RUTGERS
New Jersey Agricultural
Experiment Station

**Draft**

# Impervious Cover Assessment for Franklin Township, Somerset County, New Jersey

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

February 3, 2015

## Introduction

Pervious and impervious are terms that are used to describe the ability or inability of water to flow through a surface. When rainfall hits a surface, it can soak into the surface or flow off the surface. Pervious surfaces are those which allow stormwater to readily soak into the soil and recharge groundwater. When rainfall drains from a surface, it is called "stormwater" runoff (Figure 1). An impervious surface can be any material that has been placed over soil that prevents water from soaking into the ground. Impervious surfaces include paved roadways, parking lots, sidewalks, and rooftops. As impervious areas increase, so does the volume of stormwater runoff.

Figure 1: Stormwater draining from a parking lot

New Jersey has many problems due to stormwater runoff, including:

- Pollution: According to the 2010 New Jersey Water Quality Assessment Report, 90% of the assessed waters in New Jersey are impaired, with urban-related stormwater runoff listed as the most probable source of impairment (USEPA, 2013). As stormwater flows over the ground, it picks up pollutants including animal waste, excess fertilizers, pesticides, and other toxic substances. These pollutants are then able to enter waterways.

- Flooding: Over the past decade, the state has seen an increase in flooding. Communities around the state have been affected by these floods. The amount of damage caused also has increased greatly with this trend, costing billions of dollars over this time span.

- Erosion: Increased stormwater runoff causes an increase in the velocity of flows in our waterways. The increased velocity after storm events erodes stream banks and shorelines, degrading water quality. This erosion can damage local roads and bridges and cause harm to wildlife.

The primary cause of the pollution, flooding, and erosion problems is the quantity of impervious surfaces draining directly to local waterways. New Jersey is one of the most developed states in the country. Currently, the state has the highest percent of impervious cover in the country at 12.1% of its total area (Nowak & Greenfield, 2012). Many of these impervious surfaces are directly connected to local waterways (i.e., every drop of rain that lands on these impervious surfaces ends up in a local river, lake, or bay without any chance of being treated or soaking into the ground). To repair our waterways, reduce flooding, and stop erosion, stormwater runoff from impervious surfaces has to be better managed. Surfaces need to be disconnected with green infrastructure to prevent stormwater runoff from flowing directly into New Jersey's waterways. Disconnection redirects runoff from paving and rooftops to pervious areas in the landscape.

Green infrastructure is an approach to stormwater management that is cost-effective, sustainable, and environmentally friendly. Green infrastructure projects capture, filter, absorb, and reuse stormwater to maintain or mimic natural systems and to treat runoff as a resource. As a general principal, green infrastructure practices use soil and vegetation to recycle stormwater runoff through infiltration and evapotranspiration. When used as components of a stormwater management system, green infrastructure practices such as bioretention, green roofs, porous pavement, rain gardens, and vegetated swales can produce a variety of environmental benefits. In addition to effectively retaining and infiltrating rainfall, these technologies can simultaneously help filter air pollutants, reduce energy demands, mitigate urban heat islands, and sequester carbon while also providing communities with aesthetic and natural resource benefits (USEPA, 2013).

The first step to reducing the impacts from impervious surfaces is to conduct an impervious cover assessment. This assessment can be completed on different scales: individual lot, municipality, or watershed. Impervious surfaces need to be identified for stormwater management. Once impervious surfaces have been identified, there are three steps to better manage these surfaces.

1. ***Eliminate surfaces that are not necessary.*** For example, a paved courtyard at a public school could be converted to a grassed area.

2. ***Reduce or convert impervious surfaces.*** There may be surfaces that are required to be hardened, such as roadways or parking lots, but could be made smaller and still be functional. A parking lot that has two-way car ways could be converted to one-way car ways. There also are permeable paving materials such as porous asphalt, pervious concrete, or permeable paving stones that could be substituted for impermeable paving materials (Figure 2).

3. ***Disconnect impervious surfaces from flowing directly to local waterways.*** There are many ways to capture, treat, and infiltrate stormwater runoff from impervious surfaces. Opportunities may exist to reuse this captured water.

Figure 2: Rapid infiltration of water through porous pavement is demonstrated at the USEPA Edison New Jersey test site

## **Franklin Township Impervious Cover Analysis**

Located in Somerset County in central New Jersey, Franklin Township covers approximately 46.9 square miles west of North Brunswick. Figures 3 and 4 illustrate that Franklin Township is dominated by urban land uses. A total of 43.4% of the municipality's land use is classified as urban. Of the urban land in Franklin Township, rural residential and medium density residential are the dominant land uses (Figure 5).

The literature suggests a link between impervious cover and stream ecosystem impairment starting at approximately 10% impervious surface cover (Schueler, 1994; Arnold and Gibbons, 1996; May et al., 1997). Impervious cover may be linked to the quality of lakes, reservoirs, estuaries, and aquifers (Caraco et al., 1998), and the amount of impervious cover in a watershed can be used to project the current and future quality of streams. Based on the scientific literature, Caraco et al. (1998) classified urbanizing streams into the following three categories: sensitive streams, impacted streams, and non-supporting streams. Sensitive steams typically have a watershed impervious surface cover from 0 – 10%. Impacted streams have a watershed impervious cover ranging from 11-25% and typically show clear signs of degradation from urbanization. Non-supporting streams have a watershed impervious cover of greater than 25%; at this high level of impervious cover, streams are simply conduits for stormwater flow and no longer support a diverse stream community.

The New Jersey Department of Environmental Protection's (NJDEP) 2007 land use/land cover geographical information system (GIS) data layer categorizes Franklin 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 Franklin Township. Based upon the 2007 NJDEP land use/land cover data, approximately 14.4% of Franklin Township has impervious cover. This level of impervious cover suggests that the streams in Franklin Township are likely impacted.

