



Draft

**Impervious Cover Assessment
for
Tabernacle Township, Burlington County, New Jersey**

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

April 25, 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

Tabernacle Township Impervious Cover Analysis

Tabernacle Township is located in Burlington County, New Jersey and covers approximately 49.57 square miles west of Woodland Township. Figures 3 and 4 illustrate that Tabernacle Township is dominated by forest land uses. A total of 10.4% of the municipality's land use is classified as urban. Of the urban land in Tabernacle Township, low density 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.

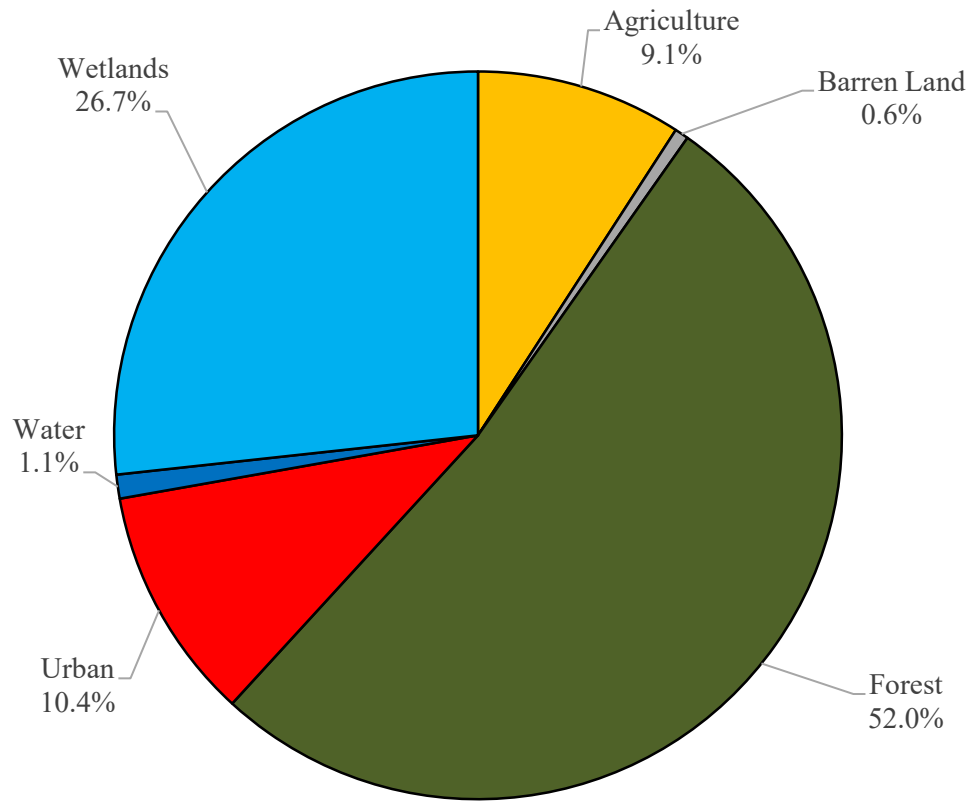


Figure 3: Pie chart illustrating the land use in Tabernacle Township

Land Use for Tabernacle Township

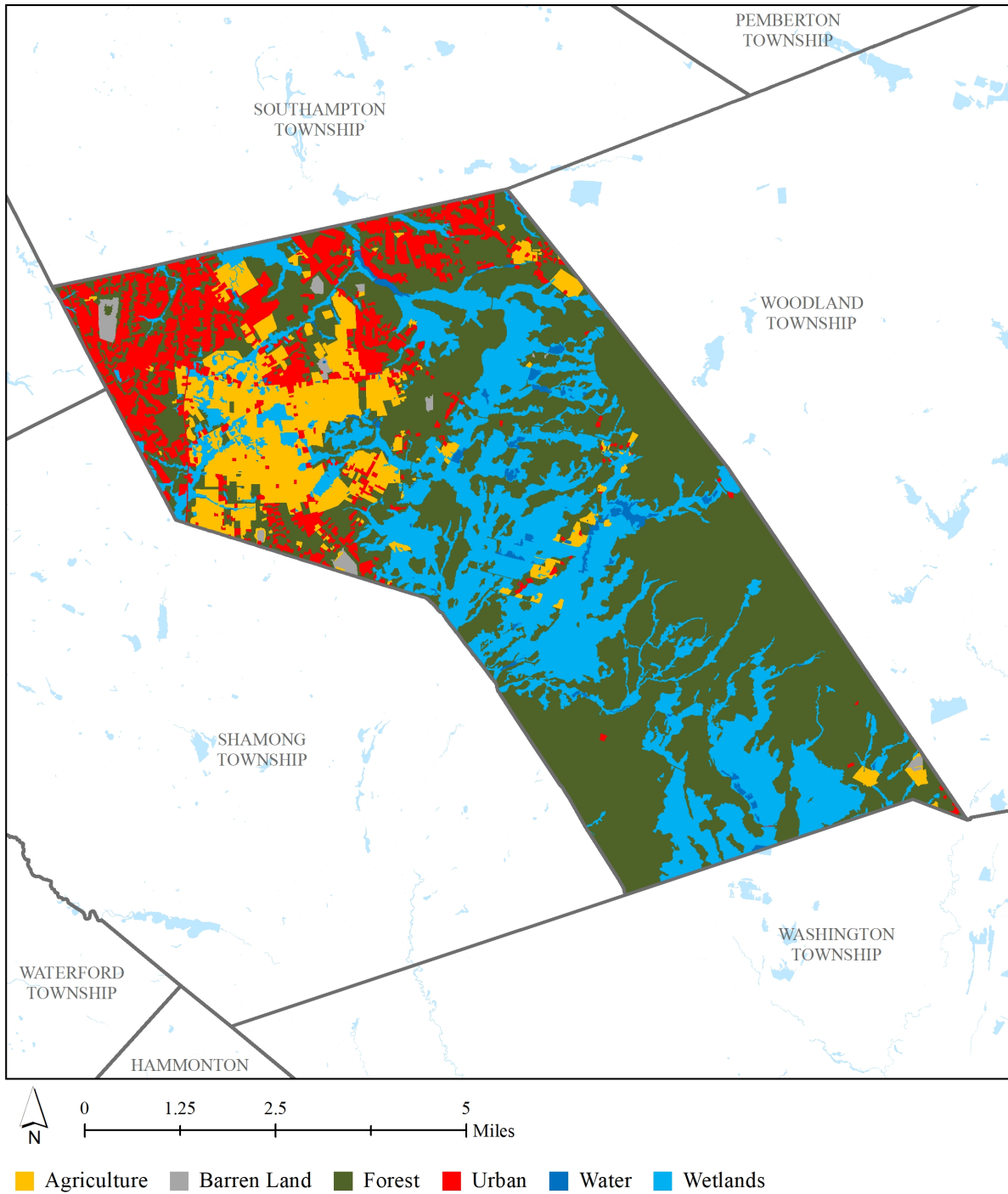


Figure 4: Map illustrating the land use in Tabernacle Township

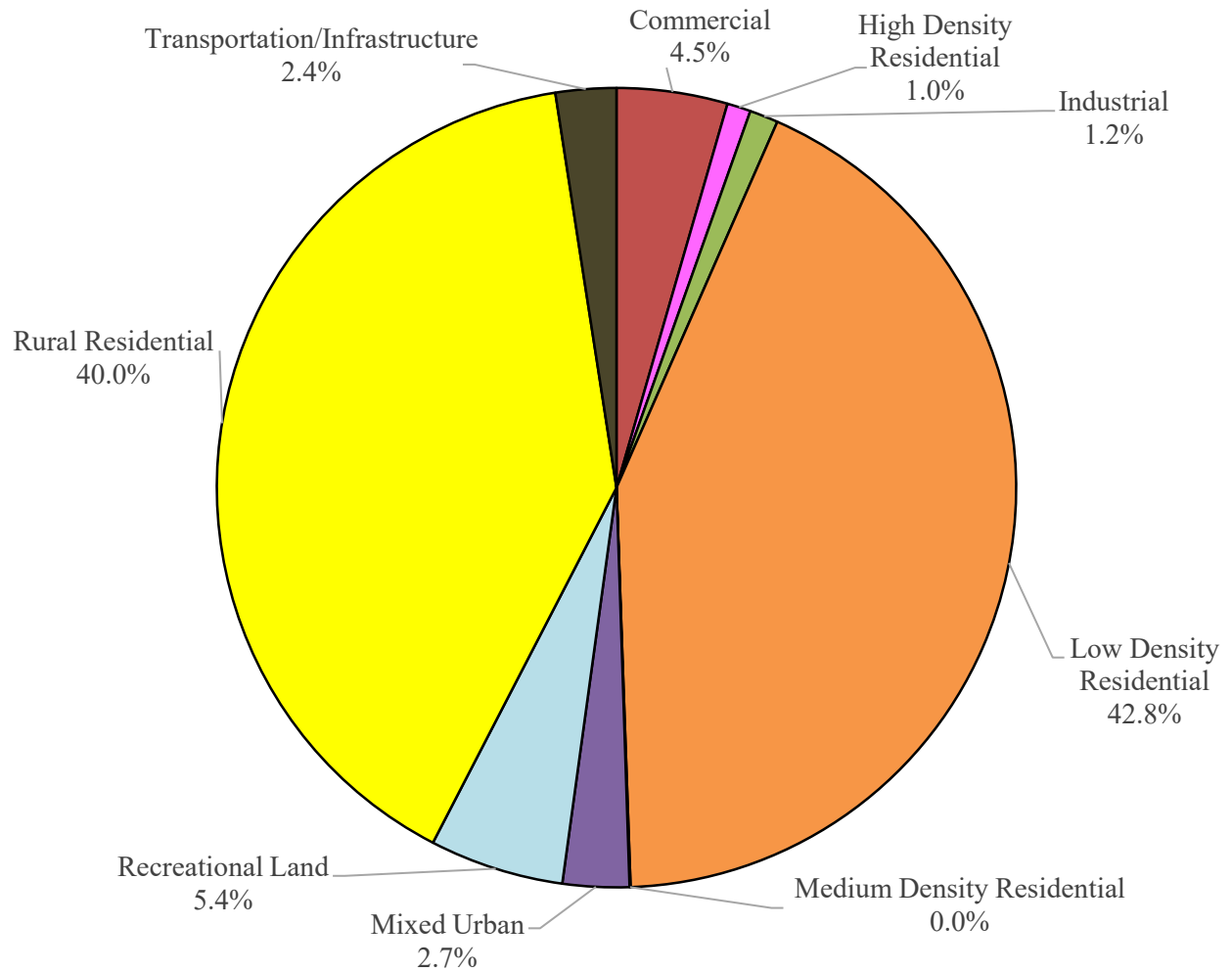


Figure 5: Pie chart illustrating the various types of urban land use in Tabernacle Township

The New Jersey Department of Environmental Protection's (NJDEP) 2012 land use/land cover geographical information system (GIS) data layer categorizes Tabernacle 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 Tabernacle Township. Based upon the 2012 NJDEP land use/land