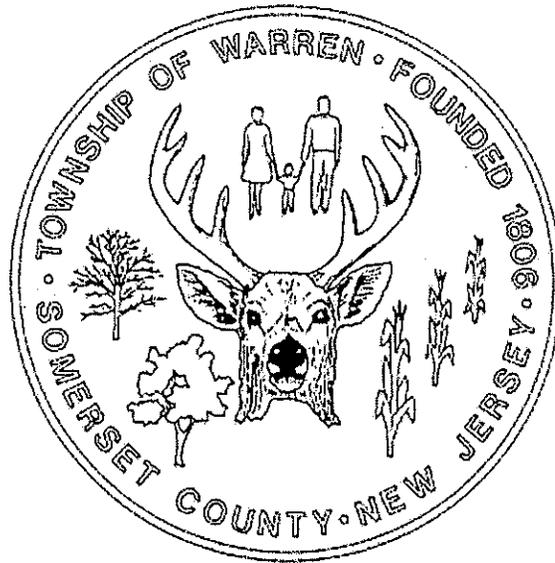


# Municipal Stormwater Management Plan



for  
**Warren Township**  
**Somerset County, New Jersey**

Prepared by:

**DPK CONSULTING, L.L.C.**

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Middlesex, New Jersey 08846

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Christian M. Kastrud, P.E.  
New Jersey Professional Engineer No. 41612  
**February 2005**

**Insert Adopting Ordinance Here**

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Daniel Gallic, Vice-Chairman  
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## **Introduction**

This Municipal Stormwater Management Plan (MSWMP) documents the strategy for Warren Township ("the Township") to address stormwater related impacts. The creation of this plan is required by N.J.A.C. 7:14A-25 Municipal Stormwater Regulations. This plan contains all of the required elements described in N.J.A.C. 7:8 Stormwater Management Rules. The plan addresses groundwater recharge, stormwater quantity, and stormwater quality impacts by incorporating stormwater design and performance standards for new major development, defined as projects that disturb one or more acre of land. These standards are intended to minimize the adverse impact of stormwater runoff on water quality and water quantity and the loss of groundwater recharge that provides baseflow in receiving water bodies. The plan describes long-term operation and maintenance measures for existing and future stormwater facilities.

This plan also addresses the review and update of existing ordinances, the Township Master Plan, and other planning documents to allow for project designs that include low impact development techniques. In addition, the plan includes a mitigation strategy for when a variance or exemption of the design and performance standards is sought. As part of the mitigation section of the stormwater plan, specific stormwater management measures are identified to lessen the impact of existing development.

## **MSWMP Goals**

The goals of this MSWMP are to:

1. Reduce flood damage, including damage to life and property;
2. Minimize, to the extent practical, any increase in stormwater runoff from any new development;
3. Reduce soil erosion from any development or construction project;
4. Assure the adequacy of existing and proposed culverts and bridges, and other in-stream structures;
5. Maintain groundwater recharge
6. Prevent, to the greatest extent feasible, an increase in nonpoint pollution;
7. Maintain the integrity of stream channels for their biological functions, as well as for drainage;

8. Minimize pollutants in stormwater from new and existing development to restore, enhance, and maintain the chemical, physical, and biological integrity of the waters of the state, to protect public health, to safeguard fish and aquatic life and scenic and ecological values and to enhance the domestic, municipal, recreational, industrial, and other uses of water; and
9. Protect public safety through the proper design and operation of stormwater basins.

In addition to the above State-mandated goals described above, the Township also encourages the following as set forth in the Master Plan of Warren Township and Reexamination Report adopted 6-4-01:

*"Preserve remaining open and forested land, natural feature areas, waterways..."*

*"Preserve steep slopes and existing stream corridors..."*

*"Continue environmental suitability analysis for development of land."*

To achieve these goals, this plan outlines specific stormwater design and performance standards for new development. Additionally, the plan proposes stormwater management controls to address impacts from existing development. Preventive and corrective maintenance strategies are included in the plan to ensure long-term effectiveness of stormwater management facilities. The plan also outlines safety standards for stormwater infrastructure to be implemented to protect public safety.

### **Stormwater Discussion**

Land development can dramatically alter the hydrologic cycle (see Figure 1) of a site and, ultimately, an entire watershed. Prior to development, native vegetation can either directly intercept precipitation or draw that portion that has infiltrated into the ground and return it to the atmosphere through evapotranspiration. Development can remove this beneficial vegetation and replace it with lawn or impervious cover, reducing the site's evapotranspiration and infiltration rates. Clearing and grading a site can remove depressions that store rainfall. Construction activities may also compact the soil and diminish its infiltration ability, resulting in increased volumes and rates of stormwater runoff from the site. Impervious areas that are

connected to each other through gutters, channels, and storm sewers can transport runoff more quickly than natural areas. This shortening of the transport or travel time quickens the rainfall-runoff response of the drainage area, causing flow in downstream waterways to peak faster and higher than natural conditions. These increases can create new and aggravate existing downstream flooding and erosion problems and increase the quantity of sediment in the channel. Filtration of runoff and removal of pollutants by surface and channel vegetation is eliminated by storm sewers that discharge runoff directly into a stream. Increases in impervious area can also decrease opportunities for infiltration which, in turn, reduces stream base flow and groundwater recharge. Reduced base flows and increased peak flows produce greater fluctuations between normal and storm flow rates, which can increase channel erosion. Reduced base flows can also negatively impact the hydrology of adjacent wetlands and the health of biological communities that depend on base flows. Finally, erosion and sedimentation can destroy habitat from which some species cannot adapt.

In addition to increases in runoff peaks, volumes, and loss of groundwater recharge, land development often results in the accumulation of pollutants on the land surface that runoff can mobilize and transport to streams. New impervious surfaces and cleared areas created by development can accumulate a variety of pollutants from the atmosphere, fertilizers, animal wastes, and leakage and wear from vehicles. Pollutants can include metals, suspended solids, hydrocarbons, pathogens, and nutrients.

In addition to increased pollutant loading, land development can adversely affect water quality and stream biota in more subtle ways. For example, stormwater falling on impervious surfaces or stored in detention or retention basins can become heated and raise the temperature of the downstream waterway, adversely affecting cold water fish species such as trout. Development can remove trees along stream banks that normally provide shading, stabilization, and leaf litter that falls into streams and becomes food for the aquatic community.

