



Draft

**Impervious Cover Assessment
for
Hopewell Township, Cumberland County, New Jersey**

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

April 2, 2018

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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 has also 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

Hopewell Township Impervious Cover Analysis

Hopewell Township is located in Cumberland County, New Jersey and covers approximately 30.89 square miles west of Fairfield Township. Figures 3 and 4 illustrate that Hopewell Township is dominated by agriculture land uses. A total of 10.2% of the municipality's land use is classified as urban. Of the urban land in Hopewell Township, rural residential is the dominant land use (Figure 5).

The literature suggests a link between impervious cover and stream ecosystem impairment (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. Schueler (1994, 2004) developed an impervious cover model that classified "sensitive streams" as typically having 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. Schueler et al. (2009) reformulated the impervious cover model based upon new research that had been conducted. This new analysis determined that stream degradation was first detected at 2 to 15% impervious cover. The updated impervious cover model recognizes the wide variability of stream degradation at impervious cover below 10%. The updated model also moves away from having a fixed line between stream quality classifications. For example, 5 to 10% impervious cover is included for the transition from sensitive to impacted, 20 to 25% impervious cover for the transition between impacted and non-supporting, and 60 to 70% impervious cover for the transition from non-supporting to urban drainage.

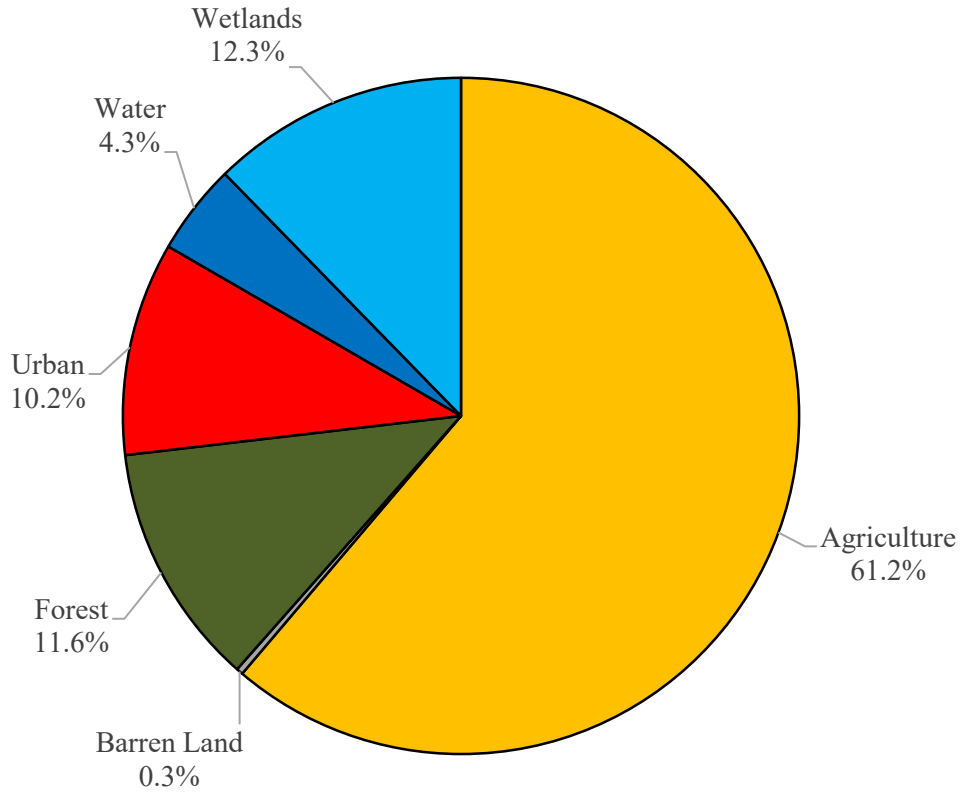


Figure 3: Pie chart illustrating the land use in Hopewell Township

Land Use for The Township of Hopewell

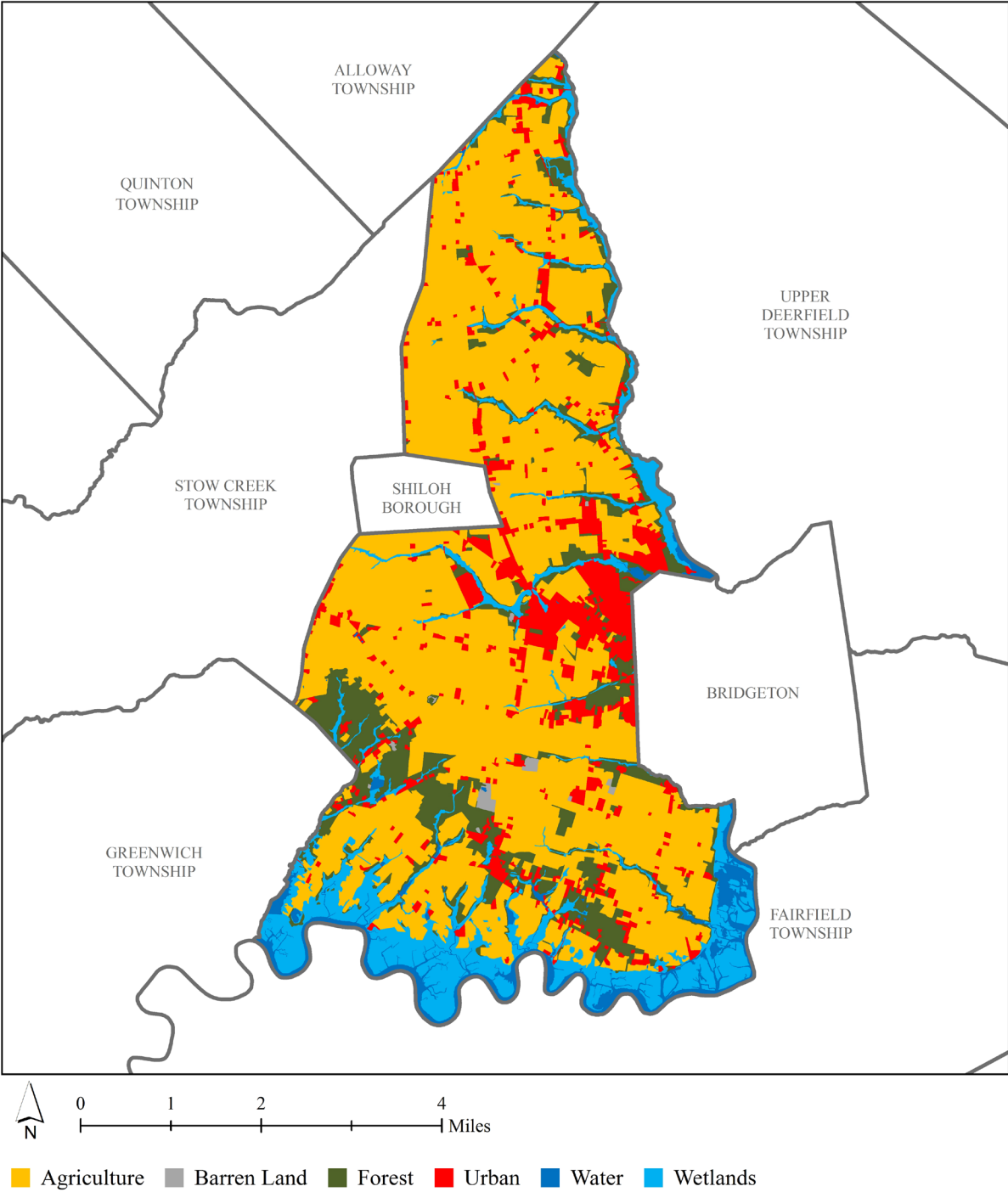


Figure 4: Map illustrating the land use in Hopewell Township

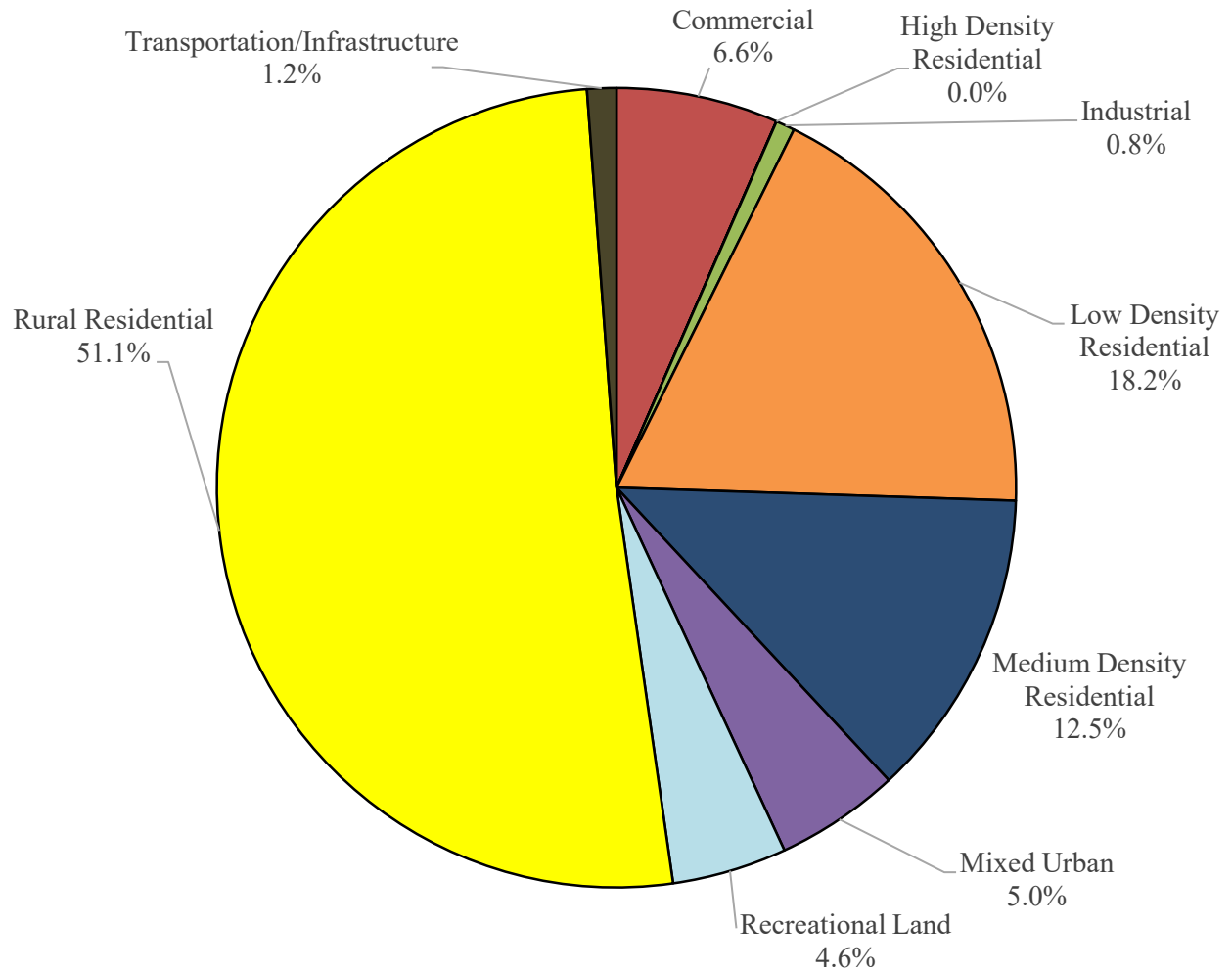


Figure 5: Pie chart illustrating the various types of urban land use in Hopewell Township

The New Jersey Department of Environmental Protection's (NJDEP) 2012 land use/land cover geographical information system (GIS) data layer categorizes Hopewell 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 Hopewell Township. Based upon the 2012 NJDEP land use/land cover data, approximately 2.9% of Hopewell Township has impervious cover. This level of impervious cover suggests that the streams in Hopewell Township are likely sensitive streams.

