Watershed Based
Municipal Stormwater Management Plan

City of Woodbury

prepared for

City of Woodbury

March 2025
Update and Revision

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Section 1. Introduction

All New Jersey municipalities were required in early 2004 to obtain a New Jersey Pollutant Discharge Elimination System permit (NJPDES) known as the Municipal Stormwater General Permit for control of their stormwater discharges.

To that end, in 2006 the GCIA undertook watershed-based municipal stormwater management planning throughout the County, and prepared Watershed Based Municipal Stormwater Management Plan (W/MSWMP) for Woodbury City that includes both municipal and watershed stormwater management information and evaluations. The W/MSWMP is an element of the City's Master Plan and is subject to the re-examination requirements in accordance with N.J.A.C. 7:8-4.3 (c) and (d) at least every 10 years.

This updated/revised W/MSWMP has been prepared to comply with these requirements the latest SWM rules at N.J.A.C. 7:8. The location of Woodbury City, in relationship to the eight major watersheds in Gloucester County, is shown on Figure 1.

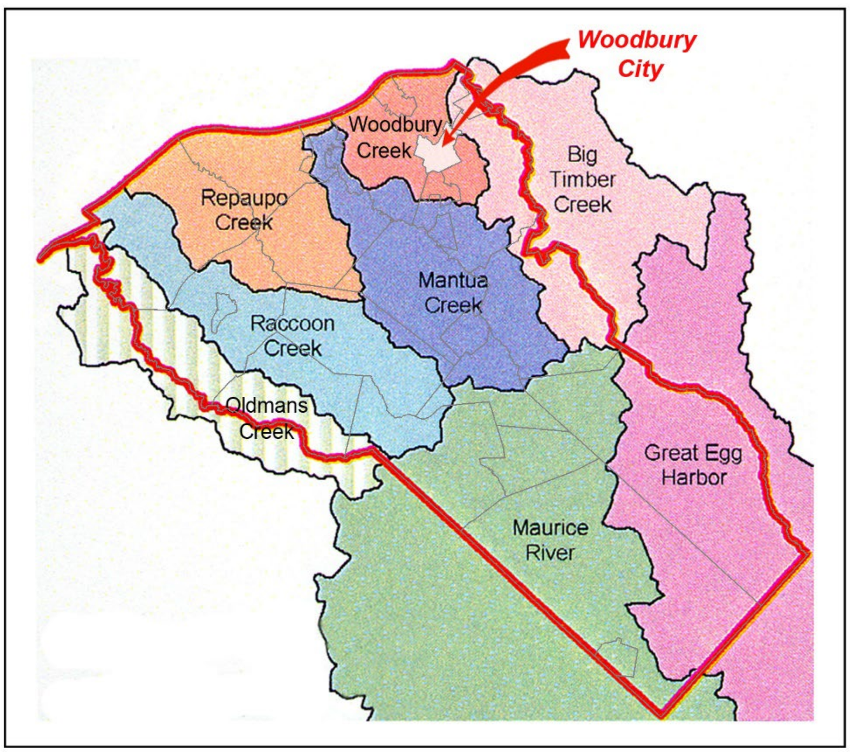
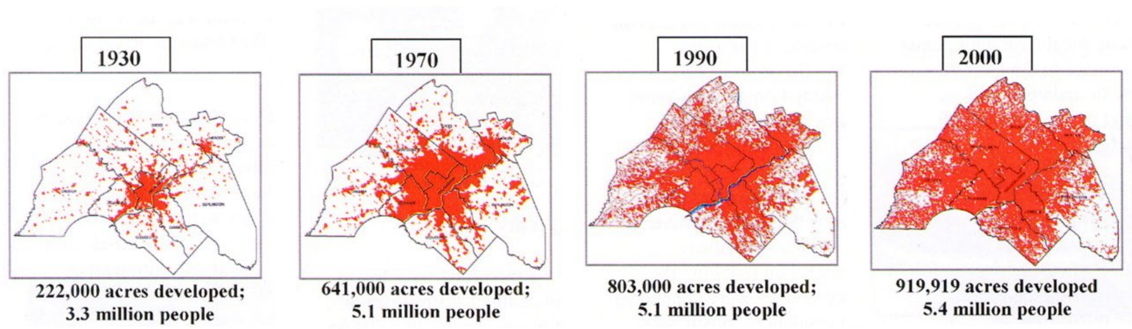


Figure 1. Woodbury City and Gloucester County Watersheds

The NJDEP's new Stormwater Management Rules in N.J.A.C. 7:8 have been developed to address the adverse impacts that unmanaged land development can have on groundwater recharge and stormwater runoff quality and quantity. Figure 2 shows the expansion of development within the Delaware Valley during the 70 year period from 1930 through

2000. Along with this development has come a corresponding increase in stormwater runoff and increased impacts associated with non-point source pollution.



Source: DVRPC

Figure 2. Delaware Valley Development Patterns (1930 – 2000)

The W/MSWMP was prepared to the extent possible in accordance with the Tier A Municipal Stormwater Guidance Document (October 2018), the 2023 Tier A Master General Permit (effective 1/1/2023), and BMP Manual (February 2004 and September 2016) that were utilized as templates for preparation of the plan.

The W/MSWMP provides strategies for Woodbury City to follow in addressing stormwater management. The plan is required by N.J.A.C. 7:14A-25, the Municipal Stormwater Regulations, and contains the elements required by N.J.A.C. 7:8, the Stormwater Management Rules.

The W/MSWMP addresses groundwater recharge and stormwater quantity and quality, by incorporating the stormwater design and performance standards for new development and redevelopment. These standards are intended to minimize the adverse impact of stormwater runoff on water quality and water quantity, and to address the loss of groundwater recharge that provides base flow in receiving water bodies.

The W/MSWMP also Addresses:

- Long-term operation and maintenance measures for existing and future stormwater facilities;
- A "build-out" analysis based upon existing zoning and the land available for development;
- Changes the review and update of existing ordinances, the Master Plan, and other municipal land use planning documents, in order to allow various low impact development techniques; and
- Mitigation strategies for variances or exemptions from the design and performance standards, including the implementation of specific mitigation projects to offset the effects of such variances or exemptions (including specific locations to lessen the impact of existing development).

Section 2. Goals

The Woodbury City W/MSWMP goals are:

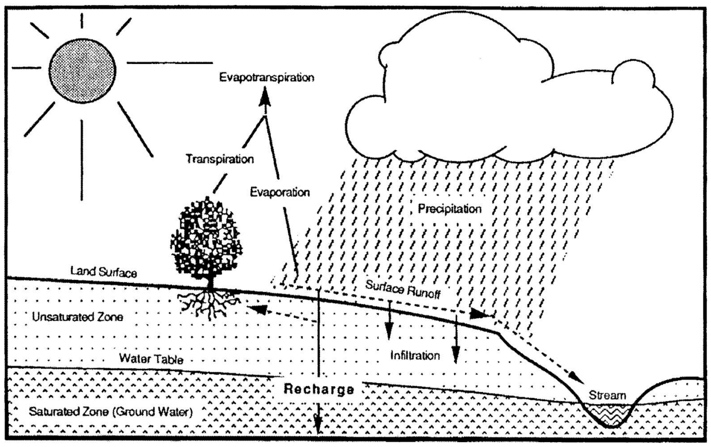
1. Reduce flood damage, including damage to life and property;
2. Minimize, to the extent practical, increases in stormwater runoff from new development;
3. Reduce soil erosion from development and construction projects;
4. Assure the adequacy of existing and proposed stormwater facilities, including culverts, bridges, and other in-stream structures;
5. Maintain groundwater recharge;
6. Prevent, to the extent feasible, in non-point stormwater pollution;
7. Maintain the integrity of stream channels for their biological functions, as well as drainage;
8. Minimize pollutants in stormwater runoff from new and existing development in order to restore, enhance and maintain the chemical, physical, and biological integrity of waters of the state, to protect public health, to safeguard fish and other aquatic life, and scenic and ecological values; and to enhance the domestic, municipal, recreational, industrial and other uses of water; and
9. Protect public safety through the proper design and operation of stormwater management basins and systems.

The W/MSWMP outlines post construction stormwater standards in new development and redevelopment and additionally includes stormwater management controls that address impacts from existing development. Preventative and corrective maintenance strategies are included to ensure the long-term effectiveness of stormwater management facilities. The W/MSWMP also provides recommendations for stormwater systems to protect safety.

This watershed-based W/MSWMP includes a discussion of both Woodbury City and its watershed(s). Land use, zoning, impervious surfaces, and pollutant loadings were evaluated using a Geographic Information System. These efforts provide an initial understanding of surface water quality in the City's watersheds, and establishes a basis for evaluating the impacts of future land use and zoning decisions.

Section 3. Stormwater and Development

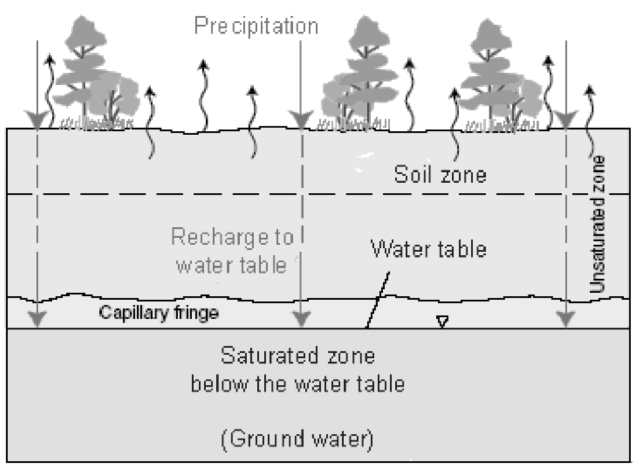
Water moves continuously through the hydrologic or water cycle (see Figure 3). Water evaporates from water bodies and the earth's surface and transpires from vegetation into the atmosphere (these components of the water cycle are jointly referred to as



Source: New Jersey Geological Survey Report GSR-32.

Figure 3. Groundwater Recharge in the Hydrologic Cycle

evapotranspiration). Water vapor in the atmosphere condenses to form clouds which produce precipitation that falls to the earth's surface. A small percentage of this precipitation falls over land and runs off into streams and lakes, flowing to the oceans.



Source: US Geological Survey

Figure 4. Subsurface Water

However, most of the precipitation that falls on land surfaces infiltrates into the ground (see Figure 4), where it either recharges shallow groundwater table aquifers and discharges to streams and springs, sustaining their base flow, or seeps into deeper confined aquifers, where it is stored for long periods and discharges regionally (see Figure 5). Human activities and development of the land can interfere with the natural water cycle, and in doing so, impact a watershed in many ways.

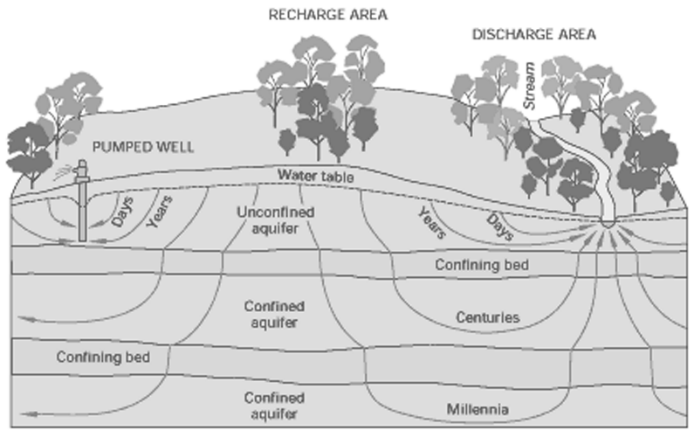


Figure 5. Groundwater Flow Paths

Development can remove beneficial vegetation; replacing it with lawns or impervious cover, thus reducing evapotranspiration and infiltration. Clearing and grading removes depressions that store rainfall and encourage infiltration. Construction activities can also compact the soil and diminish infiltration, resulting in increased volumes and rates of stormwater runoff.

Conversely, increased impervious areas that are connected to each other through gutters, channels, and storm sewers transport runoff more quickly than natural areas. Shortening runoff travel time increases the rainfall-runoff response in the watershed, causing flow in downstream waterways to reach peak rates faster and water levels to increase above natural conditions. These conditions aggravate downstream flooding and erosion and increase the quantity of sediment in stream flow and deposited in stream channels. Impervious areas and storm sewers also reduce the potential for surface vegetation to filter and remove pollutants from runoff before it reaches surface waters.

Increased impervious area from land development can also decrease infiltration, and in turn, reduce stream base flow and groundwater recharge. Reductions in stream base flow can dry up habitat in stream channels and adjacent wetlands, and in so doing, adversely impact the health of important biological communities that reside in or depend upon these stream channels and wetlands. Increased impervious area can also increase peak stream flow, channel erosion, and sedimentation and thus can destroy aquatic habitat.

Land development can also result in the addition and accumulation of pollutants on the land surface. Runoff and infiltration can mobilize and transport these pollutants to groundwater and streams. Surfaces and cleared areas within a development can receive a variety of pollutants from the atmosphere and from runoff over land surfaces that mobilizes fertilizers, animal wastes, and leakage and corrosion from vehicles. The pollutants may include suspended and dissolved solids containing metals, nutrients and other inorganic compounds; hydrocarbons, pesticides, herbicides and other organic compounds; and pathogens--all of which can become mobilized by precipitation falling on the land.

Land development can also adversely affect water quality and stream biota in subtle ways. Runoff stored in detention or retention basins can become heated, raising the temperature of the downstream waterway and adversely affecting cold water aquatic species, such as trout, and by providing conditions that support unwanted aquatic species. Additionally, development may remove trees along streams or cause stream bank instability that undermines nearby trees. These trees are valuable because they provide shade that maintains cooler water temperatures and increased dissolved oxygen levels during critical summer periods; trees also absorb carbon dioxide from the air, thus reducing green-house gas releases and mitigating climate change and sea level rise. Trees help stabilize stream banks, preventing bank erosion, and their leaf litter provides habitat and food for aquatic and terrestrial communities.

Section 4. Background

WOODBURY CITY

Woodbury City is located in northwestern Gloucester County (see Figure 1). The City's characteristics, as they relate to the stormwater management planning goals are described in this Section 4.

Zoning and Existing Land Use

Woodbury City is unique among the 24 municipalities in Gloucester County, for several reasons. In terms of both total area and land area (see Table 1), it is one of the smaller municipalities in Gloucester County.

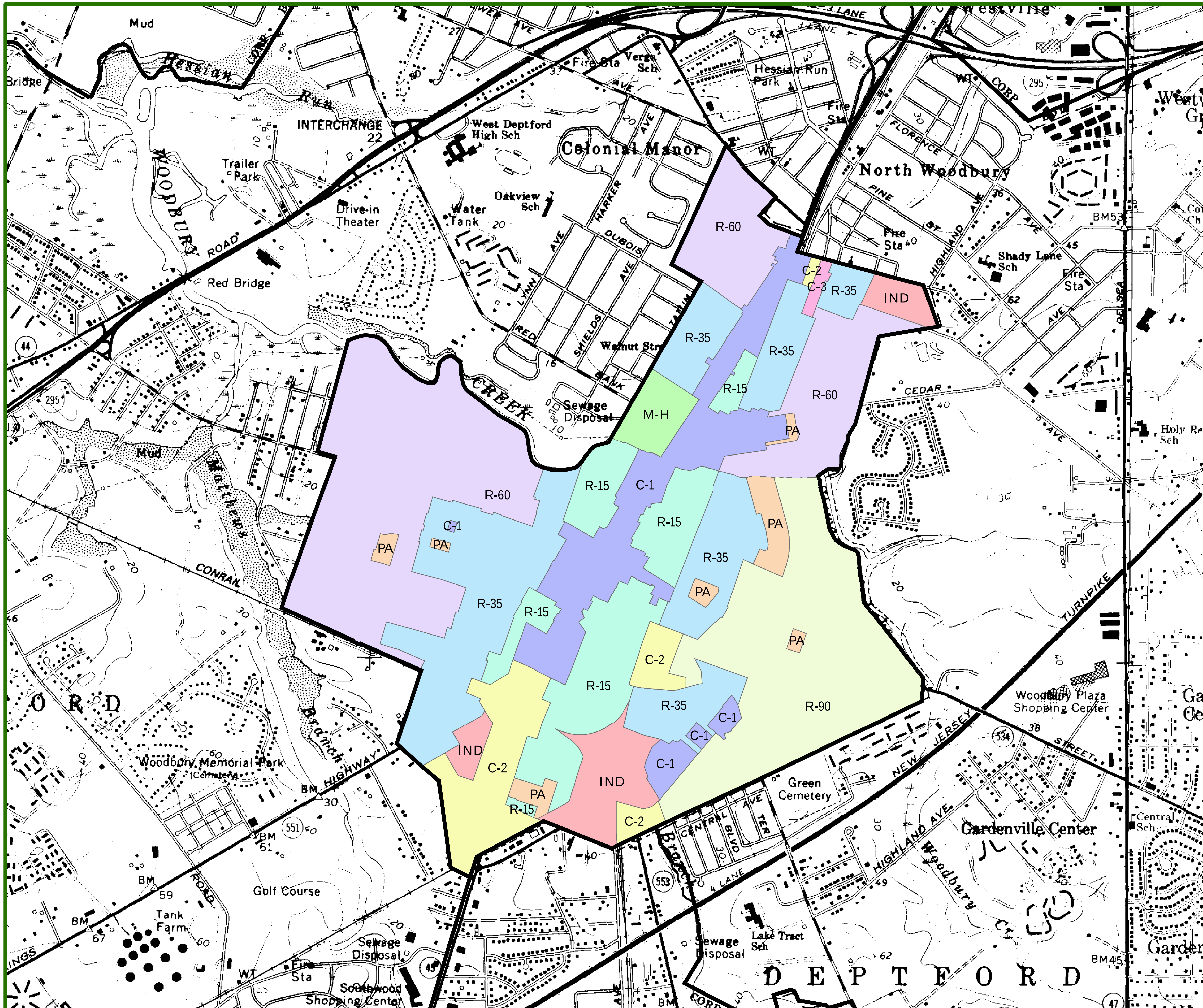
Table 1. Woodbury City Area

	Area (sq. mi.)
Total Area	2.12
Land Area	2.08
Water Area	0.04

With such little land area, its location between Philadelphia and the New Jersey Shore, and its major highway access (in particular, Routes 45 and 295), Woodbury City long ago experienced significant development. Woodbury has been the County Seat of Gloucester County for over two centuries and the County continues to develop its operational base throughout the City of Woodbury. This fact, along with the growth of Underwood Memorial Hospital, had made Woodbury the government, legal, and medical hub of the immediate vicinity. However, Underwood Hospital (aka Inspira) relocated and closed its operations in Woodbury a few years ago. However, a modern emergency room has been built and opened on the adjoining block.

The existing zoning within the City is shown on Figure 6, and the existing land use, based on the DVRPC 2000 aerial photographic land use analysis, is shown on Figure 7. The City is largely residentially developed and is currently attempting redevelopment of blighted properties. Over the past 25 years land use, population, impervious surface area, and density have not changed significantly and remain as they were when the 2006 W/MSWMP was prepared.

The projected build-out development in the Woodbury was largely met decades ago, due to its geographic location, small size, and de minimis remaining undeveloped area.



Stormwater Management Plan

Figure 6

ZONING

N
W
E
S
Geographic Information System

Legend

Municipal Boundary

Woodbury Zoning

ZONING, DESCRIPTION

- C-1, COMMERCIAL
- C-2, COMMERCIAL
- C-3, COMMERCIAL
- IND, INDUSTRIAL
- M-H, MEDICAL- HOSPITAL
- PA, PLANNED APARTMENT
- R-15, RESIDENCE
- R-35, RESIDENCE
- R-60, RESIDENCE
- R-90, RESIDENCE

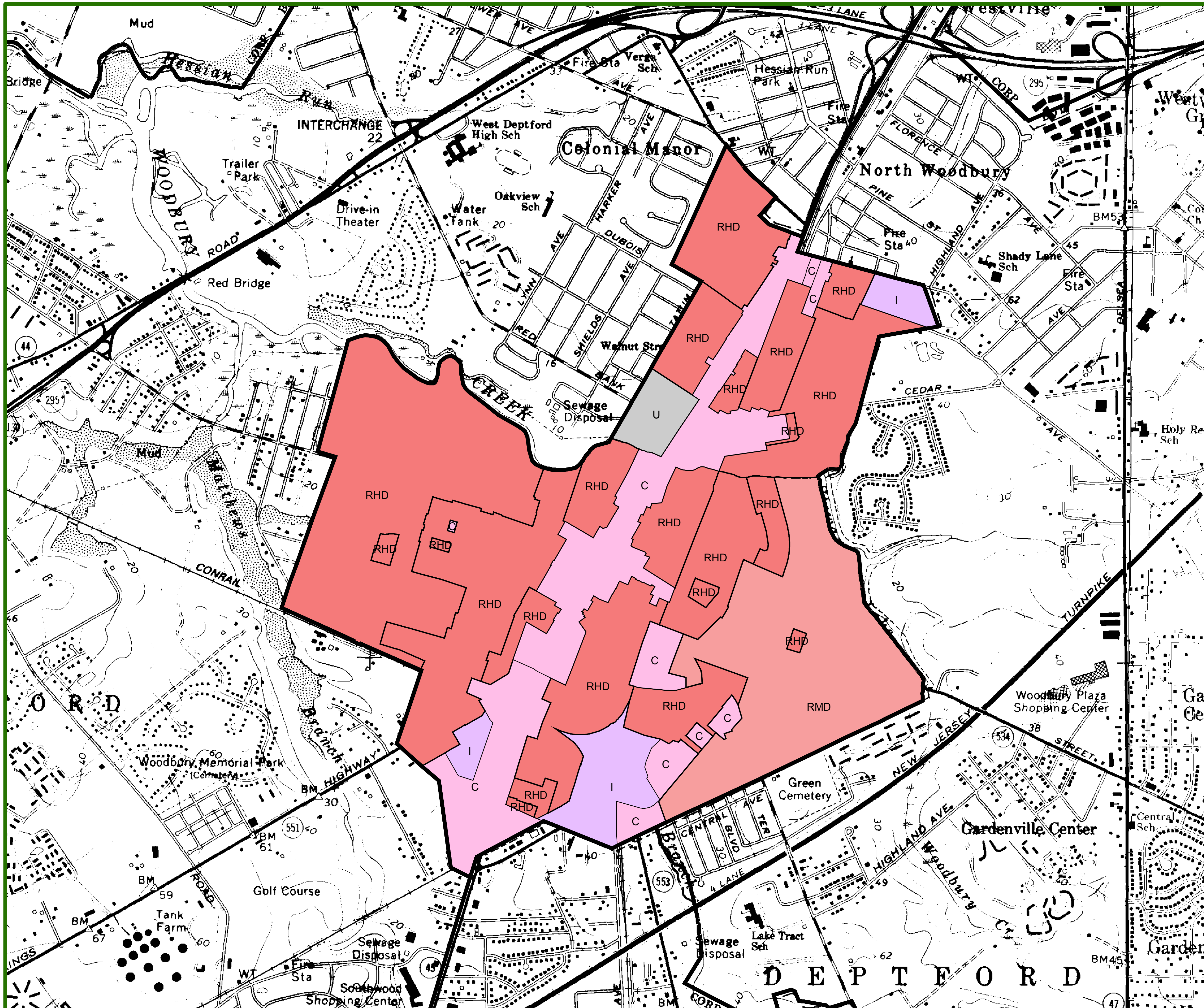
1,500 750 0 1,500
Feet

County - Gloucester
Township - Woodbury

Dated: 02/23/06
Drawn by: SEB

Quadrangles
Woodbury, NJ #114

Note:
This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.



Stormwater Management Plan

Figure 7

LAND COVER

Legend

Municipal Boundary

Land Cover

LANDCOVER

- A, Agriculture
- BL, Barren Land
- C, Commercial
- I, Industrial
- RHD, High Density Residential
- RMD, Medium Density Residential
- RLD, Low Density Residential
- RR, Rural Residential
- U, Urban
- UM, Mixed Urban
- F, Forest
- W, Water

1,500 750 0 1,500 Feet

County - Gloucester Dated: 02/23/06
Township - Woodbury Drawn by: SEB

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Population and Housing

The population and number of housing units within the City of Woodbury is provided by Table 2. Woodbury City is one of 11 municipalities in the County with no housing units classified as rural.

Table 2. Woodbury City Population and Housing (Year 2020)

	Population	Housing Units
Total	9,992	4,591
Urban	9,992	4,591
Rural	0	0

Source: U.S. Census Bureau

The City of Woodbury population density is amongst the highest in Gloucester County.

Table 3. Woodbury City Population Density (2000 – 2020)

	Population	Population Density (persons/sq. mi.)
2020	9,992	4,947
2000	10,307	4,955

Source: U.S. Census Bureau and N.J. Department of Labor

The City of Woodbury has not been growing in recent decades. Between 2000 and 2020, it experienced a -3 percent loss in population (see Table 4).

Table 4. Woodbury City Population Growth (2000 – 2020)

	Population	Population Change	Percent Growth
1990	10,911		
2000	10,307	-604	-6
2020	9,992	-315	-3

Source: U.S. Census Bureau

The Delaware Valley Regional Planning Commission (DVRPC) projects Woodbury City to decrease by 17 people over the 30-year period from 2020 to 2050 (see Table 5), with an overall decline of -0.2 percent during these three decades.

Table 5. Woodbury City Projected Population Growth (2020 – 2050)

	Population	Population Change	Percent Growth
2020	9,992		
2050	9,862	-130	-1.3

Source: DVRPC

Surface Water

(a) Watersheds and Hydrologic Unit Codes (HUCs)

There are eight major Watersheds within Gloucester County. Each of these Watersheds and their land areas within the County are shown in Table 6. Also shown in Table 6 is a two character identification code used to identify data tables and figures related to the individual watersheds.

Table 6. Watersheds Within Gloucester County

ID	Watershed	Area (acres)
BT	**Big Timber Creek**	**12,925**
GE	Great Egg Harbor River	36,997
MC	Mantua Creek	32,099
MR	Maurice River	47,177
OC	Oldman's Creek	14,558
RA	Raccoon Creek	31,822
RE	Repaupo Creek	26,222
WC	**Woodbury Creek**	**13,787**
		215,587

Woodbury City is within two of these major watersheds, as highlighted above and shown in Table 7.

Table 7. Woodbury City Watersheds

ID	Watershed	Area (acres)
WC	Woodbury Creek	1,323.64
BT	Big timber Creek	16.82
	Total	1,340.46

The NJDEP requires that municipalities evaluate the impacts of their small municipal separate storm sewer systems (small MS4s) on surface waters at the HUC14 sub-watershed level (these watershed and sub-watershed divisions were developed by the United States Geological Survey (USGS) using a coding system called Hydrological Unit Codes, or HUCs.

Figure 8 shows the HUC14s located partially or entirely within the municipal boundaries of the City of Woodbury. The names of the HUC14s are shown in Table 7.

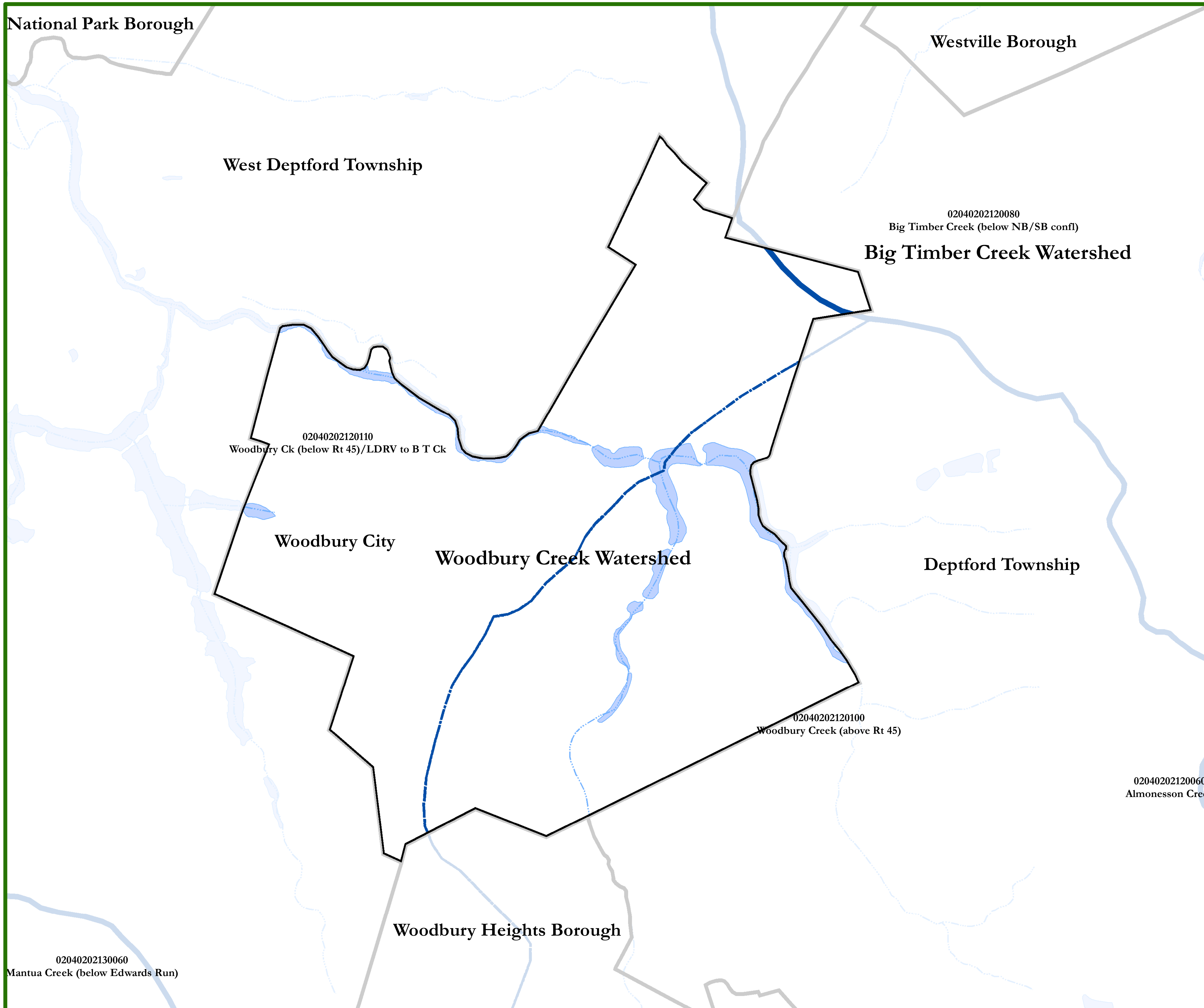
(b) New Jersey Surface Water Quality Standards

The Federal Clean Water Act requires that states maintain surface water quality in high quality waters and restore water quality in impaired waters. Surface Water Quality Standards (SWQS) have been developed by the NJDEP (and Delaware River Basin Commission (DRBC) for the Delaware River) to accomplish this goal. These standards establish "designated uses" to be achieved for surface water bodies and specify the water quality criteria necessary to achieve/allow these uses.

Designated uses established by the NJDEP for New Jersey water bodies include potable water supply (drinking water use), propagation of fish and wildlife (aquatic life use), recreation in and on the water (primary and secondary contact), agricultural and industrial supplies, and navigation. The NJDEP has established stream classifications and antidegradation designations for all of the state's surface water bodies. New Jersey's Water Quality and Monitoring Standards homepage can be found at the following link:

http://www.state.nj.us/dep/wmm/

In addition, because the Delaware River is an interstate water body, the Delaware River Basin Commission (DRBC) has established interstate zones, designated uses for each zone, and established water quality standards to achieve the designated uses along the entire length of the river. Gloucester County adjoins the lower portion of Zone 3, Zone 4, and the upper most portion of Zone 5. The DRBC's Delaware River and Bay Integrated List Water Quality Assessment Report, which contains the water quality standards for each



Stormwater Management Plan

Figure 8

HUC14s

Legend

- Municipal Boundary
- Watershed Boundary
- HUC14 Boundary (as mapped by NJDEP)
- Streams (as mapped by NJDEP)
- Lakes (as mapped by NJDEP)

1,500 750 0 1,500 Feet

County - Gloucester
Township - Woodbury

Dated: 02/23/06
Drawn by: SEB

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Note:
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Additional information for HUC14 data:
Originator: Department of Environmental Protection (NJDEP), New Jersey Geological Survey (NJGS), Publication Date: April 4th, 2000.

Table 8. Woodbury City Watersheds and HUC14s

Watersheds	HUC14 Sub-Watersheds	
	No.	**Name**
Woodbury Creek	02040202120100	Woodbury Creek (above Rt 45)
	02040202120110	Woodbury Creek (below Rt 45)/Lower Delaware River to Big Timber Creek
Big Timber Creek	02040202120080	Big Timber Creek (below NB/SB confluence)

zone, and the results of their 2024 Delaware River and Bay Water Quality Assessment, can be found at the following link:

https://nj.gov/drbc/public/publications/wq-assessment-rpts.html

The Surface Water Quality Criteria for all classified waterways in the State depend on their designated uses and reflected Surface Water Classification. The Surface Water Quality Criteria are detailed in N.J.A.C. 7:9B-1.14 and are too voluminous to include in this report.

