Draft

Impervious Cover Assessment
for
South Plainfield Borough, Middlesex County, New Jersey

Prepared for South Plainfield Borough 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

South Plainfield Borough Impervious Cover Analysis

Located in Middlesex County in central New Jersey, South Plainfield Borough covers approximately 8.3 square miles northeast of Piscataway. Figures 3 and 4 illustrate that South Plainfield Borough is dominated by urban land uses. A total of 79.0% of the municipality's land use is classified as urban. Of the urban land in South Plainfield Borough, 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 steams 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 South Plainfield Borough 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 South Plainfield Borough. Based upon the 2007 NJDEP land use/land cover data, approximately 39.4% of South Plainfield Borough has impervious cover. This level of impervious cover suggests that the streams in South Plainfield Borough are likely non-supporting streams.

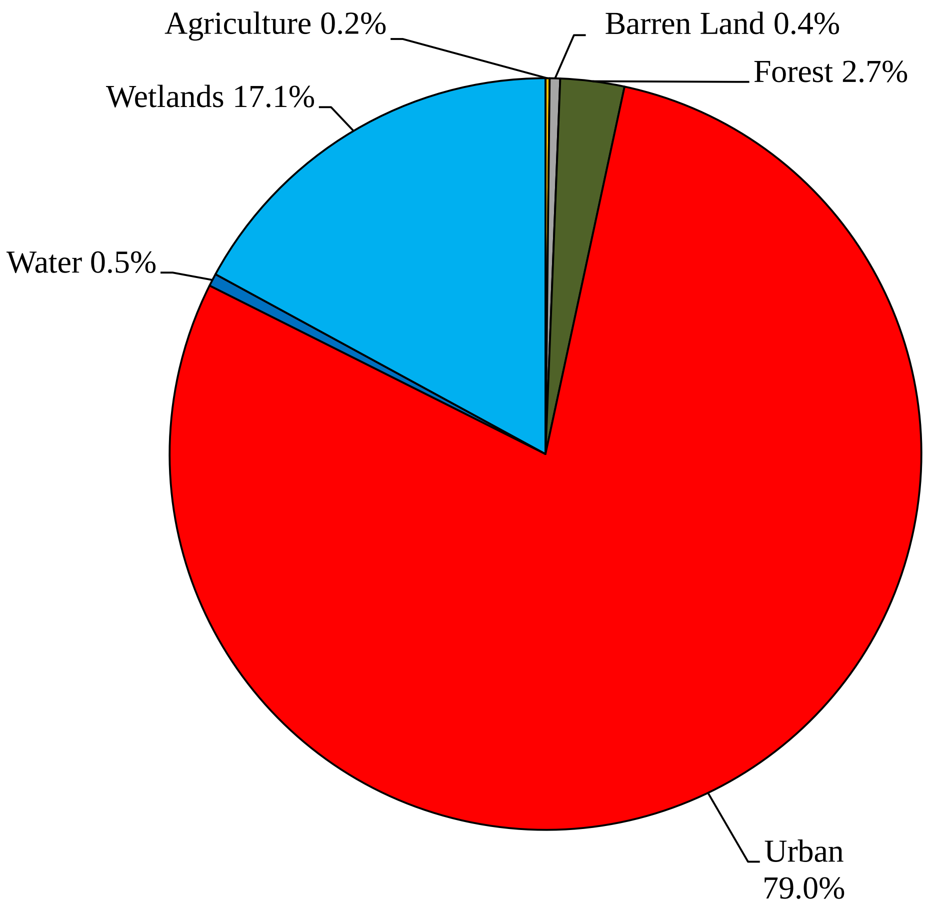


Figure 3: Pie chart illustrating the land use in South Plainfield Borough

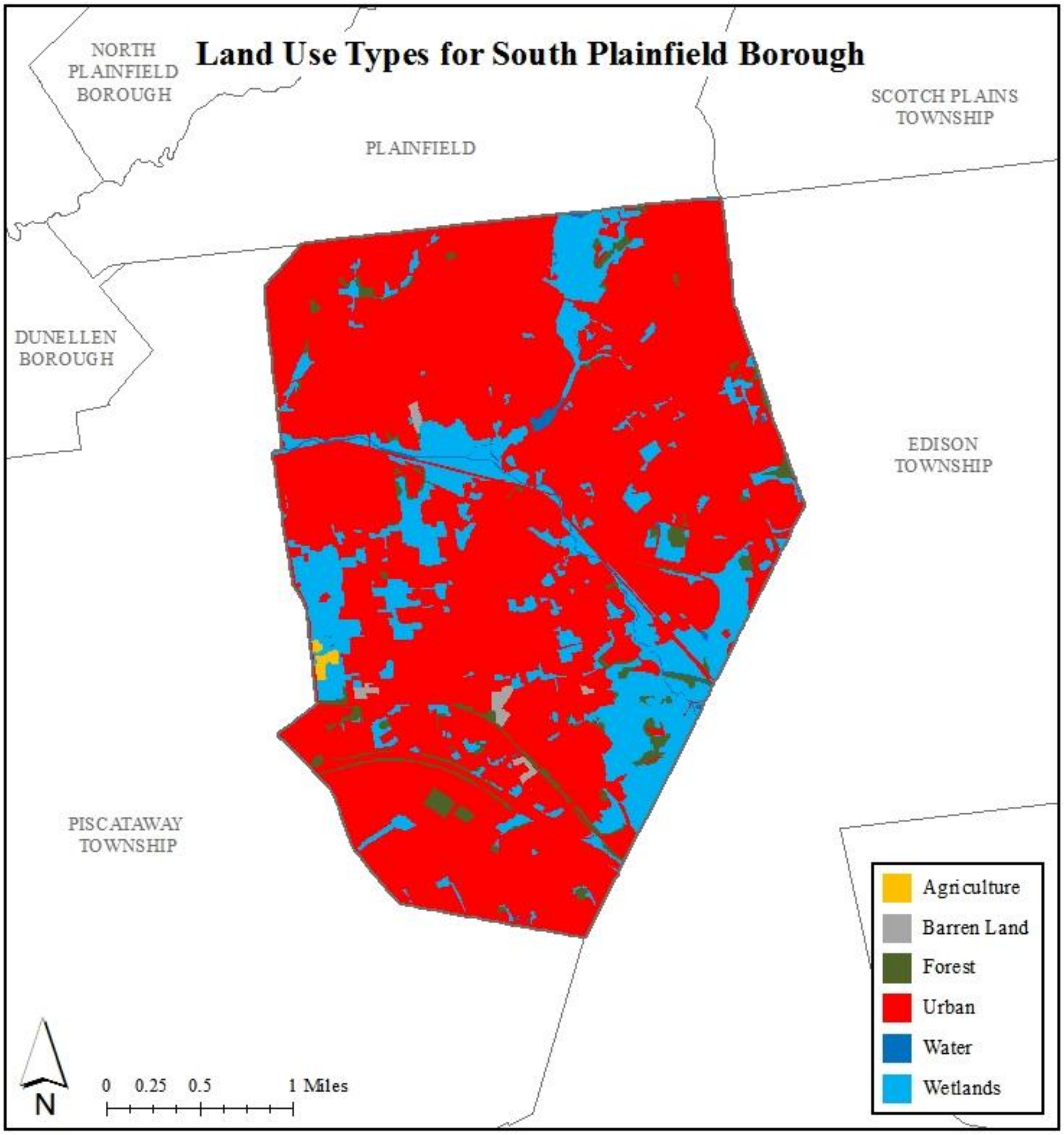


Figure 4: Map illustrating the land use in South Plainfield Borough

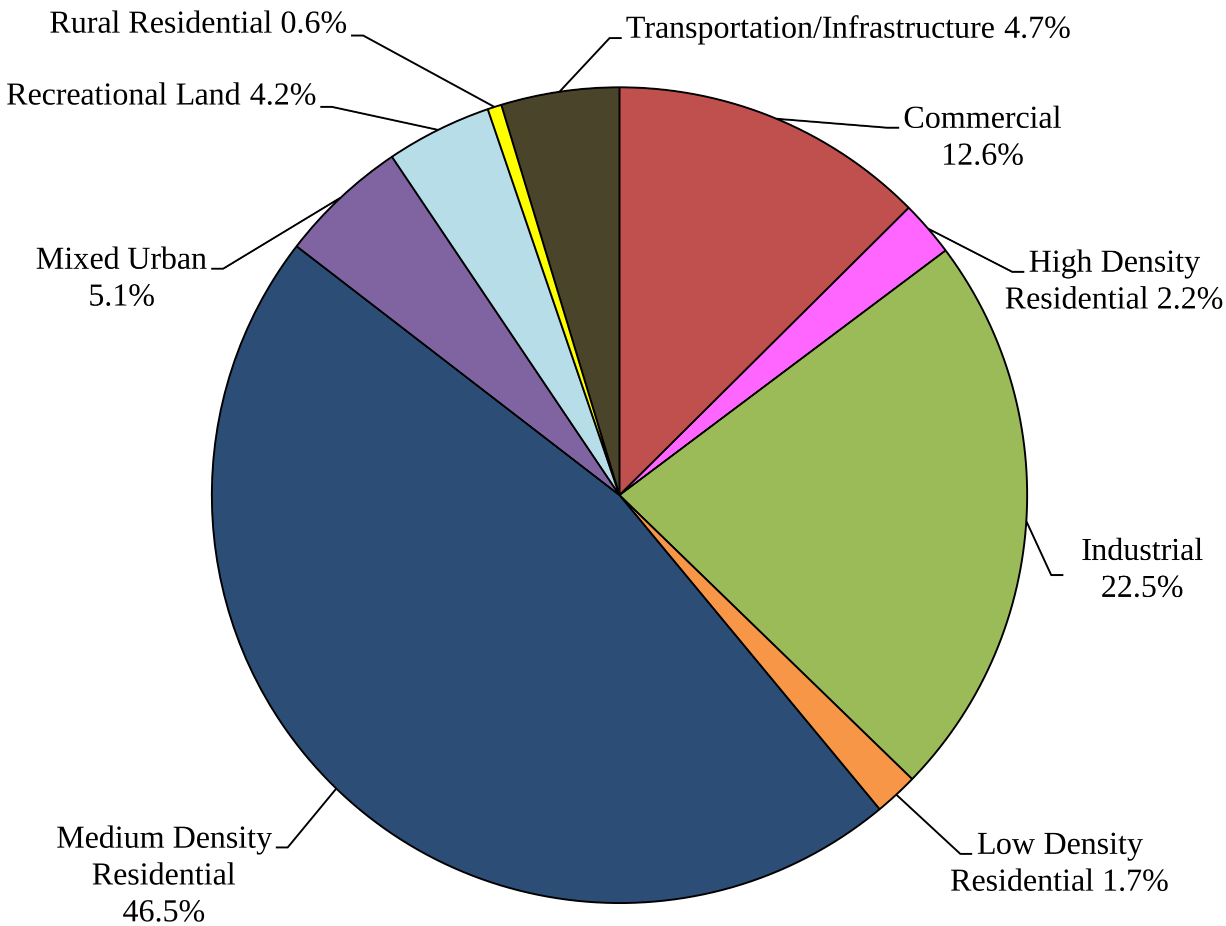


Figure 5: Pie chart illustrating the various types of urban land use in South Plainfield Borough