Water resources are typically managed on a watershed/subwatershed basis; therefore, an impervious cover analysis was performed for each subwatershed within Hopewell Township (Table 1 and Figure 6). On a subwatershed basis, impervious cover ranges from 1.8% in the Cohansey River subwatershed to 7.5% in the Barrett Run 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 Hopewell Township, Cumberland 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 (8.8 inches of rain). These runoff volumes are summarized in Table 2. A substantial amount of rainwater drains from impervious surfaces in Hopewell Township. For example, if the stormwater runoff from one water quality storm (1.25 inches of rain) in the Cohansey River subwatershed was harvested and purified, it could supply water to 87 homes for one year¹.

¹ Assuming 300 gallons per day per home

Table 1: Impervious cover analysis by subwatershed for Hopewell Township

Subwatershed	Total Area		Land Use Area		Water Area		Impervious Cover		
	(ac)	(mi ²)	(ac)	(mi ²)	(ac)	(mi ²)	(ac)	(mi ²)	(%)
Barrett Run	3,617.4	5.65	3,598.3	5.62	19.0	0.03	268.6	0.42	7.5%
Cohansey River	16,095.8	25.15	15,256.2	23.84	839.6	1.31	279.6	0.44	1.8%
Pine Mount Creek	23.5	0.04	23.3	0.04	0.2	0.00	1.0	0.00	4.2%
Stow Creek	35.3	0.06	35.3	0.06	0.0	0.00	1.0	0.00	2.9%
Total	19,772.0	30.89	18,913.2	29.55	858.8	1.34	550.2	0.86	2.9%

Subwatersheds of The Township of Hopewell

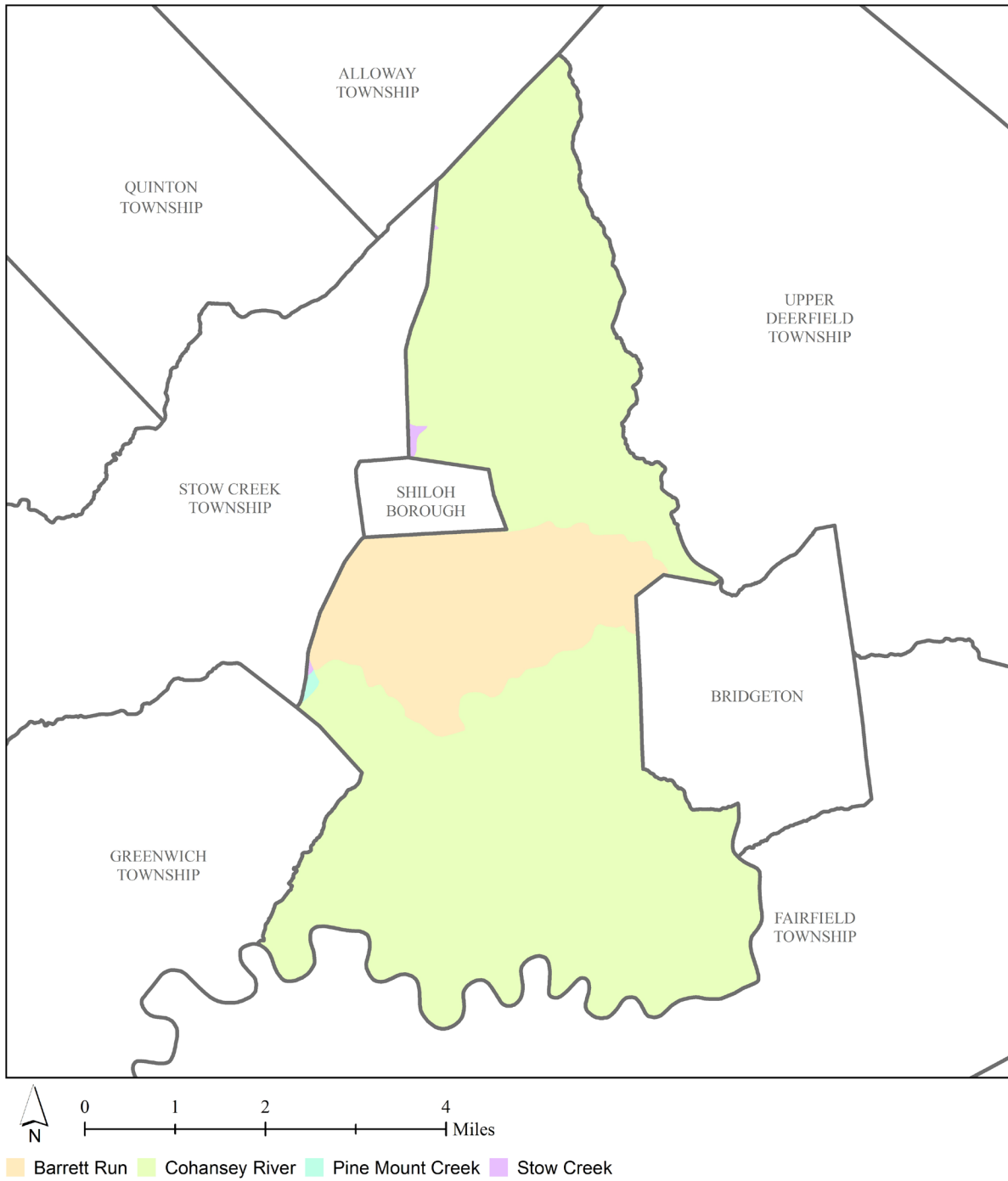


Figure 6: Map of the subwatersheds in Hopewell Township

Table 2: Stormwater runoff volumes from impervious surfaces by subwatershed in Hopewell 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 (8.8") (MGal)
Barrett Run	9.1	320.9	23.9	37.1	63.9
Cohansey River	9.5	334.0	24.8	38.6	66.5
Pine Mount Creek	0.0	1.2	0.1	0.1	0.2
Stow Creek	0.0	1.2	0.1	0.1	0.2
Total	18.7	657.4	48.9	76.0	130.9

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 Hopewell 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 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 Hopewell Township

Subwatershed	Recommended Impervious Area Reduction (10%) (ac)	Annual Runoff Volume Reduction² (Mgal)
Barrett Run	26.9	30.5
Cohansey River	28.0	31.7
Pine Mount Creek	0.1	0.1
Stow Creek	0.1	0.1
Total	55.0	62.4

² Annual Runoff Volume Reduction =

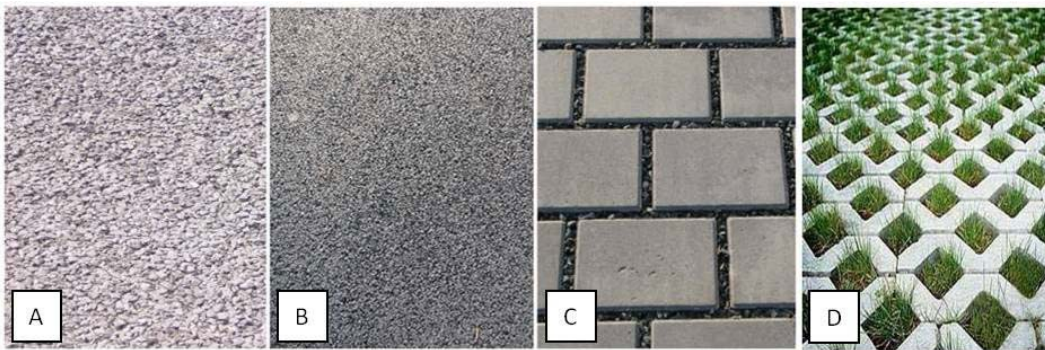
Acres of IC x 43,560 ft²/ac x 44 in x (1 ft/12 in) x 0.95 x (7.48 gal/ft³) x (1 MGal/1,000,000 gal)