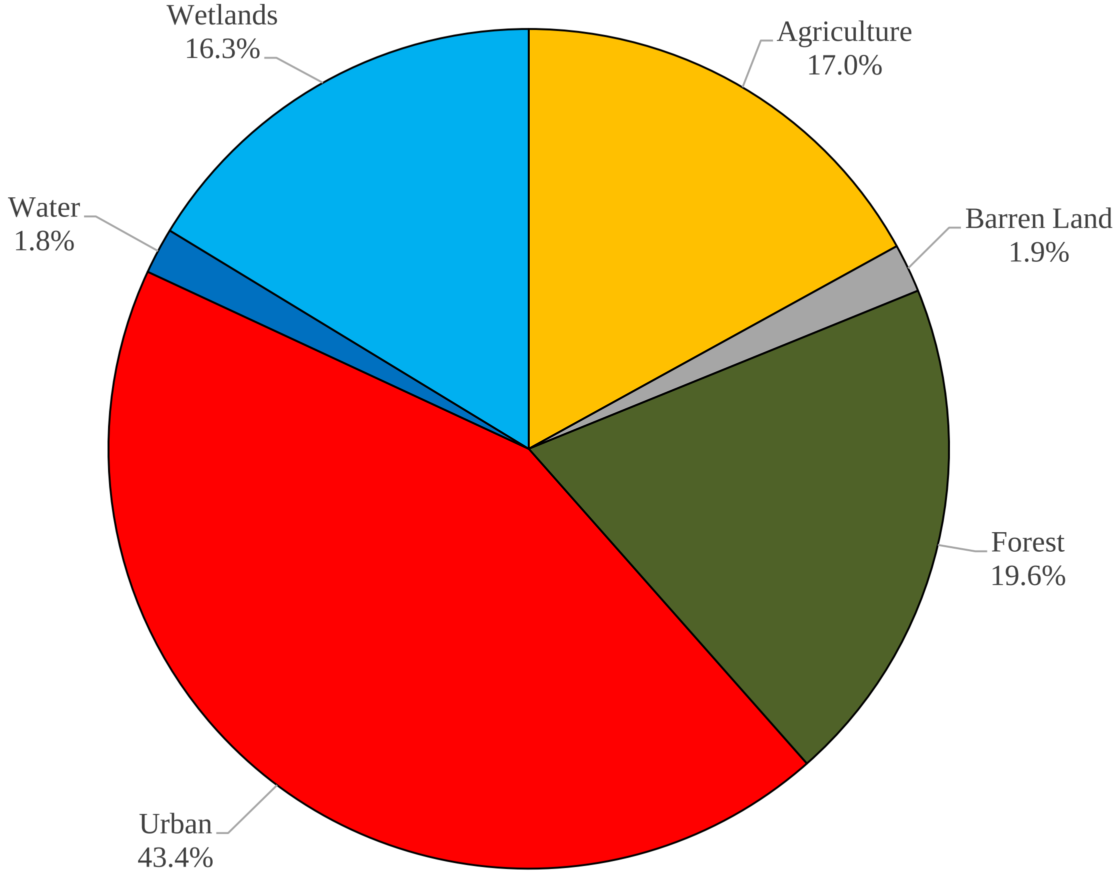



Figure 3:  Pie chart illustrating the land use in Franklin Township

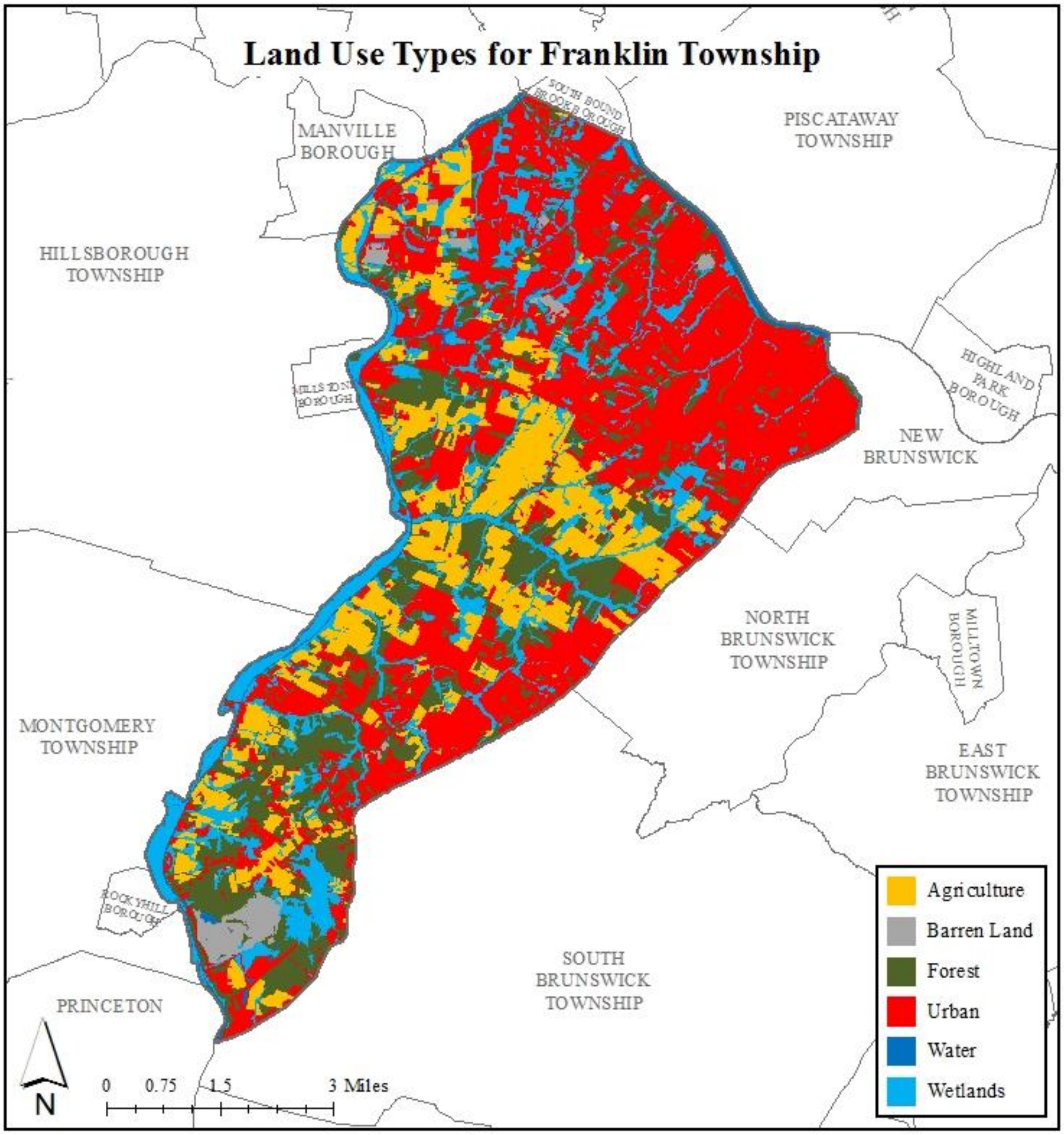



Figure 4: Map illustrating the land use in Franklin Township

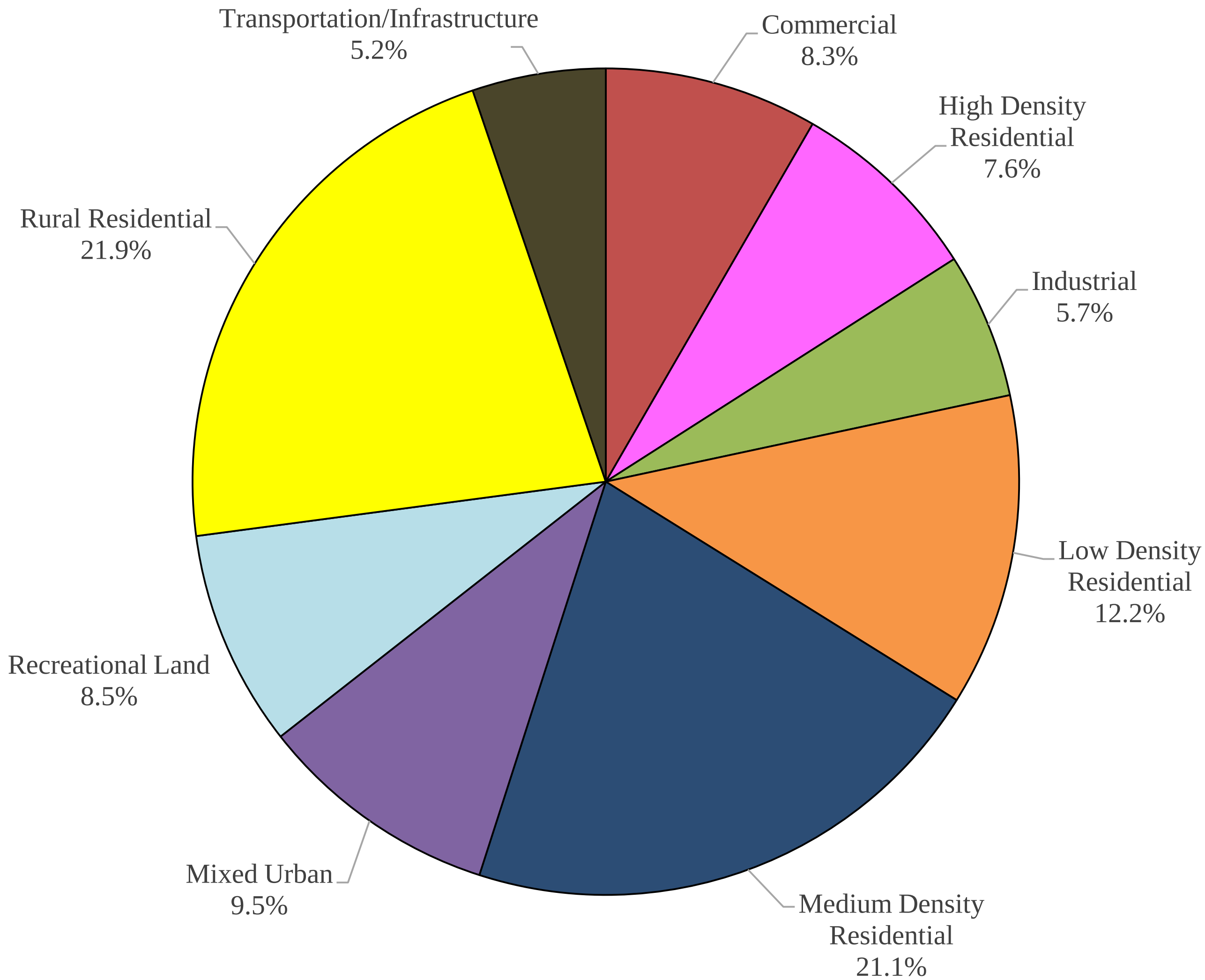



Figure 5: Pie chart illustrating the various types of urban land use in Franklin Township

Water resources are typically managed on a watershed/subwatershed basis; therefore an impervious cover analysis was performed for each Raritan River subwatershed within Franklin Township (Table 1 and Figure 6). On a subwatershed basis, impervious cover ranges from 0% in the Royce Brook subwatershed to 61.8% in the Oakeys Brook subwatershed. Evaluating impervious cover on a subwatershed basis allows the municipality to focus impervious cover reduction or disconnection efforts in the subwatersheds where frequent flooding occurs.

In developed landscapes, stormwater runoff from parking lots, driveways, sidewalks, and rooftops flows to drainage pipes that feed the sewer system. The cumulative effect of these impervious surfaces and thousands of connected downspouts reduces the amount of water that can infiltrate into soils and greatly increases the volume and rate of runoff that flows to waterways. Stormwater runoff volumes (specific to Franklin Township, Somerset County) associated with impervious surfaces were calculated for the following storms: the New Jersey water quality design storm of 1.25 inches of rain, an annual rainfall of 44 inches, the 2-year design storm (3.3 inches of rain), the 10-year design storm (5.0 inches of rain), and the 100-year design storm (8.2 inches of rain). These runoff volumes are summarized in Table 2. A substantial amount of rainwater drains from impervious surfaces in Franklin Township. For example, if the stormwater runoff from one water quality storm (1.25 inches of rain) in the Lower Raritan River subwatershed was harvested and purified, it could supply water to 681 homes for one year[1].

[1] Assuming 300 gallons per day per home

Table 1: Impervious cover analysis by subwatershed for Franklin Township

| Subwatershed | Total Area | | Land Use Area | | Water Area | | Impervious Cover | | |
|---|---|---|---|---|---|---|---|---|---|
| | (ac) | ($mi^2$) | (ac) | ($mi^2$) | (ac) | ($mi^2$) | (ac) | ($mi^2$) | (%) |
| Heathcote Brook | 980.9 | 1.53 | 979.3 | 1.53 | 1.63 | 0.00 | 44.2 | 0.07 | 4.51% |
| Mile Run | 1,321.8 | 2.07 | 1,316.1 | 2.06 | 5.71 | 0.01 | 451.2 | 0.70 | 34.3% |
| Millstone River | 12,045.2 | 18.8 | 11,721.3 | 18.3 | 323.9 | 0.51 | 672.8 | 1.05 | 5.74% |
| Oakeys Brook | 36.3 | 0.06 | 36.4 | 0.06 | 0.00 | 0.00 | 22.5 | 0.04 | 61.8% |
| Lower Raritan River | 7,937.4 | 12.4 | 7,768.3 | 12.1 | 169.2 | 0.26 | 2,199.3 | 3.44 | 28.3% |
| Royce Brook | 0.03 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00% |
| Six Mile Run | 7,676.2 | 12.0 | 7,644.5 | 11.9 | 31.6 | 0.05 | 853.9 | 1.33 | 11.2% |
| Total | 29,997.9 | 46.9 | 29,465.8 | 46.0 | 532.1 | 0.83 | 4,243.8 | 6.63 | 14.4% |

