



Draft

**Impervious Cover Assessment
for
Piscataway Township, Middlesex County, New Jersey**

*Prepared for Piscataway Township by the
Rutgers Cooperative Extension Water Resources Program*

February 2, 2015

Introduction

Pervious and impervious are terms that are used to describe the ability or inability of water to flow through a surface. When rainfall hits a surface, it can soak into the surface or flow off the surface. Pervious surfaces are those which allow stormwater to readily soak into the soil and recharge groundwater. When rainfall drains from a surface, it is called "stormwater" runoff (Figure 1). An impervious surface can be any material that has been placed over soil that prevents water from soaking into the ground. Impervious surfaces include paved roadways, parking lots, sidewalks, and rooftops. As impervious areas increase, so does the volume of stormwater runoff.



Figure 1: Stormwater draining from a parking lot

New Jersey has many problems due to stormwater runoff, including:

- **Pollution**: According to the 2010 New Jersey Water Quality Assessment Report, 90% of the assessed waters in New Jersey are impaired, with urban-related stormwater runoff listed as the most probable source of impairment (USEPA, 2013). As stormwater flows over the ground, it picks up pollutants including animal waste, excess fertilizers, pesticides, and other toxic substances. These pollutants are then able to enter waterways.
- **Flooding**: Over the past decade, the state has seen an increase in flooding. Communities around the state have been affected by these floods. The amount of damage caused also has increased greatly with this trend, costing billions of dollars over this time span.

- Erosion: Increased stormwater runoff causes an increase in the velocity of flows in our waterways. The increased velocity after storm events erodes stream banks and shorelines, degrading water quality. This erosion can damage local roads and bridges and cause harm to wildlife.

The primary cause of the pollution, flooding, and erosion problems is the quantity of impervious surfaces draining directly to local waterways. New Jersey is one of the most developed states in the country. Currently, the state has the highest percent of impervious cover in the country at 12.1% of its total area (Nowak & Greenfield, 2012). Many of these impervious surfaces are directly connected to local waterways (i.e., every drop of rain that lands on these impervious surfaces ends up in a local river, lake, or bay without any chance of being treated or soaking into the ground). To repair our waterways, reduce flooding, and stop erosion, stormwater runoff from impervious surfaces has to be better managed. Surfaces need to be disconnected with green infrastructure to prevent stormwater runoff from flowing directly into New Jersey's waterways. Disconnection redirects runoff from paving and rooftops to pervious areas in the landscape.

Green infrastructure is an approach to stormwater management that is cost-effective, sustainable, and environmentally friendly. Green infrastructure projects capture, filter, absorb, and reuse stormwater to maintain or mimic natural systems and to treat runoff as a resource. As a general principal, green infrastructure practices use soil and vegetation to recycle stormwater runoff through infiltration and evapotranspiration. When used as components of a stormwater management system, green infrastructure practices such as bioretention, green roofs, porous pavement, rain gardens, and vegetated swales can produce a variety of environmental benefits. In addition to effectively retaining and infiltrating rainfall, these technologies can simultaneously help filter air pollutants, reduce energy demands, mitigate urban heat islands, and sequester carbon while also providing communities with aesthetic and natural resource benefits (USEPA, 2013).

The first step to reducing the impacts from impervious surfaces is to conduct an impervious cover assessment. This assessment can be completed on different scales: individual lot, municipality, or watershed. Impervious surfaces need to be identified for stormwater management. Once impervious surfaces have been identified, there are three steps to better manage these surfaces.

1. ***Eliminate surfaces that are not necessary.*** For example, a paved courtyard at a public school could be converted to a grassed area.
2. ***Reduce or convert impervious surfaces.*** There may be surfaces that are required to be hardened, such as roadways or parking lots, but could be made smaller and still be functional. A parking lot that has two-way car ways could be converted to one-way car ways. There also are permeable paving materials such as porous asphalt, pervious concrete, or permeable paving stones that could be substituted for impermeable paving materials (Figure 2).
3. ***Disconnect impervious surfaces from flowing directly to local waterways.*** There are many ways to capture, treat, and infiltrate stormwater runoff from impervious surfaces. Opportunities may exist to reuse this captured water.



Figure 2: Rapid infiltration of water through porous pavement is demonstrated at the USEPA Edison New Jersey test site

Piscataway Township Impervious Cover Analysis

Located in Middlesex County in central New Jersey, Piscataway Township covers approximately 19.0 square miles. Figures 3 and 4 illustrate that Piscataway Township is dominated by urban land uses. A total of 72.5% of the municipality's land use is classified as urban. Of the urban land in Piscataway Township, medium density residential is the dominant land use (Figure 5).

The literature suggests a link between impervious cover and stream ecosystem impairment starting at approximately 10% impervious surface cover (Schueler, 1994; Arnold and Gibbons, 1996; May et al., 1997). Impervious cover may be linked to the quality of lakes, reservoirs, estuaries, and aquifers (Caraco et al., 1998), and the amount of impervious cover in a watershed can be used to project the current and future quality of streams. Based on the scientific literature, Caraco et al. (1998) classified urbanizing streams into the following three categories: sensitive streams, impacted streams, and non-supporting streams. Sensitive streams typically have a watershed impervious surface cover from 0 – 10%. Impacted streams have a watershed impervious cover ranging from 11-25% and typically show clear signs of degradation from urbanization. Non-supporting streams have a watershed impervious cover of greater than 25%; at this high level of impervious cover, streams are simply conduits for stormwater flow and no longer support a diverse stream community.

The New Jersey Department of Environmental Protection's (NJDEP) 2007 land use/land cover geographical information system (GIS) data layer categorizes Piscataway Township into many unique land use areas, assigning a percent impervious cover for each delineated area. These impervious cover values were used to estimate the impervious coverage for Piscataway Township. Based upon the 2007 NJDEP land use/land cover data, approximately 30.2% of Piscataway Township has impervious cover. This level of impervious cover suggests that the streams in Piscataway Township are likely non-supporting streams.

