Draft

Impervious Cover Assessment for Branchburg Township, Somerset County, New Jersey

Prepared for Branchburg Township by the Rutgers Cooperative Extension Water Resources Program

February 4, 2015

Introduction

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

Figure 1: Stormwater draining from a parking lot

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

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

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

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

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

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

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

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

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

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

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

Branchburg Township Impervious Cover Analysis

Located in Somerset County in central New Jersey, Branchburg Township covers approximately 20.3 square miles west of Bridgewater. Figures 3 and 4 illustrate that Branchburg Township is dominated by urban land uses. A total of 51.0% of the municipality's land use is classified as urban. Of the urban land in Branchburg Township, rural residential is the dominant urban land use (Figure 5).

The literature suggests a link between impervious cover and stream ecosystem impairment starting at approximately 10% impervious surface cover (Schueler, 1994; Arnold and Gibbons, 1996; May et al., 1997). Impervious cover may be linked to the quality of lakes, reservoirs, estuaries, and aquifers (Caraco et al., 1998), and the amount of impervious cover in a watershed can be used to project the current and future quality of streams. Based on the scientific literature, Caraco et al. (1998) classified urbanizing streams into the following three categories: sensitive streams, impacted streams, and non-supporting streams. Sensitive 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 Branchburg 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 Branchburg Township. Based upon the 2007 NJDEP land use/land cover data, approximately 11.9% of Branchburg Township has impervious cover. This level of impervious cover suggests that the streams in Branchburg Township are likely impacted.