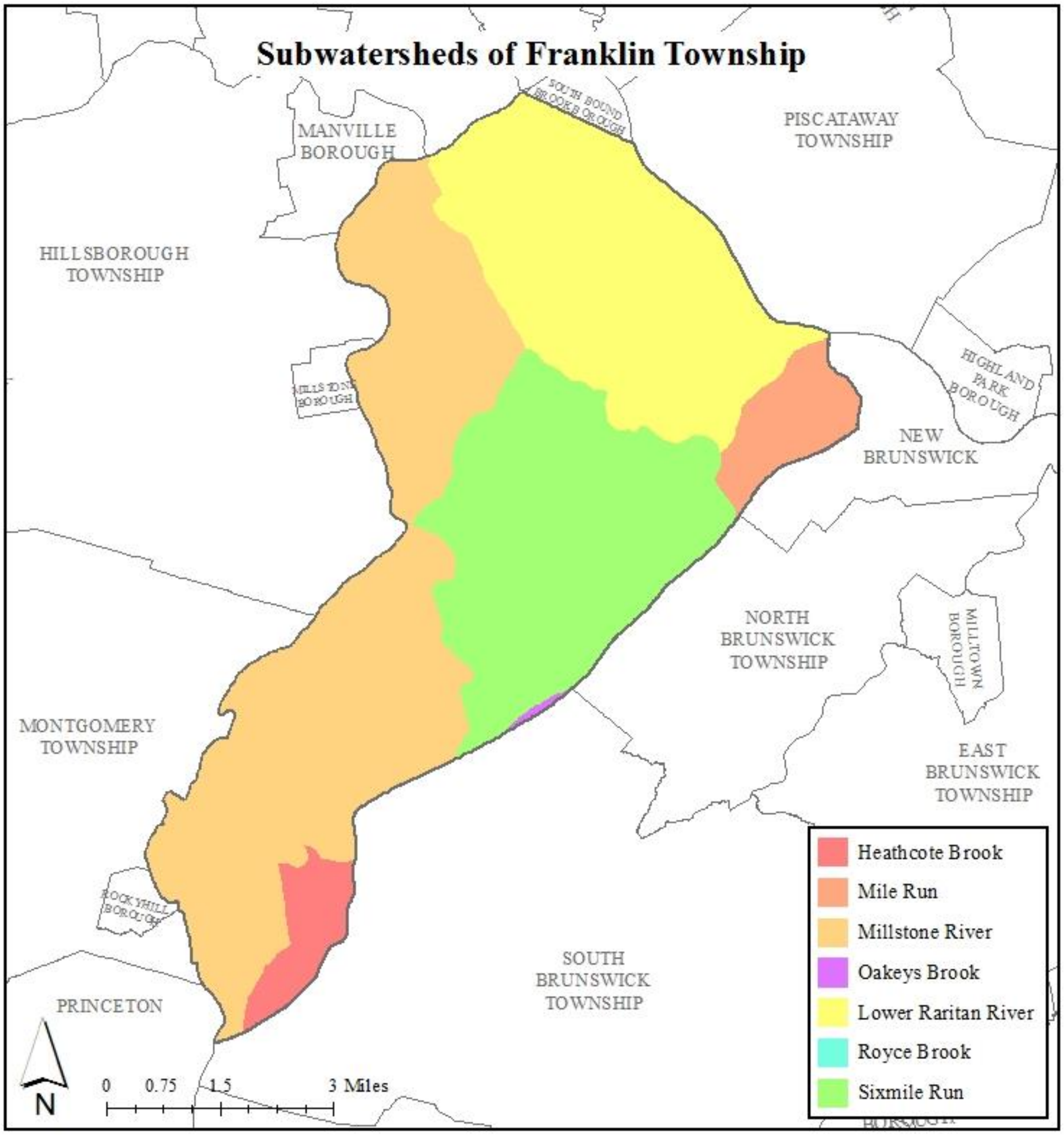



Figure 6: Map of the subwatersheds in Franklin Township

Table 2: Stormwater runoff volumes from impervious surfaces by subwatershed in Franklin 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 (8.2") (Mgal) |
|---|---|---|---|---|---|
| Heathcote Brook | 1.5 | 52.7 | 4.0 | 6.0 | 9.8 |
| Mile Run | 15.3 | 539.0 | 40.4 | 61.3 | 100.5 |
| Millstone River | 22.8 | 803.8 | 60.3 | 91.3 | 149.8 |
| Oakeys Brook | 0.8 | 26.9 | 2.0 | 3.1 | 5.0 |
| Lower Raritan River | 74.6 | 2,627.5 | 197.1 | 298.6 | 489.7 |
| Royce Brook | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Six Mile Run | 29.0 | 1,020.2 | 76.5 | 115.9 | 190.1 |
| Total | 144.0 | 5,070.2 | 380.3 | 576.2 | 944.9 |

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 Franklin 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 Franklin Township

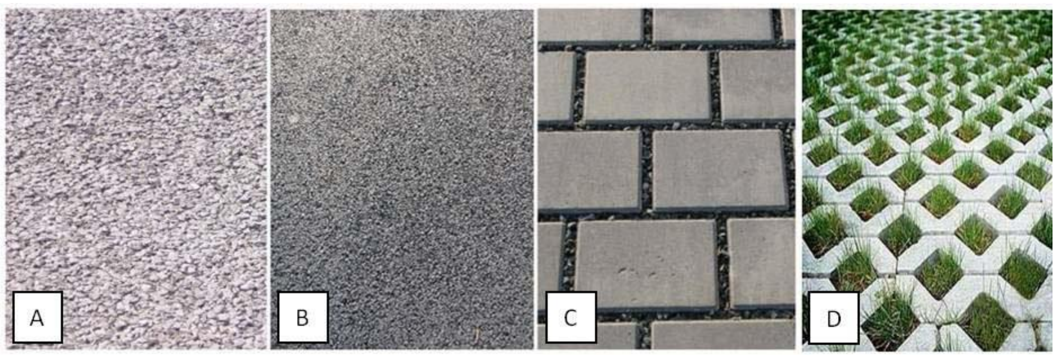
| **Subwatershed** | **Recommended Impervious Area Reduction (10%) (ac)** | **Annual Runoff Volume Reduction [2] (MGal)** |
|---|---|---|
| Heathcote Brook | 4.4 | 5.0 |
| Mile Run | 45.1 | 51.2 |
| Millstone River | 67.3 | 76.4 |
| Oakeys Brook | 2.2 | 2.6 |
| Lower Raritan River | 219.9 | 249.6 |
| Royce Brook | 0.0 | 0.0 |
| Six Mile Run | 85.4 | 96.9 |
| Total | 424.4 | 481.7 |

[2] Annual Runoff Volume Reduction =
Acres of IC x 43,560 $ft^2$/ac x 44 in x (1 ft/12 in) x 0.95 x (7.48 gal/$ft^3$) x (1 MGal/1,000,000 gal)
All 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 Franklin 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 Franklin 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

Franklin 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

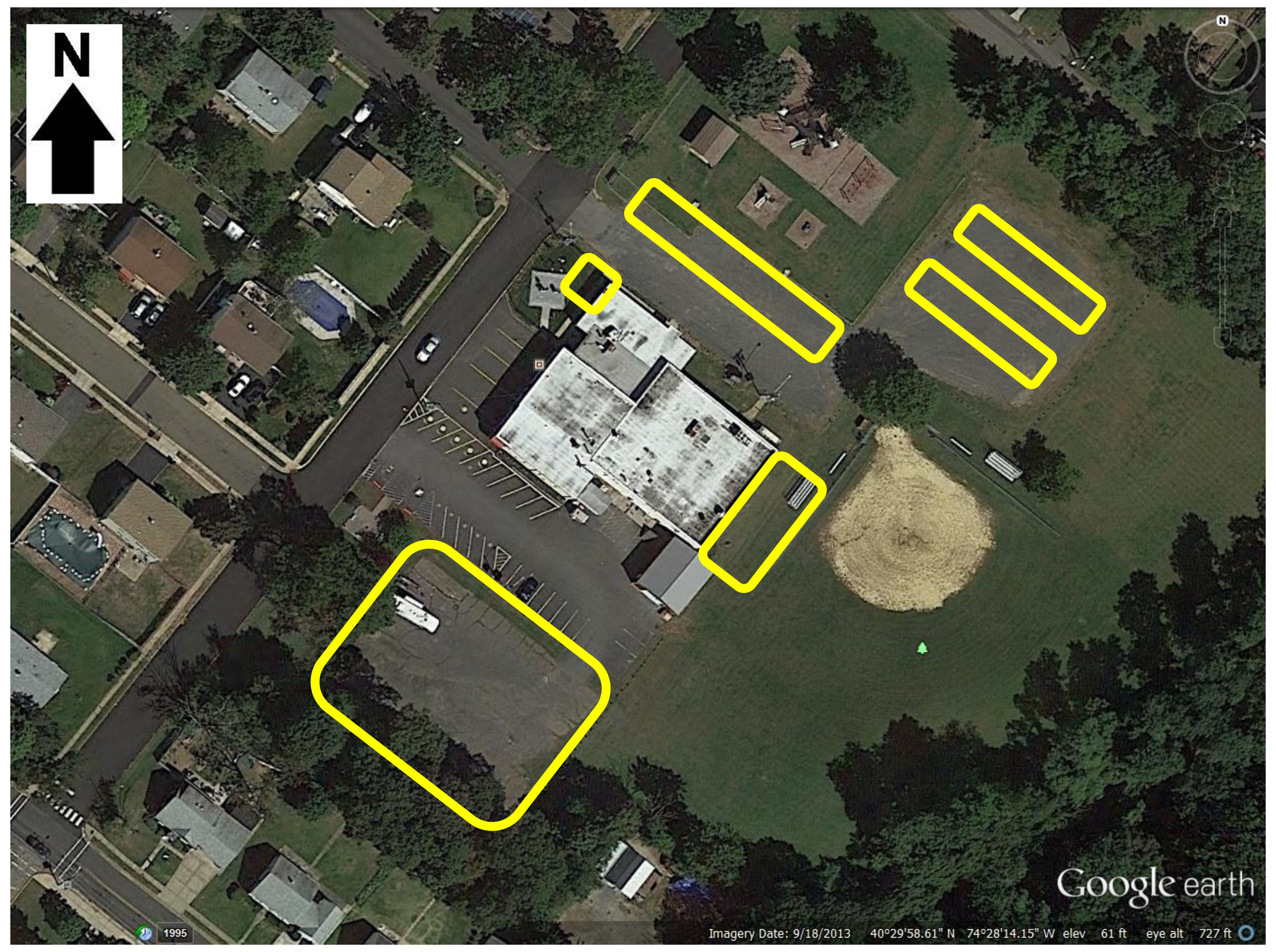
## Examples of Impervious Cover Reduction Action Plan Projects

## Concept Plans and Detailed Green Infrastructure Information Sheets

# Franklin Township
# Impervious Cover Assessment
## *East Franklin Fire Company, 121 Pinegrove Avenue*

Rutgers New Jersey Agricultural Experiment Station

### PROJECT LOCATION:




1 **BIORETENTION SYSTEMS:** Runoff from the rooftop can be conveyed to the rain gardens through rerouting of the buildings' downspouts. These rain gardens can capture, treat, and infiltrate rooftop runoff. Rain gardens can reduce sediment and nutrient loading to the local waterway while providing beautiful landscaping. The gardens also can provide habitat for birds, butterflies, and pollinators.

