



Draft

**Impervious Cover Assessment
for
Bound Brook Borough, Somerset County, New Jersey**

*Prepared for Bound Brook Borough by the
Rutgers Cooperative Extension Water Resources Program*

February 4, 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

Bound Brook Borough Impervious Cover Analysis

Located in Somerset County in central New Jersey, Bound Brook Borough covers approximately 1.7 square miles east of Bridgewater. Figures 3 and 4 illustrate that Bound Brook Borough is dominated by urban land uses. A total of 81.5% of the municipality's land use is classified as urban. Of the urban land in Bound Brook 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 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 Bound Brook 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 Bound Brook Borough. Based upon the 2007 NJDEP land use/land cover data, approximately 35.2% of Bound Brook Borough has impervious cover. This level of impervious cover suggests that the streams in Bound Brook Borough are likely non-supporting streams.

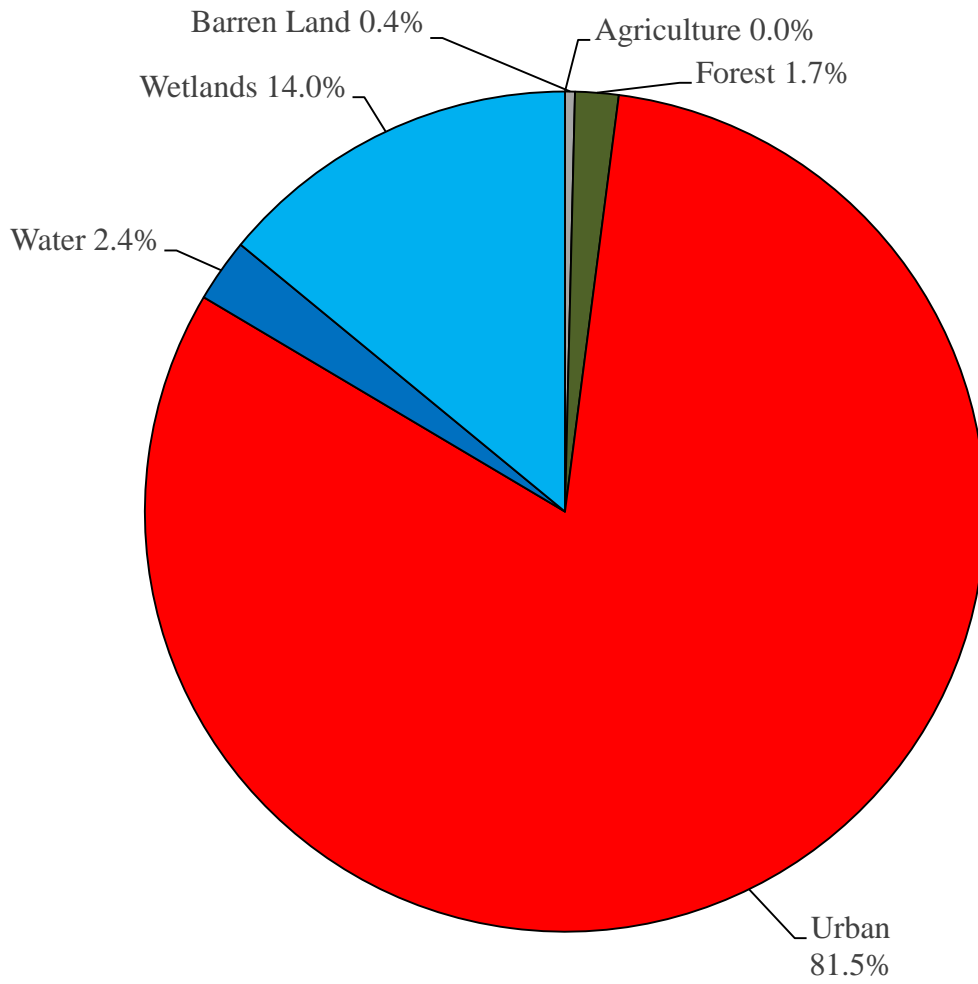


Figure 3: Pie chart illustrating the land use in Bound Brook Borough

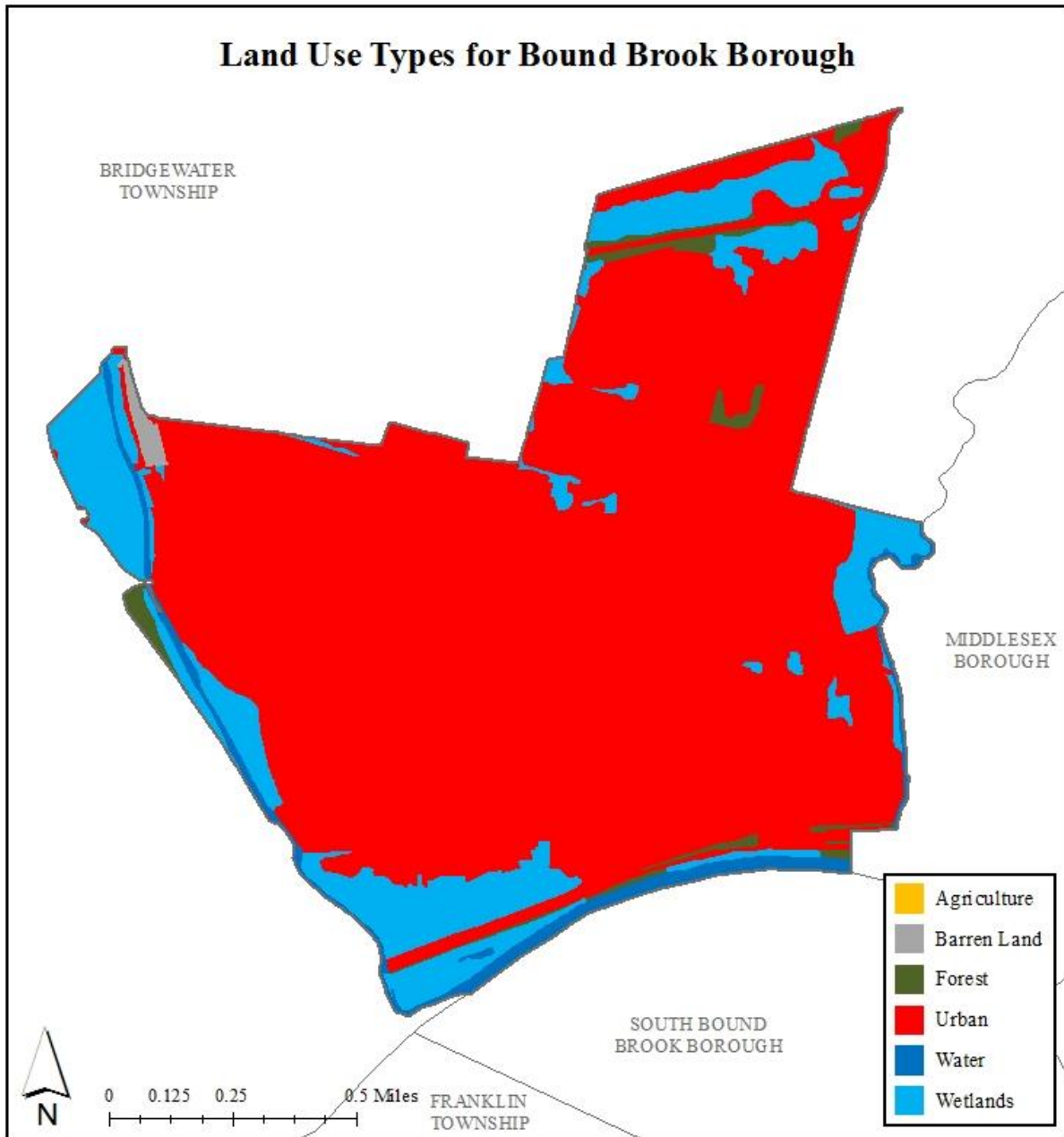


Figure 4: Map illustrating the land use in Bound Brook Borough

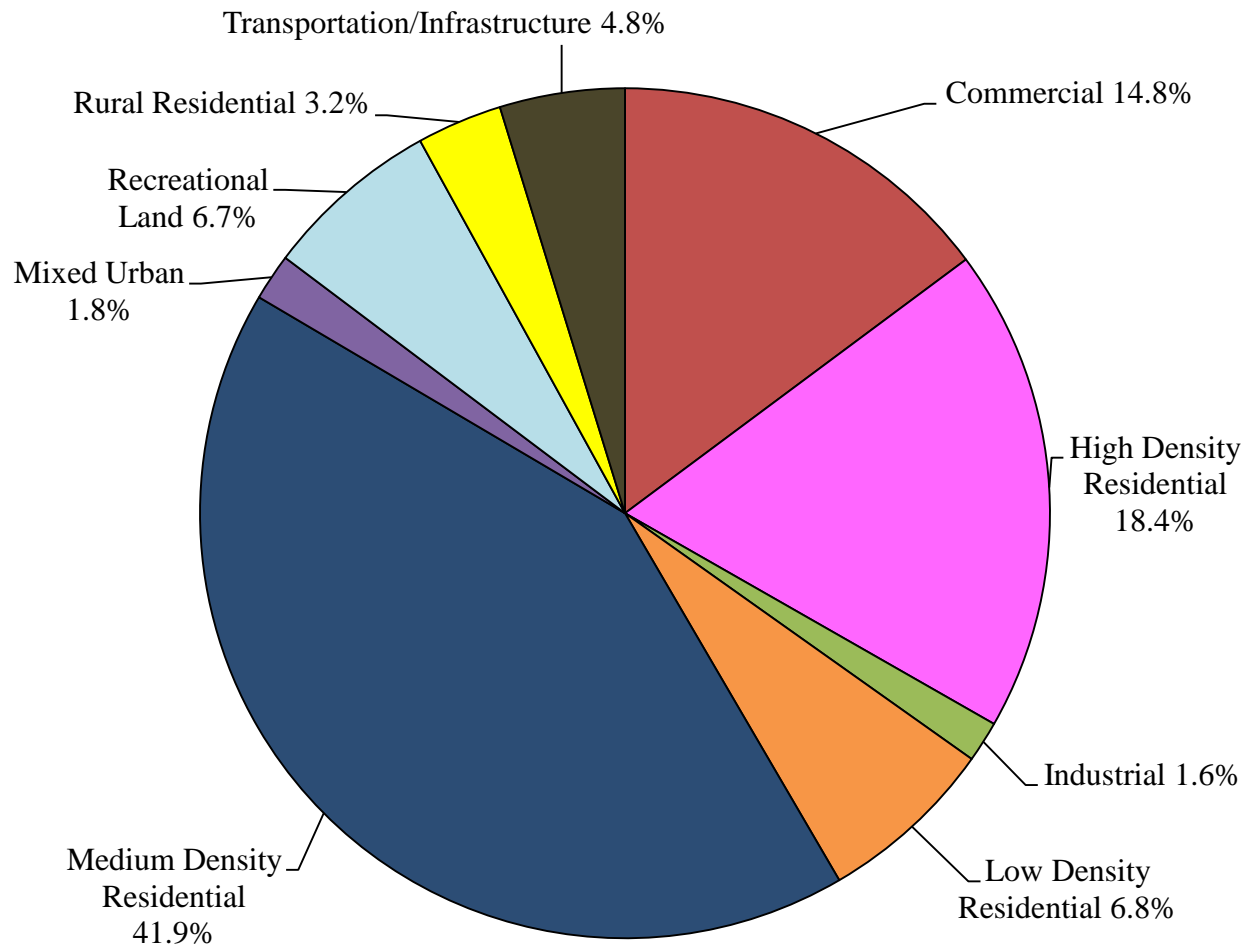


Figure 5: Pie chart illustrating the various types of urban land use in Bound Brook Borough