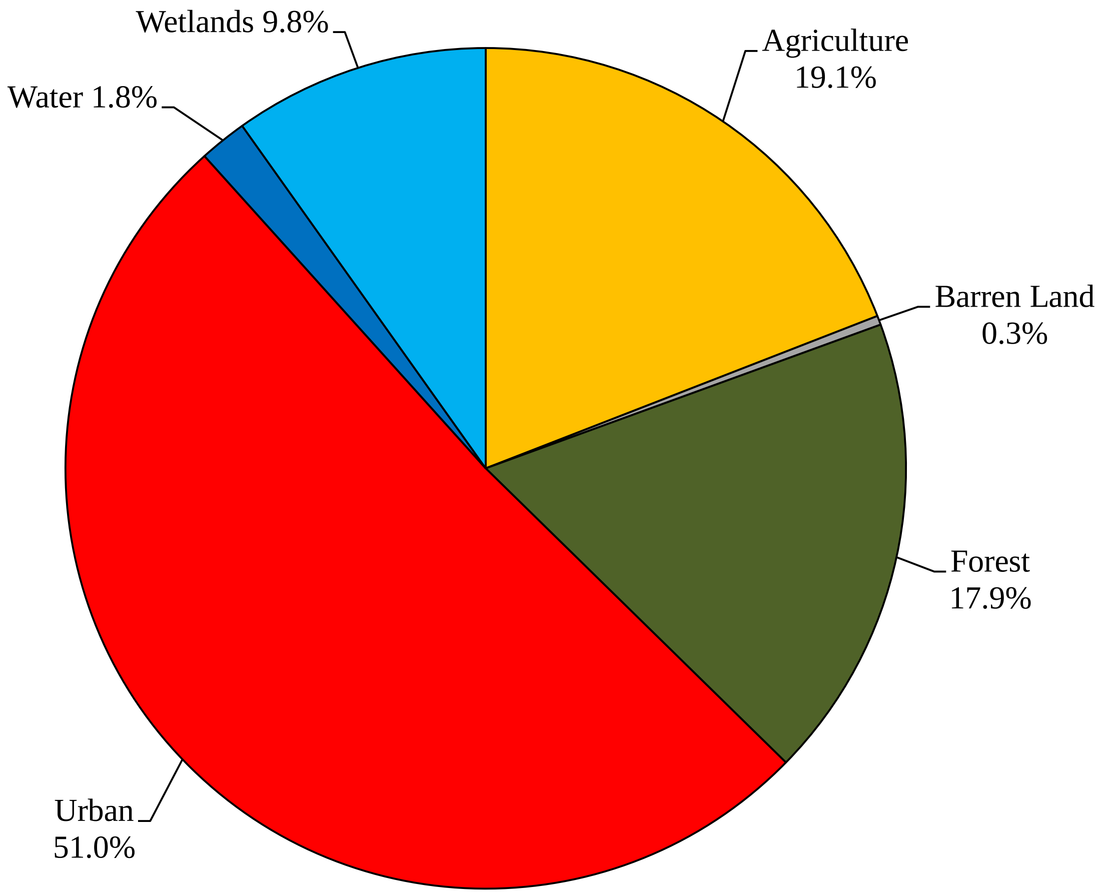


Figure 3: Pie chart illustrating the land use in Branchburg Township

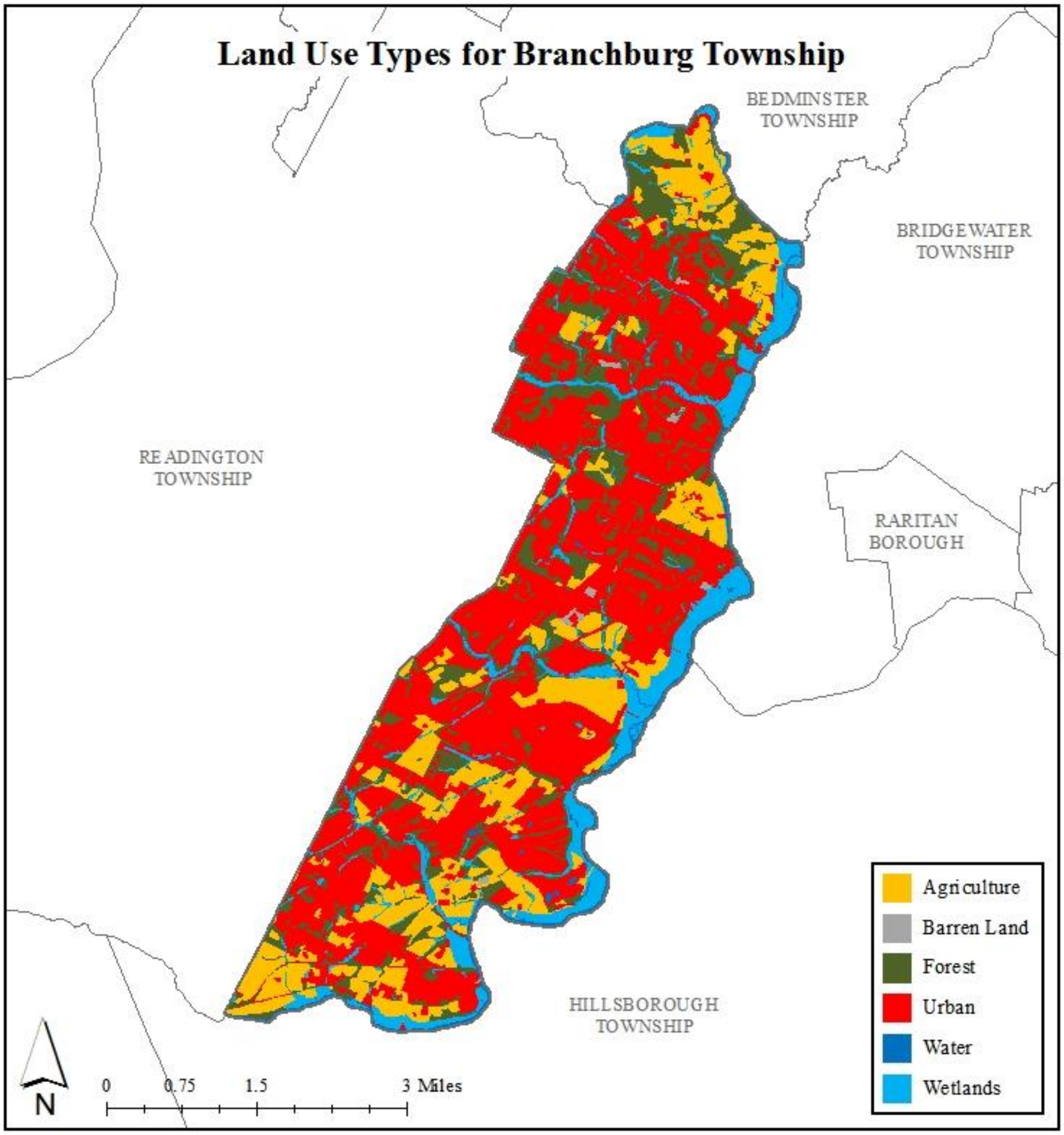


Figure 4: Map illustrating the land use in Branchburg Township

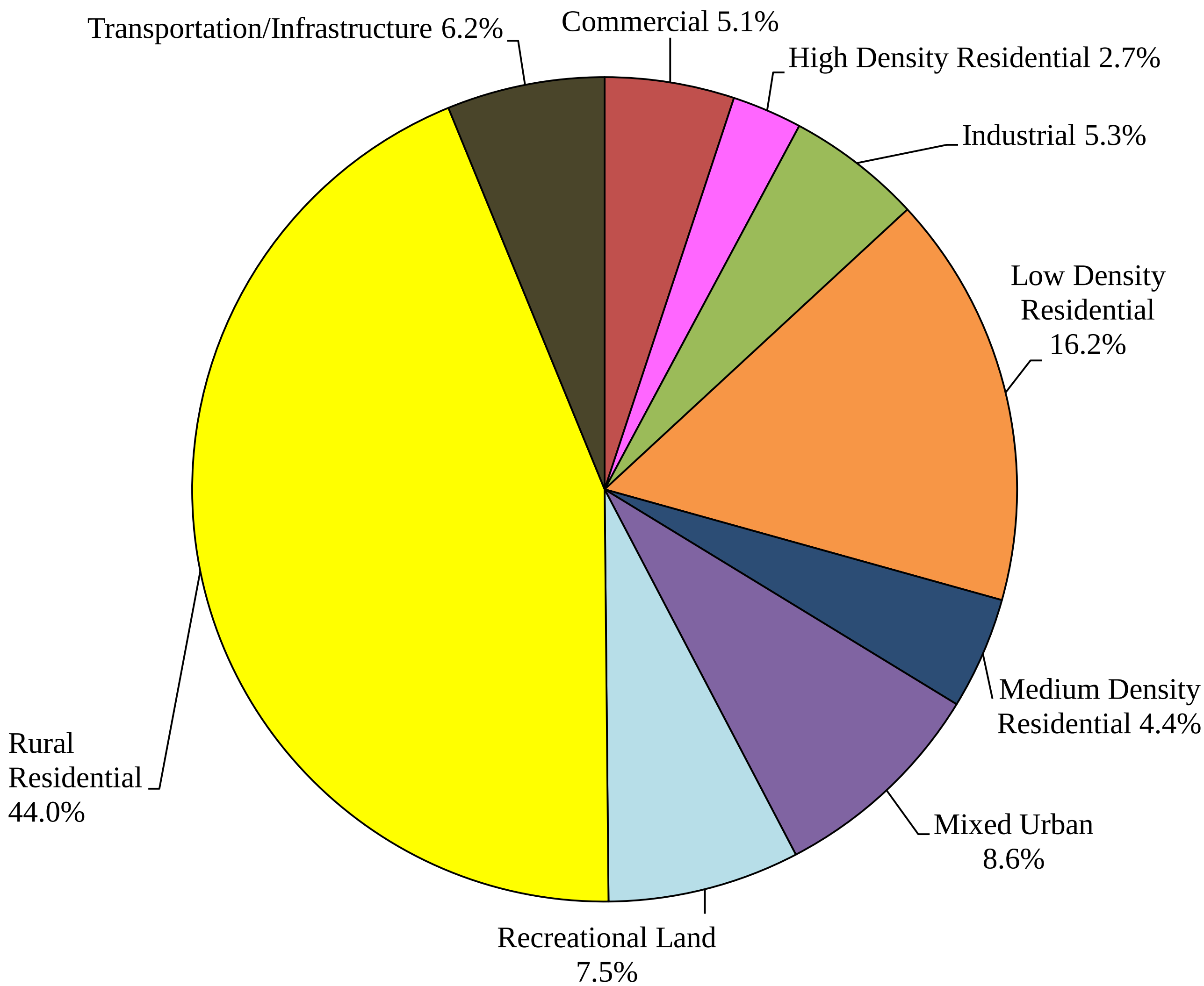


Figure 5: Pie chart illustrating the various types of urban land use in Branchburg Township

Water resources are typically managed on a watershed/subwatershed basis; therefore an impervious cover analysis was performed for each Raritan River subwatershed within Branchburg Township (Table 1 and Figure 6). On a subwatershed basis, impervious cover ranges from 0.0% in the Neshanic River and Lower Raritan River subwatersheds to 20.2% in the Chambers 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 Branchburg 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 Branchburg Township. For example, if the stormwater runoff from one water quality storm (1.25 inches of rain) in the Chambers Brook subwatershed was harvested and purified, it could supply water to 159 homes for one year[1].

[1] Assuming 300 gallons per day per home

Table 1: Impervious cover analysis by subwatershed for Branchburg Township

Subwatershed	Total Area		Land Use Area		Water Area		Impervious Cover		
	(ac)	(mi^2)	(ac)	(mi^2)	(ac)	(mi^2)	(ac)	(mi^2)	(%)
Chambers Brook	2,564.9	4.01	2,545.5	3.98	19.4	0.03	513.5	0.80	20.2%
Holland Brook	1,942.7	3.04	1,926.1	3.01	16.6	0.03	280.2	0.44	14.6%
Lamington River	802.1	1.25	788.7	1.23	13.5	0.02	53.2	0.08	6.74%
Neshanic River	0.10	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00%
Lower Raritan River	0.10	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00%
Pleasant Run	1,589.6	2.48	1,574.9	2.46	14.7	0.02	98.9	0.15	6.28%
Raritan River North Branch	2,678.0	4.18	2,611.3	4.08	66.8	0.10	346.4	0.54	13.3%
Raritan River South Branch	3,392.5	5.30	3,286.2	5.13	106.3	0.17	220.4	0.34	6.71%
Total	12,970.0	20.3	12,732.7	19.9	237.3	0.37	1,512.6	2.36	11.9%

