
Preservation of Critical Areas in the Manasquan River Watershed

A Technical Report to identify sensitive natural resources in need of protection in the Manasquan River Watershed



**New Jersey
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Acknowledgements

The Manasquan River Watershed Association and the New Jersey Water Supply Authority formed the Manasquan River Watershed Critical Areas Committee in 2004. The Committee is comprised of representatives from the New Jersey Water Supply Authority, the Manasquan River Watershed Association and nine municipal governments within the watershed. The Committee was charged with the development of critical area criteria for the selection of lands capable of protecting the Manasquan Watershed in Monmouth and Ocean County, New Jersey, and its subwatersheds. Committee members and their designated representatives are as follows:

- **New Jersey Water Supply Authority**
 - Daniel J. Van Abs, PhD, PP/AICP, Director, Watershed Protection Programs
 - Jen (Yongzhen) Zhang, GIS Specialist, Watershed Protection Programs (primary author)
- **Manasquan River Watershed Association**
 - Steve Taylor, Executive Director
- **Representatives from Local Municipalities**
 - Tim Anfuso, Colts Neck Township
 - Michael Fowler, Brick Township
 - Robert Houseal, Brielle Borough
 - Peter Krukowsky, Farmingdale Borough
 - Joseph Mavuro, Freehold Township
 - Len Miller, Manalapan Township
 - Mark Muraczewski, Charles Newcomb, Lisa Taylor, Howell Township
 - John Tischo, Nancy Tischo, Manasquan Borough
 - Matt Zahorsky, Wall Township

We thank the members of the Manasquan River Watershed Critical Area Project Committee, including all the representatives from the nine local governments, for their invaluable input to define and finalize the water resources protection open space critical area criteria, and for their support of this process. Special thanks to Eric Anderson, GIS Coordinator, Monmouth County GIS for his assistance and provision of Monmouth County GIS data. Finally, thanks to the New Jersey Water Supply Authority for funding this important project.

Preservation of Critical Area in the Manasquan River Watershed

Executive Summary

The Manasquan River serves as a significant drinking water supply source for portions of eastern Monmouth County. Protecting the lands that drain to this important river will be necessary to ensure a clean and plentiful supply of drinking water. As our towns continue to grow, it is becoming increasingly important to identify and protect the most sensitive natural resources within our communities. Protecting these areas will ensure the vital protection of the regions drinking water and provide superior river water quality, wildlife habitat and quality environs for area residents. Fortunately, new tools are available to assist us in identifying these sensitive critical areas and developing strategies to protect them.

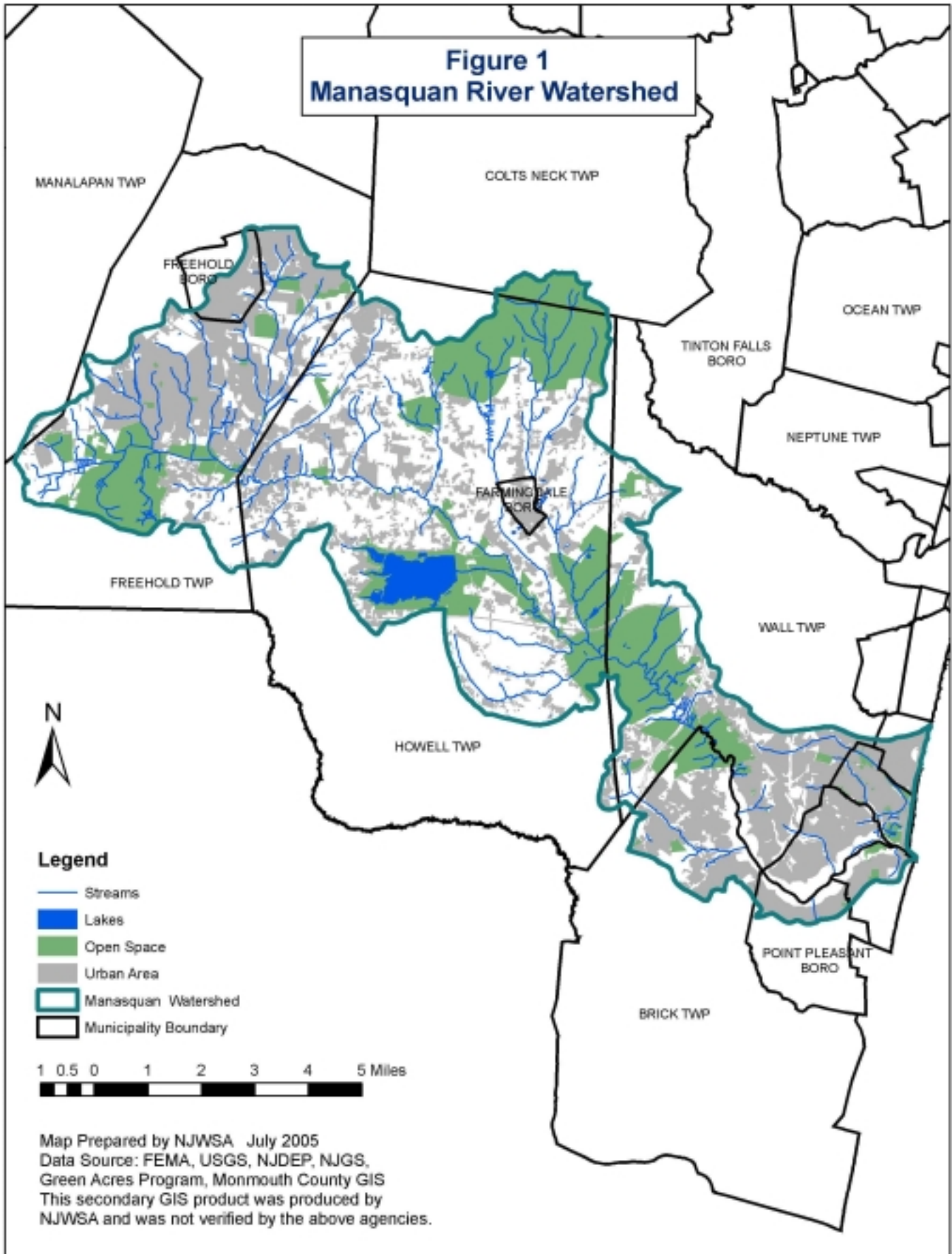
The Manasquan River Watershed Critical Areas Committee seeks to preserve critical areas within the 82.4 square mile watershed that serve as a water supply source for the Manasquan Reservoir. In the Manasquan Watershed, 12,885 acres are currently classified as preserved areas (24.4 percent of the total watershed area), and 20,492 acres are classified as developed lands as of 2002 (38.9 percent of the total watershed). Overall, about 30 percent of the watershed area is neither developed nor dedicated open space, and the region is subject to considerable development pressure due to the presence of the Garden State Parkway, Interstate Route 195, US Route 9 and other US and County Routes. Project members are concerned about the loss of natural resources, including critical water resources for local and regional use, if critical areas are not preserved properly. This report describes the techniques to identify critical areas and the strategies to preserve them, as well as recommended improvements of local ordinances for the protection of critical water resources. However, it does not address questions of appropriate zoning density or development management practices, nor remedial projects to address damages from existing or historic land uses. These issues can be addressed through municipal action and other environmental projects.

The New Jersey Water Supply Authority prepared this report in close consultation with the Manasquan River Watershed Association and project committee members – Brick Township, Colts Neck Township, Freehold Township, Howell Twp, Manalapan Township, Wall Township, Brielle Borough, Farmingdale Borough, Manasquan Borough and Sea Girt Borough – with extensive assistance from the Monmouth County GIS Department. The project committee's role was to define criteria for the identification of critical areas in the Manasquan Watershed. The critical areas map was developed showing critical areas in the watershed, and undeveloped land parcels with a high percentage of critical areas. Since not all parcels are of equal environmental value, the percent of parcels in critical areas and the parcel size thresholds provide a method to determine which parcels provide the highest value for preservation. The final critical areas results will help municipalities target acquisition funds on properties that are critical to water resource protection, focus acquisition on parcels with the highest percentage of critical areas that will aggregate into large contiguous areas, and control land development by clustering away from critical natural resource areas.

It can be anticipated that some of the currently undeveloped land would remain in some form of dedicated open space due to: acquisition of properties; creation of common open space in subdivisions; voluntary donation of easements and property in smaller parcels; property owner decisions to maintain undeveloped land on their parcels; and acquisition for active recreational areas. Because of time constraints and funding issues, a preservation program cannot be completely successful. Therefore, this report recommends that existing municipal ordinances be used to affect future subdivision designs in a manner that maximizes the preservation of critical areas. Where parcels are dominated by critical areas (many are more than 90 percent critical area), this report recommends policies to protect the most critical attributes. Finally, the report recommends improvements to municipal land use ordinances that will help planning boards make better decisions that protect these critical areas. This project did not address issues of changes in zoning or recommendations regarding allowable uses or densities, as these provisions are beyond the scope of the project. The emphasis is on preservation, followed by provisions for the configuration of subdivision lots and the use of critical area information in site design.

The Manasquan River Watershed Critical Areas Committee will work with Monmouth County, Ocean County, the Green Acres Program, land trusts and others to implement the recommendations contained in this report, and will refine the information, methods and findings over time. This project is only one part of the Manasquan River Watershed Management Plan designed to protect and enhance the Manasquan River and its tributaries.