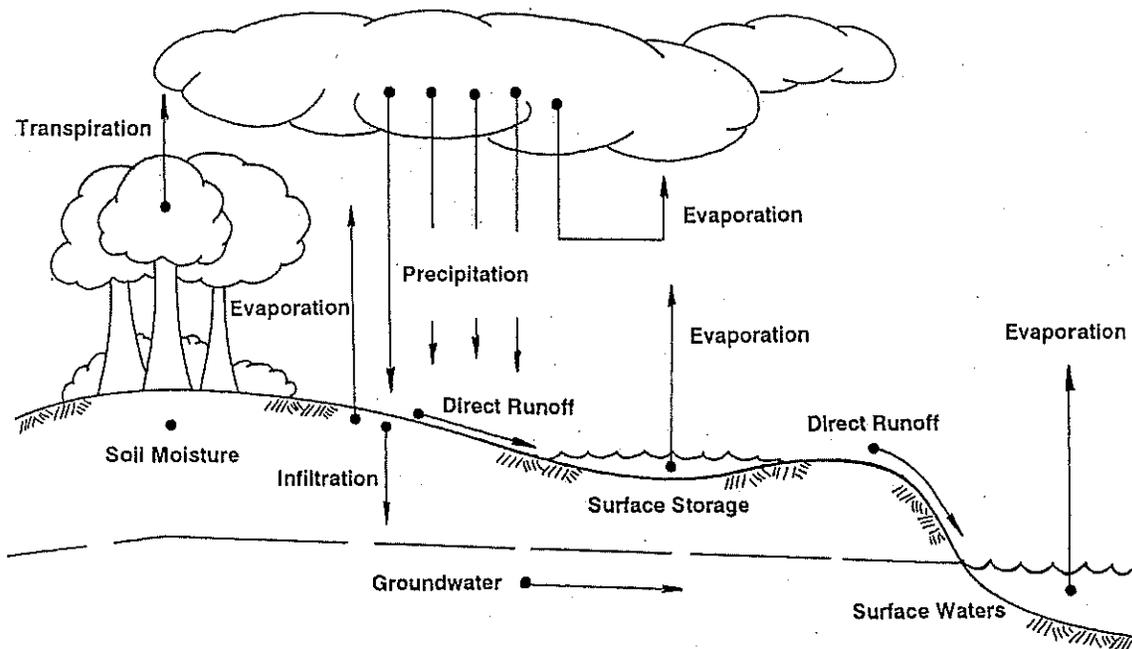


Figure 1 – Hydrologic Cycle

## **Background**

The Township encompasses 12, 355 acres (19.3 square miles) in the northeastern part of Somerset County, New Jersey. Warren was historically an agricultural community, but has now developed to a rural suburban community. The largest single land use in Warren is residential. The majority of the residential development is one to one-and-one-half acre lots. The undeveloped areas that exist are various farms and open space preserves scattered throughout the township. Stream and rivers within the Township are shown in Figure 2 and the topography of the Township is shown in Figure 3.

According to the 2000 census, the Township has 14,259 residents. The population rose approximately 32 percent since the 1990 census. This population increase is significantly more than the overall state and county increases of approximately 9 and 24 percent respectively over the same period.

The Township is situated along the south side of the Passaic River. Half of the township is in the Passaic River Basin and half is in the Raritan River Basin. It is located in Watershed Management Areas (WMA's) 6 and 9. WMA-6 is the Upper & Mid Passaic, Whippany and

Rockaway and WMA-9 is the Lower Raritan, South River and Lawrence.  
The Township contains portions of Hydrologic Unit Code (HUC) areas

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02030105120010  
02030105120030  
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#### **What are Hydrologic Unit Codes?**

Adapted from Seaber, P.R., Kapinos, F.P., and Knapp, G.L., 1987, Hydrologic Unit Maps: U.S. Geological Survey Water-Supply Paper 2294, 63 p. Updated information not from this source is enclosed in square brackets. A copy of USGS Water-Supply Paper 2294 may be ordered from [USGS Information Services](#)

The United States is divided and sub-divided into successively smaller hydrologic units which are classified into four levels: regions, sub-regions, accounting units, and cataloging units. The hydrologic units are arranged within each other, from the smallest (cataloging units) to the largest (regions). Each hydrologic unit is identified by a unique hydrologic unit code (HUC) consisting of two to eight digits based on the four levels of classification in the hydrologic unit system.

The first level of classification divides the Nation into 21 major geographic areas, or regions. These geographic areas contain either the drainage area of a major river, such as the Missouri region, or the combined drainage areas of a series of rivers, such as the Texas-Gulf region, which includes a number of rivers draining into the Gulf of Mexico. Eighteen of the regions occupy the land area of the conterminous United States. Alaska is region 19, the Hawaii Islands constitute region 20, and Puerto Rico and other outlying Caribbean areas are region 21. [The regions are shown in figure 1.]

The second level of classification divides the 21 regions into 222 subregions. A subregion includes the area drained by a river system, a reach of a river and its tributaries in that reach, a closed basin(s), or a group of streams forming a coastal drainage area.

The third level of classification subdivides many of the subregions into accounting units. These 352 hydrologic accounting units nest within, or are equivalent to, the subregions.

The fourth level of classification is the cataloging unit, the smallest element in the hierarchy of hydrologic units. [Efforts are underway to add further levels of subdivisions.] A cataloging unit is a geographic area representing part of all of a surface drainage basin, a combination of drainage basins, or a distinct hydrologic feature. These units subdivide the subregions and accounting units into smaller areas. There are 2150 Cataloging Units in the Nation

These HUC14 areas are shown in Figure 4.

The New Jersey Department of Environmental Protection (NJDEP) has established an Ambient Biomonitoring Network (AMNET) to document the health of the state's waterways. There are over 800 AMNET sites throughout New Jersey. These sites are sampled for benthic macroinvertebrates by NJDEP on a five-year cycle. Streams are classified as non-impaired, moderately impaired, or severely impaired based 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.

Based on the AMNET data, the waterbodies bordering the Township are moderately to significantly impaired. The closest AMNET site is located on Middle Brook at Green Valley Road. There are also AMNET sites upstream on the Passaic River at Valley Road in Bernards Township.

A TMDL is the amount of a pollutant that can be accepted by a waterbody without causing an exceedance of water quality standards or interfering with the ability to use a waterbody for one or more of its

designated uses. The allowable load is allocated to the various sources of the pollutant, such as stormwater and wastewater discharges, which require an NJPDES permit to discharge, and nonpoint source, which includes stormwater runoff from agricultural areas and residential areas, along with a margin of safety. Provisions may also be made for future sources in the form of reserve capacity. An implementation plan is developed to identify how the various sources will be reduced to the designated allocations. Implementation strategies may include improved stormwater treatment plants, adoption of ordinances, reforestation of stream corridors, retrofitting stormwater systems, and other BMP's.

The New Jersey Integrated Water Quality Monitoring and Assessment Report (305(b) and 303(d)) (Integrated List) is required by the federal Clean Water Act to be prepared biennially and is a valuable source of water quality information. This combined report presents the extent to which New Jersey waters are attaining water quality standards, and identifies waters that are impaired. Sub list 5 of the Integrated List constitutes the list of waters impaired or threatened by pollutants, for which one or more TMDL's are needed. The Passaic River is listed in the proposed Sub list 5 (March 1, 2004) for benthic macroinvertebrates (AN0229C) and for phosphorous, arsenic, cadmium, copper, lead mercury, silver zinc and cyanide (01379000, EWQ0224, 6-SITE-2, 6-PAS-1).

