Engineers Planners Surveyors Landscape Architects Environmental Scientists

MASER CONSULTING P. A.

Environmental Impact Report

FOR

29 HOWELL ROAD
BLOCK 164, LOT 5.01
HOWELL TOWNSHIP, MONMOUTH COUNTY, NEW JERSEY

March 2021
(Revised April 2021)

Prepared For

AAFFHW Property, LLC
5 Tenafly Road, Suite 416
Englewood, NJ 07631

Prepared By

Colliers Engineering & Design (dba Maser Consulting)
331 Newman Springs Road, Suite 203
Red Bank, NJ 07701
732.383.1950

MC Project No. 20003841A

TABLE OF CONTENTS

APPENDICES

1.0 INTRODUCTION

1.1 PURPOSE OF DOCUMENT

This report has been prepared in accordance with the Environmental Impact Report Requirements of the Township of Howell Land Use Development Ordinance (Chapter 188-6), County of Monmouth, State of New Jersey, revised May 25, 2011 which requires the preparation and submittal of an Environmental Impact Report (EIR) for all preliminary major subdivisions or preliminary site plans involving any new building or off-street parking area, use variances, or soil removal permits.

The site currently is an active cultivated agricultural field with two pole barn structures. The applicant is proposing to construct two warehouse buildings with office spaces, one being 326,008 S.F. and the second being 98,856 S.F. on the property parcel of land known as Block 164, Lot 5.01, Howell Township, Monmouth County, New Jersey in the Special Economic Development (SED) Zone. The project will also include four (4) drive in bays, 91 loading bays, 277 vehicles parking stalls, 68 trailer parking stalls, a sewage pump station, and a stormwater management basin. The driveway that services the existing property will be relocated approximately 300 ft. to the north along Howell Road. The proposed stormwater management basin and pump station will be located to the southwest of this new driveway and approximately 100 ft. from adjacent property side.

The environmental review provided herein addresses the potential impacts resulting from an increase intensity of the commercial use of this property which is located in the SED Zone. Land use related areas of investigation include, but are not limited to, the increase in intensity of the use on the property, stormwater impacts, natural resources including endangered species habitat, floodplains, wetlands and soils, and aesthetic considerations including scenic views.

1.2 METHODS

Staff at Colliers Engineering & Design (dba Maser Consulting) (Appendix A) reviewed maps, databases, reports, correspondence and other documents related to the project site. We also used

as references publications and maps regarding the geology and aquifers of the site found on New Jersey Department of Environmental Protection's (NJDEP) NJ-GeoWeb. The mapping of particular natural resources was prepared using data available on the NJDEP NJ-GeoWeb. The Natural Resource Conservation Service's web soil survey and the Monmouth County Soil Survey were used to evaluate soils. Federal Emergency Management Agency Flood Insurance Rate Maps were used to assess the presence and location of floodplains on the site. Additional reports resulting from recent visits to the property or from databases for rare, threatened and endangered species provided important information for our evaluation. A request was sent to the Natural Heritage Program for information regarding sensitive wildlife, plant, and habitat records for the subject property and vicinity. A response is currently pending. Information from the Howell Township Environmental Resource Inventory was used to supplement the available mapping.

Staff from Colliers Engineering & Design (dba Maser Consulting) visited the subject property on March 11, 2021 to make field observations. Information gathered during this site reconnaissance was used in the preparation of the EIR. The site visit included photographing the environmental setting, recording information on the flora and fauna, making incidental observations regarding geology, soils, and habitat types, and evaluating potential impacts. The project description and information gathered from these and other sources listed in Section 9.0 were used to develop the descriptions, analyses, and interpretations provided herein. Report figures including maps are presented in Appendix B; photographs are presented in Appendix C; the Natural Heritage Program correspondence is included in Appendix D; and the Freshwater Wetlands Letter of Interpretation can be found in Appendix E.

1.3 SITE LOCATION AND CHARACTERISTICS

The subject property is located at 29 Howell Road in Howell Township, Monmouth County, New Jersey. It is situated on the western side of Howell Road, and approximately 0.1 miles southwest from the intersection of Howell Road and Park Avenue (NJ Route 33 Business). The subject property (Block 164, Lot 5.01), which currently contains cultivated agricultural fields and two farm buildings, encompassing approximately 30.8± acres.

The two farm pole barns are located in the south-central portion of the property. There is an entrance driveway to the east of the two buildings, along Howell Road. The entire property is utilized in an agricultural land use.

A site plan approval is requested for the subject property to permit the placement of two warehouse buildings, associated parking, sewage pump station, and stormwater management facility on the property.

The site is situated within the Manasquan River watershed and drains to the west toward a tributary of Burkes Creek. Burkes Creek drains to the Manasquan River after its confluence with Debois Creek. Burkes Creek unnamed tributary is classified as FW2-NT waters. The site is relatively flat, gently sloping to the west. No streams or waterbodies are located on site.

The subject property currently is in an agricultural land use, located within a mixed land use setting consisting of commercial use, agricultural uses, and residential development. The site is located within the Special Economic Development (SED) Zone of Howell Township and the Rural Environmentally Sensitive Planning Area (PA-42) in the New Jersey State Plan and Redevelopment Plan.

1.4 ZONING

Local Zoning

The property is contained within the Special Economic Development (SED) Zone. The SED Zone was established to provide for a variety of economic development opportunities in areas of the Township where rail and highway infrastructure are readily available.

Permitted uses: principal uses in the SED Zone include:

1. Offices
2. Financial institutions
3. Healthcare facilities/medical centers
4. Warehousing and distribution

5. Assembly and packaging
6. Utility uses
7. Agriculture, forestry, and agricultural services
8. Manufacturing food and kindred products
9. Manufacturing textile products
10. Manufacturing apparel and similar finished products made from fabrics
11. Manufacturing lumber and wood products
12. Manufacturing furniture and fixtures
13. Manufacturing paper and allied products
14. Manufacturing printing and publishing
15. Manufacturing leather products
16. Manufacturing stone, glass and clay
17. Manufacturing fabricated metal products
18. Manufacturing electronic and electrical equipment
19. Manufacturing photographic equipment, medical, optical goods, watching, clocks
20. Construction
21. Multipurpose recreation and sports complex
22. Solar energy generation facilities
23. Microbrewery
24. Health club facility/fitness centers

Accessory uses allowed in the SED Zone included:

1. Accessory uses customarily incidental and ancillary to a permitted use
2. Outdoor storage shall be permitted in a screened rear yard only. No outdoor storage shall be permitted in association with a multipurpose recreation and sports complex
3. Retail use shall be permitted as an accessory use to a permitted warehousing/distribution facility, provided the percent of floor area devoted to retail use shall be limited to 1,000 square feet or 5% of the gross floor area, whichever is less.

Conditional uses allowed in the SED Zone include:

1. Telecommunications facilities
2. Commercial breeders, dog kennels, shelters, pounds, dog training facilities and pet shops

Prohibited uses in the SED Zone include:

1. Sexually oriented business as defined in

2. Tattoo, body piercing or branding establishments.
3. Manufacturing of asphalt and concrete shall be prohibited. of asphalt and concrete shall be prohibited.

State Zoning

The State Planning Area map layer (NJDEP NJ-GeoWeb) depicts the site as entirely within Rural Environmentally Sensitive Planning Area (PA-42). The new warehouse buildings will be constructed within a cropland and areas that have been previously disturbed by the existing use on the property.

2.0 PROJECT DESCRIPTION

2.1 PURPOSE AND SCOPE OF THE PROJECT

This document has been prepared in accordance with the requirements of Howell Township Environmental Impact Report requirements. This EIR analyzes the existing conditions, reviews or recommends ways to reduce potential impacts through project design, and discusses potential residual impacts and possible mitigation measures to compensate for these impacts.

2.2 DESCRIPTION OF PROPOSED OPERATIONS

The site currently an active agricultural field. Two pole barns exist in the south-central portion of the property. There is an entrance driveway east of the structures, along Howell Road.

The applicant is proposing to construct two warehouse buildings with office spaces, one being 326,008 S.F. and the second being 98,856 S.F. In addition to the proposed warehouses on the property, the project will also include four (4) drive in bays, 91 loading bays, 277 vehicles parking stalls, 68 trailer parking stalls, a sewage pump station, and a stormwater management basin. The entrance and exit that services the existing property will be relocated approximately 300 ft. to the north along Howell Road. The proposed stormwater management basin and pump station will be located to the southwest of this new driveway and approximately 100 ft. from adjacent property side.

3.0 ENVIRONMENTAL SETTING

The environmental setting of a region is the sum of the physical and biological features and processes that characterize the region. The physical conditions including the location, topography, geology, soils, water resources, etc. directly influence the overlying biotic communities that occur in an area. The constraints on the property resulting from the interaction of physical and biological features directly influence the design of the development plan proposed for the site and analyzed herein.

3.1 PHYSICAL RESOURCES AND CONDITIONS

3.1.1 PHYSIOGRAPHIC LANDSCAPE

Areas that have similar rock types, geologic structures, landforms, and histories are organized into regions called Physiographic Provinces. New Jersey has five provinces, which make it a rather complex state for its small size. From northwest to southeast across the State, the provinces are (1) Ridge and Valley, (2) Highlands, (3) Piedmont, (4) Inner Coastal Plain, and (5) Outer Coastal Plain. The project area occurs near the southerly edge of the New Jersey Inner Coastal Plain Physiographic Province. Coastal Plain sediments consisting of clay, silt and gravel underlie Howell Township.

3.1.2 TOPOGRAPHY

The subject property covers 30.8± acres of cultivated land, as seen on the NJDEP Aerial map of the site (Appendix B – Figure 4). The topography of the site is gently sloping. The property slopes down in a westerly direction from Howell Road from an elevation of 148 ft. to a low point on the west side of the property of 131 ft.

3.1.3 GEOLOGY

The bedrock geology of the subject property is characterized by the Vincentown Formation (Figure 5). The Vincentown Formation was formed in the upper Paleocene, Selandian era and consists of fine to very fine-grained glauconite and quartz sand. The sands are micaceous dark gray, very clayey and silty and massive in the upper portion of the formation. In the lower

portion of the formation the sands are dark gray green, with less mica and clay (Owens, et al 1998).

3.1.4 SOILS

The subject property is characterized by four soil types (Figure 6). The Freehold loam, 0 to 2% slopes (FroA), which is located in the northern portion of the property and comprises approximately 26% of the entire property. These soils formed from glauconite bearing loamy eolian deposits and/or glauconite bearing loamy fluviomarine deposits and are nearly level and well drained. The depth to water table is greater than 6ft. from the surface. This soil type has a Land Capability Class of ***1***. The **FroA** soils pose slight to severe limitations for buildings and septic systems due to cut banks cave and poor filter (Jablonski 1989, DVRPC 2008).

The Freehold sandy loam, 2 to 5% slopes (FrkB) soil comprises approximately 59% of the property and makes up most of the central portion of the property These soils formed from glauconite bearing loamy eolian deposits and/or glauconite bearing loamy fluviomarine deposits and are gently sloping and well drained. The depth to water table is greater than 6 ft. from the surface. This soil type has a Land Capability Class of ***2e***. The **FrkB** soils pose slight to severe limitations for buildings and septic systems due to cut banks cave and poor filter (Jablonski 1989, DVRPC 2008).

The Freehold sandy loam, 5 to 10% slopes (FrkC) soil comprises approximately 13% of the property and makes up most of the southcentral portion of the property. These soils formed from glauconite bearing loamy eolian deposits and/or glauconite bearing loamy fluviomarine deposits and are moderately sloping and well drained. The depth to water table is greater than 6 ft. from the surface. This soil type has a Land Capability Class of ***3e***. The **FrkC** soils pose slight to severe limitations for buildings and septic systems due to cut banks cave and poor filter (Jablonski 1989, DVRPC 2008).

The Woodstown sandy loam, 2 to 5% slopes (WoeB) soil comprises approximately 2% of the property and makes up a small area on the southern portion of the property. These soils formed

from loamy fluviomarine deposits and are gently sloped and well drained. The depth to water table is about 1.5 to 2.5 in. from the surface. This soil type has a Land Capability Class of ***IIe***. The **WoeB** soils pose slight to severe limitations for buildings and septic systems due to wetness and cut bank cave (Jablonski 1989, DVRPC 2008).

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive land forming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for forestland, or for engineering purposes (Jablonski 1989).

In the capability system, soils are generally grouped at three levels—capability class, subclass, and unit. *Capability classes*, the broadest groups, are designated by the numbers 1 through 8. The numbers indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

- Class I soils have slight limitations that restrict their use.
- Class II soils have moderate limitations that restrict the choice of plants or that require moderate conservation practices.
- Class III soils have severe limitations that restrict the choice of plants or that require special conservation practices, or both.
- Class IV soils have very severe limitations that restrict the choice of plants or that require very careful management, or both.
- Class V soils are subject to little or no erosion but have other limitations, impractical to remove, that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.
- Class VI soils have severe limitations that make them generally unsuitable for cultivation and that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.

- Class VII soils have very severe limitations that make them unsuitable for cultivation and that restrict their use mainly to grazing, forestland, or wildlife habitat.
- Class VIII soils and miscellaneous areas have limitations that preclude commercial plant production and that restrict their use to recreational purposes, wildlife habitat, watershed, or aesthetic purposes (Jablonski 1989).

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, 2e. The letter *e* shows that the main hazard is the risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c,* used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry (Jablonski 1989).

Prime Farmlands include those soils in Land Capability Class I and selected soils from Land Capability Class II. Prime Farmland is considered those lands with the combination of physical and chemical properties that produce the highest yield of crops. Prime Farmland does not include those soils that are excessively wet, excessively dry, or are highly erodible. Based upon the Land Capability Classes listed above, three of the four soils on the subject property are considered to be Prime Farmland soils (Jablonski 1989).

Based on review of historic aerial photographs, the subject property appears to have been cultivated for agricultural use since at least 1931 until present. Based on the historic/current agricultural use, the potential exists for the presence of pesticide or herbicide residuals in the soils above regulated concentrations.

The site soils were sampled and exceedances of the NJDEP soil remediation standards was detected in several samples collected within the upper 2 feet of soil from agricultural fields, which warrants further investigation/action. The investigation of the same is on-going.

3.1.5 HYDROLOGY AND DRAINAGE

The site is situated within the Manasquan River watershed and drains to the west-southwest and towards Burkes Creek tributary located offsite. Burkes Creek eventually drains to the Manasquan River. There are no streams or waterbodies located on site. Currently, drainage is sheet flow from the agricultural field to local roadways and/or adjacent properties.

3.1.6 GROUNDWATER QUALITY AND QUANTITY

Groundwater is all water within the soil and subsurface strata that is not at the surface of the land. It includes water that is within the earth that supplies wells and springs. It includes groundwater basis and water in perched water tables that lies above impervious subsurface layers. Groundwater resources are often functionally linked to overlying land areas and surface water bodies; groundwater is often recharged through "outcrop" areas at the land surface and ground water discharges ("seeps") may contribute to base flows of streams and rivers.

The groundwater yields of any particular geological formation or soil horizon are a function of the porosity and permeability of the material comprising the formation (consolidated rock or unconsolidated deposits and soils). Porosity describes the water-containing spaces between individual mineral grains, while permeability is the ease or difficulty with which water is transmitted through interconnecting spaces in the formation. Formations lacking open spaces between the mineral grains have both low porosity and low permeability. Weathering and cracking of the parent bedrock can induce secondary porosity in the formation; water can accumulate and move through these fractures in the primary rock formation.

The Composite confining unit aquifer system is mapped for the site by NJDEP NJ-GeoWeb (Figure 7). This aquifer system is described as consisting of silt and clay with localized sand lenses. Water is generally good, but iron and manganese levels may be locally elevated and require chemical treatment. Calcium-bicarbonate type waters dominate (Herman, 1998).

According to information reviewed via NJDEP DataMiner, GeoWeb and through a NJDEP file review, gasoline and diesel was stored in underground storage tanks (USTs) on the property

located at 905 Route 33 (NJDEP PI No. 004142), which is upgradient from the subject property. Based on the information reviewed, petroleum impacts from the former tanks has impacted groundwater and extends onto the subject property. Investigation of the same is on-going.

3.1.7 SURFACE WATER QUALITY

The NJDEP Geoweb does not show any streams or watercourses on site (Figure 8). NJDEP also confirmed there are not any regulated watercourse onsite in a Flood Hazard Applicability Determination, dated January 19, 2018 (NJDEP File #1319-17-0011.1 Activity # APD170001) (see Appendix F).

Based on topography, surface runoff sheet flows to the west-southwest direction toward Burkes Creek tributary located offsite. Burkes Creek drains to the Manasqaun River after joining Debois Creek. According to the NJDEP Surface Water Quality Standards (N.J.A.C. 7:9B), Burkes Creek, Debois Creek, and Manasquam River are all classified as FW2-NT.

The FW2 designation means the general surface water classification applied to those fresh waters that are not designated as FW1 or Pinelands Waters. The NT designation, nontrout waters, means fresh waters that have not been designated in N.J.A.C. 7:9B-1.15(c) through (i) as trout production or trout maintenance. These waters are generally not suitable for trout because of their physical, chemical or biological characteristics, but are suitable for a wide variety of other fish species non trout waters.

3.1.8 AIR QUALITY

Since the passage of the Clean Air Act in 1970, New Jersey's air quality has significantly improved, to the point where New Jersey is in compliance with all National Ambient Air Quality Standards (NAAQS) except for ozone (NJDEP 2008). The Federal Clean Air Act requires each state to attain and maintain specified air quality standards. Ambient Air Quality Standards have been promulgated by the federal government and by New Jersey for total suspended particulate (TSP), sulfur dioxide (SO_2), carbon monoxide (CO), nitrogen dioxide (NO_2), lead and ozone. The New Jersey standards are generally the same as the federal standards for these pollutants.

Primary air quality standards are set to protect human health and secondary standards are set to protect human welfare. The following air quality assessment is taken from the 2008 and 2009 Annual Air Quality Report published by the NJDEP Bureau of Air Monitoring.

The Township of Howell is located within the Northern Coastal Region (NCR) of the NJ Pollutant Standards Index Reporting Regions. The most recently available data from NJDEP's Bureau of Air Monitoring Air Quality Reports is provided. Not all pollutants are included in the reports every year. In 2009, air quality in the NCR was good on 333 days, moderate on 29 days, unhealthy for sensitive groups on 3 days, unhealthy or very unhealthy on 0 days. The air quality sampling stations in the NCR are located at Colliers Mills and at Monmouth University (NJDEP Bureau of Air Monitoring 2010).

Carbon monoxide is considered a poisonous gas formed when carbon in fuels is not burned completely. It is a by-product of motor vehicle exhaust, which contributes over 56% of all CO emissions nationwide (NJDEP 2009). In cities, automobile exhaust can cause 95% of all CO emissions. Carbon monoxide levels are measured at the Freehold sampling station. CO levels measured 3.4 parts per million (ppm) in Freehold for the 1-hour maximum and 1.9 ppm in Freehold for the 8-hour maximum. The New Jersey Ambient Air Quality Primary and Secondary Standards of 35 ppm for the 1-hour average standard and 9 ppm for the 8-hour maximum average standard were not exceeded (NJDEP Bureau of Air Monitoring 2009).

At ground level, ozone is considered an air pollutant that can have serious health effects. Ground-level ozone is created when nitrogen oxides and volatile organic compounds (VOCs) react in the presence of sunlight and heat (NJDEP 2009). Nitrogen oxides are primarily emitted by motor vehicles, power plants, and other sources of combustion. VOCs are emitted from motor vehicles, chemical plants, factories, consumer and commercial products, and natural sources. Because ozone needs sunlight and heat to form, it is mainly a daytime problem during the summer. Ozone (O_3) is measured at Monmouth University and Colliers Mill. Maximum Daily 1-Hour levels averaged 0.105 ppm at Monmouth University and 0.124 at Colliers Mills. The State's Maximum Daily 1-Hour Average Primary Standard is 0.12 ppm. The latter measurement exceeded the State's standard.

The 8-Hour averages were 0.089 at Monmouth University and 0.100 at Colliers Mills. The New Jersey 8-Hour standard is 0.08 ppm. Both measurements exceeded the State's standard of 0.08 ppm. Ozone is one of the pollutants responsible for the unhealthful air quality days experienced in the region (NJDEP Bureau of Air Monitoring 2009).

Particulate air pollution consists of solid particles and liquid droplets suspended in the atmosphere. They can be emitted directly, or they can form in the atmosphere from gaseous emissions. Airborne particles can harm vegetation and aquatic ecosystems and can cause damage to painted surfaces and buildings (NJDEP 2009). Coarse particulate matter was not measured in the Northern Coastal Region in 2008. Fine particulate matter (PM2.5) was measured directly in Toms River. The highest daily concentration was 39.7 $\mu g/m^2$. The annual mean concentration was 10.2 $\mu g/m^2$. "Smoke Shade" was monitored at Freehold. Smoke shade is used as an indirect way of measuring the atmosphere and is measured in "Coefficient of Haze" (COHs) (NJDEP 2009). COHs are units of light transmittance and smoke shade is not a direct measure of particle mass. The maximum 24-hour average in Freehold was 0.49 COHs. The annual mean was 0.15 COHs. Both readings were below the State benchmark of 2.0 COH (NJDEP Bureau of Air Monitoring 2009).

Monmouth County is located within the New York-N. New Jersey-Long Island, NY-NJ-CT Non-attainment Area for Fine Particulates. Fine particulate matter ($PM_{2.5}$) measured 37.1 micrograms per cubic meter for the 24-hr maximum at the Toms River station in 2008. The annual mean was 10.2 micrograms per cubic meter, respectively. None of the New Jersey monitoring stations exceeded the 24-hr standard of 45.4 micrograms per cubic meter (NJDEP Air Quality Monitoring Bureau 2009).

Sulfur dioxide (SO_2), a gas that forms when fuel containing sulfur is burned or when gasoline is extracted from oil. Nitrogen dioxide (NO_2), a gas that is emitted from exhaust of motor vehicles, the burning of coal, oil or natural gas and industrial processes, were not measured in the NC Region. Lead, a metal that occurs naturally and is also produced by human activities (NJDEP Bureau of Air Monitoring 2009), was also not measured.

3.1.9 AMBIENT SOUND CHARACTERISTICS

Sound is what we hear. Noise is unwanted sound. The difference between sound and noise depends upon the listener and the circumstances. Sound is produced by vibrating objects and reaches the listener's ears as waves in the air or other media

The kinetic energy of sound waves can be quantified in decibels (dBA). The decibel (dBA) scale ranges from 0 for the threshold of perception of sound to approximately 130 dBA for the threshold of pain at the ear; a quiet residential street may have sound levels in the 5-60 dBA range, while heavy trucks generate sound levels in the 85-95 dBA range. The project site is presumed to be within the range of moderate street traffic due to its frontage on a urban local roadway (NJDOT 2004) with sound levels in the 5-60 dBA range. The major sound generating activities associated with warehouse uses are those generated by truck traffic.

3.2 BIOLOGICAL RESOURCES

Information on the biological resources of the project area was compiled from previous reports, database searches, and personal observation. Site visits for the purpose of the EIR were conducted by Staff from Colliers Engineering & Design (dba Maser Consulting) during a site inspection of the subject property on March 11, 2021.

3.2.1 VEGETATION

The vegetation of the site reflects the geographic location (New Jersey Coastal Plain), topography and exposure, bedrock geology and soils, landscape processes, hydrogeology (i.e., the streams, ponds, high water tables, etc.), and land use history. The project site reflects the influences of each of these factors.

At the time of the site reconnaissance the agricultural field had been plowed for cultivation. No vegetation was observed on the site with the exception of a tree row (Red Maple cultivar) along the driveway to the pole barns.

3.2.2 ZOOLOGICAL RESOURCES

3.2.2.1 AQUATIC BIOTA

No Streams or watercourses were observed to be on the subject property

3.2.2.2 WILDLIFE

Dozens of species of native mammals are known to reside in New Jersey. The following wildlife species were noted by presence or sign: common mammals (Gray Squirrel, White-footed Mouse, Eastern Chipmunk, Woodchuck, Raccoon, Opossum, Eastern Cottontail, and White-tail deer) and birds (Red-tailed Hawk, Black-capped Chickadee, House Wren, Robin, Cardinal, American crow, Blue Jay, Canada Goose, Starling, Turkey buzzard, Barn swallow, Cedar waxwing, Wild turkey, Eastern phoebe, Chipping sparrow, Red-bellied woodpecker, Downy woodpecker and Wood thrush).

3.2.3 RARE SPECIES AND SPECIES OF SPECIAL CONCERN

The Freshwater Wetlands Letter of Interpretation issued for the site on January 17, 2018, stated there are no wetlands present onsite. A request was made to the NHP to search its database, as well as that of the Landscape Project, for rare, threatened and endangered species that may be present in the vicinity of the project site. The NHP response (NJDEP 2021, Appendix D) is pending.

A review of the NJDEP's Geoweb Landscape Project Mapping indicates that there is no one threatened and endangered species habitat as being mapped for the property.

3.3 CRITICAL ENVIRONMENTAL RESOURCES AND FEATURES

Critical or "sensitive" environmental resources and features are those that either have more inherent environmental value, or are more susceptible to perturbation, or both. These resources and features include those with special ecosystem functions such as wetlands; those with special regulatory status such as endangered species; those with special permitting needs such as steep slopes to be graded or floodplains planned for development; and those with special socio-

economic value such as long established trails for public access and view sheds. No such critical resources or features exist on the site.

3.3.1 WETLANDS AND WATERS

Wetlands are those areas that are inundated or saturated with surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted to life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas. Wetlands are recognized for their many important ecosystem functions and socio-economic values and are provided protection pursuant to the New Jersey Freshwater Wetlands Protection Act of 1987.

Freshwater Wetlands were not observed on the project site and were confirmed by NJDEP in a Letter of Interpretation, dated January 17, 2018 (NJDEP File #1319-17-0011.1 FWW170001) (see Appendix E).

3.3.2 CRITICAL WILDLIFE HABITATS

The New Jersey Landscape Project uses geographic information system (GIS) technology to map critical wildlife habitat throughout the State based on species location data, land cover data and species life history and habitat requirements. Habitat patches are assigned a numbered rank based on the criteria listed below.

Rank 5 is assigned to patches containing one or more occurrences of at least one wildlife species listed as endangered or threatened on the Federal list of endangered and threatened species.

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

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

Rank 2 is assigned to patches containing one or more occurrences of species considered to be species of special concern.

Rank 1 is assigned to patches that meet habitat-specific suitability requirements such as minimum size criteria for endangered, threatened or priority wildlife species, but that do not intersect with any confirmed occurrences of such species.

The New Jersey Landscape Project data accessed through the NJ-GeoWeb indicates the following one habitat cover types with corresponding patch ranks occur on the subject property: Agriculture (Rank 1). This ranking was considered by the NJDEP during their site inspection of the property. Based upon the site inspections the NJDEP determined that no threatened or endangered species occur on site.

3.3.3 STANDS OF MATURE VEGETATION

A review of historic aerial photography indicates that the entire property was used for agriculture since 1931. No mature vegetation has occupied the site from 1931 to present time.

3.3.4 FLOODPLAINS/RIPARIAN ZONES

The geomorphic area inundated by flood waters of rivers or streams is the floodplain, which has a series of structural subdivisions defined largely by elevation, position and the periodicity of inundation. Floodplains provide important ecosystem functions and socio-economic values including the dissipation of flood waters, groundwater recharge, water quality improvement, wildlife habitat, etc.

The Flood Insurance Rate Map (FIRM) dated September 25, 2009 (Community Panel Number 34025C0301F,) was reviewed to determine the approximate extent of floodplains on the subject property (Figure 9).

There are no mapped flood hazard areas that would encroach onto the subject property nor was there any regulated watercourse onsite and was confirmed by NJDEP in a Flood Hazard Applicability Determination, dated January 19, 2018 (NJDEP File #1319-17-0011.1 Activity # APD170001) (see Appendix F).

3.3.5 AQUIFER RECHARGE AREAS

The Composite confining unit aquifer system is mapped for the site by the NJDEP NJ-GeoWeb (Figure 7). The NJDEP's mapping of groundwater recharge shows that the majority of the site, with the exception of a small portion located on the southeast portion of the property, is capable of moderate (11 to 15 inches per year) groundwater recharge. (Figure 10)

3.3.6 AREAS OF HIGH WATER TABLE

Four soil types are present on the project site, Freehold loam, 0-2% slopes (FroA), Freehold sandy loam, 2-5% slopes (FrkB), Freehold sandy loam, 5-10% slopes (FrkC), and Woodstown, 2-5% slopes (WoeB). The depth to water table is at the around 1.5 to 2.5 ft. from the surface for the Woodstown soils. In the Freehold soils, the depth to water table is greater than 6 ft. from the surface (Jablonski 1989). Therefore, approximately 98% of the property will have a water table greater than 6 ft. from the surface.

3.3.7 CRITICAL GEOLOGIC AREAS

No critical geologic areas are present on the site.

3.3.8 STEEP SLOPES

Steep slopes are defined herein as areas with 15% slopes or greater. Much of the site is variable in elevation as described previously in this report. No steep slope areas are present on the site.

3.3.9 HYDRIC, ACIDIC OR HIGHLY ERODIBLE SOILS

None of the four soil types mapped for the property is on the list of New Jersey Hydric Soils (NRCS 1998). The absents of wetlands onsite further supports this.

According the map of Coastal Plain Formations of New Jersey with Acid-Producing Soils, contained in the Soil and Sediment Control Standards (NJDEP 1999); the Vincentown Formation is not mapped as an acid-producing formation and therefore should be expected to have acid-producing soils.

3.4 CULTURAL AND AESTHETIC RESOURCES

3.4.1 HISTORIC AND ARCHAEOLOGICAL RESOURCES

According to the Township's Environmental Resource Inventory, the *New Jersey* & *National Registers of Historic Places: 1970 Through* 1995 (NJDEP 2011), identifies the following sites for Howell Township:

- Dowd Site
- W. Dinnell House, 2096 US Route 9
- Freehold and Jamesburg Agricultural Railroad, masonry arch bridge over Long Branch (Killtime) Brook
- Floodplain Site West of Marsh Bog Brook
- Freehold and Jamesburg Agricultural Railroad Historic District
- Jackson Forge Complex site
- Jerseyville Methodist Episcopal Church, Howell Road near NJ Route 33
- Kandy Bar Ranch site
- New Jersey Southern Railroad Historic District, railroad right of way from Red Bank Borough, Monmouth County, to Lakewood Borough, Ocean County
- New Jersey Southern Railroad Masonry Stone Arch Bridge over the North Branch of the Metedeconk River
- J.T. Reynolds House, US Route 9 and Kent Road
- J.W. Reynolds House and outbuildings, US Route 9 and Locust Avenue
- Southard Grange, US Route 9
- Squankum Mill site

None of the historic or cultural sites shown on the Historical & Cultural Resources Map in the Howell ERI are depicted on or in the vicinity of the proposed project. However, the NJDEP's Geoweb mapping does show the subject property as a being identified as an individual historic property. Historic Properties are buildings, sites, structures or objects that are evaluated as historically significant.

4.0 ASSESSMENT OF ENVIRONMENTAL IMPACTS

The site currently is an active cultivated agricultural field with two associated pole barns. The two structures are located in the southcentral portion of the property. Agricultural fields abut the

property to the west, Howell Road to the east, Route 33 to the south and commercial properties to the north.

The applicant is proposing to construct two warehouses on the property. The project will also include four (4) drive in bays, 91 loading bays, 277 vehicles parking stalls, 68 trailer parking stalls, a sewage pump station, and a stormwater management basin.

Sensitive resources and features have not been observed on the subject property, thus the potential for environmental impacts to the property is minuscule, if any. Potential impacts are identified below according to specific site characteristics set forth in the previous sections of this document. Mitigation measures to reduce or eliminate these impacts are discussed here for the construction and operational phases of the proposed project and are also summarized in the following section on steps to minimize environmental impacts.

4.1 IMPACTS TO PHYSICAL CONDITIONS

4.1.1 TOPOGRAPHY, GEOLOGY, AND SOILS

The proposed construction two warehouse buildings on the property will result in alterations to the existing topography of the property. The relocation of the driveway entrance to the east of the existing driveway will result in some minor changes in topography in order to establish safe road grades (less than 12%). At the time of this report final elevations were not determined but based on past similar projects, material excavated from higher elevations will be used to raise the elevation of the lower elevation areas in order to make the site balance and minimize the generation of any excess material. The eastern portion of the property will have modest cuts and while the western portion will have modest fills. The elevations at this location range from 131 ft. to 148 ft.

Due to no hydric soils occurring on the subject property and the depth of the water table where construction activities are proposed (greater than 6 ft. from the surface) no intrusions below the water table should occur. A construction period soil erosion and sediment control plan, approved

by the Freehold Soil Conservation District, will be implemented to reduce construction effects of the project related to erosion and sedimentation.

Since the Vincentown Formation is not shown as an acid-producing coastal plain deposit on mapping contained within the State's Soil Erosion and Sediment Control Standards (N.J.A.C. 16:25A), acid-producing soils should not be present.

Soils impacted by past agricultural practices will be addressed prior to construction activites.

4.1.2 HYDROLOGY/WATER QUALITY

Potential impacts to surface and groundwater and water quality include short-term impacts related to the construction phase, and long-term impacts related to the operation of the development. A construction period stormwater management plan, including use of erosion reduction/prevention techniques, materials, and plantings will be prepared and implemented to prevent impacts to water quality from sedimentation and construction-related stormwater runoff.
As previously discussed in the existing conditions section of this EIR, stormwater runoff generated by the subject property drains via overland flow ultimately to an off-site tributary to Burkes Creek. The proposed warehouses will not result in any major alteration to these existing flow patterns. The warehouse facility will result in an increase in the amount of impervious cover present on the property. The additional surface water runoff from these areas will be controlled by the stormwater management facility (infiltration basin) proposed for the project. The stormwater management facility will be designed to meet the NJDEP's stormwater quality standards as required by the NJDEP's Stormwater Management Rules (N.J.A.C. 7:8).

The groundwater contaminant plume from the off-site property will continued to be monitored and addressed if needed.

4.1.3 SOUND

Construction activities on the site will cause temporary increases in sound levels in the vicinity of the site. These sound levels will be comparable to normal sound levels for construction. During the operational phase of the project, it is anticipated that the main source of sound will be

truck traffic and the operation of air conditioning units for the warehouse facility.

Ambient noise levels are typically measured in units of decibels (dBA). The recommended outdoor noise level in residential areas is 65 dBA. The primary noise generating source associated with the warehouse will air conditioning units and truck traffic. Noise levels from these sources are estimated to be <65 dBA at the source, which is within the recommended range, as noted previously in this report.

4.1.4 AIR QUALITY

The proposed project does not include industrial manufacturing uses or other types of significant point sources of air pollution. The only other source of emissions from the proposed project will be the exhaust from motor vehicle usage in and around the site during construction and heating units for the warehouse building. During construction, air quality near the project will be slightly affected by exhaust emissions and dust from construction vehicles and equipment in the immediate vicinity of the site. However, as a result of the Federal Emission Control Standards, the level of pollutants emitted from vehicle exhaust has decreased over the years. All modern-day vehicles also have to meet USEPA emission standards. Carbon monoxide and ozone are pollutants associated with motor vehicles. Idling of vehicles will not be permitted during the construction and operation phases of the project to help reduce air pollution resulting from the project. Use of water trucks will help diminish the amount of dust generated during construction.

4.2 IMPACTS TO BIOLOGICAL RESOURCES

4.2.1 VEGETATION AND FLORA

There proposed construction of the two warehouse buildings with associated parking and stormwater management facilities will result in the loss of approximately 30 acres of prime farmland. The existing and proposed commercial use will occupy majority of the subject property (29 acres). The area of proposed construction, as indicated previously in this report, has been use for agricultural cultivation dating back to the 1930's.

Due to the previous/current land use of the subject property no impacts to botanical resources will be encountered.

4.2.2 WILDLIFE

The subject project currently has limited habitat for wildlife due to the active agricultural operation. The subject property is identified by the NJDEP as not representing critical wildlife habitat for certain species of special concern and certain State listed threatened and endangered species.

The loss of the agriculture operation will result in the displacement of certain species of wildlife such as deer, raccoons, opossums, a number of species of rodents and bird species that are common to this section of New Jersey as listed previously in this report. Some of these species (deer, raccoons, rodents) are highly tolerant of human disturbance and may return to the property upon completion of the project. Other species will be displaced (bird species) but the displacement of these species is not considered significant since they are common to New Jersey and may find refuge in the surrounding habitats.

4.3 IMPACTS TO CRITICAL ENVIRONMENTAL RESOURCES

4.3.1 WETLANDS

The subject property does not contain and wetland features.

4.3.2 CRITICAL WILDLIFE HABITAT

The NJDEP confirmed no wetlands onsite, when the Letter of Interpretation was issued, and therefore supports the fact that no critical wildlife habitat will be disturbed. Landscape mapping indicated a Rank of 1, no critical wildlife is present.

4.3.3 STANDS OF MATURE VEGETATION

The site is currently an active agricultural field and has been since the 1930's, and therefore not disturb any mature vegetation.

4.3.4 FLOODPLAINS/RIPARIAN ZONES

No flood hazard areas have been identified as occurring on the property (see Figure 9). This was confirmed by NJDEP's Flood Hazard Applicability Determination, dated January 19, 2018 (NJDEP File #1319-17-0011.1 Activity # APD170001) (see Appendix F).

4.3.5 AQUIFER RECHARGE AREAS

The NJDEP's mapping of groundwater recharge shows that the majority of the site is capable of moderate (11 to 15 inches per year) groundwater recharge (Figure 10). Since impervious cover will be increased on the site, a decrease in aquifer recharge would result from the proposed development. To compensate for this decrease, groundwater recharge will be provided in accordance with the NJDEP's Stormwater Management Rules (N.J.A.C. 7:8) through the installation of the infiltration basin to off-set any potential loss in groundwater recharge.

4.3.6 AREAS OF HIGH WATER TABLE

Water tables onsite are majority greater than 6 ft. from the surface with the exception of the far southern portion, which has a water table from about 1.5 to 2.5 ft. from the surface. Therefore, minimal impacts, if any, to areas with high water tables are expected as a result of this project.

4.3.7 STEEP SLOPES

The subject property does not contain any steep slopes, therefore, the project will not impact areas of steep slopes.

4.3.8 HYDRIC, ACIDIC, OR HIGHLY ERODIBLE SOILS

No hydric soils occur on the subject property. Excavation below the water table will also be avoided. A construction period soil erosion and sediment plan, approved by the Freehold Soil Conservation District, will be implemented to reduce construction effects of the project related to erosion and sedimentation. Since the Vincentown Formation is not shown as an acid-producing coastal plain deposit on mapping contained within the State's Soil Erosion and Sediment Control Standards (N.J.A.C. 16:25A), acid-producing soils should not be present on the property.

4.4 IMPACTS TO CULTURAL RESOURCES

No historic or archaeological resources are known to be present on or in the immediate vicinity of the site. No impacts to such resources are anticipated.

5.0 STEPS TO MINIMIZE ENVIRONMENTAL DAMAGE

5.1 PLANNING PHASE MEASURES

Regarding the warehouse facilities being proposed for the site and the project to be located in the SED Zone, the planning phase is perhaps the most important aspect of proposing measure or controls that will minimize or eliminate negative impacts. The proposed project includes a series of design features included to adhere to the zoning requirements. These include but are not limited to the following:

- Appropriate setbacks and dimensional requirements.
- Preparation of a Landscape Plan associated with the proposed Site Plan
- Grading and drainage plans will be prepared in accordance with the requirements for the Site Plan.
- A Stormwater Management Plan will be prepared in accordance with State rules and guidelines.

5.2 CONSTRUCTION PHASE MEASURES

Construction phase impacts include noise, dust, traffic, environmental safety, and other short-term potential impacts. The project will adopt the following measures:

- Construction activities will adhere to the Township's adopted normal schedule for construction activities (usually 8:00 AM and 5:00 PM).
- Noise level control techniques will be utilized when feasible to reduce noise in sensitive areas such as residential neighborhoods.
- Implementation of best management practices regarding erosion and sedimentation control.
- Implementation of dust prevention measures.

- Construction access to project-oriented parcels only from non-residential roads, as feasible.
- Strict recycling and trash pickup measures to reduce stockpiling of refuse onsite.
- A no vehicular idling policy within the project area to reduce noise and air pollution.
- Adherence to all OSHA protocols and standards.
- The proposed Site Plan implementation will not require a water supply during the construction phase.
- The proposed Site Plan implementation will not require any sewage discharge or disposal during the construction phase.
- If any historic or archaeological resources are discovered during excavations and grading of the site, the State Historic Preservation Office will be contacted for guidance.

5.3 OPERATIONAL PHASE MEASURES

Operation phase impacts include traffic, noise, environmental health and safety, landscape maintenance, and other long-term potential impacts. The project will adopt the following measures:

- Conduct routine maintenance and repair activities, except for emergencies, during weekday business hours, between 8:00 AM and 5:00 PM.
- The proposed Site Plan implementation will not require a water supply during the operation phases, except perhaps as related to maintenance of landscape features.
- The proposed Site Plan implementation will not require any sewage discharge or disposal during the operation phase.
- Maintain all landscaping, setbacks, and buffers for the maximum aesthetic effect including replacement of landscape and buffer trees and other plantings as needed.

6.0 UNAVOIDABLE ADVERSE IMPACTS

Unavoidable adverse impacts are those residual impacts that remain after the implementation design control measures and specific mitigation measures, as listed and discussed herein, to reduce or eliminate, as feasible, the identified adverse impacts. Such adverse environmental, cultural, and community impacts can be short- or long-term.

7.0 BENEFICIAL ENVIRONMENTAL IMPACTS

Some beneficial impacts will be associated with the warehouse project. These include:

1. Enhancements in habitat value for those areas where landscaping plantings will occur.

8.0 REQUIRED PERMITS, LICENSES, AND APPROVALS

The following constitutes a list of licenses, permits, and approvals required for the proposed project which are to be applied for unless otherwise indicated.

Granting Authority	License, Permit, or Approval	Status
Township of Howell Zoning Board	• Permitted Use	• Subject of Application
Township of Howell Planning Board	• Preliminary and Final Site Plan Approval	• Subject of Application
Municipal Utilities Authority	• Water and sewer hookups	• To be submitted
Monmouth County Planning Board	• Land Development Application	• To be submitted
Freehold Soil Conservation District	• Soil Erosion and Sediment Control Plan Certification	• To be submitted

9.0 REFERENCES

Dalton, R. 2003. "Physiographic Provinces of New Jersey". New Jersey Geological Survey Information Circular. 2 pp

Federal Highway Authority (FHWA). 2013. FHWA Functional Classification Guidelines. (https://www.fhwa.dot.gov/planning/processes/statewide/related/highway_functional_classifications/).(Accessed 03/18/2011)

Herman,GC, RJ Canace, SD Stanford, RS Pristas, PJ Sugarman, MA French, JL Hoffman, MS Serfes, WJ Mennel. 1998. Aquifers of New Jersey. OFM 24. New Jersey, Department of Environmental Protection, Environmental Planning and Science, Division of Science and Research, Geological Survey

Jablonski, CF. 1989. Soil Survey of Monmouth County. USDA, SCS and New Jersey Agricultural Experiment Station, Cook College, Rutgers:170 pp

Monmouth County Planning Board and Monmouth County Environmental Council 2000. Ecological Resource Inventory, Mid-Coast Environmental Planning Region, Monmouth County, New Jersey

Monmouth County Planning Board. 2001 The Monmouth County Scenic Roadway Plan. (http://www.visitmonmouth.com/documents%5C24%5CMonmouth%20County%20Scenic%20Roadway%20Plan.pdf). (03/11/2021)

NJDEP, DFW, ENSP. 2001. Field Guide to Reptiles and Amphibians in New Jersey, 1st Edition

New Jersey Department of Environmental Protection [NJDEP]. 2020. Stormwater Management Rules, N.J.A.C. 7:8.

New Jersey Department of Environmental Protection [NJDEP]. 2020. Surface Water Quality Standards, N.J.A.C. 7:9B.

NJDEP Bureau of Air Monitoring. 2009. *2008 Air Quality Report*

NJDEP Bureau of Air Monitoring. 2010. *2009 Air Quality Report*

New Jersey Department of Environmental Protection [NJDEP]. 2011. New Jersey and National Registers of Historic Places, 1970-2009. (updated 12/28/2020).

(http://www.state.nj.us/dep/hpo/1identify/lists/monmouth.pdf). (Accessed 03/11/2021)

New Jersey Department of Transportation (NJDOT). 2004 2000 Urban Functional Classification, Monmouth County, June 2, 2004. (http://www.state.nj.us/transportation/refdata/roadway/gismaps/Monmouth.pdf). (Accessed 03/11/2021)

Owens, JP, PJ Sugarman, NF Sohl, RA Parker, HF Houghton, RA Volkert, AA Drake, RC Orndorff. 1998. Bedrock Geologic Map of Central and Southern New Jersey. Miscellaneous Investigations Series Map I-2540-B. US Department of the Interior and the Us Geological Survey

Soil Survey Staff, Natural Resources Conservation Service (NRCS), United States Department of Agriculture (USDA). 2020. Web Soil Survey. Available online at http://websoilsurvey.nrcs.usda.gov/. March 2021.

R:\General\Projects\2020\20003841A\Reports\Ecological\EIR\210331_EIR_Final.doc

APPENDIX A

QUALIFICATIONS OF PREPARERS

RAYMOND WALKER, Ph.D., P.W.S.

Director, Ecological Services

EDUCATION

- Ph.D., Ecology (Wetland Ecology), 1981, Rutgers University
- B.S., Environmental Biology, 1974 Manhattan College

PROFESSIONAL REGISTRATIONS

- Professional Wetland Scientist 1995, (No. 000639)
- Provisionally Certified Wetland Delineator – U.S. Army Corps of Engineers, 1994 (No. WDCP93MD100101B)

PROFESSIONAL AFFILIATIONS

- Society of Wetland Scientists

PUBLIC SERVICE

- Member of the U.S. National Park Service Task Force – Plan for the Pineland National Preserve 1978-1979
- Member of Freehold Township Open Space Committee – 1997-2000
- Member of Freehold Township Board of Adjustment– 1998- 2007
- College of Mt. St. Vincent Science Advisory Committee 2009-Present

HONORS SOCIETY / AWARDS

- Sigma Xi
- Department of the Army Official Commendation, Customer Care Award, December 22, 1986
- Department of the Army Official Commendation, Special Act Award, May 12, 1987
- Department of the Army Official Commendation, Special Act Award, December 3, 1987

EXPERIENCE

Dr. Walker has been a proven leader and effective project manager in the field of ecological services since 1980. Dr. Walker brings a creative approach to securing regulatory approvals for a broad range of private, municipal, and public development projects that involved complex and challenging ecological issues. Having worked in academia, for regulatory agencies, and as a private consultant, has allowed Dr. Walker to develop a unique understanding and perspective on what it takes to secure regulatory approvals.

Dr. Walker's scientific background coupled with his regulatory experience, open mindedness, and temperate manner has made him very effective at mediating resolutions to wetland enforcement actions. Dr. Walker has been certified as an expert in the field of ecological sciences and regulatory issues in a variety of legal venues including Federal District Court, Local Courts, Office of Administrative Law, and numerous Planning and Zoning Boards.

The staff that Dr. Walker supervises is composed of degreed experts in a variety of fields associated with ecological services. These include expertise in due diligence investigations, wetland delineations, threatened and endangered species studies, preparation of Environmental Impact Statements, preparation of NEPA and SEQRA compliance documents, development and implementation of wetland mitigation projects, submerged aquatic vegetation studies, flora and fauna inventories, rare plant studies, lake restoration and management, essential fish habitat studies, nitrate dilution modeling, carbon foot printing, greenhouse gas analyses, environmental resource inventories, resource management, and regulatory issues.