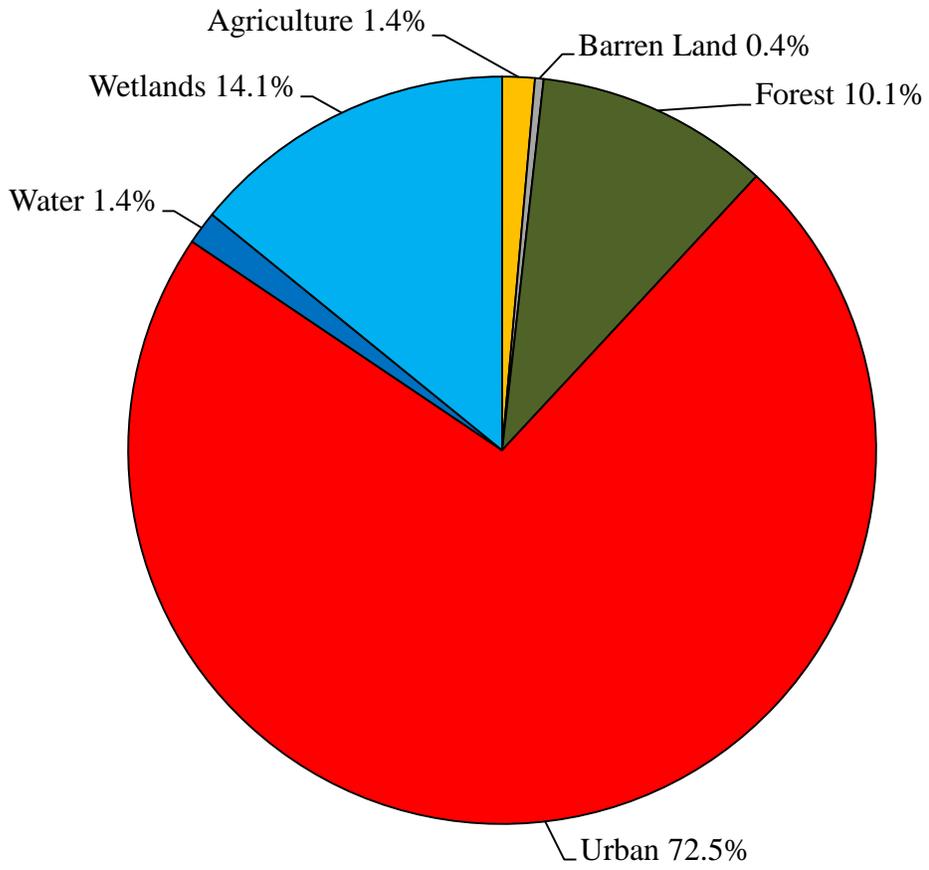


Figure 3: Pie chart illustrating the land use in Piscataway Township

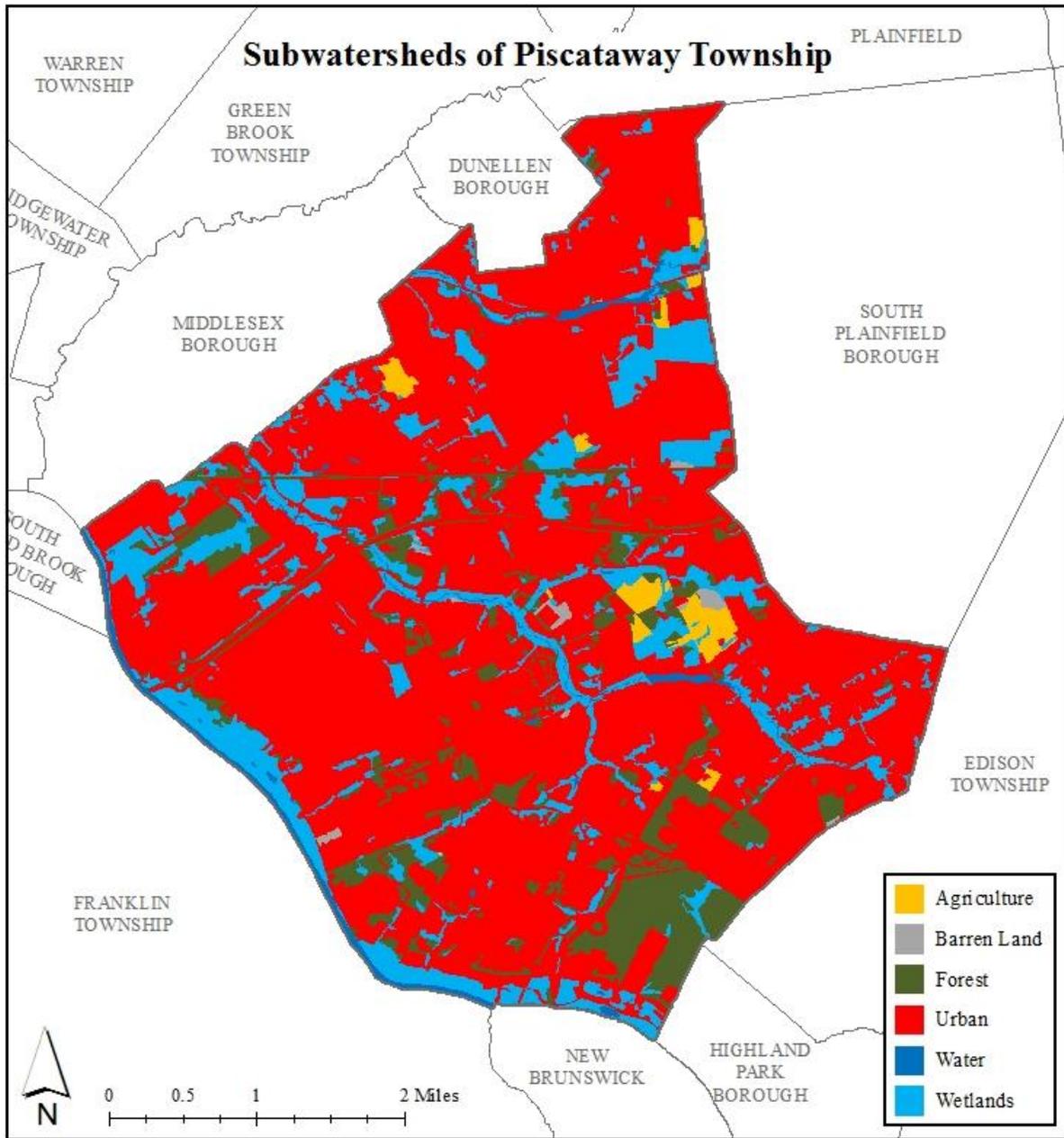


Figure 4: Map illustrating the land use in Piscataway Township

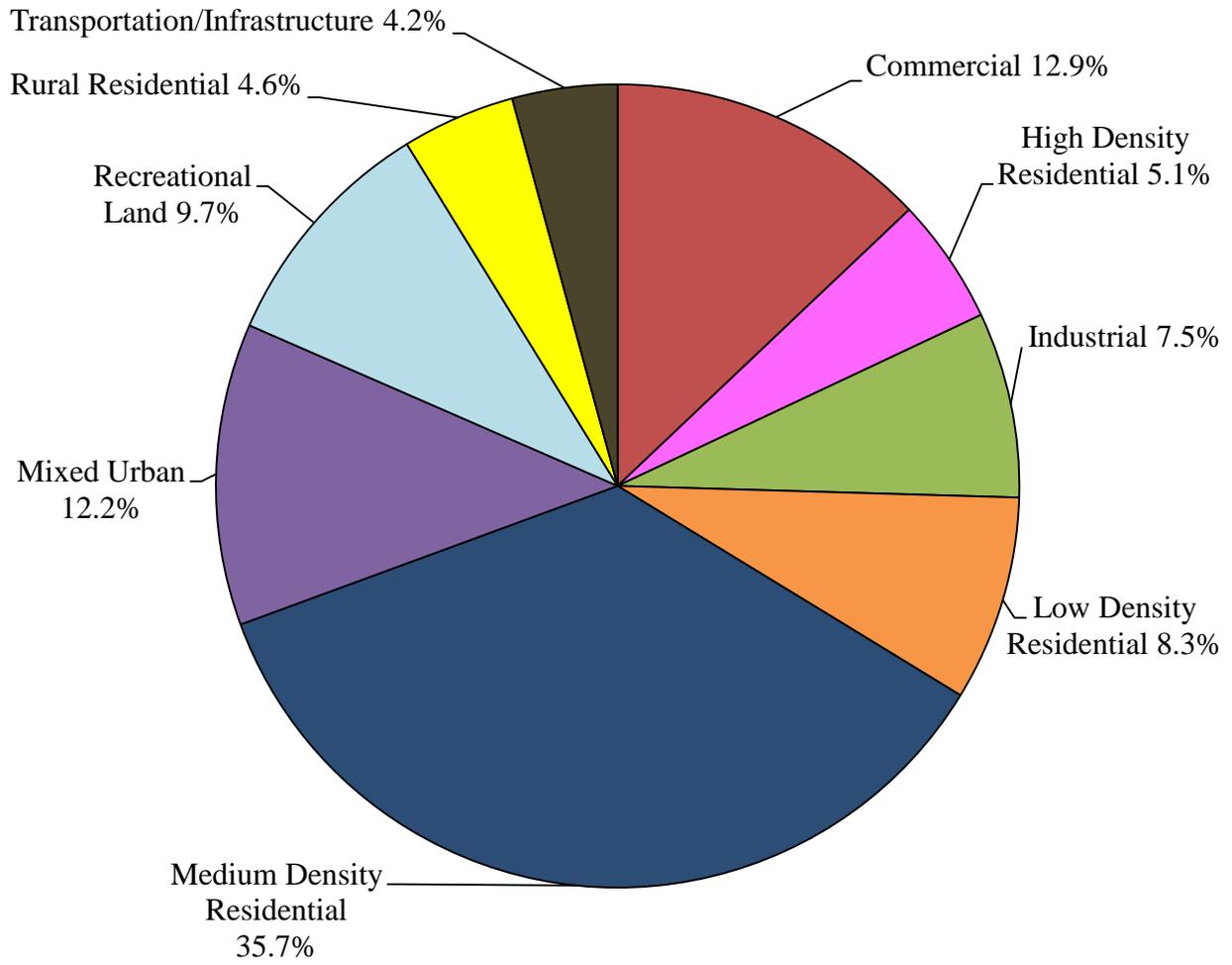


Figure 5: Pie chart illustrating the various types of urban land use in Piscataway Township

Water resources are typically managed on a watershed/subwatershed basis; therefore an impervious cover analysis was performed for each Raritan River subwatershed within Piscataway Township (Table 1 and Figure 6). On a subwatershed basis, impervious cover ranges from 23.2% in the Lower Raritan River subwatershed to 34.2% in the Green Brook subwatershed. Evaluating impervious cover on a subwatershed basis allows the municipality to focus impervious cover reduction or disconnection efforts in the subwatersheds where frequent flooding occurs.

In developed landscapes, stormwater runoff from parking lots, driveways, sidewalks, and rooftops flows to drainage pipes that feed the sewer system. The cumulative effect of these impervious surfaces and thousands of connected downspouts reduces the amount of water that can infiltrate into soils and greatly increases the volume and rate of runoff that flows to waterways. Stormwater runoff volumes (specific to Piscataway Township, Middlesex County) associated with impervious surfaces were