Water resources are typically managed on a watershed/subwatershed basis; therefore an impervious cover analysis was performed for each Raritan River subwatershed within Bound Brook Borough (Table 1 and Figure 6). On a subwatershed basis, impervious cover ranges from 29.7% in the Green Brook subwatershed to 40.2% in the Lower Raritan River 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 Bound Brook Borough, Somerset 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 (5.0 inches of rain), and the 100-year design storm (8.2 inches of rain). These runoff volumes are summarized in Table 2. A substantial amount of rainwater drains from impervious surfaces in Bound Brook Borough. For example, if the stormwater runoff from one water quality storm (1.25 inches of rain) in the Lower Raritan River subwatershed was harvested and purified, it could supply water to 69 homes for one year¹.

¹ Assuming 300 gallons per day per home

Table 1: Impervious cover analysis by subwatershed for Bound Brook Borough

Subwatershed	Total Area		Land Use Area		Water Area		Impervious Cover		
	(ac)	(mi ²)	(ac)	(mi ²)	(ac)	(mi ²)	(ac)	(mi ²)	(%)
Green Brook	501.3	0.78	498.5	0.78	2.81	0.00	148.2	0.23	29.7%
Lower Raritan River	583.4	0.91	559.8	0.87	23.6	0.04	224.8	0.35	40.2%
Total	1,084.7	1.69	1,058.3	1.65	26.4	0.04	373.0	0.58	35.2%

