BIRDSALL ENGINEERING, INC.
CONSULTING & ENVIRONMENTAL ENGINEERS

A BIRDSALL SERVICES GROUP COMPANY

Job No. 507957440001

MUNICIPAL STORMWATER MANAGEMENT PLAN

MARLBORO TOWNSHIP
MONMOUTH COUNTY, NEW JERSEY

MARLBORO PLANNING BOARD

MARCH 2006

Prepared By:

Jennifer C. Beahm, P.P., AICP
New Jersey License No. 05625

☐ 611 Industrial Way West
Eatontown, NJ 07724-2213
P 732.380.1700
F 732.380.1701

☐ 529 Route 9
Barnegat, NJ 08005-2120
P 609.698.1144
F 609.698.6814

☐ 95A Connecticut Drive
Burlington, NJ 08016
P 609.239.4378
F 609.239.4567

☐ 560 Hudson Street
Hackensack, NJ 07601
P 201.562.1500
F 201.562.1501

STORMWATER MANAGEMENT PLAN
TOWNSHIP OF MARLBORO

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF APPENDICES

1.0 INTRODUCTION

The Township of Marlboro has consulted with Birdsall Engineering, Inc. (BEI) to devise a Municipal Stormwater Management Plan (MSWMP) for the Township. This MSWMP outlines a strategy for Marlboro to alleviate the Township's stormwater management problems through the incorporation of more stringent stormwater policies within their Land Use Regulations. The creation of this MSWMP is required through N.J.A.C. 7:14A-25 (Municipal Stormwater Regulations), which were proposed in the New Jersey Registrar on January 6, 2003, and made effective on February 2, 2004. This plan also includes a model Stormwater Control Ordinance (Appendix A) that would incorporate both the goals of this plan and the new stormwater management standards into existing Township's regulations by applying the newly adopted design standards to "Major Development", which includes development or redevelopment projects that either disturb one or more acres of land, or proposes to add ¼ acre or more of impervious surface.

This plan will incorporate all of the required elements described in N.J.A.C. 7:8 Stormwater Management Rules as well as the nine planning goals that should be addressed when devising municipal level stormwater management plans (N.J.A.C. 7:8-2.2). Further, the plan addresses groundwater recharge, stormwater quantity, and stormwater quality impacts by incorporating the newly adopted stormwater design and performance standards for new development proposals. These standards are intended to minimize the adverse impact of stormwater runoff on water quality and water quantity and the loss of groundwater recharge that provides baseflow to receiving water bodies. Also, to reduce the discharge of pollutants to the maximum extent practicable and protect water quality, the plan incorporates the six control measures outlined within the Phase II New Jersey Pollutant Discharge Elimination System Stormwater Regulation Program Rules (N.J.A.C. 7:14A).

To accomplish these ends, Birdsall Engineering has completed a review of the Township's existing ordinances, the Marlboro Township Master Plan, and other planning documents to examine the extent to which nonstructural stormwater management techniques have been integrated into these documents. In addition, pursuant to N.J.A.C. 7:8 4-2, this MSWMP includes a Build Out Analysis (Appendix E), which projects future pollutant loading levels by HUC14 subwatershed, at build out, under the Township's existing zoning. Also included is a Mitigation Plan (Section 6.4) that allows Marlboro Township, in limited circumstances, to waive the strict compliance of one or more of the stormwater management design and performance standards where full compliance cannot be reasonably accommodated on site.

2.0 GOALS AND OBJECTIVES

To improve water quality, reduce the risk of flooding, and in turn improve the quality of life for residents of Marlboro, the incorporation of more stringent stormwater management techniques have been identified as a priority by both state and local level government agencies. The new stormwater management requirements and best management practices will advance the goals and objectives of both the New Jersey Department of Environmental Protection and Marlboro Township itself. A number of the goals and objectives identified within the Marlboro Master Plan would be advanced by more restrictive stormwater management standards. These objectives include:

- To secure public safety from fire, flood, panic, and other natural and man-made disasters.
- The need for local land use controls to better protect water quality in conjunction with State initiatives for improved watershed management practices.

Further, the New Jersey Department of Environmental Protection (NJDEP) has established a minimum set of goals and objectives that all municipal stormwater management plans should follow. These nine planning goals are listed below:

- Reduce flood damage, including damage to life and property;
- Minimize, to the extent practical, any increase in stormwater runoff from any new development;
- Reduce soil erosion from any development or construction project;
- Assure the adequacy of existing and proposed culverts and bridges, and other in-stream structures;
- Maintain groundwater recharge;
- Prevent, to the greatest extent feasible, an increase in nonpoint pollution;
- Maintain the integrity of stream channels for their biological functions, as well as for drainage;
- Minimize pollutants in stormwater runoff from new and existing development to restore, enhance, and maintain the chemical, physical, and biological integrity of the waters of the state, to protect public health, to safeguard fish and aquatic life and scenic and ecological values, and to enhance the domestic, municipal, recreational, industrial, and other uses of water; and
- Protect public safety through the proper design and operation of stormwater basins.

Marlboro Township is split between two New Jersey Department of Environmental Protection Watershed Management Areas (WMA's). The western portion of the Township (55% of the total land area) is included within the Lower Raritan Basin Watershed (WMA 9). The other 45% of Marlboro Township falls within the Monmouth Coastal Watershed, which is known as Watershed Management Area 12 (WMA 12). The area of WMA 12 extends from Perth Amboy to Point Pleasant Beach and includes portions of Middlesex, Monmouth and Ocean Counties. Watershed Management Areas serve a number of functions including: education and outreach activities, establishing an

issues list for the watershed, identifying Action Now projects, identifying open space acquisition priorities, establishing existing Water Quality levels and determining Target Water Quality in conjunction with the NJDEP, in order to assist and advise the Department in the development of a water budget and TMDL's for 303(d) listed segments.

This Municipal Stormwater Management Plan will incorporate the Goals and Objectives that have been established for Watershed Management Area 9 through the Raritan Basin Watershed Management Plan. The goals for the Lower Raritan Basin include:

- An effective and publicly acceptable legal and institutional structure for implementation of the watershed management plan shall be created.
- Integrate water resource related considerations into land use planning and management. All bodies governing land use will consider the environmental impacts of development on water resources on a whole-municipality and a watershed basis. Sound land use planning will protect ground water and surface water resources.
- Management of stormwater and flood damage reduction will be performed on a watershed basis in the Lower Raritan WMA.
- The open water and other wetland resources of the Lower Raritan WMA will be protected and restored to enable them to demonstrate improved functions (flood storage capacity, aquifer and ground water recharge, etc.) and ecosystem services (support of human, plant and animal communities).
- To achieve appropriate water quality goals in the Lower Raritan WMA so that ecological balance and appropriate uses of the watershed are maintained.

Source: Raritan Basin Watershed Alliance: Raritan Basin Watershed Management Plan http://www.raritanbasin.org/RBWMP_CD/index.htm Accessed March 8, 2005.

This Municipal Stormwater Management Plan will also incorporate the Goals and Objectives that have been identified for Watershed Management Area 12, which are listed below:

- Providing healthy and naturally diverse habitats to support plants and wildlife that will enrich the lives of residents;
- Maintaining safe and plentiful drinking water supplies;
- Preserving the integrity of the freshwater and tidal benthic communities that support commercial and recreational water-related uses including boating, bathing, fishing and sightseeing;
- Development and redevelopment in Area 12 will be well-planned and environmentally responsible while maintaining, enhancing and integrating the historic, cultural, scenic, recreational and open space resources that define and strengthen the unique identities of each community

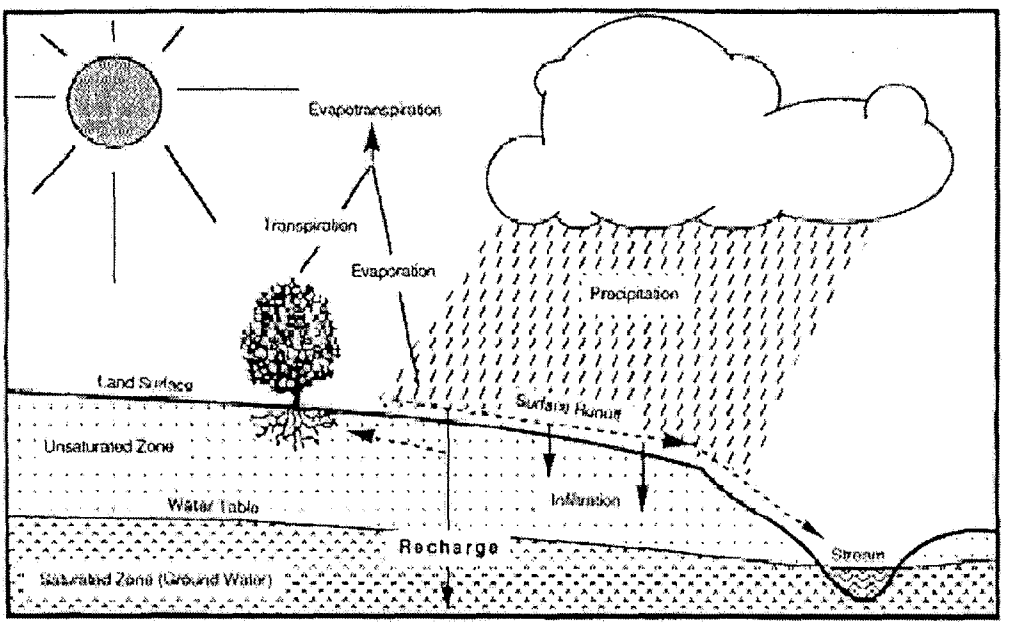
Source: Monmouth Coastal Watershed Partnerships website: http://www.shore.co.monmouth.nj.us/area12/, Accessed March 8, 2005.

To achieve these goals, this plan examines the most pressing stormwater related issues facing Marlboro, and in turn proposes possible amendments to the Township's design and performance standards to incorporate a more comprehensive code for managing stormwater. By examining the Township's history, demographics, and current conditions concerning water quality, water quantity, and flooding issues, a clearer picture can be drawn in regards to what the stormwater management issues are at this time, and what type of policy amendments should be taken to improve them. This plan also calls for additional stormwater management regulations to be adopted by the Township in order to ensure that preventative and corrective maintenance strategies have been formulated to ensure the long-term efficacy of stormwater management facilities.

3.0 EFFECTS OF STORMWATER RUNOFF

The hydrologic cycle is defined as the constant cyclical movement of water from the ground to the atmosphere and back to the ground. As illustrated by the figure below, this process includes evaporation, transpiration, evapotranspiration, condensation, transport, precipitation, infiltration, percolation, surface runoff, interflow, and groundwater flow. Land development has a dramatic effect on the natural function of this process.

GROUNDWATER RECHARGE IN THE HYDROLOGIC CYCLE



Source: New Jersey Geological Survey Report GSR-32.

Prior to development, native vegetation acts to both intercept falling precipitation, and return water that has infiltrated into the ground through evapotranspiration. By clearing vegetation, compacting soil, and replacing it with impervious cover, lawns, or landscaping, the development process serves to reduce the natural rate of water that may infiltrate into the soil, and in turn evapotranspiration.

In developed areas, following a precipitation event, both the volume and the rate of stormwater runoff will increase in proportion to the amount of additional impervious cover generated through a given development. Often streets, gutters, channels and storm sewers, are the tools with which this additional stormwater is carried to local waterways. These man-made stormwater management tools transport water more quickly which causes the stormwater flows in downstream waterways to peak faster and higher than would be produced in a natural state. The increased peak flow during and shortly after a precipitation event produces greater fluctuations between normal and storm flow rates, which can increase channel erosion.

Table 1: The Effect of Impervious Cover on Runoff	
Share of Land With Impervious Cover	**Share of Rainwater that Becomes Runoff**
0% (natural state)	10 %
10-20%	20%
35-50%	30%
75-100%	75-100%
Source: NJDEP *Planning for Clean Water: The Municipal Guide,* Trenton, NJ 2000.	

Not only does the development process increase the peak rate of stormwater flows, the addition of impervious cover also results in water pollution. Pollutants carried within stormwater runoff can take the form of nutrients such as nitrogen and phosphorous which encourage the growth of algae in downstream water ways, or trash and oils that accumulate on sidewalks and roadways between precipitation events. In locations where stormwater sewers discharge runoff directly into a stream, the aggregate accumulation of sediment and pollutants that are carried within it are dumped directly into local waterways. In addition to the chemical and physical contaminants, runoff from impervious systems also requires another form of pollution, heat. When rain falls on pavement that has collected heat through the day, the temperature of runoff can reach as high as 83 degrees Fahrenheit, which is sufficiently warm enough to damage sensitive plant and animal species. Table 2 below, includes a comprehensive list of the possible pollutants contained within untreated stormwater flows.

Table 2: Pollutants Carried in Stormwater
The following pollutants collected and carried in stormwater runoff can seriously degrade water quality in the community:
Nutrients- Include nitrogen and phosphorous, which plants need to grow. However, high levels can cause a health hazard in drinking water and stimulate excessive aquatic plant growth, which can ultimately lower dissolved oxygen levels in the water, causing fish and other aquatic life to smother. Algae blooms are examples of how excess nutrients pollute. Sources of excess nutrients include animal waste, fertilizers, septic systems, road salt applications and auto emissions. About half of the fertilizers applied to lawns in the New Jersey coastal zone enter streams and head to the bay and ocean.
Pathogens- Are disease causing bacteria and viruses associated with the presence of fecal matter. They affect human health directly when people contact contaminated water and consume shellfish. Sources include failing septic systems, animal waste, and boat sanitation facilities.
Sediment- Is fine particles of eroded soil or sand. Common origins are concentrated, excessive stormwater runoff from construction sites. Sediment smothers aquatic habitat, carries pollutants bound to soil particles, makes water cloudy and inhibits the breeding and movement of aquatic species.
Toxic Contaminants- Include pesticides as well as heavy metals such as copper, lead and zinc which are commonly found in old paint, tires, lawn chemicals and preservatives. They attach to sediments, resist breakdown, accumulate in organisms and represent threats to the food chain.
Debris- Consists of various items of trash, such as old tires, shopping carts and plastics. It comes from illegal dumping, street litter, and boating waste. It threatens aquatic life and detracts from recreational and aesthetic values.
Oil- Is one of the worst offenders. One gallon of oil dumped down a storm drain can create a slick up to 8 acres and may pollute up to 1 million gallons of water.
Thermal Stress- From elevated water temperatures reduces survival rates and disease resistance of valued native species and allows the spread of non-native (exotic) species. Water temperature rises because of increased pavement near streams, loss of vegetated stream buffers and stream channelization.
Source: Association of New Jersey Environmental Commissions (1998, Spring). ***ANJEC Report***

4.0 CURRENT CONDITONS

4.1 SETTING

Located in western Monmouth County and bordering Middlesex County, the Township of Marlboro is situated north of Freehold Township and Manalapan Township, and south of Aberdeen Township and the Borough of Matawan. Due to its accessibility to the employment centers of northern New Jersey and New York City, it has experienced rapid growth over the last several decades. Residential growth in particular has been very robust. Marlboro Township can be accessed by many major roads, including Routes 9, 18 and 537, and the Garden State Parkway.

4.2 DEMOGRAPHICS

The Township of Marlboro is a large, highly developed community located in western Monmouth County. The Township has a land area of 30.31 square miles, and contained 36,398 residents as of the 2000 census.

Marlboro Township has grown steadily over the last five decades. From 1960 to 2000, its population has increased at an average rate of 709 people per year. The growth in population from 27,974 people in 1990 to 36,398 people in 2000, a growth rate of 30.1% overall, placed Marlboro Township as having the second largest increase in total population within Monmouth County, which is the fourth fastest growing county in the State of New Jersey. Today, Marlboro accommodates a range of land uses including agriculture, offices, retail and service enterprises, light industrial use, and housing. Marlboro's housing stock includes estate homes scattered on large lots, post-war and recent single-family residential subdivisions, and higher density townhouses. As the population has grown, so too has the population density. In 2000, Marlboro Township had a population density of 1,189 persons per square mile (p/sm), falling short of the 1,304 p/sm Monmouth County figure, but exceeding the State population density of 1,134 p/sm.

Table 3: Marlboro Population Characteristics

Year	Population	% Change
1970	12,273	N/A
1980	17,560	43.1%
1990	27,974	59.3%
2000	36,398	30.1%
2004 (Projected)	40,118	1.0%

Source: Monmouth County Planning Board *At A Glance: Files and Data* accessed on February 24, 2005. http://www.monmouthplanning.com/AtAGlanceFiles/Marlboro%20Twp.pdf

4.3 WATERWAYS

Marlboro features numerous waterways that transect the Township. Major waterways that pass through Marlboro include: Big Brook, Gravelly Brook, Milford Brook, Matawan Creek, and Topanemus Brook. A more in depth analysis of the chemical, physical and biological health of these waterways is available in Appendix B, Appendix D, and in Section 4.4 of this report.

Marlboro Township also features less volumous brooks and tributaries that flow through the Township. Such tributaries that fall within the Deep Run Watershed have been the subject of in depth analysis conducted by Birdsall Engineering, Inc. (BEI) through the "Identification and Evaluation of Impairments Within the Deep Run Watershed" report, completed in January of 2005. The report produced a prioritized listing of impairments and proposed site-specific BMP alternatives to reduce the risk of flooding, improve water quality, control erosion and runoff, and recharge groundwater supplies.

Further, three additional watershed areas known as Yellow Brook, Barclay Brook and Big Brook will also undergo comprehensive watershed analysis studies in the near future. The studies are set to get underway immediately following an agreement between Marlboro Township and the United States Army Corps of Engineers. Although an official start date has not been set, the project schedule has been set to complete each watershed analysis within one year's time. Upon completion, these three studies will include prioritized lists of impaired locations and recommend BMP's akin to the lists prepared for the Deep Run Watershed by Birdsall Engineering, Inc.

4.4 WATER QUALITY

Changes in the Township's landscape have increased stormwater runoff volumes and pollutant loads to waterways that flow through the Township. Environmental concerns have brought about the development of studies, programs and networks intended to monitor the health of waterways and aid in determining methods to mitigate contamination in local waterways, where it is encountered. Among many programs, the New Jersey Department of Environmental Protection (NJDEP) has established an Ambient Biomonitoring Network (AMNET) to document the health of the State's waterways. There are now over 800 AMNET sites throughout the state of New Jersey. These sites are sampled for benthic macroinvertebrates by NJDEP on a five-year cycle. Streams are classified as "non-impaired", "moderately impaired", or "severely impaired" based upon a standardized inspection process. The data is used to generate a New Jersey Impairment Score (NJIS). According to these scores, the waterway is then classified as "non-impaired", "moderately impaired", or "severely impaired". These designations are determined by the following criteria:

Table 4: New Jersey Department of Environmental Protection AMNET Program Waterway Classification Criteria	
Non-Impaired	Benthic community comparable to other undisturbed streams within the region. A community characterized by a maximum taxa richness, balanced taxa groups and good representation of intolerant individuals.
Moderately Impaired	Macroinvertebrate richness is reduced, in particular EPT taxa. Taxa composition changes result in reduced community balance and intolerant taxa become absent.
Severely Impaired	A dramatic change in the benthic community has occurred. Macroinvertebrates are dominated by a few taxa that are very abundant. Tolerant taxa are the only individuals present.
Source: New Jersey Department of Environmental Protection Bureau of Freshwater and Biological Monitoring (NJDEP/BFBM): *http://www.state.nj.us/dep/wmm/bfbm/*. Accessed: March 30, 2005.	

Based on AMNET data, Big Brook ranges from non-impaired upstream to severely impaired downstream, including at the AMNET testing station located at Route 79 in Marlboro Township. Also, downstream of Marlboro in Manalapan Township, Milford Brook has been classified as moderately impaired for not attaining benthic macroinvertebrate standards. Finally, Gravelly Brook has been classified as "severely impaired" at AMNET monitoring sites located just upstream of Marlboro on Church Street in Aberdeen Township. Also, although not designated as "impaired" as it flows through Marlboro, further downstream, the Matawan Creek has been classified as severely impaired.

In addition to the AMNET data, the NJDEP and other regulatory agencies collect water quality chemical data on the streams in the state. The New Jersey Integrated Water Quality Monitoring and Assessment Report (305(b) and 303(d) (Integrated List) is required by the federal Clean Water Act to be prepared biennially and is a valuable source of water quality information. The integrated list is divided into five different sublists. The following table illustrates how those sublists were determined:

Table 5: New Jersey Integrated Water Quality Monitoring and Assessment Report (305(b) and 303(d) Integrated List) Sublist Criteria	
Sublist 1	Attaining a water quality standard and no use is threatened.
Sublist 2	Attaining some of the designated uses; no use is threatened; and insufficient or no data and information is available to determine if the remaining uses are attained or threatened.
Sublist 3	Insufficient or no data and information to determine if any designated use is attained.
Sublist 4	Impaired or threatened for one or more designated uses but does not require the development of a TMDL. (Three Categories). 1.TMDL has been completed. 2.Other enforceable pollution control requirements are reasonably expected to result in the attainment of the water quality standard in the near future. 3. Impairment is not caused by a pollutant.
Sublist 5	The water quality standard is not attained. The waterbody is impaired or threatened for one or more designated uses by a pollutant(s), and requires a TMDL.
Source: New Jersey Department of Environmental Protection: http://www.state.nj.us/dep/wmm/sgwqt/wat/integratedlist/integratedlist2004.html.Accessed March 30, 2005	

Sublist 5 of the Integrated List constitutes the list of waters impaired or threatened by pollutants, for which one or more TMDL's are needed. A Total Maximum Daily Load (TMDL) is the amount of a pollutant that can be accepted by a waterbody without causing an exceedance of water quality standards or interfering with the ability to use a waterbody for one or more of its designated uses. The allowable load is allocated to the various sources of the pollutant such as stormwater and wastewater discharges, which require a NJPDES permit to discharge, and non-point sources, which interfere with stormwater runoff from agricultural areas and residential areas, along with a margin of safety. Provisions may also be made for future sources in the form of reserve capacity. An implementation plan is developed to identify how the various sources will be reduced to the designated allocations. Implementation strategies may include improved stormwater treatment plants, adoption of ordinances, reforestation of stream corridors, retrofitting stormwater systems and other BMP's.

Big Brook, Gravelly Book, and Milford Brook were all listed on The New Jersey 2004 Integrated Water Quality Monitoring and Assessment Report (305(b) and 303(b)) issued

in June of 2004. Within Marlboro, Gravelly Brook does not attain water quality standards for several parameters: phosphorus, fecal coliform, nitrate, pH, and total suspended soils. Also, Big Brook, shortly downstream of Marlboro at Colts Neck exceeds water quality criteria for temperature, dissolved oxygen, pH, nitrate, total suspended soils, unionized ammonia, fecal coliform, and phosphorus. Consequently, these said rivers are "impaired" waterways. When more than one pollutant impairs an individual waterway, said waterway will remain on Sublist 5 until TMDL's for all pollutants are established and approved by the USEPA. Also included within the report within Sublist 3 is the Milford Brook at Pease Road in Manalapan, as NJDEP AMNET testing indicated that the waterway failed to meet established water quality criteria for benthic macroinvertebrates.

The east-central portions of Marlboro Township falls within the area of the Swimming River Reservoir Watershed, which is a major potable water supply facility for Monmouth County. The precipitation that falls on land within the watershed eventually finds its way to the reservoir through stormwater runoff and natural base flow. Further, as both the Willow Brook and Big Brook flow into the Swimming River Reservoir, which is now a Category One waterbody, these waters are now subject to more stringent stormwater management regulations pursuant N.J.A.C. 7:9B. These regulations require 300-foot buffers and additional best management practice techniques to be incorporated into new development applications that fall within these Special Resource Protection Area (SRPA), HUC-14 boundary areas. As illustrated through Figure 2-Wetlands Map, significant areas within the eastern half of Marlboro Township are already subject to these more stringent regulations.

Marlboro Township, the Lower Raritan Basin, and the Monmouth Watershed in general will continue to experience rapid development. Growth in Monmouth County as a whole has continued at a robust pace. However, according to the Monmouth County Planning Board, Marlboro Township (4,325), and neighboring Manalapan Township (4,335) ranked number one and two in all of Monmouth County for the number of new building permits issued between 1990 and 2003. As land development and in turn impervious cover continues to increase, stormwater related issues such as maintaining water quality, reducing impervious cover, and improving groundwater recharge will become even more crucial in order to attain the goals and objectives of both state and local governmental agencies.