In addition to water quality problems, the Township has occasional flooding problems. Flooding occurs on the Passaic River and on the Middle Brook. Flooding on the Dead River and Passaic River only affects properties on the north side of the Township. While flooding along Middle Brook affects properties along its length in the south portion of the Township. The 100-year floodplain, shown in Figure 5, depicts the Passaic River, Dead River, East Branch of the Middle Brook, Stony Brook, Cory's Brook, and Dock Watch Hollow Brook floodplains.

In conjunction with the USGS, Somerset County operates a flood information system for its 21 municipalities. The Somerset County Flood Information System (SCFIS) consists of a network of stream and precipitation gages throughout the County. Information from these gages is automatically transmitted to a central location via telephone, radio and satellite. The information is then processed and appropriate actions are taken. These actions include notifying municipal police, fire and emergency management personnel with flood potential and water level information.

There are several SCFIS stream and precipitation gages near the Township. The Township has precipitation gages to the north in Basking Ridge and to the south in Bridgewater. In addition, information from the stream gage for the Passaic River at Millington is available on the United States Geological Survey (USGS) web site in real time (<http://waterdata.usgs.gov/nj/nwis>).

The Township has a small amount of developable land. The existing land use, based on 1995/1997 aerial photography, is shown in Figure 6. The existing zoning is shown in Figure 7. A current aerial photo with parcel lot lines overlain on it is shown in Figure 8. The Township is partly/not (*choose one*) within the State Plan Designation PA1 Metropolitan Planning Area or in a designated center where infiltration requirements are not applicable. Groundwater recharge rates for native soils in this area are generally between zero inches(0") and nineteen inches (19") annually. The average annual groundwater recharge rates are shown graphically in Figure 9.

According to the NJDEP, "A Well Head Protection Area (WHPA) in New Jersey is a map area calculated around a Public Community Water Supply (PCWS) well in New Jersey that delineates the horizontal extent of ground water captured by a well pumping at a specific rate over a two-, five-, and twelve-year period of time for unconfined wells. The confined wells have a fifty foot radius delineated around each well serving as the well head protection area to be controlled by the water purveyor in accordance with Safe Drinking Water Regulations (see NJAC 7:10-11.7(b)1)."

WHPA delineations are conducted in response to the Safe Drinking Water Act Amendments of 1986 and 1996 as part of the Source Water Area Protection Program (SWAP). The delineations are the first step in defining the sources of water to a public supply well. Within these areas, potential contamination will be assessed and appropriate monitoring will be undertaken as subsequent phases of the NJDEP SWAP

As shown in Figure 10, a portion of the Township is in a well head protection area. This area is located at the extreme southern corner of the Township

In addition to the rivers and streams that run through and along the Township, there are a number of wetland areas. These wetland areas, shown in Figure 11, provide flood storage, nonpoint pollutant removal and habitat for flora and fauna.

## **Design and Performance Standards**

The Township will adopt the design and performance standards for stormwater management measures as presented in N.J.A.C. 7:8-5 to minimize the adverse impact of stormwater runoff on water quality and water quantity and loss of groundwater recharge in receiving water bodies. The design and performance standards include the language for maintenance of stormwater management measures consistent with the stormwater management rules at N.J.A.C. 7:8-5-8 Maintenance Requirements, and language for safety standards consistent with N.J.A.C. 7:8-6 Safety Standards for Stormwater Management Basins. The ordinances will be submitted to the County for review and approval within 24 month of the effective date of the Stormwater Management Rules.

## **Plan Consistency**

The Township is not within a Regional Stormwater Management Planning Area and no TMDL's have been developed for waters within the Township; therefore this plan does not need to be consistent with any regional stormwater management plans (RSWMPs) nor any TMDL's. If any RSWMPs or TMDLs are developed in the future, this Municipal Stormwater Management Plan will be updated to be consistent.

The Township is within the Raritan Basin and much information on the basin and about its characteristics has been developed as part of the Raritan Plan. Additional information concerning this plan can be found at: <http://www.raritanbasin.org>. The Township supports the Raritan Plan.

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

The Township's Stormwater Management Ordinance requires all new development and redevelopment plans to comply with New Jersey's Soil Erosion and Sediment Control Standards. During construction, Township inspectors will observe on-site soil erosion and sediment

control measures and report any inconsistencies to the local Soil Conservation District.

### **Nonstructural Stormwater Management Strategies**

The Township has reviewed the master plan and ordinances, and has provided a list of the sections in the Township land use and zoning ordinances that are to be modified to incorporate nonstructural stormwater management strategies. The existing and proposed ordinances that deal with the Stormwater Management planning are included in the Appendices at the end of this Plan. The Township currently has ordinances in place to control stormwater runoff and improve water quality. They are listed in Appendix A-1 through Appendix A-5. The Township has also drafted ordinances as required by the stormwater management rules that have not yet been adopted, but are in the process.

### **Land Use/Build-Out Analysis**

If the Township of Warren has a combined total of more than one square mile of vacant, developable lands, the Township is required to do a build-out analysis. The Township has spent the last year having in-house engineering technicians update the Township's overall basemap, tax maps and zoning maps. Based on these new maps the Township will perform a preliminary assessment of the Township maps to determine whether or not the Township has one square mile of vacant, developable land. If so, the Township will perform a Build-Out Analysis as part of this Stormwater Management Plan.

### **Mitigation Plans**

This mitigation plan is provided for a proposed development that is granted a variance or exemption from the stormwater management design and performance standards. Presented is a hierarchy of options.

#### Mitigation Project Criteria

1. The mitigation project must be implemented in the same drainage area as the proposed development. The project must provide additional protection from stormwater runoff quality and quantity from

previously developed property that does not currently meet the design and performance standards outlined in the Municipal Stormwater Management Plan. The developer must ensure the long-term maintenance of the project, including the maintenance requirements under Chapters 8 and 9 of the NJDEP Stormwater BMP Manual.

The applicant can select one or more of the following projects listed to compensate for the deficit from the performance standards resulting from the proposed project. More detailed information on the projects can be obtained from the Township Engineer. Listed below are specific projects that can be used to address the mitigation requirement.

The Township is currently compiling the list.

2. If a suitable site cannot be located in the same drainage area as the proposed development, as discussed in Option 1, the mitigation project may provide mitigation that is not equivalent to the impacts for which the variance or exemption is sought, but that addresses the same issue. For example, if a variance is given because the 80 percent TSS requirement is not met, the selected project may address water quality impacts that impact aquatic life along Cory's Brook. Listed below are specific projects that can be used to address the mitigation options.

The Township is currently compiling the list.

