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New Jersey Agricultural Experiment Station

Impervious Cover Assessment
for
Pohatcong Township, Warren County, New Jersey

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

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WILLIAM PENN FOUNDATION

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, and 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 cart ways could be converted to one-way cart 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

Pohatcong Township Impervious Cover Analysis

Located in Warren County, New Jersey, Pohatcong Township covers over 13 square miles east of the Delaware River and Pennsylvania. Figures 3 and 4 illustrate that Pohatcong Township is dominated by agricultural land uses. A total of 15.7% of the municipality's land use is classified as urban. Of the urban land in Pohatcong Township, rural residential is the dominant 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 Pohatcong 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 Pohatcong Township. Based upon the 2007 NJDEP land use/land cover data, approximately 4.5% of Pohatcong Township has impervious cover. This level of impervious cover suggests that the streams in Pohatcong Township are likely sensitive streams.

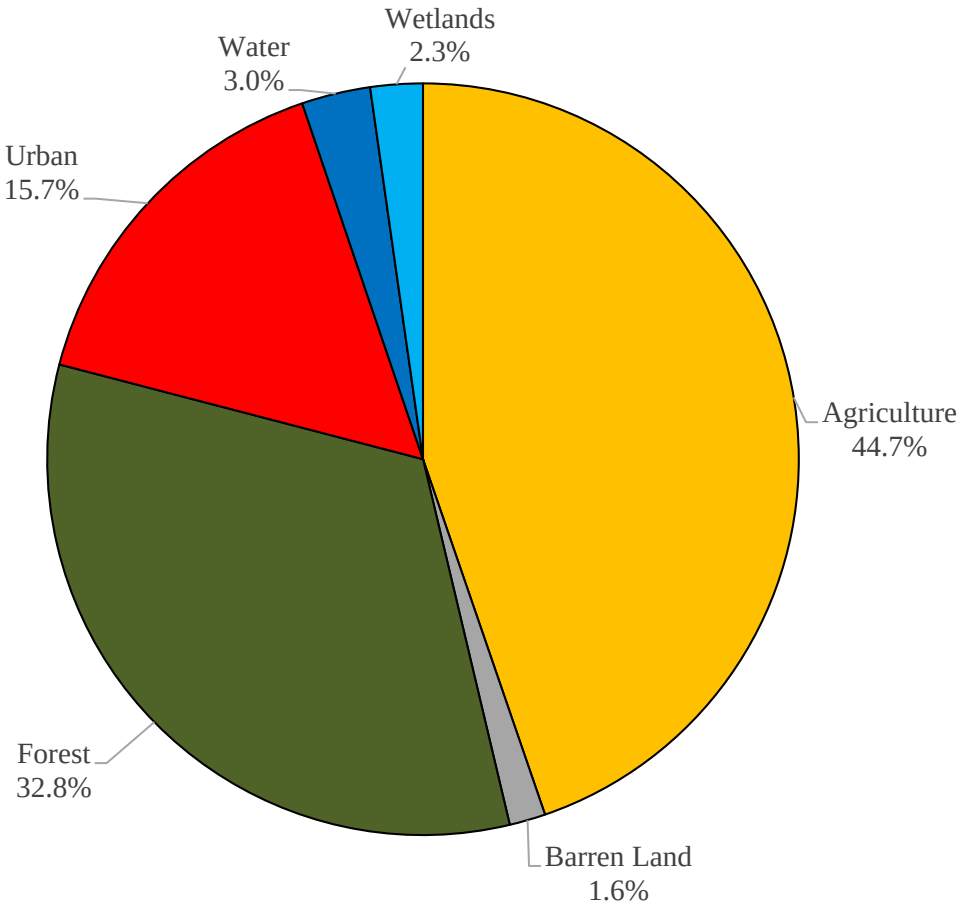


Figure 3: Pie chart illustrating the land use in Pohatcong Township

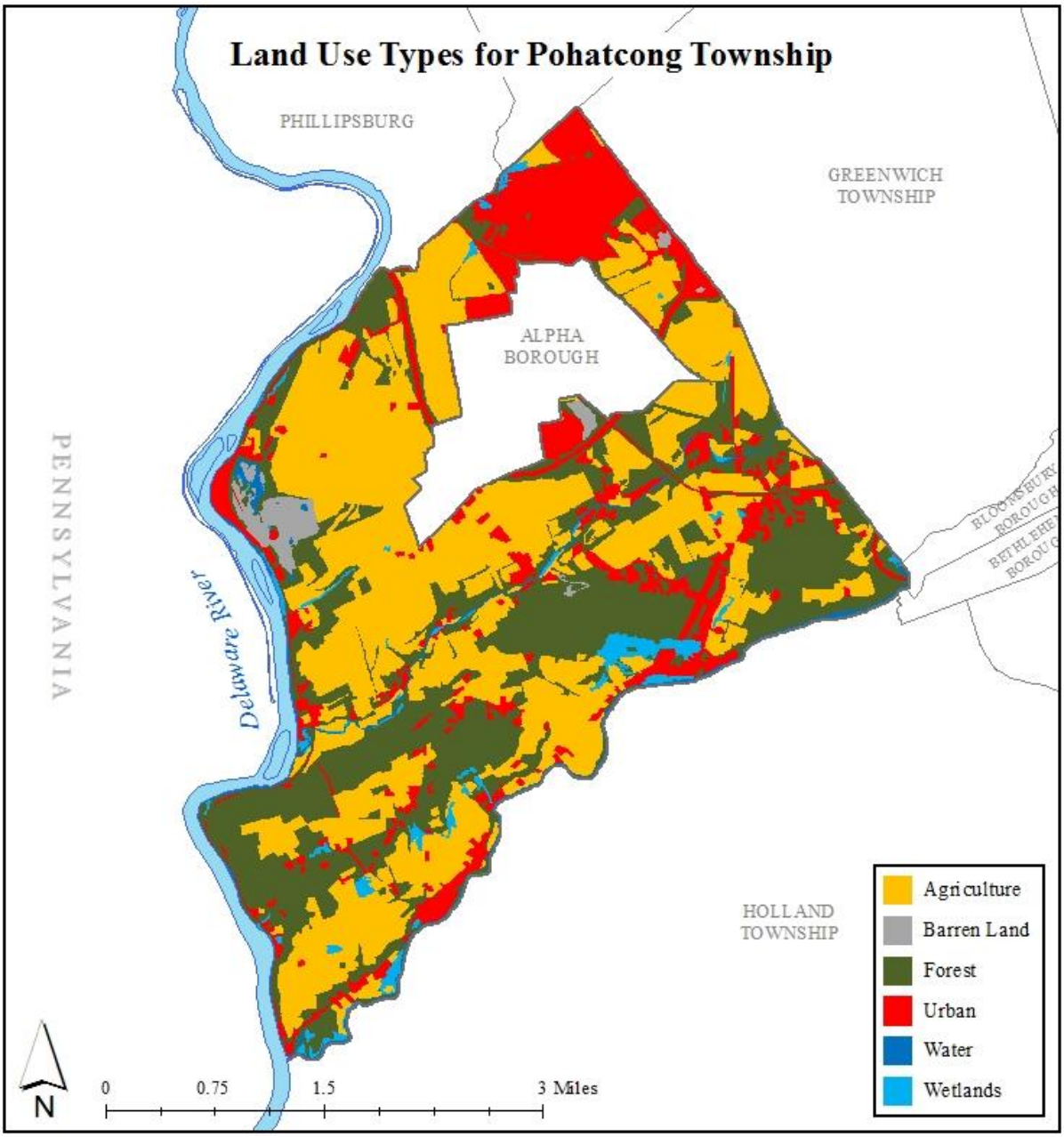


Figure 4: Map of the land use in Pohatcong Township

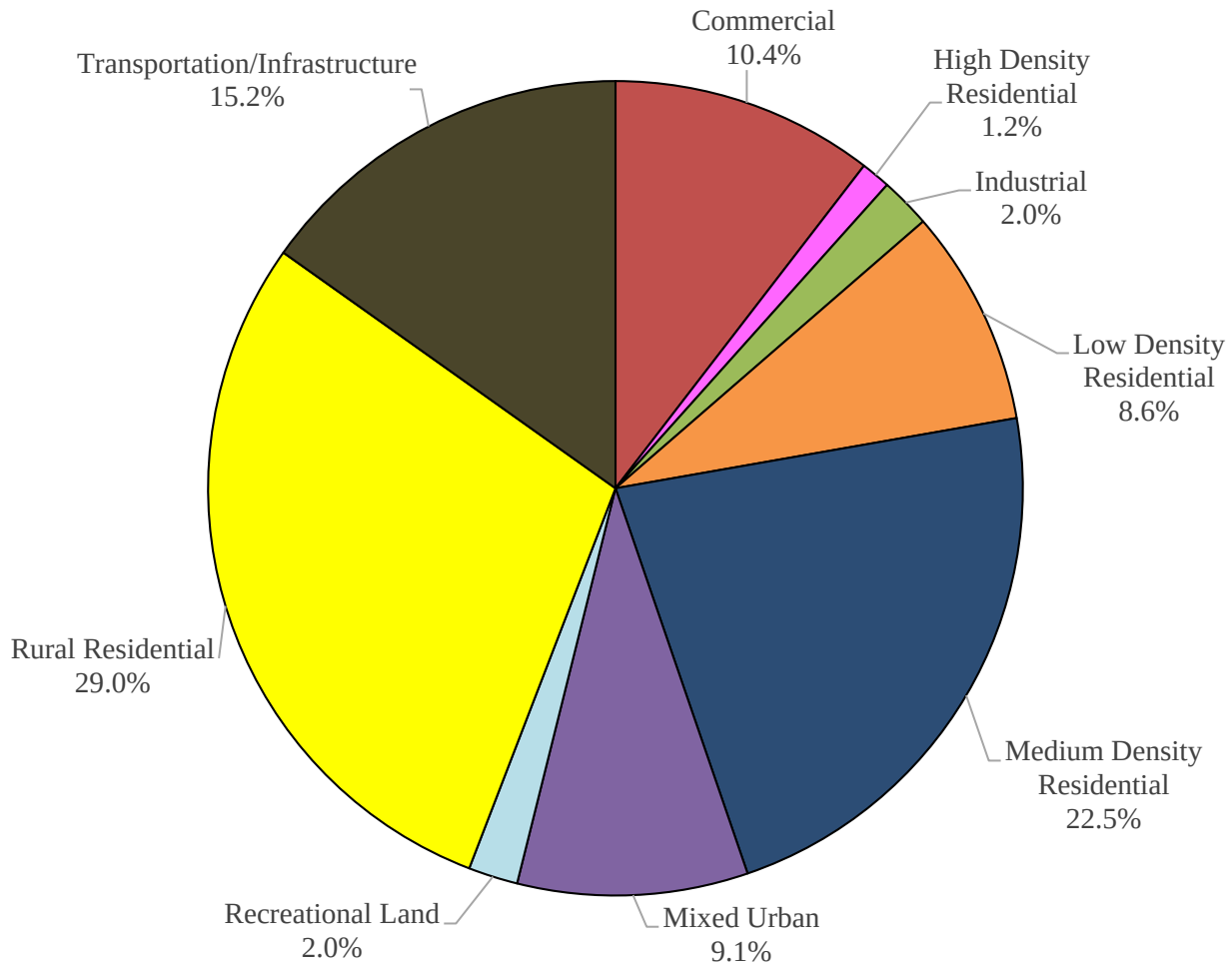


Figure 5: Pie chart illustrating the various types of urban land use in Pohatcong Township

Water resources are typically managed on a watershed/subwatershed basis; therefore an impervious cover analysis was performed for each subwatershed within Pohatcong Township (Table 1 and Figure 6). On a subwatershed basis, impervious cover ranges from 2.0% in the Musconetcong Creek subwatershed to 9.7% in the Lopatcong 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 Pohatcong Township, Warren 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 (4.9 inches of rain), and the 100-year design storm (7.8 inches of rain). These runoff volumes are summarized in Table 2. A substantial amount of rainwater drains from impervious surfaces in Pohatcong Township. For example, if the stormwater runoff from one water quality storm (1.25 inches of rain) in the Lopatcong Creek subwatershed was harvested and purified, it could supply water to 81 homes for a year[1].

[1] Assuming 300 gallons per day per home

Table 1: Impervious cover analysis by subwatershed for Pohatcong Township

Subwatershed	Total Area		Land Use Area		Water Area		Impervious Cover		
	(ac)	(mi^2)	(ac)	(mi^2)	(ac)	(mi^2)	(ac)	(mi^2)	(%)
Lopatcong Creek	2,664	4.2	2,555	4.0	109	0.2	260	0.4	9.7%
Musconetcong River	2,330	3.6	2,292	3.6	38	0.1	46	0.1	2.0%
Pohatcong Creek	3,731	5.8	3,619	5.7	112	0.2	86	0.1	2.3%
Total	8,724	13.6	8,466	13.3	259	0.5	392	0.6	4.5%