Figure 1
Manasquan River Watershed



Purpose of the Manasquan Watershed Critical Areas Project

The New Jersey Water Supply Authority (NJWSA) is a State agency, established by law in 1981 to operate the Spruce Run Reservoir, Round Valley Reservoir and Delaware & Raritan Canal as a coordinated water supply resource for Central New Jersey. NJWSA also operates the Manasquan Reservoir, completed in 1990. The 770-acre Manasquan Reservoir is located in Howell Township, on Timber Swamp Brook, a tributary of the Manasquan River. The headwaters of the Manasquan River are located in the rural and agricultural areas of Freehold and Manalapan Townships. Westernmost tributaries originate in Freehold Borough, Freehold Township, Colts Neck and Howell Townships. From this point, the river flows toward the densely populated coastal zone. The lower 6.5 miles of the river forms the estuary that is bordered by Wall Township, Brielle Borough and Manasquan Borough to the north and Brick Township, Point Pleasant Borough and Point Pleasant Beach Borough to the south. The Manasquan River Watershed includes a number of small lakes and ponds. Lakes in Monmouth County include Brisbane Lake located in Wall Township, Turkey Swamp Lake located within Turkey Swamp County Park in Freehold Township, and Stockton Lake and Mac's Pond in Manasquan. Lakes in Ocean County include Lake Louise, Little Silver Lake, and Lake of the Lilies in Point Pleasant Beach.

Land use is a vital component to clean drinking water. When it rains, rainwater flows over the landscape and into the many streams that feed the Manasquan River. During high-flow events, water is pumped from the Manasquan River to fill and supply the Manasquan Reservoir. Protecting the landscape by maintaining natural habitat conditions will ensure greater drinking water quality protection. Current land uses in the Manasquan River Watershed include agricultural and residential uses with some commercial and industrial activity. Agricultural uses in the region include a variety of crops, livestock (primarily horses), nurseries, sod farms, and orchards. However, farmland acreage has decreased in recent years as it has been converted to residential and commercial uses.¹

Water supply is one of New Jersey's most critical resources for future prosperity and environmental quality, as emphasized by the 1998-2002-drought period. Protecting both the quality and quantity of water supplies is a fundamental purpose of watershed management. Protection of supplies is far preferable to the expensive and time-consuming process of treating polluted supplies. The watersheds feeding the Manasquan Reservoir are threatened by changing land uses and are already showing signs of stress and degradation. Development is increasing in the area, as suburban development extends along the Garden State Parkway, Interstate 195, and Route 9 highway corridors. As of 2002, developed land already accounted for approximately 38.9 percent of the entire watershed. Without additional protection of its watersheds, reservoir degradation will occur, from both a water yield and water quality perspective. The stream systems themselves will also suffer, losing flow during dry periods and experiencing increased contamination and stormwater runoff.

The Manasquan River Estuary is widely recognized as one of New Jersey's top recreation fishing areas. Winter and summer flounder, bluefish and striped bass are among the more than 75 species of fish supported by this area. However, development and the changing landscape is already threatening critical habitat and water quality. In fact, some stream channels are already damaged due to the physical alteration of riparian areas, excessive stormwater flow and consequential nutrient and bacterial contamination.

¹ Manasquan Watershed Management Group, Manasquan River Watershed Initial Characterization and Assessment Report

The Critical Areas Project is intended to preserve critical lands, prevent the loss of water supply yields, and protect water quality and habitat conditions in the Manasquan River Watershed. The project will help local municipalities take the necessary actions to reduce impacts from new and existing land uses, preserve and restore water resources, improve local land use ordinances and incorporate development controls with county and State governments to minimize such impacts. The municipalities in the watershed are generally densely populated and receive significant tax rates. This social and economic standing provides an opportunity to address the implications of future development and preserve the critical area through open space acquisition or other techniques. Many municipalities have acted to achieve this through programs and ordinances, such as an open space tax program and farmland preservation strategies, however they acknowledge that there is more to be done.

The Manasquan River Watershed Critical Area Committee agrees that working cooperatively on the critical areas project will provide major benefits in public understanding and support, land acquisition targeting, and the coordination of land development activities in ways that increase the ecological value of dedicated open space from clustered development. Most of the municipalities within the Manasquan River Watershed lack the resources to develop detailed plans for linking dedicated open space parcels to protect contiguous forests, riparian corridors and critical habitats that cross property boundaries. If subdivision layout is left to individual developers, there is a great potential for creating isolated open space that does not maximize environmental benefits. In addition, municipalities benefit from linking public open spaces with the dedicated open space of cluster developments.

This project will have a number of significant outcomes associated with the protection of critical natural resources such as water quality and habitat protection, improved reservoir protection and the preservation of Trout Maintenance streams. Additional outcomes include:

1. **Preservation Targets** – Identification of the most critical land preservation targets based on the best available scientific information.
2. **Coordinating Development with Preservation** – Identification of methods to coordinate cluster developments in municipalities that allow the technique, to ensure that the resulting dedicated open spaces protect contiguous forests, stream corridors and critical habitats to the greatest extent possible. In addition, identification of critical lands that should be acquired to provide linkages between the dedicated open space of cluster developments.
3. **Improved Ordinances** – Identification of appropriate changes to municipal zoning and development ordinances that will better protect the critical natural resources, including forests and wetlands, within the Manasquan River Watershed.
4. **Educational Efforts** – Education of the general public and municipal and county planning boards and governing bodies about the process, rationale and results of this project effort.

Selection of Criteria for Critical Areas

During the kick-off meeting that occurred on December 1, 2004, project members reviewed the Spruce Run Critical Area Preservation Plan (see www.raritanbasin.org) and the Raritan Basin Critical Area Criteria Mapping to better understand the scope and potential outcomes from the Manasquan Watershed Critical Area Project. The committee members all agreed that a GIS-based planning process would be the best method to understand and map natural resource assets found in the Manasquan River Watershed.

Project committee members reviewed a wide array of information available through GIS, specifically for the Manasquan River Watershed, as listed in **Table 1**. In order to evaluate if a parcel or area is protective of water resources, the mechanisms for water resources protection needed to be determined. The threats to water resources emanate from loss of vegetation (particularly forests and wetlands), placement of impervious surfaces over high ground water recharge areas, increased runoff, and development or vegetation loss in riparian areas and floodplains. Contiguous open spaces limit these threats, and sustain the maximum benefits environmentally, ecologically, socially and economically.

Table 1 – GIS Base Information Used at the Manasquan Critical Area Meeting

<ul style="list-style-type: none"> • Base Files <ul style="list-style-type: none"> ○ Manasquan Watershed Boundary ○ Roads ○ Streams, Rivers and Lakes ○ Municipality Boundary ○ Subwatersheds ○ 2002 Aerial Photos 	<ul style="list-style-type: none"> • Land Use/Land Cover <ul style="list-style-type: none"> ○ 1995/97 Wetlands ○ 1995/97 Forests ○ Dense Forests (400 foot buffer) ○ 1995/97 Agriculture ○ 1995/97 Urban ○ 2002 Urban (updated based on aerial photos)
<ul style="list-style-type: none"> • NJDEP “Landscape Project” <ul style="list-style-type: none"> ○ Forested Wetlands ○ Forests ○ Grasslands ○ Emergent Wetlands ○ Beach 	<ul style="list-style-type: none"> • Parcels <ul style="list-style-type: none"> ○ Freehold Twp ○ Wall Twp ○ Howell Twp ○ Sea Girt Borough
<ul style="list-style-type: none"> • Steep Slopes – Monmouth <ul style="list-style-type: none"> ○ Monmouth 2 ft Contour (1997) 	<ul style="list-style-type: none"> • Open Space <ul style="list-style-type: none"> ○ Green Acres Program ○ Freehold Twp ○ Wall Twp ○ Manasquan Borough ○ Monmouth County Parks
<ul style="list-style-type: none"> • NJGS Ground Water Recharge • NRCS SSURGO Soil Data • 100-year Floodplain (FEMA) • NJDEP Flood prone areas • NJDEP Wellhead Protection Area 	<ul style="list-style-type: none"> • Known Contaminated Sites • Impaired Streams

The committee members brainstormed a list of 16 criteria that protect water resources (See **Table 2**). Because this list focuses primarily on water resources, it may not address all land conservation goals. As an innovative approach, interactive GIS analysis occurred during each meeting so that the participants could immediately view the results of their discussions as the meeting progressed. NJWSA used ArcView 3.2 on a laptop computer with a digital projector to perform these analyses. More sophisticated GIS analysis occurred between meetings.

Table 2. Initial Criteria “Brainstormed” by the Manasquan Watershed Water Resources Protection Open Space Criteria Committee on December 1, 2004

Water Quality and Quantity
a. Surface Water - Streams, Wetlands, Lakes and Ponds
b. Recharge Capacity (Soils with high infiltration capacity)
c. 100-year Flood Hazard and Flood Prone Areas
d. Riparian Areas as Defined by the Raritan Basin Watershed Management Project
e. Natural Vegetation - Dense Forested Lands (larger concentrations and those with significant core areas, defined as forest cover more than 400 feet in from the outside forest boundary)
f. Well Head Protection Areas
g. Trout Maintenance Streams
h. Soils – Highly Erodible, Glauconitic Soils

i. Steep Slopes
j. Areas Links to Existing Open Space
k. Critical Habitats - "Landscape Project" using the habitats for Federal and State endangered and threatened species as well as priority species.
l. Wildlife Corridor (Water Buffering)
m. Green Acres Open Space and Preserved Farmland
n. Local Municipality's Open Space and Preserved Farmland
o. Impaired Streams (already included in the Streams information)
p. Contaminated Sites
Note: Criteria are listed in no particular order. These criteria were specifically included for their protection of water resources.

GIS Model for the Critical Area Criteria

A GIS (geographic information system) contains linked spatial and tabular data in a group of files that are used together and called a "coverage." To facilitate the dissemination of the criteria, the project committee decided to develop a GIS-based "model", similar to the Raritan Basin Watershed Management Plan – Water Resources Open Space Critical Area Criteria.² The committee felt that by developing a model to share with interested local and regional entities, these organizations would be spared from having to undertake time consuming and costly analyses associated with determining how open space protects water resources. In addition, the maps generated from GIS could be provided to land trust organizations without GIS capabilities.

