



*State of the*  
***Watershed***  
*Report 2010*

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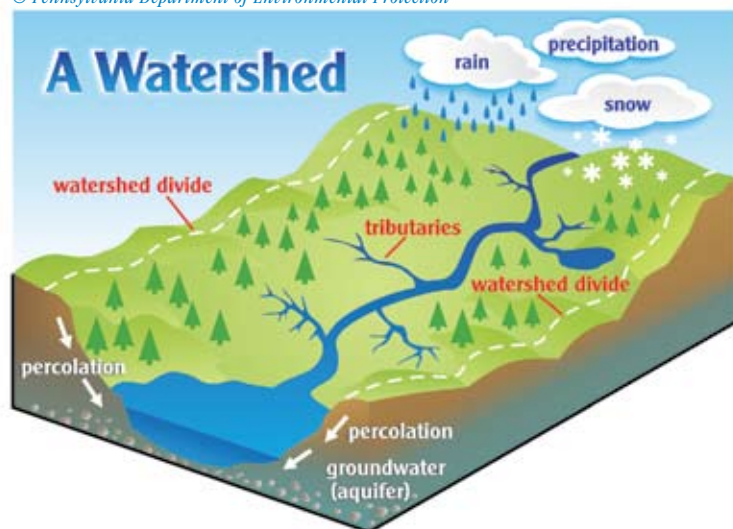
**Stony Brook-Millstone Watershed Association**  
*Your water • Your environment • Your voice.*

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(609) 737-3735 • [www.thewatershed.org](http://www.thewatershed.org)

### *What is a watershed?*

*A watershed is an area of land that drains into a particular body of water, such as a stream, river, pond or lake. A watershed is not determined by political boundaries, but instead is shaped by nature's hills and valleys. No matter where you live, you live in a watershed – and it's up to all of us to protect it.*

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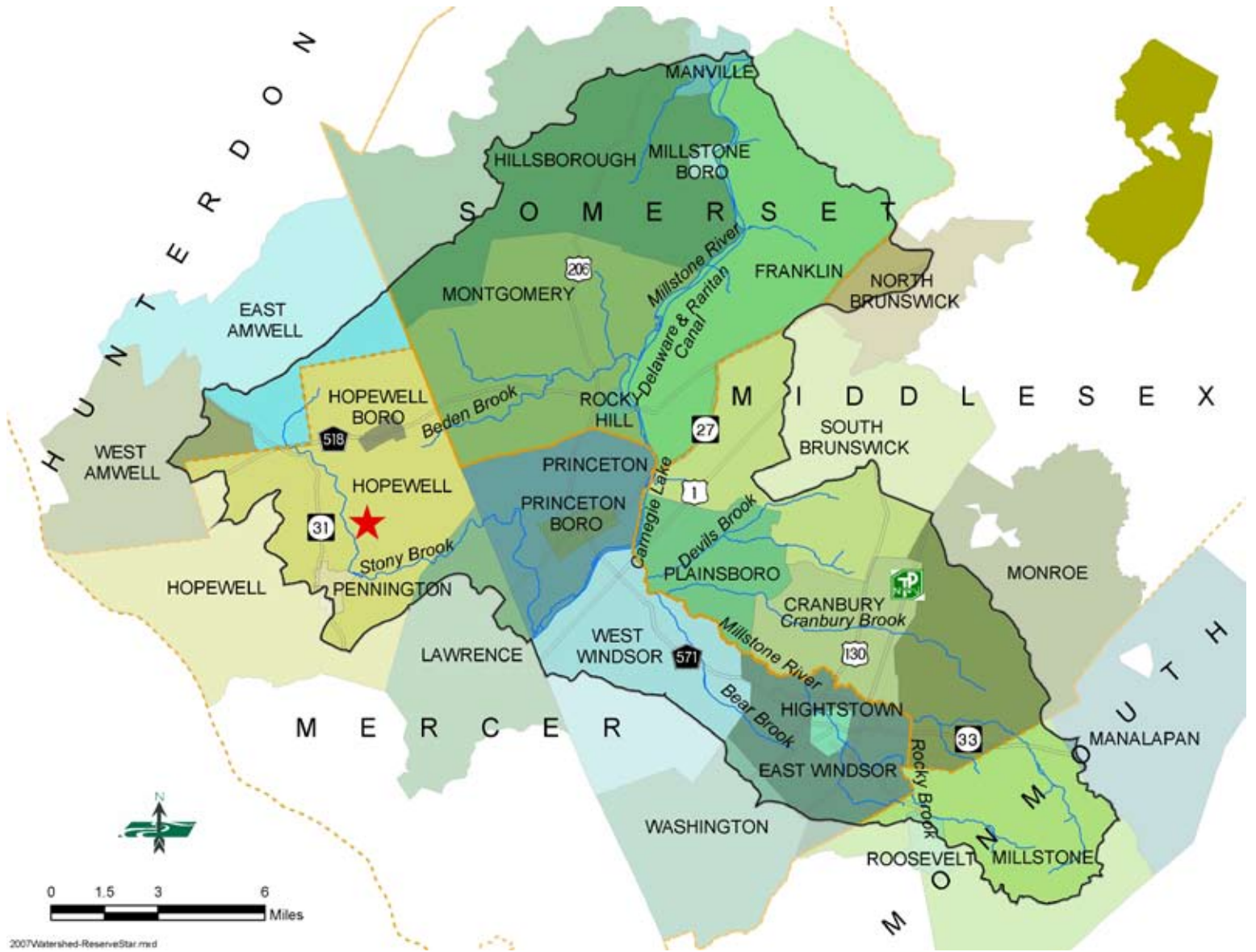
  


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## Watershed Map

★ *Stony Brook-Millstone Watershed Reserve*



2007Watershed-ReserveStar.mxd



## Introduction

Today our water is threatened as never before. From population growth and increased development to environmental changes associated with global warming, central New Jersey's lakes, rivers, streams and groundwater sources face numerous challenges. Our watershed is home to hundreds of thousands of people who rely on our valuable natural resources to maintain their quality of life.

For more than six decades, the Stony Brook-Millstone Watershed Association has worked to protect clean water and the environment in central New Jersey through conservation, advocacy, science and education. Founded in 1949 by a handful of citizens concerned about the health of our streams, the Watershed Association was one of the first organizations in the nation to protect a region based on natural boundaries instead of political borders.

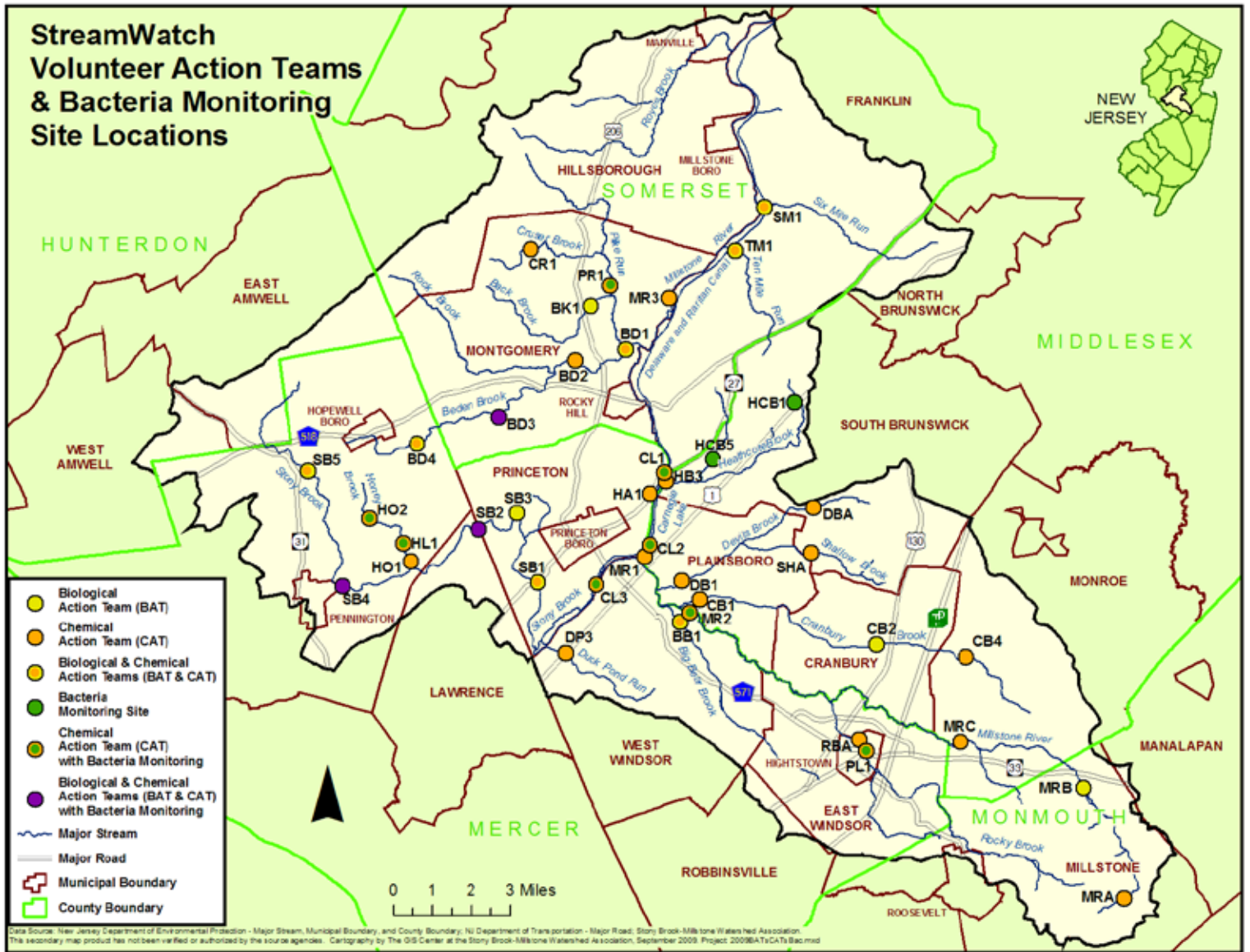
Winner of a 2009 NJ Governor's Environmental Excellence Award for our environmental leadership and dedication to protecting clean water, we protect the Stony Brook-Millstone Watershed – a 265-square-mile area of central New Jersey that drains to the Millstone River and its tributaries, including the Stony Brook. Spanning five counties and 26 towns, this region includes a wide range of important wildlife habitat and areas critical to the health of our water, such as the dense forests and vernal pools of the Sourland Mountains, the Delaware & Raritan Canal, the grasslands of Six Mile Run and vast expanses of open farmland and sensitive wetlands.

Inspired by our 60th Anniversary, we took on the challenge of compiling this first-ever comprehensive look at the Stony Brook-Millstone Watershed. Using data gathered in three categories: Water Quality, Environmental Policy and Land Use this report outlines the conditions today, what we as an Association are doing to address the problems and steps everyone can take to protect clean water and the environment.

The Watershed Association's StreamWatch program monitors the health of our water at 42 locations. Here a Chemical Action Team member takes a sample.



**StreamWatch Sites Map**




## Water Quality

### *Our watershed by the numbers ...*

- *42 StreamWatch sites*
- *Over 85 acres of trees and native grasses planted throughout the watershed since 1997*
- *5,393 linear feet of streambank restored since 1997*
- *19,428 pounds of trash removed from local waterways since 2007*

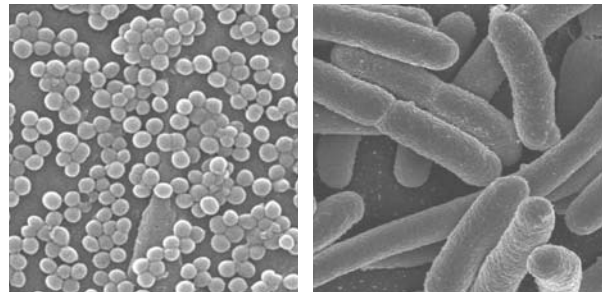
If you live in central New Jersey, your drinking water may come from the lakes, rivers, streams or groundwater of the Stony Brook-Millstone Watershed, or a combination of these sources. With so many people depending on millions of gallons of water every day, it's in all of our interests to keep our water sources clean and healthy.

The actions we take as individuals – avoiding fertilizing our lawns, removing litter, picking up pet waste – and the laws and policies adopted by our towns and the state, have a direct effect on the quality of our streams and groundwater. To ensure we all have clean water to drink and use and that fish and wildlife have healthy habitats, the Stony Brook-Millstone Watershed Association scientifically monitors the health of our water, cleans and restores ailing waterways, and works to prevent future degradation.