cover data, approximately 4.2% of Tabernacle Township has impervious cover. This level of impervious cover suggests that the streams in Tabernacle 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 Tabernacle Township (Table 1 and Figure 6). On a subwatershed basis, impervious cover ranges from 0.2% in the Wading River subwatershed to 13.9% in the Tulpehocken Creek 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.

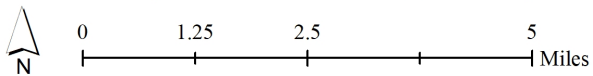
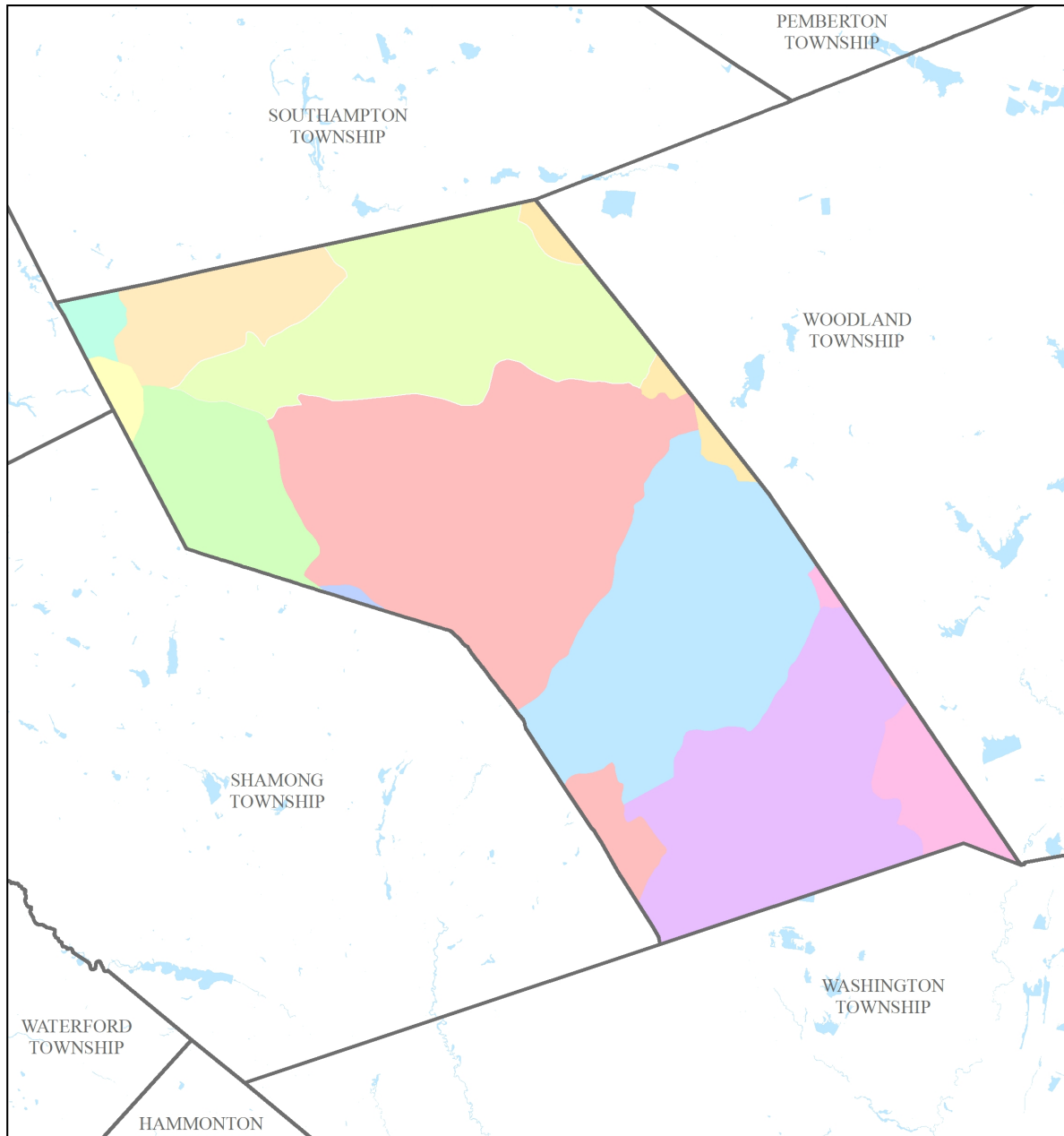
In developed landscapes, stormwater runoff from parking lots, driveways, sidewalks, and rooftops flows to drainage pipes that feed the sewer system. The cumulative effect of these impervious surfaces and thousands of connected downspouts reduces the amount of water that can infiltrate into soils and greatly increases the volume and rate of runoff that flows to waterways. Stormwater runoff volumes (specific to Tabernacle Township, Burlington 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 (3.4 inches of rain), the 10-year design storm (5.2 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 Tabernacle Township. For example, if the stormwater runoff from one water quality storm (1.25 inches of rain) in the Tulpehocken Creek subwatershed was harvested and purified, it could supply water to 225 homes for one year¹.

