strank	Identified	Last Observed	Location
<i>Amianthium muscitoxicum</i>	Fly Poison		HL	G4G5	S2	Y - Yes	1992-03-??	SOUTHSIDE OF MANTUA CREEK, SOUTH WEST OF SENIOR LAKES.	
<i>Amianthium muscitoxicum</i>	Fly Poison		HL	G4G5	S2	Y - Yes	1931-06-14	TRIBUTARY OF SOUTH BRANCH TIMBER CREEK CA. 1 MILE WEST-SOUTHWEST OF TURNERSVILLE.	
<i>Aplectrum hyemale</i>	Puttyroot	E	LP, HL	G5	S1	Y - Yes	1923-05-18	ALONG STREAMLET TRIBUTARY TO SOUTH BRANCH TIMBER CREEK N. OF BLACKWOOD.	
<i>Asclepias variegata</i>	White Milkweed		HL	G5	S1	Y - Yes	1919-05-30	TRIBUTARY TO SOUTH BRANCH, TIMBER CREEK, W. OF BLACKWOOD.	
<i>Asimina triloba</i>	Pawpaw	E	LP, HL	G5	S1	Y - Yes	1992-08-04	Approximately 1 mile east-southeast of Sewell, along Mantua Creek.	
<i>Carex aggregata</i>	Glomerate Sedge		HL	G5	S1S2	Y - Yes	1919-05-30	South of Blackwood along streamlet tributary to South Branch of Timber Creek.	
<i>Castilleja coccinea</i>	Scarlet Indian-paintbrush		HL	G5	S2	Y - Yes	1933-05-14	ON STREAMLET TRIBUTARY TO SOUTH BRANCH OF TIMBER CREEK, CA. 1 MILE WEST-SOUTHWEST OF TURNERSVILLE.	
<i>Doellingeria infirma</i>	Cornel-leaf Aster		HL	G5	S2	Y - Yes	1921-09-24	SOUTH BRANCH TIMBERCREEK, BLACKWOOD.	
<i>Epilobium strictum</i>	Downy Willowherb		HL	G5?	S2	Y - Yes	1923-09-23	Along Mantua Creek, 3/4 mile southwest of Hurffville.	
<i>Helonias bullata</i>	Swamp-pink	LT	LP, HL	G3	S3	Y - Yes	1997-08-19	AT SEVERAL LOCATIONS ALONG MANTUA CREEK AND ITS TRIBUTARIES BETWEEN GREEN TREE AND FISH POND ROADS.	

Vascular Plants

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

Scientific Name	Common Name	Federal Protection Status	State Protection Status	Regional Status	Grank	Strank	Identified	Last Observed	Location
<i>Helonias bullata</i>	Swamp-pink	LT	E	LP, HL	G3	S3	Y - Yes	2002-10-29	Beaverdam Branch and also along tributary to Beaverdam Branch. Both north and south of Rt. 322, ca 2 mi. east of Glassboro.
<i>Helonias bullata</i>	Swamp-pink	LT	E	LP, HL	G3	S3	Y - Yes	2010-09-09	1997: SOUTH BRANCH OF BIG TIMBER CREEK FROM JUST SOUTH OF THE ATLANTIC CITY EXPRESSWAY TO CA. 0.5 MILE NORTH-NORTHWEST OF JONES LAKE. 2010: Located 0.4 mile east-northeast of Whitman Square.
<i>Luzula acuminata</i> var. <i>acuminata</i>	Hairy Wood-rush		E	LP, HL	G5T5	S1	Y - Yes	1992-08-04	Branch of Mantua Creek ca. 0.8 mile east of Sewell.
<i>Lysimachia lanceolata</i>	Lance-leaf Loosestrife		E	LP, HL	G5	S1	Y - Yes	1920-06-26	Slope [w] [of] Blackwood along streamlet tributary to South Branch Timber Creek.
<i>Melanthium virginicum</i>	Virginia Bunchflower		E	LP, HL	G5	S1	Y - Yes	1934-?-?-?	STREAMLET TRIBUTARY TO SOUTH BRANCH TIMBER CREEK CA. 1 MI. WSW OF TURNERSVILLE.
<i>Phaseolus polystachios</i> var. <i>polystachios</i>	Wild Kidney Bean			HL	G5T5?	S2	Y - Yes	1992-08-04	Approximately 0.8 mile east-southeast of Sewell.
<i>Phaseolus polystachios</i> var. <i>polystachios</i>	Wild Kidney Bean			HL	G5T5?	S2	Y - Yes	1917-07-31	Along streamlet tributary to South Branch Timber Creek west of Blackwood.
<i>Phlox maculata</i> var. <i>maculata</i>	Spotted Phlox			HL	G5T4T5	S2	Y - Yes	1919-05-18	Along Mantua Creek, 3/4 mile southwest of Hurffville.
<i>Sphenopholis</i>	Swamp Oats			HL	G4	S2	Y - Yes	1915-05-25	On Bees Branch north of Hurffville.
<i>Vernonia glauca</i>	Broad-leaf Ironweed		E	LP, HL	G5	S1	Y - Yes	1999-07-21	ALONG STREAMLET TRIBUTARY TO SOUTH BRANCH TIMBER CREEK, W. OF BLACKWOOD.

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

Scientific Name	Common Name	Federal Protection Status	State Protection Status	Regional Status	Grank	Srank	Identified	Last Observed	Location
<i>Zigadenus leimanthoides</i>	Death-camus	E		LP, HL	G4Q	S1	Y - Yes	1931-09-20	1 mile West-southwest of Turnersville on streamlet tributary of the South Branch of Timber Creek.

Total number of records: 21

**Rare Wildlife Species or Wildlife Habitat Within the
Immediate Vicinity of the Project Site Based on Search of
Landscape Project 3.1 Species Based Patches**

Class	Common Name	Scientific Name	Feature Type	Rank	Federal Protection Status	State Protection Status	Grank	Srank
Aves	Bald Eagle	Haliaeetus leucocephalus	Foraging	4	NA	State Endangered	G5	S1B,S2N
	Bobolink	Dolichonyx oryzivorus	Breeding Sighting	3	NA	State Threatened	G5	S2B,S3N
	Cooper's Hawk	Accipiter cooperii	Nest	2	NA	Special Concern	G5	S3B,S4N
	Great Blue Heron	Ardea herodias	Foraging	2	NA	Special Concern	G5	S3B,S4N
	Red-shouldered Hawk	Buteo lineatus	Nest	4	NA	State Endangered	G5	S1B,S3N

**Vernal Pool Habitat
In the Immediate Vicinity of
Project Site Based on Search of
Landscape Project 3.1**

Vernal Pool Habitat Type	Vernal Pool Habitat ID
Potential vernal habitat area	979
Potential vernal habitat area	1073
Potential vernal habitat area	1100
Potential vernal habitat area	1130
Total number of records:	4

**Rare Wildlife Species or Wildlife Habitat
In the Immediate Vicinity of the
Project Site Based on Search of
Landscape Project 3.1 Stream Habitat File**

Link ID	Common Name	Scientific Name	Feature Type	Rank	Federal Protection Status	State Protection Status	Grank	Strank	Last Observed	Count
51952	Creepers	<i>Strophitus undulatus</i>	Occupied Habitat	2	NA	Special Concern	G5	S3	2003	2
51952	Triangle Floater	<i>Alasmidonta undulata</i>	Occupied Habitat	3	NA	State Threatened	G4	S2	2003	1