Water resources are typically managed on a watershed/subwatershed basis; therefore an impervious cover analysis was performed for each Raritan River subwatershed within South Plainfield Borough (Table 1 and Figure 6). On a subwatershed basis, impervious cover ranges from 10.0% in the Rahway River Robinson's Branch subwatershed to 70.7% in the Ambrose 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 South Plainfield Borough, 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 South Plainfield Borough. For example, if the stormwater runoff from one water quality storm (1.25 inches of rain) in the Bound Brook subwatershed was harvested and purified, it could supply water to 563 homes for one year[1].

[1] Assuming 300 gallons per day per home

Table 1: Impervious cover analysis by subwatershed for South Plainfield Borough

Subwatershed	Total Area		Land Use Area		Water Area		Impervious Cover		
	(ac)	(mi^2)	(ac)	(mi^2)	(ac)	(mi^2)	(ac)	(mi^2)	(%)
Ambrose Brook	387.0	0.60	386.5	0.60	0.44	0.00	273.2	0.43	70.7%
Bound Brook	4,942.9	7.72	4,914.5	7.68	28.4	0.04	1,816.3	2.84	37.0%
Rahway River Robinson's Branch	0.80	0.00	0.80	0.00	0.00	0.00	0.08	0.00	10.0%
Total	5,330.6	8.33	5,301.8	8.28	28.8	0.05	2,089.6	3.26	39.4%

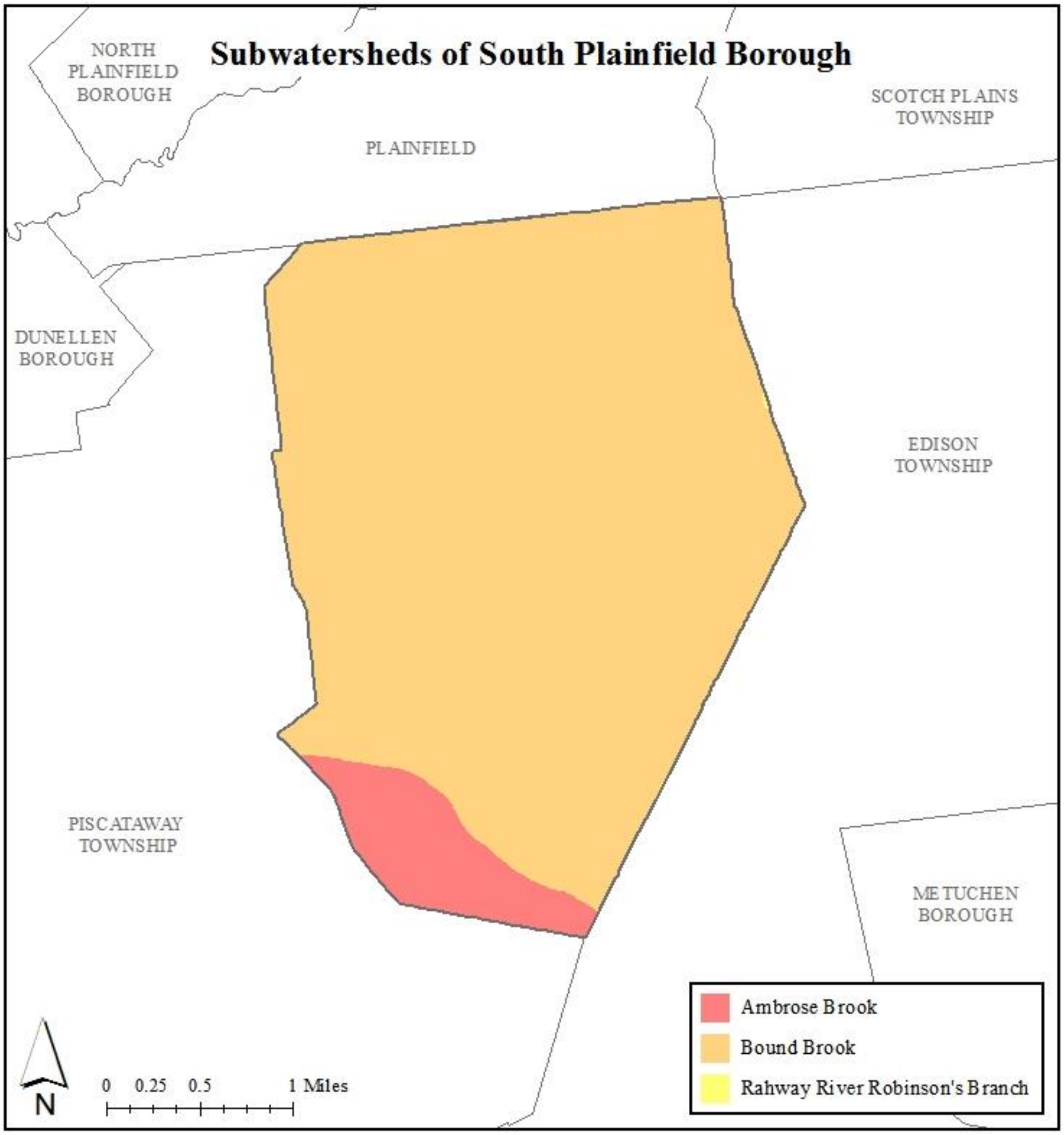


Figure 6: Map of the subwatersheds in South Plainfield Borough

Table 2: Stormwater runoff volumes from impervious surfaces by subwatershed in South Plainfield Borough