PREVIOUS WORK EXPERIENCE

Najarian Associates, L.P., Director of Ecological Sciences Section, 1987-1992.

U.S. Army Corps of Engineers, Philadelphia District, Regulatory Branch, Chief of Surveillance and Enforcement, 1986-1987

U.S. Army Corps of Engineers, Philadelphia District, Regulatory Branch, GS-11 Biologist, Application Section, 1984-1986

College of New Jersey, Trenton, NJ, Adjunct Assistant Professor of Biology, 1982-1984.

Mercer County Community College, West Windsor, NJ, Adjunct Assistant Professor of Biology, 1982-1984.

Rider University, Adjunct Assistant Professor of Biology, 1980-1982

RAYMOND WALKER, Ph.D., P.W.S.

SEMINARS/LECTURES

Pocono Environmental Education Center, Guest Lecturer, "Wetland Regulations," 1992.

New Jersey State Bar Association's Wetland Seminar, Guest Panelist, 6/91.

Rutgers University's Continuing Education Program "Introduction to Wetland Ecology"; "Freshwater Marshes," Guest Lecturer, 4/91.

Government Institutes, Inc. Wetlands and Real Estate Development Course, Philadelphia, PA; "Army Corps of Engineers' Role in Wetlands Regulation," Guest Lecturer, 3/91.

New York State Wetland Seminar Series held in Buffalo, Syracuse and Albany; "Wetlands and Development in New York State", Guest Lecturer, 2/91.

New Jersey State Bar Association's Wetland Roundtable, New Brunswick, NJ, Guest Panelist, 11/90.

Rutgers University's Graduate Course "Studies-Wetland Communities and Ecosystems"; "Practical Applications of Wetland Ecology," Guest Lecturer, 10/90.

Guest Lecturer for **Seminar Sponsored by Gloria Nilson Realtors**, Monmouth Beach, NJ entitled "Wetlands and Real Estate Transactions," Guest Lecturer, 8/90.

Guest Lecturer for **Rutgers University's Continuing Education Program "Introduction to Wetland Ecology"**; "Freshwater Marshes," Guest Lecturer, 5/90.

Guest Lecturer for the **New Jersey Chapter of Consulting and Municipal Engineers Training Program, "Environmental Permitting in New Jersey" and "Wetland Regulations in New Jersey",** 2006, 2007, 2008, and 2009**.**

Guest Lecturer for course entitled **"Environmental-Sustainable Planning In New Jersey" at Rowan University, Glassboro, New Jersey,** October 2009 **.**

Guest Lecturer course entitled **"General Ecology" at the College of Mount St. Vincent, Yonkers, New York,** November 2010**.**

Presentation at the Society of Wetland Scientists, Mid-Atlantic Chapter Meeting, December 6, 2012, **"Comparative Functional Assessment Methodology for Assessment of Wetland Resources".**

New Jersey State Bar Association – Environmental Law Forum, June 21, 2019, "**Conducting a Wetland Delineation in New Jersey"**

EXPERT TESTIMONY VENUES

- Federal District Courts in Camden and Trenton, NJ
- NJ Law Division in Camden, NJ
- NJ Office of Administrative Law; Hamilton Township, NJ
- Numerous Planning/Zoning Boards in NJ, PA, and NY
- New Jersey Tax Court, Trenton NJ

RAYMOND WALKER, Ph.D., P.W.S.

EXPERT WITNESS SERVICES

- U.S. Army Corps of Engineers, Philadelphia District Regulatory Branch; Philadelphia, PA.
- Office of the U.S. Attorney, Federal Building, Suite 309, P.O. Box 309; Scranton, PA.
- Pitney, Hardin, Kipp & Szuch, 200 Campus Drive; Florham Park, NJ.
- Giordano, Halleran & Ciesla, 270 State Highway 35; Middletown, NJ.
- Collier, Jacob & Sweet, 580 Howard Avenue, Corporate Park III; Somerset, NJ.
- Jamieson, Moore, Peskin & Spicer, 300 Alexander Road, CN5276; Princeton, NJ.
- Carella, Byrne, Bain, Gilfillan, Cecchi & Stewart, 6 Becker Farm Road; Roseland, NJ.
- Greenbaum, Rowe, Smith, Ravin, Davis & Himmel, Metro Corporate Campus One, Box 5600, Woodbridge, NJ
- Cooper, Rose & English, LLP; 480 Morris Avenue; Summit, NJ.
- Clapp & Eisenberg, 80 Park Plaza; Newark, NJ.
- Parker, McCay & Criscuolo, 3 Greentree Center, Route 73; Marlton, NJ 08053
- Levin & Hluchan, Suite 100, Laurel Oak Road, Vooorhees, NJ 08403
- Scarinci & Hollenbeck, 500 Plaza Drive, P.O. Box 3189, Secaucus, N.J. 07096-3189
- Richard Malagiere, Esq., 14 Bergen Street, 1st Floor, Hackensack, N.J. 07601
- Weiner Lesniak, PO Box 438, Parsippany, NJ 07054-0438
- Chiesa Shahinian & Giantomasi PC, One Boland Drive, West Orange, NJ 07052

PUBLICATIONS

Simpson, R.L., D.F. Whigham and R. Walker. 1978. *Seasonal patterns of nutrient movement in a freshwater tidal marsh.* In: R.E. Good, D.F. Whigham and R.L. Simpson (eds.) Freshwater Wetlands: Ecological Processes and Management Potential. Academic Press, NY.

Merrill, L.G., G.A. Bares, R. Walker, E. Russell, P.A. Buckley, N.P. Psuty, B. Liggett, R. Regensburg, C. Mizobe, F.P. McManamon, M. Bartlett and S. Berg. 1978. **A Plan for the Pinelands National Preserve**. Center for Coastal and Environmental Studies Tech. Report No. 78-6, Rutgers University, 110 pp.

Douglas, L.A. and R. Walker. 1979. *Nonpoint sources of pollution and the soils of the Pine Barrens of New Jersey.* Dept. Soils and Crops, N.J. Agricultural Experimental Sta., Rutgers University, New Brunswick, New Jersey.

Simpson, R.L., R.E. Good, R. Walker and B. Frasco. 1981. *Dynamics of nitrogen, phosphorus and heavy metals in Delaware River freshwater tidal wetlands.* Center for Coastal and Environmental Studies, Rutgers University, New Brunswick, New Jersey and the United States Environmental Protection Agency, Corvalis, Oregon.

Ferren, W.R., R.E. Good, R. Walker and J. Arsenault. 1981. *Vegetation and flora of Hog Island, a brackish wetland in the Mullica River, New Jersey*. Bartonia 48:1-10.

Simpson, R.L., R.E. Good, R. Walker and B. Frasco. 1983. *The role of Delaware River freshwater tidal wetlands in the retention of nutrients and heavy metals.* Jour. Environ. Quality 12:41-48.

Walker, R. and R.E. Good. 1976. *Vegetation and production of some Mullica River-Great Bay tidal marshes***.** Bull. N.J. Acad. Sci. 21:20.

Walker, R. and R.E. Good. 1976. *Production ecology of marsh communities in the upper Mullica estuary, New Jersey.* Aquatic Ecology Newsletter 9:24.

Frasco, B., R.E. Good and R. Walker, 1978. *Biomass and decomposition for 3 macrophytes from a brackish and saltwater tidal marsh in New Jersey.* Amer. Assoc. Adv. Sci. Publ. 78-2, p. 123.

Walker, R. and R.E. Good. 1979. *Seasonal nitrogen dynamics for Peltandra virginica in a freshwater tidal marsh*. Bull. N.J. Acad. Sci. 29:81.

RAYMOND WALKER, Ph.D., P.W.S.

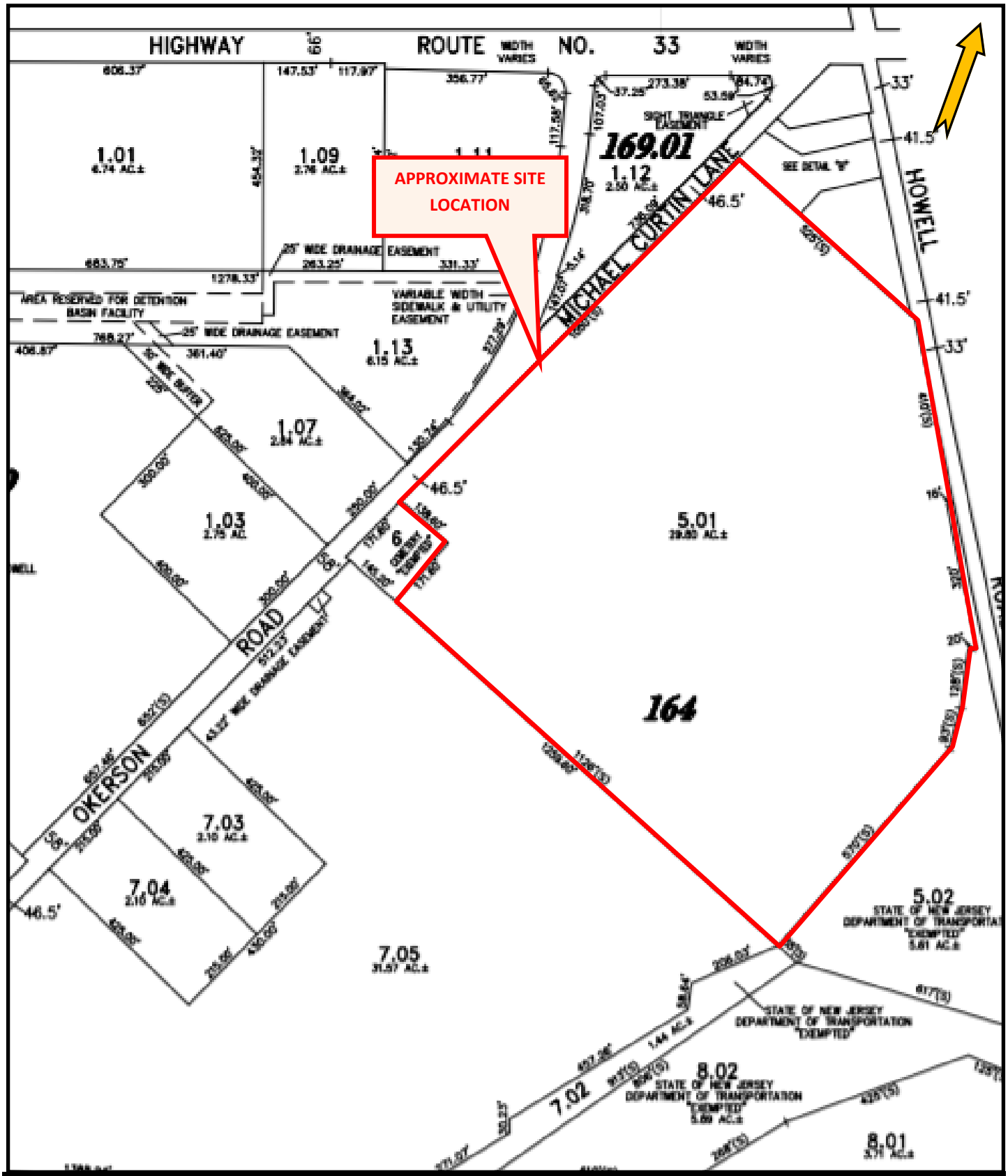
Walker, R., R.E. Good and R.L. Simpson. 1980. **Heavy metals in freshwater wetlands**. 14th Middle Atlantic Regional Meeting of the American Chemical Society, p. 77.

Simpson, R.L., R.E. Good, R. Walker and J.J. Pasquale. 1981. *Patterns of heavy metal distribution in several compartments of a freshwater tidal marsh.* Estuaries 4:271.

Walker, R. and R.E. Good. 1981. *Nitrogen, phosphorus and primary production of Peltrandra virginica (L.)Kunth in a freshwater tidal marsh.* Bull. Ecol. Soc. Amer. 62:93.

APPENDIX B

MAPS



Corporate Headquarters
331 Newman Springs Road
Suite 203
Red Bank, NJ 07701
T: 732.383.1950
F: 732.383.1984
www.maserconsulting.com

Figure 1. Tax Map

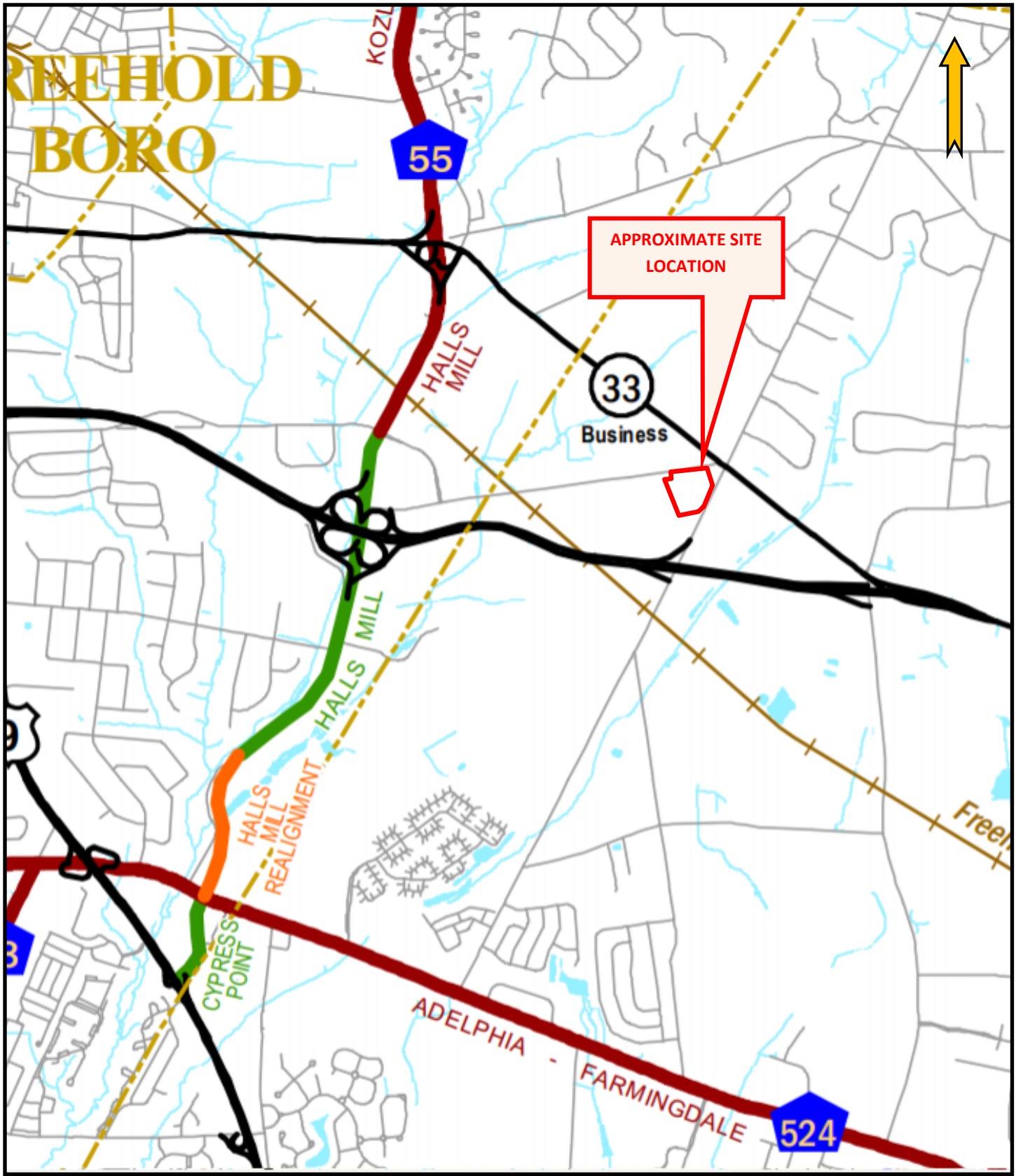
Block 164 Lot 5.01
Howell Township, Monmouth County, NJ

Source: Howell Twp Tax Maps

Scale: Not to Scale

Date: March 10, 2021

CED Project No. 20003841A



Corporate Headquarters
331 Newman Springs Road
Suite 203
Red Bank, NJ 07701
T: 732.383.1950
F: 732.383.1984
www.maserconsulting.com

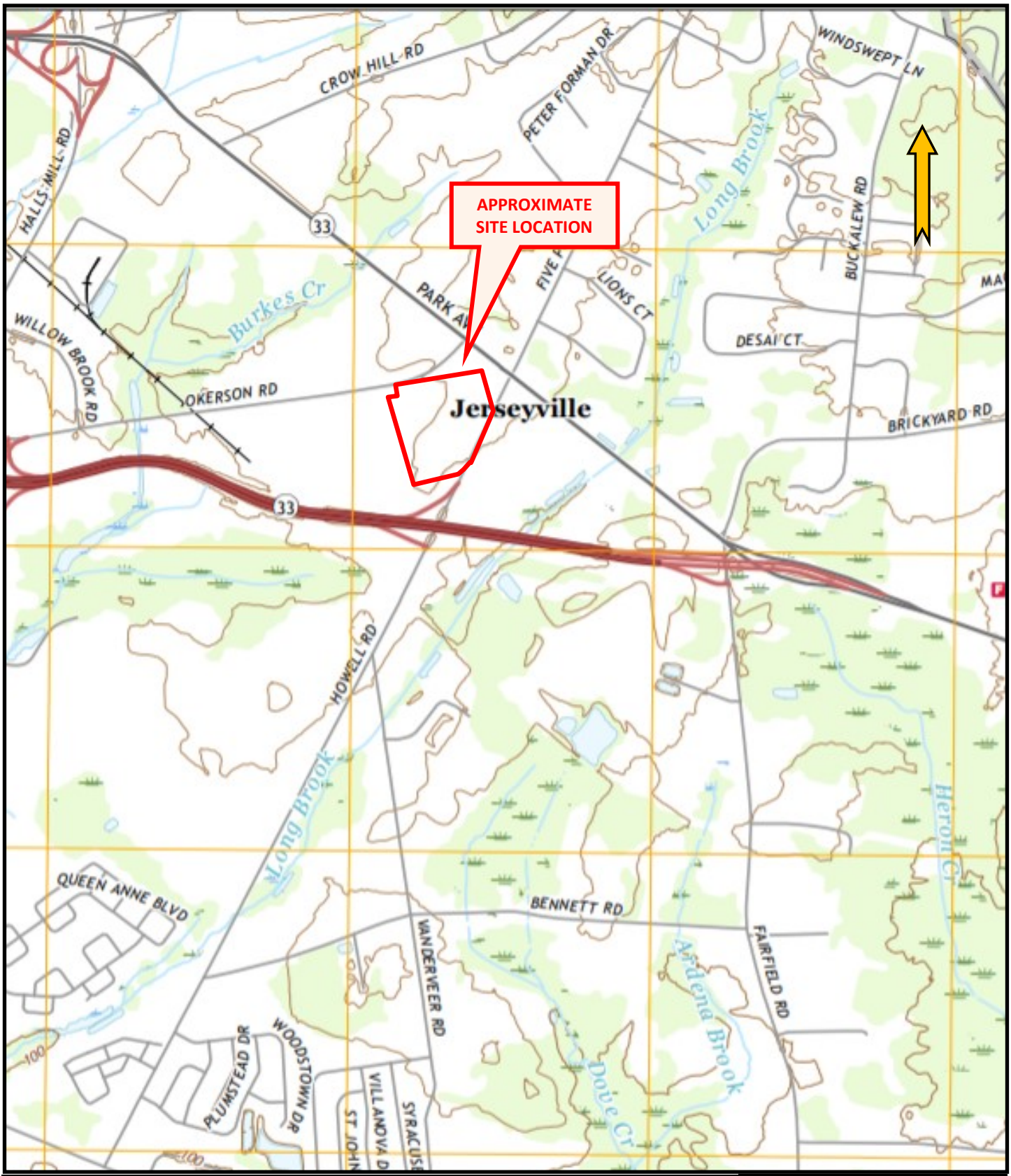
Figure 2. County Road Map
Block 164 Lot 5.01
Howell Township, Monmouth County, New Jersey

Source: NJDOT—Monmouth County Map

Scale: Not to Scale

Date: March 10, 2021

CED Project No. 20003841A



Corporate Headquarters
331 Newman Springs Road
Suite 203
Red Bank, NJ 07701
T: 732.383.1950
F: 732.383.1984
www.maserconsulting.com

Figure 3. U.S.G.S Map

Block 164 Lot 5.01
Howell Township, Monmouth County,
New Jersey

Source: USGS Farmingdale, NJ Quadrangle 2019

Scale: Not to Scale

Date: March 10, 2021

CED Project No. 20003841A

Corporate Headquarters
331 Newman Springs Road
Suite 203
Red Bank, NJ 07701
T: 732.383.1950
F: 732.383.1984
www.maserconsulting.com

Figure 4. NJDEP Aerial Map

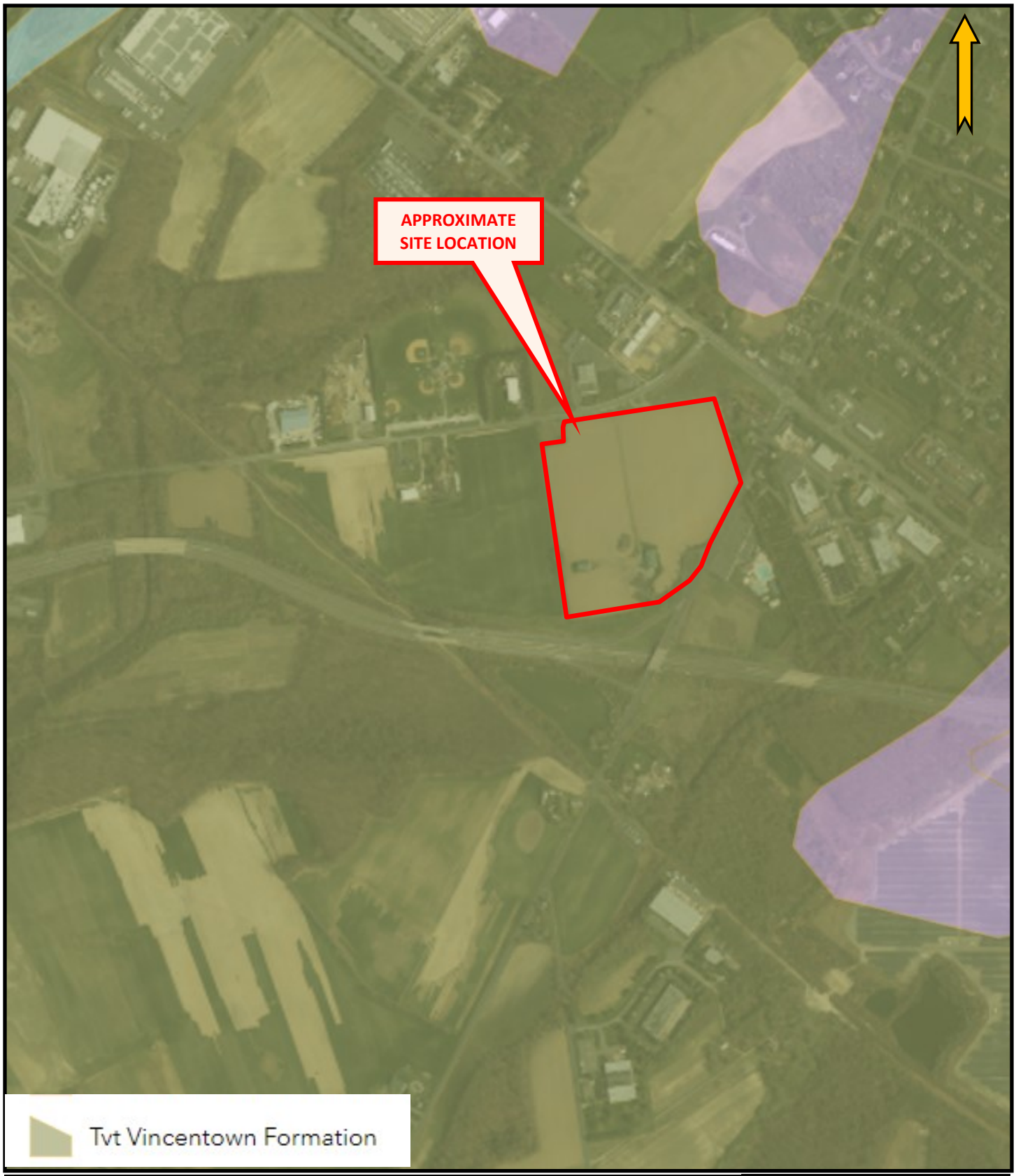
Block 164 Lot 5.01
Howell Township, Monmouth County,
New Jersey

Source: NJ-GeoWeb

Scale: Not to Scale

Date: March 10, 2021

CED Project No. 20003841A



MASER CONSULTING P.A.

Corporate Headquarters
331 Newman Springs Road
Suite 203
Red Bank, NJ 07701
T: 732.383.1950
F: 732.383.1984
www.maserconsulting.com

Figure 5. Bedrock Geology Map

Block 164 Lot 5.01
Howell Township, Monmouth County,
New Jersey

Source: NJ-GeoWeb

Scale: Not to Scale

Date: March 10, 2021

CED Project No. 20003841A

Map Unit Symbol	Map Unit Name
FrkB	Freehold sandy loam, 2 to 5 percent slopes
FrkC	Freehold sandy loam, 5 to 10 percent slopes
FroA	Freehold loam, 0 to 2 percent slopes
WoeB	Woodstown sandy loam, 2 to 5 percent slopes, Northern Coastal Plain

MASER CONSULTING P.A.

Corporate Headquarters
331 Newman Springs Road
Suite 203
Red Bank, NJ 07701
T: 732.383.1950
F: 732.383.1984
www.maserconsulting.com

Figure 6. Soil Survey Map

Block 164 Lot 5.01
Howell Township, Monmouth County, New Jersey

Source: NJ-GeoWeb

Scale: Not to Scale

Date: March 10, 2021

CED Project No. 20003841A

MASER CONSULTING P.A.

Corporate Headquarters
331 Newman Springs Road
Suite 203
Red Bank, NJ 07701
T: 732.383.1950
F: 732.383.1984
www.maserconsulting.com

Figure 7. Bedrock Aquifer Map

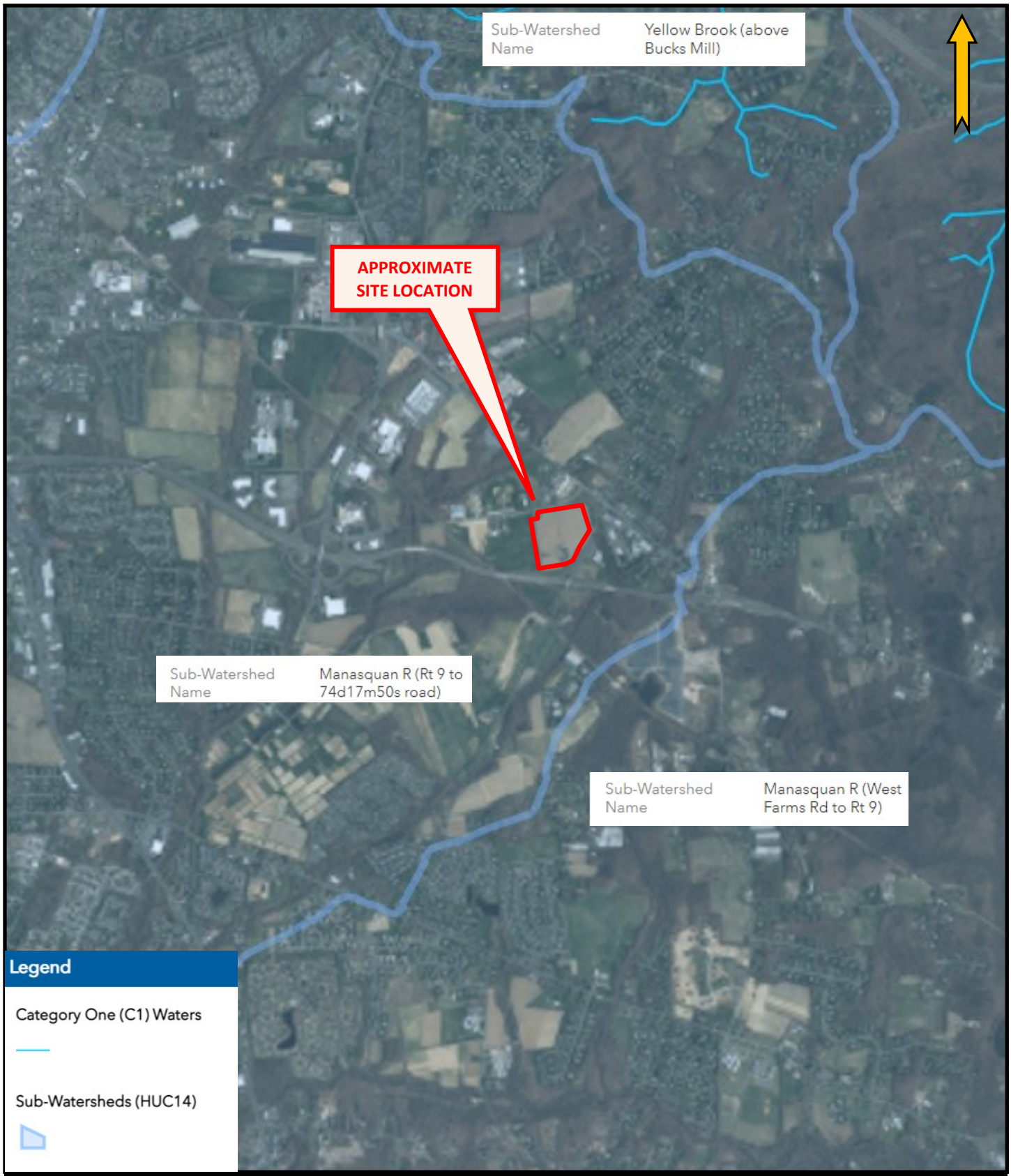
Block 164 Lot 5.01
Howell Township, Monmouth County,
New Jersey

Source: NJ-GeoWeb

Scale: Not to Scale

Date: March 10, 2021

CED Project No. 20003841A



Corporate Headquarters
331 Newman Springs Road
Suite 203
Red Bank, NJ 07701
T: 732.383.1950
F: 732.383.1984
www.maserconsulting.com

Figure 8. HUC14 & C1 Waters Map
Block 164 Lot 5.01
Howell Township, Monmouth County, New Jersey

Source: NJ-GeoWeb

Scale: Not to Scale

Date: March 10, 2021

CED Project No. 20003841A

MASER CONSULTING P.A.

Corporate Headquarters
331 Newman Springs Road
Suite 203
Red Bank, NJ 07701
T: 732.383.1950
F: 732.383.1984
www.maserconsulting.com

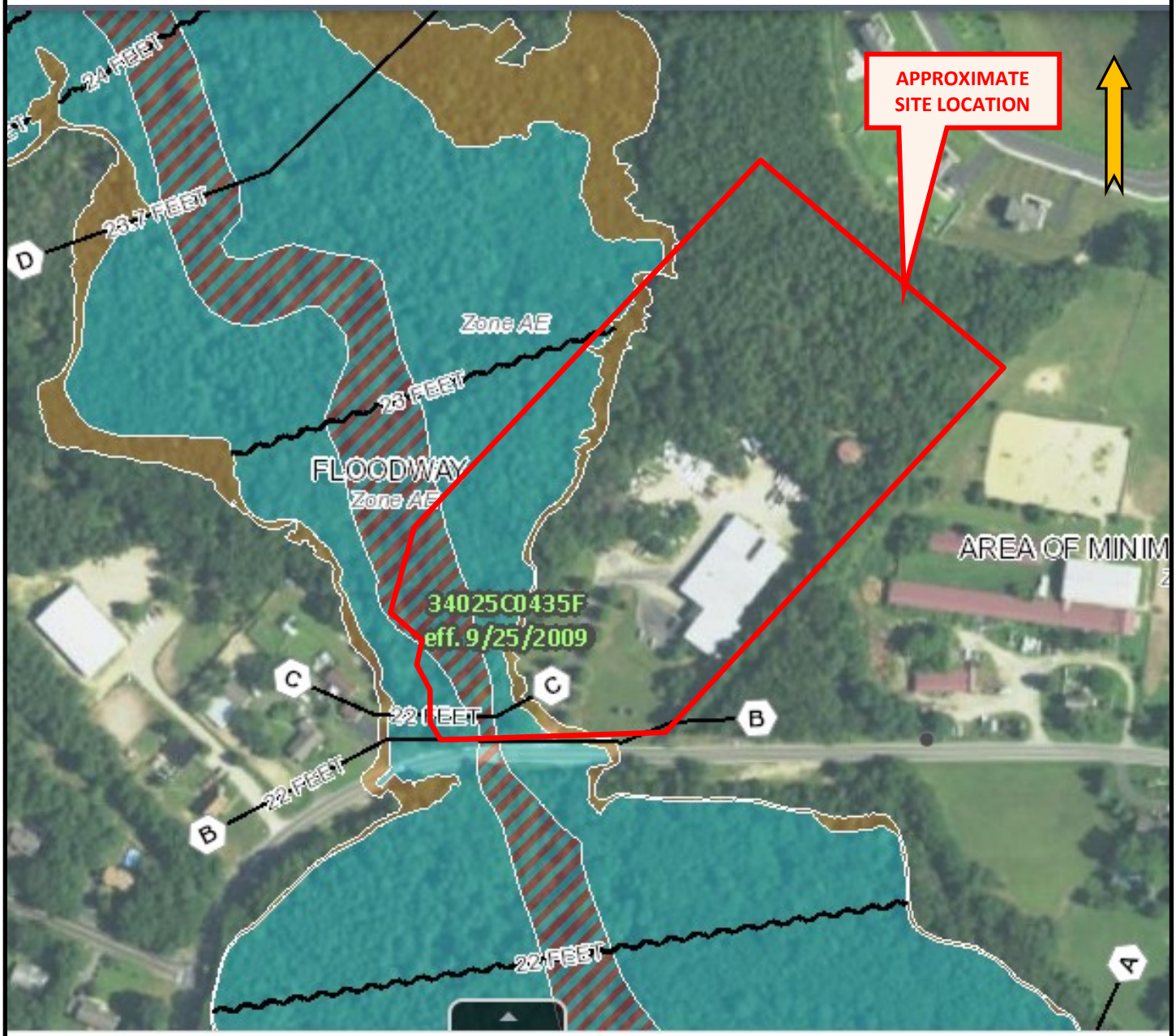
Figure 9. FEMA Flood Map

Block 164 Lot 5.01
Howell Township, Monmouth County,
New Jersey
Source: FEMA NFHL Viewer
Map Number: 34025Co301F, effective 09/25/2009

Scale: Not to Scale

Date: March 10, 2021

CED Project No. 20003841A



Corporate Headquarters
331 Newman Springs Road
Suite 203
Red Bank, NJ 07701
T: 732.383.1950
F: 732.383.1984
www.maserconsulting.com

Figure 9. FEMA Flood Map

Block 3 Lot 29
Howell Township, Monmouth County, New Jersey

Source: FEMA NFHL Viewer
Map Number: 34025C0435F, effective 09/25/2009

Scale: Not to Scale

Date: May 2020

MC Project No. 20000769A

Corporate Headquarters
331 Newman Springs Road
Suite 203
Red Bank, NJ 07701
T: 732.383.1950
F: 732.383.1984
www.maserconsulting.com

Figure 10. Groundwater Recharge Map

Block 164 Lot 5.01
Howell Township, Monmouth County,
New Jersey

Source: NJ-GeoWeb

Scale: Not to Scale

Date: March 10, 2021

CED Project No. 20003841A

APPENDIX C

SITE PHOTOGRAPHS

Characterizing the majority of the site, active agricultural field. Photo of the northwestern portion of the site.

Characterizing the majority of the site, active agricultural field.

SITE PHOTOGRAPHS
ENVIRONMENTAL IMPACT REPORT
PROJECT NO. 20003841A

Characterizing the majority of the site, active agricultural fields. Photo of the southwestern potion of the site.

Characterizing the only trees observed on site and pole barn located in the southern portion of the site.

Characterizing the majority of the site, active agricultural fields.

Characterizing the majority of the site, active agricultural fields. Photo of the northeastern portion of the site.

APPENDIX D

NJDEP NATURAL HERITAGE PROGRAM

State of New Jersey
Department of Environmental Protection
Natural Heritage Data Request Form

The New Jersey Natural Heritage Program Office of Natural Lands Management
Mail Code 501-04, P.O. Box 420, Trenton, New Jersey 08625-0420
(609) 984-1339
Fax No.: (609) 984-1427

Please print clearly. All sections are required.

1. Mr. / Ms. Austin Young Agency/Company: Colliers Engineering & Design (dba Maser Consulting)
   Address: 331 Newman Springs Road, Suite 203 City, State, Zip: Red Bank, NJ 07701
   Phone: (732) 383-1950 Ext: _____ E-mail: austin.young@colliersengineering.com cc: daniel.geran@colliersengineering.com results/invoice
2. Project Name: 29 Howell Road
   Municipality(ies): Howell Township County(ies): Monmouth
   Block(s): 164 Lot(s): 5.01
   Coordinates (NAD 1983 State Plane feet [6 digits] or Lat/Long):
   E(x) / Longitude: 40.136984 N(y) / Latitude: -74.233141
3. Project Description: Proposed warehouse development

4. Site Location Map — A map showing the project boundary (e.g., aerial imagery, street map, tax or parcel map with block and lot). Responses will be delayed if site locations are not clearly delineated. Alternatively, you may submit GIS data (e.g., shapefile, geodatabase, *.kml/kmz) by attaching it to your email submittal. If doing so, please indicate here.
   GIS data is attached: Yes ☐ No ☑
5. Riparian Zone — Is this request submitted as part of a Riparian Zone width determination? Yes ☐ No ☑
6. Acknowledgement & Signature — Any material supplied by the Office of Natural Lands Management will not be published without crediting the Natural Heritage Database as the source of the material. It is understood that there will be a charge of $70.00 per hour for the services requested. An invoice will be sent with the request response. **Please pay by check or money order (no credit card) payable to: "DEP – Office of Natural Lands Management" (please do not reference "NJ State Treasury").**
   Signed: Austin Young Date: 3/8/21

Time Frame for Response:
Data requests are processed in the order in which they are received; PLEASE ALLOW AT LEAST 30 DAYS FOR RESPONSE.
All responses will be emailed to the address provided above, unless other arrangements are specifically requested.

Submit Completed Form With Attachments To The Following Email Address: NATLANDS@DEP.NJ.GOV. You may also fax your data request to: (609) 984-1427. If you would like to send in your data request via regular mail, please use the following address:

NJDEP Office of Natural Lands Management
Mail Code 501-04
PO Box 420
Trenton, NJ 08625-0420

FOR OFFICE USE ONLY

DATE RECEIVED_____

Item Code: REG____ ST ____ NC ____ Hrs: _____

Project Code: _____ Inv.#: _____

Revised August 2019

APPENDIX E

FRESHWATER WETLANDS LETTER OF INTERPRETATION

State of New Jersey

PHIL MURPHY
Governor

SHEILA OLIVER
Lt. Governor

DEPARTMENT OF ENVIRONMENTAL PROTECTION
Division of Land Use Regulation
Mail Code 501-02A
P.O. Box 420
Trenton, New Jersey 08625-0420
www.state.ni.us/dep/landuse

RAY BUKOWSKI
Acting Commissioner

US Home Corporation dba Lennar
c/o Robert Calabro
2465 Kuser Rd
Hamilton, NJ 08690

JAN 17 2018

RE: **Letter of Interpretation: Presence/Absence Determination**
File No.: 1319-17-0011.1
Activity Number: FWW170001
Applicant: US Home Corporation dba Lennar
Block(s) and Lot(s): [164, 5.01]
Howell Township, Monmouth County

Dear Mr. Calabro:

This letter is in response to your request for a Letter of Interpretation from the Division of Land Use Regulation indicating the presence or absence of freshwater wetlands and waters on the referenced property.

In accordance with agreements between the State of New Jersey Department of Environmental Protection, the U.S. Army Corps of Engineers Philadelphia and New York Districts, and the U.S. Environmental Protection Agency, the NJDEP, Division of Land Use Regulation is the lead agency for establishing the extent of State and Federally regulated wetlands and waters. The USEPA and/or USACOE retains the right to reevaluate and modify the jurisdictional determination at any time should the information prove to be incomplete or inaccurate.

Based upon the information submitted, and upon a site inspection conducted by the staff of the Department on December 22, 2017, the Division of Land Use Regulation has determined that freshwater wetlands and waters are not present on the referenced property. In addition, the Department has determined that no part of the above referenced property occurs within a transition area or buffer as designated in N.J.A.C. 7:7A-2.5(d) and (e).

Pursuant to the Freshwater Wetlands Protection Act Rules (N.J.A.C. 7:7A), you are entitled to rely upon this jurisdictional determination for a period of five years from the date of this letter. This letter in no way legalizes any fill which may have been placed, or other regulated activities which may have been conducted on this site. This determination does not affect your responsibility to obtain any State, Federal, county or municipal permits which may be required.

In accordance with N.J.A.C. 7:7A-1.7, any person who is aggrieved by this decision may request a hearing within 30 days after notice of the decision is published in the DEP Bulletin by writing to: New Jersey Department of Environmental Protection, Office of Legal Affairs, Attention: Adjudicatory Hearing

Requests, 401 East State Street, P.O. Box 402, Trenton, NJ 08625-0402. This request must include a completed copy of the Administrative Hearing Request Checklist which can be downloaded at www.state.nj.us/dep/landuse/forms. The DEP bulletin is available through the Department's website at www.state.nj.us/dep/bulletin.

Please contact Iman Olguin-Lira of our staff by e-mail at iman.olguin-lira@dep.nj.gov or (609) 777-0454 should you have any questions regarding this letter. Be sure to indicate the Department's file number in all communication.

Sincerely,

Robert B. Kozachek
Environmental Specialist 3
Division of Land Use Regulation

c: Township Clerk
Township Construction Official

APPENDIX F

FLOOD HAZARD AREA APPLICABILITY DETERMINATION

State of New Jersey

PHIL MURPHY
Governor

SHEILA OLIVER
Lt. Governor

DEPARTMENT OF ENVIRONMENTAL PROTECTION
Division of Land Use Regulation
Mail Code 501-02A
P.O. Box 420
Trenton, New Jersey 08625-0420
www.nj.gov/dep/landuse

RAY BUKOWSKI
Acting Commissioner

FLOOD HAZARD APPLICABILITY DETERMINATION
FLOOD HAZARD AREA CONTROL ACT
N.J.A.C. 7:13-1.1 et Seq.

January 19, 2018

US Home Corporation
Attn: Robert Calabro, Director of Land, NJ Division
2465 Kuser Road
Hamilton, NJ 08690

Re: File No.: 1319-17-0011.1
Activity Number: APD170001
Applicant: US Home Corporation
Project: Lennar at Howell
Block(s) and Lot(s): [164, 5.01]
Township of Howell, Monmouth County

Dear Mr. Calabro:

This is in response to your application for the FHA Applicability Determination received on November 20, 2017, concerning the construction of a residential development, within Lot 5.01 of Block 164, in the Township of Howell, Monmouth County.

DECISION:

A review of submitted information, maps and one drawing prepared by Bowman Consulting Group, undated and unrevised, entitled:

"SCHEMATIC SITE PLAN FOR LENNAR – HOWELL, SCHEMATIC SITE PLAN, BLOCK 164, LOT 5.01, TOWNSHIP OF HOWELL, MONMOUTH COUNTY, NEW JERSEY", sheet 1 of 1

indicates that a formal flood hazard permit or authorization is not required.

REASON FOR DECISION:

Based on the submitted information, there are no mapped flood hazard areas that would encroach onto the project site. Based on a field visit conducted by the Department, it can be concluded that there are no regulated watercourses onsite. In addition, the drainage at the most downstream points of the property are less than 50 acres. Based on the above, the Department has determined that N.J.A.C. 7:13 does not apply to the proposed activities and a formal approval is not required.

This letter does not relieve the applicant of the responsibility of obtaining any other required State including Freshwater Wetlands, Federal or local permits and approvals as required by law and is based on a review of information submitted in accordance with the existing regulations. This determination shall be considered null and void if the submitted information is determined to be incorrect or site conditions change.

Pursuant to N.J.A.C.7:13-2.5(g), this applicability determination is based on the rules in effect and the information provided in the application regarding the site conditions and the proposed activities as of the date of issuance. The recipient of the applicability determination is on notice that subsequent amendments to this chapter, changes in site conditions, changes to the limits of the flood hazard area, floodway, or riparian zone, and/or changes to proposed activities may result in the water in question or proposed activities becoming regulated. The recipient remains solely responsible for determining whether any such changes have occurred and remains liable for any violation of this chapter resulting from activities conducted in reliance on the applicability determination where such changes have occurred and the determination is no longer accurate.

Should you have any questions regarding this determination, please contact Chingwah Liang of my staff at Chingwah.Liang@dep.nj.gov or by telephone at (609) 984-6216.

Sincerely,

Keith P. Stampfel, P.E.
Supervisor
Bureau of Coastal Regulation

cc: Township of Howell Construction Official & Engineer
Agent

APPENDIX G

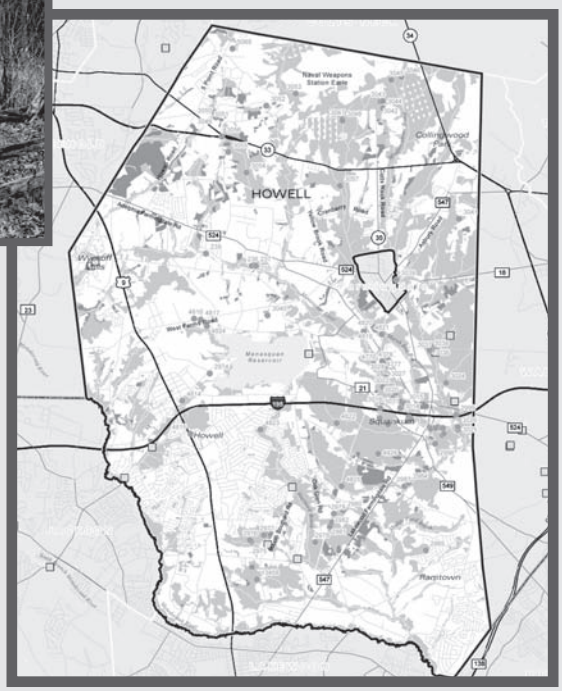
HOWELL TOWNSHIP NRI

ENVIRONMENTAL RESOURCE INVENTORY

of the CONSERVATION ELEMENT

of the HOWELL TOWNSHIP Master Plan

MONMOUTH COUNTY, NEW JERSEY



prepared by:

Delaware Valley
Regional Planning
Commission

with:

Howell Township
Environmental Commission

NOVEMBER 2008

The Delaware Valley Regional Planning Commission is dedicated to uniting the region's elected officials, planning professionals and the public with a common vision of making a great region even greater. Shaping the way we live, work and play, DVRPC builds consensus on improving transportation, promoting smart growth, protecting the environment and enhancing the economy. We serve a diverse region of nine counties: Bucks, Chester, Delaware, Montgomery and Philadelphia in Pennsylvania; and Burlington, Camden, Gloucester and Mercer in New Jersey. DVRPC is the federally designated Metropolitan Planning Organization for the Greater Philadelphia Region - leading the way to a better future.

Our logo is adapted from the official DVRPC seal, and is designed as a stylized image of the Delaware Valley. The outer ring symbolizes the region as a whole, while the diagonal bar signifies the Delaware River. The two adjoining crescents represent the Commonwealth of Pennsylvania and the State of New Jersey.

DVRPC fully complies with Title VI of the Civil Rights Act of 1964 and related statutes and regulations in all programs and activities. DVRPC'S WEBSITE MAY BE TRANSLATED INTO Spanish, Russian, and Traditional Chinese online by visiting www.dvrpc.org. Publication and other public documents can be made available in alternative languages or formats, if requested. For more information, please call (215) 238-2871.