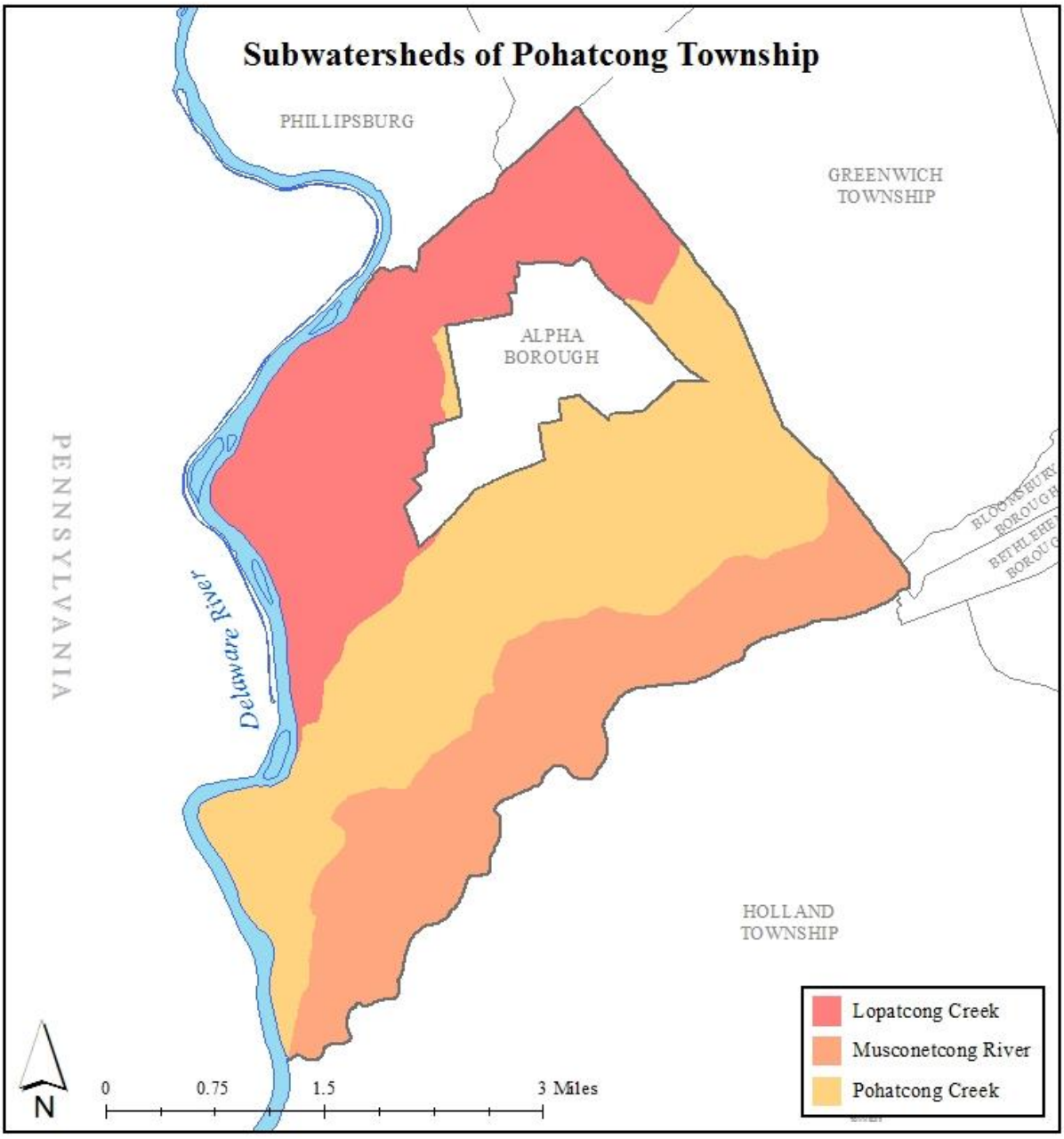


Figure 6: Map of the subwatersheds in Pohatcong Township

Table 2: Stormwater runoff volumes from impervious surfaces by subwatershed in Pohatcong 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 (4.9") (MGal)**	**Total Runoff Volume for the 100-Year Design Storm (7.8") (MGal)**
Lopatcong Creek	8.8	310.6	23.3	34.6	55.1
Musconetcong River	1.6	55.0	4.1	6.1	9.7
Pohatcong Creek	2.9	102.7	7.7	11.4	18.2
Total	13.3	468.3	35.1	52.2	83.0

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 Pohatcong 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, there 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 Pohatcong Township

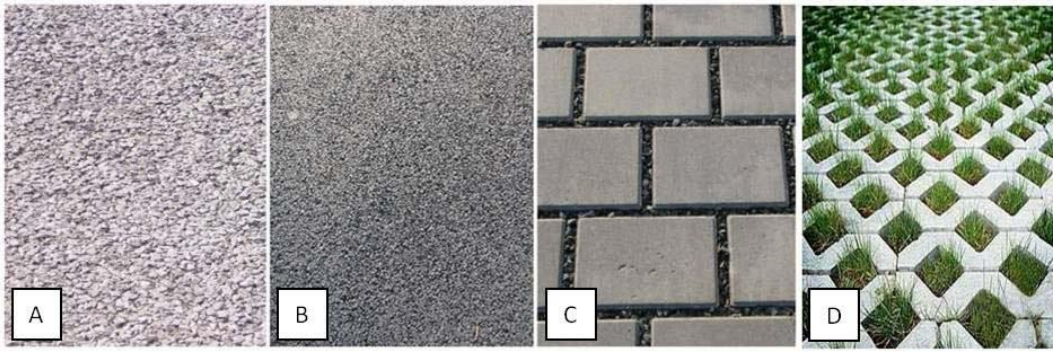
Subwatershed	**Recommended Impervious Area Reduction (10%) (ac)**	**Annual Runoff Volume Reduction [2] (MGal)**
Lopatcong Creek	26.0	29.5
Musconetcong River	4.6	5.2
Pohatcong Creek	8.6	9.8
Total	39.1	44.5

[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.

- 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 and treat 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 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 Pohatcong 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 Pohatcong Township, three sites have been included in this assessment. Examples of concept plans and detailed green infrastructure information sheets are provided in Attachment 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

Pohatcong 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

Pohatcong Township
Impervious Cover Assessment
Advanced Rehabilitation, 536 New Brunswick Avenue