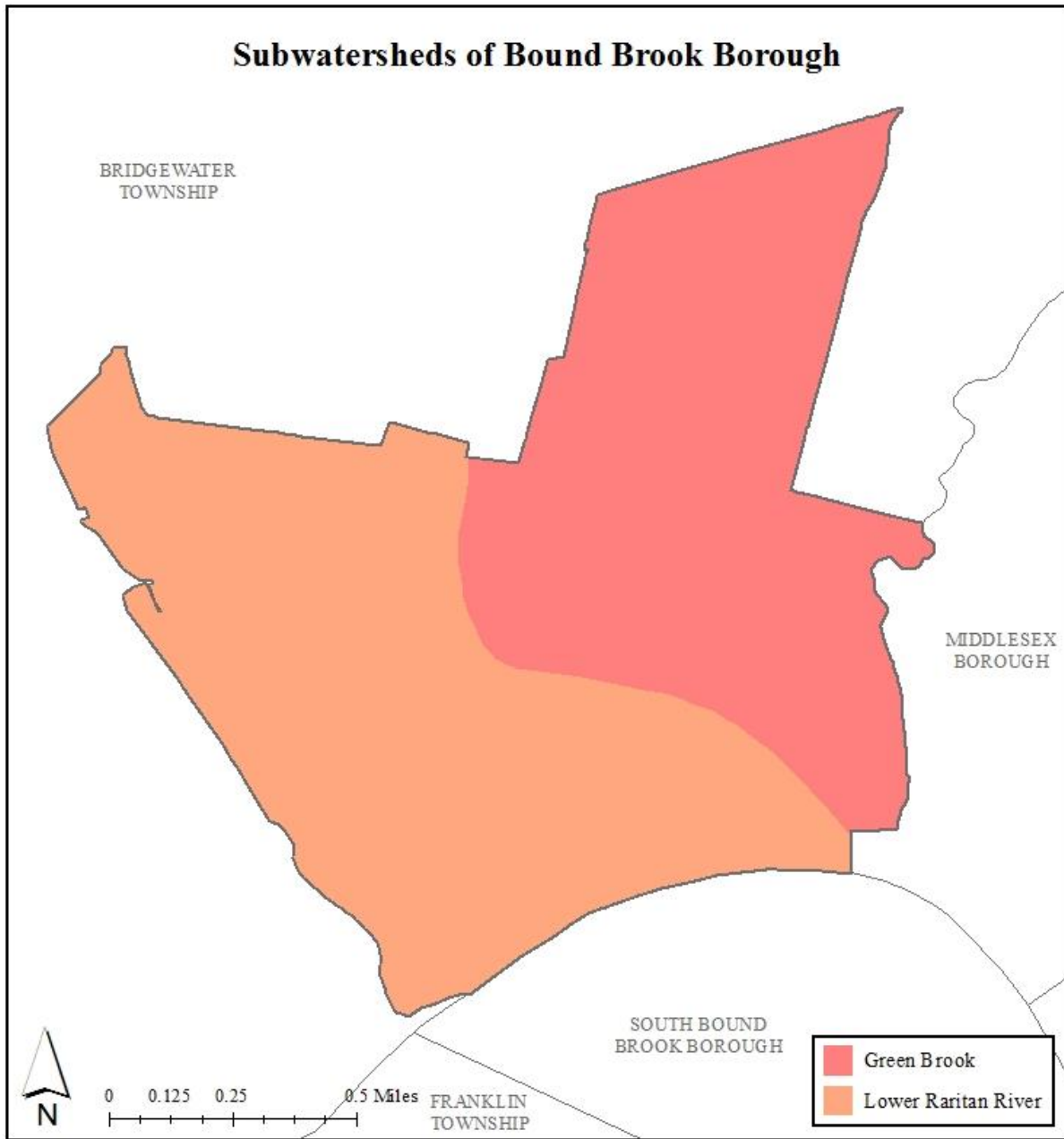


Figure 6: Map of the subwatersheds in Bound Brook Brook

Table 2: Stormwater runoff volumes from impervious surfaces by subwatershed in Bound Brook 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 (5.0") (MGal)	Total Runoff Volume for the 100-Year Design Storm (8.2") (MGal)
Green Brook	5.0	177.1	13.3	20.1	33.0
Lower Raritan River	7.6	268.6	20.1	30.5	50.0
Total	12.7	445.7	33.4	50.6	83.0

The next step is to set a reduction goal for impervious area in each watershed. Based upon the Rutgers Cooperative Extension (RCE) Water Resources Program's experience, a 10% reduction would be a reasonably achievable reduction for these watersheds in Bound Brook 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 Bound Brook Borough

Subwatershed	Recommended Impervious Area Reduction (10%) (ac)	Annual Runoff Volume Reduction ² (MGal)
Green Brook	14.8	16.8
Lower Raritan River	22.5	25.5
Total	37.3	42.3

² Annual Runoff Volume Reduction =

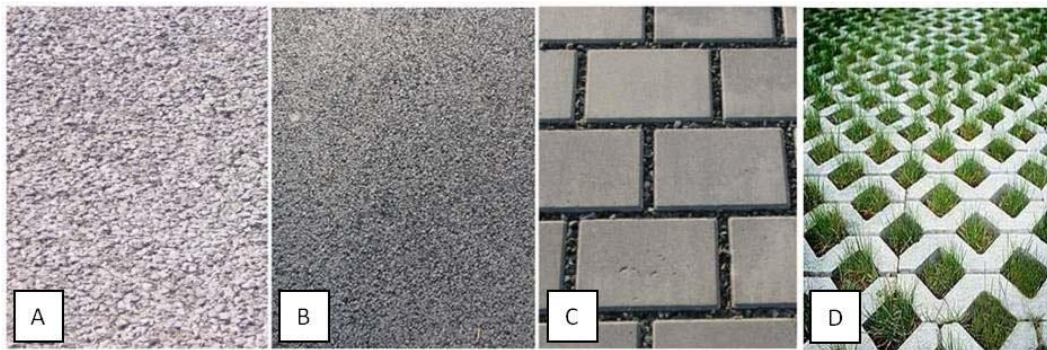
Acres of impervious cover x 43,560 ft²/ac x 44 in x (1 ft/12 in) x 0.95 x (7.48 gal/ft³) x (1 MGal/1,000,000 gal)

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 Bound Brook 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 Bound Brook 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

Bound Brook 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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<http://njaes.rutgers.edu/pubs/publication.asp?pid=FS1177>

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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

Bound Brook Borough Impervious Cover Assessment

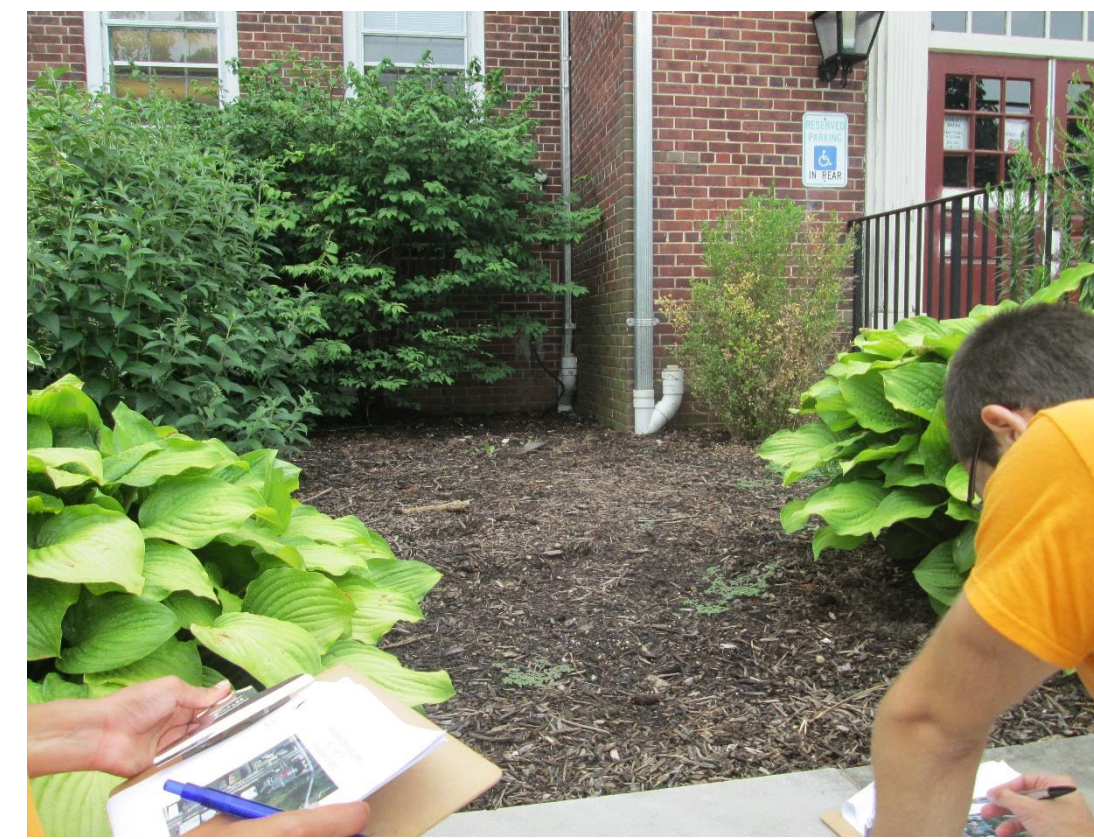
Bound Brook Memorial Library, 402 East High Street