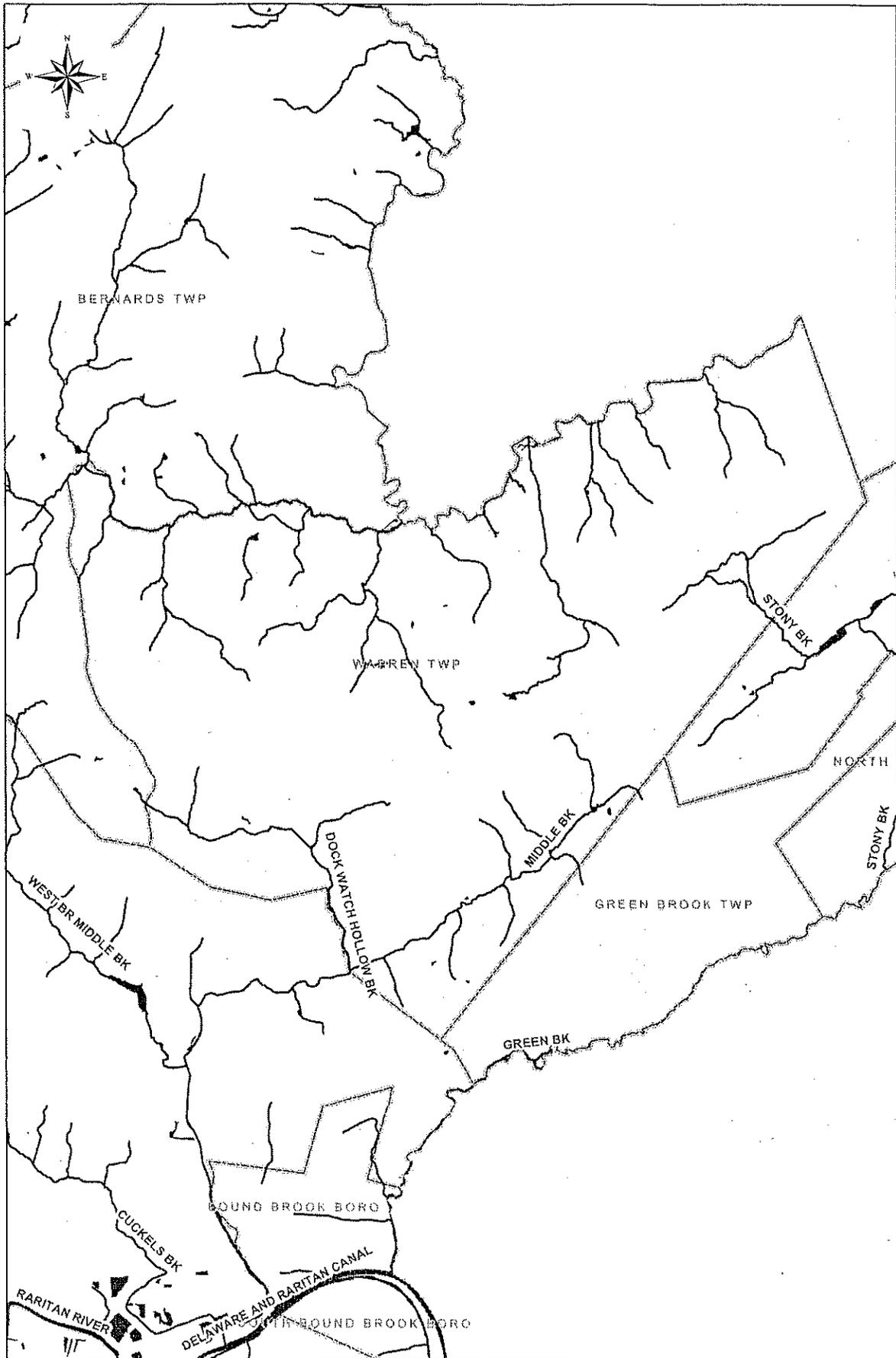
These projects (or others) must include information about permit requirements, costs (i.e., permitting fees, engineering costs, construction costs and maintenance costs) and land ownership.

The Township may allow a developer to provide funding or partial funding to the Township for an environmental enhancement project that has been identified in a Municipal Stormwater Management Plan, or towards the development of a Regional Stormwater Management Plan. The funding must be equal to or greater than the cost to implement the mitigation outlined above, including costs associated with purchasing the property or easement for mitigation, and the cost associated with the long-term maintenance requirements of the mitigation measure.

### **Recommended Implementing Stormwater Control Ordinances**

The Township currently has ordinances in place to control stormwater runoff and improve water quality. They are listed in Appendix A-1 through Appendix A-5. The Township has also drafted ordinances as

required by the stormwater management rules that have not yet been adopted, but are in the process.



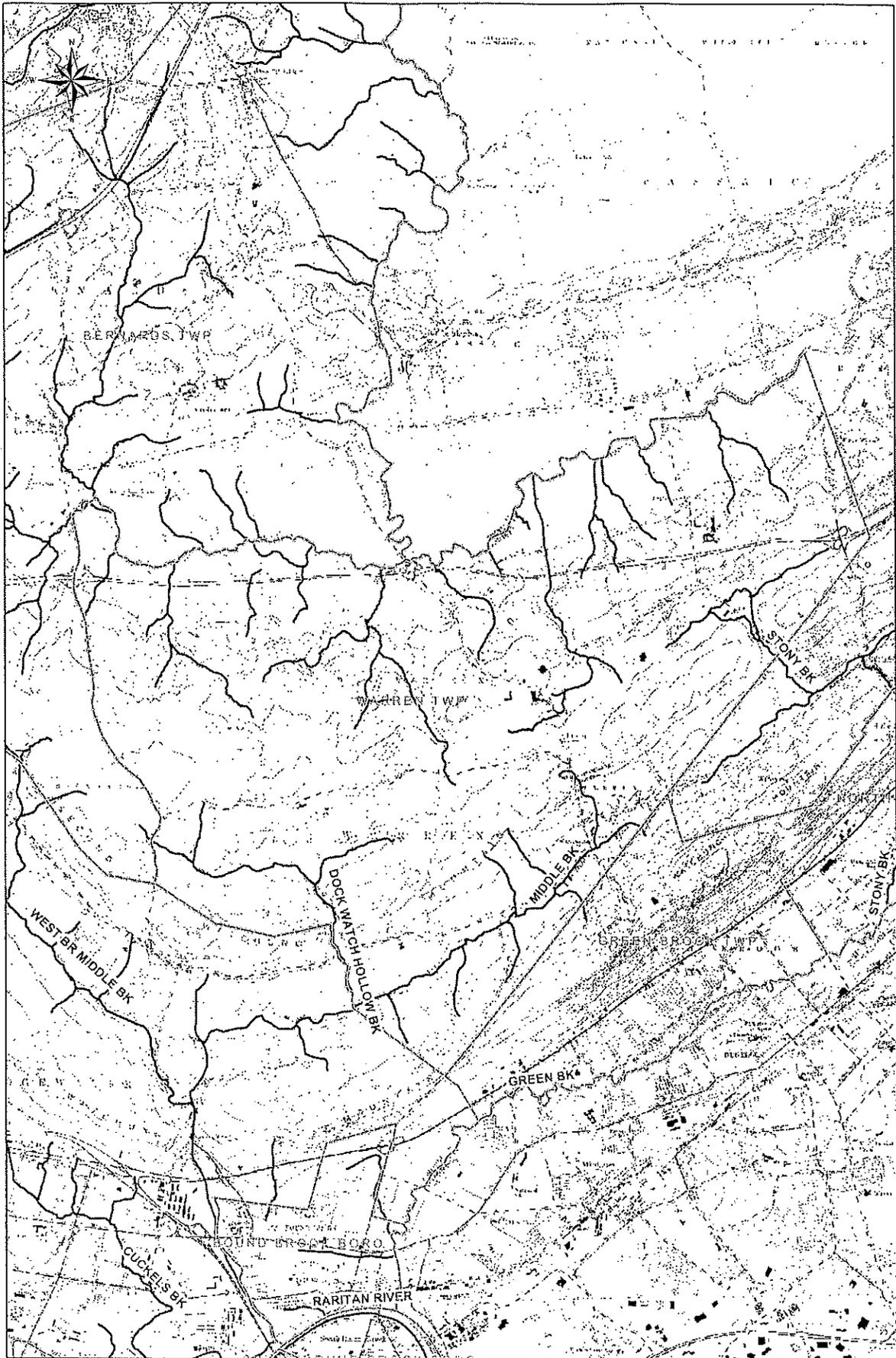
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Prepared By: Somerset County, May 2004