All BMPs should be designed to capture the first 3.3 inches of rain from each storm. This would allow the BMP 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 Hopewell 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 Hopewell 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

Hopewell 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

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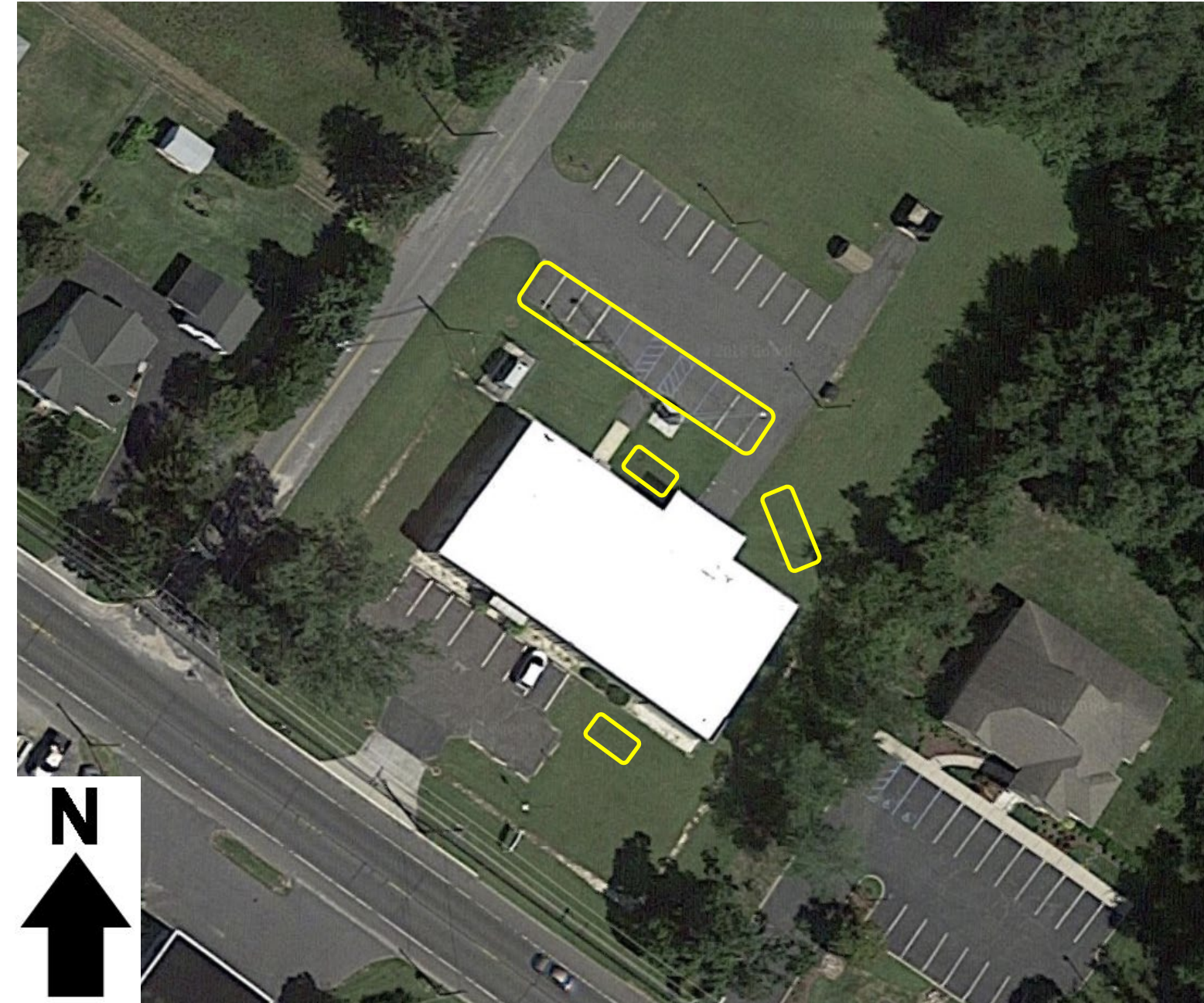
Appendix A

Concept Plans and Detailed Green Infrastructure Information Sheets

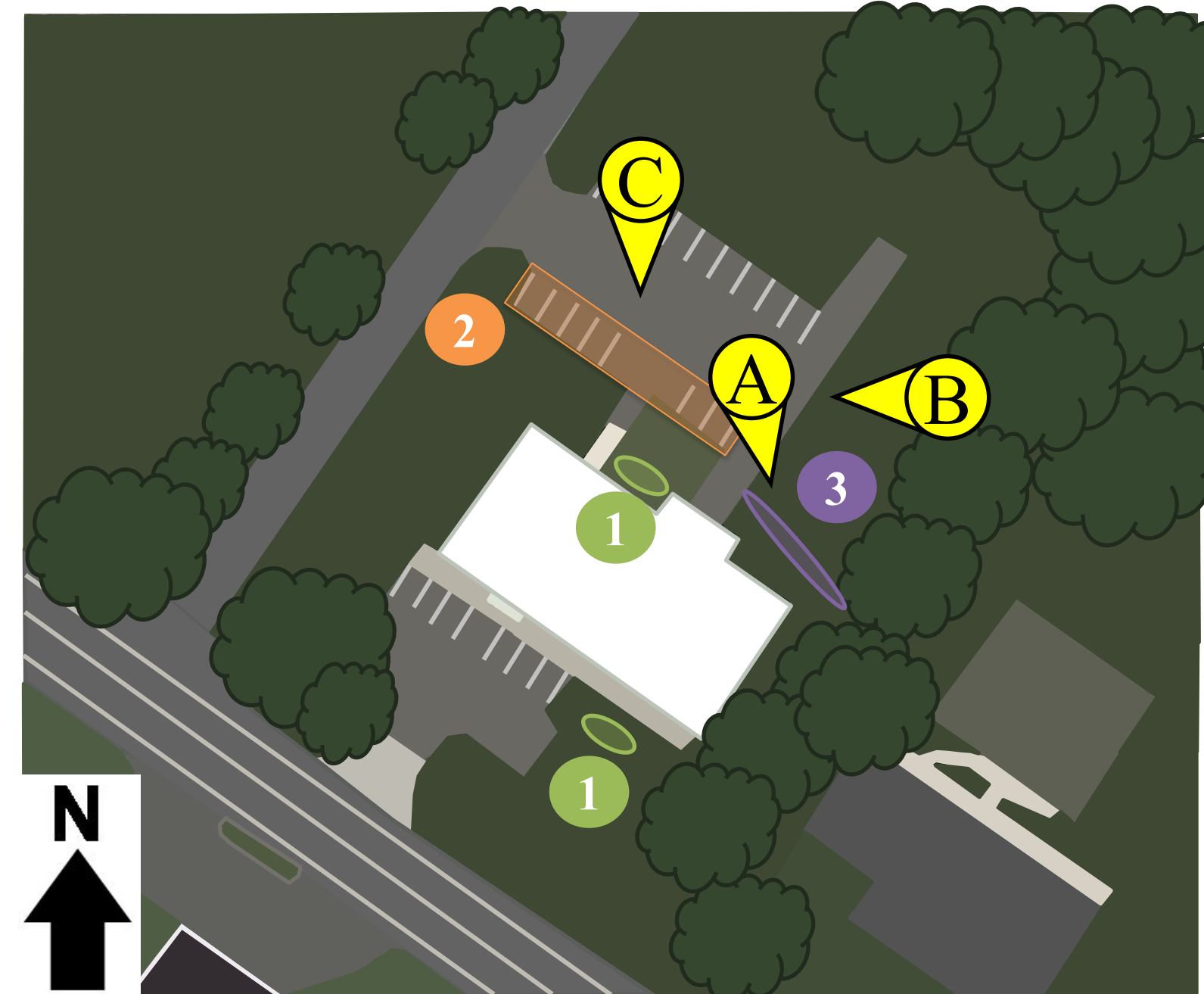
Hopewell Township Impervious Cover Assessment

Cumberland County Elections, 555 Shiloh Pike

PROJECT LOCATION:



SITE PLAN:



B

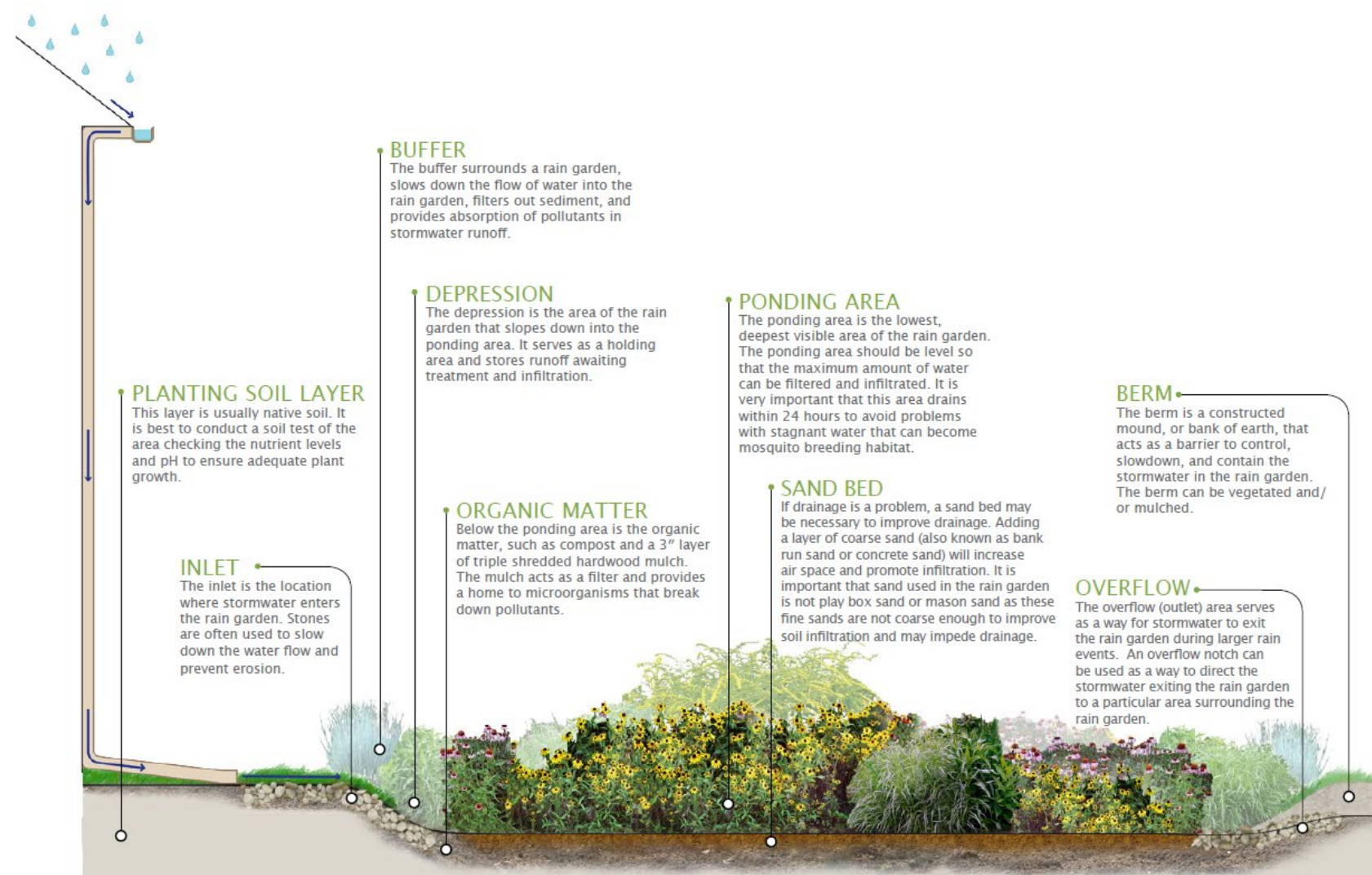


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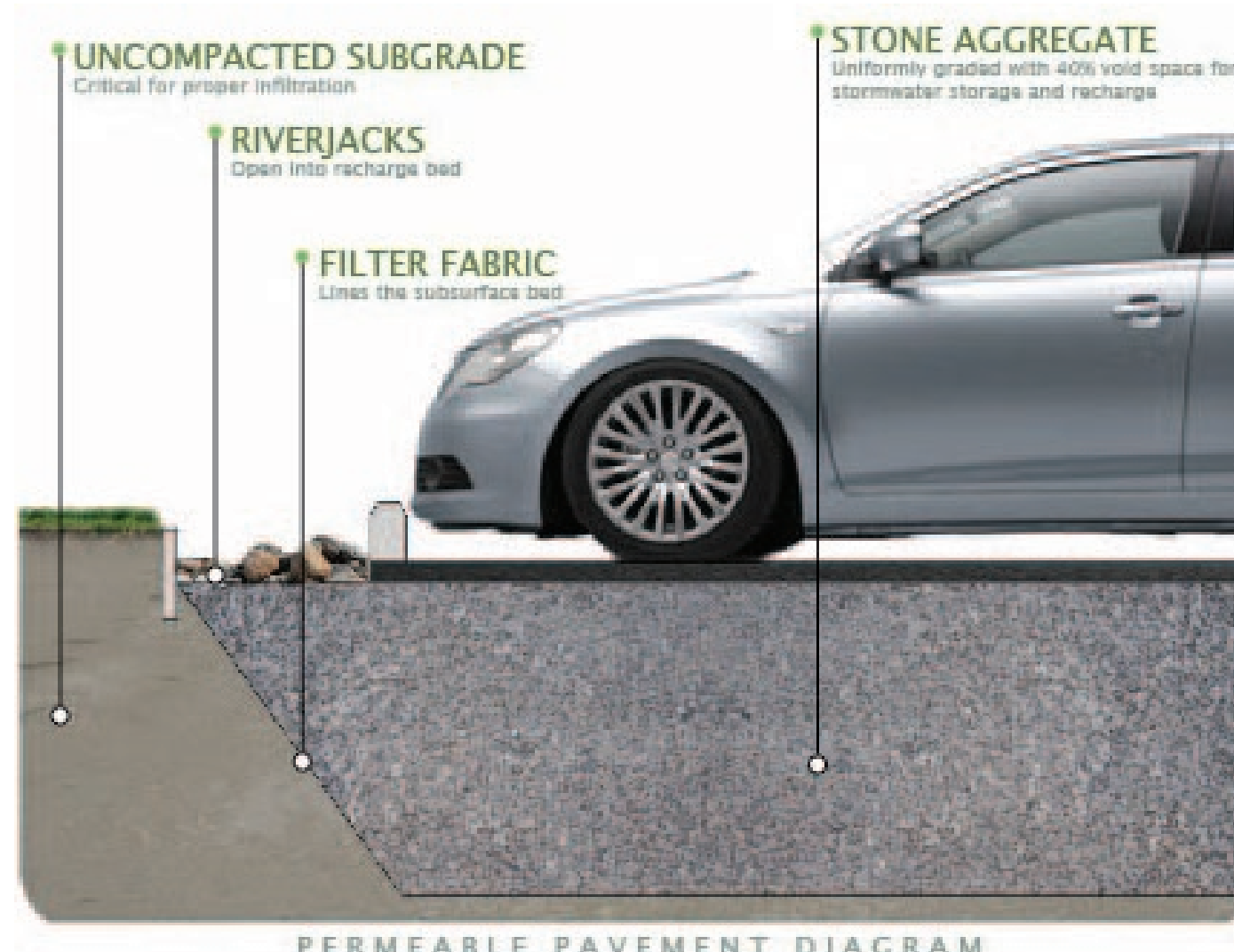


- 1 BIORETENTION SYSTEM:** A rain garden can be installed in the turfgrass areas on the north and south sides of the building. Rain gardens can be used to reduce sediment and nutrient loading to the local waterway and increase groundwater recharge.
- 2 PERVIOUS PAVEMENT:** Pervious pavement promotes groundwater recharge and filters stormwater. A strip of parking spaces on the north side of the building can be retrofitted with pervious pavement to allow some of the runoff to infiltrate.
- 3 BIOSWALE:** Bioswales are landscape features that convey stormwater from one location to another while removing pollutants and providing water an opportunity to infiltrate. A bioswale can be installed at the east corner of the building.