Total number of records: 2

MAPS

Map 1. Base Map

Map 2. Geological Formations

Map 3. Soil Series

Map 4. Agricultural Soils

Map 5. Watersheds

Map 6. Surface Water Use Classifications

Map 7. Aquifer Recharge Potential

Map 8. Aquifer Ranking

Map 9. Public Wellhead Protection Areas

Map 10. Wetlands

Map 11. Land Use/Land Cover

Map 12. Preserved Open Space

Map 13. Endangered Species





Map 14. Potential Vernal Habitat

Map 15. FEMA Flood Zones


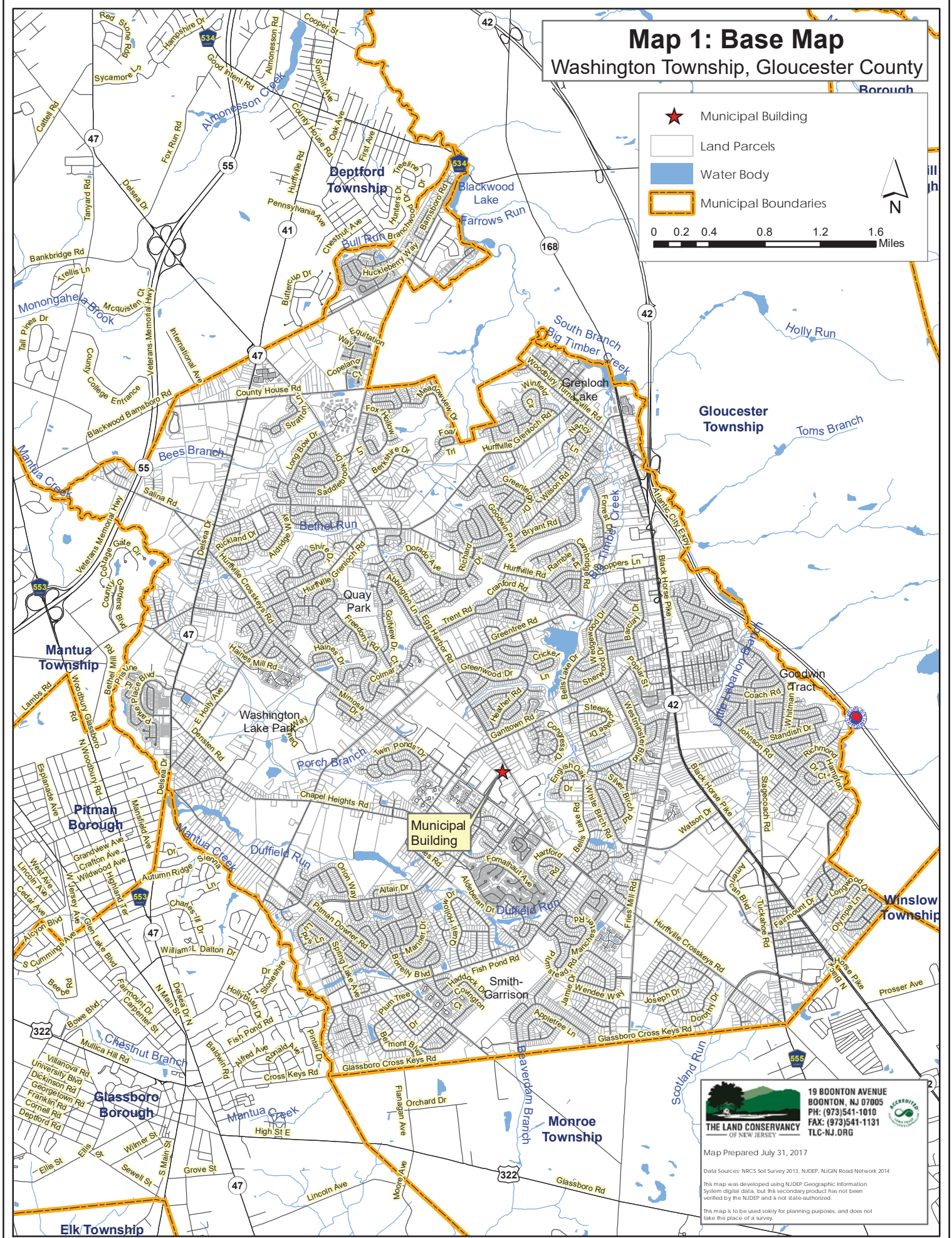

Map 16. Known Contaminate Sites (Non-Homeowner)

Map 1: Base Map

Washington Township, Gloucester County

-  Municipal Building
-  Land Parcels
-  Water Body
-  Municipal Boundaries

0 0.2 0.4 0.8 1.2 1.6 Miles









19 BOONTON AVENUE
BOONTON, NJ 07005
PH: (973)541-1010
FAX: (973)541-1131
TLC-NJ.ORG

Map Prepared July 31, 2017


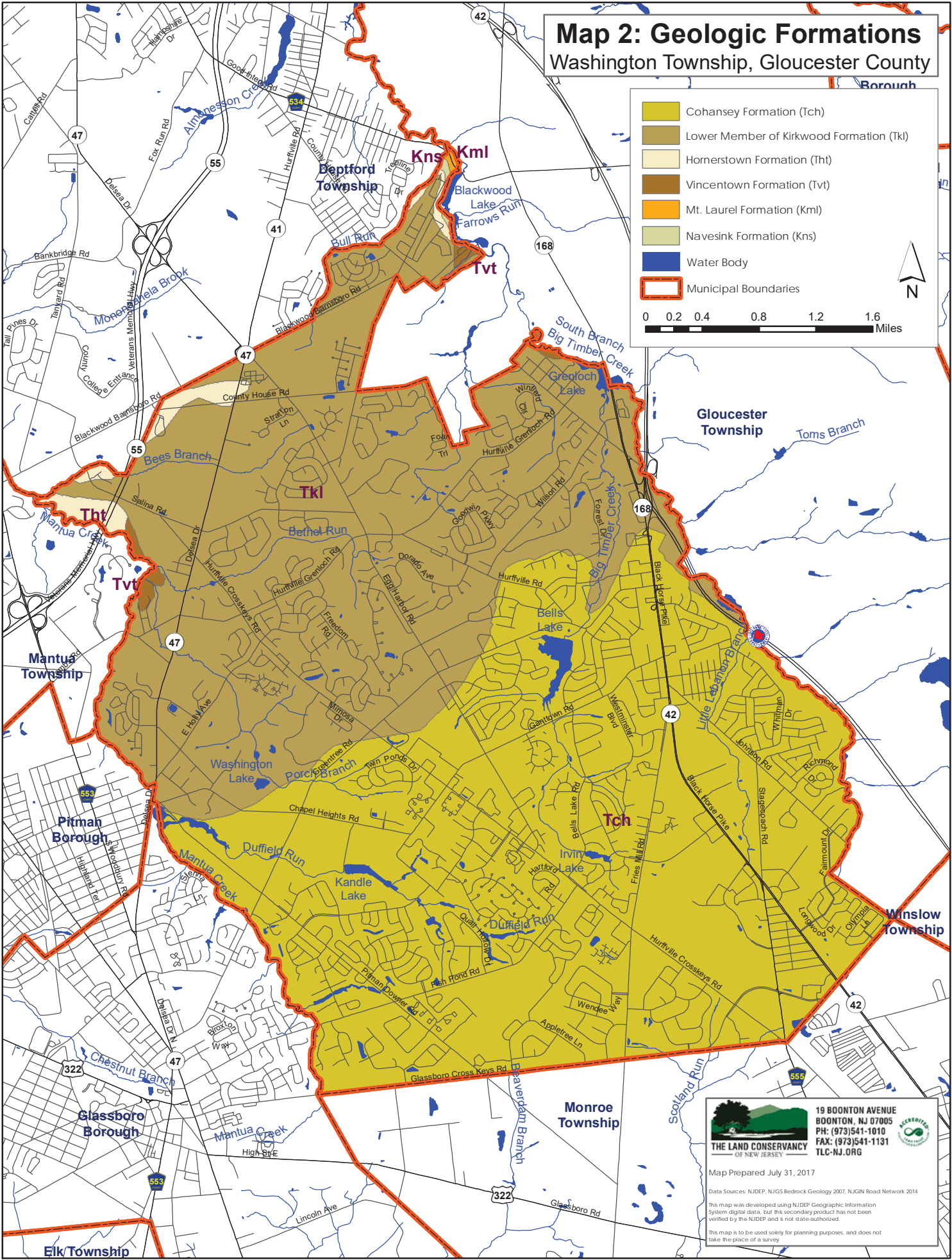

Data Sources: NRCS Soil Survey 2013, NJDEP, NJGIN Road Network 2014
This map was developed using NJDEP Geographic Information System digital data, but this secondary product has not been verified by the NJDEP and is not state-authorized.
This map is to be used solely for planning purposes, and does not take the place of a survey.

Map 2: Geologic Formations

Washington Township, Gloucester County

	Cohansey Formation (Tch)
	Lower Member of Kirkwood Formation (Tkl)
	Homerstown Formation (Tht)
	Vincetown Formation (Tvt)
	Mt. Laurel Formation (Kml)
	Navesink Formation (Kns)
	Water Body
	Municipal Boundaries

0 0.2 0.4 0.8 1.2 1.6 Miles

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TLC-NJ.ORG

Map Prepared July 31, 2017

Data Sources: NJDEP, NJGS Bedrock Geology 2007, NJGIS Road Network 2014

This map was developed using NJDEP Geographic Information System digital data, but this secondary product has not been verified by the NJDEP and is not state-authorized.

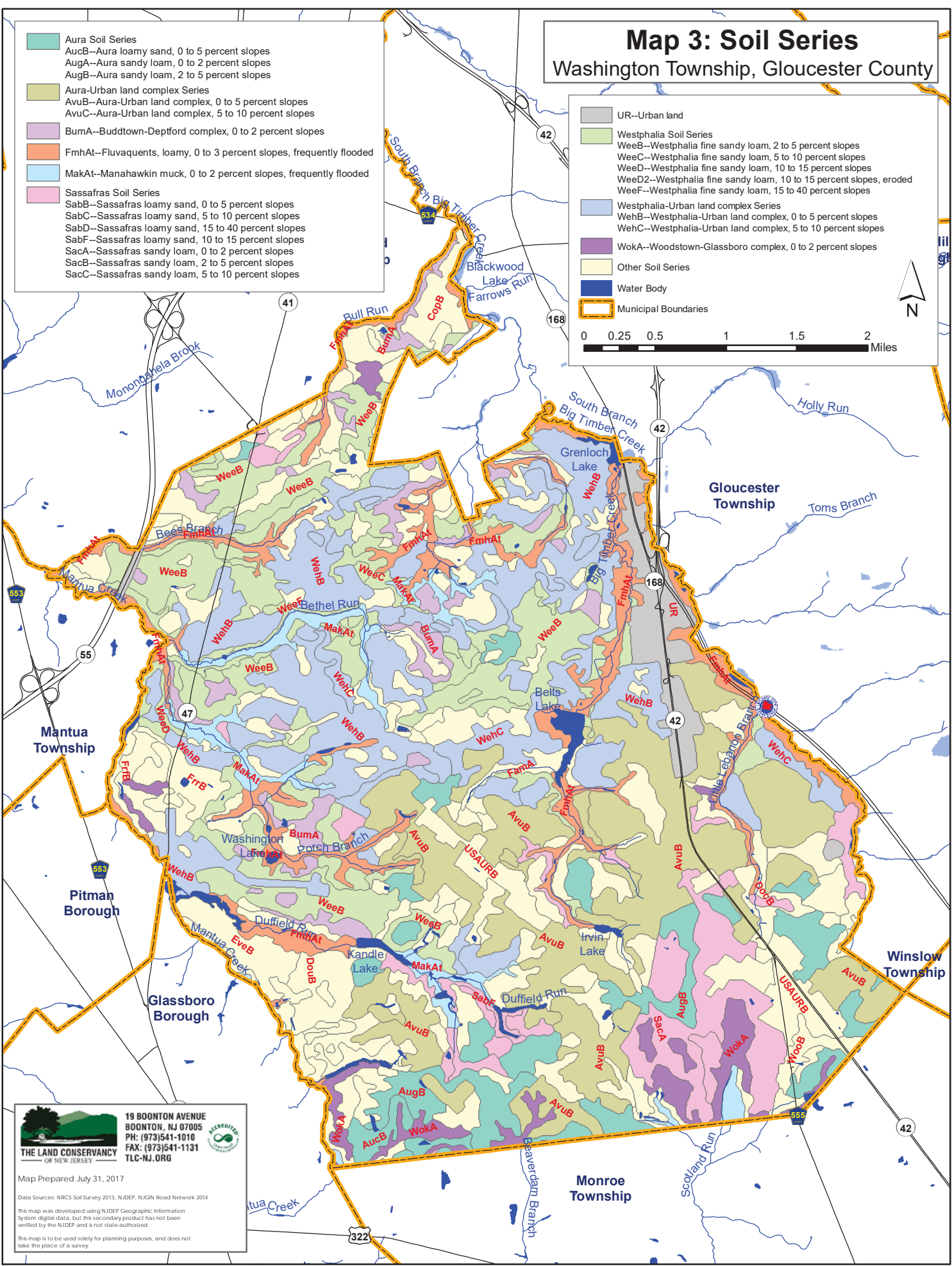
This map is to be used solely for planning purposes, and does not take the place of a survey.

