



**Impervious Cover Assessment
for
Mount Olive Township, Morris County, New Jersey**

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

June 30, 2016

Introduction

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



Figure 1: Stormwater draining from a parking lot

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

- **Pollution**: According to the 2010 New Jersey Water Quality Assessment Report, 90% of the assessed waters in New Jersey are impaired, with urban-related stormwater runoff listed as the most probable source of impairment (USEPA, 2013). As stormwater flows over the ground, it picks up pollutants including animal waste, excess fertilizers, pesticides, and other toxic substances. These pollutants are then able to enter waterways.
- **Flooding**: Over the past decade, the state has seen an increase in flooding. Communities around the state have been affected by these floods. The amount of damage caused has also increased greatly with this trend, costing billions of dollars over this time span.

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

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

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

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

1. ***Eliminate surfaces that are not necessary.*** For example, a paved courtyard at a public school could be converted to a grassed area.
2. ***Reduce or convert impervious surfaces.*** There may be surfaces that are required to be hardened, such as roadways or parking lots, but could be made smaller and still be functional. A parking lot that has two-way car ways could be converted to one-way car ways. There also are permeable paving materials such as porous asphalt, pervious concrete, or permeable paving stones that could be substituted for impermeable paving materials (Figure 2).
3. ***Disconnect impervious surfaces from flowing directly to local waterways.*** There are many ways to capture, treat, and infiltrate stormwater runoff from impervious surfaces. Opportunities may exist to reuse this captured water.



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

Mount Olive Township Impervious Cover Analysis

Located in Morris County in northern New Jersey, Mount Olive Township covers approximately 31.1 square miles south of Byram Township. Figures 3 and 4 illustrate that Mount Olive Township is dominated by forest land uses. A total of 32.5% of the municipality's land use is classified as urban. Of the urban land in Mount Olive Township, low density 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 streams 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 Mount Olive 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 Mount Olive Township. Based upon the 2012 NJDEP land use/land cover data, approximately 10.0% of Mount Olive Township has impervious cover. This level of impervious cover suggests that the streams in Mount Olive Township are likely sensitive streams.