2 **STORMWATER PLANTERS:** Runoff from the parking area adjacent to the south side of the firehouse can be captured and treated in stormwater planters between the two parking lots.

3 **POROUS PAVEMENT:** The stone and southernmost parking lot can be paved with porous pavement. This can allow for infiltration of any runoff from the parking lot as well as the surrounding grass areas.

### SITE PLAN:

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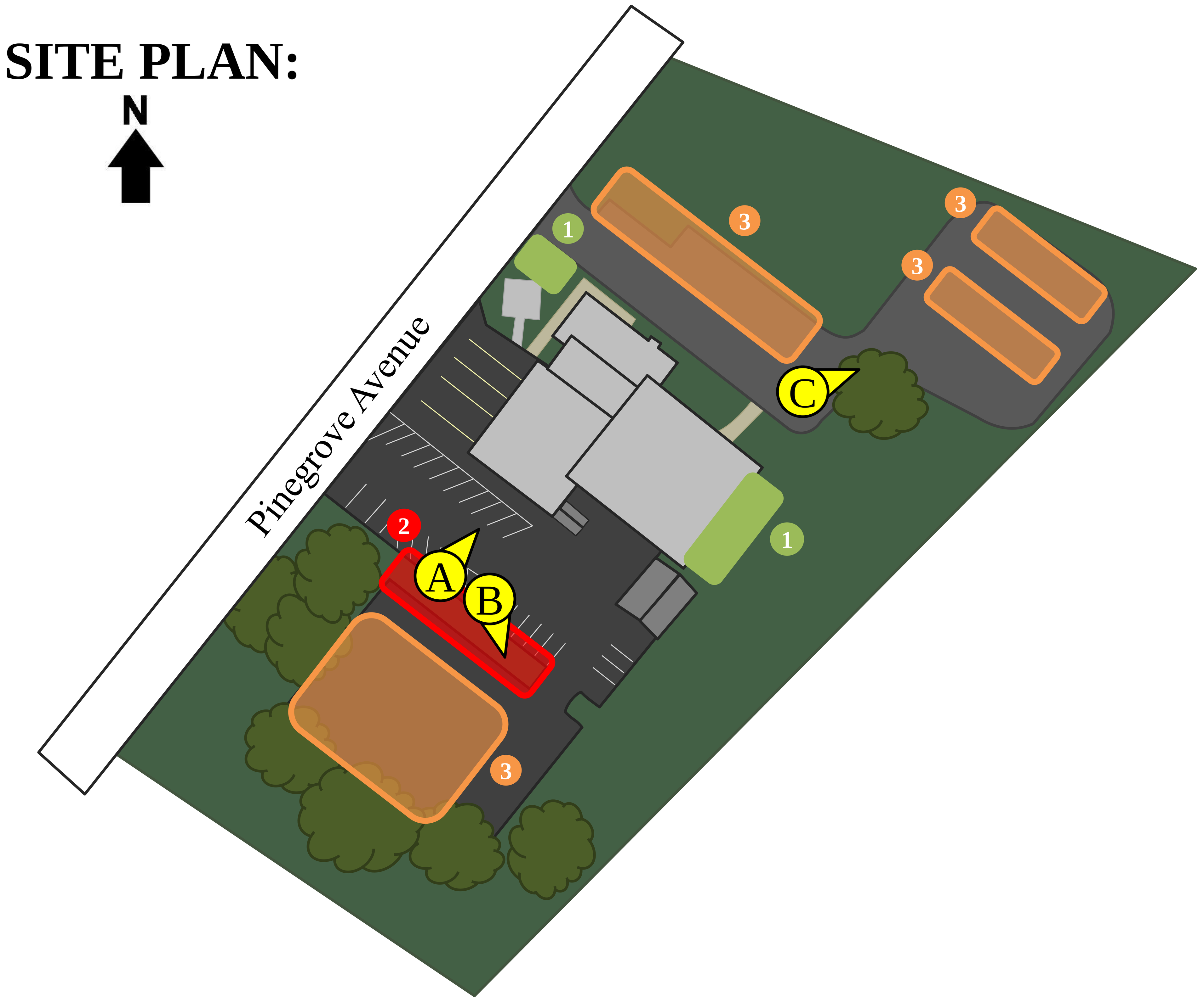


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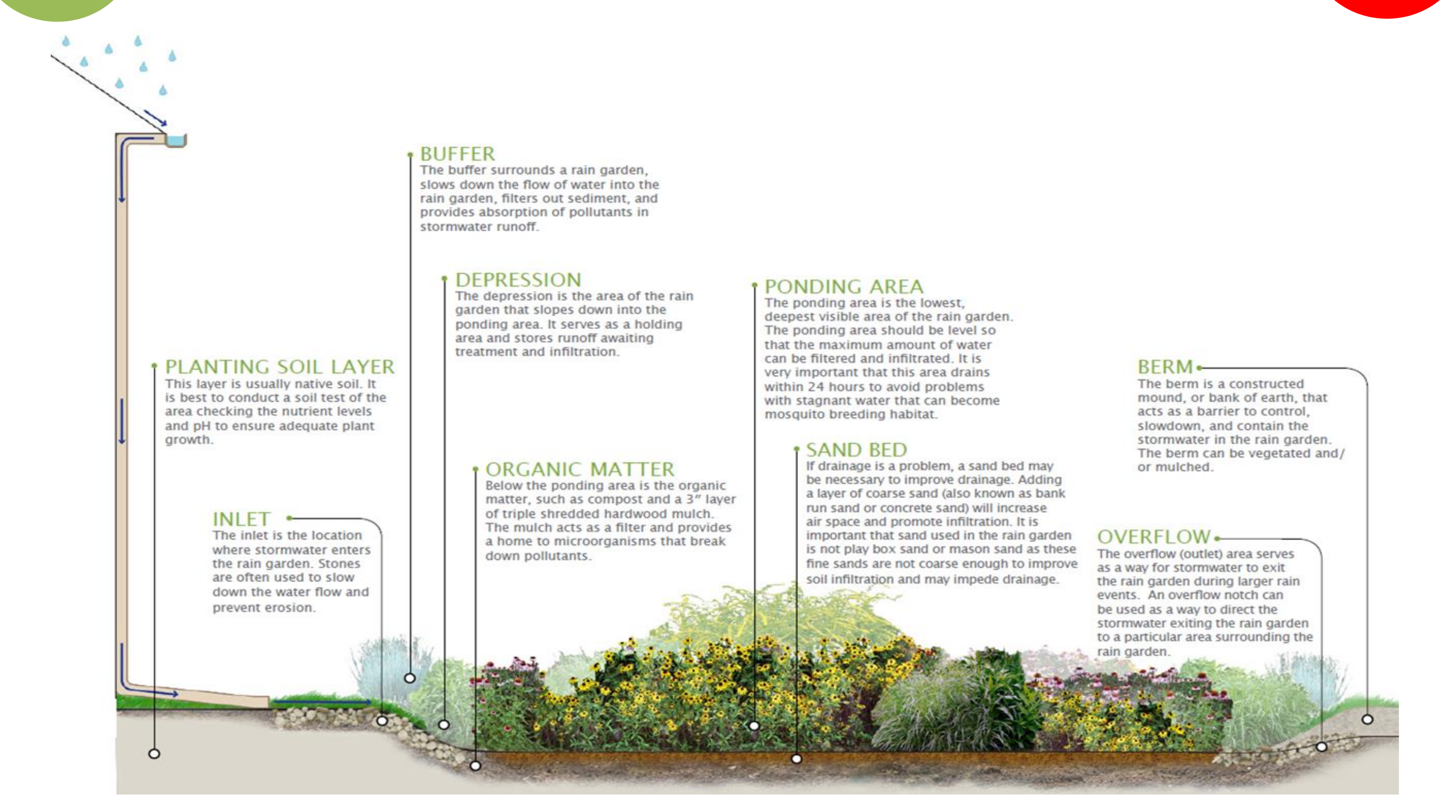
**RESTRICTIVE SOILS IN THIS REGION**

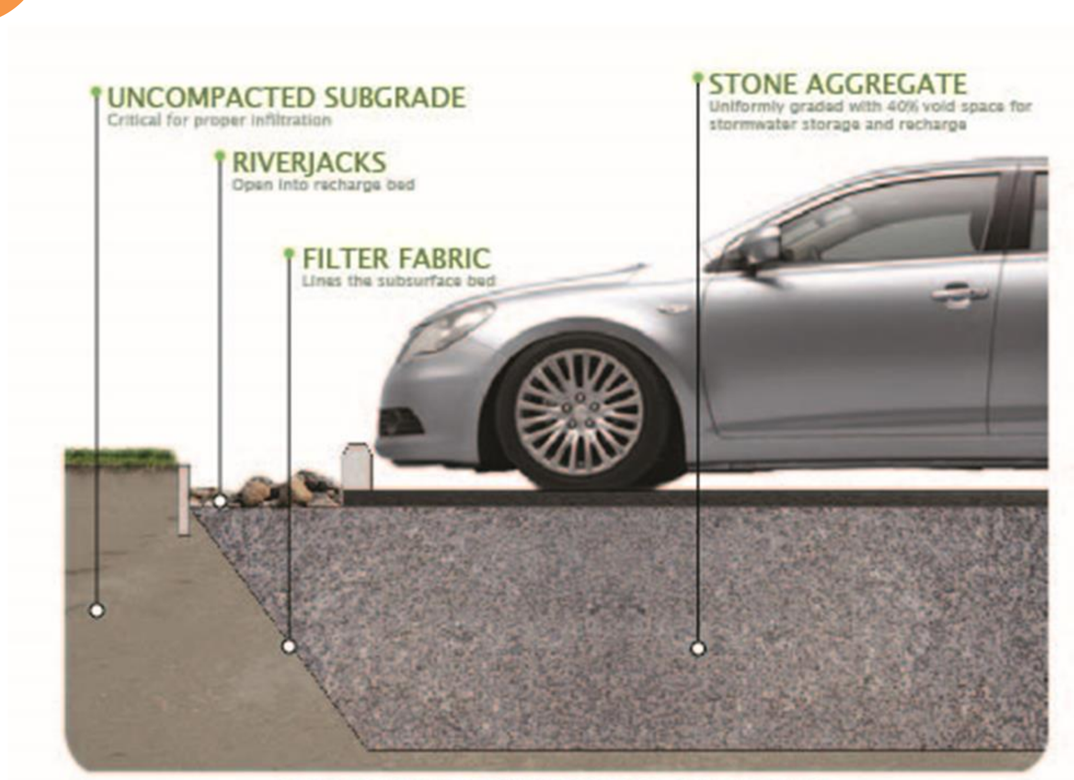
- Site specific soil testing must be conducted.
- Green infrastructure in this area may require underdrain systems.