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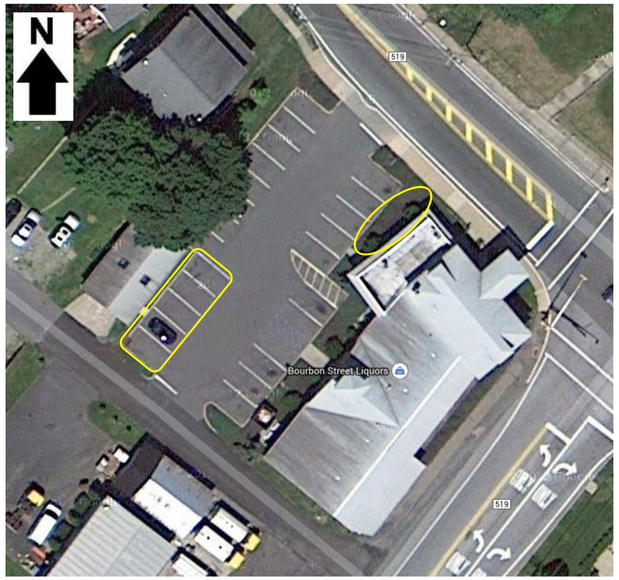
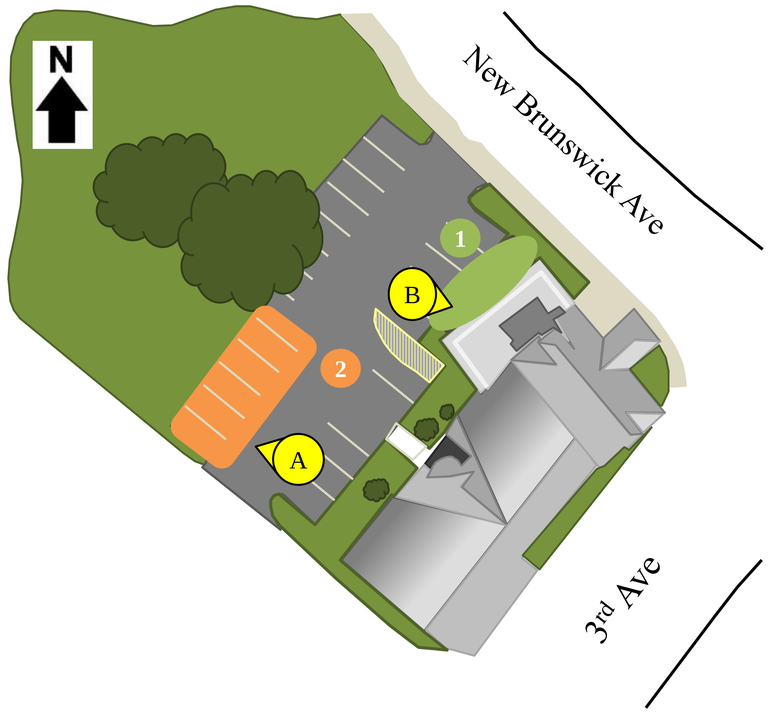
PROJECT LOCATION:



A

B

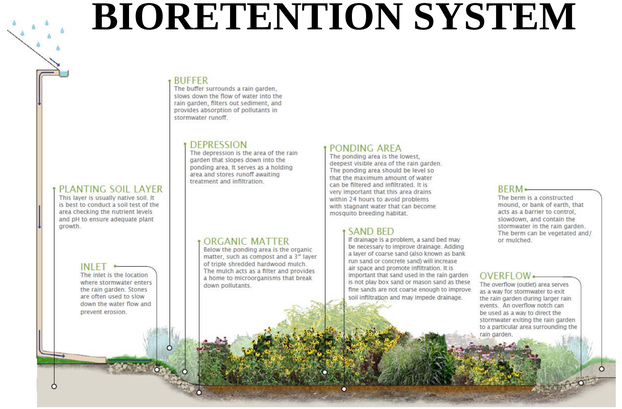
SITE PLAN:



1 **BIORETENTION SYSTEM:** A bioretention system could be installed along the northern side of the parking lot. A bioretention system will reduce runoff and allow stornwater infiltration, decreasing the amount of contaminants that reaches catch basins.

2 **POROUS PAVEMENT:** Porous pavement promotes groundwater recharge and filters stormwater.

1 BIORETENTION SYSTEM



2 POROUS PAVEMENT

Advanced Rehabilitation
Green Infrastructure Information Sheet

Location: 536 New Brunswick Avenue Pohatcong, NJ 08865	**Municipality:** Pohatcong Township **Subwatershed:** Lopatcong Creek
Green Infrastructure Description: bioretention system (rain garden) porous pavement	**Targeted Pollutants:** total nitrogen (TN), total phosphorus (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: 23,500 gal. porous pavement: 131,300 gal.

Existing Conditions and Issues:

This site contains several impervious surfaces including sidewalks, a parking lot, and one building. These impervious surfaces are directly connected to a storm sewer system. The site's impervious surfaces produce stormwater runoff during rain events. Based on the grading of the parking lot, it would seem that most of the lot's stormwater runoff would flow to the western storm drain adjacent to the neighboring garage. Based on aerial imagery and site photos, it would seem that this drain manages roughly 5,000 square feet of the parking lot's drainage area. There are several directly connected downspouts around the building. One downspout at the northern corner of the building appears to convey water from a 900 square foot roof on the building. Much of the pavement and sidewalk around the building is in poor condition. On the eastern side of the building near the entrance to Bourbon Street Liquors there is a downspout which could be routed directly into a stormwater planter. It should be noted that there appear to be several utility systems at this location.

Proposed Solution(s):

The five spaces in the southwest corner of the parking lot could be repaved with porous pavement. A bioretention system (rain garden) could be installed at this site to receive stormwater from the roof of the northern portion of the building. This system would be installed in the gravel space between the building and the northernmost four parking spaces of the parking lot. It is also recommended that the previously mentioned downspout near the entrance to Bourbon Street Liquors be connected to a stormwater planter.

Anticipated Benefits:

Since the bioretention systems would be designed to capture, treat, and infiltrate the entire 2-year design storm (3.3 inches of rain over 24 hours), these systems are estimated to achieve a 95% pollutant load reduction for TN, TP, and TSS. A bioretention system would also provide ancillary benefits, such as enhancing the site's ecological functionality and its aesthetic appeal to patrons and the local residents of Pohatcong Township. Porous pavement allows stormwater to penetrate through to soil layers which will promote groundwater recharge as well as intercept and filter

stormwater runoff. This system will achieve the same level of pollutant load reduction for TN, TP and TSS as the bioretention system.