Map 3: Soil Series

Washington Township, Gloucester County

- Aura Soil Series
 - AucB--Aura loamy sand, 0 to 5 percent slopes
 - AugA--Aura sandy loam, 0 to 2 percent slopes
 - AugB--Aura sandy loam, 2 to 5 percent slopes
- Aura-Urban land complex Series
 - AvuB--Aura-Urban land complex, 0 to 5 percent slopes
 - AvuC--Aura-Urban land complex, 5 to 10 percent slopes
- BumA--Buddtown-Deptford complex, 0 to 2 percent slopes
- FmhAt--Fluvaquents, loamy, 0 to 3 percent slopes, frequently flooded
- MakAt--Manahawkin muck, 0 to 2 percent slopes, frequently flooded
- Sassafraz Soil Series
 - SabB--Sassafraz loamy sand, 0 to 5 percent slopes
 - SabC--Sassafraz loamy sand, 5 to 10 percent slopes
 - SabD--Sassafraz loamy sand, 15 to 40 percent slopes
 - SabF--Sassafraz loamy sand, 10 to 15 percent slopes
 - SacA--Sassafraz sandy loam, 0 to 2 percent slopes
 - SacB--Sassafraz sandy loam, 2 to 5 percent slopes
 - SacC--Sassafraz sandy loam, 5 to 10 percent slopes

- UR--Urban land
- Westphalia Soil Series
 - WeeB--Westphalia fine sandy loam, 2 to 5 percent slopes
 - WeeC--Westphalia fine sandy loam, 5 to 10 percent slopes
 - WeeD--Westphalia fine sandy loam, 10 to 15 percent slopes
 - WeeD2--Westphalia fine sandy loam, 10 to 15 percent slopes, eroded
 - WeeF--Westphalia fine sandy loam, 15 to 40 percent slopes
- Westphalia-Urban land complex Series
 - WehB--Westphalia-Urban land complex, 0 to 5 percent slopes
 - WehC--Westphalia-Urban land complex, 5 to 10 percent slopes
- WokA--Woodstown-Glassboro complex, 0 to 2 percent slopes
- Other Soil Series
- Water Body
- Municipal Boundaries



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Map Prepared July 31, 2017

Data Sources: NRCS Soil Survey 2013, NJDEP, NJGIN Road Network 2014

This map was developed using NJDEP Geographic Information System digital data, but this secondary product has not been verified by the NJDEP and is not state-authorized.

This map is to be used solely for planning purposes, and does not take the place of a survey.

Map 4: Agricultural Soils

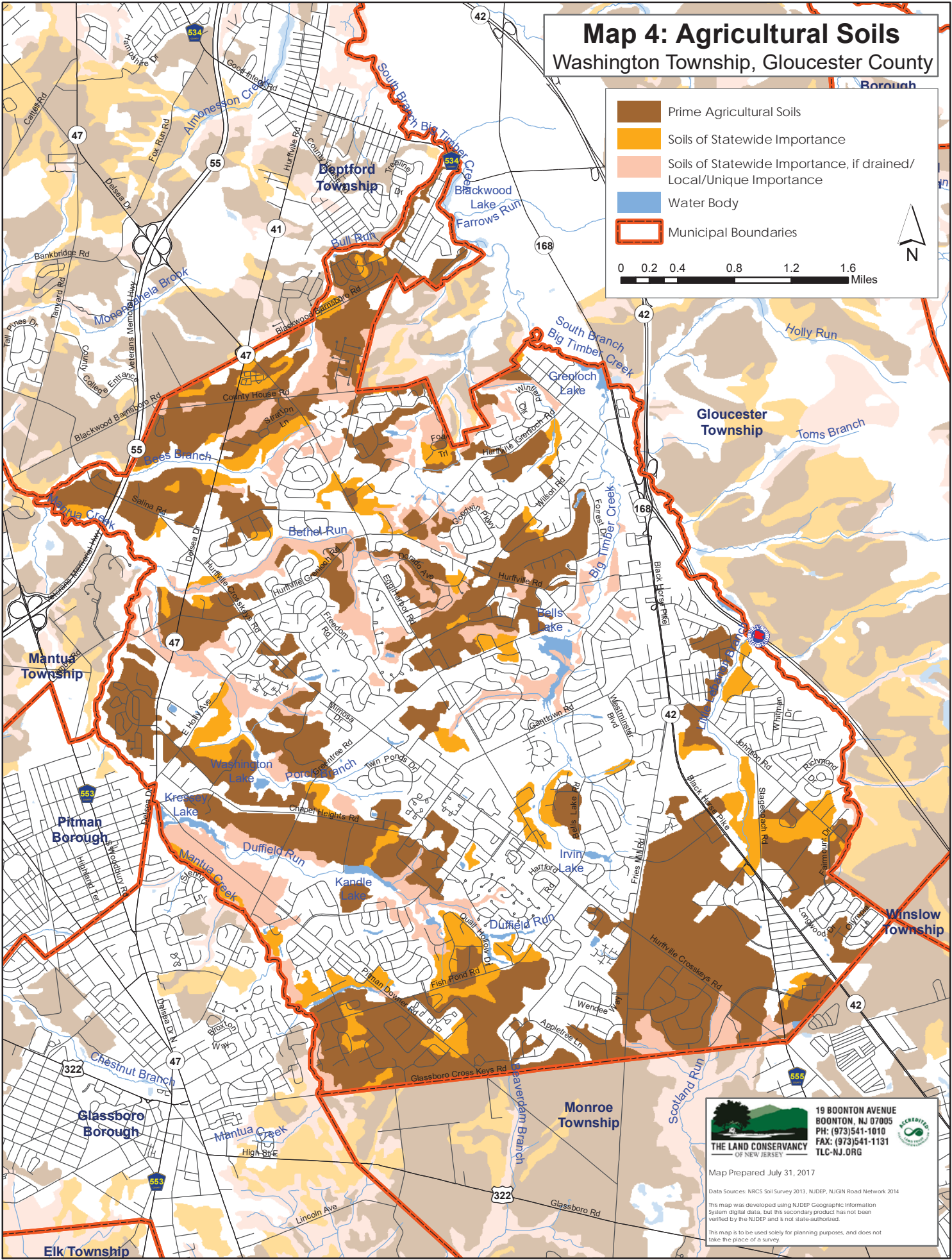
Washington Township, Gloucester County

Legend

- Prime Agricultural Soils
- Soils of Statewide Importance
- Soils of Statewide Importance, if drained/
Local/Unique Importance
- Water Body
- Municipal Boundaries

0 0.2 0.4 0.8 1.2 1.6 Miles

N



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FAX: (973)541-1131
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Map Prepared July 31, 2017

Data Sources: NRCS Soil Survey 2013, NJDEP, NJGIN Road Network 2014

This map was developed using NJDEP Geographic Information System digital data, but this secondary product has not been verified by the NJDEP and is not state-authorized.