This report was funded by the Association of New Jersey Environmental Commission (ANJEC) Smart Growth Assistance Grant Program, funded by the Geraldine R. Dodge Foundation and by the Township of Howell. The authors are solely responsible for the report's findings and conclusions, which may not represent the official views or policies of the funding agencies.

TABLE OF CONTENTS

Page

TABLES

Page

MAPS

Page

FIGURES

ACKNOWLEDGEMENTS

Many thanks are due to the organizations that provided funding for this *Environmental Resource Inventory for the Township of Howell*. They are:

- The Association of New Jersey Environmental Commissions (ANJEC) Smart Growth Assistance Grant Program, funded by the Geraldine R. Dodge Foundation
- The Township of Howell
- The Delaware Valley Regional Planning Commission's Open Space and Greenways Program

Howell Township Council

Mayor Joseph M. DiBella
Deputy Mayor Michael Howell
Committeeperson Cynthia Schomaker
Committeeperson Angela W. Dalton
Committeeperson Robert F. Walsh

The impetus for the creation of this document, and its guidance and review, came from the Howell Township Environmental Commission.

Howell Township Environmental Commission

Geoff Pritchard, Chairman
Donald Smith, Vice Chairman
John Armata
Bobbi Sue Bowers
Chris Estevez
Michael Hammer
Vijaya Keshari
Paul Schneider
Art Giambrone, Alternate
Jean Montgomerie, Alternate
Stanley Marciniak, Associate
Steve Meier, Associate

Ms. Sue Kalmar, Environmental Commission Secretary; Ms. Helene Schlegel, Howell Township Manager; Elizabeth Naskiewicz, Bear Swamp Project; Howell Township Department of Engineering; the Manasquan River Watershed Association, Monmouth County Department of Planning; the Howell Township Historical Society; and other township and county staff members, and various New Jersey state offices all provided information for this inventory. Members of the Environmental Commission and Historical Society, and the Monmouth County Parks Department graciously offered the use of photographs for this publication.

The following DVRPC staff members made significant contributions to this report:
Alison Hastings, PP/AICP – Senior Environmental Planner
Amy Miller – Environmental Planner
Kim Korejko – GIS Analyst
Elizabeth Houser – GIS Intern
Becky Maule – Cover Design
Carl Barbee – Printing and Production

INTRODUCTION

The purpose of an Environmental Resource Inventory is to identify and describe the natural resources of a community. A community's natural resources – its soil, water, air, forests, fields, and waterways – are fundamental to its character. They are the foundation for its economic success and its quality of life. The protection and wise use of those natural resources is essential to the public health, safety, and welfare of current and future residents. The Environmental Resource Inventory provides the basis for the development of methods and steps to preserve, conserve, and utilize those resources.

Howell Township's natural resources have long shaped the lives of its inhabitants. Howell's location along the Manasquan River and its richness in natural resources, such as iron, timber, marl, and clay, played a major role in its settlement and early development. Due to its very large size and wide variety of land uses, Howell Township is not easily defined. Howell is both a rural farming community and part of the US Route 9 commercial corridor; both a fast-growing suburb in the New York metropolitan area and critical habitat for threatened and endangered species. Howell Township also contains the 4.7 billion gallon Manasquan Reservoir, an important source of drinking water and recreation. With its accessibility to major roadways like US Interstate 195 and the Garden State Parkway, and its proximity to New York City, Atlantic City, and Philadelphia, Howell's historic and rural setting has attracted significant residential development in recent decades. As Howell continues to grow, the character of the township will inevitably change as well. Documentation of the community's environmental resources is necessary if Howell wishes to support a healthy mix of agricultural, commercial, industrial, and residential uses in the future.

Howell's surface water and groundwater resources will become increasingly important to its population and neighboring communities. Its wetlands, upland forests, and grasslands, which provide significant habitat for endangered and threatened plants and animals, are vital to the continued health of the community and the enjoyment of its citizenry. Knowledge of the township's environmental resources will allow its citizens to make informed decisions as they decide Howell's future path and forge its identity.

Preparing an Environmental Resource Inventory requires gathering all the existing information that can be found about those resources and presenting it in a form that is usable by a broad audience. The Inventory reflects a particular moment in time and it should be updated as new data becomes available. In 1976, the Howell Township Environmental Commission contracted with Tectonic Engineering in Somerville, New Jersey for the completion of the *Natural Resource Inventory and Environmental Planning Workbook*. This current Environmental Resource Inventory seeks to update the 1976 inventory but not completely replace it. The 1976 inventory included a large educational piece on what we would call Green Building today – minimal disturbance site design, passive energy conservation, and other low-impact construction techniques. Additionally, the workbook instructed the Environmental Commission how to review land development proposals.

Several documents and reports, along with a number of reference works, were utilized in preparing the 2008 *Environmental Resource Inventory for Howell Township* and are listed at the end of this document. The maps and data relating to Howell Township's natural resources are derived principally from the Geographic Information System (GIS) mapping by the New Jersey Department of Environmental Protection (NJDEP), and from the Landscape Project produced by the Endangered and Nongame Species Program of the New Jersey Fish and Wildlife Division.

Photo by DVRPC

Howell Township sign on Preventorium Road.

BRIEF TOWNSHIP HISTORY

The History section is indebted to the excellent historical narrative written by Louise Usechak for the Manasquan Watershed Management Association (MWMA) from the "Manasquan River Watershed Initial Characterization and Assessment Report" completed in 1999.

Early History and Lenape Settlement

The history of Howell Township is connected to its location along the Manasquan River, where humans have lived since ancient times. Archeologists have estimated that Paleo-Indians (ancient Native Americans) settled in the Manasquan watershed as early as 9000 BC. This makes the Manasquan Paleo-Indian site located within Howell Township, south of Squankum Yellowbrook Road, one of the oldest settlement areas in eastern North America (Manasquan Watershed Management Association, 1999). The discovery of a projectile point at the site led to further excavations, which revealed refuse, floors, and other prehistoric remains (Monmouth County Environmental Council, 1978). Turkey Swamp Park in Freehold Township also contains an early settlement site of Paleo-Indians. At that time, the shoreline of the Atlantic Ocean extended for 50 miles and the Manasquan watershed consisted of grasslands and marshland that was habitat for mammoths, caribou, musk oxen, and horses (Kraft, 1986).

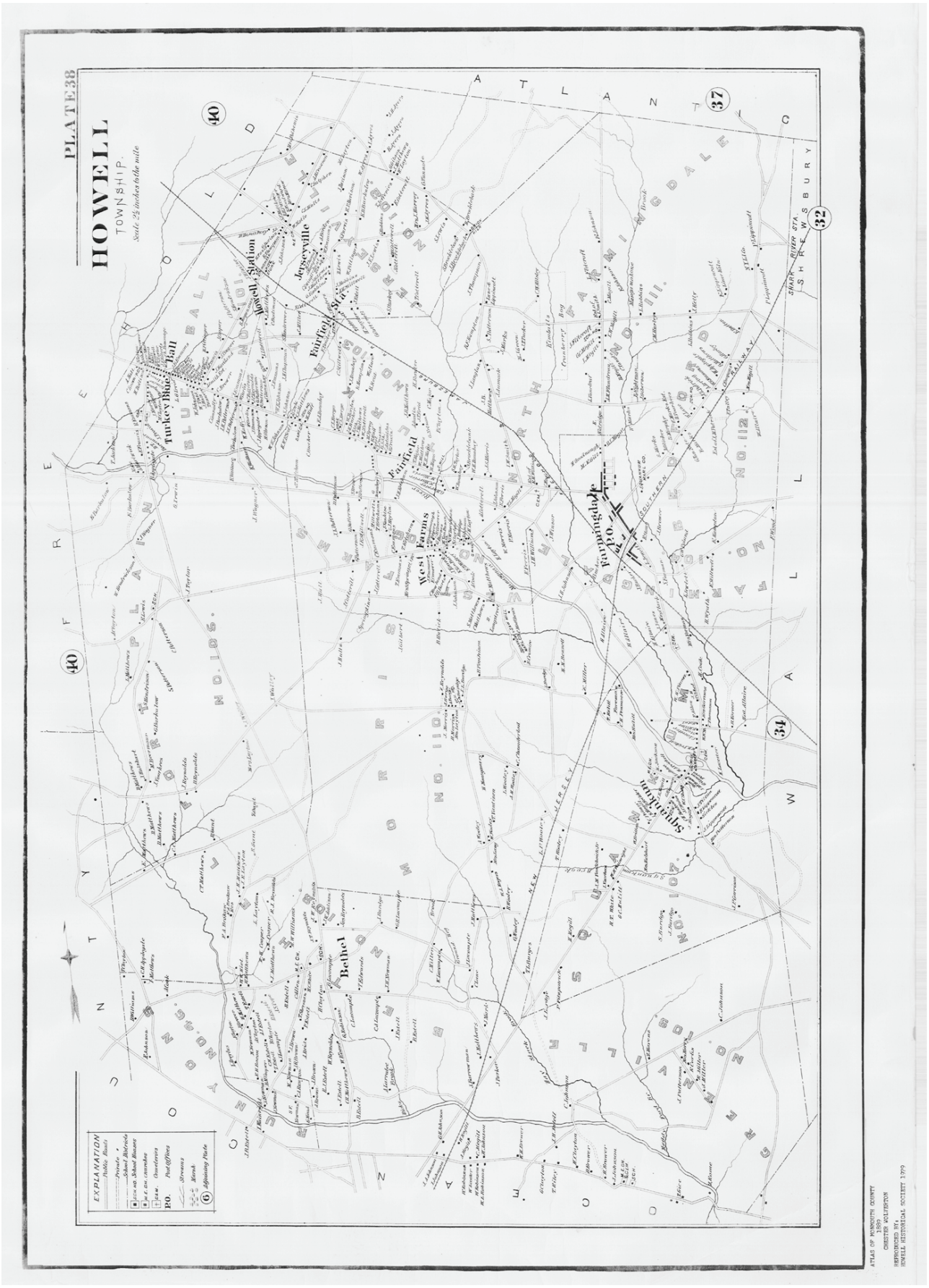
The Manasquan River was first observed by Europeans in the 1520s when Giovanni da Verrazano sailed up the coast of New Jersey. The name "Manasquan" derives from a Lenape word meaning "mouth of the river." The Lenape were a peaceful tribe that practiced agriculture, hunting, fishing, and shellfish harvesting. In addition, the Lenape possessed highly prized black wampum made from polished local seashells, which they used for trade with other tribes. Archeological relics found in Allenwood in Wall Township, adjacent to Howell Township, show evidence of a large meeting place for the Lenape (MWMA, 1999).

Settlement and Incorporation

Early colonial settlement in and surrounding present-day Howell Township revolved around agriculture as the principle industry and activity. Settlement patterns roughly corresponded to the location of high-quality soils. A Methodist church society was one of the first European settlements within Howell, founded in the 1760s, and the first Methodist meetings in Monmouth County were held in a barn. A permanent structure for the Bethesda Methodist Church was built in 1779 on what is now Lakewood Road (Donahay, 1967). The area was later called Turkey, from which Turkey Swamp Park in Freehold Township is named, before becoming known as Adelphia.

In addition to Adelphia, Howell has a number of other early settlement areas that later became suburban neighborhoods: Bethel (Southard), Jerseyville (originally called Green Grove), Ramtown, Squankum, Freewood Acres, and Ardena. Bethel, an area in the southwest part of Howell Township, was settled in 1865 when a lot was donated by Israel Reynolds to build a Methodist Church that was completed in 1866. A school house opened in 1870, followed by a store in 1872. A post office opened in 1882 and reflected the area's name change from Bethel to Southard (Donahay, 1967). Today, the J.W. Reynolds House and Outbuildings and the Southard Grange are listed on the National Register of Historic Places.

HOWELL TOWNSHIP



Map courtesy of Howell Township Historical Society

Monmouth County Atlas, 1889

The Borough of Farmingdale was known as Marsh Bog until its name was changed to Upper Squankum in 1815, before becoming known as Farmingdale in 1854. This area was a part of Howell until it became a separate borough in 1903. Farmingdale was the center of commerce in the nineteenth century and was home to churches, taverns, shops, and other establishments. During the Revolutionary War, both British and American troops were occasionally stationed at Mariner's Tavern in Farmingdale, later called Our House Tavern (Donahay, 1967).

Howell was incorporated as a township in 1801 and named after Richard Howell, the third governor of New Jersey who served from 1793 to 1801. At the time of its incorporation, Howell Township included its current area in addition to present-day Wall Township, Brick Township, Lakewood Township, as well as several small boroughs along the Atlantic Coast. Brick Township, Lakewood Township, and the coastal boroughs separated from Howell when Ocean County was formed in 1850. In 1851, Wall Township seceded from Howell Township. In 1927, Howell Township's border shrank again when a southern portion joined Lakewood Township (Greer, 2000 and Donahay, 1967).

Early roadways in the area were built to connect farms with the Manasquan River for transportation of goods, and access to other farms, mills, and churches. The roadways that would become US Highway Route 9 and State Highway Route 33 were based on old Lenape trails. Other roadways were created to connect different settlements and named accordingly – Lakewood Farmingdale Road and Adelphia Farmingdale Road are two such examples. Stagecoach service operated through the area starting in the 1850s along Route 524, part of which is called Stagecoach Road in nearby Millstone.

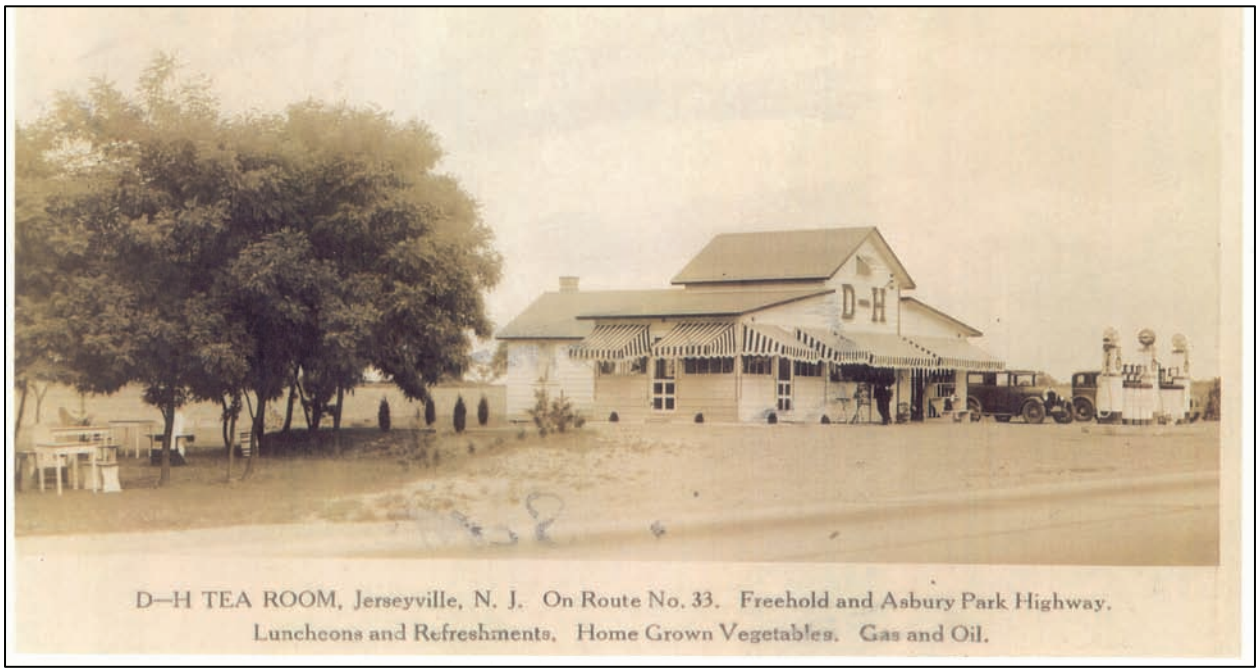


Photo courtesy Pauline Smith, Howell Historical Society

The Tea Room was the first gas station in Howell and now no longer exists.

By the early- to mid-1800s, the population in and around Howell Township had grown significantly and many schools were built to accommodate the growing youth population. A number of churches were also built during this same time period.

Agriculture and Industry

Farming continued to be the primary economic activity in the area through the early 1900s, and some estimates are that Monmouth County contained over 200,000 acres of active farmland in 1910 (MWMA, 1999). Freehold Township was the center of agricultural activity and had one of the busiest public markets in the state. Potatoes were a main crop in the region until at least the 1950s, although a Colorado potato beetle infestation in 1870 caused severe damage to the local crop. Along Marsh Bog Brook near the Squankum area of Howell were a number of large-scale cranberry bogs that operated during the late 1800s to early 1900s. The opening of the Point Pleasant Canal in 1926, however, introduced saltwater to the freshwater bogs. This saltwater intrusion, combined with persistent pest problems, led to the closure of some cranberry bogs in the 1930s, although many continued to have high production through the 1950s.

Photo courtesy Pauline Smith, Howell Historical Society

Resident "Kenny" Eckman farmed large tracts of land.in the Adelphia section of Howell. Photo circa 1948.

In addition to agriculture, natural resource extraction and processing was another primary industry in the area. One colonial industry was the production of "bog iron," a type of iron with rust resistant qualities that could be produced from natural deposits found alongside slow-moving acidic waters and marshes.

Photo courtesy Pauline Smith, Howell Historical Society

Sacks of potatoes grown in Howell about to be transported to markets.

James P. Allaire purchased 5,000 acres of land in Howell Township in 1822 and built a self-sufficient industrial company town centered on the production of bog iron. Part of the purchase included the Monmouth Furnace, a pig iron furnace built in 1814. Allaire had a three-mile canal built from Mingamahone Brook to the site to provide power for the furnace. The company, Howell Works, produced iron that was used primarily for the construction of ships, particularly at Allaire's shipping yards in New York. Many other iron products were also manufactured, such as stoves, cookware,

pipes, and irons. At the height of Howell Works, the company town boasted 70 buildings and a resident population of 500. In addition to iron manufacturing, Howell Works produced hundreds of thousands of bricks every year. The town also contained a boarding house, a hotel, individual residences, a school, a church, several mills, a blacksmith shop, a carriage house, a screw factory, a store, a bakery, and other buildings. The bog iron industry, however, began to suffer a decline, due in part to increased competition from higher quality Pennsylvania iron. In addition, the massive amount of charcoal derived from wood that was required to fuel the furnaces put an immense strain on the local timber resources.

After little more than two decades of operation, Howell Works ceased production in the 1840s and the village was abandoned. The village was a ghost town until it was purchased, along with other lands, by Arthur Brisbane in 1907 to build the Howell Preventorium, discussed below. Allaire Village was leased to the Monmouth Council of the Boy Scouts between 1927 and 1947. In 1941, the property was deeded to the State of New Jersey and underwent renovations to convert it to an educational exhibit (MWMA, 1999). Allaire Village is now an historic park that offers tours, demonstrations of traditional trades and crafts, and special events.

Another natural resource found and extracted in Howell Township was marl, which is loose, earthy material composed of calcium carbonate, clay, and silt. It is derived from decomposing prehistoric marine life deposited in central and southern New Jersey Marl had been used for fertilizer since the 1700s and was discovered in Howell Township in 1830 along the Manasquan River. Great amounts of marl were extracted from the Manasquan River and Mingamahone Brook and shipped to farms across the state. The great demand for marl led to the construction of numerous roadways and railroads, including the Freehold and Jamesburg Agricultural Railroad in 1853, the Raritan and Delaware Railroad in 1861, the Squankum Marl and Railroad in 1866, and the Farmingdale and Squan Village Railroad in 1872 (MWMA, 1999). In 1897, the United Canal and Railroad Company of New Jersey acquired several of the railroads and subsequently leased the property to the Pennsylvania Railroad for 999 years. The marl industry in Howell Township thrived until about 1900, when more efficient types of nitrogen-based fertilizers were introduced (Donahay, 1967).

In addition to iron, timber, and marl, the brickwork industry also thrived in Howell Township during the 1800s due to the area's abundance of clay suitable for bricks. The different varieties of local clay created bricks of varying colors. A number of brick-making operations were established in the northern part of Howell Township on the present-day Naval Weapons Station Earle. Similar to bog iron production, brick making required a great deal of locally resourced timber to fire the kilns. A large labor force was required to cut timber for the furnaces and to dig and transport clay. The brick-making companies within Howell largely ceased production in the late 1800s as resources and labor were more difficult to obtain and brick production became more mechanized (MWMA, 1999).

The manufacturing of munitions was another thriving local industry in the late 1800s, and several gunpowder operations were established in and around Howell Township. Like the brick-making operations, the Phoenix Powder Manufacturing Company established a plant in the northern area of Howell Township near the present-day Naval Weapons Station Earle. Another munitions operation in Howell Township was the Maxim Powder Company, located just

southwest of the Squankum area, which was founded by Hudson Maxim (MWMA, 1999). The Maxim area of Howell is named after this inventor and entrepreneur.

Local Jewish History

Jewish residents have lived in Monmouth County since the 1780s, and Revolutionary War maps labeled an area in present-day Colts Neck Township as "Jewstown" (Klerman, 2007). This name, however, was most likely not derived from a significant Jewish population, but rather from a Jewish-owned tavern called Hart's Tavern. In the late nineteenth century, many Eastern Europe Jews fled to New York City to escape persecution and many then moved to rural Howell Township (Pine, 1981).

In the 1920s and 1930s, a larger wave of Jewish New Yorkers moved to Howell with help from the Jewish Agricultural Society in New York (Hunton, 1990). The Agricultural Society encouraged the Jewish émigrés to operate poultry farms. The poultry industry, established by Jewish farmers in Howell, Farmingdale, and Freehold, grew tremendously and at its peak in the 1930s, Monmouth County was the leading egg producer in the nation. Rapid suburbanization, along with changing economic conditions, contributed to the decline of the poultry industry in Howell Township in the 1950s and 1960s (Blair 1993).

Howell's Jewish Community Center began holding meetings at members' houses in 1926 (Donahay, 1967). In 1930 a permanent building was constructed on Peskin Road on land donated by a local farmer. This original Jewish Community Center was closed in the early 1970s in conjunction with the creation of the Manasquan Reservoir and a new building was completed in 1975.

Howell Preventorium

Arthur Brisbane bought 5,000 acres in Howell Township in 1907 for the establishment of a Preventorium. This was a facility to quarantine children who had been in contact with people suffering from tuberculosis so the children would not contract the highly infectious disease. Brisbane purchased the former Allaire Village but built the Preventorium on the current site of the Howell Municipal Complex. Up to 230 children were housed at the Preventorium, which operated from 1912 until about 1962 (MWMA, 1999). The Tuberculosis Preventorium for Children is currently the Howell Township Municipal Complex.

Photo courtesy Pauline Smith, Howell Historical Society

Howell Preventorium and its environs now serve as the Howell Township Municipal Complex.

Naval Weapons Station Earle
In the midst of World War II, the US Government purchased land in northern Howell and southern Colts Neck Township to satisfy the need for a weapons facility in the New York metropolitan region. The station was commissioned in 1943 and named after Rear Admiral Ralph Earle, who during World War I was the Chief of the Bureau of Ordnance, the department in charge of the procurement, storage, and deployment of naval weapons. This facility handled most of the munitions used by the Army in Europe during the war (MWMA, 1999). In 1974, the facility's name was changed from Naval Ammunition Depot to Naval Weapons Station.

The station is divided into two sections: Main-side is located in Colts Neck and Howell, and the Waterfront Area is on Sandy Hook Bay. Normandy Road, a 15-mile road and rail line, connects the two sites. The station's Public Works Detachment maintains the railroad, which consists of 130 miles of track, nine locomotives, and 520 pieces of rolling stock. Located mostly in Colts Neck, Main-side covers more than 10,000 acres and is where most of Earle's storage facilities are located. Main-side also contains its own police and fire departments, health facilities, homes, office buildings, stores, restaurants, and recreational facilities (Naval Weapons Station Earle).

As a weapons station, Earle handles, stores, transports, renovates, and issues all types of weapons and ammunition to the US Navy and Coast Guard. The station also manages handling equipment and containers for the fleet, including design, testing, acquisition, in-service engineering, and logistical support (Naval Weapons Station Earle).

Kalmyk and Russian Immigration
Another immigrant group to settle in Howell Township is the Kalmyks (also spelled Kalmucks or Kalmuks), an ethnic group of Mongolians who migrated to southeast Europe (present-day Russia) in the seventeenth century. The Kalmyks were loyal to the Russian Tsar and fought against the Bolsheviks in the Russian Revolution of 1917. When the Bolsheviks took power, many Kalmyks fled to Turkey, and from there went to France or Eastern Europe. Those who remained at first faced persecution, although the attitude of the Soviet Union toward minority groups evolved. The Kalmyk Autonomous Oblast, in existence since 1920, became an Autonomous Soviet Socialist Republic in 1935 with a population of about 140,000 people (Thernstrom). The Kalmyk population faced additional persecution when Germany invaded Russia in 1941. The Kalmyks at first fought with the Russians against the Germans, although thousands would later switch to the German side. Still others were taken prisoner by the Germans. Due to their collaboration with the German forces, the Kalmyks were forcibly deported by the Russian Army at the end of World War II (Thernstrom). About 800 Kalmyks were sent to refugee camps near Munich where they were without citizenship and denied employment and education. In 1951 the US Board of Immigration Appeals allowed Kalmyks to immigrate to the United States (Baatar).

Of the 571 Kalmyks who immigrated to the United States that year, most moved to either Philadelphia or the Freewood Acres section of Howell Township. Many Kalmyks still live in Freewood Acres, although many moved to other states in the 1970s. The traditional religion of Kalmyks is Tibetan Buddhism and Howell Township is home to a Kalmyk Buddhist temple, the

Tashi Lhunpo Temple. The Kalmyk-American Cultural Association was founded in Howell Township in 1997 and has organized classes and events on Kalmyk culture (Baatar).

In addition to the Kalmyks, another group of Russians, known as the Old Believers, immigrated to the Freewood Acres section of Howell. The Old Believers originated in the seventeenth century in opposition to religious reforms in Russia intended to realign Russian orthodoxy with Greek texts. The Chapel of St. George, an Old Believer congregation located in Freewood Acres, was founded in 1961, and the chapel was completed in 1965 (Donahay, 1967). The Chapel of St. George is distinctive for its multiple gold-colored cupolas (onion-shaped rooftop domes) typical of Russian architecture.

s

Photo by DVRPC

Kalmyk Buddhist Temple, located on Kalmuk Road.

HOWELL TOWNSHIP LOCATION, SIZE, AND LAND USE

Howell is an incorporated township located in southern Monmouth County, New Jersey. The township is bounded by six municipalities: Colts Neck Township to the north, Wall Township to the east, Brick Township to the southeast, Lakewood Township to the south, Jackson Township to the southwest, and Freehold Township to the west. The Borough of Farmingdale is located within Howell Township and covers 320 acres, or half of a square mile. Howell Township covers 61 square miles, or 39,403 acres, making it one of the largest municipalities in New Jersey. The Metedeconk River forms the southern border of the township, as well as the boundary between Ocean and Monmouth counties.

The township is bisected horizontally by Interstate 195, a major transportation corridor between the Garden State Parkway (in Wall Township) and the City of Trenton. US Highway Route 9 runs north-south along the western side of the township and State Highway Route 33 runs east-west along the northern part of the township.

According to the US Census Bureau, Howell's population grew from 38,987 in 1990 to 48,903 by 2000, an increase of about 25% (9,916 residents). This is moderately greater than the overall population growth of Monmouth County, which was 20% between 1990 and 2000, and significantly higher than the state growth rate of 9%. The US Census estimates that Howell's population reached 51,353 in 2007, an increase of 5.0% between 2000 and 2007. The population density of Howell Township increased from 640 persons per square mile in 1990 to an estimated 841 people per square mile in 2007. This increase in population has come with a considerable amount of new residential development.

Table 1: Howell Township General Land Cover Classes (2002) shows Howell's land cover grouped into general categories based on the 2002 color infrared digital imagery of the New Jersey Department of Environmental Protection (NJDEP). The largest percent of land use is wetlands, which occupies 36%. The next largest type of use is urban, constituting 30% of land. Agriculture covers about 9% of land in Howell Township. This includes 393 acres on 14 farms that have been permanently preserved as of July 2007 (Monmouth County, 2007).

The majority of Howell Township is zoned for residential use. Areas of commercial use and highway development are located along US Highway Route 9 and along State Highway Route 33. There are three large areas of public property in the township: the Naval Weapons Station Earle, the Manasquan Reservoir, and the Allaire State Park. *Table 2: Howell Township Detailed Land Cover (2002)* breaks down the 2002 general land cover categories into detailed land cover categories. See also **Map 3: NJDEP Land Cover (2002)** on page 31.

Table 1: Howell Township General Land Cover Classes (2002)

General Land Classes	Acres	Percent
Agriculture	3,528.16	9%
Barren Land	611.36	2%
Forest	8,195.87	21%
Urban	11,967.02	30%
Water	971.91	2%
Wetlands	14,129.59	36%
Total	**39,403.91**	**100.00%**

Source: NJDEP, Bureau of Geographic Information System, 2002

Table 2: Howell Township Detailed Land Cover (2002)

Type	Acres	Percent
Agriculture - Confined feeding operations	31.15	0.08%
Agriculture - Cropland and pastureland	2,382.73	6.05%
Agriculture - Orchards/vineyards/nurseries/horticultural areas	200.36	0.51%
Agriculture - Other agriculture	913.92	2.32%
Barren land - Altered lands	156.24	0.40%
Barren land - Extractive mining	201.65	0.51%
Barren land - Transitional areas	242.74	0.62%
Barren land - Undifferentiated barren lands	10.72	0.03%
Forest - Coniferous brush/shrubland	124.28	0.32%
Forest - Coniferous forest (>50% crown closure)	718.33	1.82%
Forest - Coniferous forest (10-50% crown closure)	73.62	0.19%
Forest - Deciduous brush/shrubland	264.05	0.67%
Forest - Deciduous forest (>50% crown closure)	4,213.48	10.69%
Forest - Deciduous forest (10-50% crown closure)	401.71	1.02%
Forest - Mixed deciduous/coniferous brush/shrubland	269.49	0.68%
Forest - Mixed forest (>50% coniferous with >50% crown closure)	670.25	1.70%
Forest - Mixed forest (>50% coniferous with 10-50% crown closure)	60.34	0.15%
Forest - Mixed forest (>50% deciduous with >50% crown closure)	993.87	2.52%
Forest - Mixed forest (>50% deciduous with 10-50% crown closure)	100.89	0.26%
Forest - Old field (<25% brush covered)	261.30	0.66%
Forest - Plantation	44.25	0.11%
Urban - Athletic fields (schools)	120.66	0.31%
Urban - Cemetery	25.17	0.06%
Urban - Commercial/services	682.87	1.73%
Urban - Industrial	592.75	1.50%
Urban - Major roadway	165.08	0.42%
Urban - Military installations	353.10	0.90%
Urban - Other urban or built-up land	821.40	2.08%
Urban - Recreational land	525.99	1.33%
Urban - Residential, high density, or multiple dwelling	571.00	1.45%

Type	Acres	Percent
Urban - Residential, rural, single unit	3,058.74	7.76%
Urban - Residential, single unit, low density	1,367.14	3.47%
Urban - Residential, single unit, medium density	3,222.01	8.18%
Urban - Stormwater basin	147.49	0.37%
Urban - Transportation/communication/utilities	208.21	0.53%
Urban - Upland rights-of-way undeveloped	105.40	0.27%
Water - Artificial lakes	908.35	2.31%
Water - Bridge over water	0.65	0.00%
Water - Streams and canals	62.90	0.16%
Wetlands - Agricultural wetlands (modified)	1,193.86	3.03%
Wetlands - Atlantic white cedar wetlands	4.29	0.01%
Wetlands - Cemetery on wetland	0.40	0.00%
Wetlands - Coniferous scrub/shrub wetlands	34.41	0.09%
Wetlands - Coniferous wooded wetlands	557.44	1.41%
Wetlands - Deciduous scrub/shrub wetlands	363.12	0.92%
Wetlands - Deciduous wooded wetlands	7,754.70	19.68%
Wetlands - Disturbed wetlands (modified)	101.13	0.26%
Wetlands - Former agricultural wetland (becoming shrubby, not built-up)	45.81	0.12%
Wetlands - Herbaceous wetlands	123.62	0.31%
Wetlands - Managed wetland in built-up maintained rec area	80.07	0.20%
Wetlands - Managed wetland in maintained lawn greenspace	80.66	0.20%
Wetlands - Mixed scrub/shrub wetlands (coniferous dom.)	36.90	0.09%
Wetlands - Mixed scrub/shrub wetlands (deciduous dom.)	126.42	0.32%
Wetlands - Mixed wooded wetlands (coniferous dom.)	2,116.02	5.37%
Wetlands - Mixed wooded wetlands (deciduous dom.)	1,250.25	3.17%
Wetlands - Wetland rights-of-way	260.49	0.66%
Total	**39,403.90**	**100.00%**

Source: NJDEP, Bureau of Geographic Information System, 2002

Photo by DVRPC

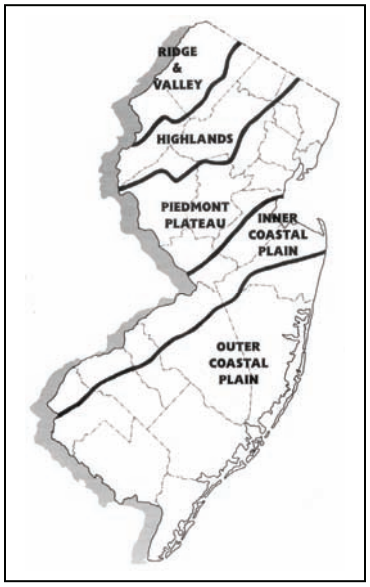
Howell Park Golf Course owned and operated by Monmouth County.

NATURAL RESOURCES

PHYSIOGRAPHY

Physiography is the study of a location in relation to its underlying geology. New Jersey is characterized by four physiographic provinces. The rocky terrain of the Appalachian Province is at one extreme and the sands of the coast are at the other. Howell Township is located in the Atlantic Coastal Plain, the most southerly of the provinces in New Jersey.

The Atlantic Coastal Plain landscape extends from Massachusetts to Texas and is divided into Inner and Outer sections. In New Jersey, the Inner Coastal Plain is made up of inter-bedded sand and clay. Deposits originating in the breakdown of Appalachian and Catskill sedimentary, metamorphic, and igneous rocks are inter-bedded with layers formed by oceanic (marine) deposition, which occurred as the ocean shoreline advanced and receded over geologic time. The Inner Plain layers date from the Cretaceous period (Mesozoic era), 135 to 65 million years ago. Soils of the Inner Coastal Plain are quite fertile.



The Physiographic Regions of New Jersey

The Outer Coastal Plain was formed more recently than the Inner Coastal Plain. It was laid down by the ocean and developed during the mid-to-late part of the Cenozoic era, 65 million years ago to the present. Outer Coastal Plain soils are sandier, less fertile, and more porous than those of the Inner Plain.

In the general vicinity of the dividing line between the two segments of the coastal plain is a belt of low hills, which runs northeast and southwest through the southern half of New Jersey. These hills are the youngest of the Cretaceous formations and are largely made up of sand and marl formations. The Inner Coastal Plain lies to the west of the band of hills and the Outer Coastal Plain lies to the east.

Howell Township lies completely within the Outer Coastal Plain, but has rocks dating from both the Cenozoic era and earlier Cretaceous period outcropping in the township. Test drilling in Howell Township conducted by the United States Geological Survey found 1,500 feet of Coastal Plain sediments consisting of clay, silt, sand, and gravel, beneath which was 162 feet of weathered bedrock. Beneath the bedrock (1,162 feet below the surface) was found a hard quartz-biotite-feldspar gneiss or schist, metamorphic rock dating from the Precambrian or lower Paleozoic era, or 540 million years ago.

TOPOGRAPHY

Howell Township is relatively flat, typical of areas on the Outer Coastal Plain. The topography is generally level to gently sloping. The landscape is heavily dominated by natural wetlands along the rivers, brooks, and smaller tributaries. Many of the streams retain lush riparian buffers of upland forest and wooded wetlands.

The central area of the township around the Manasquan Reservoir is marked by upland forest to the northwest and wooded wetlands to the southeast. The northern part of the township around the Naval Weapons Station Earle is defined by large swaths of both upland forest and wooded wetlands. The eastern half of the township is characterized by numerous waterways and their surrounding wetlands, which are mostly wooded. The New Jersey Pinelands ecological area extends to include the southern portion of Howell Township. Many ecological characteristics of the Pinelands – pine forests and sandy, acidic soils – apply to Howell Township.

The Naval Weapons Station Earle contains the highest elevation in the township at over 300 feet above sea level. Other high points occur in the northwest corner of the township, as well as in an area northwest of the Manasquan Reservoir. The lowest points are found along the Metedeconk and Manasquan rivers, at 10 and 17 feet above sea level, respectively.

The upland area is characterized by rich soils that once supported extensive mixed deciduous forests. Today, Howell's upland forests are dominated by pitch pine, sassafras, and oak species, such as chestnut oak, scarlet, oak, and white oak. Along the river valleys are freshwater wetlands and wet forests dominated by sweet gum and red maple. Also found in Howell's wooded wetlands are the tree of heaven, red cedar, red maple, rush, pokeweed, scarlet oak, Japanese honeysuckle, and black locust.

Steep Slopes

Slope is measured as the percentage of vertical rise to horizontal distance. Almost 90% of Howell Township has slopes of 5% or less. Slopes between 15% and 20% are generally considered to be steep slopes, and there are some areas of Howell with slopes of 20% or more. There is a ridge of steep slopes alongside the Manasquan River and another ridge defining a swath of upland forest to the east of the Manasquan Reservoir. In the northern part of the township, there is a large area of steep slopes within the Naval Weapons Station Earle. Other smaller areas of steep slopes are located throughout the township, particularly alongside waterways. The areas with the greatest concentrations of steep slopes are mostly forested, although residential properties may extend to the edge of a plateau.

In general, development is inadvisable in steep slope areas because they can result in soil instability, erosion, sedimentation of streams, increased stormwater runoff, and flooding. This causes habitat destruction, water pollution, and potential damage to property. Erosion on steep slopes is especially prevalent where excessive tree removal has taken place. On steep slopes, structures and septic systems should generally be limited or prohibited. See the **Erosion** section on page 119 for more details.

Where steep slopes remain forested, some very old trees can be found. Some regions have been negatively affected by fertilizers from adjoining farm fields, by runoff from development, or by recent flooding, but there may still be intact sites. Howell's steep slopes are depicted on **Map 4: Steep Slopes and Flood Prone Areas** on page 32.

Photo by DVRPC

Many of Howell's steep slopes and waterways are enveloped by forests.

On steep slopes bordering creeks and streams, it is not unusual to see trees that have fallen into the gulleys or into the streams themselves. In some places, the rate of tree loss is accelerated beyond natural rates by erosion from flash flooding, which in turn is often caused by increases in impervious surface upstream. However, trees on steep slopes fall for other reasons as well, including age, severe storms (especially if their roots have been exposed from erosion), and heat and water loss, which dries the soil.

SOILS

Soil is the foundation for all land uses. A region's soil defines what vegetation is possible, influencing agricultural uses. It also determines how land can be developed for other purposes. Soil is also a natural resource that takes millions of years to replenish.

Howell Township soils consist of 24 series types and 56 variations within those series (excluding water) as identified by the US Department of Agriculture's Natural Resources Conservation Service. These are listed in *Table 5: Howell Township Soils* and shown on **Map 5: Soils (2004)** on page 33**.**

Soil Quality Classification

State and national agricultural agencies classify farmland soils into several categories. Howell contains Prime Farmland soils, Soils of Statewide Importance, and Unique Farmland soils. Less than half, 45%, of Howell contains rich, arable, and valuable soil that is designated as either Prime Farmland or Soils of Statewide Importance. Each category of farmland is explained on the following pages. See *Table 5: Howell Township Soils* on page 26 for the acreage in each category and **Map 6**: **Soil Ratings** on page 34**.**

Prime Farmland Soils

Only 10% (4,083 acres) of Howell's soils are considered Prime Farmland (P-1) soils. Prime Farmlands are lands that have the best combination of physical and chemical characteristics for

producing food, feed, forage, fiber, and oilseed crops. They can sustain high yields of crops when managed with correct farming methods. Prime Farmlands are not excessively erodible or saturated with water for long periods of time and do not flood frequently.

The USDA outlines specific criteria for Prime Farmland classification. For example, according to Prime and Unique Farmlands federal regulations (7 CFR Part 657), soil horizons within a depth of 40 inches (or within the root zone if the root zone is less than 40 inches) must have a pH between 4.5 and 8.4. The soils must have a mean average temperature above 32 degrees Fahrenheit at a depth of 20 inches. The USDA outlines additional Prime Farmland requirements for mean summer soil temperature, erodibility factor, water table depth, permeability rate, and more. When identifying prime soil mapping units within a state, soil scientists are allowed to deviate from the permeability standard or adopt more stringent criteria for other requirements.

Land classified as Prime Farmland does not have to be farmed but does have to be available for such use. Thus, water or urban/developed land does not qualify as Prime Farmland.

Farmland of Statewide Importance

Almost 24% (9,272 acres) of Howell's soils are classified as Soils of Statewide Importance (S-1). These soils are close in quality to Prime Farmland and can sustain high yields of crops when correctly managed under favorable conditions. Under such conditions, these yields may be as high as Prime Farmland yields.

Criteria for establishing Soils of Statewide Importance are determined by state agencies. In New Jersey, soils with a capacity class of II or III that do not meet prime farmland criteria are rated as Soils of Statewide Importance.

Unique Farmland Soils

About 21% percent (8,432 acres) of Howell's soils are ranked as Unique Farmland (U-1) soils. The vast majority of this is Atsion sand and is located in large swaths across the township. Certain soil qualities, locations, growing seasons, and moisture supplies allow Unique Farmland to support specific specialized crops when properly managed. The USDA outlines specific Unique Farmland criteria: Unique Farmland exhibits specific conditions, including temperature, humidity, air drainage, elevation, aspect, or nearness to market, that support a particular food or fiber crop. In order for lands to be classified as Unique Farmland, the land must also be used for a specific high-value food or fiber crop and have an adequate moisture supply for that crop.

Soils Not Rated

Several of the soils that are present in Howell – including Evesboro, Lakehurst, and Lakewood sands – have not been rated for agricultural use by the Natural Resource Conservation Service (NRCS) and are labeled "NR" on **Map 6: Soil Ratings**. See *Table 3: Agricultural Values for Howell's Soils* for the acreage of each of these classes of farmland. These soils may be best suited for uses other than agricultural crops or may not have been assessed yet for quality by NRCS. NRCS created all the Soil Quality Classifications in 1990, but in 2005 the agency

created several new subtypes of soils, which are not yet rated for agricultural use. Soils that are not rated are not necessarily limited.

Table 3: Agricultural Values for Howell Soils

Designation	Type	Area (Acres)	Percent
S-1	Statewide Importance	9,272	23.53%
U-1	Unique Importance	8,432	21.40%
P-1	Prime Farmland	4,083	10.36%
Totals		**21,787**	**55.29%**

Source: NJ Important Farmlands Inventory, NJ Natural Resources Conservation Service, 2004

Photo by DVRPC

Most of Howell Township's remaining prime farmland is located in the northern part of the township.

Hydric Soils

Nearly 85% of Howell's soils are considered hydric soils. Hydric soils, as defined by the National Technical Committee of Hydric Soils, are soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in their subsurface, and they support the development of hydrophytic vegetation only. Hydric soils have unique soil properties and they are an important element to wetland areas. If a soil is classified as "hydric," land use may be restricted due to the relationship of hydric soils to the definition of wetlands and laws regarding wetland preservation. More detailed descriptions of Howell's wetland areas are found in this section, under "Wetlands" and "Agricultural

Wetlands" on pages 42-45, and the *Biological Resources* section under "Wetlands," on page 82-84.

Soil Acidity

An important measure of soil quality is its acidity. Acidity affects the ability of soil to absorb nutrients and also affects the microorganisms responsible for chemical transformations in the soil. Generally, a pH range of 6.0 to 7.0 is considered ideal for most plant life, although some plants require greater or lesser levels of acidity. Practically all soils in Howell Township have a pH of below 6.0, as seen in the following table and shown in **Map 7: Soil Acidity** on page 35.

Table 4: Soil Acidity in Howell Township

Soil Acidity Class	pH	Area (Acres)	Percentage
Extremely acid	3.5 - 4.4	16,252.73	42%
Very strongly acid	4.5 - 5.0	17,715.27	45%
Strongly acid	5.1 - 5.5	1,545.07	4%
Moderately acid	5.6 - 6.0	2,087.67	5%
Slightly acid	6.1 - 6.5	1,111.01	3%
Neutral	6.6 - 7.3	0	0
Slightly alkaline	7.4 - 7.8	0	0
Moderately alkaline	7.9 - 8.4	0	0
Strongly alkaline	8.5 - 9.0	0	0
Null		373.39	1%

Source: NJDEP, 2008

Liming, or adding finely ground limestone, is a common method to decrease highly acidic soils with a pH of 5.6 of lower. Strongly alkaline soils usually have sodium present, which may be a result of salts present in stormwater runoff. This soil may be reclaimed through the addition of gypsum followed by leaching, the dissolving of a substance from a solid by water. Soils with a pH of 8.0 or higher often have high levels of calcium carbonate, which must be removed before the soil pH may decrease. Adding anhydrous ammonia as a nitrogen fertilizer is another method to reduce the alkalinity of soil (USDA-NRCS, January 1989). All of Howell's soil is ranked as acidic. Most soil in Howell Township is classed as either extremely acidic (42%) or very strongly acidic (45%).

Soil Series

Several soil series appear more frequently in Howell Township in other areas and are briefly described as follows:

Atsion Series

The most abundant soil series in Howell Township is the Atsion series. About 19% (7,593 acres) of Howell is made of Atsion sand. This soil is found on the Coastal Plain, has a slope ranging from 0 to 2%, is very deep and poorly drained, and has slow or very slow surface runoff. These soils are formed by sandy marine sediments and are extrememly acidic to strongly acidic. They

are mostly in woods, although some areas are used for the production of cranberries and blueberries. It is designated as a Farmland of Unique Importance (U-1). Wooded areas are predominantly pitch pine mixed with black gum and red maple. The undergrowth consists of highbush blueberries, sweet pepperbush, sheep laurel, and greenbriar. Atsion sand can be found throughout Howell, primarily in the southern half of the township. Atsion soils are associated with the Berryland, Evesboro, Galloway, Klej, Lakehurst, and Manahawkin series.

Evesboro Series

The Evesboro series comprises about 17% (6,616 acres) of the soils in Howell. These very deep, excessively drained soils are found upland on the coastal plain. These soils have a slope between 0 and 40%, most commonly 0 to 5%. The Evesboro series is formed from sandy marine and eolian deposits and is extremely acidic to strongly acidic. They do not make good agricultural soils, but if irrigated and limed can be used for production of fruit and vegetable crops, such as peaches, grapes, sweet potatoes, pumpkins and melons. Most areas are in woodland that has been repeatedly cut for wood products. The wooded areas consist mostly of black oak, white oak, red oak, yellow poplar, and chestnut oak with scattered hickories, pitch pine, Virginia Pine, loblolly pine, and scrub and blackjack oaks. Evesboro soils are most commonly associated with the Downer, Fort Mott, Galestown, Klej, Lakehurst, Lakewood, and Matawan series.