### 1 BIORETENTION SYSTEM




### 2 STORMWATER PLANTER


### 3 POROUS PAVEMENT



| **Location:**<br>121 Pinegrove Avenue<br>Somerset, NJ 08873 | **Municipality:**<br>Franklin Township<br><br>**Subwatershed:**<br>Mile Run |
|---|---|
| **Green Infrastructure Description:**<br>bioretention system<br>porous pavement<br>stormwater planters | **Targeted Pollutants:**<br>total nitrogen (TN), total phosphorous (TP), and total suspended solids (TSS) in surface runoff |
| **Mitigation Opportunities:**<br>recharge potential: yes<br>stormwater peak reduction potential: yes<br>TSS removal potential: yes | **Stormwater Captured and Treated Per Year:**<br>rain garden: 82,424 gal.<br>porous pavement # 1: 255,342 gal.<br>porous pavement # 2: 344,422 gal.<br>porous pavement # 3: 333,112 gal.<br>stormwater planter: 33,542 gal. |

**Existing Conditions and Issues:**
There are large amounts of impervious surfaces on this site that contribute to stormwater runoff and nonpoint source pollution. Runoff is carrying nonpoint source pollution, such as sediments, nutrients, oil, and grease to local waterways. There are currently three unpaved parking lots on the site that are contributing to stormwater runoff. Multiple downspouts along the building are also causing soil erosion and stormwater runoff.

**Proposed Solution(s):**
A bioretention system or rain garden could be installed on the lawn between the firehouse and the baseball diamond. This will help capture the stormwater from the downspouts on the southeast side of the building. The 3-5 downspouts located at the northwest entrance of the building could also be captured with a rain garden. This will decrease the flow rate of the stormwater and allow pollutants to settle out before the water enters the sewer system or adjacent streams. The three gravel parking lots could be retrofitted with porous pavement. Porous pavement would be installed in the parking spaces, and traditional pavement would be used in the cart ways. This will allow the stormwater draining from the site to percolate through the pavement, helping to recharge the groundwater. Stormwater planter boxes could be used to capture and treat runoff from the parking lot on the southwest side of the building.

**Anticipated Benefits:**
A bioretention system is estimated to achieve a 30% removal rate for TN and a 60% removal rate for TP (NJDEP BMP Manual). TSS loadings may be reduced by up to 90%. If the bioretention system is designed to capture and infiltrate stormwater runoff from the 2-year design storm (3.3 inches of rain over 24 hours), these systems will prevent approximately 95% of the TN, TP, and TSS from flowing directly into local waterways. A bioretention system would also provide ancillary benefits such as enhanced wildlife and aesthetic appeal. A porous pavement parking lot is estimated to achieve an 80% removal rate for TSS, a 50% removal rate for TN, and a 60% removal rate for TP (NJDEP BMP Manual). If the porous pavement parking lot is designed to

| |
|---|
| capture and infiltrate stormwater runoff from the 2-year design storm (3.3 inches of rain over 24 hours), these systems will prevent approximately 95% of the TN, TP, and TSS from flowing directly into local waterways. A stormwater planter is estimated to achieve a 90% removal rate for TSS, a 30% removal rate for TN, and a 60% removal rate for TP (NJDEP BMP Manual). If the stormwater planter is designed to capture and infiltrate stormwater runoff from the 2-year design storm (3.3 inches of rain over 24 hours), these systems will prevent approximately 95% of the TN, TP, and TSS from flowing directly into local waterways. |
| **Possible Funding Sources:**<br>mitigation funds from local developers<br>NJDEP grant programs like 319(h) and 604(b)<br>Franklin Township home and school associations<br>Boy Scouts, Girl Scouts, or service project |
| **Partners/Stakeholders:**<br>Franklin Township<br>Rutgers Cooperative Extension |
| **Estimated Cost:**<br>The rain gardens would need to be approximately 3,160 square feet. At $5 per square foot, the estimated cost of the rain garden is $15,800. The porous pavement parking lot #1 would need to be approximately 9,800 square feet in size. At $15 per square foot, the estimated cost of the parking lot is $147,000. The porous pavement parking lot #2 would need to be approximately 13,220 square feet in size. At $15 per square foot, the estimated cost of the parking lot is $198,300. The porous pavement parking lot #3 would need to be approximately 12,790 square feet in size. At $15 per square foot, the estimated cost of the parking lot is $191,850. The stormwater planter would need to be approximately 320 square feet in size. At $30 per square foot, the estimated cost of the planter is $9,600. The total cost of the project would be approximately $562,550. |

# Franklin Township
# Impervious Cover Assessment
## *Pine Grove Manor School, 130 Highland Avenue*

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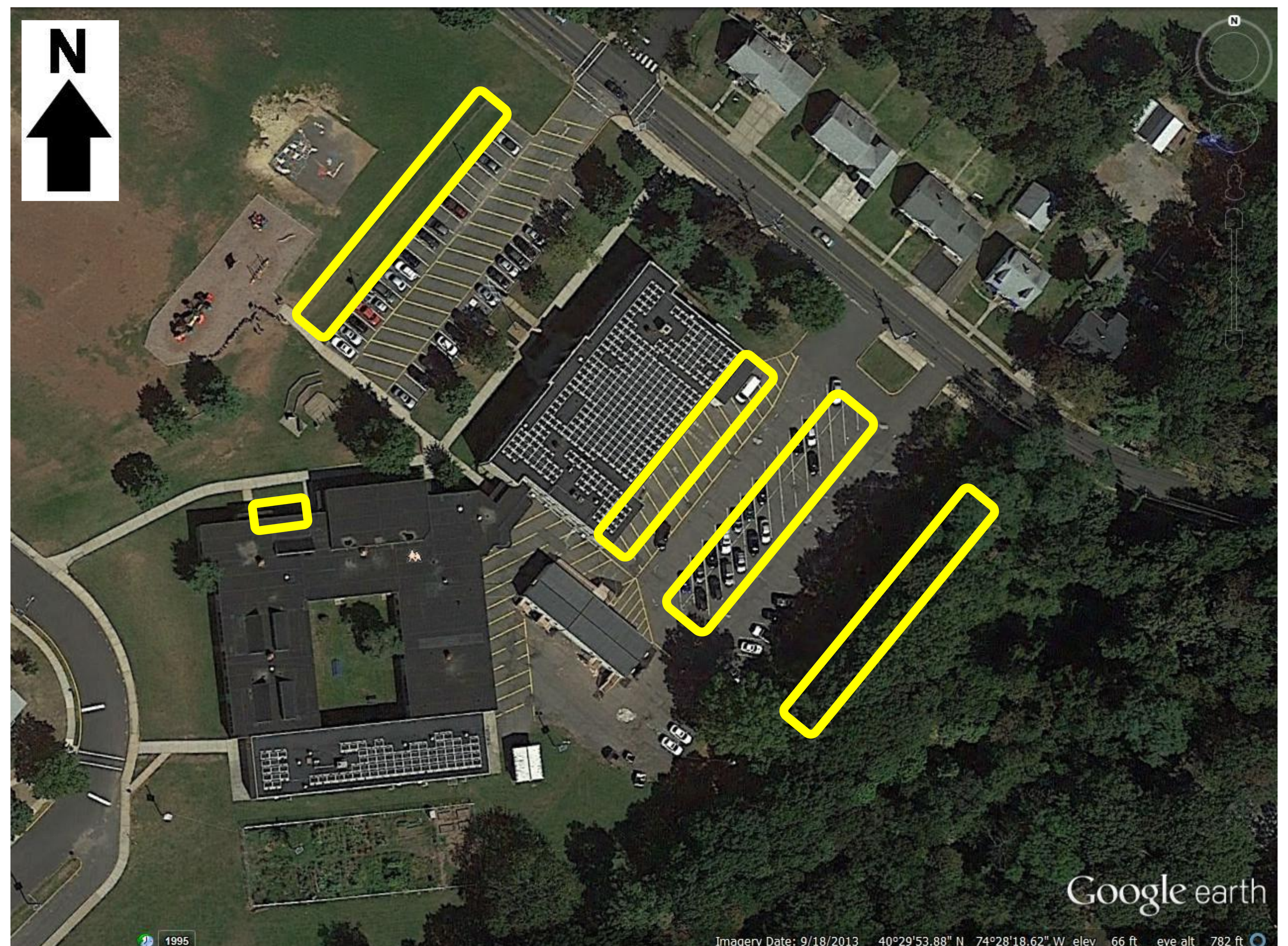
New Jersey Agricultural Experiment Station

### PROJECT LOCATION:




1 **BIORETENTION SYSTEMS:** Curb cuts along the western edge of the western parking lot can feed runoff from the lot to a bioretention system or rain garden where it can be treated and allowed to infiltrate. Another rain garden along the edge of the school can be used to capture runoff from a portion of the building's roof. The gardens can also provide habitat for birds, butterflies, and pollinators.