4.5 WATER QUANTITY

Marlboro Township has exhibited water quantity problems including flooding, steam bank erosions, and diminished base flow in streams. Many of the culverts associated with road crossings in the Township are undersized. The size and design of culverts has been cited as a major contributor to both the frequency and the severity of stormwater flow flooding, which is experienced in several locations throughout the Township. The Identification and Evaluation of Impairments, which was completed as part of the Deep Run Watershed Report lists under sized culverts and provides a prioritized list of impaired sites and suggested BMP's for areas throughout the Deep Run watershed.

The continually expanding amount of impervious surfaces in the Township has decreased groundwater recharge, and in turn contributed to the stormwater management issues that exist in Marlboro. The average annual groundwater recharge rates are shown graphically in Figure 5- Ground Water Recharge Areas. New Jersey Geologic Survey (NJGS) estimates groundwater recharge using methodology from NJGS Report GSR-32 "A Method for Evaluation of Ground-Water-Recharge Areas in New Jersey". Land-use/land-cover, soil and municipality-based climatic data were combined and used to produce an estimate of ground-water recharge in inches/year. Recharge was then ranked by volume (billions of gallons/year) using natural breaks in the percentage of total volume.

Wellhead protection areas, also required as part of the MSWMP, are illustrated in Figure 6-Wellhead Protection Areas. According to the NJDEP, "A Well Head Protection Area (WHPA) in New Jersey is a map area calculated around a Public Community Water Supply (PCWS) well that delineates the horizontal extent of ground water captured by a well pumping at a specific rate over a two, five, and twelve-year period of time for unconfined wells. ...The confined wells have a fifty foot radius delineated around each well serving as the well head protection area to be controlled by the water purveyor in accordance with Safe Drinking Water Regulations" (see NJAC 7:10-11.7(b) 1). Well Head Protection Area delineations are conducted in response to the Safe Drinking Water Act Amendments of 1986 and 1996 as part of the Source Water Area Protection Program (SWAP). The delineations are the first step in defining the sources of water to a public supply well. Within these areas, potential contamination will be assessed and appropriate monitoring will be undertaken as subsequent phases of the NJDEP SWAP program.

With respect to potable water supplies, the Bureau of Safe Drinking Waters Water Supply Administration within the New Jersey Department of Environmental Protection administers the Source Water Assessment Program (SWAP). According to the 2004 Source Water Assessment Report for the Township of Marlboro, residents receive potable water from four water supply entities: Marlboro Township Municipal Utilities Authority (MTMUA), Gordon's Corner Water Department, Marlboro Psychiatric Hospital, and Matawan Borough Water Department.

The first, the MTMUA, is a public community water system consisting of four wells, one purchased groundwater source, and one purchased surface water source. The systems ground water sources are tapped from the middle Potomac-Raritan-Magothy aquifer. Surface water is purchased from either Middlesex Water Company, or New Jersey American Water Company-Monmouth. Secondly, Marlboro Psychiatric Hospital is a public community water system consisting of three wells. The systems source water is drawn from the middle Potomac-Raritan-Magothy aquifer, the upper Potomac-Raritan-Magothy aquifer, or the Englishtown aquifer system.

Gordon's Corner Water Department serves approximately 3,500 customers in the southern sections of Marlboro Township with potable water. The Gordon's Corner community water system consists of nine wells, three purchased groundwater sources, and one purchased surface water source. As of the 2004 SWAP report, the companies 9 wells equaled a total capacity of 6.84 MGD. The systems source water is tapped from the

following aquifers: middle Potomac-Raritan-Magothy aquifer, upper Potomac-Raritan-Magothy aquifer. The system also purchases water from the following water systems: Freehold MUA, Marlboro MUA, Marlboro Water Department, and Matchaponix Water Supply.

The Marlboro Psychiatric Hospital is also a public community water system consisting of 3 wells that draw from the middle Potomac-Raritan-Magothy aquifer, the upper Potomac-Raritan-Magothy aquifer, and the Englishtown aquifer system. The hospital does not currently purchase water from any other public supplier.

The final public water supplier that serves residents of Marlboro is the Matawan Borough Water Department. This water system consists of two wells, three purchased groundwater sources, and one purchased surface water source. The system's source water comes from the upper Potomac-Raritan-Magothy aquifer. The system also purchases water from the following water systems: Marlboro MUA, Aberdeen MUA, and New Jersey American Water Company-Monmouth System.

In addition, independent water-quality laboratories regularly test water samples from around the Township. The results of these water tests show no contaminants present that contain maximum contaminants levels (MCL's), as established by Federal and NJ State government agencies. Under Federal law, all water users now receive an annual report on the quality of their drinking water, listing only the contaminants that are detected in the water.

4.6 FLOODING & PROPOSED SOLUTIONS

To inform both public and private land use decision makers of areas that are subject to flooding, the Federal Emergency Management Agency has completed Flood Insurance Rate Maps (FIRM) for Marlboro Township. Wetlands, and low relief areas immediately along the banks of Willow Brook, Gravelly Brook, Matawan Creek, Deep Run, Big Brook, and Tepehemus Brook have all been designated as an "A Flood Zone" by the FIRM maps. The areas contained within an "A Flood Zone" designation represents that they have been found to lie within the 100-year floodplain with the base flood elevation determined. Each of these points, along with its corresponding base flood elevation is listed below in Table 6:

Table 6: Elevation Reference Marks Within Marlboro Township	
Height	**Location**
286.69 ft.	P.K. nail at the intersection of Reids Hill and Nolan Roads. Established by Quinn & Associates.
178.98 ft.	P.K. nail at the intersection of Pleasant Valley and Igoe Roads. Established by Quinn & Associates.
86.75 ft.	P.K. nail at the intersection of Greenwood and Texas Roads. Established by Quinn & Associates.
121.59 ft.	Spike in pole no. JC-306-MO on northeast corner of the intersection of U.S. Highway 9 and Sandburg Drive. Established by Quinn & Associates.
118.62 ft.	Spike in pole no JC-333-MO on west side3 of U.S. Highway 9, .15 mile south of Sandburg Drive. Established by Quinn & Associates.
104.36 ft.	Spike in Guard Post on southwest corner of the intersection of U.S. Highway 9 and Clayton Road. Established by Quinn & Associates.
173.70 ft.	P.K. nail in pole no. F32-2 at the intersection of Hobart Street and State Highway 79. Established by Quinn & Associates.
117.79 ft.	P.K. nail at the intersection of Wendy Lane and School Road East. Established by Quinn & Associates.
130.40 ft.	P.K. nail 75 feet east of intersection of Oak Lane and School Road East. Established by Quinn & Associates.
Source: FEMA *Flood Insurance Rate Map (FIRM)—Marlboro Township, Monmouth County, New Jersey. Revised: April 9, 1982.*	

Large portions of the Township experience flooding on a regular basis. These flooding conditions are due at least in part to an inadequate stormwater infrastructure. Historic roads, which were constructed before modern design standards and regulatory oversight bisect expansive wetland/riparian corridors with relatively few opportunities for passing stormwater flows. These roadways include Tennent Road, Texas Road, Spring Valley Road, and Brown Road near the Marlboro Summit development. Many of these locations experience persistent year round flooding. Improving the persistent flooding issues in town will not only require the enforcement of more rigorous stormwater management regulations on new development, but also require retrofitting and improving the existing stormwater management infrastructure within watersheds that exhibit excessive siltation of streambeds, which exacerbates the threat of flooding.

Marlboro is continuously working to correct existing areas of flooding throughout the Township. The Department of Public Works routinely vacuums inlets prone to flooding and clears away fallen leaves during the autumn months. Further, each year the Township may include the most pressing drainage improvements as part of their Capital Improvement Program. In addition to these provisions, as the comprehensive watershed studies are being completed by the USACE, the Township Engineer will work with the Director of Public Works and the Road Department to develop a comprehensive list of locations in Marlboro which are prone to flooding. This list will be prioritized and mitigative solutions for each location will be listed within Marlboro's Mitigation Plan.

5.0 STORMWATER MANAGEMENT

5.1 INFRASTRUCTURE

Marlboro Township receives almost 46 inches of rain in an average year. To manage the public risk that flooding imposes on residents, a substantial stormwater management system has been developed. As illustrated earlier through Table 1, both the amount, and condition of the stormwater that finds its way into local waterways is in large part determined by the amount of impervious cover the land contains. With less absorption of rainwater into the ground, the increased volume of stormwater runoff promotes erosion, damages stream banks, and in turn dumps sediment into streambeds.

N.J.A.C. 7:8 spells out guidelines for how to manage stormwater more effectively and also how to incorporate best management practices into the planning stages of project design. These standards now require stormwater detention capacity to hold and slowly release the runoff from storms that have a likelihood of occurring once every two, ten and one hundred years. Some sites may be able to achieve these standards through vegetative swales, buffers, and landscaping to control non-point source pollution. Other sites may require the building of a structural stormwater management facility. In situations where the development of structural stormwater facilities is necessary, the NJDEP's Best Management Practice Manual should be consulted as it outlines alternatives and strategies to incorporate Best Management Practices into a projects site design. Possible alternatives include surface structures such as Infiltration Basins, Vegetative Filters, and Pervious Paving Systems as well as subsurface measures such as Sand Filters. These BMP's are strongly encouraged to be incorporated into the Township's existing stormwater management infrastructure to enhance groundwater recharge, and reduce the velocity and amount of runoff that originates on site; thus improving the quality and reducing the quantity of stormwater that originates within Marlboro.

5.2 STORM DRAINS

Marlboro Township has an annual Capital Improvement Program through which infrastructure improvements are designed and constructed. The construction or reconstruction of drainage best management practices, and stormwater management improvements within the Township are included in this program.

Further, to inform the public of the presence of storm drains, Marlboro has initiated a storm drain labeling program. The Township's Public Works Department will label all storm drain inlets that are along municipal streets with sidewalks, and all storm drain inlets within plazas, parking areas, or maintenance yards that are operated by the Township. Most storm drain inlet labels will be plastic, and applied using adhesive. However, in some case where the durability of plastic labels is a concern, some drains will be painted using pre-cast labels. Through the Township's annual catch basin cleaning program, the labels will be checked to ensure that they are still visible, and those labels that are no longer visible will be replaced as soon as possible. Marlboro Township

will label a minimum of 50% of the storm drain inlets by April of 2007 and label all remaining storm drain inlets by April of 2009.

Marlboro has also initiated programs to more effectively maintain and manage its existing stormwater infrastructure. The Township initiated an outfall pipe mapping program in July of 2004. The Engineering Department is using a GPS unit to determine the location of the end of all outfall pipes operated by the Township. For mapping purposes, the Township has been divided into two sectors of outfall point locations. Sector I is the area south of Route 520, and Sector II is the area north of Route 520. Sector I will be mapped by the end of 2006, and Sector II will be mapped by April of 2009. As of February of 2005, 162 outfall pipes have been located in Sector I. Once all outfall pipe locations have been identified, a map drawn to tax map scale will be developed using alphanumeric identifiers to illustrate the outfall locations.

Those outfall pipes for which scouring had been detected and addressed in the past should be inspected annually thereafter to ensure that the associated stabilization projects were successful. Once it is determined that the scouring repairs have adequately mitigated any subsequent scouring, those outfalls will again be inspected once during each five year permit cycle. In addition, if the Township is able to locate the illicit connection (and the connection is within Marlboro) the responsible party will be notified immediately and a citation will be issued if the connection is not corrected or removed within six (6) months of discovery. If an illicit connection is found to originate from another public entity, Marlboro Township will report the illicit connection to the Department and also notify the municipality from which it appears to originate.

Further, Marlboro Township will implement a stormwater facility maintenance program to insure that all stormwater facilities operated by the Township are functioning properly. In April of 2005, the Township initiated an annual catch basin cleaning program to maintain the function and efficiency of these facilities. Due to the very large number of catch basis (approximately 4,000) in Marlboro, the Township is currently examining the feasibility of hiring additional staff in order to clean each catch basin facility on a yearly basis. However, at the moment the Department of Public Works will be inspecting and/or cleaning at least 400 catch basins each year. All catch basins will be inspected yearly, even if they were found to be "clean" during the previous inspection. At the time of cleaning, the catch basins will also be inspected for proper function, and maintenance will be scheduled for those catch basins that are in disrepair. The annual catch basin cleaning program was initiated in April 2005.

Marlboro Township will also investigate the storm drains for illicit connections and will check outfall pipes for signs of scouring. The Township of Marlboro will begin the initial physical inspection of all outfall pipes within 18 months of the EDPA (October 1,2005), and will complete the initial physical inspection of all outfall pipes within 60 months of the EDPA (April 2009). The Township will use the NJ Department of Environmental Protection (NJDEP) Illicit Connection Inspection Report Form to conduct these inspections, and each of these forms will be kept within the appropriate SPPP records. Outfall pipes that are found to have dry weather flow or evidence of an intermittent non-

stormwater flow will be investigated to locate the illicit connection. If the Township is able to locate the illicit connection (and the connection is located within Marlboro), the responsible party will be cited for being in violation of the Township's Illicit Connection Ordinance, and the connection will be eliminated immediately. If after investigation the source is not able to be located, a Closeout Investigation Form will be sent along with Marlboro's Annual Inspection and Recertification. If an illicit connection is found to originate from another public entity, the Township of Marlboro will report the illicit connection to the NJDEP.

5.3 STORMWATER BASINS

Most of the stormwater management system within Marlboro Township relies on storm drains. However, there are two types of stormwater basins and both are present in Marlboro. First, "detention basins", which are designed to stay dry between storm events, detain stormwater for a period of time, while releasing water at a slow and controlled rate. A second type of basin that is designed to manage stormwater flows is a "retention basin", which is designed to stay wet by retaining a permanent pool so as to mimic a natural pond or lake. Over the past quarter century, as the number of subdivisions have multiplied in the Township, so to have the number of stormwater basins. Many of the existing basins in Marlboro are suited to be retrofitted to accommodate more volume, or to improve the quality of stormwater that is dispended into the basin. Due to their potential to improve the quality and manage the quantity of stormwater that enters the basin, the retrofitting of existing stormwater basins have been identified by the Township as a priority for potential mitigation projects, and are identified as such within the Township's Mitigation Plan, which is included as Section 6.4 of this report.

Together, these coordinated stormwater basin operation and maintenance programs will enable Marlboro to slowly improve the way stormwater is managed in the Township. Through mapping, maintenance, and retrofitting of the Township's existing stormwater infrastructure, Marlboro will slowly begin to alleviate the threat of flooding, protect potable water supplies, and improve the quality of stormwater that enters local waterways.

5.4 WATERSHED

Marlboro Township is split between two New Jersey Department of Environmental Protection Watershed Management Areas (WMA's). The western portion of the Township (55% of the total land area) is included within the Lower Raritan Basin Watershed (WMA 9). The Other 45% of Marlboro Township falls within the Monmouth Coastal Watershed, which is known as Watershed Management Area 12 (WMA 12). This Watershed Management Area extends from Perth Amboy to Point Pleasant Beach and includes portions of Middlesex, Monmouth and Ocean Counties.

Within this larger watershed network several sub watersheds exist within Marlboro. As noted earlier, the Deep Run Watershed drains approximately 8.9 square miles or 29% of the lands within Marlboro Township. Further, the U.S. Army Corps of Engineers have divided the remaining portions of the Township into three additional areas, which are

referred to as Yellow Brook, Barclay Brook and Big Brook. These three watershed areas will be the subject of three separate studies conducted by the U.S. Army Corps of Engineers to asses the extent and impact of impairments within these watersheds and remediate them in order to improve stormwater management and reduce the risk of flooding.

6.0 DESIGN AND PERFORMANCE STANDARDS

Section 84-104 of the Township's Zoning Code/Land Use Regulations lists the current Stormwater Management Regulations. These regulations set forth standards to protect water quality, water quantity, and detention facilities maintenance and repair. The Township has also developed a Stormwater Impact and Facilities Improvement Fund.

Also, the Township has adopted stream corridor preservation restrictions on lands owned by the Township of Marlboro. The restrictions apply to areas within the Township's Stream Corridor Preservation District, which was added to Marlboro's existing zoning designations in September of 1993. The purpose of the Stream Corridor Preservation District restrictions are as follows:

- Improve the management, care and preservation of waterways and water resources in the Township of Marlboro.
- Protect significant ecological components of Stream Corridors including, but not limited to, floodplains, woodlands, steep slopes, wildlife and plant life habitats within stream corridors to prevent flood related damage.
- Complement existing Federal, State, Regional, County and Municipal Stream Corridor and flood hazard protection, management regulations and plans.
- Coordinate the regulation of development within Stream Corridors in a manner consistent with the Township's other regulatory approaches regarding environmentally sensitive areas.
- Reduce the amount of nutrients, sediment, organic matter, pesticides and other harmful substances that reach waterways and subsurface and surface water bodies by using scientifically proven processes, including, but not limited to, filtration, deposition, absorption, adsorption, plant uptake, biodegradation, denitrification and any and all other means now or hereinafter devised and by improving infiltration, encouraging sheet flow and stabilizing concentrated flows.
- Regulate land use and development within the Township so that such uses are consistent with the intent of this section and the regulations promulgated herein and generally accepted preservation practices.
- Preserve natural, scenic and recreation areas within and adjacent to streams and waterways throughout the Township of Marlboro.
- Support the water resource policies of the New Jersey State Development and Redevelopment Plan.
- Advance the purposes of the New Jersey Municipal Land Use Law with particular emphases on those items set forth in N.J.S.A. 40:55D-2(a)(b)(d)(i) and (j).
- Protect natural drainage features.
- Aid in the reduction of flooding.

- Reduce development impacts on water quality.
- Protect the rights of others within the same waterway areas from the adverse effects of improper stream corridor development.
- Provide for potential recreation and wildlife migration corridors throughout the Township for the health, welfare and benefit of the citizens of the Township of Marlboro, County of Monmouth and State of New Jersey.

Also, The Conservation Plan element of the Township's most recent Master Plan focuses on the necessity of stream corridor greenways as a tool to preserve wildlife habitat and improve water quality. As streamside buffer zones have been shown to be effective in reducing the pollutants that are carried overland by stormwater, to help protect stream corridors, control flooding, and protect water quality, the conservation element proposes the establishment of a "Greenways Plan" along waterways within the Township. Further, to protect water quality within the Swimming River Reservoir, sections §84-49.3 and §84-49.2 (Stream Corridor Preservation Districts) were added to Marlboro Township's Land Development Regulations.

To minimize the adverse impact of stormwater runoff on water quality, water quantity and the loss of groundwater recharge in receiving water bodies, the Township will adopt design and performance standards that comply with the stormwater management measures as presented in N.J.A.C. 7:8. The design and performance standards include amended language for the inclusion of maintenance requirements, and safety standards consistent with N.J.A.C. 7:8-6. The ordinances will be submitted to the County for review and approval within 24 months of the Effective Date of Permit Authorization (EDPA).

Further, by amending their current Land Use Regulations, it is the intention of the Township of Marlboro to incorporate both structural and nonstructural stormwater management strategies as presented in N.J.A.C. 7:8-5 to the maximum extent practicable. Said regulations address erosion control, groundwater recharge, runoff quantity standards, stormwater runoff quality standards, standards for calculating stormwater runoff and groundwater recharge, structural stormwater management standards, and maintenance requirements, as stated above. The major development must meet the established design and performance standards set forth in the Soil Erosion and Sediment Control Act.

Major developments must also meet one of two standards for groundwater recharge (N.J.A.C. 7:8-5.4(a)2.): (1) maintain 100 percent of the average annual pre-construction groundwater recharge volume for the site or (2) infiltrate the increase in the stormwater runoff volume from pre-construction to post-construction for the two-year storm. For water quality (N.J.A.C. 7:8-5.5), stormwater management measures shall be designed to reduce the post-construction load of total suspended solids (TSS) in the stormwater runoff generated by the water quality design storm by 80 percent of the anticipated load from the major development.

To control stormwater runoff quantity impacts (N.J.A.C. 7:8-5.4 3.), a major development must meet one of three design standards: (1) demonstrate at no point in time that the post-construction runoff hydrograph exceed the pre-construction runoff hydrograph, (2) demonstrate there is no increase, as compared to the pre-construction condition, in the peak runoff rates of stormwater leaving the site for the 2, 10, 100-year storm event and that the increased volume or change in timing of stormwater runoff will not increase flood damage at or downstream of the site, and (3) demonstrate the postconstruction peak runoff rates for the 2, 10 and 100-year storm events are 50, 75 and 80 percent, respectively, of the pre-construction runoff rates. However, for stormwater water runoff quantity requirement (3), stream encroachment standards (N.J.A.C. 7:13-2.8) will require for the 100-year storm event 75 percent of the pre-construction peak runoff rates. Prior to adoption, these ordinances will all be submitted to the Monmouth County Planning Board for review and approval within 24 months of the EDPA.

The second set of rules is the Phase II New Jersey Pollutant Discharge Elimination System Stormwater Regulation Program Rules (N.J.A.C. 7:14A). These Rules are intended to address and reduce pollutants associated with existing stormwater runoff. The Rules establish a regulatory program for existing stormwater discharges as required under the Federal Clean Water Act. These rules govern the issuance of permits to entities that own or operate small municipal separate storm sewer systems, known as MS4s. Under this program permits must be secured by municipalities, certain public complexes such as universities and hospitals, and State, interstate and Federal agencies that operate or maintain highways. The permit program establishes the Statewide Basic Requirements that must be implemented to reduce nonpoint source pollutant loads from these sources. The Statewide Basic Requirements include measures such as: the adoption of ordinances (litter control, pet waste, wildlife feeding, proper waste disposal, etc.); the development of a municipal stormwater management plan and implementing ordinance(s); requiring certain maintenance activities (such as street sweeping and catch basin cleaning); locating discharge points and stenciling catch basins; and a public education component.

Owners or operators of MS4s would be required to develop and implement a stormwater management program designed to reduce the discharge of pollutants to the maximum extent practicable and protect water quality.

Control measures are expected to include, at a minimum, the following components:

- Public education and outreach
- Public involvement and participation
- Illicit discharge detection and elimination
- Construction site storm water runoff control
- Post-construction storm water management in new development and redevelopment
- Pollution prevention/good housekeeping for municipal operations

6.1 IMPLEMENTING NON-STRUCTURAL STORMWATER MANAGEMENT STRATEGIES

The implementation of non-structural Best Management Practices are strongly encouraged to be added to the Township's existing development regulations and applied to all new site design proposals. Whenever possible, the following nine strategies should be incorporated into site design:

- Protect areas that provide water quality benefits or areas particularly susceptible to erosion and sediment loss;
- Minimize impervious surfaces and break up or disconnect the flow of runoff over impervious surfaces;
- Maximize the protection of natural drainage features and vegetation;
- Minimize the decrease in the "time of concentration" from pre-construction to post construction. "Time of Concentration" is defined as the time it takes for runoff to travel from the hydraulically most distant point of the drainage area to the point of interest within a watershed;
- Minimize land disturbance including clearing and grading;
- Minimize soil compaction;
- Provide low-maintenance landscaping that encourages retention and planting of native vegetation and minimizes the use of lawns, fertilizers and pesticides;
- Provide vegetated open-channel conveyance systems discharging into and through stable vegetated areas; and
- Provide other source controls to prevent or minimize the use or exposure of pollutants at the site in order to prevent or minimize the release of those pollutants into stormwater runoff. These source controls include, but are not limited to:

    i. Site design features that help to prevent accumulation of trash and debris in drainage systems;

    ii. Site design features that help to prevent discharge of trash and debris from drainage systems;

    iii. Site design features that help to prevent and/or contain spills or other harmful accumulations of pollutants at industrial or commercial developments; and

    iv. When establishing vegetation after land disturbance, applying fertilizer in accordance with the requirements established under the Soil Erosion and Sediment Control Act N.J.S.A. 4:24-39 et seq., and implementing rules.

Also, Chapter 84 of the Township's Code, entitled "Land Use" was reviewed to evaluate the extent to which non-structural stormwater management techniques have been implemented into the site deign of a proposed development. This review included, but was not limited to existing provisions for Curbs and Gutters, Driveways and Accessways,

Off-Street Parking and Loading, Streets, and Sidewalks. A summary of the of the pertinent provisions is presented below:

Section 37 (Flood Damage Prevention) this section promotes the public health, safety and general welfare by minimizing the threat of both public and private losses due to flood conditions. To accomplish these goals, the ordinance restricts the type of uses, and order that the uses that are constructed be protected against flooding conditions.