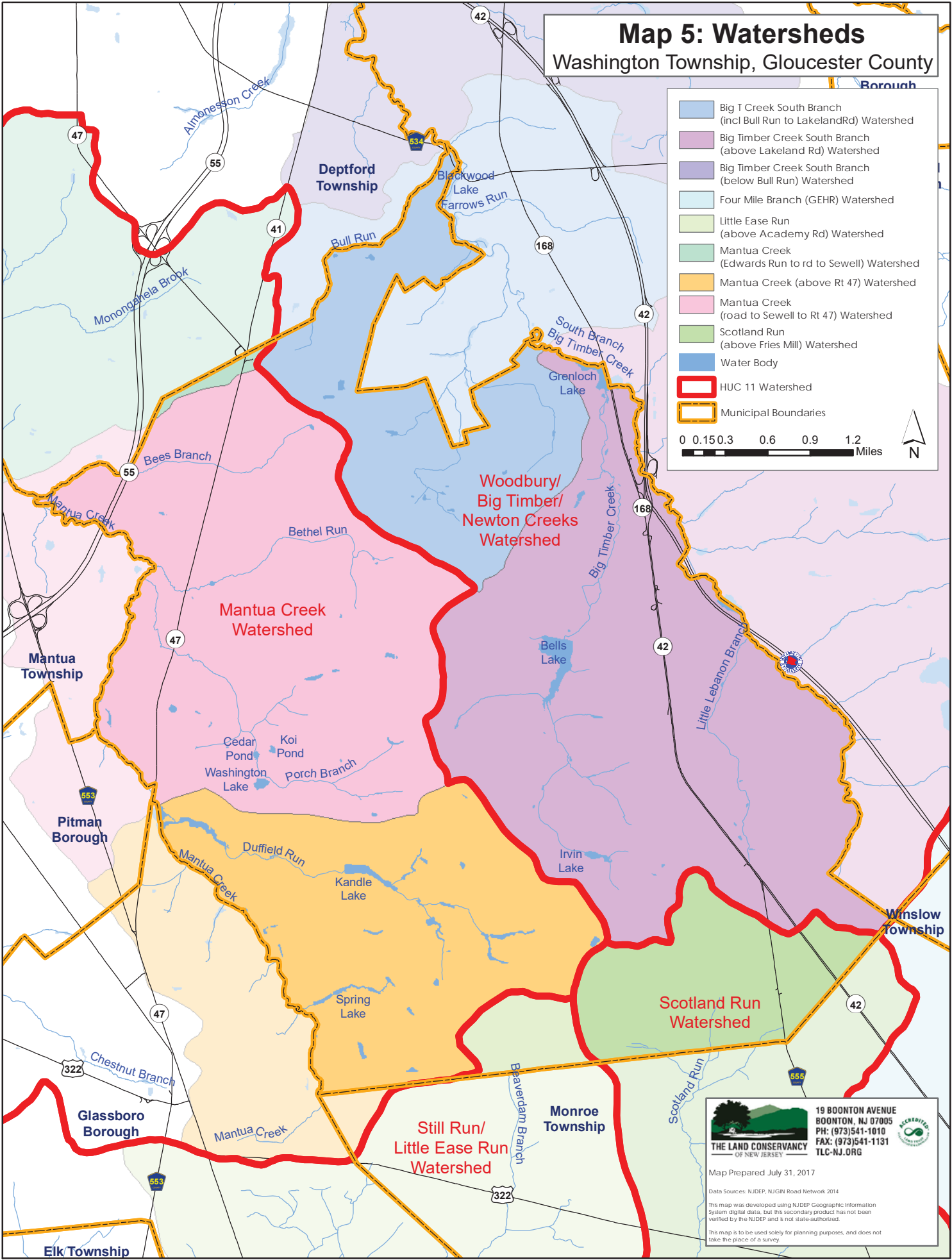

This map is to be used solely for planning purposes, and does not take the place of a survey.

Map 5: Watersheds

Washington Township, Gloucester County

- Big T Creek South Branch (incl Bull Run to LakelandRd) Watershed
- Big Timber Creek South Branch (above Lakeland Rd) Watershed
- Big Timber Creek South Branch (below Bull Run) Watershed
- Four Mile Branch (GEHR) Watershed
- Little Ease Run (above Academy Rd) Watershed
- Mantua Creek (Edwards Run to rd to Sewell) Watershed
- Mantua Creek (above Rt 47) Watershed
- Mantua Creek (road to Sewell to Rt 47) Watershed
- Scotland Run (above Fries Mill) Watershed
- Water Body
- HUC 11 Watershed
- Municipal Boundaries

0 0.15 0.3 0.6 0.9 1.2 Miles

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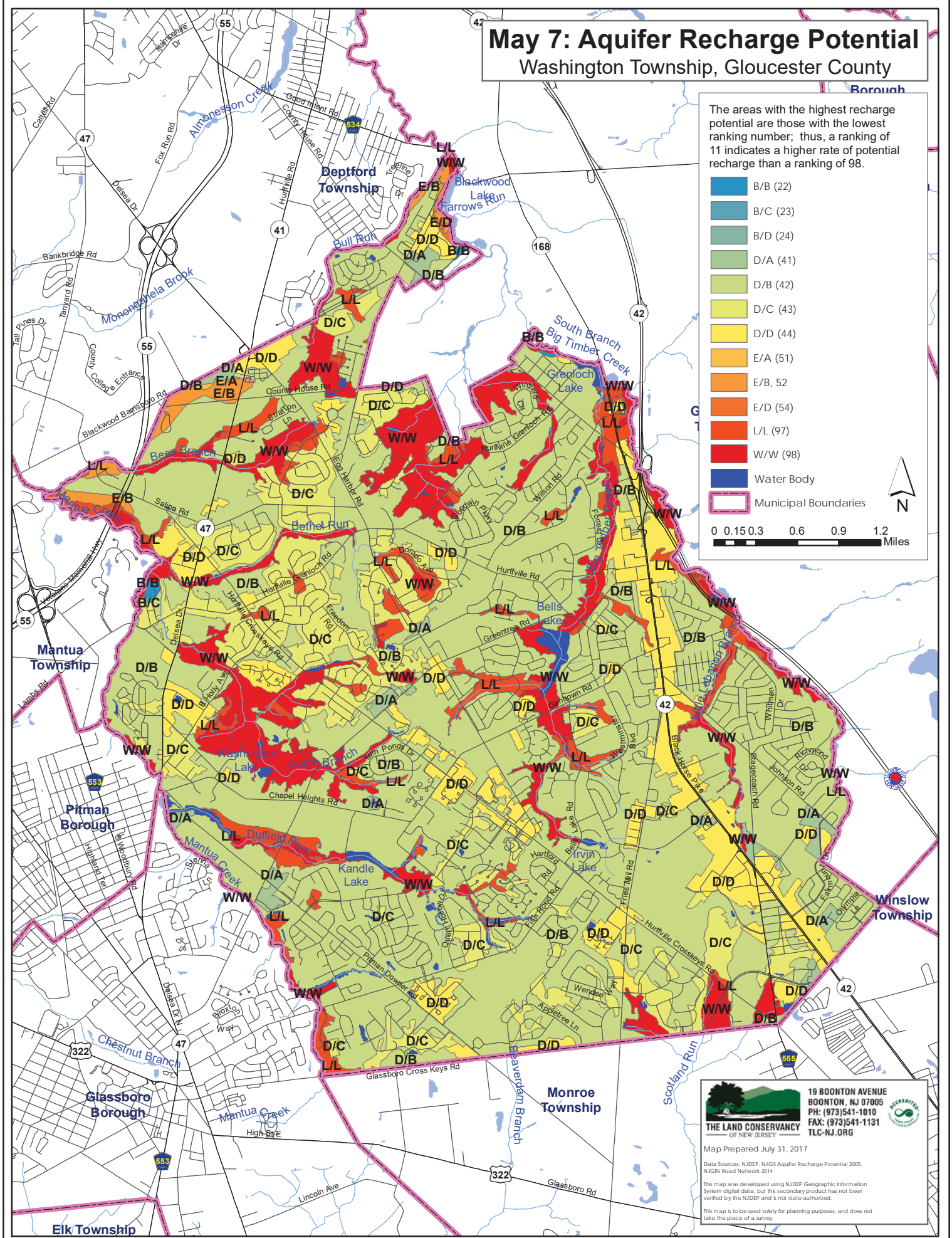
Data Sources: NJDEP, NJGIN Road Network 2014
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May 7: Aquifer Recharge Potential

Washington Township, Gloucester County

The areas with the highest recharge potential are those with the lowest ranking number; thus, a ranking of 11 indicates a higher rate of potential recharge than a ranking of 98.

- B/B (22)
- B/C (23)
- B/D (24)
- D/A (41)
- D/B (42)
- D/C (43)
- D/D (44)
- E/A (51)
- E/B (52)
- E/D (54)
- L/L (97)
- W/W (98)
- Water Body
- Municipal Boundaries



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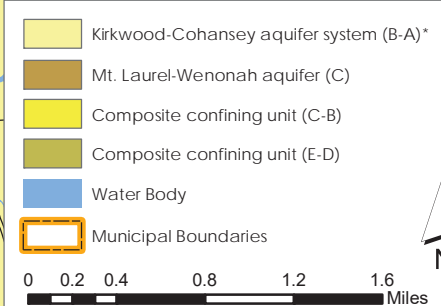
Data Sources: NJDEP, NJGIS Aquifer Recharge Potential 2005, NJGIN Road Network 2014

This map was developed using NJDEP Geographic Information System digital data, but this secondary product has not been verified by the NJDEP and is not state-authorized.