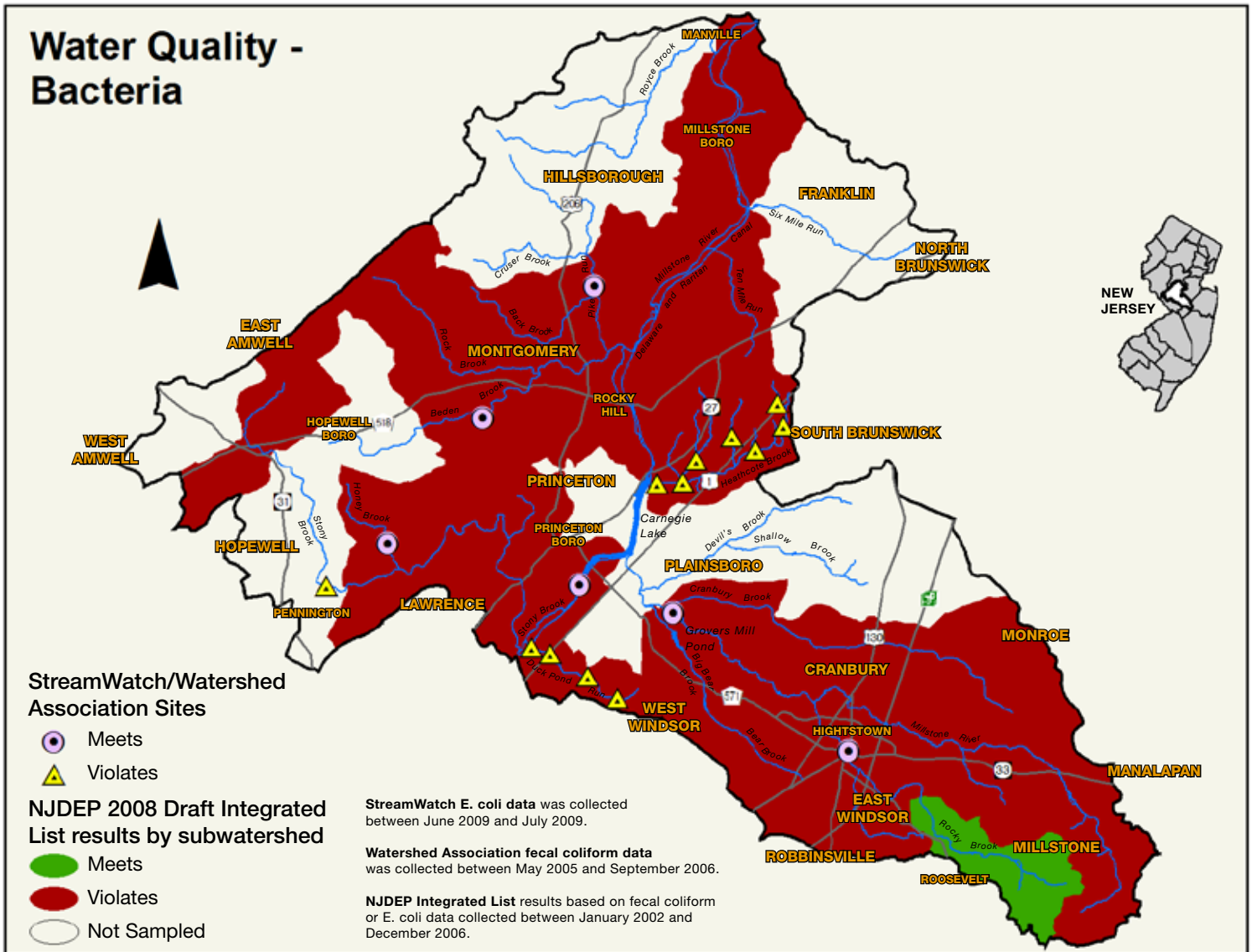
Our StreamWatch Water Quality Monitoring Program, started in 1992, collects chemical and biological data at 42 sites throughout our watershed. Through chemical testing we analyze water samples for nitrates, orthophosphates, temperature, pH, turbidity, and dissolved oxygen. Through biological testing we collect and identify insect samples to determine a water quality rating. And our bacterial monitoring gives an indication of how clean our waterways are for swimming by testing for *Escherichia coli* (abbreviated as *E. coli*) bacteria. We provide every municipality in our watershed with an annual report of test results and related ordinance recommendations. The recent purchase of new equipment, a spectrophotometer, is bolstering our testing capabilities by allowing us to confirm high test result readings with even more specificity.

The following pages focus on six parameters used to judge water quality: Bacteria, Total Suspended Solids, Nitrates, Orthophosphates, Aquatic Life and Dissolved Oxygen. Data used is from the NJ Department of Environmental Protection (NJDEP) and Watershed Association monitoring efforts. StreamWatch and the NJDEP use different analytical methods to determine test results (see Appendix on page 39 to learn more). These different testing methods and the difference in how often areas are tested account for some of the contradictions in data on the maps that follow.

*Fecal coliform and Escherichia coli (E. coli) bacteria live in the intestinal tracts of animals and are indicators that other disease-causing bacteria may be in our water.*



**Water Quality -  
Bacterial Distribution**



*Data Sources: NJ Department of Environmental Protection – Draft NJ Integrated Water Quality Monitoring and Assessment Report 2008, Stream Drainage Areas [HUC 14] 1999, Streams 2002, Lakes 2002, and Watershed Management Area 2000; NJ Department of Transportation – Roads 2007; and SBMWA – StreamWatch data. With the exception of SBMWA, this secondary map product has not been verified or authorized by the source agencies. Map created by the GIS Center of the Stony Brook-Millstone Watershed Association 10/2009. Project: 2009StateoftheWatershed-Bacteria.mxd*

<i>State Water Quality Standard (Primary Contact)</i>	<i>Geometric Average</i>	<i>Single Sample Maximum</i>
<i>E. coli</i>	<i>126 colony forming units (cfu) / 100 milliliters (mL) of water</i>	<i>235 cfu / 100 mL</i>
<i>Fecal coliform</i>	<i>200 cfu / 100 mL</i>	<i>400 cfu / 100 mL *</i>

*\* Only 10 percent or less of the total samples taken during any 30-day period may exceed this amount.*

## Bacteria

### *What you can do... at home:*

- Pick up after your pet and dispose of pet waste properly (in trash or flush down the toilet – not down a storm drain).
- Don't mow to the edge of waterways in your backyard and plant shrubs and tall grasses along ponds and lakes to discourage the nesting of geese.
- If you have a farm with animals, fence them out of streams, lakes and rivers.
- Properly care for and maintain your septic system.

### **What is it?**

Escherichia coli (abbreviated as E. coli) is a type of bacteria that lives in the intestinal tracts of animals and humans. While E. coli contamination of food can cause serious food poisoning, this bacteria's existence in water bodies is usually harmless. However, it is an indicator that other pathogens of fecal origin – disease-causing bacteria, viruses and parasites – may be present.

### **Why is it important?**

Swimming or wading in streams with high E. coli levels is considered to be a human health risk.

### **How does the watershed measure up?**

As you can see on the map to the left, much of the water in the Stony Brook-Millstone Watershed violates the state standard for bacteria. The high levels of bacteria in our water are clear indicators of the significant impact non-point source pollution – or polluted runoff – has on our region. When it rains, polluted runoff – often a combination of “people” pollution from failing septic systems and leaking sewer pipes, and animal waste (from livestock, geese and pets) – washes off the land and into our lakes, rivers and streams.

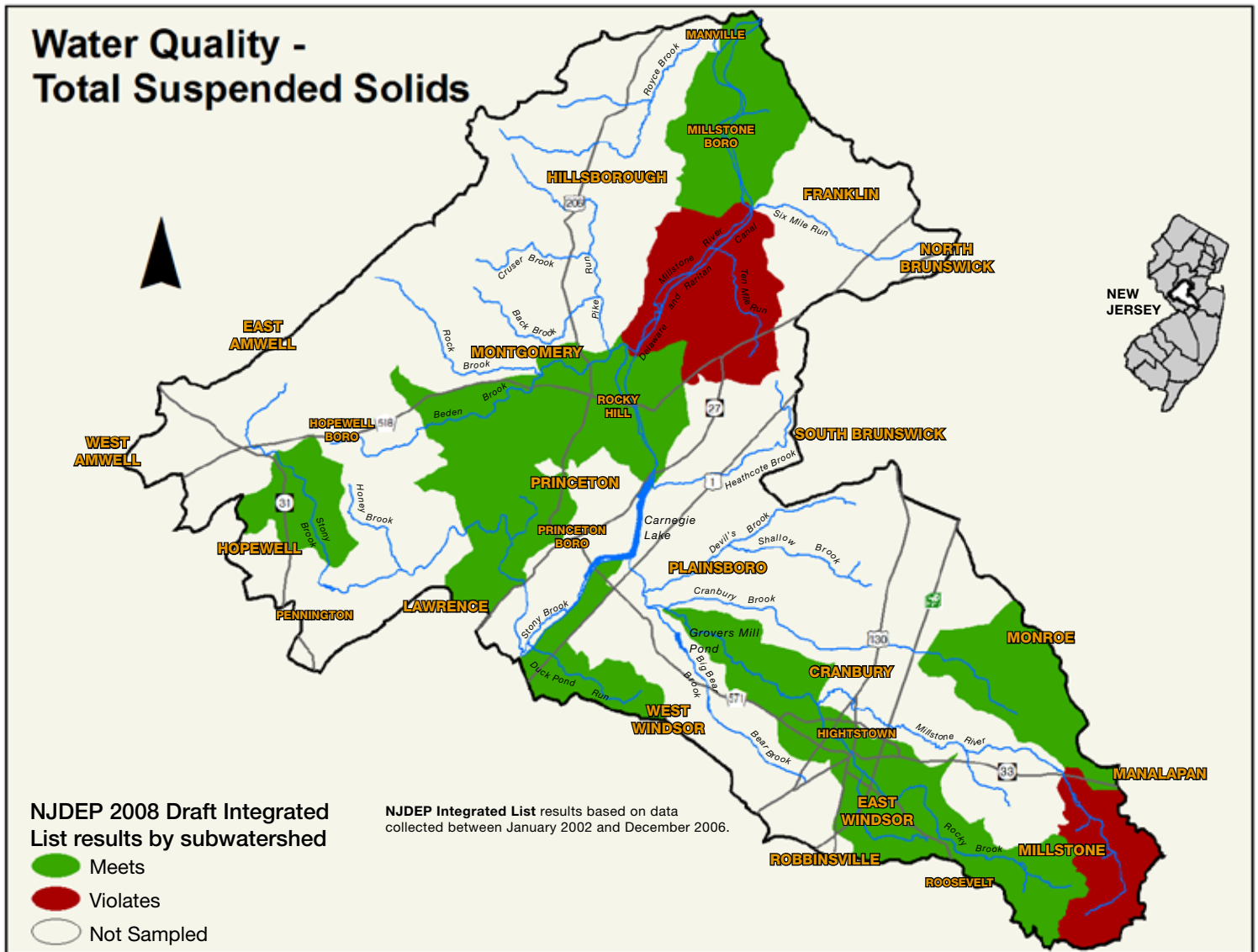
High levels of bacteria typically spike for three days after big rainstorms, but leaking septic and sewer systems can cause ongoing problems. Watershed Association testing has identified two hotspot regions – the Heathcote Brook in South Brunswick and Duck Pond Run in West Windsor. There are two distinct testing sites on the Heathcote Brook that pinpoint specific problems with leaking sewer pipes and failed septic systems.

You'll note that six StreamWatch testing sites show that areas meet state standards, while NJDEP data show they do not. These contradictions exist because while both NJDEP and the Watershed Association test bacteria, the frequency and testing methods differ. In addition, one StreamWatch site on the Stony Brook in Hopewell Township violates standards for bacteria. There is no NJDEP data available in that subwatershed region.

Water with high TSS appears cloudy (left). After a rainstorm, TSS clouds Pike Run in Montgomery Township (right).



## Water Quality - Total Suspended Solids



Data Sources: NJ Department of Environmental Protection – Draft NJ Integrated Water Quality Monitoring and Assessment Report 2008, Stream Drainage Areas [HUC 14] 1999, Streams 2002, Lakes 2002, and Watershed Management Area 2000; NJ Department of Transportation – Roads 2007; and SBMWA – StreamWatch data. With the exception of SBMWA, this secondary map product has not been verified or authorized by the source agencies. Map created by the GIS Center of the Stony Brook-Millstone Watershed Association 10/2009. Project: 2009StateoftheWatershed-TSS.mxd

<i>State Water Quality Standard</i>	<i>Meets</i>	<i>Violates</i>
<i>Total Suspended Solids</i>	<i>TSS levels at or below 40 mg/L</i>	<i>TSS levels above 40 mg/L.</i>

## Total Suspended Solids

### *What you can do... at home:*

- Plant a rain garden and direct downspouts toward it instead of pavement to help stormwater soak into the ground on your property where it lands, rather than running across property to streams picking up sediment en route.
- Plant native trees and/or shrubs to reduce runoff from your property and stabilize soils.
- Don't mow to the edge of waterways in your backyard and plant shrubs and tall grasses along streams to filter sediments out of rainfall runoff.
- Become River-Friendly! (See Conclusion on page 38 to learn how.)