(c) Impaired Waters

States are required to prepare and submit to the USEPA a report that identifies waters that do not meet or are not expected to meet surface water quality standards (SWQS). This report is commonly referred to as the 303(d) list. In accordance with Section 305(b) of the CWA, the States are also required biennially to prepare and submit to the USEPA a report addressing the overall water quality of the State's waters. This report is commonly referred to as the 305(b) Report or the Water Quality Inventory Report. Those water bodies, which are listed on the 305(d) list, are referred to as "water quality limited" water bodies and a total maximum daily load (TMDL) must be developed for each individual pollutant in these impaired water bodies. The TMDL may be viewed as a stormwater non-point source pollutant budget required to achieve the impaired standard.

In November 2001, the USEPA issued guidance that encouraged states to integrate 305(b) Report and the 303(d) List into one report. The New Jersey Department of Environmental Protection (NJDEP) chose to develop an Integrated Report for New Jersey starting in 2002. The most recent New Jersey Integrated Water Quality Report listing is 2022 and it combines these two assessments and assigns water bodies to one of five numbered Sublists each with its own subcategories. The Sublists and their subcategories are explained here:

https://dep.nj.gov/wms/bears/integrated-wq-assessment-report-2022/#water-quality-categories

Sublist 5 of the 2022 Report supersedes the previous version of Sublist 5, this newer Sublist 5 presents all water quality limited waters and includes waters for which TMDL development is occurring or will occur within two years (aka 303 (d) list of impaired waters).

The NJDEP has developed a "TMDL Look-Up" tool for the municipal stormwater program to quickly identify TMDLs and impaired waters within their municipal watersheds. The lookup tool provides a summary of all impaired water quality parameter(s) in the municipality's watersheds, the general location along the water course, and a link to the TMDL document. The look-up tool can be found here:

https://dep.nj.gov/njpdes-stormwater/municipal-stormwater-regulation-program/tmdl/

(d) Total Maximum Daily Loads (TMDLs)

TMDLs are required, under Section 303(d) of the federal Clean Water Act, for water bodies that cannot meet surface water quality standards after the implementation of “technology-based” effluent limitations. TMDLs may also be established to help maintain or improve water quality in waters that are not impaired. Based on the integrated list, the NJDEP entered into a Memorandum of Agreement with USEPA that sets out a schedule for completion of TMDLs.

A TMDL allocates the load capacity for **point sources in the form of waste load allocations (WLAs)** and for **non-point sources in the form of load allocations (LAs)**, and may also identify reserve capacity and a margin of safety. WLAs result in Water Quality Based Effluent Limits for point sources such as Wastewater Treatment Plants and requirements based on Best Management Practices (BMPs) for regulated stormwater point sources, such as Combined Sewer Overflows (CSOs). Because non-point source pollution does not come from discrete sources, LAs generally identify broad categories of non-point sources that contribute to the parameters of concern. The LA then includes specific load reduction measures, through Best Management Practices (BMPs), that may include local ordinances for stormwater management and non-point source pollution control, headwaters protection practices, or other mechanisms for addressing the parameters of concern.

A separate TMDL calculation must be prepared for each pollutant listed for each impaired stream segment or lake. A TMDL is considered "proposed" when the NJDEP publishes the TMDL Report as a proposed Water Quality Management Plan Amendment in the New Jersey Register (NJR) for public review and comment. A TMDL is considered "established" when the NJDEP finalizes the TMDL Report and formally submits it to EPA Region 2 for a thirty (30)-day review and approval. The TMDL is considered "approved" when the NJDEP-established TMDL is approved by EPA Region 2. The TMDL is considered "adopted" when the EPA-approved TMDL is adopted by the NJDEP as a water quality management plan amendment and the adoption notice is published in the NJR.

In the process of establishing a TMDL, an implementation plan is developed to identify how the various sources will be reduced to their designated allocations. Implementation strategies for non-point sources may include: improved stormwater management, the adoption of ordinances, reforestation of stream corridors, retrofitting stormwater systems, and other Best Management Practices to control stormwater runoff loadings.

Ground Water

Gloucester County is in the Atlantic Coastal Plain Physiographic Province. Beneath Gloucester County are a series of geologic units that form aquifers or aquifer systems and confining units (aquitards). The geologic units consist largely of layers of unconsolidated sediments of clays, silts, sands and gravels, deposited over many millions of years that extend from the land surface, typically hundreds to thousands of feet to rock. The sand and gravel layers/units, when grouped together, form the aquifers or aquifer systems, and the layers/units containing higher amounts of silts and clays, when grouped together, form aquifer confining units.

The geologic layers/units in the County dip gently to the south-east, and they outcrop (and are exposed) in broad, irregular, northeast-southwest trending bands (generally parallel to the River) on the land surface. The oldest formations outcrop along and under the Delaware River, and progressively younger units outcrop in sequence, moving southeasterly towards the Atlantic Coast.

There are several major coastal plain aquifers or aquifer systems which outcrop and are exposed in Gloucester County. Starting with the oldest and most westerly, they are: the Potomac-Raritan-Magothy (PRM) aquifer system, which outcrops along and under the Delaware River; the Englishtown aquifer system; the Wenonah-Mount Laurel aquifer; and the Kirkwood-Cohansey aquifer system.

The Wenonah-Mount Laurel, Englishtown, and PRM aquifers are exposed in their respective outcrops, but dip into the subsurface, becoming semi-confined or confined at depth in a southeasterly direction. The Kirkwood-Cohansey aquifer system remains exposed throughout its outcrop and is exposed and unconfined within Gloucester County.

There are a few other minor geologic units outcropping in the County that may yield very small amounts of water, including the Merchantville, Marshalltown and Vincentown Formations. However, because of their low permeability's, these formations are more often regarded as confining units. In addition to these minor geologic units, small, shallow, deposits of more recent sands with gravel from the Bridgeton, Pennsauken and Cape May Formations can be found at the surface in the County, particularly capping hills and along stream banks.

The aquifers or aquifer systems in Gloucester County are separated by relatively impermeable geologic confining units that vary in thickness and in their confining ability, ranging from semi-confining to confining. These confining units also outcrop in broad, highly irregular, northeast-southwest trending bands (generally parallel to the River) on the land surface and are located between the outcropping aquifers.

Confining geologic units in the County, starting with the oldest and most westerly outcropping, are: the Woodbury-Merchantville (between the PRM and the Englishtown); the Marshalltown (between the Englishtown and the Wenonah-Mount Laurel); and the Hornerstown-Navesink-Vincentown (between the Wenonah-Mount Laurel and the Kirkwood-Cohansey). Water in the subsurface tends to move very slowly vertically, if at all, from one aquifer system to another, because of these confining units located between the aquifer systems.

Minimizing the impacts of stormwater runoff on the ground water of Woodbury City is a primary goal of this W/MSWMP, as is protecting Woodbury City's surface waters.

(a) Stormwater Runoff and Ground Water Recharge

In New Jersey's Atlantic Coastal Plain, precipitation averages about 44 inches per year.

On average, about 45 percent of the annual precipitation results in runoff (or about 19.75 inches per year), and about 55 percent of the precipitation is lost into the atmosphere as evapotranspiration. The infiltration, or groundwater recharge, component of runoff provides the base stream flows. At an average runoff rate of 19.75 inches per year, the maximum recharge rate of 15 inches per year indicates that as much as 75 percent of the runoff is potentially available for recharge to ground water.

The northwestern corner of the City is located on the outcrop of the Merchantville Formation and the central portion of the City is located on the Woodbury Clay. Together these formations act as confining units for the PRM aquifer beneath. The southeastern portion of the City is located on the thin outcrop of the Englishtown Formation, a minor aquifer in this area.

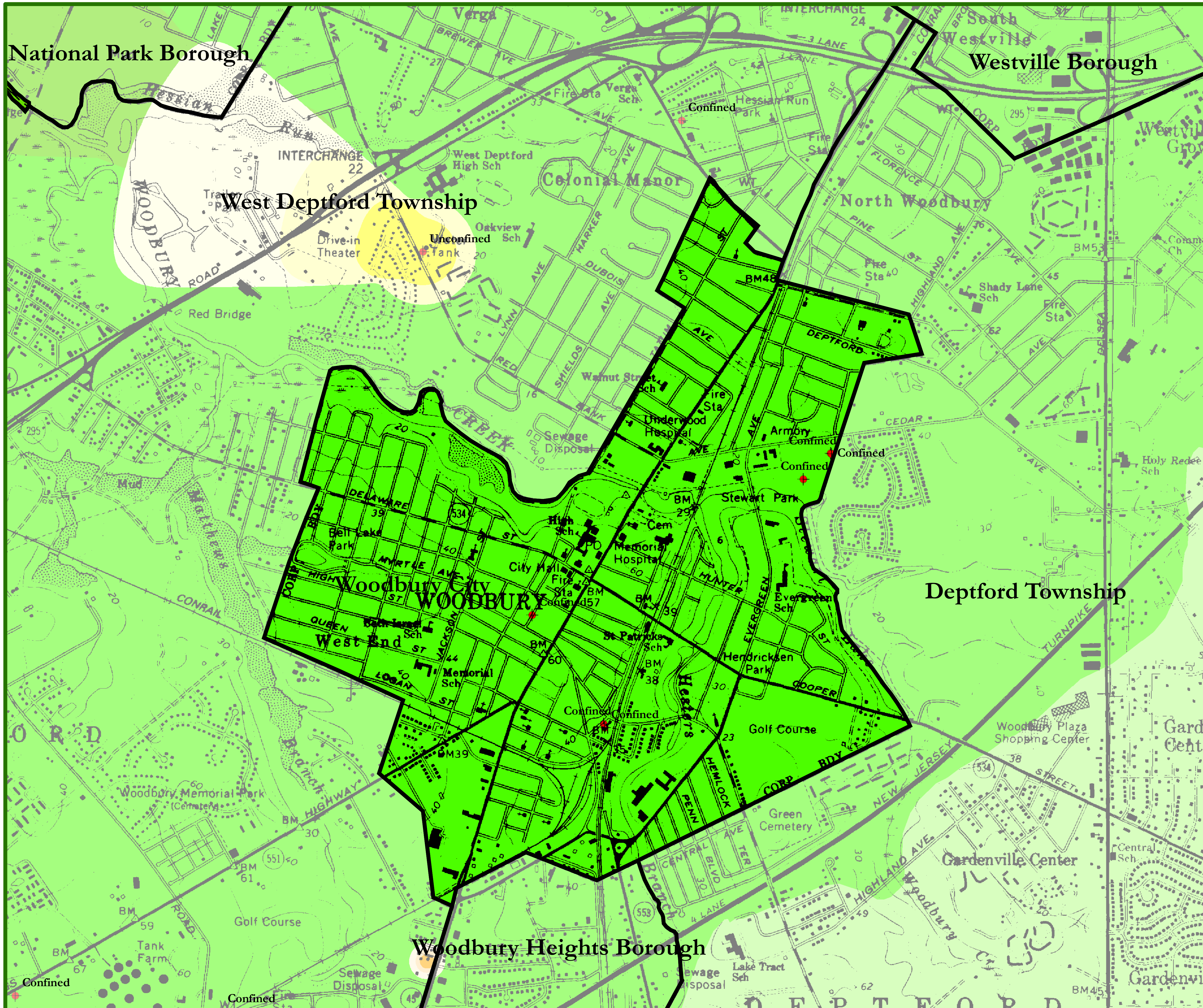
Groundwater recharge to the Merchantville Formation and the Woodbury Clay confining units is infeasible and thus will not benefit these formations or stream base flow. Groundwater recharge of the Englishtown in Woodbury City may provide very minor benefits to stream base flow locally, provided the recharge water is good quality. Additionally, because the City is largely built-out with high amounts of impervious cover, groundwater recharge in Woodbury City is not a significant stormwater management strategy. Ground water recharge to impervious surfaces and the confining units is minimal or non-existent.

(b) Well head Protection Areas (WHPAs)

Water supply wells in exposed unconfined aquifers depend on surface recharge to maintain groundwater levels and groundwater quality, thereby directly linking stormwater management and recharge with water supply. Largely because of this linkage, unconfined public community water supply (PCWS) wells and public non-community water supply (PNCWS) wells have designated “wellhead protection areas” (WHPAs). Water supply wells in the confined portions of aquifers, away from the exposed outcrop areas, are not directly linked to surface recharge, and therefore have no WHPAs.

WHPAs establish the approximate area within which contamination, released on the surface, will travel to the well head, over the prescribed period of time. WHPAs include three tiers; the inner boundary, Tier 1, includes an area with a 2 year travel time, the middle boundary, Tier 2, includes an area with a 5 year travel time and the outer boundary, Tier 3, includes an area with a 12 year travel time. WHPAs serve as warning zones, within which high risk activities should be avoided, and further provide a prioritization for clean-up of existing surface and groundwater contamination that occurs within a WHPA.

Geology (surficial) and Wellhead Protection Areas in Woodbury City are shown in Figure 9. Woodbury City has five confined PCWS wells that are not, therefore, associated with wellhead protection areas.



Stormwater Management Plan

Figure 9

GEOLOGY & WELLHEAD PROTECTION AREAS

Legend

- Municipal Boundary
- Public Community Water Supply Wells

Public Community Wellhead Protection Areas

TIER

- Tier 1 (2 years)
- Tier 2 (5 years)
- Tier 3 (12 years)

Public Non-Community Wellhead Protection Areas

TIER

- Tier 1 (2 years)
- Tier 2 (5 years)
- Tier 3 (12 years)

Gloucester County Geology

GEONAME

- Englishtown Formation
- Magothy Formation
- Marshalltown Formation
- Merchantville Formation
- Mt. Laurel Formation
- Wenonah Formation
- Woodbury Formation

1,500 750 0 1,500 Feet

County - Gloucester
Township - Woodbury

Dated: 02/23/06
Drawn by: SEB

Quadrangles
Woodbury, NJ #114

Note:
This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.
Additional Information for Wells data:
New Jersey Department of Environmental Protection NJDEP, New Jersey Geological Survey NJGS, Publication Date: April 5th, 2004.
Additional Information for Geologic data:
Originator: New Jersey Department of Environmental Protection (NJDEP), New Jersey Geological Survey (NJGS), Publication Data: June 30th, 1999.

(c) New Jersey Groundwater Quality Standards

The NJDEP's has established Ground Water Quality Standards (GWQSs) for all of the ground waters in the State of New Jersey (N.J.A.C. 7:9-6). Like the SWQSs, the GWQSs establish the designated uses for the State's ground water, and specify the ground water quality criteria for specific constituents, including toxic pollutants, consistent with those designated uses.

The GWQSs establish classification areas according to the geographic extent (both vertical and horizontal) of geologic formations, or units, within which ground water is classified for the designated uses. Designated uses may include any human withdrawal of ground water (for example, for potable, agricultural, or industrial water), the discharge of ground water to surface waters of the State which support human use or ecological systems, or the direct support of ecological systems.

The GWQSs include three major classes each with a number of subcategories of ground water that can be found here:

https://dep.nj.gov/wms/bears/ground-water-quality-standards-gwqs/#Classification

Class I	Ground Water of Special Ecological Significance
Class II	Ground Water for Potable Water Supply
Class III	Ground Water With Uses Other Than Potable Water Supply

Under the NJDEP GWQSs, the primary designated use for Class I ground waters is the maintenance of special ecological resources supported by the groundwater within the classification area; secondary designated uses of Class I waters is use for potable water, agricultural water and industrial water, if these uses are viable using water of natural quality and do not impair the primary use (for example, by altering ground water quality).

Class I ground water is further designated as either Class I-A (Exceptional Ecological Areas) or Class I-PL (Pinelands). Ground water within watersheds of FW-1 surface waters (a Category One surface water classification), and certain "Natural Areas" designated by the NJDEP in the GWQSs, are designated as Class I-A ground waters.

Class III ground waters are ground waters that are not suitable for potable use due to their natural hydrogeologic characteristics, such as aquitards - Class III-A ground water, or due to their natural water quality that is unsuitable for conversion to potable water, such as saline ground water (Class III-B).

All ground waters in New Jersey not designated as Class I or Class III are designated as Class II ground waters. Class II ground waters are further classified as either Class II-A or Class II-B. The designated uses of Class II-B waters are any reasonable use other than potable use; however, the NJDEP has not designated any ground waters as Class II-B.

Because of the different ground water quality criteria, the necessary stormwater management measures may vary among these areas. However, the three contaminants for which the NJDEP has required a projection of build-out stormwater pollutant loading are nitrogen, phosphorus, and total suspended solids (see Section 5). These three pollutants are of particular significance with regard to surface water quality, but are not included in the list of constituent criteria for ground water. It is anticipated that ground water quality issues will not be a significant concern for new major development projects, if the projects comply with the new design and performance standards in N.J.A.C. 7:8 that require removal.

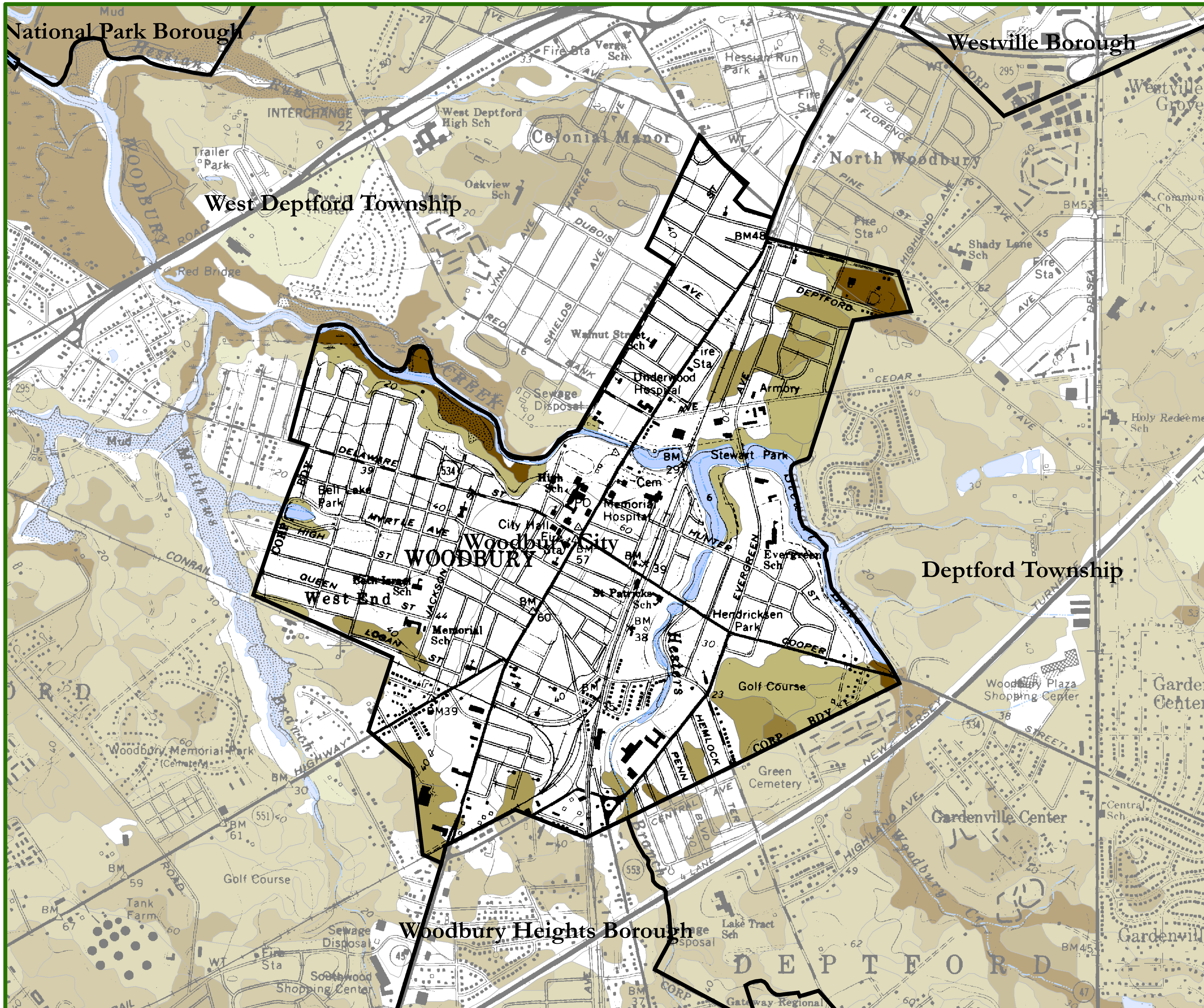
Soils

One of the main objectives of the new NJDEP Stormwater Management Rules is to promote ground water recharge in order to replenish aquifers, maintain base flow in streams, and assist in maintaining the groundwater supply. Ground water recharge is significantly affected by land use (e.g., commercial vs. agricultural uses), as well by the type of natural soil present on the ground surface. The National Resource Conservation Service (NRCS) has grouped soil types throughout the United States into four different Hydrologic Soil Groups (HSGs): A, B, C and D, depending on their infiltration ability and the potential rate of ground water recharge.

Group A soils have high infiltration rates and recharge potential and provide little direct runoff. They generally include well-drained and sorted sands and gravels. Group B soils have moderately high recharge potential, while Group C soils have lower infiltration rates and generally include more silt and clay particles with higher direct runoff potential. Group D soils have very low recharge rates and a high direct runoff potential. Some soils may have two classifications depending on whether or not they contain soil layers with different infiltration characteristics. For example, a soil classified as A/D has both a Group A soil layer that is well-drained and a Group D soil layer that is poorly drained.

The NJDEP’s new stormwater regulations encourage impervious surfaces in new development within areas with soils that do not recharge significant amounts of water to aquifers; that is, in Group C and D soil areas. The regulations encourage the protection of the natural condition, infiltration and recharge rates in Group A or B soil areas. However, many Group D soil areas are located in wetlands or adjacent to wetlands and water bodies and these areas are not developable. It may not be possible to completely avoid disturbance and new development in Group A and B soil areas. But, the NJDEP’s new stormwater regulations require equal amounts of ground water recharge before and after new development.

Figure 10 depicts the hydrologic soil groupings in Woodbury City. Woodbury soils are primarily classified as urban. Because of their disturbed nature and the underlying geology, they generally have poor recharge characteristics.



Stormwater Management Plan

Figure 10

SOILS

Legend

- Municipal Boundary
- Streams (as mapped by NJDEP)
- Lakes (as mapped by NJDEP)

Gloucester County Soils

Hydrology

- No Data
- A
- B
- B/D
- C
- C/D
- D

1,500 750 0 1,500 Feet

County - Gloucester
Township - Woodbury

Dated: 02/23/06
Drawn by: SEB

Quadrangles
Woodbury, NJ #114

Note:
This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized. Additional Information for Soils data: U.S. Department of Agriculture, Natural Resources Conservation Service. Photographic or digital enlargement of these maps to scales greater than at which they were originally mapped can cause misinterpretation of the data. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale. The depicted soil boundaries, interpretations, and analysis derived from them do not eliminate the need for onsite sampling, testing, and detailed study of specific sites for intensive uses. Thus, these data and their interpretations are intended for planning purposes only. Digital data files are periodically updated. Files are dated, and users are responsible for obtaining the latest version of the data.
Publication Data: April 7th, 2005.

WOODBURY CREEK WATERSHED

Topography

Figure WC-1 (see Appendix A) provides an aerial photograph of the Woodbury Creek Watershed and depicts general land use and other planimetric relationships within the watershed. It is a "birds-eye" view of the watershed that allows a quick assessment of watershed conditions as they exist. This watershed appears generally to be an urbanized watershed.

Figure WC-2 (see Appendix A) provides the USGS Quadrangle (topographic map) for this watershed. Relief (elevation difference) within the Woodbury Creek Watershed is about 95 feet, with elevations ranging from a low of 3.3 to a high of 98 feet above mean sea level. Lower elevations occur along the waterways and wetlands and higher elevations occur along the watershed's boundaries. The land surface elevations and relief in this watershed have been sculpted by surface runoff and erosion of the unconsolidated coastal plain sediments at the land surface. Relief in this watershed is generally small, although there are a few localized land areas with steeper slopes. Hills with steeper slopes, often capped by more erosion resistant sediments (gravels), can generally be found within the watershed, providing some structural control and forming drainage boundaries.

The Woodbury Creek is about 5 miles long, and the average stream gradient (slope) along the length of the watershed's stream channel (the long profile) is 0.001 (excluding any estuarine tidal portions). In general, stream slopes within the watershed are extremely flat.

In this watershed, surface drainage has eroded the land surface in dendritic drainage patterns that exhibit little structural control because of the relatively uniform resistance to erosion from the underlying sediments. Generally, the streams in the watershed consist of short straight sections connected by bends and kinks. For the most part, there is little or no stream braiding or meandering and stream channels are not heavily incised. The streams in the watershed appear to be "graded." Stream base level, gradient, channel section, sediment load and flow are in relative dynamic equilibrium. Uncontrolled development within the watershed, although unrealistic, could upset this equilibrium.

Hydrology

The Woodbury Creek Watershed is the smallest watershed fully contained in Gloucester County, draining an area of approximately 21.5 square miles into this five mile-long stream. Woodbury Creek's two major tributaries are Hessian Run and Matthews Branch. The River and its tributaries are shown on Figure WC-3 (see appendix A). In Gloucester County, this watershed contains 3 HUC14 sub-watersheds and these are listed in Table WC-1.

Table WC-1. Woodbury Creek Watershed HUC14s

Municipality	HUC14 Sub-Watershed	
	No.	**Name**
West Deptford Township	02040202120110	Woodbury Creek (below Rt 45)/Lower Delaware River to Big Timber Creek
	02040202120120	Main Ditch / Little Mantua Creek
Deptford Township	02040202120100	Woodbury Creek (above Rt 45)
	02040202120110	Woodbury Creek (below Rt 45)/Lower Delaware River to Big Timber Creek
Woodbury City	02040202120100	Woodbury Creek (above Rt 45)
	02040202120110	Woodbury Creek (below Rt 45)/Lower Delaware River to Big Timber Creek
Woodbury Heights Borough	02040202120100	Woodbury Creek (above Rt 45)
	02040202120110	Woodbury Creek (below Rt 45)/Lower Delaware River to Big Timber Creek
National Park Borough	02040202120110	Woodbury Creek (below Rt 45)/Lower Delaware River to Big Timber Creek
	02040202120120	Main Ditch/Little Mantua Creek

Surface Water Quality

(a) Surface Water Classifications

The surface waters in the Woodbury Creek Watershed are classified FW2-NT/SE2 or FW2-NT.

The designated uses for surface water classification FW2-NT (non-trout fresh surface waters not designated as FW1 or PL) as described by the N.J.A.C. 7:9B-1.12(c) are:

1. Maintenance, migration and propagation of the natural and established biota;
2. Primary and secondary contact recreation;
3. Industrial and agricultural water supply;
4. Public potable water supply after conventional filtration treatment (a series of processes including filtration, flocculation, coagulation, and sedimentation, resulting in substantial particulate removal but no consistent removal of chemical constituents) and disinfection; and
5. Any other reasonable uses.

The designated uses for surface water classification SE2 (saline waters of estuaries not designated as SE1 or SE3) as described by N.J.A.C. 7:9B-1.12(e) are:

1. Maintenance, migration and propagation of the natural and established biota;
2. Migration of diadromous fish;
3. Maintenance of wildlife;
4. Secondary contact recreation; and
5. Any other reasonable uses.

The designated uses for surface water classification FW2-NT/SE2 are a combination of two classifications due to a salt water/fresh water interface. The location of the interface is determined by the salinity measurements. It is located where the salinity is equal to 3.5 parts per thousand (ppt) at mean high tide. This location can change dependent on a number of factors, such as tidal effects, rainfall amounts, evapotranspiration and freshwater input. The fresh water portions or where the salinity is below or equal to 3.5 ppt at mean high tide, are classified as FW2-NT and take on the designate uses as described above. The saline portions or where the salinity is above 3.5 ppt at mean high tide, are classified as SE-2 and take on the designated uses as described above.

(b) Surface Water Quality Data

Ambient Biomonitoring Network - The NJDEP has established an Ambient Biomonitoring Network (AMNET) to document the health of the state's waterways. There are over 800 AMNET sampling sites throughout the state of New Jersey. These sites are sampled for benthic macroinvertebrates by the NJDEP on a five-year cycle. Streams are classified as non-impaired, moderately impaired, or severely impaired, based on this AMNET data. The data is used to generate a New Jersey Impairment Score (NJIS), which is based on a number of biometrics related to benthic macroinvertebrate community dynamics. The AMNET sites within this watershed are shown on Figure WC-4 (see Appendix A), and the most recent AMNET scores for Impaired Waters within this watershed can be found here:

https://njogis-newjersey.opendata.arcgis.com/datasets/njdep::ambient-biomonitoring-network-amnet-of-new-jersey/about.

Conventional Water Quality Data – The NJDEP utilizes conventional surface water quality data from a number of sources to bi-annually evaluate the impairment of surface water bodies. These water quality data include the federal Storage and Retrieval repository (STORET) data and other Existing Sources. The STORET and Existing Sources sampling locations within this watershed are shown in Figure WC-4 and the most recent data for Impaired Waters can be found here:

https://www.waterqualitydata.us/provider/STORET/

(c) Impaired Waters

For the purpose of evaluating surface water quality in this watershed, the NJDEP Integrated List (Sublists 1-5) were abridged and sorted to provide the locations of impaired waters within this watershed and these are listed in Table WC-2. A map showing the locations of impaired water is included as Figure WC-4 (Appendix A). There are four (4) different sites within this watershed that are considered impaired for their designated uses, because they do not meet their respective water quality standards for one or more pollutant parameters. The impaired parameters include: mercury, PCBs, and phosphorus.

Table WC-2. Woodbury Creek Impaired Waters List

Woodbury Applicable Stream TMDL(s)

1. Total Maximum Daily Load for Mercury Impairments Based on Concentration in Fish Tissue Caused Mainly by Air Deposition to Address 122 HUC 14s Statewide
   Mercury - 2010: Woodbury Creek (above Rt 45)
2. Total Maximum Daily Loads for Polychlorinated Biphenyls (PCBs) for Zones 2 - 5 of the Tidal Delaware River
   Polychlorinated Biphenyls (PCBs) - 2003: Big Timber Creek (below NB/SB confl)
3. Total Maximum Daily Loads for Polychlorinated Biphenyls (PCBs) for Zones 2 - 5 of the Tidal Delaware River
   Polychlorinated Biphenyls (PCBs) - 2003: Woodbury Ck (below Rt 45)/LDRV to B T Ck
4. Total Maximum Daily Loads for Polychlorinated Biphenyls (PCBs) for Zones 2 - 5 of the Tidal Delaware River
   Polychlorinated Biphenyls (PCBs) - 2003: Woodbury Creek (above Rt 45)

Woodbury Applicable Lake TMDL(s)

1. Total Maximum Daily Loads for Phosphorus To Address 13 Eutrophic Lakes in the Lower Delaware Water Region
   Total Phosphorus - 2003: Bell Lake
2. Total Maximum Daily Loads for Phosphorus To Address 13 Eutrophic Lakes in the Lower Delaware Water Region

Total Phosphorus - 2003: Woodbury/Stewart Lake

Applicable Shellfish TMDL(s)

1. None

(d) TMDL Proposals

The NJDEP has proposed TMDLs that address the impaired water bodies in this watershed. The full text of these proposals can be found and downloaded at the following link:

https://dep.nj.gov/njpdes-stormwater/municipal-stormwater-regulation-program/tmdl/.

A list of this watershed's TMDL proposals is included in Table WC-3. The locations of TMDLs in this watershed are shown on Figure WC-4 Water Quality (Appendix A).

Table WC-3. Woodbury Creek TMDL Proposals

Location	Parameter	Status
Streams		
1. Woodbury Creek (above Rte 45)	Mercury	Approved 2010
2. Big Timber Creek (below NB/SB confl)	PCBs	Approved 2003
3. Woodbury Creek (below Rte 45)	PCBs	Approved 2003
4. Woodbury Creek (above Rte 45)	PCBs	Approved 2003
Lakes		
1. Bell Lake	Phosphorous	Approved September 2003
2. Woodbury Lake	Phosphorous	Approved September 2003

The TMDL documents provide the Waste load allocation reductions proposed for the affected waterways. The TMDL proposals discuss possible sources as well as the methods used to develop the TMDLs and remediation plan. (See Section 8 Water Quality-TMDL Stormwater Management Strategies).

Category One Waters

There are no Category One waters in the Woodbury Creek Watershed.

Hydrogeology

The western portion of the Woodbury Creek Watershed, to approximately the eastern edge of National Park Borough, is in the exposed outcrop of the PRM aquifer system, which is unconfined at the surface and provides the water table aquifer in this portion of the watershed. The central portion of the watershed is on the outcrop of the Woodbury-Merchantville confining unit. The eastern portion of the Woodbury Creek Watershed is on the outcrops of (west to east) the Englishtown aquifer, the Marshalltown confining unit (beginning at about the New Jersey Turnpike), and the Wenonah-Mount Laurel aquifer near the eastern headwaters of the aquifer.