Klej Series

The Klej series accounts for about 13% (5,192 acres) of the township's soils. Klej series soils consist of very deep, somewhat poorly drained soils with nearly level slopes of 0 to 5%. These loamy sand soils are found on broad upland depressions and flats on the coastal plain. The parent material of the soils is sandy fluvio-marine sediments that are highly siliceous. They are extremely acidic to strongly acidic unless limed. Except where urban, the Klej series soils in Howell Township are considered Farmland of Statewide Importance. Some areas are irrigated, and the cultivated areas are used for corn, soybeans, hay, and other crops. The native vegetation of the Klej series is mixed oaks, sweetgum, red maple, pond pine and loblolly pine. There are a number of soils closely associated with the Klej series, including the Atsion, Berryland, Downer, Evesboro, Fallsington, Fort Mott, Hurlock, Galestown, Lakehurst, Lakewood, Matawan, Sassafras, and Woodstown series.

Lakewood Series

Another common soil series in Howell Township is the Lakewood series. About 9% (3,353 acres) of Howell is made up of Lakewood soils. These sandy soils can be found on the coastal plain in New Jersey, are very deep, are excessively drained, and have slopes ranging from 0 to 25%. They are formed from sandy marine sediments and are extremely acidic unless limed. These soils are not considered Prime Farmland, but are mostly used for woodland. Dominant vegetation in wooded areas includes pitch pine, black oak, and white oak. Where wildfires have been severe trees are dwarfed and reach a maximum height of five feet tall. These dwarf trees consist primarily of pitch pine, scrub oak, and blackjack oak. Geographically associated soils include the Atsion, Berryland, Downer, Evesboro, Klej, Lakehurst, Pittsgrove, and Woodmansie series.

Lakehurst Series

The fifth most common soil in Howell Township is the Lakehurst series, which composes about 8% (3,100 acres) of the total soil in the township. Found on the coastal plains of New Jersey and Virginia, the Lakehurst series soils are moderately well-drained, very deep, and nearly level soils formed by sandy coastal plain sediments. These soils are extremely acidic unless limed and are not considered Prime Farmland. Areas once farmed have now been abandoned, and most of these areas are wooded. Dominant trees include pitch pine, shortleaf pine, black, and white oak, with an understory of lowbush blueberries and scrub oak. Where wildfires have been severe, pitch pine and black jack oak are dominant. The Lakehurst series soils are most closely geographically associated with the Lakewood, Atsion, Berryland, and Woodmansie series.

Table 5: Howell Township Soils

Soil Series	Soil Code	Area (Acres)	Percent	Designation*
Adelphia loam, 0 to 2% slopes	AdnA	2.0	0.0%	P-1
Atsion sand, 0 to 2% slopes	AtsA	7,592.6	19.3%	U-1
Berryland sand, 0 to 2% slopes, frequently flooded	BerAt	666.9	1.7%	NA
Collington sandy loam, 5 to 10% slopes, eroded	CokC2	24.7	0.1%	S-1
Downer loamy sand, 0 to 5% slopes	DocB	692.1	1.8%	S-1
Downer loamy sand, 5 to 10% slopes	DocC	183.5	0.5%	S-1
Downer sandy loam, 0 to 2% slopes	DoeA	76.5	0.2%	P-1
Downer sandy loam, 2 to 5% slopes	DoeB	494.7	1.3%	P-1
Downer-Urban land complex, 0 to 5% slopes	DouB	152.7	0.4%	NA
Elkton loam, 0 to 2% slopes, rarely flooded	EkaAr	427.6	1.1%	S-1
Evesboro sand, 0 to 5% slopes	EveB	4,273.7	10.8%	NA
Evesboro sand, 5 to 10% slopes	EveC	844.6	2.1%	NA
Evesboro sand, 10 to 15% slopes	EveD	643.9	1.6%	NA
Evesboro sand, 15 to 25% slopes	EveE	228.2	0.6%	NA
Evesboro-Urban land complex, 0 to 5% slopes	EvuB	625.9	1.6%	NA
Fallsington loam, 0 to 2% slopes	FapA	417.9	1.1%	S-1
Freehold loamy sand, 0 to 5% slopes	FrfB	173.7	0.4%	P-1
Freehold loamy sand, 5 to 10% slopes	FrfC	8.4	0.0%	S-1
Freehold sandy loam, 2 to 5% slopes	FrkB	473.3	1.2%	P-1
Freehold sandy loam, 5 to 10% slopes	FrkC	162.9	0.4%	S-1
Freehold sandy loam, 10 to 15% slopes	FrkD	43.5	0.1%	NA
Freehold sandy loam, 10 to 15% slopes, eroded	FrkD2	2.2	0.0%	NA
Freehold sandy loam, 15 to 25% slopes, eroded	FrkE2	21.9	0.1%	NA
Freehold loam, 0 to 2% slopes	FroA	85.6	0.2%	P-1
Hammonton loamy sand, 0 to 5% slopes	HbmB	324.0	0.8%	S-1
Hammonton sandy loam, 0 to 2% slopes	HboA	381.1	1.0%	P-1
Hammonton sandy loam, 2 to 5% slopes	HboB	361.7	0.9%	P-1
Holmdel sandy loam, 0 to 2% slopes	HocA	291.4	0.7%	P-1
Holmdel sandy loam, 2 to 5% slopes	HocB	14.9	0.0%	P-1
Humaquepts, 0 to 3% slopes, frequently flooded	HumAt	1,647.8	4.2%	NA
Keyport sandy loam, 0 to 2% slopes	KemA	238.1	0.6%	P-1
Keyport sandy loam, 2 to 5% slopes	KemB	269.9	0.7%	P-1
Keyport sandy loam, 5 to 10% slopes	KemC	15.7	0.0%	S-1
Klej loamy sand, 0 to 5% slopes	KkgB	4,867.0	12.4%	S-1

Soil Series	Soil Code	Area (Acres)	Percent	Designation*
Klej loamy sand, clayey substratum, 0 to 5% slopes	KkgkB	228.6	0.6%	S-1
Klej loamy sand-Urban land complex, 0 to 5% slopes	KkhB	96.3	0.2%	NA
Lakehurst sand, 0 to 5% slopes	LakB	3,100.8	7.9%	NA
Lakewood sand, 0 to 5% slopes	LasB	3,080.6	7.8%	NA
Lakewood sand, 5 to 10% slopes	LasC	272.5	0.7%	NA
Manahawkin muck, 0 to 2% slopes, frequently flooded	MakAt	839.8	2.1%	U-1
Pemberton loamy sand, 0 to 5% slopes	PegB	448.2	1.1%	S-1
Phalanx loamy sand, 5 to 10% slopes	PhbC	62.0	0.2%	NA
Pits, sand and gravel	PHG	205.9	0.5%	NA
Sassafras sandy loam, 2 to 5% slopes	SacB	230.4	0.6%	P-1
Sassafras sandy loam, 5 to 10% slopes	SacC	74.4	0.2%	S-1
Sassafras sandy loam, 10 to 15% slopes	SacD	39.0	0.1%	S-1
Sassafras sandy loam, 15 to 25% slopes	SacE	4.2	0.0%	NA
Sassafras loam, 0 to 2% slopes	SafA	143.5	0.4%	P-1
Shrewsbury sandy loam, 0 to 2% slopes	ShrA	451.6	1.1%	S-1
Tinton loamy sand, 0 to 5% slopes	ThgB	749.7	1.9%	S-1
Tinton loamy sand, 5 to 10% slopes	ThgC	157.0	0.4%	S-1
Tinton loamy sand, 10 to 25% slopes	ThgE	27.4	0.1%	NA
Udorthents, 0 to 8% slopes	UdaB	1,072.5	2.7%	NA
Udorthents-Urban land complex, 0 to 8% slopes	UdauB	466.9	1.2%	NA
Water	WATER	75.3	0.2%	NA
Woodstown sandy loam, 2 to 5% slopes	WoeB	398.1	1.0%	P-1
Woodstown loam, 0 to 2% slopes	WogA	448.7	1.1%	P-1

Source: USDA-Natural Resources Conservation Service (2002)

*Explanation of Designations

P–1	Prime Farmland
S–1	Statewide Importance
L–1	Local Importance
U-1	Unique Importance
NA	Land not appropriate for farming, e.g., eroded, very steep slopes, pits, permanently wet soils, water, etc.

Soil characteristics can severely restrict the use of sites for construction and development. *Table 6: Soil Limitations for Development* records the soils and their possible limitations for building foundations and septic systems. As indicated in the table, the township has some soils that are severely limited for on-site septic systems. Septic systems require soils that have a low water table (five feet or more from the surface) and high permeability to allow for proper drainage of wastewater. Soils with high water tables (five feet or less from the surface) create a potential for erosion, wet basements, and low permeability, often allowing wastewater to collect near the surface.

Table 6: Soil Limitations for Development

Soil Series	Soil Code	Acres	Land Use Implications		
			Building without Basement	Building with Basement	Septic Systems
Adelphia	AdnA	1.95	B	C	C
Atsion	AtsA	7,592.56	C	C	C
Berryland	BerAt	666.91	C	C	C
Collington	CokC2	24.68	B	B	C
Downer	DocB, DocC, DoeA, DoeB, DouB	1,599.45	A	A	C
Elkton	EkaAr	427.57	C	C	C
Evesboro	EveB, EveC, EveD, EveE, EvuB	6,616.26	A/B	A/B	C
Fallsington	FapA	417.92	C	C	C
Freehold	FrfB, FrfC, FrkB, FrkC, FrkD, FrkD2, FrkE2, FroA	971.47	A/B/C	A/B/C	C
Hammonton	HbmB, HboA, HboB	1,066.80	A	C	C
Holmdel	HocA, HocB	306.28	B	C	C
Humaquepts	HumAt	1,647.75	C	C	C
Keyport	KemA, KemB, KemC	523.60	B	C	C
Klej	KkgB, KkgkB, KkhB	5,191.91	B	C	C
Lakehurst	LakB	3,100.77	A	C	C
Lakewood	LasB, LasC	3,353.13	A	A	C
Manahawkin	MakAt	839.81	C	C	C
Pemberton	PegB	448.19	A	C	C
Phalanx	PhbC	61.99	B	B	C
Pits, sand, gravel	PHG	205.90	NA	NA	NA
Sassafras	SacB, SacC, SacD, SacE, SafA	491.50	A	A/B	C
Shrewsbury	ShrA	451.56	C	C	C
Tinton	ThgB, ThgC, ThgE	934.22	A/B	A/B	C
Udorthents	UdaB, UdauB	1,539.44	A	A	C
Water	WATER	75.26	NA	NA	NA
Woodstown	WoeB, WogA	846.78	A	C	C
Total		**39,403.66**			

Source: US Department of Agriculture, Natural Resource Conservation Service

Key to Land Use Implications	
A = Slight.	Little or no limitation(s) or easily corrected by use of normal equipment and design techniques.
B = Moderate.	Presence of some limitations that normally can be overcome by careful design and management at somewhat greater cost.
C = Severe.	Limitations that normally cannot be overcome without exceptional, complex, or costly measures.

CLIMATE

Geographically situated midway between the North Pole and the equator, New Jersey's climate is extremely variable. The state's temperate, continental climate is influenced by hot, cold, dry, and humid airstreams and local weather is highly changeable. From May through September, New Jersey is dominated by moist, tropical air originating in the Gulf of Mexico that is swept in by prevailing winds from the southwest. In winter, winds generally prevail from the northwest, bringing cold, polar air masses from subarctic Canada.

Climate also varies within distinctive climate zones found throughout the state, including: the ridges and valleys, the highlands, the central piedmont plateau, the inner coastal plain, and the outer coastal plain. For example, Monmouth County is split between the Inner and Outer Coastal Plain, with Howell located in the outer. The soils in the outer coastal plain are sandier and exhibit a strong radiational cooling after sunset. Therefore, temperatures can be significantly lower in Howell and towns just a few miles east than in those towns more inland.

Additionally, the Office of the New Jersey State Climatologist has divided the state into five climate regions: North, Central, Southwest, Pine Barrens, and Coastal. Howell Township is split between two zones, Pine Barrens and Coastal, which have slightly different properties, although both are encompassed by the Outer Coastal Plain. The sandy soils that characterize the Pine Barrens are so porous that the heat absorbed during the day is radiated into space after sunset. These porous soils also cause precipitation to infiltrate rapidly, leaving surfaces very dry. Drier conditions allow a wider range between high and low temperatures and increase vulnerability to forest fires. The climate of the coastal zone is dominated more by the interaction of coastal and continental forces than by soils. The high heat capacity of the Atlantic Ocean relative to land moderates the temperature along the coast, making it less prone to extremes. The heat retention of the ocean causes warmer temperatures in the coastal zone during autumn and early winter. However, cool ocean breezes during the spring and summer keep temperatures cooler along the coast during these months. Another coastal climate phenomenon is coastal storms, which are most frequent between October and April. Most years experience at least one such storm, and some years can experience five to 10 coastal storms.

The National Climate Data Center (NCDC) operates 19 stations in Monmouth County, including the Freehold Marlboro Station, which is closest to Howell Township. According to data tabulated from 1971-2000, the annual mean temperature at this station was 52.6°F, with an average annual rainfall of approximately 47 inches per year. However, in the year 2006 alone, the annual mean temperature was 66.0°F, the hottest month was July, with a mean temperature of 87.1°F, and the coldest month was January, with a mean temperature of 44.8°F.

SURFACE WATER RESOURCES

All of Howell's land ultimately drains to the Atlantic Ocean through a network of small streams and rivers. A majority of the township's land surface drains to the Manasquan River and Manasquan Reservoir. A significant southern portion of the township drains into the Metedeconk River North Branch. A northern portion of the township, containing part of the Naval Weapons Station Earle, drains to Mine Brook in the Navesink River/Lower Shrewsbury

River watershed. A very small portion of the township drains to the Shark River, located in Tinton Falls Township. The following are the named streams and waterbodies in the township:

Aldrich Lake
Al's Brook
Applegates Creek
Ardena Brook
Bannen Meadow Brook
Bass Run
Bear Swamp Brook
Betty's Creek
Birch Creek
Bitten Brook
Branch Mingamahone Brook
Bud's Brook
Burkes Creek
Cathy's Brook
Cedar Run
Charley's Brook
Crane Creek
Cricket Creek
Crow Creek
Dace Creek
Dawn's Creek
Debois Creek
Dicks Brook
Dove Creek
Dyanne's Creek
Echo Lake
Fawn Creek
Finch Brook
Fox Creek
Frog Creek
Gail's Brook
Gravelly Run
Ground Hog Brook
Grouse Brook
Hawk Creek
Haystack Brook
Haystack Brook North Branch
Heron Creek
Jim's Brook
John's Brook
King Fisher Creek
Lake Louise
Long Brook Creek
Long Swamp Brook
Lori's Brook
Lynne's Brook
Mae's Brook
Manasquan Reservoir
Manasquan River
Maple Run
Marl Pit Brook
Marsh Bog Brook
Marsh Bog Brook East Fork
Marsh Bog Brook West Fork
Marsh Creek
Metedeconck River
Mine Brook
Mingamahone Brook
Mingamahone Brook East Fork
Mingamahone East Branch
Mink Run
Muddy Ford Brook
Newt's Creek
North Creek
Pat's Creek
Peggy's Creek
Pete's Brook
Pine Creek
Plover Brook
Polypod Brook
Pree Swamp Brook
Quail Creek
Ridge Creek
Sandy Hill Run
Sharon's Creek
Sherrie's Creek
Small Creek
Snake Creek
Snipe Creek
South Creek
Sparrow Creek
Squankum Brook
Stan Brook
Suzy's Brook
Sweet Gum Brook
Tadpole Creek
Tail Brook
Terr-Kiln Brook
Terry's Creek
Timber Swamp Brook
Tim's Brook
Titmouse Creek
Toad Creek
Turtle Creek East Fork
Turtle Creek West Fork
Weasel Creek
West Fork
Willow Run
Woodcock Brook
Yellow Brook East Fork
Yellow Brook West Fork

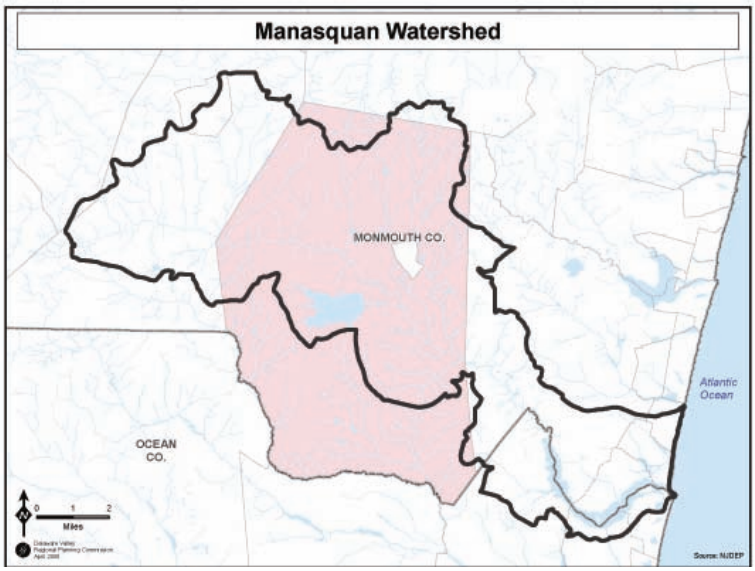
Watersheds

A watershed is all the land that drains to a particular waterway, such as a river, stream, lake, or wetland. The high points in the terrain, such as hills and ridges, define the boundaries of a watershed. Large watersheds are made up of a succession of smaller ones, and smaller ones are made up of the smallest area – the catchment area of a local site. The land drains to the body of water for which each subwatershed is named. These subwatersheds can be further subdivided into smaller ones, each surrounding smaller tributaries that flow to the larger channel, and so on down to the catchment level. Each watershed corresponds to a hydrological unit code, or HUC, as delineated by the United States Geological Survey (USGS). A HUC-11 watershed (identified by an 11-digit code) contains a number of HUC-14 subwatersheds (identified by a 14-digit code). The State of New Jersey has 152 HUC-11 watersheds and over 900 HUC-14 subwatersheds. Within Howell Township, there are portions of four HUC-11 watersheds: Manasquan River, Metedeconk River North Branch, Whale Pond Brook/Shark River/Wreck Pond Brook, and Navesink River/Lower Shrewsbury River. See **Map 8: Watersheds** on page 36.

Watershed Management Areas 12 and 13

NJDEP manages natural resources on a watershed basis. The state has been divided into 20 Watershed Management Areas (WMAs). Howell Township is within two WMAs, 12 and 13, both of which cover coastal areas. The Manasquan River, Whale Pond Brook/Shark River/Wreck Pond Brook, and Navesink River/Lower Shrewsbury River watersheds are all located within the 297,460-acre WMA 12, "Monmouth." WMA 12 includes subwatersheds that drain directly to both the Raritan Bay and the Atlantic Ocean. The Metedeconk River North Branch is located in WMA 13, "Barnegat Bay." WMA 13 is very large and covers 660 square miles, half of which is forested. This includes protected public land, such as Double Trouble State Park, Island Beach State Park, and Edwin B. Forsythe National Wildlife Refuge (Barnegat Division).

Watersheds are natural ecological units, where soil, water, air, plants, and animals interact in a complex relationship. The four watersheds that cover large or small portions of the township are briefly described below.



Manasquan River HUC 11 Watershed

Manasquan River Watershed

The Manasquan River Watershed is the main water system in Howell Township, draining about 62% (24,587 acres) of the township's land. This watershed covers a total area of about 81 square miles; the river runs a length of about 23

miles southeasterly from Freehold Township to the Manasquan Inlet, emptying into the Atlantic Ocean. The entire watershed covers all or parts of 13 municipalities in Monmouth County in addition to Howell, including Sea Girt Borough, Brielle Borough, Wall Township, Farmingdale Borough, Colts Neck Township, Freehold Borough, Freehold Township, and Manasquan Borough, although Howell Township covers the greatest amount of acreage within the watershed. A number of major tributaries flow into the Manasquan River, including Debois Creek, Mingamahone Brook, and Marsh Bog Brook.

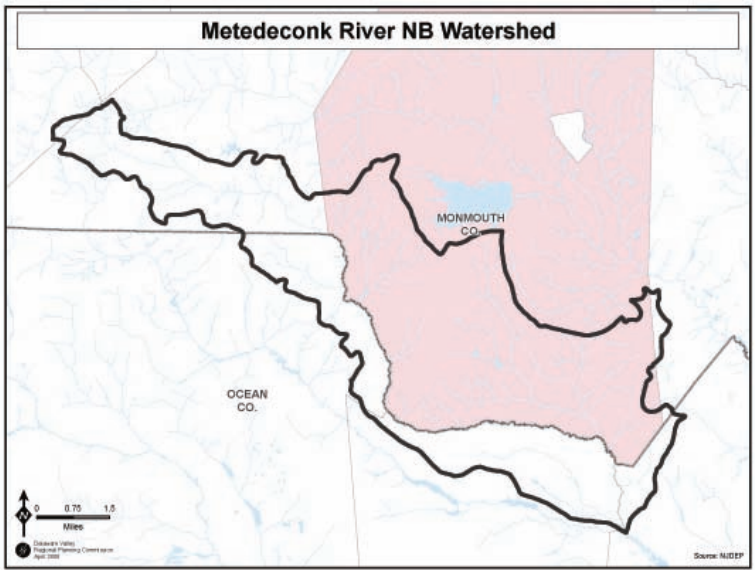
The Manasquan River Watershed is divided into 10 subwatersheds, or HUC-14 areas, eight of which are located within Howell Township. Divisions between the subwatersheds align with natural corridors, such as the Marsh Bog Brook, the Mingamahone Brook, and tributaries of the Manasquan River, as well as manmade corridors, such as Asbury Road (County Route 547). Five subwatersheds within Howell flow directly to the Manasquan River, two flow to the Mingamahone Brook, and one empties into Marsh Bog Brook.

In addition to providing valuable habitat and contributing to local quality of life, the Manasquan River is a significant source of drinking water for Monmouth and Ocean counties. Within the watershed lies the 4.7 billion gallon Manasquan Reservoir, completed in 1990 by damming the Timber Swamp Brook. The reservoir is owned and operated by the New Jersey Water Supply Authority, which sells bulk water to a number of municipalities and private water purveyors, the largest of which is New Jersey American Water. It is estimated that at least 500,000 people in the area rely on the Manasquan Reservoir for at least part of their water needs. The Manasquan Reservoir is capable of yielding 30 million gallons per day, even during drought conditions, although typically 2 million gallons are withdrawn per day. Additionally, an estimated 10.8 million gallons of ground water are pumped per day by area residents (MWMA, 2000).

The Manasquan Estuary is the body of water that the Manasquan River flows into before entering the Atlantic Ocean through the Manasquan Inlet. The Manasquan Estuary includes more than 1,500 acres of shellfish growing waters, which constitutes a major economic resource for the state. The Manasquan Inlet marks the northern boundary of the 116-mile long New Jersey Intracoastal Waterway, a passage that roughly parallels the Atlantic Coast from the Manasquan River south to Florida. The New Jersey portion of the Intracoastal Waterway extends 118 miles through bays, lagoons, thoroughfares, and land cuts from Manasquan Inlet to the Delaware Bay, 2 miles north of Cape May Lighthouse. The New Jersey Intracoastal Waterway is mainly used by pleasure craft and commercial and sport fishing vessels (NOAA, 1994). Approximately 2,500 boats are docked in the estuary and the inlet is heavily used by both commercial and recreational boats, particularly during the summer months (Monmouth County Health Department). Efforts to protect the Manasquan watershed and its many valuable resources are discussed in the **Environmental Issues** section on pages 121-122.

Metedeconk River North Branch Watershed

The southern third (13,118 acres) of Howell Township drains to the Metedeconk River North Branch (NB) Watershed. Like the Manasquan, the name Metedeconk derives from the Lenape Indian language. This watershed is divided into five subwatersheds in Howell Township. One subwatershed drains to the Muddy Ford Brook, another drains to the Haystack Brook, and the other three subwatersheds drain to the Metedeconk River. The entire Metedeconk River



Metedeconk River HUC 11 Watershed

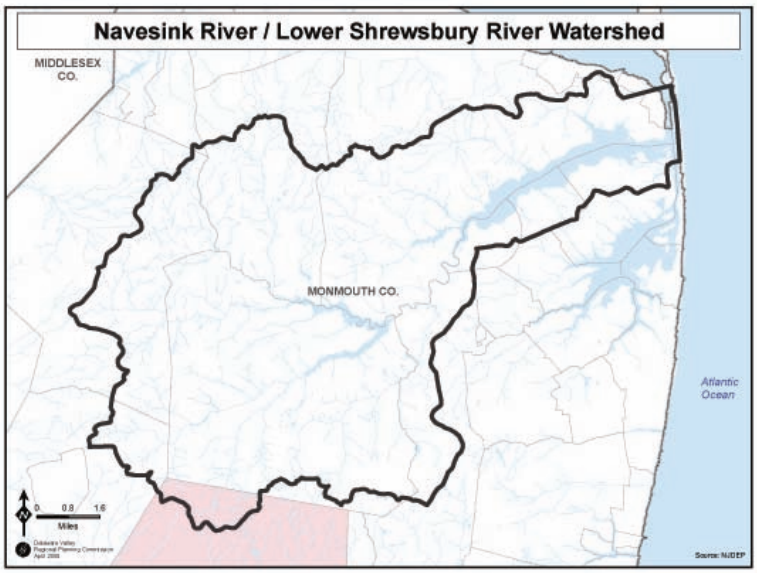
Watershed (both North and South branches) covers nearly 90 square miles and portions of seven municipalities from its headwaters to the Barnegat Bay, and its water resources serve over 200,000 people. Jackson and Howell alone cover 60% of the entire watershed (Barten et al., 2003). The Metedeconk River Watershed is a subwatershed of the Barnegat Bay Watershed, which was designated by the EPA in 1995 as a National Estuary Program (NEP) site [Brick Township Municipal Utilities Authority (BTMUA), 2003b]. Where the two branches of the Metedeconk River converge at Forge Pond, the river widens and then flows into Barnegat Bay, which then empties into the Atlantic Ocean. The Metedeconk River Watershed is characterized by low, slightly rolling land, from sea level to only 320 feet above sea level. Most of the river's base flow comes from the shallow, unconfined Kirkwood-Cohansey aquifer system, which provides high conductivity and high yields of water owing to its fine sands (BTMUA, 2003a). The average streamflow of the Metedeconk River North Branch in 2006 was 78 cubic feet per second (cfs), less than the Manasquan River's average streamflow of 96 cfs (USGS Streamflow Measurements for the Nation).

Although the Metedeconk River Watershed underlies an area with very high rates of growth and development, its water quality and quantity is protected by a number of factors. The Turkey Swamp Wildlife Management Area, located in Freehold Township, protects the headwaters of both North and South branches of the Metedeconk River (Barten et al., 2003). Covering nearly 4,000 acres of preserved land, the Turkey Swamp Wildlife Management Area is publicly owned land that was aquired mostly through Green Acres funding (NJDEP, Wildlife Management Areas, 2008). There are no direct discharges of pollution from either industry or wastewater treatment plants into the Metedeconk River, which also maintains the river's quality (BTMUA, 2000). In addition, a large portion of the watershed is wetlands; riparian forests are relatively intact; there are few slopes exceeding 5%; and soils are sandy, deep, and well drained. These physical characteristics allow rainfall and stormwater runoff to infiltrate easily to recharge the groundwater and maintain water quantity in the Metedeconk River.

In spite of these factors, the Metedeconk River watershed is threatened by increasing development pressures. The two main threats to the water quantity of the Metedeconk River watershed are (1) excessive withdrawals from the shallow Kirkwood-Cohansey aquifer and (2) decreasing amounts of rainfall recharging the groundwater due to increasing impervious coverage. Water quality is threatened by the rapid flows of groundwater in the Metedeconk

River, which can quickly carry pollutants deeper from septic systems, parking lots, underground storage tanks, urban runoff, and spills (BTMUA, 2003a).

Completed in 1926, the two-mile Point Pleasant Canal connected the Barnegat Bay (of which the Metedeconk watershed is a part) with the Manasquan River to the north. Before the canal was completed, the Metedeconk River and the upper portion of the Barnegat Bay flowed into freshwater bodies. However, the Manasquan River empties directly into the Atlantic Ocean and is therefore saltwater. The completion of the Point Pleasant Canal inadvertently led to salt water intrusion from the Manasquan River into the Barnegat Bay and changed the nature of the Metedeconk River from freshwater to saltwater. This had a number of environmental repercussions, including a loss in bass, pike, and perch populations as well as the loss of cranberry bogs on the Metedeconk (Woolley and Heim, n.d.).



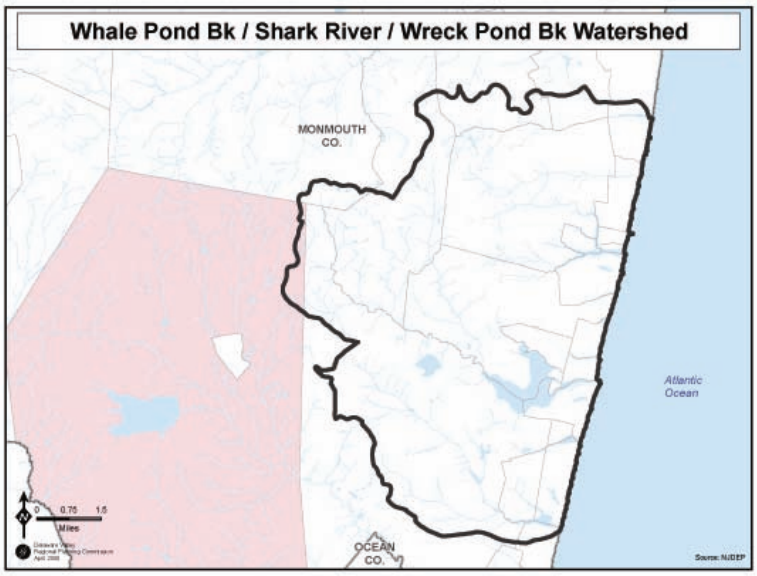
Navesink River HUC 11 Watershed

Navesink River/Lower Shrewsbury River Watershed

About 3% (1,278 acres) of the northwest corner of Howell Township drains to the Navesink River/Lower Shrewsbury River Watershed. This watershed covers much of neighboring Colts Neck, as well as parts of Freehold Township and Tinton Falls Township. There are two subwatersheds covering parts of the township, one flowing to Yellow Brook and the other to Mine Brook.

Whale Pond Brook/Shark River/Wreck Pond Brook Watershed

The remaining 1% (422 acres) of Howell Township is part of the Whale Pond Brook/Shark



Whale Pond Brook/Shark River/Wreck Pond Brook HUC 11 Watershed

River/Wreck Pond Brook Watershed. Much of Tinton Falls Township and Wall Township drain to this watershed. Howell Township's portion drains directly to Shark River.

Table 7: Watersheds in Howell Township

Watershed (HUC 11 Number)	Subwatershed within Howell	Acreage within Howell	Percent of Howell land	HUC 14 Number
Manasquan River (2030104100)			**62.40%**	
	Manasquan R (Rt 9 to 74d17m50s road)	2,156.39	5.47%	02030104100020
	Manasquan R (West Farms Rd to Rt 9)	7,073.93	17.95%	02030104100030
	Marsh Bog Brook	2,985.78	7.58%	02030104100040
	Manasquan R (gage to West Farms Rd)	3,515.41	8.92%	02030104100050
	Mingamahone Brook (above Asbury Rd)	2,976.09	7.55%	02030104100060
	Mingamahone Brook (below Asbury Rd)	2,437.44	6.19%	02030104100070
	Manasquan R (74d07m30s to Squankum gage)	3,285.78	8.34%	02030104100080
	Manasquan R (Rt 70 br to 74d07m30s)	156.01	0.40%	02030104100090
Metedeconk River NB (02040301020)			**33.29%**	
	Metedeconk R NB (above I-195)	960.01	2.44%	02040301020010
	Metedeconk R NB (Rt 9 to I-195)	4,097.41	10.40%	02040301020020
	Haystack Brook	3,913.98	9.93%	02040301020030
	Muddy Ford Brook	2,899.59	7.36%	02040301020040
	Metedeconk R NB (confluence to Rt 9)	1,246.71	3.16%	02040301020050
Navesink River / Lower Shrewsbury River (02030104070)			**3.24%**	
	Yellow Brook (above Bucks Mill)	307.23	0.78%	02030104070040
	Mine Brook (Monmouth Co)	970.46	2.46%	02030104070050
Whale Pond Bk / Shark R / Wreck Pond Bk (02030104090)			**1.07%**	
	Shark River (above Remsen Mill gage)	421.69	1.07%	02030104090040
Total		**39,403.92**	**100.00%**	

Source: NJDEP, 2006

Streams

There are two major streams within Howell Township, Manasquan River and Metedeconck River, both of which have many named and unnamed tributaries. There are over 132 stream miles flowing across Howell Township. Over 100 miles of these are first or second order (headwater) streams, meaning they are the initial sections of stream channels with no contributing tributaries (first order streams), or they are stream channels formed from only one branching section of tributaries above them (second order streams). The headwaters are where a stream is "born" and actually begins to flow.

Headwaters are of particular importance because they tend to contain a diversity of aquatic species and their condition affects downstream water quality. Because of their small size, they are highly susceptible to impairment by human activities on the land. First and second order streams are narrow and often shallow and are characterized by relatively small base flows. This makes them subject to greater temperature fluctuations, especially when forested buffers on their banks are removed. They are also easily oversilted by sediment-laden runoff and their water quality can be rapidly degraded. In addition, first order streams are greatly affected by changes in the local water table because they are fed by groundwater sources. Headwaters are important sites for the aquatic life that is at the base of the food chain and often serve as spawning or nursery areas for fish.

Table 8: Howell Township Streams

Stream Order	Miles
First Order (smallest)	75.13
Second Order	25.80
Third Order	15.40
Fourth Order and above	16.14
Total	**132.47**

Source: NJDEP

Wetlands

Wetlands support unique communities that serve as natural water filters and as incubators for many beneficial species. The term "wetland" is applied to areas where water meets the soil surface and supports a particular biological community. The source of water for a wetland can be an estuary, river, stream, lake edge, or groundwater that rises close to the land surface. Under normal circumstances, wetlands are those areas that support a prevalence of defined wetland plants on a wetland soil. The US Fish and Wildlife Service designates all large vascular plants as wetland (hydric), nonwetland (nonhydric) or in between (facultative). Wetland soils, also known as hydric soils, are areas where the land is saturated for at least seven consecutive days during the growing season. Wetlands are classified as either tidal (coastal) or nontidal (interior). Tidal wetlands can be either saline or freshwater. There are also special wetland categories to denote saturated areas that have been altered by human activities.

New Jersey protects freshwater (interior) wetlands under the New Jersey Freshwater Wetlands Protection Act Rules: N.J.A.C. A 7:7A. The law also protects transition areas, or "buffers,"

around freshwater wetlands. The New Jersey freshwater wetlands maps provide guidance on where wetlands are found in New Jersey, but they are not the final word. Only an official determination from DEP, called a "letter of interpretation (LOI)," can legally determine for certain if there are freshwater wetlands on a property. An LOI verifies the presence, absence, and boundaries of freshwater wetlands and transition areas on a site. Wetlands are delineated using a "three-parameter-approach;" three biological indicators must be present. The area must have hydric soils (water inundated or saturated soils and rocks), a prevalence of hydrophytes (plant types adapted to living in saturated soil condition), and hydrology (ground or surface water for a significant part of the growing season, at least seven to 10 days).

Under the Freshwater Wetlands Protection Act, wetlands are categorized as Exceptional, Intermediate, or Ordinary, and each type has slightly different protections. Exceptional wetlands are associated with FW-1 water and FW-2 "Trout Production" waters and their tributaries and have documented habitat or potential habitat for rare, threatened, or endangered species. These wetlands require a 150-foot transition area. Intermediate wetlands are those wetlands not defined as Exceptional or Ordinary; they require a transition area of 50 feet. Ordinary wetlands are those wetlands that are not Exceptional wetlands and are typically isolated, and manmade stormwater facilities such as ditches, swales, and detention basins. No transition area is required by NJDEP, but buffers may be required by municipal zoning ordinances.

Activities permitted to occur within wetlands and their transition areas are very limited and most require permits. Additional information on wetlands rules and permits is available through NJDEP and on its web site under "land use."

All of Howell's wetlands are freshwater. Natural wetlands of all types total approximately 12,367 acres within the township (31% of total land area), of which 11,683 acres are wooded wetlands and 684 acres are low-growing emergent, scrub/shrub or herbaceous wetlands. See **Map 9: Surface Water, Wetlands, and Vernal Pools** on page 61.

Howell also includes approximately 1,762 acres (about 4% of total land area) of modified or disturbed wetlands. Modified wetlands are former wetland areas that have been altered by human activities and that no longer support typical wetland vegetation, or are not vegetated at all. Modified wetland areas do, however, show obvious signs of soil saturation and exist in areas shown to have hydric soils on US Soil Conservation Service soil surveys.

Howell's modified wetlands fall into the following categories: 1,194 acres of agricultural wetlands, 260 acres of wetlands used as right-of-ways, 161 acres of wetlands found in maintained greenspace, lawn, or recreation area, 101 acres of disturbed wetlands, and 46 acres of former agricultural wetlands. A more detailed description of all of Howell's natural wetland areas is found in the **Biological Resources** section, under "Wetlands," on page 82.

Agricultural Wetlands

Agricultural wetlands occupy 1,194 acres (slightly more than 3% of total land area) of Howell Township. Agricultural wetlands are lands under cultivation that are modified former wetland

areas, but that still exhibit evidence of soil saturation in aerial infrared photo surveys. See **Map 9: Surface Water, Wetlands, and Vernal Pools**.

Agricultural wetlands were usually drained by a technique called "tile drainage." Tile drainage was a common method of removing excess water from farm fields that exhibited one or more of the following characteristics: (1) small areas of isolated wetlands, (2) very flat land that ponded in wet weather, (3) soils were slow to warm in the spring because of a relatively high water table, or (4) soils had a very high clay content and, therefore, drained slowly. Tile drainage was very labor intensive, as it involved installing subsurface drainage pipes throughout a field at a depth of three to six feet. Tile drains were used sparingly, only where there were extremely wet spots. Therefore, the existence of tile drainage strongly indicates a natural wetland hydrology.

The Natural Resources Conservation Service sponsors the Wetlands Reserve Program, a voluntary program that offers landowners a chance to receive payments for restoring and protecting wetlands on their property, including agricultural wetlands. Restoring agricultural wetlands would require removing them from agricultural use and restoring them to their natural state. This program provides technical and financial assistance to eligible landowners who can enroll eligible lands through permanent easements, 30-year easements, or restoration cost-share agreements.

Vernal Pools

Vernal pools are bodies of water that appear following snowmelt and during spring rains, but that disappear or are dry during the rest of the year. They are highly important sites for certain rare species of amphibians. Particular types of frogs and salamanders will only breed in vernal ponds (obligate breeders), which provide their offspring with a measure of protection because the pond's impermanence prevents residence by predators of the eggs and young.

Vernal pools are so intermittent that their existence as wetlands has frequently not been recognized. Consequently, many of them have disappeared from the landscape, or have been substantially damaged. This in turn is a principal cause of the decline of their obligate amphibian species.

The New Jersey Division of Fish and Wildlife has been conducting a Vernal Pool Survey project since 2001 to identify, map, and certify vernal ponds throughout the state. Once a vernal pond is certified, regulations require that a 75-foot buffer be maintained around the pond. NJDEP's division of Land Use Regulation oversees this designation and restricts development around vernal ponds by denying construction permits. Local municipalities can provide additional protection by negotiating conservation easements on the land surrounding the pond or by instituting restrictive zoning, such as passing a stream corridor protection overlay ordinance that specifically includes the vernal pools. A township can also include the pools on its official map.

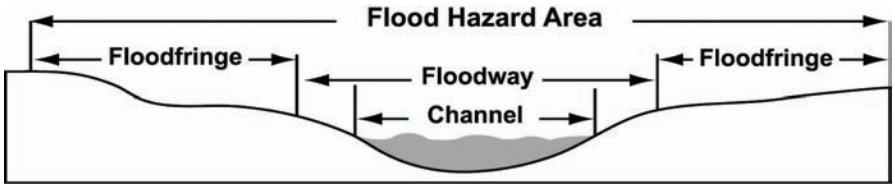
The state has identified 93 potential vernal pools in Howell Township. Surveys of each pond are needed to determine if the pond is still in existence as a natural habitat, and if it is, what species are present. None of these had been surveyed and certified as vernal pools as of February 2008.

Additionally, more vernal pools may be undocumented, and thus threatened. See **Map 9: Surface Water, Wetlands, and Vernal Ponds.**

Floodplains

Areas naturally subject to flooding are called floodplains, or flood hazard areas. Floodplains encompass a floodway, which is the portion of a floodplain subject to high velocities of moving water, and the adjacent flood fringe, which helps to hold and carry excess water during overflow of the normal stream channel. The 100-year floodplain is defined as the land area that will be inundated by the overflow of water resulting from a 100-year flood (a flood that has a one percent chance of occurring in any given year).

Figure 1: Parts of a Flood Hazard Area



Although the terms "flood hazard area" and "100-year floodplain" denote similar concepts, NJDEP defines them in slightly different ways. New Jersey's regulations define the flood hazard area as the area of the 100-year floodplain increased by 25%. This type of flood is called the "flood hazard area design flood" and is regulated by NJDEP.

Floodplains require protection in order to prevent loss to residents, especially within the boundaries of the floodway. Equally important is the preservation of the environmentally sensitive aquatic communities that exist in floodplains. These communities are often the first link in the food chain of the aquatic ecosystem. In addition, floodplains serve the function of removing and mitigating various pollutants through the uptake by their vegetation of excess chemical loads in the water and by the filtering of sediments generally. All efforts to keep development out of floodplains will help to preserve the flood-carrying capacity of streams and their water quality.

Photo by DVRPC
At certain places, the Manasquan River has a wide channel and floodplain.

In New Jersey and throughout the country, building in areas subject to flooding is regulated to protect lives, property, and the environment. New Jersey regulates construction in the flood hazard area under the Flood Hazard Area Control Act, N.J.S.A. 58:16A-50 et seq., and its implementing rules at N.J.A.C. 7:13. Activities that are proposed to occur in a flood hazard area will require issuance of a stream encroachment permit or a letter of

nonapplicability from NJDEP. Additional information on floodplain activities is available from NJDEP and from its web site under "Land use." See **Sources of Information**, page 131.

New Jersey's flood hazard area maps are not available in digital form. Consequently, it is only possible to approximate the spatial extent of the flood hazard area in Howell by using the Federal Emergency Management Agency's (FEMA's) 100-year floodplain maps. According to FEMA data, 5,947 acres, or 15%, of Howell Township's land is flood prone. Nearly all of Howell's floodplain areas are located along the Manasquan River and Metedeconk River and their tributaries. Marsh Bog Brook's floodplain widens as it flows between Cranberry Road and Adelphia Farmingdale Road (County Route 524). There is also a wide flood plain surrounding the headwater branches of Yellow Brook south of State Route 33. These and other flood prone areas are largely free of residences and are categorized as wetlands.

Howell Township revised its riparian buffer and stream corridor preservation ordinance in March 2008. This revised ordinance prohibits development in the stream corridor, as defined by the stream channel plus an area of 100 feet on either side of the stream channel. The ordinance also prohibits development in the stream corridor buffer, defined as an area of 100 feet on either side of the stream corridor, for a total buffer area of 200 feet on either side of a stream. See **Map 4: Steep Slopes and Flood Prone Areas** on page 32.

Surface Water Quality

Water quality standards are established by federal and state governments to ensure that water is suitable for its intended use. The federal Clean Water Act (P.L. 95-217) requires that wherever possible, water-quality standards provide water suitable for fish, shellfish, and wildlife to thrive and reproduce and for people to swim and boat.

All waterbodies in New Jersey are classified by NJDEP as either freshwater (FW), pinelands water (PL), saline estuarine water (SE), or saline coastal water (SC). Freshwater is further broken down into freshwater that originates and is wholly within federal or state parks, forests, or fish and wildlife lands (FW1) and all other freshwater (FW2). The water quality for each of these groups must be able to support designated uses that are assigned to each waterbody classification (see Surface Water Quality Standards N.J.A.C. 7:9B-1.12). In addition to being classified as FW1 and FW2, fresh waterbodies are classified as trout producing (TP), trout maintaining (TM) or nontrout waters (NT). Each of these classifications may also be subject to different water quality standards.

Photo by DVRPC

Brindle Lake provides water recreation opportunities at Camp Sacajawea.

All the streams in Howell Township are freshwater streams. About half of these are trout maintaining and half are not. Bear Swamp Brook, Haystack Brook (also listed as Hay Stack Brook), Marsh Bog Brook, Mingamahone Brook East Branch, and Yellow Brook are classified by NJDEP as FW2-NT, which means that they are freshwater streams that are not trout producing or trout maintaining. All of those brooks except Yellow Brook are classified as Category One (C-1) streams. This designation indicates an extra level of protection for waterbodies that "provide drinking water, habitat for Endangered and Threatened species, and popular recreational and/or commercial species, such as trout or shellfish." Any exceptionally significant waterway can be designated C-1, whether that significance is ecological, recreational, or for drinking water quality. A C-1 waterway operates under more stringent stormwater regulations that emphasize groundwater recharge and also provide wider riparian buffers of 300 feet from the top of the bank on each side. These riparian buffers are required to remain in their natural state and the clearing or cutting of trees or brush is prohibited. The use of fertilizers, pesticides, or other chemicals is also prohibited within the buffer in order to protect water quality (Howell Township Municipal Stormwater Management Plan).

The Manasquan River's main stem, Metedeconk River North Branch, Mingamahone River's main stem, Muddy Ford Brook, and Titmouse Brook are all freshwater streams that are trout maintaining. All of these are designated as Category One (C-1) streams, except one portion of the Manasquan River's main stem (from the Route 9 Bridge to the West Farms Road Bridge).

Table 9: Water Quality Classifications of Streams in Howell Township

Stream Name	Classification
Bear Swamp Brook	FW2-NT(C1)
Haystack Brook	FW2-NT(C1)
Manasquan River Main Stem (Rt. 9 bridge to the West Farms Road Bridge)	FW2-TM
Manasquan River Main Stem (West Farms Road Bridge to the downstream boundary of Manasquan River Wildlife Management Area)	FW2-TM(C1)
Marsh Bog Brook	FW2-NT(C1)
Metedeconk River North Branch (Aldrich Rd. to Lanes Mills)	FW2-TM(C1)
Mingamahone Brook Main Stem	FW2-TM(C1)
Mingamahone Brook East Branch (Source to confluence with mainstem north of Farmingdale)	FW2-NT(C1)
Muddy Ford Brook	FW2-TM(C1)
Titmouse Brook	FW2-TM(C1)
Yellow Brook	FW2-NT

Source: NJDEP, 2006

According to NJDEP rules, FW2 (both trout maintaining and not) waters must provide for (1) the maintenance, migration, and propagation of the natural and established biota; (2) primary and secondary contact recreation (i.e., swimming and fishing); (3) industrial and agricultural water supply; (4) public potable water supply after conventional filtration and disinfection; and (5) any other reasonable uses.

The determination of whether or not water quality is sufficient to meet a waterbody's designated use(s) is based on whether or not the waterbody is within established limits for certain surface water quality parameters. Some examples of surface water quality parameters include fecal coliform, dissolved oxygen, pH, phosphorous, and toxic substances. NJDEP also evaluates water quality by examining the health of aquatic life in a stream.

New Jersey's Integrated Water Quality Monitoring and Assessment Report

The Federal Clean Water Act of 1977 mandates that states submit biennial reports to the US Environmental Protection Agency (USEPA) describing the quality of their waters. States must submit two reports: the *Water Quality Inventory Report*, or "305(b) Report," documenting the status of principal waters in terms of overall water quality and support of designated uses, and a list of waterbodies that are not attaining water quality standards – the "303(d) List." States must also prioritize 303(d)-listed waterbodies for Total Maximum Daily Load (TMDL) analyses and identify those high-priority waterbodies for which they anticipate establishing TMDLs in the next two years.