PROJECT LOCATION:



A



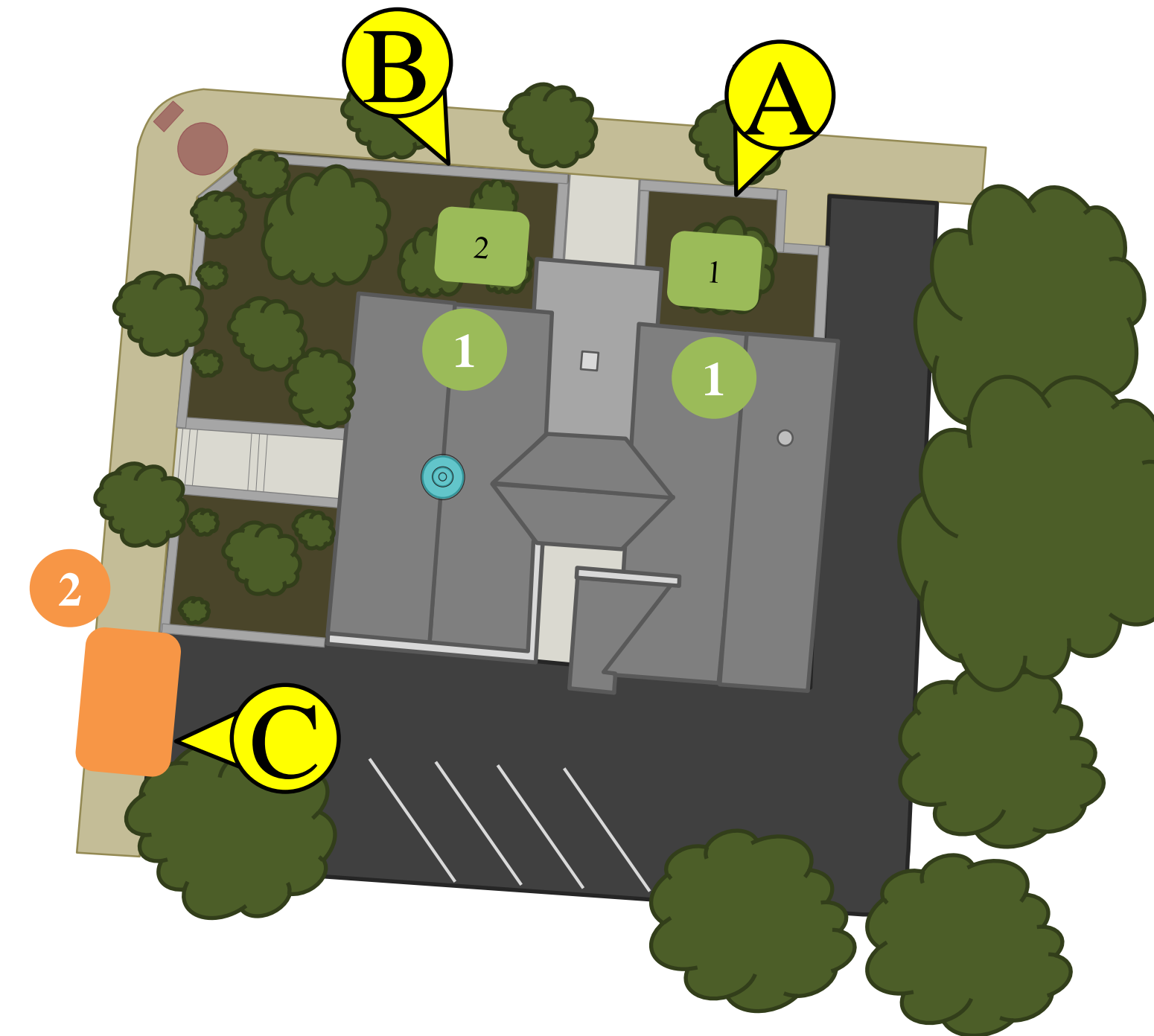
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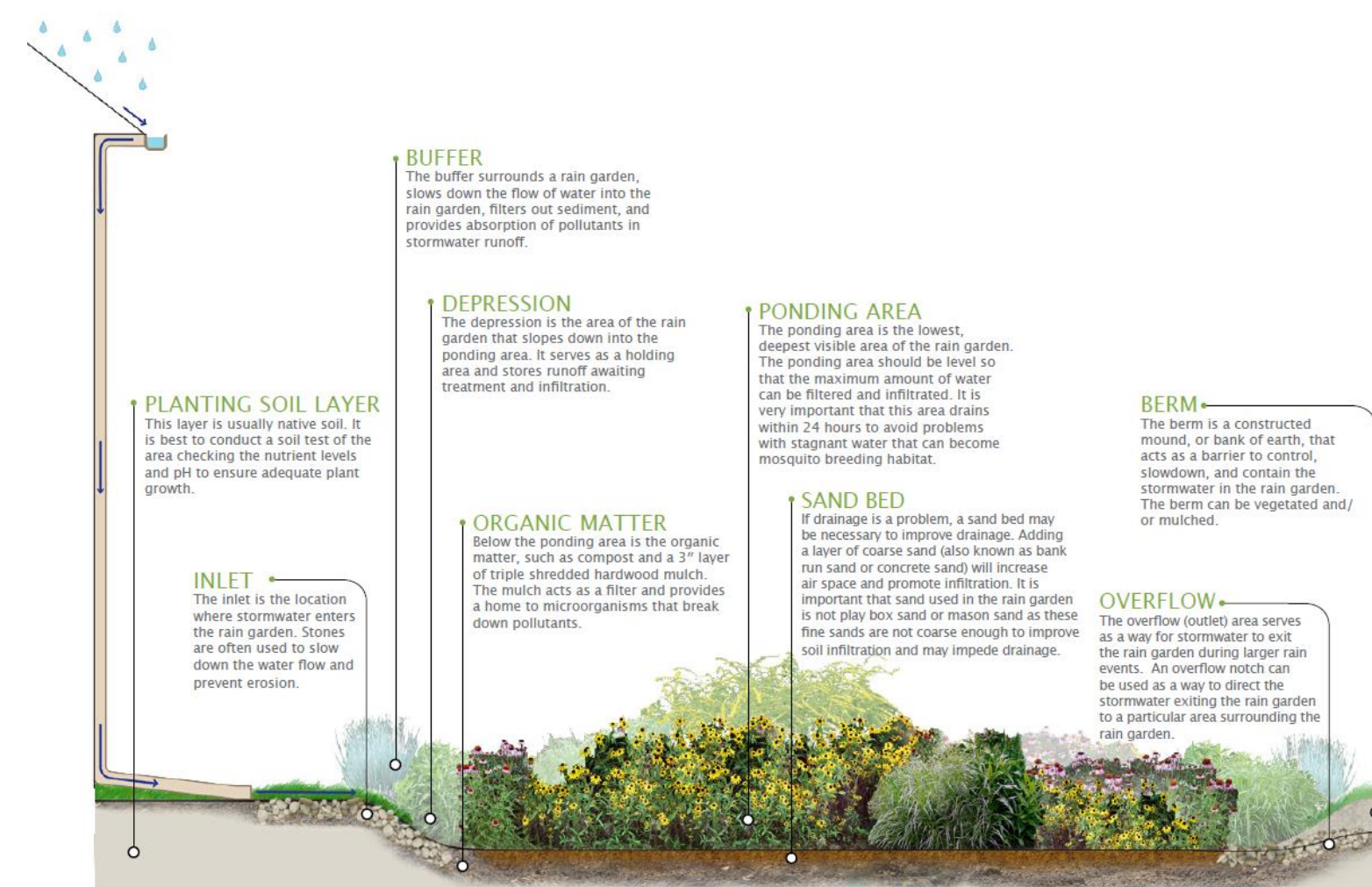


SITE PLAN:



- 1 BIORETENTION SYSTEMS:** Rain gardens can be used to reduce sediment and nutrient loading to the local watershed and increase groundwater recharge. On both sides of the front entrance there are areas which could benefit from rain gardens to treat a portion of the building's runoff by disconnecting the connected downspouts to capture the runoff.
- 2 POROUS PAVEMENT:** Porous pavement promotes groundwater recharge and filters stormwater.