Possible Funding Sources:
mitigation funds from local developers
NJDEP grant programs
Pohatcong Township
Advanced Rehabilitation
Bourbon Street Liquors
local social and community groups

Partners/Stakeholders:
Pohatcong Township
Advanced Rehabilitation
Bourbon Street Liquors
local social and community groups
residents and patrons
Rutgers Cooperative Extension

Estimated Cost:
The bioretention system would need to be approximately 230 square feet. At $5 per square foot, the estimated cost of this bioretention system is $1,150. The porous pavement would cover approximately 900 square feet and have a 2 foot deep stone reservoir under the surface. At $25 per square foot, the cost of the porous pavement system would be $22,500. The total cost of the project will thus be approximately $23,650.

Pohatcong Township
Impervious Cover Assessment

Pohatcong Township Elementary School, 240 County Road 519

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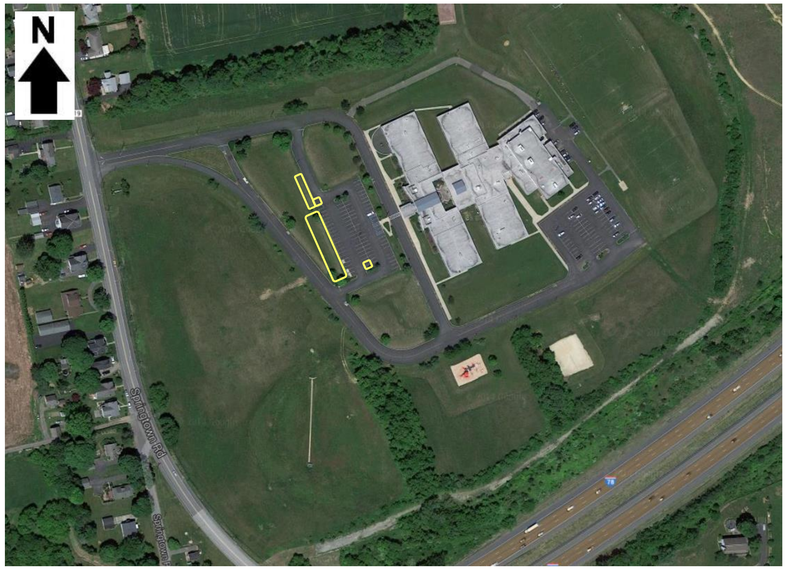
New Jersey Agricultural Experiment Station

PROJECT LOCATION:



A

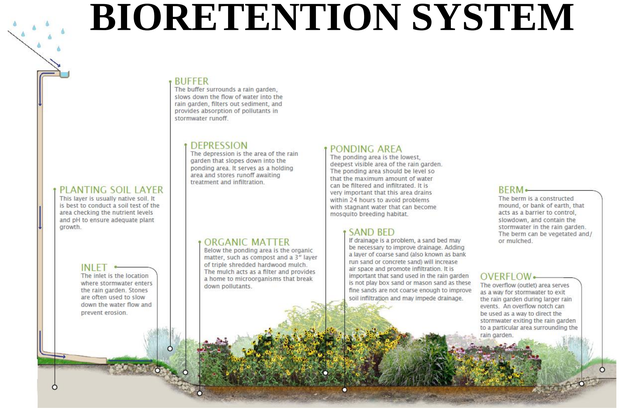
B

SITE PLAN:

1 **BIORETENTION SYSTEM:** Bioretention systems could be installed in the large island neighboring the western parking lot as well as along the adjacent parking lot entrance. Bioretenion systems will reduce runoff and allow stormwater infiltration, decreasing the amount of contaminants entering the catch basin. Curb cuts should be installed to allow the flow of runoff into the bioretention systems.

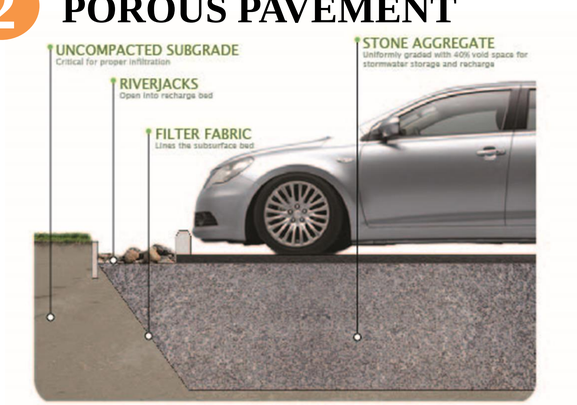
2 **POROUS PAVEMENT:** Porous pavement promotes groundwater recharge and filters stormwater.

1 BIORETENTION SYSTEM



CURB CUTS

2 POROUS PAVEMENT



PERMEABLE PAVEMENT DIAGRAM

Pohatcong Township Elementary School
Green Infrastructure Information Sheet

Location: 240 County Road 519 Pohatcong, NJ 08865	**Municipality:** Pohatcong Township **Subwatershed:** Pohatcong Creek
Green Infrastructure Description: bioretention systems (rain gardens) curb cuts porous pavement	**Targeted Pollutants:** total nitrogen (TN), total phosphorus (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: 531,500 gal. bioretention system #2: 52,100 gal. porous pavement #1: 70,000 gal. porous pavement #2: 57,300 gal.