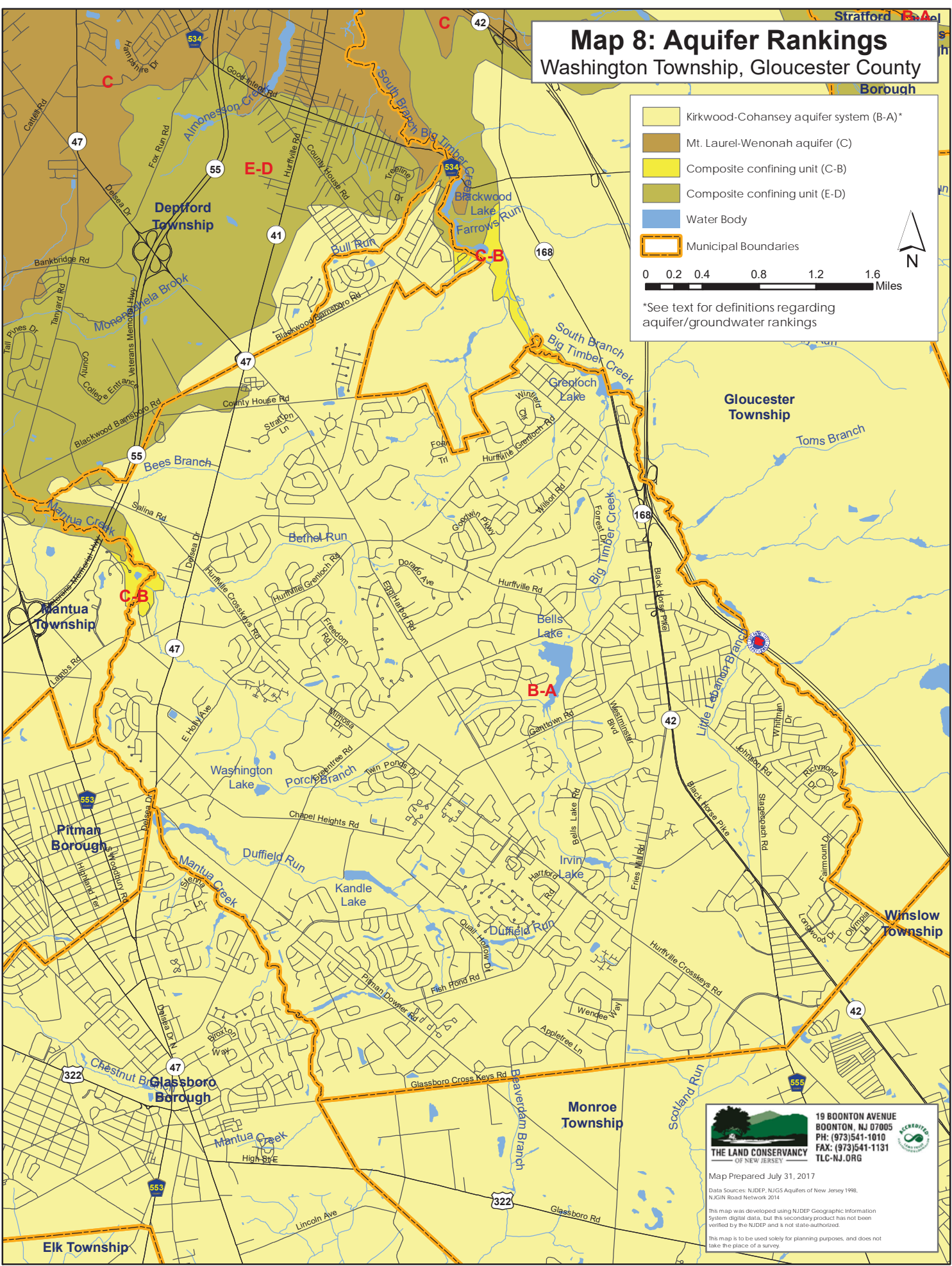
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Map 8: Aquifer Rankings

Washington Township, Gloucester County



*See text for definitions regarding aquifer/groundwater rankings










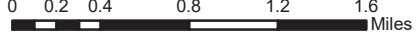

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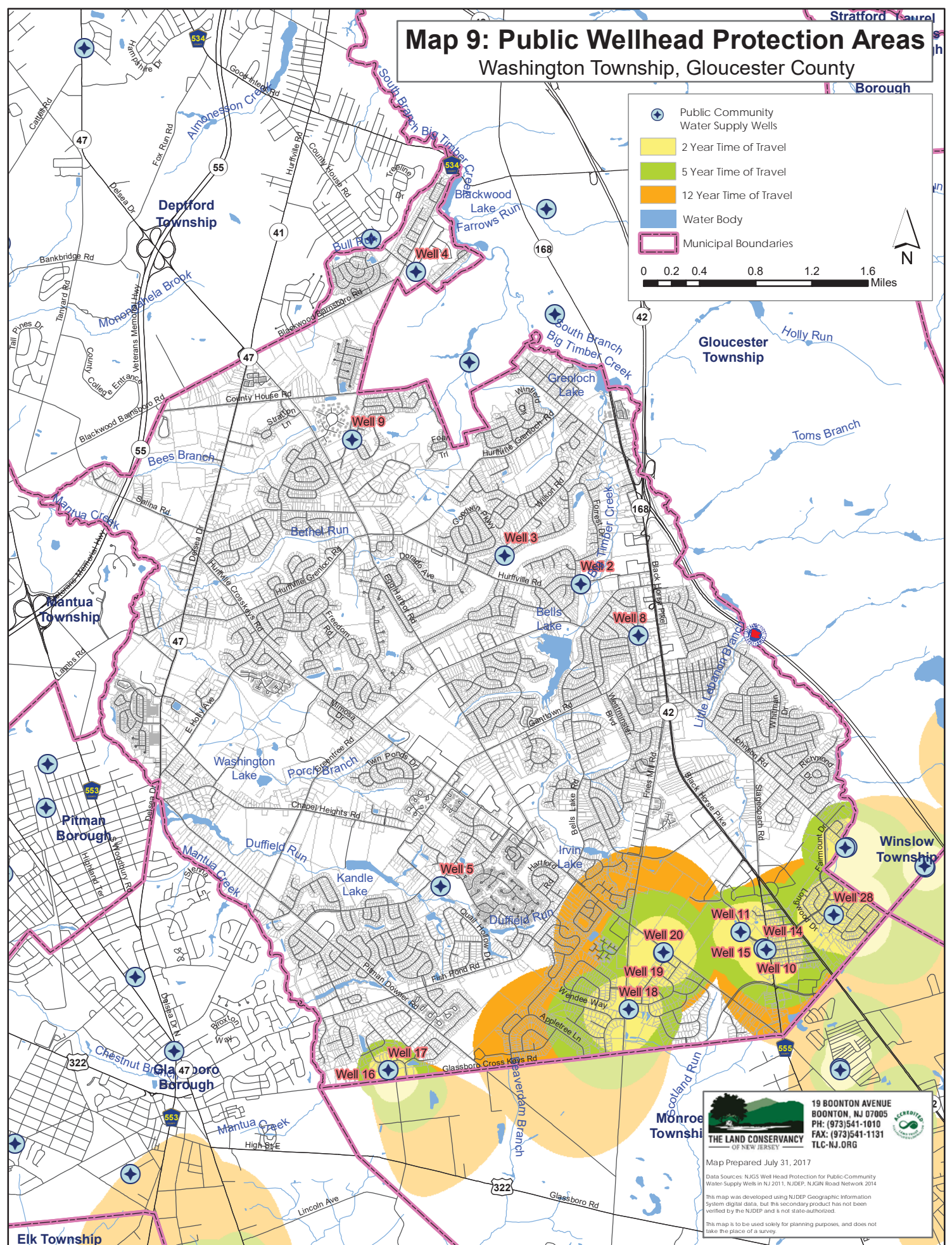
Map Prepared July 31, 2017
 Data Sources: NJDEP, NJGCS Aquifers of New Jersey 1998, NJGIN Road Network 2014
 This map was developed using NJDEP Geographic Information System digital data, but this secondary product has not been verified by the NJDEP and is not state-authorized.
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Map 9: Public Wellhead Protection Areas

Washington Township, Gloucester County

 Public Community Water Supply Wells
 2 Year Time of Travel
 5 Year Time of Travel
 12 Year Time of Travel
 Water Body
 Municipal Boundaries

 N
 0 0.2 0.4 0.8 1.2 1.6 Miles




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Map Prepared July 31, 2017
 Data Sources: NJGS Well Head Protection for Public-Community Water Supply Wells in NJ 2011, NJDEP, NJGIN Road Network 2014
 This map was developed using NJDEP Geographic Information System digital data, but this secondary product has not been verified by the NJDEP and is not state-authorized.
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Map 10: Wetlands