¹ Assuming 300 gallons per day per home

Table 1: Impervious cover analysis by subwatershed for Tabernacle Township

Subwatershed	Total Area		Land Use Area		Water Area		Impervious Cover		
	(ac)	(mi ²)	(ac)	(mi ²)	(ac)	(mi ²)	(ac)	(mi ²)	(%)
Batsto River	8,941.7	13.97	8,825.1	13.79	116.5	0.18	61.9	0.10	0.7%
Bear Swamp River	1,786.4	2.79	1,783.3	2.79	3.1	0.00	163.6	0.26	9.2%
Burrs Mill Brook	461.5	0.72	460.1	0.72	1.4	0.00	3.0	0.00	0.7%
Friendship Creek	5,412.3	8.46	5,342.6	8.35	69.8	0.11	213.3	0.33	4.0%
Haynes Creek	250.9	0.39	250.9	0.39	0.0	0.00	25.5	0.04	10.2%
Indian Mills Brook	2,207.8	3.45	2,202.4	3.44	5.4	0.01	83.1	0.13	3.8%
Little Creek	314.2	0.49	314.2	0.49	0.0	0.00	34.1	0.05	10.9%
Skit Branch / Batsto River	5,933.9	9.27	5,829.3	9.11	104.6	0.16	2.3	0.00	0.0%
Springers Brook / Deep Run	62.6	0.10	62.6	0.10	0.0	0.00	1.2	0.00	2.0%
Tulpehocken Creek	5,244.6	8.19	5,210.7	8.14	33.9	0.05	724.3	1.13	13.9%
Wading River	1,108.6	1.73	1,106.4	1.73	2.2	0.00	1.8	0.00	0.2%
Total	31,724.5	49.57	31,387.6	49.04	337.0	0.53	1314.2	0.86	4.2%

Subwatersheds of Tabernacle Township



- | | | |
|---|---|---|
| ■ Batsto River | ■ Haynes Creek | ■ Springers Brook / Deep Run |
| ■ Bear Swamp River | ■ Indian Mills Brook / Muskingum Brook | ■ Tulpehocken Creek |
| ■ Burrs Mill Brook | ■ Little Creek | ■ Wading River West Branch |
| ■ Friendship Creek | ■ Skit Branch | |

Figure 6: Map of the subwatersheds in Tabernacle Township

Table 2: Stormwater runoff volumes from impervious surfaces by subwatershed in Tabernacle 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 (3.4") (Mgal)	Total Runoff Volume for the 10-Year Design Storm (5.2") (Mgal)	Total Runoff Volume for the 100-Year Design Storm (8.8") (Mgal)
Batsto River	2.1	74.0	5.6	8.7	14.8
Bear Swamp River	5.6	195.5	14.9	23.0	39.1
Burrs Mill Brook	0.1	3.6	0.3	0.4	0.7
Friendship Creek	7.2	254.9	19.5	30.0	51.0
Haynes Creek	0.9	30.5	2.3	3.6	6.1
Indian Mills Brook	2.8	99.3	7.6	11.7	19.9
Little Creek	1.2	40.8	3.1	4.8	8.2
Skit Branch / Batsto River	0.1	2.7	0.2	0.3	0.5
Springers Brook / Deep Run	0.0	1.5	0.1	0.2	0.3
Tulpehocken Creek	24.6	865.3	66.1	101.9	173.3
Wading River	0.1	2.2	0.2	0.3	0.4
Total	44.6	1,570.1	119.9	184.8	314.4

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 Tabernacle 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 (3.4 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 Tabernacle Township

Subwatershed	Recommended Impervious Area Reduction (10%) (ac)	Annual Runoff Volume Reduction ² (MGal)
Batsto River	6.2	7.0
Bear Swamp River	16.4	18.6
Burrs Mill Brook	0.3	0.3
Friendship Creek	21.3	24.2
Haynes Creek	2.6	2.9
Indian Mills Brook	8.3	9.4
Little Creek	3.4	3.9
Skit Branch / Batsto River	0.2	0.3
Springers Brook / Deep Run	0.1	0.1
Tulpehocken Creek	72.4	82.2
Wading River	0.2	0.2
Total	131.4	149.2

² Annual Runoff Volume Reduction =

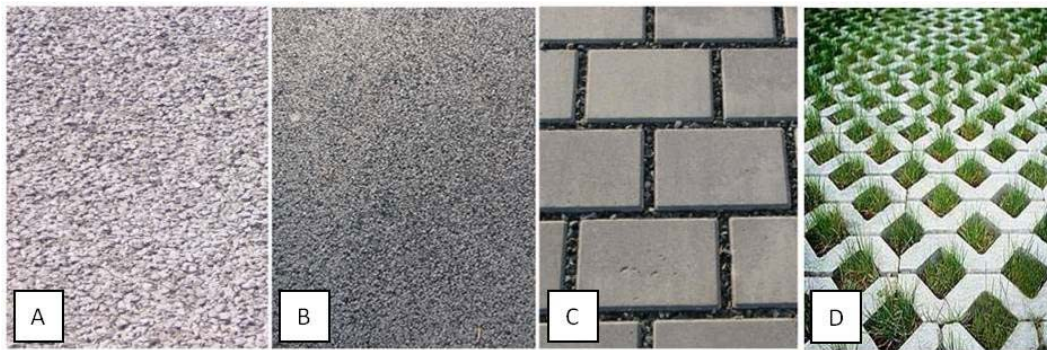
Acres of IC x 43,560 ft²/ac x 44 in x (1 ft/12 in) x 0.95 x (7.48 gal/ft³) x (1 MGal/1,000,000 gal)

All BMPs should be designed to capture the first 3.4 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 Tabernacle 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 Tabernacle 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