In 2002, 2004, and again in 2006, NJDEP integrated the 303(d) List and the 305(b) Report into a single report according to USEPA's guidance. The 2006 *Integrated Water Quality Monitoring and Assessment Report* (www.state.nj.us/dep/wmm/sgwqt), released in early 2007, places the state's waters on one of five "sublists." Sublists 1 and 2 contain waters that are attaining standards. Sublist 3 contains waters for which there is insufficient data to determine their status. Sublist 4 contains waters that do not attain water quality standards, but that meet one of the following three conditions: (1) a TMDL has been completed for the pollutant causing non-attainment; (2) other enforceable pollution control requirements are reasonably expected to result in conformance with the applicable water quality standards; or (3) non-attainment is caused by something other than a pollutant. Sublist 5 contains waters that do not attain their designated use and for which a TMDL is required. Sublist 5 is equivalent to the 303(d) List.

Photo by DVRPC

Nearly all of Howell Township's watersheds are impaired for aquatic life.

In the 2002 and 2004 Integrated Reports, NJDEP placed each of the state's water quality monitoring stations on a sublist. Stations that tested for more than one water quality parameter, (i.e., pH, phosphorous, fecal coliform, dissolved oxygen, temperature, etc.) could be placed on different sublists for different parameters. For example, a station could be on Sublist 5 (non-attaining) for phosphorous and Sublist 1 (attaining) for temperature. Individual stream segments (also referred to as waterbodies) were then associated with water quality sampling stations using a methodology established by NJDEP. However, the ability of a waterbody to meet its designated uses was not explicitly stated in the 2002 and 2004 Integrated Reports.

In 2006, NJDEP revised its methodology so as to report the attainment of water quality standards required for achieving designated uses on a subwatershed basis. Rather than placing water quality monitoring stations and their associated stream segments on a sublist for an individual parameter, NJDEP identified the designated uses applicable to each HUC-14 watershed (assessment unit) and assessed the status of use attainment for each applicable designated use. Designated uses include:

- Aquatic life (general)
- Aquatic life (trout)
- Primary contact recreation
- Secondary contact recreation
- Drinking water supply
- Industrial water supply
- Agricultural water supply
- Shellfish harvesting
- Fish consumption

The assessment unit was then placed on the appropriate sublist for each use. (Note: not all designated uses are applicable for all HUC-14 watersheds).

NJDEP based the assessment of entire HUC-14 watersheds on the results of one or more monitoring site(s) within the watershed. The results from monitoring site(s) located within the HUC-14 subwatershed were extrapolated to represent all the waters within the entire HUC boundary. In practice, the HUC-14 approach provides a more conservative assessment since any impairment of any waterbody (stream, river, etc.) in a given HUC-14 watershed will result in that entire watershed being listed as impaired for that use/parameter. In addition, where a HUC-14 watershed contains waters of different classification, the more stringent classification was used to assess impairment and that impairment was then applied to the entire watershed. Because of the extent of extrapolation required for this approach, NJDEP will perform more detailed testing to determine the actual cause, source, and extent of impairment in the HUC-14 watershed before developing a TMDL or taking other regulatory action to address the impairment.

See *Table 10: New Jersey Integrated Water Quality Monitoring and Assessment Report, 2006*, for the status of each of Howell's HUC-14 watersheds.

Table 10: New Jersey Integrated Water Quality Monitoring and Assessment Report (2006)

Assessment Unit ID	Assessment Unit Name	Aquatic Life General	Aquatic Life (trout)	Primary Contact Rec.	Secondary Contact Rec.	Drinking Water Supply	Agri. Water Supply	Indus. Water Supply	Fish Consump.
		Sublists							
Manasquan River (2030104100)									
02030104100020	Manasquan R (Rt 9 to 74d17m50s road)	5	N/A	4A	4A	2	2	2	3
02030104100030	Manasquan R (West Farms Rd to Rt 9)	5	5	4A	2	2	2	2	3
02030104100040	Marsh Bog Brook	5	N/A	4A	3	2	2	2	3
02030104100050	Manasquan R (gage to West Farms Rd)	5	5	4A	3	2	2	2	3

Assessment Unit ID	Assessment Unit Name	Aquatic Life General	Aquatic Life (trout)	Primary Contact Rec.	Secondary Contact Rec.	Drinking Water Supply	Agri. Water Supply	Indus. Water Supply	Fish Consump.
		Sublists							
02030104100060	Mingamahone Brook (above Asbury Rd)	5	5	4A	3	2	2	2	3
02030104100070	Mingamahone Brook (below Asbury Rd)	5	5	3	3	3	3	3	3
02030104100080	Manasquan R (74d07m30s to Squankum gage)	5	5	4A	3	2	2	2	3
02030104100090	Manasquan R (Rt 70 br to 74d07m30s)	5	5	2	2	N/A	N/A	N/A	3
Metedeconk River NB (02040301020)									
02040301020010	Metedeconk R NB(above I-195)	5	N/A	4A	3	2	2	2	3
02040301020020	Metedeconk R NB(Rt 9 to I-195)	5	5	4A	3	2	2	2	3
02040301020030	Haystack Brook	5	N/A	4A	4A	2	2	2	3
02040301020040	Muddy Ford Brook	5	5	2	2	2	2	2	3
02040301020050	Metedeconk R NB (confluence to Rt 9)	5	5	4A	3	2	2	2	3
Navesink River / Lower Shrewsbury River (02030104070)									
02030104070040	Yellow Brook (above Bucks Mill)	2	N/A	4A	3	2	2	2	2
02030104070050	Mine Brook (Monmouth Co)	5	N/A	2	2	2	2	2	3
Whale Pond Bk / Shark R / Wreck Pond Bk (02030104090)									
02030104090040	Shark River (above Remsen Mill gage)	5	5	4A	3	2	2	2	5

Source: NJDEP, 2006

Note: The designated use, "Shellfish Harvesting," is not applicable for any of the HUC-14 watersheds/assessment units in Howell Township and is therefore not included in the above table.

Key to Integrated Report Sublists

Sublist	Placement Conditions
Sublist 1	The designated use is assessed and attained AND all other designated uses in the assessment unit area are assessed and attained. (Fish consumption use is not factored into this determination based on EPA guidance).
Sublist 2	The designated use is assessed and attained BUT one or more designated uses in the assessment unit are not attained and/or there is insufficient data to make a determination.
Sublist 3	Insufficient data is available to determine if the designated use is attained.
Sublist 4	The designated use is not attained or is threatened; however, development of a TMDL is not required for one of the following reasons: A TMDL has been completed for the pollutant causing non-attainment. Other enforceable pollution control requirements are reasonably expected to result in the conformance with the applicable water quality standard(s) in the near future and the designated use will be attained through these means. Non-attainment is caused by something other than a pollutant.
Sublist 5	The designated use is not attained or is threatened by a pollutant or pollutants and a TMDL is required.

As shown in *Table 10* above, an assessment unit may be listed on one or more sublists depending on the results of the assessment (i.e., on Sublist 2 for drinking water, Sublist 3 for aquatic life, etc.). Only if all uses for an individual HUC-14 are assessed and attained can the assessment unit be placed on Sublist 1. In order to determine whether or not an assessment unit supports a designated use, NJDEP identified a suite of parameters that serve as the minimum data set associated with each designated use.

If one or more designated uses are assessed as "non-attainment" (Sublist 5), the pollutant(s) causing the non-attainment status is identified on the "303(d) List of Impaired Waters with Priority Ranking." When the pollutant causing non-attainment is not known, the pollutant is listed as "pollutant unknown" or "toxic unknown." The ranking (low, medium, high) refers to the priority given a specific assessment unit when determining the schedule for a TMDL. As shown in *Table 11* below, all but one HUC-14 assessment unit in Howell Township was listed as impaired due to one or more parameters.

Table 11: New Jersey's 303(d) List of Impaired Waters with Priority Ranking (2006)

Assessment Unit ID	Assessment Unit Name	Parameter	Ranking
HUC-11: Manasquan River (2030104100)			
02030104100020	Manasquan R (Rt 9 to 74d17m50s road)	Total suspended solids	High
02030104100030 (1)	Manasquan R (West Farms Rd to Rt 9)	pH	High
02030104100030 (2)	Manasquan R (West Farms Rd to Rt 9)	Temperature	Low
02030104100030 (3)	Manasquan R (West Farms Rd to Rt 9)	Total suspended solids	High
02030104100040	Marsh Bog Brook	pH	Medium
02030104100050 (1)	Manasquan R (gage to West Farms Rd)	pH	High
02030104100050 (2)	Manasquan R (gage to West Farms Rd)	Total suspended solids	High
02030104100060 (1)	Mingamahone Brook (above Asbury Rd)	pH	Medium
02030104100060 (2)	Mingamahone Brook (above Asbury Rd)	Total suspended solids	Low
02030104100060 (3)	Mingamahone Brook (above Asbury Rd)	Turbidity	Low
02030104100070	Mingamahone Brook (below Asbury Rd)	Pollutant Unknown	Low
02030104100080	Manasquan R (74d07m30s to Squankum gage)	pH	High
02030104100090	Manasquan R (Rt 70 br to 74d07m30s)	Dissolved Oxygen	Medium
HUC 11: Metedeconk River NB (02040301020)			
02040301020010 (1)	Metedeconk R NB(above I-195)	Dissolved Oxygen	Medium
02040301020010 (2)	Metedeconk R NB(above I-195)	pH	Medium
02040301020020 (1)	Metedeconk R NB(Rt 9 to I-195)	Dissolved Oxygen	Medium
02040301020020 (2)	Metedeconk R NB(Rt 9 to I-195)	pH	Medium
02040301020020 (3)	Metedeconk R NB(Rt 9 to I-195)	Phosphorus	Medium
02040301020020 (4)	Metedeconk R NB(Rt 9 to I-195)	Temperature	Low
02040301020030 (1)	Haystack Brook	pH	Medium
02040301020030 (2)	Haystack Brook	Phosphorus	Medium
02040301020040 (1)	Muddy Ford Brook	pH	Medium
02040301020040 (2)	Muddy Ford Brook	Phosphorus	Medium
02040301020040 (3)	Muddy Ford Brook	Total suspended solids	Low
02040301020050 (1)	Metedeconk R NB (confluence to Rt 9)	pH	Medium
02040301020050 (2)	Metedeconk R NB (confluence to Rt 9)	Temperature	Low

Assessment Unit ID	Assessment Unit Name	Parameter	Ranking
HUC 11: Navesink River / Lower Shrewsbury River (02030104070)			
02030104070040	Yellow Brook (above Bucks Mill)	N/A	N/A
02030104070050	Mine Brook (Monmouth Co)	pH	Medium
HUC 11: Whale Pond Bk / Shark R / Wreck Pond Bk (02030104090)			
02030104090040 (1)	Shark River (above Remsen Mill gage)	Chlordane	Medium
02030104090040 (2)	Shark River (above Remsen Mill gage)	DDX	Medium
02030104090040 (3)	Shark River (above Remsen Mill gage)	Mercury	Medium
02030104090040 (4)	Shark River (above Remsen Mill gage)	PCBs	Medium
02030104090040 (5)	Shark River (above Remsen Mill gage)	Pollutant Unknown	Low

Source: NJDEP, 2006

Water Quality Monitoring Networks

The determination of whether or not water quality is sufficient to meet an assessment unit's designated use(s) is based on testing results from various water quality monitoring networks. Across the state, NJDEP primarily relies on two water quality monitoring networks: the *Ambient Stream Monitoring Network (ASMN)* and the *Ambient Biomonitoring Network (AMNET).* NJDEP runs the ASMN network in cooperation with the USGS. This network contains 115 stations that monitor for nutrients (i.e., phosphorous and nitrogen), bacteria, dissolved oxygen, metals, sediments, chemical, and other parameters. AMNET, which is administered solely by NJDEP, evaluates the health of aquatic life as a biological indicator of water quality. This network includes 820 monitoring stations located throughout the state. Each station is sampled once every five years. The first round of sampling for all stations took place between 1992 and 1996 and a second round occurred between 1997 and 2001. A third round of sampling took place between 2002 and 2006.

Ambient Stream Monitoring Network

There are seven sites in Howell Township that are part of the USGS/NJDEP ASWM network. Two sites are on the Manasquan River, one is on Mingamahone Brook, one is on Marsh Bog Brook, one is on Long Brook, one is on Haystack Brook, and one is on the Metedeconk River. These sites are tested for fecal coliform, pH, temperature, dissolved oxygen, ammonia, nitrogen, phosphorous, metals, and a wide range of organic and inorganic chemicals. Discharge, field parameters, filtered common ions, total and filtered nutrients, suspended solids, and BOD are monitored quarterly; metals are monitors biannually; and bacterial parameters (five times in 30 days), diurnal DO, pesticides, sediment metals, sediment nutrients, and sediment polyaromatic hydrocarbons (PAH) are monitored annually at selected sites. The station locations are depicted on **Map 11: Water Quality (2006)** on page 63.

Ambient Biomonitoring Network

Sixteen AMNET stations are located within Howell. Each of the five major water regions is sampled on a rotational basis, every five years. NJDEP sampled each of these AMNET sites in January 1995, and again in January 2001 (data for the third most recent round of sampling from 2006 was not available yet from NJDEP as of February 2008). Each AMNET site was tested for only one water quality parameter – the diversity of the aquatic communities at the site, specifically, benthic (bottom-dwelling) macroinvertebrates (insects, worms, mollusks, and

crustaceans that are large enough to be seen by the naked eye). Sites can be classified as either non-impaired, moderately impaired, or severely impaired for aquatic life support.

In the 1995 (first round) sampling, all 16 of the sites within or near Howell were tested. Only one site – Debois Creek, Strickland Rd (AN0487) – was ranked as severely impaired. Ten sites (AN0488, AN0489, AN0490, AN0491, AN0492, AN0493, AN0494, AN0501, AN0502, and AN0503) were ranked moderately impaired, and five sites (AN0495, AN0496, AN0497, AN0504, and AN0505) were ranked non-impaired.

All 10 sites that were ranked as moderately impaired in 1995 remained moderately impaired in the 2001 testing. The quality of the severely impaired site on Debois Creek worsened somewhat. Two of sites – AN0495 and AN0504 – were downgraded from non-impaired to moderately impaired. Three sites continued to be non-impaired.

Howell's AMNET stations are listed below in *Table 12: New Jersey AMNET Sampling Locations for Howell Township* and are depicted on **Map 11: Water Quality (2006)**.

Table 12: New Jersey AMNET Sampling Locations for Howell Township

Site ID	Station Name/Waterbody	Municipality	Parameters Measured	1995 NJ Impairment Score*	2001 NJ Impairment Score*
AN0487	Debois Creek, Strickland Rd	Howell Twp	Benthic Macroinvertebrates	6	3
AN0488	Manasquan Run tributary, Strickland Rd	Howell Twp	Benthic Macroinvertebrates	12	9
AN0489	Manasquan River, Rt 9	Wyckoff Mills	Benthic Macroinvertebrates	12	15
AN0490	Manasquan River, W. Farms Rd	Howell Twp	Benthic Macroinvertebrates	18	18
AN0491	Marsh Bog Brook, Cranberry Bog Rd,	Howell Twp	Benthic Macroinvertebrates	12	12
AN0492	Marsh Bog Brook, Yellow Brook Rd	Squankum	Benthic Macroinvertebrates	21	21
AN0493	Manasquan River, Rt 547	Squankum	Benthic Macroinvertebrates	18	18
AN0494	Mingamahone Brook, Cranberry Bog Rd	Howell Twp	Benthic Macroinvertebrates	15	15
AN0495	Mingamahone Brook, Rt 524	Squankum	Benthic Macroinvertebrates	24	21
AN0496	Stan Brook, Easy St	Howell Twp	Benthic Macroinvertebrates	27	24
AN0497	Squankum Brook, Spur 549	Howell Twp	Benthic Macroinvertebrates	24	24
AN0501	North Branch Metedeconk River, Aldrich Rd	Howell Twp	Benthic Macroinvertebrates	21	21
AN0502	North Branch Metedeconk River, Rt 9	Lakewood	Benthic Macroinvertebrates	18	21
AN0503	Haystack Brook, Southard Rd	Howell Twp	Benthic Macroinvertebrates	9	12

Site ID	Station Name/Waterbody	Municipality	Parameters Measured	1995 NJ Impairment Score*	2001 NJ Impairment Score*
AN0504	Haystack Brook, Rt 547	Howell Twp	Benthic Macroinvertebrates	27	18
AN0505	Muddy Ford, Greenville Rd	Howell Twp	Benthic Macroinvertebrates	24	24

Source: NJDEP, 1995, 2001

***Explanation of NJ Impairment Score:**

NJ Impairment Score	Biological Assessment
0-6	Severely Impaired
9-21	Moderately Impaired
24-30	Non-impaired

Manasquan River Ambient Sampling

In addition to the ASMN and AMNET water quality monitoring, the Manasquan River watershed is also monitored by the Monmouth County Health Department. According to a 1999 trend analysis report, the water quality of the Manasquan River has greatly improved in recent years, although it is continually threatened by nonpoint runoff pollution from residential, commercial, and agricultural activities. The 1997 designation of the Manasquan River as a "No Discharge Zone," which prohibits recreational and commercial boats from discharging sewage, was an important step in improving the river's water quality. The Monmouth County Health Department monitors the ambient stream quality of the Manasquan watershed at four sites in Howell Township, and at one site within Farmingdale Borough. The locations of these stations are the following: Long Brook on Howell Road (site 25), Marsh Bog Brook on Preventorium Road (site 24), Squankum Brook on Easy Street (site 16), and Yellowbrook on Route 524 (site 15). The Farmingdale site is on Mingamahone Brook on Belmar Boulevard (site 23). These sites are tested for nitrate, ammonia, and phosphorous biannually; fecal coliform is tested quarterly. The Long Brook site near the Howell/Freehold border is the most impacted by nonpoint pollution according to the county's 1999 study.

Other Monitoring

Certain fish may contain toxic chemicals, such as PCBs, dioxins, or mercury, which accumulate in water and aquatic life. Chemical contaminants, such as dioxin and PCBs, are classified by the USEPA as probable cancer-causing substances in humans. Elevated levels of mercury can pose health risks to the human nervous system. Infants, children, pregnant women, nursing mothers, and women of childbearing age are considered to be at higher risk from contaminants in fish than other members of the general public. Since 1982, NJDEP has been catching fish at numerous sampling stations throughout the state and testing for contaminant levels of PCB, Dioxin, and Mercury, adopting advisories to guide residents on safe consumption practices. Within Howell Township, NJDEP conducts fish sampling in the Manasquan Reservoir for four species of fish. For the general population, NJDEP recommends one meal per month of largemouth bass, one

meal per week of the black crappie, and no restrictions on either the chain pickerel or yellow perch. For high risk individuals, NJDEP recommends they do not eat largemouth bass, and consume no more than one meal per month of black crappie and chain pickerel, and no more than one meal per week of yellow perch.

The Howell Township Environmental Commission (EC) performed their own monthly water monitoring at 28 sites within the township from the mid-1990s until 2002. However, a mold problem in the basement laboratory caused the EC to lose the equipment. Although the EC asked the Monmouth County Board of Health for a new facility, this request was not granted. Knowing the actual condition of streams and stream banks and planning for their improvement requires fuller surveys and more frequent monitoring than the state can provide. The state primarily monitors main channels in nontidal areas and only does biological assessments on a five-year cycle. Stream surveys by local organizations are much needed, along with regular monitoring of water quality on all of a community's waterways.

Total Maximum Daily Loads

For each impaired waterway (waters on Sublist 5), the state is required by the USEPA to establish a Total Maximum Daily Load (TMDL). A TMDL quantifies the amount of a pollutant a waterbody can assimilate (its loading capacity) without violating water quality standards. A TMDL's purpose is to initiate a management approach or restoration plan based on identifying the sources of a pollutant and determining the percent reductions of the pollutant that must be achieved by each source. These sources can be point sources, such as sewage treatment plants, or nonpoint sources, such as runoff from various types of residential, commercial, or agricultural lands. A TMDL goes through four stages; it is "proposed" in a report by NJDEP, "established" when NJDEP finalizes their report, "approved" by EPA Region 2, and "adopted" when NJDEP adopts it as an amendment to a water quality management plan.

In general, implementation of a TMDL relies on actions mandated by the Municipal Stormwater Management program, including the ordinances that municipalities are required to adopt under that permit (see **inset box** on page 57 for details of the Statewide Basic Requirements of this program). It also depends on voluntary improvements in land and runoff management of agricultural areas. A list of US Department of Agriculture and New Jersey Department of Agriculture programs that provide funding and technical assistance on relevant projects for farm landowners is included in *Appendix B: Federal and State Conservation Programs for Farmers*.

A TMDL determines the percentage of reduction needed in order for a stream segment to meet the water quality standard. Nonpoint and stormwater point sources are the largest contributors as runoff from various land uses transports fecal coliform from sources, such as geese, farms, and domestic pets during rain events into waterbodies. Nonpoint sources also include inputs from "illicit" sources, such as failing sewage conveyance systems, sanitary sewer overflows, and failing or inappropriately located septic systems.

Reductions in fecal coliform are first determined by calculating a "load" that the stream segment can accommodate and still be below the concentration of the standard given the range of flows at the monitoring station. TMDL for fecal coliform was approved in September 2003 for 31 stream segments in the Atlantic Water Region, nine of which are in or bordering Howell Township.

Within HUC 11# 02030104100, Manasquan River, there are five stream segments with the following TMDL requirements for fecal coliform:

- Squankum Brook at Easy Street (site 16) requires a 94% reduction
- Mingamahone Brook near Earle (site 01408009) requires a 79% reduction
- Long Brook at Wyckoff Mills (site 01407868) requires a 92% reduction
- Marsh Bog Brook at Squankum (site 01407997) requires a 92% reduction
- Manasquan River at Squankum (site 01408000) requires a 92% reduction

Within HUC 11# 02040301020, Metedeconk River North Branch, there are four stream segments with the following TMDL requirements for fecal coliform:

- Muddy Ford Brook at Lakewood-Allenwood Road (site 17) requires a 90% reduction
- Haystack Brook at Maxim-Southard Road (site 18) requires a 90% reduction
- Titmouse Creek at Friendship Road (site 19) requires a 90% reduction
- North Branch Metedeconk River at Lakewood (site 01408100) requires a 90% reduction

Reductions in phosphorous are first determined by calculating a "load" that the stream segment can accommodate and still be below the concentration of the standard given the range of flows at the monitoring station. In September 2005, TMDL for phosphorus were approved for the following two stream segments in Howell Township within HUC 11# 02030104100, Manasquan River:

- Long Brook at Wyckoff Mills (site 01407868) requires a 53.3% reduction
- Manasquan River at Squankum (site 01408000) requires a 52.3% reduction

To meet this reduction, NJDEP identified the general sources of phosphorous, assigned a reasonable "load" to each source (a "load allocation"), and established the reduction needed from each source. Within this subwatershed, there are no regulated point sources. Nonpoint sources consist of both natural sources (forests, wetlands, water, and barren land) and stormwater sources. Load allocations were formulated based on the type of land uses within the subwatershed.

Causes of Water Quality Impairments

Water quality best management practices are concerned with protecting the quality of surface waters while protecting and promoting vibrant habitats. Some of these practices addressed in Howell Township's *2005 Conservation Plan Element* include the following:

- Clustering new development on the least porous soils;
- Use of buffer strips, grassed swales, filter strips, and other techniques to maximize overland flow;
- Regional stormwater management approaches;
- Use of retention basins and wetland or marsh creation;
- Use of nonstructural infiltration techniques, such as trenches, basins, and drywells; and
- Water quality inlets and oil/grit separators.

Stormwater Runoff

Stormwater runoff and other pollution coming from a wide variety of sources rather than from a single point, such as a discharge pipe (nonpoint sources), have the largest effect on the water quality and channel health of streams in Howell. These sources are also the most difficult to identify and remediate because they are diffuse, widespread, and cumulative in their effect. Known causes of nonpoint source pollution include septic system effluent, agricultural runoff, construction activities, and stormwater drainage. Most nonpoint source pollution in Monmouth County derives from stormwater drainage off paved surfaces, such as streets, commercial, industrial, and residential areas (with and without detention basins), and from agricultural fields that lack adequate vegetative buffers. Some of this runoff comes to the waterways from similar sources in upstream townships and some of it derives from Howell land uses. Howell Township contains a number of major roadways, such as Interstate 195 and US routes 9, 33, and 34, which leads to high rates of stormwater runoff.

In March 2003, NJDEP issued a new Stormwater Management Rule as required by the USEPA's Phase II Stormwater Management Program for Municipal Separate Stormwater Sewer Systems (referred to as MS4). The rule lays out guidance and requirements for management of and education about stormwater at the local level. It applies to all towns in New Jersey, all county road departments, and all public institutional facilities on large sites (such as hospitals and colleges). Beginning in 2004, municipalities were required to obtain a New Jersey Pollution Discharge Elimination System (NJPDES) general permit for the stormwater system and its discharges within their borders, which are considered to be owned and "operated" by the municipality.

Under the 2004 NJPDES permit, a town must meet certain specific requirements in planning, ordinance adoption, education, management of township facilities, and investigation of parts of the stormwater system. Fulfillment of these

Stormwater Management Statewide Basic Requirements

Towns, Highway Agencies, and Institutions

Control post-construction stormwater management in new development and redevelopment through:

- Adoption of a stormwater management plan in accordance with N.J.A.C. 7:8.
- Adoption and implementation of a stormwater control ordinance in accordance with N.J.A.C. 7:8. This ordinance requires retention on site of 100% of preconstruction recharge and use of low-impact design in stormwater facilities, among other features.
- Ensuring compliance with Residential Site Improvement Standards for stormwater management. The RSIS was revised to incorporate the low-impact design and other requirements of the stormwater control ordinance.
- Ensuring long-term operation and maintenance of Best Management Practices on municipal property.
- Requiring that new storm drain inlets meet new design standards.

Conduct local public education:

- Distribute educational information about stormwater requirements, nonpoint source pollution, and stewardship annually to residents and businesses and conduct a yearly "event" (such as a booth with these messages at a community day).
- Have most municipal storm drain inlets labeled with some type of "don't dump" message.
- Distribute information annually regarding fertilizer/pesticide application, storage, disposal, and landscaping alternatives.
- Distribute information annually regarding proper identification, handling, and disposal of wastes, including pet waste and litter.

Control improper disposal of waste through improved yard waste collection and through adoption of ordinances (pet waste, litter, improper dumping, and wildlife feeding).

Control solids and floatables through increased street sweeping, retrofitting storm drain inlets during road repairs, and instituting programs for stormwater facility management, for roadside erosion control, and for outfall pipe scouring/erosion.

Improve maintenance yard operations, specifically for de-icing material storage, fueling operations, vehicle maintenance, and housekeeping operations.

Increase employee training about all of the above.

Source: NJDEP

Statewide Basic Requirements is scheduled to occur over the course of five years. All of the requirements are intended to reduce the water pollution from stormwater runoff. See **inset box** on page 57 for details of the Statewide Basic Requirements of this program.

Howell Township adopted its Municipal Stormwater Management Plan in April 2005, which was revised in May 2007. The plan describes a number of stormwater quantity problems in the township, including flooding, stream bank erosion, and diminished base-flow in streams. For example, the Manasquan River at Bergerville Road has severe stream bank erosion, which causes chronic flooding and ponding. There are other chronic flooding areas in the township that are affected by undersized culverts, or man-made channels for draining water. These inadequate culverts were designed for different hydrological conditions, such as less impervious surface, than actually exists today. During heavy storms, these culverts are inadequate to handle the amount of stormwater and so there is a backwater effect and flooding upstream. These chronic flooding areas are found: (1) within Blake Drive discharging to the Metedeconk River in the far southeast corner of the township, (2) on Fairfield Road near Ardena Brook (a tributary of the Manasquan River), and (3) on Easy Street and Newton's Corner Road near Muddy Ford Brook (Howell Township Municipal Stormwater Management Plan, 2005).

Howell's plan discusses specific stormwater design and performance standards for new development. It also proposes stormwater management controls to address impacts from existing development. The plan includes preventative as well as corrective measures to ensure the long-term effectiveness of stormwater management facilities. The plan also outlines safety standards for stormwater infrastructure to protect public safety. Some examples of stormwater management techniques listed in the plan include preserving forested areas and riparian corridors, utilizing the minimum pavement widths, and minimizing soil compaction during construction.

In addition to the Municipal Stormwater Management Plan, Howell Township has a Stormwater Ordinance that encourages the slowing down of the rate and volume of runoff. This ordinance also requires that for new developments, the peak flow must equal the peak flow predevelopment (BTMUA, 2000).

Impervious Coverage

The volume of runoff that is carried to a stream impacts stream channel condition. Increased volume usually results from increased impervious surface within a subwatershed. As an area becomes developed, more stormwater is directed to the streams from neighborhood storm drains, residential and commercial stormwater facilities, and road drainage. An increase in impervious coverage can decrease groundwater recharge potential, which can lead to a decrease in stream base flow during the dry summer months. In general, scientists have found that levels of impervious cover of 10% or more within a subwatershed are directly linked to increased stormwater runoff, enlargement of stream channels, increased stream bank erosion, lower dry weather flows, higher stream temperatures, lower water quality, and declines in aquatic wildlife diversity. When impervious cover reaches 25% to 30%, streams can become severely degraded.

All HUC 14 subwatersheds in Howell Township contain less than 20% impervious surface. The Route 9 corridor contains the greatest concentration of impervious surfaces, particularly in the

Wyckoff Mills area. Of the 16 HUC 14 subwatersheds that are completely or partially within Howell Township, 13 have less than 13% impervious surface, and three have between 18% and 20%. **See Map 8: Watersheds** on page 36 for a depiction of these subwatersheds. In particular, the subwatersheds in the southwest portion of the township near the intersection of I-195 and Route 9 as well as those near the Garden State Parkway in the southeast portion of the township have a greater concentration of impervious surface.

A number of HUC 14 subwatersheds in Howell Township have a very low amount of impervious surface. For example, a subwatershed of the Navesink River/Lower Shrewsbury River Watershed (HUC 02030104070050) that contains a portion of the Naval Weapons Station Earle has only 1.3% impervious coverage. A few subwatersheds of the Manasquan River also have very low percentages of impervious surface. The subwatersheds of the Metedeconk River have a greater amount of impervious surface because they underlie the areas of Howell with the greatest amount of residential and commercial development. See *Table 13: Impervious Coverage by HUC 14 Watersheds* for information regarding impervious cover.

Howell Township has an ordinance limiting the percentage of impervious coverage for all zoning categories but residential. For example, the maximum allowable percentage of impervious coverage is 70% for commercial and 85% for special economic development zones.

Table 13: Impervious Coverage by HUC 14 Watersheds

HUC 14	Subwatershed Name	Percent of subwatershed covered by impervious surface within Howell
Manasquan River (2030104100)		
02030104100020	Manasquan R (Rt 9 to 74d17m50s road)	11.08%
02030104100030	Manasquan R (West Farms Rd to Rt 9)	8.69%
02030104100040	Marsh Bog Brook	4.59%
02030104100050	Manasquan R (gage to West Farms Rd)	5.05%
02030104100060	Mingamahone Brook (above Asbury Rd)	3.61%
02030104100070	Mingamahone Brook (below Asbury Rd)	2.86%
02030104100080	Manasquan R (74d07m30s to Squankum gage)	2.68%
02030104100090	Manasquan R (Rt 70 br to 74d07m30s)	19.67%
Metedeconk River NB (02040301020)		
02040301020010	Metedeconk R NB(above I-195)	10.94%
02040301020020	Metedeconk R NB(Rt 9 to I-195)	18.73%
02040301020030	Haystack Brook	12.88%
02040301020040	Muddy Ford Brook	6.59%
02040301020050	Metedeconk R NB (confluence to Rt 9)	17.90%
Navesink River / Lower Shrewsbury River (02030104070)		
02030104070040	Yellow Brook (above Bucks Mill)	6.16%
02030104070050	Mine Brook (Monmouth Co)	1.31%
Whale Pond Bk / Shark R / Wreck Pond Bk (02030104090)		
02030104090040	Shark River (above Remsen Mill gage)	10.68%

Source: NJDEP Impervious Coverage, based on 2002 aerials, released 2006

Inadequate Stream Buffers

The stream buffer is the region immediately beyond the banks of a stream that serves to limit the entrance of sediment, pollutants, and nutrients into the stream itself. Stream buffers are quite effective at filtering substances washing off the land. The vegetation of the buffer traps sediment and can actually utilize (uptake) a percentage of the nutrients flowing from lawns and farm fields. When forested, a stream buffer promotes bank stability and serves as a major control of water temperature. The buffer region also serves as a green corridor ─ a greenway ─ for wildlife to move between larger forested habitat areas. Residents can utilize these greenways for recreation with the addition of trails, bikeways, and access points to water for fishing and canoe/kayak launching.

The importance of a healthy, intact buffer zone (also referred to as a "riparian corridor") has been well documented scientifically over the past 20 years, especially for headwater streams. There is less agreement and much continuing research on the appropriate minimum width of a buffer. In literature on this issue, a recommended minimum buffer width of 100 feet is most common, with differing activities permitted in each of three zones within the buffer. Buffers of up to 300 feet are recommended for wildlife corridors and potential passive recreational use, such as walking trails (Honachefsky, 2000).

The New Jersey Freshwater Wetlands Protection Act incorporates buffer requirements into its wetland protection regulations. The width of the "transition zone" extending beyond a wetland is determined by the value of the wetland based on its current use and on the documented presence/absence of threatened or endangered species. Municipalities may not establish buffers on wetlands that exceed those required by the state statute. However, the municipality can make certain that those limits are accurate through its review of the wetlands delineation process, and it can also monitor use of the land within the transition area and take action against encroachments.

Restoration of stream buffers on agricultural lands is supported by various programs of the US Department of Agriculture (USDA) and the New Jersey Department of Agriculture (NJDA), such as the Conservation Reserve Program (CRP), administered by the USDA's Farm Service Agency (FSA). This program compensates farming landowners for the loss of land being converted into a buffer or other habitat. It also funds or directly creates new buffers where they are absent. Programs, such as the Environmental Quality Incentive Program (EQIP), administered by the Natural Resources Conservation Service (NRCS) of USDA, encourage the "due care" management of agricultural lands, involving the proper levels of fertilizer and pesticide applications to farmland. It funds up to 75% of the costs of eligible conservation practices. These are all programs in which individual landowners volunteer to take part.

Point Sources of Pollution

Point sources of pollution, which come from a single source, or "point," such as an industrial pipe discharge, are regulated by NJDEP through the New Jersey Pollution Discharge Elimination System (NJPDES). New Jersey created NJPDES in response to the Federal Clean Water Act of 1972, which mandated that each state develop water quality standards and regulate the amount of pollution entering water bodies. The Act classified all water pollution into one of two categories: "point source" pollution coming from a single source, such as an industrial pipe; and "nonpoint

source" pollution, which comes from many diffuse sources. The 1972 act only required states to regulate point sources.

NJDEP, through the Division of Water Quality and the Bureau of Point Source Permitting, administers the NJPDES program. Under NJPDES, any facility discharging over 2,000 gallons per day (gpd) of wastewater directly into surface water or ground water (generally through a septic system) must apply for and obtain a permit for discharging. Rather than creating individually tailored permits for each and every facility, the Division of Water Quality uses scientific standards to create and issue general permits for different categories of dischargers. NJDEP enforces the terms of the NJPDES permit by visiting discharging facilities and requiring facilities to conduct water quality, biological, and toxicological analyses, and thermal impact and cooling water assessments periodically.

As of February 2008, 27 NJPDES permits were issued to individual facilities in Howell Township. These are shown in *Table 14: New Jersey Pollution Discharge Elimination Permit System Permits in Howell Township*.

Since the adoption of the federal Clean Water Act and the implementation of NJPDES in subsequent years, water pollution from point sources has decreased dramatically. However, as development has continued to spread throughout New Jersey, nonpoint source pollution has increased substantially in recent decades. NJDEP's new Stormwater Management Rules, described previously, focus on reducing and controlling nonpoint sources of water pollution.

Table 14: New Jersey Pollution Discharge Elimination Permit System Permits in Howell Township

NJPDES Permit Number	Facility Name	Effective Start Date	Expiration Date	Discharge Category Description	Mailing Address
NJG0133213	Allaire State Park	6/1/2003	5/31/2008	Sanitary Subsurface Disposal (GP)	PO Box 220
NJG0142719	Anchor Concrete Products Inc	7/1/2007	9/30/2008	Concrete Products Manufacturing (GP)	103 Yellowbrook Rd
NJ0061824	Angle In Mobile Home Park	7/1/2004	6/30/2009	Discharge to Groundwater	Rt 33
NJG0089630	Angle In Mobile Home Park	6/1/2003	5/31/2008	Sanitary Subsurface Disposal (GP)	Rt 33
NJG0139521	Arnold Steele Co Inc	6/1/2007	5/31/2012	Basic Industrial Stormwater GP - NJ0088315 (5G2)	79 Randolph Rd
NJG0140481	Cabin Restaurant	6/1/2003	5/31/2008	Sanitary Subsurface Disposal (GP)	984 Rt 33
NJG0117803	Central Concrete Corp	10/1/2003	9/30/2008	Concrete Products Manufacturing (GP)	86 Yellowbrook Rd
NJG0087696	Chapter House	11/1/2004	5/31/2008	Sanitary Subsurface Disposal (GP)	Rt 9 S
NJG0143847	Compounders Inc	6/1/2007	5/31/2012	Basic Industrial Stormwater GP - NJ0088315 (5G2)	15 Marl Rd
NJG0160211	Cumberland Farms Facility # 126458	9/1/2005	5/31/2007	General Permit GW Petro Prod Cleanup	4001 Rt 9 N
NJG0131377	Disanti Concrete Products Inc	10/1/2003	9/30/2008	Concrete Products Manufacturing (GP)	165 Victory Rd

NJPDES Permit Number	Facility Name	Effective Start Date	Expiration Date	Discharge Category Description	Mailing Address
NJ0034771	Emil A Schroth Inc	5/1/2002	4/30/2007	Stormwater	Yellowbrook Rd & Copper Ave
NJG0072681	Five Points Square	6/1/2003	5/31/2008	Sanitary Subsurface Disposal (GP)	Rt 33
NJG0084271	Green Acres Manor	6/1/2003	5/31/2008	Sanitary Subsurface Disposal (GP)	1 Snyder Rd
NJG0129755	Howell Facility	5/1/2004	4/30/2009	Hot Mix Asphalt Producers (GP)	Yellowbrook Rd
NJG0153940	Howell Twp	9/1/2005	2/28/2009	Tier A Municipal Stormwater General Permit	251 Preventorium
NJG0107948	John Blewett	2/1/2005	1/31/2010	Scrap Metal Processing/Auto Recycling (GP)	246 Herbertsville Rd
NJG0140996	Nagasaki Sushi Hibachi & Steak House Rest	6/1/2003	5/31/2008	Sanitary Subsurface Disposal (GP)	6950 Us Hwy 9
NJG0127752	Nine North Plaza	6/1/2003	5/31/2008	Sanitary Subsurface Disposal (GP)	6531-6571 Rt 9
NJG0159000	NJDOT Rt 9 & CR 524 Intersection Improvements	5/25/2005	2/28/2007	Construction Activity Stormwater (GP)	949 Adelphia Farmingdale Rd
NJG0158844	NJDOT Rt 33 & Howell Rd	6/20/2005	2/28/2007	Construction Activity Stormwater (GP)	Rt 33 & Howell Rd
NJG0115533	NJ Transit/Howell Bus Garage	6/1/2007	5/31/2012	Basic Industrial Stormwater GP - NJ0088315 (5G2)	238 Rt 9 N
NJG0156108	Northeast Remsco Construction Inc	6/1/2007	5/31/2012	Basic Industrial Stormwater GP - NJ0088315 (5G2)	1120 Lakewood Farmingdale Rd
NJ0142115	Orchard Estates	3/1/2004	2/28/2009	Discharge to Groundwater	Yellowbrook Rd
NJG0160440	Rad Cure Corp	6/1/2007	5/31/2012	Basic Industrial Stormwater GP - NJ0088315 (5G2)	9 Audrey Pl
NJG0166936	Rosano Asphalt LLC	1/1/2008	4/30/2009	Hot Mix Asphalt Producers (GP)	360 Asbury Rd
NJG0162647	Rosano Trucking Inc	6/1/2007	5/31/2012	Basic Industrial Stormwater GP - NJ0088315 (5G2)	Asbury & Tinton Falls Rd

Source: NJDEP, Division of Water Quality, February 2008
*GP = General Permit; 5G2 = Basic Industrial Stormwater Permit

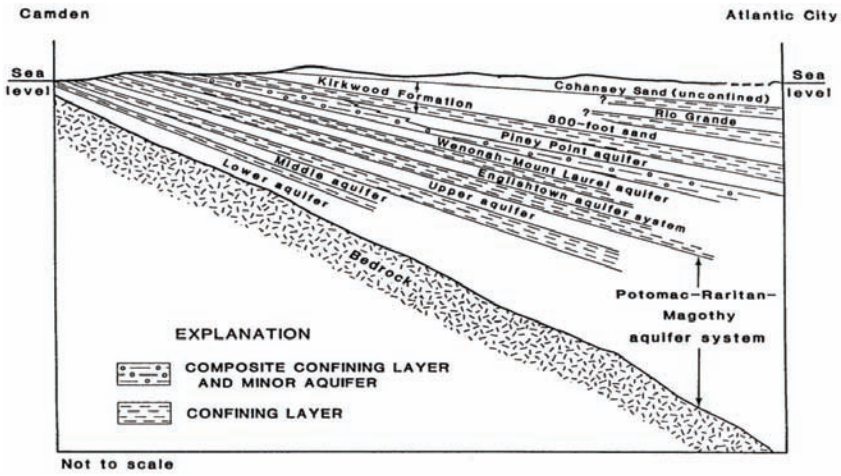
GROUNDWATER

The geology of the New Jersey Coastal Plain can be visualized as a tilted layer cake, with its "layers," or strata, formed of gravels, sands, silts, and clays. The saturated gravel and sand layers, with their large pore spaces, are the aquifers from which water is drawn. The silt and clay layers, which impede the movement of water, are called confining beds.

A cross section across southern New Jersey from west to east would show that the aquifers are not horizontal but tilt toward the southeast, getting deeper as they cross the state toward the Atlantic Ocean. Because of this tilting, each aquifer emerges on the land surface in a sequential

manner. The deepest strata emerge on the surface near the Delaware River. Where a layer emerges is its "outcrop" area. Howell Township is entirely within the vast Kirkwood-Cohansey aquifer system, the most shallow aquifer system in New Jersey.

Figure 2: Aquifers of Southern New Jersey Along a Line from Camden to Atlantic City



Source: US Geological Survey

Geological Formations

Six geological formations outcrop in Howell Township- the Kirkwood-Cohansey aquifer and five confining beds. The Vincentown Formation is the largest outcropping confining bed and is located in the northwest corner of the township. Other confining beds that outcrop in much smaller areas include the Cohansey, Hornerstown, Manasquan, and Shark River formations. See **Map 12: Geologic Outcrops** on page 64 for a visual depiction of the aquifer and confining bed outcrop areas.

Aquifers

The Kirkwood-Cohansey aquifer system outcrops in the majority of Howell Township. A composite confining unit aquifer outcrops in the northwest portion of the township. Along a section of the Manasquan River between Squankum and West Farms roads, a composite confining unit outcrops. Also known as an aquitard, a confining unit is an impenetrable layer of fine, compact clay that divides one aquifer from another. Four aquifers are used by the township, although they do not outcrop: Englishtown, Wenonah-Mount Laurel, Potomac-Raritan-Magothy, and Vincentown.

Kirkwood-Cohansey Aquifer

The Kirkwood-Cohansey aquifer is a major aquifer system underlying about 3,000 square miles of southern New Jersey on the coastal plain and is exposed extensively in Howell Township. It

is an unconfined aquifer, meaning it is located on the surface and is not confined between two impenetrable layers. This aquifer is composed of the Kirkwood Formation overlain by Cohansey sand, both dating from the Miocene age. The Kirkwood Formation contains variable types of sand, clay, and gravel. The Cohansey sand is made from coarser grained materials, predominantly light-colored quartz sand. The Manasquan Formation underlies the Kirkwood, separating it from lower aquifers by a layer between 25 feet and 100 feet thick.

Englishtown Aquifer System

The Englishtown formation, of the late Cretaceous age, outcrops in the inner coastal plain in an irregular band that extends from the Raritan Bay to the Delaware River adjacent to Salem County. Where the Englishtown formation is exposed, the primary components are fine- to medium-grained sands. In Howell Township, the Englishtown aquifer has a thickness of between 100 and 180 feet and is located between 150 and 550 feet below sea level. In Monmouth and Ocean counties, this aquifer system is a significant water source.

Wenonah-Mount Laurel Aquifer

The Mount Laurel and Wenonah formations are hydraulically interconnected as a single aquifer. The Wenonah-Mount Laurel aquifer is composed of course-grained sand that dates from the late Cretaceous age and outcrops in the inner coastal plain along the same line as the Englishtown formation. This aquifer is about 60 to 100 feet thick within Howell Township and is located between approximately 100 and 400 feet below sea level.

Potomac-Raritan-Magothy Aquifer System (PRM)

The Potomac-Raritan-Magothy (PRM) is actually a multiple aquifer composed of a large series of formations that have been combined and described as a single unit because the individual formations – the Potomac group and the Raritan and Magothy formations – are lithologically indistinguishable from one another over large areas of the coastal plain. That is, they are composed of materials of like kind and size laid down by both an advancing and retreating sea across southern New Jersey and by deposits of material that came from the breakdown and erosion of the Appalachian and Catskill mountains beginning in the Cretaceous period. In New Jersey, three aquifers have been distinguished within the PRM system, designated as low, middle, and upper, and divided by two confining units or layers between the three water-bearing strata. The aquifers themselves are largely made up of sands and gravels, locally inter-bedded with silt and clay. The lower aquifer sits on the bedrock surface. Confining beds between the aquifers are composed primarily of very fine-grained silt and clay sediments that are less permeable and thus reduce the movement of water between the aquifers. They also help to slow the entry of any contaminants on the surface down into the groundwater.

Vincentown Aquifer

The Vincentown formation functions mostly as a confining unit. However, the formation is tapped by many wells where it outcrops. The composite confining unit that outcrops in the northwest portion of Howell has Vincentown as its bedrock geology. In the Howell area, the Vincentown aquifer is moderately permeable and composed mostly of massive quartz sand from

the Paleocene age. The aquifer is thickest and most productive in Monmouth County, exceeding 140 feet in thickness, but still yields lower amounts of water than other aquifers.

Groundwater Levels

In the last decade, groundwater levels in the township's observation wells have remained relatively stable. *Table 15: USGS Field Groundwater Level Measurements* lists the recorded groundwater levels for the six observation sites in Howell Township at their first and most recent observation. As a "water level" reading increases, the groundwater level decreases, which means that the depth below the land surface at which one would find water is increasing; pumps must work harder and wells must be drilled deeper to reach sizable and usable quantities of water. Only two of the six sites in Howell recorded a decrease in the groundwater level as measured by an increase in the water level.

