



Draft

**Impervious Cover Assessment
for
Upper Pittsgrove Township, Salem County, New Jersey**

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

April 25, 2018

Table of Contents

Introduction	1
Upper Pittsgrove Township Impervious Cover Analysis	4
Elimination of Impervious Surfaces	12
Pervious Pavement	14
Impervious Cover Disconnection Practices	14
Examples of Opportunities in Upper Pittsgrove Township	17
Conclusions	17
References	18
Appendix A: Concept Plans and Detailed Green Infrastructure Information Sheets	

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

Upper Pittsgrove Township Impervious Cover Analysis

Upper Pittsgrove Township is located in Salem County, New Jersey and covers approximately 40.38 square miles east of Pilesgrove Township. Figures 3 and 4 illustrate that Upper Pittsgrove Township is dominated by agriculture land uses. A total of 8.9% of the municipality's land use is classified as urban. Of the urban land in Upper Pittsgrove 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.

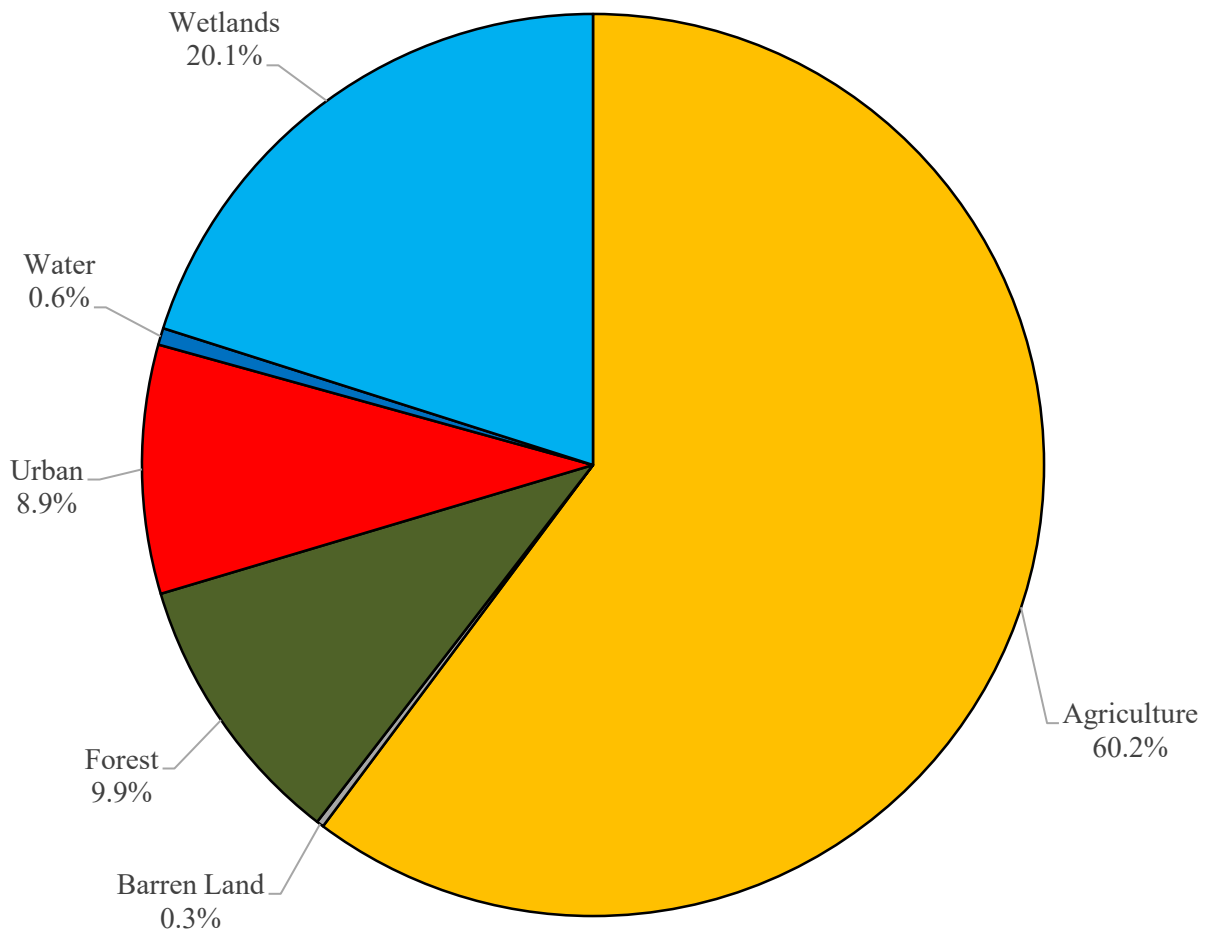


Figure 3: Pie chart illustrating the land use in Upper Pittsgrove Township

Land Use Types for Upper Pittsgrove Township

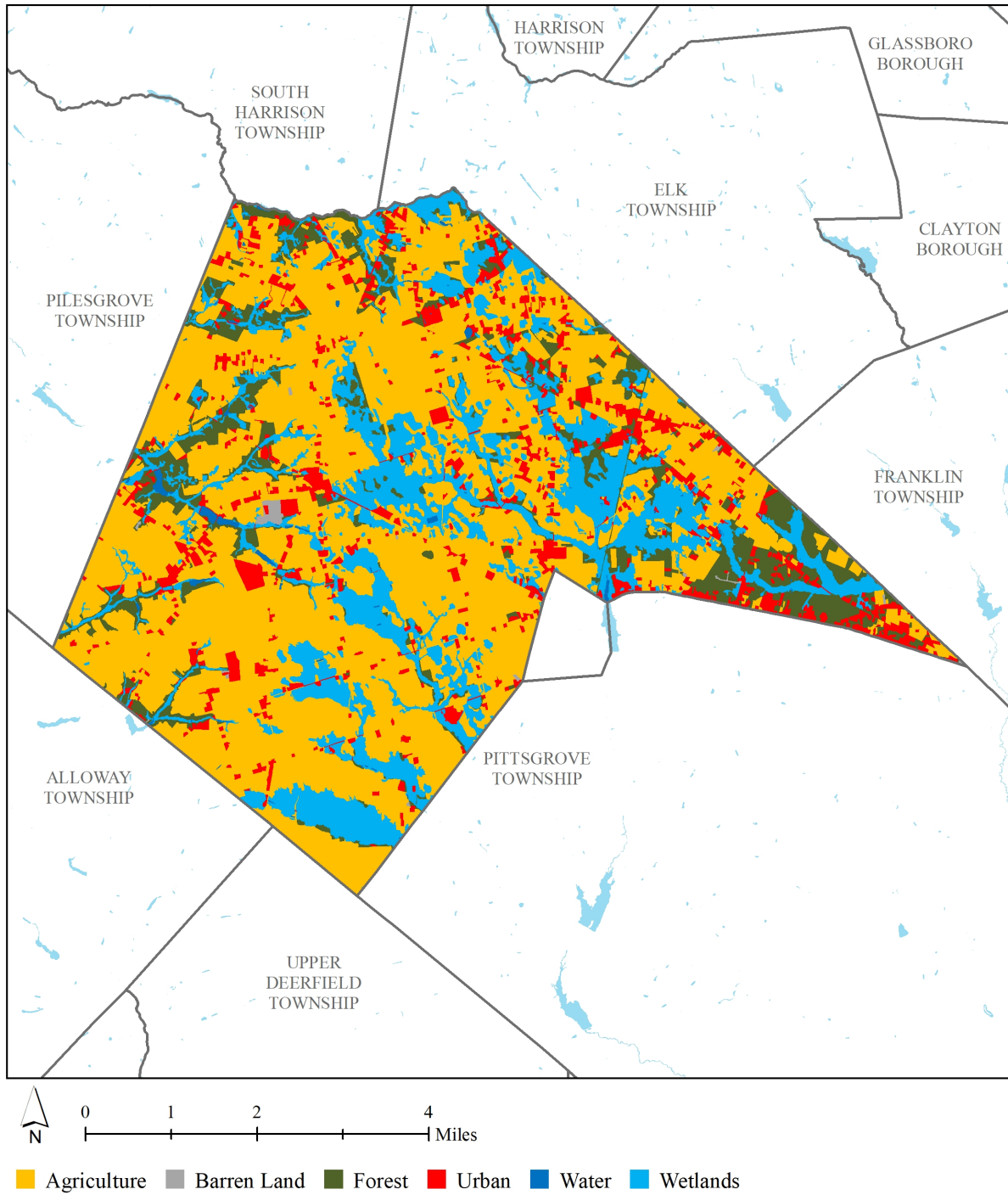


Figure 4: Map illustrating the land use in Upper Pittsgrove Township

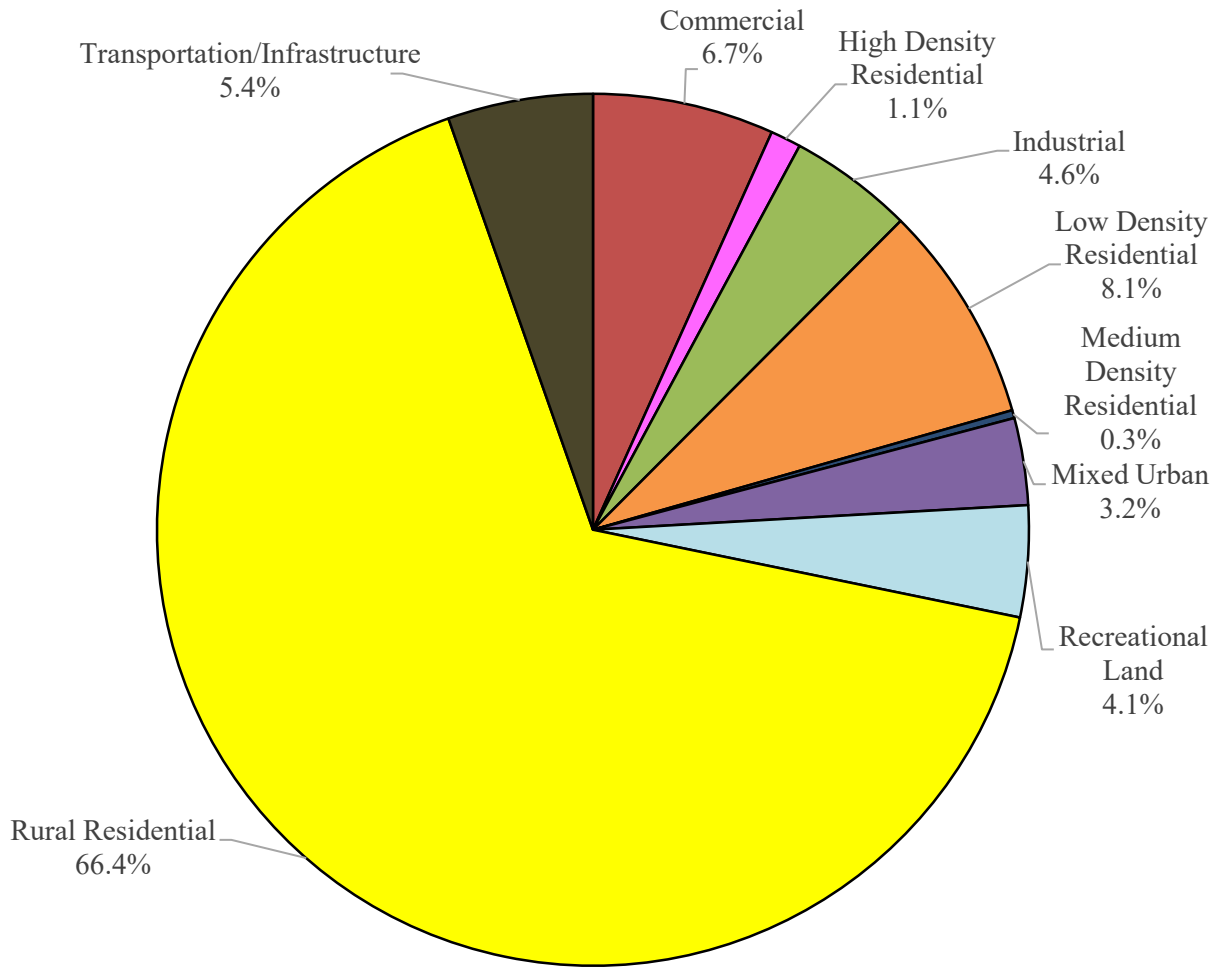


Figure 5: Pie chart illustrating the various types of urban land use in Upper Pittsgrove Township