In this watershed, the exposed outcrops of these aquifers are susceptible to contamination from development, stormwater runoff, and the quality of groundwater recharge.

Soils

The Woodbury Creek watershed is highly developed, with approximately one third of its soils categorized as "Urban". The watershed has over one third of its area covered by moderately well-drained Group B soils, primarily in the eastern portion of the watershed and in the northern corner. There is a significant area of National Park and east of National Park characterized by high recharge or Group A soils. Hydric soils and wetlands are scattered throughout the watershed. Figure WC-5 (see Appendix A) shows the potential amounts of infiltration and ground water recharge throughout the watershed.

Critical Habitats

The NJDEP Division of Fish and Wildlife Endangered Nongame Species Program developed a Geographic Information System (GIS) called the *Landscape Project*, which is described as a "pro-active, ecosystem-level approach to the long-term protection of imperiled and priority species and their important habitats in New Jersey." Version 3.3 of the Landscape project is now available interactively on the web and for download (see NJ Geoweb). The resulting data layer identifies, delineates and ranks (based on the conservation status of species present) habitat statewide. Each patch is coded for the number of sightings of priority, state threatened, state endangered and federally listed species present. The data is designed to be used for state and local planning, open space acquisition, and land-use regulation."

The NJDEP Division of Fish and Wildlife describes the *Landscape Project* and the importance of preserving natural habitat as follows:

> New Jersey is the most densely populated state in the nation. One of the consequences of this distinction is the extreme pressure that is placed on our natural resources. As the population grows, we continue to lose or impact the remaining natural areas of the state. As more and more habitat is lost, people are beginning to appreciate the benefits and necessity of maintaining land in its natural state.
>
> For example, we know that wetlands are critical for recharging aquifers, lessening the damage from flooding and naturally breaking down contaminants in the environment. Forests and grasslands protect the quality of our drinking water, help purify the air we breathe and provide important

> areas for outdoor recreation. Collectively, these habitats are of critical importance to the diverse assemblage of wildlife found in New Jersey, including more than 70 species classified as threatened or endangered.
>
> Many imperiled species require large contiguous tracts of habitat for survival. The consequence of the rapid spread of suburban sprawl is the loss and fragmentation of important wildlife habitat and the isolation and degradation of the smaller habitat patches that remain. Small patches of fields, forests and wetlands interspersed with development provide habitat for common species that do well living near humans, but do not provide the necessary habitat for most of our imperiled wildlife. We need to protect large, contiguous blocks of forest, grassland and wetlands to assure the survival of imperiled species over the long-term.
>
> In addition to providing habitat for the conservation of imperiled species, protecting critical wildlife areas will result in more open space for outdoor recreation. Recent surveys by the U.S. Fish and Wildlife Service show that more than 60% of Americans participate in some form of wildlife-related recreation. Open spaces provide places where people can escape the confines of urban and suburban living.

Most critical habitats are supported in part or in total by the surrounding surface and ground water resources, and they are consequently impacted by development, non-point source pollution, and stormwater runoff. Critical Habitats mapped by the NJDEP's Landscape Project within this watershed are shown on Figure WC-6 (based on Landscape Version 2.0) (see Appendix A. The Critical Habitats within this watershed may include Grassland, Forest, Forested Wetland, Emerging Wetland, Beach, Bald Eagle Foraging, Urban Peregrine Falcon Nesting, and Wood Turtle habitats that should, to the extent practical, be conserved and protected from the adverse impacts caused by uncontrolled development and stormwater runoff.

BIG TIMBER CREEK WATERSHED

Topography

Figure BT-1 (see Appendix A) provides an aerial photograph of the Big Timber Creek Watershed and depicts general land use and other planimetric relationships within the watershed. It is a "birds-eye" view of the watershed that allows a quick assessment of watershed conditions as they existed at that time. This watershed appears generally to be an urbanized watershed. **Only 16.4 acres of the watershed are within the City's boundaries**.

Figure BT-2 (see Appendix A) provides the USGS Quadrangle (topographic map) for this watershed. Relief (elevation difference) within the Big Timber Creek Watershed is about 194 feet, with elevations ranging from a low of 3.3 to a high of 197 feet above mean sea level. Lower elevations occur along the waterways and wetlands and higher elevations occur along the watershed's boundaries. The land surface elevations and relief in this watershed have been sculpted by surface runoff and erosion of the unconsolidated coastal plain sediments at the land surface. But, the relief in this watershed is generally small, although there are a few localized land areas with steeper slopes. Hills with steeper slopes, often capped by more erosion resistant sediments (gravels), can generally be found within the watershed, providing some structural control and forming drainage boundaries.

The creek is about 17 miles long, and the average stream gradient (slope) along the length of the watershed's stream channel (the long profile) is 0.0014 (excluding any estuarine tidal portions). In general, stream slopes within the watershed are extremely flat.

In this watershed, surface drainage has eroded the land surface in dendritic drainage patterns that exhibit little structural control because of the relatively uniform resistance to erosion from the underlying sediments. Generally, the streams in the watershed consist of short straight sections connected by bends and kinks. For the most part, there is little or no stream braiding or meandering and stream channels are not heavily incised. The streams in the watershed appear to be "graded." Stream base level, stream gradient, channel section, sediment load and flow are in relative dynamic equilibrium. Uncontrolled development within the watershed, although unlikely, could change this equilibrium.

Hydrology

The main stem of Big Timber Creek and the south Branch form much of the boundary between Gloucester and Camden Counties. Because over 50 percent of the Big Timber Creek Watershed is outside of the County, neighboring municipalities in Camden County also impact the hydrology and water quality in the watershed.

The area of Gloucester County which drains into Big Timber Creek is approximately 20 square miles. The only major tributary of the Creek within Gloucester County is Almonesson Creek. The River and its tributaries are shown on Figure BT-3 (see Appendix A). In Gloucester County, this watershed contains six HUC14 sub-watersheds, and these are listed in Table BT-1.

Table BT-1. Big Timber Creek Watershed HUC14s

Municipality	HUC14 Sub-Watershed No.	HUC14 Sub-Watershed Name
Deptford	02040202120040	Big Timber Creek SB (including Bull Run to Lakeland Road
	02040202120050	Big Timber Creek SB (below Bull Run)
	02040202120060	Almonesson Creek
	02040202120080	Big Timber Creek (below NB/SB confluence)
Washington Township	02040202120030	Big Timber Creek SB (above Lakeland Rd)
	02040202120040	Big Timber Creek SB (including Bull Run to Lakeland Rd)
West Deptford Township	02040202120080	Big Timber Creek (below NB/SB confluence)
Westville Borough	02040202120080	Big Timber Creek (below NB/SB confluence)
Woodbury City	02040202120080	Big Timber Creek (below NB/SB confluence)

Surface Water Quality

(a) Surface Water Classifications

The surface waters in the Big Timber Creek Watershed are classified FW2-NT or FW2-NT/SE2.

The designated uses for surface water classification FW2-NT (non-trout fresh surface waters not designated as FW1 or PL) as described by the N.J.A.C. 7:9B-1.12(c) are:

6. Maintenance, migration and propagation of the natural and established biota;
7. Primary and secondary contact recreation;
8. Industrial and agricultural water supply;
9. Public potable water supply after conventional filtration treatment (a series of processes including filtration, flocculation, coagulation, and sedimentation, resulting in substantial particulate removal but no consistent removal of chemical constituents) and disinfection; and
10. Any other reasonable uses.

The designated uses for surface water classification SE2 (saline waters of estuaries not designated as SE1 or SE3) as described by N.J.A.C. 7:9B-1.12(e) are:

6. Maintenance, migration and propagation of the natural and established biota;
7. Migration of diadromous fish;
8. Maintenance of wildlife;
9. Secondary contact recreation; and
10. Any other reasonable uses.

The designated uses for surface water classification FW2-NT/SE2 are a combination of two classifications due to a salt water/fresh water interface. The location of the interface is determined by the salinity measurements. It is located where the salinity is equal to 3.5 parts per thousand (ppt) at mean high tide. This location can change dependent on a number of factors, such as tidal effects, rainfall amounts, evapotranspiration and freshwater input. The fresh water portions or where the salinity is below or equal to 3.5 ppt at mean high tide, are classified as FW2-NT and take on the designated uses as described above. The saline portions or where the salinity is above 3.5 ppt at mean high tide, are classified as SE-2 and take on the designated uses as described above.

(b) Surface Water Quality Data

Ambient Biomonitoring Network - The NJDEP has established an Ambient Biomonitoring Network (AMNET) to document the health of the state's waterways. There are over 800 AMNET sampling sites throughout the state of New Jersey. These sites are sampled for benthic macroinvertebrates by the NJDEP on a five-year cycle. Streams are classified as non-impaired, moderately impaired, or severely impaired, based on the AMNET data. The data is used to generate a New Jersey Impairment Score (NJIS), which is based on a number of biometrics related to benthic macroinvertebrate community dynamics. The AMNET sites within this watershed are shown in Figure BT- 4 (see Appendix A) and the most recent AMNET scores for Impaired Waters within this watershed can be found here:

https://njogis-newjersey.opendata.arcgis.com/datasets/njdep::ambient-biomonitoring-network-amnet-of-new-jersey/about.

Conventional Water Quality Data – The NJDEP utilizes conventional surface water quality data from a number of sources to bi-annually evaluate the impairment of surface water bodies. These water quality data include the federal Storage and Retrieval repository (STORET) data and other Existing Sources. The STORET and Existing Sources sampling locations within this watershed are shown in Figure BT-4 (see Appendix A), and the most recent data for Impaired Waters can be found here:

https://www.waterqualitydata.us/provider/STORET.

(c) Impaired Waters

For the purpose of evaluating surface water quality in this watershed, the NJDEP Integrated List (Sublists 1-5) were abridged and sorted to provide the locations of impaired waters within this watershed and these are listed in Table BT-2. A map showing the locations of impaired water is included as Figure BT-4 (Appendix A). There were seven (7) different sites within this watershed that are considered impaired for their designated uses, because they do not meet their respective water quality standards for one or more pollutant parameters. The impaired parameters include: phosphorus, mercury, benthic macroinvertebrates, and fecal coliform.

Table BT-2. Big Timber Creek Impaired Waters List

No.	Location	Parameter	Priority
1.	Big Timber Creek	Mercury	High
2.	S. Br. Big Timber Creek at Almonesson Rd. in Blenheim	Phosphorus	Medium
3a.	S. Br. Big Timber Creek at Blackwood Terrace	Phosphorus	Medium
3b.	S. Br. Big Timber Creek at Blackwood Terrace	Fecal Coliform	High
4.	S. Br. Big Timber Creek at Turnersville - Sicklerville Rd in Washington	Benthic Macroinvertebrates	Low
5.	Grenloch Lake	Phosphorus	Medium
6.	S. Br. Big Timber Creek at Grenlock	Fecal Coliform	High

No.	Location	Parameter	Priority
7.	Blackwood Lake	Phosphorous	Medium

(d) TMDL Proposals

Because the NJDEP Look-up Tool does not provide for TMDL watershed searches, and because the vast majority of the Big Timber Creek Watershed does not involve the City of Woodbury (16.82 ac of 12,925 ac in Gloucester County) updating of this TMDL information for the Creek is beyond the scope of this W/MSWMP and would have little or no impact on the City's W/MSWMP.

The NJDEP had proposed four (4) sets of TMDLs that address impaired water bodies in this watershed. The full text of these proposals can be found and downloaded at the following link:

http://www.nj.gov/dep/watershedmgt/tmdl.htm#intro .

Three of the four sets of TMDLs were proposed by the NJDEP in April 2003 and were based on the 2002 Integrated Report. These TMDLs were approved in September 2003, but had not yet been adopted at that time. One of the four sets of TMDLs was proposed by the NJDEP in July 2005 and was not yet established.

A list of this watershed's TMDL proposals including the impaired water bodies, the addressed parameter and their current adoption status is included in Table BT-3. The locations of TMDLs in this watershed are shown on Figure BT-4 (Appendix A).

Table BT-3. Big Timber Creek TMDL Proposals

Location	Parameter	Status
S. Br. Big Timber Creek at Grenlock	Fecal Coliform	Approved September 2003
S. Br. Big Timber Creek at Blackwood Terrace	Fecal Coliform	Approved September 2003
Blackwood Lake	Phosphorus	Approved September 2003
S. Br. Big Timber Creek at Blackwood Terrace	Phosphorus	Proposed July 5, 2005

TMDLs were proposed for fecal coliform for the South Branch Big Timber Creek at Grenlock and the South Branch Big Timber Creek at Blackwood Terrace. Waste load allocation reductions were proposed. The TMDL proposals describe the possible sources of fecal coliform as well as the method for developing the TMDL and remediation plan. (See Section 8 Stormwater Management Strategies.)

TMDLs were proposed for phosphorous for the South Branch of Big Timber Creek at

Blackwood Terrace and for Blackwood Lake on the South Branch of Big Timber Creek. Waste load allocation reductions were proposed. The TMDL proposal describes possible sources of phosphorous and the method for developing the TMDL and remediation plan. (See Section 8 Water Quality-TMDL Stormwater Management Strategies.)

Category One Waters

There are no Category One waters in the Gloucester County portion of this watershed. However, there are Category One waters in the Camden County portion of the watershed.

Hydrogeology

The eastern half of the Big Timber Creek Watershed within Gloucester County, to approximately the Washington Township/Deptford Township boundary, is in the exposed outcrop of the Kirkwood-Cohansey aquifer system, which is unconfined at the surface and provides the water table aquifer in this watershed.

Moving west across the watershed, the other aquifers and confining units in the County outcrop in narrow irregular bands. The Wenonah-Mount Laurel, Englishtown, and PRM aquifers or aquifer systems are exposed in their respective outcrops, but dip into the subsurface, becoming semi-confined or confined at depth in a southeasterly direction.

In this watershed, the exposed outcrops of these four aquifers are susceptible to contamination from development, stormwater runoff and the quality of groundwater recharge.

Soils

Over half of the drainage area of Big Timber Creek is covered by Group B or moderately well-draining soils. These Group B soils are predominant in the eastern side of the watershed. Between Route 47 and the boundary between Deptford and Washington Townships, there is an area of Group C and C/D soils, as in the area in Deptford Township between Route 544 and the New Jersey Turnpike. Figure BT-5 (see Appendix A) shows the potential amounts of infiltration and ground water recharge throughout the watershed.

Critical Habitats

The NJDEP Division of Fish and Wildlife Endangered Nongame Species Program developed a Geographic Information System (GIS) called the *Landscape Project*, which is described as a "pro-active, ecosystem-level approach to the long-term protection of imperiled and priority species and their important habitats in New Jersey." Version 3.3 of the Landscape project is now available interactively on the web and for download (see NJGeoweb). The resulting data layer identifies, delineates and ranks (based on the conservation status of species present) habitat statewide. Each patch is coded for the number of sightings of priority, state threatened, state endangered and federally listed species present. The data is designed to be used for state and local planning, open space acquisition and land-use regulation."

The NJDEP Division of Fish and Wildlife describes the *Landscape Project* and the importance of preserving natural habitat as follows:

> New Jersey is the most densely populated state in the nation. One of the consequences of this distinction is the extreme pressure that is placed on our natural resources. As the population grows, we continue to lose or impact the remaining natural areas of the state. As more and more habitat is lost, people are beginning to appreciate the benefits and necessity of maintaining land in its natural state.
>
> For example, we know that wetlands are critical for recharging aquifers, lessening the damage from flooding and naturally breaking down contaminants in the environment. Forests and grasslands protect the quality of our drinking water, help purify the air we breathe and provide important areas for outdoor recreation. Collectively, these habitats are of critical importance to the diverse assemblage of wildlife found in New Jersey, including more than 70 species classified as threatened or endangered.
>
> Many imperiled species require large contiguous tracts of habitat for survival. The consequence of the rapid spread of suburban sprawl is the loss and fragmentation of important wildlife habitat and the isolation and degradation of the smaller habitat patches that remain. Small patches of fields, forests and wetlands interspersed with development provide habitat for common species that do well living near humans, but do not provide the necessary habitat for most of our imperiled wildlife. We need to protect large, contiguous blocks of forest, grassland and wetlands to assure the survival of imperiled species over the long-term.
>
> In addition to providing habitat for the conservation of imperiled species, protecting critical wildlife areas will result in more open space for outdoor recreation. Recent surveys by the U.S. Fish and Wildlife Service show that more than 60% of Americans participate in some form of wildlife-related recreation. Open spaces provide places where people can escape the confines of urban and suburban living.

Most critical habitats are supported in part or in total by the surrounding surface and ground water resources, and they are consequently impacted by development, non-point source pollution and stormwater runoff. Critical Habitats mapped by the NJDEP's Landscape Project Version 2 within this watershed are shown on Figure BT-6. These Critical Habitats within this watershed may include Grassland, Forest, Forested Wetland, Emerging Wetland, Beach, Bald Eagle Foraging, Urban Peregrine Falcon Nesting, and Wood Turtle habitats that should, to the extent practical, be conserved and protected from the adverse impacts caused by uncontrolled development and stormwater runoff.

Section 5. Build-Out Analysis and Pollutant Loading Projections

Build-out analyses and pollutant loading projections has been prepared for the City of Woodbury, HUC14s and watersheds generally in accordance with the NJDEP's methodology described by their guidance and regulations. The build-out analyses and pollutant loading projections are tools to assess the potential impacts from development and stormwater runoff.

Woodbury is essentially fully developed (i.e., "built–out"); little new development can or will occur. However, the potential for redevelopment exists, and existing development in built-out municipalities contributes pollutants to the watersheds.

In order to add more meaning to the pollutant loading projections, the present land use and future (build-out) land use was projected under both pollutant loading conditions. GIS data management and mapping software were used to perform these analyses within the City and HUC14 watersheds.

The build-out analyses and pollutant loading projections allow Woodbury to quantifiably project the impacts from development on surface waters. Using this tool, Woodbury is in a better position to develop strategies to minimize, manage and/or mitigate these impacts through improved stormwater management and construction practices and potentially through modifications to the land use and zoning, before build-out occurs.

Build-out analyses and pollutant loading projections are a tool and an initial step for assessing and quantifying adverse impacts from development and stormwater runoff. There are, however, a number of reservations associated with the NJDEP's Build-out methodology, and with build-out and pollutant loading analyses in general.

1. The methodology over-simplifies the complex hydrologic and pollutant transport mechanisms associated with these processes and development.

2. The methodology does not account for the transient nature of development within a given municipality and watershed. It ignores the differences in time over which build-out will occur. For example, one municipality or portion of a watershed might take 10 years to essentially build-out, while another might take 100 years or more.

3. The impervious surface coverage analyses presume that all development within a zone occur at the maximum impervious coverage permitted within the zone. Although it would be reasonable to assume an average impervious coverage, the maximum permitted impervious coverage is the extreme. Furthermore, many

municipal land use zones do not specify a maximum impervious coverage and an assumption must be used that may not be optimal.

4. The NJDEP presented very little information about the origin and conditions that apply to their land cover pollutant loading coefficients for total phosphorus, total nitrogen and total suspended solids. For example, what are the climatic, soils, hydrologic, geologic, topographic, and vegetative conditions that these coefficients represent, and even more importantly, what stormwater runoff controls were employed that generated these coefficients? Without this information, it is not possible to fully understand the implications of pollutant loadings using these coefficients. The methodology is highly sensitive to these coefficients.

5. Because the NJDEP's methodology projects pollutant loadings for only three parameters, total phosphorus, total nitrogen and total suspended solids, the pollutant loading projections are biased against agricultural land uses. For example, changes in land use from agriculture to low density rural development. The NJDEP's pollutant loading coefficients for agriculture are two to three times greater than those for low density residential development. The resulting annual pollutant loadings will then be two to three times lower for land transitioning from agriculture to residential development.

   This might be misconstrued to imply that the loss of agricultural lands to residential development is somehow desirable. Furthermore, because of the significant amount of agricultural land in some municipalities and watersheds, the method makes residentially and commercially developed municipalities and watersheds appear less prone to the impacts of nonpoint source pollution, which is not the case.

6. The NJDEP's land cover coefficients did not appear to consider or incorporate the new stormwater management techniques now required by the New Jersey stormwater regulations and the new LID BMP strategies. Furthermore, most municipalities have required some form of stormwater runoff control in new development for 20 years or more. The NJDEP land cover coefficients may, therefore, be very conservative with respect to existing development conditions and greatly overestimate the adverse impacts at build-out.

7. In addition to nitrogen, phosphorous and suspended solids there are a number of other pollutants associated with non-point source pollution and stormwater runoff from development. These include among other parameters, petroleum hydrocarbons, metals, and pathogenic organisms which are not currently accounted for by the NJDEP's methodology.

8. Malfunctioning and/or inadequate onsite wastewater disposal systems are believed to be a major source of non-point pollution. The NJDEP's method does not account for pollution resulting from onsite systems.

Despite these reservations, the build-out analyses and pollutant loading projections are useful tools for assessing the potential impacts from development and stormwater runoff. The build-out analyses and pollutant loading projections in Gloucester County have been developed with the flexibility to easily adjust the pollutant loading coefficients, zoning and other elements of the analyses and projections. GIS data management and mapping software was used to perform these analyses and create this flexibility for Woodbury, and each HUC14 watershed. In the future, Woodbury may choose to make adjustments that will better project the impacts of stormwater runoff and development.

The following GIS-based method was used for the build-out analyses and pollutant loading projections and to prepare the figures presented in this report.

1. Using GIS digital coverages from the NJDEP and DVRPC (existing land use), the watersheds were identified, their boundaries delineated, and the results saved as a GIS feature layers. ESRI's ArcGIS mapping software was then used to provide the land areas of existing land uses within Woodbury, each HUC14 and watershed.

2. Using the Gloucester County Planning Department's GIS data, municipal zoning areas were integrated with the HUC14 drainage areas to establish the zoning within each municipality and HUC14 drainage area. Zoning is highly variable throughout the County. A "crosswalk" was used to associate municipal zones with the zones provided by the NJDEP for pollutant loading projections.

3. Existing (present) impervious land coverage was determined for each HUC14 and municipality using aerial mapping techniques.

4. Constrained areas were determined from the NJDEP's and the County's GIS coverages, including surficial water bodies, wetland areas, Category One resource protection areas and their associated 300 foot buffers, designated open space and protected park areas. These were saved as GIS feature layers and integrated with the existing land use, HUC14 and municipal zoning feature layers. The build-out amount of impervious land coverage within each HUC14 and municipality was then calculated from the zoning layer.

   Build-out land areas available for new development and redevelopment were calculated by subtracting the constrained areas from the developable areas based on zoning for each HUC14, Watershed and municipality. In essence, the land available for new development is agricultural, forest and/or barren lands and the land available for redevelopment consists of the existing residential, commercial and industrially zoned areas.

5. The build-out (future) impervious surface coverage was calculated by multiplying build-out land areas available for new development and redevelopment by the maximum impervious surface coverage, using (whenever available) the maximum impervious surface coverage percentages specified within each municipal zoning ordinance for that area.

6. Pollutant loading projections were calculated for each municipality and HUC14, using the pollutant loading coefficients provided by the NJDEP Stormwater BMP Manual and shown in Table 9. Pollutant loading projections were made for watersheds for both the existing land use (present) and build-out (future) conditions.

Table 9. Pollutant Loads For Various Land Cover Types

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.

WOODBURY CITY

City: Build-Out, Impervious Cover, and Pollutant Loading Projections

The results of the Woodbury City Build-out analysis, including the existing and build-out (future) conditions, are presented in Table 10. This table provides the total area, constrained area, and developable area in acres for each HUC14 within Woodbury City.

Table 10 also provides the impervious areas in acres and percent for both existing and build-out conditions, in order to allow comparison of the results for these conditions. In general, impervious percentages greater than about 10 to 15 percent may indicate potential watershed impairment from stormwater and development. The total pollutant loadings for phosphorous, nitrogen and total suspended solids are projected in pounds per year for both the existing and build-out conditions, in order to allow comparison of the pollutant loadings.

Included in this plan and in the New Jersey Stormwater Management Regulations and guidance are strategies to minimize, manage and/or mitigate build-out impacts, through improved stormwater management and construction practices. In addition, modifications to current land use and zoning will change the build-out impacts and the County's GIS can be used to evaluate the results of such changes.

Table 10. Woodbury City Pollutant Loading Projections

Watershed	HUC14 Sub-Watershed		Area (Acres)			Impervious Area				Total Pollutant Load (Lbs/Year)					
	No.	Name	Total	Constrained	Developable	Acres		Percent		Phosphorus		Nitrogen		Total Suspended Solids	
						Existing	Build-Out	Existing	Build-Out	Existing	Build-Out	Existing	Build-Out	Existing	Build-Out
Big Timber Creek Watershed	02040202120080	Big Timber Creek (below NB/SB confluence)	14.80	0.53	14.27	9.96	8.29	67.30%	56.01%	19	21	204	226	2,567	2,694
Woodbury Creek Watershed	02040202120100	Woodbury Creek (above Rt 45)	540.60	89.86	450.74	117.70	220.90	21.77%	40.86%	394	682	3,848	7,269	50,783	69,304
	02040202120110	Woodbury Creek (below Rt 45)/Lower Delaware River to Big Timber Creek	790.50	76.87	713.63	257.31	392.59	32.55%	49.66%	665	1,102	6,387	11,712	85,594	109,475
		Sub-Total	**1,331.10**	**166.73**	**1,164.37**	**375.01**	**613.49**	**28.17%**	**46.09%**	**1,058**	**1,784**	**10,234**	**18,981**	**136,377**	**178,779**
		Total	**1,345.90**	**167.26**	**1,178.64**	**384.97**	**621.78**	**28.60%**	**46.20%**	**1,078**	**1,805**	**10,439**	**19,207**	**138,945**	**181,472**

WOODBURY CREEK WATERSHED

WC: Build-out, Impervious Cover, and Pollutant Loading Projections

The Woodbury Creek Watershed is located in the northwestern portion of Gloucester County. These build-out projections include Gloucester County municipalities and their relative contribution (area) to the watershed: West Deptford Township (61%), Deptford Township, (17%), Woodbury City (11%), Woodbury Heights Borough (6%) and National Park Borough (5%). Figure WC-7 (see Appendix A) shows the existing land use, based on DVRPC 2000 land use data. Figure WC-8 (see Appendix A) shows the constrained areas in the watershed.

The Woodbury Creek watershed is substantially developed and close to reaching its build-out potential. Approximately 10 percent of the land is undeveloped (agriculture, wooded land, vacant). The results of the Woodbury Creek Watershed build-out analysis, including both existing and build-out (future) conditions, are presented in Table WC-4. This table provides the total area, constrained area, and developable area in acres for each HUC14 within the watershed and County.

Table WC-4 also provides the impervious areas in both acres and percent for existing and build-out conditions, in order to allow comparison of the results. In general, impervious percentages greater than about 10 to 15 percent may indicate potential watershed impairment from stormwater and development. The total pollutant loadings for phosphorous, nitrogen and total suspended solids are projected in pounds per year for both the existing and build-out conditions, in order to allow comparison of the pollutant loadings.

Table WC-4. Woodbury Creek Watershed Pollutant Loading Projections

Municipality	HUC14 Sub-Watershed		Area (Acres)			Impervious Area				Total Pollutant Load (Lbs/Year)					
	No.	Name	Total	Constrained	Developable	Acres		Percent		Phosphorus		Nitrogen		Total Suspended Solids	
						Existing	Build-Out	Existing	Build-Out	Existing	Build-Out	Existing	Build-Out	Existing	Build-Out
Deptford Twp	02040202120100	Woodbury Creek (above Rte. 45)	2,102.21	446.96	1,655.28	346.82	594.01	16.50%	28.26%	1,036	2,122	10,565	22,097	155,162	226,120
	02040202120110	Woodbury Creek (below Rte. 45) / Lower Delaware River to Big Timber Creek	37.12	3.84	33.28	10.49	13.36	28.26%	35.99%	27	49	253	519	3,668	4,874
		Sub-Total	**2,139.33**	**450.80**	**1,688.56**	**357.31**	**607.37**	**16.70%**	**28.39%**	**1,063**	**2,171**	**10,818**	**22,616**	**158,830**	**230,994**
National Park Boro	02040202120110	Woodbury Creek (below Rte. 45) / Lower Delaware River to Big Timber Creek	773.20	460.42	312.78	110.90	126.42	14.34%	16.35%	184	477	1,670	5,080	28,164	50,851
	02040202120120	Main Ditch / Little Mantua Creek	153.91	143.99	9.91	0.16	6.19	0.10%	4.02%	5	15	49	155	585	1,930
		Sub-Total	**927.11**	**604.41**	**322.69**	**111.06**	**132.61**	**11.98%**	**14.30%**	**189**	**491**	**1,719**	**5,235**	**28,750**	**52,780**
West Deptford Twp	02040202120110	Woodbury Creek (below Rte. 45) / Lower Delaware River to Big Timber Creek	5,023.96	1,960.23	3,063.78	697.85	1,557.11	13.89%	30.99%	2,495	4,299	24,356	45,438	362,047	477,244
	02040202120120	Main Ditch / Little Mantua Creek	3,445.01	1,717.40	1,727.62	431.04	1,166.71	12.51%	33.87%	1,905	2,547	18,253	27,102	327,021	328,740
		Sub-Total	**8,468.97**	**3,677.63**	**4,791.40**	**1,128.89**	**2,723.82**	**13.33%**	**32.16%**	**4,400**	**6,846**	**42,609**	**72,540**	**689,068**	**805,984**
Woodbury City	02040202120100	Woodbury Creek (above Rte. 45)	540.60	89.86	450.74	117.70	220.90	21.77%	40.86%	394	682	3,848	7,269	50,783	69,304
	02040202120110	Woodbury Creek (below Rte. 45) / Lower Delaware River to Big Timber Creek	790.50	76.87	713.63	257.31	392.59	32.55%	49.66%	665	1,102	6,387	11,712	85,594	109,475
		Sub-Total	**1,331.10**	**166.73**	**1,164.37**	**375.01**	**613.49**	**28.17%**	**46.09%**	**1,058**	**1,784**	**10,234**	**18,981**	**136,377**	**178,779**
Woodbury Heights Boro	02040202120100	Woodbury Creek (above Rte. 45)	467.74	63.62	404.11	91.19	173.05	19.50%	37.00%	297	601	2,982	6,417	41,943	62,333
	02040202120110	Woodbury Creek (below Rte. 45) / Lower Delaware River to Big Timber Creek	257.80	4.08	253.71	77.66	108.54	30.12%	42.10%	214	392	2,075	4,175	28,572	38,949
		Sub-Total	**725.54**	**67.70**	**657.82**	**168.85**	**281.59**	**23.27%**	**38.81%**	**511**	**993**	**5,056**	**10,592**	**70,515**	**101,282**
		Total	**13,592.05**	**4,967.27**	**8,624.84**	**2,141.12**	**4,358.88**	**15.75%**	**32.07%**	**7,221**	**12,285**	**70,437**	**129,964**	**1,083,539**	**1,369,820**

BIG TIMBER CREEK WATERSHED

BT: Build-out, Impervious Cover, and Pollutant Loading Projections

The Big Timber Creek watershed is located in the northwestern portion of Gloucester County and includes municipalities in Gloucester and Camden Counties. Gloucester County occupies less than 50 percent of the watershed. These build-out projections include Gloucester County municipalities and their relative contribution (area) to the watershed: Washington Township (48%), Deptford Township (44%), Westville Borough (5%), West Deptford (3%) and Woodbury City (.1%). Figure BT-7 (see Appendix A) shows the existing land use, based on DVRPC 2000 land use data. Figure BT-8 (see Appendix A) shows the constrained areas in the watershed.

The Gloucester County portion of the watershed is largely developed; only about 25 percent remains as developable lands (agriculture, woodlands, vacant, etc.). The results of the Big Timber Creek Watershed build-out analysis, including both existing and build-out (future) conditions, are presented in Table BT-4. This table provides the total area, constrained area, and developable area in acres for each HUC14 within the watershed and County.

Table BT-4 also provides the impervious areas in both acres and percent for existing and build-out conditions, in order to allow comparison of the results. In general, impervious percentages greater than about 10 to 15 percent may indicate potential watershed impairment from stormwater and development. The total pollutant loadings for phosphorous, nitrogen and total suspended solids are projected in pounds per year for both the existing and build-out conditions, in order to allow comparison of the pollutant loadings.