Tabernacle 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

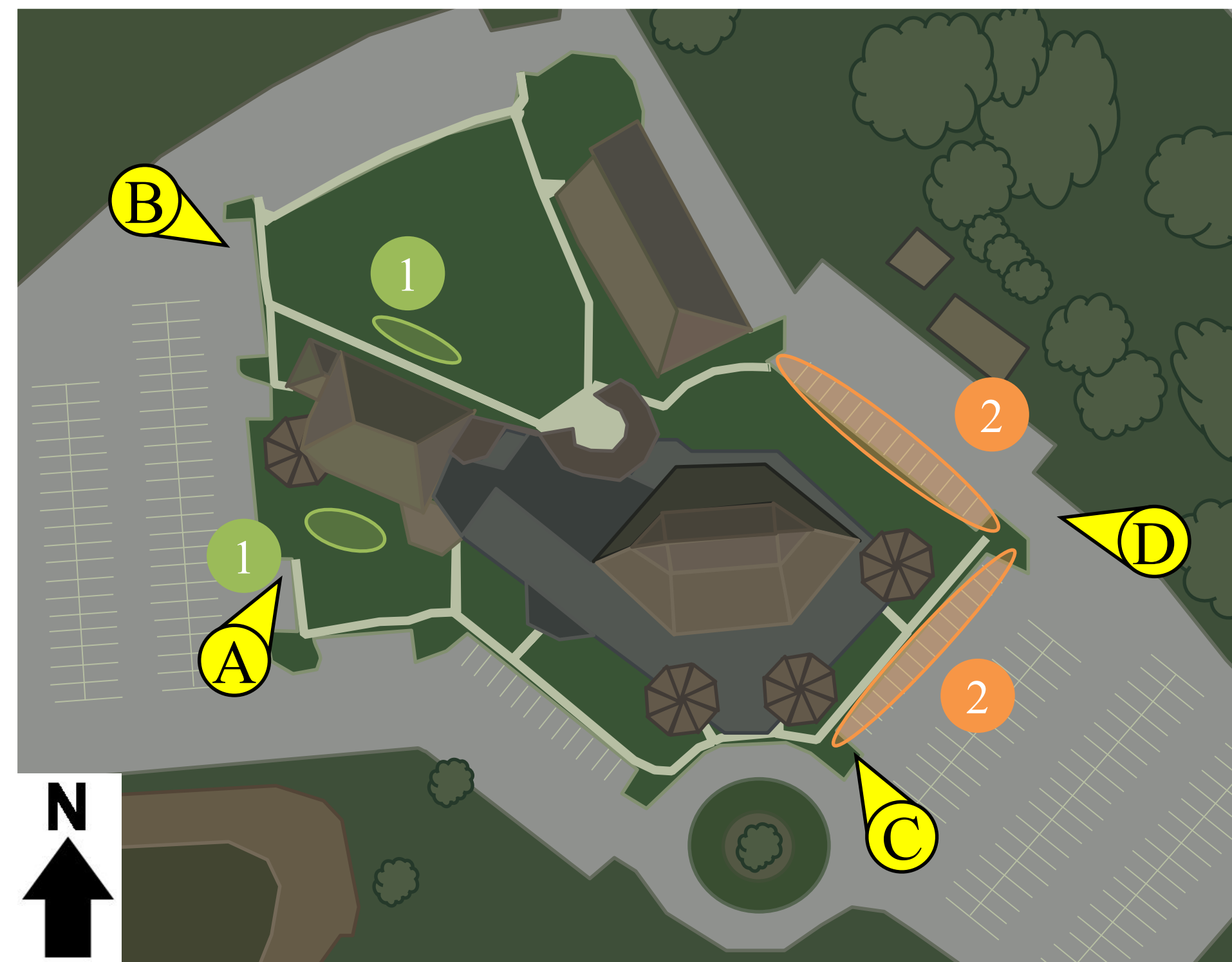
Tabernacle Township Impervious Cover Assessment

Church of the Holy Eucharist, 520 Medford Lakes Road

PROJECT LOCATION:



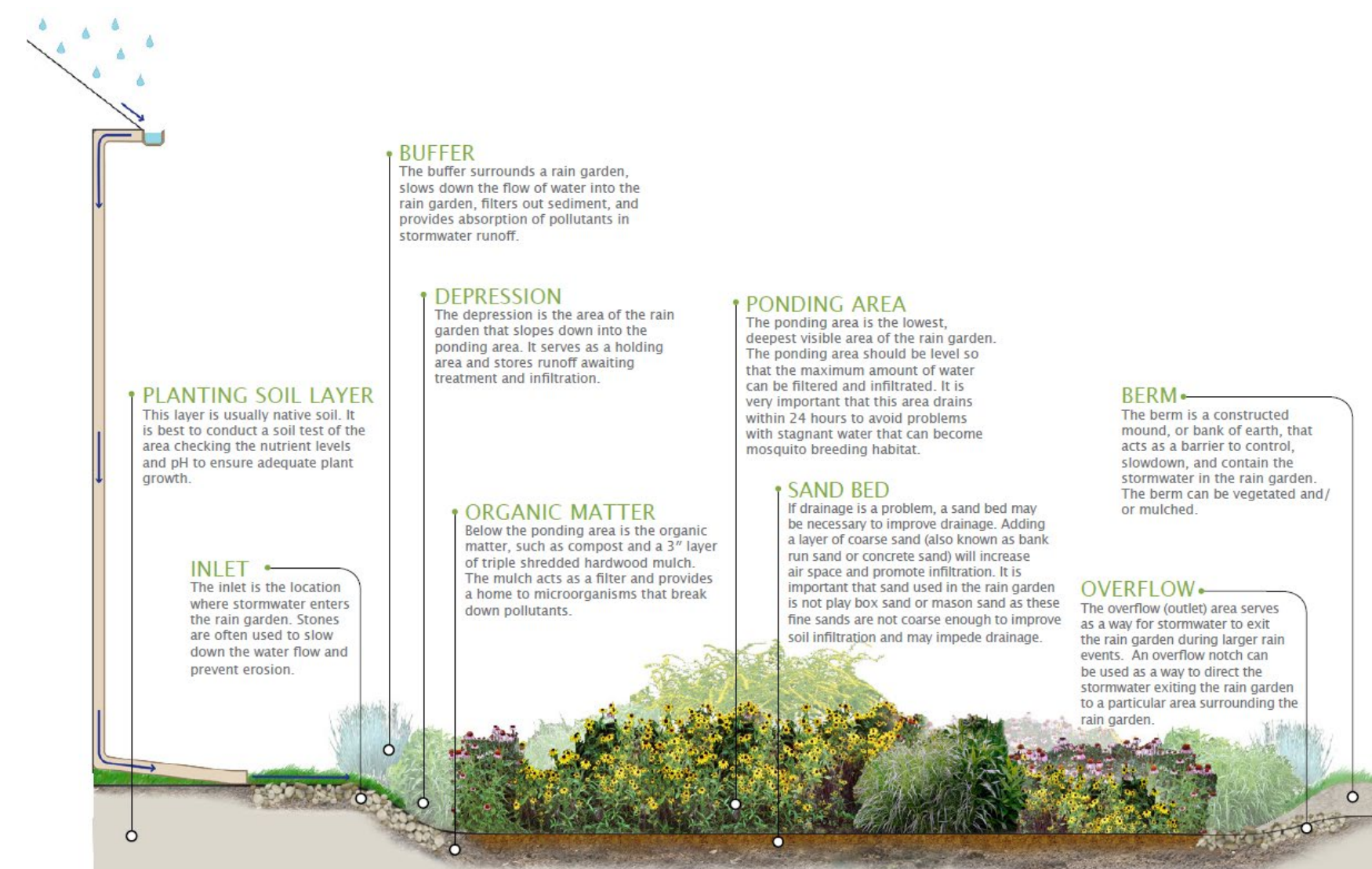
SITE PLAN:



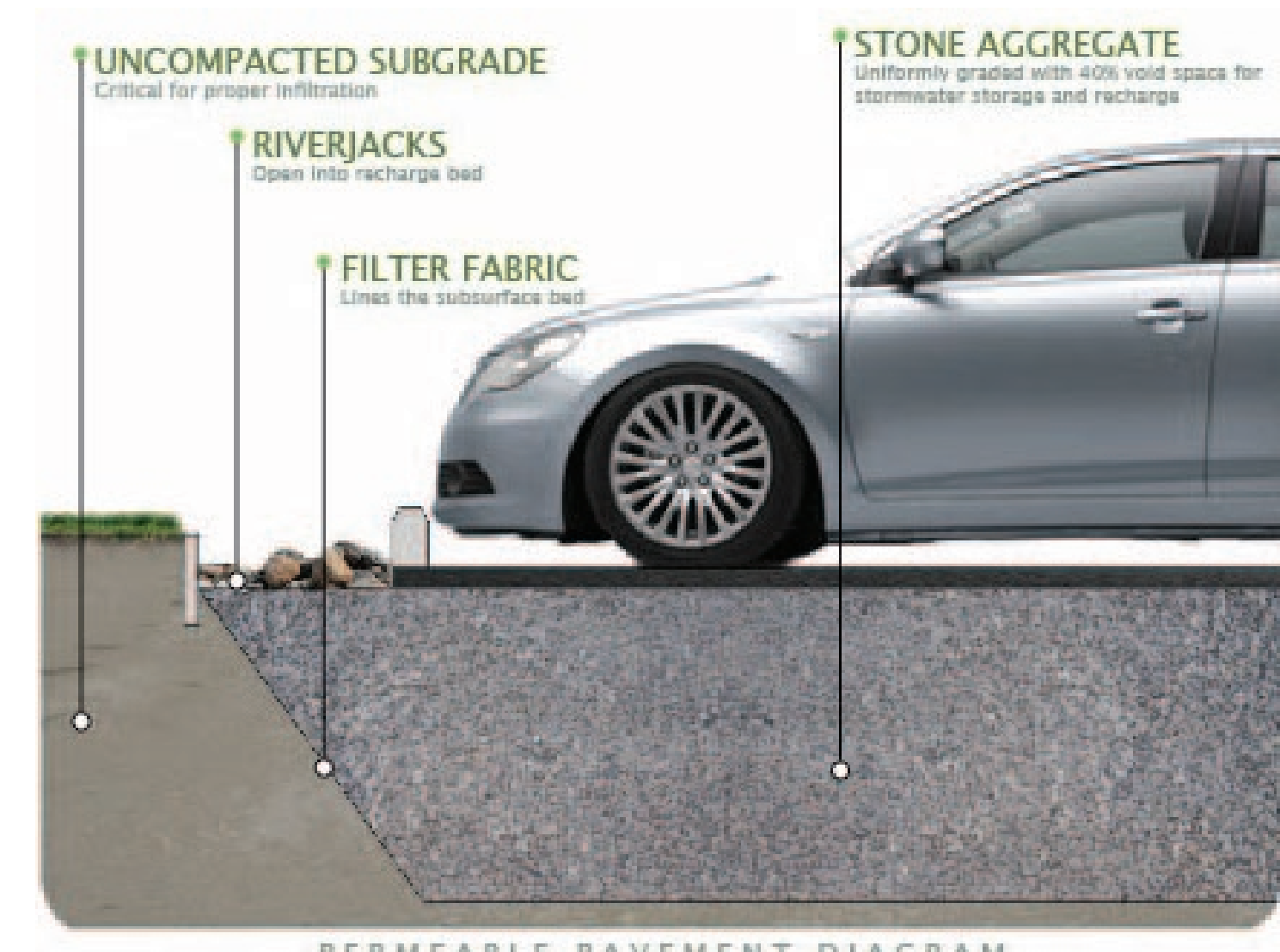
1 BIORETENTION SYSTEM: Rain gardens can be installed on the north and south side of the westernmost building on the church property. Rain gardens are used to reduce sediment and nutrient loading to the local waterway and to increase groundwater recharge.

2 PERVIOUS PAVEMENT: Pervious pavement promotes groundwater recharge and filters stormwater. There are opportunities for pervious pavement in parking spaces along the southeast and northeast sides of the main church building to capture stormwater runoff from the roof as well as part of the parking lot.

1 BIORETENTION SYSTEM



2 PERVIOUS PAVEMENT



D

Church of the Holy Eucharist
Green Infrastructure Information Sheet

<p>Location: 520 Medford Lakes Road Tabernacle, NJ 08088</p>	<p>Municipality: Tabernacle Township</p>
<p>Green Infrastructure Description: bioretention system (rain garden) pervious pavement</p>	<p>Subwatershed: Friendship 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 stormwater peak reduction potential: yes total suspended solids removal potential: yes</p>	<p>Stormwater Captured and Treated Per Year: bioretention system # 1: 68,260 gal. bioretention system # 2: 74,390 gal. pervious pavement system # 1: 236,580 gal. pervious pavement system # 2: 319,050 gal.</p>
<p>Existing Conditions and Issues: The site has a parking lot and multiple buildings which makes up the site's impervious surfaces. Sediment accumulation in some areas of the parking lot is evidence of pooling water. There are a few connected downspouts and many disconnected downspouts along the central building. The disconnected downspouts are currently directing stormwater over pavement, turfgrass, or existing landscaping. There are trenches along the south side of the parking lot directing runoff to a detention basin on the southwest corner of the property.</p>	
<p>Proposed Solution(s): Pervious pavement can be installed in two different locations on the property to help reduce pooling and capture stormwater from the roof and runoff from adjacent areas of the parking lot. The two areas are strips of handicap parking spaces alongside the northeast (porous pavement system #1) and southeast (porous pavement system #2) sides of the central building. Disconnected downspouts, and one connected downspout, on the north side of the westernmost portion of the central building can be redirected to bioretention system #1 which will be a rain garden installed on the north side of a sidewalk that runs along that portion of the building. Additionally, disconnected downspouts on the south side of that same portion of the building can be redirected to bioretention system #2 which will be a rain garden that could be installed near and around the existing flag pole.</p>	
<p>Anticipated Benefits: Since the bioretention systems would be designed to capture, treat, and infiltrate the entire 2-year design storm (3.4 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 parishioners of the church.</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>	

Church of the Holy Eucharist
Green Infrastructure Information Sheet

Possible Funding Sources:

mitigation funds from local developers
NJDEP grant programs
Tabernacle Township
parishioners
Church of the Holy Eucharist
local social and community groups

Partners/Stakeholders:

Tabernacle Township
Church of the Holy Eucharist
local community groups
parishioners
Rutgers Cooperative Extension

Estimated Cost:

Rain garden #1 would need to be approximately 655 square feet. At \$5 per square foot, the estimated cost is \$3,275.

Rain garden #2 would need to be approximately 715 square feet. At \$5 per square foot, the estimated cost is \$3,575.

The pervious pavement system # 1 would cover 2,330 square feet in total and have a two-foot stone reservoir under the surface. At \$25 per square foot, the total cost of the porous asphalt system would be \$58,250.

The pervious pavement system # 2 would cover 2,545 square feet in total and have a two-foot stone reservoir under the surface. At \$25 per square foot, the total cost of the porous asphalt system would be \$63,625.

The total cost of the project will thus be approximately \$128,725.