Section 35 (Cluster Provisions) indicates that cluster development alternatives exist within the following zones LC, R-60, R-60, and R-30. The cluster option is an excellent tool for reducing the impervious cover imposed by roads and driveways. It also minimizes the disturbance of large tracts of land, reduces lot size, and protects large areas of environmentally sensitive land, while providing additional open space. Although the ordinance does not provide a specific percentage of the cluster development that must be dedicated to open space, it does stipulate that each open space area shall contain a minimum of two contiguous acres, and also that open space areas shall not be less than twenty (20) feet in width at any location for any extended length.

Sections 60 and 61 (Off-Street Parking and Loading Regulations) These two sections address a number of areas where nonstructural stormwater management principles can be incorporated into the site design of a project. These areas include: parking requirements, driveway requirements and loading regulations. Each off-street parking space shall measure not less than ten by twenty (10 x 20) feet, exclusive of access drives and aisles, except that parallel curb parking spaces shall be nine by twenty-three (9 x 23) feet. Driveways shall have a minimum width of twelve (12) feet for one-way traffic and twenty-five (25) feet for two-way traffic for single-family residences, and a minimum width of twenty (20) feet for one-way traffic and twenty-five (25) feet for two-way traffic for all other uses. Parking areas of over 20 vehicles require landscaped islands to disconnect areas of impervious surfaces, but they don't currently contain provisions for incorporating these islands as stormwater management tools to both filter stormwater and maximize groundwater recharge. This section also outlines parking ratios adopted by the Township. In general, the existing ratios have been found to be consistent with the principles of low impact development, but considering the magnitude of the Township's flooding problems, in the future these ratios may be reduced to an even greater extent.

Section 30 (General Provisions) outlines Marlboro's Stream Corridor Preservation restrictions. These provisions, which institute a 100 foot buffer along all stream corridors apply to all lands contained in Marlboro, including, but not limited to any and all tracts of land that are the subject of an application for subdivision, site plan or any land use approvals that fall, in whole or in part, within a stream corridor and/or stream corridor buffer.

Section 133 (Erosion and Sediment Control) no major site plan or major subdivision shall be granted preliminary approval until a soil erosion and sediment control plan has been certified by the Freehold Soil Conservation District. However, the applicant may submit a soil erosion and sedimentation control plan that has been approved and certified by the

Freehold Soil Conservation District and request that it be accepted in lieu of the requirements of this section, and the approving agency shall approve, partially approve or disapprove said request.

Section 134 (Soil Removal and Redistribution) this section subjects applicants that are proposing to remove greater than hundred (100) cubic yards in excavation that takes place on any lot other than a single-family residence to receive a soil removal permit before excavation commences.

Section 128 (Shade Trees) the Township requires a minimum number of shade trees per lot to be planted in the front yard. The trees shall be planted an average of fifty (50) feet apart and four (4) feet from the sidewalk in the front lawn area. If there is no sidewalk, then these trees shall be planted eleven (11) feet inside the right-of-way line on the residence side or as otherwise designated by the Planning Board. This section also identifies particular species that are more suited for Marlboro's soils than others as red maple, sugar maple, Norway maple, honey locust, American beech, Norway spruce, white pine, eastern red cedar and Canadian hemlock are recommended, while poplar, sweet-gum, silver maple, sassafras, tulip tree, all types of willow and all evergreens are prohibited. In addition, removing existing trees from the lot or filling soil around trees on a lot shall not be permitted unless it can be shown that grading or construction requirements necessitate removal of trees, in which case these lots shall be replanted with trees to reestablish the tone of the area and to conform to adjacent lots.

Section 129 (Sidewalks) describes the sidewalk requirements for the Township. The ordinance specifies both the materials and design standards to be used when constructing sidewalks, but does not specify the zones for which they are required. The incorporation of language to require developers to design sidewalks to discharge stormwater to neighboring lawns where feasible to disconnect these impervious surfaces, or use permeable paving where appropriate is encouraged.

Section 116 (Natural features) natural features such as trees, brooks, swamps, hilltops and views shall be preserved whenever possible. On individual lots, care shall be taken to preserve selected trees in order to enhance soil stability and the landscape treatment of the area.

Section 104(Stormwater Management) this section states that dished gutters shall be permitted at any street intersection on rural and local streets and at the intersection of rural and local streets with minor collector streets and at the intersection of minor collector streets with major collector streets where the street of the lower classification is to be officially designated and signed as a stop street. In such cases, the dished gutter shall cross only the street of the lower classification. At the intersections of primary and secondary arterial streets and major collector streets, sufficient catch basins, at the discretion of the reviewing agency, shall be installed at each street intersection to avoid gutter overflow and at low points in the street grade, and dished gutters shall not be permitted

Section 105 (Environmental Impact Report) this section indicates that an environmental impact report shall accompany all applications for major subdivision and site development plans and shall provide the information needed to evaluate the effects of the proposed development upon the environment and shall include data, be distributed, reviewed and passed upon by the approving board.

Section 109 (Floodplain Regulations) this section of the ordinance aims to 1) implement the land use rules and regulations promulgated by the New Jersey Department of Environmental Protection for floodways and the flood fringe portion of a flood hazard area. 2) To discourage construction and regrading in flood hazard areas. 3) To prevent encroachments into flood hazard areas which would obstruct or constrict the area through which water must pass 4) To prevent pollution of watercourses during low or high-water periods by preventing the placing or storing of unsanitary or dangerous substances in the flood hazard areas.

As illustrated above, Marlboro has adopted a number of provisions to incorporate nonstructural stormwater management into their Land Development Regulations. However, several sections of the existing ordinance may be examined to determine if it is practicable to incorporate additional nonstructural stormwater management regulations into the Township's existing design standards. For example, the Township may consider revising its landscaping provisions to require the planting of native vegetation (which requires less fertilization and watering than non-native species) on site. Further, the Township may examine the feasibility of amending their current design standards to incorporate language encouraging vegetated open swale conveyance as opposed to standard curb and gutter conveyance. Also, whenever feasible the design standards may be amended to encourage pervious paving materials to be used in the construction of sidewalks and driveways. Also applicants should be required to disconnect impervious surfaces, where practical, to promote pollutant removal and groundwater recharge. Although, additional amendments may be made, the Township's existing provisions have been found to be compatible with N.JA.C. 7:8-5.3 (Nonstructural Stormwater Management Strategies).

In addition, Appendix B provides a model ordinance that has been provided by the NJDEP to assist municipalities in drafting stormwater control ordinances that comply with the State's newly adopted stormwater management design and performance standards. Following the adoption of this plan a new Stormwater Management Control Ordinance per the NJDEP's new Stormwater Management Rules will be prepared and adopted by Marlboro Township. A number of additional provisions relating to stormwater basin fees and maintenance, design standards, pertaining to both structural and non structural methods that must be incorporated into a projects design, safety standards for stormwater basins, and maintenance and repair fees and responsibility will all be included within the amended ordinance. Upon completion, the ordinances will then be sent to the Monmouth County Stormwater Technical Advisory Committee for review and approval within 24 months of the EDPA. A copy will also be sent to the Department of Environmental Protection at the time of submission.

6.2 IMPLEMENTING STRUCTURAL STORMWATER MANAGEMENT STRATEGIES

As mentioned earlier, the NJDEP has implemented more rigid regulations regarding the volume, rate, and quality of stormwater originating on a new development site. Some sites may be able to achieve these standards through vegetative swales, and buffers, and landscaping to control non-point source pollution. Other sites may require the building of a stormwater basin. In these cases, where the development of structural stormwater facilities is necessary, the New Jersey Department of Environmental Protection's BMP guide should be consulted. The structural BMP's utilized in low impact development concentrate on the following practices to be utilized in site development in conjunction with the non-structural methods described above:

- Bio-retention Systems – A bioretention system consists of a soil bed planted with native vegetation located above and underdrained sand layer. It can be configured either as a basin or a swale.
- Constructed Stormwater Wetlands – Constructed wetlands are wetlands systems designed to maximize the removal of pollutants from stormwater runoff through settling and both uptake and filtering by the vegetation.
- Dry Wells - A dry well is a subsurface storage facility that receives and temporarily stores stormwater runoff from roofs and structures. Discharge of the accumulated stormwater from a dry well occurs through infiltration into the surrounding soils.
- Extended Detention Basins - An extended detention basin is a facility constructed through excavation or embankments that provides temporary storage of stormwater runoff. It has an outlet structure that detains runoff inflow and allows for controlled outflow to aid in mitigating stormwater flows from development. Usually this type of structure is utilized to provide both water quantity and water quality mitigation.
- Infiltrative Basins – Infiltration Basins are similar to detention basins in that they both temporarily store stormwater runoff generated from development project. The principal outlet to this type of basin is not a constructed outlet structure, but rather the highly permeable soils allowing for infiltration into the surrounding subsoils.
- Manufactured Treatment Devices – A manufactured treatment device is a pre-fabricated stormwater treatment structure utilizing settling, filtration, absorptive materials, vortex separation, vegetative components, and/or other appropriate technology to remove pollutants from stormwater runoff.
- Pervious Paving Systems – Pervious pavement utilizes paving material which allows for stormwater to infiltrate through the pavement rather than accumulate as is the case with standard paving material. Pervious pavement utilizes void areas within the paving material to provide for this permeable feature.
- Sand Filters – A sand filter consists of a forebay and an underdrained sand bed. Runoff entering the sand filter is conveyed first through the forebay, which removes trash, debris and coarse sediments, and then infiltrates through the sand bed to an outlet pipe at the bottom of said filter.

- Vegetative Filters – A vegetative filter is an area designed to remove suspended solids and other pollutants from stormwater runoff flowing through a length of vegetation, called a vegetative filter strip. The vegetation in a filter strip can range from turf grass to woody vegetation.
- Wet Ponds - A wet pond is a facility constructed through excavation or embankments that provides both permanent and temporary storage of stormwater runoff. It has an outlet structure that creates a permanent pool and detains and attenuates runoff inflows promoting the settlement of pollutants.

Further, all structural stormwater management measures (structural BMP's) shall be designed according to the following conditions:

- They should to take into account the existing site conditions, including, for example, environmentally critical areas, wetlands; flood-prone areas; slopes; depth to seasonal high water table; soil type, permeability and texture; drainage area and drainage patterns; and the presence of solution-prone carbonate rocks (limestone).
- They should be designed to minimize maintenance, facilitate maintenance and repairs, and ensure proper functioning. Trash racks shall be installed at the intake to the outlet structure as appropriate, and shall be parallel bars with one-inch (1") spacing between the bars to the elevation of the water quality design storm. For elevations higher than the water quality design storm, the parallel bars at the outlet structure shall be spaced no greater than one-third (1/3) the width of the diameter of the orifice or one-third (1/3) the width of the weir, with a minimum spacing between bars of one-inch and a maximum spacing between bars of six inches. In addition, the design of trash racks must comply with the requirements of N.J.A.C. 7:8-7.D.
- They should be designed, constructed, and installed to be strong, durable, and corrosion resistant. Measures that are consistent with the relevant portions of the Residential Site Improvements Standards at N.J.A.C. 5:21-7.3, 7.4, and 7.5 shall be deemed to meet this requirement.
- At the intake to the outlet from the stormwater management basin, the orifice size shall be a minimum of two and one-half inches in diameter.
- Stormwater management basins shall be designed to meet the minimum safety standards for stormwater management basins at Section N.J.A.C. 7:8-7.
- Stormwater management measure guidelines are available in the New Jersey Stormwater Best Management Practices Manual. Other stormwater management measures may be utilized provided the design engineer demonstrates that the proposed measure and its design will accomplish the required water quantity, groundwater recharge and water quality design and performance standards established by this subchapter.
- Manufactured treatment devices may be used to meet the requirements of this subchapter, provided the pollutant removal rates are verified by the New Jersey Corporation for Advanced Technology and certified by the Department.
- In order to ensure adequate long term operation as well as preventative and corrective maintenance of stormwater management measures and structural

BMP's, the designers of such facilities should submit to the municipality a *Maintenance Plan* indicating specific maintenance tasks and schedules as indicated in N.J.A.C. 7:8-5.8 "Maintenance Requirements". This maintenance plan will require the ultimate user of said structural BMP's to provide an annual certification that the stormwater management measures approved are functioning as designed and that the proper maintenance and inspection of said measures have been performed. Random spot inspections by the municipality will be conducted to ensure compliance along with appropriate enforcement actions such as fines to be levied should non-compliance result.

By adhering to the State's newly adopted design standards, the BMP's engineered for each proposed development project will serve to improve stormwater quality, enhance groundwater recharge, and reduce stormwater runoff. Combined, these methods will serve to improve the environment and protect the public interest by minimizing the risk of flooding and maintain the Township's water supply through the future.

6.3 PLAN CONSISTENCY

Currently, Marlboro Township is not contained within the bounds of an adopted Regional Stormwater Management Plan (RSWMP) and no TMDL's have been developed for waters within the Township. Therefore, this plan does not need to be consistent with any Regional Stormwater Management Plans, nor any TMDL's. However, the DEP is coordinating the establishment of TMDL's for several waterways that pass through the Township including: Gravelly Brook, Big Brook, Milford Brook, and Matawan Creek. In addition, recently the Navesink Swimming River Group has met several times over the course of 2005 to begin the process of organizing a coalition of partners to draft a Navesink River Regional Stormwater Management Plan. Marlboro Township has joined this effort with a number of other partners which includes six other municipalities (Middletown Township, Rumson Boro, Tinton Falls Boro, Holmdel Township, Colts Neck Township, and Howell Township) as well as other governmental organizations such as the Monmouth County GIS department, the Freehold Soil Conservation District, the New Jersey Board of Agriculture, and New Jersey American Water. If a TMDL, or RSWMP were to be adopted, this plan would be reviewed and revised to incorporate the principles and design standards so as to comply with the objectives of that plan.

This Municipal Stormwater Management Plan is also consistent with the Residential Site Improvement Standards (RSIS) N.J.A.C. 5:21, and the Township will utilize the most current update of the RSIS in the stormwater management review of residential areas. The Township's Stormwater Management Ordinance requires all new development and redevelopment plans to comply with New Jersey's Soil Erosion and Sediment Control Standards.

The goals of this plan are also consistent with the goals and objectives that have been identified within Marlboro Townships newly amended Land Use Element of the Master Plan. These goals include:

- Continue to use practical and flexible development controls in order to gain open space, conserve the natural landscape and protect the sensitive ecological areas of the Township.

- Establish a Conservation Plan that will protect environmentally sensitive areas of the Township including wetlands, floodplains, and steep slopes.

- Endorse development of a Stormwater Management Element of the Master Plan.

Further, the ecologically sensitive measures that are being pursued through this plan and other Township initiatives are consistent with the State Plan. On September 8, 2005, the Marlboro Township Council adopted the "upzoning" of all properties within the LC (Land Conservation) zoning district by incorporating a 5-acre minimum lot area for all development proposals, this district was formerly 2-acre minimum lots. The rezoning of these properties is consistent with the State Plan as they have been qualified as part of an Environmentally Sensitive Planning Area (PA5) due to their environmentally sensitive nature, and/or the presence of wetlands.

6.4 MITIGATION PLAN

OVERVIEW

A municipal mitigation plan is an element of the Municipal Stormwater Management Plan that allows municipalities to grant variances or exemptions to the design and performance standards for stormwater runoff quality, stormwater runoff quantity, and groundwater recharge established in N.J.A.C. 7:8-5, and adopted into the municipal stormwater control ordinance. The existence of a mitigation plan does not preclude the requirement that an applicant meet the design and performance standards for any one of the three key stormwater requirements, namely maintaining pre-development recharge, stormwater runoff quantity reduction and stormwater runoff quality. Instead, a mitigation plan, once it is approved by the Monmouth County Stormwater Technical Advisory Committee (STAC) under the requirements of N.J.A.C. 7:8-4, will allow Marlboro Township, in limited circumstances to waive the strict compliance of one or more of the performance standards, where full compliance cannot be reasonably accommodated on site. In addition, approval of a waiver or exemption from one of the three criteria outlined above provides no guarantee that, if requested, an exemption or waiver will be granted for either or both of the remaining criteria. However, under no circumstances shall Marlboro Township waive the Special Resources Protection Area (SRPA) established under the stormwater management rules at N.J.A.C. 7:8-5.5 (h).

Supporting evidence for an exemption or waiver shall be prepared in the form of a "stormwater management report" which will be signed and sealed by a New Jersey licensed professional engineer. The report shall include at a minimum:

- Detailed hydrologic and hydraulic calculations identifying the sizing criteria for each BMP and the stormwater collection system based upon the anticipated peak flow and/or volume.

- A map of the planned project showing existing conditions with drainage boundaries and land features, including delineated wetlands, proposed improvements, including all BMPs, grading, utilities, impervious features, and landscaping.

- Construction details for each BMP with appropriate contact information.

When applying for a waiver, the applicants professional engineer must first demonstrate that on-site compliance is either a) not possible, or b) possible but would result in tangible negative environmental or structural impacts. Such impacts may include:

- If the strict application of the regulations would result in a reduction of open space and/or undisturbed buffer areas. It is important to note that in this situation, the applicant must demonstrate that such reductions are caused by compliance with State and local regulations and not an attempt to maximize buildable area.

- The degradation of groundwater quality due to the infiltration of poor quality runoff. For example, if runoff from a shopping plaza with heavy traffic volume will be directed to a protected water supply aquifer to achieve compliance, alternative recharge locations may be more practical and environmentally sound.

- The modification to the elevation of the groundwater table due to rapid infiltration of stormwater will have demonstrable negative impacts on local structures and/or local groundwater quality. For example, rapid infiltration in a highly pervious soil near a basement may cause flooding and settlement; and also

- Flooding due to changes in the time of peak for a storm attenuated in compliance with *N.J.A.C. 7:8* and the *New Jersey Stormwater Best Management Practices Manual.* Despite the requirement for peak reductions to be applied to the 2-year, 10-year and 100-year events, peak runoff from a sub-basin of a HUC-14 may actually experience increases due to changes to peak timing.

An applicant may also propose a mitigation project on a site that has not been identified in this mitigation plan. However, in each circumstance the selection of a mitigation project must incorporate the following requirements:

- The project must be within the same area that would contribute to the receptor impacted by that project. If there is no specific sensitive receptor impacted, then the location of the mitigation project may be located anywhere within the municipality, preferably at a location that would provide the greatest benefit.

- Legal authorization must be obtained to construct the project at the location selected. This includes the maintenance and any access needs for the project through throughout its operation.

- The mitigation project should be located close to the original development project. If possible, the mitigation project should be located at a similar distance from the identified sensitive receptor. This distance should not be based on actual location, but on a similar hydraulic distance to the sensitive receptor. For example, if a project for which a waiver is obtained discharges to a tributary, but the closest location discharges to the main branch of a waterway, it may be more beneficial to identify a location discharging to the same tributary.

- It is preferable to have one location that addresses any and all of the performance standards waived, rather than one location for each performance standard.

- The project location must demonstrate no adverse impacts to other properties.

- For projects addressing the groundwater recharge performance standard, a mitigation project site upstream of the location of the actual project site is preferable to a downstream location.

- Mitigation projects that address stormwater runoff quantity can choose to provide storage for proposed increases in runoff volume, as opposed to a direct peak flow reduction.

- Mitigation projects that address stormwater runoff quality can choose to address another pollutant other than TSS, which has been demonstrated to be of particular concern, such as streams that have been listed as an impaired waterbody for other pollutants. However, care must be taken to ensure that waivers that are granted for the TSS requirements do not result in the impairment of an existing unimpaired area.

All mitigation plans and reviews should consider the location of the mitigation project in relation to the property where the projected damage will occur. For example, if a project were unable to achieve the stormwater quantity performance standards upstream of an inadequate culvert, a mitigation project downstream of that culvert would not offer similar protection. Or, if the groundwater recharge is the major contributor to a wetlands area, the new project should continue to provide recharge to the wetlands area.

Also, in environmentally critical areas, the quality of stormwater that is being directed to infiltration facilities should be assessed. If the quality of stormwater that would be infiltrated following development poses a threat to groundwater supplies, off-site mitigation should be considered. Off-site mitigation should also be undertaken when on-site recharge is precluded by site conditions, or when stormwater quality assessments indicate that on-site stormwater infiltration will degrade ambient groundwater quality in environmentally sensitive areas. Environmentally critical areas include locations where

groundwater is classified by the State as holding either special ecological significance, wellhead protection areas, areas of known groundwater contamination, or areas of on-going groundwater remediation. Groundwater recharge is of particular concern in areas discharging to Category 1 (C1) groundwater or in wellhead protection areas. Options for off-site groundwater recharge include:

- Retrofitting an existing stormwater basin
- Reducing the amount of impervious cover on site by adding vegetation or incorporating pervious paving materials
- Splitting flows to isolate high quality runoff and constructing infiltration basins to receive only the high quality runoff
- Acquiring upland recharge areas

SENSITIVE RECEPTORS

Within Figure 7, entitled Sensitive Receptor Map, Marlboro has taken care to indicate the sensitive receptor areas within the Township that are especially susceptible to stormwater changes. However, due to the ongoing USACE watershed analysis projects, this list of sensitive receptors is not comprehensive. Further, as many of the mitigation measures that will be employed to these sensitive receptor areas are in the planning and preliminary design stage, when appropriate, Marlboro will allow developers to fund studies to plan and engineer the most suitable mitigation measure for each project site, and each performance standard. An applicant may also provide compensatory mitigation through the contribution of funds when, due to the small amount of the waiver given for the performance standard, it is not practical to provide a full mitigation project. In these circumstances, the receipt of financial contributions shall be considered the completion of mandatory mitigation for that project. However, in these instances, the Township will be responsible to ensure that mitigation occurs based on the collection of these funds. If such a situation were to arise, a detailed description of the circumstances, funding amount and performance standard that was mitigated will be provided in Marlboro's annual NJPDES report.

MITIGATION CRITERIA

The mitigation requirements listed below offer a hierarchy of options that are intended to offset the effect on groundwater recharge, stormwater quantity control, and/or stormwater quality control to an equal or greater extent than was created by the granting of a waiver or exemption from the stormwater management requirements.

The mitigation criteria are listed below in order of preference:

1) **Identify, design, and implement a compensating measure to mitigate impacts**- The preferred option is to identify and develop a compensating mitigation project in the same drainage area as the proposed development. In these cases, the applicant will address the same issue within the design and performance standards for which the variance or exemption is being sought, and

demonstrate that the proposed mitigating measures provide equal or greater compensation to offset the non-complying aspect of the stormwater management system on site. The developer must also ensure the long-term maintenance of the project as outlined in Chapters 8 and 9 of the NJDEP Stormwater BMP Manual. If the Township agrees to control a new stormwater management facility, arrangement in the form of an escrow account will be made to stipulate the payment amount, schedule, and long term responsibilities of the facility to ensure that it functions to capacity.

2) **Complete a project identified by the municipality as equivalent to the environmental impact created by the exemption or variance-** If a suitable site cannot be located in the same drainage area as the proposed development, as discussed in Option 1, the mitigation project may provide measures that are not directly equivalent to the impacts for which the variance or exemption is being sought, but that addresses the same issue to an equal or greater extent. For example if a variance is given because the 80% TSS requirement has not been met, the selected project may address water quality impacts that increase the siltation of a waterbody within the applicable HUC 14 subwatershed.

   If these criteria cannot be met on-site, the Township has identified the retrofitting of existing basins as the primary mode for mitigation measures to follow. Through clearing sediment, expanding capacity, or bringing the basin into compliance with water quality standards, mitigation opportunities have the potential to significantly improve stormwater management issues that face Marlboro Township.

   As many of the developments in Marlboro were constructed with curb and gutter drainage, stormwater is often funneled and released directly into an adjoining waterbody. As these methods are contrary to the stormwater management BMP's outlined in the NJDEP's BMP Manual and endorsed through the adoption of the State's new stormwater regulations, the retrofitting of these basins can dramatically improve the Township's existing stormwater management infrastructure. Mitigation projects can utilize a number of BMP's to offset the stormwater management of a project that is unable to comply with the new design standards. However, these BMP's, which may include sand filters, vegetative filters, or the incorporation of a manufactured treatment device, among other possibilities, will be engineered and applied on a site-by-site basis. In general, the engineering necessary to determine the mitigative measure that is most suited for a particular basin is the responsibility of the applicant, and must be determined and submitted by the applicant along with the particular projects site plan.

   Marlboro has identified locations within the Deep Run watershed where BMP's can be utilized to improve stormwater management and reduce flooding. These locations, which have been identified by catchment area, offer developers specific options such as improving culverts, or upgrading infrastructure to use as mitigative alternatives. Applicants that are seeking waivers for development

proposals located within the Deep Run watershed are strongly encouraged to reference the ten Subwatershed Impact Assessment and Implementation Project Summary Tables included within this study when drafting specific mitigation project submissions.