calculated for the following storms: the New Jersey water quality design storm of 1.25 inches of rain, an annual rainfall of 44 inches, the 2-year design storm (3.3 inches of rain), the 10-year design storm (5.1 inches of rain), and the 100-year design storm (8.6 inches of rain). These runoff volumes are summarized in Table 2. A substantial amount of rainwater drains from impervious surfaces in Piscataway Township. For example, if the stormwater runoff from one water quality storm (1.25 inches of rain) in the Ambrose Brook subwatershed was harvested and purified, it could supply water to 641 homes for one year¹.

¹ Assuming 300 gallons per day per home

Table 1: Impervious cover analysis by subwatershed for Piscataway Township

Subwatershed	Total Area		Land Use Area		Water Area		Impervious Cover		
	(ac)	(mi ²)	(ac)	(mi ²)	(ac)	(mi ²)	(ac)	(mi ²)	(%)
Ambrose Brook	6,353.6	9.93	6,302.3	9.85	51.3	0.08	2,067.4	3.23	32.8%
Bound Brook	1,768.6	2.76	1,735.7	2.71	32.9	0.05	588.6	0.92	33.9%
Green Brook	397.8	0.62	397.8	0.62	0.00	0.00	136.1	0.21	34.2%
Lower Raritan River	3,611.5	5.64	3,521.7	5.50	89.8	0.14	816.9	1.28	23.2%
Total	12,131.4	19.0	11,957.5	18.7	173.9	0.27	3,609.1	5.64	30.2%

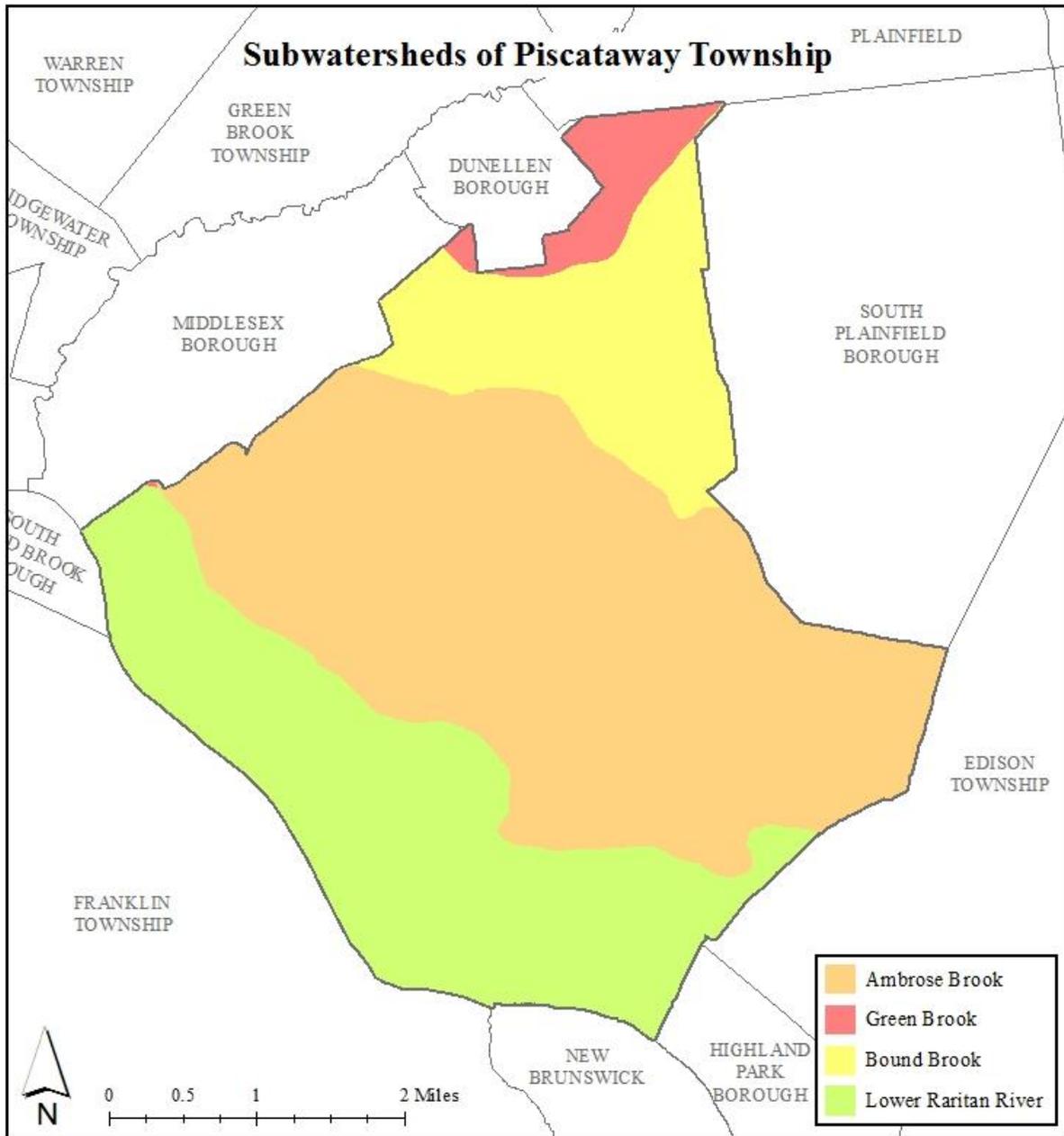


Figure 6: Map of the subwatersheds in Piscataway Township

Table 2: Stormwater runoff volumes from impervious surfaces by subwatershed in Piscataway Township