Table BT-4. Big Timber Creek Watershed Pollutant Loading Projections

Municipality	HUC14 Sub-Watershed		Area (Acres)			Impervious Area				Total Pollutant Load (Lbs/Year)					
	No.	Name	Total	Constrained	Developable	Acres		Percent		Phosphorus		Nitrogen		Total Suspended Solids	
						Existing	Build-Out	Existing	Build-Out	Existing	Build-Out	Existing	Build-Out	Existing	Build-Out
Deptford Twp	02040202120040	Big Timber Creek SB (including Bull Run to Lakeland Rd)	302.32	31.06	271.24	42.19	96.61	13.96%	31.96%	163	403	1,639	4,298	28,556	39,941
	02040202120050	Big Timber Creek SB (below Bull Run)	688.15	164.83	523.32	98.97	301.32	14.49%	44.12%	321	760	3,435	7,898	46,919	78,787
	02040202120060	Almonesson Creek	2,433.16	351.71	2,081.46	488.70	967.01	20.10%	39.76%	1,769	2,949	18,332	30,311	236,152	312,329
	02040202120080	Big Timber Creek (below NB/SB confluence)	2,206.28	867.81	1,338.45	347.34	683.34	15.93%	32.03%	1,109	2,016	11,063	21,308	163,221	205,954
		Sub-Total	**5,629.91**	**1,415.41**	**4,214.47**	**977.20**	**2,048.28**	**17.36%**	**36.38%**	**3,362**	**6,127**	**34,468**	**63,815**	**474,848**	**637,012**
Washington Twp	02040202120030	Big Timber Creek SB (above Lakeland Rd)	4,373.35	655.87	3,717.47	990.62	979.42	22.73%	22.49%	3,049	5,362	29,469	56,248	435,986	547,895
	02040202120040	Big Timber Creek SB (including Bull Run to Lakeland Rd)	1,739.64	475.00	1,264.62	286.70	358.04	16.70%	20.90%	903	1,569	8,859	16,175	139,571	185,093
		Sub-Total	**6,112.99**	**1,130.87**	**4,982.09**	**1,277.32**	**1,337.46**	**20.90%**	**21.88%**	**3,952**	**6,931**	**38,328**	**72,423**	**575,557**	**732,988**
West Deptford Twp	02040202120080	Big Timber Creek (below NB/SB confluence)	392.66	102.99	289.66	61.16	190.95	15.58%	48.63%	289	449	3,079	4,782	38,873	55,829
Westville Borough	02040202120080	Big Timber Creek (below NB/SB confluence)	774.58	247.40	527.19	191.24	267.83	24.69%	34.58%	479	763	4,686	8,185	62,086	80,696
Woodbury City	02040202120080	Big Timber Creek (below NB/SB confluence)	14.80	0.53	14.27	9.96	8.29	67.30%	56.01%	19	21	204	226	2,567	2,694
		Total	**12,924.94**	**2,897.20**	**10,027.68**	**2,516.88**	**3,852.81**	**19.47%**	**29.81%**	**8,101.50**	**14,290.85**	**80,765.23**	**149,429.86**	**1,153,931.74**	**1,509,217.95**

Section 6. Design and Performance Standards

Woodbury City has amended its land use ordinances to incorporate the latest design and performance standards for stormwater management measures as presented in N.J.A.C. 7:8 to minimize the adverse impact of stormwater runoff on water quality and water quantity and loss of groundwater recharge in receiving water bodies. This requirement was met by adopting the latest Municipal Stormwater Control Ordinance (2024).

The design and performance standards in the latest adopted ordinance references N.J.A.C. 7:8 and the ordinance will be updated by reference each time the NJDEP updates the regulations. It includes the requirements for maintenance of stormwater management measures in N.J.A.C. 7:8-5.8 and The Safety Standards for Stormwater Management Basins in N.J.A.C. 7:8-6. 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.

The latest adopted ordinance was submitted to the County for review and was approved by the County Planning Board (January, 2025).

Furthermore, during construction of major development within the Woodbury City, municipal inspectors will observe the construction of stormwater management measures to ensure that they are constructed and function as designed.

The New Jersey stormwater design and performance standards represent an effort to control non-point sources of pollution and to improve groundwater recharge. The effective control of point sources of pollution took many years to be realized by water quality improvements. The USEPA and the NJDEP believe that further water quality improvements can now best be achieved by controlling non-point sources of pollution and stormwater runoff.

New stormwater management measures and design and performance standards will emerge over the ensuing years. The stormwater rules, NJPDES stormwater permits, and municipal stormwater plans and ordinances will similarly evolve and require amendments. Municipalities are expected to control stormwater runoff, to improve or maintain surface water quality and groundwater recharge and to continue to utilize appropriate stormwater design and performance standards to achieve this goal.

With the increasing emphasis on non-point source pollution, climate change, and concerns over the adverse impacts of uncontrolled land development, effective alternatives to the centralized stormwater conveyance and treatment strategies have been developed that are the basis for many of the new stormwater management standards in the State. New strategies have been developed to minimize and even prevent adverse stormwater runoff impacts from occurring.

Such strategies, known collectively as Low Impact Development techniques or (LIDs) and Green Infrastructure (GI) reduce and/or prevent adverse runoff impacts through sound site planning and both nonstructural and structural techniques that preserve or closely mimic a site's natural or pre-developed hydrologic response to precipitation. These new stormwater management requirements are described in more detail in Section 8 of this W/MSWMP.

Major development is subject to the stormwater management requirements in effect provided that the application includes the documents required by ordinance for one of the following approvals pursuant to the Municipal Land Use Law (N.J.S.A. 40:55D-1 et seq.):

i. Preliminary or final site plan approval;
ii. Final municipal building or construction permit;
iii. Minor subdivision approval where no subsequent site plan approval is required;
iv. Final subdivision approval where no subsequent site plan approval is required; or
v. Preliminary subdivision approval where no subsequent site plan approval is required;

Post Construction Stormwater Management in New Development and Redevelopment

The City has developed, updated, implemented, and enforced its stormwater management program to address post construction stormwater runoff in new development and redevelopment and to ensure compliance with the Stormwater Management rules at N.J.A.C. 7:8. At a minimum these include the following measures are provided by the latest Stormwater Permit and Stormwater Control Ordinance.

1. The post construction stormwater management program addresses stormwater runoff from "major development" as defined in the Stormwater Management rules at N.J.A.C. 7:8 (unless any additional development is defined as "major development" by the permittee's Stormwater Control Ordinance).

2. The post construction stormwater management program requires compliance with the applicable design, performance and maintenance standards established under N.J.A.C. 7:8 for "major development".

3. The City will review and analyze development plans for compliance with N.J.A.C. 7:8, the SCO or RSIS as applicable, even if a permit is required by the Department for the same or similar activity (e.g., a Land Use permit).

4. The City will ensure that "major development" projects are constructed in accordance with the approved development plans.

5. The City's review engineer for compliance with N.J.A.C. 7:8 will be independent from the design engineer, shall not have been involved in the design of the development plans, and shall have completed the Department's Stormwater

Management Design Review Course within the last 5 years, and the Stormwater Management Rule Amendment Training if required, as per Part IV.F.8 and 9.

6. The City will ensure that the post construction stormwater management program requires that any residential development and redevelopment projects that are subject to the Residential Site Improvement Standards (RSIS) for stormwater management (N.J.A.C. 5:21-7) comply with those standards, including any exception, waiver, or special area standard that was approved under N.J.A.C. 5:21.

7. The City will include each approved major development on the Major Development Project List and submit the Major Development Project List to the Department annually with the MSRP Annual Report.

8. The Stormwater Management rules (N.J.A.C. 7:8) and the Residential Site Improvement Standards for stormwater management (N.J.A.C. 5:21-7), independently and as implemented will apply to all areas of the City.

Section 7. Plan Consistency & Approval

There are no approved Regional Stormwater Management Plans (RSWMPs) involving the City of Woodbury and the Woodbury Creek Watershed at this time.

Presently, TMDLs have been proposed for certain surface water bodies in the City of Woodbury. Section 4 of this W/MSWMP addresses impaired surface waters, TMDLs and provides Web Links to supporting surface water quality data. When these ongoing TMDL proposals or any future TMDLs proposals are approved, the New Jersey stormwater management regulations require that municipal stormwater management plans be revised to provide consistency.

The Woodbury City W/MSWMP is consistent with the Residential Site Improvement Standards (RSIS) at N.J.A.C. 5:21. Woodbury City utilizes the most current update of the RSIS in the stormwater management review of residential areas. This Municipal Stormwater Management Plan will be updated to be consistent with any future updates to the RSIS.

Furthermore, Woodbury City's latest stormwater management ordinance(s) currently require all new development and redevelopment plans to comply with New Jersey's Soil Erosion and Sediment Control Standards. During construction, municipal inspectors observe on-site soil erosion and sediment control measures and report any inconsistencies to the Gloucester County Soil Conservation District.

The *Comprehensive Master Plan of the City of Woodbury* was prepared and is dated December 4, 2006. The Master Plan was re-examined by the *2019 Woodbury Master Plan Re-Examination Report*. These reports can be found here:

https://woodbury.nj.us/1272/Woodbury-Master-Plan

The aforementioned 2006 Master Plan and 2019 Re-Examination Report were reviewed and this 2025 W/MSWMP update/revision is consistent with these plans.

The City must submit a copy of the adopted stormwater management plan (and stormwater control ordinance) to the county review agency and the Department. In reviewing the adopted municipal stormwater management plan (and ordinance), the county review agency will consider whether the plan and ordinance(s) conform with the requirements of this chapter.

In accordance with N.J.S.A. 40:55D-97, it is the county review agency's responsibility to review and approve, conditionally approve (specifying the necessary amendments to the plan and ordinance(s)) or disapprove the adopted municipal stormwater management plan (and ordinance) within 60 calendar days of receipt of the plan (and ordinance). If the county review agency does not approve, conditionally approve, or disapprove the plan (or ordinance) within 60 calendar days, the plan (and ordinance) is deemed approved.

The county review agency will issue a written decision to the City, with a copy to the Department. A municipal stormwater management plan (and ordinance) as approved above will take effect immediately. A municipal stormwater management plan (and ordinance) conditionally approved will take effect upon adoption by the City of the amendments specified by the county review agency.

Within 30 days of the effective date of the W/SWMP, the City will place the plan on its website and notify the Department, the Soil Conservation District, and State Soil Conservation Committee, or: submit a copy of the approved to the Department; and provide notice of such approval to the Soil Conservation District and the State Soil Conservation Committee and, upon request, submit a copy of the approved plan.

Section 8. Stormwater Management Strategies

Stormwater management measures for major development

Stormwater management measures for major development must be designed to provide erosion control, groundwater recharge, stormwater runoff quantity control, and stormwater runoff quality treatment as follows: 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 at N.J.A.C. 2:90 and 16:25A. 2; the minimum design and performance standards for groundwater recharge, stormwater runoff quality, and stormwater runoff quantity at N.J.A.C. 7:8-5.4, 5.5, and 5.6 shall be met by incorporating green infrastructure in accordance with N.J.A.C. 7:8- 5.3.

The development shall incorporate a maintenance plan under N.J.A.C. 7:8-5.8 for the stormwater management measures.

Stormwater management measures shall avoid adverse impacts of concentrated flow on habitat for threatened and endangered species as documented in the Department's Landscape Project or Natural Heritage Database established under N.J.S.A. 13:1B15.147 through 15.150, particularly Helonias bullata (swamp pink) and/or Clemmys muhlnebergi (bog turtle).

The following linear development projects are exempt from the groundwater recharge, stormwater runoff quantity, and stormwater runoff quality requirements at N.J.A.C. 7:8-5.4 and 5.5:

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

A waiver from strict compliance from the green infrastructure, groundwater recharge, stormwater runoff quantity, and stormwater runoff quality requirements at N.J.A.C. 7:8-5.3, 5.4, 5.5, and 5.6 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 stormwater management measures, the option selected complies with the requirements of N.J.A.C. 7:8-5.3, 5.4, 5.5, and 5.6 to the maximum extent practicable;
3. The applicant demonstrates that, in order to meet the requirements at N.J.A.C. 7:8-5.3, 5.4, 5.5, and 5.6 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 (e)3 above within the upstream drainage area of the receiving stream, that would provide additional opportunities to mitigate for requirements of N.J.A.C. 7:8-5.3, 5.4, 5.5, and 5.6 that were not achievable onsite.

The tables in N.J.A.C 7:8 5-2 (f) provide the ability of stormwater best management practices in the New Jersey Stormwater Best Management Practices Manual to satisfy the green infrastructure, groundwater recharge, stormwater runoff quality, and stormwater runoff quantity standards. When designed in accordance with the *New Jersey Stormwater Best Management Practices Manual*, (latest version) the stormwater management measures listed in Tables 5-1, 5-2, and 5-3 are capable of providing stormwater controls meeting the design and performance standards.

An alternative stormwater management measure, alternative removal rate, and/or alternative method to calculate the removal rate may be used if the design engineer demonstrates the capability of the proposed alternative stormwater management measure and/or the validity of the alternative rate or method to the review agency. Where the Department is the review agency, documentation must be submitted in accordance with N.J.A.C. 7:8-1.3.

Where the Department is not the review agency, a copy of any approved alternative stormwater management measure, alternative removal rate, and/or alternative method to calculate the removal rate shall be provided to the Department in accordance with N.J.A.C. 7:8-1.3. Alternative stormwater management measures may be used to satisfy the requirements at N.J.A.C. 7:8-5.3 only if the measures meet the definition of green infrastructure at N.J.A.C. 7:8-1.2.

Alternative stormwater management measures that function in a similar manner to a BMP listed at N.J.A.C. 7:8-5.3(b) are subject to the contributory drainage area limitation specified at N.J.A.C. 7:8-5.3(b) for that similarly functioning BMP. Alternative stormwater management measures approved in accordance with this subsection that do not function in a similar manner to any BMP listed at N.J.A.C. 7:8-5.3(b) shall have a contributory drainage area less than or equal to 2.5 acres, except for alternative stormwater management measures that function similarly to cisterns, grass swales, green roofs, standard constructed wetlands, vegetative filter strips, and wet ponds, which are not subject to a contributory drainage area limitation. Alternative measures that function similarly to standard constructed wetlands or wet ponds shall not be used for compliance with the stormwater runoff quality standard unless a variance in accordance with N.J.A.C. 7:8-4.6 or a waiver from strict compliance in accordance with N.J.A.C. 7:8-5.2(e) is granted from N.J.A.C. 7:8-5.3.

Whenever the stormwater management design includes one or more BMPs that will infiltrate stormwater into subsoil, 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 or other subsurface structures within the zone of influence of the groundwater mound, or interference with the proper functioning of the stormwater management measure itself.

Design standards for stormwater management measures are as follows:

1. Stormwater management measures shall be designed to consider the existing site conditions, including, but not limited to, 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. 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 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 the width of the diameter of the orifice or one-third 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- 6.2(a);

3. 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. Stormwater management basins shall be designed to meet the minimum safety standards for stormwater management basins at N.J.A.C. 7:8-6; and 5. The size of the orifice at the intake to the outlet from the stormwater management basin shall be a minimum of two and one-half inches in diameter;

4. Stormwater management basins shall be designed to meet the minimum safety standards for stormwater management basins at N.J.A.C. 7:8-6; and

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

Manufactured treatment devices may be used to meet the requirements provided the pollutant removal rates are verified by the New Jersey Corporation for Advanced Technology and certified by the Department. Manufactured treatment devices that do not meet the definition of green infrastructure at N.J.A.C. 7:8- 1.2 may be used only under the circumstances described at N.J.A.C. 7:8-5.3(d).

If there is more than one drainage area, the groundwater recharge, stormwater runoff quality, and stormwater runoff quantity standards at N.J.A.C. 7:8-5.4, 5.5, and 5.6 shall be met in each drainage area, unless the runoff from the drainage areas converge onsite and no adverse environmental impact would occur as a result of compliance with any one or more of the individual standards being determined utilizing a weighted average of the results achieved for that individual standard across the affected drainage areas.

Any stormwater management measure authorized under N.J.A.C. 7:8, a municipal stormwater management plan, or ordinance must be reflected in a deed notice recorded in the Office of the County Clerk or the registrar of deeds and mortgages of the county in which the development, project, project site, or mitigation area containing the stormwater management measure is located. A form of deed notice must be submitted to the reviewing agency for approval prior to filing. The deed notice shall contain a description of the stormwater management measure(s) used to meet the green infrastructure, groundwater recharge, stormwater runoff quality, and stormwater runoff quantity standards at N.J.A.C. 7:8-5.3, 5.4, 5.5, and 5.6 and shall identify the location of the stormwater management measure(s) in NAD 1983 State Plane New Jersey FIPS 2900 US Feet or by the Latitude and Longitude in decimal degrees.

The deed notice shall also reference the maintenance plan required to be recorded upon the deed pursuant to N.J.A.C. 7:8-5.8(d). Prior to the commencement of construction, proof that the above required deed notice has been filed shall be submitted to the review agency. Proof that the required information has been recorded on the deed shall be in the form of either a copy of the complete recorded document or a receipt from the clerk or other proof of recordation provided by the recording office. However, if the initial proof provided to the review agency is not a copy of the complete recorded document, a copy of the complete recorded document shall be provided to the review agency within 180 calendar days of the authorization granted by the review agency.

A stormwater management measure approved under N.J.A.C. 7:8, a municipal stormwater management plan, or ordinance may be altered or replaced with the approval of the applicable review agency, if the review agency determines that the proposed alteration or replacement meets the design and performance standards pursuant to N.J.A.C. 7:8-5 and provides the same level of stormwater management as the previously approved stormwater management measure that is being altered or replaced. If an alteration or replacement is approved, a revised deed notice shall be submitted to the reviewing agency for approval and subsequently recorded with the appropriate Office of the County Clerk or the registrar of deeds and mortgages and shall contain a description and location of the stormwater management measure, as well as reference to the maintenance plan, as above. Prior to the commencement of construction, proof that the above required deed notice has been filed shall be submitted to the review agency.

Additionally, the following standards apply as a whole:

1. The requirements of N.J.A.C. 7:8-5.3, Green Infrastructure standards, which specify the types of green infrastructure BMPs that may be used to satisfy the groundwater recharge, stormwater runoff quality, and stormwater runoff quantity standards;

2. The requirements of N.J.A.C. 7:8-5.4, Groundwater recharge, which contain minimum design and performance standards for groundwater recharge. This groundwater recharge requirement does not apply to projects within the "urban redevelopment area," or to projects with high pollutant loading (as defined in the regulations) and Industrial stormwater exposed source material (as defined in the regulations);

3. The requirements of N.J.A.C. 7:8-5.5, Stormwater runoff quality standards, which contain the minimum design and performance standards to control stormwater runoff quality impacts of major development. Stormwater runoff quality standards are applicable when the major development results in an increase of one-quarter acre or more of regulated motor vehicle surface;

4. The requirements of N.J.A.C 7:8-5.6, Stormwater runoff quantity standards, which contains the minimum design and performance standards to control stormwater runoff quantity impacts of major development; and

5. The requirements of N.J.A.C. 7:8-5.7, Calculation of stormwater runoff and groundwater recharge, which describes the methodologies that must be used for both calculating stormwater runoff, groundwater recharge, precipitation depths for the two, 10-, and 100-year storms (current and future).

Other recommended strategies are presented below that might be utilized for Mitigation:

1. **Lake and Stream Sedimentation**: A number of lakes and some stream sections in Woodbury City are filling with sediment including Bell Lake, the lake near St. Patrick's school and Woodbury Creek itself near former Inspira Hospital. Dredging has been done on Bell Lake (twice) and these other areas are currently in need of dredging. The upstream source of the sediment has not been determined. Stream bank stabilization measures have been installed in some areas. Additional sediment control measures enforced through the soil conservation district were suggested.

   The New Jersey stormwater regulations now require the control and removal of 80 percent of the suspended solids from stormwater in new development and redevelopment. This should reduce the sediment load from new development and redevelopment. However, the watershed is already highly urbanized and it may be necessary to reduce the sediment loading from existing sources in order to reduce the sediment loading to the lakes and streams in this watershed.

2. **Localized Roadway Flooding:** Localized roadway flooding occurs at a number of locations in the watershed, including Evergreen Avenue and Red Bank Avenue near the railroad overpasses, and in neighborhoods. Particularly at locations where state, county and municipal roadways intersect, runoff sometimes becomes a burden to local roads and stormwater systems. Ownership and responsibility for stormwater management is sometimes unclear and neglected.

The New Jersey stormwater regulations and the design and performance standards, address this issue for all new major development (defined as projects that disturb one or more acres of land or increase the amount of impervious surface by one-quarter acre or more), including new roadway construction and reconstruction. State, County and local roadway agencies must comply with these new regulations and control their stormwater runoff accordingly. Unfortunately, the new regulations cannot resolve already existing, localized roadway flooding.

3. **Sanitary Sewer Overflows:** There are two areas in Woodbury where sanitary sewer overflows have occurred that may have affected surface water quality on a temporary basis. The sanitary sewer on Lake Drive may not have adequate capacity and has backed-up and overflowed. Also, the County interceptor sewer near the high school has experienced back-ups and has overflowed into Woodbury Creek. The nature and frequency of these problems has been investigated by their respective owners and appropriate corrective actions were taken to minimize potential water quality impacts.

(b) Regional Stormwater Management Planning

There is no Regional Stormwater Management Plan (RSWMP) for the Woodbury Creek Watershed.

The Woodbury Creek Watershed is the smallest watershed fully contained in Gloucester County, draining an area of approximately 21.5 square miles into this five mile-long stream. Woodbury Creek's two major tributaries are Hessian Run and Matthews Branch. Woodbury Creek is tidal up to dam at Broad Street in the City Woodbury.

A significant percentage of the Woodbury Creek watershed has been developed and is defined as urban land. Stormwater management practices throughout the watershed have evolved, from the simple collection and discharge of direct runoff to the extended detention and water quality treatment practices required by the new state stormwater design and performance standards. Appropriate stormwater management strategies for the Woodbury Creek watershed are presented below.

- **Stormwater Basin and Existing Development Retrofit** – Older under-maintained stormwater basins may not adequately provide mitigation for the most frequently occurring rain storms nor provide stormwater quality treatment. To improve the water quality and mitigate peak flows during these high frequency storms, existing stormwater basins can be retrofitted. Additionally, existing development retrofit strategies can be implemented during stormwater infrastructure improvements or as a separate retrofit project, including such techniques as roof water infiltration or reuse, stormwater inlet modifications, roadside rain gardens or infiltration structures and bio-retention facilities.

- **Stream and Streambank Stabilization** – Erosion is significantly accelerated by human activities and development in the watershed. Streambank erosion introduces excess sediment loads to the stream and in turn chokes lakes and ponds with sediment. Watershed-wide stream and stream bank restoration and stabilization priorities and guidelines should be adopted by all involved municipalities and agencies working in the watershed in order to improve water quality, upgrade in-stream and riparian habitat and reduce sedimentation in receiving waterbodies.

- **Regional Storage** – Runoff from older developed areas in the watershed may not be adequately managed on site. Peak flows and the volumes of runoff generated from even a small rainfall event may be adequate to cause immediate responses in the streams and contribute significantly to the stream bank erosion and sedimentation. Stream response can be evaluated and regional storage options investigated prior to initiation of stream restoration and lake dredging. Regional storage includes strategies to store excess runoff in either newly constructed wetlands or ponds or the rehabilitation of existing, but inadequate or failed facilities. Though costly, regional storage may provide the best opportunity to avoid continuing degradation and maintenance costs

- **Redevelopment:** – Although much of the watershed is developed, during redevelopment, stormwater runoff from previously unmanaged or under-managed sites will be mitigated.

- **Stormwater Outfall Restoration** –Failing outfalls are a concern for public safety and they may contribute excess sediment to the receiving waterway. Repairs can be prioritized throughout the watershed.

- **Geese Management**: Increasing geese populations have become a problem throughout both the suburban and rural portions of southern New Jersey. Stormwater detention ponds, grass and lawn areas and farm fields provide habitat for geese. Although the populations sometimes add to the areas aesthetics, there are adverse impacts to water quality and the land that result, especially with over population.

  The City of Woodbury passes an ordinance prohibiting the feeding of waterfowl. In addition, the City encourages land cover types and practices in new development that discourage geese from resting, nesting and feeding in areas that would otherwise provide attractive habitat, such as stormwater management facilities.

- **Lake and Pond Management and Maintenance –** Ponds and lakes in the Woodbury Creek Watershed provide significant aesthetic benefit, and these waterbodies reduce stream slopes, provide storage and attenuate peak runoff rates and serve as sediment basins, trapping sediment carried by the streams. They also provide a diverse aquatic habitat for certain species not found in streams. Programmatic management and maintenance of public and privately held lakes and ponds, including dam maintenance, dredging, and vegetation management, has and will continue to be utilized to sustain these benefits.

(c) Water Quality-TMDL Stormwater Management Strategies

The NJDEP has proposed TMDLs that address impaired water bodies in this watershed. The full text of these proposals can be found and downloaded at the following link:

https://dep.nj.gov/njpdes-stormwater/municipal-stormwater-regulation-program/tmdl/.

The TMDLs include: Mercury in Woodbury Creek, PCBs in Woodbury Creek and Big Timber Creek, and phosphorous in Bell Lake and Woodbury Lake. Waste load allocation reductions have been proposed for the affected waterways. The TMDL proposals discuss possible sources as well as the methods used to develop the TMDLs and remediation plan. (The following has been extracted from the respective TMDL documents.

Mercury

Impairments are based on concentrations in fish tissue caused mainly by air deposition in 122 HUC 14s statewide. The target for the TMDL is a concentration of 0.18 µg/g in fish tissue, which is the concentration at which the recommended rate of fish consumption for the high-risk population is not more than 1 meal per week of top trophic level fish. At this concentration unlimited consumption is appropriate for the general population. An overall reduction of 84.3% in existing mercury loads is required to achieve the target. In its New Jersey Mercury Reduction Plan, the NJDEP outlined measures needed to achieve these reductions.

The implementation actions recommended by the NJDEP's Mercury Task Force (NJDEP, 2009) were intended to reduce anthropogenic sources of mercury. None of these corrective measures are within the purview of the City of Woodbury and/or this W/MSWMP.

1. Consider developing legislation that reflects the provisions of the Mercury Education and Reduction Model Act prepared by the Northeast Waste Management Officials' Association (NEWMOA), as part of the New England Governors' Mercury Action Plan. This plan addresses mercury-containing products and limits the sale of mercury for approved purposes. Provisions of the model legislation have been adopted by 16 states, including all of the New England states.

2. Continue monitoring of mercury in environmental media. Needed follow-up monitoring is described in Section 6 and is essential for determining the effectiveness of the mercury Total Maximum Daily Load (TMDL).

3. New Jersey contributes only 12.5% to the state mercury deposition; 52% is background deposition (natural and anthropogenic) and the remaining percentage comes from surrounding states, Mexico, and Canada. Reductions required in this TMDL cannot be achieved from the New Jersey anthropogenic air sources alone. Mercury reductions on the nationwide and global scales are necessary to meet the TMDL targets set up above.

4. The NJDEP plans to update its mercury water quality criteria based upon the EPA recommended Clean Water Act Section 304(a) for methyl mercury in fish tissue. This

criterion requires the development of regional bioaccumulation factors (BAFs) to address differences in the rate of methylation based on other water quality parameters such as pH and 44 dissolved organic carbon. While the EPA's recommended Clean Water Act Section 304(a) water quality criterion is based on a methyl mercury fish tissue concentration value of 0.3 mg/kg, New Jersey plans to develop criteria based upon a methyl mercury fish tissue concentration of 0.18 mg/kg which is based upon consumption of 1 meal per week by high risk individuals.

PCBs

The impairments are based on the findings of elevated levels of polychlorinated biphenyls (PCBs) in the tissue of fish caught in portions of the Delaware River and tributaries. In the late 1980s, the states of Delaware, New Jersey and Pennsylvania began issuing fish consumption advisories for portions of the Delaware Estuary due to elevated concentrations of PCBs measured in fish tissue. Today, the states' advisories cover the entire estuary and bay. The advisories range from a no-consumption recommendation for all species taken between the C&D Canal and the Delaware-Pennsylvania border to consumption of no more than one meal per month of striped bass or white perch in Zones 2 through 4.

More than 1.5 billion pounds of PCBs were manufactured in the United States before their manufacture and general use, with a few small exceptions, was banned by the EPA in the late 1970s. PCBs accumulate in the tissue of fish and other wildlife, entering the organism through absorption or ingestion. As a result, they may be present in fish and marine mammals at levels many times higher than in the surrounding water and at levels unsuitable for human consumption.

The water quality standards that form the basis for the TMDLs are the current Delaware River Basin Commission water quality criteria for total PCBs for the protection of human health from carcinogenic effects. These criteria were identified as the TMDL targets by a letter dated April 16, 2003 from the Regional Administrators of EPA Regions II and III to the Executive Director of the Delaware River Basin Commission. The criteria are 44.4 picograms per liter in Zones 2 and 3, 44.8 picograms per liter in Zone 4 and the upper portion of Zone 5, and 7.9 picograms per liter in lower Zone 5. The more stringent criterion in the lower estuary reflects a higher fish consumption rate utilized by the Commission and the State of Delaware, based upon an evaluation of fish consumption there. A consequence of the inconsistency in criteria is that a critical location occurs at the point between upper and lower Zone 5 where the criteria drop sharply from 44.8 picograms per liter to 7.9 picograms per liter. Achieving the lower standard in a portion of Zone 5 will require much larger reductions in the upper zones than would otherwise be necessary. Significant reductions are required throughout the estuary in any case, as ambient concentrations of PCBs in the water body currently exceed the criteria by two to three orders of magnitude.

PCBs have been dispersed throughout the environment by human activity. They enter the atmosphere as a gas, spill into soils and waterways, and lodge in sediments. They continue to be generated as a byproduct by some industrial processes. Thus, the sources of PCBs to the Delaware Estuary are multiple. They include loadings from the air, the main stem Delaware River above Trenton, tributaries to the Delaware both above and below Trenton, industrial and municipal point source discharges, combined sewer overflows, and storm water runoff, including runoff from seriously contaminated sites. For purposes of these TMDLs, point sources include all municipal and industrial discharges subject to regulation by the NPDES permit program, including combined sewer overflows and stormwater discharges. Other discharges are considered nonpoint sources.

Reducing point source discharges alone will not be sufficient to achieve the estuary water quality standards. Runoff from contaminated sites is a significant source of PCBs. Significant reductions will be required in point and nonpoint sources to the major tributaries. However, even if all the TMDLs are achieved, the water quality criteria in the estuary will not be attained until the concentration in the Schuylkill is reduced to 9.68 picograms per liter and the concentration in the main stem Delaware River falls to 10.72 picograms per liter.

Although the ocean boundary has a less significant influence on Zone 5 than does the main stem Delaware River, sources contributing to elevated PCB concentrations in the Atlantic Ocean also must be reduced. The concentration of PCBs in ocean water at the estuary boundary currently exceeds the water quality criterion for Delaware Bay by one to two orders of magnitude.

Finally, air concentrations of PCBs in the region currently are two orders of magnitude above the concentration required to achieve equilibrium and halt contributions of PCBs from the air to the water. Air monitoring data collected at several sites in New Jersey, Delaware, and Pennsylvania suggest that PCB air concentrations primarily result from local sources. Thus, source reductions must focus on PCBs in the local and regional airshed.

Current EPA regulations do not require an implementation plan to be included with TMDLs. EPA NPDES regulations do require that effluent limitations must be consistent with approved WLAs [40 CFR Part 122.44(d)(1)(vii)(B)]. EPA regulations allow the use of non-numeric effluent limits in certain circumstances [40 CFR Part 122.44(K)]. In addition to EPA regulations, the Commission and its signatory parties currently have in place an implementation procedure for utilizing wasteload allocations and other effluent requirements formally issued by the Delaware River Basin Commission's Executive Director.

As part of the implementation strategy, the NPDES permitting authorities believe that it is appropriate for 142 NPDES point source discharges to receive non-numeric WQBELs consistent with the WLAs. It is expected that the non-numeric WQBELs resulting from the Stage 1 WLAs require PCB minimization and reduction programs and additional monitoring using Method 1668A consistent with state and federal NPDES regulations.

While implementation actions and corrective measures are not generally beyond the purvey of the City of Woodbury, reductions in runoff and sediment transport from new development is an objective of the City's W/MSWMP.

Phosphorous: **Bell Lake and Woodbury Lake (aka Stewart Lake)**

Bell Lake - Bell Lake is a shallow bean shaped lake with a mean depth of 2.6 feet reaching a maximum of 5.4 feet. The lake is primarily stormwater feed through the storm sewer system of the city and discharges into the Matthews Branch of Woodbury Creek. The drainage basin area of the lake is about 275 acres lying entirely within the city boundaries and the surface area of the lake is 1.8 acres, making the drainage area to lake surface area ratio about 150:1. Total Lake volume is estimated to be 5,800 m3. Mean discharge is approximately 409,000 m3 / yr, making the mean hydraulic residence time for the lake 5.2 days. (depth and discharge taken from F.X. Browne Associates, Inc., 1989)

The major land use within the Bell Lake watershed is urban comprising of over 93% of the area. The majority of the urban land is single family homes with the remainder consisting of multifamily apartments as well as industrial and manufacturing uses. There are no point source discharges in the Bell Lake Watershed; therefore, the primary source of pollutants to the waterbody are nonpoint sources, specifically urban run-off.

Woodbury (Stewart) Lake - Woodbury Lake is a 47-acre lake located on Woodbury Creek Woodbury Lake has two main tributaries, Woodbury Creek and an unnamed tributary flowing into the western section of the lake. The lake consists of two long, narrow arms divided into an interconnected series of small impoundments. Mean depth (1.52 meters) and total annual inflow (7,780,000 m^3) were obtained from NJDEP, 1983. Detention time is estimated to be about 14 days. The lake's 3,200- acre watershed area (69 times the lake area) is predominately composed of urban land uses.