Following the United States Army Corps of Engineers (USACE) completion of the three remaining watershed analysis studies (Yellow Brook, Barclay Brook and Big Brook), the Township Engineer, in coordination with the director of Public Works and other stakeholders will compile all the potential mitigation projects and arrange a hierarchy of the most pressing potential projects, along with the design and performance standard it will improve (water quantity, water quality, or groundwater recharge) for applicants to refer to.

3) **Provide funding for municipal projects that would address existing stormwater impacts-** The third and least preferable stormwater mitigation option is for the applicant to provide funding or partial funding for an environmental enhancement project that has been identified in the Municipal Stormwater Management Plan, or towards the development of a Regional Stormwater Management Plan. The contributed funds must be equal or greater than the cost to implement the required on-site stormwater measure for which relief is requested including the cost of land, easements, engineering design, and long-term maintenance. However, with this option Marlboro Township, not the applicant is ultimately responsible for the design, property acquisition, construction, construction management, maintenance (short term and long term) and follow-up study, unless that project and its prospective costs have been outlined within this Mitigation Plan.

REQUIREMENTS FOR MITIGATION PROJECTS

Whether the applicant is proposing the mitigation project, or Marlboro has identified the project within this Mitigation Plan, the following requirements for mitigation must be included in the project submission.

- **Impact from noncompliance-** The applicant must provide a table to show the required values, and the values provided in the project, and include an alternatives analysis that demonstrates that on-site compliance was maximized to the greatest extent practicable.

- **Narrative and Supporting Information Regarding the Need for the Waiver-** The waiver cannot be granted for a condition that was created by the applicant. If the applicant can provide compliance with the stormwater rules through a reduction in the scope of the project, the applicant has created the condition and a waiver cannot be issued. The applicant must provide a discussion and supporting information of the site conditions that would not allow the construction of a stormwater management facility to provide compliance with these requirements,

FIGURES

and/or if the denial of the application would impose an extraordinary hardship on the applicant brought about by circumstances peculiar to the subject property. The site conditions to be considered are soil type, the presence of karst geology, acid soils, a high groundwater table, unique conditions that would create an unsafe design, as well as conditions that may provide a detrimental impact to public health, welfare, and safety.

- **Sensitive Receptor**- Identify the sensitive receptor related to the performance standard for which a waiver is sought. Demonstrate that the mitigation site contributes to the same sensitive receptor.

- **Design of the Mitigation Project**- Provide the design details of the mitigation project. This includes, but is not limited to, drawings, calculations, and other information needed to evaluate the mitigation project.

- **Responsible Party**- The mitigation project submission must list the party or parties responsible for the construction or maintenance of the mitigation project. Documentation must be provided to demonstrate that the responsible party is aware of, has authority to perform, and accepts the responsibility for the construction and the maintenance of the mitigation project. Under no circumstances shall the responsible party be an individual single-family homeowner.

- **Maintenance**- The applicant must include a maintenance plan that addresses the maintenance criteria at N.J.A.C. 7:8-5 as part of a mitigation plan. In addition, if the maintenance responsibility is being transferred to Marlboro Township, or another entity, the entity responsible for the cost of the maintenance must be identified. Marlboro provides applicants with the option of conveying the mitigation project to the Township, provided that the applicant funds the cost of maintenance of the facility in perpetuity.

- **Permits**- The applicant is solely responsible to obtain any and all necessary local, State, or other applicable permits for the identified mitigation project or measure. The applicable permits must be obtained prior to the municipal approval of the project for which the mitigation is being sought.

- **Construction**- The applicant must demonstrate that the construction of the mitigation project coincides with the construction of the proposed project. A certificate of occupancy or final approval by the municipality for the application permit cannot be issued until the mitigation project or measure receives final approval. Any mitigation projects proposed by the municipality to offset the stormwater impacts of the Township's own projects must be completed within six months of the completion of the municipal project, in order to remain in compliance with Marlboro's NJPDES General Permit.

APPENDIX A

MODEL STORMWATER ORDINANCE

Section 1: Scope and Purpose

A. Policy Statement

Flood control, groundwater recharge, and pollutant reduction through nonstructural or low impact techniques shall be explored before relying on structural BMPs. Structural BMPs should be integrated with nonstructural stormwater management strategies and proper maintenance plans. Nonstructural strategies include both environmentally sensitive site design and source controls that prevent pollutants from being placed on the site or from being exposed to stormwater. Source control plans should be developed based upon physical site conditions and the origin, nature, and the anticipated quantity or amount of potential pollutants. Multiple stormwater management BMPs may be necessary to achieve the established performance standards for water quality, quantity, and groundwater recharge.

B. Purpose

It is the purpose of this ordinance to establish minimum stormwater management requirements and controls for "major development," as defined in Section 2.

C. Applicability

1. This ordinance shall be applicable to all site plans and subdivisions for the following major developments that require preliminary or final site plan or subdivision review:

   a. Non-residential major developments; and

   b. Aspects of residential major developments that are not pre-empted by the Residential Site Improvement Standards at N.J.A.C. 5:21.

2. This ordinance shall also be applicable to all major developments undertaken by said municipality.

D. Compatibility with Other Permit and Ordinance Requirements

Development approvals issued for subdivisions and site plans pursuant to this ordinance are to be considered an integral part of development approvals under the subdivision and site plan review process and do not relieve the applicant of the responsibility to secure required permits or approvals for activities regulated by any other applicable code, rule, act, or ordinance. In their interpretation and application, the provisions of this ordinance shall be held to be the minimum requirements for the promotion of the public health, safety, and general welfare. This ordinance is not intended to interfere with, abrogate, or annul any other ordinances, rule or regulation, statute, or other provision of law except that, where any provision of this ordinance imposes restrictions different from those imposed by any other ordinance, rule or regulation, or other provision of law, the more restrictive provisions or higher standards shall control.

Section 2: Definitions

Unless specifically defined below, words or phrases used in this ordinance shall be interpreted so as to give them the meaning they have in common usage and to give this ordinance its most reasonable application. The definitions below are the same as or based on the corresponding definitions in the Stormwater Management Rules at N.J.A.C. 7:8-1.2.

"CAFRA Planning Map" means the geographic depiction of the boundaries for Coastal Planning Areas, CAFRA Centers, CAFRA Cores and CAFRA Nodes pursuant to N.J.A.C. 7:7E-5B.3.

"CAFRA Centers, Cores or Nodes" means those areas within boundaries accepted by the Department pursuant to N.J.A.C. 7:8E-5B.

"Compaction" means the increase in soil bulk density.

"Core" means a pedestrian-oriented area of commercial and civic uses serving the surrounding municipality, generally including housing and access to public transportation.

"County review agency" means an agency designated by the County Board of Chosen Freeholders to review municipal stormwater management plans and implementing ordinance(s). The county review agency may either be:

A county planning agency; or

A county water resource association created under N.J.S.A 58:16A-55.5, if the ordinance or resolution delegates authority to approve, conditionally approve, or disapprove municipal stormwater management plans and implementing ordinances.

"Department" means the New Jersey Department of Environmental Protection.

"Designated Center" means a State Development and Redevelopment Plan Center as designated by the State Planning Commission such as urban, regional, town, village, or hamlet.

"Design engineer" means a person professionally qualified and duly licensed in New Jersey to perform engineering services that may include, but not necessarily be limited to, development of project requirements, creation and development of project design and preparation of drawings and specifications.

"Development" means the division of a parcel of land into two or more parcels, the construction, reconstruction, conversion, structural alteration, relocation or enlargement of any building or structure, any mining excavation or landfill, and any use or change in the use of any building or other structure, or land or extension of use of land, by any person, for which permission is required under the Municipal Land Use Law , N.J.S.A. 40:55D-1 et seq. In the case of development of agricultural lands, development means: any activity that requires a State permit; any activity reviewed by the County Agricultural Board (CAB) and the State Agricultural Development Committee (SADC), and municipal review of any activity not exempted by the Right to Farm Act , N.J.S.A 4:1C-1 et seq.

"Drainage area" means a geographic area within which stormwater, sediments, or dissolved materials drain to a particular receiving waterbody or to a particular point along a receiving waterbody.

"Environmentally critical areas" means an area or feature which is of significant environmental value, including but not limited to: stream corridors; natural heritage priority sites; habitat of endangered or threatened species; large areas of contiguous open space or upland forest; steep slopes; and well head protection and groundwater recharge areas. Habitats of endangered or threatened species are

identified using the Department's Landscape Project as approved by the Department's Endangered and Nongame Species Program.

"Empowerment Neighborhood" means a neighborhood designated by the Urban Coordinating Council "in consultation and conjunction with" the New Jersey Redevelopment Authority pursuant to N.J.S.A 55:19-69.

"Erosion" means the detachment and movement of soil or rock fragments by water, wind, ice or gravity.

"Impervious surface" means a surface that has been covered with a layer of material so that it is highly resistant to infiltration by water.

"Infiltration" is the process by which water seeps into the soil from precipitation.

"Major development" means any "development" that provides for ultimately disturbing one or more acres of land. Disturbance for the purpose of this rule is the placement of impervious surface or exposure and/or movement of soil or bedrock or clearing, cutting, or removing of vegetation.

"Municipality" means any city, borough, town, township, or village.

"Node" means an area designated by the State Planning Commission concentrating facilities and activities which are not organized in a compact form.

"Nutrient" means a chemical element or compound, such as nitrogen or phosphorus, which is essential to and promotes the development of organisms.

"Person" means any individual, corporation, company, partnership, firm, association, [*insert name of municipality*], or political subdivision of this State subject to municipal jurisdiction pursuant to the Municipal Land Use Law , N.J.S.A. 40:55D-1 et seq.

"Pollutant" means any dredged spoil, solid waste, incinerator residue, filter backwash, sewage, garbage, refuse, oil, grease, sewage sludge, munitions, chemical wastes, biological materials, medical wastes, radioactive substance (except those regulated under the Atomic Energy Act of 1954, as amended (42 U.S.C. 2011 et seq.), thermal waste, wrecked or discarded equipment, rock, sand, cellar dirt, industrial, municipal, agricultural, and construction waste or runoff, or other residue discharged directly or indirectly to the land, ground waters or surface waters of the State, or to a domestic treatment works. "Pollutant" includes both hazardous and nonhazardous pollutants.

"Recharge" means the amount of water from precipitation that infiltrates into the ground and is not evapotranspired.

"Sediment" means solid material, mineral or organic, that is in suspension, is being transported, or has been moved from its site of origin by air, water or gravity as a product of erosion.

"Site" means the lot or lots upon which a major development is to occur or has occurred.

"Soil" means all unconsolidated mineral and organic material of any origin.

"State Development and Redevelopment Plan Metropolitan Planning Area (PA1)" means an area delineated on the State Plan Policy Map and adopted by the State Planning Commission that is intended to be the focus for much of the state's future redevelopment and revitalization efforts.

"State Plan Policy Map" is defined as the geographic application of the State Development and Redevelopment Plan's goals and statewide policies, and the official map of these goals and policies.

"Stormwater" means water resulting from precipitation (including rain and snow) that runs off the land's surface, is transmitted to the subsurface, or is captured by separate storm sewers or other sewage or drainage facilities, or conveyed by snow removal equipment.

"Stormwater runoff" means water flow on the surface of the ground or in storm sewers, resulting from precipitation.

"Stormwater management basin" means an excavation or embankment and related areas designed to retain stormwater runoff. A stormwater management basin may either be normally dry (that is, a detention basin or infiltration basin), retain water in a permanent pool (a retention basin), or be planted mainly with wetland vegetation (most constructed stormwater wetlands).

"Stormwater management measure" means any structural or nonstructural strategy, practice, technology, process, program, or other method intended to control or reduce stormwater runoff and associated pollutants, or to induce or control the infiltration or groundwater recharge of stormwater or to eliminate illicit or illegal non-stormwater discharges into stormwater conveyances.

"Tidal Flood Hazard Area" means a flood hazard area, which may be influenced by stormwater runoff from inland areas, but which is primarily caused by the Atlantic Ocean.

"Urban Coordinating Council Empowerment Neighborhood" means a neighborhood given priority access to State resources through the New Jersey Redevelopment Authority.

"Urban Enterprise Zones" means a zone designated by the New Jersey Enterprise Zone Authority pursuant to the New Jersey Urban Enterprise Zones Act, N.J.S.A. 52:27H-60 et. seq.

"Urban Redevelopment Area" is defined as previously developed portions of areas:

(1) Delineated on the State Plan Policy Map (SPPM) as the Metropolitan Planning Area (PA1), Designated Centers, Cores or Nodes;

(2) Designated as CAFRA Centers, Cores or Nodes;

(3) Designated as Urban Enterprise Zones; and

(4) Designated as Urban Coordinating Council Empowerment Neighborhoods.

"Waters of the State" means the ocean and its estuaries, all springs, streams, wetlands, and bodies of surface or ground water, whether natural or artificial, within the boundaries of the State of New Jersey or subject to its jurisdiction.

"Wetlands" or "wetland" means an area that is inundated or saturated by surface water or ground water at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions, commonly known as hydrophytic vegetation.

Section 3: General Standards

A. Design and Performance Standards for Stormwater Management Measures

1. Stormwater management measures for major development shall be developed to meet the erosion control, groundwater recharge, stormwater runoff quantity, and stormwater runoff quality standards in Section 4. To the maximum extent practicable, these standards shall be met by incorporating nonstructural stormwater management strategies into the design. If these strategies alone are not sufficient to meet these standards, structural stormwater management measures necessary to meet these standards shall be incorporated into the design.

2. The standards in this ordinance apply only to new major development and are intended to minimize the impact of stormwater runoff on water quality and water quantity in receiving water bodies and maintain groundwater recharge. The standards do not apply to new major development to the extent that alternative design and performance standards are applicable under a regional stormwater management plan or Water Quality Management Plan adopted in accordance with Department rules.

Section 4: Stormwater Management Requirements for Major Development

A. The development shall incorporate a maintenance plan for the stormwater management measures incorporated into the design of a major development in accordance with Section 10.

B. Stormwater management measures shall avoid adverse impacts of concentrated flow on habitat for threatened and endangered species as documented in the Department' Landscape Project or Natural Heritage Database established under N.J.S.A. 13:1B-15.147 through 15.150.

C. The following linear development projects are exempt from the groundwater recharge, stormwater runoff quantity, and stormwater runoff quality requirements of Sections 4.F and 4.G:

1. The construction of an underground utility line provided that the disturbed areas are revegetated upon completion;

2. The construction of an aboveground utility line provided that the existing conditions are maintained to the maximum extent practicable; and

3. The construction of a public pedestrian access, such as a sidewalk or trail with a maximum width of 14 feet, provided that the access is made of permeable material.

D. A waiver from strict compliance from the groundwater recharge, stormwater runoff quantity, and stormwater runoff quality requirements of Sections 4.F and 4.G may be obtained for the enlargement of an existing public roadway or railroad; or the construction or enlargement of a public pedestrian access, provided that the following conditions are met:

1. The applicant demonstrates that there is a public need for the project that cannot be accomplished by any other means;

2. The applicant demonstrates through an alternatives analysis, that through the use of nonstructural and structural stormwater management strategies and measures, the option selected complies with the requirements of Sections 4.F and 4.G to the maximum extent practicable;

3. The applicant demonstrates that, in order to meet the requirements of Sections 4.F and 4.G, existing structures currently in use, such as homes and buildings, would need to be condemned; and

4. The applicant demonstrates that it does not own or have other rights to areas, including the potential to obtain through condemnation lands not falling under D.3 above within the upstream drainage area of the receiving stream, that would provide additional opportunities to mitigate the requirements of Sections 4.F and 4.G that were not achievable on-site.

E. Nonstructural Stormwater Management Strategies

1. To the maximum extent practicable, the standards in Sections 4.F and 4.G shall be met by incorporating nonstructural stormwater management strategies set forth at Section 4.E into the design. The applicant shall identify the nonstructural measures incorporated into the design of the project. If the applicant contends that it is not feasible for engineering, environmental, or safety reasons to incorporate any nonstructural stormwater management measures identified in Paragraph 2 below into the design of a particular project, the applicant shall identify the strategy considered and provide a basis for the contention.

2. Nonstructural stormwater management strategies incorporated into site design shall:

a. Protect areas that provide water quality benefits or areas particularly susceptible to erosion and sediment loss;

b. Minimize impervious surfaces and break up or disconnect the flow of runoff over impervious surfaces;

c. Maximize the protection of natural drainage features and vegetation;

d. Minimize the decrease in the "time of concentration" from pre-construction to post construction. "Time of concentration" is defined as the time it takes for runoff to travel from the hydraulically most distant point of the watershed to the point of interest within a watershed;

e. Minimize land disturbance including clearing and grading;

f. Minimize soil compaction;

g. Provide low-maintenance landscaping that encourages retention and planting of native vegetation and minimizes the use of lawns, fertilizers and pesticides;

h. Provide vegetated open-channel conveyance systems discharging into and through stable vegetated areas;

i. Provide other source controls to prevent or minimize the use or exposure of pollutants at the site, in order to prevent or minimize the release of those pollutants into stormwater runoff. Such source controls include, but are not limited to:

(1) Site design features that help to prevent accumulation of trash and debris in drainage systems, including features that satisfy Section 4.E.3. below;

(2) Site design features that help to prevent discharge of trash and debris from drainage systems;

(3) Site design features that help to prevent and/or contain spills or other harmful accumulations of pollutants at industrial or commercial developments; and

(4) When establishing vegetation after land disturbance, applying fertilizer in accordance with the requirements established under the Soil Erosion and Sediment Control Act, N.J.S.A. 4:24-39 et seq., and implementing rules.

3. Site design features identified under Section 4.E.2.i.(2) above shall comply with the following standard to control passage of solid and floatable materials through storm drain inlets. For purposes of this paragraph, "solid and floatable materials" means sediment, debris, trash, and other floating, suspended, or settleable solids. For exemptions to this standard see Section 4.E.3.c below.

a. Design engineers shall use either of the following grates whenever they use a grate in pavement or another ground surface to collect stormwater from that surface into a storm drain or surface water body under that grate:

(1) The New Jersey Department of Transportation (NJDOT) bicycle safe grate, which is described in Chapter 2.4 of the NJDOT Bicycle Compatible Roadways and Bikeways Planning and Design Guidelines (April 1996); or

(2) A different grate, if each individual clear space in that grate has an area of no more than seven (7.0) square inches, or is no greater than 0.5 inches across the smallest dimension.

Examples of grates subject to this standard include grates in grate inlets, the grate portion (non-curb-opening portion) of combination inlets, grates on storm sewer manholes, ditch grates, trench grates, and grates of spacer bars in slotted drains. Examples of ground surfaces include surfaces of roads (including bridges), driveways, parking areas, bikeways, plazas, sidewalks, lawns, fields, open channels, and stormwater basin floors.

b. Whenever design engineers use a curb-opening inlet, the clear space in that curb opening (or each individual clear space, if the curb opening has two or more clear spaces) shall have an area of no more than seven (7.0) square inches, or be no greater than two (2.0) inches across the smallest dimension.

c. This standard does not apply:

(1) Where the review agency determines that this standard would cause inadequate hydraulic performance that could not practicably be overcome by using additional or larger storm drain inlets that meet these standards;

(2) Where flows from the water quality design storm as specified in Section 4.G.1 are conveyed through any device (e.g., end of pipe netting facility, manufactured treatment device, or a catch basin hood) that is designed, at a minimum, to prevent delivery of all solid and floatable materials that could not pass through one of the following:

(a) A rectangular space four and five-eighths inches long and one and one-half inches wide (this option does not apply for outfall netting facilities); or

(b) A bar screen having a bar spacing of 0.5 inches.

(3) Where flows are conveyed through a trash rack that has parallel bars with one-inch (1") spacing between the bars, to the elevation of the water quality design storm as specified in Section 4.G.1; or

(4) Where the New Jersey Department of Environmental Protection determines, pursuant to the New Jersey Register of Historic Places Rules at N.J.A.C. 7:4-7.2(c), that action to meet this standard is an undertaking that constitutes an encroachment or will damage or destroy the New Jersey Register listed historic property.

4. Any land area used as a nonstructural stormwater management measure to meet the performance standards in Sections 4.F and 4.G shall be dedicated to a government agency, subjected to a conservation restriction filed with the appropriate County Clerk's office, or subject to an approved equivalent restriction that ensures that measure or an equivalent stormwater management measure approved by the reviewing agency is maintained in perpetuity.

5. Guidance for nonstructural stormwater management strategies is available in the New Jersey Stormwater Best Management Practices Manual. The BMP Manual may be obtained from the address identified in Section 7, or found on the Department's website at www.njstormwater.org.

F. Erosion Control, Groundwater Recharge and Runoff Quantity Standards

1. This subsection contains minimum design and performance standards to control erosion, encourage and control infiltration and groundwater recharge, and control stormwater runoff quantity impacts of major development.

a. The minimum design and performance standards for erosion control are those established under the Soil Erosion and Sediment Control Act, N.J.S.A. 4:24-39 et seq. and implementing rules.

b. The minimum design and performance standards for groundwater recharge are as follows:

(1) The design engineer shall, using the assumptions and factors for stormwater runoff and groundwater recharge calculations at Section 5, either:

(a) Demonstrate through hydrologic and hydraulic analysis that the site and its stormwater management measures maintain 100 percent of the average annual pre-construction groundwater recharge volume for the site; or

(b) Demonstrate through hydrologic and hydraulic analysis that the increase of stormwater runoff volume from pre-construction to post-construction for the 2-year storm is infiltrated.

(2) This groundwater recharge requirement does not apply to projects within the "urban redevelopment area," or to projects subject to (3) below.

(3) The following types of stormwater shall not be recharged:

(a) Stormwater from areas of high pollutant loading. High pollutant loading areas are areas in industrial and commercial developments where solvents and/or petroleum products are loaded/unloaded, stored, or applied, areas where pesticides are loaded/unloaded or stored; areas where hazardous materials are expected to be present in greater than "reportable quantities" as defined by the United States Environmental Protection Agency (EPA) at 40 CFR 302.4; areas where recharge would be inconsistent with Department approved remedial action work plan or landfill closure plan and areas with high risks for spills of toxic materials, such as gas stations and vehicle maintenance facilities; and

(b) Industrial stormwater exposed to "source material." "Source material" means any material(s) or machinery, located at an industrial facility, that is directly or indirectly related to process, manufacturing or other industrial activities, which could be a source of pollutants in any industrial stormwater discharge to groundwater. Source materials include, but are not limited to, raw materials; intermediate products; final products; waste materials; by-products; industrial machinery and fuels, and lubricants, solvents, and detergents that are related to process, manufacturing, or other industrial activities that are exposed to stormwater.

(4) The design engineer shall assess the hydraulic impact on the groundwater table and design the site so as to avoid adverse hydraulic impacts. Potential adverse hydraulic impacts include, but are not limited to, exacerbating a naturally or seasonally high water table so as to cause surficial ponding, flooding of basements, or interference with the proper operation of subsurface sewage disposal systems and other subsurface structures in the vicinity or downgradient of the groundwater recharge area.

c. In order to control stormwater runoff quantity impacts, the design engineer shall, using the assumptions and factors for stormwater runoff calculations at Section 5, complete one of the following:

(1) Demonstrate through hydrologic and hydraulic analysis that for stormwater leaving the site, post-construction runoff hydrographs for the two, 10, and 100-year storm events do not exceed, at any point in time, the pre-construction runoff hydrographs for the same storm events;

(2) Demonstrate through hydrologic and hydraulic analysis that there is no increase, as compared to the pre-construction condition, in the peak runoff rates of stormwater leaving the site for the two, 10, and 100-year storm events and that the increased volume or change in timing of stormwater runoff will not increase flood damage at or downstream of the site. This analysis shall include the analysis of impacts of existing land uses and projected land uses assuming full development under existing zoning and land use ordinances in the drainage area;

(3) Design stormwater management measures so that the post-construction peak runoff rates for the 2, 10 and 100 year storm events are 50, 75 and 80 percent, respectively, of the pre-construction peak runoff rates. The percentages apply only to the post-construction stormwater runoff that is attributable to the portion of the site on which the proposed development or project is to be constructed. The percentages shall not be applied to post-

construction stormwater runoff into tidal flood hazard areas if the increased volume of stormwater runoff will not increase flood damages below the point of discharge; or

(4) In tidal flood hazard areas, stormwater runoff quantity analysis in accordance with (1), (2) and (3) above shall only be applied if the increased volume of stormwater runoff could increase flood damages below the point of discharge.