### *Local Advocacy:*

- Make sure your town adopts stream corridor and forest protection ordinances and encourage your town to improve water quality by updating stormwater mitigation plans to address existing runoff problems.

### **What is it?**

Total Suspended Solids (TSS) is a direct measurement of the particles suspended in water and removable by lab filtering techniques. Suspended solids consist of inorganic elements (silts, clays, sand and rock fragments) and organic elements (algae, zooplankton and bacteria) that are carried along by water as they run off the land.

### **Why is it important?**

Water with high TSS levels, or high sediment loads, is harmful to aquatic life. High levels of TSS make water cloudy and block sunlight needed for plant life. When TSS settles it can smother eggs and aquatic insects. More TSS also raises the cost of cleaning water to make it drinkable.

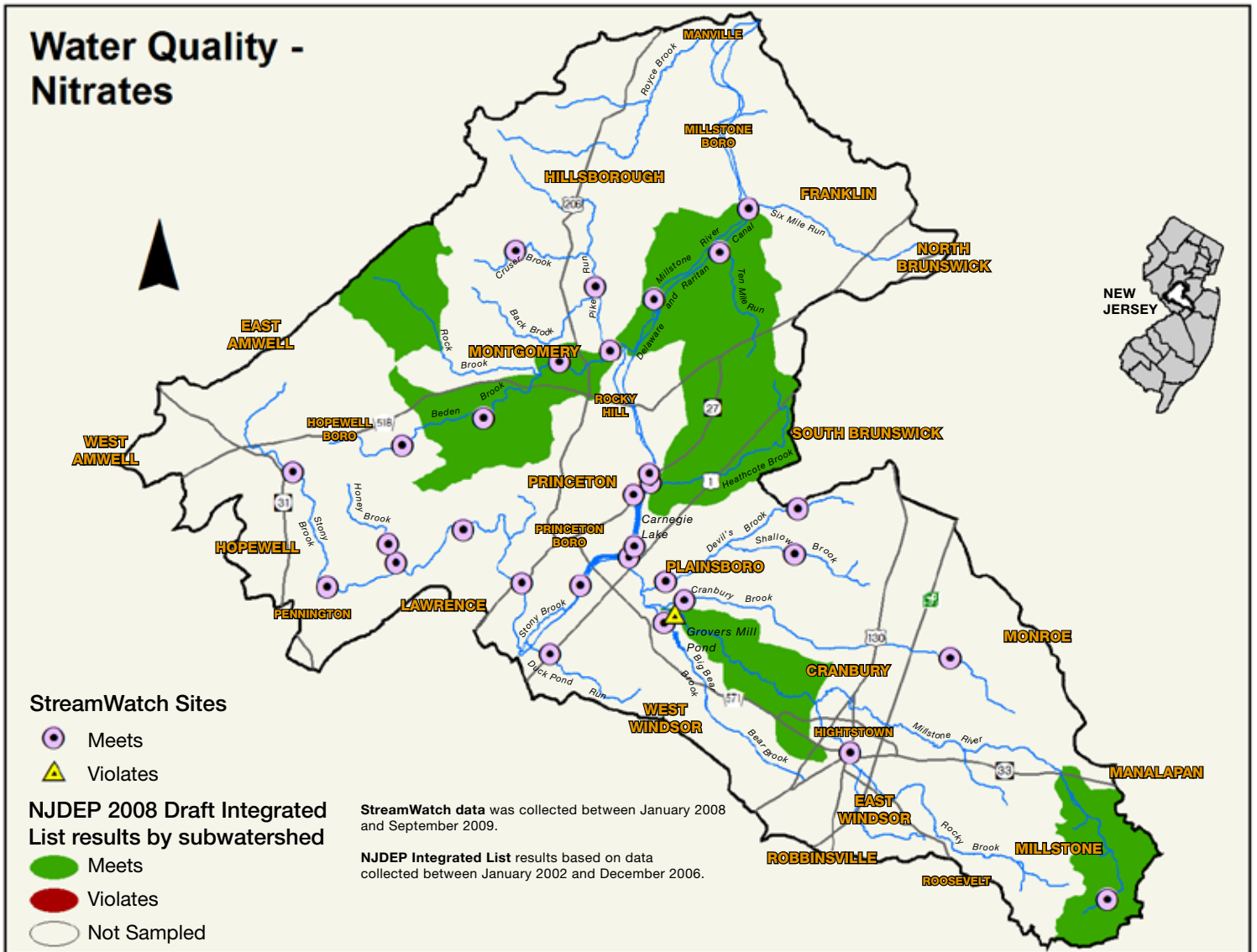
### **How does the watershed measure up?**

As you can see on the map to the left, the majority of the areas sampled by the NJDEP meet state standards. The Watershed Association does not sample TSS. Erosion is the leading cause of high TSS levels.

*In our lakes, rivers and streams, nutrients act as fertilizers and can stimulate excessive algal and plant growth.*



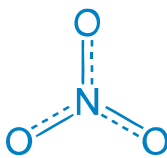
**Water Quality - Nitrate Distribution**



*Data Sources: NJ Department of Environmental Protection – Draft NJ Integrated Water Quality Monitoring and Assessment Report 2008, Stream Drainage Areas [HUC 14] 1999, Streams 2002, Lakes 2002, and Watershed Management Area 2000; NJ Department of Transportation – Roads 2007; and SBMWA – StreamWatch data. With the exception of SBMWA, this secondary map product has not been verified or authorized by the source agencies. Map created by the GIS Center of the Stony Brook-Millstone Watershed Association 10/2009. Project: 2009StateoftheWatershed-Nitrates.mxd*

<i>State Water Quality Standard</i>	<i>Safe to Drink</i>	<i>For Aquatic Life to Thrive*</i>
<i>Nitrate</i>	<i>At or below 10 mg / L</i>	<i>Less than 1 mg / L</i>

*\* Research shows that aquatic life needs less than 1 mg / L of nitrates to thrive. However, this is not recognized as an official state standard.*



## Nutrients

### *What you can do... at home:*

- Obtain a soil test kit to determine how much and what type of fertilizer your lawn or plants really need.
- Only apply the fertilizer if absolutely necessary at the appropriate rate and time to help nutrients stay in your yard.
- Buy fertilizers and cleaning products with no phosphates.
- Pick up after your pets and dispose of it properly.
- Ensure your septic tank and sewage pipes are properly maintained.
- Plant shrubs and tall grasses along backyard streams to filter nutrients from rainfall runoff.
- Become River-Friendly! (See Conclusion on page 38 to learn how.)

### *Local Advocacy:*

- Encourage your town to adopt stream corridor, fertilizer, septic and pet waste ordinances.

### **What is it?**

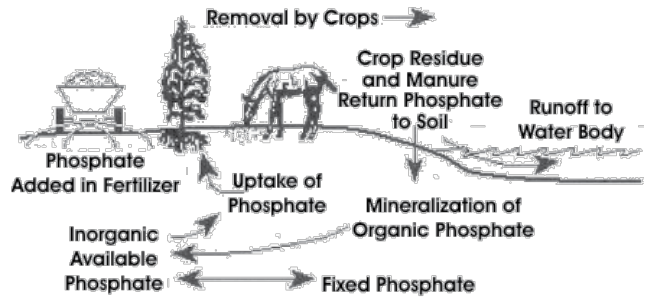
Nutrients are needed by all living things to grow and thrive. In this section we are taking a look at two types of nutrients: nitrates and phosphates.

Nitrates help build proteins, which are the building blocks for growth and color for plants. Phosphorus promotes flowering, root development, and helps prevent stress and disease. These nutrients occur naturally in air, soil, rocks, and organic materials. Sources of excess nitrates in streams include fertilizers, animal and pet waste, leaking sewer pipes and malfunctioning septic systems. The primary source of excess phosphates in streams is from fertilizers, cleaning products and industrial uses.

### **Why is it important?**

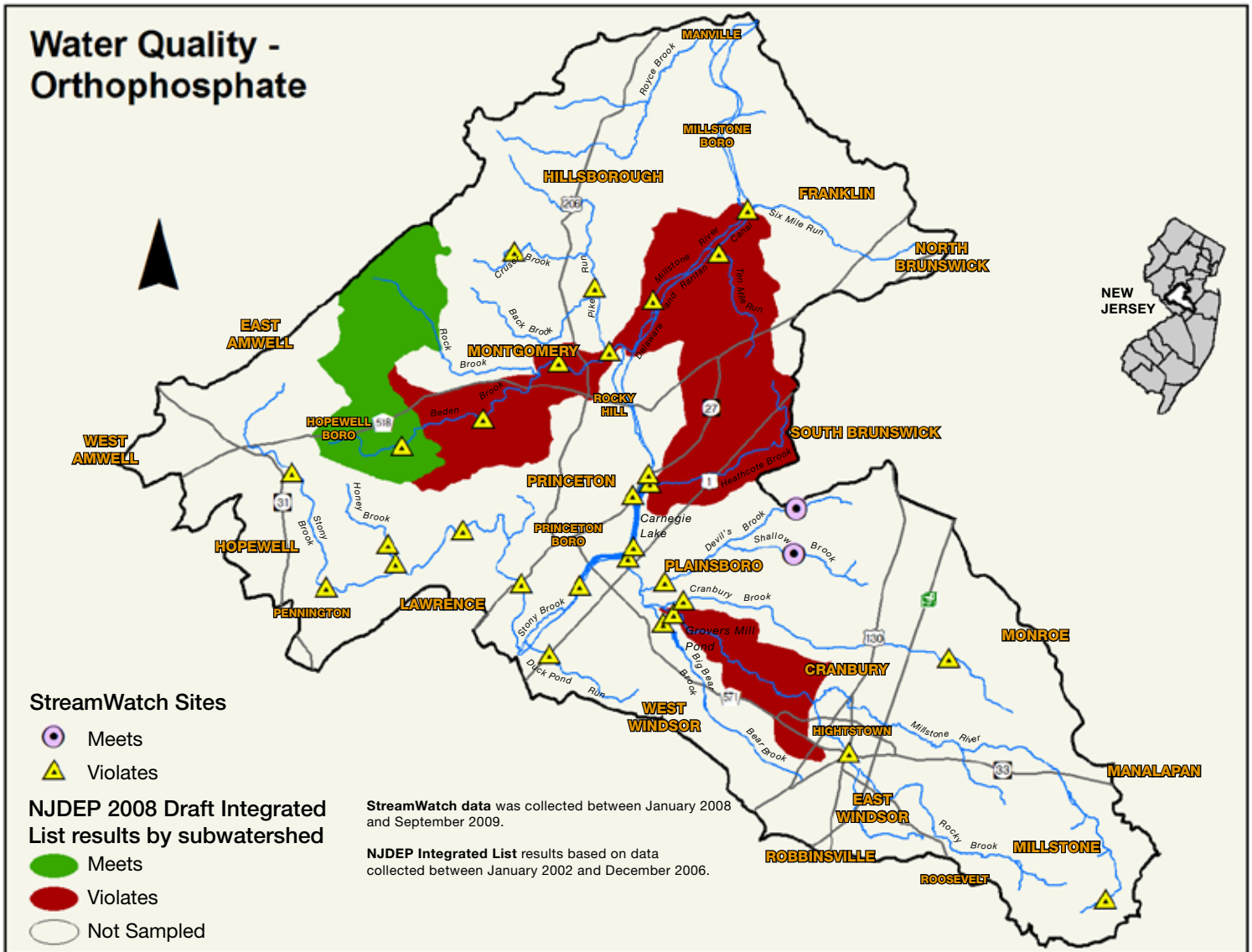
Nutrients help support aquatic life, but become detrimental in large quantities when they act as fertilizers to stimulate excessive algal and plant growth in streams. Algal blooms block sunlight and reduce dissolved oxygen in the water when they die and decompose. The accumulation of dead and decomposing plant material can smother important aquatic insect and fish habitats. In addition, nitrates can be toxic to our health when people consume excess amounts through water, plants or animals.

# The Phosphorus Cycle



Source: Busman et al., 1997.

## Water Quality - Orthophosphate Distribution



Data Sources: NJ Department of Environmental Protection – Draft NJ Integrated Water Quality Monitoring and Assessment Report 2008, Stream Drainage Areas [HUC 14] 1999, Streams 2002, Lakes 2002, and Watershed Management Area 2000; NJ Department of Transportation – Roads 2007; and SBMWA – StreamWatch data. With the exception of SBMWA, this secondary map product has not been verified or authorized by the source agencies. Map created by the GIS Center of the Stony Brook-Millstone Watershed Association 10/2009. Project: 2009StateoftheWatershed-Orthophosphate.mxd

<i>State Water Quality Standard</i>	<i>Freshwater Streams</i>	<i>Lakes</i>
<i>Total Phosphorus *</i>	<i>0.1 mg / L</i>	<i>0.05 mg / L</i>

*\* Because there is no state standard directly for orthophosphate, the Watershed Association has set an action limit for orthophosphate of 0.1 mg / L for freshwater streams and 0.05 mg / L for lakes. Streams or lakes with orthophosphates above those levels violate our action limit.*

## Nutrients (continued)

### Nitrate

#### How does the watershed measure up?

The map on page 12 illustrates that nitrate levels in the Stony Brook-Millstone Watershed meet state standards. According to our StreamWatch data only one site in our watershed – the Millstone River in West Windsor – has shown nitrate levels above the acceptable limit. The cause is undetermined at this time and we continue to monitor this site.