The project committee consolidated the 16 initial criteria into 7 GIS coverages that encompass water resource protection criteria. The committee also recommended use of the land use and existing open space coverages to exclude developed and preserved lands from the targeting process. **Table 3** outlines the GIS coverages and the criteria represented by each. An explanation of the chosen coverages is provided on the following page.

Table 3. Elements of the GIS Model for Water Resources Protection

GIS Coverage to be Used	Initial Criteria Addressed by Coverage (see table 2)	Protection Area Includes
1. Riparian Areas	Surface Water(a), Flood Plain Area (c), Riparian Areas (d), Trout Maintenance Stream (g), Wildlife Corridor (l), Impaired Streams (o),	Use Raritan Project methodology (Flood Plain Area, Streams, Lakes, Wetlands, Wildlife Corridors, Wetland Transition Areas, Hydric and Alluvial Soils)
2. Wellhead Protection Areas (WHPA)	Wellhead Protection Areas (f)	Undeveloped portions of Tiers 1 & 2
3. Ground Water Recharge Area	Recharge Capacity (b)	Undeveloped areas of highest recharge rate that comprise 25% of the total ground water recharge volume of Manasquan Watershed
4. Critical Habitats	Threatened, Endangered and Priority Species (k); Wildlife Corridor (l)	Emergent Wetlands, Forests, Grasslands and Forested Wetlands that protect various categories of threatened, endangered and priority species, from NJDEP Landscape Project.

² NJWSA, 2002, please contact NJWSA staff for more information about this model

GIS Coverage to be Used	Initial Criteria Addressed by Coverage (see table 2)	Protection Area Includes
5. Soils – Highly Erodible and Potentially Erodible Soils	Soils – Highly Erodible, Glauconitic Soils (h)	Both highly erodible and potentially highly erodible soils defined by NRCS SSURGO dataset
6. Steep Slopes	Steep Slopes (i)	Areas greater or equal to 10% of steep slopes using Monmouth County 2 foot contour data (1997)
7. Dense Forests	Dense Forested Lands (e)	Large concentrations of forest land with significant core areas, defined as forest cover more than 400 feet in from the outside forest boundary
8. Preserved Open Space	Area Linked to Existing Open Space (j) Green Acres Open Space and Preserved Farmland (m) Local Municipality's Open Space and Preserved Farmland (n) (Determines proximity and linkage of preservation targets to existing, dedicated open space)	All open space identified in Green Acres Program and Monmouth County plus Wall Twp, Freehold Twp and Manasquan Borough open space data
9. Urban Area	Contaminated Sites (p)	Updated to 2002 urban area from 1995/97 land use/land cover using 2002 USGS aerial photos

Riparian Areas: The Raritan Project methodology defines riparian areas as the undeveloped areas adjacent to streams that are within the 100-year flood prone areas, contain hydric soils, contain streamside wetlands and associated transition areas, or are within a 150-foot to 300-foot of a wildlife passage corridor on both sides of a stream (with the width dependent on stream order). The Manasquan riparian area borrowed the Raritan Project riparian methodology and refined it further to fully consider the interaction between each component and included all the interacted continuous riparian parameters. The new method has approximately 1% more area than is covered by the old method. A visual check has been used to make sure that no ponds in sand mines are included as lakes. Data to develop the riparian areas coverage were obtained from FEMA (floodplains), NRCS (hydric soils) and the NJDEP hydrographic information (wetlands, lakes and ponds, stream information).

Wellhead Protection Areas: Wellhead Protection Areas show the spatial extent from where ground water flows into a well for a specific time period. A Wellhead Protection Area is divided by multiple times of travel: Tier 1 (2 years), Tier 2 (5 years), Tier 3 (12 years). Tier 1 and Tier 2 are used in this open space model to indicate the spatial extent in which ground water pollution, if it occurs, poses a significant threat to the water quality of the well. Tier 3 was not included in this model because it allows a longer time frame in which to manage a threat to water quality. To focus attention on potentially available open space, developed lands within a Wellhead Protection Area were excluded from this coverage. Of note, this GIS coverage, available from NJDEP, only includes wellhead protection areas for public community supply wells. Individual home or property owner wells are excluded.

Primary Ground Water Recharge Areas: Ground water recharge rates were calculated using NJGS Method GSR-32, which estimates ground water recharge below the plant root zone using municipality-based climatic, soil type, and land use/land cover information. (Note: only a portion of ground water recharge becomes aquifer recharge.) The Manasquan Project members agreed to the criterion used in the Raritan Project, in which both the volume and the rate of recharge were

used. The goal of the criterion is to protect areas that contribute the largest amount of recharge per year. Areas that most efficiently contribute 25 percent of the recharge should be preserved. To determine the area that preserves the top 25 percent of volume, the recharge volumes for each land use polygon were ranked by recharge rate, and then cumulatively summed to equal 25 percent of the annual recharge volume for the whole watershed. This ensures that properties desirable to be preserved recharge the quickest. In doing so, large, slowly recharging areas will not be selected over quickly recharging areas based on volume alone.

Wildlife Critical Habitat: Wildlife species habitat information was derived from the NJDEP Division of Fish and Wildlife's Landscape Project data. Each habitat can be broken into three levels: 1) habitat which harbors Federal Threatened & Endangered species, 2) habitat which harbors State Endangered species, State Threatened species or Priority Species, and 3) habitat which may provide Suitable Habitat. In the Manasquan Watershed Critical Area model, threatened, endangered and priority species habitats were included to represent high quality vegetated areas, which are beneficial to and protective of water resources. Several types of habitat, including forests, grasslands, forested wetlands and emergent wetlands were used in the model.

Erodible Soil: "Highly erodible soil" means a portion of land surface that is very susceptible to erosive forces and is characterized by steep or long slopes. The USDA-NRCS SSURGO GIS database defines "highly erodible soil" based on slope and soil composition. Protection of erodible soils will help protect water quality and support wildlife activities. The erodible soil information used in the final criterion includes both the "highly erodible soil" and "potentially highly erodible soil".

Steep Slopes: The steep slopes information was developed from the 2-foot contour data from Monmouth County (Ocean County data were not available). Initially, using 15% or greater slope was discussed based on common use of the value in NJ ordinances for storm water management and zoning. According to the storm water ordinances, slopes of 15% or greater generally require additional storm water control measures to effectively filter and control storm water runoff. When interactively working with and looking at the data, most of the areas with 15% or greater steep slopes are scattered in the project area. Given the relatively small areas of steep slopes and the soil types of the watershed, project members agreed to choose 10% or greater to define steep slopes.

Dense Forests: The criterion for dense forests focuses on the special ecological role that such forest areas serve for bird and other species that cannot tolerate invasive species. The criterion used to define dense forest is borrowed from the Spruce Run Initiative Project, which defined dense forests as woodlands in which core areas exist beyond a 400-foot buffer from the forest edges. The dense forest coverage was created using NJDEP 1995/97 land use/land cover data.

Preserved Open Space: The preserved open space coverage is a compilation of all known open space and preserved areas including federal and state-owned lands, land trust properties, county and municipal open space properties, etc. The preserved open space data used in this model came from the Green Acres Program, Monmouth County, Freehold Township, Wall Township and Manasquan Borough. All the open space data were combined into one coverage and was used to exclude areas from the model since they are already preserved. This coverage will allow land preservation entities to coordinate their efforts in making greenways or aggregating preserved lands to further protect water resources.

Urban Area: NJDEP's 1995/1997 Land use/ land cover data were used to create the original file of developed areas, and then USGS New Jersey 2002 aerial photos were used to update and digitize the new developed area between 1995/97 and 2002. As of 1995, approximately 34.4 percent (total 18,115 acres) of the area was developed in some manner; between 1995 and 2002, another 2,377 acres of lands were developed (total 20,492 acres developed as of 2002). This

demonstrates an increase of 13 percent since 1995, leaving the whole Manasquan watershed (total 82.4 square miles, 52,736 acres) 38.9 percent developed lands as of 2002. The updated 2002 urban area data were used in this model to exclude the developed lands.

The project members reviewed these criteria several times, refining them (e.g., 10% steep slopes was used instead of 15%) and developing rules for exceptions. The resulting criteria were approved by consensus. The known contaminated sites concept brainstormed in the first meeting was not included in the model since it does not have strong relationship with water resources protection, but land preservation organizations can use this information to find potential troublesome sites near lands desired for preservation. The contaminated site GIS information was available via NJDEP's website.

The final GIS model aggregated the seven water resource protection open space criteria shown in Table 3 into a single coverage. Each criterion of the model was given the same weight. For an area of land, the number of criteria met was calculated resulting in each area receiving a score from 0-7. **Figure 2** shows the Manasquan River Watershed area with different critical area criteria values. The database file associated with the final GIS coverage contains the information about which criteria were met. Also contained in the coverage's database is information regarding land use, and its current status (e.g., preserved open space versus developed land). These were added to the database so that developed land and preserved open space would not be included as preservation targets, even if some criteria were met.

Parcel data were available for most but not the entire watershed. Parcel data in GIS can be plotted over the critical area criteria to obtain the actual number of criteria the parcel meets. Without parcel data or access to GIS, the critical area criteria map can be used to approximate the number of criteria met. Many Manasquan Watershed municipalities lack digitized parcel data, making a watershed-wide analysis of target parcels impossible at this time. As of May 2005, Freehold Township, Howell Township, Sea Girt Borough and Wall Township parcel data were obtained and a percentage of parcels in critical areas were analyzed for these municipalities. These municipalities constitute 79.6 % of the total watershed.