2. Any application for a new agricultural development that meets the definition of major development at Section 2 shall be submitted to the appropriate Soil Conservation District for review and approval in accordance with the requirements of this section and any applicable Soil Conservation District guidelines for stormwater runoff quantity and erosion control. For the purposes of this section, "agricultural development" means land uses normally associated with the production of food, fiber and livestock for sale. Such uses do not include the development of land for the processing or sale of food and the manufacturing of agriculturally related products.

G. Stormwater Runoff Quality Standards

1. Stormwater management measures shall be designed to reduce the post-construction load of total suspended solids (TSS) in stormwater runoff by 80 percent of the anticipated load from the developed site, expressed as an annual average. Stormwater management measures shall only be required for water quality control if an additional 1/4 acre of impervious surface is being proposed on a development site. The requirement to reduce TSS does not apply to any stormwater runoff in a discharge regulated under a numeric effluent limitation for TSS imposed under the New Jersey Pollution Discharge Elimination System (NJPDES) rules, N.J.A.C. 7:14A, or in a discharge specifically exempt under a NJPDES permit from this requirement. The water quality design storm is 1.25 inches of rainfall in two hours. Water quality calculations shall take into account the distribution of rain from the water quality design storm, as reflected in Table 1. The calculation of the volume of runoff may take into account the implementation of non-structural and structural stormwater management measures.

Table 1: Water Quality Design Storm Distribution

Time (Minutes)	Cumulative Rainfall (Inches)	Time (Minutes)	Cumulative Rainfall (Inches)
0	0.0000	65	0.8917
5	0.0083	70	0.9917
10	0.0166	75	1.0500
15	0.0250	80	1.0840
20	0.0500	85	1.1170
25	0.0750	90	1.1500
30	0.1000	95	1.1750
35	0.1330	100	1.2000

40	0.1660	105	1.2250
45	0.2000	110	1.2334
50	0.2583	115	1.2417
55	0.3583	120	1.2500
60	0.6250		

2. For purposes of TSS reduction calculations, Table 2 below presents the presumed removal rates for certain BMPs designed in accordance with the New Jersey Stormwater Best Management Practices Manual. The BMP Manual may be obtained from the address identified in Section 7, or found on the Department's website at www.njstormwater.org. The BMP Manual and other sources of technical guidance are listed in Section 7. TSS reduction shall be calculated based on the removal rates for the BMPs in Table 2 below. Alternative removal rates and methods of calculating removal rates may be used if the design engineer provides documentation demonstrating the capability of these alternative rates and methods to the review agency. A copy of any approved alternative rate or method of calculating the removal rate shall be provided to the Department at the following address: Division of Watershed Management, New Jersey Department of Environmental Protection, PO Box 418 Trenton, New Jersey, 08625-0418.

3. If more than one BMP in series is necessary to achieve the required 80 percent TSS reduction for a site, the applicant shall utilize the following formula to calculate TSS reduction:

   $R = A + B - (AXB)/100$

   Where

   R = total TSS percent load removal from application of both BMPs, and

   A = the TSS percent removal rate applicable to the first BMP

   B = the TSS percent removal rate applicable to the second BMP

Table 2: TSS Removal Rates for BMPs

Best Management Practice	TSS Percent Removal Rate
Bioretention Systems	90
Constructed Stormwater Wetland	90
Extended Detention Basin	40-60
Infiltration Structure	80
Manufactured Treatment Device	See Section 6.C
Sand Filter	80
Vegetative Filter Strip	60-80
Wet Pond	50-90

4. If there is more than one onsite drainage area, the 80 percent TSS removal rate shall apply to each drainage area, unless the runoff from the subareas converge on site in which case the removal rate can be demonstrated through a calculation using a weighted average.

5. Stormwater management measures shall also be designed to reduce, to the maximum extent feasible, the post-construction nutrient load of the anticipated load from the developed site in stormwater runoff generated from the water quality design storm. In achieving reduction of nutrients to the maximum extent feasible, the design of the site shall include nonstructural strategies and structural measures that optimize nutrient removal while still achieving the performance standards in Sections 4.F and 4.G.

6. Additional information and examples are contained in the New Jersey Stormwater Best Management Practices Manual, which may be obtained from the address identified in Section 7.

7. In accordance with the definition of FW1 at N.J.A.C. 7:9B-1.4, stormwater management measures shall be designed to prevent any increase in stormwater runoff to waters classified as FW1.

8. Special water resource protection areas shall be established along all waters designated Category One at N.J.A.C. 7:9B, and perennial or intermittent streams that drain into or upstream of the Category One waters as shown on the USGS Quadrangle Maps or in the County Soil Surveys, within the associated HUC14 drainage area. These areas shall be established for the protection of water quality, aesthetic value, exceptional ecological significance, exceptional recreational significance, exceptional water supply significance, and exceptional fisheries significance of those established Category One waters. These areas shall be designated and protected as follows:

   a. The applicant shall preserve and maintain a special water resource protection area in accordance with one of the following:

      (1) A 300-foot special water resource protection area shall be provided on each side of the waterway, measured perpendicular to the waterway from the top of the bank outwards or from the centerline of the waterway where the bank is not defined, consisting of existing vegetation or vegetation allowed to follow natural succession is provided. (2) Encroachment within the designated special water resource protection area under Subsection (1) above shall only be allowed where previous development or disturbance has occurred (for example, active agricultural use, parking area or maintained lawn area). The encroachment shall only be allowed where applicant demonstrates that the functional value and overall condition of the special water resource protection area will be maintained to the maximum extent practicable. In no case shall the remaining special water resource protection area be reduced to less than 150 feet as measured perpendicular to the top of bank of the waterway or centerline of the waterway where the bank is undefined. All encroachments proposed under this subparagraph shall be subject to review and approval by the Department.

   b. All stormwater shall be discharged outside of and flow through the special water resource protection area and shall comply with the Standard for Off-Site Stability in the "Standards For Soil Erosion and Sediment Control in New Jersey," established under the Soil Erosion and Sediment Control Act , N.J.S.A. 4:24-39 et seq.

   c. If stormwater discharged outside of and flowing through the special water resource protection area cannot comply with the Standard For Off-Site Stability in the "Standards for Soil Erosion and Sediment Control in New Jersey," established under the Soil Erosion and Sediment Control

Act , N.J.S.A. 4:24-39 et seq., then the stabilization measures in accordance with the requirements of the above standards may be placed within the special water resource protection area, provided that:

(1) Stabilization measures shall not be placed within 150 feet of the Category One waterway;

(2) Stormwater associated with discharges allowed by this section shall achieve a 95 percent TSS post-construction removal rate;

(3) Temperature shall be addressed to ensure no impact on the receiving waterway;

(4) The encroachment shall only be allowed where the applicant demonstrates that the functional value and overall condition of the special water resource protection area will be maintained to the maximum extent practicable;

(5) A conceptual project design meeting shall be held with the appropriate Department staff and Soil Conservation District staff to identify necessary stabilization measures; and

(6) All encroachments proposed under this section shall be subject to review and approval by the Department.

d. A stream corridor protection plan may be developed by a regional stormwater management planning committee as an element of a regional stormwater management plan, or by a municipality through an adopted municipal stormwater management plan. If a stream corridor protection plan for a waterway subject to Section 4.G(8) has been approved by the Department of Environmental Protection, then the provisions of the plan shall be the applicable special water resource protection area requirements for that waterway. A stream corridor protection plan for a waterway subject to G.8 shall maintain or enhance the current functional value and overall condition of the special water resource protection area as defined in G.8.a.(1) above. In no case shall a stream corridor protection plan allow the reduction of the Special Water Resource Protection Area to less than 150 feet as measured perpendicular to the waterway subject to this subsection.

e. Paragraph G.8 does not apply to the construction of one individual single family dwelling that is not part of a larger development on a lot receiving preliminary or final subdivision approval on or before February 2, 2004 , provided that the construction begins on or before February 2, 2009.

Section 5: Calculation of Stormwater Runoff and Groundwater Recharge

A. Stormwater runoff shall be calculated in accordance with the following:

1. The design engineer shall calculate runoff using one of the following methods:

a. The USDA Natural Resources Conservation Service (NRCS) methodology, including the NRCS Runoff Equation and Dimensionless Unit Hydrograph, as described in the NRCS National Engineering Handbook Section 4 – Hydrology and Technical Release 55 – Urban Hydrology for Small Watersheds; or

b. The Rational Method for peak flow and the Modified Rational Method for hydrograph computations.

2. For the purpose of calculating runoff coefficients and groundwater recharge, there is a presumption that the pre-construction condition of a site or portion thereof is a wooded land use

with good hydrologic condition. The term "runoff coefficient" applies to both the NRCS methodology at Section 5.A.1.a and the Rational and Modified Rational Methods at Section 5.A.1.b. A runoff coefficient or a groundwater recharge land cover for an existing condition may be used on all or a portion of the site if the design engineer verifies that the hydrologic condition has existed on the site or portion of the site for at least five years without interruption prior to the time of application. If more than one land cover have existed on the site during the five years immediately prior to the time of application, the land cover with the lowest runoff potential shall be used for the computations. In addition, there is the presumption that the site is in good hydrologic condition (if the land use type is pasture, lawn, or park), with good cover (if the land use type is woods), or with good hydrologic condition and conservation treatment (if the land use type is cultivation).

3. In computing pre-construction stormwater runoff, the design engineer shall account for all significant land features and structures, such as ponds, wetlands, depressions, hedgerows, or culverts, that may reduce pre-construction stormwater runoff rates and volumes.

4. In computing stormwater runoff from all design storms, the design engineer shall consider the relative stormwater runoff rates and/or volumes of pervious and impervious surfaces separately to accurately compute the rates and volume of stormwater runoff from the site. To calculate runoff from unconnected impervious cover, urban impervious area modifications as described in the NRCS Technical Release 55 – Urban Hydrology for Small Watersheds and other methods may be employed.

5. If the invert of the outlet structure of a stormwater management measure is below the flood hazard design flood elevation as defined at N.J.A.C. 7:13, the design engineer shall take into account the effects of tailwater in the design of structural stormwater management measures.

B. Groundwater recharge may be calculated in accordance with the following:

1. The New Jersey Geological Survey Report GSR-32 A Method for Evaluating Ground-Water Recharge Areas in New Jersey, incorporated herein by reference as amended and supplemented. Information regarding the methodology is available from the New Jersey Stormwater Best Management Practices Manual; at http://www.state.nj.us/dep/njgs/; or at New Jersey Geological Survey, 29 Arctic Parkway, P.O. Box 427 Trenton, New Jersey 08625-0427; (609) 984-6587.

Section 6: Standards for Structural Stormwater Management Measures

A. Standards for structural stormwater management measures are as follows:

1. Structural stormwater management measures shall be designed to take into account the existing site conditions, including, for example, environmentally critical areas, wetlands; flood-prone areas; slopes; depth to seasonal high water table; soil type, permeability and texture; drainage area and drainage patterns; and the presence of solution-prone carbonate rocks (limestone).

2. Structural stormwater management measures shall be designed to minimize maintenance, facilitate maintenance and repairs, and ensure proper functioning. Trash racks shall be installed at the intake to the outlet structure as appropriate, and shall have parallel bars with one-inch (1") spacing between the bars to the elevation of the water quality design storm. For elevations higher than the water quality design storm, the parallel bars at the outlet structure shall be spaced no greater than

one-third (1/3) the width of the diameter of the orifice or one-third (1/3) the width of the weir, with a minimum spacing between bars of one-inch and a maximum spacing between bars of six inches. In addition, the design of trash racks must comply with the requirements of Section 8.D.

3. Structural stormwater management measures shall be designed, constructed, and installed to be strong, durable, and corrosion resistant. Measures that are consistent with the relevant portions of the Residential Site Improvement Standards at N.J.A.C. 5:21-7.3, 7.4, and 7.5 shall be deemed to meet this requirement.

4. At the intake to the outlet from the stormwater management basin, the orifice size shall be a minimum of two and one-half inches in diameter.

5. Stormwater management basins shall be designed to meet the minimum safety standards for stormwater management basins at Section 8.

B. Stormwater management measure guidelines are available in the New Jersey Stormwater Best Management Practices Manual. Other stormwater management measures may be utilized provided the design engineer demonstrates that the proposed measure and its design will accomplish the required water quantity, groundwater recharge and water quality design and performance standards established by Section 4 of this ordinance.

C. Manufactured treatment devices may be used to meet the requirements of Section 4 of this ordinance, provided the pollutant removal rates are verified by the New Jersey Corporation for Advanced Technology and certified by the Department.

Section 7: Sources for Technical Guidance

A. Technical guidance for stormwater management measures can be found in the documents listed at 1 and 2 below, which are available from Maps and Publications, New Jersey Department of Environmental Protection, 428 East State Street, P.O. Box 420, Trenton, New Jersey, 08625; telephone (609) 777-1038.

1. Guidelines for stormwater management measures are contained in the New Jersey Stormwater Best Management Practices Manual, as amended. Information is provided on stormwater management measures such as: bioretention systems, constructed stormwater wetlands, dry wells, extended detention basins, infiltration structures, manufactured treatment devices, pervious paving, sand filters, vegetative filter strips, and wet ponds.

2. The New Jersey Department of Environmental Protection Stormwater Management Facilities Maintenance Manual, as amended.

B. Additional technical guidance for stormwater management measures can be obtained from the following:

1. The "Standards for Soil Erosion and Sediment Control in New Jersey" promulgated by the State Soil Conservation Committee and incorporated into N.J.A.C. 2:90. Copies of these standards may be obtained by contacting the State Soil Conservation Committee or any of the Soil Conservation Districts listed in N.J.A.C. 2:90-1.3(a)4. The location, address, and telephone number of each Soil

Conservation District may be obtained from the State Soil Conservation Committee, P.O. Box 330, Trenton, New Jersey 08625; (609) 292-5540;

2. The Rutgers Cooperative Extension Service, 732-932-9306; and

3. The Soil Conservation Districts listed in N.J.A.C. 2:90-1.3(a)4. The location, address, and telephone number of each Soil Conservation District may be obtained from the State Soil Conservation Committee, P.O. Box 330, Trenton, New Jersey, 08625, (609) 292-5540.

Section 8: Safety Standards for Stormwater Management Basins

A. This section sets forth requirements to protect public safety through the proper design and operation of stormwater management basins. This section applies to any new stormwater management basin.

Note: The provisions of this section are not intended to preempt more stringent municipal or county safety requirements for new or existing stormwater management basins. Municipal and county stormwater management plans and ordinances may, pursuant to their authority, require existing stormwater management basins to be retrofitted to meet one or more of the safety standards in Sections 8.B.1, 8.B.2, and 8.B.3 for trash racks, overflow grates, and escape provisions at outlet structures.

B. Requirements for Trash Racks, Overflow Grates and Escape Provisions

1. A trash rack is a device designed to catch trash and debris and prevent the clogging of outlet structures. Trash racks shall be installed at the intake to the outlet from the stormwater management basin to ensure proper functioning of the basin outlets in accordance with the following:

   a. The trash rack shall have parallel bars, with no greater than six inch spacing between the bars.

   b. The trash rack shall be designed so as not to adversely affect the hydraulic performance of the outlet pipe or structure.

   c. The average velocity of flow through a clean trash rack is not to exceed 2.5 feet per second under the full range of stage and discharge. Velocity is to be computed on the basis of the net area of opening through the rack.

   d. The trash rack shall be constructed and installed to be rigid, durable, and corrosion resistant, and shall be designed to withstand a perpendicular live loading of 300 lbs/ft sq.

2. An overflow grate is designed to prevent obstruction of the overflow structure. If an outlet structure has an overflow grate, such grate shall meet the following requirements:

   a. The overflow grate shall be secured to the outlet structure but removable for emergencies and maintenance.

   b. The overflow grate spacing shall be no less than two inches across the smallest dimension.

   c. The overflow grate shall be constructed and installed to be rigid, durable, and corrosion resistant, and shall be designed to withstand a perpendicular live loading of 300 lbs./ft sq.

3. For purposes of this paragraph 3, escape provisions means the permanent installation of ladders, steps, rungs, or other features that provide easily accessible means of egress from stormwater management basins. Stormwater management basins shall include escape provisions as follows:

   a. If a stormwater management basin has an outlet structure, escape provisions shall be incorporated in or on the structure. With the prior approval of the reviewing agency identified in Section 8.C a free-standing outlet structure may be exempted from this requirement.

   b. Safety ledges shall be constructed on the slopes of all new stormwater management basins having a permanent pool of water deeper than two and one-half feet. Such safety ledges shall be comprised of two steps. Each step shall be four to six feet in width. One step shall be located

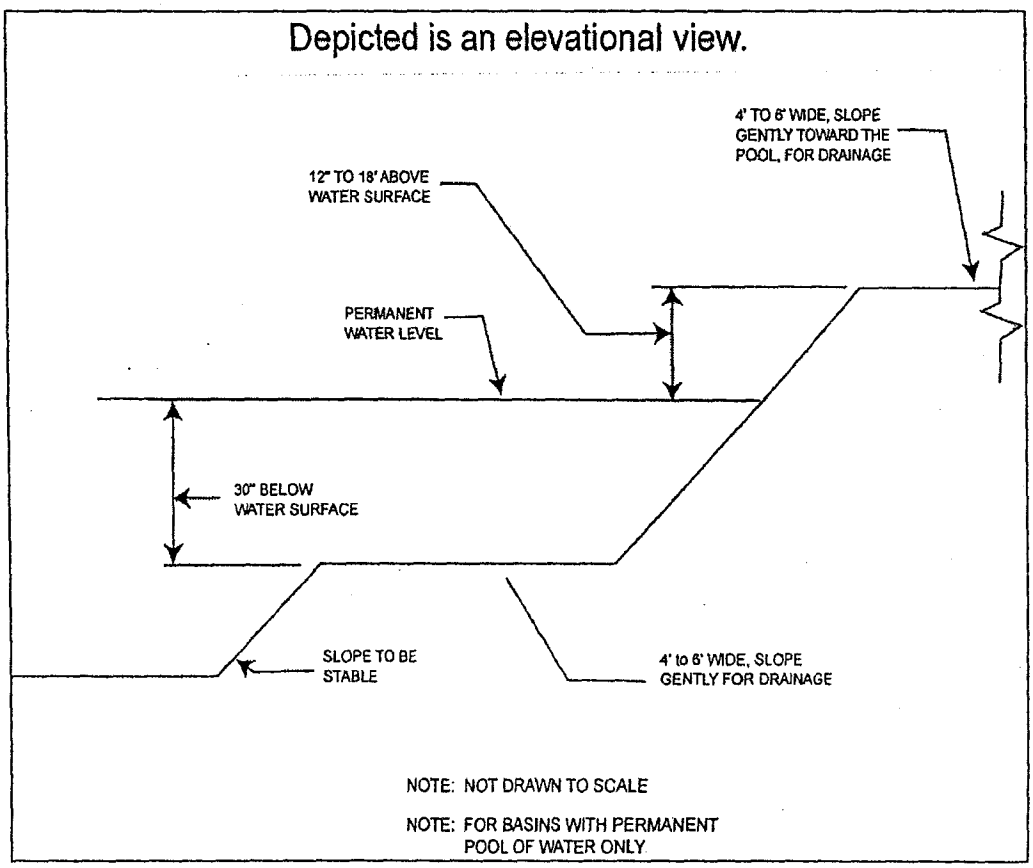
approximately two and one-half feet below the permanent water surface, and the second step shall be located one to one and one-half feet above the permanent water surface. See Section 8.D for an illustration of safety ledges in a stormwater management basin.

c. In new stormwater management basins, the maximum interior slope for an earthen dam, embankment, or berm shall not be steeper than 3 horizontal to 1 vertical.

C. Variance or Exemption from Safety Standards

1. A variance or exemption from the safety standards for stormwater management basins may be granted only upon a written finding by the appropriate reviewing agency (municipality, county or Department) that the variance or exemption will not constitute a threat to public safety.

D. Illustration of Safety Ledges in a New Stormwater Management Basin



Section 9: Requirements for a Site Development Stormwater Plan

A. Submission of Site Development Stormwater Plan

1. Whenever an applicant seeks municipal approval of a development subject to this ordinance, the applicant shall submit all of the required components of the Checklist for the Site Development Stormwater Plan at Section 9.C below as part of the submission of the applicant's application for subdivision or site plan approval.

2. The applicant shall demonstrate that the project meets the standards set forth in this ordinance.

3. The applicant shall submit [*specify number*] copies of the materials listed in the checklist for site development stormwater plans in accordance with Section 9.C of this ordinance.

B. Site Development Stormwater Plan Approval

The applicant's Site Development project shall be reviewed as a part of the subdivision or site plan review process by the municipal board or official from which municipal approval is sought. That municipal board or official shall consult the engineer retained by the Planning and/or Zoning Board (as appropriate) to determine if all of the checklist requirements have been satisfied and to determine if the project meets the standards set forth in this ordinance.

C. Checklist Requirements

The following information shall be required:

1. Topographic Base Map

The reviewing engineer may require upstream tributary drainage system information as necessary. It is recommended that the topographic base map of the site be submitted which extends a minimum of 200 feet beyond the limits of the proposed development, at a scale of 1"=200' or greater, showing 2-foot contour intervals. The map as appropriate may indicate the following: existing surface water drainage, shorelines, steep slopes, soils, erodible soils, perennial or intermittent streams that drain into or upstream of the Category One waters, wetlands and flood plains along with their appropriate buffer strips, marshlands and other wetlands, pervious or vegetative surfaces, existing man-made structures, roads, bearing and distances of property lines, and significant natural and manmade features not otherwise shown.

2. Environmental Site Analysis

A written and graphic description of the natural and man-made features of the site and its environs. This description should include a discussion of soil conditions, slopes, wetlands, waterways and vegetation on the site. Particular attention should be given to unique, unusual, or environmentally sensitive features and to those that provide particular opportunities or constraints for development.

3. Project Description and Site Plan(s)

A map (or maps) at the scale of the topographical base map indicating the location of existing and proposed buildings, roads, parking areas, utilities, structural facilities for stormwater management and sediment control, and other permanent structures. The map(s) shall also clearly show areas where alterations occur in the natural terrain and cover, including lawns and other landscaping, and seasonal high ground water elevations. A written description of the site plan and justification of proposed changes in natural conditions may also be provided.

4. Land Use Planning and Source Control Plan

This plan shall provide a demonstration of how the goals and standards of Sections 3 through 6 are being met. The focus of this plan shall be to describe how the site is being developed to meet the

objective of controlling groundwater recharge, stormwater quality and stormwater quantity problems at the source by land management and source controls whenever possible.

5. Stormwater Management Facilities Map

The following information, illustrated on a map of the same scale as the topographic base map, shall be included:

a. Total area to be paved or built upon, proposed surface contours, land area to be occupied by the stormwater management facilities and the type of vegetation thereon, and details of the proposed plan to control and dispose of stormwater.

b. Details of all stormwater management facility designs, during and after construction, including discharge provisions, discharge capacity for each outlet at different levels of detention and emergency spillway provisions with maximum discharge capacity of each spillway.

6. Calculations

a. Comprehensive hydrologic and hydraulic design calculations for the pre-development and post-development conditions for the design storms specified in Section 4 of this ordinance.

b. When the proposed stormwater management control measures (e.g., infiltration basins) depends on the hydrologic properties of soils, then a soils report shall be submitted. The soils report shall be based on onsite boring logs or soil pit profiles. The number and location of required soil borings or soil pits shall be determined based on what is needed to determine the suitability and distribution of soils present at the location of the control measure.

7. Maintenance and Repair Plan

The design and planning of the stormwater management facility shall meet the maintenance requirements of Section 10.

8. Waiver from Submission Requirements

The municipal official or board reviewing an application under this ordinance may, in consultation with the municipal engineer, waive submission of any of the requirements in Sections 9.C.1 through 9.C.6 of this ordinance when it can be demonstrated that the information requested is impossible to obtain or it would create a hardship on the applicant to obtain and its absence will not materially affect the review process.

Section 10: Maintenance and Repair

A. Applicability

1. Projects subject to review as in Section 1.C of this ordinance shall comply with the requirements of Sections 10.B and 10.C.

B. General Maintenance

1. The design engineer shall prepare a maintenance plan for the stormwater management measures incorporated into the design of a major development.

2. The maintenance plan shall contain specific preventative maintenance tasks and schedules; cost estimates, including estimated cost of sediment, debris, or trash removal; and the name, address, and telephone number of the person or persons responsible for preventative and corrective maintenance (including replacement). Maintenance guidelines for stormwater management measures are available in the New Jersey Stormwater Best Management Practices Manual. If the maintenance plan identifies a person other than the developer (for example, a public agency or homeowners' association) as having the responsibility for maintenance, the plan shall include documentation of such person's agreement to assume this responsibility, or of the developer's obligation to dedicate a stormwater management facility to such person under an applicable ordinance or regulation.