2 **BIOSWALE**: A bioswale can be used to capture and treat any runoff from the larger parking lot. The rain garden and bioswale can reduce sediment and nutrient loading to the local waterway while providing beautiful landscaping to the school grounds.

3 **POROUS PAVEMENT:** While repaving the main parking lot, portions can be made with porous pavement. These sections can allow for the infiltration of runoff from the parking lot as well as the downspouts along the building once they are disconnected.

**EDUCATIONAL PROGRAM:** The RCE Water Resources Program's *Stormwater Management in Your Schoolyard* can be delivered at Parkview Elementary School to educate the students about stormwater management. Additionally, the students can help design and build some of the stormwater management systems.

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### SITE PLAN:


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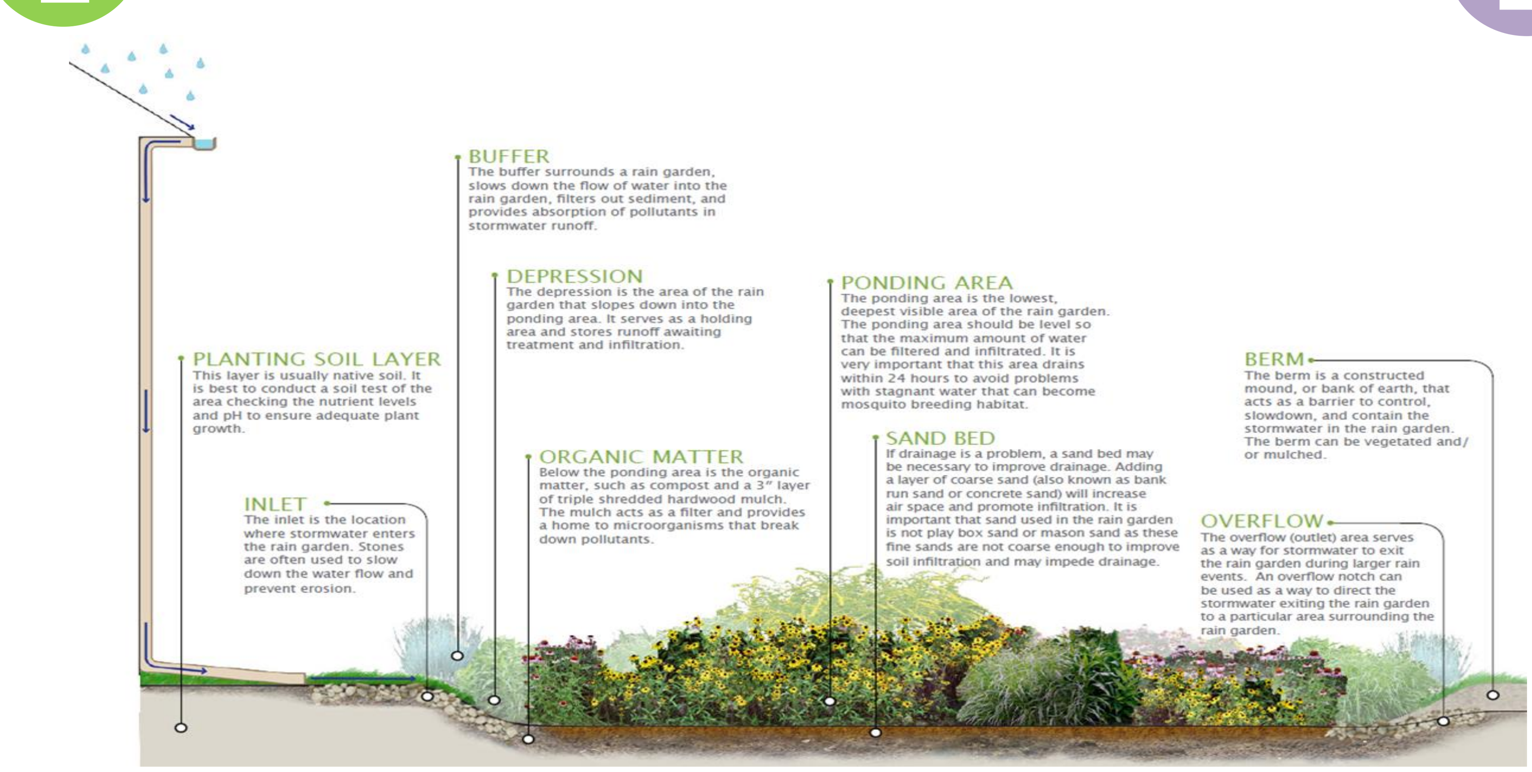
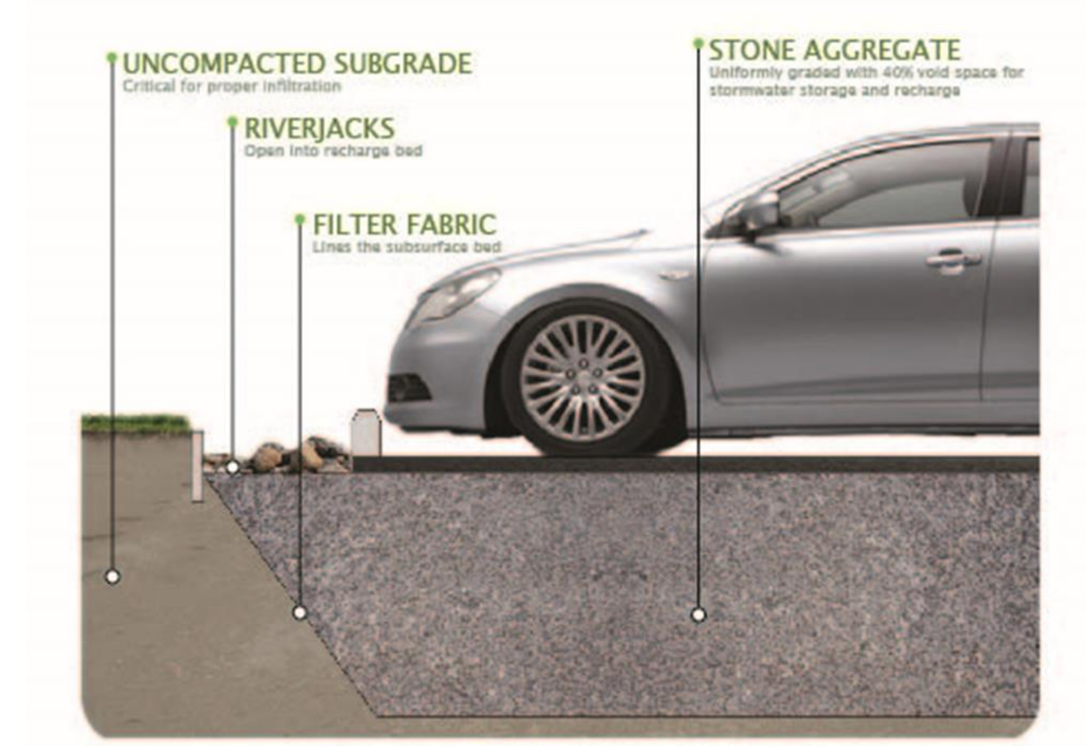
## 1 BIORETENTION SYSTEM




## 2 BIOSWALE

## 3 POROUS PAVEMENT




**RESTRICTIVE SOILS IN THIS REGION**

- Site specific soil testing must be conducted.
- Green infrastructure in this area may require underdrain systems.

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| **Location:**<br>130 Highland Avenue<br>Somerset, NJ 08873 | **Municipality:**<br>Franklin Township<br><br>**Subwatershed:**<br>Mile Run |
| **Green Infrastructure Description:**<br>bioretention systems (rain garden)<br>bioswale<br>porous pavement<br>*Stormwater Management in Your Schoolyard* education program | **Targeted Pollutants:**<br>total nitrogen (TN), total phosphorous (TP), and total suspended solids (TSS) in surface runoff |
| **Mitigation Opportunities:**<br>recharge potential: yes<br>stormwater peak reduction potential: yes<br>TSS removal potential: yes | **Stormwater Captured and Treated Per Year:**<br>rain garden (parking lot): 173,268 gal.<br>rain garden (school): 26,055gal.<br>bioswale: 148,620 gal.<br>porous pavement: 222,929 gal. |

**Existing Conditions and Issues:**

There are large amounts of impervious surfaces at this site that contribute to stormwater runoff and nonpoint source pollution. Runoff is carrying nonpoint source pollution such as sediments, nutrients, oil, and grease to local waterways. There are currently three parking lots on the site that are contributing to stormwater runoff. Multiple downspouts along the building are also causing soil erosion and water pollution.

**Proposed Solution(s):**

Rain gardens could be installed on this site to help manage stormwater. A rain garden could be installed along the north entrance of the school to capture and treat parking lot runoff. A second rain garden could be installed to intercept rooftop runoff. A bioswale could be located along the southeastern edge of the southeastern parking lot. This bioswale will slow the stormwater draining from the site as well as remove pollutants before it enters the adjacent stream. Preventing runoff from this parking lot is very important to the water quality of the stream and the health of its existing wildlife. This same parking lot is currently in bad condition and could be retrofitted with porous pavement to help further slow stormwater runoff from the site. The Rutgers Cooperative Extension (RCE) Water Resources Program has a youth education program called *Stormwater Management in Your Schoolyard* that also could be used at this school.

**Anticipated Benefits:**

A bioretention system is estimated to achieve a 30% removal rate for TN and a 60% removal rate for TP (NJDEP BMP Manual). TSS loadings may be reduced by up to 90%. If the bioretention system is designed to capture and infiltrate stormwater runoff from the 2-year design storm (3.3 inches of rain over 24 hours), these systems will prevent approximately 95% of the TN, TP, and TSS from flowing directly into local waterways. A bioretention system would also provide ancillary benefits such as enhanced wildlife and aesthetic appeal to faculty and students. A porous pavement parking lot is estimated to achieve a 50% removal rate for TN and a 60% removal rate for TP (NJDEP BMP Manual). TSS loadings may be reduced by up to 80%. If the porous pavement parking lot is designed to capture and infiltrate stormwater runoff from the 2-year design storm (3.3 inches of rain over 24 hours), these systems will prevent approximately 95% of the TN, TP, and TSS from flowing directly into local waterways. A porous pavement parking lot is estimated to achieve an 80% removal rate for TSS, a 50% removal rate for TN, and a 60% removal rate for TP (NJDEP BMP Manual). If the porous pavement parking lot is designed to capture and infiltrate stormwater runoff from the 2-year design storm (3.3 inches of rain over 24 hours), these systems will prevent approximately 95% of the TN, TP, and TSS from flowing directly into local waterways. Since the proposed site is located at the school, there is an opportunity to educate school children about the importance of watersheds and stormwater management. This can be completed through the youth education program called *Stormwater Management in Your Schoolyard*. The students could assist with installing the bioretention systems as part of a hands-on class activity.