Critical Area Results

Based on the water resource protection criteria discussed above, NJWSA developed GIS coverages of the resulting critical areas and presented the results in three ways. First, a composite detailed map shows lands based on the collection of criteria that qualify that land for inclusion (see example in **Figure 2**). For example, one strip of land (which could be part of one or more parcels) could be included because it has both critical wildlife habitat and riparian area; the next one over could have both of those attributes plus dense forest; while a third land area could be included only due to critical habitat. From this map, it is clear that a great deal of the entire watershed is included within one or more critical areas, showing the importance of land preservation efforts and sound development management. The region has a threaded pattern of riparian areas throughout the area, pockets of exceptional ground water recharge areas, and significant areas of wildlife critical habitats. **Figure 3** shows the detailed map focused around the Manasquan Reservoir.

Second, the individual criteria are all available as individual GIS maps. **Figure 4** shows the riparian areas within the watershed. Third, the parcels in the project areas were then subject to two types of analysis. First, each parcel was assessed to determine the extent to which the parcel was included in critical areas, by percent. **Figure 5** shows the results of this analysis. It is important to note that some of the parcels on the watershed borders extend into the neighboring watersheds. The GIS analysis shows the percent of each total property that is within the critical area of the Manasquan

River Watershed – properties that extend across borders may show artificially low scores. For this reason and others, the detailed critical areas map was then revised to show the number of criteria in each portion of each parcel, so that it is easy to determine which parts of a parcel are included in anywhere from one to seven of the seven criteria. To aid in the next step, the parcel (lot) boundaries were overlain on top of the critical area (see example in **Figure 6**).

Using the critical area analyses and these information tools, it is possible for local representatives to understand the preservation priorities, opportunities for creating large nodes and corridors of open space, opportunities for using open space zoning and other subdivision tools to protect parts of lots that are critical areas, and how these general ideas actually fit into the local landscape. Since the watershed-wide parcel data were not available at this point, this parcel analysis is only available to those municipalities who provided NJWSA digital parcel data.

Figure 2
Water Resources Protection Open Space Criteria
in the Manasquan River Watershed

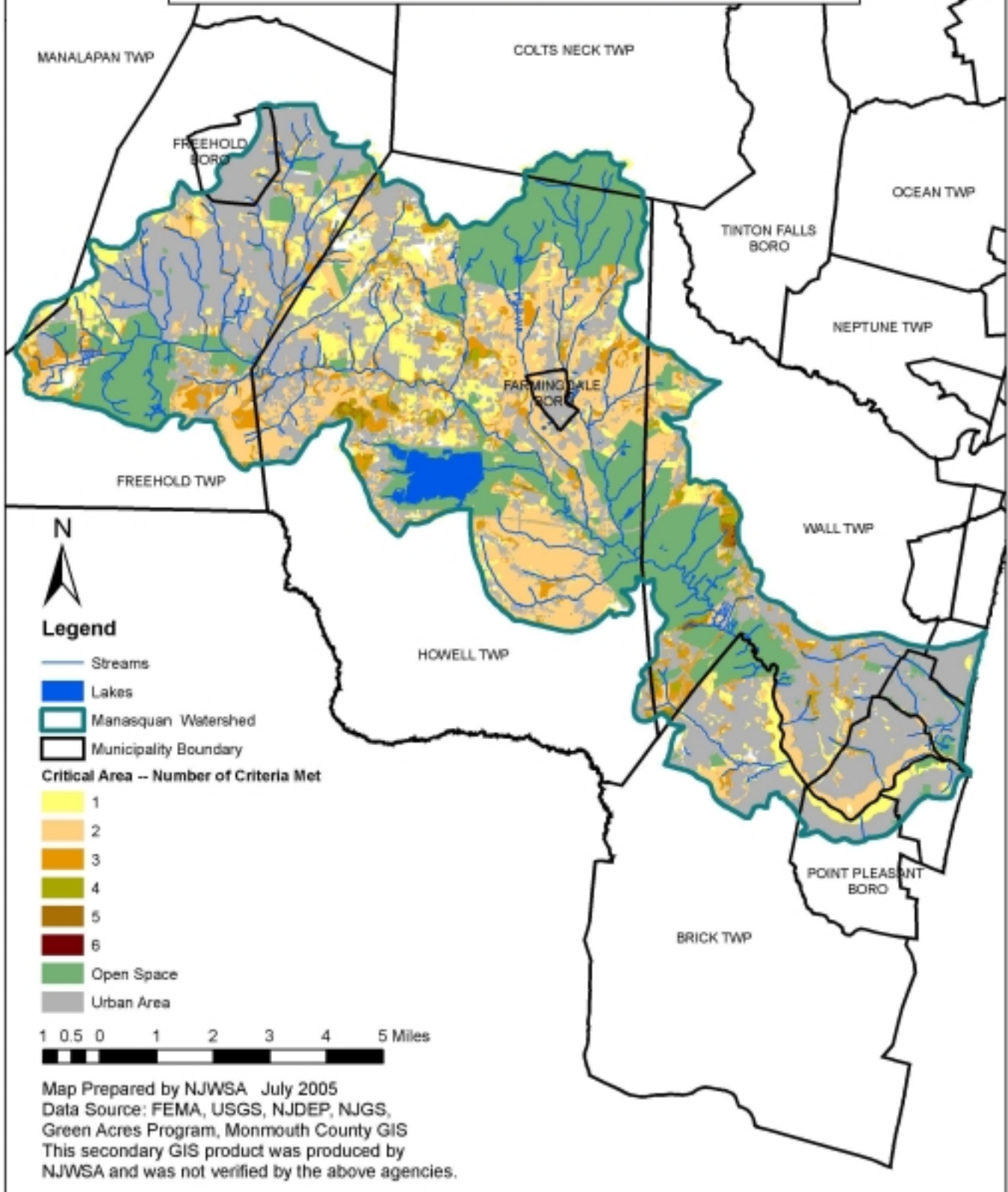


Figure 3
Water Resources Protection Open Space Criteria
around the Manasquan Reservoir

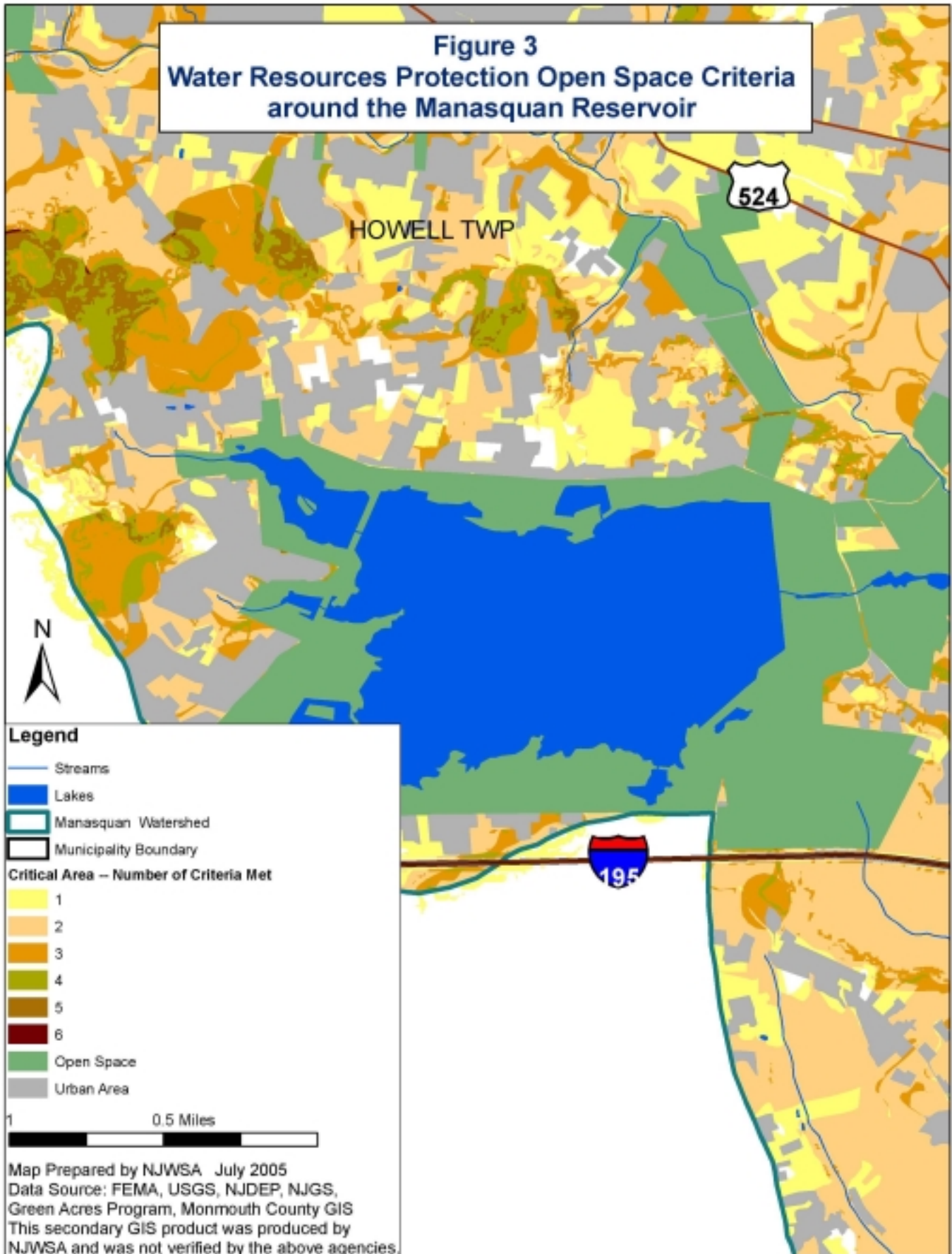
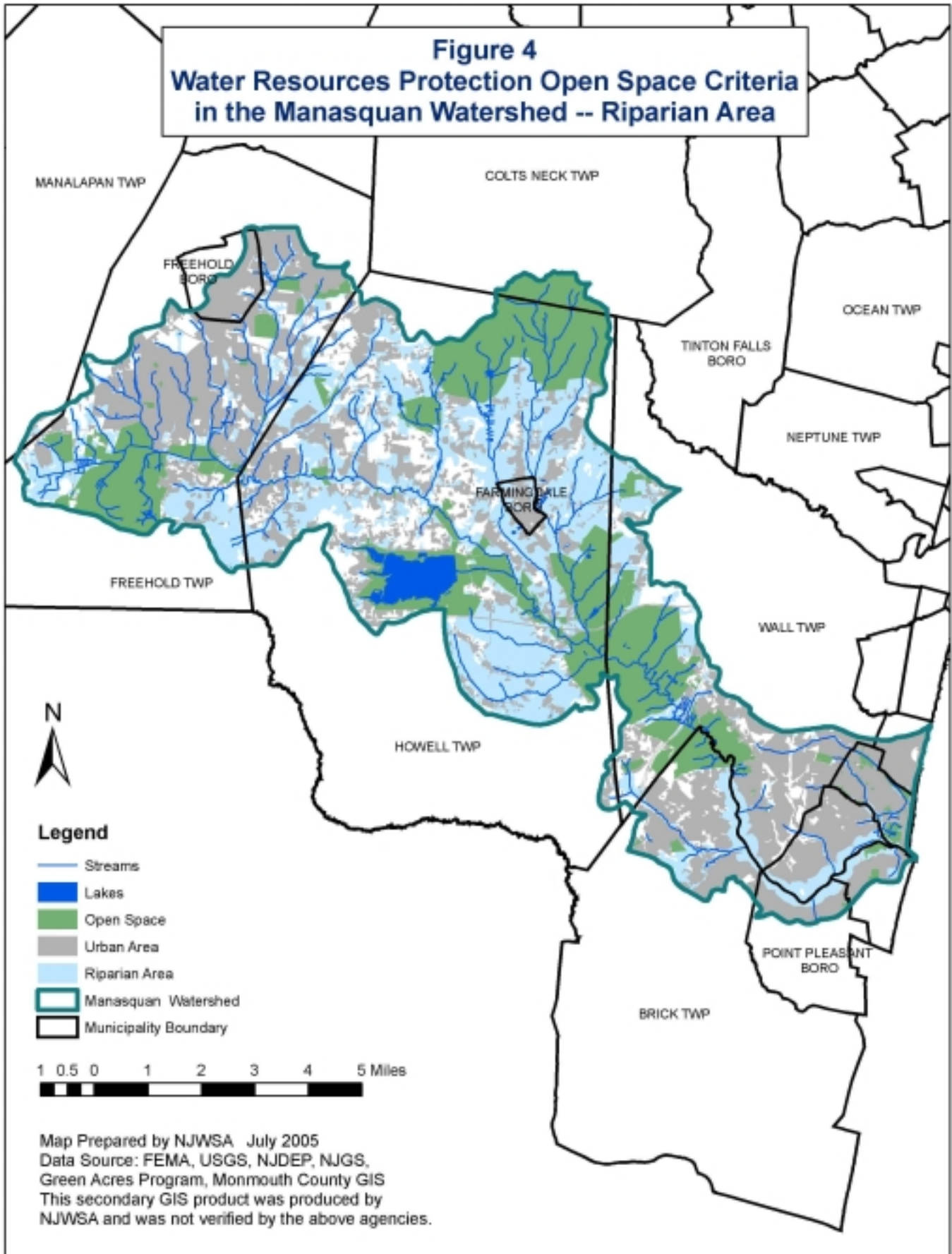