3. Responsibility for maintenance shall not be assigned or transferred to the owner or tenant of an individual property in a residential development or project, unless such owner or tenant owns or leases the entire residential development or project.

4. If the person responsible for maintenance identified under Section 10.B.2 above is not a public agency, the maintenance plan and any future revisions based on Section 10.B.7 below shall be recorded upon the deed of record for each property on which the maintenance described in the maintenance plan must be undertaken.

5. Preventative and corrective maintenance shall be performed to maintain the function of the stormwater management measure, including repairs or replacement to the structure; removal of sediment, debris, or trash; restoration of eroded areas; snow and ice removal; fence repair or replacement; restoration of vegetation; and repair or replacement of nonvegetated linings.

6. The person responsible for maintenance identified under Section 10.B.2 above shall maintain a detailed log of all preventative and corrective maintenance for the structural stormwater management measures incorporated into the design of the development, including a record of all inspections and copies of all maintenance-related work orders.

7. The person responsible for maintenance identified under Section 10.B.2 above shall evaluate the effectiveness of the maintenance plan at least once per year and adjust the plan and the deed as needed.

8. The person responsible for maintenance identified under Section 10.B.2 above shall retain and make available, upon request by any public entity with administrative, health, environmental, or safety authority over the site, the maintenance plan and the documentation required by Sections 10.B.6 and 10.B.7 above.

9. The requirements of Sections 10.B.3 and 10.B.4 do not apply to stormwater management facilities that are dedicated to and accepted by the municipality or another governmental agency.

Note: It may be appropriate to delete requirements in the maintenance and repair plan that are not applicable if the ordinance requires the facility to be dedicated to the municipality. If the municipality does not want to take this responsibility, the ordinance should require the posting of a two year maintenance guarantee in accordance with N.J.S.A. 40:55D-53. Guidelines for developing a maintenance and inspection program are provided in the New Jersey Stormwater Best Management Practices Manual and the NJDEP Ocean County Demonstration Study, Stormwater Management Facilities Maintenance Manual, dated June 1989 available from the NJDEP, Watershed Management Program.

10. In the event that the stormwater management facility becomes a danger to public safety or public health, or if it is in need of maintenance or repair, the municipality shall so notify the responsible person in writing. Upon receipt of that notice, the responsible person shall have fourteen (14) days to effect maintenance and repair of the facility in a manner that is approved by the municipal engineer or his designee. The municipality, in its discretion, may extend the time allowed for effecting maintenance and repair for good cause. If the responsible person fails or refuses to perform such maintenance and repair, the municipality or County may immediately proceed to do so and shall bill the cost thereof to the responsible person.

B. Nothing in this section shall preclude the municipality in which the major development is located from requiring the posting of a performance or maintenance guarantee in accordance with N.J.S.A. 40:55D-53.

Section 11: Penalties

Any person who erects, constructs, alters, repairs, converts, maintains, or uses any building, structure or land in violation of this ordinance shall be subject to the following penalties: [*Municipality to specify*].

Section 12: Effective Date

This ordinance shall take effect immediately upon the approval by the county review agency, or sixty (60) days from the receipt of the ordinance by the county review agency if the county review agency should fail to act.

Section 13: Severability

If the provisions of any section, subsection, paragraph, subdivision, or clause of this ordinance shall be judged invalid by a court of competent jurisdiction, such order of judgment shall not affect or invalidate the remainder of any section, subsection, paragraph, subdivision, or clause of this ordinance.

APPENDIX B

MONMOUTH COUNTY HEALTH DEPARTMENT TESTING RESULTS

The Monmouth County Department of Health (MCHD) monitors 62 representative stations throughout Monmouth County. Stations are sampled quarterly for fecal coliform and twice annually for ammonia and total phosphorus. The MCHD Environmental Laboratory analyzes the samples. Standards are: Fecal Coliform - 200 fecal colonies/100 ml, Ammonia - 0.05 mg/L, Phosphorus - 0.1 mg/l

GRAVELLY BROOK, MARLBORO

Collection Date	Fecal	Ammonia	Phosphorus	Ph	TSS	Turbidity	SWQS	Salinity	Temperature (Celsius)
6/14/2005	10			3.92	2.8	0.93	FW2NT	0	22.6
3/22/2005	10	0.1	0.134	4.29	26	22.2		0.1	7.2
11/15/2004	10		0.2	5.71	79.2	13.7		0.7	7.8
9/27/2004	10			3.89	5.6	2.12		0.1	14.9
6/9/2004	10	0.14	0.06	3.82	4.4	0.99		0.1	22.6
2/19/2004	<10 10			4.31	7.2	3.08			
9/11/2003	10	0.12	0.03	3.8	4.8	0.92			
6/24/2003	< 10			4.48	4	16			
3/11/2003	< 10	0.25	0.07	4.42	5.2	3.5			
12/17/2002	< 10			3.8	4	1.9			
10/15/2002	< 10	0.94	0.05	5.92	6.4	4.1			
6/18/2002	20			4	12.42	2.1			
3/19/2002	< 10	0.2	0.15	6.1	23				
12/11/2001	< 10			4.41	1				
10/16/2001	< 10	0.1	0.17	3.9	12				
6/18/2001	8			4.3	4				
3/20/2001	< 10	< 0.07	0.05	9.12	2				
12/19/2000	< 4								
10/17/2000	< 10	< 6	0.034						
6/20/2000	10								
3/21/2000	< 10	0.14	0.11						
12/15/1999	10								
10/13/1999	< 10	< 0.03	0.02						
6/22/1999	50								
3/9/1999	< 10	0.21	< 0.02						

The Monmouth County Department of Health (MCHD) monitors 62 representative stations throughout Monmouth County. Stations are sampled quarterly for fecal coliform and twice annually for ammonia and total phosphorus. The MCHD Environmental Laboratory analyzes the samples. Standards are: Fecal Coliform - 200 fecal colonies/100 ml, Ammonia - 0.05 mg/L, Phosphorus - 0.1 mg/l

BIG BROOK, MARLBORO

Collection Date	Fecal	Ammonia	Phosphorus	Ph	TSS	Turbidity	SWQS	Salinity	Temperature (Celsius)
6/14/2005	420			7.2	10.4	19.9	FW2NT	0.1	24.1
3/22/2005	10	0.1	0.071	7.21	6.8	5.15		0.1	6.9
11/15/2004	20		0.12	6.95	11.2	6.56		0.1	6.5
9/27/2004	150			7.16	7.6	10.8		0.1	15.5
6/9/2004	470	0.17	0.14	6.59	10	20		0.1	23.1
2/19/2004	< 10			6.95	3.2	5.54			
9/11/2003	210	< 0.1	0.08	7	2.4	18.9			
6/24/2003	300			6.99	8.4	14.2			
3/11/2003	20	0.2	0.13	7.03	9.2	4.9			
12/17/2002	30			6.5	10.4	7			
10/15/2002	120	0.34	0.08	6.76	6.8	5.4			
6/18/2002	170			7	14.8	13.2			
3/19/2002	40	< 0.1	0.07	7.1	10				
12/11/2001	30			6.68	18				
10/16/2001	860	0.66	0.07	6.84	10				
6/18/2001	340			7.1	10				
3/20/2001	70	< 0.07	0.09	7.07	4				
12/19/2000	8								
10/17/2000	120	0.1	0.058						
6/20/2000	960								
3/21/2000	60	< 0.05	0.09						
12/15/1999	20								
10/13/1999	100	< 0.03	0.105						
6/22/1999	320								
3/9/1999	< 10	0.47	0.18						

The Monmouth County Heath Department also conducts Rapid Bioassessment (RBA) to determine the health of various streams across the county. The following tables illustrate the results of RBA testing that has been completed in Marlboro Township.

Biological Assessment	NJIS Score	Habitat Assessment	Habitat Score
Non-impaired	24-30	Optimal	16-20
Moderately Impaired	9-21	Suboptimal	11-15
Severly Impaired	0-6	Marginal	6-10
		Poor	0-5

Rapid Bioassessment Sites	Sample Date	NJIS Score	Habitat Assessment Score
Matawan Creek, Greenwood Rd., Marlboro @ Raritan Bayshore Site Code:MATA1	6/6/2003	9	15.5

Biological Assessment	NJIS Score	Habitat Assessement	Habitat Score
Non-impaired	24-30	Optimal	16-20
Moderately Impaired	9-21	Suboptimal	11-15
Severly Impaired	0-6	Marginal	6-10
		Poor	0-5

Rapid Bioassessment Sites	Sample Date	NJIS Score	Habitat Assessment Score
Deep Run, Marlboro @ South River Site Code:90	11/17/1999	0	13

APPENDIX C

NEW JERSEY 2004 LIST OF INTEGRATED WATERBODIES

Water Quality Testing Sites Within Marlboro Township Included in the New Jersey 2004 Integrated List of Waterbodies

Sublist	Watershed Region	WMA	Station Name/Waterbody	Site ID	Parameters	Data Source
3	Atlantic Coast	12	Big Brook at Rt 79 in Marlboro	AN0469	Benthic Macroinvertebrates	NJDEP AMNET
5	Atlantic Coast	12	Gravelly Brook at Lloyd Rd in Marlboro	20	Phosphorus	Monmouth Co HD
1	Atlantic Coast	12	Gravelly Brook at Lloyd Rd in Marlboro	20	Fecal Coliform, Nitrate	Monmouth Co HD
3	Atlantic Coast	12	Gravelly Brook at Lloyd Rd in Marlboro	20	pH, Total Suspended Solids	Monmouth Co HD
5	Atlantic Coast	12	Willow Brook Trib. at Igoe Rd in Marlboro	AN0468A	Benthic Macroinvertebrates	NJDEP AMNET

APPENDIX D

NJDEP AMNET PROGRAM RESULTS

Station: AN0469
Big Brook, Nj Rt. 79, Marlboro Twp., Monmouth
Marlboro USGS Quadrangle
Date Sampled: 08/11/99

Family	Family Tolerance Value (FTV)	Number of Individuals
Chironomidae	6	61
Empididae	6	6
Hydropsychidae	4	6
Psychomyiidae	2	4
BloodRed Chironomidae	8	4
Physidae	7	4
Calopterygidae	5	3
Tubificidae	10	3
Dytiscidae	5	1
Lumbriculidae	8	1
Veliidae	9	1
Tipulidae	3	1

Statistical Analysis

Number of Taxa: 12
Total Number of Individuals: 95
% Contribution of Dominant Family: 64.21 % (Chironomidae)
Family Biotic Index: 5.94
Scraper/Filterer Collector Ratio: 1.33
Shredder/Total Ratio: 0.65
E+P+T (Ephemeroptera, Plecoptera, Trichoptera): 2
% EPT: 10.53
EPT/C: 0.15
NJIS Rating: 12
Biological Condition: Moderately Impaired
Habitat Analysis: 114
Deficiency(s) noted: Chironomidae Family Overwhelmingly Dominant - Paucity of Clean Water Organisms

Observations

Streamwater: Clear....Flow: Moderate....Width/Depth (ft): 8/<1
Substrate: Gravel/Sand, Silt....StreamBank Vegetation/Stability: Trees, Shrubs/Poor
Canopy: Mostly Closed....Other: Suburban; Storm sewers
Fish, Trash, Iron precipitate; Water temp. 18.2C / pH 6.7SU / DO 7.5mg/L / Cond. 317umhos

Station: AN0453
Deep Run, Rt 9 , Old Bridge Twp., Middlesex County
S Amboy USGS Quadrangle
Date Sampled: 08/20/98

Family	Family Tolerance Value (FTV)	Number of Individuals
Chironomidae	6	36
Tipulidae	3	4
Polycentropodidae	6	4
Phryganeidae	4	4
Sialidae	4	4
Enchytraeidae	10	3
Tubificidae	10	3
BloodRed Chironomidae	8	3
Calopterygidae	5	2
Elmidae	4	2
Corydalidae	0	2
Simuliidae	6	2
Gyrinidae	3	1
Coenagrionidae	9	1
Physidae	7	1
Naididae	7	1

Statistical Analysis

Number of Taxa: 16
Total Number of Individuals: 73
% Contribution of Dominant Family: 49.32 % (Chironomidae)
Family Biotic Index: 5.81
Scraper/Filterer Collector Ratio: 0.50
Shredder/Total Ratio: 0.10
E+P+T (Ephemeroptera, Plecoptera, Trichoptera): 2
% EPT: 10.96
EPT/C: 0.28
NJIS Rating: 15
Biological Condition: Moderately Impaired
Habitat Analysis: 182
Deficiency(s) noted:
- Paucity of Clean Water Organisms -

Observations

Streamwater: Slightly Turbid....Flow: Slow....Width/Depth (ft): 20/2
Substrate: Gravel,sand,mud....StreamBank Vegetation/Stability: Trees/Stable
Canopy: Closed....Other: Rural/Forested; Water temp.17.6 /pH 4.9 /DO 7.7 /Cond.317

Station: AN0454
Deep Run, Rt 516 , S Old Bridge, Old Bridge Twp., Middlesex County
S Amboy USGS Quadrangle
Date Sampled: 09/10/98

Family	Family Tolerance Value (FTV)	Number of Individuals
Tubificidae	10	50
Coenagrionidae	9	24
Asellidae	8	13
Chironomidae	6	12
Calopterygidae	5	2
Aeshnidae	3	1

Statistical Analysis

Number of Taxa: 6
Total Number of Individuals: 102
% Contribution of Dominant Family: 49.02 % (Tubificidae)
Family Biotic Index: 8.87
Scraper/Filterer Collector Ratio: 0.00
Shredder/Total Ratio: 0.00
E+P+T (Ephemeroptera, Plecoptera, Trichoptera): 0
% EPT: 0.00
EPT/C: 0.00
NJIS Rating: 6
Biological Condition: Severely Impaired
Habitat Analysis: 141
Deficiency(s) noted:
- Significant Organic Pollution - Paucity of Clean Water Organisms -

Observations

Streamwater: Turbid....Flow: Slow....Width/Depth (ft): 22/3
Substrate: Gravel,silt....StreamBank Vegetation/Stability: Trees,shrubs/Unstable
Canopy: Mostly Closed....Other: Rural/Forested/Construction in area; Water temp.16.9 /pH 6.3 /DO 6.0 /Cond.265

APPENDIX E

BUILD OUT ANALYSIS

MARLBORO TOWNSHIP STORMWATER MANAGEMENT BUILD OUT ANALYSIS

As Marlboro Township contains more than one acre of agricultural and/or vacant land, in compliance with N.J.A.C 7:8 4-2, the Township has completed a Build Out Analysis. This Build Out Analysis projects the maximum amount of additional pollutant loadings that would be incurred within each of the Township's HUC 14 subwatersheds at full build out according to Marlboro Township's current zoning provisions.

This analysis utilized data sets that have been produced by the New Jersey Department of Environmental Protection (NJDEP) and incorporated them into a Geographical Information System (Arc View 9.0) to project the amount of additional pollutant loads.

To determine the extend to which pollutants will affect each HUC 14 subwatershed, multipliers projecting additional Phosphorous, Nitrogen, and Total Suspended Solids were completed and are included in Table 8 below. These multipliers can be found in the NJDEP's Best Management Practices Manual and has been provided below.

Land Cover	Total Phosphorus Load (lbs/acre/year)	Total Nitrogen Load (lbs/acre/year)	Total Suspended Solids Load (lbs/acre/yr)
High, Medium Density Residential	1.4	15	140
Low Density, Rural Residential	0.6	5	100
Commercial	2.1	22	200
Industrial	1.5	16	200
Urban, Mixed Urban, Other Urban	1.0	10	120
Agricultural	1.3	10	300
Forest, Water, Wetlands	0.1	3	40
Barrenland/Transitional Area	0.5	5	60

Source: NJDEP Stormwater BMP Manual 2004.

A detailed land use analysis of the Township was conducted. Figure 3 Land Use Map, illustrates the existing land use in the Township based on 1995/97 GIS information from NJDEP. Figure 2, Wetlands Map, also illustrates the HUC14s within Marlboro. In addition, Marlboro's most up to date zoning map is also illustrated in Figure 2. As expected, when developing agricultural land and forested lands, the build out of these HUC-14's in Marlboro will result in a significant increase in impervious surfaces. The pollutant load projections at full build out are presented in Table 8 "Marlboro Township MSWMP Build Out Analysis Table", below.

Marlboro Township MSWMP Build Out Analysis Table

HUC 14	Zone	Build-Out Zoning	Acres per Zone	Existing Impervious Acres	Undeveloped Constrained (Acres)*	Undeveloped Unconstrained (Acres)	Max Impervious Allowed	Additional Impervious Acres	TP (lbs/acre/year)**	TP(lbs/year)**	TN (lbs/acre/year)**	TN (lbs/year)**	TSS (lbs/acre/year)**	TSS (acre/year)**
	LI (Industrial District)	Industrial	270.55	56.01	85.17	129.37	60%	77.62	1.5	11.43	16	1241.92	200	15524.0
	PAC-II (Residential District)	High Density Residential	13.44	.28	2.14	11.02	60%	6.61	1.4	9.25	15	99.15	140	925.4
	PAC (Residential District)	Medium Density Residential	.01	0	0	0	60%	0	1.4	0	15	0	140	0
	MZ (Municipal Zone)	Commercial	65.45	1.19	19.36	44.9	60%	26.94	1.0	26.94	10	269.4	120	3232.8
	R30/20 (Residential District)	High Density Residential	698.41	174.29	84.31	439.81	28%	123.14	1.4	172.39	15	1847.1	140	17239.6
	R-80 (Residential District)	Low Density Residential	309.55	11.88	36.75	260.92	15%	39.13	0.6	23.47	5	195.65	100	3913.0
	SCPR (Residential District)	Low Density Residential	261.80	.22	54.09	207.49	25%	51.87	0.6	31.12	5	259.35	100	5187.0
	R-15 (Residential District)	Medium Density Residential	45.15	7.53	9.54	28.08	28%	7.86	1.4	11.0	15	117.9	140	1100.4
	R-20 (Residential District)	Medium Density Residential	13.77	3.35	0	10.42	28%	8.33	1.4	11.66	15	124.95	140	1166.2
	R-20/AH1 (Residential District)	Medium Density Residential	199.22	1.48	74.56	123.18	28%	34.49	1.4	48.28	15	517.35	140	4828.6
	R-20/AH2 (Residential District)	Medium Density Residential	57.76	.60	14.47	22.69	28%	6.35	1.4	8.89	15	95.25	140	869.0
Total			**3397.07**	**327.87**	**861.52**	**2208.47**		**479.59**		**495.58**		**6192.84**		63731.6
02030104070040	R-40/GAH (Residential District)	Low Density Residential	81.80	.08	9.61	72.11	15%	10.81	0.6	6.48	5	54.05	100	1081.0
	R-80 (Residential District)	Low Density Residential	932.39	59.11	230.69	642.59	15%	96.38	**0.6**	57.83	5	**481.9**	100	9638.0
Total			**1014.19**	**59.19**	**241.30**	**714.7**		**107.19**		**64.13**		**535.95**		**10719.0**
02030105150020	THD (Townhouse District)	High Density Residential	36.06	12.86	7.05	16.15	20%	3.23	1.4	4.52	15	48.45	140	452.2
	FSC (Flexible Senior Citizen District)	High Density Residential	37.46	11.29	0	26.17	32%	8.37	1.4	11.71	15	125.55	140	1171.8
	PAC (Residential District)	High Density Residential	342.76	114.01	63.86	164.89	28%	46.16	1.4	64.62	15	692.4	140	6462.4
	C-1 (Commercial District)	Commercial	.08	0	0	0	60%	0	2.1	0	22	0	100	0
	C-2 (Community Commercial District)	Commercial	41.26	10.92	2.54	27.8	60%	16.68	2.1	35.02	22	366.96	100	1668.0
	R-30/20 (Residential District)	Medium Density Residential	172.10	47.87	.49	123.74	28%	34.64	1.4	48.49	15	519.6	140	4849.6
	R-40/GAH (Residential District)	Low Density Residential	33.62	0	9.58	24.04	15%	3.6	0.6	2.16	5	18.0	100	360.0
	R-80 (Residential District)	Low Density Residential	82.31	2.30	11.94	68.07	15%	10.21	0.6	6.12	5	51.05	100	1021.0
	FSC (Flexible Senior Citizen District)	High Density Residential	37.46	11.29	0	26.17	32%	8.37	1.4	11.71	15	125.55	140	1171.8
	LI (Light Industrial District)	Industrial	1.37	.05	0	1.32	60%	79	2.1	1.65	22	17.38	100	7.90
	MZ (Municipal Zone)	Commercial	112.72	2.95	29.11	80.66	60%	18.39	2.1	38.61	22	404.58	100	1839.0
	C-5 (Commercial District)	Commercial	275.01	19.63	52.02	203.36	60%	122.01	2.1	256.22	22	2684.22	100	1220.10
	PAC-II (Residential District)	High Density Residential	97.65	1.17	36.7	59.78	55%	32.87	1.4	46.01	15	493.05	140	4601.8
	R-20 (Residential District)	Medium Density Residential	216.62	45.63	32.63	138.36	28%	52.57	1.4	73.59	15	788.55	140	7359.8
	R-25 (Residential District)	Medium Density Residential	83.00	26.44	10.91	45.65	25%	11.41	1.4	15.97	15	171.15	140	1597.4
	R-60 (Residential District)	Low Density Residential	158.32	29.36	38.82	90.14	15%	13.5	0.6	8.1	5	67.5	100	1350.0
Total			**1727.8**	**335.77**	**345.65**	**1046.3**		**382.8**		**624.5**		6573.99		**35132.8**
02030105150030	MZ (Municipal Zone)	Commercial	296.64	42.89	104.48	149.27	60%	89.56	2.1	188.07	22	1970.32	100	8956.0
	FSC (Flexible Senior Citizen District)	High Density Residential	206.38	66.45	19.14	120.79	32%	38.65	**1.4**	**54.11**	15	579.75	140	5411.0
	R-20 (Residential District)	Medium Density Residential	622.87	140.30	47.22	435.35	28%	121.89	1.4	170.64	15	1823.85	140	17064.6
	R-60 (Residential District)	Low Density Residential	6.11	.66	3.74	1.71	15%	.25	0.6	.15	5	**1.25**	100	250.0
	R-80 (Residential District)	Low Density Residential	1.55	.19	0	1.36	15%	.20	0.6	.12	5	1.0	100	200.0
	R-15 (Residential District)	Medium Density Residential	6.93	2.07	0	4.86	28%	1.36	1.4	1.90	15	**20.4**	140	190.4
	R30/20 (Residential District)	Medium Density Residential	416.07	80.49	77.5	258.08	28%	72.26	1.4	101.16	15	1083.9	140	10190.4
Total			**1556.55**	**333.05**	**252.08**	**971.42**		**324.17**		**516.15**		**5480.47**		**42264.2**
02030105150040	FRD (Flexible Residential District)	High Density Residential	104.22	24.39	11.45	68.38	28%	19.14	1.4	26.79	15	287.1	140	2679.6
	R-20 (Residential District)	Medium Density Residential	409.69	88.73	19.42	301.54	28%	84.43	1.4	118.2	15	1266.45	140	11820.2
	C-3 (Commercial District)	Commercial	77.55	28.89	9.05	39.61	60%	23.76	2.1	49.89	22	522.72	100	2376.0
	MZ (Municipal Zone)	Commercial	5.6	3.36	0	2.0	60%	1.2	2.1	2.52	22	26.4	100	120.0
	R-40/30 (Residential District)	Low Density Residential	46.03	5.05	14.20	26.78	20%	5.35	0.6	3.21	5	26.75	100	535.0
	R-60 (Residential District)	Low Density Residential	03	0	0	0	20%	0	0.6	0	5	0	100	0
	R-80 (Residential District)	Low Density Residential	245.81	38.21	46.21	181.39	20%	36.27	0.6	21.76	5	181.35	100	3627.0
	RSC (Senior Citizen Residential District)	High Density Residential	56.52	20.65	4.87	31.0	32%	9.92	1.4	13.88	15	148.8	140	1388.8
Total			**945.45**	**189.28**	**105.2**	**650.7**		**180.07**		**236.25**		**2459.7**		**22546.6**

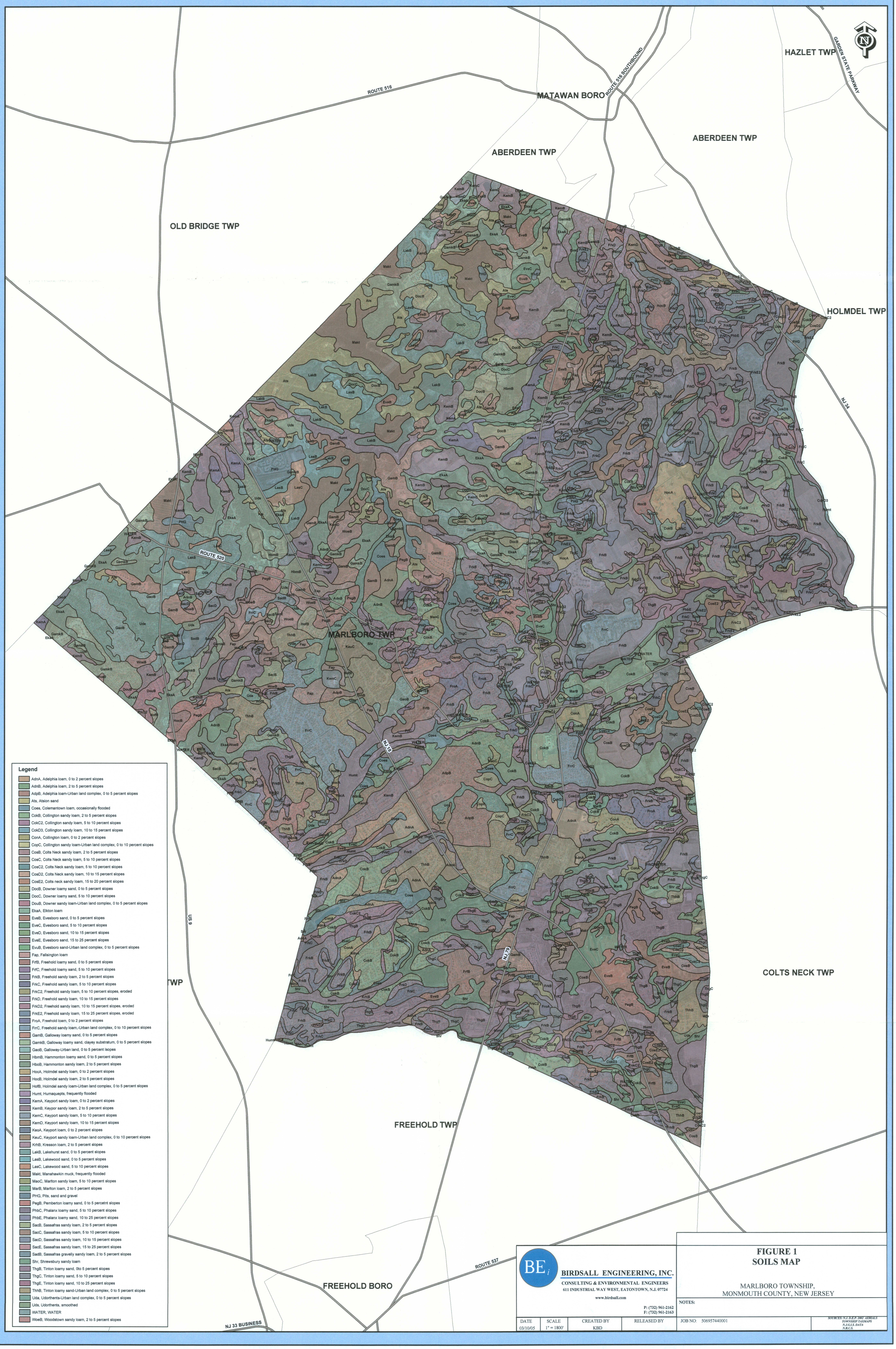
*Undeveloped Constrained Acres were calculated by utilizing NJDEP 95/97 Land Use/Land Cover data layers to sum the area of wetlands, surface water, and steep slopes within each zoning designation.