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	9.3	326.3	24.5	37.8	63.8
Bound Brook	61.6	2,170.0	162.7	251.5	424.1
Rahway River Robinson's Branch	0.0	0.1	0.0	0.0	0.0
Total	70.9	2,496.4	187.2	289.4	487.9

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 South Plainfield Borough. 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 disconnect 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 South Plainfield Borough

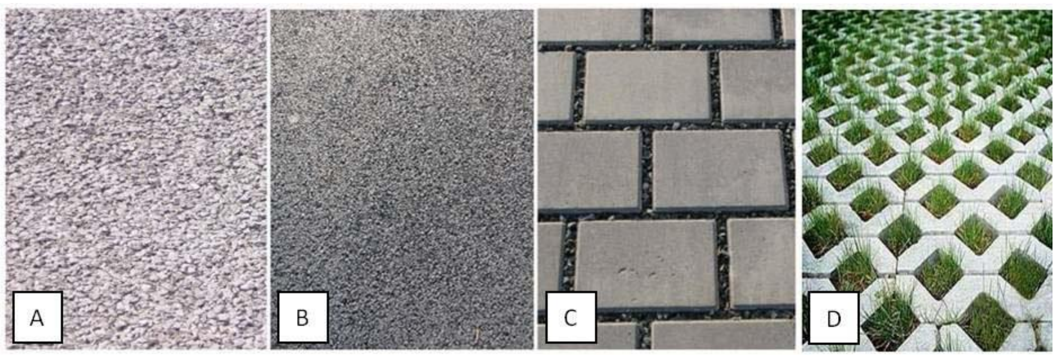
Subwatershed	**Recommended Impervious Area Reduction (10%) (ac)**	**Annual Runoff Volume Reduction [2] (MGal)**
Ambrose Brook	27.3	31.0
Bound Brook	181.6	206.1
Rahway River Robinson's Branch	0.0	0.0
Total	209.0	237.2

[2] Annual Runoff Volume Reduction =
Acres of impervious cover x 43,560 ft^2/ac x 44 in x (1 ft/12 in) x 0.95 x (7.48 gal/ft^3) 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 South Plainfield Borough

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 South Plainfield Borough, 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

South Plainfield Borough 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

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Appendix A

Examples of Impervious Cover Reduction Action Plan Projects

Concept Plans and Detailed Green Infrastructure Information Sheets

South Plainfield Borough
Impervious Cover Assessment
South Plainfield Recreation, 1250 Maple Avenue

A

B

RUTGERS
New Jersey Agricultural Experiment Station

PROJECT LOCATION:

SITE PLAN:

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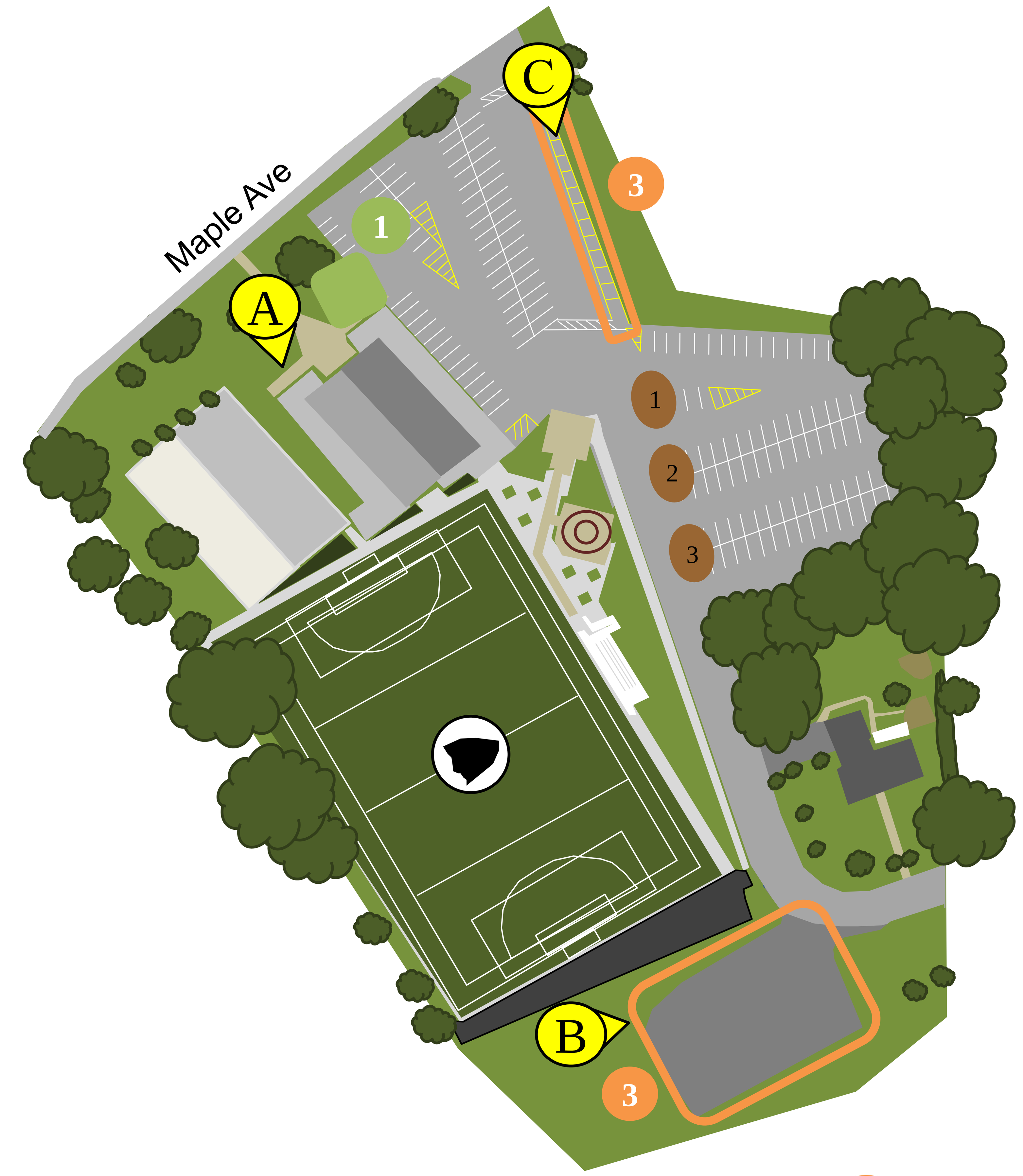