1 BIORETENTION SYSTEM



2 POROUS PAVEMENT



Bound Brook Memorial Library
Green Infrastructure Information Sheet

<p>Location: 402 East High Street Bound Brook, NJ 08805</p>	<p>Municipality: Bound Brook Borough</p>
<p>Green Infrastructure Description: bioretention system (rain garden) pervious concrete</p>	<p>Subwatershed: Green Brook</p>
<p>Mitigation Opportunities: recharge potential: yes TSS removal potential: yes stormwater peak reduction potential: yes</p>	<p>Targeted Pollutants: total nitrogen (TN), total phosphorous (TP), and total suspended solids (TSS) in surface runoff</p> <p>Stormwater Captured and Treated Per Year: rain garden #1: 23,710 gal. rain garden #2: 15,602 gal. porous pavement: 27,862 gal.</p>
<p>Existing Conditions and Issues: This site contains several impervious surfaces including the library building walkways and a parking lot. There are currently two connected downspouts on either side of the main entrance. On the side of the building by Hamilton Street there is a garden on the side closest to the driveway that has one connected downspout in it. The driveway onto Hamilton Street has sediment that settles on both sides of the asphalt, and the concrete sidewalk onto Hamilton Street is eroding and in bad shape.</p>	
<p>Proposed Solution(s): The front of the building on East High Street could benefit from a bioretention system that goes on both sides of the entrance. The connected downspouts in each section could be disconnected so that water could flow into the new rain bioretention system before it goes directly into the local waterways. The sidewalk area before the driveway on Hamilton Street would be a good candidate for porous pavement.</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. This bioretention system would provide additional benefits such as aesthetic appeal and enhanced wildlife habitat. The porous pavement addition would reduce stormwater volumes and prevent flooding.</p>	
<p>Possible Funding Sources: mitigation funds from local developers NJDEP grant programs grants from foundations</p>	
<p>Partners/Stakeholders: Bound Brook Township Bound Brook Memorial Library local community groups (Boy Scouts, Girl Scouts, etc.)</p>	

Bound Brook Memorial Library
Green Infrastructure Information Sheet

NY/NJ Baykeeper
Raritan Riverkeeper
Rutgers Cooperative Extension

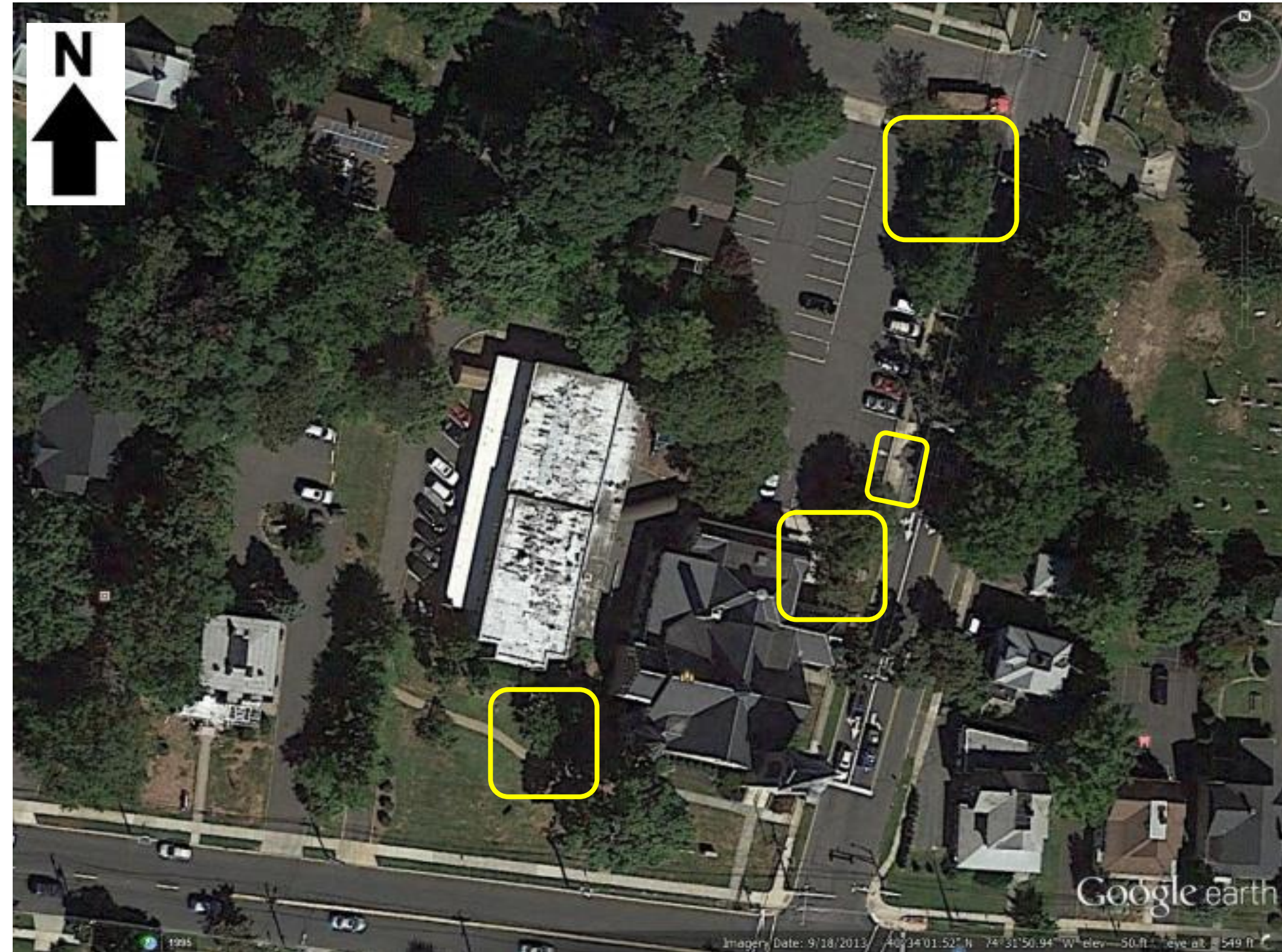
Estimated Cost:

Bioretention system #1 would need to be approximately 150 square feet. At \$5 per square foot, the estimated cost would be \$750. Bioretention system #2 would need to be approximately 150 square feet. At \$5 per square foot, the estimated cost would be \$750. The porous pavement would cover approximately 230 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 \$5,750. The total cost of the project would be approximately \$7,250.