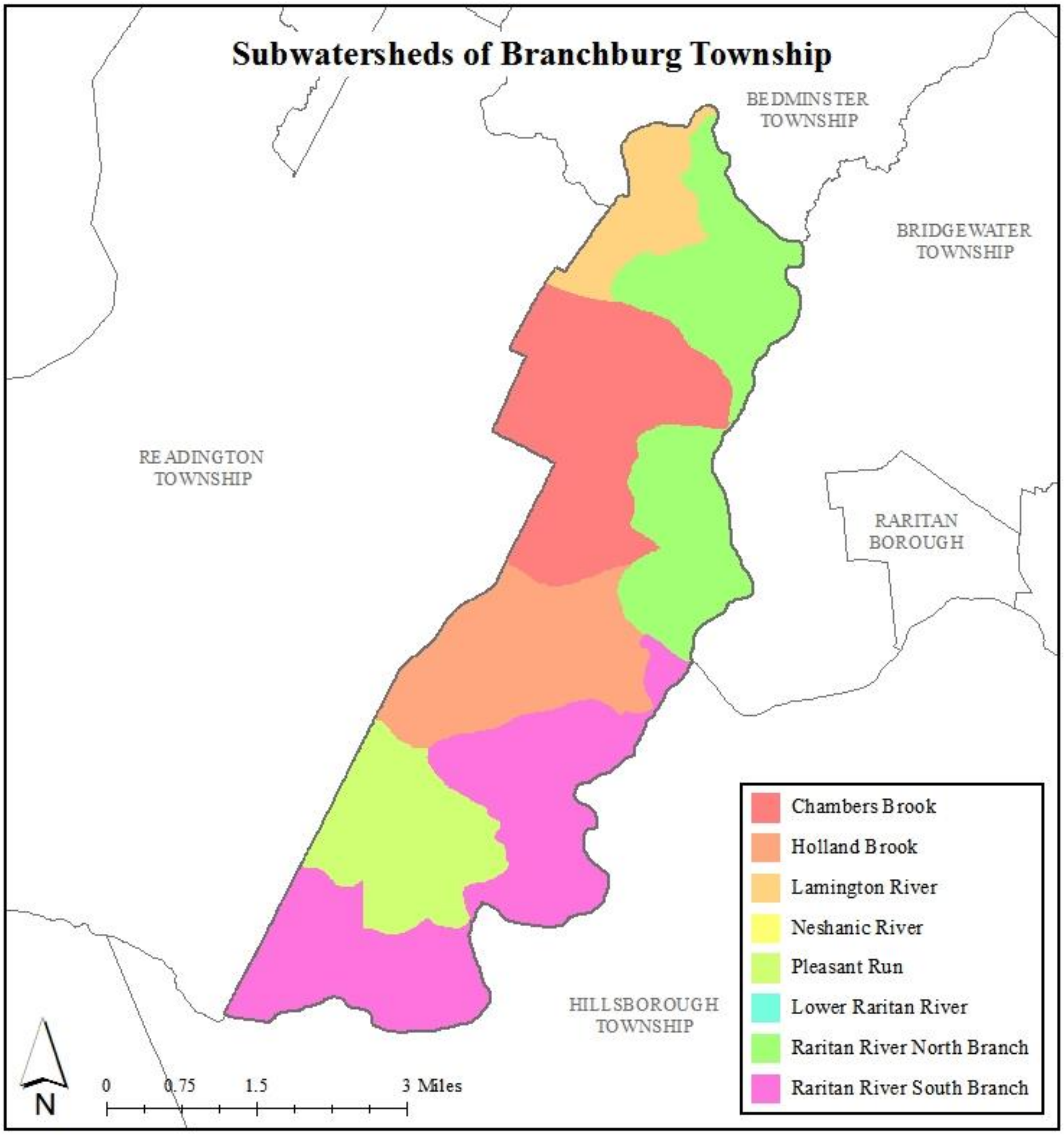


Figure 6: Map of the subwatersheds in Branchburg Township

Table 2: Stormwater runoff volumes from impervious surfaces by subwatershed in Branchburg 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)
Chambers Brook	17.4	613.5	46.0	69.7	114.3
Holland Brook	9.5	334.8	25.1	38.0	62.4
Lamington River	1.8	63.6	4.8	7.2	11.8
Neshanic River	0.0	0.0	0.0	0.0	0.0
Lower Raritan River	0.0	0.0	0.0	0.0	0.0
Pleasant Run	3.4	118.2	8.9	13.4	22.0
Raritan River North Branch	11.8	413.8	31.0	47.0	77.1
Raritan River South Branch	7.5	263.3	19.7	29.9	49.1
Total	51.3	1,807.2	135.5	205.2	336.8

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

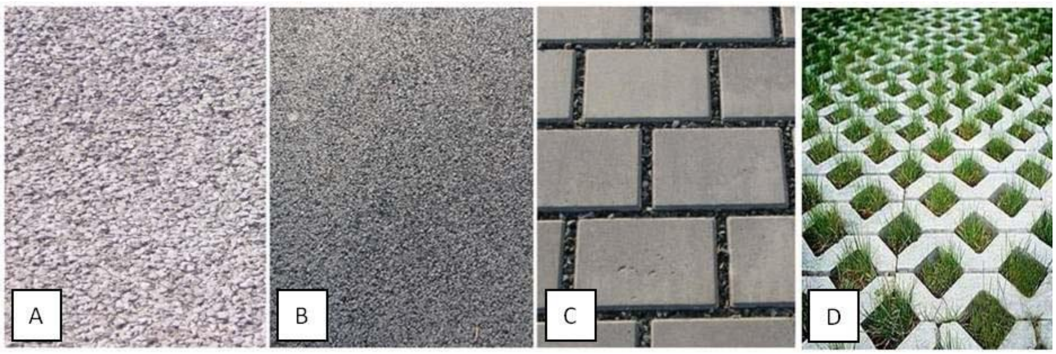
Subwatershed	Recommended Impervious Area Reduction (10%) (ac)	Annual Runoff Volume Reduction [2] (MGal)
Chambers Brook	51.4	58.3
Holland Brook	28.0	31.8
Lamington River	5.3	6.0
Neshanic River	0.0	0.0
Lower Raritan River	0.0	0.0
Pleasant Run	9.9	11.2
Raritan River North Branch	34.6	39.3
Raritan River South Branch	22.0	25.0
Total	151.2	171.8

[2] Annual Runoff Volume Reduction =
Acres of impervious cover 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 green infrastructure should be designed to capture the first 3.3 inches of rain from each storm. This would allow the green infrastructure to capture 95% of the annual rainfall of 44 inches.

Pervious Pavement

There are four different types of permeable pavement systems that are commonly being used throughout the country to reduce the environmental impacts from impervious surfaces. These surfaces include pervious concrete, porous asphalt, interlocking concrete pavers, and grid pavers.

> *"Permeable pavement is a stormwater drainage system that allows rainwater and runoff to move through the pavement's surface to a storage layer below, with the water eventually seeping into the underlying soil. Permeable pavement is beneficial to the environment because it can reduce stormwater volume, treat stormwater water quality, replenish the groundwater supply, and lower air temperatures on hot days (Rowe, 2012)."*



Permeable surfaces: (A) pervious concrete, (B) porous asphalt, (C) interlocking concrete pavers, (D) grid pavers (Rowe, 2012)

Pervious concrete and porous asphalt are the most common of the permeable surfaces. They are similar to regular concrete and asphalt but without the fine materials. This allows water to quickly pass through the material into an underlying layered system of stone that holds the water allowing it to infiltrate into the underlying uncompacted soil.

Impervious Cover Disconnection Practices

By redirecting runoff from paving and rooftops to pervious areas in the landscape, the amount of directly connected impervious area in a drainage area can be greatly reduced. There are many cost-effective ways to disconnect impervious surfaces from local waterways.

- Simple Disconnection: This is the easiest and least costly method to reduce stormwater runoff for smaller storm events. Instead of piping rooftop runoff to the street where it enters the catch basin and is piped to the river, the rooftop runoff is released onto a grassed area to allow the water to be filtered by the grass and soak into the ground. A healthy lawn typically can absorb the first one to two inches of stormwater runoff from a rooftop. Simple disconnection also can be used to manage stormwater runoff from paved areas. Designing a parking lot or driveway to drain onto a grassed area, instead of the street, can dramatically reduce pollution and runoff volumes.

- <u>Rain Gardens</u>: 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

- <u>Rainwater Harvesting</u>: 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 Branchburg 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 Branchburg 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