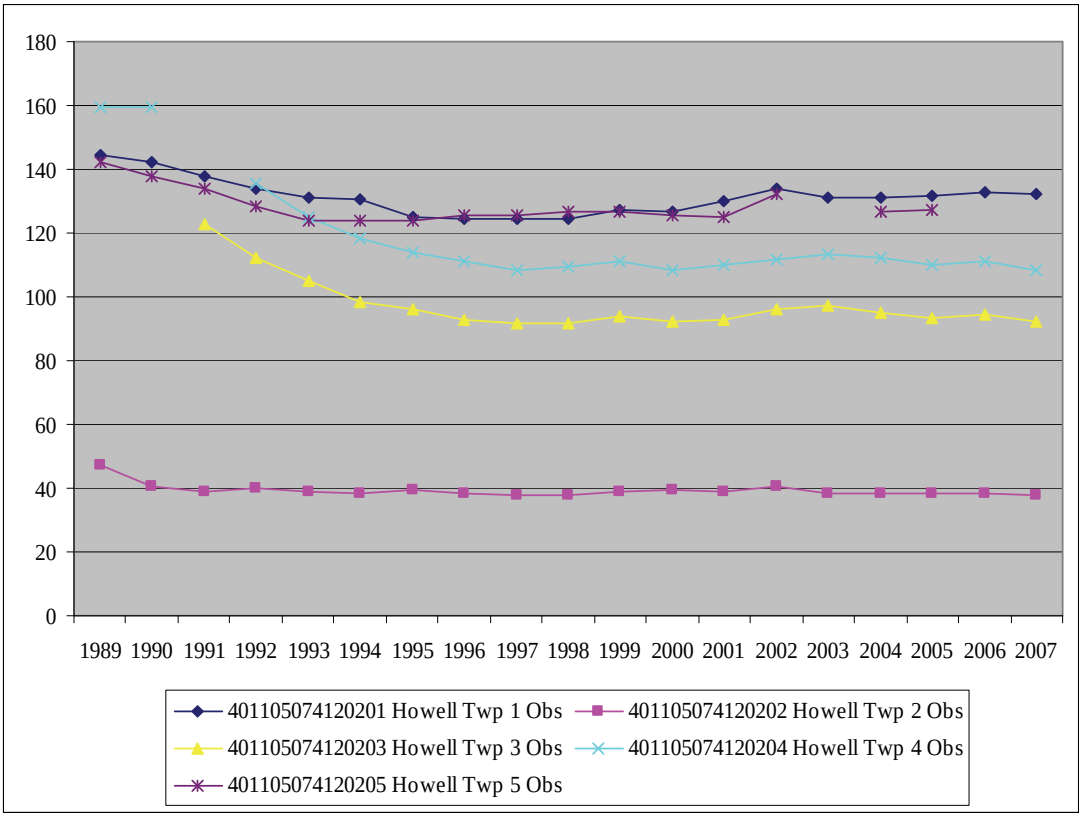
Table 15: USGS Field Groundwater Level Measurements

Station Number	Obesrvation Well	Date of First Observation	Water level (feet below land surface)	Date of Last Observation	Water level (feet below land surface)	Aquifer
400832074082101	Allaire State Park	12/26/1963	140.00	8/28/2007	146.27	Englishtown aquifer system
401105074120201	Howell Twp 1	12/7/1987	143.84	9/20/2007	140.79	Potomac-Raritan-Magothy aquifer
401105074120202	Howell Twp 2	10/19/1987	43.38	9/20/2007	40.03	Vincentown aquifer
401105074120203	Howell Twp 3	10/19/1987	137.21	9/20/2007	97.60	Wenonah-Mount Laurel aquifer
401105074120204	Howell Twp 4	10/19/1987	161.20	9/20/2007	114.18	Englishtown aquifer system
401105074120205	Howell Twp 5	3/8/1988	133.63	9/20/2007	139.07	Upper Potomac-Raritan-Magothy aquifer

Source: USGS, accessed December 2007.

The following graph, *Figure 3: USGS Annual Statistics of Groundwater Level Measurements, 1989-2007*, shows the average yearly measurement of the depth to water level for five of the six sites in Howell Township. There was insufficient annual data available for the Allaire State Park site. This graph shows that groundwater levels decreased for most of the sites in the early 1990s and have generally been level since the late 1990s.

Figure 3: USGS Annual Statistics of Groundwater Level Measurements (1989-2007)



Source: USGS, accessed December 2007

Water Supply Wells

There are 24 active public community water supply wells serving Howell Township and they are listed in *Table 16: Public Water Supply Wells Serving Howell Township* below and shown on **Map 14: Public Water Supply Wells**. Howell's public wells draw on six different aquifer systems – the Englishtown, the Kirkwood-Cohansey, the Middle PRM, the Upper PRM, the Vincentown, and the Wenonah-Mount Laurel.

Table 16: Public Water Supply Wells Serving Howell Township

Well ID	Original Owner	Aquifer	Depth of Top of Well	Depth of Bottom of Well
2905851	Adelphia Water Company	Upper Potomac-Raritan-Magothy aquifer	765	897
2906947	Adelphia Water Company	Upper Potomac-Raritan-Magothy aquifer	773	839
2916821	Adelphia Water Company	Wenonah-Mount Laurel aquifer	0	255
0000343	Angle Inn Motor Court	Vincentown aquifer	0	150
0000344	Angle Inn Motor Court	Vincentown aquifer	0	150
2906063	Green Acres Manor	Wenonah-Mount Laurel aquifer	0	255

Well ID	Original Owner	Aquifer	Depth of Top of Well	Depth of Bottom of Well
4947863	Green Acres Manor	Kirkwood-Cohansey aquifer system	0	150
2901995	NJ American Water Co	Wenonah-Mount Laurel aquifer	370	370
2903105	NJ American Water Co	Wenonah-Mount Laurel aquifer	0	440
2904381	NJ American Water Co	Potomac-Raritan-Magothy aquifer	0	396
2905346	NJ American Water Co	Englishtown aquifer system	0	550
2906276	NJ American Water Co	Vincentown aquifer	195	195
2907784	NJ American Water Co	upper Potomac-Raritan-Magothy aquifer	877	900
2910756	NJ American Water Co	Vincentown aquifer	177	230
2912324	Parkway Water Co	Kirkwood-Cohansey aquifer system	69	75
2913461	Parkway Water Co	Kirkwood-Cohansey aquifer system	73	74
2915287	Parkway Water Co	Kirkwood-Cohansey aquifer system	56	66
2915870	Parkway Water Co	Kirkwood-Cohansey aquifer system	61	65
2916728	Parkway Water Co	Englishtown aquifer system	649	649
2930899	Parkway Water Co	Kirkwood-Cohansey aquifer system	75	84
2949634	Parkway Water Co	Kirkwood-Cohansey aquifer system	75	75
2949789	Parkway Water Co	Kirkwood-Cohansey aquifer system	66	76
0000348	Winding Brook Mobile Home Park	Englishtown aquifer system	0	550
4932713	Winding Brook Mobile Home Park	Wenonah-Mount Laurel aquifer	0	410

Source: NJDEP (2005)

Public non-community wells are another part of a public water system. Non-community water systems can be classified as either transient or non-transient, which refers to the type of populations that utilize them. A non-transient water system serves at least 25 of the same people daily at a minimum of 6 months per year. These water systems serve places, such as schools, factories, and office parks. On the other hand, a transient non-community water system serves at least 25 people daily, but the population changes each day. These systems are found at such places as rest stops, gas stations, and restaurants. Howell Township has 80 public non-community wells; see *Appendix F: Public Non-Community Wells in Howell Township* for a full listing.

Groundwater Recharge

Recharge of groundwater is an important issue in southern New Jersey because of the dependence on aquifers for drinking supply and for agricultural use. The amount of rainwater that actually enters an aquifer is a function of many factors, including the nature and structure of the aquifer itself. The amount of precipitation that infiltrates the soil and reaches the saturated zone to become groundwater – the recharge of the aquifer – is also dependent on climatic conditions, the nature of the soil, and the vegetation of an area.

The New Jersey Geological Survey has developed a methodology for evaluating land areas for their ability to transmit water to the subsurface, using precipitation records, soil surveys, and land use/land cover data. NJDEP has used this methodology to map and rank land areas throughout the state as to groundwater potential. Recharge is equivalent to the amount of precipitation that will reach the water table in an area with a particular combination of soils and land use. It is expressed as inches per year.

About half of Howell Township has groundwater recharge of only 0 to one inches per year. Large areas with this low recharge rate are located immediately adjacent to Howell's numerous rivers and streams and contain wetlands. Since these areas are already wet, their low groundwater recharge rate is misleading – the water table is very close to the land surface, which creates the wetland conditions. Slightly less than half of the township has groundwater recharge of 11 to 18 inches per year, much of which is located in large areas in between streams. The areas of Howell with the highest elevations all have groundwater recharge of 11 inches or more per year, including high points in the Naval Weapons Station Earle, the northwest corner of the township, an area to the northwest of the Manasquan Reservoir, and a slight ridge running north-south through the Salem Hill/Candlewood neighborhood. A sizable area that has groundwater recharge of 11 inches or greater is located in the southeast portion of the township surrounding the Muddy Ford Brook. Another such area is located to the north, west, and south of the Manasquan Reservoir. There is a concentration of land with a groundwater recharge of only 0 to one inches per year located around the Squankum area of Howell.

Photo by DVRPC

The Moon Motel on Route 9, a local landmark, is served by public water.

See *Table 17: Groundwater Recharge in Howell Township* below and **Map 15: Groundwater Recharge**.

Table 17: Groundwater Recharge in Howell Township

Recharge Rate (inches per year)	Acres
0 to 3	21,008.22
4 to 6	257.84
7 to 9	117.61
10 to 12	2,099.85
13 to 15	7,843.22
16 and above	8,076.70
Total	39,403.44

Source: NJDEP, 2006

In general, on high recharge lands, the amount of paving and other impervious cover has the most detrimental impact, although they are also usually the places that are most suitable for building because they are areas of well-drained soils. Conversely, these are also regions where the dilution of substances from septic systems, such as nitrates, may require a larger land area because the soils are usually more "porous." For example, minimum average lot sizes of two to four acres are often needed for proper nitrate dilution from septic systems in areas having 10 or more inches per year of groundwater recharge.

Wellhead Protection Areas

As part of its 1991 Wellhead Protection Program Plan, NJDEP has delineated Wellhead Protection Areas (WHPAs) around all community wells. A WHPA is the area from which a well draws its water within a specified time frame (tiers). Pollutants spilled directly on or near the wellhead will enter the water source within that time frame. Once delineated, these areas become a priority for efforts to prevent and clean up groundwater contamination. Other components of the Wellhead Protection Plan include implementing best management practices to protect groundwater, land use planning, and education to promote public awareness of groundwater resources.

Once WHPAs are delineated, potential pollution sources may be managed by landowners or municipalities in relation to the tier locations. Protection of land and restrictions on activities within wellhead zones relating to uses that generate contaminants, and to the storage, disposal, or handling of hazardous materials, are

Delineating a Wellhead Protection Area (WHPA)

A WHPA consists of three tiers, each based on time of travel to the well:

Tier 1 = two years
Tier 2 = five years
Tier 3 = twelve years

Calculation of the tier boundaries is based in findings of how long specific contaminants can survive in groundwater, how much time would be required to undertake specific remedies, and the likelihood of natural dilution over distance. The tiers are shown as rings around a well, with the groundwater direction of travel factored in to create plume-like shapes.

important for maintaining the quality of water within those zones.

There are eight public community wells with wellhead protection areas in Howell. Seven of these are located in the Ramtown area in the southeast corner of the township, while the other is located on West Farms Road west of US Route 9. Additionally, a majority of the public non-community wellhead protection areas are located along the US Route 9 corridor. See **Map 14: Public Water Supply Wells.**

AIR QUALITY

Air quality is one of the most difficult environmental resources to measure because its sources are diffuse and regional in nature. Sources of air pollution include industry, cars, trucks, and buses, fires, and dust. Air pollutants can travel extremely far from their source. For example, the burning of coal in Ohio, Michigan, and Western Pennsylvania to generate electricity sends pollutants like sulfur, nitrogen, and particulate matter all the way to the East Coast. Locally produced sources of air pollution are caused daily by traffic and industrial complexes in New Jersey.

Increasing public awareness regarding air pollution led to the passage of a number of state and federal laws, including the original Clean Air Act of 1963 and a much stronger Clean Air Act of 1970 (CAA). In 1990, the CAA was amended and expanded by Congress to include a market approach to reducing air pollution by allowing certain companies to buy and sell emission "allowances," or "credits." The 1990 CAA required transportation projects receiving federal funding to be in conformity with state air quality goals. The 1990 act also

CRITERIA POLLUTANTS

Ground level ozone is formed when volatile organic compounds (VOC) and **nitrogen oxides** react with sunlight and heat, is produced more in the summer months, and is the primary constituent of smog. Ground level ozone is a pulmonary irritant which, even in low levels, can be dangerous to sensitive populations, such as people with asthma or emphysema, and the elderly. It can also affect plant growth and is responsible for hundreds of millions of dollars in lost crop production.

Particulate matter (PM), or particle pollution, is made up of dust, ash, smoke, and other small particles formed from the burning or crushing of materials, such as wood, rocks, or oil. When ingested, particulate matter can lodge deep in the lungs and can contribute to serious respiratory illnesses, such as asthma or lung disease. Particulate matter also creates haze, reduces visibility, and covers buildings in dirty soot.

Carbon monoxide (CO_2) is a colorless, odorless gas that is formed when carbon fuel is not burned completely. It is a component of motor vehicle exhaust; therefore higher levels of CO generally occur in areas with heavy traffic congestion. The highest levels of CO in the outside area typically occur during the colder months, when air pollution becomes trapped near the ground beneath a layer of rising warm air.

Nitrogen oxides are a group of highly reactive gases that contain nitrogen and oxygen in varying amounts. Motor vehicles, electric utilities, and homes and businesses that burn fuels emit nitrogen oxides; they can also be found naturally. Nitrogen oxides are primary components in ground-level ozone (smog), acid precipitation, and other toxic chemicals. Acid precipitation can cause lung ailments in humans, property damage, harm to aquatic life, and other environmental and human health problems.

Sulfur dioxide (SO_2) is released into the atmosphere when fuel containing sulfur, such as coal and oil, is burned, and when gasoline is refined from oil. SO dissolves in water vapor to form acid precipitation.

CRITERIA POLLUTANTS continued

Lead (Pb) is a pollutant that was historically released by cars and trucks burning leaded fuel, but metals processing plants and trash incinerators are the major source of emissions today. Lead tends to be a localized air pollutant, found in urban or high traffic areas, and is deposited in soil and water, harming fish and wildlife.

revised the way air toxins were regulated, increasing the number of regulated toxic air pollutants from seven to 187.

In 1970, the USEPA was formed to enforce the CAA. In New Jersey, the USEPA allows NJDEP to enforce the CAA because the state agency developed more stringent air standards and created a State Implementation Plan (see NJAC 7:27). The CAA identified six *criteria* pollutants – ozone, particulate matter, sulfur dioxide, nitrogen oxides, carbon monoxide, and lead – that are destructive to human health and the built and natural environment. The EPA sets National Ambient Air Quality Standards (NAAQS) for these pollutants.

Between 1970 and 2007, total emissions of the six criteria air pollutants decreased by more than 50%. The industrial sector reduced its toxic air emissions by 70% during this time period. Stricter emissions standards in the auto industry have made cars 90% "cleaner" since 1970. Cars also pollute less because refineries are required to produce cleaner fuels; leaded gasoline was completely banned in 1996.

Under the CAA, the EPA limits the amount of other air pollutants and toxins that are emitted by point sources, such as chemical plants, industrial factories, power plants, and steel mills. The NJDEP Air Quality Permitting Program issues permits for stationary sources of air pollution, such as power plants, oil refineries, dry cleaners, food processing centers, and manufacturing plants, and regulates and monitors their emissions. There are 65 active air quality permits in Howell Township.

NJDEP enacted the Emission Statement Rule in 1992 requiring certain sites that have an air quality permit to report specific air contaminants, including carbon monoxide (CO), sulfur dioxide (SO_2), ammonia (NH_3), total suspended particulate matter (TSP), respirable particulate matter (PM_{10} and $PM_{2.5}$), lead (Pb), volatile organic compounds (VOC), nitrogen oxides, and 38 other toxic air pollutants. Howell does not have any facilities that are required to submit emission statements.

NJDEP's Bureau of Air Monitoring maintains a network of 43 continuous monitoring stations across the state, most of which are clustered in the New York metropolitan area. These stations continually monitor some or all of seven parameters – carbon monoxide, nitrogen oxides, ozone, sulfur dioxide, smoke shade, particulate matter, and meteorological data. EPA and, when enabled, NJDEP have set NAAQS for the six criteria pollutants. There are two kinds of NAAQ Standards: the primary standard is based on human health effects, while the secondary standard is based on environmental and property damage.

The monitoring stations closest to Howell Township are located in Freehold and Colliers Mills and at Monmouth University. In the most recent round of testing in 2005, carbon monoxide

(CO) and smoke shade were measured at Freehold and ozone (O_3) was measured at Colliers Mills and Monmouth University.

Carbon Monoxide

There are two primary NAAQ standards for carbon monoxide: (1) a one-hour concentration of 35 ppm and (2) an eight-hour average concentration of 9 ppm. In 2005, none of the monitoring stations in New Jersey exceeded these standards. The maximum one-hour concentration of carbon monoxide in Freehold for 2005 was 5.4 ppm, the second-highest in the state after Jersey City. The highest eight-hour concentration was 2.0 ppm, one of the lowest in the state. Carbon monoxide levels in New Jersey have improved dramatically over the past 20 years and the state has not had a day that exceeded the CO health standard since 1995.

Ground-level Ozone

For ground-level ozone (O_3), there are two NAAQ standards: (1) a one-hour concentration of 0.12 ppm and (2) an eight-hour average concentration of 0.08 ppm. For the national standards, these are the same for both primary and secondary effects. New Jersey, however, has tightened the one-hour concentration standard for secondary effects to 0.08 ppm. In 2004, the one-hour maximum concentration of ozone was 0.115 ppm in Colliers Mills and 0.108 ppm in Monmouth University, both of which were within the standard (2005 data was unavailable at the time of this writing). No site in New Jersey exceeded the one-hour standard for 2004. However, both sites closest to Howell Township exceeded the eight-hour standard during 2004. For Colliers Mills, the highest eight-hour concentration of ozone was 0.103 ppm and eight days exceeded the NAAQ standard of 0.08 ppm. For Monmouth University, the highest eight-hour concentration of ozone was 0.099 ppm and two days exceeded the NAAQ standard of 0.08 ppm. The amount of ozone has decreased greatly in New Jersey since the 1980s and one-hour concentrations have not exceeded 0.200 ppm since 1988.

Air Quality Index

EPA created the Air Quality Index (AQI) to indicate a region's air quality by measuring levels of five of the six criteria pollutants (excluding lead). The AQI is focused on the potential human health hazards experienced by breathing unhealthy air. Scores for the AQI range from 0 to 500 and are divided into six color-coded categories:

Figure 4: Air Quality Index (AQI)

Numerical Air Quality Index (AQI) Rating	Descriptive Rating	AQI Color Code
0 to 50	Good	Green
51 to 100	Moderate	Yellow
101 to 150	Unhealthy for Sensitive Groups	Orange
151 to 200	Unhealthy	Red
201 to 300	Very Unhealthy	Purple
301 to 500	Hazardous	Maroon

Source: NJDEP, 2005

The daily score is based on the highest individual pollutant score reported. For example, if ozone scored 150 and particulate matter scored 100, the daily AQI would be 150 – Unhealthy for Sensitive Groups. The index is used to measure overall air quality by counting the number of days per year when the AQI of each region exceeds 100.

New Jersey is subdivided into nine regions, which report their respective AQI. Howell is located in Region 6, which covers Monmouth and Ocean counties. Monitoring sites for this region are located in Colliers Mills, Freehold, and Monmouth University. The AQI for Region 6 is based on three pollutants: carbon monoxide, particulate matter, and ozone. In 2005, Region 6 reported 312 good and 37 moderate days, as well as 15 days that were unhealthy for sensitive groups and one unhealthy day.

Other Monitoring

In addition to the continuous monitoring network, the NJDEP Bureau of Air Monitoring operates a manual monitoring network that measures a greater number of parameters. At these stations, samples are taken, which are then analyzed in a laboratory for different sizes of particulate matter, lead, total suspended particulates, atmospheric deposition, ozone precursors, and a number of toxic pollutants. These stations are concentrated in the New York metropolitan region. The closest station to Howell is located 37 kilometers away in Toms River and measures particulate matter on the neighborhood scale (representative of 1 to 10 kilometers), so it may not be representative of the air quality in Howell.

BIOLOGICAL RESOURCES

When a community protects wildlife and habitat, it is also protecting biodiversity, which is important for the health and productivity of the ecosystem and its inhabitants, including humans. Biodiversity refers to the variety of genetic material within a species population, the variety of species (plants, animals, and microorganisms) within a community, and the variety of natural communities within a given region. Biodiversity facilitates adaptation and evolution, improving a species' chance of survival as the environment changes. A diversity of plant and animal species is also necessary to maintain healthy human environments, working landscapes, and productive ecosystems. Lower organisms, many not well known, contribute to nutrient cycling, decomposition of organic matter, soil rehabilitation, pest and disease regulation, pollination, and water filtering. Once biodiversity declines, it is extremely hard for an ecosystem to recover or replace species.

Howell contains numerous types of habitats, all of which are important for maintaining biodiversity. Wooded wetlands are the most common natural ecosystem type in Howell. Upland forests occur where land is dry and undeveloped. The following sections will identify and describe in more detail the plant and animal communities that inhabit these unique ecosystems within Howell Township.

NATURAL VEGETATION

A region's vegetation is dependent on many factors, the most important of which are climate and soils. Howell's climate is cool and temperate, with rainfall averaging 46 to 47 inches per year. Howell Township has a significant amount of well-drained soils, which support a large diversity of trees and crops. To a lesser extent, the township also has a great deal of poorly-drained soils that exhibit ponding and sustain wetland plants. See the *Soils* section on pages 21-28 for a detailed description of Howell's soils.

Howell's natural vegetation types, along with human-influenced types of land cover, have been tabulated and mapped by NJDEP's 2002 land cover analysis. This data, based on infrared aerial photography, is the most recent available. The designation of a particular land cover as a vegetation type is based on definitions provided by the Anderson Land Use Classification System, created by the US Geologic Survey. See **Map 16: Natural Vegetation (NJDEP 2002)**.

Table 18: Howell Township Natural Vegetation

Type of Vegetation	Acres	% of Total Land Area
Brush/Shrubland	657.82	1.67%
Brush/Shrubland - Oldfield	261.30	0.66%
Upland Forest - Coniferous	791.95	2.01%
Upland Forest - Deciduous	4,615.20	11.71%
Upland Forest - Mixed (Coniferous Dominated)	730.59	1.85%
Upland Forest - Mixed (Deciduous Dominated)	1,094.76	2.78%
Water	971.91	2.47%
Wetlands - Cemetery	0.40	0.00%
Wetlands - Herbaceous	123.62	0.31%
Wetlands - Modified	1,716.21	4.36%
Wetlands - Scrub/Shrub	606.67	1.54%
Wetlands – Wooded - Atlantic White Cedar	4.29	0.01%
Wetlands – Wooded - Coniferous	557.44	1.41%
Wetlands – Wooded - Deciduous	7,754.70	19.68%
Wetlands – Wooded Mixed (Coniferous Dominated)	2,116.02	5.37%
Wetlands – Wooded Mixed (Deciduous Dominated)	1,250.25	3.17%
Total	**23,253.12**	**59.01%**

Source: NJDEP, DVRPC (2002 data, released 2006)

Wetlands

Wetlands are a critical ecological resource, supporting both terrestrial and aquatic animals and boasting biological productivity far greater than those found on dry land. Wetlands play a vital role in maintaining water quality by cleaning surface and ground waters. The ecological importance of wetlands, however, has not always been appreciated. For over three centuries, people drained, dredged, filled, and leveled wetlands to make room for development and agriculture. Although the pace of wetland destruction has slowed markedly in the past three decades, human activities have destroyed approximately 115 million of the original 221 million acres of wetlands in the United States since the beginning of European settlement.

Nearly all wetlands in Howell Township are found in association with major streams and their tributaries. Wetlands are dominant along the township's major waterways: the Manasquan and Metedeconk rivers, as well as streams, including the Mingamahone, Marsh Bog, Muddy Ford, Yellow, and Haystack. Wetlands provide high-quality animal and plant habitat, purify the township's surface and ground waters, and create picturesque landscapes that add immeasurably to the quality of life for township residents.

Common throughout Howell Township are deciduous wooded wetlands (sometimes referred to as forested wetlands). Deciduous wooded wetlands occupy 7,754 acres, making up more than half of all wetlands in Howell and about 20% of the township's total land area. Sweetgum and red maple are the most common trees in Howell's deciduous wooded wetlands, which also contain the American tulip, osage-orange, ironwood, white birch, and scarlet oak trees. Additionally, mixed wooded wetlands make up about 9% of all land in Howell Township.

In Howell, herbaceous wetlands occupy about 123 acres (0.3%) of the township's land area. Herbaceous wetlands generally occur along lake edges, open floodplains, and former agricultural wetland fields. Herbaceous wetlands are found in close proximity to wooded wetlands along some of Howell's major and minor streams. Herbaceous wetland plants include rice cutgrass, reed canary grass, pond lily, tearthumb, arrow-leafed tearthumb, broadleaf cattail, and the common reed (*Phragmites*).

Modified wetlands are areas that have been altered by human activities and do not support natural wetland vegetation, but which do show signs of soil saturation on aerial infrared surveys. Modified wetlands encompass agricultural wetlands, former agricultural wetlands, disturbed wetlands, and wetlands that occur in maintained greenspaces, such as open lawns, golf courses, and stormwater swales. Howell has about 1,716 acres of modified wetlands, covering about 4% of the township's land area. About 80% of Howell's modified wetlands consist of agricultural wetlands. In fact, agricultural wetlands are the second most common type of wetlands in Howell, after wooded wetlands

In Howell Township, wetlands are protected through enforcement of the buffer requirements of the New Jersey Freshwater Wetlands Protection Act. Additionally, the township's stream corridor ordinance increases wetland protection through the development process (BTMUA, 2000).

Upland Forests

Upland areas are those locations without water at or near the soil surface. About 7,233 acres (18.4% of total land) of Howell is composed of upland forests. Large swaths of upland forest are located in the Allaire State Park, Naval Weapons Station Earle, Camp Sacajawea, and in an area northeast of the Manasquan Reservoir. These and other large areas of contiguous forest are important for providing habitat for many animal species and for supporting a great diversity of plants.

Upland forests are the second most abundant natural vegetative land cover in Howell, after natural wetlands. The vast majority, 4,615 acres, of Howell's upland forests consists of deciduous trees, and another 1,095 acres are mixed deciduous dominant. Howell's deciduous upland forests are largely dominated by oak trees, such as the chestnut, scarlet, and white oak, as well as pitch pine and sassafras. Upland forests that are either coniferous or mixed coniferous dominant occupy about 1,523 acres (4% of total land) in Howell. These forests are dominated by pitch pine, and often have a scrub layer of dangleberry, highbush blueberry, lowbush blueberry, huckleberry, and greenbriar.

The 2005 Conservation Plan Element of Howell Township's Master Plan recommends seven approaches to preserve the township's forest resources. These include requiring a woodland management plan for all new development; establishing performance standards to limit forest removal; establishing performance standards to preserve large and connected habitat areas; retaining and enhancing hedgerows and forested areas along roadways and other boundaries; and reforesting open spaces resulting from cluster design development.

Grasslands and Agricultural Lands

NJDEP defines grassland habitat as brushland, shrubland or old field that were cleared or disturbed at one time and then abandoned. Following abandonment, old fields are overgrown by perennial herbs and grasses. These pioneer plants remain the dominant species for three to 20 years. Later, woody plants take over. This habitat is visible especially along wood edges, roadsides, and in landscapes where mowing is infrequent and where woody plants are not yet the dominant vegetation.

Photo by DVRPC
Agricultural lands provide important habitat for grassland species.

Roughly 919 acres (2.3%) of Howell's land cover consists of brushland, shrubland, or old field. In Howell, brushland is generally found adjacent to residential, commercial, and industrial development, while oldfield occurs more often near deciduous or wetland areas. Trees, such as sassafras, black cherry, red cedar, and white oak are common on oldfield lands. Meadow onion, broom-sedge, common dogbane, and vines of Japanese honeysuckle can also be found in grassland habitat.

In addition to brushland and oldfield, active agricultural cropland and pastureland is considered suitable "grassland" habitat for wildlife. That is, grassland species will use agricultural cropland and pastureland as well as brushland and oldfield. Agricultural cropland and pastureland account for 2,383 acres, or 6%, of land in Howell Township.

LANDSCAPE PROJECT PRIORITY HABITATS

The Landscape Project, developed by the Endangered and Nongame Species Program of the NJDEP Division of Fish and Wildlife, documents the value of various types of habitats within New Jersey. It categorizes these habitats into one of five groups according to their importance (five being the highest). Categories three through five include habitats throughout the state that possess two exceptional conditions: (1) a documented occurrence of one or more species on either the federal or the state threatened and endangered species lists, and (2) a sufficient amount of habitat type to sustain these species. These habitats are collectively known as "critical habitat." Categories one and two include habitats that either have a documented occurrence of a *species of special concern*[1] in New Jersey, or are deemed suitable for species on the state or federal threatened and endangered species lists, but for which there are no documented occurrences or sightings. These habitats are labeled "suitable habitats."

A remarkable 61% (24,046 acres) of Howell Township has been identified by the Landscape Project as critical or suitable habitat for threatened or endangered species. It is important to preserve both levels of habitat in order to maintain the diversity of species that still exists in the

[1] A Species of Special Concern is a formal definition; it indicates a species that may be under consideration for listing as threatened due to documented population decline or habitat loss.

township. The rankings in Howell are primarily the result of habitat being either critical or suitable for rare bird species, such as the bald eagle, barred owl, Cooper's hawk, and red-shouldered hawk, for endangered reptiles and amphibians, such as the bog turtle, Pine Barrens tree frog, and northern pine snake, or for mammals, such as the bobcat. See **Map 17: Landscape Project Priority Habitat (2004)** on page 101.

There are two Natural Heritage Sites either totally or partially within Howell Township. One is the Manasquan River Woods site located on the eastern side of the Manasquan Reservoir. This is an area of wet lowland woods and it contains one state imperiled species. It has a biodiversity rank of B4, which means that it is moderately significant on a global level. Another is the Shark River Station Site located to the east of the Naval Weapons Station Earle. This site is also partially in Wall Township and Tinton Falls Borough and it consists of typical pine barren upland/wetland complex. It is a known habitat for one critically imperiled plant species and other global and state rare plant species. This site has a biodiversity rank of B2, which means that it has very high significance on a global level.

Table 19: Landscape Project Habitat Rankings – Acreage in Howell Township

Category	Rank	Area (Acres)	% of Total Habitat	% of All Land
Emergent Wetlands	Critical Habitat (5)	15.53	0.06%	0.04%
	Critical Habitat (4)	127.61	0.53%	0.32%
	Critical Habitat (3)	52.68	0.22%	0.13%
	Suitable Habitat (2)	958.60	3.99%	2.43%
	Suitable Habitat (1)	594.78	2.47%	1.51%
		1,749.20	**7.27%**	**4.44%**
Forested Wetlands	Critical Habitat (5)	311.41	1.30%	0.79%
	Critical Habitat (4)	1,474.46	6.13%	3.74%
	Critical Habitat (3)	5,358.66	22.28%	13.60%
	Suitable Habitat (2)	4,130.65	17.18%	10.48%
	Suitable Habitat (1)	848.48	3.53%	2.15%
		12,123.65	**50.42%**	**30.77%**
Upland Forest	Critical Habitat (4)	2,656.94	11.05%	6.74%
	Critical Habitat (3)	4,270.45	17.76%	10.84%
	Suitable Habitat (2)	1,050.71	4.37%	2.67%
		7,978.09	**33.18%**	**20.25%**
Grasslands	Critical Habitat (4)	99.49	0.41%	0.25%
	Critical Habitat (3)	95.34	0.40%	0.24%
	Suitable Habitat (2)	1,103.18	4.59%	2.80%
	Suitable Habitat (1)	897.15	3.73%	2.28%
		2,195.15	**9.13%**	**5.57%**
Total Habitat		**24,046.10**	**100.00%**	**61.03%**
Total Howell Land		**39,403.00**		**100.00%**

Source: NJDEP, 2005

Landscape Project Data on Wetland Habitat

The Landscape Project divides wetland habitats into two types – forested and emergent wetlands. Emergent wetlands are marshy areas characterized by low-growing shrubs and herbaceous plants in standing water. About 1,749 acres (4% of total land area) in Howell are identified as priority emergent wetlands habitat, with the majority ranked at the 'suitable' level. Animal species that can be found in these wetland habitats include endangered turtles, salamanders, fish, and insects. Emergent wetlands are also important habitat for migratory waterfowl and passerines (smaller perching birds), such as migrating flycatchers and warblers. Rare and endangered species that utilize emergent wetland habitat found in Howell include the bald eagle, black skimmer, black-crowned night-heron, bog turtle, wood turtle, least tern, osprey, peregrine falcon, pied-billed grebe, Pine Barrens tree frog, Cooper's hawk, barred owl, red-headed woodpecker, and yellow-crowned night-heron.

At 12,124 acres (31% of total land area), forested wetlands cover a large amount of land in Howell, and much of this is ranked as critical habitat. Forested wetlands are located throughout the township, particularly within the Naval Weapons Station Earle, Bear Swamp, and along the stream corridors of all rivers and streams. These areas support species, such as migratory and nesting warblers, many of which are species of special concern. They can also be home to various rare amphibians. Howell's wooded wetlands are habitat for the bald eagle, Cooper's hawk, red-shouldered hawk, and bog turtle, all of which are on the New Jersey Threatened and Endangered Species list, as well as to more common species, such as the Carolina chickadee and spotted turtle.

Landscape Project Data on Upland Forest Habitat

The Landscape Project ranks 7,978 acres (20%) of Howell's total land cover as suitable or critical upland forest habitat. Over 6,927 acres (18% of total land area) are ranked as critical upland habitat. This critical upland forest is found across the entire township. A large area of critical upland forest habitat is found in the northern section of the township around the Naval Weapons Station Earle. Other large areas of critical upland forest habitat are located around the Manasquan Reservoir as well as the southern part of the township between the Ramtown and Howell settlements. Howell's upland forests provide habitat for the bald eagle, Cooper's Hawk, timber rattlesnake, northern pine snake, red-headed woodpecker, and other animal communities.

Landscape Project Data on Grassland-Dependent Species Habitat

The Landscape Project designates about 2,195 acres (6%) of the township as grassland-dependent species habitat, nearly all of which is ranked as suitable. These areas are scattered around the township, particularly along Adelphia Farmingdale Road and Five Points Road. Both of these swaths of critical habitat are between a half mile and one mile wide. Grassland-dependent species are the most threatened group of species in New Jersey, primarily because the most common form of grassland species habitat, agricultural fields, is also the most threatened habitat in the state. This is due to development pressure associated with rising land values and changes in agricultural practices on remaining agricultural lands.

Examples of rare grassland-dependent species that use Howell's grassland habitat for nesting or feeding include the bald eagle, bobolink, grasshopper sparrow, savannah sparrow, vesper sparrow, upland sandpiper, and some species of butterflies and moths.

ANIMAL COMMUNITIES

Although no comprehensive inventory of the different animal species within Monmouth County or Howell Township exists, there are records of sightings, biological studies of range, and assessments of endangered and threatened species status. The presence of a number of threatened and endangered species in Howell Township is a testament to the historic land stewardship in the township that has protected and maintained these species. Using federal, state, and other scientific sources, it is possible to identify and describe known and possible animal communities of Howell Township. Theses are included in *Appendix C: Vertebrate Animals Known or Probable in the Township of Howell.*

Invertebrates

Invertebrates are the basis of a healthy environment and are part of every food chain – either as food for amphibians and fish, or as a part of nutrient cycling systems that create and maintain fertile soils. Invertebrates consist of insects (beetles, butterflies, moths, dragonflies, ants, termites, bees, wasps, flies, and others), arachnids (spiders, ticks, and mites), crustaceans (crayfish and microscopic copepods), mollusks (mussels, clams, snails, and slugs), and worms.

Macroinvertebrates are invertebrates that are visible to the naked eye but are smaller than 50 millimeters. Benthic (bottom dwelling) macroinvertebrate communities provide a basis for ecological monitoring and are relatively simple to collect from shallow stream bottoms. These communities consist largely of the juvenile stages of many insects, such as dragonflies and mayflies, as well as mollusks, crustaceans, and worms. Monitoring for diverse assemblages of macroinvertebrates reveals the effect of pollutants over a long period of time. The Ambient Biomonitoring Network (AMNET) surveys streams for macroinvertebrate communities, which indicate certain levels of water quality, as was discussed in the **Surface Water Quality** section of this document (pages 46-55).

There are nine endangered invertebrate species (two beetle species, four butterfly species, and three mussel species) and eight threatened invertebrate species (three butterfly species and five mussel species) in the State of New Jersey. Of particular interest are freshwater mussels. At one time freshwater mussels were abundant in the streams of the area and were a major food source for native peoples. Unfortunately, due to destruction of suitable aquatic habitats by dams and pollution, the native mussel population has sharply declined. Of those species on the New Jersey Endangered and Threatened List, one, the dwarf wedgemussel, is listed as endangered under the federal Endangered Species Act.

There are 18 rare invertebrate species recorded in the New Jersey Natural Heritage Database for Monmouth County. These include the Triangle Floater, Henry's Elfin, Northeastern Beach Tiger Beetle, Golden Winged-skimmer, Sunflower Borer Moth, and Regal Fritillary. In addition, the Pine Barrens Bluet, a rare damselfly, has been documented within Howell Township.

Vertebrates

Vertebrates are less numerous than invertebrates, but their larger size makes them much more visible, and thus better studied and recorded. Fish species are fairly well documented, as are mammals. Birds that nest in the township are known, but migrants that depend on Howell's wetlands and wet forests as stopover sites in which to rest and feed are not as thoroughly inventoried.

Mammals

Mammals appear to be abundant because they tend to be larger and live in habitats also ideal for human development. There are over 500 mammal species in New Jersey, of which only nine are listed as endangered and none are listed as threatened by the state. Some common mammals found in Monmouth County include the following, most of which have a stable or increasing status in New Jersey according to the New Jersey Department of Environmental Protection:

Table 20: Mammals in Monmouth County

Common Name	Scientific Name	Status
Beaver	*Castor candensis*	Increasing
Big brown bat	*Eptesicus fuscus*	Stable
Black bear	*Ursus americanus*	Increasing
Bobcat	*Felis rufus*	Endangered
Eastern chipmunk	*Tamias striatus*	Stable
Eastern cottontail rabbit	*Sylvilagus floridanus*	Stable
Eastern coyote	*Canis latrans, var.*	Increasing
Eastern gray squirrel	*Sciurus carolinensis*	Stable
Eastern mole	*Scalopus aquaticus*	Stable
Eastern pipistrel	*Pipistrellus subflavus*	Undetermined
European hare	*Lepus capensis*	Increasing
Gray fox	*Urocyon cinereoargenteus*	Stable
Hoary bat	*Lasiurus cinereus*	Undetermined
House mouse	*Mus musculus*	Increasing
Keen myotis (bat)	*Myotis septentrionalis*	Undetermined
Least shrew	*Crytotis parva*	Undetermined
Little brown bat	*Myotis lucifugus*	Stable
Long-tailed weasel	*Mustela frenata*	Stable
Masked shrew	*Sorex cinereus*	Stable
Meadow jumping mouse	*Zapus hudsonius*	Undetermined
Meadow vole	*Microtus pennsylvanicus*	Stable
Mink	*Mustela vison*	Stable
Muskrat	*Ondatra zibethicus*	Stable
New England cottontail rabbit	*Sylvilagus transitionalis*	Undetermined
Norway rat (brown rat)	*Rattus norvegicus*	Increasing
Opossum	*Didelphis marsupialis*	Stable
Pine vole	*Microtus pinetorum*	Stable
Porcupine	*Erethizon dorsatum*	Increasing

Common Name	Scientific Name	Status
Raccoon	*Procyon lotor*	Stable
Red bat	*Lasiurus borealis*	Stable
Red fox	*Vulpes vulpes*	Stable
Red squirrel	*Tamiasciurus hudsonicus*	Stable
Red-backed vole	*Clethrionomys gapperi*	Stable
River otter	*Lutra canadensis*	Stable
Short-tailed shrew	*Blarina brevicauda*	Stable
Silver-haired bat	*Lasionycteris noctivagans*	Undetermined
Small-footed myotis (bat)	*Myotis leibii*	Undetermined
Smokey shrew	*Sorex fumeus*	Undetermined
Southern bog lemming	*Synaptomys cooperi*	Undetermined
Southern flying squirrel	*Glaucomys volans*	Undetermined
Star-nosed mole	*Condylura cristata*	Undetermined
Striped skunk	*Mephitis mephitis*	Stable
White-footed mouse	*Peromyscus leucopus*	Stable
White-tailed deer	*Odocoileus virginianus*	Decreasing
Woodchuck	*Marmota monax*	Stable

Sources: NJDEP, Herpetological Associates (2002), Monmouth County Parks System (1975), Monmouth County Environmental Council (1978)

According to the Natural Heritage Database, the only rare mammal present in Howell Township is the bobcat, which currently has an endangered status.

Management of white-tailed deer is an issue in New Jersey. While many residents prize the presence of mammalian life, deer often come into conflict with humans in suburban areas. According to the US Department of Agriculture, deer cause more damage to agricultural crops than any other vertebrate wildlife species. Farmers in densely human-populated areas appear to be the most affected. Additionally, deer can devastate the understory of forests through overgrazing, destroying the growth of seedlings and young trees. Finally, as most motorists are aware, collisions between deer and automobiles frequently result in serious damage.

Controlling deer numbers has become increasingly difficult in New Jersey, primarily because suburban landscaping provides year-round food, which supports population growth, and because the principal method of culling the population – hunting – is not feasible in suburban environments.

To minimize human-deer conflicts, the New Jersey Agricultural Experiment Station recommends both lethal and nonlethal deer management options for community-based deer management programs. For example, municipalities can extend the hunting season, issue depredation permits to private landowners, engage in sharp shooting, and employ traps and euthanasia to reduce deer numbers. Alternatively, communities and private landowners can choose to apply nonlethal, although more costly, deer management strategies, such as installing reflectors and reducing speed limits on rural roads to decrease deer-vehicle collisions, modifying habitat by planting bad tasting plants on commercial and residential properties, using taste-based and odor-based repellents, and employing traps and translocation techniques.

Birds

There are over 500 species of birds in New Jersey, which is an exceptional number given the state's small size. New Jersey is an important location for migratory birds heading south for the winter. Not only is the state an important "rest stop" for birds migrating to warmer climates in Central and South America, but the New Jersey Atlantic Coast and the Delaware Bay are also major parts of the Eastern Flyway (established migratory air route) in North America.

The following table lists the birds that have been sighted in Monmouth County, along with their status in New Jersey:

Table 21: Common Birds in Monmouth County

Common Name	Scientific Name	New Jersey Status
American Black Duck	*Anas rubripes*	Regional Priority
American Crow	*Corvus brachyrhynchos*	Stable
American Robin	*Turdus migratorius*	Stable
American Woodcock	*Philohela minor*	Regional Priority
Baltimore Oriole	*Icterus galbula*	Regional Priority
Blue Jay	*Cyanocitta cristata*	Decreasing
Blue-winged Teal	*Anas discors*	Stable
Bob-white Quail	*Colinus virginianus*	Regional Priority
Brown Thrasher	*Toxostoma rufum*	Regional Priority
Carolina Chickadee	*Parus carolinensis*	Undetermined
Common Grackle	*Quiscalus major*	Decreasing
Downy Woodpecker	*Picoides pubescens*	Stable
Eastern Towhee	*Pipilo erythrophthalmus*	Regional Priority
Eastern Wild Turkey	*Meleagris gallopavo*	Increasing
European Starling	*Sturnus vulgaris*	Increasing
Field Sparrow	*Spizella pusilla*	Regional Priority
Gray Catbird	*Dumetella carolinensis*	Regional Priority
Great Horned Owl	*Bubo virginianus*	Stable
House Finch	*Carpodacus mexicanus*	Stable
House Sparrow	*Passer domesticus*	Increasing
Mourning Dove	*Zenaida macroura*	Stable
Northern Cardinal	*Cardinalis cardinalis*	Increasing
Northern Flicker	*Colaptes auratus*	Regional Priority
Northern Mockingbird	*Mimus polyglottos*	Decreasing
Ovenbird	*Seiurus aurocapillus*	Decreasing
Pileated Woodpecker	*Dryocopus pileatus*	Decreasing
Red-Bellied Woodpecker	*Melanerpes carolinus*	Increasing
Red-tailed Hawk	*Buteo jamaicensis*	Increasing
Red-winged Blackbird	*Agelaius phoeniceus*	Stable
Ruffed Grouse	*Bonasa umbellus*	Decreasing
Scarlet Tanager	*Piranga olivacea*	Regional Priority
Tufted Titmouse	*Parus bicolor*	Increasing
Turkey Vulture	*Cathartes aura*	Increasing
Warblers		

Common Name	Scientific Name	New Jersey Status
Whip-poor-will (Whippoorwill)	*Caprimulgus vociferus*	Regional Priority
Wood Thrush	*Hylocichla mustelina*	Regional Priority

Source: NJDEP, Herpetological Associates (2002), Monmouth County Parks System (1975), Monmouth County Environmental Council (1978)

Foraging areas and nests of the Bald Eagle, an endangered species in the state with a federal status as threatened, are present in Howell Township. The following table lists all bird species with an endangered, threatened, or special concern status that have been sighted in Monmouth County:

Table 22: Rare Birds in Monmouth County

Common Name	Scientific Name	New Jersey Status
American Kestrel	*Falco sparverius*	Special Concern
Bald Eagle	*Haliaeetus leucocephalus*	Endangered
Barred Owl	*Strix varia*	Threatened/Threatened*
Black Skimmer	*Rynchops niger*	Endangered
Black-Crowned Night-Heron	*Nycticorax nycticorax*	Threatened/Stable*
Black-Throated Green Warbler	*Dendroica caerulescens*	Special Concern
Bobolink	*Dolichonyx oryzivorus*	Threatened/Threatened*
Cooper's Hawk	*Accipiter Cooperii*	Threatened/Threatened*
Grasshopper Sparrow	*Ammodramus savannarum*	Threatened/Stable*
Least Bittern	*Ixobrychus exilis*	Declining/Stable*
Least Flycatcher	*Empidonax minimus*	Special Concern
Least Tern	*Sterna antillarum*	Endangered
Northern Parula	*Parula americana*	Special Concern
Osprey	*Pandion haliaetus*	Threatened/Threatened*
Peregrine Falcon	*Falco peregrinus*	Endangered
Pied-Billed Grebe	*Podilymbus podiceps*	Endangered/Stable*
Piping Plover	*Charadrius melodus*	Endangered
Red-Headed Woodpecker	*Melanerpes erythrocephalus*	Threatened
Red-Shouldered Hawk	*Buteo lineatus*	Endangered
Rough-Legged Hawk	*Buteo lagopus*	Decreasing
Savannah Sparrow	*Passerculus sandwichensis*	Threatened/Threatened*
Sharp-Shinned Hawk	*Accipiter striatus*	Special Concern
Upland Sandpiper	*Bartramia longicauda*	Endangered
Vesper Sparrow	*Pooecetes gramineus*	Endangered
Yellow-Crowned Night-Heron	*Nyctanassa violaceus*	Threatened/Threatened*

**Denotes status for Breeding/Nonbreeding populations.*
Source: NJDEP, Herpetological Associates (2002), Monmouth County Parks System (1975), Monmouth County Environmental Council (1978)

According to the Landscape Project, Howell contains suitable habitat for a variety of predatory birds including hawks, falcons, and eagles. Due to the highly transitory nature of birds, compiling a complete list of bird species that may be found throughout the year is very difficult.

Another common bird is the Canada goose. The State of New Jersey has a "resident" Canada goose population of approximately 100,000 birds that no longer migrate to more southern locales, and that number may double in the next five to 10 years. While geese are a valuable component of the urban/suburban environment, providing enjoyable wildlife opportunities for the public, they can also cause property and environmental damage. Goose droppings that wash into lakes during storm events can elevate coliform bacteria to unhealthy levels, closing lakes to swimming. Goose droppings limit human use of grassy areas in parks, and because geese can be quite aggressive during the nesting season, they can also injure humans.