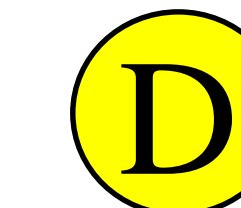
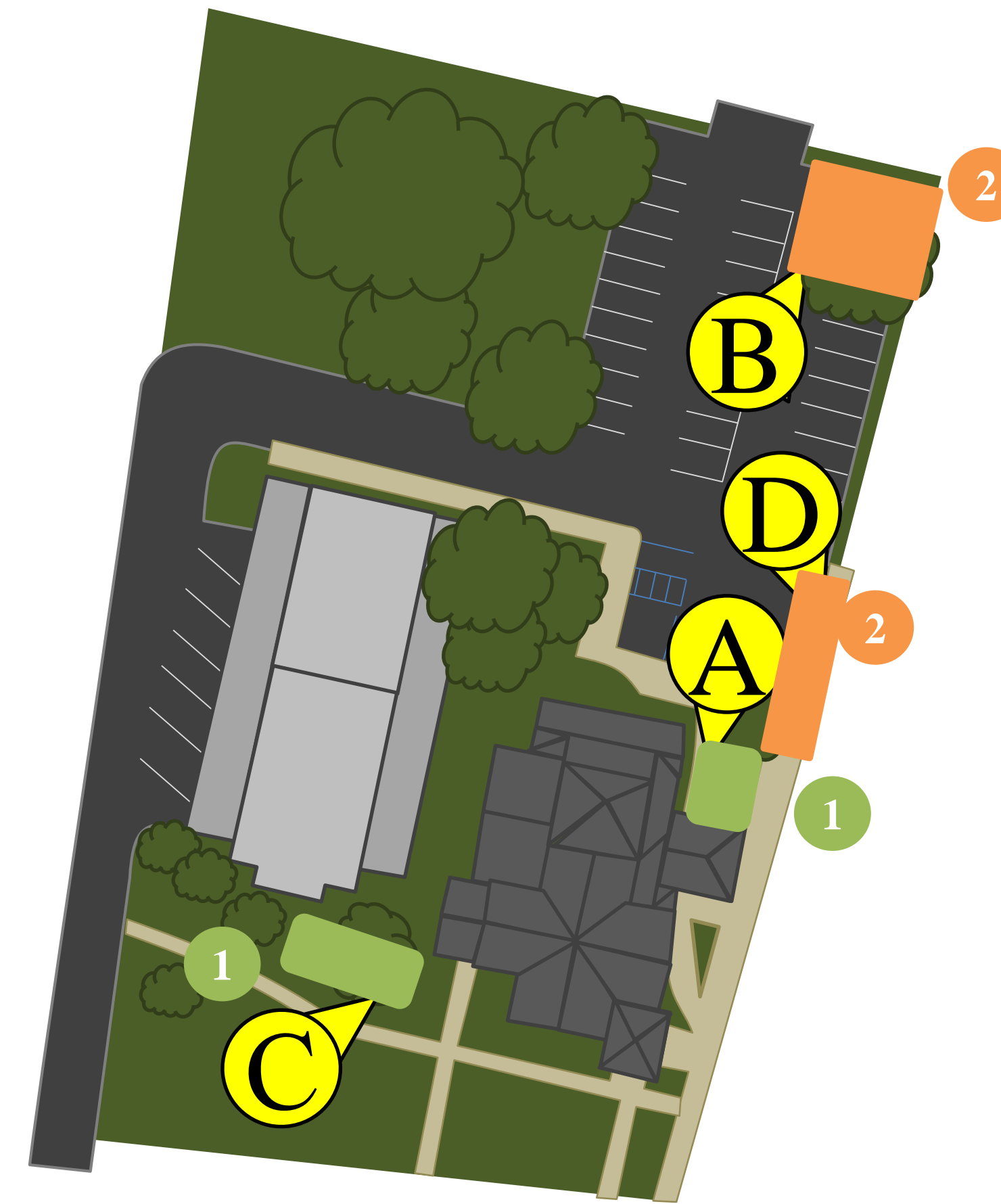
Bound Brook Borough Impervious Cover Assessment

Presbyterian Church, 409 Mountain Avenue

PROJECT LOCATION:

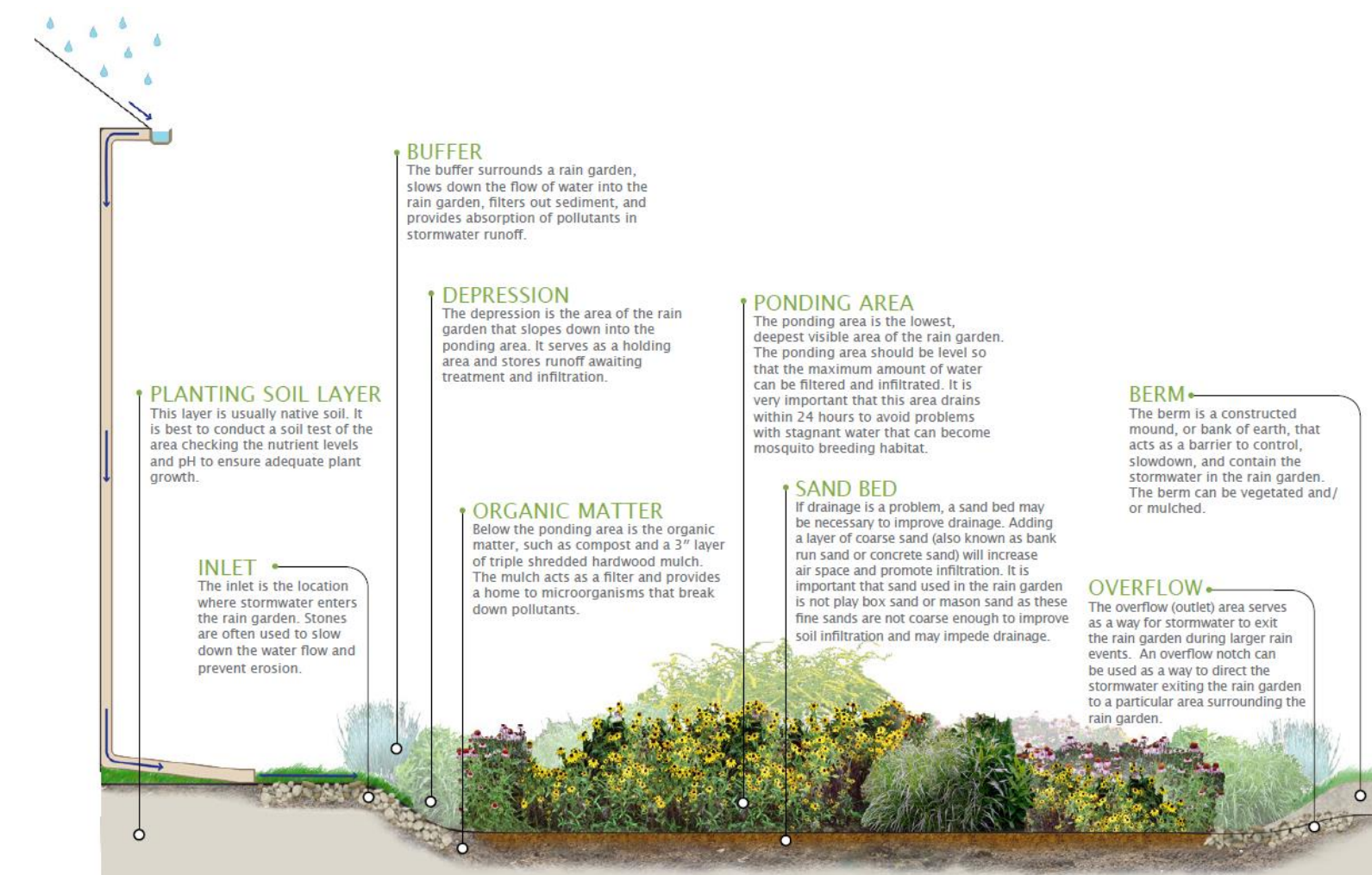


SITE PLAN:



- 1** **BIORETENTION SYSTEMS:** On this property rain gardens can be used to reduce sediment and nutrient loading to the local watershed and increase groundwater recharge. There are two areas which may be able to accommodate these systems, treating the building and parking lot runoff. Curb cuts will allow water from the parking lot into one of the garden.
- 2** **POROUS PAVEMENT:** Porous pavement promotes groundwater recharge and filters stormwater.