Tabernacle Township Impervious Cover Assessment

Tabernacle Rescue Squad, 134 New Road

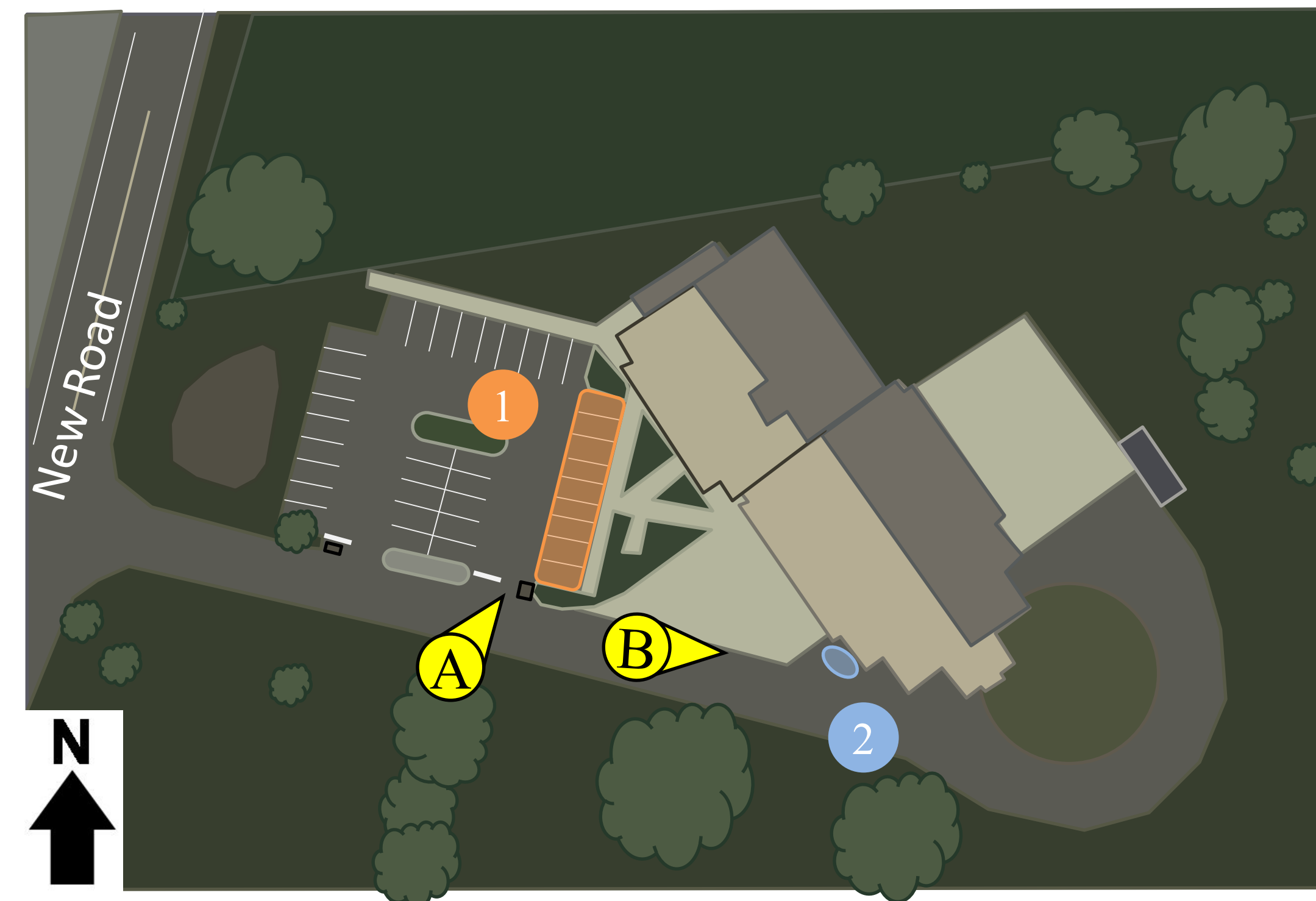
PROJECT LOCATION:



1 PERVIOUS PAVEMENT: Pervious pavement promotes groundwater recharge and filters stormwater. On this site parking spaces on the east side of the parking lot can be replaced using pervious pavement to capture stormwater before it reaches an existing catch basin.

2 RAINWATER HARVESTING SYSTEM: Rainwater can be harvested from the roof of the building and stored in a cistern. The water can be used to wash the rescue vehicles and water existing landscaping.

SITE PLAN:



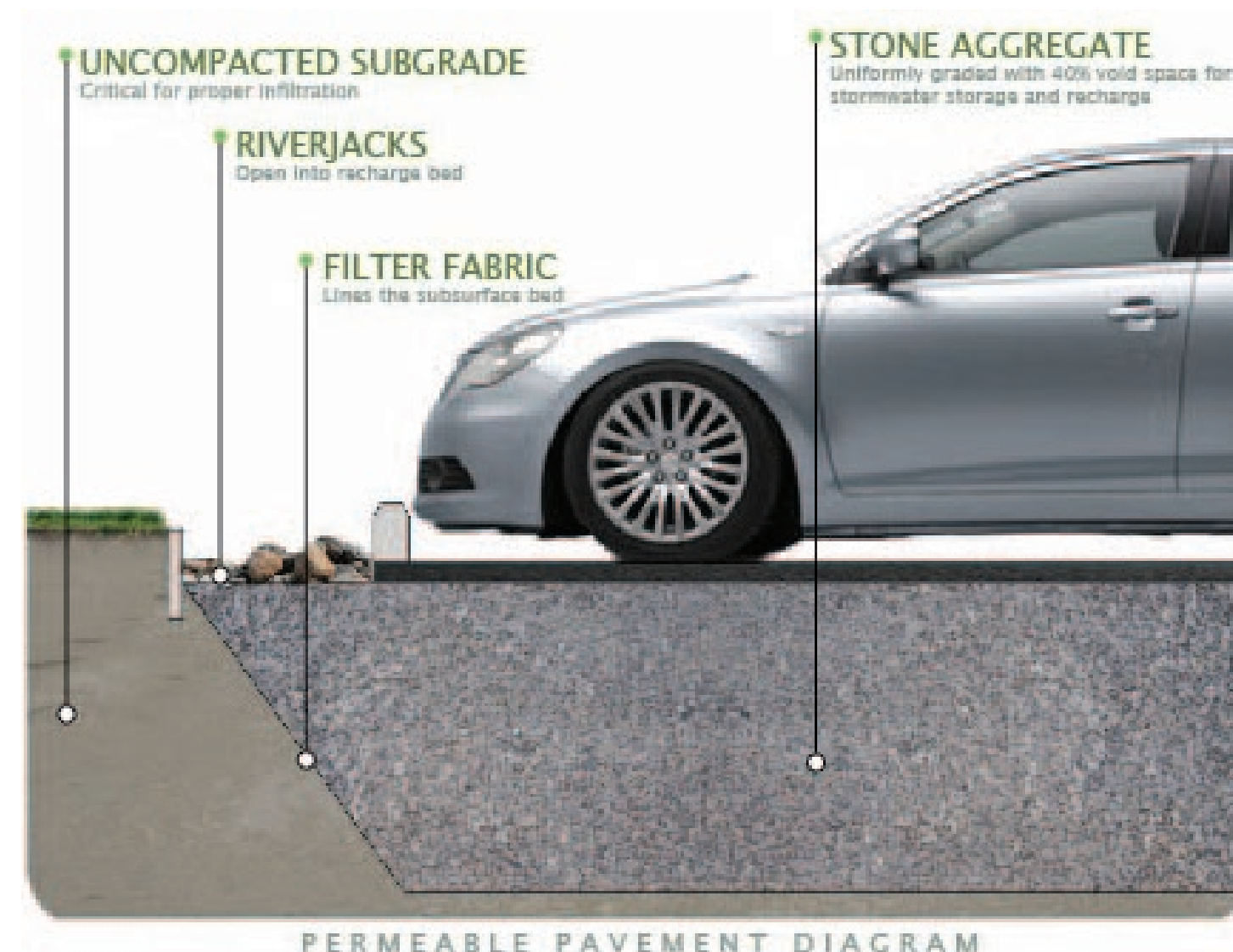
A



B



1 PERVIOUS PAVEMENT



2 RAINWATER HARVESTING SYSTEM



Tabernacle Rescue Squad
Green Infrastructure Information Sheet

<p>Location: 134 New Road Tabernacle, NJ 08088</p>	<p>Municipality: Tabernacle Township</p>
<p>Green Infrastructure Description: pervious pavement rain harvesting system (cistern)</p>	<p>Subwatershed: Batsto 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: porous pavement system: 135,750 gal. rain harvesting system: 47,515 gal.</p>
<p>Existing Conditions and Issues: The property has a parking lot with two catch basins and is flanked on the north and west side by a detention basin and retention basin, respectively. There is sediment accumulation near the parking spaces on the east side of the parking lot in front of the main building. Most of the downspouts on the building are connected and are either connected to the catch basins or the detention or retention basins on the property.</p>	
<p>Proposed Solution(s): Pervious pavement can be installed in the parking spaces on the east side of the parking lot to capture runoff from the parking lot and stormwater from the roof before it reaches an existing catch basin. If the connected downspouts are not already directed towards the existing detention and/or retention basins, then they can be disconnected and redirected towards the installed pervious pavement. Additionally, a cistern can be installed adjacent to the front south corner of the main building to capture water from the nearby downspouts by disconnecting and redirecting them.</p>	
<p>Anticipated Benefits: 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 reduce TN by 30%, TP by 60%, and TSS by 90%.</p> <p>Cisterns can harvest stormwater which can be used for watering plants, washing vehicles, or other purposes which cuts back on 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 Tabernacle Township local social and community groups</p>	

Tabernacle Rescue Squad
Green Infrastructure Information Sheet

Partners/Stakeholders:

Tabernacle Township
Tabernacle Rescue Squad
local community groups
Rutgers Cooperative Extension

Estimated Cost:

The porous asphalt would cover 930 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 \$23,250.