**Possible Funding Sources:**
mitigation funds from local developers
NJDEP grant programs like 319(h) and 604(b)
Franklin Township home and school associations
Boy Scouts, Girl Scouts, or service project

**Partners/Stakeholders:**
Franklin Township
teachers, students, and parents
Rutgers Cooperative Extension

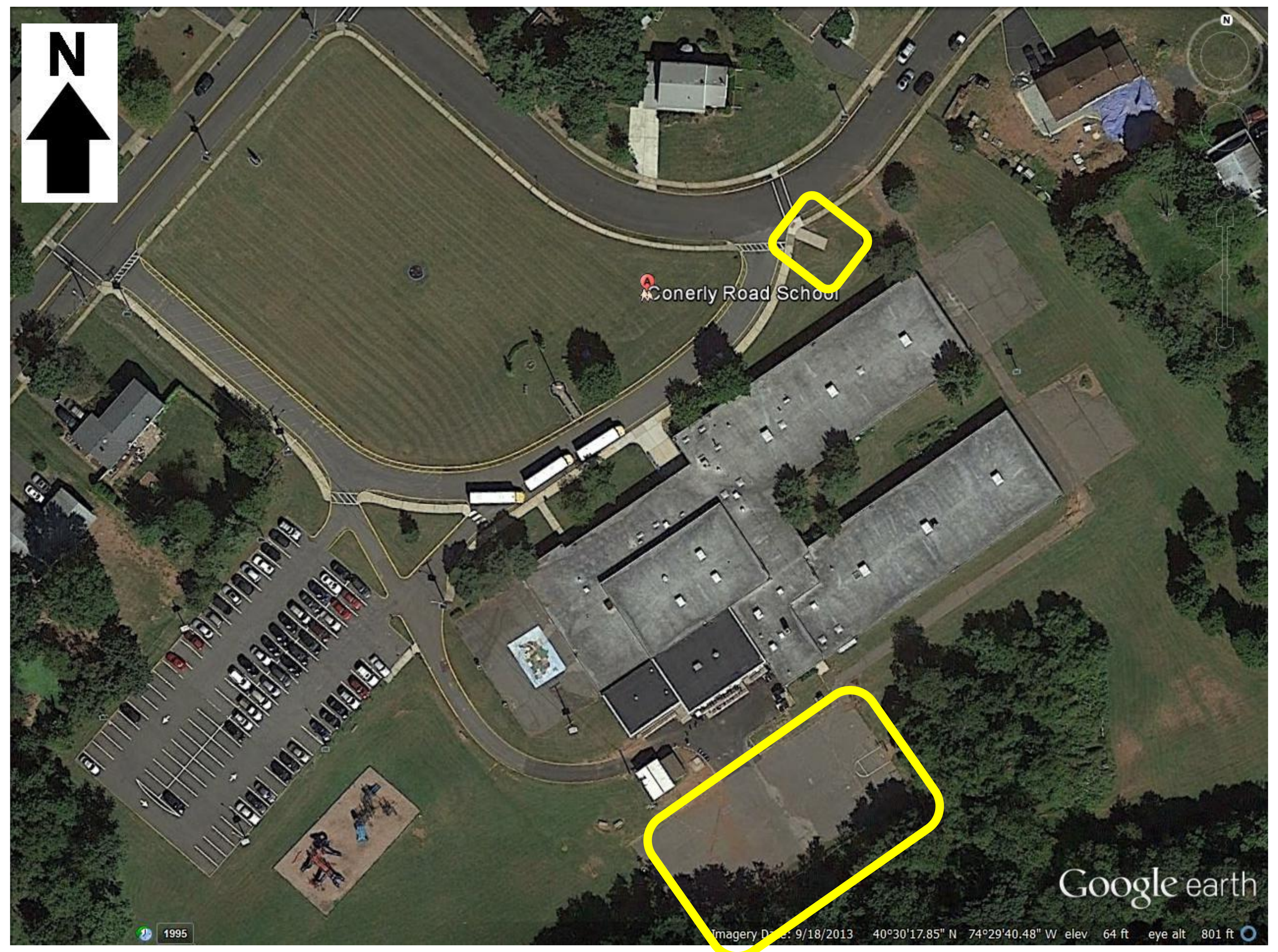
**Estimated Cost:**
The rain garden capturing parking lot runoff would need to be approximately 1,500 square feet. At $5 per square foot, the estimated cost of the rain garden is $7,500. The rain garden capturing roof top runoff from the school would need to be approximately 250 square feet. At $5 per square foot, the estimated cost of the rain garden is $1,250. The bioswale would need to be approximately 1,430 square feet. At $5 per square foot, the estimated cost of the bioswale is $7,150. The porous pavement parking lot would need to be approximately 5,420 square feet in size. At $15 per square foot, the estimated cost of the parking lot is $81,300. The total cost of the project would be approximately $97,200.

# Franklin Township
# Impervious Cover Assessment
## *Conerly Road School, 35 Conerly Road*

A

B

### PROJECT LOCATION:




### SITE PLAN:

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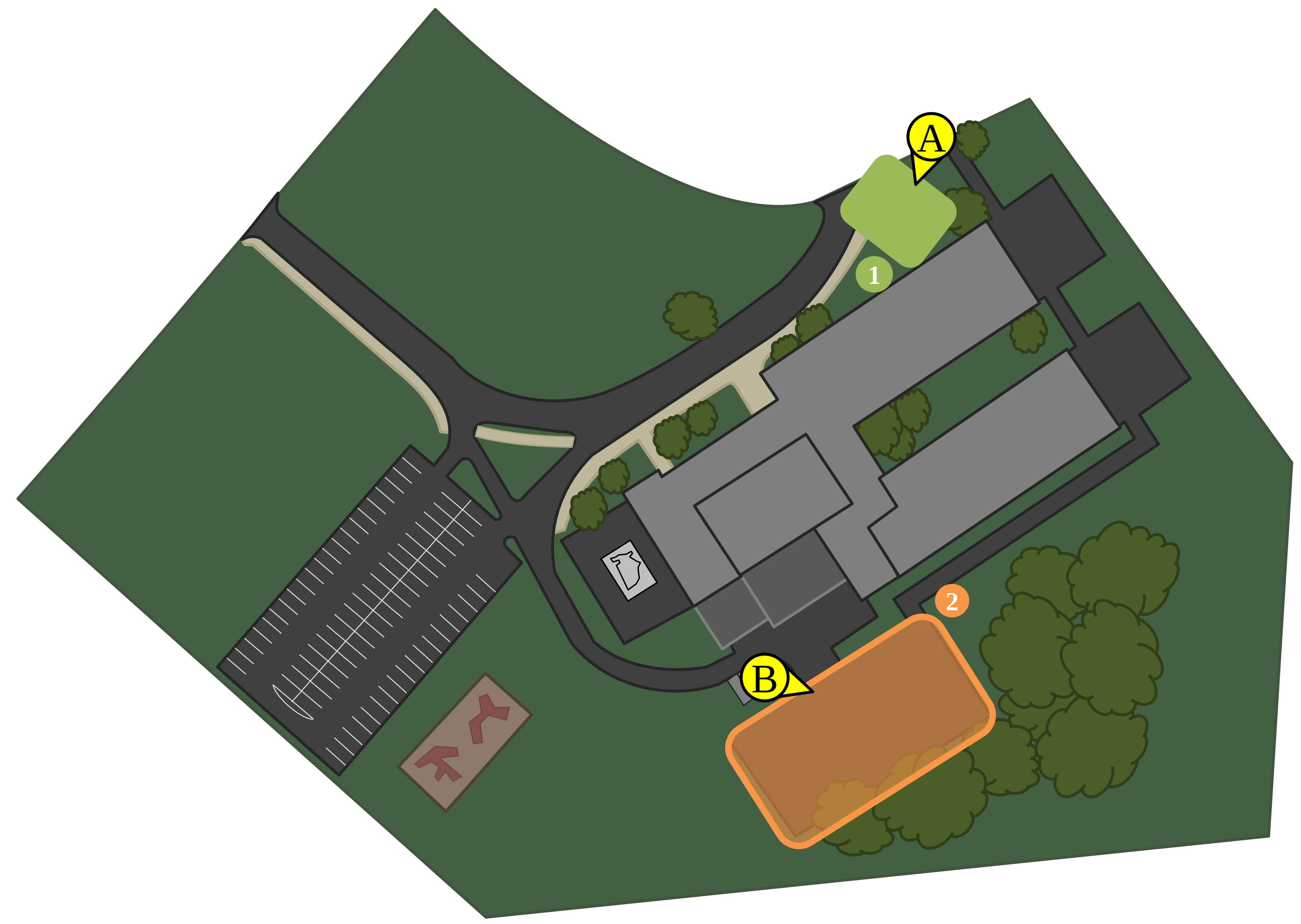
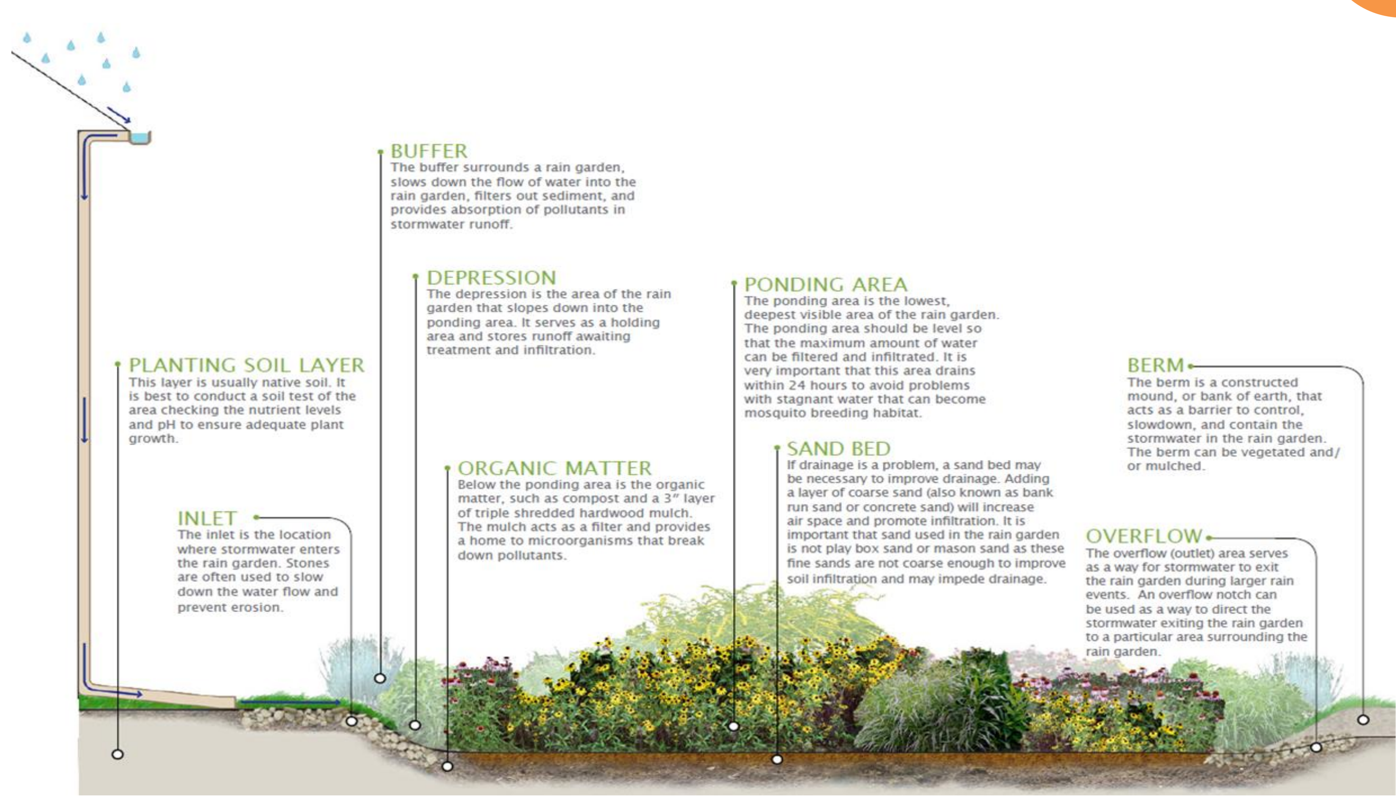