1 BIORETENTION SYSTEM



2 POROUS PAVEMENT



Presbyterian Church
Green Infrastructure Information Sheet

<p>Location: 409 Mountain Avenue Bound Brook, NJ 08805</p>	<p>Municipality: Bound Brook Borough</p>
<p>Green Infrastructure Description: bioretention system porous pavement</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: bioretention system #1: 7,295 gal. bioretention system #2: 12,507 gal. porous pavement #1: 151, 043 gal. porous pavement #2: 181,606 gal.</p>
<p>Existing Conditions and Issues: This site contains the side of the building off of Mountain Avenue and the back parking lot area by Mountain Avenue and East Maple Avenue. There are currently two disconnected downspouts in the back corner of the building that flow into an existing garden. In the back parking lot by Mountain and East Maple Avenues there seems to be pooling in the parking lot as well as deteriorated asphalt. During large storm events, there is a possibility of flooding on Mountain and East Maple Avenues. There is also flooding off of the Mountain Avenue entrance. On the side of the building off of East Union Avenue there is an area with an existing garden and a disconnected downspout.</p>	
<p>Proposed Solution(s): The side of the building off of Mountain Avenue with the existing garden could be a good candidate for a bioretention system (#1) installation because of the disconnected downspout that flows directly into it. The existing garden off of East Union Avenue would also be a good candidate for a bioretention system (#2). In the back parking lot in the corner by Mountain and East Maple Avenues where the pooling occurs would be suitable for porous pavement (#1). The entrance off of Mountain Avenue would be a good candidate for porous pavement (#2) because of the flooding that occurs there.</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.</p>	
<p>Possible Funding Sources: mitigation funds from local developers NJDEP grant programs like 319(h) Bound Brook Township</p>	

Presbyterian Church
Green Infrastructure Information Sheet

Somerset County
youth groups
Boy Scouts, Girl Scouts, or service project

Partners/Stakeholders:

Bound Brook Township
Presbyterian Church
Rutgers Cooperative Extension
congregation
local community groups (Boy Scouts, Girl Scouts, etc.)

Estimated Cost:

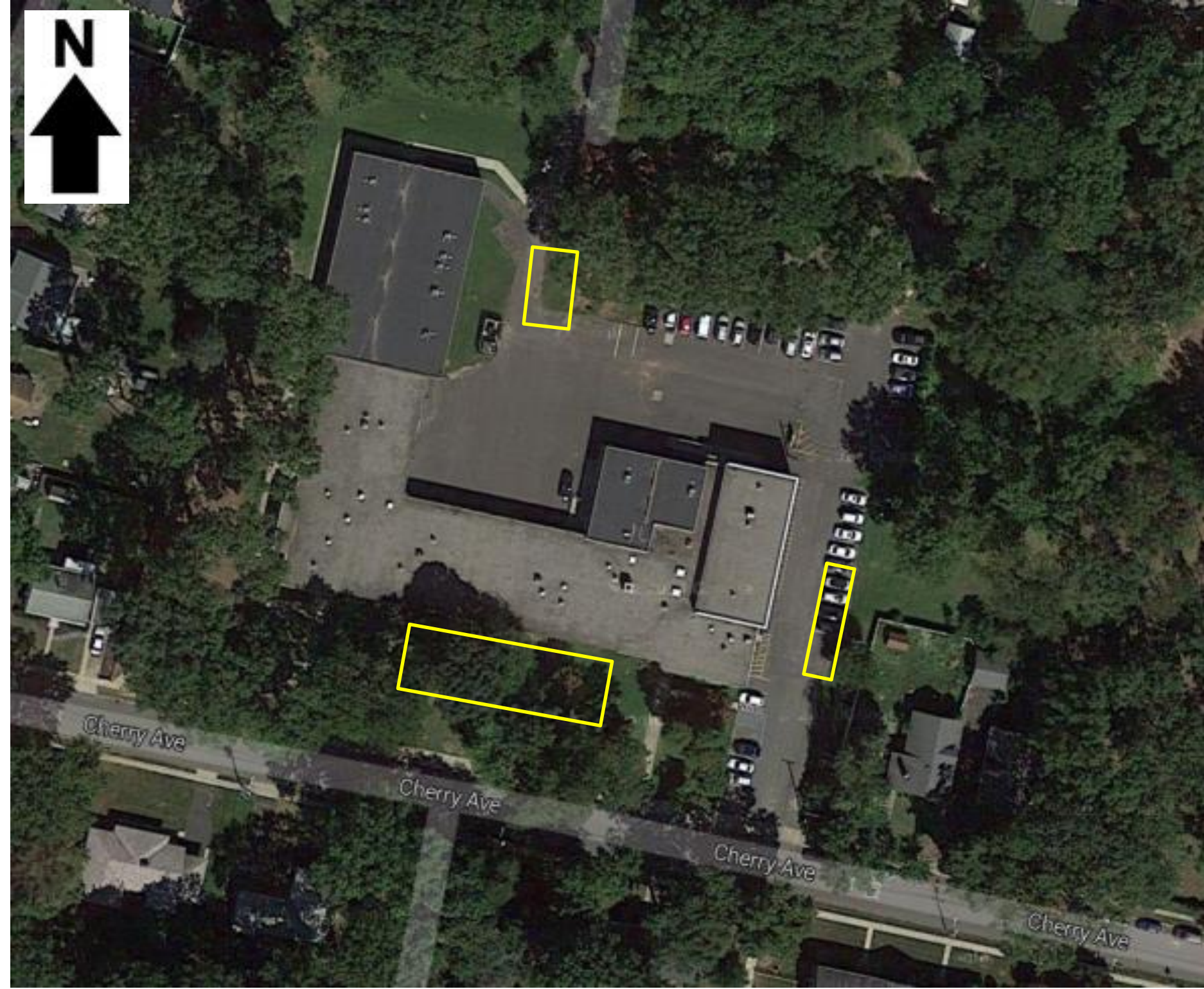
Bioretention system #1 would need to be approximately 70 square feet in size. At \$5 per square foot, the estimated cost of the bioretention system is \$350. Bioretention system #2 would need to be approximately 120 square feet. At \$5 per square foot, the estimated cost of the bioretention system is \$600. The porous pavement #1 would cover 2,900 square feet and have a one foot stone reservoir under the surface. At \$20 per square foot, the cost of the porous asphalt system would be \$58,000. The porous pavement #2 would cover 950 square feet and have a three foot stone reservoir under the surface. At \$30 per square foot, the cost of the porous asphalt system would be \$28,500. The total cost of the project would be approximately \$87,450.