There are also 24 sites (all of which meet state standards) tested by StreamWatch where there is no NJDEP data available. This additional StreamWatch data paints a clearer picture of what’s happening throughout our watershed.

### Orthophosphate

#### How does the watershed measure up?

StreamWatch data on the map at left shows that orthophosphates are a serious problem in our watershed. Of the 31 StreamWatch sites where orthophosphates are tested, only two meet StreamWatch standards – Devil’s Brook and Shallow Brook in Plainsboro. The high levels of orthophosphate in our water are a clear indicator of the impact over-fertilization has on our region. Most of the soils in our watershed already have adequate to high levels of phosphate. Adding fertilizer when not necessary to lawns, gardens, fields, etc. leads to excess levels of phosphate in our streams when soils wash into our waterways and contribute to the decline of aquatic life. Phosphates can also come from cleaning products and industrial uses.

You’ll note that one of the StreamWatch testing sites on Beden Brook in Hopewell Township violates StreamWatch standards, while NJDEP data show the area meets state standards. This contradiction probably exists because StreamWatch and NJDEP data are not directly comparable based on the frequency of sample collection and testing methods used. NJDEP collects at least four orthophosphate samples a year, while the Watershed Association tests for orthophosphates 24 times a year.

In addition, there are 25 sites (two meet, 23 violate) that StreamWatch tested where there is no NJDEP data available. This additional StreamWatch data paints a clearer picture of what’s happening throughout our watershed.



<i>New Jersey Impairment Score</i>		
<i>Category*</i>	<i>Biological Assessment Score**</i>	<i>Assessment Result shown on Map</i>
<i>Non-Impaired</i>	<i>24-30</i>	<i>Non-Impaired</i>
<i>Moderately Impaired</i>	<i>9-21</i>	<i>Impaired</i>
<i>Severely Impaired</i>	<i>0-6</i>	<i>Impaired</i>

*\* The NJDEP classifies both severely and moderately impaired streams as “impaired.” Through our StreamWatch testing and employment of the New Jersey Impairment Score, we have determined that of the 12 StreamWatch sites monitored for aquatic life, two sites are severely impaired (17 percent), nine sites are moderately impaired (75 percent) and one site is non-impaired (8 percent).*

*\*\* For more information about the assessment score, view the Round 3 Raritan Water Region Benthic Macro-invertebrate Data report, available for download on the NJDEP website: <http://www.nj.gov/dep/wms/bf/bm/downloads.html> (see pages 8, 9 and 28).*



## Aquatic Life

### *What you can do... at home:*

- Don't mow to the edge of waterways in your backyard and plant trees along backyard streams to shade the stream, keeping oxygen levels higher for the bugs that live there.
- Become River-Friendly to reduce your contribution of “people” pollution to our streams. (See Conclusion on page 38 to learn how.)

### *Local Advocacy:*

- Encourage your town to adopt stream corridor, forest protection, fertilizer, pesticide and pet waste ordinances. These ordinances provide shade for streams and keep pollutants harmful to aquatic life out of our waterways.

### **What is it?**

Macroinvertebrates are aquatic insects, crustaceans and clams that can be seen with the naked eye and inhabit stream bottoms.

### **Why is it important?**

Macroinvertebrates are an important food source for fish and serve as the base of the food chain. Like the canary in the coalmine, unhealthy macroinvertebrates are the early warning system for overall environmental health. They are also important indicators of water quality. Different species of macroinvertebrates have different tolerance levels to pollution – some need very clean water to survive, while others are highly tolerant of pollution. The types of macroinvertebrates living in a stream indicate how healthy or polluted it may be. For example, mayflies need clean well-oxygenated water to survive, while leeches and worms can live almost anywhere. Finding a variety of clean water organisms is indicative of a healthy stream.

### **How does the watershed measure up?**

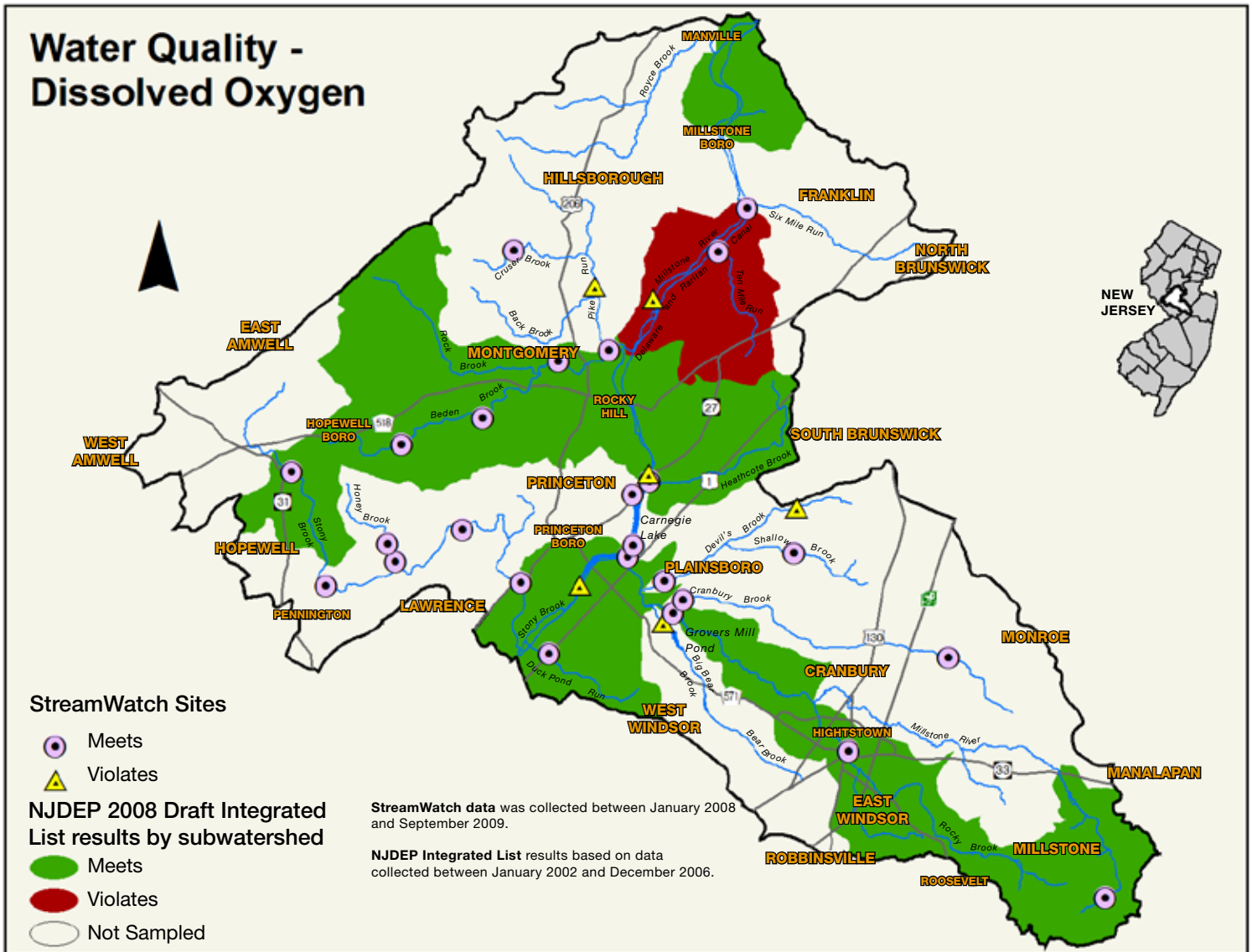
As you can see on the map at left, the majority of the watershed is impaired based on macroinvertebrate populations. The NJDEP estimates that stormwater runoff accounts for 60 percent of the pollution in surface waters (NJDEP, 2008). As mentioned in the previous sections, stormwater carries with it “people” pollution—waste from leaking septic and sewer systems, excess fertilizers and pesticides, pet and animal waste—to our lakes, rivers and streams. To combat the effect of “people” pollution on aquatic life, it is important for all of us—individuals, businesses, governments, etc.—to change our behavior to help protect and improve the health of our waterways.

You'll note that two of the StreamWatch testing sites on the Stony Brook in Hopewell Township are impaired, while the NJDEP data show the area is non-impaired. In addition, one StreamWatch site on the Beden Brook in Hopewell Township is non-impaired, while NJDEP data show the area is impaired. These contradictions exist because StreamWatch and NJDEP data are not directly comparable based on the frequency of sample collection and testing methods used. NJDEP's results are based on samples taken once over a five-year period while the Watershed Association collects macroinvertebrate samples three times a year, every year.

*In a joint effort with NJDEP Fish and Wildlife, Watershed Association staff and volunteers examine the species of fish living in Pike Run in Montgomery Township.*



## Water Quality - Dissolved Oxygen



*Data Sources: NJ Department of Environmental Protection – Draft NJ Integrated Water Quality Monitoring and Assessment Report 2008, Stream Drainage Areas [HUC 14] 1999, Streams 2002, Lakes 2002, and Watershed Management Area 2000; NJ Department of Transportation – Roads 2007; and SBMWA – StreamWatch data. With the exception of SBMWA, this secondary map product has not been verified or authorized by the source agencies. Map created by the GIS Center of the Stony Brook-Millstone Watershed Association 10/2009. Project: 2009StateoftheWatershed-DO.mxd*

<i>State Water Quality Standard</i>	<i>Meets</i>	<i>Violates</i>
<i>Dissolved Oxygen Levels</i>	<i>At or Greater than 4.0 ppm</i>	<i>Below 4.0 ppm</i>

## Dissolved Oxygen

### *What you can do... at home:*

- Plant trees along backyard streams to provide shade, keeping the water cool and oxygen levels higher for the bugs and fish that live there.
- Become River-Friendly! (See Conclusion on page 38 to learn how.)

### *Local Advocacy:*

- Encourage your town to adopt stream corridor and forest protection ordinances to help provide shade to streams throughout your town. (See page 24 to learn about your town's stream corridor ordinance.)

### **What is it?**

Dissolved oxygen is produced by plants during photosynthesis or by aeration from currents flowing over rocks and is consumed by fish and other animals.

### **Why is it important?**

Oxygen levels are influenced by the amount of photosynthesis taking place in the water, water temperature, salt content and aeration from currents. Fish, macroinvertebrates and other wildlife need adequate levels of dissolved oxygen to survive.

### **How does the watershed measure up?**

As you can see from the map at left the majority of areas tested in our watershed meet state standards for dissolved oxygen.

You'll note that one StreamWatch testing site on the Stony Brook and one site on the Millstone River, both in Princeton Township, violate state standards, while the NJDEP data show the area meets state standards. In addition, one StreamWatch site on Ten Mile Run in Franklin Township meets state standards while NJDEP data show the area violates state standards.

Both StreamWatch and NJDEP test to the same standard level, but these contradictions exist because of the frequency of sample collection and testing methods used. NJDEP collects at least four dissolved oxygen samples a year, while the Watershed Association tests dissolved oxygen 24 times a year.

There are 15 additional StreamWatch sites (13 meet, two violate) that StreamWatch tested where there is no NJDEP data available. This additional StreamWatch data paints a clearer picture of what's happening throughout our watershed. For those StreamWatch sites that do not meet state standards, the Watershed Association is continuing to monitor to see if the problem is ongoing and to look for trends.