The cistern would be 3,000 gallons and cost approximately \$6,000 to purchase and install.

The total cost of the project will thus be approximately \$29,250.

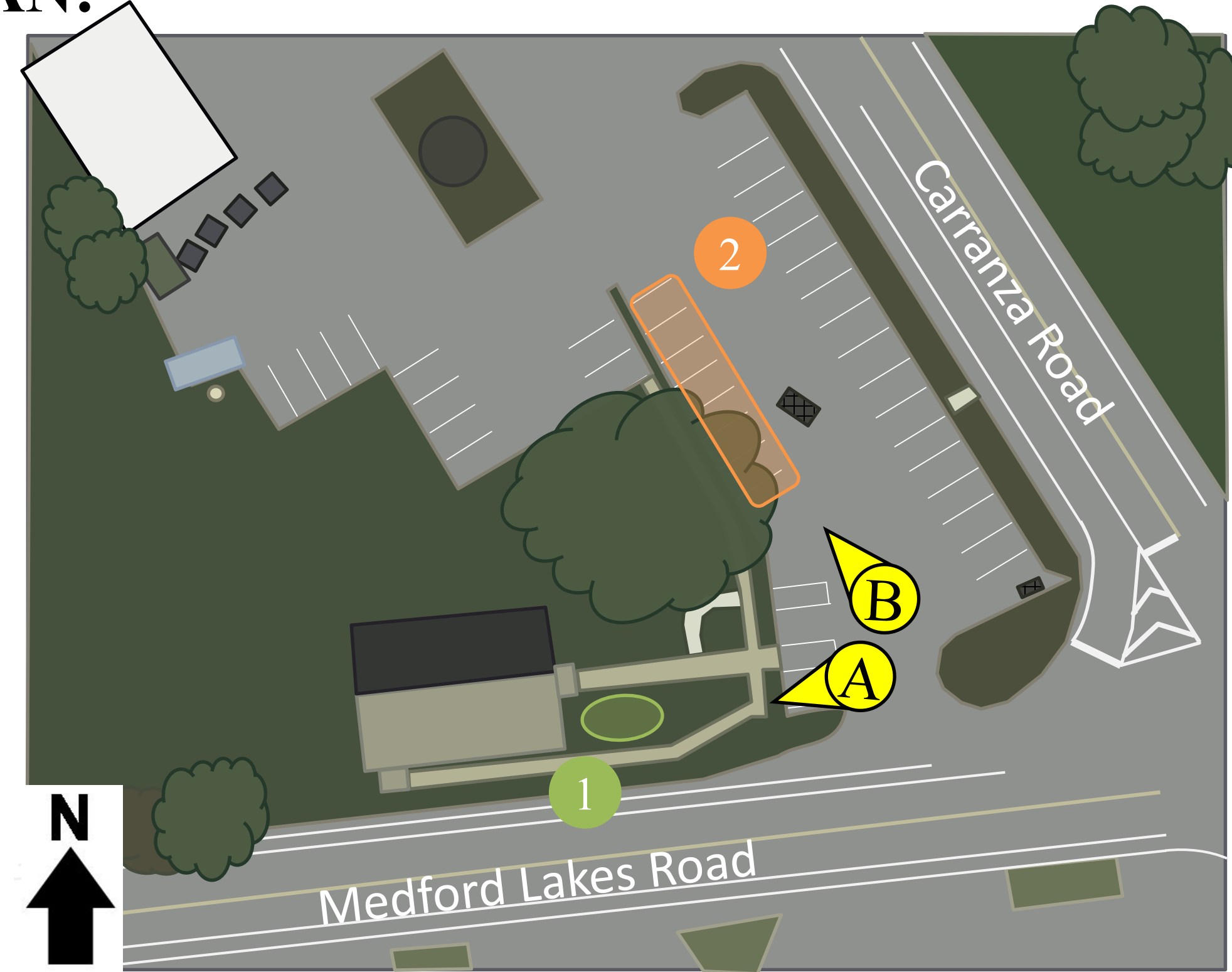
Tabernacle Township Impervious Cover Assessment

Tabernacle Municipal Center, 163 Carranza Road

PROJECT LOCATION:



SITE PLAN:



A



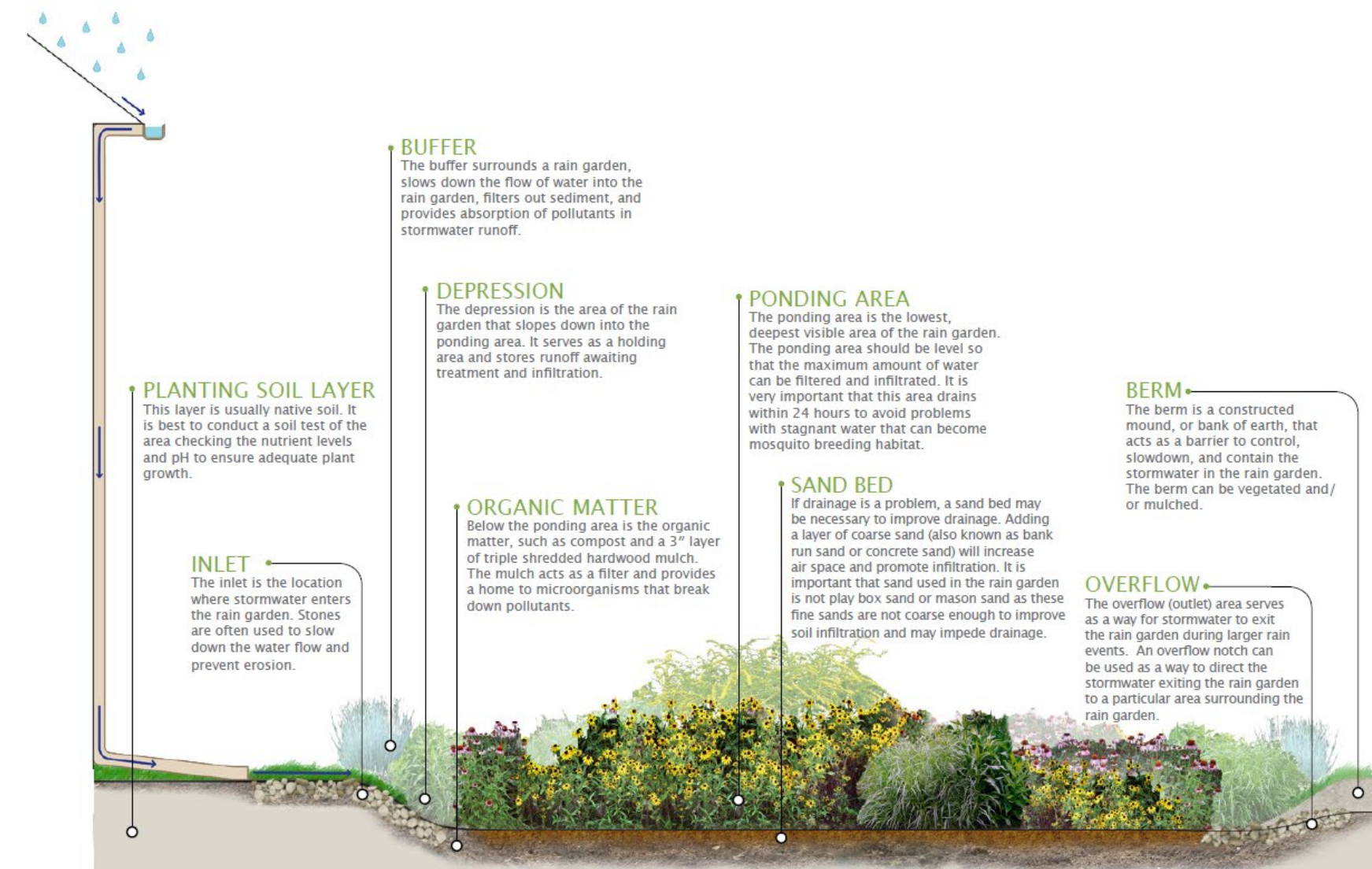
B



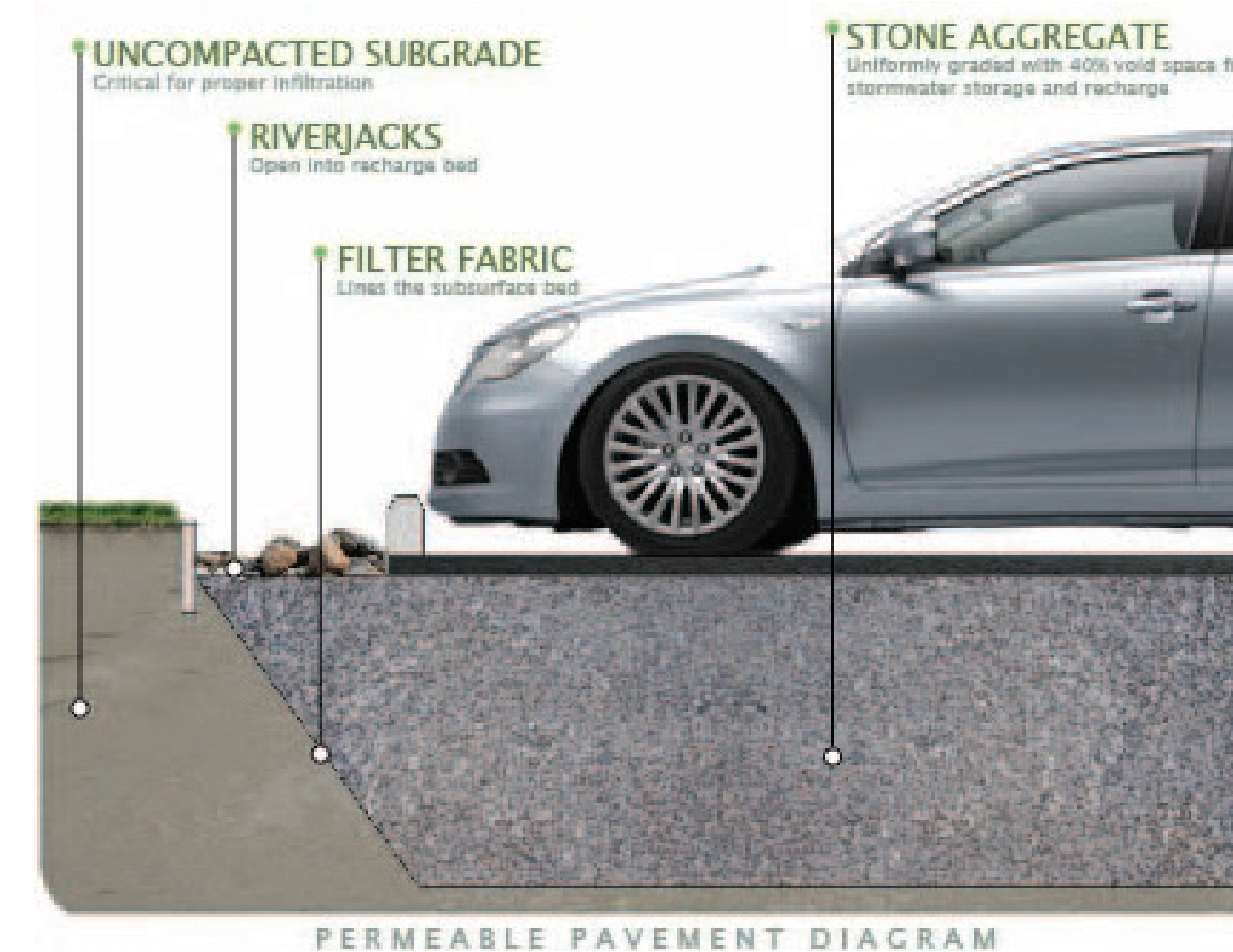
1 BIORETENTION SYSTEM: A rain garden can be installed in front of the municipal building near the flag pole. Rain gardens are used to reduce sediment and nutrient loading to the local waterway and increase groundwater recharge.

2 PERVIOUS PAVEMENT: Pervious pavement can be installed in parking spots to capture stormwater before it reaches the catch basin. Pervious pavement promotes groundwater recharge and filters stormwater.

1 BIORETENTION SYSTEM



2 PERVIOUS PAVEMENT



Tabernacle Municipal Center
Green Infrastructure Information Sheet

<p>Location: 163 Carranza Road Tabernacle, NJ 08088</p>	<p>Municipality: Tabernacle Township</p>
<p>Green Infrastructure Description: bioretention system (rain garden) pervious pavement</p>	<p>Subwatershed: Friendship 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 stormwater peak reduction potential: yes total suspended solids removal potential: yes</p>	<p>Stormwater Captured and Treated Per Year: bioretention system: 17,720 gal. porous pavement system: 109,170 gal.</p>
<p>Existing Conditions and Issues: The municipal building has a parking lot with a catch basin in a central low spot. The area around the catch basin is patched asphalt, which could be evidence of excessive water damage creating a need to replace and patch the asphalt. In addition, there is a multitude of cracks in the pavement of the parking lot leading up to the catch basin as well as some sediment accumulation, which could be evidence of pooling water. There are multiple connected downspouts on the front (east facing) side of the building.</p>	
<p>Proposed Solution(s): A strip of pervious pavement installed in the parking spaces between the building's lawn and the catch basin can help reduce the issues caused by water draining to the existing catch basin. The connected downspouts can be disconnected and redirected to a bioretention system. This would be a rain garden installed at the front of the building near the flag pole to capture stormwater from the roof through the redirected downspouts.</p>	
<p>Anticipated Benefits: Since the bioretention system would be designed to capture, treat, and infiltrate the entire 2-year design storm (3.4 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 Tabernacle 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>Possible Funding Sources: mitigation funds from local developers NJDEP grant programs Tabernacle Township local social and community groups</p>	

Tabernacle Municipal Center
Green Infrastructure Information Sheet

Partners/Stakeholders:

Tabernacle Township
Tabernacle Municipal Center
local social and community groups
Rutgers Cooperative Extension

Estimated Cost:

A rain garden to capture the runoff from the municipal building roof would need to be approximately 170 square feet. At \$5 per square foot, the estimated cost of the rain garden is \$850.

The porous asphalt would cover 750 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 \$18,750.

The total cost of the project will thus be approximately \$19,600.