Subwatershed	Total Runoff Volume for the 1.25" NJ Water Quality Storm (MGal)	Total Runoff Volume for the NJ Annual Rainfall of 44" (MGal)	Total Runoff Volume for the 2-Year Design Storm (3.3") (MGal)	Total Runoff Volume for the 10-Year Design Storm (5.1") (MGal)	Total Runoff Volume for the 100-Year Design Storm (8.6") (MGal)
Ambrose Brook	70.2	2,470.0	185.2	286.3	482.8
Bound Brook	20.0	703.3	52.7	81.5	137.5
Green Brook	4.6	162.6	12.2	18.8	31.8
Lower Raritan River	27.7	976.0	73.2	113.1	190.8
Total	122.5	4,311.8	323.4	499.8	842.8

The next step is to set a reduction goal for impervious area in each subwatershed. Based upon the Rutgers Cooperative Extension (RCE) Water Resources Program's experience, a 10% reduction would be a reasonably achievable reduction for these subwatersheds in Piscataway Township. While it may be difficult to eliminate paved areas or replace paved areas with permeable pavement, it is relatively easy to identify impervious surfaces that can be disconnected using green infrastructure practices. For all practical purposes, disconnecting an impervious surface from a storm sewer system or a water body is an "impervious area reduction." The RCE Water Resources Program recommends that all green infrastructure practices that are installed to disconnected impervious surfaces should be designed for the 2-year design storm (3.3 inches of rain over 24-hours). Although this results in management practices that are slightly over-designed by NJDEP standards, which require systems to be designed for the New Jersey water quality storm (1.25 inches of rain over 2-hours), these systems will be able to handle the increase in storm intensities that are expected to occur due to climate change. By designing these management practices for the 2-year design storm, these practices will be able to manage 95% of the annual rainfall volume. The recommended annual reductions in runoff volumes are shown in Table 3.

As previously mentioned, once impervious surfaces have been identified, the next steps for managing impervious surfaces are to 1) eliminate surfaces that are not necessary, 2) reduce or convert impervious surfaces to pervious surfaces, and 3) disconnect impervious surfaces from flowing directly to local waterways.

Elimination of Impervious Surfaces

One method to reduce impervious cover is to "depave." Depaving is the act of removing paved impervious surfaces and replacing them with pervious soil and vegetation that will allow for the infiltration of rainwater. Depaving leads to the re-creation of natural space that will help reduce flooding, increase wildlife habitat, and positively enhance water quality as well as beautify neighborhoods. Depaving also can bring communities together around a shared vision to work together to reconnect their neighborhood to the natural environment.

Table 3: Impervious cover reductions by subwatershed in Piscataway Township

Subwatershed	Recommended Impervious Area Reduction (10%) (ac)	Annual Runoff Volume Reduction ² (MGal)
Ambrose Brook	206.7	234.6
Bound Brook	58.9	66.8
Green Brook	13.6	15.4
Lower Raritan River	81.7	92.7
Total	360.9	409.6

² Annual Runoff Volume Reduction =

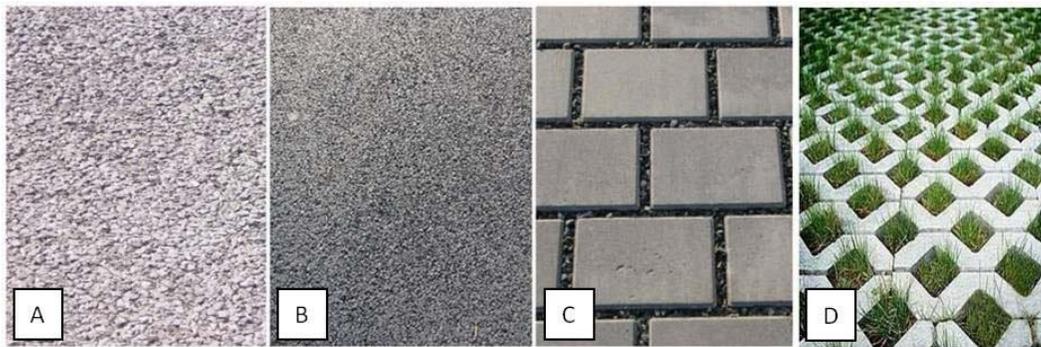
Acres of impervious cover x 43,560 ft²/ac x 44 in x (1 ft/12 in) x 0.95 x (7.48 gal/ft³) x (1 MGal/1,000,000 gal)

All green infrastructure should be designed to capture the first 3.3 inches of rain from each storm. This would allow the green infrastructure to capture 95% of the annual rainfall of 44 inches.

Pervious Pavement

There are four different types of permeable pavement systems that are commonly being used throughout the country to reduce the environmental impacts from impervious surfaces. These surfaces include pervious concrete, porous asphalt, interlocking concrete pavers, and grid pavers.

“Permeable pavement is a stormwater drainage system that allows rainwater and runoff to move through the pavement’s surface to a storage layer below, with the water eventually seeping into the underlying soil. Permeable pavement is beneficial to the environment because it can reduce stormwater volume, treat stormwater water quality, replenish the groundwater supply, and lower air temperatures on hot days (Rowe, 2012).”



Permeable surfaces: (A) pervious concrete, (B) porous asphalt, (C) interlocking concrete pavers, (D) grid pavers (Rowe, 2012)

Pervious concrete and porous asphalt are the most common of the permeable surfaces. They are similar to regular concrete and asphalt but without the fine materials. This allows water to quickly pass through the material into an underlying layered system of stone that holds the water allowing it to infiltrate into the underlying uncompacted soil.

Impervious Cover Disconnection Practices

By redirecting runoff from paving and rooftops to pervious areas in the landscape, the amount of directly connected impervious area in a drainage area can be greatly reduced. There are many cost-effective ways to disconnect impervious surfaces from local waterways.

- **Simple Disconnection**: This is the easiest and least costly method to reduce stormwater runoff for smaller storm events. Instead of piping rooftop runoff to the street where it enters the catch basin and is piped to the river, the rooftop runoff is released onto a grassed

area to allow the water to be filtered by the grass and soak into the ground. A healthy lawn typically can absorb the first one to two inches of stormwater runoff from a rooftop. Simple disconnection also can be used to manage stormwater runoff from paved areas. Designing a parking lot or driveway to drain onto a grassed area, instead of the street, can dramatically reduce pollution and runoff volumes.

- Rain Gardens: Stormwater can be diverted into shallow landscaped depressed areas (i.e., rain gardens) where the vegetation filters the water, and it is allowed to soak into the ground. Rain gardens, also known as bioretention systems, come in all shapes and sizes and can be designed to disconnect a variety of impervious surfaces (Figure 7).