Phosphorus – Lake TMDL Implementation

The next steps toward implementation are preparation of lake characterizations and lake restoration plans, where they have not already been developed. In the development of these plans, the loads by source will be revised, as necessary, to reflect refinements in source contributions. It will be on the basis of refined source estimates that specific strategies for reduction will be developed. These will consider issues such as cost and feasibility when specifying the reduction target for any source or source type. As appropriate, WLAs or other measures to be applied to traditional or stormwater point sources through NJPDES permits will be adopted by the Department as amendments to the applicable areawide Water Quality Management Plan.

The Department recognizes that TMDLs alone are not sufficient to restore eutrophic lakes. The TMDL establishes the required nutrient reduction targets and provides the regulatory framework to affect those reductions. However, the nutrient load only affects the eutrophication potential of a lake. The implementation plan therefore calls for the collection of additional monitoring data and the development of a Lake Restoration Plan for each lake. The plans will consider in-lake measures that need to be taken to supplement the nutrient reduction measures required by the TMDL. In addition, the plans will consider the ecology of the lake and adjust the eutrophication indicator target as necessary to protect the designated uses.

Phosphorous sources include domestic and industrial wastewater treatment plants that discharge to surface waters as point sources, as well as stormwater non-point source discharges subject to regulation under the New Jersey Pollutant Discharge Elimination System (NJPDES) municipal stormwater permitting program. Non-point sources include stormwater runoff from various land uses, deposition from the air, malfunctioning sewage conveyance systems, failing or inappropriately designed septic systems and direct contributions from wildlife, livestock and pets.

The NJDEP Bell Lake TMDL proposal estimates that about 70 percent of the phosphorus load on Bell Lake is from medium and high density residential land use and that 26 percent is from commercial land use. The NJDEP TMDL proposal for Woodbury Lake indicates that about 51 percent of the phosphorous load is from medium and high density residential land use, 11 percent is from low and rural residential land use and 16 percent is from commercial land use. The NJDEP’s TMDL percent reduction in phosphorous load required from all land uses to meet water quality standards is 94 percent for Bell Lake and 85 percent for Woodbury Lake.

The NJDEP TMDL proposals indicate that additional monitoring is required in order to develop Lake Restoration Plans to implement the TMDLs. Woodbury Lake was scheduled for characterization by the NJDEP for the summer of 2007 and Bell Lake was scheduled for the summer of 2009. Development of lake restoration plans, based on the lake characterizations, is then scheduled for the spring of the preceding year. The City is not aware that this work was accomplished by the NJDEP.

Typical stormwater management strategies that may be employed include:

- **BMP Implementation**: Additional phosphorous loadings from new development and redevelopment may be reduced through BMP implementation.

- **Low Phosphorous Fertilizer Ordinances:** As an additional measure to their NJPDES stormwater permits, municipalities may be required to adopt an ordinance that prohibits the outdoor application of fertilizers, other than low phosphorous fertilizer. The ordinance must be consistent with a model ordinance provided by the NJDEP.

Section 9. Mitigation Plans

Section 6 and 8 of this W/MSWMP addresses the design and performance standards for stormwater management measures applicable to major development projects and provide the basic information for potential mitigation projects. In some instances, however, site specific conditions may prevent strict compliance with these standards. In accordance with N.J.A.C. 7:8-4.2(c)11, such projects may be granted a variance or exemption from these standards by the City Planning/Zoning Board, if a mitigation plan is approved by the Board, and the mitigation plan implementation is a condition of the major development project approval.

To the extent possible, a mitigation plan should offset the impacts on groundwater recharge, stormwater quantity control, and/or stormwater quality control that would be created by granting the variance or exemption to the development project. In addition, to the extent possible, the proposed mitigation project(s) should be located within the same HUC14 sub-drainage basin(s) as is the major development project, and if not, within the same Watershed Management Area.

A mitigation plan may include more than one mitigation project, in order to achieve the objectives of location and/or impact offsets. The Municipal Stormwater Coordinator and Engineer will consider mitigation projects that can be implemented in order to comply with the mitigation plan provisions of this W/MSWMP. Projects will have quantitative estimates of the offsets to groundwater recharge, stormwater quantity control, and/or stormwater quality control for each of the mitigation projects.

The mitigation plan must include a detailed plan and schedule for implementation of the mitigation project(s). Implementation may be accomplished as a part of the major development project, or the City may accept funding for the project(s), at its discretion. If it chooses to accept funding in lieu of implementation, such funding shall include any costs that must be incurred in implementing the mitigation project(s), including design, permitting, land and/or easement acquisition, construction, and provisions for the long-term operation and maintenance of the mitigation project(s).

A mitigation plan must clearly demonstrate that strict compliance with the design and performance standards for stormwater management measures cannot be achieved. Before submitting a mitigation plan that does not meet the objectives of the W/MSWMP with regard to mitigation project location and/or impact offsets, the developer shall request that the City determine whether it can identify other projects, consistent with those objectives.

A mitigation plan that includes a mitigation project or projects identified by this W/MSWMP may be submitted for review by the City. Such projects must be reviewed and accepted before a mitigation plan including such projects can be submitted to the Planning/Zoning Board for review. A mitigation plan must include quantitative estimates of the offsets to groundwater recharge, stormwater quantity control, and/or stormwater quality control for each mitigation project.

The mitigation plan must include provisions for ensuring the long-term operation and maintenance of the mitigation project(s), by clearly identifying the party responsible for the operation and maintenance of each mitigation project. If the City accepts a mitigation plan that designates the City as the responsible party for mitigation project operation and maintenance, provisions for funding the associated costs by the developer must be included in the mitigation plan.

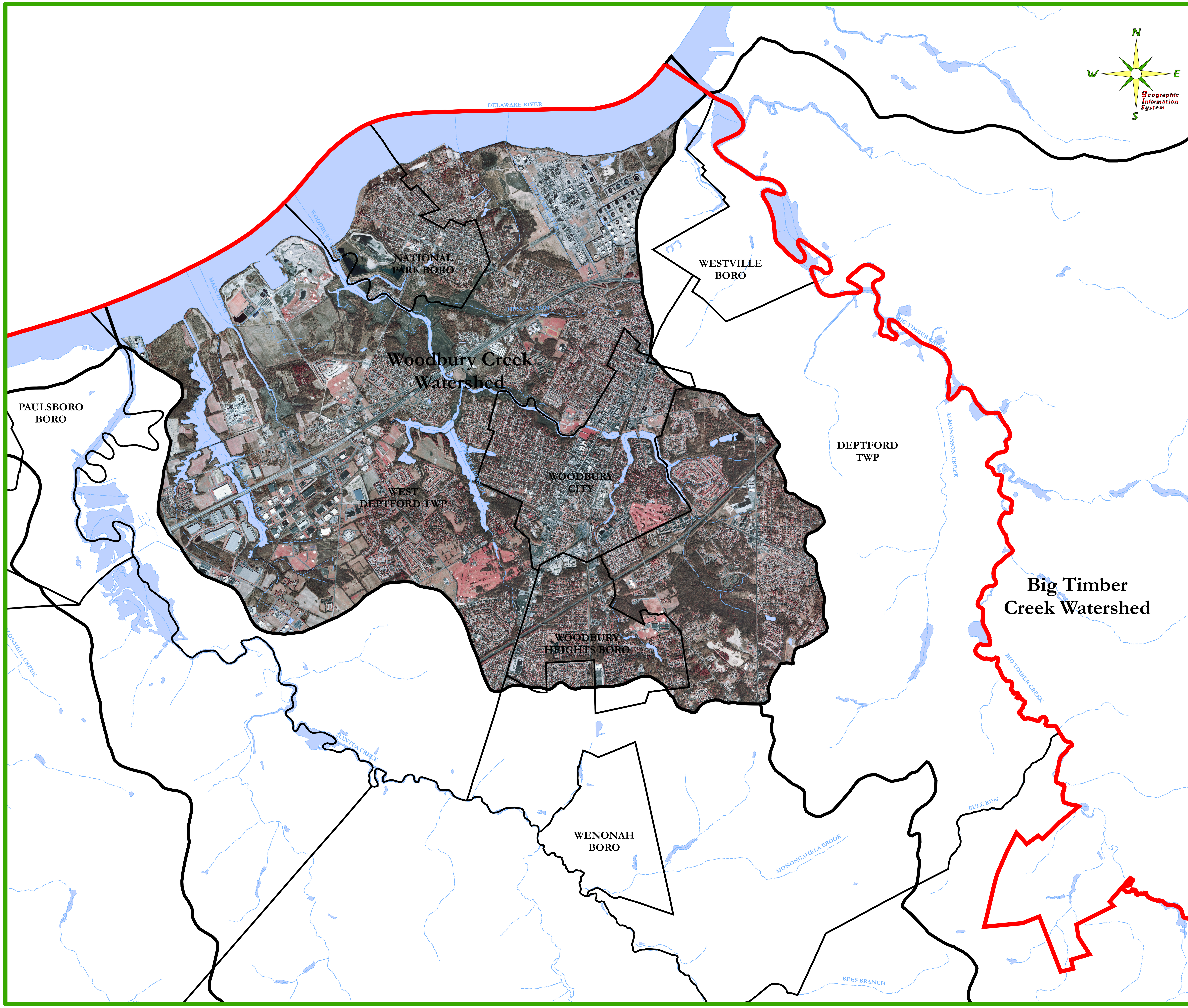
If implementation of a mitigation plan is a condition of approval for a major development project by the Planning/Zoning Board, such approval must also include the requirement that the developer execute a funding agreement with the City for the mitigation plan implementation, as a further condition of approval. The funding agreement, in form acceptable to the Municipality, must provide for funding by the developer of the costs to implement the plan that will be incurred by the City, including the cost of long-term operation and maintenance of mitigation projects.

The City may only grant a variance from the design and performance standards for stormwater management measures, if the permittee has a mitigation plan included in the approved MSWMP and SCO(s) which meets the following requirements:

1. The mitigation plan identifies measures that are necessary to offset the deficit created by granting the variance. The mitigation plan must satisfy the criteria in the Stormwater Management rules at N.J.A.C. 7:8-4.2(c)11 and 4.6. (See Chapter 3 of the NJ Stormwater BMP Manual at https://www.njstormwater.org for guidance); and

2. The City submits, within (30) days after approving a variance, a written report to the County review agency and to the Department via email (dwq-bnpcstormwatermanagement@dep.nj.gov) describing the variance and the required mitigation in accordance with N.J.A.C. 7:8-4.6(a)3.

APPENDIX A. WATERSHED FIGURES



Gloucester County Stormwater Management Plan

Figure No. WC-1

AERIAL PHOTOGRAPHY (2002)

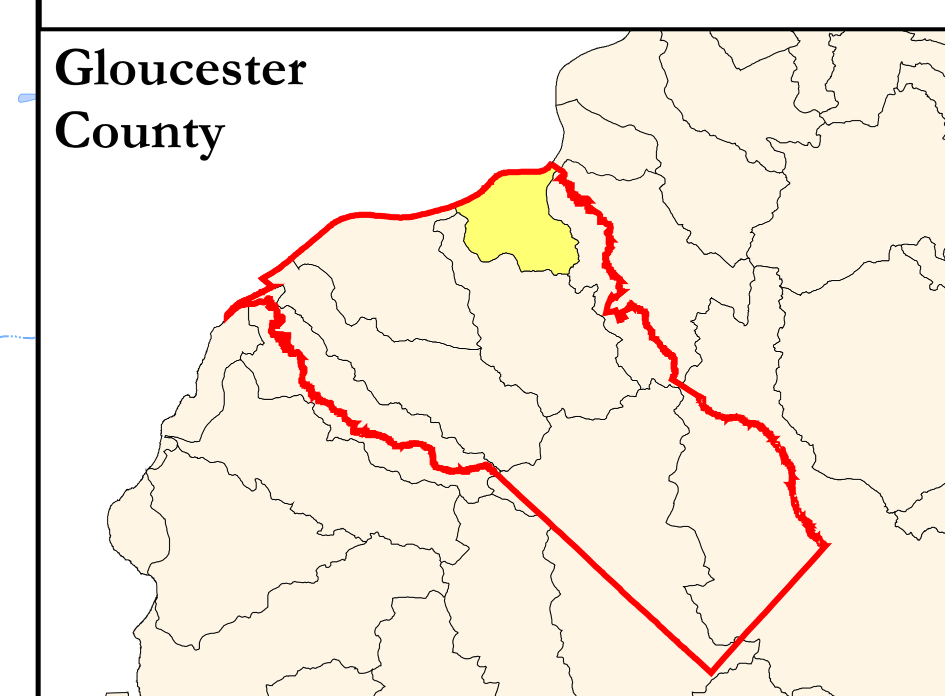
Legend

2,000 1,000 0 2,000 Feet

- County Boundary
- Municipal Boundary
- Watershed Boundary
- Streams (as mapped by NJDEP)
- Lakes (as mapped by NJDEP)

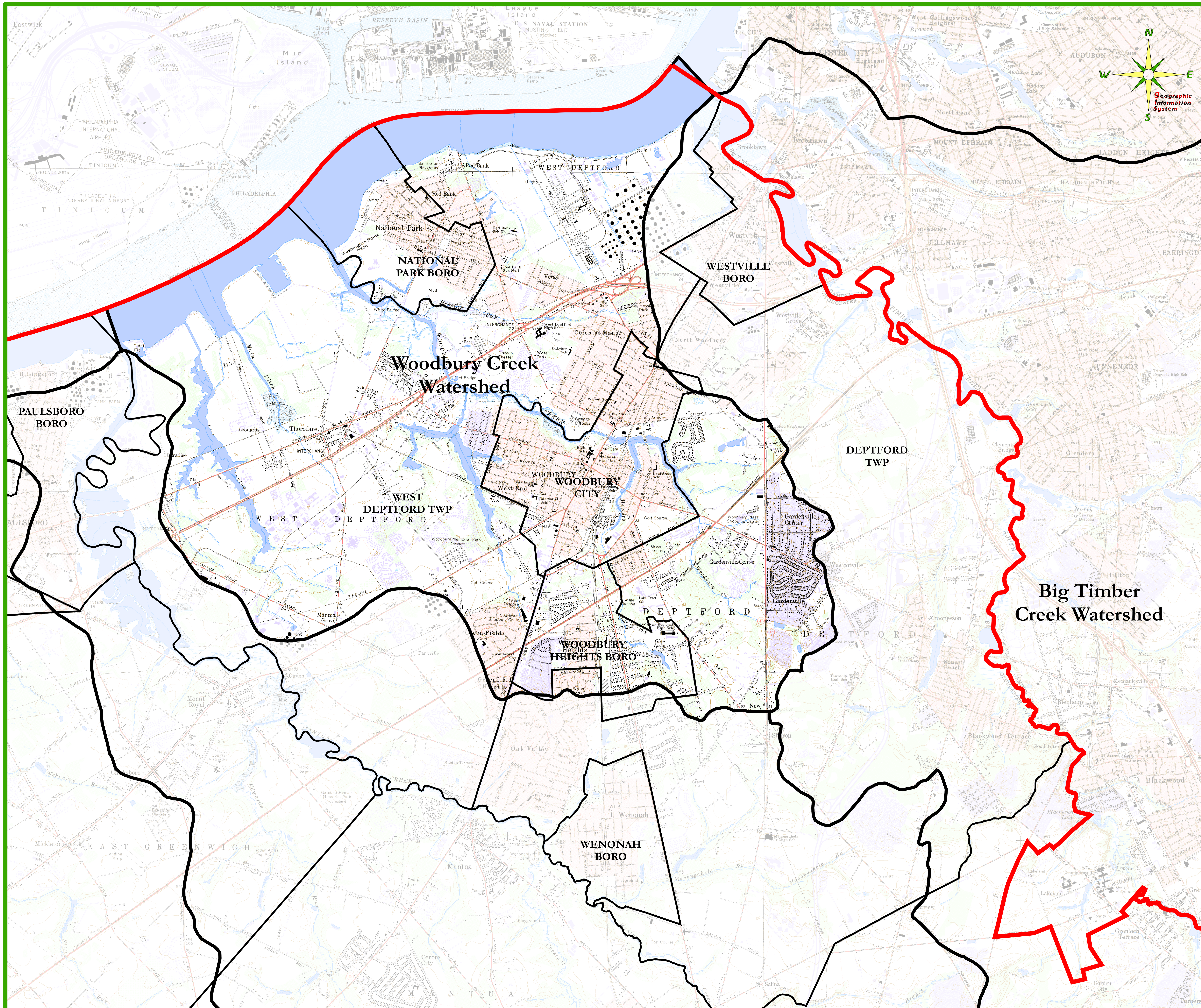
Gloucester County Improvement Authority
Freeholder Director
Stephen M. Sweeney, Liaison

Gloucester County



Gloucester County, New Jersey, USA
Dated: 02/18/06 Drawn By: SEB

Note:
This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.



Gloucester County Stormwater Management Plan

Figure No. WC-2

TOPOGRAPHY

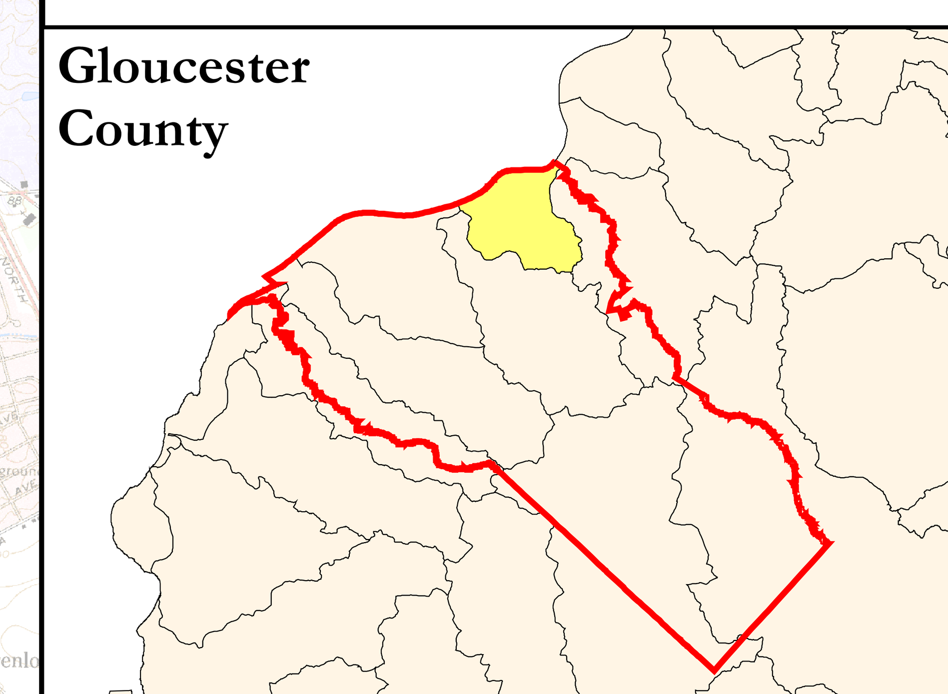
Legend

2,000 1,000 0 2,000 Feet

- County Boundary
- Municipal Boundary
- Watershed Boundary
- Streams (as mapped by NJDEP)
- Lakes (as mapped by NJDEP)

Gloucester County Improvement Authority
Freeholder Director
Stephen M. Sweeney, Liaison

Gloucester County



Gloucester County, New Jersey, USA
Dated: 02/18/06 Drawn By: SEB

Note:
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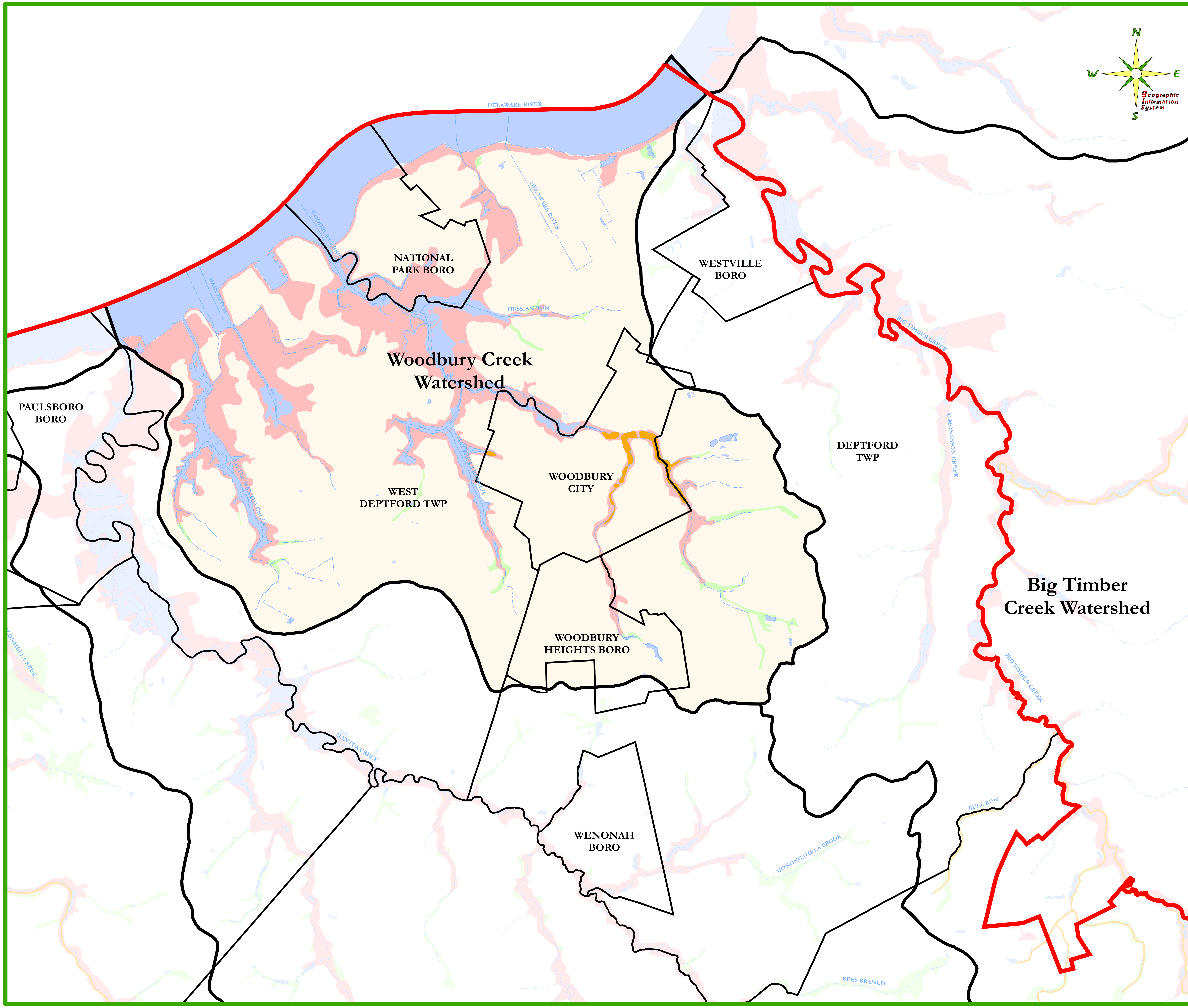
Gloucester County Stormwater Management Plan

Figure No. WC-3

WATERWAYS MAP



Legend

2,000 1,000 0 2,000 Feet

- County Boundary
- Municipal Boundary
- Watershed Boundary
- Streams (as mapped by NJDEP)
- Lakes (as mapped by NJDEP)
- Total Maximum Daily Loads for Streams
- Total Maximum Daily Loads for Lakes
- Category One Stream Segment
- Category One Buffer Area

Floodprone Areas

FLOODPRONE

- Documented Floodprone Area
- Undocumented Floodprone Area
- Water

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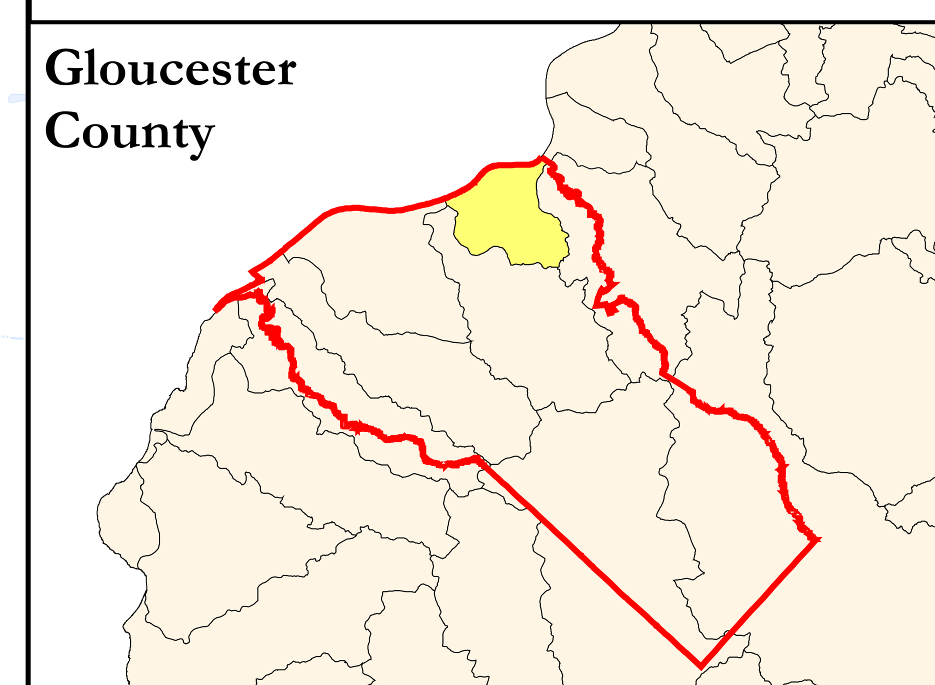

Gloucester County, New Jersey, USA
Dated: 02/18/06 Drawn By: SEB

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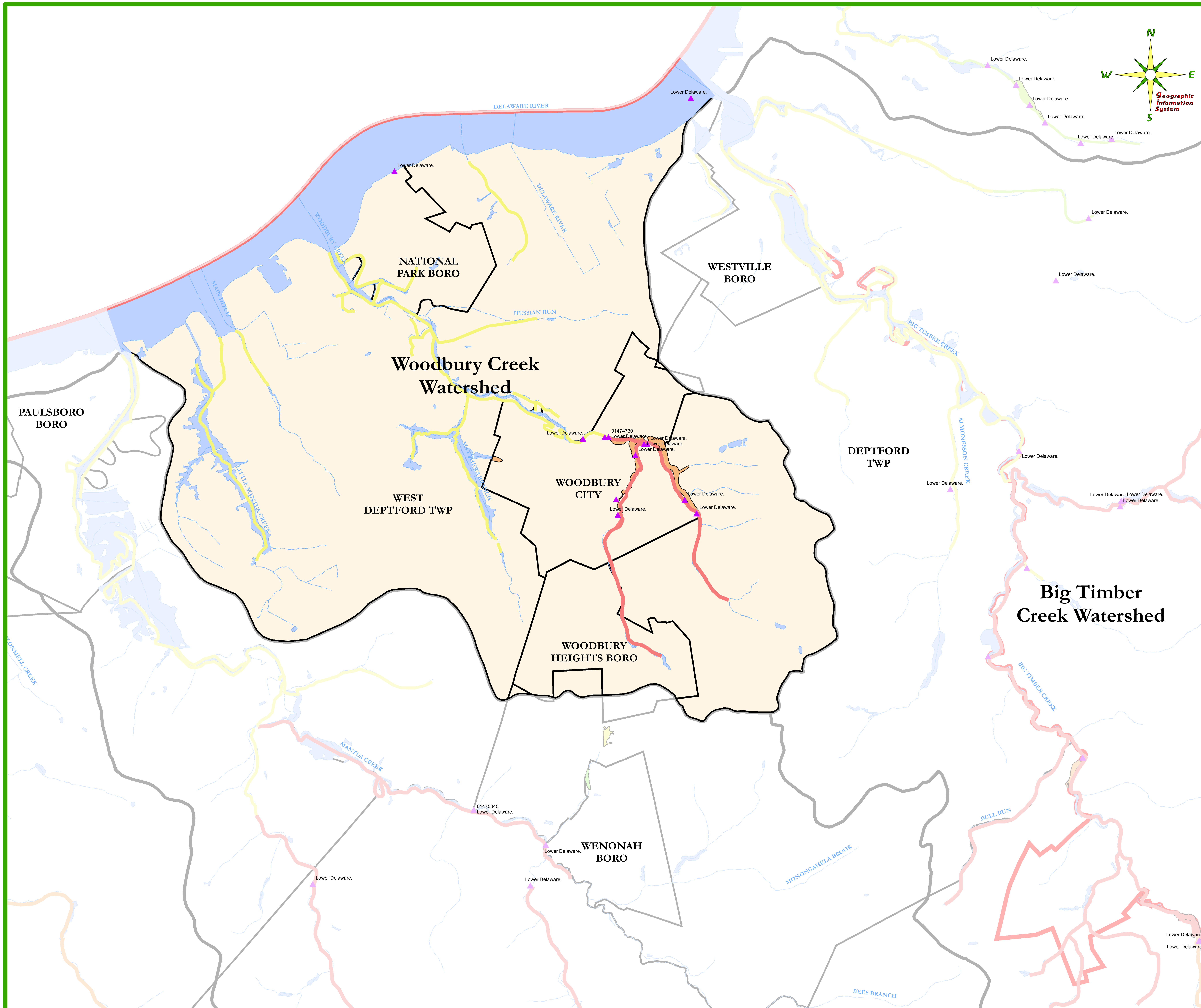

Gloucester County Stormwater Management Plan

Figure No. WC-4

WATER QUALITY

Legend

2,000 1,000 0 2,000 Feet

- County Boundary
- Municipal Boundary
- Watershed Boundary
- STORET Sites
- Ambient Monitoring Network Sites
- Existing Water Quality Stations
- Streams (as mapped by NJDEP)
- Lakes (as mapped by NJDEP)
- TMDL Streams (as mapped by NJDEP)
- TMDL Lakes (as mapped by NJDEP)

NJDEP 2004 Integrated Report Results for Lakes

OVERALL

- Full Attain
- Insufficient
- Fish Advisory Only
- List 4
- Non Attain

NJDEP 2004 Integrated Report Results for Conventionals in Non-Tidal Rivers

OVERALL

- Full Attain
- Insufficient
- Fish Advisory Only
- List 4
- Non Attain

Gloucester County Improvement Authority
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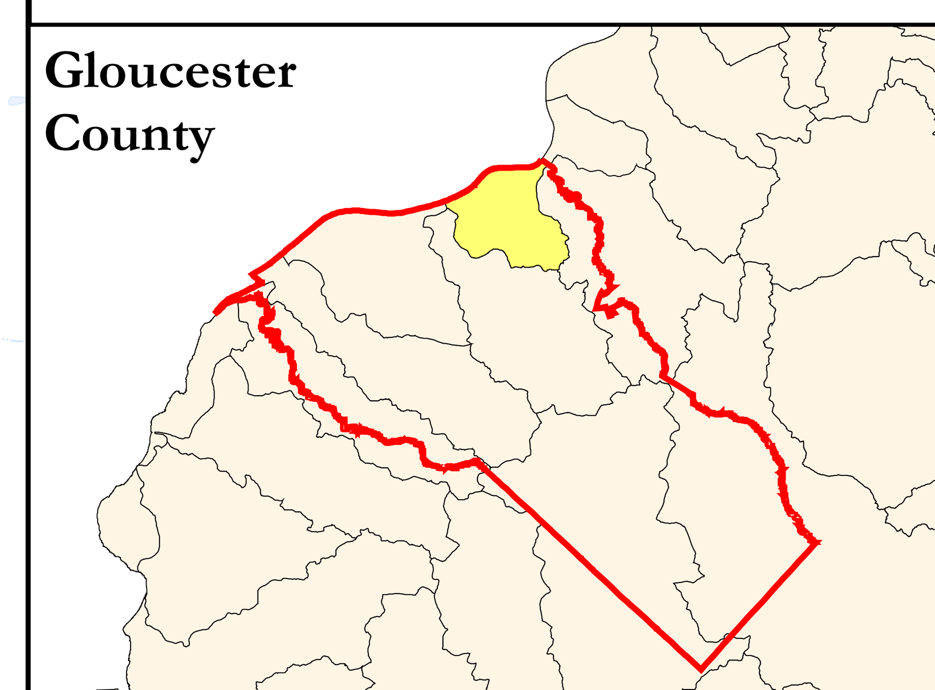
Gloucester County