Branchburg 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

Examples of Impervious Cover Reduction Action Plan Projects

Concept Plans and Detailed Green Infrastructure Information Sheets

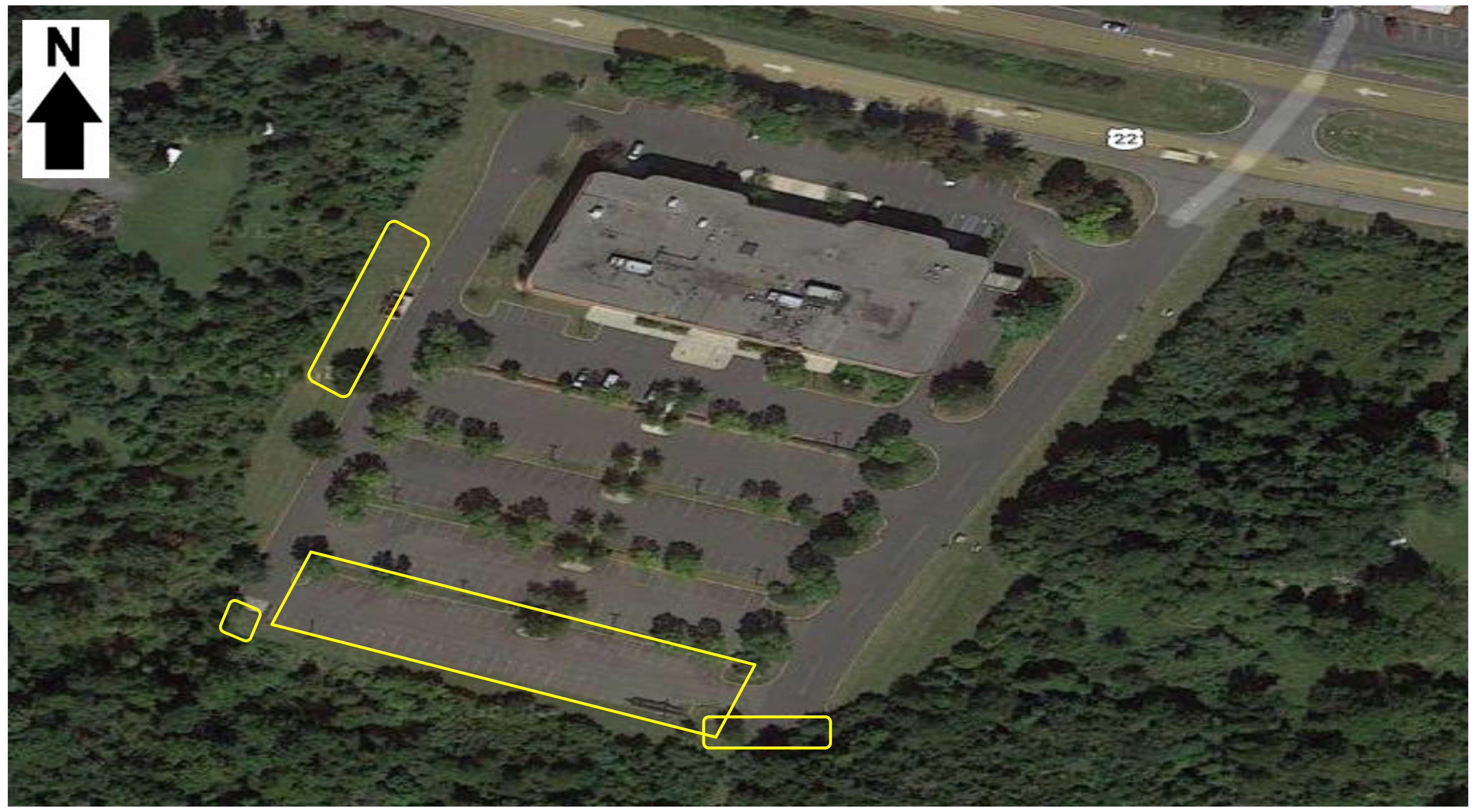
Branchburg Township

Impervious Cover Assessment

Branch Point Church, 3421 U.S. 22

RUTGERS New Jersey Agricultural Experiment Station

PROJECT LOCATION:



A

B

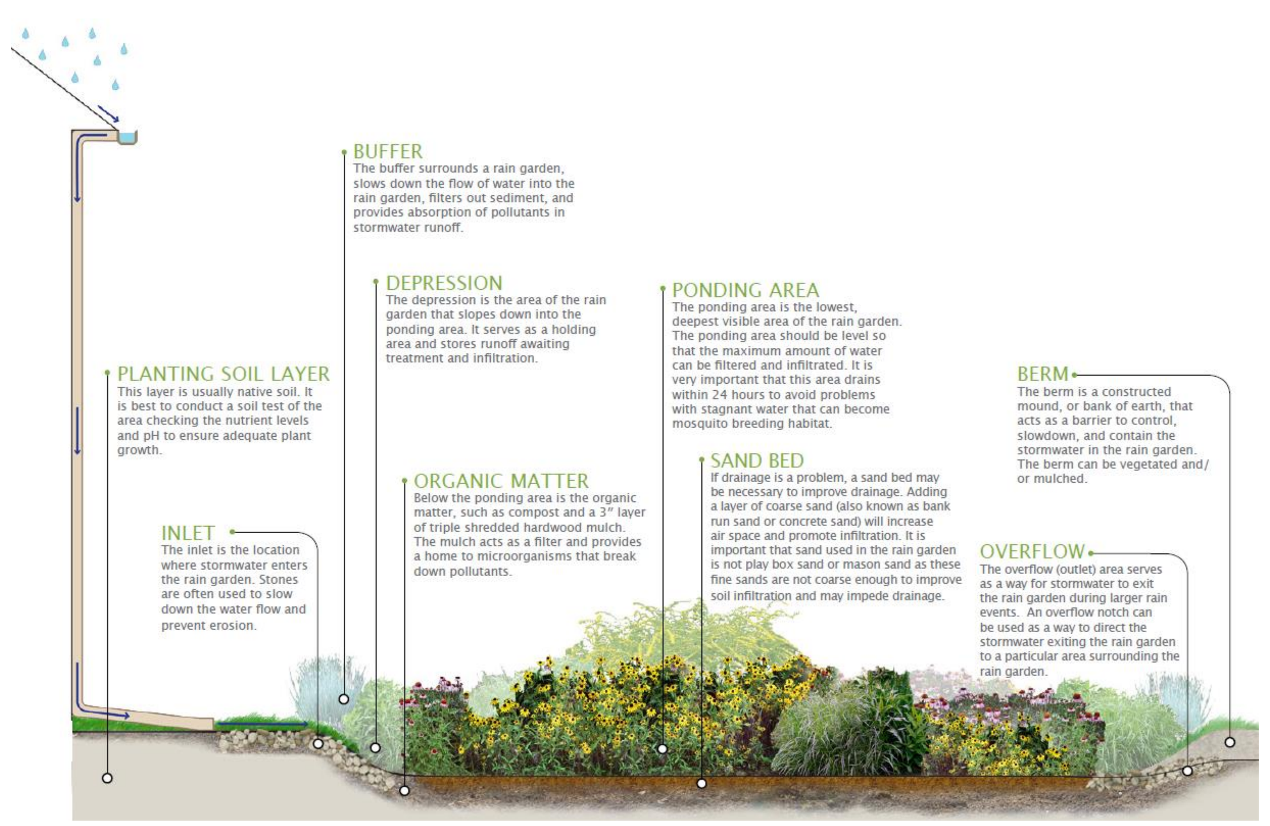
C

SITE PLAN:

1 **BIORETENTION SYSTEM:** Two bioretention systems could be installed at both far corners of the parking lot. A third bioretention system can be installed along the western edge of the parking lot. Curb cuts should be installed to allow the flow of runoff into the bioretention systems. Bioretention systems can be used to intercept, infiltrate, and treat runoff from the parking lots and the roadway on the property.

2 **POROUS PAVEMENT:** Porous pavement promotes groundwater recharge and filters stormwater. The selected parking spots could be replaced with porous pavement.

1 BIORETENTION SYSTEM



CURB CUT

2 POROUS PAVEMENT

Location: 3421 U.S. 22 Branchburg, NJ 08876	**Municipality:** Branchburg Township **Subwatershed:** Chambers Brook
Green Infrastructure Description: bioretention system (rain garden) porous pavement	**Targeted Pollutants:** total nitrogen (TN), total phosphorous (TP), and total suspended solids (TSS) in surface runoff
Mitigation Opportunities: recharge potential: yes stormwater peak reduction potential: yes TSS removal potential: yes	**Stormwater Captured and Treated Per Year:** bioretention system #1: 135,488 gal. bioretention system #2: 99,010 gal. bioretention system #3: 166,754 gal. porous pavement: 2,540,395 gal.

Existing Conditions and Issues:
There are impervious surfaces at this site that contribute to stormwater runoff volumes and nonpoint source pollution. Runoff is carrying nonpoint source pollution, such as sediments, nutrients, oil, and grease to local waterways. The northern edge of this site, along U.S. 22 has a parking lot that is eroded, uneven, and cracked. Sediments accumulate at the corner curb of every island. The parking lot on the southern end of the property slopes to the south.

Proposed Solution(s):
Bioretention systems could be installed in three areas around the parking lot. Bioretention system #1 could be placed around the large inlet on the west side lawn of the parking lot with the inlet acting as an overflow to manage stormwater runoff from the parking lot. Bioretention system #2 could be placed on the far west corner of the parking lot after the area of concrete separating the lawn and the parking lot is removed to capture stormwater runoff from the parking lot. Bioretention system #3 could be placed on the far east corner of the parking lot. Installing bioretention system #3 will reduce, capture, and filter stormwater from the eastern side of the parking lot. Porous pavement can be installed in the last two rows of parking and the driving lane. This will reduce the area of impervious cover as well as manage stormwater runoff. This area is likely used for overflow parking and is designed to handle stormwater runoff from the entire parking lot.

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

stormwater runoff to enter into vegetated areas or rain gardens. Porous pavement will promote groundwater recharge as well as intercept and filter stormwater runoff.