Figure 4
Water Resources Protection Open Space Criteria
in the Manasquan Watershed -- Riparian Area



**Figure 5
Parcels by Percent Critical Area
in the Manasquan River Watershed**

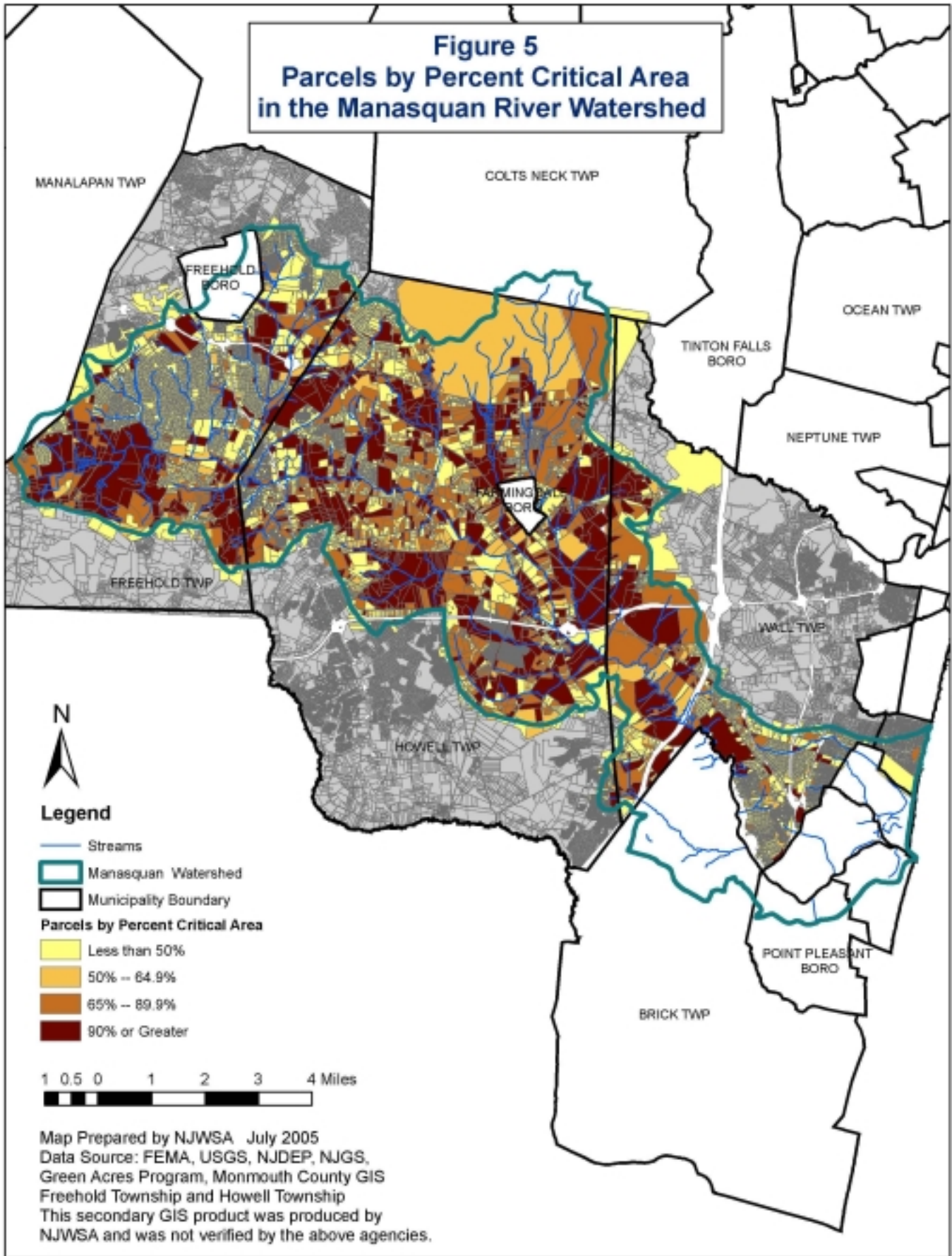
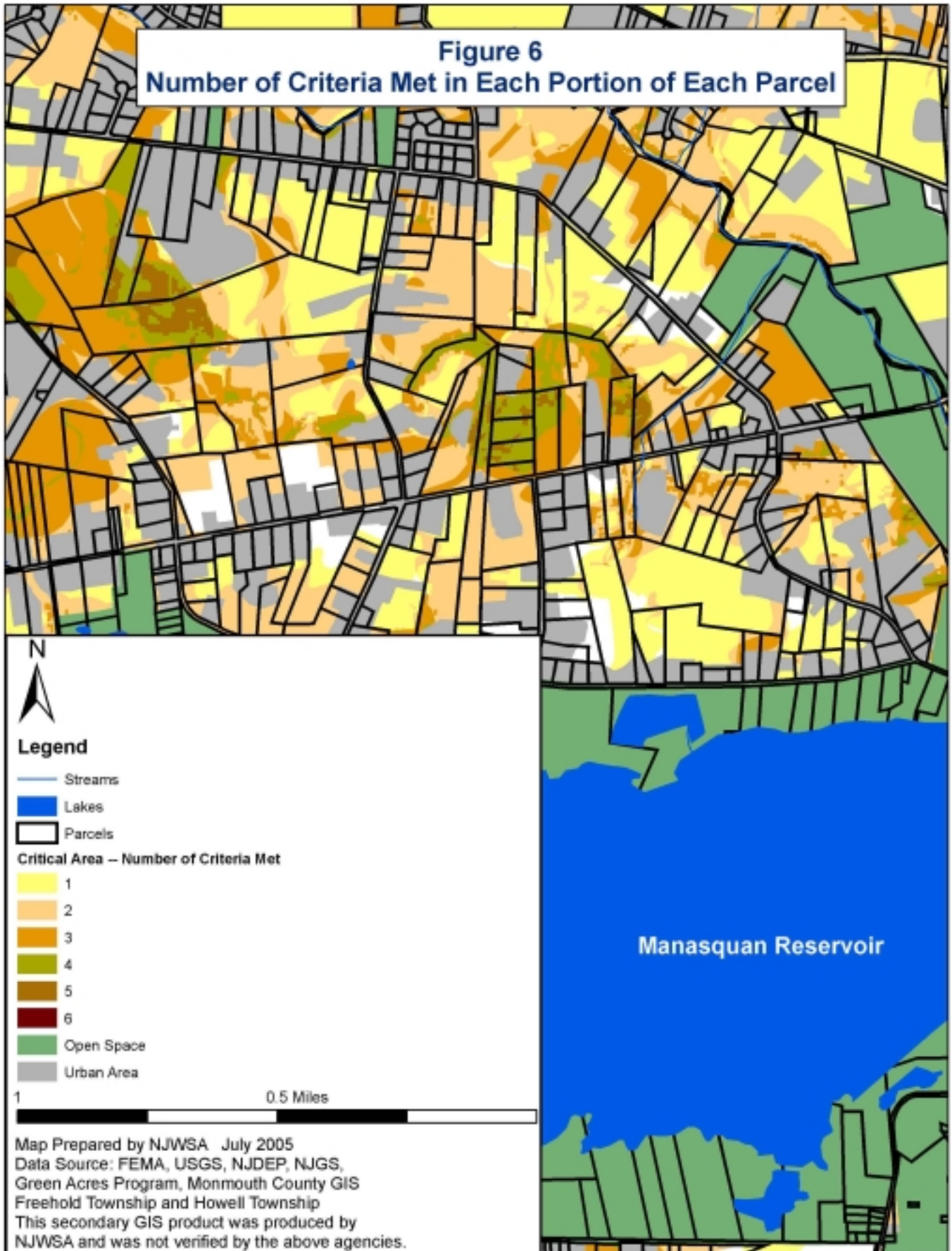