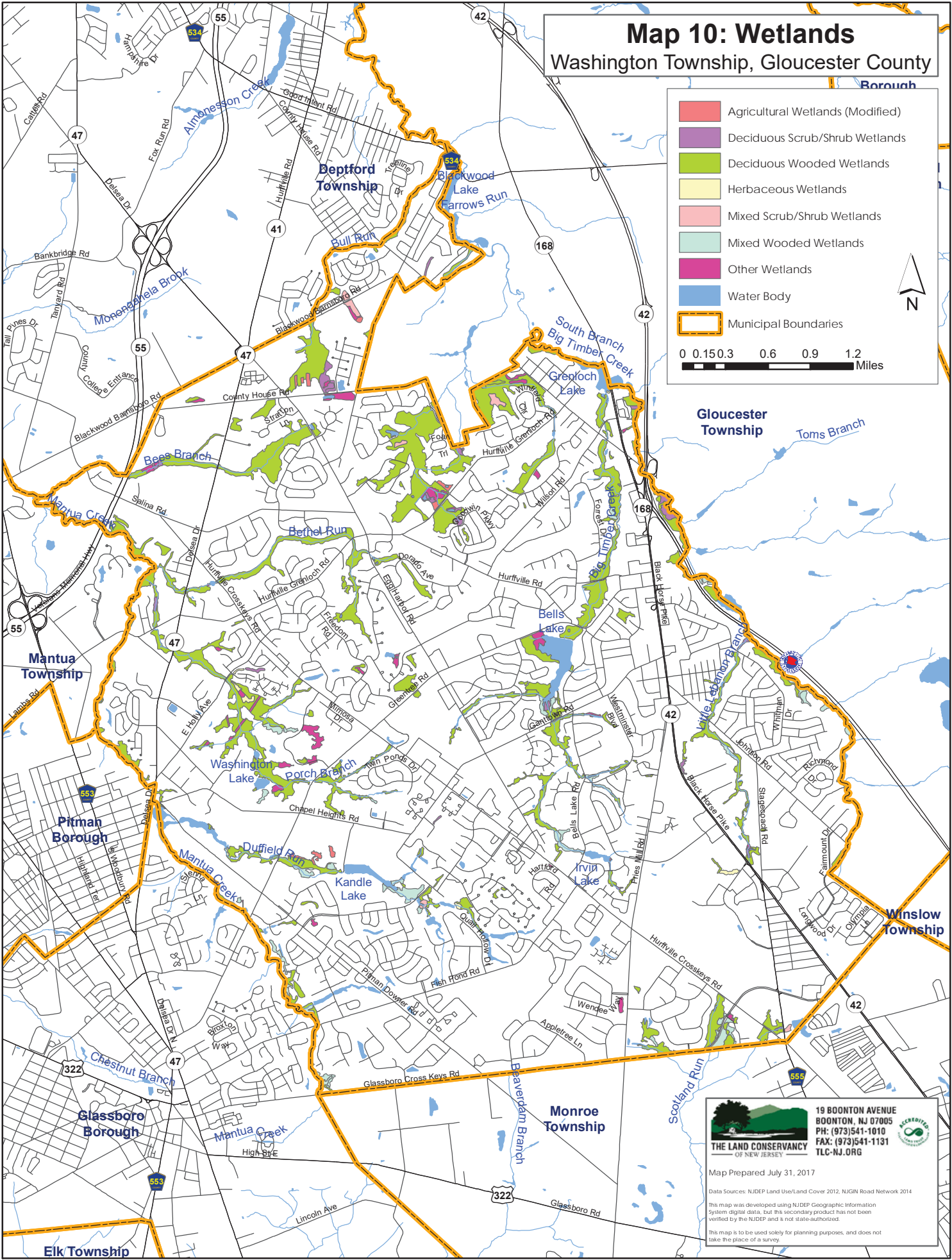
Washington Township, Gloucester County

Legend:

- Agricultural Wetlands (Modified)
- Deciduous Scrub/Shrub Wetlands
- Deciduous Wooded Wetlands
- Herbaceous Wetlands
- Mixed Scrub/Shrub Wetlands
- Mixed Wooded Wetlands
- Other Wetlands
- Water Body
- Municipal Boundaries

Scale: 0 0.150.3 0.6 0.9 1.2 Miles

North Arrow: N



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Map Prepared July 31, 2017

Data Sources: NJDEP Land Use/Land Cover 2012, NJGIN Road Network 2014
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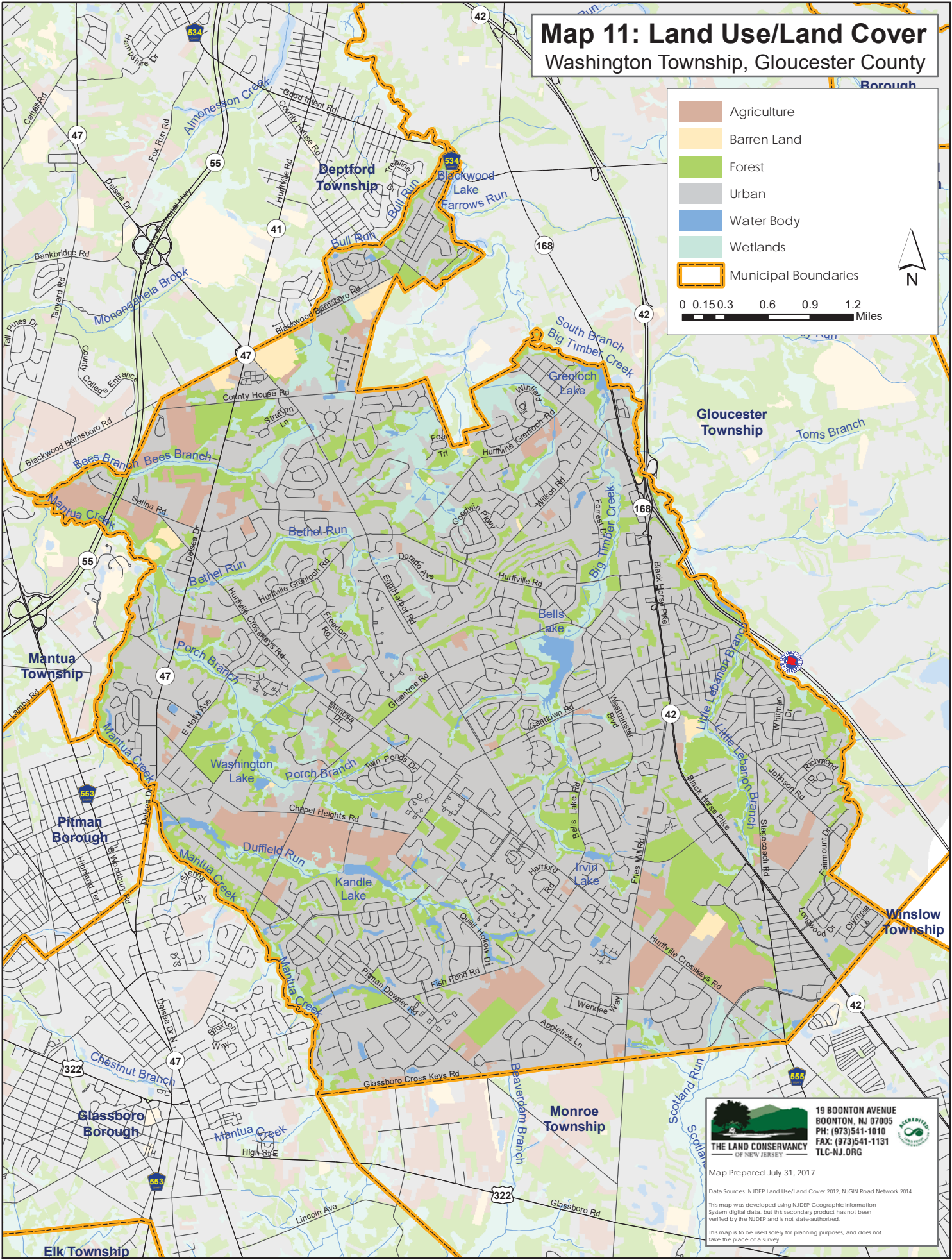
Map 11: Land Use/Land Cover

Washington Township, Gloucester County

Agriculture
 Barren Land
 Forest
 Urban
 Water Body
 Wetlands
 Municipal Boundaries

0 0.15 0.3 0.6 0.9 1.2 Miles

N



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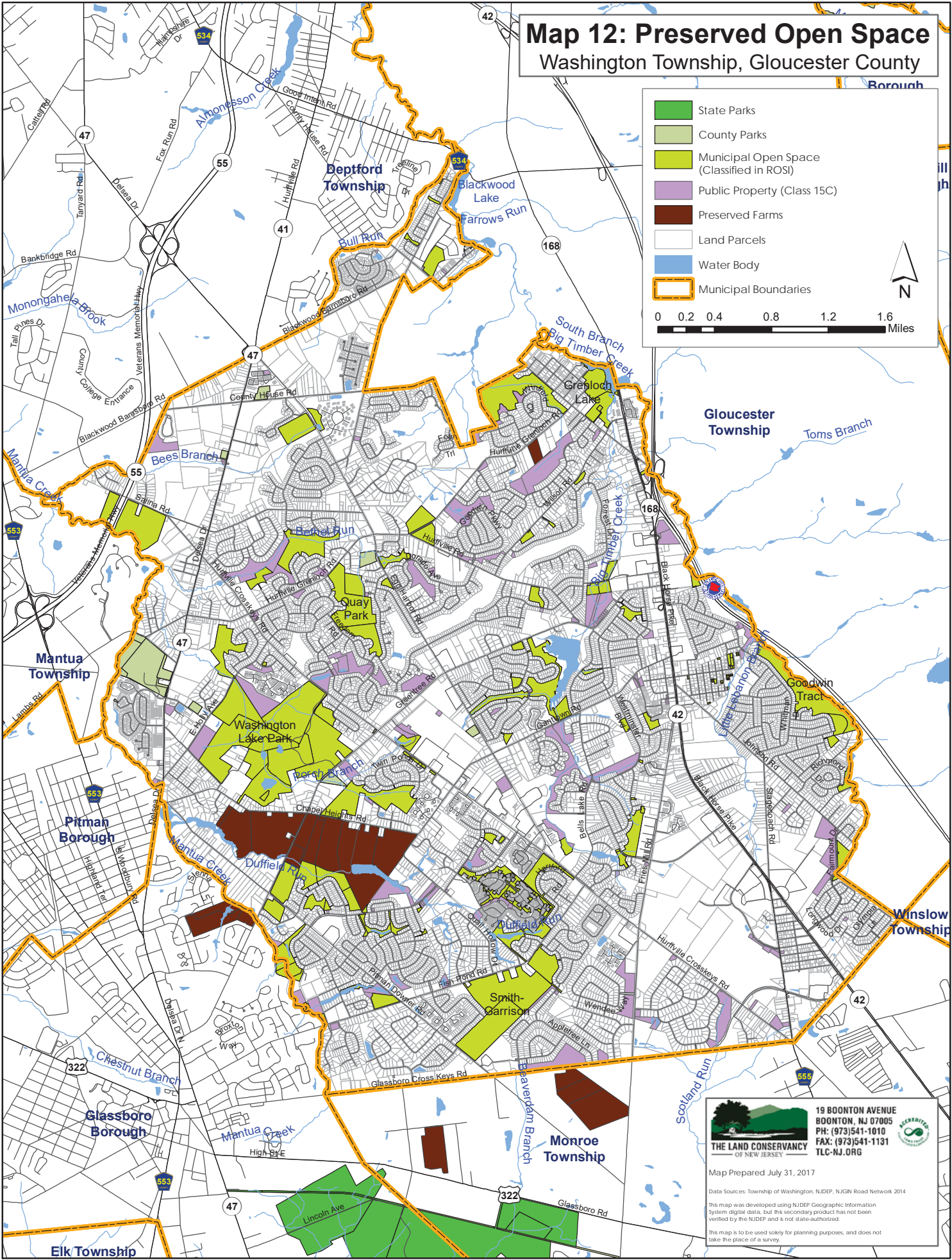