Figure 7: Rain garden outside the RCE of Gloucester County office which was designed to disconnect rooftop runoff from the local storm sewer system

- Rainwater Harvesting: Rainwater harvesting includes the use of rain barrels and cisterns (Figures 8a and 8b). These can be placed below downspouts to collect rooftop runoff. The collected water has a variety of uses including watering plants and washing cars. This practice also helps cut down on the use of potable water for nondrinking purposes. It is important to divert the overflow from the rainwater harvesting system to a pervious area.



Figure 8a: Rain barrel used to disconnect a downspout with the overflow going to a flower bed



Figure 8b: A 5,000 gallon cistern used to disconnect the rooftop of the Department of Public Works in Clark Township to harvest rainwater for nonprofit car wash events

Examples of Opportunities in Piscataway Township

To address the impact of stormwater runoff from impervious surfaces, the next step is to identify opportunities in the municipality for eliminating, reducing, or disconnecting directly connected impervious surfaces. To accomplish this task, an impervious cover reduction action plan should be prepared. Aerial photographs are used to identify sites with impervious surfaces in the municipality that may be suitable for inclusion in the action plan. After sites are identified, site visits are conducted to photo-document all opportunities and evaluate the feasibility of eliminating, reducing or disconnecting directly connected impervious surfaces. A brief description of each site discussing the existing conditions and recommendations for treatment of the impervious surfaces is developed. After a number of sites have been selected for inclusion in the action plan, concept plans and detailed green infrastructure information sheets are prepared for a selection of representative sites.

For Piscataway Township, three sites have been included in this assessment. Examples of concept plans and detailed green infrastructure information sheets are provided in Appendix A. The detailed green infrastructure information sheets describe existing conditions and issues, proposed solutions, anticipated benefits, possible funding sources, potential partners and stakeholders, and estimated costs. Additionally, each project has been classified as a mitigation opportunity for recharge potential, total suspended solids removal, and stormwater peak reduction. Finally, these detailed green infrastructure information sheets provide an estimate of gallons of stormwater captured and treated per year by each proposed green infrastructure practice. The concept plans provide an aerial photograph of the site and details of the proposed green infrastructure practices.

Conclusions

Piscataway Township can reduce flooding and improve its waterways by better managing stormwater runoff from impervious surfaces. This impervious cover assessment is the first step toward better managing stormwater runoff. The next step is to develop an action plan to eliminate, reduce, or disconnect impervious surfaces where possible and practical. Many of the highly effective disconnection practices are inexpensive. The entire community can be engaged in implementing these disconnection practices.

References

Arnold, C.L. Jr. and C.J. Gibbons. 1996. Impervious Surface Coverage The Emergence of a Key Environmental Indicator. *Journal of the American Planning Association* 62(2): 243-258.

Caraco, D., R. Claytor, P. Hinkle, H. Kwon, T. Schueler, C. Swann, S. Vysotsky, and J. Zielinski. 1998. Rapid Watershed Planning Handbook. A Comprehensive Guide for Managing Urbanizing Watersheds. Prepared by Center For Watershed Protection, Ellicott City, MD. Prepared for U.S. Environmental Protection Agency, Office of Wetlands, Oceans and Watersheds and Region V. October 1998.

May, C.W., R.R. Horner, J.R. Karr, B.W. Mar, E.G. Welch. 1997. Effects of Urbanization on Small Streams in the Puget Sound Lowland Ecoregion. *Watershed Protection Techniques* 2(4): 483-493.

Nowak, D. J., and E. J. Greenfield, 2012. Trees and Impervious Cover in the United States. *Landscape and Urban Planning* 107 (2012): 21-30.
http://www.nrs.fs.fed.us/pubs/jrnl/2012/nrs_2012_nowak_002.pdf

Rowe, A., 2012. Green Infrastructure Practices: An Introduction to Permeable Pavement. Rutgers NJAES Cooperative Extension, FS1177, pp. 4.
<http://njaes.rutgers.edu/pubs/publication.asp?pid=FS1177>

Schueler, T. 1994. The Importance of Imperviousness. *Watershed Protection Techniques*1(3): 100-111.

United States Environmental Protection Agency (USEPA), 2013. Watershed Assessment, Tracking, and Environmental Results, New Jersey Water Quality Assessment Report.
http://ofmpub.epa.gov/waters10/attains_state.control?p_state=NJ

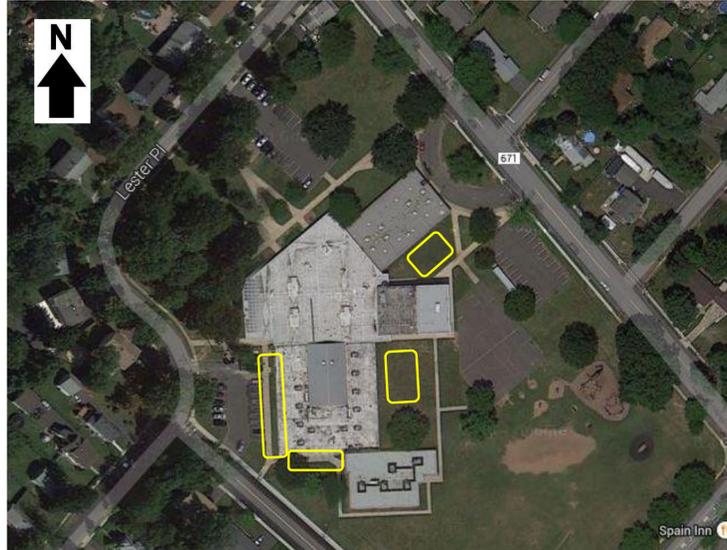
Appendix A

Examples of Impervious Cover Reduction Action Plan Projects Concept Plans and Detailed Green Infrastructure Information Sheets

Piscataway Township Impervious Cover Assessment

Arbor Intermediate School, 1717 Lester Place

PROJECT LOCATION:



A



B



C



D



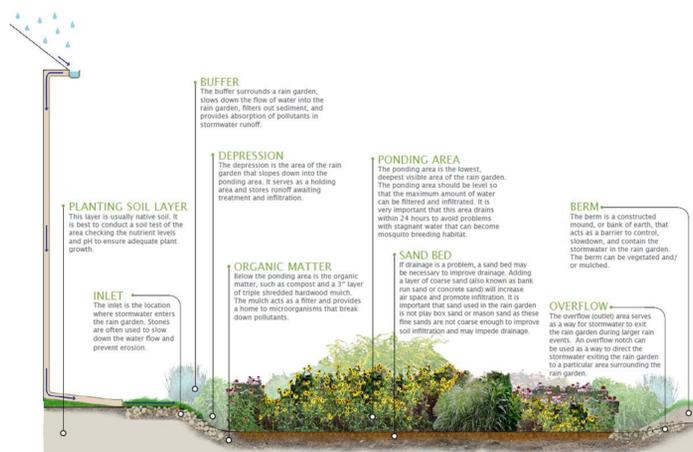
SITE PLAN:



- 1 BIORETENTION SYSTEMS:** Downspouts along the building can be disconnected, conveying stormwater to a series of three rain gardens. These rain gardens can capture, treat, and infiltrate rooftop runoff and runoff from the grass areas around the school. The existing catch basins can handle any overflow from the gardens. The rain gardens can reduce sediment and nutrient loading to the local waterway while providing beautiful landscaping to the school grounds. The gardens can also provide habitat for birds, butterflies, and pollinators.
- 2 POROUS PAVEMENT:** Porous pavement promotes groundwater recharge and can allow for the infiltration of runoff from the school's rooftop.

EDUCATIONAL OPPORTUNITY: The RCE Water Resources Program's *Stormwater Management in Your Schoolyard* program can be delivered at Arbor Intermediate School to educate the students about stormwater management.