Figure 6
Number of Criteria Met in Each Portion of Each Parcel



Applicable Laws

A number of laws are useful for preservation of critical natural resources through municipal government, as discussed in “Laws and Regulations for Watershed Management,” a report of the Raritan Basin Watershed Management Project. The Municipal Land Use Law provides the basis for municipal regulation of new and changing land uses. There are some additional laws that affect municipal land use regulation in the process of establishing State regulatory programs (e.g., Freshwater Wetlands Protection Act, Flood Hazard Area Control Act). The acts establishing the Green Acres Program, the Farmland Preservation Program, and the Garden State Preservation Trust that oversees them all have applicability to this project. Finally, legislation signed by Governor McGreevey on 29 August 2002 (PL 2002, Chapter 76) mandates that NJDEP develop an open space plan that includes preservation of water resources, and also that the Green Acres Program emphasize protection of open spaces that protect water resources.

The **Municipal Land Use Law** (NJSA 40:55D-1 et seq.) authorizes planning boards to adopt municipal master plans, which must include a land use element and may include a conservation plan element and a farmland preservation element, among others.

- A land use plan element is a document “(a) taking into account and stating its relationship to [the purpose statement of the master plan], and other master plan elements... and natural conditions, including, but not necessarily limited to, topography, soil conditions, water supply, drainage, flood plain areas, marshes, and woodlands; (b) showing the existing and proposed location, extent and intensity of development of land to be used in the future for varying types of residential, commercial, industrial, agricultural, recreational, educational and other public and private purposes or combination of purposes; and stating the relationship thereof to the existing and any proposed zone plan and zoning ordinance...”
- Conservation Plan Elements provide for “the preservation, conservation, and utilization of natural resources, including, to the extent appropriate, energy, open space, water supply, forests, soil, marshes, wetlands, harbors, rivers and other waters, fisheries, endangered or threatened species wildlife and other resources, and which systemically analyzes the impact of each other component and element of the master plan on the present and future preservation, conservation and utilization of those resources.” Open Space plans are often adopted as part of Conservation Elements, and serve as a valuable foundation for Green Acres funding.
- A farmland preservation plan element, if adopted, “shall include: an inventory of farm properties and a map illustrating significant areas of agricultural land; a statement showing that municipal ordinances support and promote agriculture as a business; and a plan for preserving as much farmland as possible in the short term by leveraging monies made available by P.L.1999, c.152 (C.13:8C-1 et al.) through a variety of mechanisms including, but not limited to, utilizing option agreements, installment purchases, and encouraging donations of permanent development easements.” (NJSA 40:55D-28)

The Municipal Land Use Law also authorizes municipal governing bodies to adopt zoning and subdivision/site plan ordinances. Zoning ordinances relate “to the nature and extent of the uses of land and of buildings and structures thereon. Such ordinance shall be adopted after the planning board has adopted the land use plan element and the housing plan element of a master plan, and all of the provisions of such zoning ordinance or any amendment or revision thereto shall either be substantially consistent with the land use plan element and the housing plan element of the master plan...” with certain exceptions (NJSA 40:55D-62). Under a zoning ordinance, municipalities “Regulate the bulk, height, number of stories, orientation, and size of buildings and the other structures; the percentage of lot or development area that may be occupied by structures; lot sizes

and dimensions; and for these purposes may specify floor area ratios and other ratios and regulatory techniques governing the intensity of land use..." (NJSA 40:55D-65)

Subdivision/site plan ordinances must address "Suitable size, shape and location for any area reserved for public use...Reservation ... of any open space to be set aside for use and benefit of the residents of planned development, resulting from the application of standards of density or intensity of land use, contained in the zoning ordinance... Regulation of land designated as subject to flooding...Protection of potable water supply reservoirs from pollution or other degradation of water quality resulting from the development or other uses of surrounding land areas, which provisions shall be in accordance with any sitting, performance, or other standards or guidelines adopted therefore by the Department of Environmental Protection."³ Further, subdivision/site plan ordinances may address "Provisions for standards encouraging and promoting flexibility, and economy in layout and design through the use of planned unit development, planned unit residential development and residential cluster; provided that such standards shall be appropriate to the type of development permitted... Provisions for planned development setting forth how the amount and location of any common open space shall be determined." (NJSA 40:55D-38 through 40)

PL2002, c.76, as signed by Governor McGreevey, provides "that of the open space preserved, as much of those lands as possible shall protect water resources and preserve adequate habitat and other environmentally sensitive areas; the department shall accord three times the weight to acquisitions of lands that would protect water resources, and two times the weight to acquisitions of lands that would protect flood-prone areas, as those criteria are compared to the other criteria in the priority ranking process.... The Department of Environmental Protection, in consultation with the Office of State Planning in the Department of Community Affairs and the Pinelands Commission, shall prepare and submit to the Governor and the Legislature an Open Space Master Plan, which shall indicate those areas of the State where the acquisition and development of lands by the State for recreation and conservation purposes is planned or is most likely to occur, and those areas of the State where there is a need to protect water resources, including the identification of lands where protection is needed to assure adequate quality and quantity of drinking water supplies in times of drought, and which shall provide a proposed schedule and expenditure plan for those acquisitions and developments for the next reporting period, which shall include an explanation of how those acquisitions and developments will be distributed throughout all geographic regions of the State to the maximum extent practicable and feasible." (Emphasis added.)

The provisions of the Municipal Land Use Law, the Garden State Preservation Trust, the Farmland Preservation Program, the Green Acres Program and the recent PL2002, c.76, when viewed as a whole, provide a solid and compelling justification for a watershed-based preservation plan for the Manasquan River watershed.

Application of Protection Methods to Critical Areas

Protection Methods: Preservation versus Development Controls

There are several important methods for preserving the critical areas defined above. Each has its strengths and weaknesses, but can be combined into a broad program that tailors a method to each lot, based on the nature of the critical areas, availability of funding, and whether the property is proposed for development. This report does not recommend "reactive acquisition" (i.e., the pursuit of property once development is proposed) for two reasons: these properties are usually

³ No standards or guidelines have been developed by NJDEP for this purpose.

owned by or under contract to the developer, making acquisition very difficult; and the costs are usually higher than proactive acquisition efforts that seek willing sellers. The most applicable methods are:

- **Green Acres Program** – The Garden State Preservation Trust and NJDEP are responsible for this program, which has three relevant components. The NJDEP directly purchases land for preservation. NJDEP also provides matching grants for counties and municipalities to purchase open space. Finally, NJDEP provides matching grants to non-profit land trusts. The State acquisition program primarily focuses on preservation of natural resources, and can include the purchase of both entire properties (most frequently) and conservation easements (usually with right of public access). The local grants program covers both natural resource preservation and recreational area purchases. Green Acres provides up to 50% of the acquisition cost, with the rest coming from local matching funds.
- **State Farmland Preservation Program** – The Garden State Preservation Trust and the NJ Department of Agriculture-State Agricultural Development Board (SADB) operate a program that purchases development rights from farmland owners. Like the Green Acres Program, the SADB can purchase farmland development rights directly or can contribute matching funds to local programs, in this case County Agricultural Development Boards (CADB). Unlike the Green Acres Program, these purchases must be targeted to specific areas – Agricultural Development Areas designated by the CADBs in consultation with municipalities. The SADB also can purchase farms in fee simple, where the current owner has no interest in continuing the farming operation, and then sells the farm (without development rights) to a private buyer.
- **County and Municipal Open Space Funds** – Many municipalities within the Manasquan River Watershed have dedicated open space taxes as part of their property tax programs, including Brick Township, Freehold Township, Howell Township and Manasquan Borough. These funds are available for land purchases in the area, both for farmland preservation, and natural resources preservation. In many if not most cases, the municipal funds are used to match Green Acres grants, allowing the local programs to stretch their own resources.
- **Environmental Infrastructure Financing Program** – Low-interest loans are available for the purchase of lands critical to the protection of water quality, through a combination of Clean Water Act funds from NJDEP and Environmental Infrastructure Trust market-rate loans. The result is loans at one quarter of the market rate, which can be repaid using open space funds or other resources. Interim financing is available for projects that are pre-approved for loans, where the loans have not yet achieved Legislature approval.
- **Non-profit Land Trusts** – These organizations often have a combination of internal resources derived from members, foundations and other donors, and Green Acres grants.
- **Voluntary Preservation** – Landowners can donate their development rights or the land itself to a land trust or government to ensure that the land is not developed at a later date. The donation is made part of a deed restriction. The landowner often can gain a tax deduction for the donated easement and may be able to receive a lower tax assessment. One advantage to this easement approach (from the landowner's perspective) is that a conservation easement of this type does not require public access, unlike the sale of conservation easements to Green Acres.
- **Development Restrictions** – Municipalities can use their zoning and subdivision ordinances to preserve critical areas up to a point. Development of some critical areas is well recognized as a potential threat to public health, safety and welfare, and State law authorizes municipalities to impose controls for the protection of those areas (e.g., flood plains, floodways). Freshwater wetlands, on the other hand, are regulated by the State and a