The New Jersey Department of Environmental Protection's (NJDEP) 2012 land use/land cover geographical information system (GIS) data layer categorizes Upper Pittsgrove 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 Upper Pittsgrove Township. Based upon the 2012 NJDEP land use/land cover data, approximately 1.6% of Upper Pittsgrove Township has impervious cover. This level of impervious cover suggests that the streams in Upper Pittsgrove 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 Upper Pittsgrove Township (Table 1 and Figure 6). On a subwatershed basis, impervious cover ranges from from 0.6% in the Indian Run/Muddy Run subwatershed to 3.2% in the Still 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.

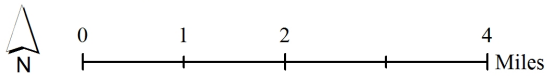
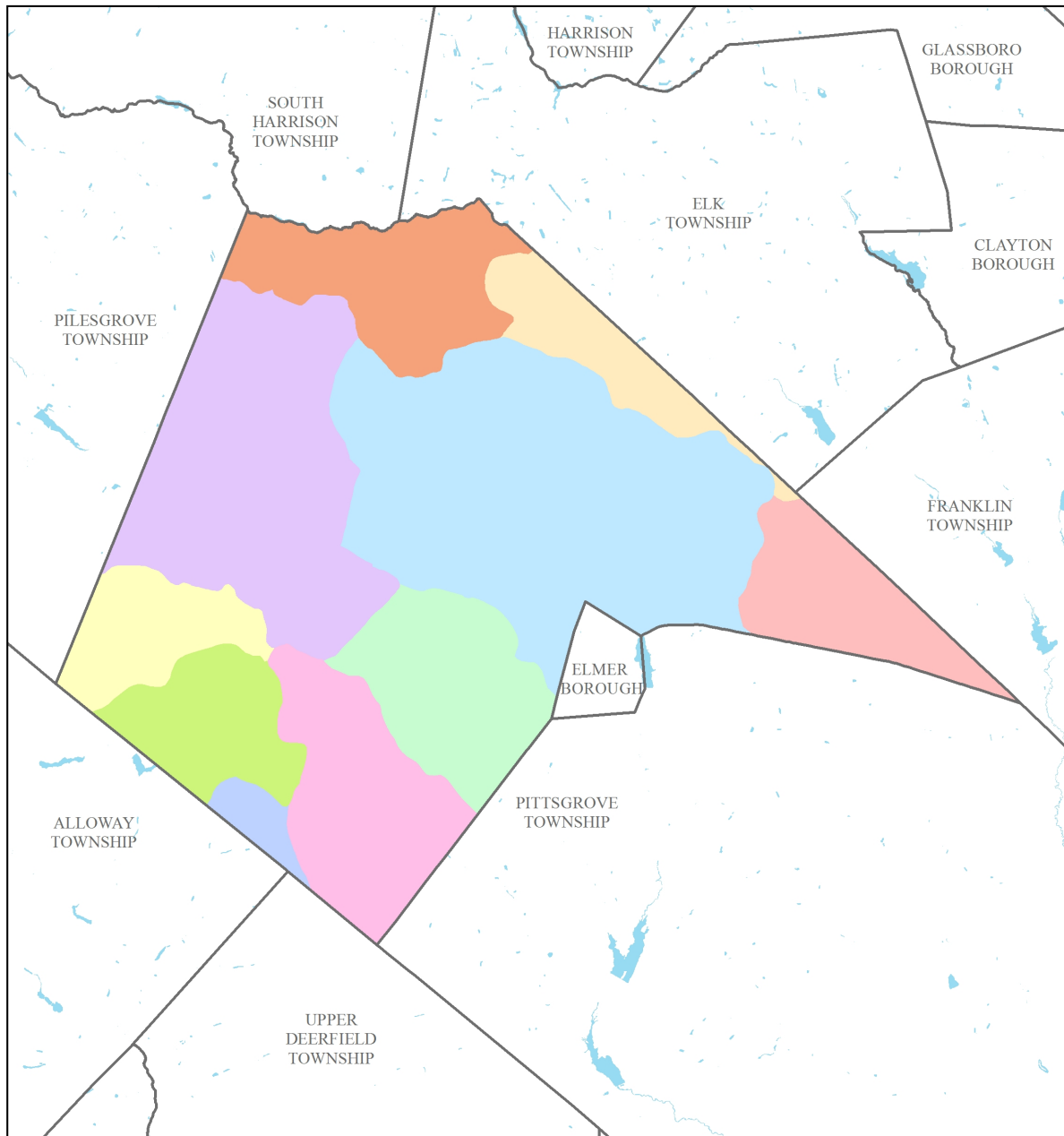
In developed landscapes, stormwater runoff from parking lots, driveways, sidewalks, and rooftops flows to drainage pipes that feed the sewer system. The cumulative effect of these impervious surfaces and thousands of connected downspouts reduces the amount of water that can infiltrate into soils and greatly increases the volume and rate of runoff that flows to waterways. Stormwater runoff volumes (specific to Upper Pittsgrove Township, Salem 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 (8.5 inches of rain). These runoff volumes are summarized in Table 2. A substantial amount of rainwater drains from impervious surfaces in Upper Pittsgrove Township. For example, if the stormwater runoff from one water quality storm (1.25 inches of rain) in the Muddy Run subwatershed was harvested and purified, it could supply water to 43 homes for one year¹.