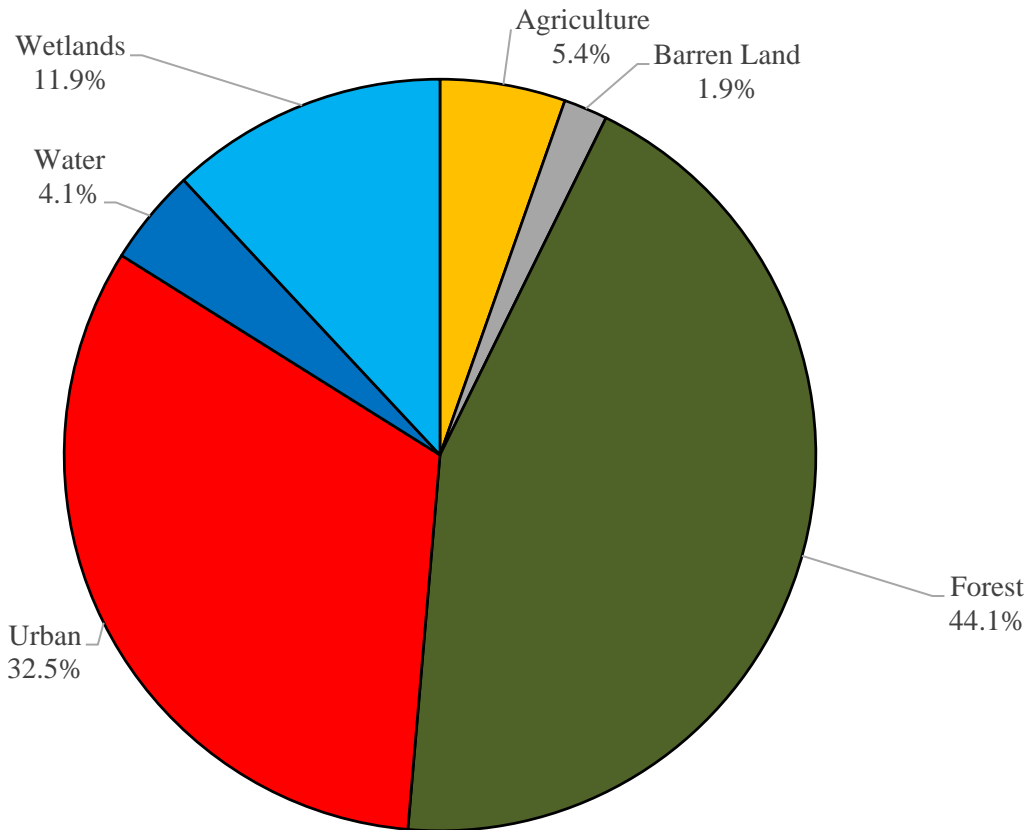


Figure 3: Pie chart illustrating the land use in Mount Olive Township

Land Use Types for Mount Olive

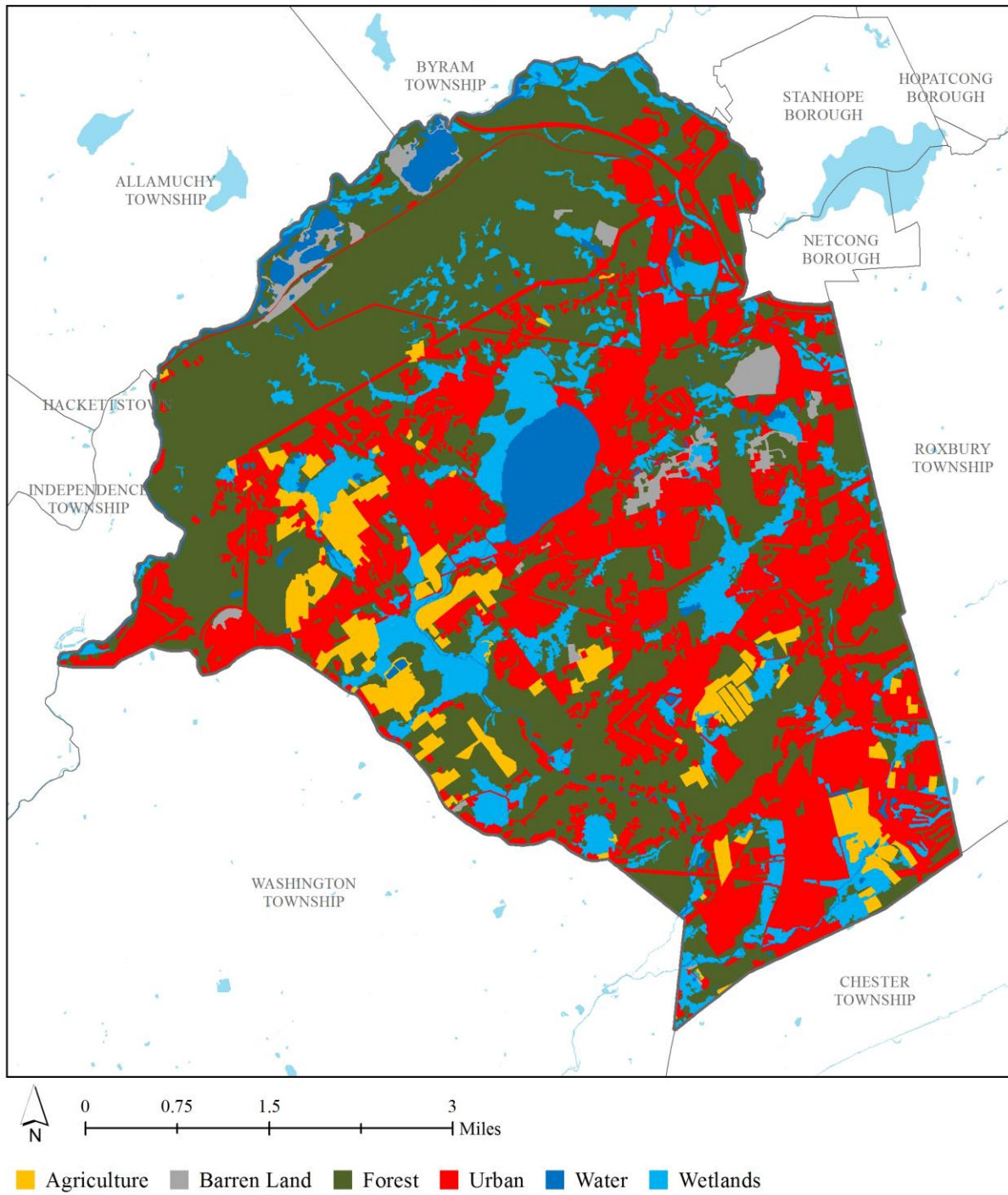


Figure 4: Map illustrating the land use in Mount Olive Township

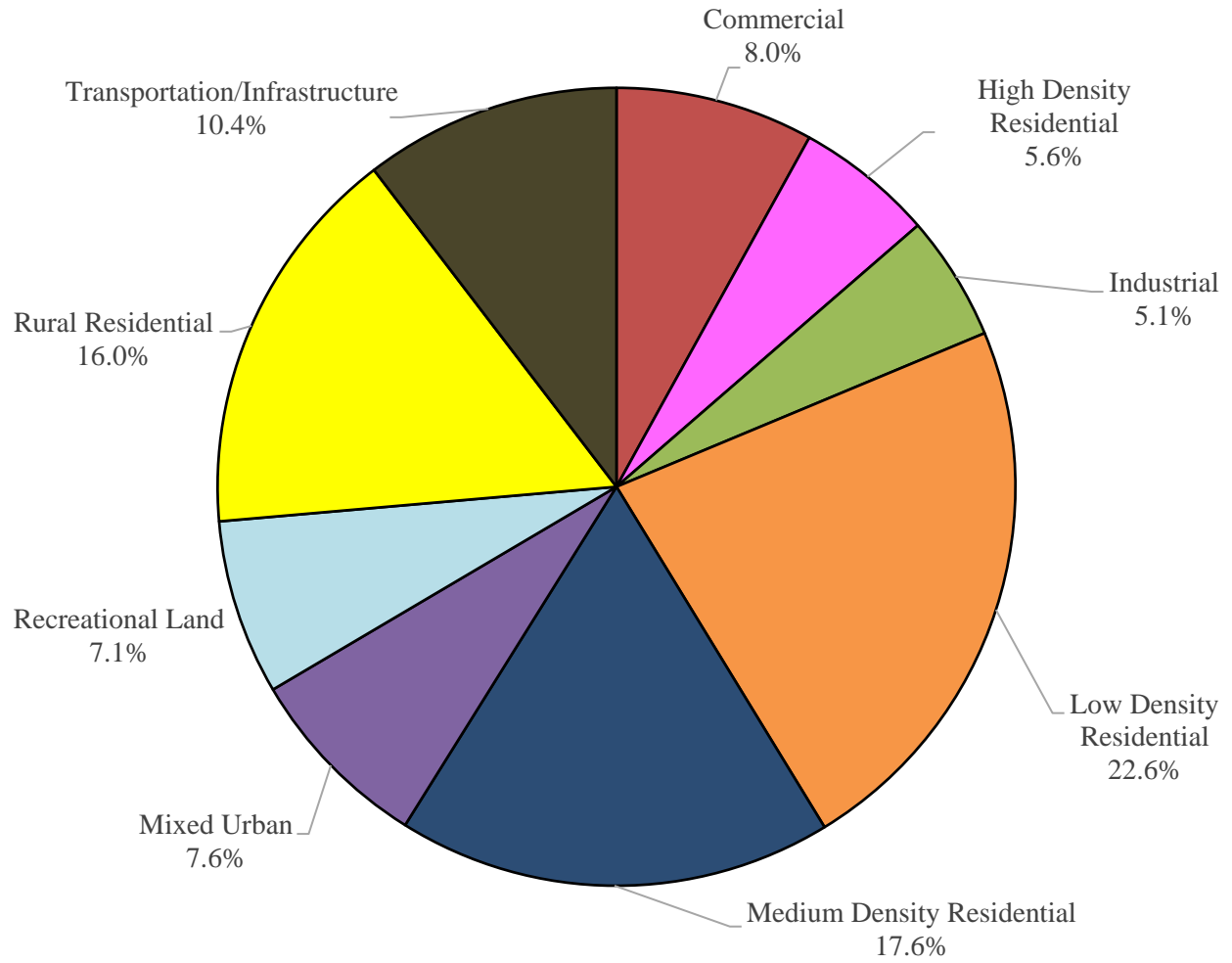


Figure 5: Pie chart illustrating the various types of urban land use in Mount Olive Township

Water resources are typically managed on a watershed/subwatershed basis; therefore an impervious cover analysis was performed for each subwatershed within Mount Olive Township (Table 1 and Figure 6). On a subwatershed basis, impervious cover ranges from 8.1% in the Musconetcong River subwatershed to 14.7% in the Drakes 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 Mount Olive Township, Morris 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 (3.5 inches of rain), the 10-year design storm (5.2 inches of rain), and the 100-year design storm (8.3 inches of rain). These runoff volumes are summarized in Table 2. A substantial amount of rainwater drains from impervious surfaces in Mount Olive Township. For example, if the stormwater runoff from one water quality storm (1.25 inches of rain) in the Raritan River South Branch subwatershed was harvested and purified, it could supply water to 211 homes for one year¹.