Gloucester County, New Jersey, USA
Dated: 02/18/06 Drawn By: SEB

Note:
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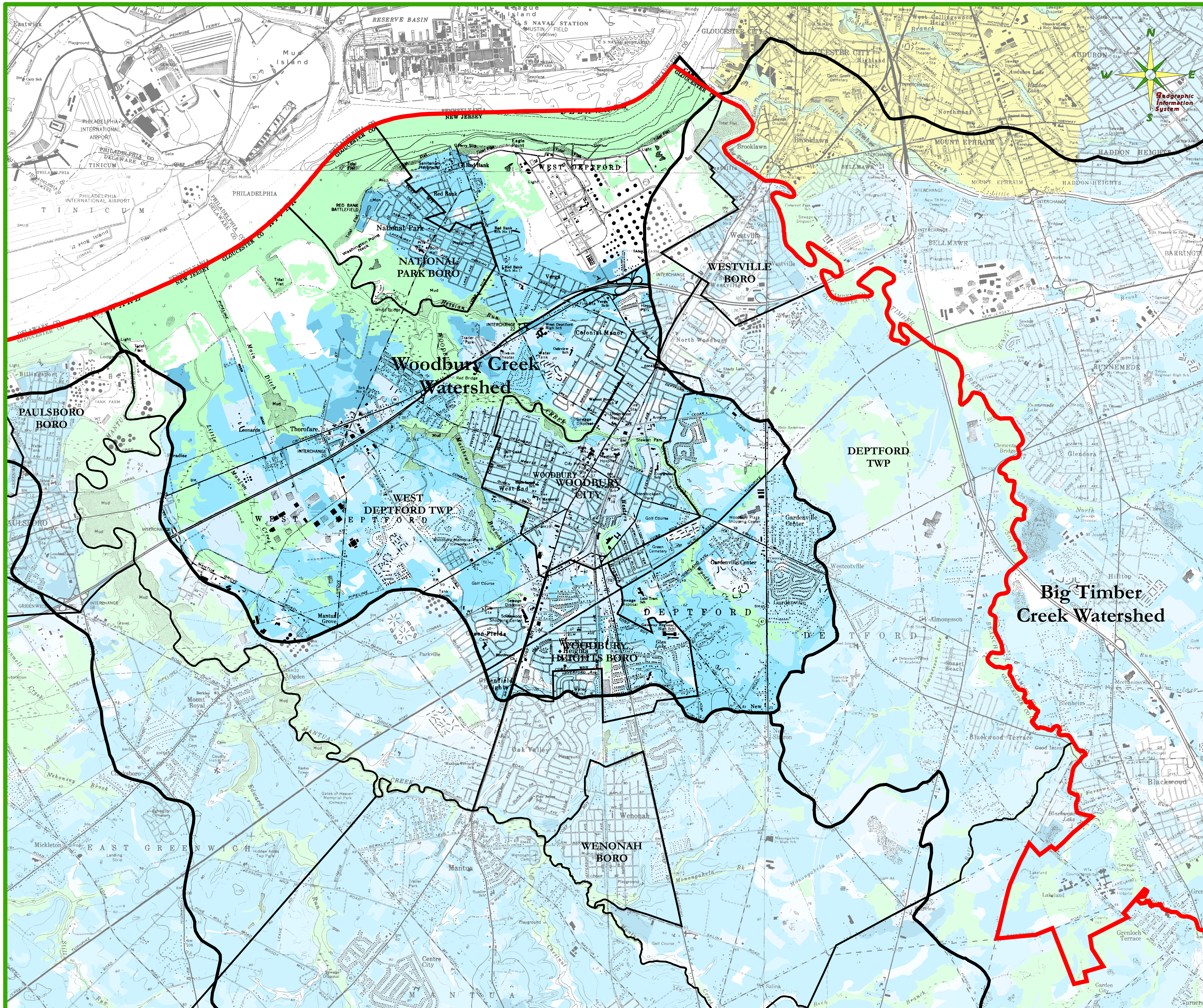


Gloucester County Stormwater Management Plan

Figure No. WC-5

GROUND WATER RECHARGE

Legend

2,000 1,000 0 2,000 Feet

- County Boundary
- Municipal Boundary
- Watershed Boundary

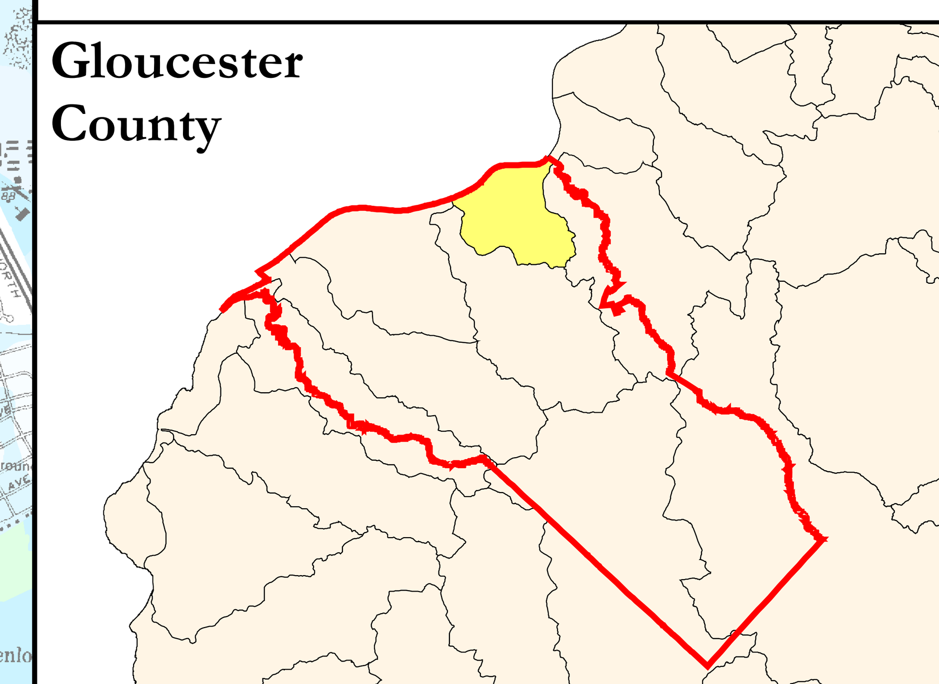
Ground Water Recharge Areas

County Ranking

- 15 to 16 in/yr
- 10 to 14 in/yr
- 8 to 9 in/yr
- 1 to 7 in/yr
- 0 in/yr
- Hydric Soils
- Wetlands and Open Water
- No Recharge Calculated

Gloucester County
Improvement Authority
Freeholder Director
Stephen M. Sweeney, Liaison

Gloucester County



Gloucester County, New Jersey, USA
Dated: 02/18/06 Drawn By: SEB

Note:
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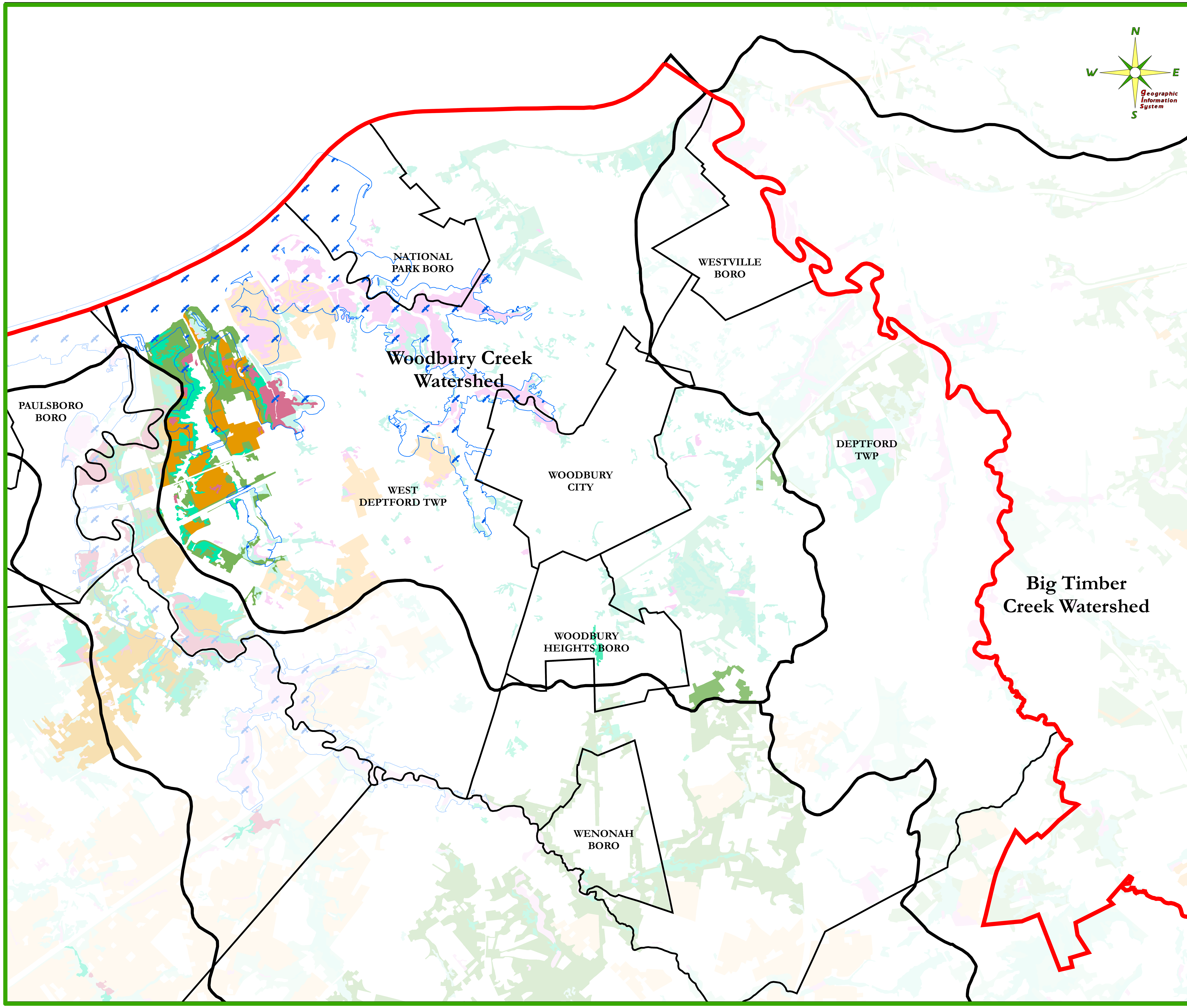


Gloucester County Stormwater Management Plan

Figure No. WC-6

CRITICAL HABITAT

Legend

County Boundary
Municipal Boundary
Watershed Boundary
Bald Eagle Foraging Area
Urban Peregrine Falcon Nest
Wood Turtle

Beach
RANK
Suitable Habitat (1)
Priority Species (2)
State Threatened (3)
State Endangered (4)
Federal T and E (5)

Grassland
RANK
Suitable (1)
Priority Species (2)
State Threatened (3)
State Endangered (4)
Federal T and E (5)

Forest
RANK
Suitable (1)
Priority Species (2)
State Threatened (3)
State Endangered (4)
Federal T and E (5)

Forested Wetland
RANK
Suitable (1)
Priority Species (2)
State Threatened (3)
State Endangered (4)
Federal T and E (5)

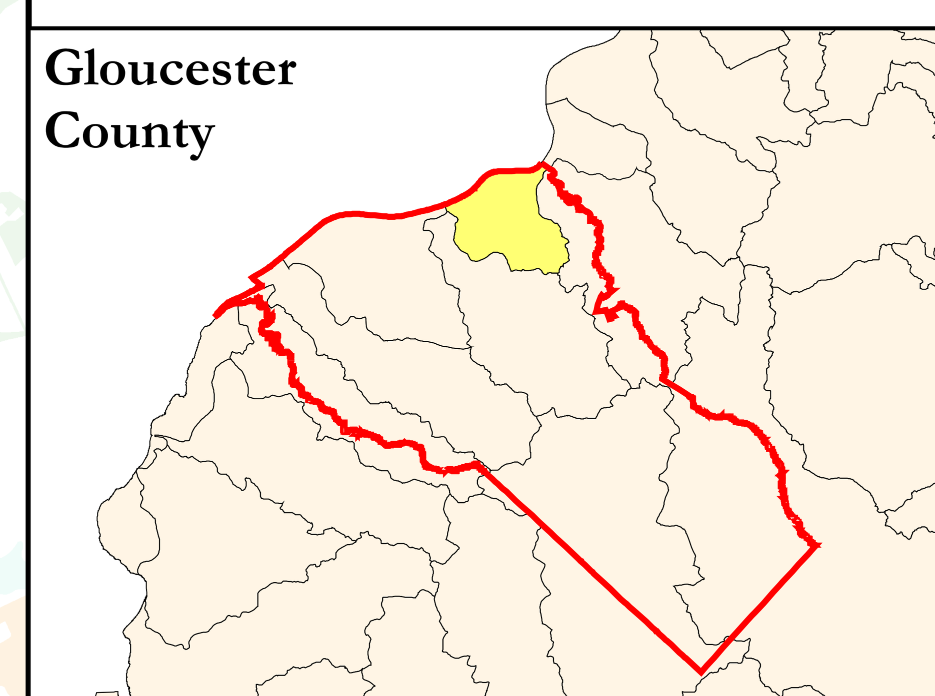
Emergent Wetland
RANK
Suitable Habitat (1)
Priority Species (2)
State Threatened (3)
State Endangered (4)
Federal T and E (5)

2,0001,000 0 2,000
Feet

Gloucester County
Improvement Authority
Freeholder Director
Stephen M. Sweeney, Liaison

GLOUCESTER COUNTY IMPROVEMENT AUTHORITY

Gloucester County



Gloucester County, New Jersey, USA
Dated: 02/22/06 Drawn By: SEB

Note:
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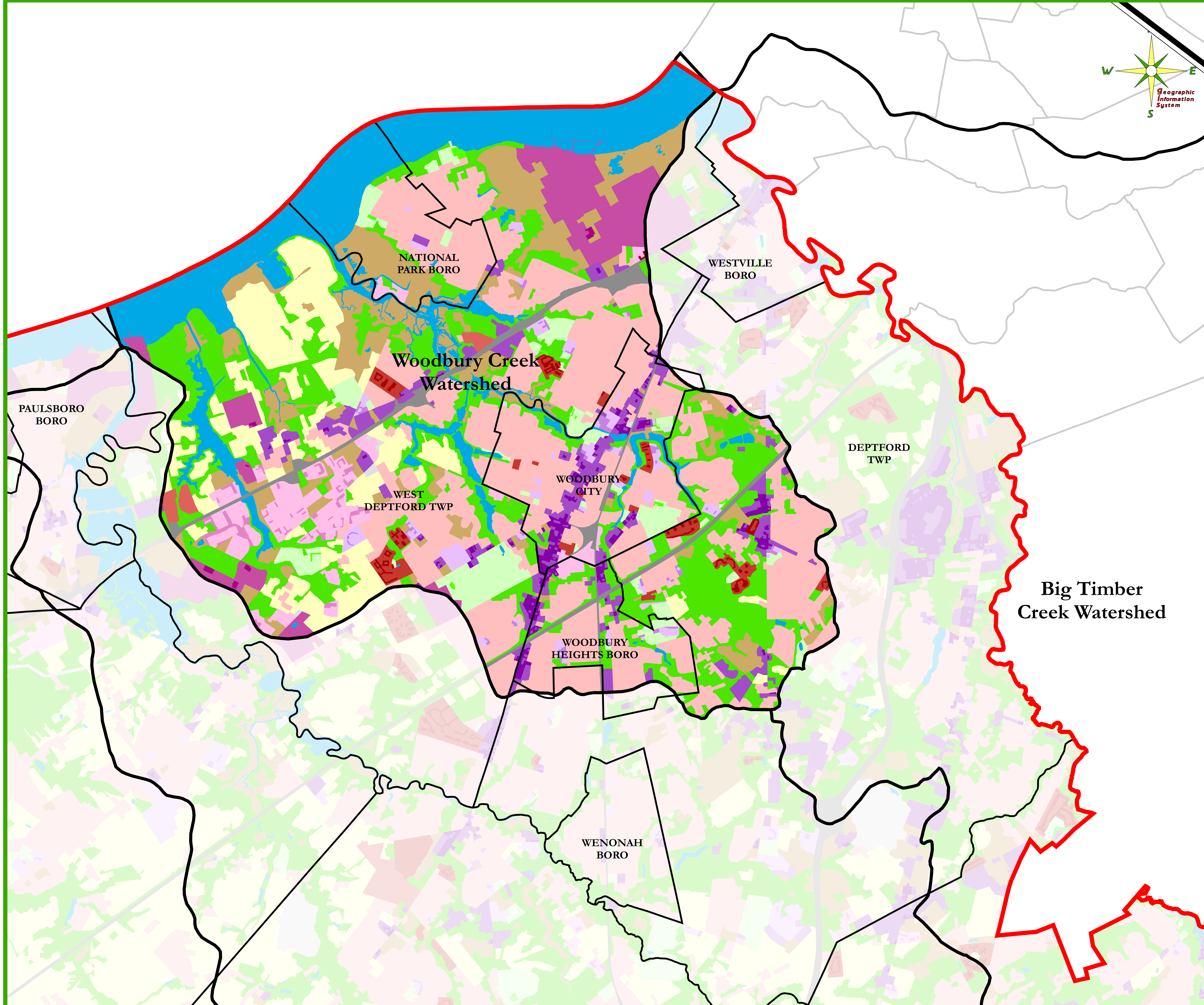
Gloucester County Stormwater Management Plan

Figure No. WC-7

LAND USE



Legend

- County Boundary
- Municipal Boundary
- Watershed Boundary

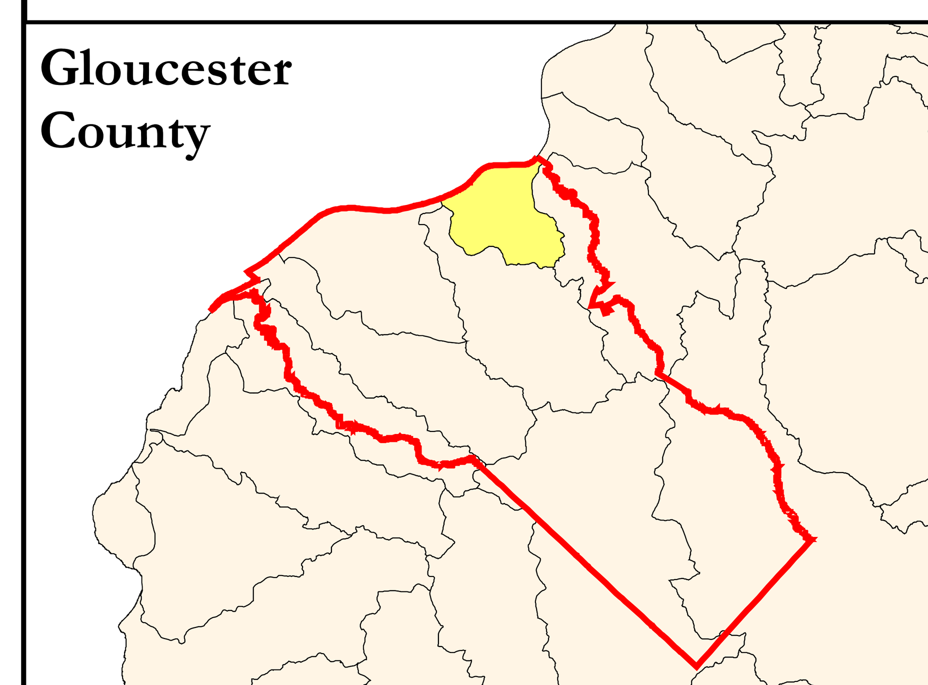
Gloucester County Land Use (as mapped by DVRPC)

DESCRIPTION

Agriculture	Recreation
Agriculture:Agricultural Bog	Parking:Recreation
Community Services	Residential:Single-Family Detached
Parking:Community Services	Residential:Row Home
Commercial	Residential:Mobile Home
Parking:Commercial	Residential:Multi-Family
Manufacturing:Light Industrial	Parking:Multi-Family
Parking:Light Manufacturing	Utility
Manufacturing:Heavy Industrial	Parking:Utility
Parking:Heavy Manufacturing	Transportation
Military	Parking:Transportation
Parking:Military	Vacant
Mining	Water
Parking:Mining	Wooded

Gloucester County Improvement Authority
Freeholder Director
Stephen M. Sweeney, Liaison

THE GREAT SEAL OF THE COUNTY OF GLOUCESTER, NEW JERSEY · GLOUCESTER COUNTY IMPROVEMENT AUTHORITY



Gloucester County, New Jersey, USA
Dated: 02/18/06 Drawn By: SEB

Note:
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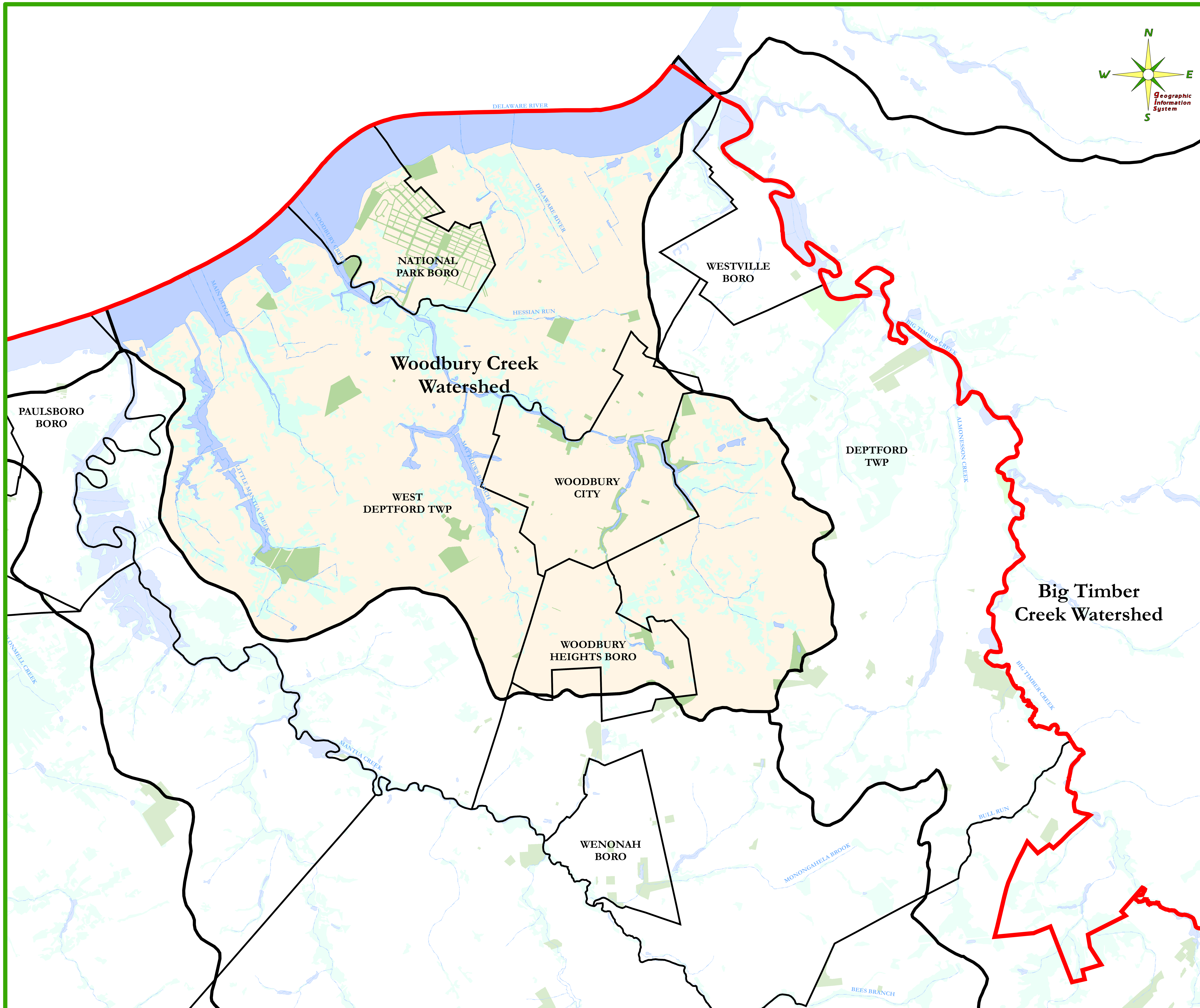
Gloucester County Stormwater Management Plan

Figure No. WC-8

CONSTRAINED AREAS



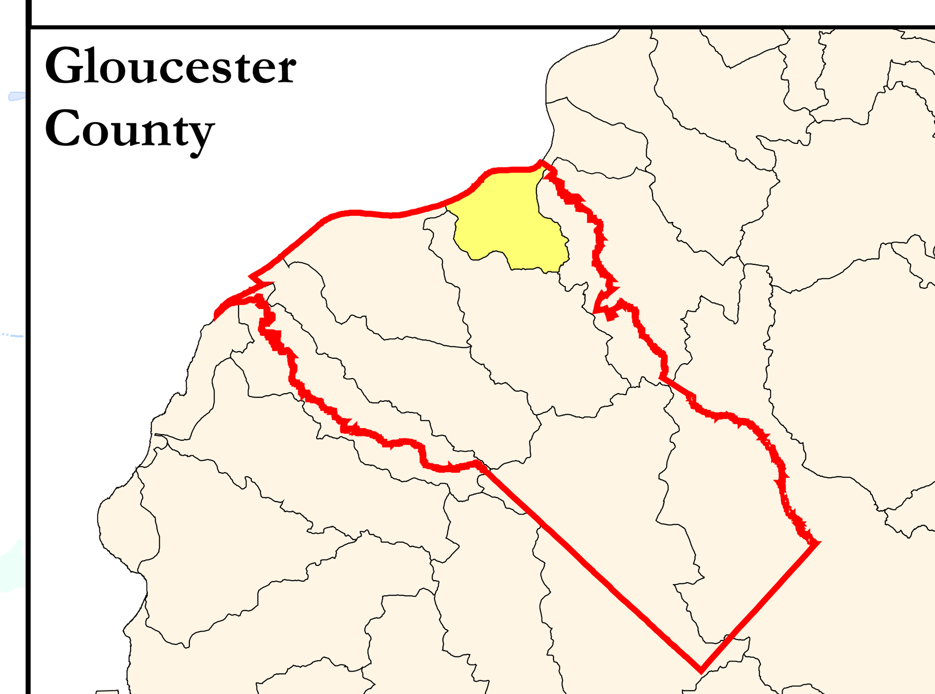
Legend

2,000 1,000 0 2,000 Feet

- County Boundary
- Municipal Boundary
- Watershed Boundary
- Streams (as mapped by NJDEP)
- Lakes (as mapped by NJDEP)
- Open Space (as mapped by NJDEP)
- County Open Space
- Wetlands (as mapped by NJDEP)

Gloucester County Improvement Authority
Freeholder Director
Stephen M. Sweeney, Liaison

Gloucester County



Gloucester County, New Jersey, USA
Dated: 02/18/06 Drawn By: SEB

Note:
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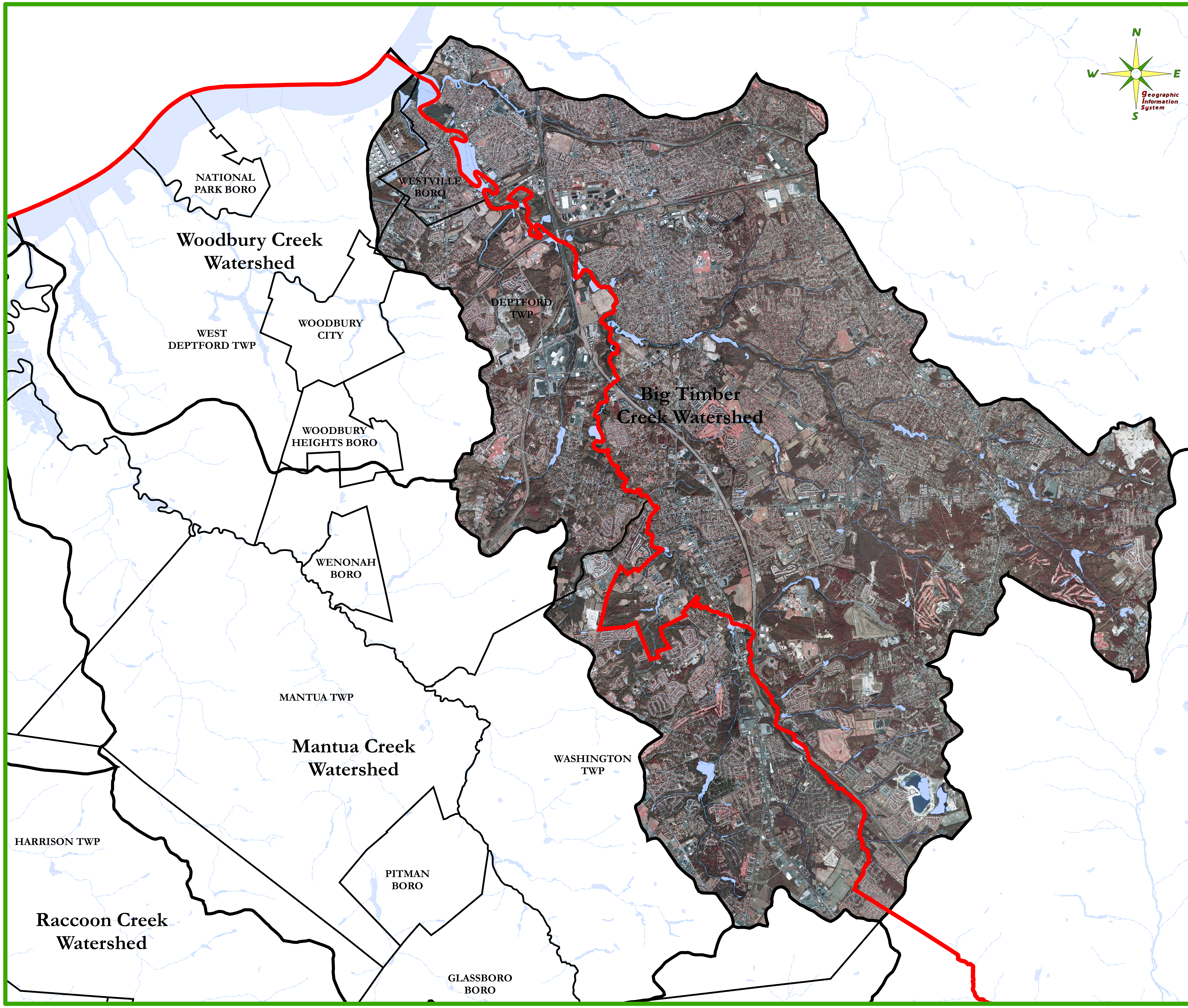
Gloucester County Stormwater Management Plan

Figure No. BT-1

AERIAL PHOTOGRAPHY (2002)

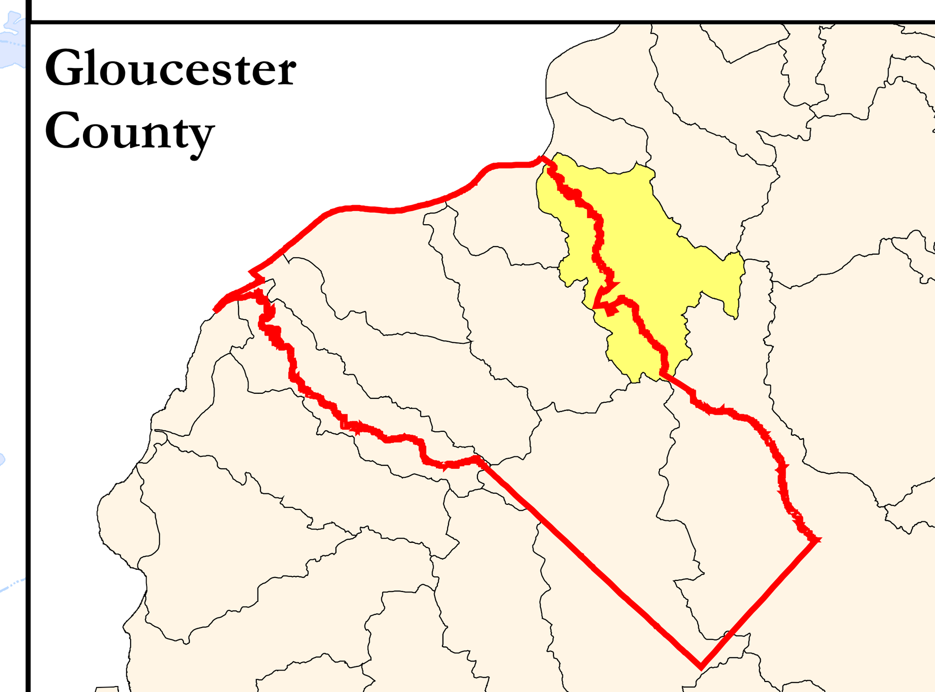


Legend

3,000 1,500 0 3,000 Feet

- County Boundary
- Municipal Boundary
- Watershed Boundary
- Streams (as mapped by NJDEP)
- Lakes (as mapped by NJDEP)

Gloucester County Improvement Authority
Freeholder Director
Stephen M. Sweeney, Liaison