1 BIORETENTION SYSTEMS



2 POROUS PAVEMENT



EDUCATIONAL PROGRAM



Arbor Intermediate School
Green Infrastructure Information Sheet

<p>Location: 1717 Lester Place Piscataway, NJ 08854</p>	<p>Municipality: Piscataway Township</p>
<p>Green Infrastructure Description: bioretention systems (rain gardens) porous pavement <i>Stormwater Management in Your Schoolyard</i> educational program</p>	<p>Subwatershed: Green Brook</p> <p>Targeted Pollutants: total nitrogen (TN), total phosphorous (TP), and total suspended solids (TSS) in surface runoff</p>
<p>Mitigation Opportunities: recharge potential: yes stormwater peak reduction potential: yes TSS removal potential: yes</p>	<p>Stormwater Captured and Treated Per Year: rain garden #1: 104,221 gal. rain garden #2: 206,228 gal. rain garden #3: 115,555 gal. porous pavement: 114,774 gal.</p>
<p>Existing Conditions and Issues: There are impervious surfaces at this site that contribute to stormwater runoff volumes and nonpoint source pollution. Runoff is carrying nonpoint source pollution, such as sediments, nutrients, oil, and grease to local waterways. The downspouts from the rooftop are directly connected to the stormwater sewer which conveys the water to local waterways.</p>	
<p>Proposed Solution(s): Bioretention systems or rain gardens could be installed to capture a portion of the rooftop runoff. Rain garden #1 would be constructed on the west side of the building in a section of grass between the sidewalk and building. Rain garden #2 would be constructed on the eastern side of the building near the paved recess area. Rain garden #3 would be constructed on the western side of the northern portion of the school. With the disconnection of the adjacent downspouts each of these rain gardens would intercept a portion of the rooftop runoff. These bioretention systems would capture, treat, and infiltrate the stormwater runoff, thereby reducing localized flooding and improving water quality. While the sidewalk is in good condition, a section could be converted to porous pavement to enhance the capture of rooftop runoff. Porous pavement can treat the stormwater runoff and slowly allow it to infiltrate into the ground.</p>	
<p>Anticipated Benefits: Since the bioretention systems would be designed to capture, treat, and infiltrate the entire 2-year design storm (3.3 inches of rain over 24 hours), these systems are estimated to achieve a 95% pollutant load reduction for TN, TP, and TSS. The porous pavement system will achieve the same level of pollutant load reduction for TN, TP and TSS. A bioretention system would also provide ancillary benefits such as enhanced wildlife habitat and aesthetic appeal. The RCE Water Resources Program's <i>Stormwater Management in Your Schoolyard</i> program can be delivered at Arbor Intermediate School to educate the students about stormwater management.</p>	

Arbor Intermediate School
Green Infrastructure Information Sheet

Possible Funding Sources:

mitigation funds from local developers
NJDEP grant programs

Partners/Stakeholders:

Piscataway residents
local community groups (Boy Scouts, Girl Scouts, etc.)
students and parents
Rutgers Cooperative Extension

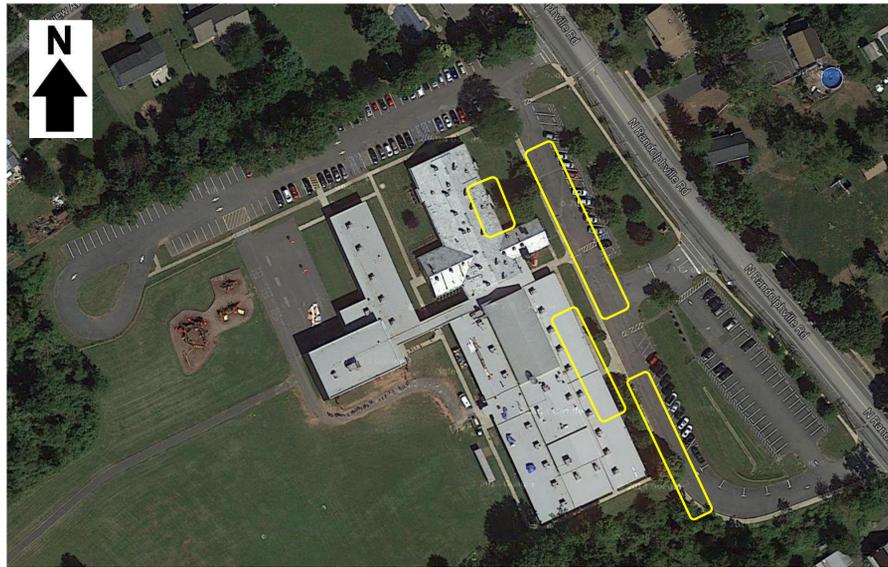
Estimated Cost:

Rain garden #1 would need to be approximately 1,000 square feet. At \$5 per square foot, the estimated cost for the rain garden is \$5,000. Rain garden #2 would need to be approximately 1,980 square feet. At \$5 per square foot, the estimated cost for the rain garden is \$9,900. Rain garden #3 would need to be approximately 1,110 square feet. At \$5 per square foot, the estimated cost for the rain garden is \$5,550. The porous pavement would cover 820 square feet and have a two foot stone reservoir under the surface. At \$25 per square foot, the cost of the porous pavement system would be \$20,500. The total cost of the project would be approximately \$40,950.

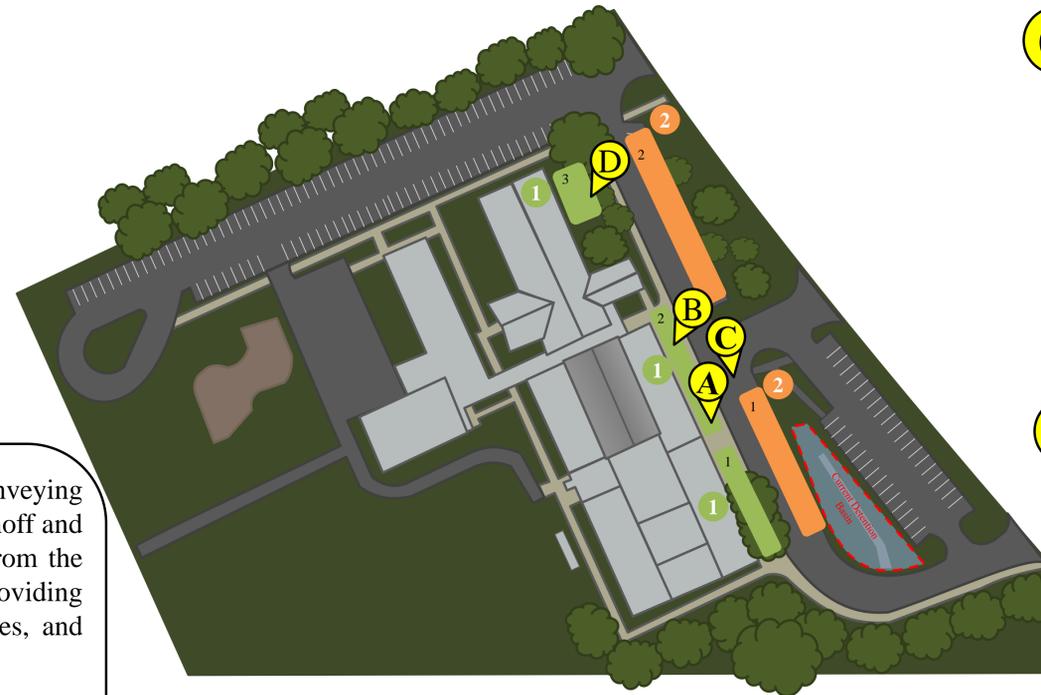
Piscataway Township Impervious Cover Assessment