¹ Assuming 300 gallons per day per home

Table 1: Impervious cover analysis by subwatershed for Upper Pittsgrove Township

Subwatershed	Total Area		Land Use Area		Water Area		Impervious Cover		
	(ac)	(mi ²)	(ac)	(mi ²)	(ac)	(mi ²)	(ac)	(mi ²)	(%)
Alloway Creek	1,360.7	2.13	1,351.5	2.11	9.2	0.01	18.8	0.03	1.4%
Cohansey River	349.3	0.55	348.2	0.54	1.1	0.00	9.0	0.01	2.6%
Cool Run	1,564.3	2.44	1,560.1	2.44	4.1	0.01	17.6	0.03	1.1%
Indian Run / Muddy Run	2,549.2	3.98	2,545.6	3.98	3.5	0.01	14.8	0.02	0.6%
Muddy Run	7,490.9	11.70	7,455.1	11.65	35.8	0.06	137.7	0.22	1.8%
Oldman's Creek	2,317.9	3.62	2,295.7	3.59	22.2	0.03	41.4	0.06	1.8%
Palatine Branch / Muddy Run	2,269.2	3.55	2,266.2	3.54	2.9	0.00	18.3	0.03	0.8%
Reed Branch / Still Run	1,252.8	1.96	1,249.6	1.95	3.2	0.00	18.3	0.03	1.5%
Salem River	4,940.5	7.72	4,870.6	7.61	69.9	0.11	85.3	0.13	1.8%
Still Run	1,749.8	2.73	1,746.3	2.73	3.5	0.01	56.4	0.09	3.2%
Total	25,844.3	40.38	25,688.9	40.14	155.5	0.24	417.6	0.65	1.6%

Subwatersheds of Upper Pittsgrove Township



- | | | | |
|--|---|--|---|
| Alloway Creek | Indian Run / Muddy Run | Palatine Branch / Muddy Run | Still Run |
| Cohansey River | Muddy Run | Reed Branch / Still Run | |
| Cool Run | Oldmans Creek | Salem River | |

Figure 6: Map of the subwatersheds in Upper Pittsgrove Township

Table 2: Stormwater runoff volumes from impervious surfaces by subwatershed in Upper Pittsgrove 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 (5.0") (Mgal)	Total Runoff Volume for the 100-Year Design Storm (8.5") (Mgal)
Alloway Creek	0.6	22.4	1.7	2.5	4.3
Cohansey River	0.3	10.7	0.8	1.2	2.1
Cool Run	0.6	21.0	1.6	2.4	4.0
Indian Run / Muddy Run	0.5	17.7	1.3	2.0	3.4
Muddy Run	4.7	164.5	12.2	18.7	31.6
Oldman's Creek	1.4	49.5	3.7	5.6	9.5
Palatine Branch / Muddy Run	0.6	21.8	1.6	2.5	4.2
Reed Branch / Still Run	0.6	21.8	1.6	2.5	4.2
Salem River	2.9	101.9	7.6	11.6	19.6
Still Run	1.9	67.4	5.0	7.7	12.9
Total	14.2	498.9	37.0	56.7	95.8

The next step is to set a reduction goal for impervious area in each subwatershed. Based upon the Rutgers Cooperative Extension (RCE) Water Resources Program's experience, a 10% reduction would be a reasonably achievable reduction for these subwatersheds in Upper Pittsgrove 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 Upper Pittsgrove Township

Subwatershed	Recommended Impervious Area Reduction (10%) (ac)	Annual Runoff Volume Reduction ² (MGal)
Alloway Creek	1.9	2.1
Cohansey River	0.9	1.0
Cool Run	1.8	2.0
Indian Run / Muddy Run	1.5	1.7
Muddy Run	13.8	15.6
Oldman's Creek	4.1	4.7
Palatine Branch / Muddy Run	1.8	2.1
Reed Branch / Still Run	1.8	2.1
Salem River	8.5	9.7
Still Run	5.6	6.4
Total	41.8	47.4

² Annual Runoff Volume Reduction =

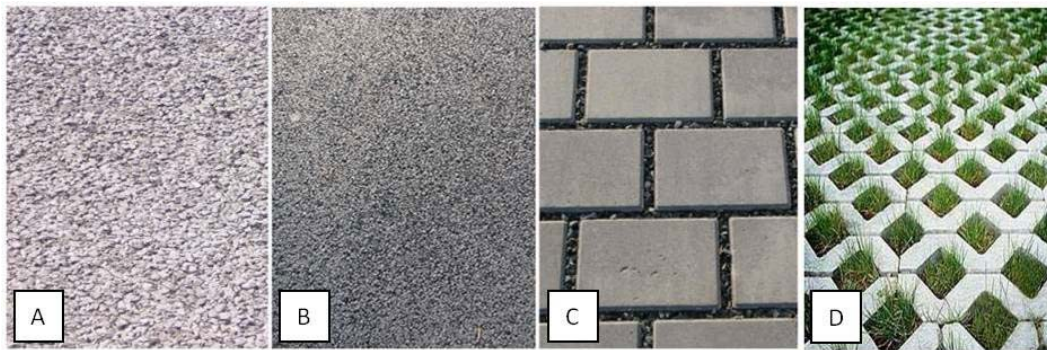
Acres of IC x 43,560 ft²/ac x 44 in x (1 ft/12 in) x 0.95 x (7.48 gal/ft³) x (1 MGal/1,000,000 gal)

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 Upper Pittsgrove 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 Upper Pittsgrove 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

Upper Pittsgrove 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.