Data Sources: NJDEP Land Use/Land Cover 2012, NJGIN Road Network 2014
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Map 12: Preserved Open Space

Washington Township, Gloucester County

-  State Parks
-  County Parks
-  Municipal Open Space (Classified in ROSI)
-  Public Property (Class 15C)
-  Preserved Farms
-  Land Parcels
-  Water Body
-  Municipal Boundaries

0 0.2 0.4 0.8 1.2 1.6 Miles

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Data Sources: Township of Washington, NJDEP, NJGN Road Network 2014
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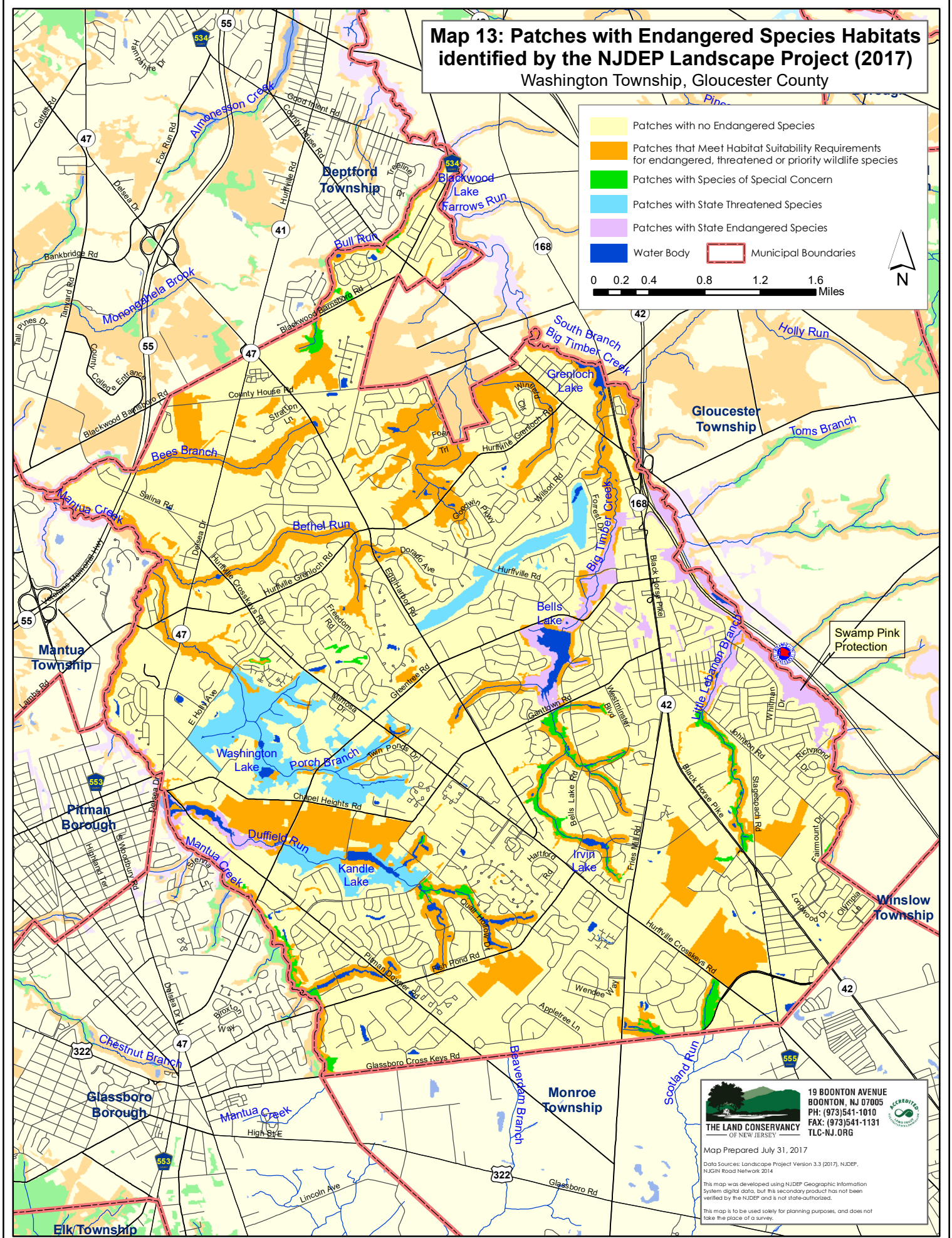
Map 13: Patches with Endangered Species Habitats identified by the NJDEP Landscape Project (2017)


Washington Township, Gloucester County

Patches with no Endangered Species
 Patches that Meet Habitat Suitability Requirements for endangered, threatened or priority wildlife species
 Patches with Species of Special Concern
 Patches with State Threatened Species
 Patches with State Endangered Species
 Water Body Municipal Boundaries

0 0.2 0.4 0.8 1.2 1.6 Miles

N




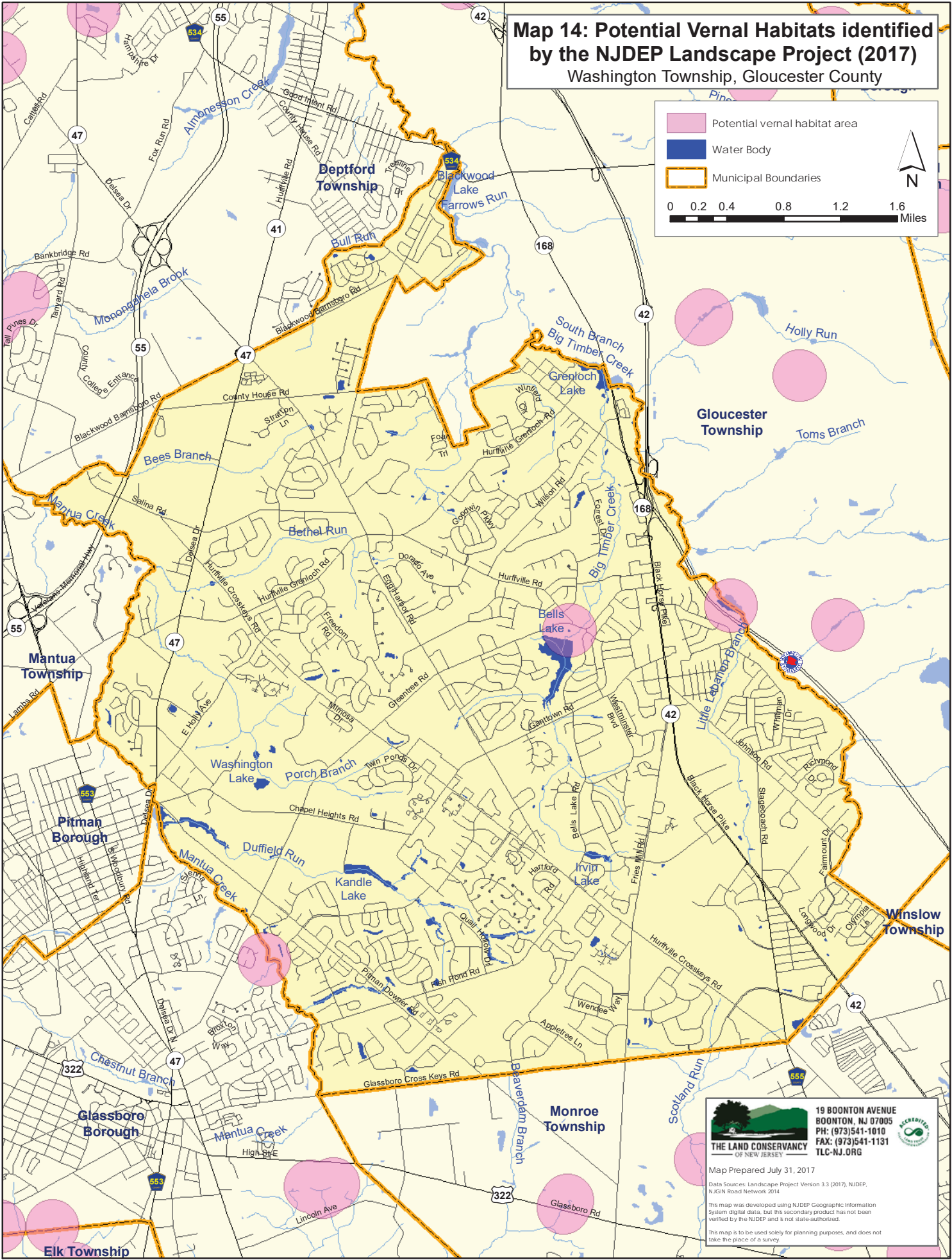


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Map Prepared July 31, 2017
 Data Sources: Landscape Project Version 3.3 (2017), NJDEP, NJGIN Road Network 2014
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Map 14: Potential Vernal Habitats identified by the NJDEP Landscape Project (2017)
Washington Township, Gloucester County