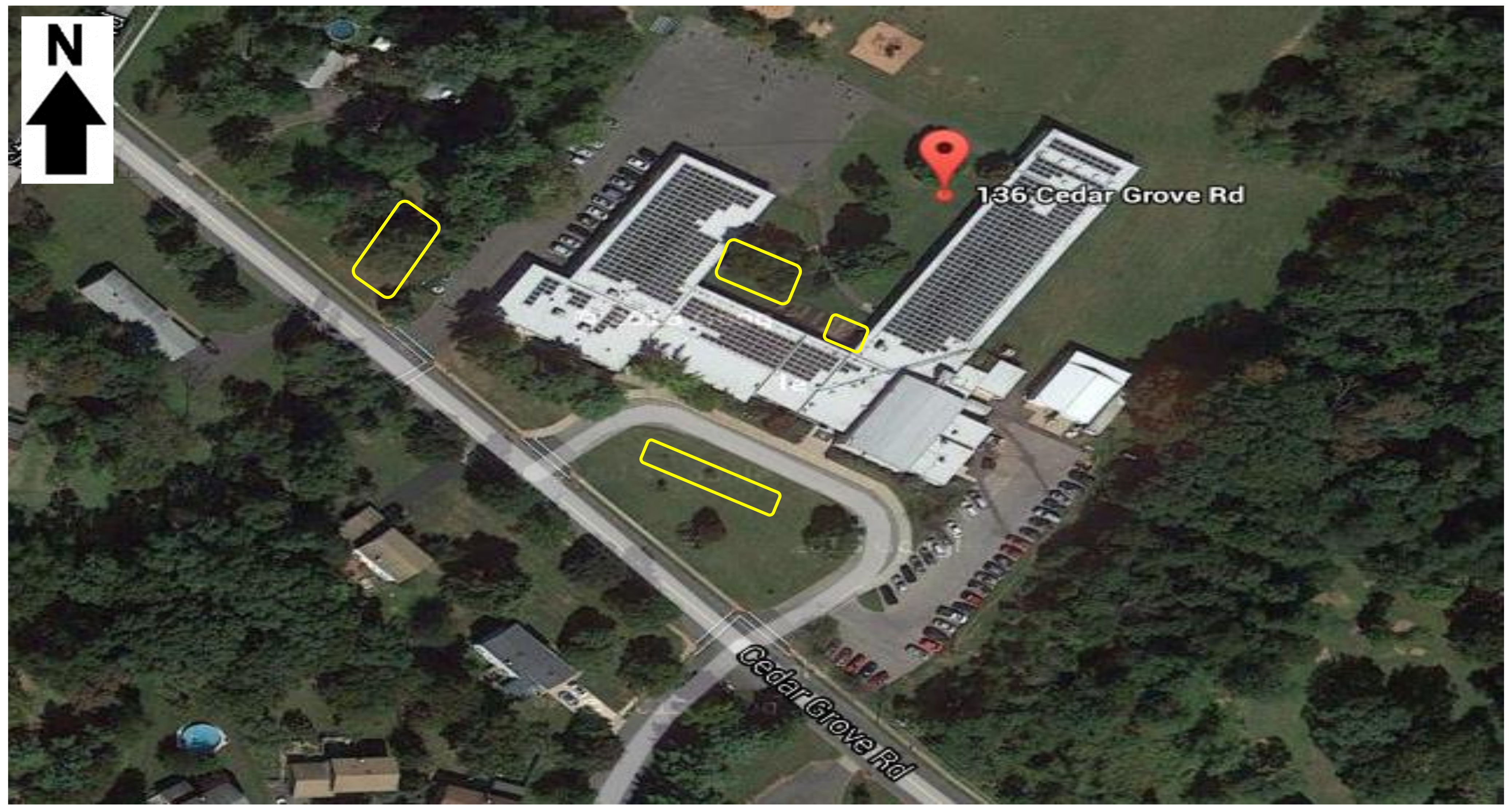
Possible Funding Sources:
mitigation funds from local developers
NJDEP grant programs
Branchburg Township
local social and community groups

Partners/Stakeholders:
Branch Point Church
Branchburg Township
local community groups
Rutgers Cooperative Extension

Estimated Cost:
Bioretention system #1 would need to be approximately 1,300 square feet. At $5 per square foot, the estimated cost of the rain garden is $6,500. Bioretention system #2 would need to be approximately 950 square feet in size. At $5 per square foot, the estimated cost of the rain garden is $4,750. Bioretention system #3 would need to be approximately 1,600 square feet. At $5 per square foot, the estimated cost of the bioretention system is $8,000. Porous pavement would be approximately 12,000 square feet and three feet thick. At $30 per square foot, the estimated cost is $360,000. The total cost of the project would be approximately $379,250.

Branchburg Township
Impervious Cover Assessment
Stony Brook Elementary School,136 Cedar Grove Road

PROJECT LOCATION:



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SITE PLAN:

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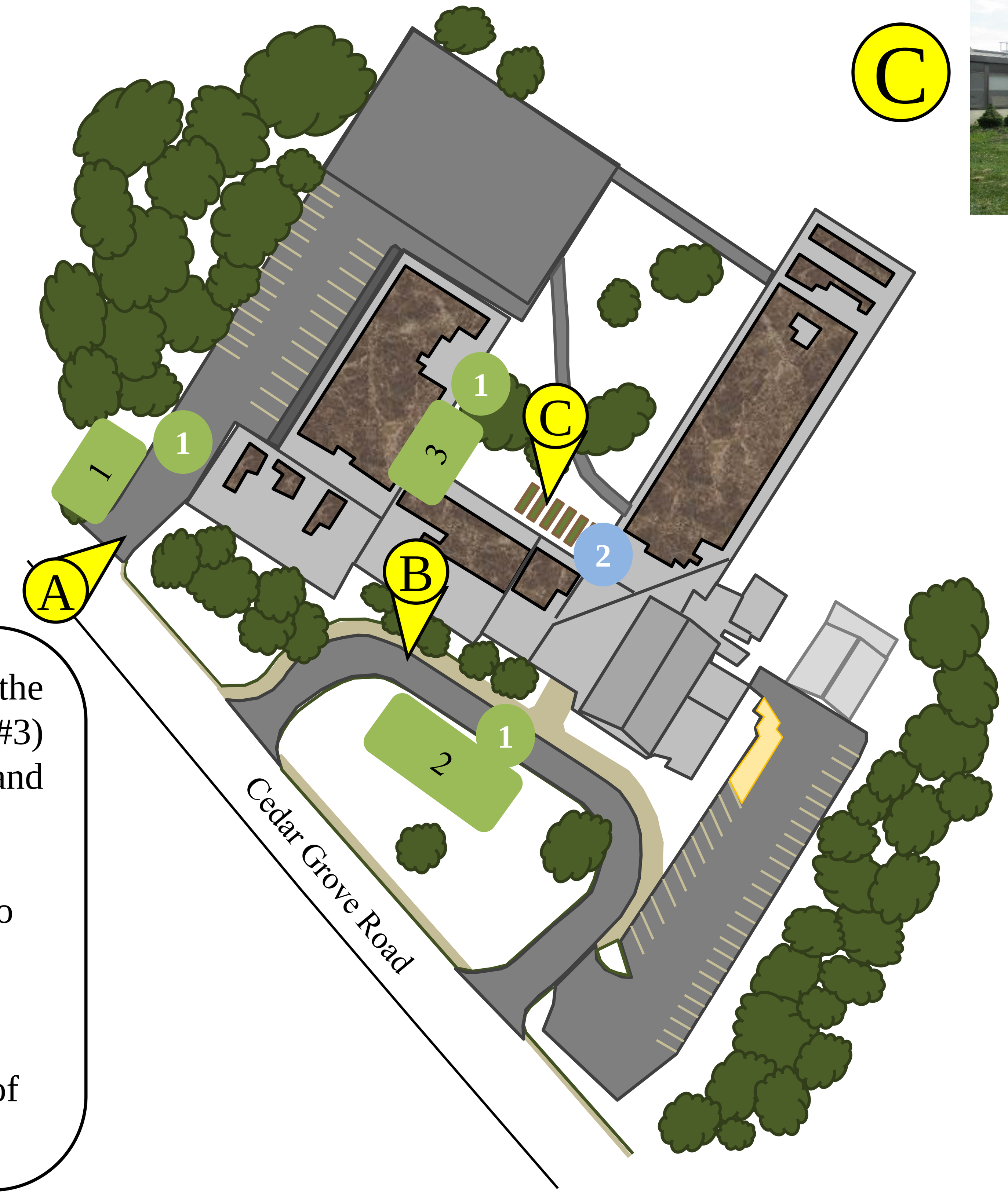
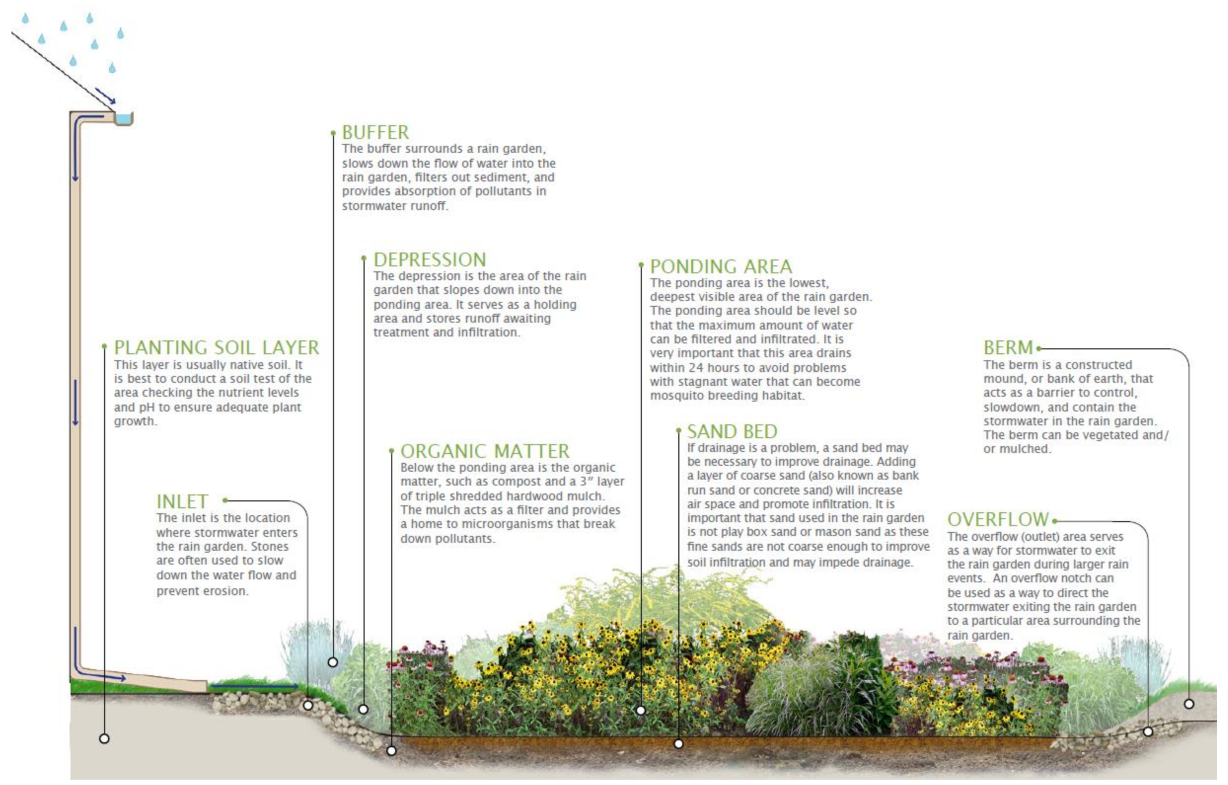