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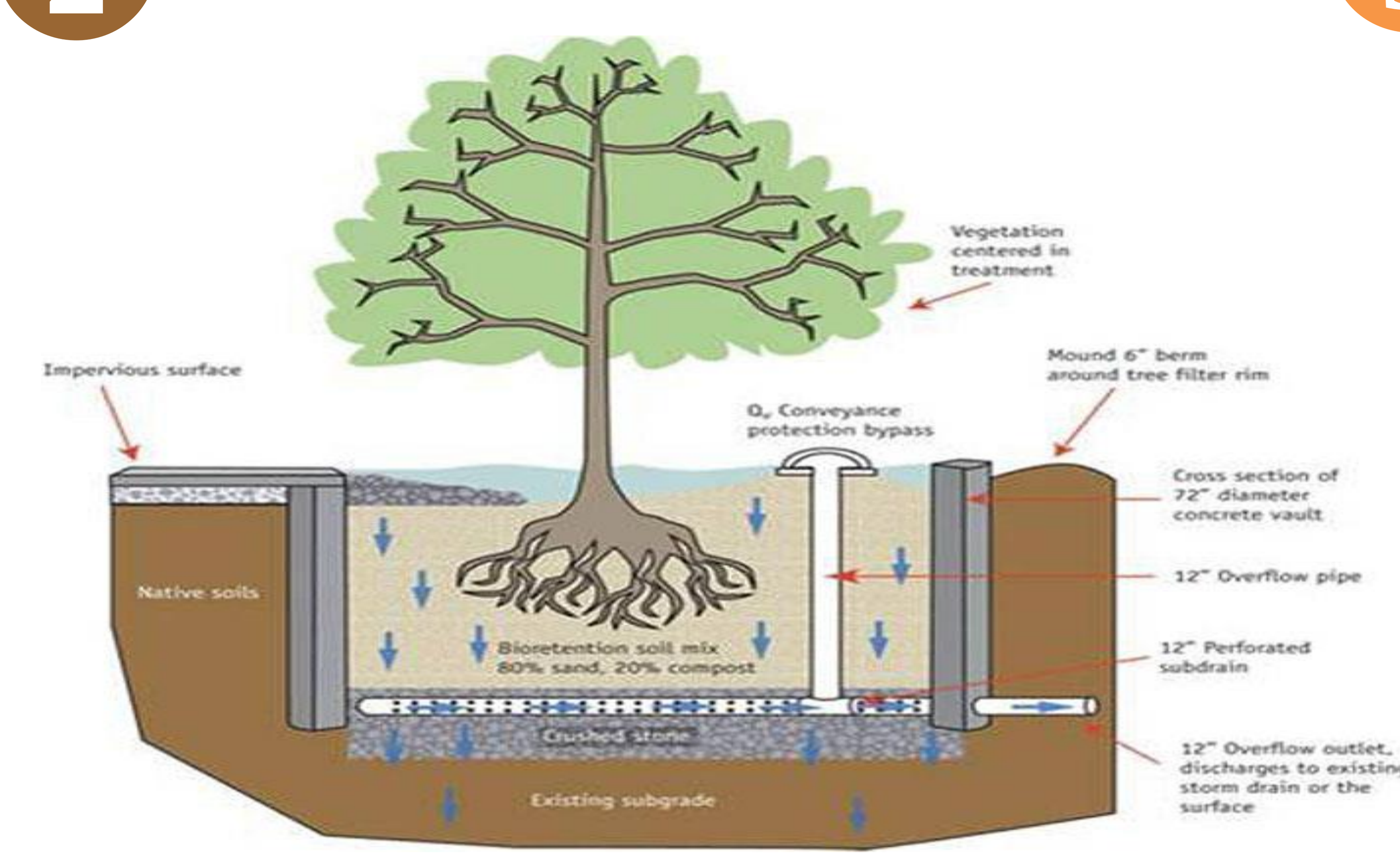
1 **BIORETENTION SYSTEM:** A rain garden can capture, collect, and treat runoff from a portion of the northern parking lot in the turf grass area in front of the building. The bioretention system will reduce sediment and nutrient loading to the local waterway.

2 **TREE FILTER BOX:** Tree filter boxes could be installed to help capture runoff from the parking lot. These tree filter boxes will reduce pollutant loading to the catch basins while increasing infiltration.

3 **POROUS PAVEMENT:** Porous pavement promotes groundwater recharge and filters stormwater. There are two areas that could be converted to porous pavement to intercept roadway and parking lot runoff before entering the stormwater sewer.

1 BIORETENTION SYSTEM

2 TREE FILTER BOX



3 POROUS PAVEMENT

Location: 1250 Maple Avenue South Plainfield, NJ 07080	**Municipality:** South Plainfield Borough **Subwatershed:** Spring Lake Fork of Bound Brook
Green Infrastructure Description: bioretention system porous pavement tree filter boxes	**Targeted Pollutants:** total nitrogen (TN), total phosphorous (TP), and total suspended solids (TSS) in surface runoff
Mitigation Opportunities: recharge potential: yes stormwater peak reduction potential: yes TSS removal potential: yes	**Stormwater Captured and Treated Per Year:** bioretention system: 75,560 gal. tree filter boxes #1: 115,477 gal. tree filter boxes #2: 147,213 gal. tree filter boxes #3: 100,574 gal. porous pavement northeast: 148,515 gal. porous pavement south: 1,216,784 gal.

Existing Conditions and Issues:
This site is located right off of Maple Street. The parking lot has some significant wear especially in certain areas along the main driveway. Stormwater appears to flow into storm drains along this main driveway. At the front of the building facing the street, there is a turf grass area with four storm drains located throughout. There are connected downspouts at the front of the building. The adjacent fields drain into this parking lot and cause erosion and flooding. There are two storm drains at each end of this parking lot.

Proposed Solution(s):
Three tree filter boxes could be installed in the east parking lot to capture and treat runoff. A bioretention system can be installed in the grass area near the front of the building closest to the northern parking lot. The northeast side of the parking driveway closest to the pool could be redone with a strip of porous pavement to capture, treat, and infiltrate stormwater from the parking lot before it reaches the storm drains. The southern parking lot could be redone completely with porous pavement to absorb runoff from the parking lot and adjacent fields before reaching the storm drains.

Anticipated Benefits:
Since the bioretention system would be designed to capture, treat, and infiltrate the entire 2-year design storm (3.3 inches of rain over 24 hours), it is estimated to achieve a 95% 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 porous pavement system and tree filter boxes will achieve the same level of pollutant load reduction for TN, TP and TSS. Tree filter boxes also enhance aesthetic appeal while reducing localized flooding. The porous pavement would have a stone reservoir beneath it to store stormwater and slowly let it infiltrate into the ground. The system would contain an underdrain so larger rainfall events could bypass the system.