However, removing geese or preventing them from residing in park areas is a difficult task. Because geese move freely, the most effective management solutions are best conducted at the community level. Canada geese are protected by the Migratory Bird Treaty Act. Therefore, a management program may require the US Department of Agriculture's approval and permits. A new federal rule signed into law in December 2005 eases hunting restrictions and allows county and municipal officials to coordinate with state fish and wildlife departments to destroy birds and/or eggs that pose a threat to public health and safety. Management techniques include planting shrubby vegetation around streams, lakes, and ponds to block waterfowl access, discouraging humans from feeding geese, and removing geese eggs and replacing with decoys.

Reptiles and Amphibians

Reptiles can be quite elusive when surveys attempt to document them. The following is a list of common reptiles and amphibians that have been sighted in Monmouth County:

Table 23: Reptiles and Amphibians in Monmouth County

Common Name	Scientific Name	Status
American Toad	*Bufo americanus*	Stable
Black Rat Snake	*Elaphe o. obsoleta*	Undetermined
Bullfrog	*Rana catesbeiana*	Stable
Common Snapping Turtle	*Chelydra s. serpentina*	Stable
Eastern Garter Snake	*Thamnophis s. sirtalis*	Stable
Eastern Hognose Snake	*Heterodon platyrhinos*	Decreasing
Eastern King Snake	*Lampropeltis g. getulus*	Undetermined
Eastern Milk Snake	*Lampropeltis t. triangulum*	Stable
Eastern Mud Turtle	*Kinosternon s. subrubrum*	Undetermined
Eastern Painted Turtle	*Chrysemys p. picta*	Stable
Eastern Red-backed Salamander	*Plethodon c. cinereus*	Stable
Eastern Ribbon Snake	*Thamnophis s. sauritus*	Stable
Eastern Smooth Earth Snake	*Virginia v. valeriae*	Undetermined
Eastern Smooth Green Snake	*Opheodrys v. vernalis*	Undetermined
Eastern Spadefoot Toad	*Scaphiopus h. holbrookii*	Decreasing
Eastern Spiny Softshell	*Trionyx spiniferus*	Increasing
Eastern Worm Snake	*Carphophis a. amoenus*	Undetermined

Common Name	Scientific Name	Status
Five-lined Skink	*Eumeces fasciatus*	Undetermined
Four-toed Salamander	*Hemidactylium scutatum*	Decreasing
Green Frog	*Rana clamitans melanota*	Stable
Musk Turtle (Stinkpot)	*Sternotherus odoratus*	Stable
New Jersey Chorus Frog	*Pseudacris triseriata kalmi*	Stable
Northern Black Racer	*Coluber c. constrictor*	Undetermined
Northern Brown Snake	*Storeria d. dekayi*	Stable
Northern Copperhead	*Agkistrodon contortrix mokasen*	Undetermined
Northern Cricket Frog	*Acris c. crepitans*	Undetermined
Northern Diamondback Terrapin	*Malaclemys t. terrapin*	Decreasing
Northern Dusky Salamander	*Desmognathus f. fuscus*	Stable
Northern Fence Lizard (Fence Swift)	*Sceloporus undulatus hyacinthinus*	Stable
Northern Gray Treefrog	*Hyla versicolor*	Stable
Northern Leopard Frog	*Rana pipiens*	Undetermined
Northern Red Salamander	*Pseudotriton r. ruber*	Decreasing
Northern Red-bellied Snake	*Storeria o. occipitomaculata*	Stable
Northern Ringneck Snake	*Diadophis punctatus edwardsi*	Stable
Northern Scarlet Snake	*Cemophora coccinea copei*	Undetermined
Northern Spring Peeper	*Hyla c. crucifer*	Stable
Northern Two-lined Salamander	*Eurycea b. bislineata*	Stable
Northern Water Snake	*Nerodia s. sipedon*	Stable
Pickerel Frog	*Rana palustris*	Stable
Queen Snake	*Regina septemvittata*	Undetermined
Red-bellied Turtle	*Pseudemys rubriventris*	Undetermined
Red-eared Turtle	*Pseudemys scripta elegans*	Increasing
Rough Green Snake (Keeled Green Snake)	*Opheodrys aestivus*	Stable
Silvery Salamander	*Ambystoma platineum*	Decreasing
Slimy Salamander	*Plethodon g. glutinosus*	Stable
Southern Leopard Frog	*Rana spenocephala*	Stable
Southern Ringneck Snake	*Diadophis p. punctatus*	Stable
Spotted Salamander	*Ambystoma maculatum*	Decreasing
Upland Chorus Frog	*Pseudacris triseriata feriarum*	Undetermined
Wood Frog	*Rana sylvatica*	Stable

Source: NJDEP, Herpetological Associates (2002), Monmouth County Parks System (1975), Monmouth County Environmental Council (1978)

The presence of the Bog Turtle, an endangered species in New Jersey with a federal status as threatened, has been confirmed in Howell Township. Other species are rare because they depend on vernal ponds, as discussed in the *Surface Waters Resources* section of this document (page 29). The following table lists the rare reptile and amphibian species present in Monmouth County:

Table 24: Rare Reptiles and Amphibians in Monmouth County

Common Name	Scientific Name	Status
Bog Turtle	*Clemmys muhlenbergi*	Endangered
Carpenter Frog	*Rana virgatipes*	Special Concern
Corn Snake	*Elaphe g. guttata*	Endangered
Eastern Box Turtle	*Terrapene c. carolina*	Special Concern
Fowler's Toad	*Bufo woodhousii fowleri*	Special Concern
Jefferson Salamander	*Ambystoma jeffersonianum*	Special Concern
Marbled Salamander	*Ambystoma opacum*	Special Concern
Northern Pine Snake	*Pituophis m. melanoleucus*	Threatened
Northern Spring Salamander	*Gyrinophilus p. porphyriticus*	Special Concern
Pine Barrens Treefrog	*Hyla andersonii*	Threatened
Spotted Turtle	*Clemmys guttata*	Special Concern
Timber Rattlesnake	*Crotalus h. horridus*	Endangered
Wood Turtle	*Clemmys insculpta*	Threatened

Source: NJDEP, Herpetological Associates (2002), Monmouth County Parks System (1975), Monmouth County Environmental Council (1978)

Fishes

Due to the unintended consequences of urban development, industrial advancement, overfishing, and mechanized agriculture, the amount and diversity of aquatic life has decreased dramatically throughout most of New Jersey.

The New Jersey Division of Fish and Wildlife, under the Bureau of Freshwater Fisheries, monitors and actively aids the propagation, protection, and management of the state's freshwater fisheries. The bureau raises several million fish for stocking in suitable waterbodies, and conducts research and management surveys.

Rudolf G. Arndt, a professor at the Richard Stockton College of New Jersey, created the "Annotated Checklist and Distribution of New Jersey Freshwater Fishes, With Comments and Abundance" (see Sources of Information) by drawing together all the fish inventories for New Jersey, along with his own collection data. Additionally, ESP Associates performed a fish survey in 1993 on selected streams in Howell Township. There are a total of 35 fish species documented in the waterways of Howell. A record of those fish species is included in *Appendix C: Vertebrate Animals Known or Probable in Howell Township.*

Endangered Vertebrates

According to the Natural Heritage Database and the Landscape Project, a significant amount of rare wildlife has been sighted in Howell Township over the course of the past 100 years. The Natural Heritage Database and the Landscape Project cite 17 rare vertebrates found in Howell Township. Brief descriptions, provided by the New Jersey Fish and Wildlife Service, of some of those species listed on the Natural Heritage Database for Howell Township follow. Additionally, there are other rare species sighted by township residents that have not yet been verified by the Endangered and Nongame Species Program; they are, therefore, not included in this list.

N.J. Department of Environmental Protection Freshwater Fish Advisories

Fishing provides enjoyable and relaxing recreation and many people like to eat the fish they catch. Fish are an excellent source of protein, minerals and vitamins, are low in fat and cholesterol, and play an important role in maintaining a healthy, well-balanced diet.

However, certain fish may contain toxic chemicals, such as polychlorinated biphenyls (PCBs), dioxins, or mercury, which accumulate in water and aquatic life. Chemical contaminants, such as dioxin and PCBs are classified by the US Environmental Protection Agency as probably cancer-causing substances in humans. Elevated levels of mercury can pose health risks to the human nervous system. Infants, children, pregnant women, nursing mothers, and women of childbearing age are considered to be at higher risk from contaminants in fish than other members of the general public. Since 1982, NJDEP catches fish at numerous sampling stations throughout the state and tests for contaminant levels, adopting advisories to guide residents on safe consumption practices.

NJDEP issued a fish advisory for the following species of fish in Monmouth County: largemouth bass, black crappie, chain pickerel, and yellow perch. Recreational fishermen and women should regularly check for local fish advisories on NJDEP's Division of Science, Research and Technology web site: http://www.nj.gov/dep/dsr/njmainfish.htm

The **Bald Eagle** (*Haliaeetus leucocephalus*) is an endangered species in New Jersey. Their seven to eight foot wingspan, full white heads, and dark brown plumage make the adult bald eagle easily identifiable. Their habitat consists of areas of forest near the Delaware River and its tributaries. Bald eagles choose the largest and tallest trees in a forest to set up their nests. They also prefer these trees to be in close proximity to water. This allows the bald eagle to forage for fish from their nest. The bald eagle population was depleted in New Jersey through habitat destruction, shootings, intentional poisons, and especially the application of DDT, a pesticide that was widely used in post-World War II New Jersey to control the mosquito population. This chemical accumulated in the bodies of the bald eagle, which caused the eggshells of fledgling bald eagles to crack easily during the incubation period. By 1970, only one bald eagle nest remained in the state. As a direct result, the bald eagle was listed as endangered under New Jersey's Endangered Species Act in 1974. New Jersey's bald eagle population has improved since the federal government placed a ban on DDT in 1972. In 2006, the New Jersey Endangered and Nongame Species Program recorded 55 bald eagle nests as active in the state. Bald eagle nest buffers have been designated in many different habitats in Howell Township, including a nesting area at the Manasquan Reservoir, where a number of eaglets have been identified as of March 2008.

The **Barred Owl** (*Strix varia*) is a threatened species in New Jersey. It is a large, fluffy-looking owl with brown barring on the upper breast and brown streaking on the lower breast and belly. Its eyes are a distinctive dark brown color. Traditionally, the barred owl was known as the "swamp owl." This name originated from the barred owl's choice habitat in old-growth wetland forests. The owl needs old-growth mature wet woods that contain large trees with cavities for nesting. In southern New Jersey, the barred owl inhabits both deciduous wetland forests and

Atlantic white cedar swamps associated with stream corridors. Mixed hardwood swamps dominated by red maple and black gum are also suitable habitats. The destruction of these old-growth wetland forests during the post-World War II building boom is thought to be the main reason for the decline of the barred owl. Hunting has also played a part in the barred owl's precarious situation. In 1979, the barred owl was listed as a threatened species in New Jersey. Currently, the barred owl population is declining further as forested lands become developed. However, the barred owl has been documented present in Howell Township in forested wetlands and upland forest.

The **Cooper's Hawk** (*Accipiter cooperii*) is a threatened species in New Jersey. This raptor resides in both wetland and upland forests and is present year-round in the state. The adult has a dark cap and flies with its head extended, exhibiting a cross-shaped silhouette. It has a rounded tail with a white edge and short, rounded wings. The Cooper's hawk lives in old-growth forests with closed canopies and moderate to heavy shrub cover. It prefers nesting in dense woods, such as cedar forests and conifer groves. The population of the Cooper's hawk began to decline in the 1950s as development encroached upon its habitat. Like the bald eagle, the Cooper's hawk was affected by the application of the pesticide DDT during the 1950s to 1970s. It was placed on the endangered species list for New Jersey in 1974, although it does not have federal endangered species status. Also like the bald eagle, the population of the Cooper's hawk has rebounded greatly after the federal ban on DDT, and its status in New Jersey changed from "endangered" to "threatened" in 1999. However, the loss of large, contiguous forest land in the state continues to be a threat to the species.

The **Bog Turtle** (*Clemmys muhlenbergii*) is an endangered species in New Jersey, and a threatened species in the United States. Adult bog turtles are very small and grow to only about 3.0 to 3.9 inches long. The shell, head, and limbs are dark brown or black, and there are distinctive orange patches on both sides of the head. Bog turtles inhabit calcareous (limestone) fens, sphagnum bogs, and wet, grassy pastures that are characterized by soft, muddy bottoms and perennial groundwater. Bog turtle habitats are well-drained and the water depth rarely exceeds four inches above the surface. Due to population declines, restricted habitat preference, habitat loss, and collecting, the bog turtle was placed on the endangered species in New Jersey in 1974. In 1997, the US Fish and Wildlife Service placed the bog turtle on the federal list of threatened species. Current conservation efforts include habitat management, population monitoring, land acquisition, and landowner outreach. Since most bog turtle populations occur on private lands, biologists devote substantial amounts of time educating private landowners about bog turtle conservation. Private landowners can benefit from having bog turtles on their land through various federal cost-sharing programs, which provide funding for habitat management and improvement. Biologists from the New Jersey Endangered and Nongame Species Program (ENSP) are presently implementing a watershed-based management strategy for the protection of critical bog turtle areas.

The **Pine Barrens Tree Frog** (*Hyla andersonii*) is a threatened species in New Jersey, where, as its name suggests, it is only found in the Pine Barrens. Other populations of this species, however, can be found in portions of Florida, Alabama, North Carolina, and South Carolina. The coloring of the Pine Barrens tree frog is dark emerald green, with a yellow-white stripe on both sides. Below the white is a lavender or plum color that extends to the belly, and the

underside of the hind legs is yellow or orange. The Pine Barrens tree frog has "suction cups" on its fingers and toes that allow it to climb trees with great agility. Its call is a rapid and frequent nasal honking sound. The Pine Barrens tree frog prefers a specialized acidic environment, such as Atlantic white cedar swamps and pitch pine lowlands that have dense mats of sphagnum moss. They can be found in a variety of habitat types in the state typified by temporary, early successional pond-like habitats dominated by shrub and herbaceous vegetation. They are generally not found in habitats with fish populations, such as permanent streams or ponds. Because the Pine Barrens tree frog breeds late in the season and prefers temporary wet areas, it may be more susceptible to drought conditions. Its habitat is largely protected by the New Jersey Pinelands Comprehensive Management Plan.

The **Northern Pine Snake** (*Pituophis melanoleucus melanoleucus*) is a threatened species in New Jersey. It can grow to upwards of seven feet long and its skin has a black and tan-white pattern. Its belly is white with a row of black dots on either side. The Northern pine snake is found in many other areas in the eastern United States and prefers dry, upland forest habitats, often coniferous. Specifically, it prefers dry pine-oak forest types growing on very infertile sandy soils, such as Lakehurst or Lakewood sands. The Northern pine snake prefers nesting in open sandy areas with little ground cover. It tunnels underground to excavate its nests and is the only snake species known to dig summer dens and hibernacula, or places to hibernate. Because this snake is secretive and fossorial, meaning it burrows underground, it often goes undetected, making monitoring difficult. Some of the threats the Northern pine snake faces include illegal collection for the pet trade and killing by hikers, cars, and off-road vehicles in addition to habitat destruction resulting from development.

The **Bobcat** (*Felis refus*) is an endangered species in New Jersey. The bobcat has tawny to grayish-brown fur with spots and streaks and a whitish-colored underside that is also spotted and streaked. The fur around it lips, chin, and the underside of the neck is also light-colored. Bobcats have ruffs of fur on both sides of their face and small tufts on the ears. The top of their tail, which is normally 5 to 7 inches long, is tipped black. The hind legs of the bobcat are longer than the front, accentuating the tail. In the Northeast, bobcats inhabit forests and areas of mixed forest and agriculture, as well as rural areas near cities and small towns. In general, bobcats use rough, broken habitat that has a mix of early and late successional stages. Bobcats prefer habitats that provide dense cover in the form of understory vines, briars, shrubs, and saplings, which can provide areas for resting and protection from both weather and predators. Bobcats are extremely versatile creatures that have the ability to adapt to a wide variety of habitat types and prey species. In New Jersey, the bobcat population experienced severe declines near the turn of the nineteenth century, as most forests were cleared for lumber, fuel, charcoal, and agricultural use. As the remaining habitat became highly fragmented, bobcat numbers plummeted so greatly that by the early 1970s it was thought that the species no longer existed in the state. The bobcat gained full legal protection under New Jersey regulations in 1972, when it was classified as a game species with a closed season. In 1977, the New Jersey Division of Fish, Game, and Wildlife initiated a project to restore the species to suitable habitat within the state by releasing 24 bobcats in northern New Jersey that had been captured in Maine. In the years that followed, reports of bobcat sightings increased, suggesting that the project was successful. In 1991 the bobcat was listed as endangered under New Jersey's Endangered and Nongame Species

Conservation Act. There have been a number of bobcat sightings in Howell Township, including a road kill sighting near the Wyckoff Mills neighborhood.

See *Appendix C* for a list of *Vertebrate Animals Known or Probable in Howell Township*. See *Appendix D* for a list of *Rare Plant and Animal Species and Natural Communities Presently Recorded in the NJ Natural Heritage Database for Howell Township*. See *Appendix E* for a list of *State Endangered and Threatened Species*.

Photo by Monmouth County Parks System

Young eaglets at the Manasquan Reservoir

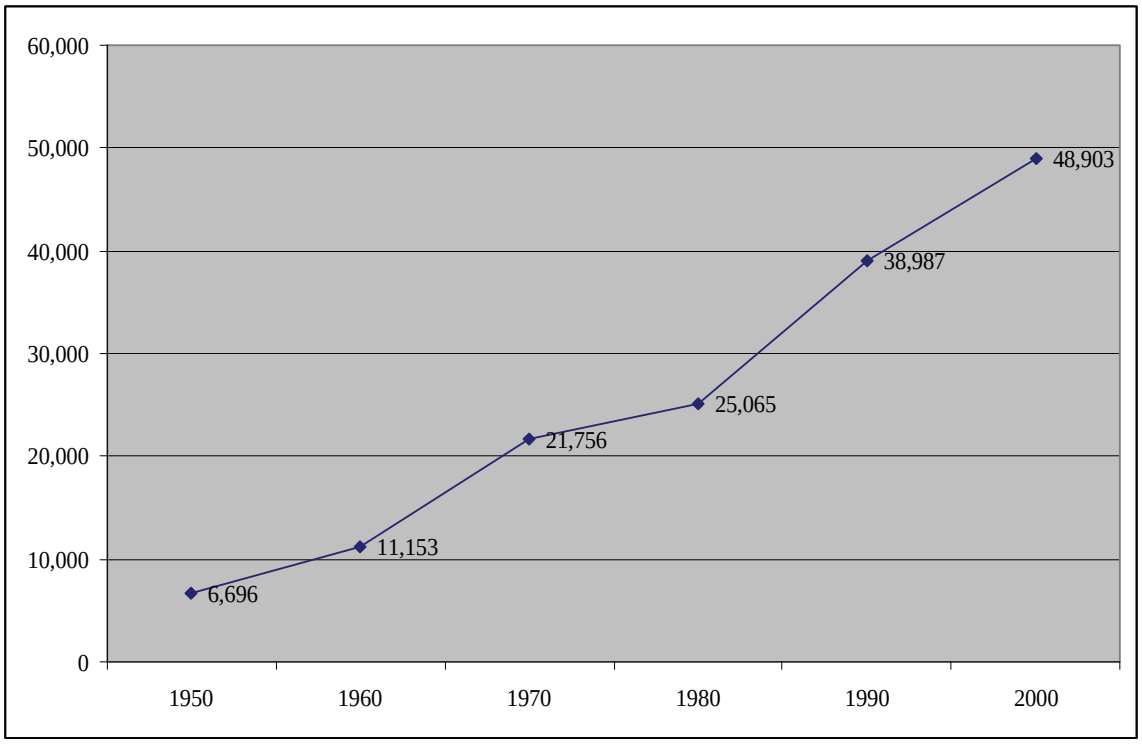
THE BUILT ENVIRONMENT

POPULATION

The population of Howell Township has grown exponentially over the past 50 years. Between 1950 and 2000, the population of the township grew by an astonishing 630%, from 6,696 to 48,903. The population increased by nearly 10,000 people during the 1990s alone, from 38,987 in 1990 to 48,903 in 2000. The US Census estimates that Howell's population reached 50,512 in 2005, an increase of 2.8% between 2000 and 2005.

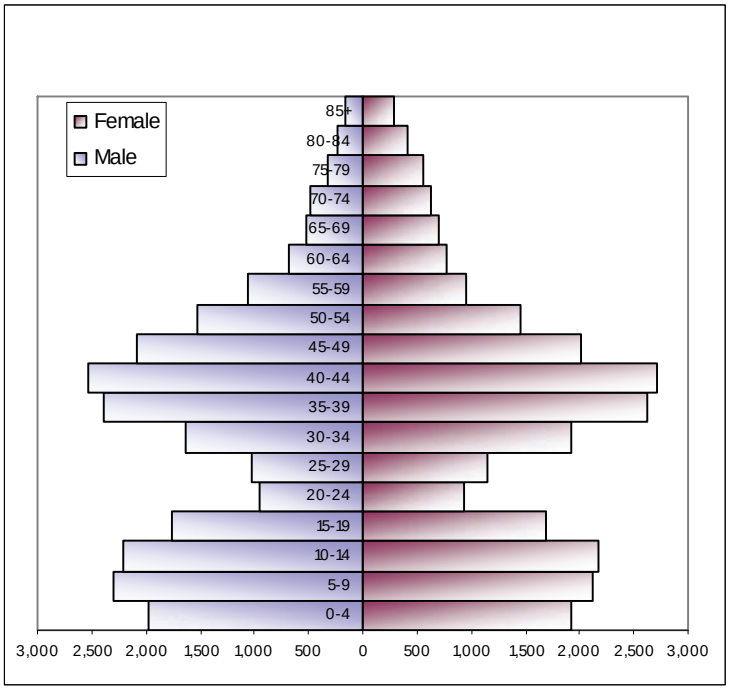
For the year 2000, the median age in Howell Township was 35.7 years. About 31% of the population was under 18 years, implying a great demand on Howell's school facilities. About 9% of Howell Township was over 65 years of age in 2000.

Figure 5: Population of Howell Township (1950-2000)



Source: US Census Bureau

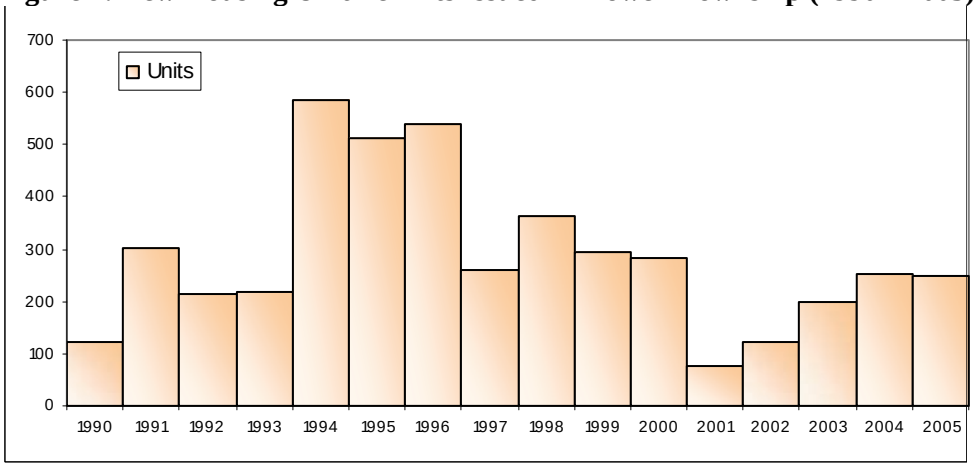
Figure 6: Population of Howell Township by Age and Sex (2000)



Source: US Census Bureau

According to the US Census, the number of housing units in Howell Township increased from 13,563 in 1990 to 16,572 in 2000, representing a 22% increase in Howell's housing stock. Between 2000 and 2005, 1,187 permits were granted, representing a 7% increase if all permitted housing permits were to be built. This increase is comparative to Monmouth County, which would have a 6% increase in housing if all permitted housing units issued permits were constructed. According to the 2000 US Census, 509 (3%) of Howell's 16,572 units were vacant, lower than the average vacancy rate of Monmouth County, which was 7%.

Figure 7: New Housing Unit Permits Issued in Howell Township (1990 – 2005)



Sources: DVRPC, Regional Data Bulletins #65, June 2000 and *#83, May 2006*

TRANSPORTATION

A number of major roads cross through Howell Township, including US Interstate 195 and State Routes 9, 33 and 34. The Garden State Parkway is located less than two miles from Howell in adjacent Wall Township, easily accessible by 195 and Route 33. Howell Township is conveniently located equidistant from Philadelphia and New York; the trip to either city is about 60 miles.

Photo by DVRPC

This bridge over the Manasquan River is a remnant of Howell Township's history as a rural community.

In 2004, the Monmouth County Planning Board completed the Western Monmouth Development Plan, which focused mainly on US Route 9, the primary north-south arterial linking seven municipalities in the county. This plan advocates such smart growth initiatives and goals as improving or creating mixed use centers, preserving natural resources, and improving conditions for all transportation modes. For US Route 9 in particular, this plan recommends design improvements to reduce traffic congestion and to enhance the aesthetic character of the corridor (Howell Township, *2005 Periodic Reexamination Report*).

The tri-county area of Monmouth, Ocean, and Middlesex counties has experienced a great deal of traffic congestion in recent years, as intense suburban development and population growth have put a strain on the existing transportation infrastructure. A proposed solution to this problem is the Monmouth-Ocean-Middlesex (MOM) commuter rail line, which would be operated by NJ Transit. Of the three proposed routes for the MOM line, all would pass directly through Howell Township, although only one would result in the construction of a station stop in the township. Although this project is still in the evaluation stages, if completed, it could have a significant impact on transportation, population, and land use in the township (New Jersey Transit, 2002).

The high rate of car usage in Howell Township is reflected in the fact that 90% of the township's employed population commutes to work by car, as reported by the 2000 US Census (82% drive alone, while 8% carpool). The average travel time to work for Howell residents is 38.7 minutes, higher than Monmouth County's average commute time of 34.8 minutes, and significantly higher than New Jersey's average commute time of 30 minutes. About 47% of workers in Howell Township commute outside of Monmouth County for employment.

HISTORIC RESOURCES

Protection and preservation of historic structures, lands, and views are of high importance to Howell Township residents. Although it does not have any properties or districts included on

Photo by DVRPC

The Jerseyville Church is a historic property in Howell Township that is eligible for the national register but has not been formally nominated.

either the New Jersey Register of Historic Places or the National Register of Historic Places, Howell Township has 13 recognized historic sites. Of these 13, five were issued State Historic Preservation Office (SHPO) Opinions, which review a site's eligibility for inclusion on the State Register of Historic Places.[2] It also has seven sites that were issued a Determination of Eligibility (DOE), which is a formal certification that a property is eligible for registration on the National Register. In addition, the township has one site that was issued a Certificate of Eligibility (COE), a designation that satisfies a prerequisite to apply for funds from the New Jersey Historic Trust, as well as several county preservation funding programs.

Other sites may have the potential to be listed as local, state, or national landmarks, but have not been nominated by local citizens or identified by SHPO for such a designation. See *Table 25: Sites listed on the National and State Registers of Historic Places* for sites currently listed on the national and state registers.

The Howell Historical Society is a volunteer-run organization that serves the township and collects and holds information on the community's historic resources, as well as genealogies and biographies. The historical society offers activities and tours to two historic sites in Howell: the Old Ardena Schoolhouse and the MacKenzie Museum.

New Jersey municipalities are permitted to identify, designate, and regulate their own historic resources through the adoption of historic preservation ordinances (which are recognized as zoning laws under the New Jersey Municipal Land Use Law). The township does not have an established historic district or historic preservation commission.

[2] Filing an Environmental Impact Statement (EIS) usually prompts the issuance of a SHPO Opinion. The use of federal funding for a project often triggers the requirement to perform an EIS, which may result in NJDEP recognizing possible threats to certain historic sites and identifying those sites as eligible for listing in the State Register of Historic Places.

Table 25: Sites Listed on the National and State Registers of Historic Places

Name	Location	Register	State ID#
Dowd Site	Archeological Site	DOE: 4/12/1979	3345
W. Dwinnell House	2096 US Route 9	SHPO Opinion: 6/7/1979	1989
Floodplain Site East of Marsh Bog Brook	Archeological Site	DOE: 4/12/1979	3346
Floodplain Site West of Marsh Bog Brook	Archeological Site	DOE: 4/12/1979	3347
Jackson Forge Complex Site	Archeological Site	DOE: 4/12/1979	3348
Jerseyville Methodist Episcopal Church	Howell Road, near NJ Route 33	COE: 5/6/1992	1992
Kandy Bar Ranch Site	Archeological Site	DOE: 4/12/1979	3349
Naval Weapons Station Earle Historic District	Roughly bounded by NJ Route 33, Garden State Parkway, and NJ Route 18	SHPO Opinion: 1/29/2001	4096
J.T. Reynolds House	US Route 9 and Kent Road	SHPO Opinion: 6/7/1979	1995
J.W. Reynolds House and Outbuildings	US Route 9 and Locust Avenue	SHPO Opinion: 6/7/1979	1996
Southard Grange	US Route 9	SHPO Opinion: 6/7/1979	1997
Squankum Mill Site	Archeological Site	DOE: 4/12/1979	3350
Squankum Mill Site	Archeological Site	DOE: 4/12/1979	3510

Source: NJDEP Historic Preservation Office, 2007

Photo by DVRPC

The MacKenzie Museum is home to the Howell Township Historical Society.

The National Park Service and the New Jersey SHPO jointly administer the Certified Local Governments (CLG) program, which provides technical assistance and funding for community-based preservation efforts. As of May 2007, only two municipalities in Monmouth County – Freehold Township and Middletown Township – are CLGs. To participate, municipalities must maintain a historic preservation commission, survey local historic properties, provide opportunities for public participation in preservation activities, and develop and enforce local preservation laws. If Howell Township were to become a CLG, it would be eligible to draw on an exclusive pool of matching federal and state funds for program implementation or rehabilitation work.

There are also federal incentives for individuals, organizations, or firms who own historic properties and are interested in historic preservation. Interested parties can take advantage of the Rehabilitation Investment Tax Credit, a federal tax incentive to encourage the preservation and

reuse of older income-producing properties, including offices, apartment buildings, and retail stores.

Investing in historic preservation efforts can provide a municipality with important and impressive returns. Private and public efforts to preserve and rehabilitate historic districts create attractive places to live, work, and play and stimulate new investment in older residential and commercial centers. An historic district, like that in nearby Middletown, can become a regional draw for tourists and boutique customers. Furthermore, historic preservation maintains a municipality's character, distinctly separating it from other rural and suburban communities for both new and established residents.

TOWNSHIP UTILITIES AND SERVICES

Drinking Water

Although the majority of Howell Township is serviced by private drinking water wells, New Jersey American Water (NJAW) supplies public drinking water to many residences. NJAW is a wholly owned subsidiary of American Water, a national company composed of locally managed utility subsidiaries that are regulated by the state in which each operates. NJAW is a member of the EPA's Partnership for Safe Water Program, a partnership of governments and water utilities that is committed to providing water that exceeds federal water quality standards. NJAW monitors the quality of its drinking water at the source, from the distribution system after treatment and, for lead and copper monitoring, to the customer's tap.

The Lakewood/Howell area of the Monmouth system of NJAW acquires its drinking water supply from a combination of 15 wells and one surface water supply. The groundwater for Howell is sourced from the following six aquifers: Englishtown, Kirkwood-Cohansey, Mount Laurel-Wenonah, Potomac-Raritan-Magothy, upper Potomac-Raritan-Magothy, and Vincentown.

NJDEP has assessed Monmouth County as having ample water supplies. Even during a period of severe drought in 2002, Monmouth County's watersheds were plentiful.

There are 24 public water supply wells in Howell Township. Eight of these are owned by the Parkway Water, seven by New Jersey American Water, three by Adelphia Water Company, and the remaining six are owned by three different mobile home parks. They are listed in *Table 16: Public Water Supply Wells Serving Howell Township* on page 72. **Map 14: Public Water Supply Wells** on page 66 shows the location of both public community and non-community water supply wells.

Sewer

As with public water, sewer service is provided to the more developed sections of Howell since access to public utilities is a primary determinant of development potential. Of the developed area in Howell, slightly less than half is provided with sewer service, with the remainder being

served by individual septic systems. About 60% of the sewer service area is the responsibility of two private sewer companies – New Jersey American Water (NJAW) serves the northwestern section of the township and Maxim Sewer Company (MSC) serves an area east of Route 9. Both sewer companies provide service primarily for residential uses. The other 40% is served by the Howell Township Municipal Utilities Department, which also has the responsibility of the maintenance and operation of the sewer infrastructure in the township. The Municipal Utilities Department will have jurisdiction over essentially all future sewer improvements. As of 2001, the municipal sewer system in Howell Township had 5,537 connections (customer households), 51 miles of sewer mains, 1,276 manholes, 3.15 miles of force mains, and 9 pump stations, in addition to 4 privately owned and operated sewage pumping stations (Howell Township Wastewater Management Plan, 2002).

The Sewer Ordinance in Howell Township allows septic systems on lots over 40,000 square feet (slightly less than one acre), and sewers are required for higher density lots (BTMUA, 2000). The Land Use Element of Howell Township's 2002 Master Plan acknowledges the designation of most of northern and eastern Howell as a "Discharge to Groundwater District," a designation that limits the growth in these areas and encourages development to areas with existing public sewer service (2005 Periodic Reexamination Report of the Master Plan and Development Regulations for Howell Township, Monmouth County, New Jersey).

In 1996, NJDEP designated the Monmouth County Board of Chosen Freeholders through the offices of the County Planning Board as the regional water quality management planning agency. Responsibility for sewage conveyance (transporting waste) in Howell Township is split between the Manasquan River Regional Sewerage Authority (MRRSA) and the Ocean County Utilities Authority (OCUA). The OCUA is a regional wastewater reclamation system that serves 31 municipalities in Ocean County, as well as five municipalities in southern Monmouth County. The treatment of sewage generated by Howell Township is the sole responsibility of the OCUA, which operates three wastewater treatment facilities in Ocean County. Howell Township's sewage is treated at OCUA's Northern Water Pollution Control Facility located off Mantoloking Road in Brick Township, Ocean County (Howell Township Wastewater Management Plan, 2002).

See **Map 19: Approved Sewer Service Area (NJDEP 2006)** on page 113 for the location of the currently approved sewer service areas. It is important to note that the Monmouth County Planning Board submitted an updated Wastewater Management Plan to NJDEP for review. Through discussions with NJDEP and county planning staff, the approved sewer service area depicted in this map will change – NJDEP recommends the removal of certain areas throughout the county, including Howell Township. However, the revised sewer service area is not available, as NJDEP has not officially approved the changes.

Township Services

Trash and Recycling

Howell Township does not provide trash service for the municipality. Residents are responsible for choosing their own trash company and paying for this service. Howell Township does,

however, provide curbside recycling, which is picked up on a biweekly basis and includes corrugated cardboard, newspapers, aluminum and tin cans, and glass and plastic bottles. In addition to these recyclables, items, such as branches, used motor oil, appliances, leaves, used clothing, and light metals may be dropped off at the Recycling Center. For the disposal of bulk household items, residents can call the Department of Public Works to schedule pick-up. Residents must also schedule an appointment with Monmouth County Hazardous Waste to dispose of paints, chemicals, and/or gasoline.

Education

Howell Township has 10 public elementary schools: Adelphia, Aldrich, Ardena, Greenville, Griebling, Land O' Pines, Newbury, Ramtown, Southard, and Taunton schools. There are also three public middle schools in the township: Middle School North, Middle School South, and Memorial Middle School. After middle school, students in Howell Township attend either Howell High School or Freehold Township High School, two of six high schools in the Freehold Regional High School District. The Freehold Regional High School District, serving over 11,000 students in a 200-square-mile area of western Monmouth County, is the largest regional high school district in New Jersey.

Photo by DVRPC

The Ardena Consolidated School was opened in 1939 to educate Howell children in grades 1 through 8 who were previously educated in one-room school houses throughout the township. Today, the Ardena School serves students from Kindergarten through 5th grade.

Parks and Recreation

Befitting a township as large in size as Howell, the township has an extensive parks system and maintains 16 parks. Howell Township updated its Open Space and Recreation Plan (OSRP) in 2003, recognizing the improvements that had occurred since the plan was adopted in 2001. The OSRP acknowledged a number of initiatives undertaken by and within Howell Township, including receiving a Planning Incentive Grant from the State Agriculture Development Committee (SADC), the protection of the Manasquan Reservoir and watershed, Capitol-to-the-Coast Greenway (a bike path from Trenton to the Manasquan River), Monmouth County Park, Recreation and Open Space Plan amendments, and township regulatory activity, such as ordinances and zoning (Howell Township, 2005).

A source of drinking water, the Manasquan Reservoir is also a major recreational facility. The Manasquan Reservoir Park covers over 1,200 acres (1.9 square miles) and includes a five-mile trail, a playground, ice skating, fishing areas, and boat rentals. The Manasquan Reservoir Environmental Center is located in the park and provides educational exhibits and activities about wetlands ecology, wildlife, and habitat protection.

Adjacent to the Manasquan Reservoir is the 308-acre, 18-hole Howell Park Golf Course. Opened in 1970, it is one of only six public and private golf courses in Monmouth County. The Howell Park Golf Course is a public course operated by the Monmouth County Park System and often ranks among the top 50 public golf courses in the country (Monmouth County Park System, 2006).

Both major rivers in Howell Township, the Manasquan and the Metedeconk, have preserved greenways managed by the Monmouth County Park System. Both the 335-acre Manasquan River Greenway and the 83-acre Metedeconk River Greenway are located in both Howell and Freehold townships. Greenways serve both conservation and recreational purposes and are often located around existing corridors, such as streams, railroads, or utility corridors (Monmouth County Park System, 2006).

Photo courtesy of Jean Montgomery
Osprey nest at the Manasquan Reservoir.

The township has proposed a restoration project for Echo Lake Park. Currently, Echo Lake Park is a passive recreational area with a gazebo, benches, and a small building used

for events. Proposed improvements to the park include a portable ice rink, picnic tables, grills, a volleyball court, horseshoe pits, and a nature trail. The township is currently raising funds for the project, partially through the sale of engraved bricks for the site.

In addition, the Yellow Brook Conservation Area in Howell Township occupies 337 acres of preserved open space to advance watershed protection and growth management objectives. Open lands, such as the Yellow Brook Tract are not intended for formal recreational use or park facilities and receive only minimal maintenance and patrolling (Monmouth County Park System, 2006).

Also located in Howell Township is Camp Sacajawea, a camp owned and operated by the Girl Scouts, which offers summer day and overnight camping. Camp Sacajawea opened in the 1960s and occupies 143 acres (Girl Scouts, 2008).

Photo by DVRPC

Howell Township Municipal Building.

Howell Township Parks and Recreation also plans Howell Day, an annual event of entertainment, musical performances, rides, crafts, food, and fireworks. This event has been held at Oak Glen Park for over 20 years and is supported in part by local businesses. In addition, the Parks and Recreation Department plans a number of activities throughout the year, including special events, summer camps, sports, trips, and exercise and dance programs.

Howell Township and Monmouth County are also dedicated to preserving the rural character and agrarian economy of the township. According to 2007 tax assessment records, Howell Township had 6,043 acres of active farmland of which 393 acres were permanently preserved. Howell taxpayers also approved a referendum to levy a property tax of $.02 per $100 of valuation dedicated to open space preservation. This tax raises about $1.175 million annually. The township also has two citizen committees – the Preservation Task Force and the Farmers Advisory Committee – that make recommendations to the Township Council on which pieces of land to preserve and how to better support the agricultural community (Monmouth County Planning Board, 2008).

See **Map 20: Existing Open Space (2008)** on page 114.

ENVIRONMENTAL ISSUES

KNOWN CONTAMINATED SITES

There are 49 active Known Contaminated Sites within Howell Township as of May, 2008. Additionally, there are five Pending Sites and 165 Closed Sites in the township. An active site has one or more active cases with confirmed contamination, and may have one or more pending or closed cases. A Pending Site has one or more cases with confirmed contamination, no active cases, and may include closed cases. Closed Sites are those with remediated contamination and have no active or pending cases. See *Table 26: Active Known Contaminated Sites in Howell Township* on page 26. Some sites in this table have more than one remedial level due to multiple cases. See also **Map 21: Known Contaminated Sites (2006)** on page 125.

The New Jersey *Known Contaminated Sites List* includes former factory sites, landfills, locations of current or former leaking underground storage tanks where chemicals or wastes were once routinely discharged, and places where accidents have resulted in spills and pollution. Contamination may have affected soil, groundwater, surface water, or a combination of site conditions. The most dangerous sites from a human health standpoint can be listed as Superfund sites, which make them eligible for federal and state cleanup funds. Other sites may be remediated by state cleanup funds (via the New Jersey Spill Compensation and Control Act), and the majority of the sites are remediated by the responsible parties as required pursuant to state and federal regulations.

Of the 10 hazardous waste sites in Monmouth County currently on the National Priority List (NPL), one – the Naval Weapons Station Earle – is located partially within Howell; and two – Bog Creek and Zschiegner Refining Company – are located entirely within the township. Commonly referred to as Superfund sites, such sites pose a major human health hazard and are in need of federal funds for cleanup.

The Naval Weapons Station Earle covers over 11,000 acres in Monmouth County, mostly in Colts Neck Township and partially in Howell Township. The headwaters of the Mingamahone Brook, Marsh Bog, and Yellow Brook are located within the site. The US Navy has used this station since the 1940s to upgrade, store, and maintain munitions. Weapons maintenance has caused toxic waste from paint and metals to be released into the environment. Testing of various locations within the base has shown that soil, sediments, and groundwater contain elevated levels of lead, chromium, and volatile organic contaminants (VOCs). These materials can cause severe health risks to people after prolonged exposure. This site was placed on the NPL on August 30, 1990 and cleanup is still in progress.

A four-acre area of Bog Creek Farm was placed on the NPL due to the disposal between 1973 and 1974 of organic solvents and paint residues in a trench on the property. This 12-acre farm is located near the Squankum area of Howell Township and contains a pond and bog. Volatile organic compounds and heavy metals were found in the pond and bog, as well as nearby Squankum Brook. The Manasquan River, which the brook feeds into, does not appear to have been affected. Bog Creek Farm was placed on the NPL on September 1, 1983 and initial cleanup

began in 1988. The final remedy was selected in 1989, and construction was completed in 1994. There are many stages in the cleanup process, including post-construction work, and this site has not been deleted yet from the Superfund list.

Zschiegner Refining Company, located on 6.1 acres in the Howell residential area, was in operation as a precious metals recovery facility between the years of 1964 and 1992. The facility was raided by the Federal Drug Enforcement Administration in October of 1992 on suspicion of illegal drug manufacturing. This raid discovered thousands of gallons of about 3,000 different chemicals that were improperly stored. The soil, sediments, ground water, and surface water had organic and inorganic contamination, primarily of metals. This site was placed on the NPL on March 6, 1998 and clean-up is ongoing. The on-site building, which had inorganic contamination, was demolished in early 2007 and field work for the remedial action began in the spring.

Table 26: Active Known Contaminated Sites in Howell Township

Site ID	PI Number	Name	Address	Contact Bureau	Remedial Level
257944	330415	Advanced Auto	120 Main St	BFO-S	C1
62769	G000062131	American Russian Welfare Society	234 Alexander Ave	BFO-S	C2, U
40720	G000003346	Bog Creek Farm	Easy St & Herbertsville Rd	BOMM	C1
4554	000975	BP Service Station 5146	695 Rt 9	BUST	C2
123593	016965	Central Jersey Concrete Pipe Co	89 Yellowbrook Rd	BISR	B, C1
4592	006711	Cumberland Gulf 126458	4001 Rt 9	BUST	C2, U
4566	007864	Exxon R/S 38576	3400 Rt 9	BOMM	C2
15684	019058	Fred McDowell Inc	Rt 547	BISR	D
66248	G000004410	Frequency Engineering Laboratories	Lakewood Farmingdale Rd	BOMM	C3
15262	017625	Grattons Garage	288 Squankum Yellowbrook Rd	BUST	C1
80455	G000043769	H R Transmissions	5499 Rt 9	BFO-S	C2
66551	G000007147	Hess Service Station Howell Township	Rt 9 S & Ford Rd	BUST	C2
50231	032459	Howell Bd of Ed Adm Bldg	449 Adelphia Farmingdale Rd	BUST	C1, C2
4564	011741	Howell Bus Garage	1251 Rt 9	BOMM	C2
68671	G000026193	Howell Township Dump	Southard Ave	OBR	C3
69781	G000031070	Howell Township Health & Human Services	450 Rt 524	BFO-S	C1
39881	030023	Howell Twp Bd of Ed Transportation	280 Old Tavern Rd	BUST	C1, C2
48814	020891	Howell Twp Municipal Complex	251 Preventorium Rd	BFO-S, BUST	B, C1
46124	006759	Howell Twp Municipal DPW	278 Old Tavern Rd	BUST	C1, C2
49864	030017	Howell Twp PAL Facility	251 W Farms Rd	BUST	C1, C2
16769	034072	Howell Valero	6870 I-195	BUST	C1, U
38196	158694	John Blewett Inc	2250 Rt 9	BFO-S	B

Site ID	PI Number	Name	Address	Contact Bureau	Remedial Level
54493	023772	Judco Corp	5500 Rt 9	BUST	C2, U
187321	246217	Lakewood Carpeting-Square Block Mall	6475 Rt 9	BFO-S	C1
21473	018568	Larrabee Dispatch Center	Randolph Rd & Rt 547	BFO-S	C2
4571	022960	Lukoil #57724	3401 Rt 9	BOMM	C2
4580	015707	Monmouth Cnty Hwy Dist 5	383 Cranberry Rd	BUST	C1, C2
146614	193907	Monmouth County Fire & Police Academy Training	Rt 33	BFO-S	C2
226112	295123	Ney Trucking Diesel Spill	Rt 547	BFO-S	C1
4557	002732	Nezihe H Sadik Inc - World Gas	2001 Rt 9	BUST	C1, C2
95695	026109	One Stop	1205 1207 Rt 9	BUST	C1, C2
13663	019153	Poly One Corp	10 Ruckle Ave	BISR	B
342728	423856	Private Residence	Feathertree Ct	BFO-S	C1
370751	458790	Private Residence	Flamingo Dr	BFO-S	C1
368652	456042	Private Residence	Flamingo Dr	BFO-S	C1
359186	444154	Private Residence	Flamingo Dr	BFO-S	C1
362399	447578	Private Residence	Merrick Rd	BFO-S	C1
181691	237817	Private Residence	Kent Rd	BFO-S	C2
225117	293833	Private Residence	Freewood St	BFO-S	C1
376126	466170	Private Residence	Oak Glen Rd	BFO-S	C1
364555	450504	Private Residence	Flamingo Dr	BFO-S	C1
221650	289493	Private Residence	Fort Plains Rd	BFO-S	C2
79494	G000037671	Private Residence	Oak Glen Rd	BFO-S	C1
181166	237186	Private Residence	Hazelwood Ct	BFO-S	C2
95852	134887	Schuch Property	Adelphia Farmingdale Rd	BOMM	C1
192468	270602	Schuch Property	Adelphia Farmingdale Rd	BFO-S	B
15269	031691	T&A Auto Service Center (Former)	504 Rt 9	BOMM	C2
66311	G000004595	Waste Disposal Incorporated Landfill	505 Allenwood Lakewood Rd	BOMM	C3
66587	G000008575	Zschiegner Refining Company	1442 Maxim Southard Rd	BIDC	C1

Source: NJDEP, May 2008

Table 27: Pending Known Contaminated Sites in Howell Township

Site ID	PI Number	Name	Address	Status
68637	G000026050	Aldrich Laundry	2332 Rt 9	Pending
13664	G000002381	Emil A Schroth Inc	Yellowbrook Rd & Copper Ave	Pending
68500	G000025257	Private Residence	Tice Rd	Pending
66926	G000009873	Private Residence	Shafto Way	Pending
45212	012253	Southard Fire Dept 1	Rt 9 & New Friendship Rd	Pending

Source: NJDEP, May 2008

Explanation of Codes

Contact Agency Code	Contact Agencies
BOMM	Bureau of Operation, Maintenance and Monitoring
BFO-S	Bureau of Field Operations – Southern Office
BSCM / BUST	Bureau of Southern Case Management (formerly BUST – Bureau of Underground Storage Tanks)
BDC	Bureau of Design and Construction
BISR	Bureau of Industrial Site Remediation

Explanation of Remedial Levels

Remedial Level	Explanation of Site Complexity
B	A single-phase remedial action in emergency response; simple removal activities of contaminants; usually no impact to soil or groundwater.
C1	A remedial action with simple sites; one or two contaminants localized to soil and the immediate spill or discharge area.
C2	A remedial action with more complicated contaminant discharges; multiple site spills and discharges; more than one contaminant, with both soil and groundwater impacted or threatened.
C3	A multiphase remedial action with high complexity and threatening sites. Multiple contaminants, some at high concentrations with unknown sources continuing to impact soils, groundwater, and possibly surface waters and potable water resources. Dangerous for direct contact with contaminated soils.
D	Same conditions as C3 except that D levels are also usually designated federal "Superfund Sites."
U	Not yet determined

Underground Storage Tanks

There are 22 commercial sites with underground storage tanks that contain hazardous substances in Howell Township, *N.J.A.C. 7:14B et seq*, listed in *Table 28: Underground Storage Tanks in Howell Township*. If there is a known release to soil and/or groundwater, a site will also be listed on *Table 26: Active Known Contaminated Sites in Howell Township* on page 116. There may also be private residences in Howell Township that still have underground storage tanks, used primarily to hold home heating oil. As these tanks age and rust, they often begin to leak, which becomes a serious threat to the groundwater below them. Those private residences are not publicly listed by NJDEP unless they pose a human health hazard.