1 **BIORETENTION SYSTEM:** A bioretention system (#1) could be installed on the grassed area perpendicular to Cedar Grove Road on the left of the school. A second bioretention system (#2) could be installed on the turf grass area inside the semicircular driveway. Another bioretention system (#3) could be installed in the school courtyard. These systems will capture, treat, and infiltrate stormwater runoff from a portion of the parking lot and playground. Curb cuts could be installed to allow the flow of runoff into the bioretention systems .

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 water the new bioretention systems and existing landscaped areas.

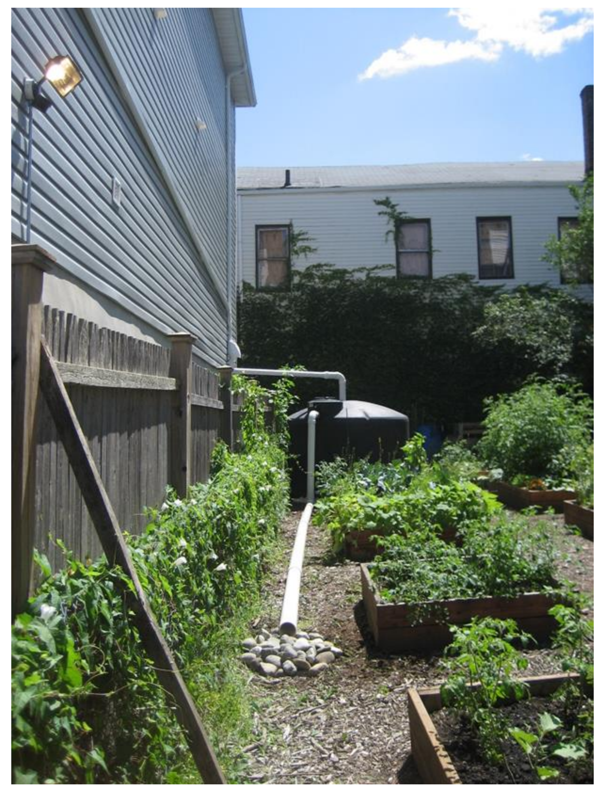
EDUCATIONAL PROGRAM: The RCE Water Resources Program *Stormwater Management in Your Schoolyard* program could be delivered at the Stony Brook Elementary School to educate the teachers and students about stormwater management and engage them in the design and construction of the bioretention systems.

1 BIORETENTION SYSTEM



CURB CUTS

2 RAINWATER HARVESTING SYSTEM



EDUCATIONAL PROGRAM

Location: 136 Cedar Grove Road Branchburg, NJ 08876	**Municipality:** Branchburg Township **Subwatershed:** Chambers Brook and Raritan River
Green Infrastructure Description: bioretention system (rain garden) rainwater harvesting system (cistern) educational program	**Targeted Pollutants:** total nitrogen (TN), total phosphorous (TP), and total suspended solids (TSS) in surface runoff
Mitigation Opportunities: recharge potential: yes stormwater peak reduction potential: yes TSS removal potential: yes	**Stormwater Captured and Treated Per Year:** bioretention system #1: 114,643 gal. bioretention system #2: 91,194 gal. bioretention system #3: 104,221 gal. cistern: 14,810 gal.

Existing Conditions and Issues:
There are impervious surfaces at this site that contribute to stormwater runoff volumes and nonpoint source pollution. Runoff is carrying nonpoint source pollution, such as sediments, nutrients, oil, and grease to local waterways. This site includes turf grass area along the western edge of the site off of Cedar Grove Drive. The turf grass area in front of the arc driveway has two inlets that are directly connected to the storm sewer system. The school has many connected downspouts.

Proposed Solution(s):
A bioretention system (#1) can be installed along the western edge of the site, near the entrance off of Cedar Grove Road. Curb cuts would allow runoff to leave the driveway and be redirected into the bioretention system. Another bioretention system (#2) could be installed inside the turf grass area inside the semicircular driveway. A curb cut would allow runoff from the driveway to flow south into the bioretention system. A third bioretention system (#3), can be installed in the courtyard area along the northern face of the school. The connected downspouts can be redirected into it. The remaining connected downspouts on the north side of the school can be redirected into a rainwater harvesting cistern. The cistern can collect water to be used to water the new bioretention systems and existing landscaped areas. The RCE Water Resources Program has a program entitled *Stormwater Management in Your Schoolyard* where Water Resources Program staff provide educational programming about stormwater management and work with the students to design and implement bioretention systems.

Anticipated Benefits:
A bioretention system is estimated to achieve a 30% removal rate for TN and a 60% removal rate for TP (NJDEP BMP Manual). TSS loadings may be reduced by up to 80%. If these bioretention systems are designed to capture and infiltrate stormwater runoff from the 2-year design storm (3.3 inches of rain over 24 hours), these systems will prevent approximately 95% of the TN, TP and TSS from flowing directly into local waterways. A bioretention system would also provide ancillary benefits such as enhanced wildlife habitat and aesthetic appeal. Since the proposed site is located at Stony Brook Elementary School, there is an opportunity to educate school children on the importance of watershed and stormwater management. This can be completed through the RCE Water Resources Program's *Stormwater Management in Your Schoolyard* program. The students could assist with installing the bioretention systems as part of a hands-on class activity. The curb cut would allow water to enter into the bioretention system from the impervious surface. The cistern captures stormwater runoff from the rooftop to be used for non-potable water needs, such as watering the existing raised beds.