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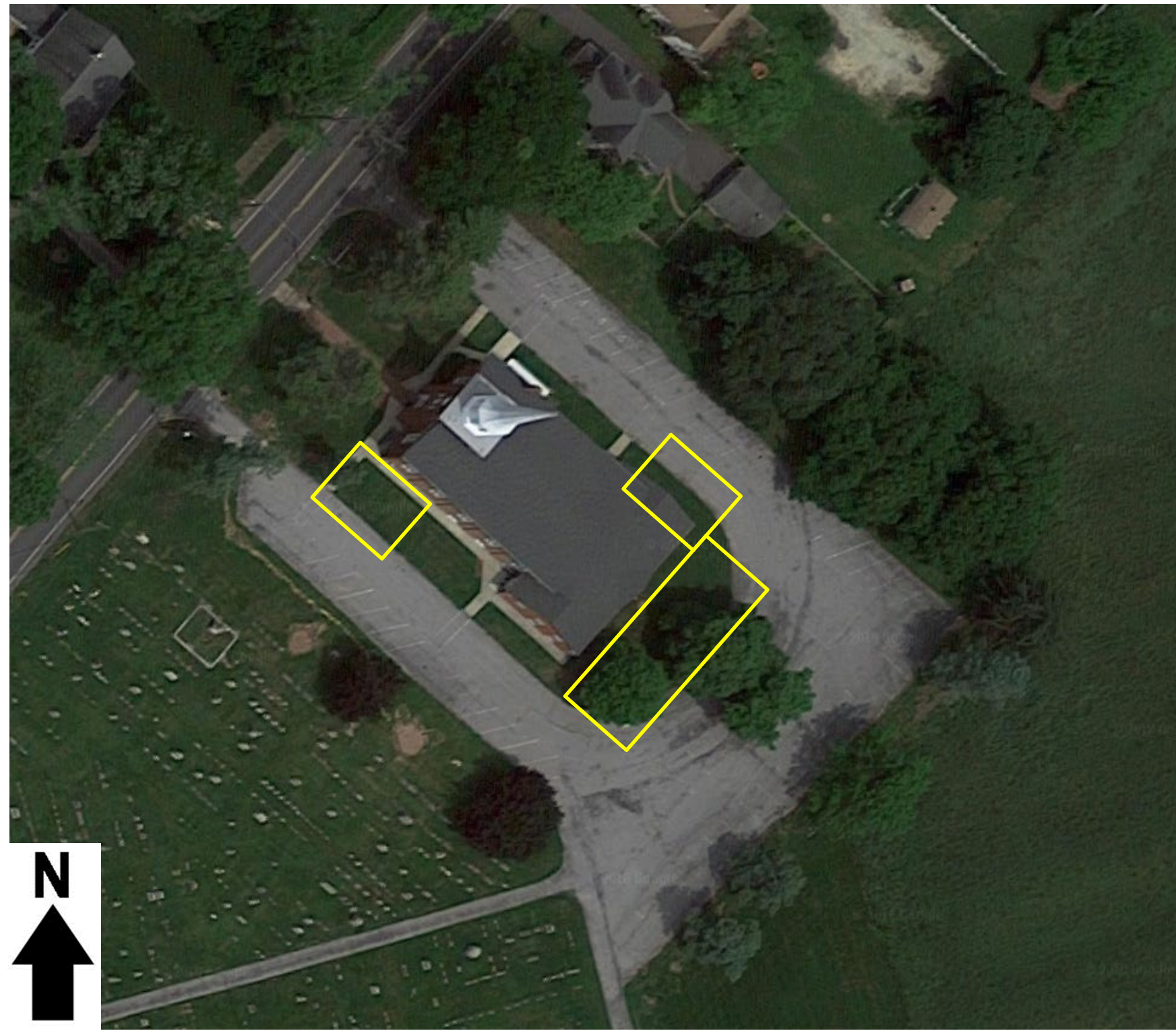
Appendix A

Concept Plans and Detailed Green Infrastructure Information Sheets

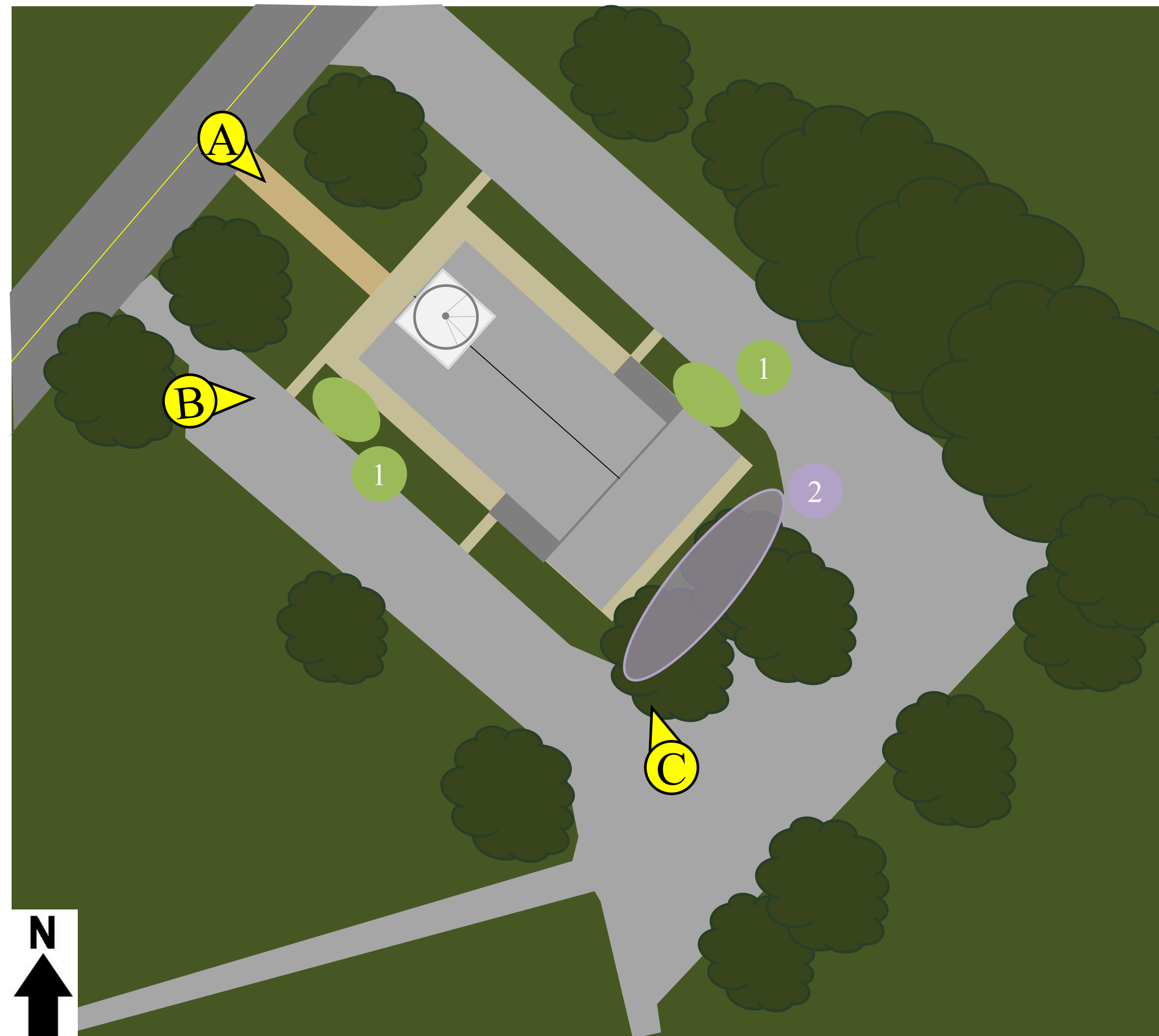
Upper Pittsgrove Township Impervious Cover Assessment

Pittsgrove Presbyterian Church, 312 Daretown Road

PROJECT LOCATION:



SITE PLAN:



- 1 BIORETENTION SYSTEM:** Rain gardens are used to reduce sediment and nutrient loading to the local waterway and increase groundwater recharge. Rain gardens can be built at the northwest end and the southeast end of the building.
- 2 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 southern end of the building.