¹ Assuming 300 gallons per day per home

Table 1: Impervious cover analysis by subwatershed for Mount Olive Township

| Subwatershed | Total Area | | Land Use Area | | Water Area | | Impervious Cover | | |
|----------------------------|------------|--------------------|---------------|--------------------|------------|--------------------|------------------|--------------------|-------|
| | (ac) | (mi ²) | (ac) | (mi ²) | (ac) | (mi ²) | (ac) | (mi ²) | (%) |
| Drakes Brook | 3,975.7 | 6.21 | 3,940.9 | 6.16 | 34.8 | 0.05 | 579.6 | 0.91 | 14.7% |
| Mine Brook | 1,397.8 | 2.18 | 1,376.3 | 2.15 | 21.5 | 0.03 | 138.2 | 0.22 | 10.0% |
| Musconetcong River | 6,610.9 | 10.33 | 6,289.2 | 9.83 | 321.7 | 0.50 | 512.5 | 0.80 | 8.1% |
| Raritan River South Branch | 8,007.5 | 12.51 | 7,556.6 | 11.81 | 451.0 | 0.71 | 680.0 | 1.06 | 9.0% |
| Total | 19,992.0 | 31.24 | 19,163.0 | 29.94 | 829.0 | 1.30 | 1,910.4 | 2.99 | 10.0% |