Existing Conditions and Issues:
This site contains several impervious surfaces including driveways, sidewalks, parking areas, and a large school complex. These impervious surfaces are directly connected to a storm sewer system. The site's impervious surfaces produce stormwater runoff during rain events. This site is located on a plot of land adjacent to Route 78 and Country Road 519. Stormwater from the parking lot and its northern entrance primarily flows into two storm drains on its western edge. These drains convey stormwater from the parking lot to a large detention basin at the front entrance to the school off of County Road 519. Based on aerial imagery, this parking lot has 24,000 square feet of drainage area. It should also be noted that three light poles are located in the center of the parking lot. The parking lot's pavement is in poor condition along its western curb.

Proposed Solution(s):
The grass area to the west of the front parking lot could be retrofitted with curb cuts and bioretention systems to manage the majority of the parking lot's stormwater runoff. The first system would be located along the western edge of the front parking lot. The second system would be located along the western edge of the northern entrance to this lot between the light pole and the storm drain. It may be desirable to excavate several inches of the ground to enhance the grading into these systems from the curb cuts. The remaining drainage areas would be managed by strategically located porous pavement. The first porous pavement system would be located in two spaces adjacent to the southern parking island. The second porous pavement system would be located near the drain at the northern entrance to the lot.

Anticipated Benefits:
Since the bioretention systems would be designed to capture, treat, and infiltrate the entire 2-year design storm (3.3 inches of rain over 24 hours), these systems are estimated to achieve a 95% pollutant load reduction for TN, TP, and TSS. A bioretention system would also provide ancillary

benefits such as enhanced wildlife habitat and aesthetic appeal. Porous pavement allows stormwater to penetrate through to soil layers which will promote groundwater recharge as well as intercept and filter stormwater runoff. The system is expected to achieve a 95% pollutant load reduction for TN, TP, and TSS. Rutgers Cooperative Extension could additionally present the *Stormwater Management in Your Schoolyard* program to students and include them in bioretention system planting efforts to enhance the program. This may also be used as a demonstration project for the Pohatcong Township Department of Public Works staff to launch educational programming.

Possible Funding Sources:
mitigation funds from local developers
NJDEP grant programs
Pohatcong Township
Pohatcong Township Elementary School
parents – teacher associations
local social and community groups

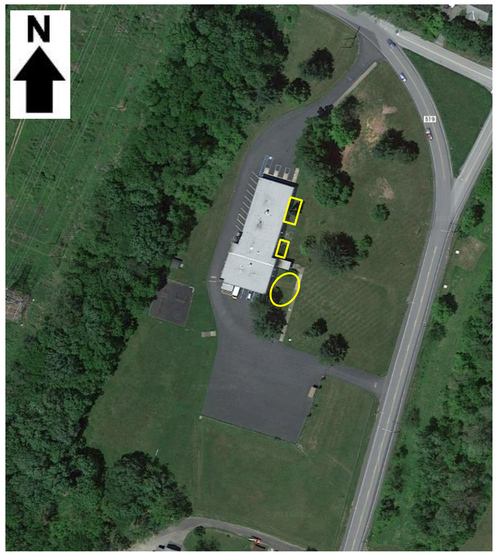
Partners/Stakeholders:
Pohatcong Township
Pohatcong Township Elementary School
local social and community groups
students, parents, faculty, staff
Rutgers Cooperative Extension

Estimated Cost:
Bioretention system #1 would need to be approximately 5,100 square feet. At $5 per square foot, the estimated cost of this bioretention system is $25,500. Bioretention system #2 would need to be approximately 500 square feet. At $5 per square foot the estimated cost of this bioretention system is $2,500. Porous pavement system #1 would cover approximately 320 square feet and have a 3 foot deep stone reservoir under the surface. At $30 per square foot the cost of the porous pavement system would be approximately $9,600. Porous pavement system #2 would cover approximately 270 square feet and have a 3 foot deep stone reservoir under the surface. At $30 per square foot the cost of the porous pavement system would be approximately $8,100. The total cost of the project will be approximately $45,700.

Pohatcong Township
Impervious Cover Assessment
Stepping Stone School, 45 County Road 519

RUTGERS
New Jersey Agricultural Experiment Station

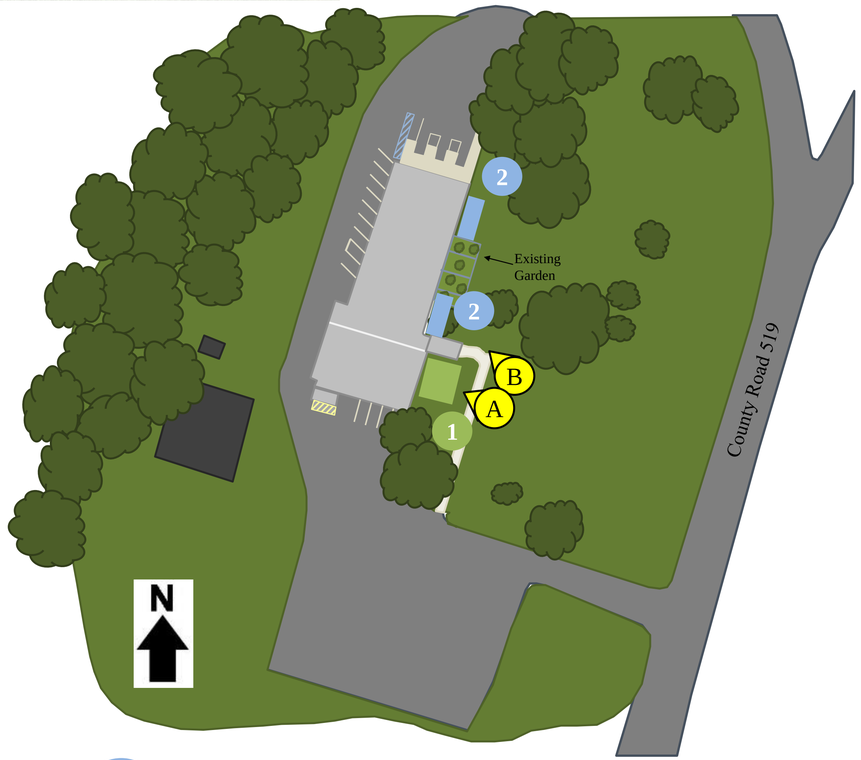
PROJECT LOCATION:



A

B

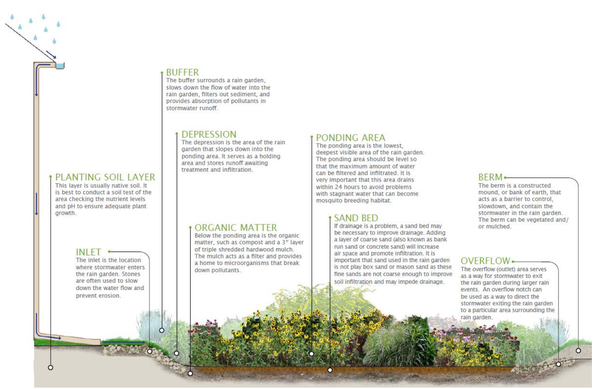
SITE PLAN:



1 **BIORETENTION SYSTEM:** A bioretention system could be installed in the grass near the entrance. Bioretention systems will reduce runoff and allow stormwater infiltration, decreasing the amount of contaminants entering the catch basin.

2 **RAINWATER HARVESTING SYSTEM:** A cistern can capture and store stormwater runoff for use in watering the bioretention system as well as the existing garden.

1 BIORETENTION SYSTEM



2 RAINWATER HARVESTING SYSTEM

Stepping Stone School
Green Infrastructure Information Sheet

Location: 45 County Road 519 Bloomsbury, NJ 08804	**Municipality:** Pohatcong Township **Subwatershed:** Musconetcong River
Green Infrastructure Description: bioretention system (rain garden) rainwater harvesting systems (cisterns / rain barrel)	**Targeted Pollutants:** total nitrogen (TN), total phosphorus (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: 6,300 gal. cistern #1: 21,000 gal. cistern #2: 25,900 gal.

Existing Conditions and Issues:

This site contains several impervious surfaces including driveways, parking areas, and a school building. The site's impervious surfaces produce stormwater runoff during rain events. One downspout on the left side of the front entrance conveys water from the entrance's roof. This water runs down the lawn eroding its soil. There is a garage and a separate entrance at the south end of the building. The downspouts for these extensions of the building run directly into the parking lot. The main building does not appear to have a gutter-downspout system. There is a sizable fence in the garden area on the eastern side of the building.

Proposed Solution(s):

A bioretention system (rain garden) could be installed along the hill on the left side of the front entrance to the school. This system would most likely take the form of a terraced garden. One downspout would be directed to this system. Gutters could be installed on the eastern side of the building so that stormwater could be conveyed to slim-line cisterns. One cistern would be installed on each side of the existing garden in front of the school. The water from these cisterns would be used to water the garden. The northern cistern (#1) would be 1,300 gallons, and the southern cistern (#2) would be 1,600 gallons.

Anticipated Benefits:
Since the bioretention system would be designed to capture, treat, and infiltrate the entire 2-year design storm (3.3 inches of rain over 24 hours), the system is estimated to achieve a 95% pollutant load reduction for TN, TP, and TSS. A bioretention system would provide ancillary benefits such as enhanced wildlife habitat and aesthetic appeal. Since the rainwater harvesting systems (the cisterns and rain barrel) would be designed to capture the first 1.25 inches of rain, they would reduce the pollutant loading by 90% during the periods when they are operational (i.e., they would not be used in the winter when there is a chance of freezing). The rainwater harvested from the roofs of the building could be used for watering the plants in the existing garden or new rain garden.

Possible Funding Sources:
mitigation funds from local developers
NJDEP grant programs
Pohatcong Township
Stepping Stone School
local social and community groups

Partners/Stakeholders:
Pohatcong Township
Stepping Stone School
local social and community groups
parents, students, faculty, and staff
Rutgers Cooperative Extension

Estimated Cost:
The rain garden would need to be approximately 60 square feet. At $5 per square foot, the estimated cost of this bioretention system is $300, plus an additional $250 to disconnect a downspout. Cistern #1 would cost approximately $2,600 to purchase and install, plus an additional $500 to put gutters and a downspout on the building to collect its stormwater. Cistern #2 would cost approximately $3,200 to purchase and install, plus an additional $500 to put gutters and a downspout on the building to collect its stormwater. The total cost of the project will be approximately $7,350.