Potential vernal habitat area
 Water Body
 Municipal Boundaries

0 0.2 0.4 0.8 1.2 1.6 Miles

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Map Prepared July 31, 2017

Data Sources: Landscape Project Version 3.3 (2017), NJDEP, NJSIN Road Network 2014

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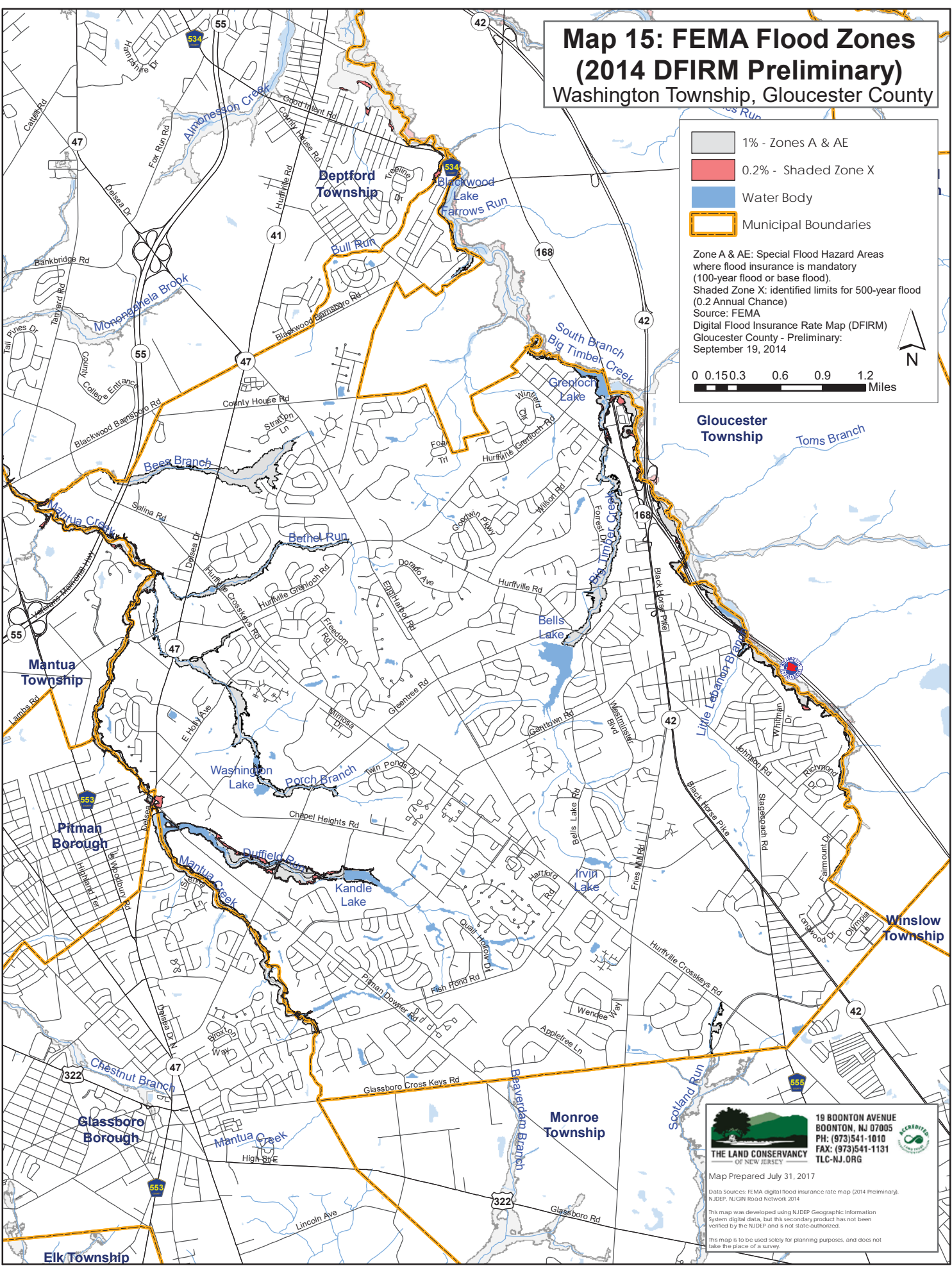

Map 15: FEMA Flood Zones (2014 DFIRM Preliminary)

Washington Township, Gloucester County

1% - Zones A & AE
 0.2% - Shaded Zone X
 Water Body
 Municipal Boundaries

Zone A & AE: Special Flood Hazard Areas where flood insurance is mandatory (100-year flood or base flood).
 Shaded Zone X: identified limits for 500-year flood (0.2 Annual Chance)
 Source: FEMA
 Digital Flood Insurance Rate Map (DFIRM)
 Gloucester County - Preliminary:
 September 19, 2014

0 0.150.3 0.6 0.9 1.2 Miles









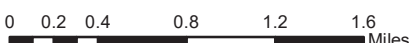
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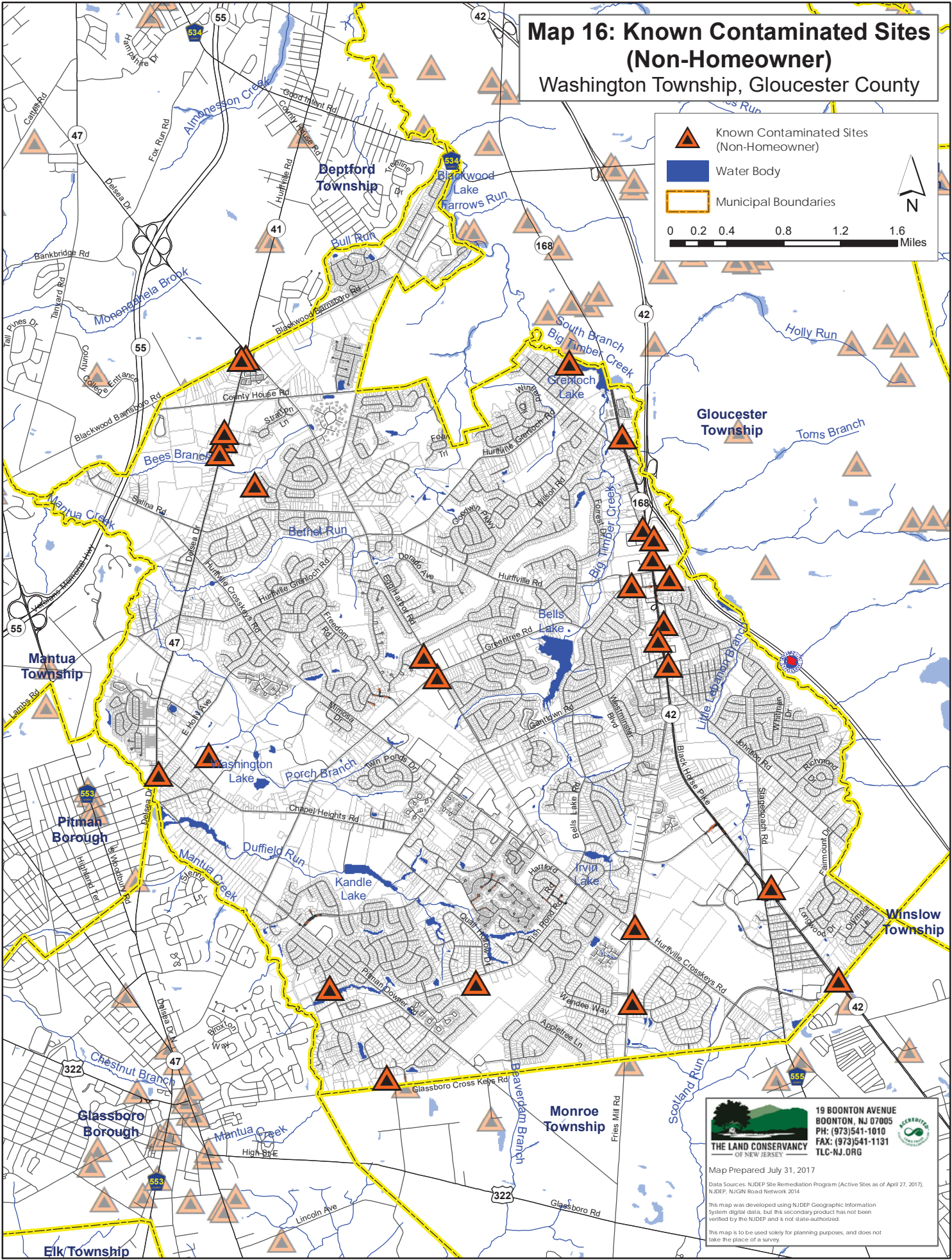
Map Prepared July 31, 2017
 Data Sources: FEMA digital flood insurance rate map (2014 Preliminary), NJDEP NJGIS Road Network 2014
 This map was developed using NJDEP Geographic Information System digital data, but this secondary product has not been verified by the NJDEP and is not state-authorized.
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Map 16: Known Contaminated Sites (Non-Homeowner)

Washington Township, Gloucester County

 Known Contaminated Sites (Non-Homeowner)
 Water Body
 Municipal Boundaries

 N
 0 0.2 0.4 0.8 1.2 1.6 Miles




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Map Prepared July 31, 2017
 Data Sources: NJDEP Site Remediation Program (Active Sites as of April 27, 2017), NJDEP, NJGN Road Network 2014

This map was developed using NJDEP Geographic Information System digital data, but this secondary product has not been verified by the NJDEP and is not state-authorized.
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