** TP=Total Phosphorous, TN= Total Nitrogen, TSS=Total Suspended Soils

Note: This analysis was prepared using Marlboro Township's adopted Zoning Designation boundaries as of 2/1/06.

Marlboro Township MSWMP Build Out Analysis Table

HUC 14	Zone	Build-Out Zoning	Acres per Zone	Existing Impervious Acres	Undeveloped Constrained (Acres)*	Undeveloped Unconstrained (Acres)	Max Impervious Allowed	Additional Impervious Acres	TP (lbs/acre/year)**	TP(lbs/year)**	TN (lbs/acre/year)**	TN (lbs/year)**	TSS (lbs/acre/year)**	TSS (acre/year)**
02030104060030	CS (Commercial Service District)	Commercial	18.07	4.9	1.66	11.51	60%	6.9	2.1	14.49	22	151.8	200	1380
	C-2 (Commercial District)	Commercial	58.72	16.13	9.59	33.0	60%	19.8	2.1	41.58	22	435.6	200	3960
	C-3 (Commercial District)	Commercial	19.13	5.72	6.62	6.79	60%	4.07	2.1	8.54	22	89.54	200	814
	LC (Land Conservation District)	Low Density Residential	2.06	.21	0	1.85	5%	.93	0.6	.56	5	4.65	100	93
	LI (Industrial District)	Industrial	6.25	.72	0	5.53	60%	3.31	1.5	4.97	16	52.96	200	662
	MFD (Multifamily District)	High Density Residential	46.61	.38	35.02	11.21	20%	2.24	1.4	3.14	15	33.6	140	313.6
	MFD-I (Multifamily District)	High Density Residential	137.84	23	69.67	67.94	38%	25.81	1.4	36.13	15	387.15	140	3613.4
	MFD-II (Multifamily District)	High Density Residential	4.93	.30	0	4.63	32%	1.48	1.4	2.07	15	22.2	140	207.2
	MZ (Municipal Zone)	Commercial	25.07	.89	13.51	10.67	60%	6.40	2.1	13.44	22	140.8	200	1280
	R30/20 (Residential District)	Medium Density Residential	331.86	64.49	80.41	186.96	28%	52.35	1.4	73.29	15	785.25	140	7329
	R-60 (Residential District)	Low Density Residential	132.83	12.44	58.19	62.2	15%	9.33	0.6	5.60	5	46.65	100	933
	R-60/15 (Residential District)	Medium Density Residential	64.11	0	50.51	13.6	32%	4.35	1.4	6.09	15	65.25	140	609
	R-80 (Residential District)	Low Density Residential	84.26	4.69	17.78	61.79	15%	9.27	0.6	5.56	5	46.35	100	927
	SCMFD-I (Senior Citizen Multifamily District)	Urban	30.99	.36	7.21	23.42	32%	7.49	1.4	10.49	15	112.35	140	1048.6
Total			**962.73**	**111.46**	**350.17**	**501.1**		**153.73**		**225.95**		**2374.15**		**23169.8**
02030104070020	A/LC(Agriculture Land Conservation District)	Low Density Residential	236.29	5.65	59.17	171.47	15%	25.72	0.6	15.43	5	128.6	100	2572.0
	C-3 (Commercial District)	Commercial	75.61	4.1	29.73	41.78	60%	26.06	2.1	54.73	22	573.32	200	5212.0
	LC (Land Conservation District)	Low Density Residential	1554.91	26.1	559.15	969.66	8%	48.48	0.6	29.09	5	242.4	100	4848.0
	R20/15 (Residential District)	Medium Density Residential	88.47	3.51	29.79	58.33	32%	18.67	1.4	26.14	15	280.05	140	2613.8
	R20AH2 (Residential District)	Medium Density Residential	52.31	.012	9.47	22.83	32%	7.31	1.4	10.23	15	109.65	140	1023.4
	R-40/30 (Residential District)	Low Density Residential	368	0	0	368	20%	.07	0.6	0.04	5	.35	100	7.0
	R-80 (Residential District)	Low Density Residential	338.69	21.54	95.98	221.17	15%	33.18	0.6	19.91	5	165.9	100	3318.0
Total			**2326.65**	**60.91**	**783.29**	1485.61	N/A	**159.49**		155.57		**1500.27**		**19594.2**
02030104060020	LC (Land Conservation District)	Low Density Residential	173.87	3.04	95.89	74.94	5%	3.75	0.6	2.25	5	18.75	100	3750.0
	MFD-II (Multifamily District)	High Density Residential	72.05	.48	9.79	61.78	32%	19.77	1.4	27.68	15	296.55	140	2767.8
	R20/15 (Residential District)	Medium Density Residential	32.15	.81	5.57	25.77	32%	8.25	1.4	11.55	15	123.75	140	1155.0
	C-2 (Commercial District)	Commercial	54.38	8.79	10.08	35.51	60%	21.31	2.1	44.75	22	468.82	100	2131.0
	CS (Commercial Service District)	Commercial	2.10	.74	0	1.36	60%	.82	2.1	1.72	22	18.04	100	8.20
	MZ (Municipal Zone)	Commercial	1.03	.33	.01	.69	60%	.41	2.1	.86	22	9.02	100	4.10
	R-10AH (Residential District)	High Density Residential	12.59	.22	1.39	10.98	32%	3.51	1.4	4.91	15	52.65	140	491.40
	R-30/20 (Residential District)	Medium Density Residential	25.38	6.76	2.23	16.39	28%	4.59	1.4	6.43	15	68.85	140	642.60
	R-60 (Residential District)	Low Density Residential	414.22	25.18	168.58	220.46	15%	33.07	0.6	19.84	5	165.35	100	3307.0
	SCMFD-I (Senior Citizen Multifamily District)	Urban	.05	.01	0	.04	55%	.02	0.6	.01	5	.10	100	2.0
	RSCS (Residnetial District)	High Density Residential	157.07	14.39	46.63	96.05	36%	36.50	1.4	51.1	15	547.50	140	5110.0
Total			**944.89**	**60.75**	**340.17**	**543.97**		**132.0**		**171.10**		**1769.38**		**19369.1**
02030105160020	R-60 (Residential District)	Low Density Residential	.87	.43	.32	0.12	20%	.02	1.4	.03	15	0.3	140	2.8
	MHD II (Residential District)	High Density Residential	30.56	3.25	8.85	18.46	55%	10.15	1.4	14.21	15	152.25	140	1421.0
	MZ (Municipal Zone)	Urban	4.59	0	0	4.59	60%	2.75	1.4	3.85	15	41.25	140	385.0
	R-10AH (Residential District)	High Density Residential	1.41	.28	.49	0.64	28%	.18	1.4	.25	15	2.7	140	25.2
	R-20/15 (Residential District)	Medium Density Residential	25.76	.42	4.67	20.67	32%	6.61	1.4	9.25	15	99.15	140	925.4
	C-2 (Commercial District)	Commercial	60.52	5.22	.46	54.84	60%	32.90	2.1	69.09	22	723.8	200	6580.0
	LC (Land Conservation District)	Low Density Residential	562.16	18.98	319.71	233.47	5%	11.67	0.6	7.0	5	58.35	100	1167.0
	RSCS (Residnetial District)	High Density Residential	80.72	19.23	43.72	17.77	38%	6.75	1.4	9.45	15	101.25	140	945.0
Total			**766.59**	**47.81**	**378.22**	**350.56**		**71.03**		**113.13**		**1179.05**		**11451.4**
02030105160010	MZ (Municipal Zone)	Commercial	107.12	9.13	39.18	58.81	60%	35.28	1.0	35.28	10	352.8	120	4233.6
	C-2 (Commercial District)	Commercial	133.44	18.32	47.08	68.04	60%	40.84	2.1	85.76	22	898.48	100	4084.0
	CS (Commercial Service District)	Commercial	19.44	2.08	7.31	10.05	60%	6.03	2.1	12.66	22	132.66	200	1206.0
	IOR (Industrial Office Research District)	Industrial	223.32	7.11	126.08	90.13	72%	64.89	1.5	97.33	16	1038.24	200	12,978.0
	LC (Land Conservation District)	Low Density Residential	865.55	9.46	430.82	425.22	5%	21.26	0.6	12.75	5	106.3	100	2126.0
	LI (Industrial District)	Industrial	5.2	1.22	0	3.98	60%	2.38	1.5	3.57	16	38.08	200	476.0
	MFD (Multifamily District)	High Density Residential	125.08	34.86	18.62	71.58	20%	14.31	1.4	20.03	15	214.65	140	2003.4
	MFD II (Multifamily District)	High Density Residential	2.64	.124	0	2.51	32%	.80	1.4	1.12	15	12.0	140	112.0
	OPT-2 (Commercial District)	Commercial	3.69	.45	.93	2.31	50%	1.15	2.1	2.41	22	25.3	200	230.0
	PAC (Residential District)	Medium Density Residential	55.49	.32	16.26	38.91	28%	10.89	1.4	15.24	15	163.35	140	1524.6
	PAC III (Residential District)	Low Density Residential	111.54	.25	33.92	77.37	55%	42.55	0.6	25.53	5	212.75	100	4255.0
	R-10AH (Residential District)	High Density Residential	20.44	.09	0	20.35	32%	6.51	1.4	9.11	15	97.65	140	911.4
	R-15 (Residential District)	Medium Density Residential	142.45	7.09	43.84	91.52	28%	25.62	1.4	35.86	15	348.3	140	3586.8
	R-20 (Residential District)	Medium Density Residential	488.68	110.0	34.25	344.43	28%	96.44	1.4	135.01	15	1446.15	140	13501.6
	R-20AH2 (Residential District)	Medium Density Residential	3.26	.145	0	3.11	28%	.87	1.4	1.21	15	13.05	140	121.8
	R40/30 (Residential District)	Low Density Residential	367.23	1.50	238.93	126.8	20%	25.36	0.6	15.21	5	126.8	100	2536.0
	R40AH (Residential District)	Low Density Residential	20.61	.186	13.80	6.62	15%	.99	0.6	.59	5	4.95	100	99.0
	R60 (Residential District)	Low Density Residential	59.0	3.93	5.37	49.7	15%	7.45	0.6	4.47	5	37.25	100	745.0
	R60/40 (Residential District)	Low Density Residential	48.0	8.66	13.37	25.97	15%	3.89	0.6	2.33	5	19.45	100	389.0
	RSCS (Residnetial District)	High Density Residential	44.48	4.48	19.78	20.22	38%	7.68	1.4	10.75	15	115.2	140	1075.2
	MHD (Residential District)	High Density Residential	43.68	19.01	2.58	22.09	55%	12.15	1.4	17.01	15	182.25	140	1701.0
	MHD II (Residential District)	High Density Residential	1.50	.07	0	1.43	55%	78	1.4	1.09	15	11.7	140	109.2
	R-80 (Residential District)	Low Density Residential	1324.48	61.25	612.83	650.42	15%	97.56	0.6	58.53	5	487.8	100	9756.0
Total			**4216.32**	**299.75**	**1704.93**	**2211.57**		**525.68**		**602.85**		**6085.16**		**67760.6**
02030104070030	A/LC (Agricultural Land Conservation District)	Low Density Residential	796.38	50.08	259.67	486.73	5%	24.34	0.6	14.6	5	121.7	100	2434.0
	C-1 (Commercial District)	Commercial	58.26	.58	6.27	51.41	60%	30.85	2.1	64.78	22	678.7	100	3085.0
	LC (Land Conservation District)	Low Density Residential	567.06	15.69	197.2	354.17	5%	17.70	0.6	10.62	5	88.5	100	1770.0
	OPT-2 (Commercial District)	Commercial	25.52	4.36	5.67	15.49	60%	9.29	2.1	19.51	22	204.58	100	929.0
	C-2 (Community Commercial District)	Commercial	34.74	.34	9.28	25.12	60%	15.07	2.1	31.64	22	331.54	100	1507.0



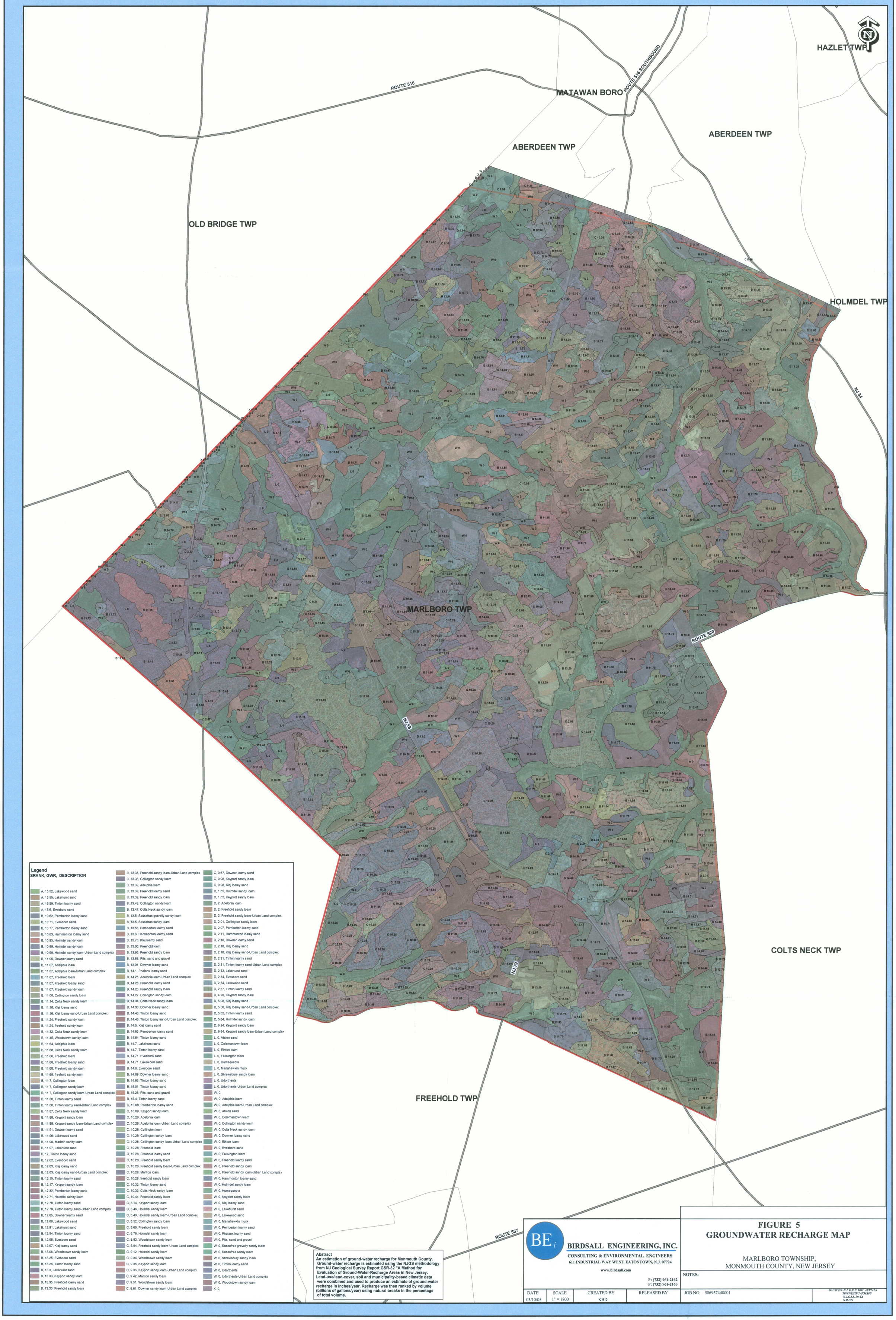
BE*i* **BIRDSALL ENGINEERING, INC.**
CONSULTING & ENVIRONMENTAL ENGINEERS
611 INDUSTRIAL WAY WEST, EATONTOWN, N.J. 07724
www.birdsall.com
P: (732) 961-2162
F: (732) 961-2163

FIGURE 1
SOILS MAP

MARLBORO TOWNSHIP,
MONMOUTH COUNTY, NEW JERSEY

NOTES:

DATE	SCALE	CREATED BY	RELEASED BY	JOB NO: 506957440001	SOURCES: N.J. D.E.P. 2002 AERIALS TOWNSHIP TAXMAPS N.J.G.I.S. DATA N.R.C.S.
03/10/05	1" = 1800'	KBD			



Legend
SRANK, GWR, DESCRIPTION

- A, 15.52, Lakewood sand
- A, 15.55, Lakehurst sand
- A, 15.59, Tinton loamy sand
- A, 15.6, Evesboro sand
- B, 10.62, Pemberton loamy sand
- B, 10.71, Evesboro sand
- B, 10.77, Pemberton loamy sand
- B, 10.83, Hammonton loamy sand
- B, 10.95, Holmdel sandy loam
- B, 10.99, Holmdel sandy loam
- B, 10.99, Holmdel sandy loam-Urban Land complex
- B, 11.06, Downer loamy sand
- B, 11.07, Adelphia loam
- B, 11.07, Adelphia loam-Urban Land complex
- B, 11.07, Freehold loam
- B, 11.07, Freehold loamy sand
- B, 11.07, Freehold sandy loam
- B, 11.08, Collington sandy loam
- B, 11.14, Colts Neck sandy loam
- B, 11.16, Klej loamy sand
- B, 11.16, Klej loamy sand-Urban Land complex
- B, 11.24, Freehold sandy loam
- B, 11.24, freehold sandy loam
- B, 11.32, Colts Neck sandy loam
- B, 11.45, Woodstown sandy loam
- B, 11.64, Adelphia loam
- B, 11.68, Colts Neck sandy loam
- B, 11.68, Freehold loam
- B, 11.68, Freehold loamy sand
- B, 11.68, Freehold sandy loam
- B, 11.68, freehold sandy loam
- B, 11.7, Collington loam
- B, 11.7, Collington sandy loam
- B, 11.7, Collington sandy loam-Urban Land complex
- B, 11.86, Tinton loamy sand
- B, 11.86, Tinton loamy sand-Urban Land complex
- B, 11.87, Colts Neck sandy loam
- B, 11.88, Keyport sandy loam
- B, 11.88, Keyport sandy loam-Urban Land complex
- B, 11.91, Downer loamy sand
- B, 11.96, Lakewood sand
- B, 11.96, Marlton sandy loam
- B, 11.97, Lakehurst sand
- B, 12, Tinton loamy sand
- B, 12.02, Evesboro sand
- B, 12.03, Klej loamy sand
- B, 12.03, Klej loamy sand-Urban Land complex
- B, 12.15, Tinton loamy sand
- B, 12.17, Keyport sandy loam
- B, 12.32, Pemberton loamy sand
- B, 12.71, Holmdel sandy loam
- B, 12.78, Tinton loamy sand
- B, 12.78, Tinton loamy sand-Urban Land complex
- B, 12.85, Downer loamy sand
- B, 12.88, Lakewood sand
- B, 12.91, Lakehurst sand
- B, 12.94, Tinton loamy sand
- B, 12.95, Evesboro sand
- B, 12.97, Klej loamy sand
- B, 13.06, Woodstown sandy loam
- B, 13.25, Evesboro sand
- B, 13.26, Tinton loamy sand
- B, 13.3, Lakehurst sand
- B, 13.33, Keyport sandy loam
- B, 13.35, Freehold loamy sand
- B, 13.35, Freehold sandy loam
- B, 13.35, Freehold sandy loam-Urban Land complex
- B, 13.36, Collington sandy loam
- B, 13.39, Adelphia loam
- B, 13.39, Freehold loamy sand
- B, 13.39, Freehold sandy loam
- B, 13.43, Collington sandy loam
- B, 13.47, Colts Neck sandy loam
- B, 13.5, Sassafras gravelly sandy loam
- B, 13.5, Sassafras sandy loam
- B, 13.56, Pemberton loamy sand
- B, 13.6, Hammonton loamy sand
- B, 13.73, Klej loamy sand
- B, 13.86, Freehold loam
- B, 13.86, Freehold sandy loam
- B, 13.88, Pits, sand and gravel
- B, 13.91, Downer loamy sand
- B, 14.1, Phalanx loamy sand
- B, 14.25, Adelphia loam-Urban Land complex
- B, 14.26, Freehold loamy sand
- B, 14.26, Freehold sandy loam
- B, 14.27, Collington sandy loam
- B, 14.34, Colts Neck sandy loam
- B, 14.36, Downer loamy sand
- B, 14.46, Tinton loamy sand
- B, 14.46, Tinton loamy sand-Urban Land complex
- B, 14.5, Klej loamy sand
- B, 14.63, Pemberton loamy sand
- B, 14.64, Tinton loamy sand
- B, 14.7, Lakehurst sand
- B, 14.7, Tinton loamy sand
- B, 14.71, Evesboro sand
- B, 14.71, Lakewood sand
- B, 14.8, Evesboro sand
- B, 14.89, Downer loamy sand
- B, 14.93, Tinton loamy sand
- B, 15.01, Tinton loamy sand
- B, 15.28, Pits, sand and gravel
- B, 15.4, Tinton loamy sand
- C, 10.08, Pemberton loamy sand
- C, 10.09, Keyport sandy loam
- C, 10.26, Adelphia loam
- C, 10.26, Adelphia loam-Urban Land complex
- C, 10.28, Collington loam
- C, 10.28, Collington sandy loam
- C, 10.28, Collington sandy loam-Urban Land complex
- C, 10.28, Freehold loam
- C, 10.28, Freehold loamy sand
- C, 10.28, Freehold sandy loam
- C, 10.28, Freehold sandy loam-Urban Land complex
- C, 10.28, Marlton loam
- C, 10.28, freehold sandy loam
- C, 10.32, Tinton loamy sand
- C, 10.33, Colts Neck sandy loam
- C, 10.44, Freehold sandy loam
- C, 8.14, Keyport sandy loam
- C, 8.46, Holmdel sandy loam
- C, 8.46, Holmdel sandy loam-Urban Land complex
- C, 8.52, Collington sandy loam
- C, 8.66, Freehold sandy loam
- C, 8.76, Holmdel sandy loam
- C, 8.82, Woodstown sandy loam
- C, 8.94, Freehold sandy loam-Urban Land complex
- C, 9.12, Holmdel sandy loam
- C, 9.34, Woodstown sandy loam
- C, 9.36, Keyport sandy loam
- C, 9.36, Keyport sandy loam-Urban Land complex
- C, 9.42, Marlton sandy loam
- C, 9.51, Woodstown sandy loam
- C, 9.61, Downer sandy loam-Urban Land complex
- C, 9.67, Downer loamy sand
- C, 9.98, Keyport sandy loam
- C, 9.98, Klej loamy sand
- D, 1.65, Holmdel sandy loam
- D, 1.82, Keyport sandy loam
- D, 2, Adelphia loam
- D, 2, Freehold sandy loam
- D, 2, Freehold sandy loam-Urban Land complex
- D, 2.01, Collington sandy loam
- D, 2.07, Pemberton loamy sand
- D, 2.11, Hammonton loamy sand
- D, 2.16, Downer loamy sand
- D, 2.18, Klej loamy sand
- D, 2.18, Klej loamy sand-Urban Land complex
- D, 2.31, Tinton loamy sand
- D, 2.31, Tinton loamy sand-Urban Land complex
- D, 2.33, Lakehurst sand
- D, 2.34, Evesboro sand
- D, 2.34, Lakewood sand
- D, 2.37, Tinton loamy sand
- D, 4.26, Keyport sandy loam
- D, 5.08, Klej loamy sand
- D, 5.08, Klej loamy sand-Urban Land complex
- D, 5.52, Tinton loamy sand
- D, 5.64, Holmdel sandy loam
- D, 6.94, Keyport sandy loam
- D, 6.94, Keyport sandy loam-Urban Land complex
- L, 0, Atsion sand
- L, 0, Colemantown loam
- L, 0, Elkton loam
- L, 0, Fallsington loam
- L, 0, Humaquepts
- L, 0, Manahawkin muck
- L, 0, Shrewsbury sandy loam
- L, 0, Udorthents
- L, 0, Udorthents-Urban Land complex
- W, 0,
- W, 0, Adelphia loam
- W, 0, Adelphia loam-Urban Land complex
- W, 0, Atsion sand
- W, 0, Colemantown loam
- W, 0, Collington sandy loam
- W, 0, Colts Neck sandy loam
- W, 0, Downer loamy sand
- W, 0, Elkton loam
- W, 0, Evesboro sand
- W, 0, Fallsington loam
- W, 0, Freehold loamy sand
- W, 0, Freehold sandy loam
- W, 0, Freehold sandy loam-Urban Land complex
- W, 0, Hammonton loamy sand
- W, 0, Holmdel sandy loam
- W, 0, Humaquepts
- W, 0, Keyport sandy loam
- W, 0, Klej loamy sand
- W, 0, Lakehurst sand
- W, 0, Lakewood sand
- W, 0, Manahawkin muck
- W, 0, Pemberton loamy sand
- W, 0, Phalanx loamy sand
- W, 0, Pits, sand and gravel
- W, 0, Sassafras gravelly sandy loam
- W, 0, Sassafras sandy loam
- W, 0, Shrewsbury sandy loam
- W, 0, Tinton loamy sand
- W, 0, Udorthents
- W, 0, Udorthents-Urban Land complex
- W, 0, Woodstown sandy loam
- X, 0,