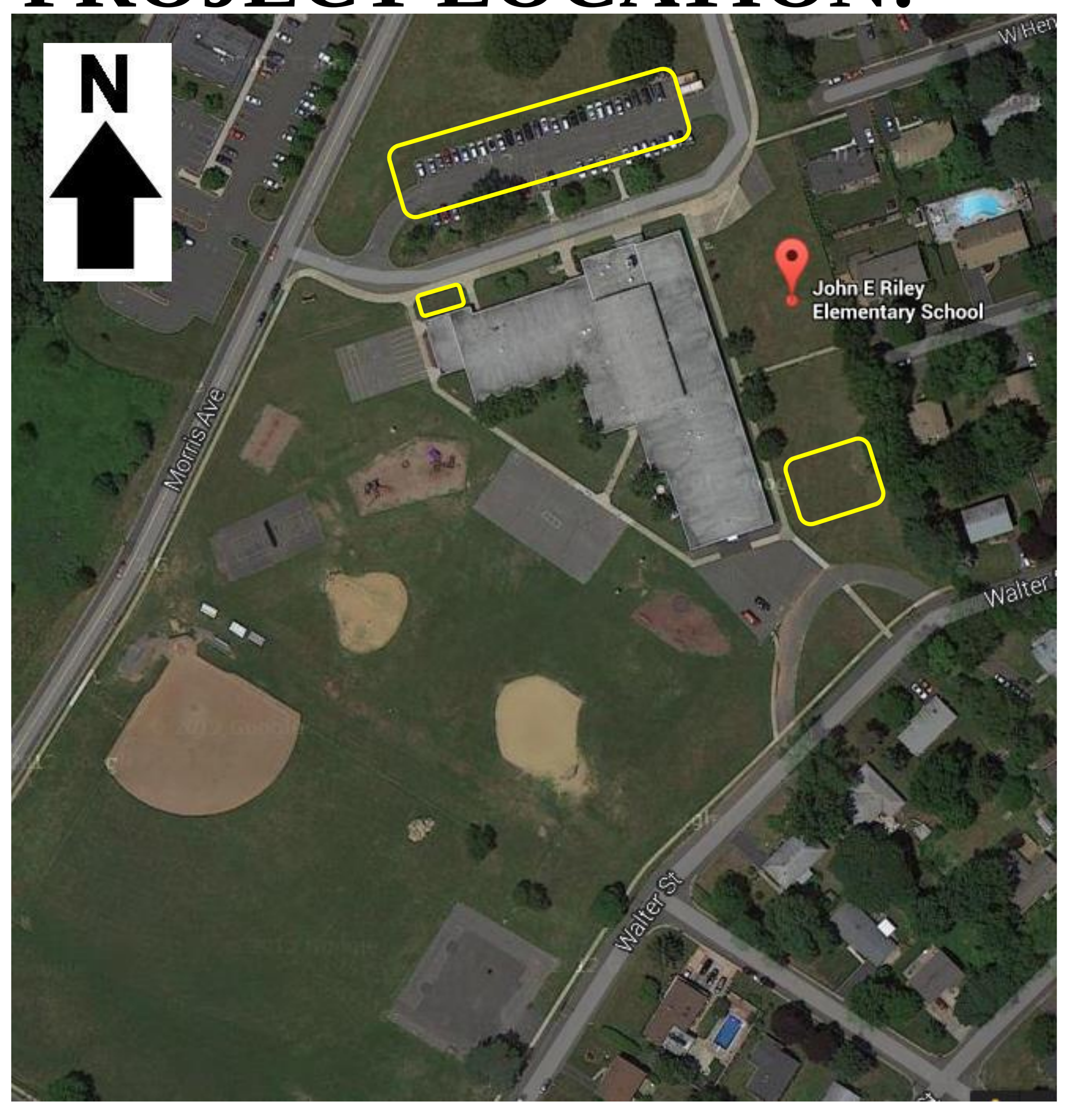
Possible Funding Sources:
mitigation funds from local developers
NJDEP grant programs like 319(h) and 604(b)
South Plainfield Borough
local social and community groups

Partners/Stakeholders:
South Plainfield Borough
South Plainfield Recreation
local residents
Rutgers Cooperative Extension

Estimated Cost:
The bioretention system would need to be approximately 725 square feet. At $5 per square foot, the estimated cost of the rain garden is $3,625. The three tree filter boxes proposed would cost approximately $7,500 each, for a combined total of $22,500. The section of porous pavement located at the northeast portion of the site would cover approximately 2,000 square feet and have a 1 foot stone reservoir under the surface. At $20 per square foot, the cost of the porous pavement system would be approximately $40,000. The porous pavement section suggested for the southern section of the site would cover approximately 10,800 square feet and have a 1.5 foot stone reservoir under the surface. At $22.50 per square foot, the cost of the porous pavement system would be $243,000. The total cost of the project would be approximately $309,125.

South Plainfield Borough
Impervious Cover Assessment
John E. Riley Elementary School, 100 Morris Avenue

PROJECT LOCATION:



SITE PLAN:

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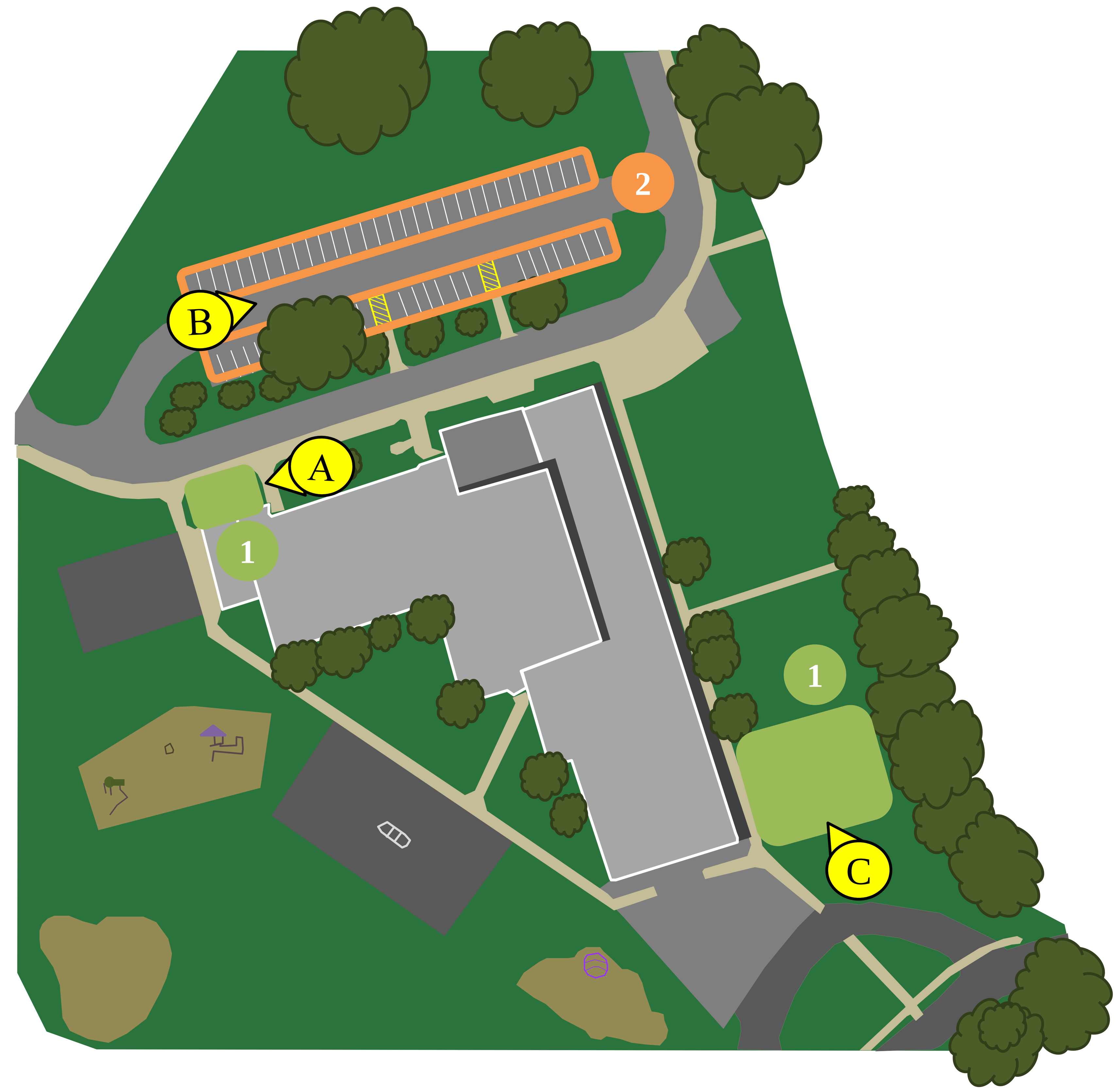

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1 **BIORETENTION SYSTEM:** A rain garden could be installed in the turf grass area located in the southeast portion of the site. Three connected downspouts could be disconnected and redirected to capture runoff in the proposed rain garden. Another rain garden could be installed to capture roof runoff in the northwest section of the site. These rain gardens would reduce sediment and nutrient loading to the local waterway while providing beautiful landscaping to the school grounds.