A



B



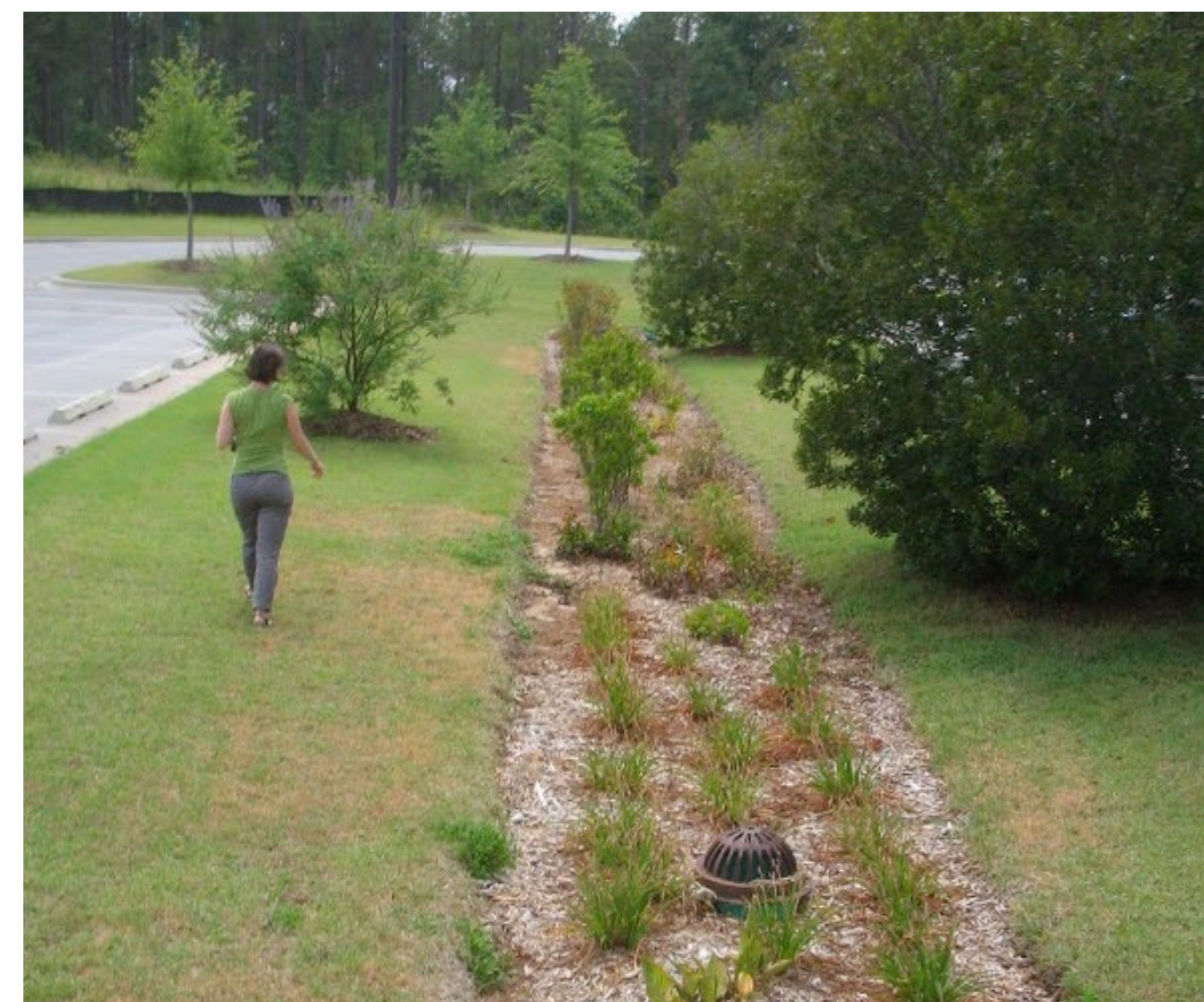
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1 BIORETENTION SYSTEM



2 BIOSWALE



Pittsgrove Presbyterian Church
Green Infrastructure Information Sheet

<p>Location: 312 Daretown Road Elmer, NJ 08318</p>	<p>Municipality: Upper Pittsgrove</p>
<p>Green Infrastructure Description: bioretention systems (rain gardens) bioswale</p>	<p>Subwatershed: Alloway Creek</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 TSS removal potential: yes stormwater peak reduction potential: yes</p>	<p>Stormwater Captured and Treated Per Year: rain garden #1: 48,980 gal. rain garden #2: 50,030 gal. bioswale: 8,730 gal.</p>
<p>Existing Conditions and Issues: Six connected downspouts surround the perimeter of the church. There is a cemetery present on the western majority of property.</p>	
<p>Proposed Solution(s): On both the western and eastern facing sides of the church, two respective rain gardens can be installed to treat runoff by disconnecting and redirecting the downspouts. A bioswale can be built behind the church, alongside the pavement, to capture runoff from the roof as well as the parking lot.</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 wildlife habitat.</p> <p>The bioswale will capture, treat, and infiltrate stormwater and reduce TN by 30%, TP by 60%, and TSS by 90%.</p>	
<p>Possible Funding Sources: mitigation funds from local developers NJDEP grant programs grants from foundations Upper Pittsgrove Township Pittsgrove Presbyterian Church</p>	
<p>Partners/Stakeholders: Upper Pittsgrove Township local parishioners local community groups (Boy Scouts, Girl Scouts, etc.) Rutgers Cooperative Extension</p>	

Pittsgrove Presbyterian Church
Green Infrastructure Information Sheet

Estimated Cost:

Rain garden #1 would need to be approximately 470 square feet. At \$5 per square foot, the estimated cost is \$2,350. Rain garden #2 would need to be approximately 480 square feet. At \$5 per square foot, the estimated cost is \$2,400.

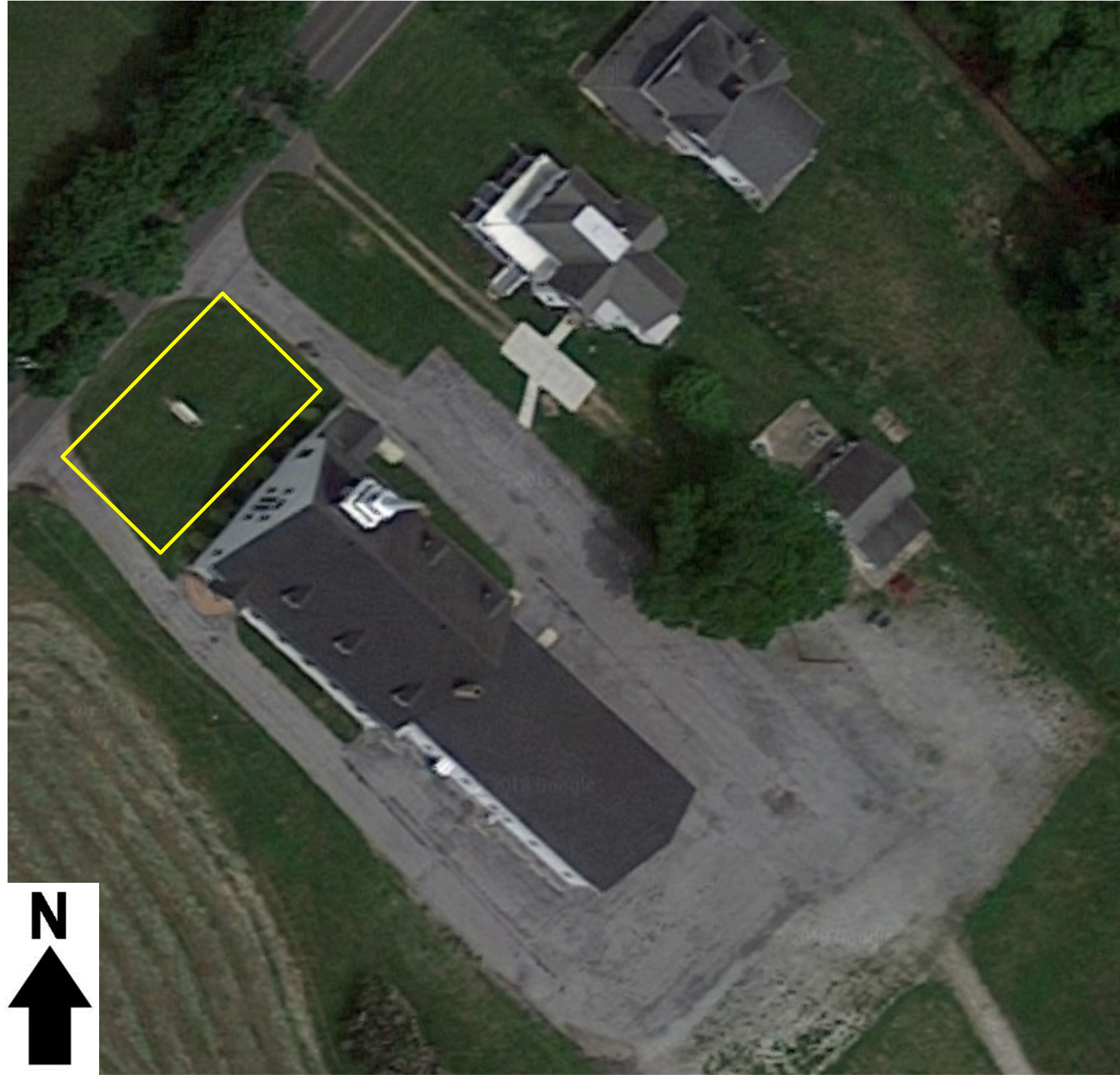
The bioswale would need to be 21 feet long and 4 feet wide (84 sq.ft.). At \$5 per square foot, the estimate cost of the bioswale is \$420.