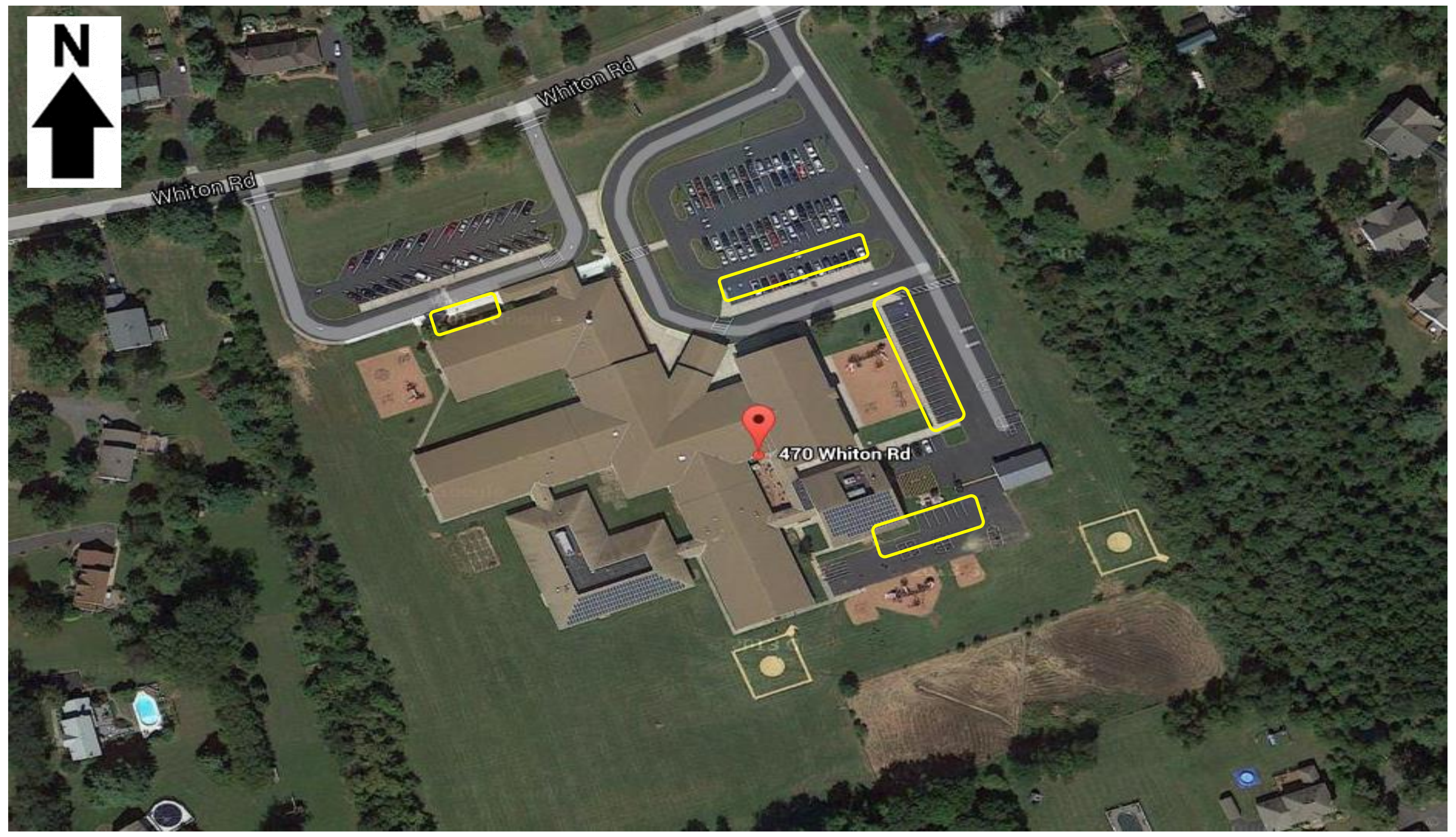
Possible Funding Sources:
mitigation funds from local developers
NJDEP grant programs
Branchburg Township
local social and community groups
Stoney Brook Home and School Association

Partners/Stakeholders:
Branchburg Township
Stony Brook Elementary School
local community groups
students and parents
Rutgers Cooperative Extension

Estimated Cost:
Bioretention system #1 would need to be approximately 1,300 square feet. At $5 per square foot, the estimated cost of the rain garden is $6,500. Bioretention system #2 would need to be approximately 950 square feet in size. At $5 per square foot, the estimated cost of the rain garden is $4,750. Bioretention system #3 would need to be approximately 1,600 square feet. At $5 per square foot, the estimated cost of the bioretention system is $8,000. The cistern would be approximately 1000 gallons and cost approximately $2,000. The total cost of this project would be about $21,250.

Branchburg Township
Impervious Cover Assessment
Whiton Elementary School, 470 Whiton Road

PROJECT LOCATION:



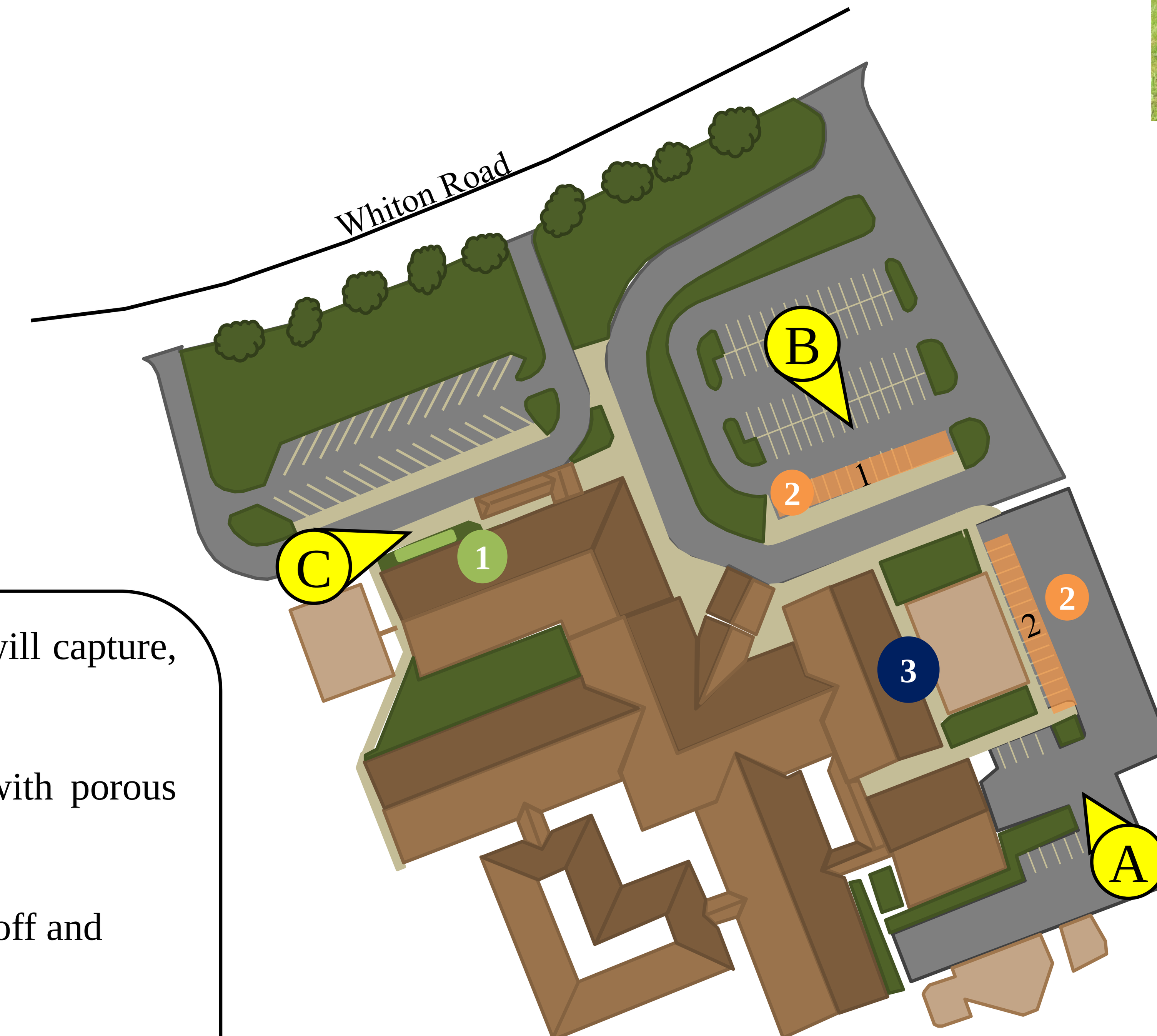
A

B

C

SITE PLAN:

N



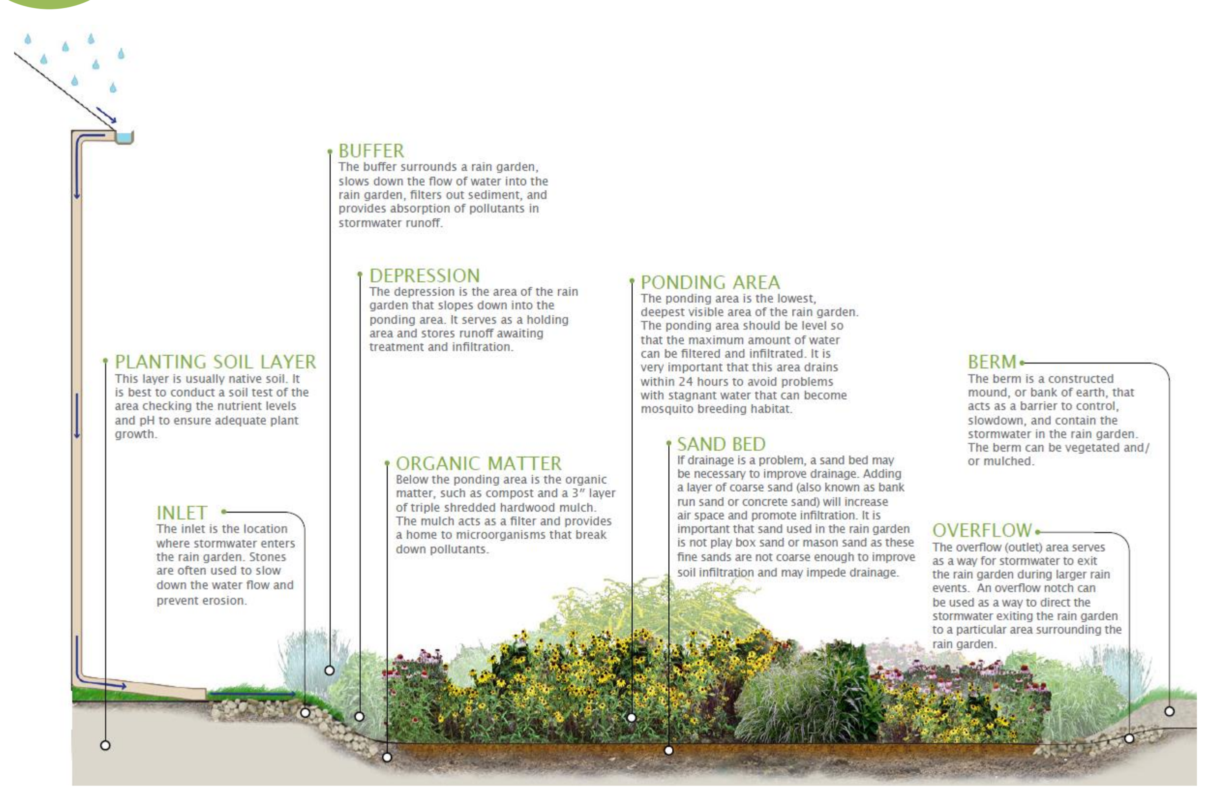
1 **BIORETENTION SYSTEM:** A bioretention system could be installed in the turf grass area on the northern side of the school. This systems will capture, treat, and infiltrate stormwater runoff from a portion of the school's roof via redirected downspouts.

2 **POROUS PAVEMENT:** Porous pavement promotes groundwater recharge and filters stormwater. The parking spots could be replaced with porous pavement.

3 **DOWNSPOUT PLANTER BOX:** A planter box could be installed at the southeast corner of the building. Downspout planter boxes reduce runoff and allow water to slowly infiltrate while being treated for pollutants.

EDUCATIONAL PROGRAM: The RCE Water Resources Program *Stormwater Management in Your Schoolyard* program could be delivered at the Whiton Elementary School to educate the teachers and students about stormwater management and engage them in the design and construction of the bioretention systems.

1 BIORETENTION SYSTEM



2 POROUS PAVEMENT

3 DOWNSPOUT PLANTER BOX

EDUCATIONAL PROGRAM

Location: 470 Whiton Road Neshanic Station, NJ 08853	**Municipality:** Branchburg Township **Subwatershed:** Raritan River
Green Infrastructure Description: bioretention system (rain garden) porous pavement downspout planter box	**Targeted Pollutants:** total nitrogen (TN), total phosphorous (TP), and total suspended solids (TSS) in surface runoff
Mitigation Opportunities: recharge potential: yes stormwater peak reduction potential: yes TSS removal potential: yes	**Stormwater Captured and Treated Per Year:** bioretention system : 44,294 gal. porous pavement #1: 78,166 gal. porous pavement #2: 262,560 gal. planter box: 52,111 gal.

Existing Conditions and Issues:

There are impervious surfaces at this site that contribute to stormwater runoff volumes and nonpoint source pollution. Runoff is carrying nonpoint source pollution, such as sediments, nutrients, oil, and grease to local waterways. This site includes the parking spots and sidewalk area in the front of the school closest to the building, the grassy area in the front of the building by the main entrance, the side parking lot area closest to the building, and the parking spots by the playground. The front of the building has deteriorated pavement. The turf grass area by the front of the building has connected downspouts. The side of the building has another section of deteriorated pavement and a sidewalk with at least two inlets that go out into the parking lot. The parking spots by the playground also are deteriorated and have at least two inlets near them.

Proposed Solution(s):

A bioretention system can be installed on the western side of the property, north side of the school. The downspouts in this area of the property can be disconnected and redirected into the bioretention system. Porous pavement can be installed in the first row of parking stalls, closest to the school in the northeast parking lot. Porous pavement can also be installed in the parking stalls on the eastern edge of the property (porous pavement #2). A downspout planter box can be installed on the southeastern corner of the school. The RCE Water Resources Program has a program entitled *Stormwater Management in Your Schoolyard* where Water Resources Program staff provide educational programming about stormwater management and work with the students to actually design and implement bioretention systems.

Anticipated Benefits:

A bioretention system is estimated to achieve a 30% removal rate for TN and a 60% removal rate for TP (NJDEP BMP Manual). TSS loadings may be reduced by up to 80%. If these bioretention systems are designed to capture and infiltrate stormwater runoff from the 2-year design storm (3.3

inches of rain over 24 hours), these systems will prevent approximately 95% of the TN, TP and TSS from flowing directly into local waterways. A bioretention system would also provide ancillary benefits such as enhanced wildlife habitat and aesthetic appeal. Porous pavement allows stormwater to infiltrate through to soil layers which will promote groundwater recharge as well as intercept and filter stormwater runoff. These systems are expected to achieve a 95% pollutant load reduction for TN, TP, and TSS. Downspout planter boxes can capture, treat, and infiltrate rooftop runoff. They also enhance aesthetic appeal, while reducing localized flooding. Since the proposed site is located at Whiton Elementary School, there is an opportunity to educate school children on the importance of watershed and stormwater management. This can be completed through the RCE Water Resources Program's *Stormwater Management in Your Schoolyard* program.

Possible Funding Sources:
mitigation funds from local developers
NJDEP grant programs
Branchburg Township
local social and community groups
Whiton Elementary Home and School Association

Partners/Stakeholders:
Branchburg Township
Whiton Elementary School
local community groups
students and parents
Rutgers Cooperative Extension

Estimated Cost:
The bioretention system would need to be approximately 425 square feet. At $5 per square foot, the estimated cost of the bioretention system is $2,125. The downspout planter box would treat approximately 500 square feet and cost approximately $300. The porous pavement #1 would need to be approximately 3,000 square feet and 1 foot thick. At $20 per square foot, not including sub base, the estimated cost of the porous pavement is $60,000. The porous pavement #2 would need to be approximately 2,500 square feet and 1.5 feet thick. At $22.50 per square foot the estimated cost of the porous pavement is $56,250. The total cost for this project would be $120,875.