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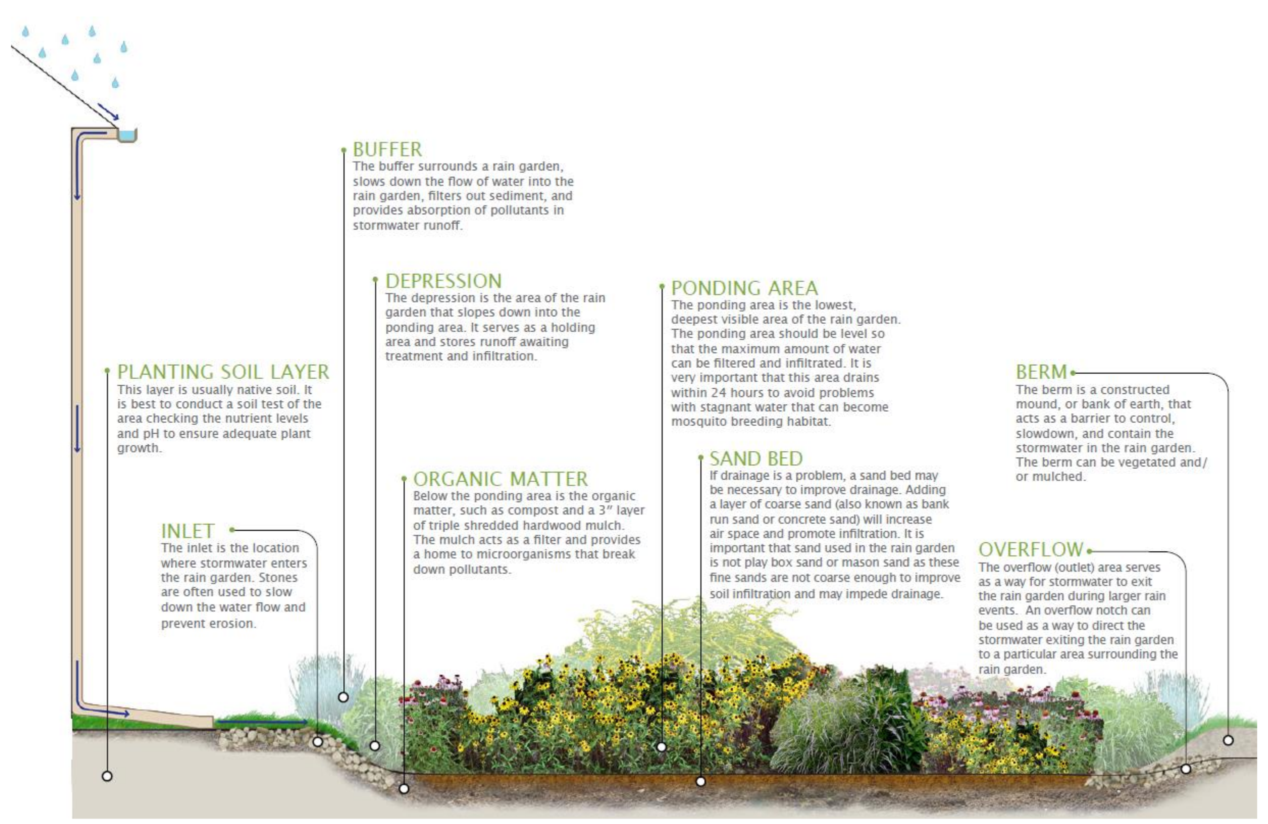
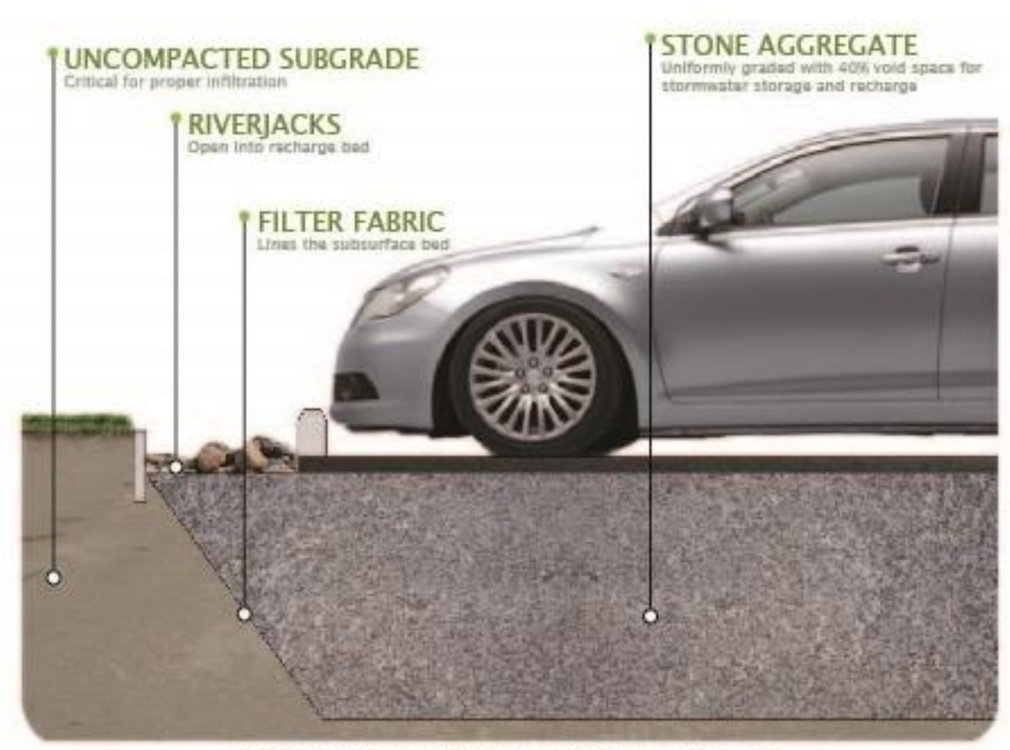
2 **POROUS PAVEMENT:** Repaving the main parking area with sections of porous pavement will allow stormwater to infiltrate into the ground, reducing sediment and nutrient loading to the local waterways.

EDUCATIONAL PROGRAM: The RCE Water Resources Program's *Stormwater Management in Your Schoolyard* program can be delivered at the John E. Riley Elementary School to educate the students about stormwater management and engage them in building the bioretention systems.

1 BIORETENTION SYSTEM



2 POROUS PAVEMENT



EDUCATIONAL PROGRAM

RUTGERS
New Jersey Agricultural Experiment Station

John E. Riley Elementary School
Green Infrastructure Information Sheet

<table>
<tr><td rowspan="2">Location:
100 Morris Avenue
South Plainfield, 07080</td><td>Municipality:
South Plainfield Borough</td></tr>
<tr><td>Subwatershed:
Spring Lake Fork of Bound Brook</td></tr>
<tr><td>Green Infrastructure Description:
bioretention systems (rain gardens)
porous pavement</td><td>Targeted Pollutants:
total nitrogen (TN), total phosphorous (TP), and total suspended solids (TSS) in surface runoff</td></tr>
<tr><td>Mitigation Opportunities:
recharge potential: yes
stormwater peak reduction potential: yes
TSS removal potential: yes</td><td>Stormwater Captured and Treated Per Year:
bioretention system northwest: 22,147 gal.
bioretention system southeast: 122,460 gal.
porous pavement: 468,996 gal.</td></tr>
<tr><td colspan="2">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. There is an area on the eastern side of the building that is suitable for the installation of multiple or one large bioretention system. At the end of the southeast end of the building there is a connected downspout. The eastern end of the parking lot has two storm drains which have sediment built up inside and around them. The parking lot is in fair condition.</td></tr>
<tr><td colspan="2">Proposed Solution(s):
To relieve the amount of water that the storm drains in the parking lot receive, and since the lot may be in need of repaving, it could be repaved with porous pavement. Porous pavement would prevent the lot from deteriorating as quickly and eliminate the sediment build up around the storm drains. Three of the connected downspouts at the end of the southeastern side of the building could be disconnected, and a bioretention system could be installed in that area. The front of the building could also be a suitable area for a bioretention system.</td></tr>
<tr><td colspan="2">Anticipated Benefits:
A bioretention system is estimated to achieve a 30% removal rate for TN and a 60% removal rate for TP (NJDEP BMP Manual). TSS loadings may be reduced by up to 80%. If these bioretention systems are designed to capture and infiltrate stormwater runoff from the 2-year design storm (3.3 inches of rain over 24 hours), these systems will prevent approximately 95% of the TN, TP and TSS from flowing directly into local waterways. A bioretention system would also provide ancillary benefits, such as enhanced wildlife habitat and aesthetic appeal. The porous pavement system will achieve the same level of pollutant load reduction for TN, TP and TSS. The porous pavement would have a one and one-half foot stone reservoir beneath it to store the stormwater and slowly let it infiltrate into the ground. The system would contain an underdrain so larger rainfall events could bypass the system.</td></tr>
</table>