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### Warren Twp. Waterways

Figure 2



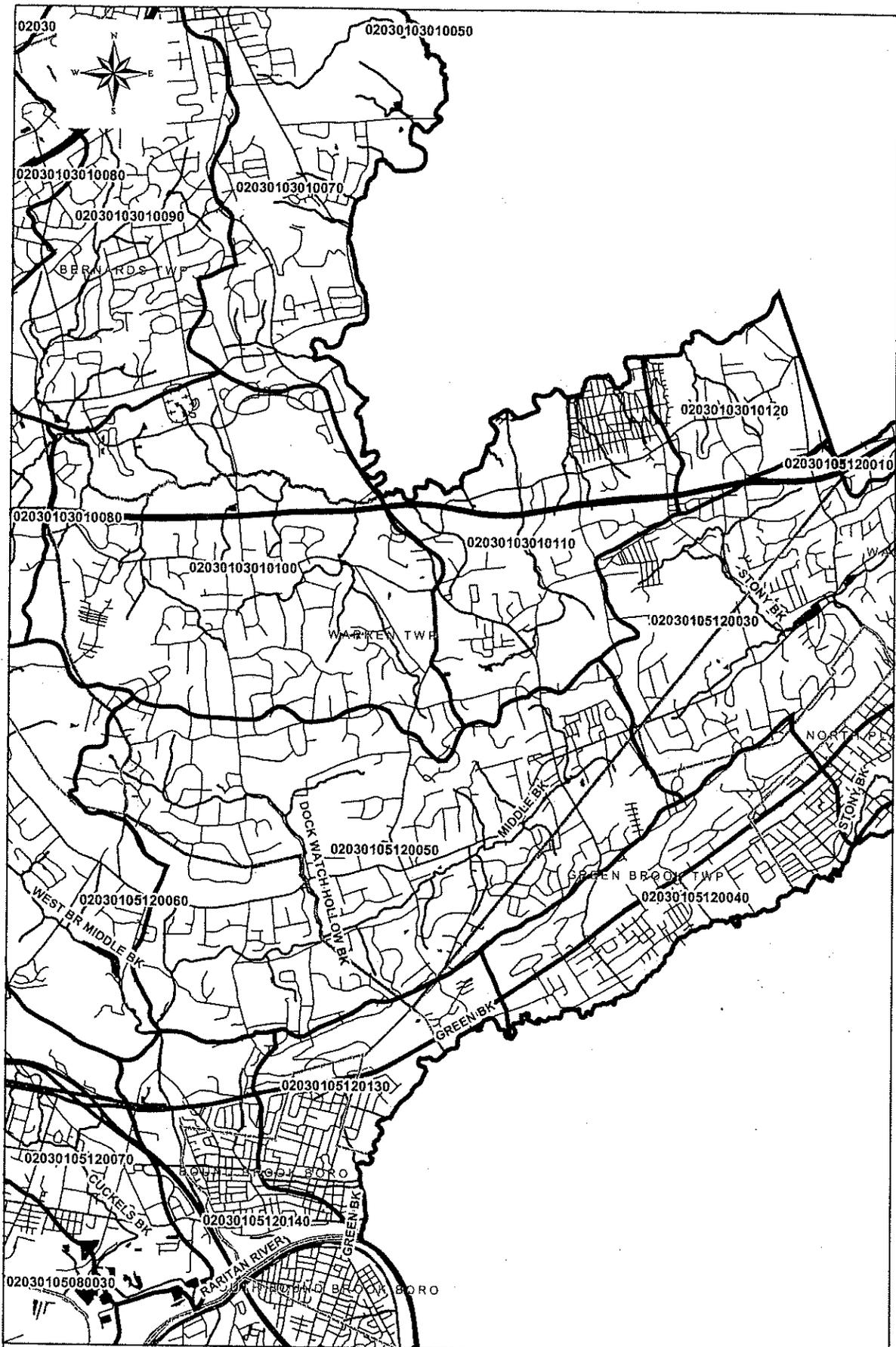
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Warren Twp.  
USGS Quadrangle Map

Figure 3



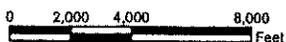
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**Warren Twp.  
Hydrologic Unit Code 14 (HUC14) Areas**