*The Stony Brook-Millstone Watershed throughout the seasons.*





## Environmental Policy

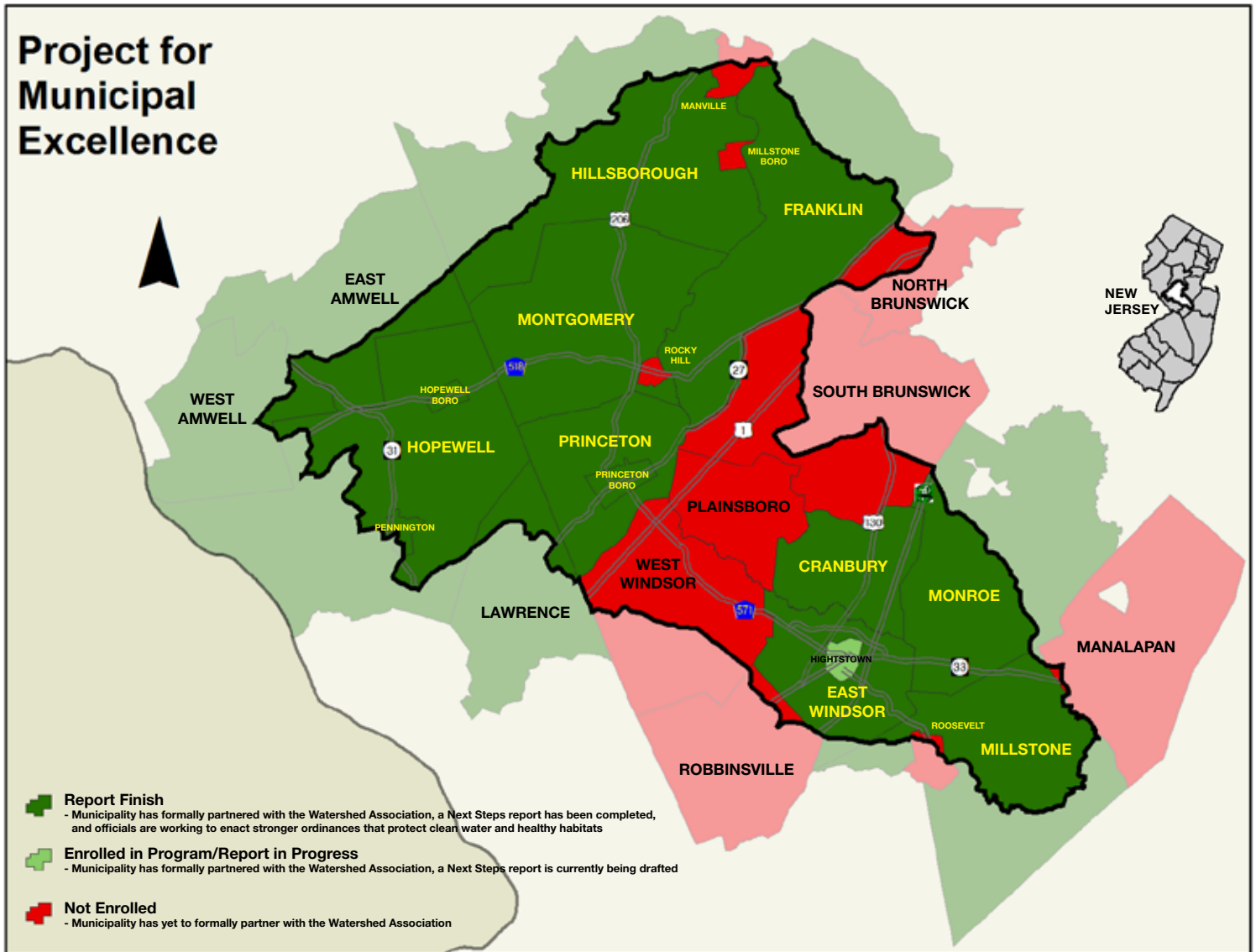
Scientifically testing our water to determine its health and quality is just part of the battle to protect our water resources. To ensure that our water stays clean and healthy, we need to educate the public and enact strong environmental policies at the state and local level to protect our waterways and critical lands from pollution, encroachment and development.

Throughout our 60-year history, the Watershed Association has been on the forefront of environmental protection for our region. In addition to working closely with municipalities, we have a long tradition of advocating for stronger statewide policies and legislation. We halted sewage discharges into the Delaware & Raritan Canal, stopped Interstate 95 from cutting through the Hopewell Valley, helped lead the way for enactment of the NJ Freshwater Wetlands Protection Act, and even earned special state “Category One” protection for a 10-mile stretch of the Stony Brook in Hopewell, Lawrence and Princeton.

The following pages outline four ways the Watershed Association is working with municipalities to ensure that there are adequate protections in place to keep our waterways clean and healthy on the local level: Project for Municipal Excellence, Stream Corridor Protection, Septic System Maintenance and Forest Protection.

The environmental policies that we examine in the following pages are among the most important measures of local protection that the Watershed Association believes municipalities should adopt in order to protect existing water quality and healthy habitats. By adopting the type of ordinances discussed in the following pages, municipalities can help protect the natural resources we have today and ensure that they will be around for the next generation. As you’ll see from the maps and data that follow, some towns have stronger protections and environmental policies than others.

**Project for Municipal Excellence Map**



*Data Source: NJ Department of Environmental Protection – Municipal Boundary; NJ Department of Transportation – Major Road; SBMWA Municipal Excellence 08/09. With the exception of SBMWA, this secondary map product has not been verified or authorized by the source agencies. Map created by the GIS Center of the Stony Brook-Millstone Watershed Association 10/2009. Project: 2009StateoftheWatershed-MuniExc.mxd*



# Project for Municipal Excellence

## *What you can do... at home:*

- Visit the Watershed Association's website, your local library or town hall, and read the Next Steps report for your municipality.
- Call the Watershed Association staff to assist with policy initiatives we are currently working on in your area.

## *Local Advocacy:*

- Review our maps to see how your municipality is protecting natural resources.
- Attend your local Environmental Commission, Planning Board and Town Council or Committee meetings to encourage them to adopt stronger ordinances that protect clean water and healthy habitats.

## **What is it?**

The Project for Municipal Excellence is a program through which the Watershed Association establishes partnerships with local governments to evaluate local planning and improve ordinances to protect clean water and healthy habitats. The Watershed Association founded the Project for Municipal Excellence in 2002 to provide a comprehensive approach to planning that protects natural resources and helps municipalities meet future needs. We produce a Next Steps report with recommendations for each municipality in the program and Watershed Association staff then assist local officials with implementing recommendations.

In 2004, the Watershed Association received the New Jersey Planning Officials' Achievement in Planning Award for the Project for Municipal Excellence. At least two additional New Jersey organizations have adopted and successfully implemented this program. Several groups across the country are using the techniques of the program to change the policies of their local governments and watersheds.

## **Why is it important?**

In New Jersey, town councils, committees and planning boards make local land use decisions. Planning boards make decisions based on the requirements in local land use plans and ordinances. It is imperative that local land use plans and zoning ordinances include protection for our shared natural resources; otherwise the quality of our water and habitats will continue to decline.

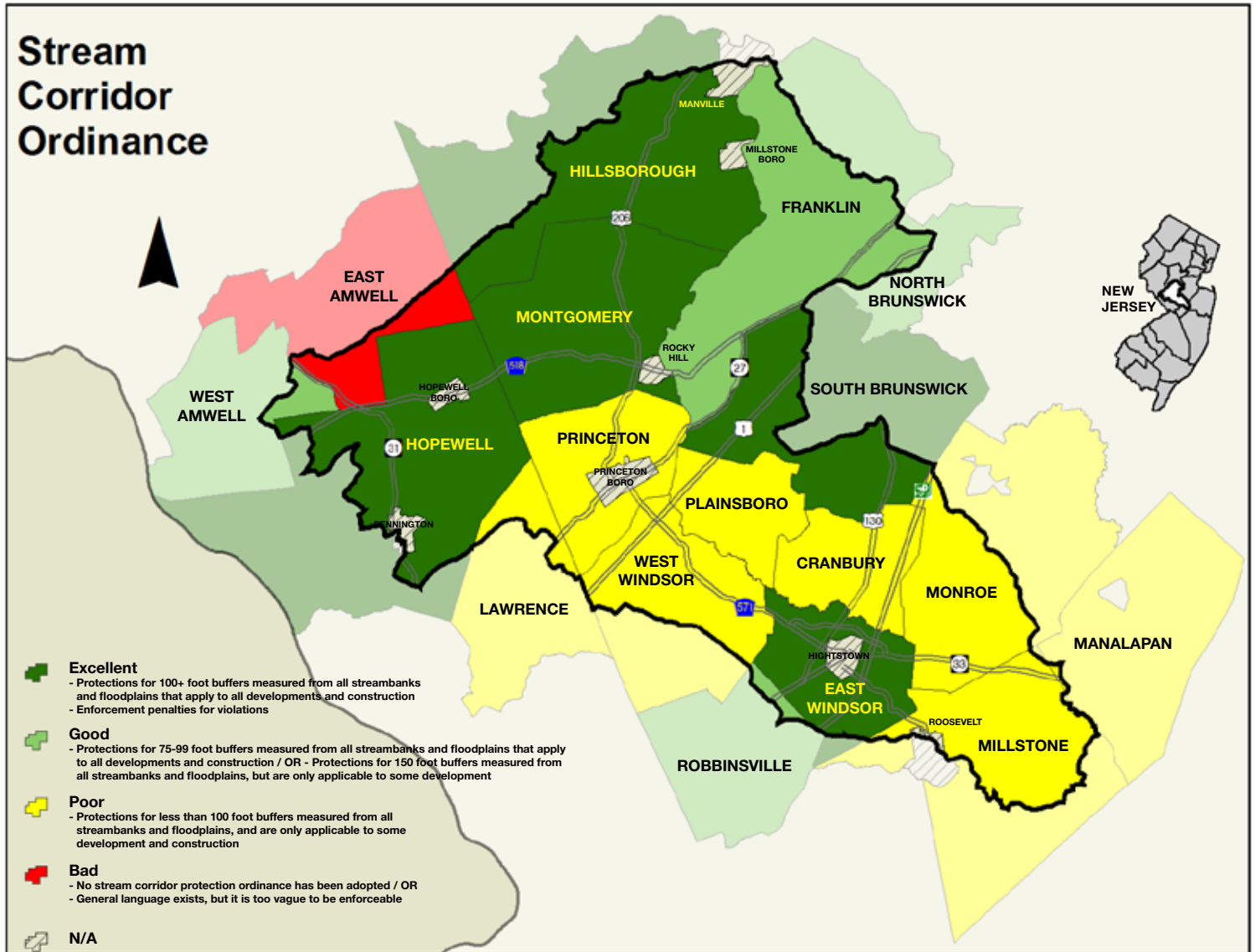
## **How does the watershed measure up?**

The map on the opposite page shows that 16 of the 26 municipalities in the Stony Brook-Millstone Watershed have officially partnered with the Watershed Association since this project began. We look forward to partnering with additional municipalities, particularly Plainsboro and West Windsor townships because of the significant amount of land they occupy in our watershed, to improve local planning and policies that protect clean water and the natural environment. We will also continue to assist municipalities already enrolled in the program by helping them strengthen their ordinances. The next three maps in this report demonstrate some of the most important environmental protection ordinances that municipalities can adopt.

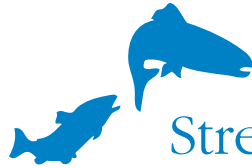
Ten Mile Run in Franklin Township.



**Stream Corridor Protection Ordinance Map**



Data Source: NJ Department of Environmental Protection – Municipal Boundary; NJ Department of Transportation – Major Road; SBMWA Stream Corridor Ordinance 08/09. With the exception of SBMWA, this secondary map product has not been verified or authorized by the source agencies. Map created by the GIS Center of the Stony Brook-Millstone Watershed Association 10/2009. Project: 2009StateoftheWatershed-StreamCorridor.mxd



## Stream Corridor Protection

### *What you can do... at home:*

- Get your soil tested for nutrients and apply only the amount and type of fertilizers that your lawn, garden, and flowers need.
- Plant buffers to absorb pollutants before they reach your stream.

### *Local Advocacy:*

- Encourage your local officials to adopt or improve your community's stream corridor protection ordinance.

### **What is it?**

A stream corridor includes the stream itself and the land immediately surrounding it. These corridors often include wetlands, forests and floodplains, and can have steep slopes. Protecting stream corridors in their natural condition is the best way to ensure that we have enough clean water for drinking, recreation, farming and other uses, and habitats for fish and wildlife.

### **Why is it important?**

More than half of New Jersey families rely on water from streams for drinking and household use. In the Stony Brook-Millstone Watershed all streams, rain and snowmelt drain to the Millstone River. The Millstone River connects to the Raritan River in Franklin Township and Marville Borough, Somerset County; some of that water is withdrawn from the river at that point, treated and then piped into homes and businesses throughout central New Jersey.