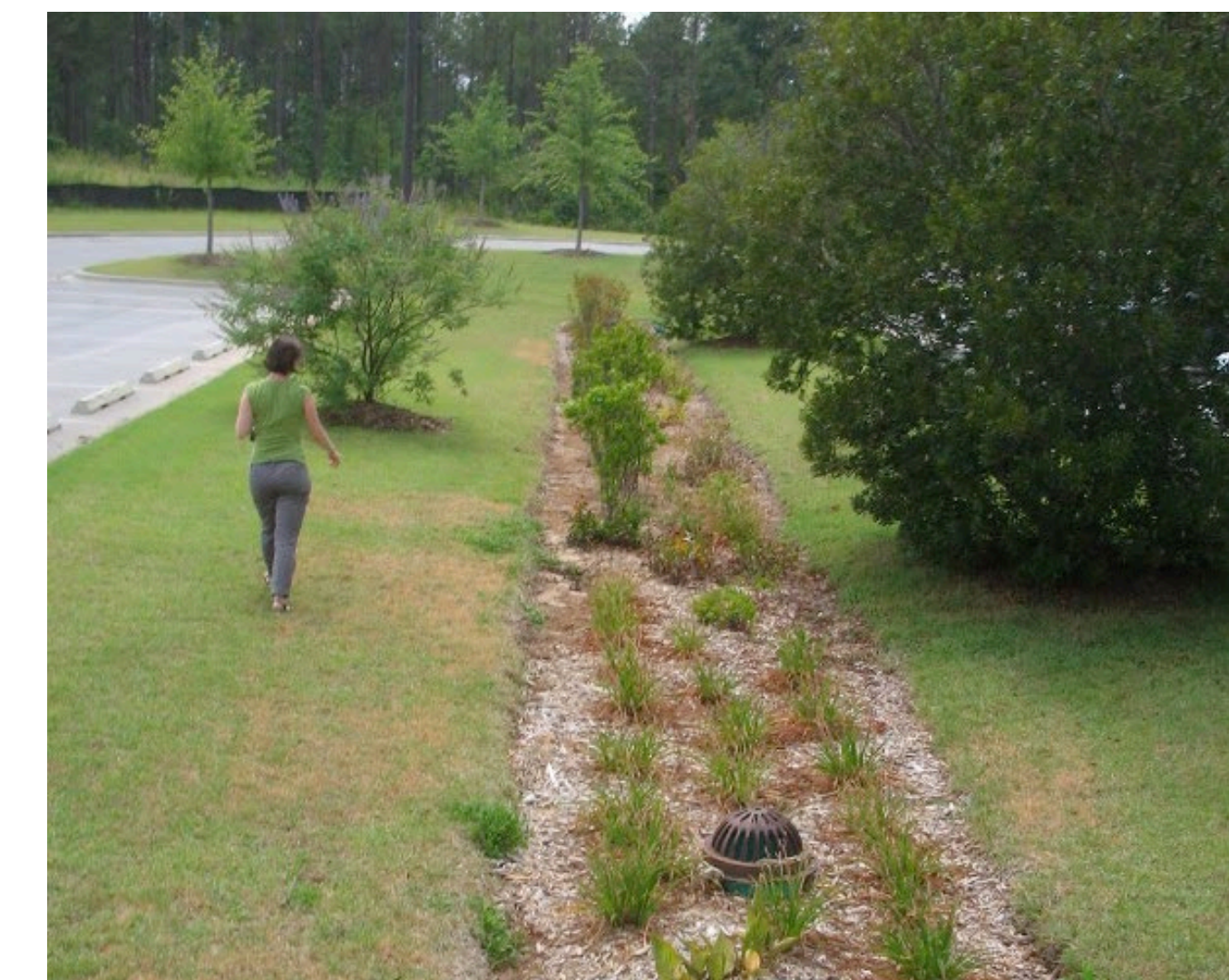
1 BIORETENTION SYSTEM



2 PERVIOUS PAVEMENT



3 BIOSWALE



Cumberland County Elections
Green Infrastructure Information Sheet

<p>Location: 555 Shiloh Pike Bridgeton, NJ 08302</p>	<p>Municipality: Hopewell Township</p>
<p>Green Infrastructure Description: bioretention system (rain garden) bioswale pervious pavement</p>	<p>Subwatershed: Cohansey River</p> <p>Targeted Pollutants: total nitrogen (TN), total phosphorus (TP), and total suspended solids (TSS) in surface runoff</p>
<p>Mitigation Opportunities: recharge potential: yes stormwater peak reduction potential: yes total suspended solids removal potential: yes</p>	<p>Stormwater Captured and Treated Per Year: bioretention system #1: 7,030 gal. bioretention system #2: 21,760 gal. bioswale: 23,450 gal. pervious pavement: 178,090 gal.</p>
<p>Existing Conditions and Issues: This site contains several impervious surfaces including walkways, a parking lot, and a building. On the south and north sides of the building there are parking lots. Impervious pavement in the parking lot is eroded and cracking. At the east corner of the building there is a depressed channel.</p>	
<p>Proposed Solution(s): A rain garden can be placed next to the downspout on the north side of the building to capture and filter runoff. The connected downspout on the south side of the building can be disconnected and led to another rain garden. A strip of impervious pavement in the north parking lot can be replaced with pervious pavement. A vegetated bioswale can be put in the depressed channel at the northeast corner of the building.</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 reduce TN by 30%, TP by 60%, and TSS by 90%. A bioretention system would also provide ancillary benefits, such as enhanced wildlife and aesthetic appeal, to the local residents of Hopewell Township.</p> <p>The bioswale will capture, treat, and infiltrate stormwater reducing TN by 30%, TP by 60%, and TSS by 90%.</p> <p>Pervious pavement allows stormwater to infiltrate through to soil layers which will promote groundwater recharge as well as intercept and filter stormwater runoff. The pervious pavement system will achieve the same level of pollutant load reduction for TN, TP, and TSS as the bioretention system.</p>	
<p>Possible Funding Sources: mitigation funds from local developers NJDEP grant programs Hopewell Township local social and community groups</p>	

Cumberland County Elections
Green Infrastructure Information Sheet

Partners/Stakeholders:

Hopewell Township
Cumberland County Elections
local community groups
Rutgers Cooperative Extension

Estimated Cost:

Rain garden #1 would need to be approximately 70 square feet. At \$5 per square foot, the estimated cost is \$350. Rain garden #2 would need to be approximately 210 square feet. At \$5 per square foot, the estimated cost is \$1,050.

The bioswale would need to be 40 feet long and 6 feet wide (240 sq.ft.). At \$5 per square foot, the estimate cost of the bioswale is \$1,200.

The porous asphalt would cover 1,835 square feet and have a two-foot stone reservoir under the surface. At \$25 per square foot, the cost of the porous asphalt system would be \$45,875.

The total cost of the project will be approximately \$48,475.

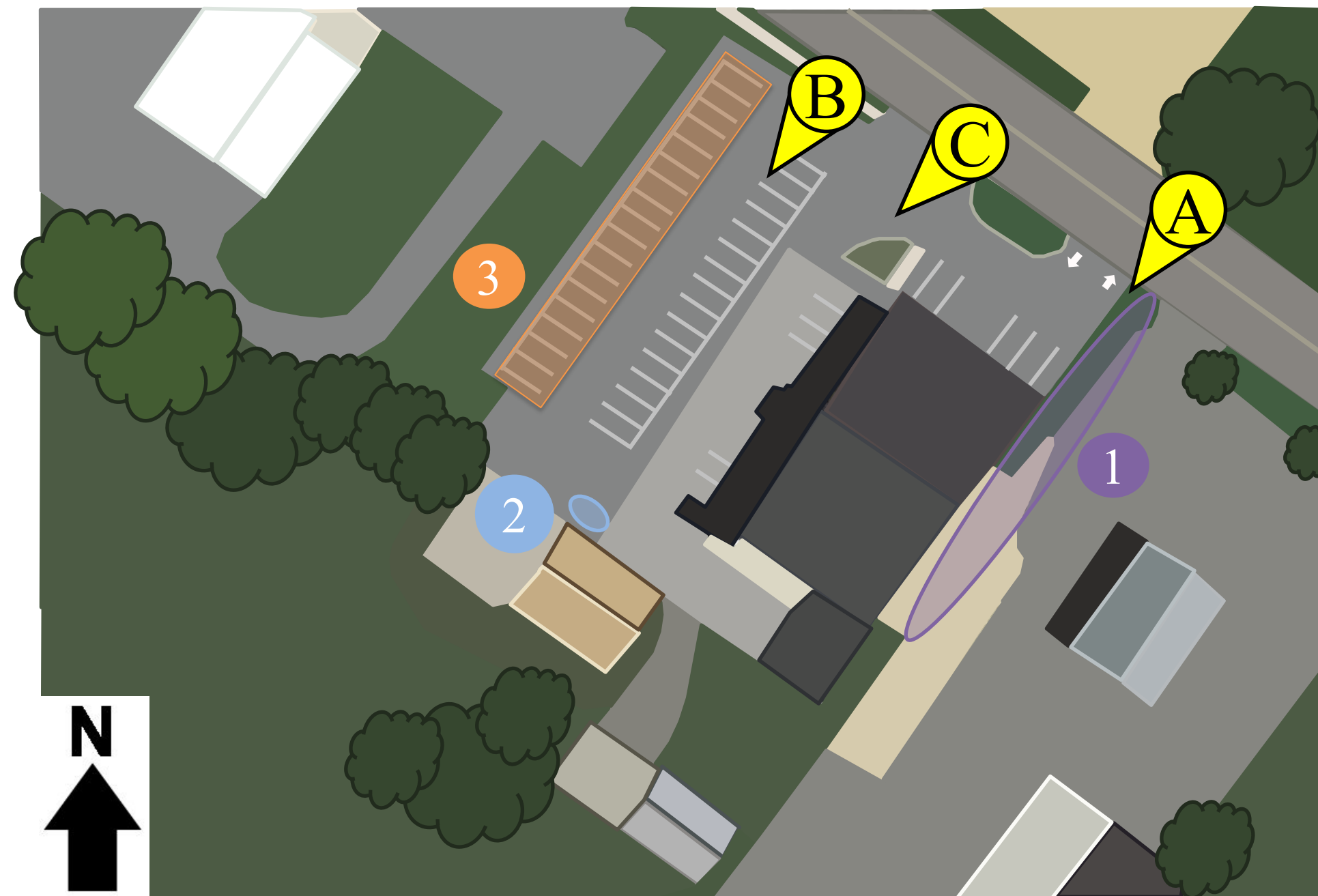
Hopewell Township Impervious Cover Assessment

Hopewell Township Municipal Building, 590 Shiloh Pike

PROJECT LOCATION:



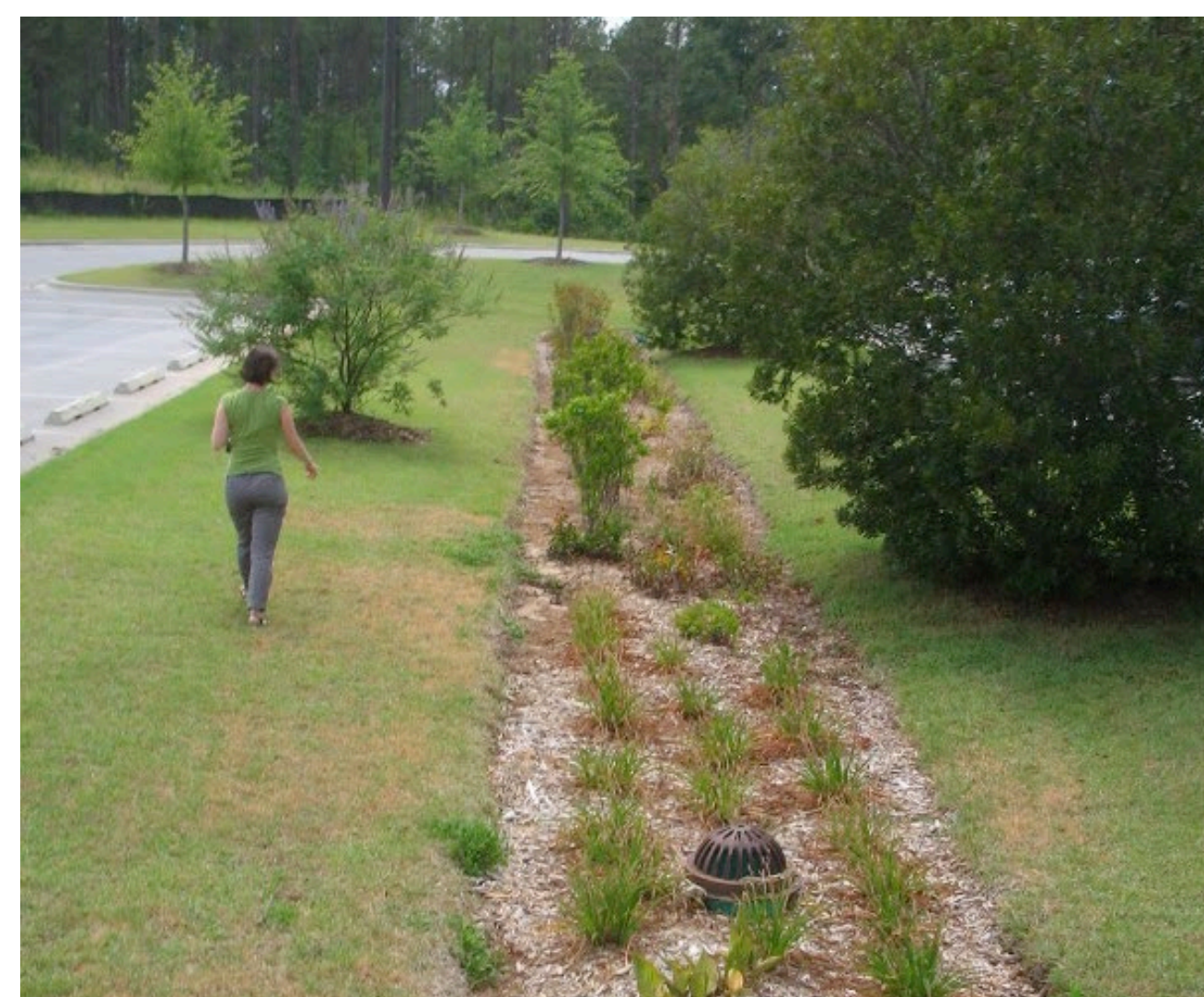
SITE PLAN:



- 1 BIOSWALE:** Bioswales are landscape features that convey stormwater from one location to another while removing pollutants and providing water an opportunity to infiltrate. A bioswale can be installed along the east side of the building.
- 2 RAINWATER HARVESTING SYSTEM:** Rainwater can be harvested from the roof of the building and stored in a cistern at the small building on the south side of the parking lot. The water can be used to wash vehicles and water existing landscape.
- 3 PERVIOUS PAVEMENT:** Pervious pavement promotes groundwater recharge and filters stormwater. A strip of parking spaces on the west side of the parking lot can be retrofitted with porous pavement to allow some of the runoff to infiltrate.



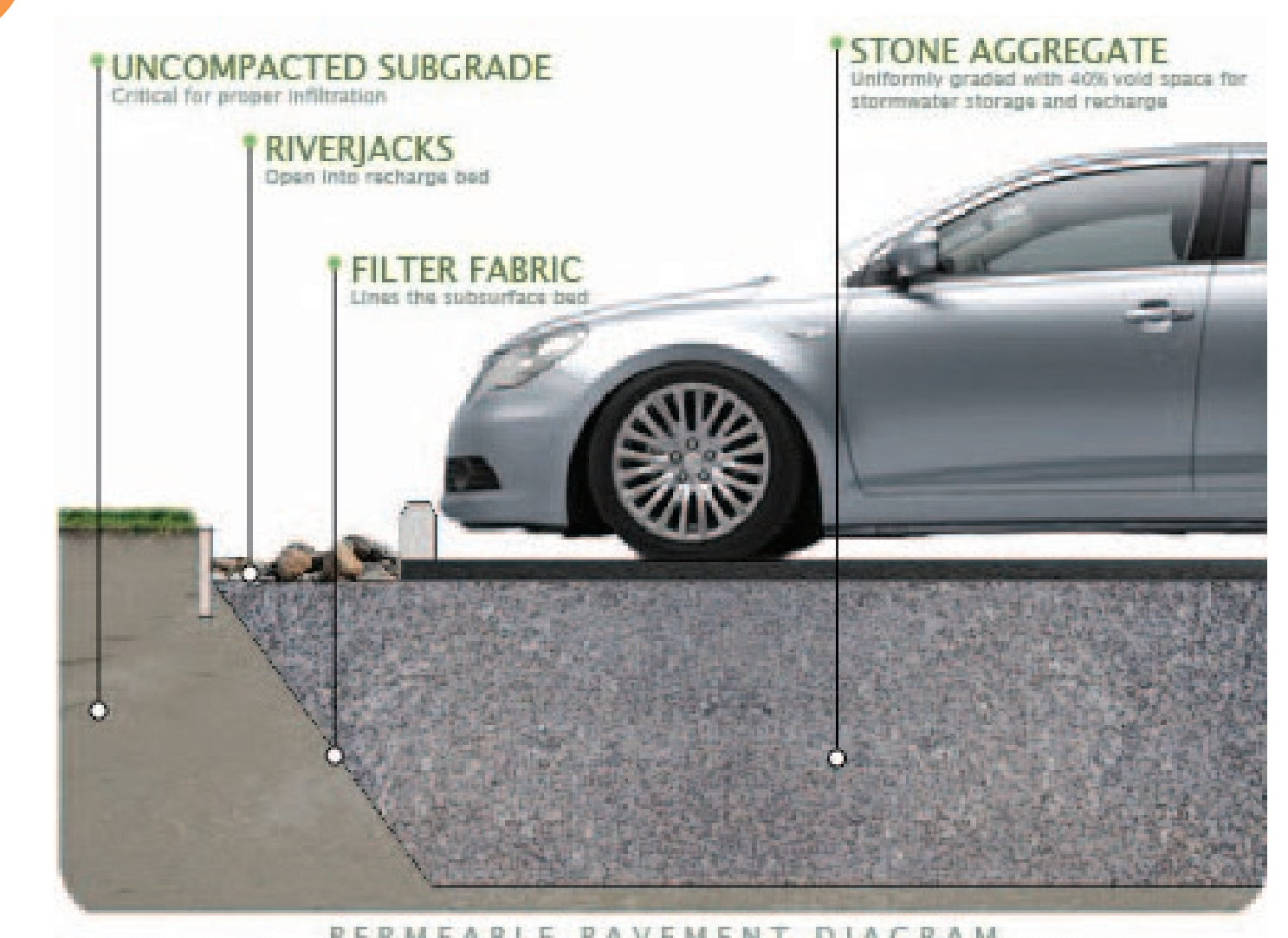
1 BIOSWALE



2 RAINWATER HARVESTING SYSTEM



3 PERVIOUS PAVEMENT



Hopewell Township Municipal Building
Green Infrastructure Information Sheet

<p>Location: 590 Shiloh Pike Bridgeton, NJ 08302</p>	<p>Municipality: Hopewell Township</p>
<p>Green Infrastructure Description: bioswale pervious pavement rain harvesting system (rain barrel/cistern)</p>	<p>Subwatershed: Barrett Run</p> <p>Targeted Pollutants: total nitrogen (TN), total phosphorus (TP), and total suspended solids (TSS) in surface runoff</p>
<p>Mitigation Opportunities: recharge potential: yes stormwater peak reduction potential: yes total suspended solids removal potential: yes</p>	<p>Stormwater Captured and Treated Per Year: bioswale: 81,940 gal. porous pavement: 198,930 gal. rain harvesting system: 10,800 gal.</p>
<p>Existing Conditions and Issues: This site contains several impervious surfaces including walkways, a parking lot, and a building. There is a parking lot on the west side of the building with cracking and erosion. On the east side of the building there are several disconnected downspouts that lead to a depressed channel.</p>	
<p>Proposed Solution(s): The disconnected downspouts on the east side of the building can lead to a bioswale that takes the place of the depressed channel. A strip of parking spaces on the west side of the parking lot can be replaced with pervious pavement. The downspout on the corner of the small building at the south side of the site can drain to a cistern.</p>	
<p>Anticipated Benefits: The bioswale will capture, treat, and infiltrate stormwater reducing TN by 30%, TP by 60%, and TSS by 90%.</p> <p>Pervious pavement allows stormwater to infiltrate through to soil layers which will promote groundwater recharge as well as intercept and filter stormwater runoff. The pervious pavement system will achieve the same level of pollutant load reduction for TN, TP, and TSS as the bioswale.</p> <p>A cistern can harvest stormwater which can be used for watering plants or other purposes which cuts back on the use of potable water for nondrinking purposes. Since the rainwater harvesting system would be designed to capture the first 1.25 inches of rain, it would reduce the pollutant loading by 90% during the periods it is operational (i.e., it would not be used in the winter when there is a chance of freezing).</p>	
<p>Possible Funding Sources: mitigation funds from local developers NJDEP grant programs Hopewell Township local social and community groups</p>	

Hopewell Township Municipal Building
Green Infrastructure Information Sheet

Partners/Stakeholders:

Hopewell Township
local community groups
Rutgers Cooperative Extension

Estimated Cost:

The bioswale would need to be 100 feet long and 8 feet wide (800 square feet). At \$5 per square foot, the estimate cost of the bioswale is \$4,000.

The porous asphalt would cover 2,844 square feet and have a two-foot stone reservoir under the surface. At \$25 per square foot, the cost of the porous asphalt system would be \$71,100.