**Figure 4**

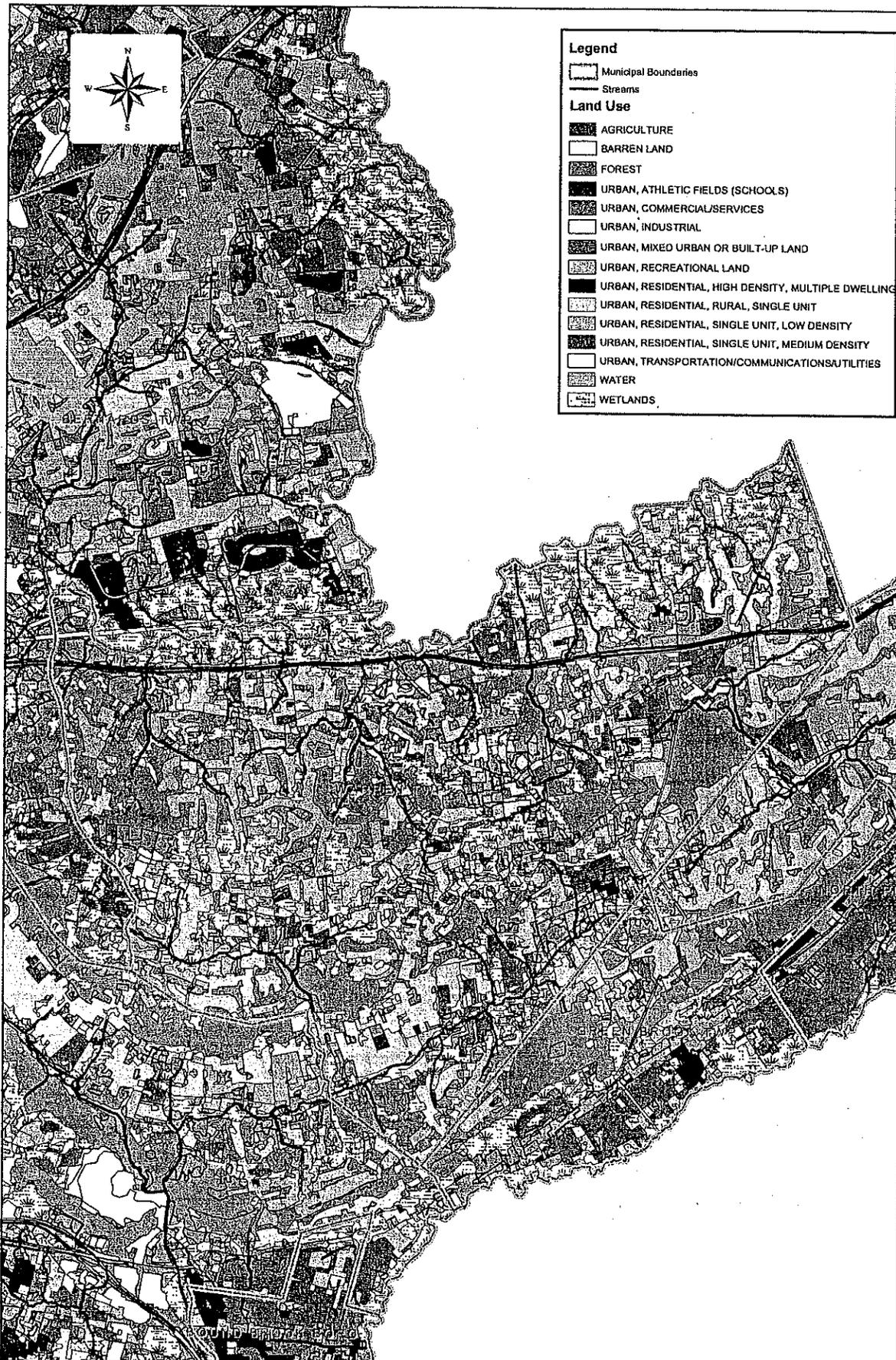


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**Warren Twp.  
100-Year Frequency Flood Plain**

**Figure 5**



**Legend**

- Municipal Boundaries
- Streams

**Land Use**

- AGRICULTURE
- BARREN LAND
- FOREST
- URBAN, ATHLETIC FIELDS (SCHOOLS)
- URBAN, COMMERCIAL/SERVICES
- URBAN, INDUSTRIAL
- URBAN, MIXED URBAN OR BUILT-UP LAND
- URBAN, RECREATIONAL LAND
- URBAN, RESIDENTIAL, HIGH DENSITY, MULTIPLE DWELLING
- URBAN, RESIDENTIAL, RURAL, SINGLE UNIT
- URBAN, RESIDENTIAL, SINGLE UNIT, LOW DENSITY
- URBAN, RESIDENTIAL, SINGLE UNIT, MEDIUM DENSITY
- URBAN, TRANSPORTATION/COMMUNICATIONS/UTILITIES
- WATER
- WETLANDS

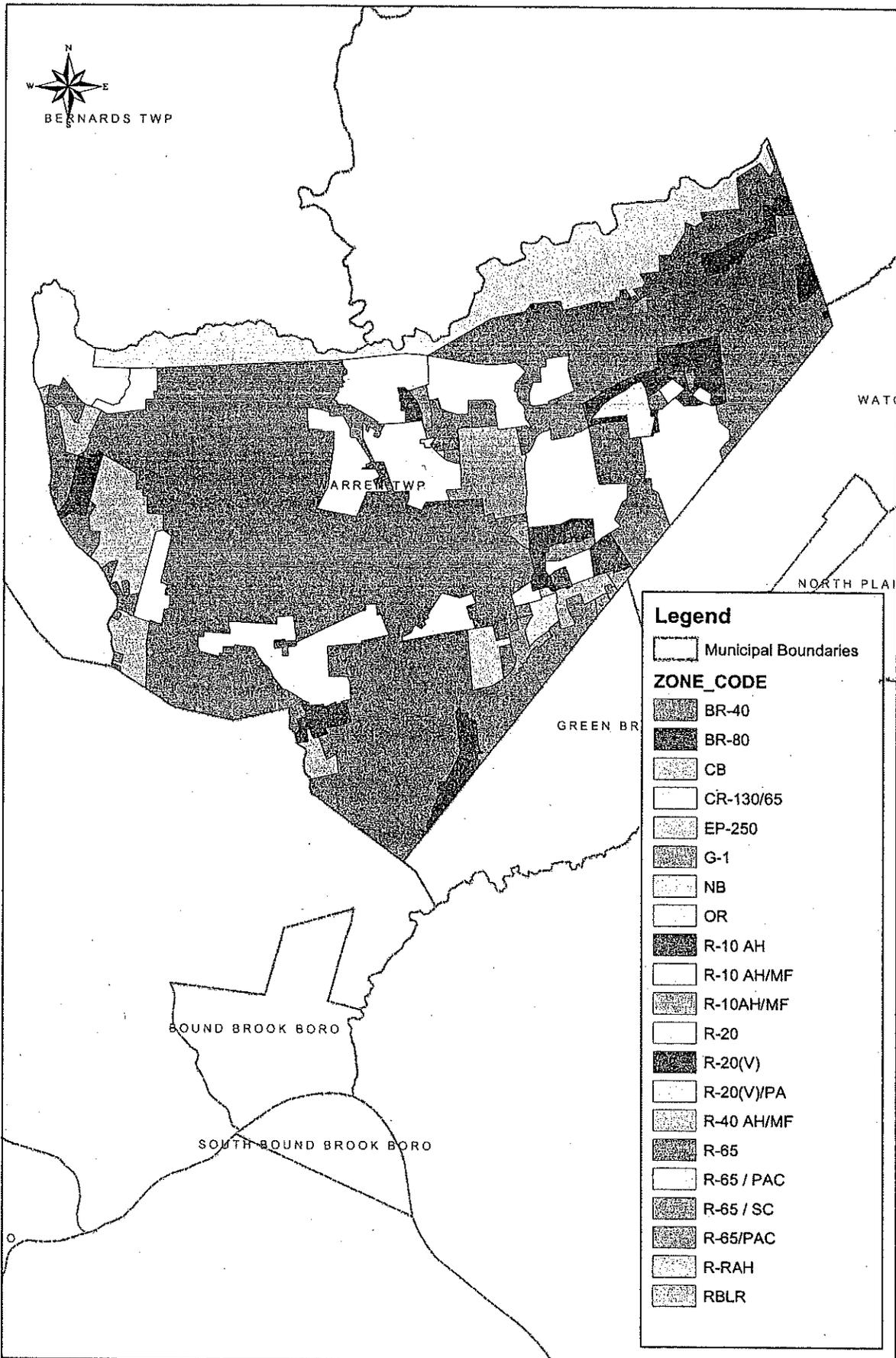
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**Warren Twp.  
Existing Land Use**