Grandview Elementary School, 130 North Randolphville Road

PROJECT LOCATION:



SITE PLAN:



A



B



C



D



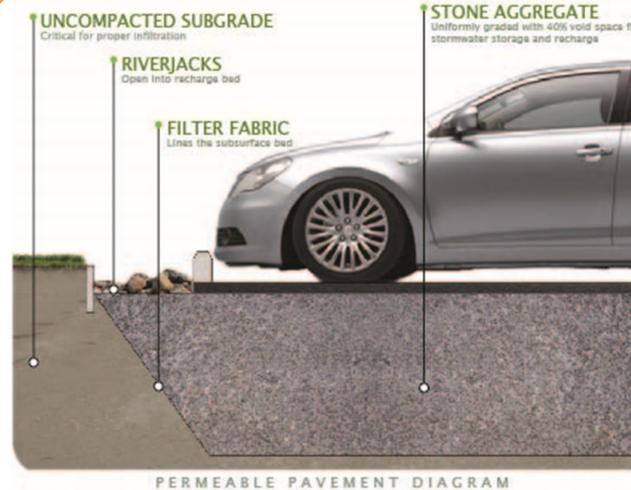
- 1 BIORETENTION SYSTEMS:** Downspouts along the front of the building can be disconnected, conveying stormwater to a series of three rain gardens. These rain gardens can capture, treat, and infiltrate rooftop runoff and runoff from the grass area in front of the school. The existing catch basins can handle any overflow from the gardens. The rain gardens can reduce sediment and nutrient loading to the local waterway while providing beautiful landscaping to the school grounds. The gardens can also provide habitat for birds, butterflies, and pollinators.
- 2 POROUS PAVEMENT:** Porous pavement promotes groundwater recharge and can allow for the infiltration of runoff from the school's entrance road.

EDUCATIONAL OPPORTUNITY: The RCE Water Resources Program's *Stormwater Management in Your Schoolyard* program can be delivered at Grandview Elementary School to educate the students about stormwater management.

1 BIORETENTION SYSTEMS



2 POROUS PAVEMENT



EDUCATIONAL PROGRAM



Grandview Elementary School
Green Infrastructure Information Sheet

<p>Location: 130 North Randolphville Road Piscataway, NJ 08854</p>	<p>Municipality: Piscataway Township</p>
<p>Green Infrastructure Description: bioretention systems (rain gardens) porous pavement <i>Stormwater Management in Your Schoolyard</i> educational program</p>	<p>Subwatershed: Ambrose Brook</p> <p>Targeted Pollutants: total nitrogen (TN), total phosphorous (TP), and total suspended solids (TSS) in surface runoff</p>
<p>Mitigation Opportunities: recharge potential: yes stormwater peak reduction potential: yes TSS removal potential: yes</p>	<p>Stormwater Captured and Treated Per Year: rain garden #1: 142,418 gal. rain garden #2: 123,893 gal. rain garden #3: 107,348 gal. porous pavement #1: 150,157 gal. porous pavement #2: 226,030 gal.</p>
<p>Existing Conditions and Issues: There are impervious surfaces at this site that contribute to stormwater runoff volumes and nonpoint source pollution. Runoff is carrying nonpoint source pollution, such as sediments, nutrients, oil, and grease to local waterways. The downspouts from the rooftop are directly connected to the stormwater sewer which conveys the water to local waterways. The incoming road and parking spaces in front of the school are showing signs of deterioration.</p>	
<p>Proposed Solution(s): Bioretention systems or rain gardens could be installed to capture a portion of the rooftop runoff. Rain garden 1, 2 and 3 would be constructed directly in front of the school. With the disconnection of the adjacent downspouts each of these rain gardens would intercept a portion of the rooftop runoff. These bioretention systems would capture, treat, and infiltrate the stormwater runoff, thereby reducing localized flooding and improving water quality. Additionally, the parking spaces in front of the school can be converted to porous pavement to capture water from the incoming road and any potential overflow from the rain gardens. Porous pavement will treat the stormwater runoff and slowly allow it to infiltrate into the ground.</p>	
<p>Anticipated Benefits: Since the bioretention systems would be designed to capture, treat, and infiltrate the entire 2-year design storm (3.3 inches of rain over 24 hours), these systems are estimated to achieve a 95% pollutant load reduction for TN, TP, and TSS. The porous pavement system will achieve the same level of pollutant load reduction for TN, TP and TSS. A bioretention system would also provide ancillary benefits such as enhanced wildlife habitat and aesthetic appeal. The RCE Water Resources Program's <i>Stormwater Management in Your Schoolyard</i> program can be delivered at Grandview Elementary School to educate the students about stormwater management.</p>	

Grandview Elementary School
Green Infrastructure Information Sheet

Possible Funding Sources:

mitigation funds from local developers
NJDEP grant programs

Partners/Stakeholders:

Piscataway residents
local community groups (Boy Scouts, Girl Scouts, etc.)
students and parents
Rutgers Cooperative Extension

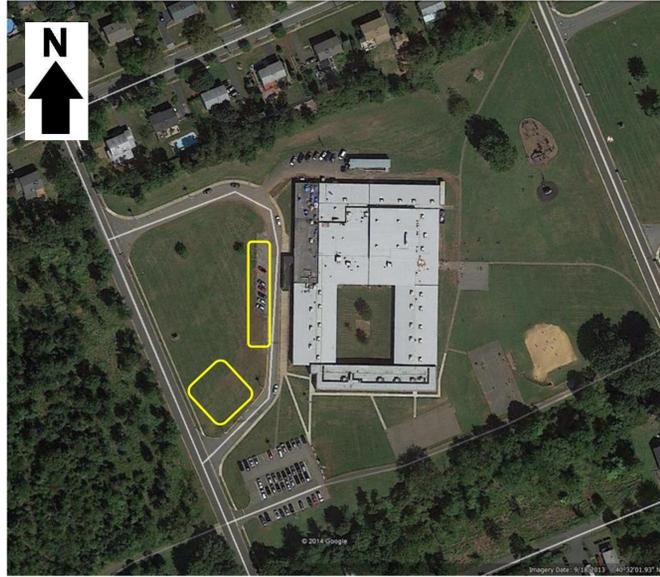
Estimated Cost:

Rain garden #1 would need to be approximately 1,370 square feet. At \$5 per square foot, the estimated cost for the rain garden is \$6,850. Rain garden #2 would need to be approximately 1,190 square feet. At \$5 per square foot, the estimated cost for the rain garden is \$5,950. Rain garden #3 would need to be approximately 1,030 square feet. At \$5 per square foot, the estimated cost for the rain garden is \$5,150. The porous pavement section #1 would cover 4,920 square feet and have a half foot stone reservoir under the surface. At \$15 per square foot, the estimated cost of porous pavement section #1 would be \$73,800. The porous pavement section #2 would cover 2,250 square feet and have a one and a half foot stone reservoir under the surface. At \$22.50 per square foot, the estimated cost of porous pavement section #1 would be \$50,625. The total cost of the project would be approximately \$142,375.