The total cost of the project will thus be approximately \$5,170.

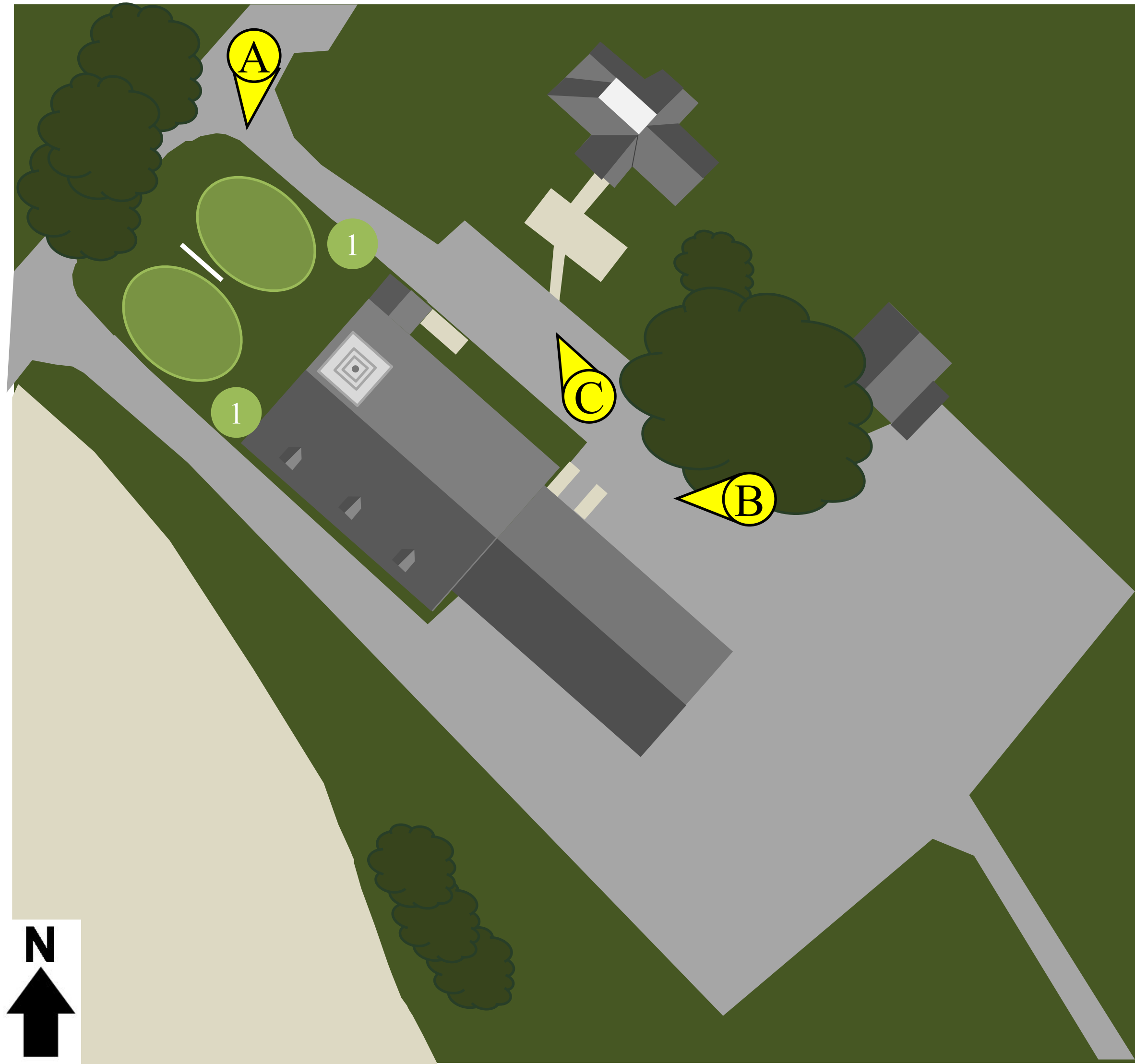
Upper Pittsgrove Township Impervious Cover Assessment

Pittsgrove Baptist Church, 368 Daretown Road

PROJECT LOCATION:

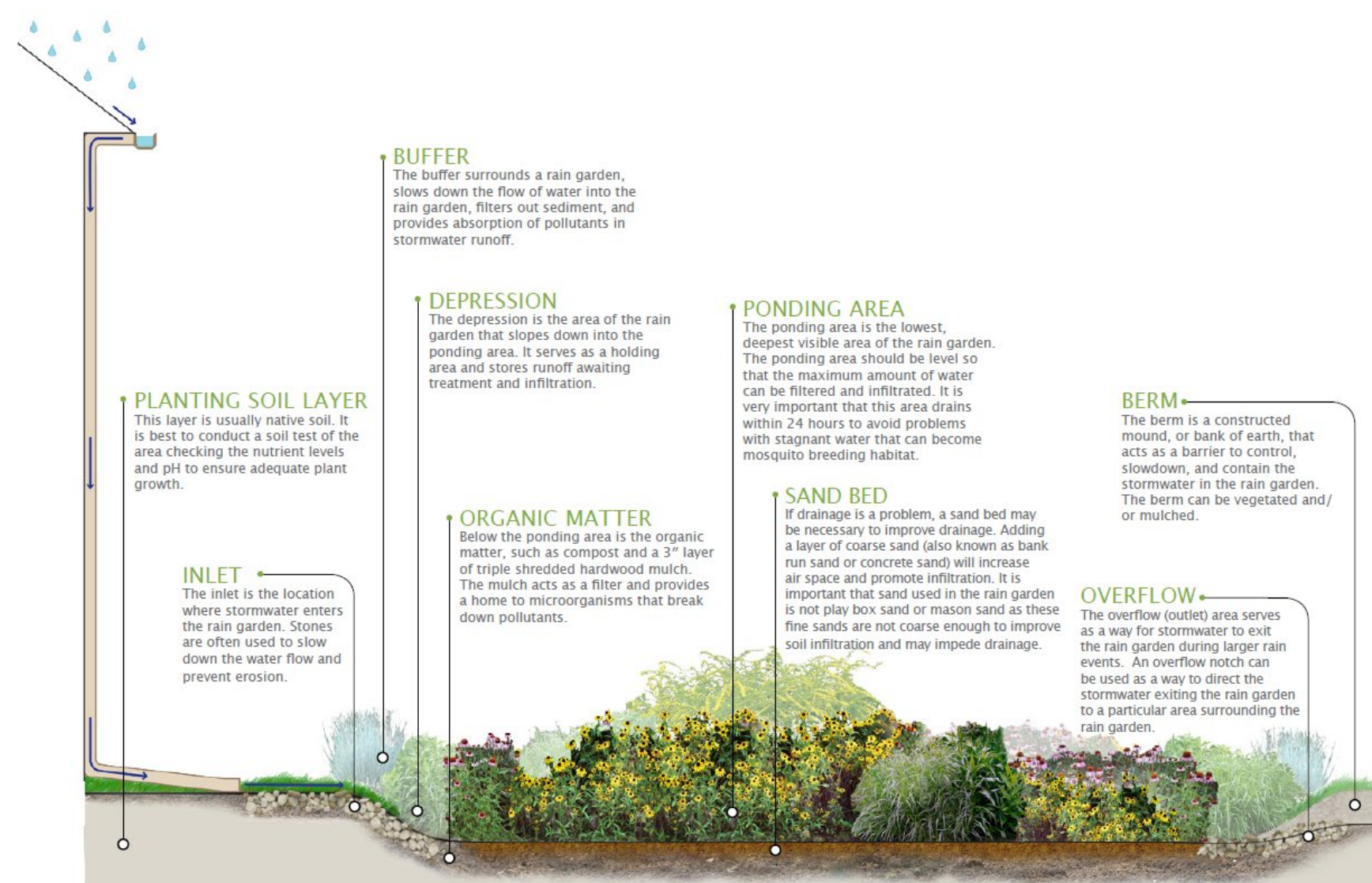


SITE PLAN:



1 BIORETENTION SYSTEM: Rain gardens can be used to reduce sediment and nutrient loading to the local waterway and increase groundwater recharge. Two rain gardens can be installed in front of the church.