Gloucester County, New Jersey, USA

Dated: 02/18/06 Drawn By: SEB

Note:
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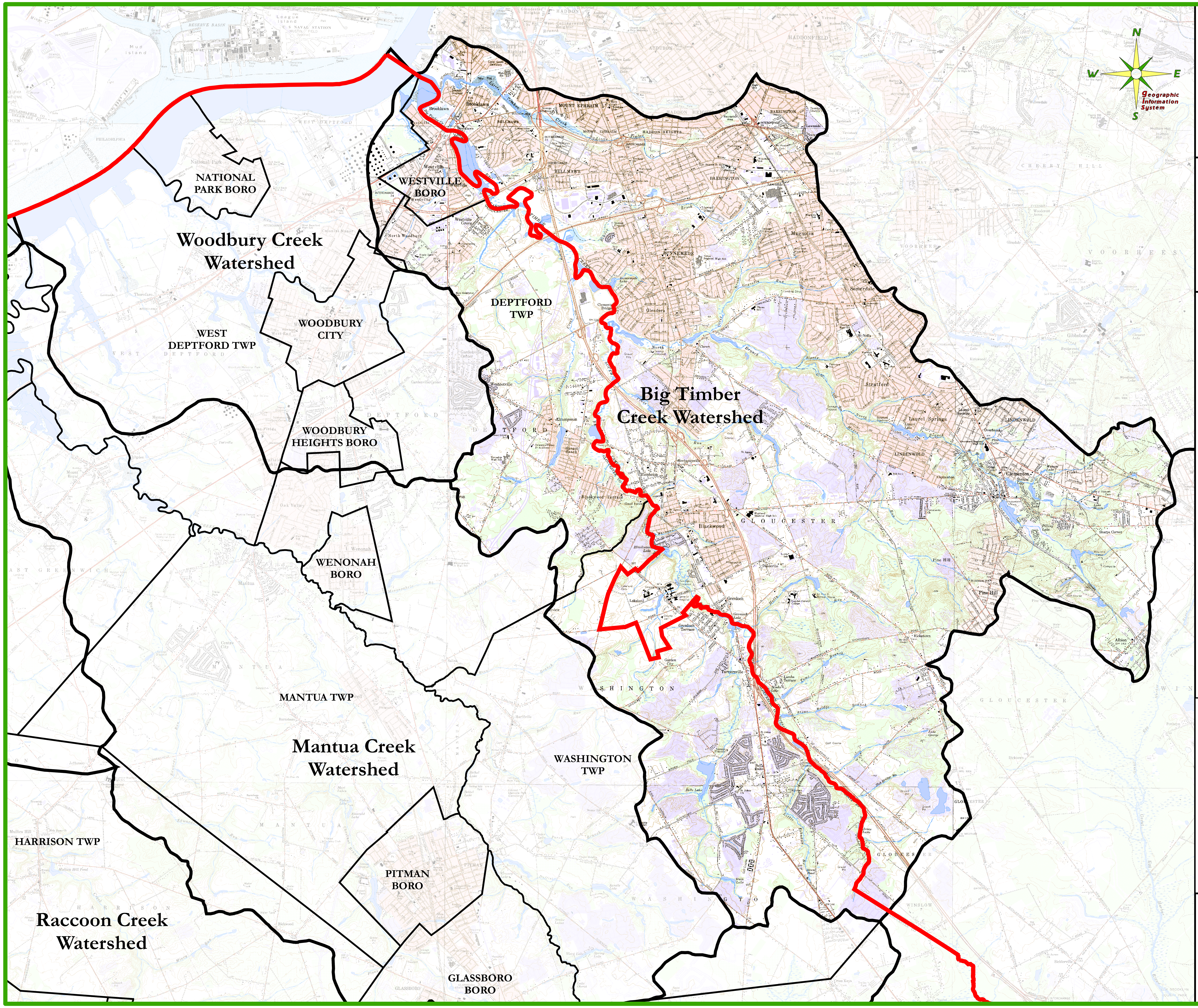


Gloucester County Stormwater Management Plan

Figure No. BT-2

TOPOGRAPHY

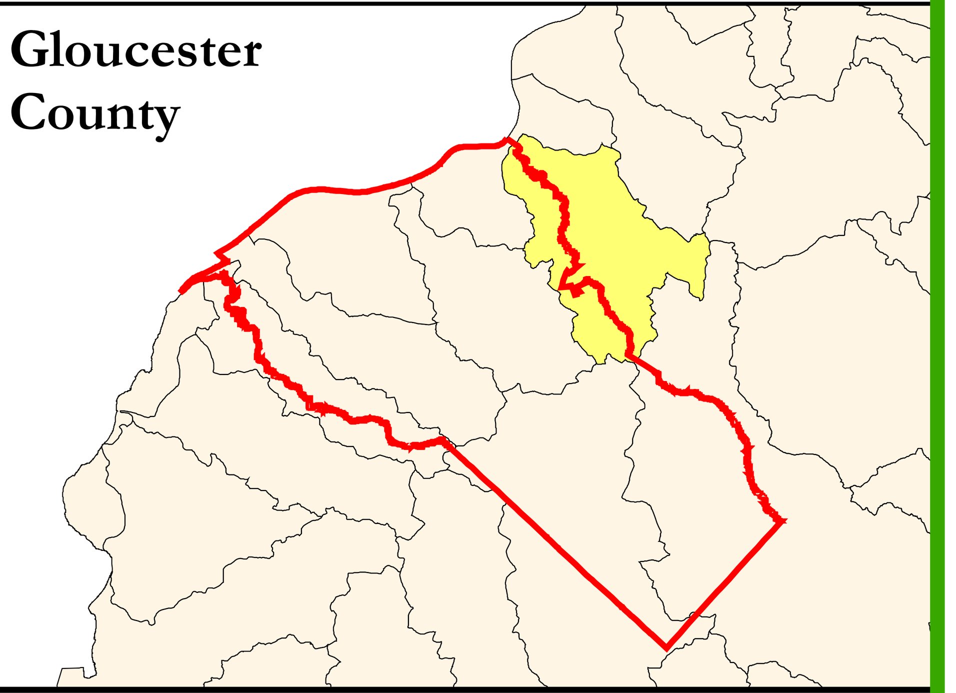
Legend

3,000 1,500 0 3,000 Feet

- County Boundary
- Municipal Boundary
- Watershed Boundary
- Streams (as mapped by NJDEP)
- Lakes (as mapped by NJDEP)

THE SEAL OF THE COUNTY OF GLOUCESTER NEW JERSEY
GLOUCESTER COUNTY IMPROVEMENT AUTHORITY

Gloucester County Improvement Authority
Freeholder Director
Stephen M. Sweeney, Liaison



Gloucester County, New Jersey, USA
Dated: 02/18/06 Drawn By: SEB

Note:
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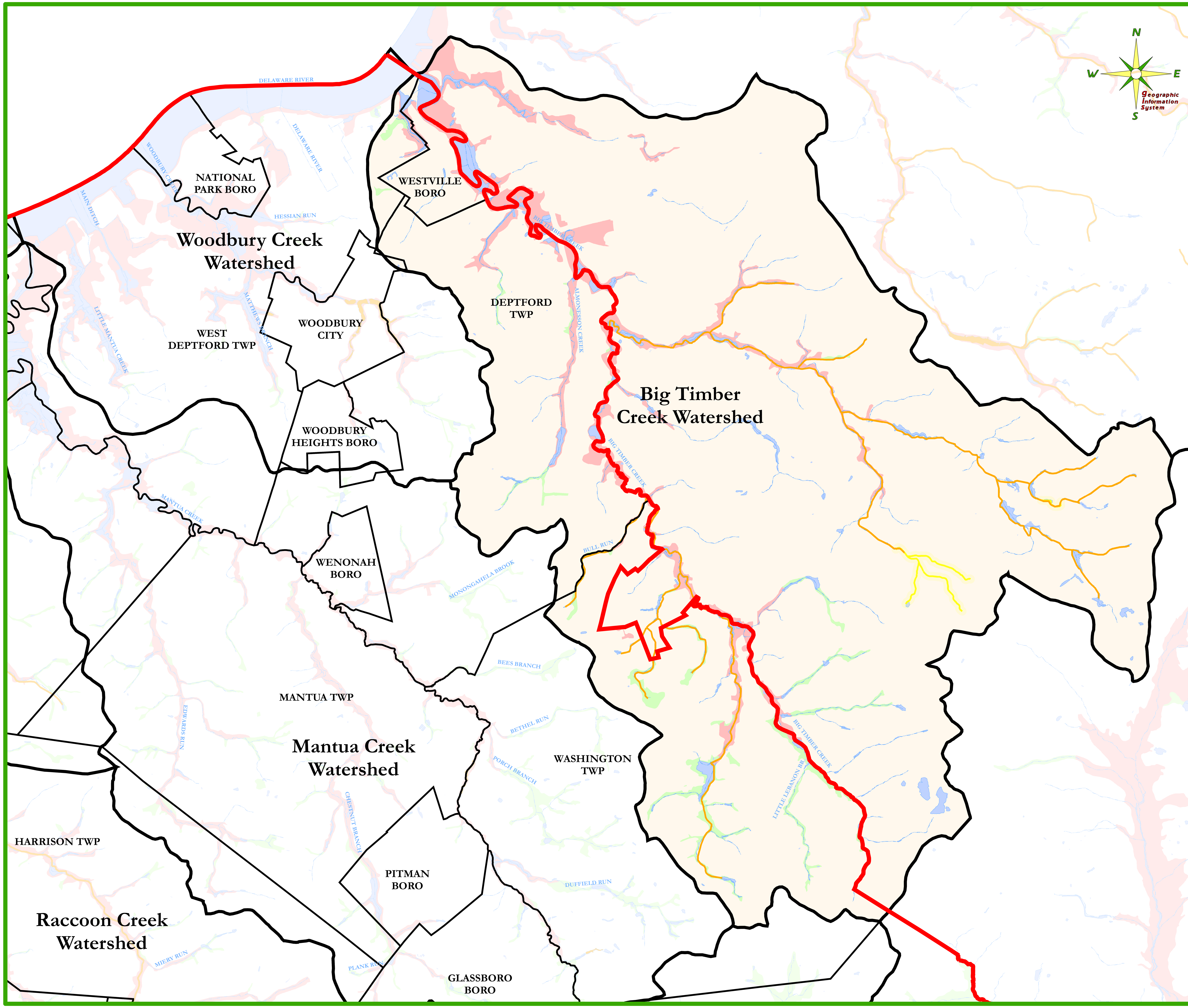


Gloucester County Stormwater Management Plan

Figure No. BT-3

WATERWAYS

Legend

3,000 1,500 0 3,000 Feet

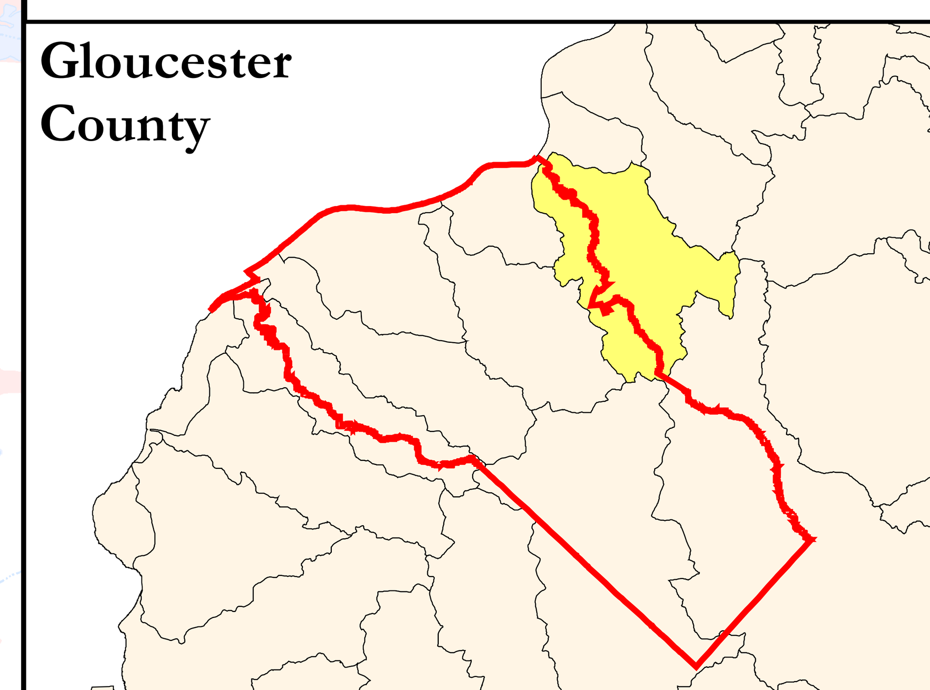
- County Boundary
- Municipal Boundary
- Watershed Boundary
- Streams (as mapped by NJDEP)
- Lakes (as mapped by NJDEP)
- Total Maximum Daily Loads for Streams
- Total Maximum Daily Loads for Lakes
- Category One Stream Segment
- Category One Buffer Area

Floodprone Areas

FLOODPRONE

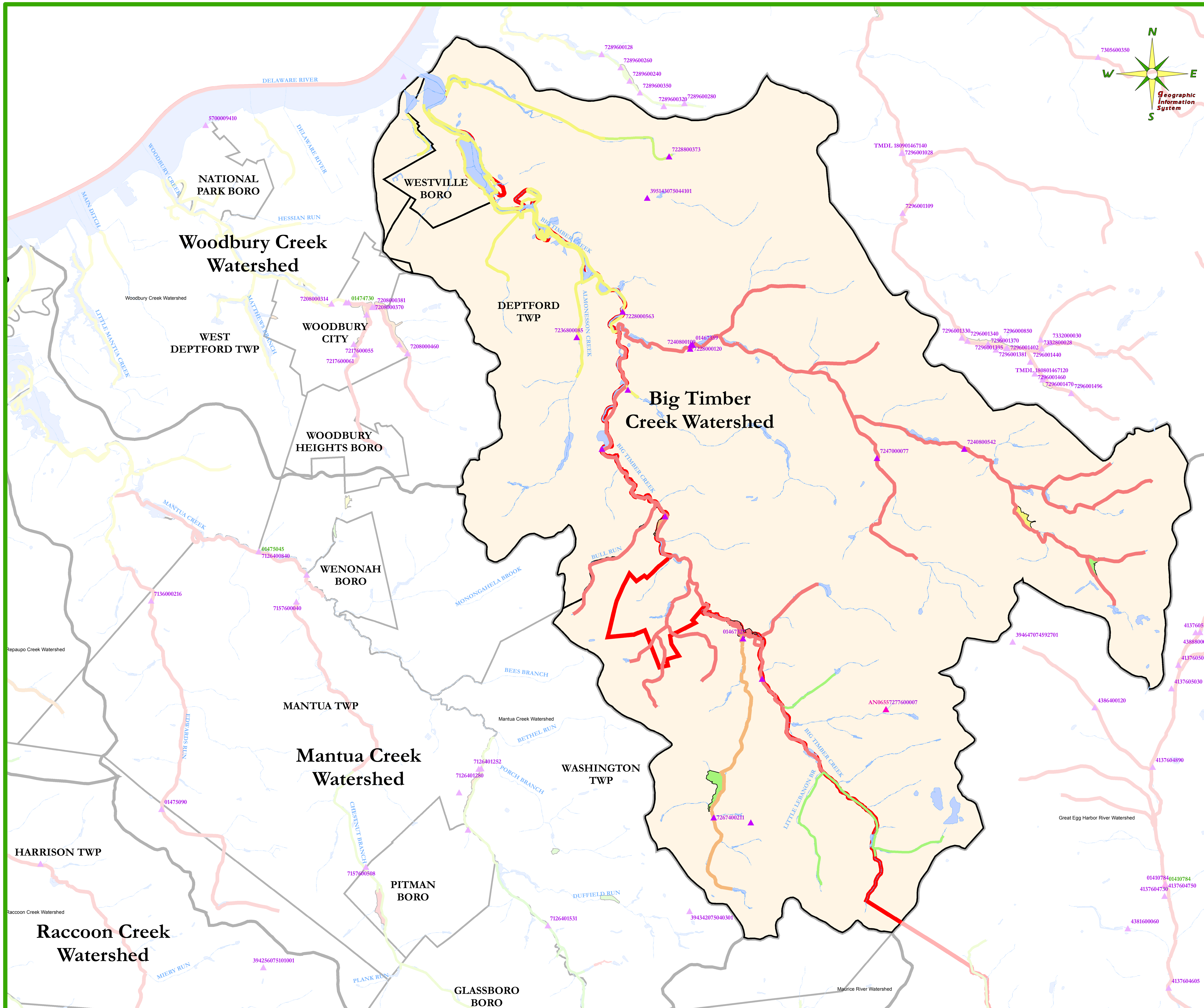
- Documented Floodprone Area
- Undocumented Floodprone Area
- Water

Gloucester County Improvement Authority
Freeholder Director
Stephen M. Sweeney, Liaison



Gloucester County, New Jersey, USA
Dated: 02/18/06 Drawn By: SEB

Note:
This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.



Gloucester County Stormwater Management Plan

Figure No. BT-4

WATER QUALITY

Legend

3,000 1,500 0 3,000 Feet

- County Boundary
- Municipal Boundary
- Watershed Boundary
- Ambient Monitoring Network Sites
- STORET Sites
- Existing Water Quality Stations
- TMDL Streams (as mapped by NJDEP)
- TMDL Lakes (as mapped by NJDEP)

NJDEP 2004 Integrated Report Results for Conventionals in Non-Tidal Rivers

OVERALL

- Full Attain
- Insufficient
- Fish Advisory Only
- List 4
- Non Attain

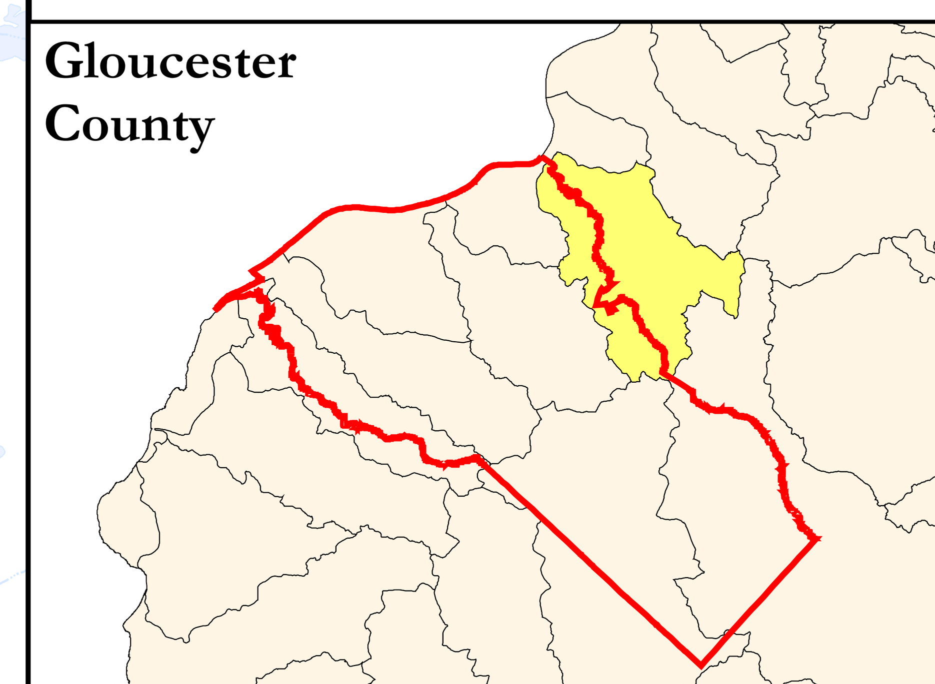
NJDEP 2004 Integrated Report Results for Lakes

OVERALL

- Full Attain
- Insufficient
- Fish Advisory Only
- List 4
- Non Attain

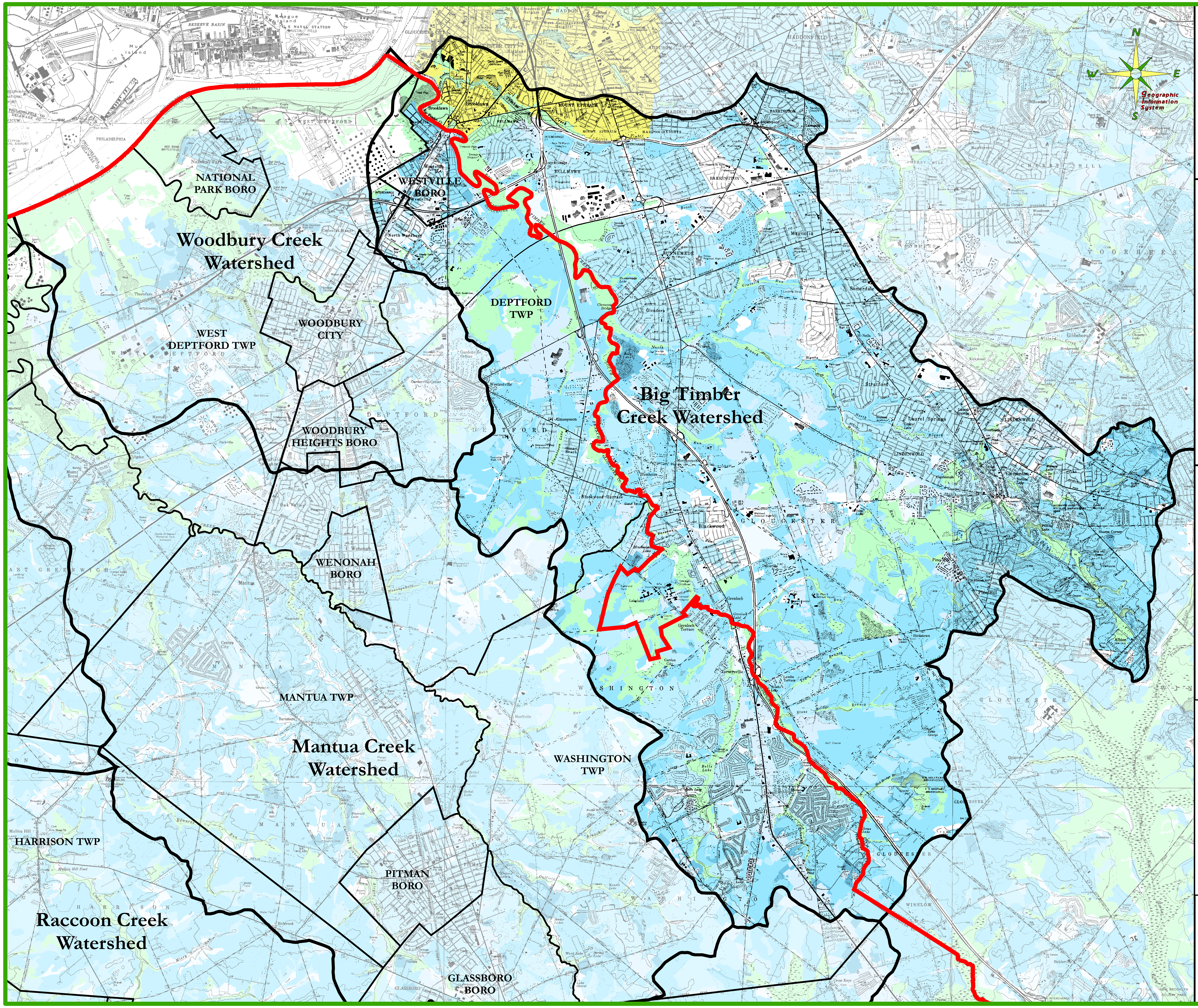
Gloucester County Improvement Authority
Freeholder Director
Stephen M. Sweeney, Liaison

Gloucester County



Gloucester County, New Jersey, USA
Dated: 02/18/06 Drawn By: SEB

Note:
This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.



Gloucester County Stormwater Management Plan

Figure No. BT-5

GROUND WATER RECHARGE

Legend

3,000 1,500 0 3,000 Feet

- County Boundary
- Municipal Boundary
- Watershed Boundary

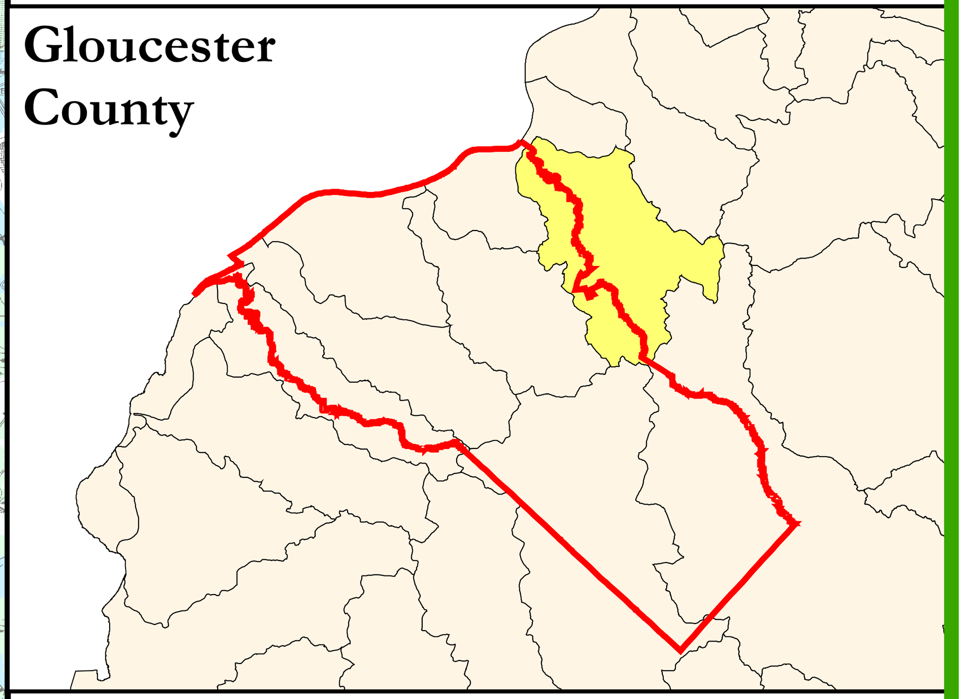
Ground Water Recharge Areas

County Ranking

- 15 to 16 in/yr
- 10 to 14 in/yr
- 8 to 9 in/yr
- 1 to 7 in/yr
- 0 in/yr
- Hydric Soils
- Wetlands and Open Water
- No Recharge Calculated

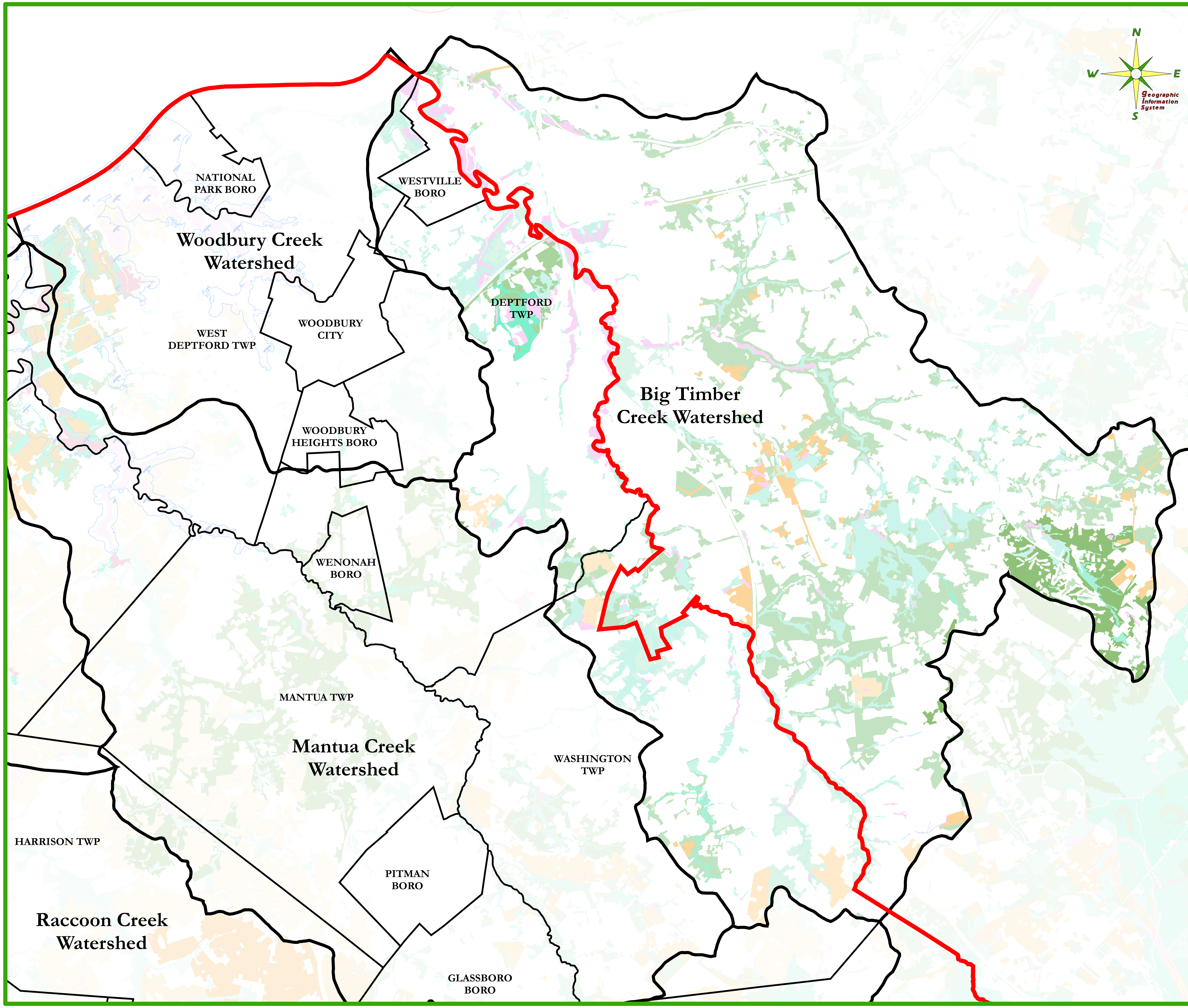
Gloucester County Improvement Authority
Freeholder Director
Stephen M. Sweeney, Liaison

THE GREAT SEAL OF THE COUNTY OF GLOUCESTER, NEW JERSEY
GLOUCESTER COUNTY IMPROVEMENT AUTHORITY



Gloucester County, New Jersey, USA
Dated: 02/18/06 Drawn By: SEB

Note:
This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.