Piscataway Township Impervious Cover Assessment

Martin Luther King School, 5205 Ludlow Street

PROJECT LOCATION:



A



B



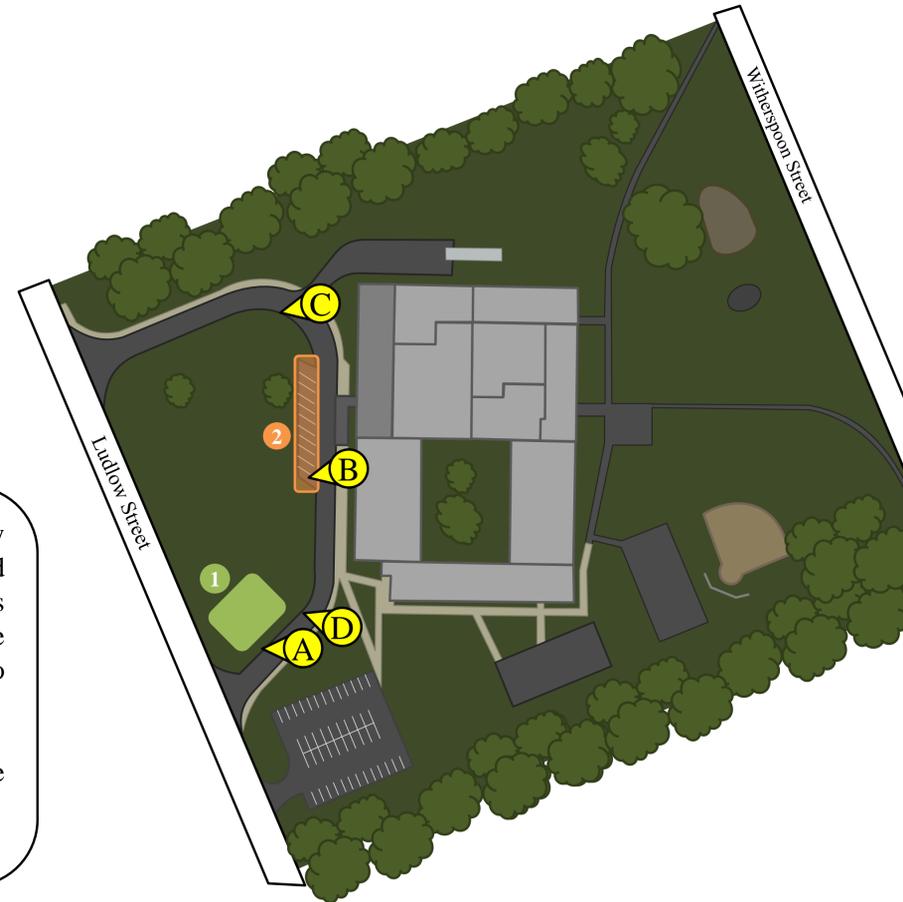
C



D



SITE PLAN:

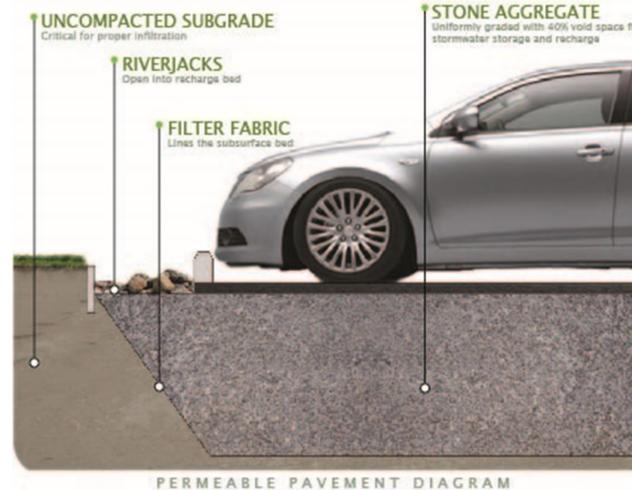


- 1 BIORETENTION SYSTEMS:** Trench drains placed along the entrance road to the school can convey runoff from the road to a rain garden in front of the school. This rain garden can capture, treat, and infiltrate roadway runoff and runoff from the grass area in front of the school. The existing catch basins can handle any overflow from the garden. The rain garden can reduce sediment and nutrient loading to the local waterway while providing beautiful landscaping to the school grounds and can be incorporated into the school's science curriculum. The garden can also provide habitat for birds, butterflies, and pollinators.
- 2 POROUS PAVEMENT:** Porous pavement promotes groundwater recharge and can allow for the infiltration of runoff from the school's entrance road.

1 BIORETENTION SYSTEMS



2 POROUS PAVEMENT



TRENCH DRAIN



Martin Luther King School
Green Infrastructure Information Sheet

<p>Location: 5205 Ludlow Street Piscataway, NJ 08854</p>	<p>Municipality: Piscataway Township</p>
<p>Green Infrastructure Description: bioretention systems (rain gardens) porous pavement <i>Stormwater Management in Your Schoolyard</i> education program</p>	<p>Subwatershed: Lower Raritan River</p> <p>Targeted Pollutants: total nitrogen (TN), total phosphorous (TP), and total suspended solids (TSS) in surface runoff</p>
<p>Mitigation Opportunities: recharge potential: yes stormwater peak reduction potential: yes TSS removal potential: yes</p>	<p>Stormwater Captured and Treated Per Year: rain garden: 105,342 gal. porous pavement: 142,336 gal.</p>
<p>Existing Conditions and Issues: There are large amounts of impervious surfaces at this site that contribute to stormwater runoff volumes and nonpoint source pollution. Runoff is carrying nonpoint source pollution, such as sediments, nutrients, oil, and grease to local waterways. The incoming road and parking spaces in front of the school are showing signs of deterioration.</p>	
<p>Proposed Solution(s): A bioretention system could be installed to capture a portion of the runoff from the road as well as a portion of the runoff from the grassed area in front of the school. The rain garden on this site would be constructed in the large grassed area in front of the school. A trench drain would be used to convey stormwater from the road to the garden. This bioretention system would capture, treat, and infiltrate the stormwater runoff, thereby reducing localized flooding and improving water quality. Additionally, the parking spaces in front of the school can be converted to porous pavement to capture water from the incoming road. Porous pavement will treat the stormwater runoff and slowly allow it to infiltrate into the ground.</p>	
<p>Anticipated Benefits: Since the bioretention systems would be designed to capture, treat, and infiltrate the entire 2-year design storm (3.3 inches of rain over 24 hours), these systems are estimated to achieve a 95% pollutant load reduction for TN, TP, and TSS. The porous pavement system will achieve the same level of pollutant load reduction for TN, TP and TSS. A bioretention system would also provide ancillary benefits such as enhanced wildlife habitat and aesthetic appeal. The RCE Water Resources Program's <i>Stormwater Management in Your Schoolyard</i> program can be delivered at Martin Luther King School to educate the students about stormwater management.</p>	
<p>Possible Funding Sources: mitigation funds from local developers NJDEP grant programs</p>	

Martin Luther King School
Green Infrastructure Information Sheet

Partners/Stakeholders:

Piscataway residents
local community groups (Boy Scouts, Girl Scouts, etc.)
students and parents
Rutgers Cooperative Extension

Estimated Cost:

The rain garden would need approximately 1,020 square feet for its respective drainage area. At \$5 per square foot, the estimated cost of the rain garden is \$5,100. The porous pavement would cover approximately 2,660 square feet and have a one foot stone reservoir under the surface. At \$20 per square foot, the cost of the porous pavement system would be \$53,200. The total cost of the project would be approximately \$58,300.