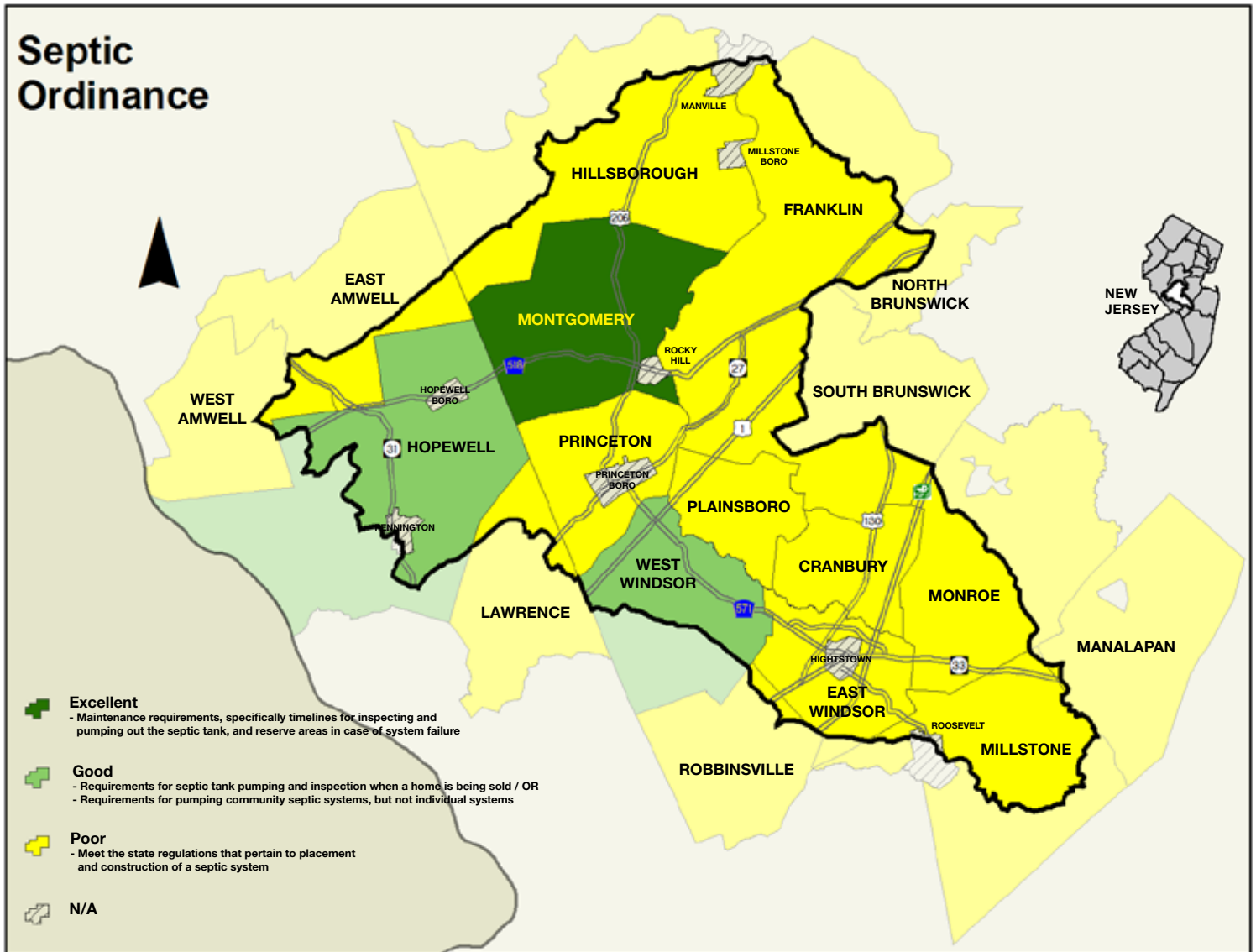
Stream corridors help protect our drinking water because the grasses, shrubs and trees that grow in these locations filter pollutants before they reach the stream and slow storm runoff. Protecting the health and quality of our streams is critical to protecting our drinking water and human health, because they provide places for families to play, explore, canoe and fish. Wildlife also depends upon thriving stream corridors for food, water and shelter.

Healthy stream corridors save money by lessening flood-related damages and associated costs because they allow streams to overflow their banks in a natural way during floods. By keeping development away from stream corridors we can reduce flood damage.

### **How does the watershed measure up?**

While there are state laws that protect some stream corridors, they are not strong enough to ensure the health and quality of our streams. The Watershed Association is working with municipalities to adopt local stream corridor protection ordinances, which protect your water by limiting disturbance and development along streams. As you can see on the map at left, five of the 26 municipalities in our watershed have "excellent" stream corridor ordinances, while others should strengthen protections for our streams. Municipalities with a N/A designation have very limited open land next to streams.

## Septic Ordinance Map



Data Source: NJ Department of Environmental Protection – Municipal Boundary; NJ Department of Transportation – Major Road; SBMWA Septic Ordinance 08/09. With the exception of SBMWA, this secondary map product has not been verified or authorized by the source agencies. Map created by the GIS Center of the Stony Brook-Millstone Watershed Association 10/2009. Project: 2009StateoftheWatershed-Septic.mxd



# Septic System Management

## *What you can do... at home:*

- Find out if you have a septic system. Call your town, and they will be able to tell you if you have a septic system.
- Do not pour household toxics down the drain, including oil-based paints and wood stains.
- Don't dispose of large amounts of household cleaners down the drain.
- Maintain your system. Systems should be inspected annually and pumped every 3-5 years. However, individual systems vary depending on their size and age, the number of people they serve and past performance.

## **What is it?**

Septic systems process wastewater from the toilet, shower, washing machine and dishwasher. When placed in proper locations and maintained regularly, septic systems are an effective and efficient means of wastewater management.

## **Why is it important?**

Neglect or abuse of a septic system will cause it to fail and have negative financial, ecological, and property consequences, such as flooded basements. Septic system care and management are the responsibility of homeowners. As people move into suburbia from cities where waste is managed by sewers, residents are often unfamiliar with how their lifestyle can affect the ability of their septic systems to function properly. Many new residents are unaware that they even own a septic system.

In most communities, septic system inspections are not required prior to the sale of a home. Homebuyers often unknowingly purchase a home with a failing or abused system. Repair or replacement of a failing septic system is expensive, but failure to do so can degrade clean water and healthy habitats.

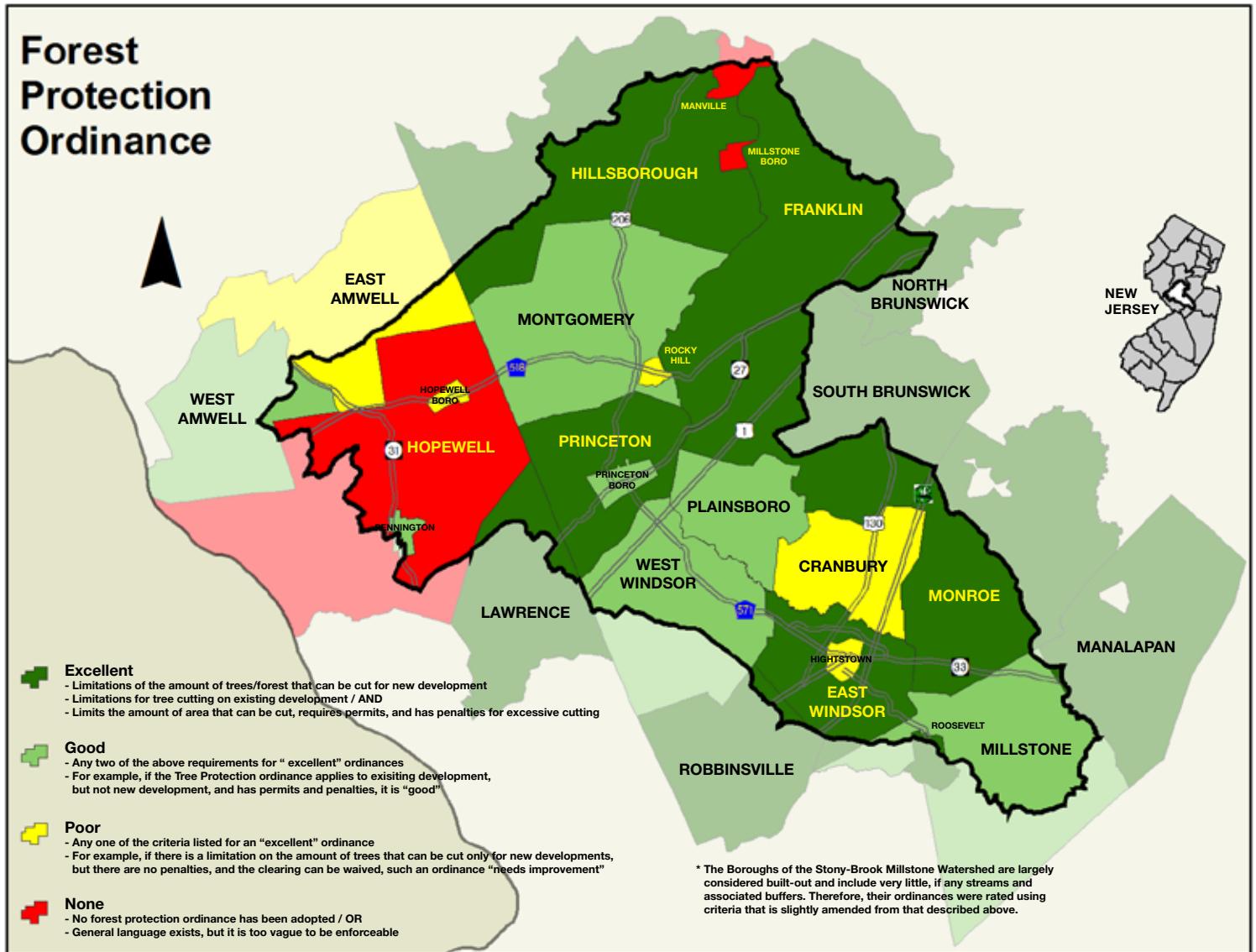
## **How does the watershed measure up?**

As you can see on the map at left, only one municipality has an "excellent" septic ordinance and 15 have "poor" septic ordinances. Municipalities with a N/A designation manage wastewater exclusively using sewers. Requiring septic system inspections and maintenance can be controversial because homeowners will spend money to regularly inspect, pump, fix or replace their systems. Therefore, few communities have implemented strict requirements. Because leaking and failing septic systems are a major threat to clean water, the Watershed Association supports local ordinances that require a septic system inspection before homes or other buildings are sold. We also support ordinances that require the regular care and maintenance of septic systems because it will protect clean water and the environment. Such maintenance will also usually save money in the long run. To educate the community, we have organized several septic system education forums to help residents understand how they can care for their septic systems and developed a publication designed to help residents learn how best to use and maintain their septic systems. It is available on our website ([www.thewatershed.org](http://www.thewatershed.org)) and is titled: A Residential Guide to Septic System Management & Maintenance.

*Tree clearing can lead to problems with flooding (left). A volunteer helps plant a native shrub in Montgomery (right).*



## Forest Protection Ordinance Map



Data Source: NJ Department of Environmental Protection – Municipal Boundary; NJ Department of Transportation – Major Road; SBMWA Forest Ordinance 08/09. With the exception of SBMWA, this secondary map product has not been verified or authorized by the source agencies. Map created by the GIS Center of the Stony Brook-Millstone Watershed Association 10/2009. Project: 2009StateoftheWatershed-Forest.mxd



## Forest Protection

### *What you can do... at home:*

- When planting new trees on your property use native species, which provide higher quality habitat and food sources for wildlife.
- Identify the existing trees on your property and replace them if they are an invasive species. Invasive species can crowd out native species. The Native Plant Society of New Jersey is a great resource for learning about tree and plant species, which are considered native or invasive.

### *Local Advocacy:*

- Your community can adopt a local ordinance that prohibits planting invasive species as landscaping for developments.
- If your municipality does not have a woodlands or forest protection ordinance, you can encourage your local officials to adopt one.

### **What is it?**

Forest and tree protection are important to a community's character, provide recreation and shade, and habitat for wildlife. Forests and trees can be protected in several ways including preservation, stewardship of privately owned lands and by enforcement of local ordinances restricting the amount of tree removal permitted when land is developed. Forest and woodlands protection ordinances can also require that when development occurs or trees are removed illegally that a comparable number of trees are planted in their place.

### **Why is it important?**

As we develop our communities, we increase the overall amount of hard surfaces such as roads and building rooftops. During rainstorms, water runs off these surfaces at a very fast rate. It carries pollution such as oil and grit from streets, chemicals from lawns, and heat from these surfaces to our streams and ground water sources. Trees and forests act as filters, removing much of this pollution. Trees also shade streams, making them more habitable for fish and other wildlife.

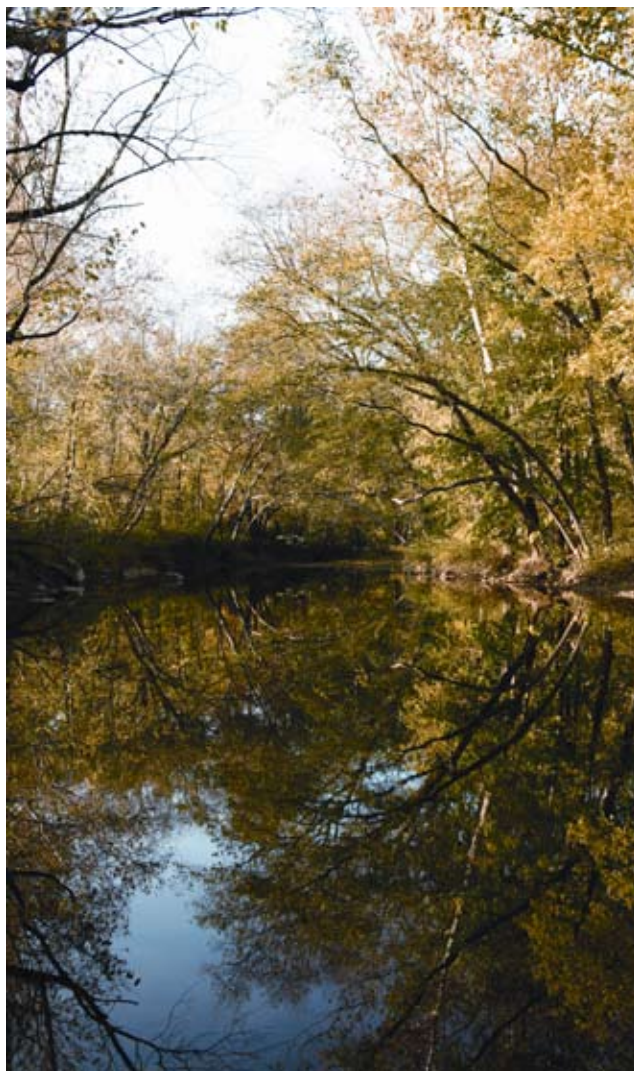
### **How does the watershed measure up?**

Eighteen of the 26 municipalities in the watershed have adopted "excellent" or "good" forest and tree protection ordinances. Princeton Township is the most recent municipality\* in our watershed to adopt a tree protection ordinance that requires a permit to remove trees and enforces penalties for tree removal. The Watershed Association continues to work with local elected officials to adopt additional forest protection ordinances in places where more protection is needed. Hopewell Township and Manville and Millstone boroughs have no local ordinances that protect forests in those municipalities.