**Figure 6**



**Legend**

Municipal Boundaries

**ZONE\_CODE**

- BR-40
- BR-80
- CB
- CR-130/65
- EP-250
- G-1
- NB
- OR
- R-10 AH
- R-10 AH/MF
- R-10AH/MF
- R-20
- R-20(V)
- R-20(V)/PA
- R-40 AH/MF
- R-65
- R-65 / PAC
- R-65 / SC
- R-65/PAC
- R-RAH
- RBLR

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**Warren Twp.  
Zoning**

**Figure 7**



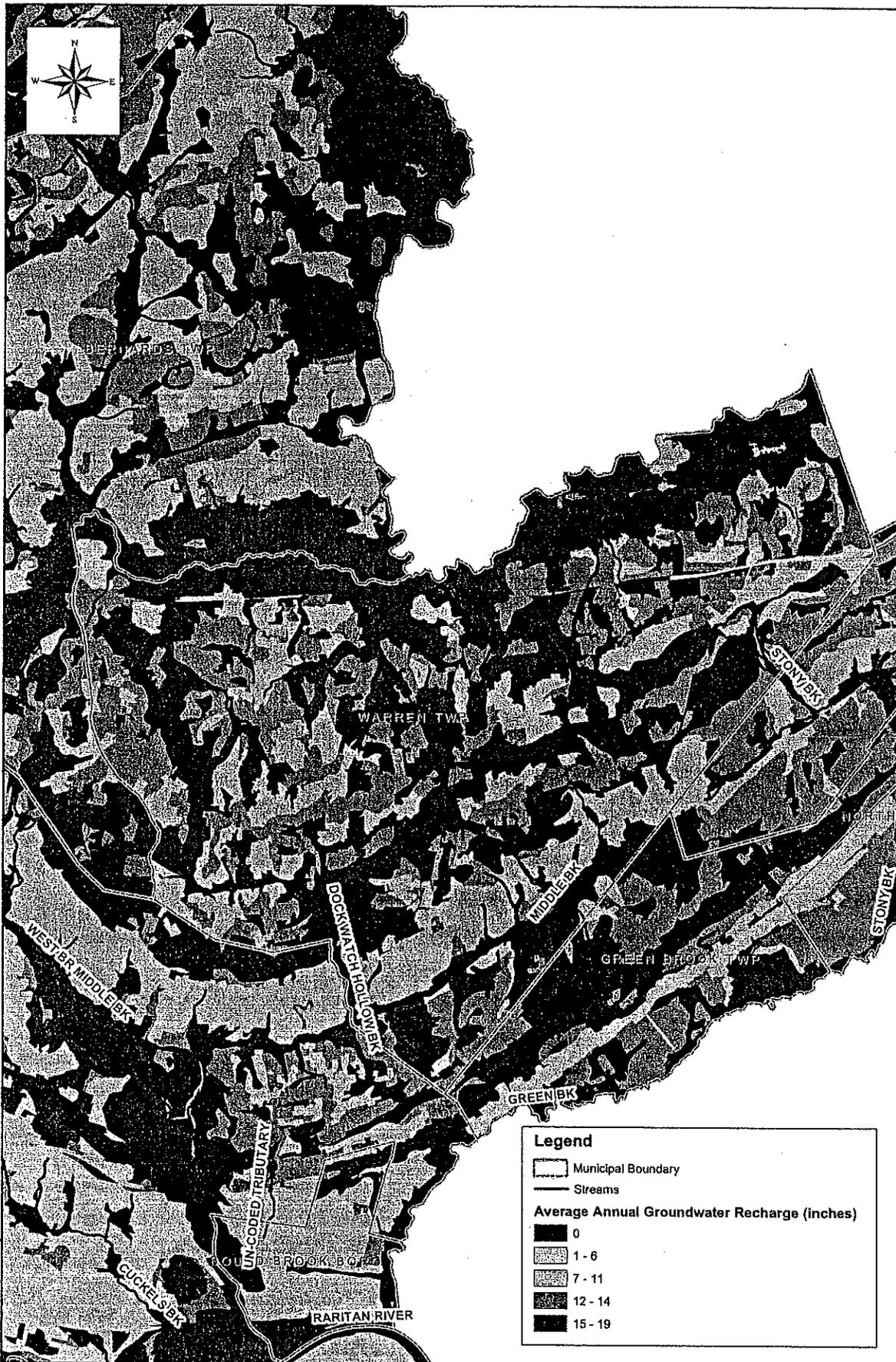
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**Warren Twp.  
Aerial Photo with Parcels**