municipality has no authority to regulate such wetlands development per se, though they can retain zoning power regarding lands that include wetlands. Finally, some critical areas are commonly recognized as important, but a balancing of public and private harm is necessary to determine the extent to which a municipal zoning or subdivision ordinance can mandate their preservation. Non-traditional techniques are available that can reduce the conflict with development expectations. Several municipalities in the area allow, recommend or essentially require that development within a subdivision be sited in a manner that protects critical areas while allowing the same development density of a “normal” subdivision. These techniques have various names, such as:

- Clustering (usually where development is concentrated in one area, with one or more undeveloped lots being created),
- Lot-size averaging (where some lots are smaller and others larger than the nominal zoning density, but the entire site is contained with lots that are sold to private interests and the critical areas are concentrated in the large lots), and
- Open space subdivisions (where developed lots are smaller than the nominal zoning density and the remainder of the land is placed in common open space lots. Site design maximizes both natural resource preservation and lot value, rather than clustering lots into one part of the site or conserving only the unbuildable portions of the site).

Identification of Potential Preservation Lands

In order to rank the most critical parcels and avoid open space isolation, parcel size and fragmentation criteria should be applied to the critical areas maps to identify the potential preservation lands. For example, in the Spruce Run Initiative Project, the criteria for Preservation of Large Open Spaces and Avoiding Land Cover Fragmentation included parcels of 100 acres or more, parcels of 30 acres or more that are contiguous to 100+ acre parcels, and contiguous parcels of 30+ acres that in aggregate are more than 100 acres. Occasionally parcels of slightly less than 30 acres were also included because they provided valuable links between other targeted parcels and contained similar environmental resources. (Please refer to the Spruce Run Initiative Preservation Plan Report for more information)

The Manasquan River Watershed resource protection project can borrow the same idea from Spruce Run Initiative project and decide what threshold should be applied to parcel size to identify potential parcels for preservation and restoration. Proximity to existing preserved open space should also be included as a factor, to create large aggregate areas of green space and greenways. Large aggregate parcels provide the greatest opportunity for water resources protection, cost-effective preservation, contiguous habitats, greenways, and wildlife corridors, etc. Since the watershed-wide parcel data were not available prior to publication of this report, the appropriate parcel size threshold could not be applied to rank each property, but each municipality can take the critical area criteria GIS information, combine it with their open space preservation plan and decide what is the best approach to target open space preservation. The ranking below is only based on the percentage of each parcel in critical area. Please be advised that this ranking should be combined with parcel size and other appropriate criteria customized by each local municipality.

- **Highest Value for Preservation** – A parcel with 90+ percent critical area, where the parcel fits well into a large cluster of targeted parcels or would be a key link in an existing or proposed greenway or wildlife corridor; or a parcel with 65+ percent critical area, if that parcel is an important link between other top priority parcels or preserved open space or is essentially surrounded by such parcels. In some cases, parcels with 50 – 65 percent critical area should be included, if they extend beyond the watershed boundary but the portion within the

watershed has very dense critical area coverage. In these cases, the percent critical area may be artificially low due to the GIS mapping process.

- **High Value for Preservation** – A parcel with 65+ percent critical area, unless the parcel qualifies for top priority as defined above; or a parcel with less than 65 percent critical area where the configuration of critical areas does not allow for site development in a manner that protects the critical areas.
- **Preservation by Subdivision Control** – A parcel that has less than 65 percent critical area, where the configuration of the critical area would allow site development (using clustering, open space design or lot size averaging) that does not unduly infringe upon the critical areas.
- **Existing Dedicated Open Space** – All existing, dedicated open space parcels should remain in their existing condition. It is critically important that preserved farmland soils be maintained for active agriculture, rather than being buried under impervious surfaces. Likewise, preserved lands with natural habitats such as forests should not be diverted to uses that involve significant impervious surfaces or loss of habitat value. Not only do such losses degrade watershed values, they also can reduce public support for further preservation.

These results are available as confidential information to the municipalities for use by their open space programs regarding acquisition negotiations. However, these maps address specific acquisition priorities for specific parcels, and therefore are not included in this report.

Responding to Development of Targeted Preservation Areas

One final issue is critical to project success. Any State acquisition using Green Acres funds must be on a “willing seller” basis – eminent domain powers of the State of New Jersey may not be used. Municipalities and counties can use eminent domain with Green Acres funds, but condemnation of land can be procedurally, politically and financially difficult. A key issue is how a municipality should guide site design to minimize the loss of critical areas if a parcel identified as a highest or high value for acquisition is developed instead. NJWSA and the Manasquan River Watershed Association note that a parcel with 90+ percent critical area cannot be developed under any existing municipal ordinance without some loss of critical area; of course the members recognized that the answers depend on the types of critical areas involved and their relationship to surrounding parcels and critical areas. The following guidelines are recommended to municipalities for regulation of development:

- 1) In all cases, protection of riparian areas, flood plains and high ground water recharge areas should be maintained. If so much of the parcel is contained within these areas that full protection is not possible, some loss of ground water recharge area can be allowed if the development provides for alternative recharge.
- 2) Wherever possible, the preserved portions of developed subdivisions should link to critical areas in surrounding parcels, so that contiguous habitat, wildlife corridors and greenway opportunities are preserved despite the partial loss of critical areas.
- 3) Within Agricultural Development Areas (ADA) (currently the GIS information for ADA is not available, so watershed-wide ADA analysis is not available at this time), the protection of prime agricultural soils from loss to site development should have priority over the protection of forest cover. The sole exception is where the forest cover within the parcel is part of a dense forest area – such dense forest areas are rapidly being lost, with international impacts on migratory birds.

- 4) Outside of Agricultural Development Areas, forest cover should have priority over the protection of prime agricultural soils when a preservation target goes to development. In these cases, the prime agricultural soils tend to be small in scale, and the farms are often small, isolated or of limited production capacity. Therefore, protection of forests is more important.
- 5) Where a parcel is mostly covered by critical habitat for priority, threatened and endangered species, greater preference should be given to parts of the parcel that meet multiple critical area criteria (e.g., critical habitat plus other critical area criteria). If all such areas can be preserved within the development, then priority should go to remaining areas that provide habitat for Federal threatened and endangered species followed by State endangered and threatened species and then priority species.

Recommended Planning Process

The municipal project members should meet, discuss and decide each element of the preservation plan, especially for critical area preservation that cross municipal borders. NJWSA and Manasquan River Watershed Association will serve as staff, planning and technical assistants and facilitators, and confer between meetings to develop information requested by the project members. Meetings should also be held with local professional planners to solicit input and update them on the planning process.

The following tasks are recommended by the Authority through the practice experience from the Spruce Run Initiative Project:

- 1) **Partnership Development** – NJWSA and the local municipality can create a partnership through Memoranda of Understanding and other techniques.
- 2) **Coordination Process** – NJWSA and the Manasquan River Watershed Association can convene regular meetings to discuss tasks, review draft work products, assess progress and decide next steps, through the project life and beyond.
- 3) **Assess Available GIS Information** –NJWSA compiled a great deal of GIS information for review and assessment. Of special note are products from the Manasquan River Watershed Critical Area Preservation Project (e.g., primary ground water recharge area, riparian area delineations).
- 4) **Identify Preservation Priorities** – Using the information from the Manasquan Watershed Critical Area Project, the project members will be able to identify preservation priorities, with full justification for the priorities. Funding for land acquisition can come from many sources, each with its own priorities. With a detailed justification for preservation priorities, it will be possible to better match funding with acquisition targets. In addition, there are many regulatory mechanisms for land preservation, each with its own priorities, legislative mandates and limitations. Matching these legal needs and limits to the justification for preservation priorities will limit the exposure of any municipality to legal challenges.
- 5) **Review Existing Master Plans and Ordinances** – The project members can review existing land use control ordinances in detail to determine the extent to which they currently do or do not protect natural resources that typify the water resources protection. This critical area GIS and assessment information provides a foundation for recommendations regarding desirable improvements to the master plans and ordinances related to critical water resources area protection.
- 6) **Identify Challenges and Opportunities** – The local municipalities can identify the key challenges and opportunities needed to implement the preservation priorities. Major **challenges** are: financial constraints; the difficulty of master plan and ordinance changes;

landowner disinterest; State requirements for “willing seller” transactions; limited local staff; and the complexity of coordinating regulatory and non-regulatory mechanisms to achieve a “seamless” protection of the watersheds and the reservoir. **Opportunities** include: ongoing preservation work by municipalities, Monmouth County, land trusts, and others; available municipal powers; Green Acres and farmland preservation funding; municipal and county land acquisition funds; and strong public interest in the area.