*\* As of January 2010*

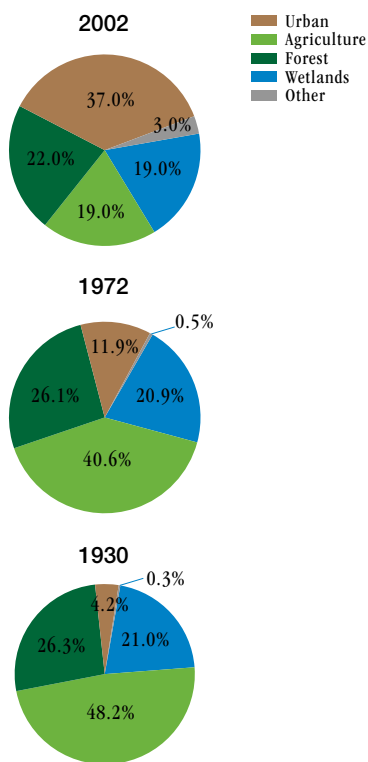
## ***Types of Land Use in our Watershed***

1. *Left: Stream*
2. *Top right: Walking on trail*
3. *Bottom right: Urbanized landscape*
4. *Middle: Agricultural landscape*



# Land Use

## Land Use Distribution



Over the last 60 years New Jersey's population has grown dramatically, just about doubling from 4.8 million residents in 1950 to an estimated 8.6 million in 2008 (U.S. Census Bureau, 2009). Recognized as the most densely populated state in the nation, New Jersey is projected to reach full build-out in the next 15 to 25 years, meaning that all tracts of land in our state will either be developed or preserved.

According to NJDEP Land Use/Land Cover data more than 21,000 acres of land were developed in the Stony Brook-Millstone Watershed between 1986 and 2002 (the latest year for which data is available), a rate of approximately 110 acres – or more than 100 football fields – per month (NJDEP, 2003).

More development means more buildings, roads and parking lots, which create more impervious cover – or surfaces that prevent rainfall from percolating into the soil. This increases the instances and severity of flooding and quantity of pollution that enter our streams. Land use also shapes environmental policy decisions. Urban, suburban and rural communities all have their own challenges and limitations. It is equally important to protect both places with less development to keep open spaces and natural areas healthy, and areas of more dense development to prevent further degradation.

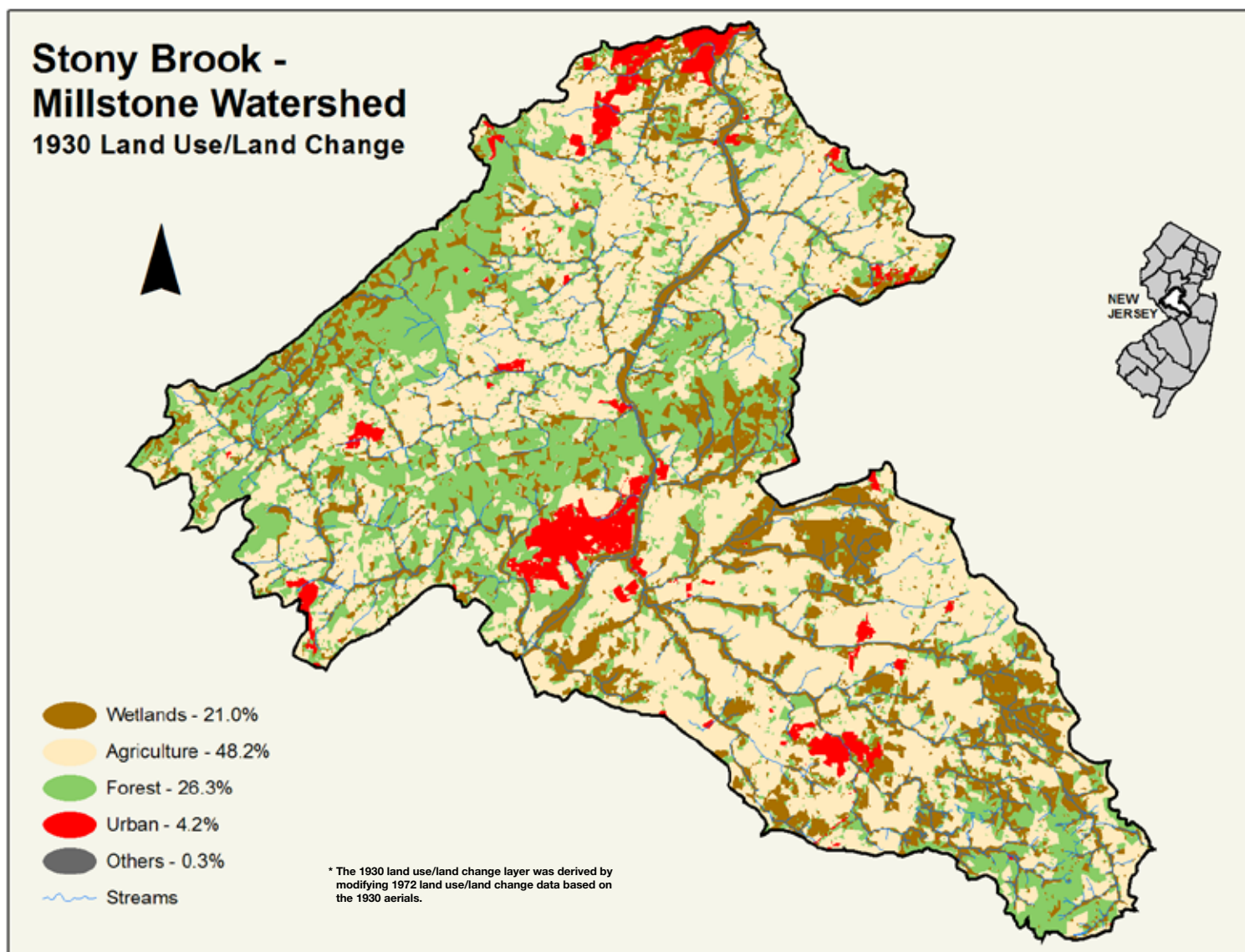
## Our watershed by the numbers ...

*59,068 acres of additional urban development (1930-2002)*

*52,521 acres of farmland lost*

*8,157 acres of forest lost*

## Land Use Map 1930



Data Sources: NJ Department of Environmental Protection - Land use/Land cover 1972, Streams 2002, and Watershed Management Area 2000; and NJ Office of Information Technology, Office of GIS - AirPhotos 1930. This secondary map product has not been verified or authorized by the source agencies. Map created by the GIS Center of the Stony Brook-Millstone Watershed Association 10/2009 Project: 2009StateoftheWatershed-LULC1930.mxd

## Land Use (continued)

### *What you can do... at home:*

- Evaluate the land use of your property and management it appropriately.
- Consider a conservation easement for your property.
- Become River-Friendly. (See Conclusion on page 38 to learn how.)

### *Local Advocacy:*

- Advocate for strong environmental policy in your community to encourage smart planning and zoning decisions.
- Encourage your town to adopt or expand its open space preservation program.

### **What is it?**

The categories of land use included in the maps that follow are: wetland, agriculture, forest, urban and other.

### **Why is it important?**

Land use is the glue that ties water quality and environmental policy together. How we use or manage the land has a direct effect on the health and quality of our water and shapes decisions on environmental policy.

### **How does the watershed measure up?**

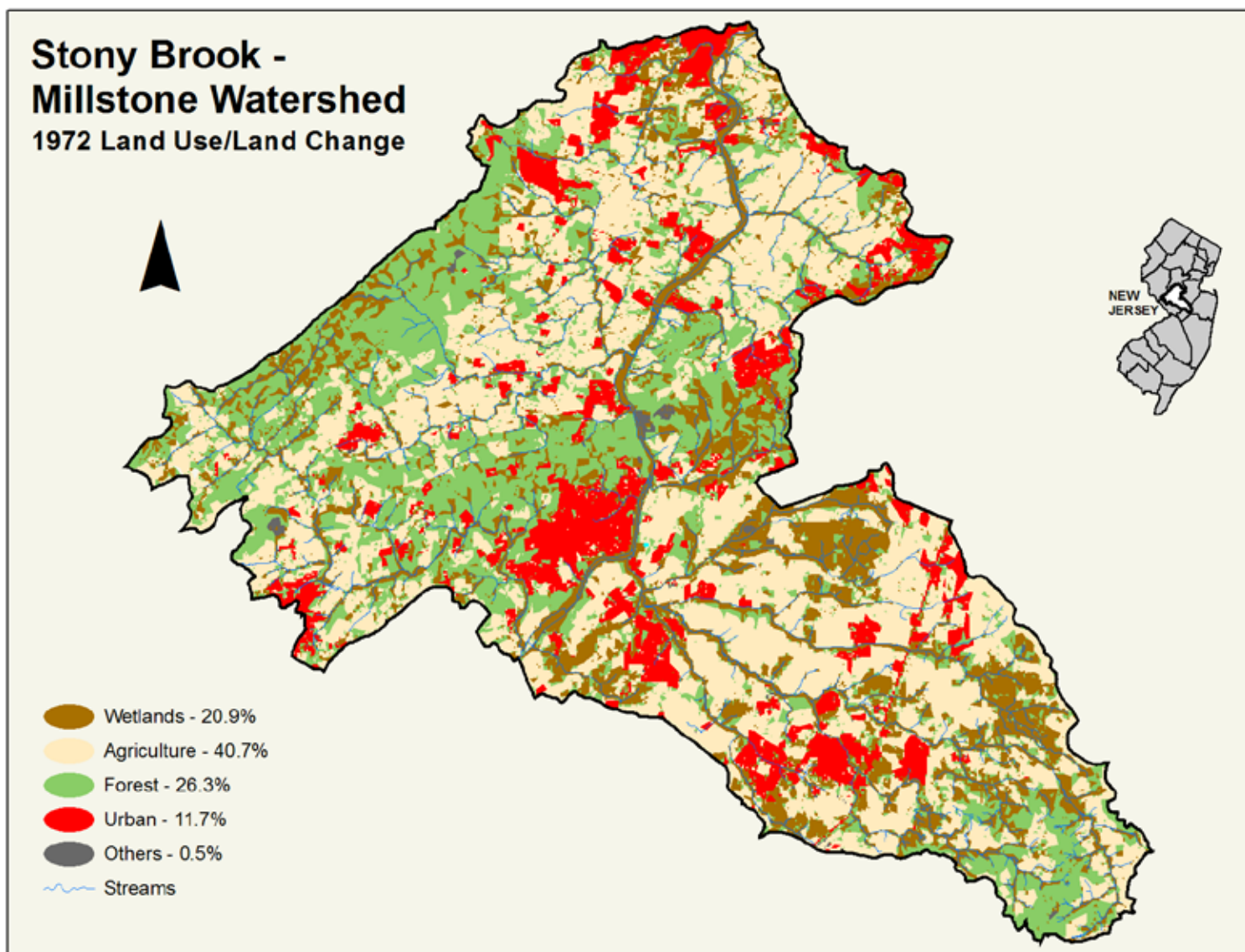
The series of maps in this section illustrate how our watershed's land use has changed in the years from 1930 to 2002 (the latest year for which land use data is available\*).

Overall agricultural lands in our watershed have diminished greatly, while urban areas increased. This change can put additional pressure on our water and environment through habitat loss, increased flooding and "people" pollution. On the positive side, our watershed has experienced only a 2 percent loss of wetland and a 5 percent loss of forested habitat. The Sourland Mountains (the green band across the northwest portion of the watershed) have remained relatively intact, and development has occurred more slowly near the headwaters of the Millstone River (the southernmost tip of the watershed).