Table 28: Underground Storage Tanks in Howell Township

PI Number	Name	Street Address
32743	19 Petroleum Inc Citgo	1175 Rt 33 W
261544	412 Fairfield Road	412 Fairfield Rd
33192	Central Concrete Corp	86 Yellowbrook Rd
6711	Cumberland Gulf 126458	4001 Rt 9 N
6455	DD & DJ Realty LLC	433 Oak Glenn Rd
7864	Exxon R/S 38576	3400 Rt 9 S
19725	Exxon R/S 38936	639 Rt 9N & Strickland Rd
1710	Getty 00658	2217 Highway Rt 9
11741	Howell Bus Garage	1251 Rt 9 N
31864	Howell Car Wash & Lube Center Inc	4629 Rt 9 N
30023	Howell Twp Bd Of Ed Transportation	280 Old Tavern Rd
6759	Howell Twp Municipal DPW	278 Old Tavern Rd
34072	Howell Valero	6870 Rt 9 S
26067	Jonathan Green & Sons Inc	48 Squankum Yellowbrook Rd
22960	Lukoil #57724	3401 Rt 9 N

PI Number	Name	Street Address
133043	Lukoil #57739	2510 Hwy Rt 9
15707	Monmouth Cnty Hwy Dist 5	Cranbury Rd
2732	Nezihe H Sadik Inc - World Gas	2001 Rt 9 N
4106	Upper Manasquan Pumping Station	Havens Bridge Rd
6631	Verizon Howell Twp WC(55385)	333 Fairfield Rd
162745	Wawa Food Market #938	4690 Rt 9
264499	Wawa Food Market #955	US Rt 9

Source: NJDEP, 2008

EROSION

Soil erosion is a natural process. Geologic, or "background," erosion occurs at approximately the same rate as soil formation, leading to neither a net loss nor a net gain of soil. Background erosion is an important process; erosion from rock is carried and deposited by wind and water. In areas with vegetative cover, the rock mixes with decomposed vegetation and creates more nutrient-rich soil.

Erosion caused by human activity has greatly increased the amount, and the rate, of soils lost (accelerated erosion). Unfortunately, human activity cannot significantly contribute to soil formation, a process that takes place over thousands of years. Human-caused erosion is a serious environmental problem across the world. In the United States, the most significant impacts are the loss of prime-agricultural soils (on-site erosion), pollution of stream and rivers (off-site erosion), and increased flooding due to stream siltation. In Howell Township, development must adhere to soil erosion and sediment control programs, although these do not address stream protection (BTMUA, 2000).

The immediate environmental impact of on-site erosion is unproductive farmland. Topsoil, which is the most quickly eroded soil, also contains the majority of the nutrients and soil biota required for plant life. In addition, once topsoil is eroded, the water-holding capacity of soil decreases. This further impacts plant life and increases flooding. The agricultural industry compensates for the loss of soil fertility with the use of chemical fertilizers. However, these fertilizers can wash directly into streams and rivers, causing water pollution downstream before they can be used by plants.

The built environment also causes erosion. Construction on or near steep slopes greatly increases the incidence of soil erosion. The loss of tree cover and plant material on steep slopes is especially damaging. Where steep slopes adjoin streams, erosion may contaminate the water and endanger wildlife habitat. In road building, there are numerous means for managing roadside erosion during and after construction, ranging from the highly technical (polyester or steel) to the simple (compost or tree plantings). Most state departments of transportation have best management practices to alleviate and manage roadside erosion, to protect the environment, and to ensure the future safety of the road itself. The USEPA recently began a program called "GreenScapes," which promotes environmental alternatives for large-scale landscaping projects, including reducing erosion from road construction.

Furthermore, in New Jersey, any development that creates soil disturbance of greater than 5,000 square feet is required to file a Soil Conservation Management Plan. All disturbances must be within the approved limits of the plan.

The New Jersey Department of Agriculture (NJDA) houses the State Soil Conservation Committee (SSCC), which is responsible for the conservation and management of New Jersey's soils. The SSCC administers the natural resources conservation program, which supports the work of 16 local Soil Conservation Districts and the New Jersey Conservation Partnership (NJCP), another diverse group of federal and state regulatory and advocacy organizations. The NJCP and individual soil conservation districts offer a wide range of voluntary conservation, technical assistance, and education programs that focus on agricultural conservation planning assistance, cost-sharing programs, application of organic materials, water supply and management, soil erosion and sediment control, stormwater discharge, and soil surveys. More information about NRCS programs is available in *Appendix B: Federal and State Conservation Programs for Farmers*.

RADON

Radon is a radioactive gas that comes from the natural decay of uranium found in nearly all soils. It is invisible, odorless, and tasteless. It moves up through the ground to the air above and into all types of homes through cracks and other holes in foundations. A build-up of radon-contaminated air within a home can pose a long-term health hazard to residents, specifically for lung cancer. The only method of detection is to conduct a test of the air within a home. Fortunately, radon testing is inexpensive.

NJDEP classifies townships into three categories as to the risk of having high radon levels. Howell Township is listed as a Tier 3 municipality, indicating a low risk of high radon levels in homes. The radon concentration at which homeowners should take immediate action is 4.0 picocuries per liter in air. While state law does not require radon testing before a real estate transaction, NJDEP recommends that a contingency clause be included in a sales contract allowing the buyer to have the home tested for radon and addressing the problem if an elevated level of radon gas is discovered. State law (N.J.A.C. 26:2D-73) does require, at the time of a real estate transaction, that the seller provide the buyer with a copy of the results of any radon testing if such testing was conducted during tenure.

If radon levels are high in a home, NJDEP suggests that the homeowner take the following actions: (1) prevent radon from entering the house by repairing cracks and insulation; and (2) dilute radon concentrations currently in the house. The latter can be done with an inexpensive pipe-and-fan system that draws radon out from under the foundation and vents it outside.

NJDEP provides information on testing, mitigation, radon's health effects, and additional information on their website at www.state.nj.us/dep/rrp/radon. They can also be reached for radon-related questions by phone at 800/648-0394.

ENVIRONMENTAL MANAGEMENT

Manasquan River Watershed

Nearly two-thirds of Howell Township lies within the Manasquan watershed, so protection of this important resource is critical to the ecological health of the township. The Manasquan Watershed Management Association (MWMA) is an organization founded by concerned citizens in the late 1990s with the goal of protecting and restoring the Manasquan River. Members of the organization have included citizens, scientists, environmentalists, municipal officials, and others interested in the condition of the watershed. The first effort by the MWMA was to obtain a "No Discharge Zone" designation for the Manasquan River, which was achieved in 1999. The organization has focused on regional issues affecting the overall health of the entire watershed.

The tasks of the MWMA have included conducting environmental research, managing restoration projects, identifying strategies for improving the river, forming partnerships with other organizations, and expanding a public education program. Some of the publications produced by and for the MWMA include a water quality trend analysis; a watershed management plan; a report on the preservation of critical areas (issued by the New Jersey Water Supply Authority); and a Compilation of the Management, Regulatory, and Operational Tools Available for the Watershed (issued by the Monmouth County Water Resources Association). In addition, the MWMA provides technical assistance to local municipalities, such as providing templates of ordinances to protect water quality and sensitive habitats. The MWMA also helps municipalities fulfill new legal requirements issued by the state regarding stormwater management through its education programs.

The Manasquan River Watershed Critical Areas Committee seeks to protect critical areas in the Manasquan watershed with the primary goals of protecting water quality and natural habitat. Outcomes of the critical areas project include identifying these critical land preservation targets, coordinating development with preservation goals, improving municipal ordinances, and educating the public and governing bodies. About 30% of the watershed is neither developed nor dedicated open space and is thus subject to significant development pressure. The identification of critical areas is intended to allow municipalities to target acquisition funds on properties critical to water resource protection, particularly in large continuous areas, as well as to cluster land development away from these critical areas. See **Map 22: Manasquan Watershed Critical Areas (2005)** on page126 for a depiction of high value land in Howell Township.

According the compilation of watershed management tools, Howell Township has programs or policies relevant to the health of the watershed in a number of areas, including the following:

- Capital improvements (roadwork, traffic control, construction)
- Catch basin cleaning
- Community service programs
- Composting programs
- Emergency management (oil hazardous waste spill, response plans, evacuation plans for flooding or storm events)
- Environmental code enforcement
- Environmental inspections health or construction related

- Environmental inventories/assessments
- Fertilizer application/turf management
- Flooding and floodplains
- Freshwater wetlands
- Landscaping requirements or policies
- Litter clean-ups
- Local permits and licenses
- "No dumping" fines
- On-site septic systems
- Open space acquisition
- Pesticide application/integrated pest management
- Pet walking areas/pooper scooper laws
- Public trails and access to water and open space
- Recreation program
- Recycling
- Riparian (natural water course) corridors
- Sediment and erosion controls
- Special Conservation Zones or easements
- Steep slopes
- Stormwater controls and maintenance
- Stream cleaning/removing blockages
- Stream monitoring (former activity of the Howell Township Environmental Commission)
- Street cleaning, salting, and sanding
- Structural inspections
- Tree planting/removal

(Monmouth County Water Resources Association, 1999)

Metedeconk River Watershed

Nearly 100,000 people rely on the Metedeconk River for water. However, the watershed is extremely vulnerable considering its location in a densely populated area and the fact that only seven percent of land in the watershed is protected from development (BTMUA, 2003b). The Metedeconk River does not have a watershed management association like the Manasquan River. However, the Brick Township Municipal Utilities Authority (BTMUA), being the only purveyor utilizing the river, has significant technical and staffing capabilities and is the lead agency in protecting the watershed.

The Metedeconk River watershed was the focus of one of four Source Water Stewardship Projects organized by the Trust for Public Land, the University of Massachusetts-Amherst, and the US Forest Service with financial support from the EPA. As part of this project, the BTMUA led a local committee of representatives from Monmouth and Ocean counties to conduct a watershed assessment and to recommend strategies for implementation. The *Exchange Team Report* resulting from this study encouraged the Metedeconk Watershed community to take immediate steps to protect the watershed because the shared water resource is threatened by accelerating development pressure. The report also points to the changing regulatory environment that will require municipalities to adopt stormwater management regulations, which would be abetted by cooperation among multiple municipalities. In addition, the report encourages taking advantage of the current public support for land protection and funding programs (BTMUA, 2003a).

The Brick Township Municipal Utilities Authority completed a Preliminary Metedeconk River Watershed Study in 1989, which was followed by a Watershed Management Plan begun in 1998 (BTMUA, 2003b). Phase I of this plan points to the following actions municipalities should take to better protect the Metedeconk River watershed:

- Township Stormwater Management Plans need to be developed
- Stormwater Ordinances need to be updated to reflect water quality concerns
- Riparian buffers need better protection
- Allowable Impervious Surface percentage within watershed should be reduced
- Wetlands need to be better protected
- Watershed protection should be incorporated into updates of Master Plans

Some of these actions have since been addressed by Howell Township, such as the adoption of the Municipal Stormwater Management Plan in 2005, which was updated in 2007.

The Metedeconk River watershed is monitored by the BTMUA's Watershed Monitoring Program. The BTMUA's Watershed Team consists of a staff dedicated specifically to watershed monitoring that conducts daily sampling throughout the watershed for a variety of parameters. The routine sampling program monitors for ammonia, dissolved oxygen, fecal coliform, pH, total dissolved solids, total organic carbon, and water temperature (BTMUA, 2000). Since the 1980s, more than 500,000 water samples have been taken (BTMUA, 2003b). Phase I of BTMUA's Watershed Management Plan points to the following goals for protecting the Metedeconk River:

- Complete Phase 2 of the Metedeconk River Watershed Management Plan
- Establish a cooperative relationship with the upstream municipalities to protect the watershed
- Implement a Regional Stormwater Management Plan that is tailored to the specific issues affecting the Metedeconk Watershed
- Establish an application review process with municipal planning boards whereby BTMUA must have the opportunity to comment on new development proposals
- Mitigate the impacts of existing development on the River (i.e. retrofits, rain gardens, etc.)
- Create a Stormwater Utility for the Metedeconk Watershed
- Delineate strategic land parcels for future acquisition and preservation
- Adoption of the Category 1 Stream Classification (BTMUA, 2003b)

Howell Environmental Commission

The environmental quality of Howell Township is protected by a number of commissions and other civic initiatives. The Howell Environmental Commission was formed to protect all natural resources within the township. According to the township website, the powers of the Environmental Commission include the following:

- Promoting the conservation and development of the natural resources of the Township.
- Planning, implementing, and informing the public about local conservation programs.
- Conducting research into the possible use of the open areas of the township.
- Recommending to the Planning Board plans and programs for inclusion in a Township Master Plan and the development and use of such open areas.

- Advertising, preparing, printing, and distributing books, maps, charts, plans, and pamphlets that in its judgment it deems necessary for its purposes.
- Managing donated or purchased lands for conservation purposes and operating conservation programs.
- Acting as the coordinating agency for the community on conservation matters and as a liaison between local conservation needs and regional, county, state and federal agencies administering to those needs.
- Keeping an index of all open areas publicly or privately owned, including open marsh lands, swamps, and other wetlands, in order to obtain information on the proper use of such areas.

One action taken by the Howell Environmental Commission was to hire Herpetological Associates, Incorporated to perform a study on the presence and habitat suitability of a number of endangered, threatened, and rare plant and animal species in Howell Township. The 2000-2001 study focused on the following species: swamp pink, pine snake, Pine Barrens tree frog, bog turtle, and wood turtle. Although the study resulted in no confirmed sightings of these species, there were prior sightings of the bog turtle and wood turtle at a location that still is ideal habitat for these rare reptiles. The encroachment of residential and commercial development has fragmented the natural habitat in Howell, and this study concluded that the preservation of continuous undeveloped areas of natural habitat should be the highest priority to protect these and other species (Herpetological Associates, Inc., 2002).

An ongoing project of the Howell Environmental Commission is the preservation of the Bear Swamp Natural Area. This project was conceived in 1987 in order to create a greenway linking the Manasquan Reservoir and Allaire State Park. The Bear Swamp Natural Area encompasses nearly 900 acres that links the Manasquan Reservoir's 1,100 acres and Allaire State Park's 3,000 acres to create an invaluable 5,000-acre greenbelt. Preservation of this area was complicated by nearly 5,000 very small "postage stamp" parcels that covered about 400 acres of the Bear Swamp Natural Area. These 20' by 100' lots were given away by a newspaper in the 1920s as a subscription promotion (Meggitt, 2004). Howell Township has recently completed the acquisition of all of these "newspaper lots." Preservation of Bear Swamp Natural Area provides not only aesthetic and recreational opportunities, but also contributes to the quality of life in Howell Township. In addition, preservation protects numerous headwaters of the Manasquan River and provides habitat for threatened and endangered species, such as a colony of the endangered Pine Barrens tree frog.

Other Environmental Management Initiatives

Municipal boards or committees involved in the environment or open space in Howell Township include the Environmental Task Force, the Farmers Advisory Committee, the Gypsy Moth Representative, the Lake Restoration and Wildlife Management Committee, the Preservation Task Force, the Recreation Advisory Committee, and the Shade Tree Commission.

There are a number of municipal initiatives impacting the environment in Howell Township, including the Master Plan, which was most recently updated in 2002, and amendments to the Master Plan, including the Conservation Plan Element updated in 2005, the Land Use Plan

Element updated in 2006, the Open Space and Recreation Plan Element updated in 2003, and the Historic Preservation Plan Element. Specific ordinances in Howell Township impacting environmental management include Soil Erosion and Sediment Control, Stream and Watercourse Protection, Conservation Easement, Tree Removal and Woodlands Management Ordinance, Riparian Buffer Ordinance, Sewer Requirements, Stormwater Runoff, and Environmental Impact Report Requirement, some of which have been described in previous sections of this report (BTMUA, 2000).

Additionally, there was a Natural Resources Inventory produced in 1976 by Tectonic, of which this report is an update. There are also a number of county-level initiatives that affect the quality and protection of the environment of Howell Township, including the Monmouth County Farmland Preservation Plan and the Monmouth County Open Space Plan, adopted in 2006.

New Jersey State Development and Redevelopment Plan

The New Jersey State Development and Redevelopment Plan (SDRP 2001) provides a vision for the state's future development. The SDRP 2001 contains eight major goals and strategies, which are further expounded upon as statewide policies.

The SDRP 2001 has six Planning Areas, each with its own goals, objectives, policies, and strategies. The Planning Area descriptions reflect varying levels of development, infrastructure capacity, and presence of natural resources. Howell Township has five planning areas – PA2-Suburban Planning Area; PA3-Fringe Planning Area; PA4-Rural Planning Area; PA4B-Rural Environmentally Sensitive Planning Area; PA5-Environmentally Sensitive Planning Area –while Farmingdale Borough is classified as PA1-Metropolitan Planning Area. See **Map 23: State Development and Redevelopment Plan** on page 129 for a depiction of the planning areas in Howell Township.

Monmouth County participated in the Cross-Acceptance process, which was completed in August 2007. During the negotiation and public hearing process, the Office of Smart Growth and Monmouth County proposed changes to several areas in Howell Township. Most notably, several centers were proposed, which include Freehold Regional Center Expansion, Route 33 Center, Farmingdale Village Center (in Farmingdale Borough) and Ramtown Village Center. However, these changes were not necessarily made. See **Map 24: Cross Acceptance III Map** for relevant information about Howell Township and its SDRP designations.

SOURCES OF INFORMATION

Arndt, Rudolf G. "Annotated Checklist and Distribution of New Jersey Freshwater Fishes, with Comments on Abundance." *The Bulletin [of the] New Jersey Academy of Science*, V. 49, No. 1, Spring, 2004.

Association of New Jersey Environmental Commissions (ANJEC):
- *Acting Locally: Municipal Tools for Environmental Protection*. Mendham, NJ: ANJEC, 2002.
- *The Environmental Manual for Municipal Officials*. Mendham, NJ: ANJEC, 1998.

AVA Environmental Consultants, Inc. *Revised Environmental Impact Report for The Fountains at Howell*. Mount Holly, NJ: 9 October 2002.

Baatar, T.S. Social and Cultural Change in the Mongol-American Community. Academy of Sciences, Mongolia.

Barten, Paul K., Avril L. de la Cretaz, and Yanli Zhang. *Conservation, Restoration, and Stormwater Management Priorities for Source Water Protection in the Metedeconk River Watershed, New Jersey*. University of Massachusetts-Amherst, Department of Natural Resources Conservation, January 2003.

Blair, Jeannette. Freehold Township: The First 300 Years. Freehold Township, NJ: Freehold, 1993.

Brick Township Municipal Utilities Authority (BTMUA)
- *Metedeconk River Watershed Management Plan, Phase I: Watershed Characterization and Preliminary Analysis*. December 2000.
- *Metedeconk Source Water Stewardship Exchange Team Report*. December 2003a.
- *Metedeconk Watershed Source Water Stewardship Exchange Team Report*. Brick Township, New Jersey, December 2003a.
- *Strategies for Protecting a Watershed: The Metedeconk River Watershed Management Plan*. Brick Township, New Jersey, 2003b.

Britton, Nathaniel, and Addison Brown. *An Illustrated Flora of the Northern United States and Canada*. New York: Dover, 1970.

Brown, G. A. and Zapecza, OS. Results of Test Drilling in Howell Township, Monmouth County, New Jersey. USGS Water-Resources Investigations Report 90-4062. USGS, January 1991.

Brown, Lauren. *Grasses: An Identification Guide*. New York: Houghton Mifflin, 1979.

Burton, Dr. Maurice, and Robert Burton, eds. *The International Wildlife Encyclopedia: Vol. 5*. New York: Marshall Cavendish, 1969.

Caduto, Michael. *Pond and Brook: A Guide to Nature in Freshwater Environments*. Hanover: University Press of New England, 1990.

Cammarota, Ann Marie T. *Pavements in the Garden: The Suburbanization of Southern New Jersey, Adjacent to the City of Philadelphia, 1769 - to the present*. Madison: FDU Press, 2001.

Collins, Beryl Robichaud, and Karl H. Anderson. *Plant Communities of New Jersey: A Study in Landscape Diversity*. New Brunswick, NJ: Rutgers University Press, 1994.

Commonwealth of Australia. Department of the Environment, Sport and Territories. Biodiversity Series Paper No. 1: Biodiversity and its Value. 1993.

Dahl, T.E. *Status and Trends of Wetlands in the Conterminous United States 1986 to 1997*. Washington D.C.: US Department of the Interior, US Fish and Wildlife Service, 1991.

Delaware Valley Regional Planning Commission.
- Locally Funded Open Space Programs. <http://www.dvrpc.org/planning/environmental/openspace/local.htm>
- Regional Data Bulletin #65, 1990-99 Residential Building Permits, by Minor Civil Division (28-County Service Area). June 2000.
- Regional Data Bulletin #83, Housing Units Authorized by Residential Building Permits: 2000 – 2005. May 2006.
- Regional Data Bulletin #84, Municipal, County, and Regional Population Estimates, 2000- 2005. June 2006.

Donahay, Alma. *History of Howell*. Howell, NJ: Howell Historical Society, 1967.

Donatiello, Gene. "Historic Sites of Brick Township, New Jersey." <http://www.bricktwphistoricalsociety.com/hist/hist.htm>. 1997.

ESP Associates.
- *Fish Survey of Selected Stream Sites in Howell Township, NJ on November 20, 1993*. 13 December 1993.
- NRI Update Mapping, Howell Township. 1996.

Food and Agricultural Organization of the United States. Biological Diversity in Food and Agriculture. 22 July 2004 <http://www.fao.org/biodiversity/index.asp>.

Freehold Regional High School District. <http://www.frhsd.com>. Accessed, 22 May 2007.

Girl Scouts. Girl Scouts of the Jersey Shore. Camp Sacajawea, 2008. <http://www.girlscoutsjs.org/outdoor/sacajaweaOverview.php>.

Great Egg Harbor Watershed Association. Rare and Endangered Species. 19 July 2004 <http://www.greategg.org/plants_and_animals/rare_and_endangered_species.htm>.

Greater Mercer Transportation Management Association
- Bike/Ped Projects in Mercer County. <http://www.gmtma.org/bikeprojects.htm>.

Greer, Juliet. A Day in the Life of Howell and Farmingdale. *Asbury Park Press*, 21 September 2000.

Herpetological Associates, Inc. Bog Turtle (*Clemmys muhlenbergii*), Pine Snake (*Pituophis m. melanoleucus*), Pine Barrens Tree Frog (*Hyla andersonii*), and Swamp Pink (*Helonias bullata*) Habitat Evaluations and Surveys in Howell Township, Monmouth County, New Jersey. Presented to the Howell Township Environmental Commission by Robert T. Zappalorti, Matthew P. McCort, David W. Schneider, and Raymond Farrell of Herpetological Associates, Inc. Jackson, New Jersey, 25 February 2002.

Honachefsky, William B. *Ecologically Based Municipal Land Use Planning*. Boca Raton, FL: Lewis Publishers (CRC Press), 2000.

Howell Chamber of Commerce. <http://www.howellchamber.com>. Accessed, 23 May 2007.

Howell Historical Society. <http://www.howellnj.com/historic>.

Howell Township.
- *2005 Conservation Plan Draft for Howell Township, Monmouth County, New Jersey*. 29 April 2005.
- *2005 Periodic Reexamination Report of the Master Plan and Development Regulations for Howell Township, Monmouth County, New Jersey*.
- *2006 Land Use Plan Element for Howell Township, Monmouth County, New Jersey.*
- *Green Acres Recreation and Open Space Inventory*. October 2002, revised June 2006.
- *Howell Township Official Website.* <http://www.twp.howell.nj.us>.

- Municipal Stormwater Management Plan, Master Plan Element for the Township of Howell, Monmouth County, New Jersey. Prepared by CME Associates in conjunction with the Howell Township Engineering Department. March 2005, revised May 2007.
- Wastewater Management Plan for the Township of Howell, Monmouth County, New Jersey. Prepared by Birdsall Engineering, Inc. March 2002.

Howell Township Environmental Commission. *Howell Township Natural Resource Inventory*. Prepared by Tectonic. February, 1976.

Hunton, G. and McCabe, J. Monmouth County Historic Sites Inventory: Summary Report 1980-1984. Monmouth County, NJ: Office of New Jersey Heritage, Monmouth County Park System, Monmouth County Historical Association, 1990.

Janick, Jules. *History of Horticulture, Lecture 31: Agricultural Scientific Revolution: Chemical.* 28 November 2005. <http://www.hort.purdue.edu/newcrop/history/lecture31/r_31-1.html>

Kenderian Zilinski Associates. *Environmental Impact Statement for Farmingdale Estates*. Wall Township, NJ: 20 June 2005.

Klerman, Jean. The Search for "Jewstown," Monmouth County, 1787. <http://monmouth.ujcfedweb.org/page.html?ArticleID=56806>.

Koss, Walter J., et al. "Freeze/Frost Data." Asheville, NC. National Climatic Data Center, 1988.

Kraft, Herbert. *The Lenape*. Newark, NJ: New Jersey Historical Society, 1986.

Lane, Alexander. "The Birds Have Flown." *Star-Ledger* [Newark], 4 July 2004.

Ludlum, David. "The New Jersey Weather Book." New Brunswick: Rutgers University Press, 1983.

Manasquan River Watershed Management Association (MWMA) (AKA Manasquan River Watershed Management Group).
- <http://www.manasquanriver.org.>.
- Manasquan River Watershed Initial Characterization and Assessment Report. Eatontown, New Jersey, March 1999.
- Manasquan River Watershed Land Development Capacity Analysis. Prepared for the Manasquan River Watershed Management Group. Prepared by Thomas A. Thomas, P.P., A.I.C.P., T&M Associates. Middletown, New Jersey, 30 March 1999.
- Manasquan River Watershed Management Plan. Eatontown, New Jersey, 31 March 2000.

Mapping New Jersey's Vernal Ponds. Grant F. Walton Center for Remote Sensing and Spatial Analysis at Rutgers University. 5 August 2004 <http://www.dbcrssa.rutgers.edu/ims/vernal/>.

Martin, Alexander, Herbert Zim, and Arnold Nelson. *American Wildlife and Plants.* New York: Dover, 1951.

Martine, Christopher T. *Trees of New Jersey and the Mid-Atlantic States*. Jackson, NJ: NJ Department of Environmental Protection, Division of Parks and Forestry, New Jersey Forest Service, 2003.

McMahon, William. *South Jersey Towns.* New Brunswick, NJ: Rutgers University Press, 1973.

Meggitt, Jane. "Residents honored for land preservation work." *News Transcript*, 19 May 2004.

Monmouth County Environmental Council.
- *Monmouth County Unique Areas Study*. December, 1978,
- *Natural Features Study for Monmouth County*. April 1975, reprinted January 1988.

Monmouth County Health Department.
- *The Manasquan River Watershed: A Trend Analysis Focusing on Impacts to Water Quality*. Prepared for the Manasquan Watershed Management Group, 31 January 1999.
- Water Quality Monitoring. <http://www.visitmonmouth.com/health/environmental/water/water.htm>. Accessed, 21 May 2007.

Monmouth County Park System.
- Howell Park Golf Course. <http://www.monmouthcountyparks.com/Golf/howell_gc.asp>.
- *Monmouth County Open Space Plan*. Monmouth County Planning Board Resolution #06-38. Adopted 21 August 2006.
- Monmouth County Park System. <http://www.monmouthcountyparks.com>. Accessed, January 2008.

Monmouth County Planning Board.
- <http://www.monmouthplanning.com>. Accessed, 22 May 2007.
- *Draft Monmouth County Farmland Preservation Plan: The Comprehensive Plan*. Monmouth County Planning Board, August 2000.
- Monmouth County Profile 2006. Monmouth County Planning Board, April 2006.
- *South Coast Environmental Planning Region Monmouth County, New Jersey Ecological Resource Inventory*. Monmouth County Planning Board and the Monmouth County Environmental Council, December 1996.

Monmouth County Water Resources Association. *Compilation and Assessment of Management, Regulatory, and Operational Tools Available for the Manasquan River Watershed*. Prepared for the Manasquan Watershed Management Group (MWMG), New Jersey Department of Environmental Protection (NJDEP), and National Oceanic and Atmospheric Administration (NOAA). Eatontown, New Jersey, March 1999. Farmland Plan

National Climatic Data Center (NCDC). Climatography of the United States No. 20, 1971 – 2000, Freehold Marlboro, New Jersey.

National Oceanic and Atmospheric Administration (NOAA).
- United States Coast Pilot 3, Atlantic Coast, Sandy Hook, New Jersey, to Cape Henry, Virginia. National Oceanic and Atmospheric Administration, National Ocean Service. Washington, DC, 1994.
- <www.ncdc.noaa.gov/oa/ncdc.html>. Accessed January 2008.

National Park Service Certified Local Government Program (CLG). <http://www.cr.nps.gov/hps/clg>. Accessed, 22 May 2007.

National Register of Historic Places
<http://www.nationalregisterofhistoricplaces.com/welcome.html>.

Naval Weapons Station Earle. <http://www.globalsecurity.org/military/facility/earle.htm>.

Navoy, Anthony S. "Gloucester County Ground-Water Resources and Issues." *Watershed News Early Spring 2001, The Newsletter of the Federation of Gloucester County Watersheds and the South Jersey Land Trust*, Gloucester Co., April 2001. <www.sjwatersheds.org.>.

New Jersey American Water (NJAW).
- <http://www.amwater.com/awpr1/njaw/default.html>.
- *2006 Annual Water Quality Report*: Monmouth, Middlesex, and Ocean Counties. <http://www.amwater.com/awpr1/njaw/pdf/NJ-Monmouth-web.pdf>.

New Jersey Department of Environmental Protection (NJDEP):
- *2004 Air Quality Report*. Bureau of Air Monitoring.
- *2005 Air Quality Report*. Bureau of Air Monitoring.

- Ambient Biomonitoring Network (AMNET): Atlantic Coastal Drainage Basin, 1994-1995 Benthic Macroinvertebrate Data. NJDEP, January 1996.
- Ambient Biomonitoring Network (AMNET): Watershed Management Areas 12, 13, 14, 15, and 16, Atlantic Region, 1999-2000 Benthic Macroinvertebrate Data. DJDEP, March 2001.
- Ambient Lake Monitoring Project. Bureau of Freshwater and Biological Monitoring. Division of Water Monitoring and Standards. <http://www.state.nj.us/dep/wmm/bfbm/lakes.html>.
- Bald Eagle. <http://www.nj.gov/dep/fgw/ensp/pdf/end-thrtened/baldeagle.pdf>.
- Barred Owl. <http://www.state.nj.us/dep/fgw/ensp/pdf/end-thrtened/barredowl.pdf>.
- Bobcat. <http://www.nj.gov/dep/fgw/ensp/pdf/end-thrtened/bobcat.pdf>.
- Bog Turtle. <http://www.nj.gov/dep/fgw/ensp/pdf/end-thrtened/bogtrtl.pdf>.
- Bureau of Geographic Information Systems <www.state.nj.us/dep/gis>.
- *Bureau of Underground Storage Tanks (BUST).* 30 August 2005 <http://www.nj.gov/dep/srp/bust/bust.htm>.
- Bureau of Water Quality Standards and Assessment (BWQSA). <http://www.state.nj.us/dep/wms/bwqsa>. Accessed, 21 May 2007.
- *The Clean Water Book: Lifestyle Choices for Water Resource Protection*, Trenton, NJ, 1997.
- Cooper's Hawk. <http://www.state.nj.us/dep/fgw/ensp/pdf/end-thrtened/coopers.pdf>.
- Department of Fish and Wildlife. <http://www.state.nj.us/dep/fgw/index.htm>. Accessed January 2008.
- Department of Parks and Forestry. Allaire State Park. <http://www.state.nj.us/dep/parksandforests/parks/allaire.html>. Accessed 18 May 2007.
- Division of Land Use Regulation <www.state.nj.us/dep/landuse>.
- Division of Science, Research, and Technology. Fish Consumption Advisories. 29 June 2007. <http://www.state.nj.us/dep/dsr/fishadvisories/maps/monmouth.htm>.
- Division of Water Quality <www.state.nj.us/dep/dwq>.
- Division of Watershed Management. 29 May 2007. <http://www.state.nj.us/dep/watershedmgt>.
- *Governors Report on Deer Management in New Jersey*. NJDEP, October 2004.
- Historic Preservation Office. New Jersey and National Registers of Historic Places. 20 July 2006 <http://www.state.nj.us/dep/hpo/>.
- *Homeowner's Manual for Septic Systems, A*, Division of Water Quality, Bureau of Nonpoint Pollution Control. Trenton, NJ, 1999.
- *Known Contaminated Sites.* 10 August 2005 <www.state.nj.us/dep/srp/kcs–nj>.
- *New Jersey Integrated Water Quality Monitoring and Assessment Report 2002*. NJDEP, December 2002.
- *New Jersey Integrated Water Quality Monitoring and Assessment Report 2004*. NJDEP, June 2004.
- *New Jersey Integrated Water Quality Monitoring and Assessment Report 2006*. NJDEP, December 2006.
- New Jersey Natural Heritage Database. NJDEP, August 2004.
- Northern Pine Snake. <http://www.nj.gov/dep/fgw/pinesnak.htm> and <http://www.nj.gov/dep/fgw/ensp/pdf/end-thrtened/norpinesnake.pdf>.
- Pine Barrens Tree Frog. <http://www.state.nj.us/pinelands/infor/fact/treefrog%20JFB.pdf> and <http://www.nj.gov/dep/fgw/ensp/pdf/end-thrtened/pbtreefrog.pdf>.
- Red-shouldered Hawk. <www.nj.gov/dep/fgw/ensp/pdf/end-thrtened/redshldhwk.pdf>.
- Total Maximum Daily Loads (TMDL) for Fecal Coliform to Address 31 Streams in the Atlantic Water Region. NJDEP, 29 September 2003.
- Total Maximum Daily Loads (TMDL) for Total Phosphorus to Address Two Stream Segments in the Manasquan River Watershed, Monmouth County, Atlantic Coastal Water Region. NJDEP, 23 September 2005.
- Vernal Pool Project <www.dbcrssa.rutgers.edu/ims/vernal>.
- Wildlife Management Areas <http://www.nj.gov/dep/fgw/wmaland.htm>. January, 2008.

To learn more about a contaminated site, contact one of the lead agencies overseeing the case or visit the web site: <http://www.state.nj.us/dep/srp/>. Site Remediation and Waste Management, formerly known as the Site Remediation Program, is a program unit within NJDEP that provides financial aid and technical guidance in cleaning up the state's more serious contaminated sites that pose a danger to human health and the environment. SRWM maintains an inventory of 38,000 sites, of which 25,000 require no further remediation action. The bureaus within SRWM are listed below for easy reference:

Bureau	Acronym	Telephone No.	Bureau	Acronym	Telephone No.
Contract & Fund Management	BCFM	(609) 777-0101	Operation, Maintenance & Monitoring	BOMM	(609) 984-2990
Case Management	BCM	(609) 633-1455	Southern Case Management (formerly BUST)	BSCM	(609) 292-8761
Design & Construction	BDC	(609) 984-2991	Case Assignment Section	CAS	(609) 292-2943
Emergency Response Region I	BER-I	(973) 631-6385	Initial Notice Section	INS	(609) 633-1464
Emergency Response Region II	BER-II	(609) 584-4130	Office of Brownfield Reuse	OBR	(609) 292-1251
Field Operations - Northern Field Office	BFO-N	(973) 631-6401	Office of Wellfield Remediation	OWR	(609) 984-2990
Field Operations - Southern Field Office	BFO-S	(609) 584-4150	Site Assessment	SA	(609) 584-4280
Landfill Compliance & Recycling Management	BLRM	(609) 984-6650	Cleanup Star Program	STAR	(609) 292-1251
Northern Case Management (formerly BEECRA)	BNCM	(609) 777-0899			

New Jersey State Climatologist, Office of the. Rutgers University. 2006. <http://climate.rutgers.edu/stateclim/>.

New Jersey State Development and Redevelopment Plan, The. New Jersey State Planning Commission. Adopted March 1, 2001.

New Jersey Transit. *Monmouth-Ocean-Middlesex Rail Environmental Impact Statement*. November 2002.

New Jersey Water Supply Authority (NJWSA).
- <http://www.njwsa.org>. Accessed, 23 May 2007.
- *Preservation of Critical Areas in the Manasquan River Watershed: A Technical Report to identify sensitive natural resources in need of protection in the Manasquan River Watershed.* September 2005.

Niles, L. J., M. Valent, J. Tash, and J. Myers. *New Jersey's The Landscape Project: Wildlife Habitat Mapping for Community Land–Use Planning and Endangered Species Conservation.* Project report. Endangered and Nongame Species Program, New Jersey Division of Fish and Wildlife, NJ Department of Environmental Protection, 2001.

Nutty Birdwatcher. *Eastern Forests: Pine Barrens and Pinelands*. 30 Aug. 2004 <http://www.birdnature.com/pines.html>.

Ocean County Utilities Authority (OCUA). <http://www.ocua.com>.

O'Toole, Katrina M. "Geese rule County." *Philly Burbs*. 25 December 2005 <http://www.phillyburbs.com/pb-dyn/news/112-12252005-589040.html>.

Philly Roads (and NYC Roads). *New Jersey Turnpike (I-95): Historic Overview.* 21 October 2004 <http://www.nycroads.com/roads/nj-turnpike/>.

Pine, Alan S. *Peddler to Suburbanite: The History of the Jews of Monmouth County, New Jersey : From the Colonial Period to 1980.* Deal Park, NJ: Monmouth Jewish Community Council, 1981.

Rangelands West. *Overview of the Clean Water Act.* 27 Aug. 2004 <http://ag.arizona.edu/agnic/policy/cwahome.html>.

Rutgers and New Jersey Agricultural Experiment Station. *Deer and People in New Jersey.* 14 October 2004 <http://www.deer.rutgers.edu>.

Synder, Rebecca. The Garrett Building: An Architectural Record of the Children's Preventorium Movement. <http://www.faculty.virginia.edu/blueridgesanatorium/preventorium.html>.

State of Connecticut. Department of Environmental Protection. *Learn About CT's Wildlife.* 15 Aug. 2004 <http://dep.state.ct.us/burnatr/wildlife/learn.htm>.

Stokes, Donald, and Lillian Stokes. *Stokes Nature Guides: A Guide to Bird Behavior Vol. III*. New York: Little, Brown and Company, 1989.

Stokes, Donald and Lillian Stokes. *Stokes Nature Guides: Animal Tracking and Behavior*. New York: Little, Brown and Company, 1986.

Tedrow, J.C.F. "Greensand and Greensand Soils of New Jersey: A Review." Rutgers Cooperative Extension, 2002.

Thernstrom, Stephan. Kalmyks. *Harvard Encyclopedia of American Ethnic Groups*. Cambridge, MA: Harvard University Press, 1980,

Trident Environmental Consultants. *Environmental Impact Report: Schuch Tract*. Toms River, NJ: November 2005.

Trust for Public Land (TPL). *Metedeconk Watershed Land Conservation Funding Options*. January 2003.

Tyning, Thomas F. *Stokes Nature Guides: A Guide to Amphibians and Reptiles.* Boston, MA: Little, Brown, and Company, 1990.

Union of Concerned Scientists. *Backgrounder: The Science of Biodiversity.* 26 July 2004 <http://www.ucsusa.org/global_environment/archive/page.cfm?pageID=392>.

United States Census Bureau. *Your Gateway to Census 2000*. < http://www.census.gov/main/www/ cen2000.html>.

United States Department of Agriculture.

- *Important Trees of the Eastern Forest.* Atlanta, GA: USDA, 1968.
- *A Community-based Approach to Dealing with Canada Goose Damage*. Animal Plant Health Inspection Service, September 1999.
- *Controlling Canada Goose Damage*. Animal Plant Health Inspection Service, September 1999.
- *New Jersey Annual Precipitation*. Natural Resources Conservation Service, Apr. 1998. 5 Aug. 2004 <ftp://ftp.ftw.nrcs.usda.gov/pub/ams/prism/ maps/nj.pdf>.

United States Department of Agriculture, Natural Resources Conservation Service.

- *Environmental Quality Incentives Program.* , <www.nrcs.usda.gov/programs/eqip/>.
- *Soil Survey of Gloucester County, New Jersey*. Soil Conservation Service, in cooperation with N.J. Agricultural Experiment Station, Cook College, Rutgers, the State University, June 1962.
- New Jersey Soils of Statewide Importance. September 24, 1990. <www.nj.nrcs.usda.gov/technical/soils/njfarmindex.html>.
- Soil Quality Indicators: pH. January 1989.

- *Soil Survey of Monmouth County New Jersey*. USDA-NRCS, 1989.
- Water Quality Assessment and Monitoring Guidance Documents. <http://www.wcc.nrcs.usda.gov/wqam/wqam-docs.html>.
- Web Soil Survey. <http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx>. Accessed, 6 July 2007.

United States Environmental Protection Agency.
- National Priorities List Sites in New Jersey. Accessed 29 June 2007. <http://www.epa.gov/superfund/sites/npl/nj.htm>.

United States Geological Survey (USGS).
- Streamflow Measurements for the Nation. <http://nwis.waterdata.usgs.gov/nwis/measurement>. Accessed, 21 May 2007.
- Water Quality Samples for USA. <http://nwis.waterdata.usgs.gov/usa/nwis/qwdata>. Accessed, 21 May 2007.
- Water Resources. Site Information for the Nation. <http://waterdata.usgs.gov/nwis/si>.
- *Water Resources Investigations Report 90-4142*. West Trenton, NJ, 1991.

Watt, Martha K. *A Hydrologic Primer for New Jersey Watershed Management*. West Trenton, NJ: US Geological Survey, Water-Resources Investigation Report 00-4140. Available at <http//nj.usgs.gov/publications/WRIR/00–4140.pdf>.

Wernert, Susan, et.al., eds. *Reader's Digest: North American Wildlife.* Pleasantville, NY: Reader's Digest, 1982.

Widmer, Kemble. *The New Jersey Historical Series, Vol. 19: The Geology and Geography of New Jersey.* Princeton, NJ: D. Van Nostrand Company, 1964.

Winter, Thomas, et al. *Ground Water and Surface Water: A Single Resource*. Denver, CO: US Geological Survey, 1998.

Woolley, Jerry and Jeff Heim. The Point Pleasant Canal. Point Pleasant Historical Society. <http://home.att.net/~ppbhist/time_canal.htm>.

The Xerces Society. *Why are Invertebrates Important?* 30 Aug. 2004 <http://xerces.org/why_conserve_inverts.htm>

Zapecza, Otto S. *Hydrogeologic Framework of the New Jersey Coastal Plain*. US Geological Survey Professional Paper 1404-B. Washington D.C: United States Government Printing Office, 1989.

Zim, Herbert and Alexander Martin. *Trees: A Guide to Familiar American Trees.* New York: Simon and Schuster, 1956.

CITATIONS

P.L. 93-205. *Federal Endangered Species Act of 1973 (ESA).*

P.L. 95-217. *Federal Clean Water Act.*

P.L. 96-510. *Federal Comprehensive, Environmental Response, Compensations and Liability Act of 1980 (CERCLA).*

P.L. 105-312. *Federal Migratory Bird Treaty Act of 1918.*

N.J.S.A. 13:1B-15.151 et seq. *New Jersey Endangered Plant Species Act.*

N.J.S.A. 23:2A et seq. *New Jersey Endangered and Nongame Species Conservation Act of 1973.*

N.J.S.A. 58:10A-1 et seq. *New Jersey Water Pollution Control Act.*

N.J.S.A 58:16A-50 et seq. *New Jersey Flood Hazard Area Control Act.*

N.J.A.C. 7:7A et seq. *New Jersey Freshwater Wetlands Protection Act Rules.*

N.J.A.C 7:8 et seq. *Stormwater Management Rules*

N.J.A.C. 7:9B-1.12. *New Jersey Surface Water Quality Standards.*

N.J.A.C. 7:9E. *Private Well Testing Act*

N.J.A.C. 7:13 et seq. *New Jersey Flood Hazard Area Control.*

N.J.A.C. 7:14A-2 et seq. *New Jersey Pollution Discharge Elimination System – General Program Requirements.*

N.J.A.C 7:15 et seq. *Water Quality Management Planning Rule*

N.J.A.C. 10:1B. *Open Public Records Act of 2002*

DELAWARE VALLEY REGIONAL PLANNING COMMISSION

Publication Abstract

Title: ***Environmental Resource Inventory of the Conservation Element of the Howell Township Master Plan***

Date Published: **November 2008**
Publication No. **08072**

Geographic Area Covered: Howell Township, Monmouth, New Jersey

Key Words: Agriculture, air, aquifers, biodiversity, biological resources, built environment, climate, conservation, development, endangered species, environmental issues, environmental resource inventory, floodplains, forests, grasslands, groundwater, habitat, Howell Township, land preservation, Landscape Project, Manasquan River, master planning, Metedeconk River, natural resources, open space, population, soils, steep slopes, topography, U.S. Census, vernal pools, water quality, watersheds, wetlands.

ABSTRACT

This publication documents the natural and community resources of Howell Township, Monmouth County, New Jersey. The natural resource information includes descriptions, tables, and maps of: land use; soils; drinking water, aquifers, and wells; surface waters, including watersheds, streams, lakes, wetlands, and floodplains; impacts on water resources and surface water quality; impervious coverage; vegetation, including wetlands, forests, and grasslands; animal communities; threatened and endangered species; deer management; Heritage Priority Sites; and known contaminated sites. Community resources that are briefly described include population, transportation, township utilities and services, and protected open space. A short history of the community is also included.

For More Information Contact:

Howell Township Environmental Commission
251 Preventorium Road
P.O. Box 580
Howell, New Jersey 07731
www.twp.howell.nj.us
732.938.4500 ext: 2370

DVRPC
190 North Independence West
8th Floor, ACP Building
Philadelphia, PA 19106-1520
www.dvrpc.org
215-592-1800

Alison Hastings, PP/AICP
Senior Environmental Planner