- 7) **Develop Action Plan** – Tasks 5 and 6 can provide the basis for an action plan; a set of strategies to achieve preservation of the priority areas, overcoming the challenges and making best use of the opportunities.
- 8) **Develop Public Education Program** – As part of the action plan, public education efforts can be implemented to assist with: building support for the action plan; encouraging landowners to become involved in the voluntary protection agreements or the donation or sale of land rights; and improving public understanding of the area’s natural resources and the benefits of land conservation in the Manasquan River Watershed.
- 9) **Plan Adoption** – This report is offered to the municipalities to help provide technical support and GIS analysis of the critical natural resources - the Conservation Element of their Municipal Master Plans, as authorized by the Municipal Land Use Law. Once the watershed-wide preservation plan is developed and adopted, the preservation plan associated with this technical report can be used as part of the basis for changing subdivision ordinances, for review of subdivisions and for targeting land preservation efforts. NJWSA will encourage Monmouth County, Ocean County and the NJDEP Green Acres Program to use this report for their land preservation activities.

Recommended Improvements for Municipal Ordinances

NJWSA and the Manasquan River Watershed Association have not reviewed the municipal ordinances for each local government due to time restrictions, so the recommended improvements below for municipal ordinances is very general based on the preservation needs identified through this project. Local municipalities can choose appropriate recommendations to improve their management of new development.

- 1) Local municipalities should consider integrating the critical area criteria used in this project in their ordinances for protection of environmentally sensitive areas and use the criteria in site review proceedings. In addition, many technical changes will be needed in ordinances to address site-specific data needs (in recognition that regional GIS data cannot substitute for site-specific information).
- 2) Local municipal ordinances may have critical area criteria that are not used in this project. When the new criteria are added to these ordinances, the affected municipality must decide where the other criteria fit with regard to preservation priorities as discussed above. In addition, measures to ensure that each lot contains enough non-critical area to support a building, and to ensure a minimum level of dedicated open space in the subdivision will be important.
- 3) The use of zoning mechanisms to provide for the movement of development away from critical areas and into non-critical areas is extremely important. However, the best techniques are not equivalent to the popular conception of “clustering” where all development is forced to a corner of a lot, or into the center, and the open space is comprised primarily of those areas unsuitable for development anyway. NJWSA supports methods of arranging development that begin with the open space critical areas criteria, and defining the portions of a site that should be preserved (see Conservation Design/Open Space Subdivisions, below). Allowable

development (based on the zoning) is then fit into the appropriate, non-critical parts of the site. This approach is variously known as conservation subdivision design or open space subdivisions. For smaller lots or where there is no desire to have a dedicated parcel of common open space, lot-size averaging is often effective.

Therefore, NJWSA strongly recommends that the conservation subdivision design or open space subdivision approach be used to protect the most critical resources first, and arrange the resulting development in ways that maximize natural resource preservation. The region will benefit to the extent that these techniques are maximized in developments, but the best approach for each municipality may differ. However, there is little need for incentives for such approaches, as municipalities have the ability to strongly favor such approaches, and subdivisions using these techniques can avoid expenses for land sculpting, roads and utilities. Evidence exists that such subdivisions also sell faster, and can provide a greater profit depending on the site and the costs of project approval. There are several options available:

- Mandate conservation subdivision design/open space subdivisions unless the site makes them infeasible.
- Allow these techniques as a by-right option for subdivisions. This is essentially the approach used in most municipalities.
- Allow these techniques as a conditional use.

In each case, the ordinances must make very clear what is to be preserved, how development may and may not be oriented within the site, methods for siting ancillary facilities such as septic systems and roads so that critical areas are preserved, what types of critical areas have greater or lesser priority than others (see Responding to Development of Targeted Preservation Areas, above), and preferences for the orientation of lots to maximize community amenities and site value. Municipalities can benefit from ordinances that maximize development value while simultaneously maximizing environmental protection – the ratable value of each house will be higher and easier to maintain, the community ambiance will benefit, and a profitable development is more likely to allow for better construction practices if compliance is assured through local action.

Municipal and Public Education Opportunities

The Manasquan River Watershed Critical Area Project has benefited from the participation of representatives from local municipalities, allowing for a good flow of information to and from the municipalities, and ensuring that the final result has a good chance for implementation. However, it is important that education about the project and its development goes well beyond those involved directly in the project process.

During the course of this project, live GIS presentations were provided to project participants summarizing the status of the project. The final GIS results and maps were formally presented to Manasquan River Watershed Association on May 17, 2005. NJWSA will continue to make public presentations about the Manasquan River Watershed Critical Area Project as needed, and technical and planning assistance will be provided by NJWSA to help the municipalities become more familiar with the results and use them in their planning and acquisition efforts.

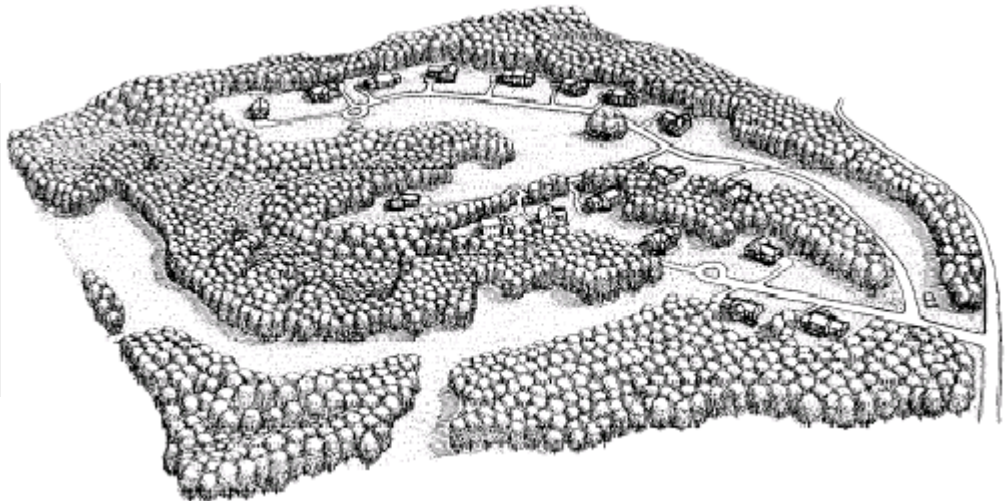
Local municipalities can choose other public education ideas for this project, which include: public displays that could be moved among municipal buildings and local libraries, neighborhood meetings, videos for library use, loans on environmentally sensitive property management, and information in municipal newsletters and mailings.

Conservation Subdivision Design/Open Space Subdivisions

Randall Arendt (formerly of the Natural Lands Trust) has developed, compiled and presented a great deal of information on alternative methods for designing subdivisions and developments in zones ranging from rural to village or town commercial (see www.natlands.org). The State of Pennsylvania co-sponsored a book on these techniques, Growing Greener: Putting Conservation into Local Plans and Ordinances, as part of the Growing Greener program cosponsored by Pennsylvania and the Natural Lands Trust. The concept revolves around identifying critical community resources (e.g., farmland, woodlands, riparian corridors) and providing for lot size flexibility that is directed toward preserving these features in a manner that also preserves or even enhances the profitability of the development. In Growing Greener, Arendt cites an example in Delaware County, Pennsylvania, where the subdivision design resulted in lot premiums for many subdivision lots. However, he notes, "The first lots sold tended to be those adjoining the open space, despite the premiums added because of that proximity." Through this technique, potential perceptions of diminished property value (due to the smaller lot sizes for each home) are overcome by the lot amenities – views of open space that minimize the visual interference of other homes. In other words, actual lot size becomes unimportant because the homeowners don't really pay much attention to the actual size of their lot – it is their perceived lot size (as established by sight lines, lack of noise, etc.) that really matters.

Some of these same techniques tie into a relatively new concept for site design called Low Impact Development, an approach pioneered in Prince Georges County, Maryland. Low Impact Development focuses more on the environmental impacts of the actual site development, while conservation subdivision design focuses more on the layout of the subdivision. However, these concepts are clearly complementary. Conservation subdivision design can be used to ensure that the critical natural resources are preserved while protecting the amenity value of the proposed lots and therefore developers profit. Low impact development techniques can then protect natural resources both within the development envelope and outside the disturbed area through appropriate lot design, stormwater reduction measures, landscaping, construction practices, etc. The Low Impact Development Center in Maryland is a good source of information on these practices (see www.lowimpactdevelopment.org/).

A sample conservation design subdivision from "Growing Greener" (Arendt, 1999) showing a birds-eye view of the subdivision without lot lines delineated.



Next Steps

The following steps, plus educational efforts, are critical for implementation of this project:

- 1) Use of this project by local municipalities as the basis for preservation of parcels within the Manasquan River Watershed, through open space purchases as well as farmland conservation easements. (The Agricultural Development Area analysis was not included in this study because the dataset was not available).
- 2) Using the findings from this project as a component of the Municipal Master Plan's Conservation Plan Element, in support of improved subdivision design. The adoption of project results as part of the Open Space Plan or an open space component of the Master Plan is beneficial when soliciting state funds. .
- 3) Allocations of sufficient financial resources, including special funds that are not currently available through State programs, to fully implement this project for critical environmental resources protection.
- 4) Use of this study by Monmouth County and Ocean County as the basis for preservation of parcels within the Manasquan River Watershed for both open space purchases and farmland conservation easement. (The farmland preservation priorities were not analyzed in this report because GIS data were not available).
- 5) Use of project findings by the Green Acres Program as the basis for land preservation efforts in the Manasquan River Watershed.
- 6) Use of project results by local and regional land trusts as the basis for preservation of lands within the project area.
- 7) Use of project findings by local landowners as justification for preservation of their lands, or of critical areas on their lands, within and outside of the project areas. NJWSA especially encourages landowners to preserve the riparian areas running along streams, as these lands have a direct and important impact on stream health.

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