To protect our remaining natural resources, the Watershed Association works on both the state and local level to support funds and ballot initiatives for open space protection, including the Open Space and Land Preservation Bond passed by New Jersey voters in 2009. To date, with our assistance, 22 of the 26 municipalities within the Stony Brook-Millstone Watershed have open space funds or programs to preserve land (see chart on page 35). In addition, through the acquisition of open space and generous land donation the Watershed Association manages our own 860-acre Watershed Reserve in Hopewell Township. It serves as a model for land conservation and responsible land management. We host the Honey Brook Organic Farm, educate the public and work one-on-one with landowners to implement environmentally conscious land management techniques.

\* 2007 Land use data is expected to be released no sooner than 2011

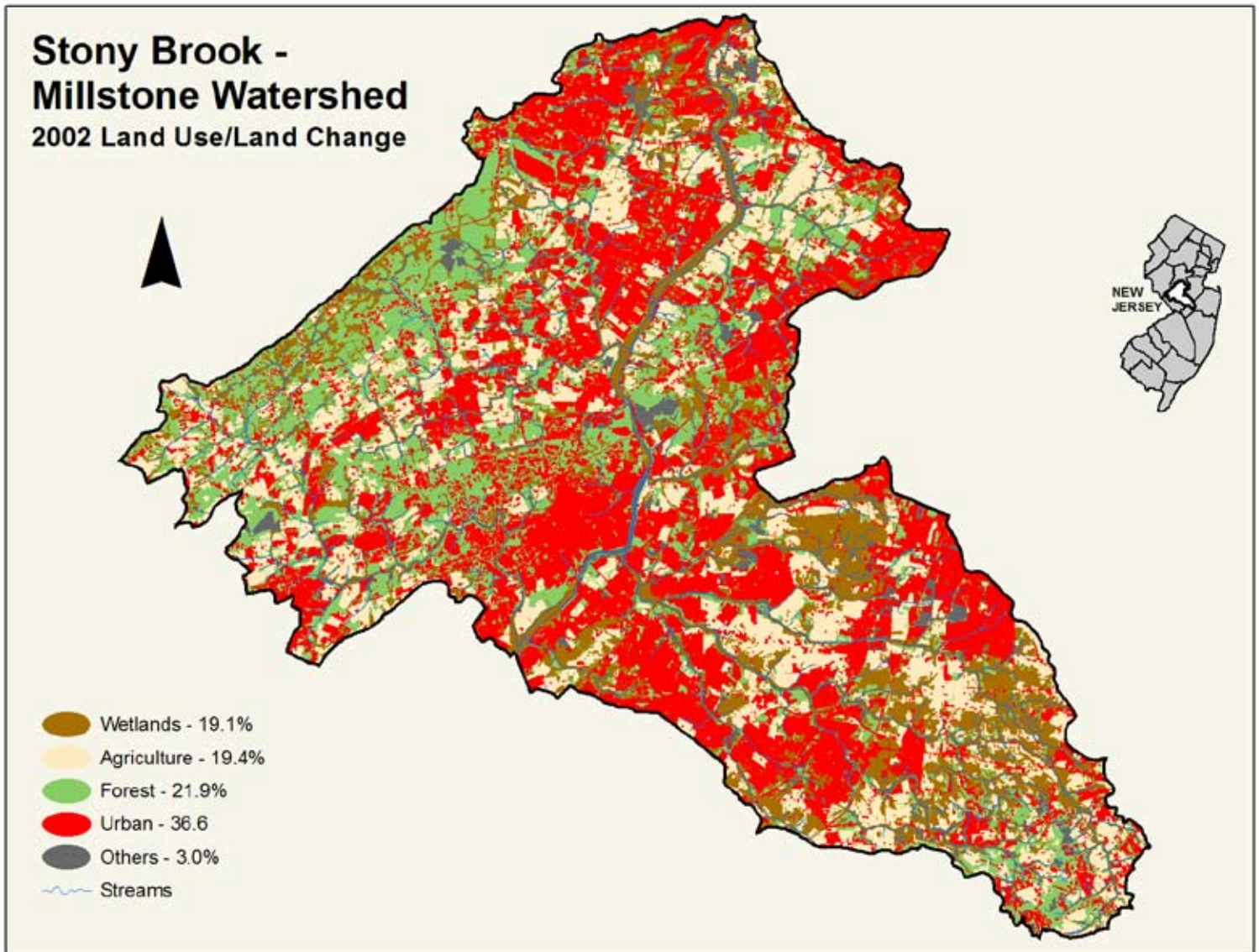
## Land Use Map 1972



Data Sources: NJ Department of Environmental Protection - Land use/Land cover 1972, Streams 2002, and Watershed Management Area 2000. This secondary map product has not been verified or authorized by the source agency. Map created by the GIS Center of the Stony Brook-Millstone Watershed Association 10/2009 Project: 2009StateoftheWatershed-LULC1972.mxd

<i>Municipalities with Open Space Funds or Programs</i>					
<i>Municipality</i>	<i>Yes/No</i>	<i>Municipality</i>	<i>Yes/No</i>	<i>Municipality</i>	<i>Yes/No</i>
<i>Cranbury Township</i>	<i>Y</i>	<i>Manville Borough</i>	<i>N</i>	<i>Princeton Borough</i>	<i>Y</i>
<i>East Amwell Township</i>	<i>Y</i>	<i>Manalapan Township</i>	<i>Y</i>	<i>Princeton Township</i>	<i>Y</i>
<i>East Windsor Township</i>	<i>Y</i>	<i>Millstone Borough</i>	<i>N</i>	<i>Robbinsville Township</i>	<i>Y</i>
<i>Franklin Township</i>	<i>Y</i>	<i>Millstone Township</i>	<i>Y</i>	<i>Rocky Hill Borough</i>	<i>N</i>
<i>Hightstown Borough</i>	<i>N</i>	<i>Monroe Township</i>	<i>Y</i>	<i>Roosevelt Borough</i>	<i>Y</i>
<i>Hillsborough Township</i>	<i>Y</i>	<i>Montgomery Township</i>	<i>Y</i>	<i>South Brunswick Township</i>	<i>Y</i>
<i>Hopewell Borough</i>	<i>Y</i>	<i>North Brunswick Township</i>	<i>Y</i>	<i>West Amwell Township</i>	<i>Y</i>
<i>Hopewell Township</i>	<i>Y</i>	<i>Pennington Borough</i>	<i>Y</i>	<i>West Windsor Township</i>	<i>Y</i>
<i>Lawrence Township</i>	<i>Y</i>	<i>Plainsboro Township</i>	<i>Y</i>		

**Land Use Map 2002**



*Data Sources: NJ Department of Environmental Protection - Land use/Land cover 2002, Streams 2002, and Watershed Management Area 2000. This secondary map product has not been verified or authorized by the source agency. Map created by the GIS Center of the Stony Brook-Millstone Watershed Association 10/2009 Project: 2009StateoftheWatershed-LULC2002.mxd*

## Water Quality: StreamWatch Data

Parameter Tested	Number of Sites that Meet	Number of Sites that Violate	N/A
Bacteria	6	12	
TSS	--	--	No StreamWatch data
Nitrate	30	1	
Orthophosphate	2	29	
Aquatic Life	1	11	
Dissolved Oxygen	25	6	

## NJDEP Data

Parameter Tested	Number of Municipalities that Meet	Number of Municipalities that Violate	N/A
Bacteria	3	22	17
TSS	19	6	21
Nitrate	13	0	26
Orthophosphate	5	11	25
Aquatic Life	9	23	8
Dissolved Oxygen	22	4	22

\* Because NJDEP data is not collected on a municipal boundary basis, the total municipalities in this chart do not add up to 26 across each parameter. Some municipalities may have areas that meet and/or violate and/or are not tested.

## Environmental Policy: Project for Municipal Excellence

Number of Municipalities with Completed Reports	Number of Municipalities Undergoing Assessment	Number of Municipalities Not Enrolled
15	1	10

## Municipal Ordinances

Number of Municipalities With:					
	Excellent	Good	Poor	Bad / None	N/A
Stream Corridor Protection Ordinance	5	4	8	1	8
Septic Ordinance	1	2	15	0	8
Forest Protection Ordinance	11	7	5	3	0

## Land Use: Land Use Acreage

	1930	1972	2002
Wetland	38,197.35	38,041.88	34,821.66
Agriculture	87,847.33	74,217.86	35,326.14
Forest	47,974.92	47,652.25	39,818.14
Urban	7,573.22	21,335.05	66,640.99
Other *	552.66	898.45	5,538.55

\* Other accounts for barren land or water.



## Our findings:

It's important to understand the interrelated connections between water quality, environmental policy and land use. Here are the connections we found:

- **Land use** affects water quality and shapes environmental policy. What we do on the land has a direct effect on our water. All three of the biggest water quality issues facing our watershed – **bacteria, orthophosphate** and **aquatic life** – are all directly related to how we care for our land and illustrate the huge effect individual actions have on the health and quality of our water.
- Excess levels of **orthophosphate** in our watershed are contributing to the decline in **aquatic life**. With a majority of soils in our watershed already laden with phosphate, additional fertilizers packed with phosphates are not needed. Continued use of fertilizers and cleaning products with phosphates is contributing to impaired aquatic life.
- With increasing urban land use, **septic** and **sewer system maintenance** is critical to the health of our water. The majority of our watershed violates state standards for **bacteria**, is not safe for swimming and fishing, and where applicable the majority of municipalities in our watershed have poor **septic ordinances**. Strengthening environmental policy and educating homeowners is vital to ensuring we all have clean water to drink and use.
- Continued protection of our **forests** and **stream corridors** is key to protecting the quality of our water. Our stream corridors and forests protect our streams by reducing the amount of **sediment** and **nutrients** that reach our streams. Another benefit is they help shade our streams. All of these factors keep **dissolved oxygen** at acceptable levels. The majority of our watershed meets state standards for **TSS, nitrate** and **dissolved oxygen**. More than one third of our municipalities have “excellent” **forest protection ordinances** and almost one quarter have “excellent” **stream corridor ordinances**. It's critical to strengthen forest protection and stream corridor measures to ensure our water stays healthy.
- As the population in our watershed has grown and **land use** changed from primarily an agricultural region to an area with increased urban development our forests and wetlands have remained relatively intact. As our watershed continues to develop it is vital to protect our forests, wetlands and environmental resources through strong **forest and stream corridor protection ordinances**.
- Whether an area is in good condition or bad, urban or rural, strong environmental policies are needed to keep healthy areas in good condition, and faltering areas from further degradation. The **land use** and **water quality** conditions at hand influence the appropriate **environmental policy** solution.

## Conclusion



*Be a part of the solution to our environmental problems. Become River-Friendly.*

The Stony Brook-Millstone Watershed Association is central New Jersey's first environmental group. For more than six decades, we have worked to protect clean water and the environment through a combination of conservation, advocacy, science and education.

In our watershed increasing population and steady conversion of fields, forest and wetlands to asphalt and concrete have had a direct effect on the health and quality of our water and environment. Today, polluted run-off – “people” pollution from excess lawn fertilizers, leaking septic systems and sewer lines, and pet waste – is the biggest contributor to water pollution in our watershed.

To protect the quality of our water we need strong environmental policies. The Watershed Association is working with nearly all 26 of our watershed municipalities to strengthen environmental protections. Equally as important, everyone in central New Jersey needs to take individual action be part of the solution to our environmental problems. How?

Become River-Friendly. From picking up your pet's waste and testing your soil before using lawn fertilizer, to telling your municipal leaders you want see septic management and tree protection ordinances on the books in your hometown – together we can ensure we all have clean water and a healthy environment for years to come.

Whether you are a resident, business owner, school or golf course the Watershed Association's free River-Friendly stewardship program provides concrete steps and tools to reducing your individual impact on the health of the Stony Brook-Millstone Watershed. Since 2002, more than 2,500 acres in central New Jersey have been certified as River-Friendly. Call (609) 737-3735 or email [river-friendly@thewatershed.org](mailto:river-friendly@thewatershed.org) to become River-Friendly today.

# Appendix

## References

NJDEP, 2003. Commissioner's Udate. September-October 2003. [Online WWW]. Available URL: <http://www.nj.gov/dep/commissioner/update/updateseptoct03.pdf>

NJDEP, 2008. DEP Awards \$3.2 Million in Grants to Aid Local Water-Quality Improvement Projects. Media Release, May 7, 2008.

U.S. Census Bureau, 2009. State & County Quickfacts: New Jersey. [Online WWW]. Available URL: <http://quickfacts.census.gov/qfd/states/34000.html>

## Differences in analytical methods:

As referenced on page 7, StreamWatch and the NJDEP use different analytical methods to determine results. StreamWatch volunteers analyze nitrates and orthophosphates using LaMotte test kits; dissolved oxygen is measured using a modified Winkler titration method; and E. coli is analyzed in-house with the Coliscan Easygel method. NJDEP data for these parameters used to determine the 2008 Draft Integrated List results are analyzed either in a lab or in-situ with a meter. Both StreamWatch and NJDEP collect macroinvertebrate samples and identify them down to family.

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This report was made possible by  
the Geraldine R. Dodge Foundation