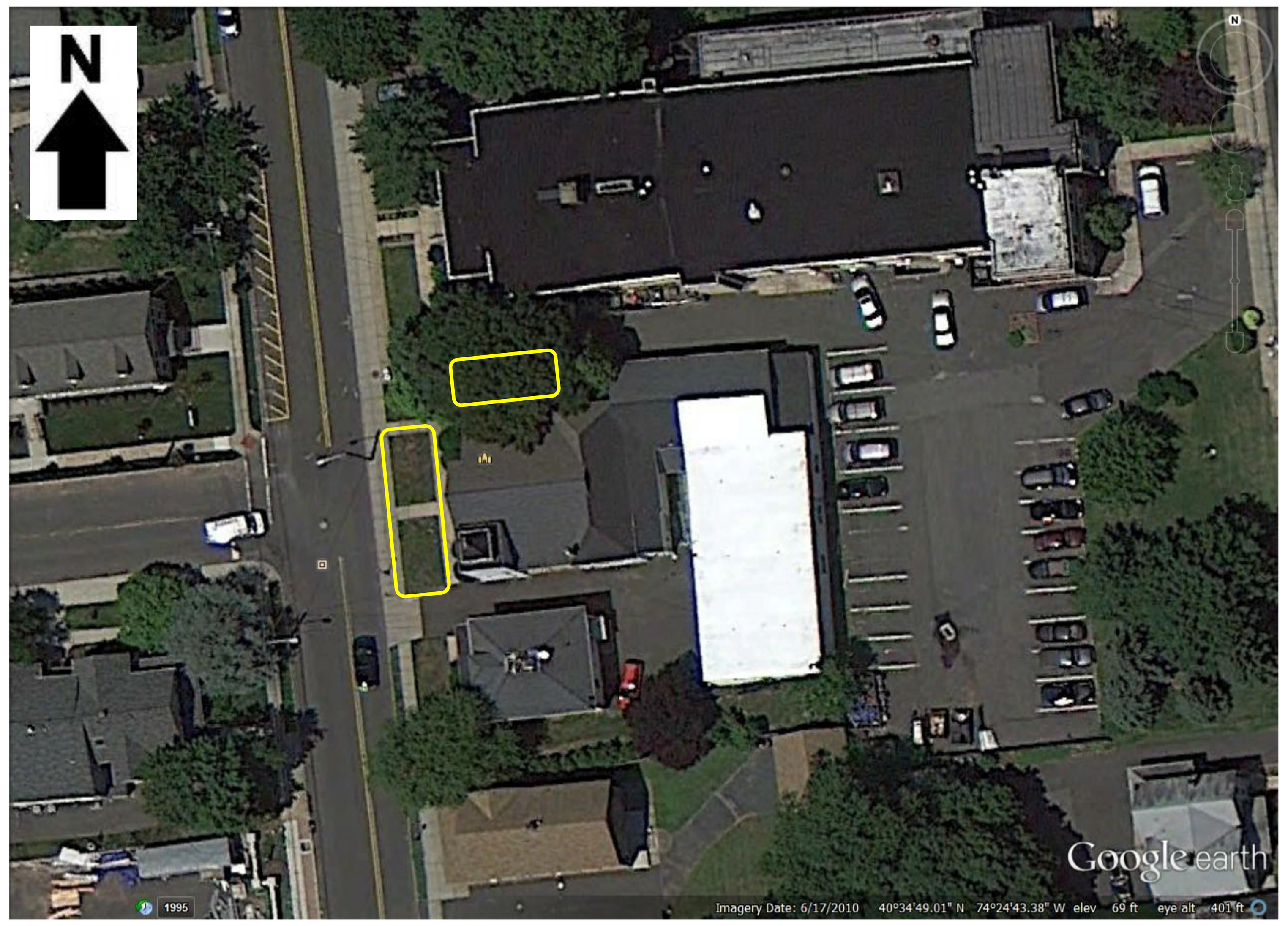
Possible Funding Sources:
mitigation funds from local developers
NJDEP grant programs like 319(h) and 604(b)
local social and community groups

Partners/Stakeholders:
South Plainfield residents
local community groups (Boy Scouts, Girl Scouts, etc.)
students and parents
American Littoral Society
Rutgers Cooperative Extension

Estimated Cost:
The northwest bioretention system would need to be approximately 210 square feet. At $5 per square foot, the estimated cost of the rain garden is $1,050. The southeast bioretention system would need to be approximately 1,180 square feet. At $5 per square foot, the estimated cost of the rain garden is $5,900. The porous pavement would cover 10,500 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 $210,000. The total cost of the project would be approximately $216,950.

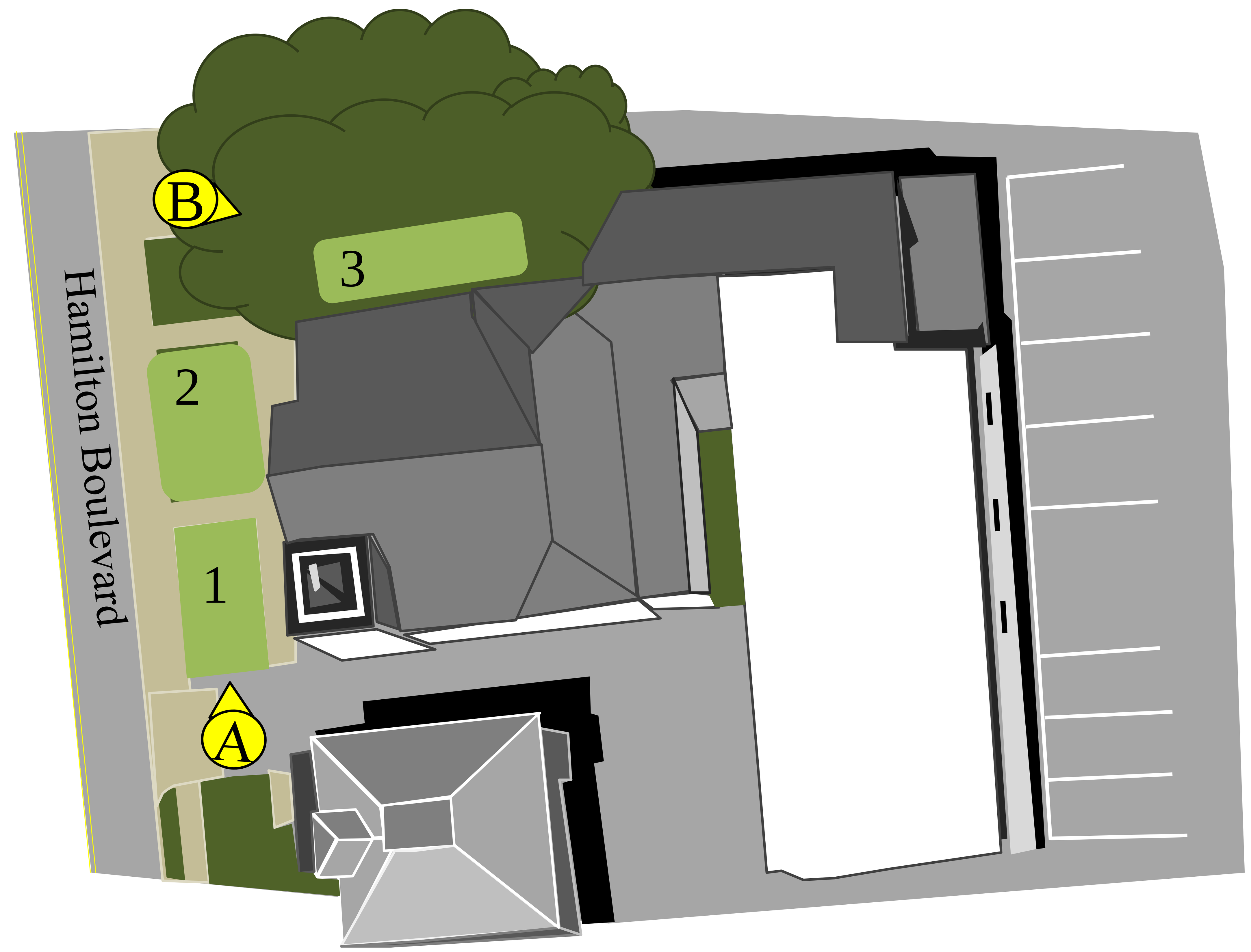
South Plainfield Borough
Impervious Cover Assessment
First Baptist Church, 201 Hamilton Boulevard