Gloucester County Stormwater Management Plan

Figure No. BT-6

CRITICAL HABITAT

Legend

County Boundary
Municipal Boundary
Watershed Boundary
Bald Eagle Foraging Area
Urban Peregrine Falcon Nest
Wood Turtle

Beach
RANK
Suitable Habitat (1)
Priority Species (2)
State Threatened (3)
State Endangered (4)
Federal T and E (5)

Grassland
RANK
Suitable (1)
Priority Species (2)
State Threatened (3)
State Endangered (4)
Federal T and E (5)

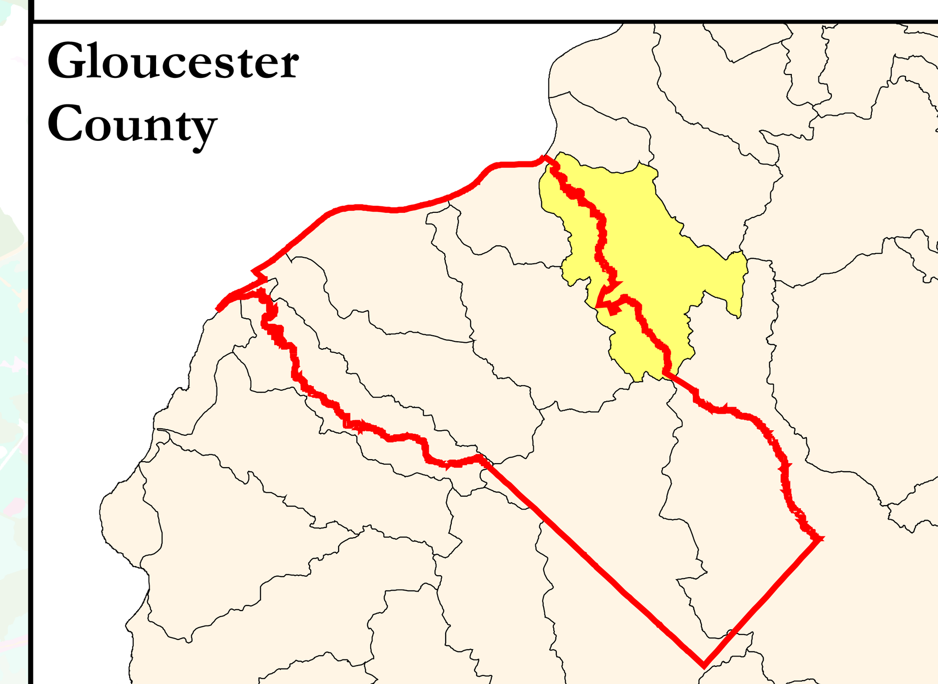
Forest
RANK
Suitable (1)
Priority Species (2)
State Threatened (3)
State Endangered (4)
Federal T and E (5)

Forested Wetland
RANK
Suitable (1)
Priority Species (2)
State Threatened (3)
State Endangered (4)
Federal T and E (5)

Emergent Wetland
RANK
Suitable Habitat (1)
Priority Species (2)
State Threatened (3)
State Endangered (4)
Federal T and E (5)

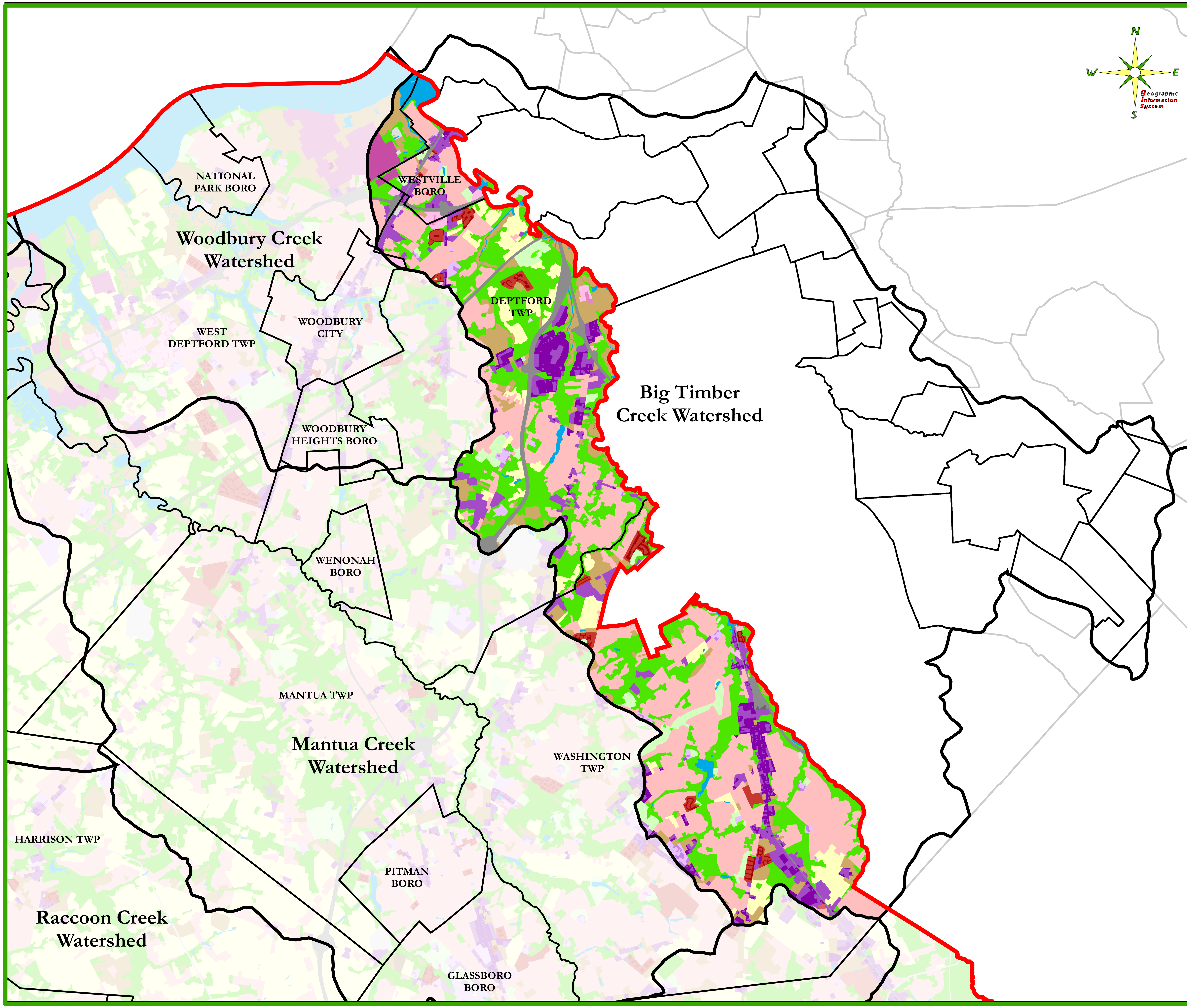
3,000 1,500 0 3,000 Feet

Gloucester County Improvement Authority
Freeholder Director
Stephen M. Sweeney, Liaison



Gloucester County, New Jersey, USA
Dated: 11/07/05 Drawn By: SEB

Note:
This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.



Gloucester County Stormwater Management Plan

Figure No. BT-7

LAND USE

Legend

3,000 1,500 0 3,000 Feet

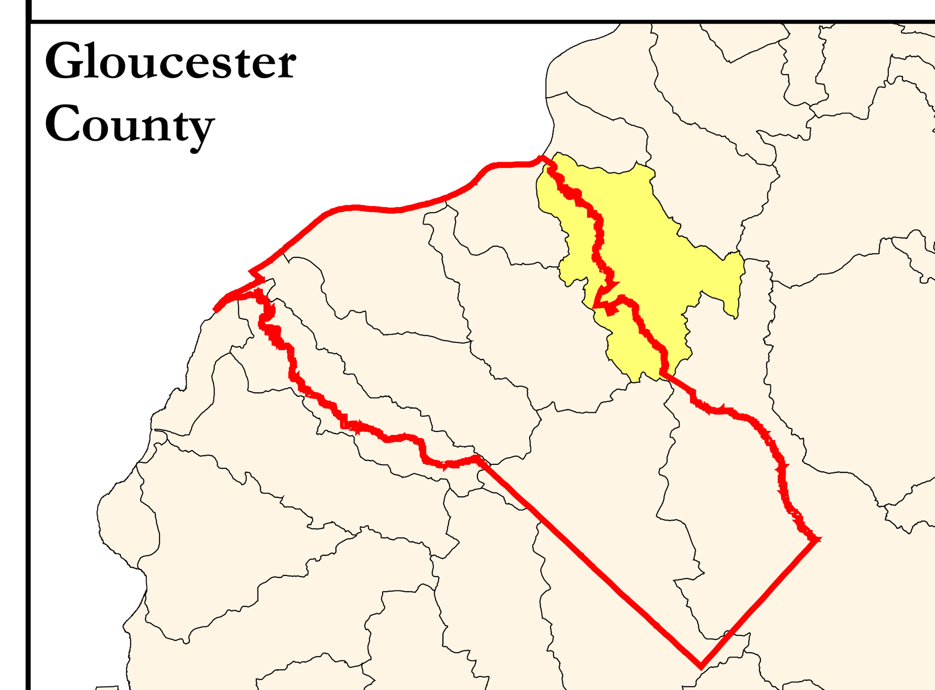
- County Boundary
- Municipal Boundary
- Watershed Boundary

Gloucester County Land Use (as mapped by DVRPC)

DESCRIPTION

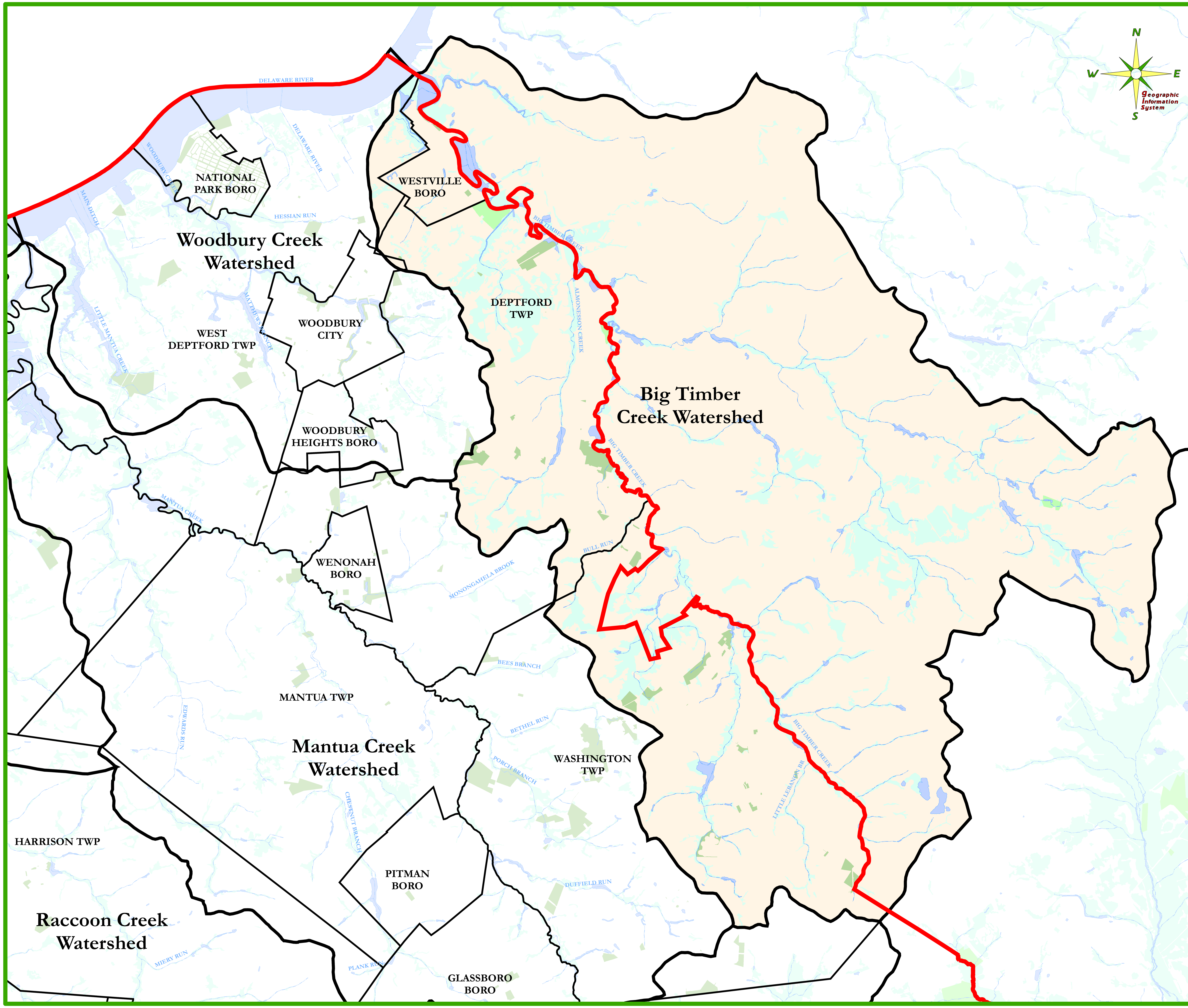
Agriculture	Recreation
Agriculture:Agricultural Bog	Parking:Recreation
Community Services	Residential:Single-Family Detached
Parking:Community Services	Residential:Row Home
Commercial	Residential:Mobile Home
Parking:Commercial	Residential:Multi-Family
Manufacturing:Light Industrial	Parking:Multi-Family
Parking:Light Manufacturing	Utility
Manufacturing:Heavy Industrial	Parking:Utility
Parking:Heavy Manufacturing	Transportation
Military	Parking:Transportation
Parking:Military	Vacant
Mining	Water
Parking:Mining	Wooded

Gloucester County
Improvement Authority
Freeholder Director
Stephen M. Sweeney, Liaison



Gloucester County, New Jersey, USA
Dated: 02/18/06 Drawn By: SEB

Note:
This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.



Gloucester County Stormwater Management Plan

Figure No. BT-8

CONSTRAINED AREAS

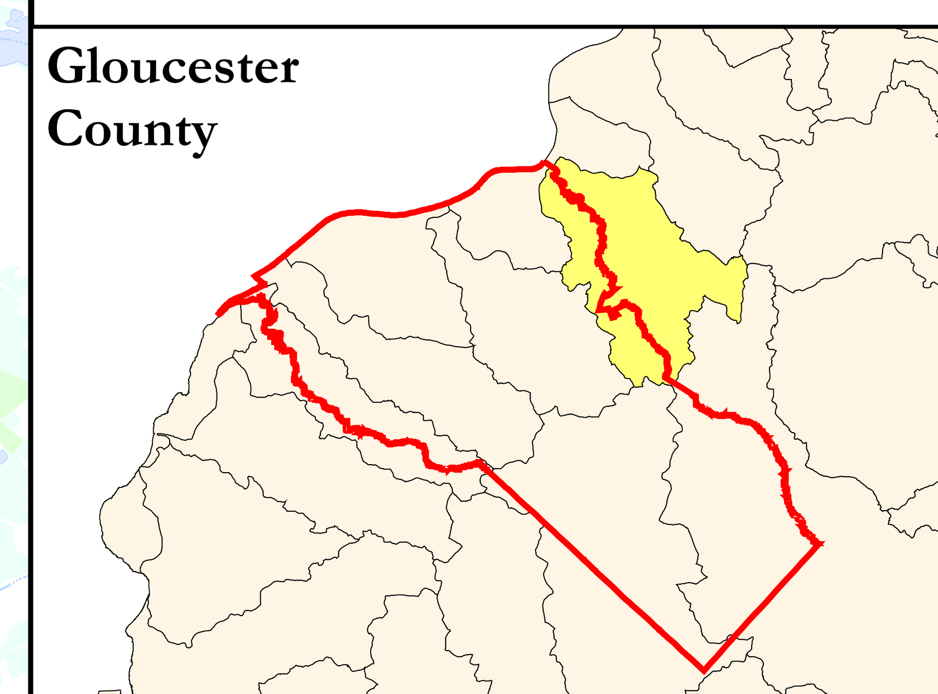
Legend

3,000 1,500 0 3,000 Feet

- County Boundary
- Municipal Boundary
- Watershed Boundary
- Streams (as mapped by NJDEP)
- Lakes (as mapped by NJDEP)
- Open Space (as mapped by NJDEP)
- County Open Space
- Wetlands (as mapped by NJDEP)

Gloucester County Improvement Authority
Freeholder Director
Stephen M. Sweeney, Liaison

THE GREAT SEAL OF THE COUNTY OF GLOUCESTER, NEW JERSEY — GLOUCESTER COUNTY IMPROVEMENT AUTHORITY



Gloucester County, New Jersey, USA
Dated: 02/18/06 Drawn By: SEB

Note:
This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.

Gloucester County Stormwater Management Plan

Figure No. 9

DATA INFORMATION

Note:
All listed data has been displayed "as-is", with no alterations, with the exception of the Category One Stream Segment and subsequent Category One Buffer Areas which were derived from the Surface Water Quality Standards.

NJDEP Streams of Atlantic, Camden, Cumberland, Gloucester, and Salem counties, New Jersey (1:24000)

Originator:
NJ Department of Environmental Protection (NJDEP), Office of Information Resources Management (OIRM), Bureau of Geographic Information and Analysis (BGIA)

Publication Date:
November 1st, 1998

Abstract:
This data represents the streams of Atlantic County, New Jersey. The hydrography stream network for this county was generated as a line ArcInfo coverage from USGS 1:24,000 Digital Line Graph(DLG) files, with subsequent editing and updating.

NJDEP Wetlands of Atlantic, Camden, Cumberland, Gloucester, and Salem counties, New Jersey, 1986

Originator:
NJ Department of Environmental Protection (NJDEP), Office of Information Resources Management (OIRM), Bureau of Geographic Information and Analysis (BGIA)

Publication Date:
November 1st, 1999

Abstract:
This is a graphical representation of this county's wetlands data and it contains all the tidal and non-tidal wetlands as of 1986. It was created by reselecting wetlands out of this county's 1986 LULC (land use/land cover) data. This was done so that this new data would contain both tidal and non-tidal wetlands.

NJDEP Existing Water Quality Stations in New Jersey

Originator:
New Jersey Department of Environmental Protection (NJDEP), Division of Land Use Management (LUM), Water Monitoring & Standards, Bureau of Freshwater Biological Monitoring (BFBM)

Publication Date:
May 12th, 2003

Abstract:
This data represents sampling points for the EWQ (Existing Water Quality) project at NJDEP. The EWQ Network was designed to provide supplemental data for water quality for the entire state.

NJDEP 2004 Integrated Report Results for Lakes

Originator:
New Jersey Department of Environmental Protection (NJDEP), Water Assessment Team (WAT)

Publication Date:
June, 2004

Abstract:
This data represents the 2004 Integrated Report final assessment results for aquatic life and recreation designated uses as well as fish advisories and eutrophication assessments of lakes. The assessments are based on data from the NJDEP Bureau of Freshwater Fisheries, local and county health departments, and NJDEP Clean Lakes Program.

NJDEP 2004 Integrated Report Results for Conventionals in Non-Tidal Rivers

Originator:
New Jersey Department of Environmental Protection, Water Assessment Team

Publication Date:
March, 2003

Abstract:
This data represents the 2004 Integrated Report final assessment results for conventionals, aquatic life, metals, toxics, fish advisories, and shellfish harvesting for rivers in New Jersey. Also included are data for location of the rivers, monitoring station where data came from, and parameters listed on the 1998 303(d) list (for conventionals, metals, and toxics only).

Gloucester County Open Space

Originator:
Civil Solutions; Adams, Rehmann, and Heggan, Assoc. Inc.

Publication Date:
Currently Unpublished

Abstract:
This data contains all the open space areas for Gloucester County, NJ, as defined by the MODIV tax data created by Civil Solutions. Property Class Codes were evaluated to show public propeties.

NJDEP Open Water Areas of Atlantic, Camden, Cumberland, Gloucester, and Salem counties, New Jersey 1986 (1:24000)

Originator:
NJ Department of Environmental Protection (NJDEP), Office of Information Resources Management (OIRM), Bureau of Geographic Information and Analysis (BGIA)

Publication Date:
November 1st, 1998

Abstract:
This data contains all the open water areas for this county as of 1986. Open water areas such as as lakes, ponds, tidal waters, reservoirs, bays, etc., are included. This file was created by reselecting the water series out of its LULC (land use/land cover) data. The following reselect was performed on LULC in ArcView to create this data: land_use greater than 5000 and land_use less than 6000 (the numeric codes refer to the Anderson classification system, and represent all codes that refer to bodies of water). Non-open water wetlands polygons can be found in the county's "Wetlands" data and the streams in its "Streams" data.

Category One Stream Segments and Buffer Areas

Derived from: NJDEP Surface Water Quality Standards of New Jersey
Civil Solutions Query: ["ANTIDEG" = 'C1'], Buffer = 300

Originator:
NJ Department of Environmental Protection, Division of Landuse Management, Bureau of Freshwater & Biological Monitoring

Publication Date:
August 4th, 2005

Abstract:
This data is a digital representation of New Jersey's Surface Water Quality Standards in accordance with "Surface Water Quality Standards for New Jersey Waters" as designated in N.J.A.C. 7:9 B. The Surface Water Quality Standards (SWQS) establish the designated uses to be achieved and specify the water quality (criteria) necessary to protect the State's waters. Designated uses include potable water, propagation of fish and wildlife, recreation, agricultural and industrial supplies, and navigation. These are reflected in use classifications assigned to specific waters. The linework has been broken/altered to reflect the location written in the standards text. When interpreting the surface water quality standards, the Surface Water Quality Standards regulations at N.J.A.C. 7:9B always take precedence. The GIS layer is supplemental only and is not legally binding.

NJDEP Flood-Prone Areas of Atlantic, Camden, Cumberland, Gloucester, and Salem Counties, NJ

Originator:
NJ Department of Environmental Protection (NJDEP), Office of Information Resources Management (OIRM), Bureau of Geographic Information and Analysis (BGIA)

Publication Date:
February 1st, 1996

Abstract:
The flood-prone areas have been delineated through the use of readily available information on past floods rather than from detailed surveys and inspections. In general, the delineated areas are for natural conditions and do not take into consideration the possible effects of existing or proposed flood control structures except where those effects could be evaluated. Flood areas have been identified for: (1) urban areas where the upstream drainage basin exceeds 25 square miles, (2) rural areas in humid regions where the upstream drainage basin exceeds 100 square miles, (3) rural areas where in semiarid regions where the upstream drainage basin exceeds 250 square miles, and (4) smaller drainage basins, depending on topography and potential use of the flood plains.

NJDEP Total Maximum Daily Loads (TMDLs) for Fecal Streams

Originator:
NJ Department of Environmental Protection (NJDEP), Bureau of Environmental Analysis and Restoration (BEAR)

Publication Date:
September 29th, 2003

Abstract:
The pollutant of concern for these Stream TMDLs is pathogens, the presence of which is indicated by elevated concentrations of fecal coliform bacteria. Fecal coliform concentrations were found to exceed New Jersey's Surface Water Quality Standards (SWQS), published at N.J.A.C. 7-9B et seq., for the segments identified in the Reports. In accordance with Section 305(b) of the Federal Clean Water Act (CWA), the State of New Jersey developed the 2002 Integrated List of Waterbodies, addressing the overall water quality of the State's waters and identifying impaired waterbodies for which Total Maximum Daily Loads (TMDLs) may be necessary. As reported in the 2002 Integrated List of Waterbodies, also identified is the river miles and management response associated with each listed segment. All of these waterbodies have a high priority ranking, as described in the 2002 Integrated List of Waterbodies.

NJDEP Total Maximum Daily Loads (TMDL) for Eutrophication Lakes

Originator:
NJ Department of Environmental Protection (NJDEP), Bureau of Environmental Analysis and Restoration (BEAR)

Publication Date:
September 29th, 2003

Absract:
The pollutant of concern for the Eutrophic Lake TMDLs is phosphorus. Phosphorus is an essential nutrient for plants and algae, but is considered a pollutant when it stimulates excessive plant and algae growth. Overgrown vegetation and algae blooms in lakes can prevent recreational use for fishing and swimming. In severe cases, plant and algae die-off can deplete oxygen in the lake raising the potential for killing fish in the lake.
Potential sources of phosphorus include discharges from sewage treatment plants, combined sewer overflows and stormwater runofff. As stormwater flows over the land, it may pick up phosphorus. Phosphorus contributions to stormwater runoff are calculated based on land uses within the lake's watershed.

NJDEP State Owned, Protected Open Space and Recreation Areas in New Jersey

Originator:
NJ Department of Environmental Protection (NJDEP), Green Acres

Publication Date:
1995

Abstract:
This data set contains protected open space and recreation areas owned in fee simple interest by the State of New Jersey Department of Environmental Protection (NJDEP). Types of property in this data layer include parcels such as parks, forests, historic sites, natural areas and wildlife management areas. The data was derived from a variety of source maps including tax maps, surveys and even hand-drafted boundary lines on USGS topographic maps. These source materials vary in scale and level of accuracy. Due to the varied mapped sources and methods of data capture, this data set is limited in its ability to portray all open space lands accurately, particularly the parcels purchased prior to 1991.

DVRPC Land Use for 2000 Gloucester County, New Jersey

Originator:
Delaware Valley Regional Planning Commission

Publication Date:
March, 2004

Abstract:
Every five years, since 1990, the Delaware Valley Regional Planning Commission has produced a GIS Land Use layer for its 9-county region. In 2000, digital orthophotography was flown by DVRPC. Utilizing this orthophotography, all Land Use annotation and digitizing was performed on-screen, or "heads-up," a first at DVRPC. Digitizing was done using ESRI ArcGIS 8 software at a 1:2400 (1 inch = 200 feet) scale. An ArcGIS Personal GeoDatabase was created for each county in the DVRPC region. These Personal GeoDatabases were then exported to ESRI shapefiles for distribution to the public.

STORET Water Quality Monitoring Stations

Originator:
New Jersey Department of Environmental Protection (NJDEP), NJDEP Bureau of Freshwater Biological Monitoring

Publication Date:
2004

Abstract:
The STORET data maintains the locations of water quality monitoring stations from NJDEP's NJ STORET (Modernized) database. A station is a location at which a data collection event takes place, such a collection of a field sample, measurement of field parameters or evaluation of environmental habitats. NJ STORET maintains NJDEP's water quality monitoring data from January 1, 1999 to the present. Note: water quality monitoring data sampled prior to this date is stored in EPA's Legacy STORET database.

NJDEP AMNET Reference Sites with Ecoregion Sections for New Jersey

Originator:
New Jersey Department of Environmental Protection (NJDEP), Division of Watershed Management, Water Monitoring Management, Bureau of Freshwater Biological Monitoring

Publication Date:
February 26th, 2000

Abstract:
This data represents reference sites for the AMNET project at NJDEP. The NJDEP AMNET database supplied the list of sites (ecoregion table). The locations were selected because they were minimally impacted, had sampling data for 4 seasons, and provided a good point of comparison for other sites.

New Jersey Geologic Survey - DGS02-3: Ground-Water Recharge for New Jersey

Originator:
Mark French, NJGS/BGWRE

Publication Date:
Currently Unpublished Material

Abstract:
An estimation of ground-water recharge for Altantic 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.

New Jersey 2002 High Resolution Orthophotography (MrSID format)

Originator:
State of New Jersey Office of Information Technology, Office of Geographic Information Systems

Publication Date:
July 31st, 2003

Abstract:
Digital color infrared (CIR) orthophotography of New Jersey in State Plane NAD83 Coordinates, U.S. Survey Feet. The digital orthophotography was produced at a scale of 1:2400 (1"=200') with a 1 foot pixel resolution. Digital orthophotography combines the image characteristics of a photograph with the geometric qualities of a map. Digital orthophotography is a process which converts aerial photography from an original photo negative to a digital product that has been positionally corrected for camera lens distortion, vertical displacement and variations in aircraft altitude and orientation. Aerial photography of the entire State of New Jersey was captured during February-April, 2002. The ortho-rectification process achieved a +/-4.0 ft. horizontal accuracy at a 95% confidence level, National Standard for Spatial Data Accuracy (NSSDA). This dataset consists of 5000' x 5000' files in MrSID format with a 15:1 compresssion ratio. The files were produced utilizing MrSID Geospatial Edition 1.4 and are approximately 5 MB in size.

NJDEP Forest

Originator:
New Jersey Department of Environmental Protection (NJDEP), Division of Fish Wildlife, Endangered Nongame Species Program (ENSP)

Publication Date:
October 23rd, 2004

Abstract:
The Forest data depicts critical area maps for forest-dependent species which are generated by selecting specific land-use classes from the NJDEP's LULC data set. This data set is a product of the Landscape Project, a pro-active, ecosystem-level approach to the long-term protection of imperiled and priority species and their important habitats in New Jersey. Version 1 was created by intersecting imperiled and priority species data with 1995 cover data derived from TM satellite imagery. This version (version 2) was created by intersecting imperiled and priority species data with NJDEP 1995/97 Land use/Land cover Update. The resulting data layer identifies, delineates and ranks (based on the conservation status of species present) habitat statewide. Each patch is coded for the number of sightings of priority, state threatened, state endangered and federally listed species present. The data is designed to be used for state and local planning, open space acquisition and land-use regulation.

NJDEP Forested Wetland

Originator:
New Jersey Department of Environmental Protection (NJDEP), Division of Fish Wildlife, Endangered Nongame Species Program (ENSP)

Publication Date:
October 23rd, 2004

Abstract:
The Forested Wetland data depicts critical area maps for dependent species which are generated by selecting specific land-use classes from the NJDEP's LULC data set. This data set is a product of the Landscape Project, a pro-active, ecosystem-level approach to the long-term protection of imperiled and priority species and their important habitats in New Jersey. Version 1 was created by intersecting imperiled and priority species data with 1995 cover data derived from TM satellite imagery. This version (version 2) was created by intersecting imperiled and priority species data with NJDEP 1995/97 Land use/Land cover Update. The resulting data layer identifies, delineates and ranks (based on the conservation status of species present) habitat statewide. Each patch is coded for the number of sightings of priority, state threatened, state endangered and federally listed species present. The data is designed to be used for state and local planning, open space acquisition and land-use regulation.

NJDEP Emergent Wetland

Originator:
New Jersey Department of Environmental Protection (NJDEP), Division of Fish Wildlife, Endangered Nongame Species Program (ENSP)

Publication Date:
October 23rd, 2004

Abstract:
The Emergent Wetland data depicts critical area maps for dependent species which are generated by selecting specific land-use classes from the NJDEP's LULC data set. This data set is a product of the Landscape Project, a pro-active, ecosystem-level approach to the long-term protection of imperiled and priority species and their important habitats in New Jersey. Version 1 was created by intersecting imperiled and priority species data with 1995 cover data derived from TM satellite imagery. This version (version 2) was created by intersecting imperiled and priority species data with NJDEP 1995/97 Land use/Land cover Update. The resulting data layer identifies, delineates and ranks (based on the conservation status of species present) habitat statewide. Each patch is coded for the number of sightings of priority, state threatened, state endangered and federally listed species present. The data is designed to be used for state and local planning, open space acquisition and land-use regulation.

NJDEP Beach

Originator:
New Jersey Department of Environmental Protection (NJDEP), Division of Fish Wildlife, Endangered Nongame Species Program (ENSP)

Publication Date:
October 23rd, 2004

Abstract:
The Beach data depicts critical area maps for beach-dependent species which are generated by selecting specific land-use classes from the NJDEP's LULC data set. This data set is a product of the Landscape Project, a pro-active, ecosystem-level approach to the long-term protection of imperiled and priority species and their important habitats in New Jersey. Version 1 was created by intersecting imperiled and priority species data with 1995 cover data derived from TM satellite imagery. This version (version 2) was created by intersecting imperiled and priority species data with NJDEP 1995/97 Land use/Land cover Update. The resulting data layer identifies, delineates and ranks (based on the conservation status of species present) habitat statewide. Each patch is coded for the number of sightings of priority, state threatened, state endangered and federally listed species present. The data is designed to be used for state and local planning, open space acquisition and land-use regulation.

NJDEP Grassland

Originator:
New Jersey Department of Environmental Protection (NJDEP), Division of Fish Wildlife, Endangered Nongame Species Program (ENSP)

Publication Date:
October 23rd, 2004

Absract:
The Grassland data depicts critical area maps for grassland -dependent species which are generated by selecting specific land-use classes from the NJDEP's LULC data set. This data set is a product of the Landscape Project, a pro-active, ecosystem-level approach to the long-term protection of imperiled and priority species and their important habitats in New Jersey. Version 1 was created by intersecting imperiled and priority species data with 1995 cover data derived from TM satellite imagery. This version (version 2) was created by intersecting imperiled and priority species data with NJDEP 1995/97 Land use/Land cover Update. The resulting data layer identifies, delineates and ranks (based on the conservation status of species present) habitat statewide.
Each patch is coded for the number of sightings of priority, state threatened, state endangered and federally listed species present. The data is designed to be used for state and local planning, open space acquisition and land-use regulation.

NJDEP Urban Peregrine

Originator:
New Jersey Department of Environmental Protection (NJDEP), Division of Fish Wildlife, Endangered Nongame Species Program (ENSP)

Publication Date:
October 23rd, 2001

Abstract:
This data set is a product of the Landscape Project, a pro-active, ecosystem-level approach to the long-term protection of imperiled and priority species and their important habitats in New Jersey. Peregrine falcon records have been separated into 2 types, urban and non-urban. Non-urban records are treated the same way they were in version 1.0. Nesting locations are buffered with a 1-km radius. Suitable emergent wetland patches that intersect with this buffer are designated as critical. In version 2.0 urban nesting locations are buffered with a 1-km radius. These urban peregrine buffers are no longer used to value patches, the urban peregrine buffer is a stand-alone GIS layer.

NJDEP Bald Eagle Foraging

Originator:
New Jersey Department of Environmental Protection (NJDEP), Division of Fish Wildlife, Endangered Nongame Species Program (ENSP)

Publication Date:
October 23rd, 2001

Abstract:
This data set is a product of the Landscape Project, a pro-active, ecosystem-level approach to the long-term protection of imperiled and priority species and their important habitats in New Jersey. All known bald eagle nests are recorded using GPS equipment. To run the model, all water polygons from the DEP LULC having an area greater than 8 hectares are converted to a 5 meter grid. A radius around the nest site is incrementally increased, one cell (5 m) at a time, until an area of 660 ha of open water has been identified. All emergent wetland patches within 90 meters of the identified water are selected. These emergent patches are merged with the identified open water to become the foraging habitat. A 90-meter buffer is applied to the identified foraging habitat to protect perching sites. In the previous version (1.0) all suitable habitat patches that intersected with the foraging habitat and 90-m buffer were designated as critical. In version 2.0 bald eagle foraging habitat, and its associated 90-meter buffer, is no longer used to value patches that intersect with it. The bald eagle foraging model is a stand-alone GIS layer.

NJDEP Wood Turtle

Originator:
New Jersey Department of Environmental Protection (NJDEP), Division of Fish Wildlife, Endangered Nongame Species Program (ENSP)

Publication Date:
October 23rd, 2001

Abstract:
This data set is a product of the Landscape Project, a pro-active, ecosystem-level approach to the long-term protection of imperiled and priority species and their important habitats in New Jersey. 1) A 322 meter (0.2 miles) buffer is applied to all streams (NJDEP Streams of Blank County) within a one mile radius of each wood turtle sighting location. The buffers are clipped so that all areas being designated as critical wood turtle habitat are within one mile of a wood turtle sighting. 2) The NJDEP LULC layer is overlaid on the buffered areas. All areas classified as urban, with the exception of powerline corridors, are deleted from the buffered areas. 3) Next, the NJDEP Freshwater Wetlands layer is overlaid on the stream buffers, and all wetlands that are contiguous with the buffered areas are selected and clipped to only include wetlands within one mile of a sighting. Those wetlands are then merged into the stream buffers. 4) Lastly, a staff turtle biologist conducts a detailed inspection and revision of each resultant polygon to ensure biological accuracy. The wood turtle model is a stand-alone layer that is not used to value habitat patches.

Project Completed by:

CHURCHILL Consulting Engineers

arh ENGINEERS SURVEYORS PLANNERS

melvin|kernan development strategies

for:

Gloucester County Improvement Authority
Freeholder Director
Stephen M. Sweeney, Liaison