Abstract
An estimation of ground-water recharge for Monmouth County. Ground-water recharge is estimated using the NJGS methodology from NJ Geological Survey Report GSR-32 "A Method for Evaluation of Ground-Water-Recharge Areas in New Jersey. Land-use/land-cover, soil and municipality-based climatic data were combined and used to produce an estimate of ground-water recharge in inches/year. Recharge was then ranked by volume (billions of gallons/year) using natural breaks in the percentage of total volume.

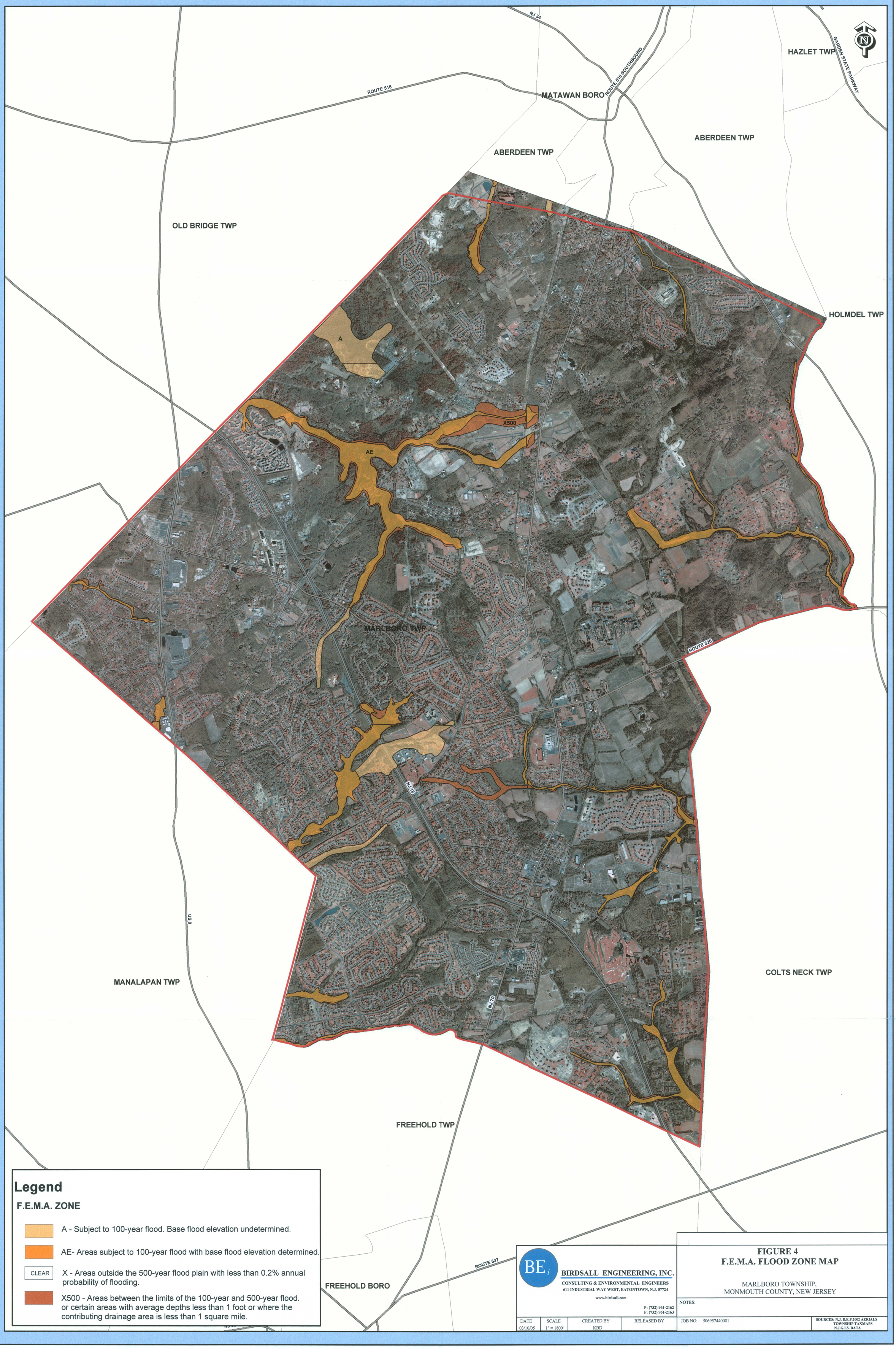
BIRDSALL ENGINEERING, INC.
CONSULTING & ENVIRONMENTAL ENGINEERS
611 INDUSTRIAL WAY WEST, EATONTOWN, N.J. 07724
www.birdsall.com
P: (732) 961-2162
F: (732) 961-2163

FIGURE 5
GROUNDWATER RECHARGE MAP

MARLBORO TOWNSHIP,
MONMOUTH COUNTY, NEW JERSEY

NOTES:

DATE	SCALE	CREATED BY	RELEASED BY	JOB NO: 506957440001	SOURCES: N.J. D.E.P. 2002 AERIALS, TOWNSHIP TAXMAPS, N.J.G.I.S. DATA, N.R.C.S.
03/10/05	1" = 1800'	KBD			



BIRDSALL ENGINEERING, INC.
CONSULTING & ENVIRONMENTAL ENGINEERS
611 INDUSTRIAL WAY WEST, EATONTOWN, N.J. 07724
www.birdsall.com
P: (732) 961-2162
F: (732) 961-2163

FIGURE 4
F.E.M.A. FLOOD ZONE MAP

MARLBORO TOWNSHIP,
MONMOUTH COUNTY, NEW JERSEY

NOTES:

DATE	SCALE	CREATED BY	RELEASED BY	JOB NO:	SOURCES:
03/10/05	1" = 1800'	KBD		506957440001	N.J. D.E.P.2002 AERIALS TOWNSHIP TAXMAPS N.J.G.I.S. DATA

A Well Head Protection Area (WHPA) in New Jersey is a map area calculated around a Public Community Water Supply (PCWS) well in New Jersey that delineates the horizontal extent of ground water captured by a well pumping at a specific rate over a two-, five-, and twelve-year period of time for confined wells. The area of capture over two-, five-, and twelve-years is defined using line boundaries and polygon areas generated with the ARC/INFO Geographic Information System (GIS).

BE*i* **BIRDSALL ENGINEERING, INC.**
CONSULTING & ENVIRONMENTAL ENGINEERS
611 INDUSTRIAL WAY WEST, EATONTOWN, N.J. 07724
www.birdsall.com
P: (732) 961-2162
F: (732) 961-2163

FIGURE 6
WELLHEAD PROTECTED AREAS MAP

MARLBORO TOWNSHIP,
MONMOUTH COUNTY, NEW JERSEY

LEGEND:
- MARLBORO PUBLIC SUPPLY WELLS
- MARLBORO WELLHEAD PROTECTED AREAS (TIER ONE-2 YEAR)

DATE	SCALE	CREATED BY	RELEASED BY	JOB NO:	SOURCES:
03/10/05	1" = 1800'	KBD		506957440001	N.J. D.E.P.2002 AERIALS TOWNSHIP TAXMAPS N.J.G.I.S. DATA

Tennent Brook (below 74d 19m 05s) 020301051600 60

Tennent Brook (above 74d 19m 05s) 020301051600 50

ROUTE 516

UNT to Matawan Ck Morganville Rd MODERATE MODERATE

Gravelly Bk Church St SEVERE SEVERE

Wilkson Ck Church St SEVERE MODERATE

LUPPATATONG CREEK

MATAWAN BORO

N.J.

ABERDEEN TWP

MOHINGSON BROOK

ABERDEEN TWP.

Matawan Creek (above Ravine Drive) 020301040600 20

RESIDENTIAL

Matawan Creek (below Ravine Drive) 020301040600 30

Deep Run (below Rt 9) 020301051600 40

OLD BRIDGE TWP.

Deep Run Rt 9 MODERATE MODERATE

Deep Run (Rt 9 to Monmouth Co line) 020301051600 70

RESIDENTIAL

HIGHWAY COMMERCIAL

Hop Brook 020301040700 10

Duhernal Lake / Iresick Brook 020301051600 30

SPRING VALLEY RD

TEXAS RD

TPD II

OFFICE

MFD

RSCS

C4

OPT 2

RESIDENTIAL

Deep Run (above Monmouth Co line) 020301051600 10

TPD

IOR

TENNENT RD

OPT2

OPT1

C-5

ROUTE 9

Barclay Brook 020301051500 50

FRD

BARCLAY BROOK

NEIGHBORHOOD COMMERCIAL

RETIREMENT COMMUNITY OFFICE

RSC

PINE BROOK

Matchaponix Brook (above/incl Pine Br) 020301051500 40

MANALAPAN

RESIDENTIAL

ROBERTSVILLE RD

McGellairds Brook (below Taylors Mills) 020301051500 30

MILFORD BROOK

Milford Bk Pease Rd MODERATE MODERATE

TEPEHEMUS BROOK

Tepehemus Bk Tennent Rd MODERATE MODERATE

McGellairds Brook (above Taylors Mills) 020301051500 20

FREEHOLD

RESIDENTIAL

GORDONS CORNER RD

ROUTE 79

THD

C-5

US 9

McGellairds Bk Rt 9 MODERATE MODERATE

MCGELLAIRDS BROOK

WEAMACONK CREEK

Weamaconk Ck Rt 9 SEVERE MODERATE

Weamaconk Creek 020301051500 10

WEMROCK BROOK

Manalapan Brook (above 40d 16m 15s) 020301051400 10

Wemrock Bk Wemrock Rd MODERATE MODERATE

ROUTE 522

Manasquan R (Rt 9 to 74d17m50s road) 0

DEBOIS CREEK

ROUTE 537

Willow Brook 020301040700 20

Willow Bk Shank Rd M

RESIDENTIAL AND AGRICULTURE

PLEASANT VALLEY RD

HOPP BROOK

CONOVER RD

ROUTE 520

A/LC

HOLMDEL TWP

PAC II

C2 OPT2

Big Brook 020301040700 30

BIG BROOK

SCPR

VANDERBURG RD

RESIDENTIAL AND AGRICULTURE

Swimming River Reservior / Slope Bk 020301040700 70

Yellow Brook (below Bucks Mill) 020301040700 60

COLTS NECK TWP

Yellow Brook (above Bucks Mill) 020301040700 40

YELLOW BROOK

Yellow Bk Rt 537 MODERATE MODERATE

REIDS HILL RD

WILLOW BROOK

PPB BROOK

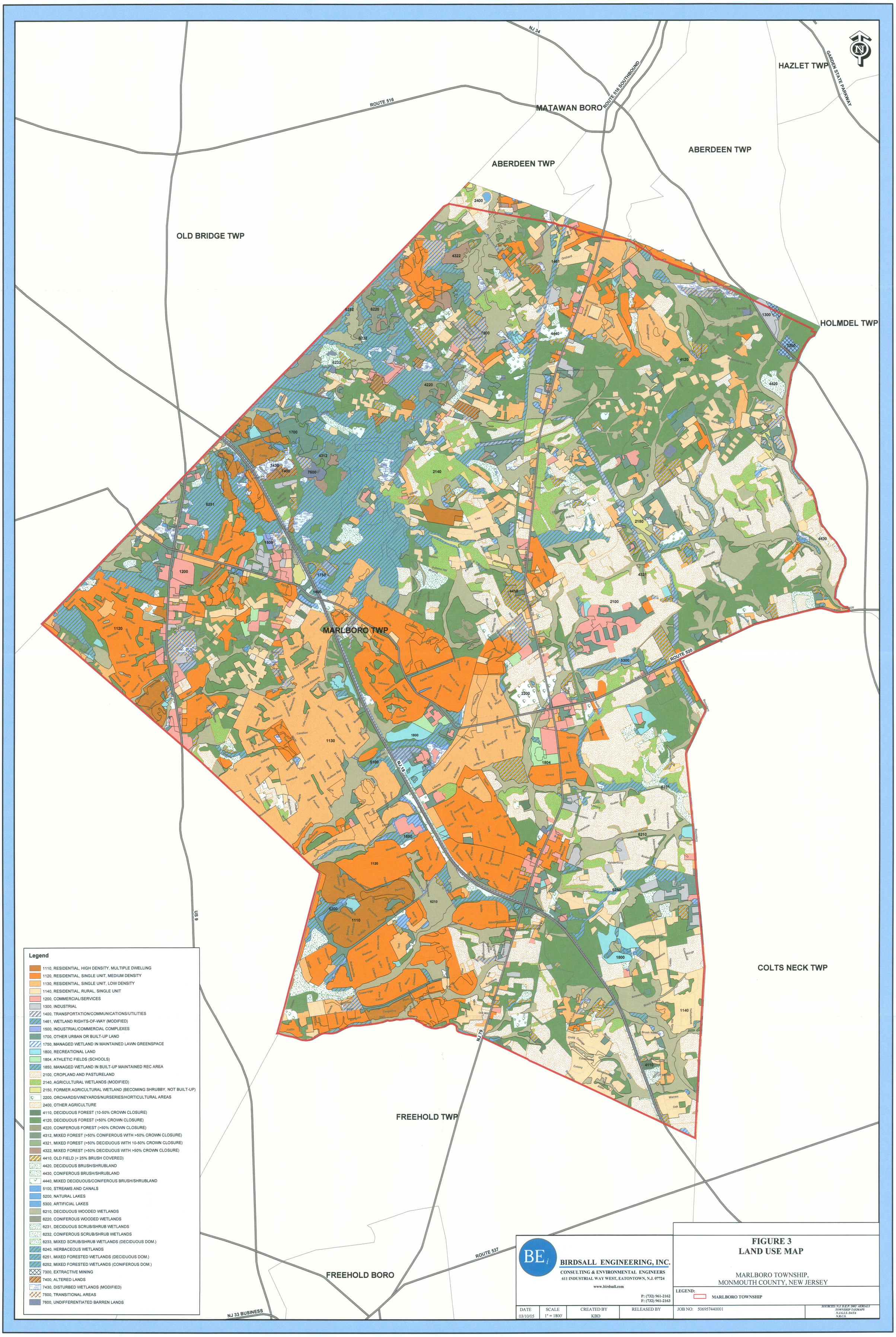
FIGURE 7
SENSITIVE RECEPTORS MAP
MARLBORO TOWNSHIP,
MONMOUTH COUNTY, NEW JERSEY

BIRDSALL ENGINEERING, INC.
CONSULTING & ENVIRONMENTAL ENGINEERS
611 INDUSTRIAL WAY WEST, EATONTOWN, N.J. 07719
www.birdsall.com
P: (732) 961-2162
F: (732) 961-2163

LEGEND:
- FRESHWATER WETLANDS
- DEEP RUN WATERSHED
- NJDEP STORMWATER RULE AREAS AFFECTED BY 300 FOOT BUFFER
- NJDEP Ambient Biomonitoring Network (AMNET) 2004
- H.U.C. 14/ SUBWATERSHED
- MONMOUTH COUNTY STREAM DATA

DATE	SCALE	CREATED BY	RELEASED BY
03/10/05	1" = 1800'		

SOURCES: N.J. D.E.P.2002 AERIALS/GIS DATA
TOWNSHIP TAX AND ZONING MAPS
COUNTY G.I.S. DATA



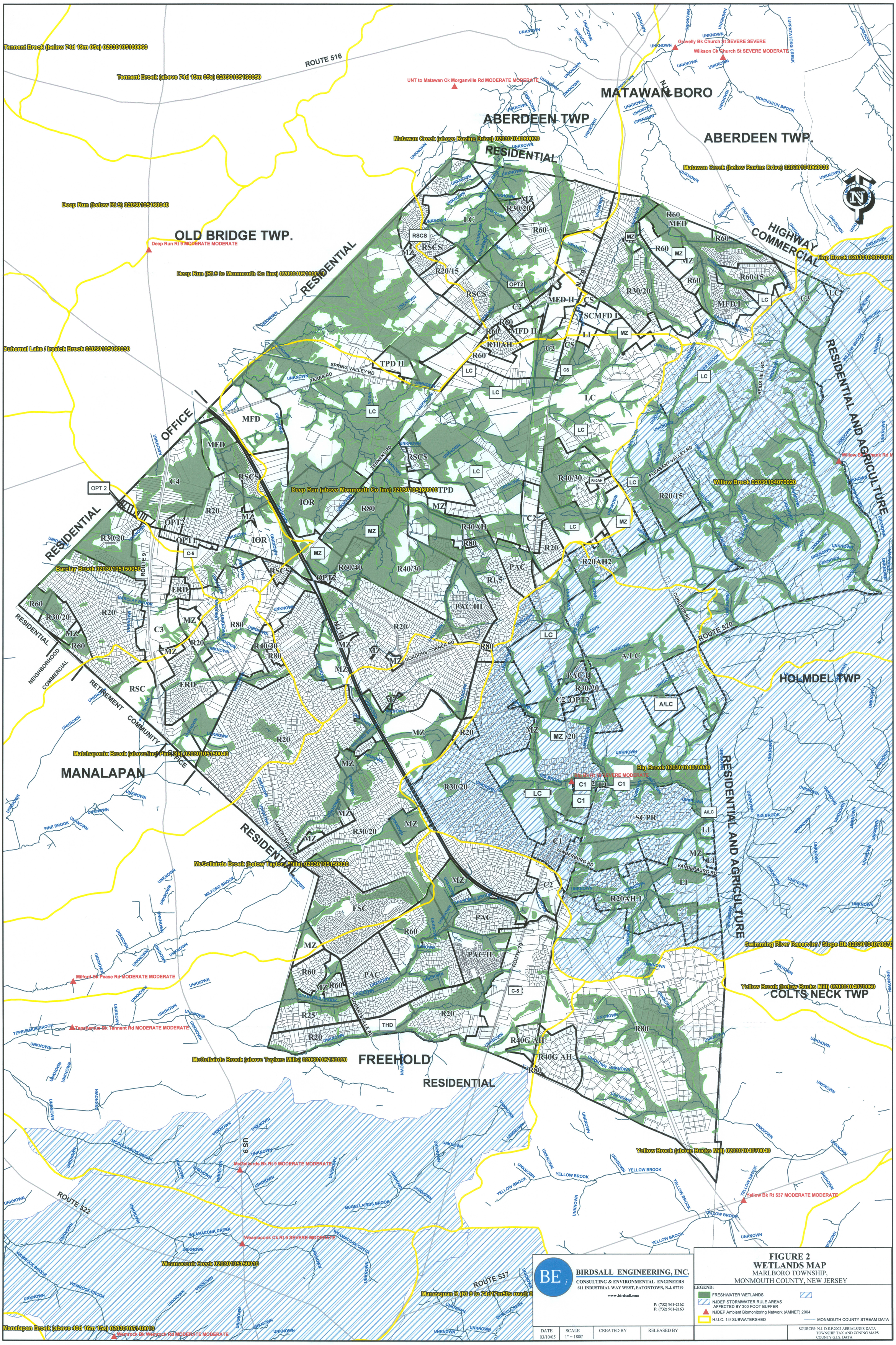
BIRDSALL ENGINEERING, INC.
CONSULTING & ENVIRONMENTAL ENGINEERS
611 INDUSTRIAL WAY WEST, EATONTOWN, N.J. 07724
www.birdsall.com
P: (732) 961-2162
F: (732) 961-2163

DATE	SCALE	CREATED BY	RELEASED BY	JOB NO:	SOURCES:
03/10/05	1" = 1800'	KBD		506957440001	N.J. D.E.P. 2002 AERIALS; TOWNSHIP TAXMAPS; N.J.G.I.S. DATA; N.R.C.S.

FIGURE 3
LAND USE MAP

MARLBORO TOWNSHIP,
MONMOUTH COUNTY, NEW JERSEY

LEGEND:
MARLBORO TOWNSHIP



BIRDSALL ENGINEERING, INC.
CONSULTING & ENVIRONMENTAL ENGINEERS
611 INDUSTRIAL WAY WEST, EATONTOWN, N.J. 07719
www.birdsall.com
P: (732) 961-2162
F: (732) 961-2163

DATE	SCALE	CREATED BY	RELEASED BY
03/10/05	1" = 1800'		

FIGURE 2
WETLANDS MAP
MARLBORO TOWNSHIP,
MONMOUTH COUNTY, NEW JERSEY

SOURCES: N.J. D.E.P.2002 AERIALS/GIS DATA
TOWNSHIP TAX AND ZONING MAPS
COUNTY G.I.S. DATA