1 BIORETENTION SYSTEM



A



B



C



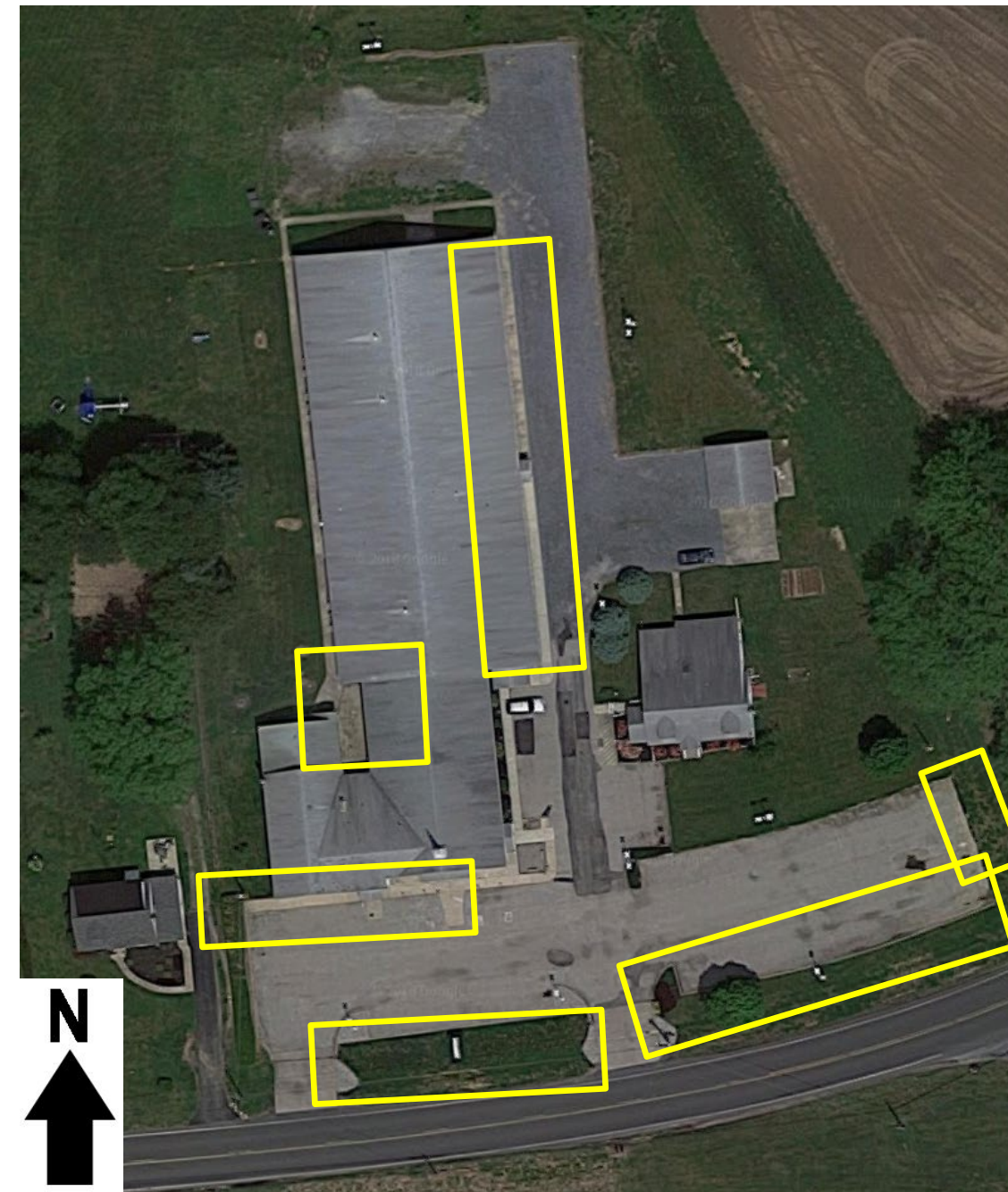
Pittsgrove Baptist Church
Green Infrastructure Information Sheet

<p>Location: 368 Daretown Road Elmer, NJ 08318</p>	<p>Municipality: Upper Pittsgrove Township</p>
<p>Green Infrastructure Description: bioretention systems (rain gardens)</p>	<p>Subwatershed: Salem River</p>
<p>Mitigation Opportunities: recharge potential: yes TSS removal potential: yes stormwater peak reduction potential: yes</p>	<p>Targeted Pollutants: total nitrogen (TN), total phosphorus (TP), and total suspended solids (TSS) in surface runoff</p>
<p>Stormwater Captured and Treated Per Year: bioretention system: 97,970 gal.</p>	
<p>Existing Conditions and Issues: Several connected and six disconnected downspouts surround the perimeter of the church.</p>	
<p>Proposed Solution(s): A rain garden can be installed in front of the church and would be able to capture the stormwater runoff from the roof by redirecting the nearby downspouts into the rain garden.</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 wildlife habitat.</p>	
<p>Possible Funding Sources: mitigation funds from local developers NJDEP grant programs grants from foundations Pittsgrove Baptist Church Upper Pittsgrove Township</p>	
<p>Partners/Stakeholders: local parishioners local community groups (Boy Scouts, Girl Scouts, etc.) Rutgers Cooperative Extension Upper Pittsgrove Township</p>	
<p>Estimated Cost: A rain garden to capture the parking lot runoff would need to be approximately 940 square feet. At \$5 per square foot, the estimated cost of the rain garden is \$4,700.</p>	

Upper Pittsgrove Township Impervious Cover Assessment

Faith Orthodox Presbyterian Church, 545 Daretown Road

PROJECT LOCATION:



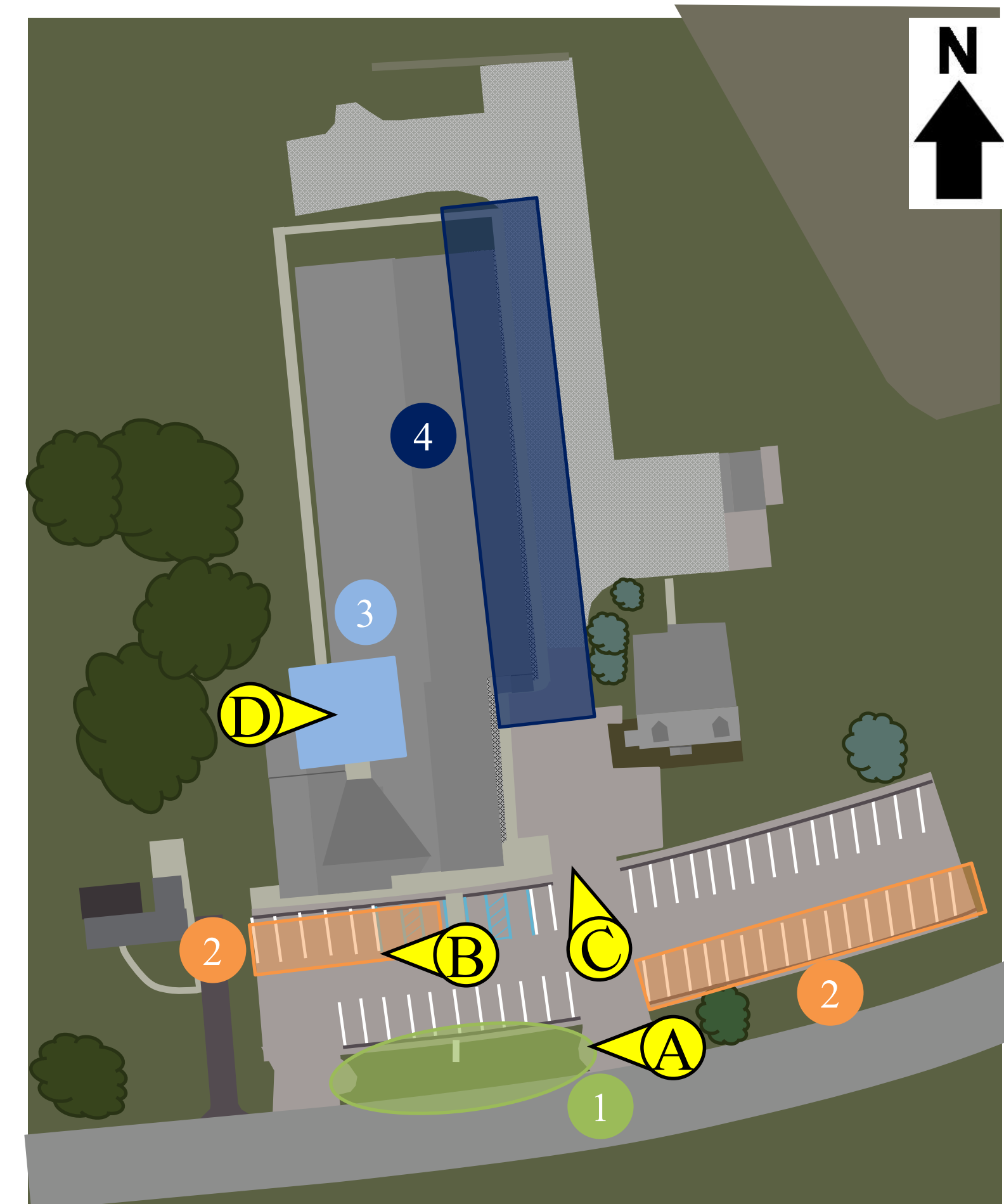
A



B



SITE PLAN:



C



D



- 1 BIORETENTION SYSTEM:** Rain gardens are used to reduce sediment and nutrient loading to the local waterway and increase groundwater recharge.
- 2 PERVIOUS PAVEMENT:** Parking spaces can be replaced with pervious pavement to infiltrate runoff.
- 3 RAINWATER HARVESTING SYSTEM:** These systems capture rainwater in cisterns or rain barrels. The water can then be used for watering gardens, washing vehicles, or for other non-potable uses.
- 4 DOWNSPOUT PLANTER:** These are wooden boxes with plants installed at the base of a downspout that provide an opportunity to beneficially reuse rooftop runoff.

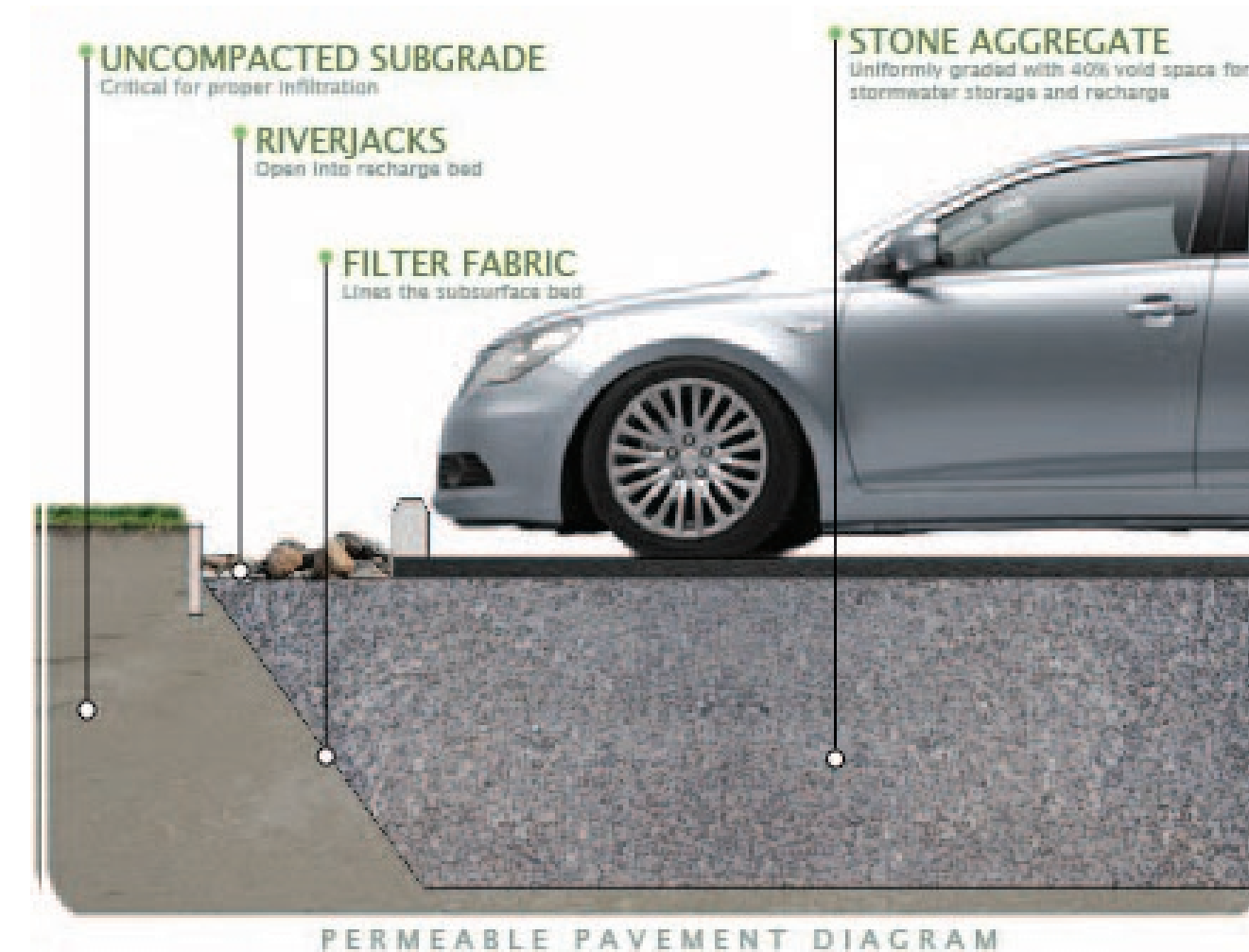
1

BIORETENTION SYSTEM



2

PERVIOUS PAVEMENT



3

RAINWATER HARVESTING SYSTEM



4

DOWNSPOUT PLANTER



Faith Orthodox Presbyterian Church
Green Infrastructure Information Sheet

<p>Location: 545 Daretown Road Elmer, NJ 08318</p>	<p>Municipality: Upper Pittsgrove Township</p>
<p>Green Infrastructure Description: bioretention systems (rain gardens) downspout planter pervious pavement rainwater harvesting system (cistern)</p>	<p>Subwatershed: Salem 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 TSS removal potential: yes stormwater peak reduction potential: yes</p>	<p>Stormwater Captured and Treated Per Year: bioretention system: 79,730 gal. six downspout planters: 7,960 gal. pervious pavement: 364,770 gal. rainwater harvesting system: 31,655 gal.</p>
<p>Existing Conditions and Issues: Connected downspouts surround the church. The back driveway and parking lot is gravel. Erosion and sediment accumulation were present in the parking lot in front of the church when assessed.</p>	
<p>Proposed Solution(s): Adjacent to the parking lot in front of the church, a rain garden can be built to treat stormwater from the pavement. Pervious pavement can be used to replace parking spaces in the parking lot near the front of the building. Six downspout planter boxes can be set up to reuse runoff from the east side of the church. A cistern can be placed at the west side of the building, which can capture and store rainwater from the church roof.</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 Upper Pittsgrove 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>Cisterns can harvest stormwater which can be used for washing vehicles, 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>	

Faith Orthodox Presbyterian Church
Green Infrastructure Information Sheet

Downspout planters will take in runoff from downspouts and achieve similar reductions in TN, TP, and TSS as the bioretention systems.

Possible Funding Sources:

mitigation funds from local developers
NJDEP grant programs
grants from foundations
Upper Pittsgrove Township
home and school associations

Partners/Stakeholders:

local parishioners
local community groups (Boy Scouts, Girl Scouts, etc.)
Rutgers Cooperative Extension

Estimated Cost:

A rain garden to capture the parking lot runoff would need to be approximately 765 square feet. At \$5 per square foot, the estimated cost of the rain garden is \$3,825.

The porous asphalt would cover 2,500 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 \$62,500.

The cistern would be 2,000 gallons and cost approximately \$4,000 to purchase and install.

The estimated cost of each planter box is \$1,000 for a total cost of \$6,000.

The total cost of the project will thus be approximately \$76,325.