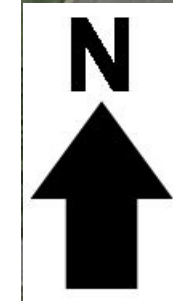
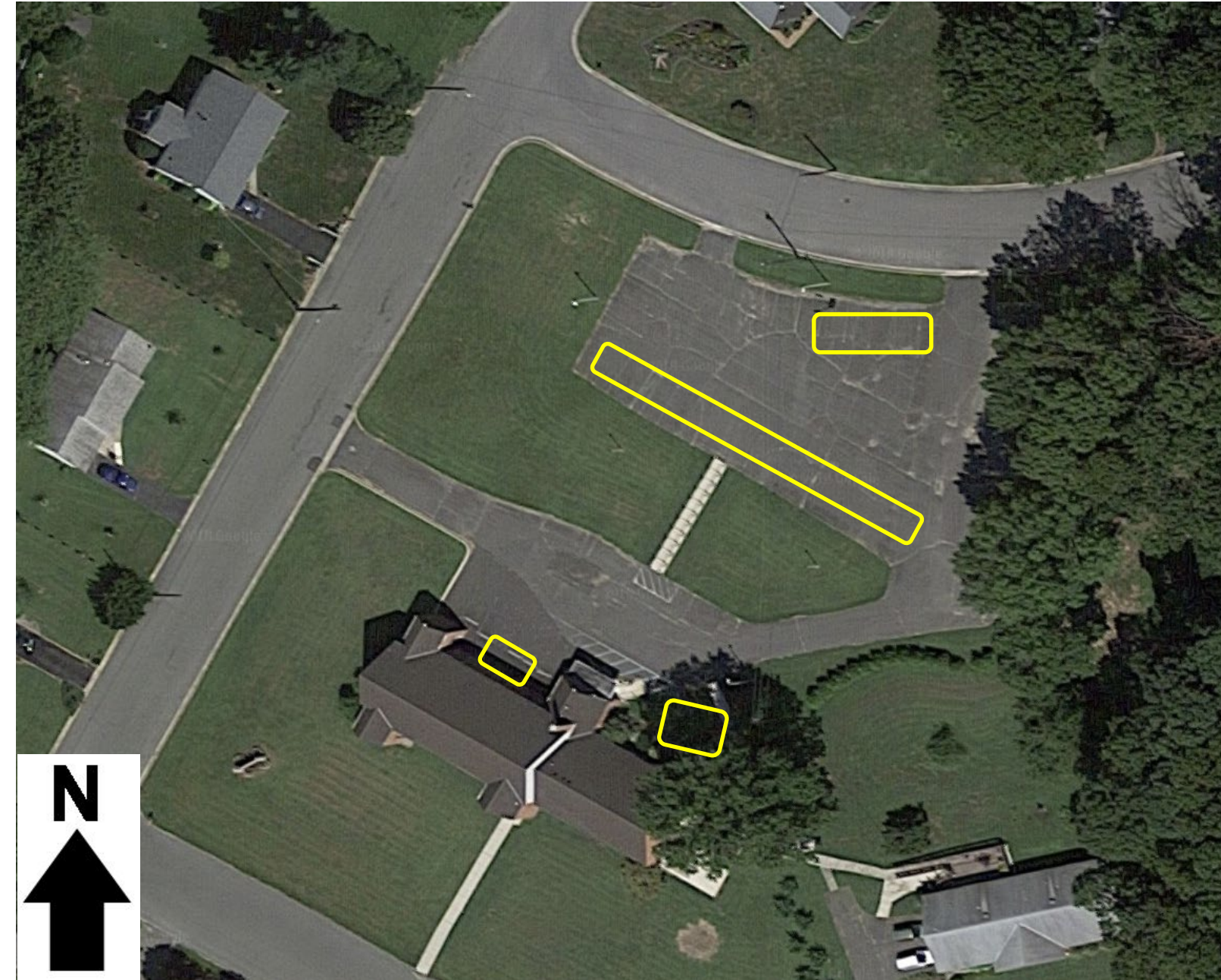
The cistern would be 680 gallons and cost approximately \$1,360 to purchase and install.

The total cost of the project will be approximately \$76,460.

Hopewell Township Impervious Cover Assessment

New Hope Presbyterian Church, 65 Hitchner Avenue

PROJECT LOCATION:



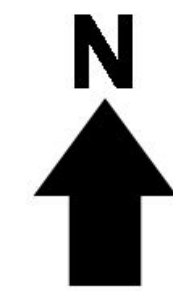
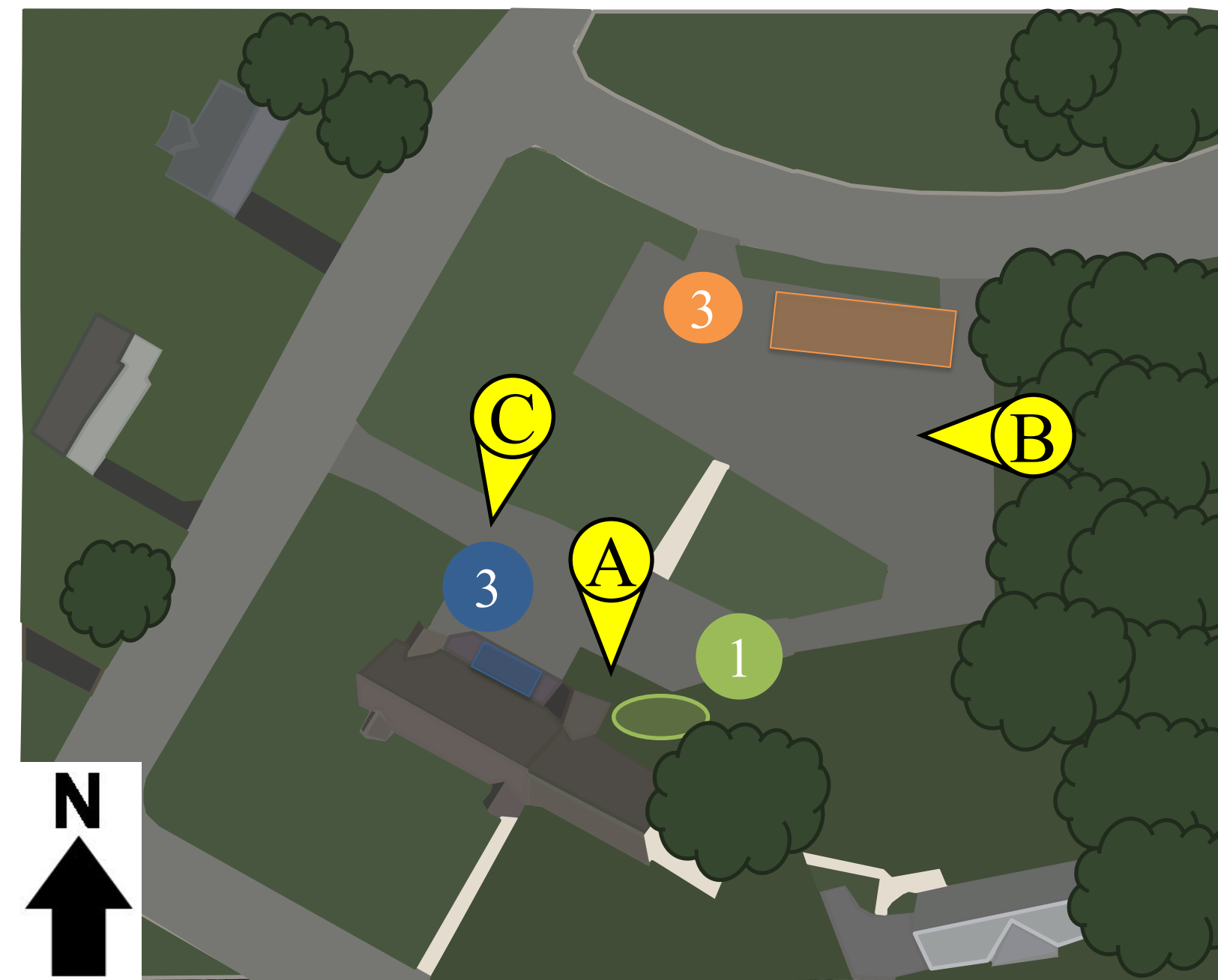
A



B



SITE PLAN:

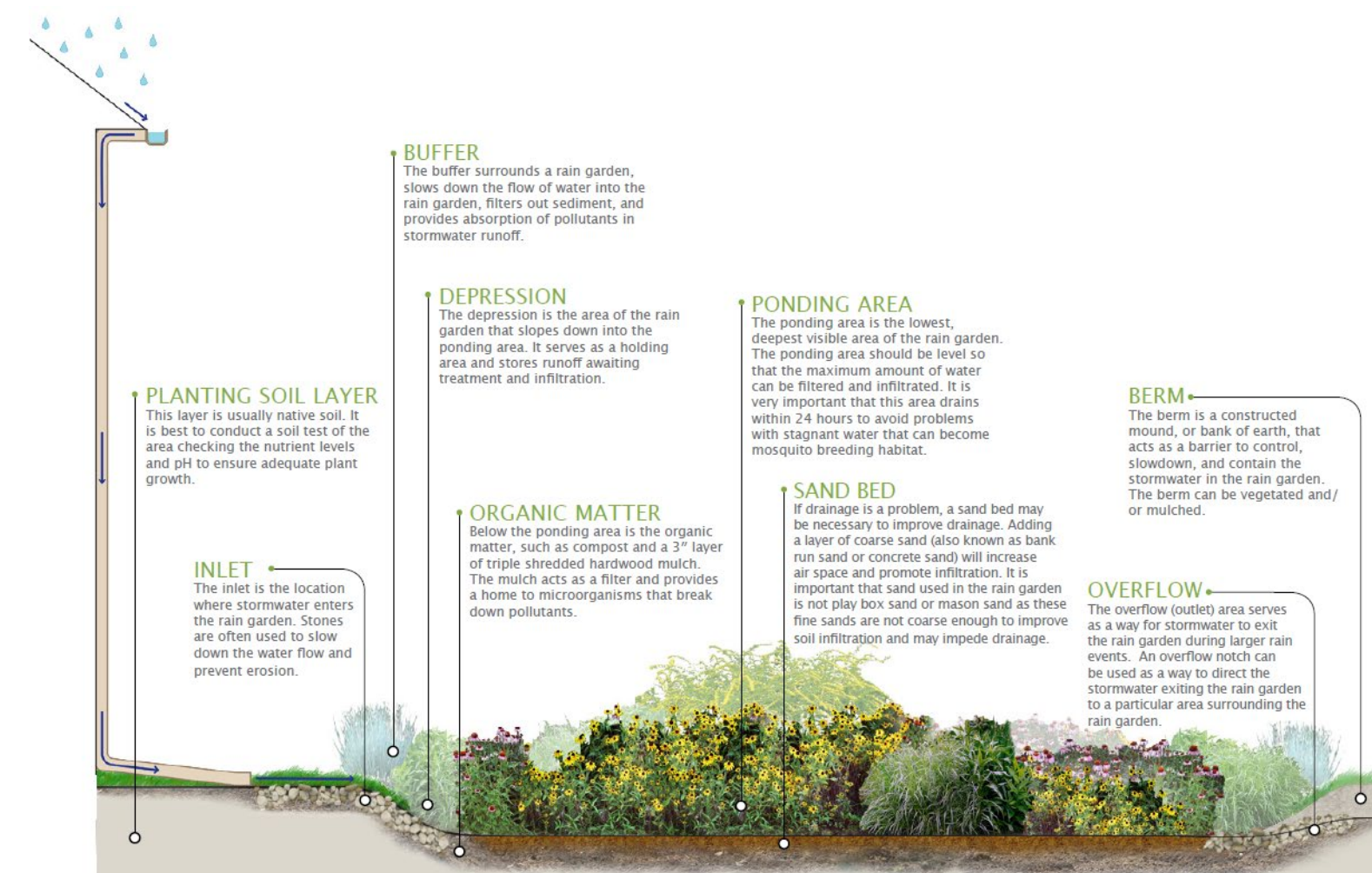


C

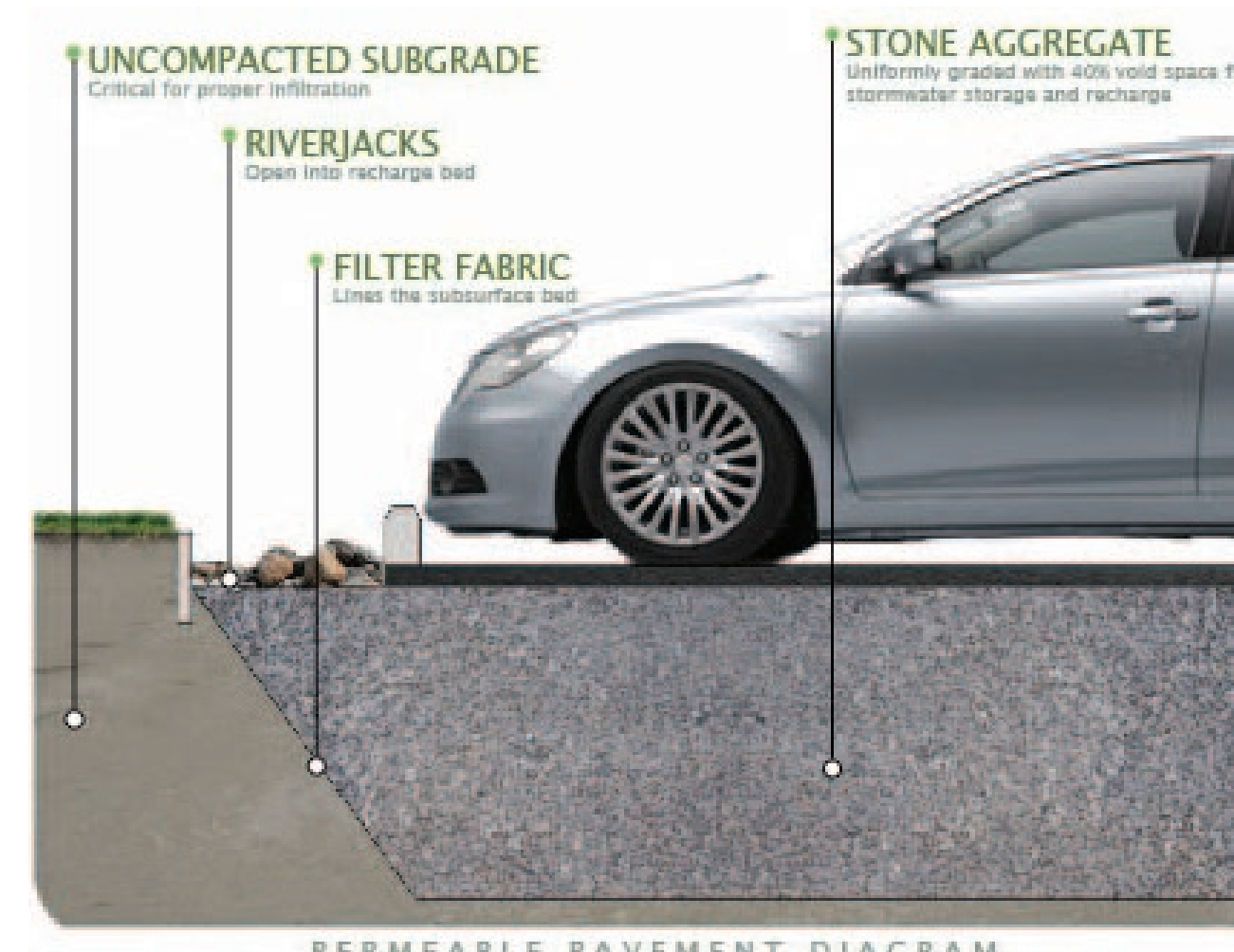


- 1 **BIORETENTION SYSTEM:** A rain garden can be installed at the northeast corner of the church to capture roof runoff. A rain garden can be used to reduce sediment and nutrient loading to the local waterway and increase groundwater recharge.
- 2 **PERVIOUS PAVEMENT:** Pervious pavement promotes groundwater recharge and filters stormwater. A strip of parking spaces in the north parking lot can be retrofitted with pervious pavement to allow some of the runoff to infiltrate.
- 3 **PLANTER BOX:** Planter boxes can be installed on the north side of the church to collect water from the nearby downspout. Planter boxes reduce runoff and allow water to slowly infiltrate while being treated for pollutants.

1 BIORETENTION SYSTEM



2 PERVIOUS PAVEMENT



3 PLANTER BOX



New Hope Presbyterian Church
Green Infrastructure Information Sheet

<p>Location: 65 Hitchner Avenue Bridgeton, NJ 08302</p>	<p>Municipality: Hopewell Township</p>
<p>Green Infrastructure Description: bioretention system (rain garden) porous pavement planter boxes</p>	<p>Subwatershed: Cohansey River</p> <p>Targeted Pollutants: total nitrogen (TN), total phosphorus (TP), and total suspended solids (TSS) in surface runoff</p>
<p>Mitigation Opportunities: recharge potential: yes stormwater peak reduction potential: yes total suspended solids removal potential: yes</p>	<p>Stormwater Captured and Treated Per Year: bioretention system: 12,510 gal. porous pavement: 226,160 gal. planter boxes: 8,390 gal.</p>
<p>Existing Conditions and Issues: This site contains several impervious surfaces including walkways, a parking lot, and a building. There are two parking lots on the north side of the church. In the northern parking lot there is evidence of erosion and flooding. On the north side of the building there is a disconnected downspout that leads to a parking lot. At the northeast corner of the building there is a disconnected downspout leading to grass.</p>	
<p>Proposed Solution(s): The disconnected downspout at the northeast corner of the building can lead to a rain garden installed in the turfgrass area. Planter boxes can be installed on the north side of the building to collect water from the nearby downspouts. A strip of impervious pavement in the south part of the northern parking lot can be replaced with pervious pavement. A few parking spaces at the northernmost entrance to the parking lot can be replaced with pervious pavement to help control flooding.</p>	
<p>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), this system is estimated to reduce TN by 30%, TP by 60%, and TSS by 90%. A bioretention system would also provide ancillary benefits, such as enhanced wildlife and aesthetic appeal, to the local residents of Hopewell Township.</p> <p>Pervious pavement allows stormwater to infiltrate through to soil layers which will promote groundwater recharge as well as intercept and filter stormwater runoff. The pervious pavement system will achieve the same level of pollutant load reduction for TN, TP, and TSS as the bioretention system.</p> <p>Planter boxes will take in runoff from downspouts and achieve similar reductions in TN, TP, and TSS as the bioretention systems.</p>	

New Hope Presbyterian Church
Green Infrastructure Information Sheet

Possible Funding Sources:

mitigation funds from local developers
NJDEP grant programs
Hopewell Township
local social and community groups

Partners/Stakeholders:

Hopewell Township
New Hope Presbyterian Church
local community groups
residents and parishioners
Rutgers Cooperative Extension

Estimated Cost:

For a rain garden to capture the roof runoff, it would need to be approximately 120 square feet. At \$5 per square foot, the estimated cost of the rain garden is \$600.

The porous asphalt would cover 1,550 square feet and have a two-foot stone reservoir under the surface. At \$25 per square foot, the cost of the porous asphalt system would be \$38,750.

The estimated cost of each planter box is \$1,000 for a total cost of \$4,000 to install four.

The total cost of the project will be approximately \$43,350.