PROJECT LOCATION:



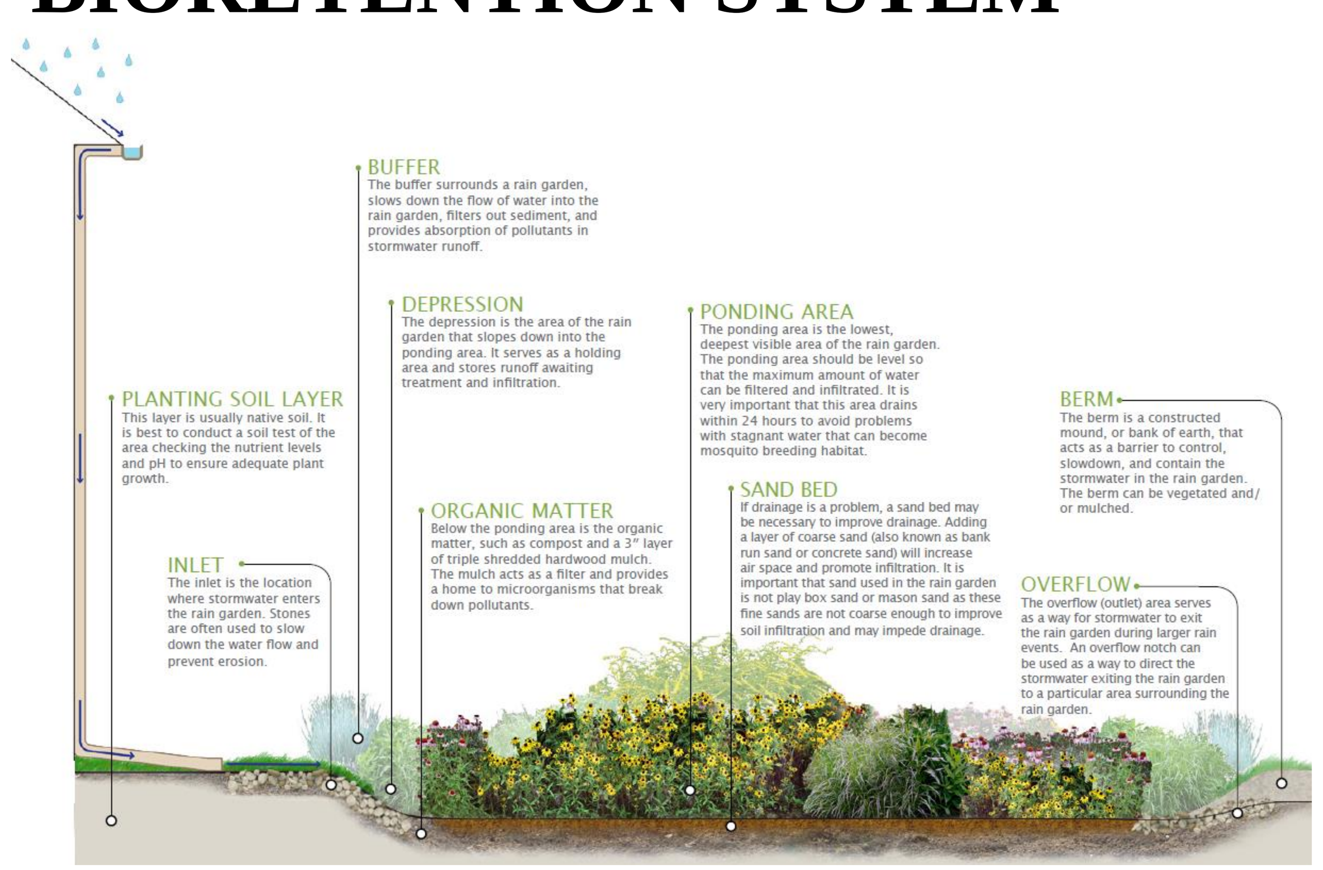
SITE PLAN:

N



1 **BIORETENTION SYSTEMS:** Three rain gardens could be installed to capture runoff from the building's rooftop and driveway through use of various drainage methods. These rain gardens will reduce sediment and nutrient loading to the local waterway while providing beautiful landscaping to the church grounds. The gardens will also provide habitat for birds, butterflies, and pollinators.

1 BIORETENTION SYSTEM



First Baptist Church
Green Infrastructure Information Sheet

Location: 201 Hamilton Boulevard South Plainfield, NJ 07080	**Municipality:** South Plainfield Borough **Subwatershed:** South Fork of Bound Brook
Green Infrastructure Description: bioretention systems (rain gardens)	**Targeted Pollutants:** total nitrogen (TN), total phosphorous (TP), and total suspended solids (TSS) in surface runoff
Mitigation Opportunities: recharge potential: yes stormwater peak reduction potential: yes TSS removal potential: yes	**Stormwater Captured and Treated Per Year:** bioretention system #1: 28,661 gal. bioretention system #2: 28,661 gal. bioretention system #3: 17,197 gal.

Existing Conditions and Issues:
This site is located on Hamilton Boulevard and is an old historic building built in 1792 with multiple additions. The building's front faces the street, and there are two lawn areas. There are five disconnected downspouts along the south side of the building, most of which flow out directly onto the pavement and into the street. On the building's north side, there are more disconnected downspouts, and there is a turf grass area on this side as well. There is also a drainage issue that causes the basement and driveway to flood.

Proposed Solution(s):
The downspouts on the building's south side could be rerouted away from the foundation into a universal pipe or a slit drain dug into the driveway to route water to the front south lawn area which could then be converted into a bioretention system. Something similar could be done for the front north side of the building. A third bioretention system could be constructed in the northern turf grass area to capture rooftop runoff from rerouted downspout extensions as well.

Anticipated Benefits:
Bioretention systems are estimated to achieve a 30% removal rate for TN and a 60% removal rate for TP (NJDEP BMP Manual). TSS loadings may be reduced by up to 80%. If these bioretention systems are designed to capture and infiltrate stormwater runoff from the 2-year design storm (3.3 inches of rain over 24 hours), these systems will prevent approximately 95% of the TN, TP and TSS from flowing directly into local waterways. A bioretention system would also provide ancillary benefits such as enhanced wildlife habitat and aesthetic appeal.

Possible Funding Sources:
mitigation funds from local developers
NJDEP grant programs like 319(h) and 604(b)
South Plainfield Borough
local social and community groups

Partners/Stakeholders:
South Plainfield Borough
First Baptist Church
residents and parishioners
Rutgers Cooperative Extension

Estimated Cost:
The first rain garden would need to be approximately 240 square feet. At $5 per square foot, the estimated cost of the rain garden is $1,200. The second rain garden would need to be approximately 240 square feet. At $5 per foot, the total estimated cost of the rain garden is $1,200. The first rain garden would need to be approximately 160 square feet. At $5 per square foot, the estimated cost of the rain garden is $800. The total cost of the project would be approximately $3,200.