Bound Brook Borough Impervious Cover Assessment

Smalley Middle School, 153 Cherry Avenue



PROJECT LOCATION:



SITE PLAN:



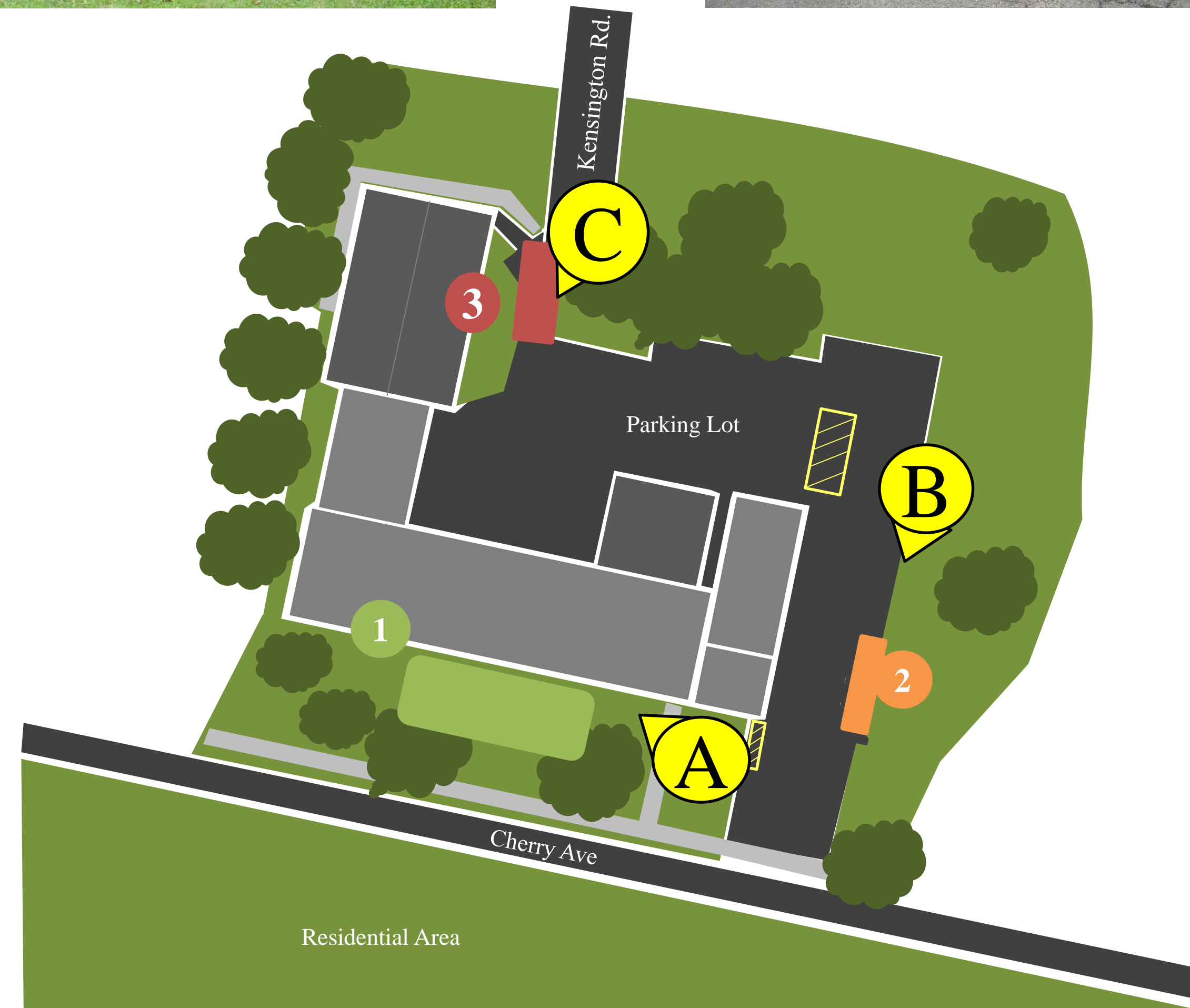
A



B



C



- 1 **BIORETENTION SYSTEMS:** At this location, existing downspouts near the southern portion of the school can be disconnected into a rain garden. This system will reduce runoff and allow stormwater infiltration, decreasing the amount of contaminants reaching local waterways.
- 2 **POROUS PAVEMENT:** Porous pavement can be installed near the parking lot entrance. This green infrastructure practice promotes groundwater recharge and filters stormwater.
- 3 **GRASS PAVERS:** Grass pavers reduce stormwater runoff by allowing it to infiltrate into the ground.

1 BIORETENTION SYSTEM



2 POROUS PAVEMENT



3 GRASS PAVERS



Smalley Middle School
Green Infrastructure Information Sheet

<p>Location: 163 Cherry Ave Bound Brook, NJ 08805</p>	<p>Municipality: Bound Brook Borough</p>
<p>Green Infrastructure Description: bioretention system <i>Stormwater Management in Your Schoolyard</i> education program grass pavers porous pavement</p>	<p>Subwatershed: Green Brook</p>
<p>Mitigation Opportunities: recharge potential: yes stormwater peak reduction potential: yes total suspended solids removal potential: yes</p>	<p>Targeted Pollutants: total nitrogen (TN), total phosphorous (TP), and total suspended solids (TSS) in surface runoff</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. This site contains the lawn in front of the Smalley Middle School as well as the side driveway off of Cherry Avenue and the driveway on Kensington Road. There are currently five connected downspouts in the front of the school. On the side of the school, off of Cherry Avenue there is pooling in the parking lot as well as deteriorated asphalt. In the back entrance of the school on Kensington Road there is pooling that occurs on both sides of the street. During large storm events, there is a possibility of flooding on Cherry Avenue and Kensington Road and in the faculty parking lot on the side of the building.</p>	<p>Stormwater Captured and Treated Per Year: rain garden: 289,214 gal. porous pavement: 151,043gal. grass pavers: 12,342 gal.</p>
<p>Proposed Solution(s): The lawn in front of the Smalley Middle School could benefit from a bioretention system to catch the water from the downspouts before it reaches Cherry Avenue. The side driveway into the faculty parking lot off of Cherry Avenue could benefit from porous pavement in the parking spots along the grass. This would collect water from the parking lot as well as the stormwater runoff from the roof when the closest connected downspout is disconnected and allowed to flow over the pavement. The area closest to the school on Kensington Road could benefit from having grass pavers put on both sides of the street to capture the settling stormwater.</p>	
<p>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. Since the proposed site is located at the Smalley Middle School, there is an opportunity to educate school children on the</p>	

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importance of watersheds and stormwater management. This can be completed through the RCE Water Resources Program's *Stormwater Management in Your Schoolyard* program. The students could assist with installing the bioretention systems as part of a hands-on class activity. The porous asphalt additions would greatly reduce stormwater volumes and prevent flooding. The grass pavers reduce stormwater runoff by allowing it to infiltrate into the ground.

Possible Funding Sources:

mitigation funds from local developers
NJDEP grant programs like 319(h) and 604(b)
Bound Brook Township home and school associations
Boy Scouts, Girl Scouts, or service project
Smalley Home and School Association

Partners/Stakeholders:

Bound Brook Township
Smalley Middle School
Rutgers Cooperative Extension
teachers and students

Estimated Cost:

The rain garden would need to be approximately 2,780 square feet in size. At \$5 per square foot, the estimated cost of the rain garden is \$13,900. The porous pavement would need to be approximately 2,560 square feet. At \$20 per square foot, with 1 foot thickness, the estimated cost of the pervious asphalt is \$51,200. The grass pavers would need to be approximately 250 square feet on each side of the driveway. At \$35 per square foot the estimated cost of both pieces of grass pavers is \$17,500. In total the estimated price would be \$82,600.