**Figure 8**



**Legend**

- Municipal Boundary
- Streams

**Average Annual Groundwater Recharge (inches)**

- 0
- 1 - 6
- 7 - 11
- 12 - 14
- 15 - 19

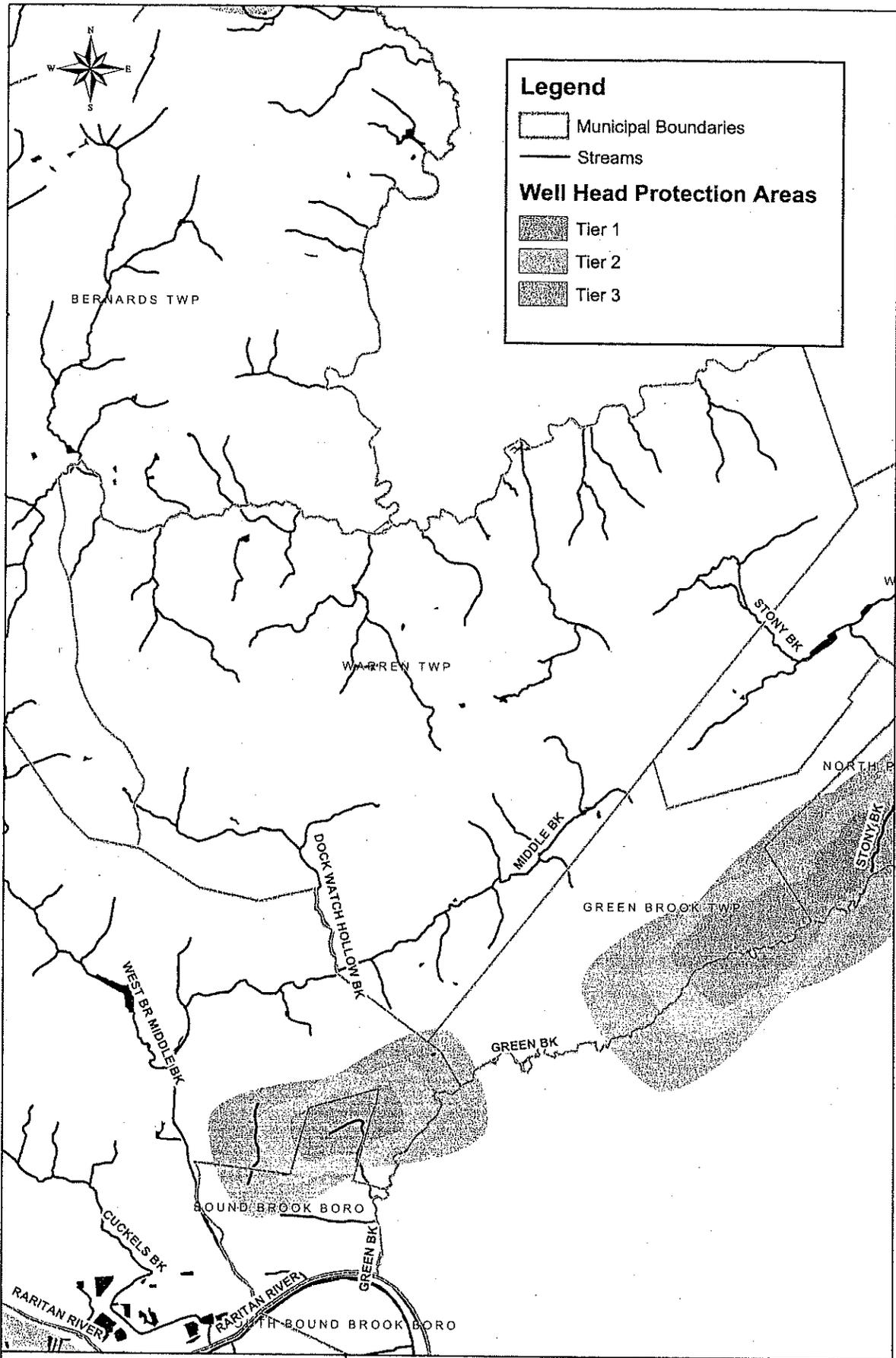
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**Warren Twp.  
Groundwater Recharge**

**Figure 9**



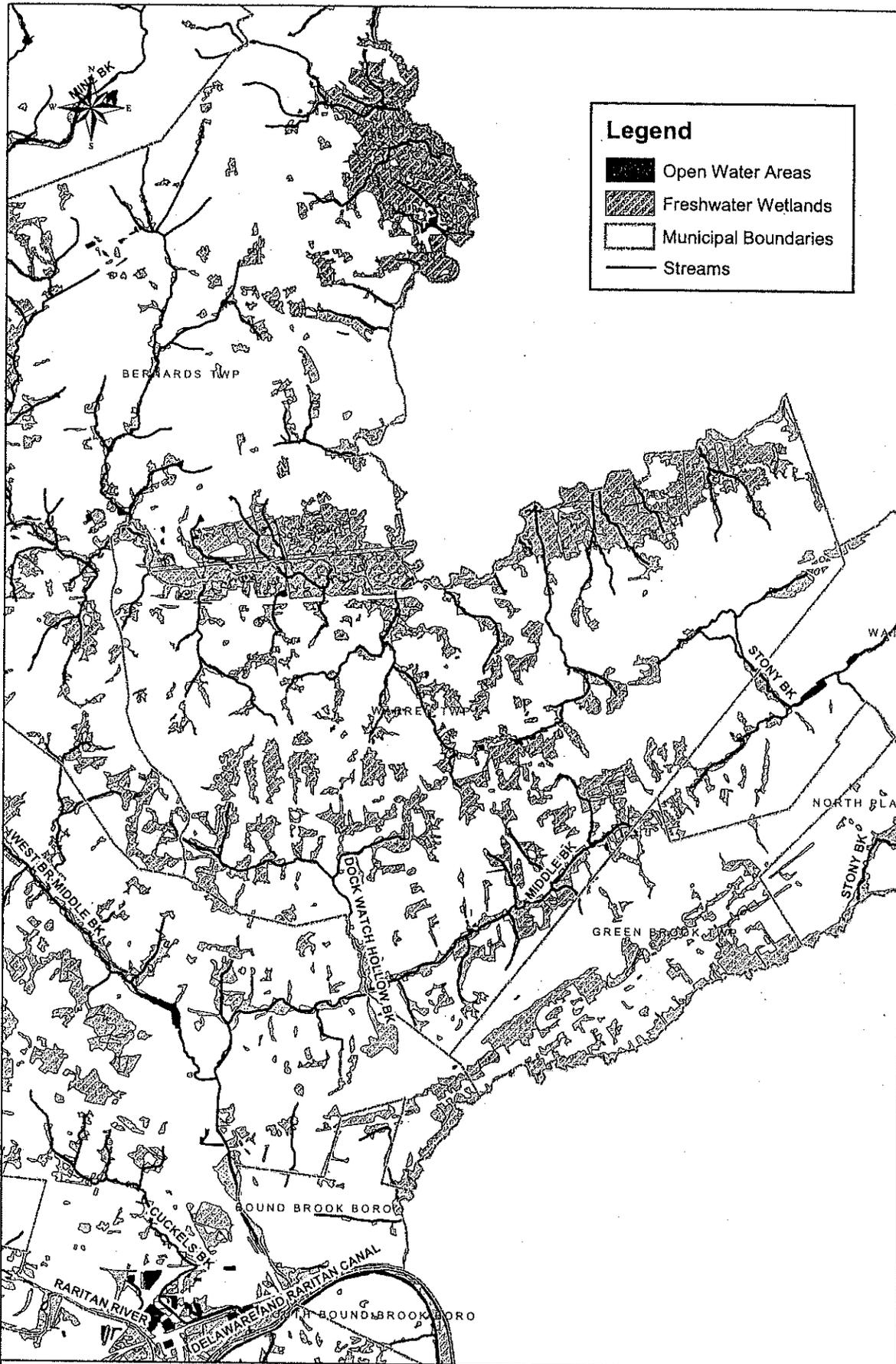
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**Warren Twp.  
Well Head Protection Areas**

**Figure 10**



**Legend**

- Open Water Areas
- Freshwater Wetlands
- Municipal Boundaries
- Streams

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**Warren Twp.  
Wetlands and Water**

**Figure 11**