1 **BIORETENTION SYSTEMS:** Trench drains can carry water from Cornerly Road into a bioretention system or rain garden. This rain garden can capture, treat, and infiltrate roadway runoff and roof runoff from neary downspouts in front of the school. The existing catch basins can handle any overflow from the garden. The rain garden can reduce sediment and nutrient loading to the local waterway while providing beautiful landscaping to the school grounds. The gardens can also provide habitat for birds, butterflies, and pollinators.

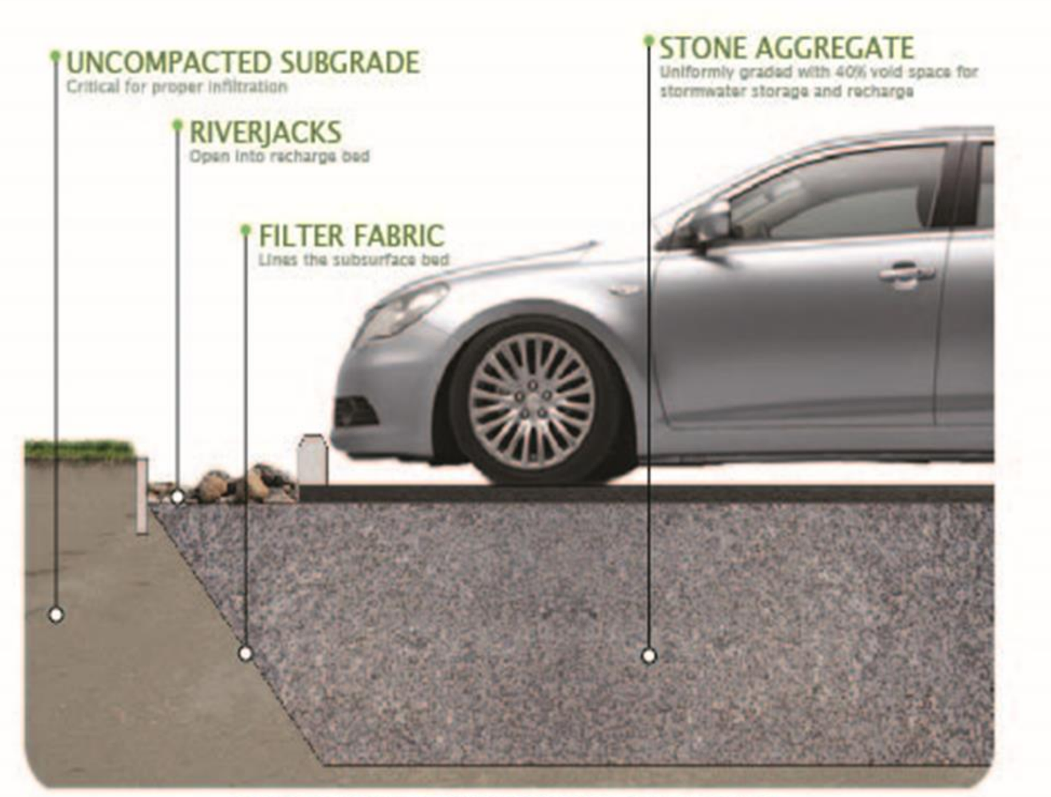
2 **POROUS PAVEMENT:** The asphalt where there is currently a basketball court can be converted into porous pavement. Porous pavement can allow for the infiltration of runoff from a portion of the building and the surrounding paved areas, preventing the water from reaching local waterways.

**EDUCATIONAL PROGRAM:** The RCE Water Resources Program's *Stormwater Management in Your Schoolyard* can be delivered at Cornerly Road School to educate the students about stormwater management, and incorporated into the elementary school educational curriculum on the water cycle

### 1 BIORETENTION SYSTEM




### 2 POROUS PAVEMENT




### EDUCATIONAL PROGRAM

**RESTRICTIVE SOILS IN THIS REGION**

- Site specific soil testing must be conducted.
- Green infrastructure in this area may require underdrain systems.

Conerly Road School
Green Infrastructure Information Sheet

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| **Location:**<br>35 Conerly Road<br>Somerset, NJ 08873 | **Municipality:**<br>Franklin Township<br><br>**Subwatershed:**<br>Raritan River Lower |
| **Green Infrastructure Description:**<br>bioretention system (rain garden)<br>porous pavement<br>*Stormwater Management in Your Schoolyard* education program | **Targeted Pollutants:**<br>total nitrogen (TN), total phosphorous (TP), and total suspended solids (TSS) in surface runoff |
| **Mitigation Opportunities:**<br>recharge potential: yes<br>stormwater peak reduction potential: yes<br>TSS removal potential: yes | **Stormwater Captured and Treated Per Year:**<br>rain garden: 272,799 gal.<br>porous pavement: 495,963 gal. |

**Existing Conditions and Issues:**
There are large amounts of impervious surfaces on this site that contribute to stormwater runoff and nonpoint source pollution. Runoff is carrying nonpoint source pollution such as sediments, nutrients, oil, and grease to local waterways. There is currently an asphalt basketball court in poor condition that is contributing to stormwater runoff. Multiple downspouts along the building are connected directly to the sewer system, adding pressure on the sewer system and carrying with it pollutants from the roof top.

**Proposed Solution(s):**
A bioretention system or rain garden could be installed at the north end of the site where the old sidewalk is covered with grass. Downspouts along the building could be connected to this rain garden to allow for pollutant removal and groundwater recharge. The basketball court on the site is in poor condition and is causing a large amount of stormwater runoff. Converting it to porous pavement will not only help manage stormwater runoff on the site but will also help educate students on the importance of stormwater management. The Rutgers Cooperative Extension (RCE) Water Resources Program has a youth education program called *Stormwater Management in Your Schoolyard* that could also be used at this school.

**Anticipated Benefits:**
A bioretention system is estimated to achieve a 30% removal rate for TN and a 60% removal rate for TP (NJDEP BMP Manual). TSS loadings may be reduced by up to 90%. If the bioretention system is designed to capture and infiltrate stormwater runoff from the 2-year design storm (3.3 inches of rain over 24 hours), these systems will prevent approximately 95% of the TN, TP, and TSS from flowing directly into local waterways. A bioretention system would also provide ancillary benefits such as enhanced wildlife and aesthetic appeal to faculty and students. A porous pavement basketball court is estimated to achieve a 50% removal rate for TN and a 60% removal rate for TP (NJDEP BMP Manual). TSS loadings may be reduced by up to 80%. If the porous pavement basketball court is designed to capture and infiltrate stormwater runoff from the 2-year design storm (3.3 inches of rain

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| over 24 hours), these systems will prevent approximately 95% of the TN, TP, and TSS from flowing directly into local waterways. |
| **Possible Funding Sources:**<br>mitigation funds from local developers<br>NJDEP grant programs like 319(h) and 604(b)<br>Franklin Township home and school associations<br>Boy Scouts, Girl Scouts, or service project |
| **Partners/Stakeholders:**<br>Franklin Township<br>teachers, students, and parents<br>Rutgers Cooperative Extension |
| **Estimated Cost:**<br>The rain garden would need to be approximately 2,620 square feet. At $5 per square foot, the estimated cost of the rain garden is $13,100. The porous pavement basketball court would need to be approximately 14,750 square feet in size. At $15 per square foot, the estimated cost of the parking lot is $221,250. The total cost of the project would be approximately $234,350. |