Subwatersheds of Mount Olive

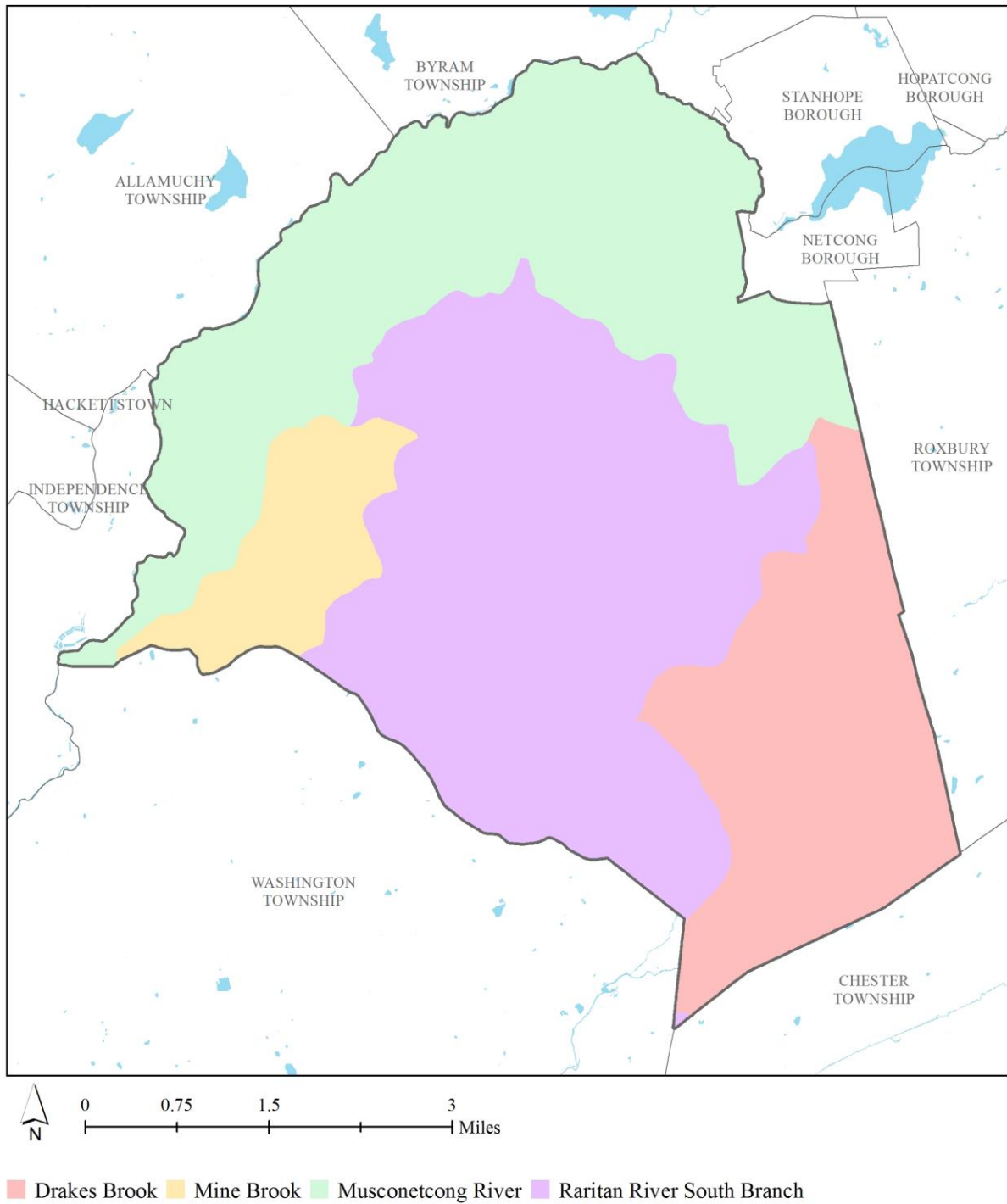


Figure 6: Map of the subwatersheds in Mount Olive Township

Table 2: Stormwater runoff volumes from impervious surfaces by subwatershed in Mount Olive 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 (3.5") (MGal) | Total Runoff Volume for the 10-Year Design Storm (5.2") (MGal) | Total Runoff Volume for the 100-Year Design Storm (8.3") (MGal) |
|----------------------------|--|---|--|---|--|
| Drakes Brook | 19.7 | 692.5 | 55.1 | 81.8 | 130.6 |
| Mine Brook | 4.7 | 165.1 | 13.1 | 19.5 | 31.2 |
| Musconetcong River | 17.4 | 612.3 | 48.7 | 72.4 | 115.5 |
| Raritan River South Branch | 23.1 | 812.4 | 64.6 | 96.0 | 153.3 |
| Total | 64.8 | 2,282.4 | 181.6 | 269.7 | 430.5 |

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 Mount Olive 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 (3.5 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 Mount Olive 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 =

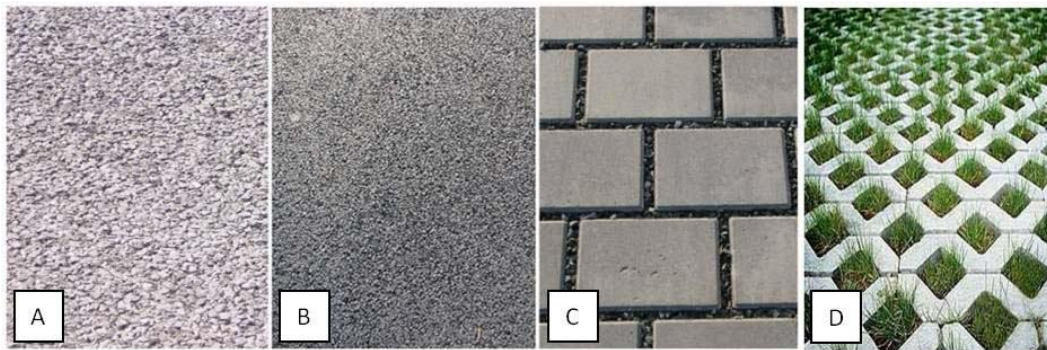
Acres of IC x 43,560 ft²/ac x 44 in x (1 ft/12 in) x 0.95 x (7.48 gal/ft³) x (1 MGal/1,000,000 gal)

All BMPs should be designed to capture the first 3.5 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 Mount Olive 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 Mount Olive 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

Mount Olive 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

Arnold, C.L. Jr. and C.J. Gibbons. 1996. Impervious Surface Coverage The Emergence of a Key Environmental Indicator. *Journal of the American Planning Association* 62(2): 243-258.

Caraco, D., R. Claytor, P. Hinkle, H. Kwon, T. Schueler, C. Swann, S. Vysotsky, and J. Zielinski. 1998. Rapid Watershed Planning Handbook. A Comprehensive Guide for Managing Urbanizing Watersheds. Prepared by Center For Watershed Protection, Ellicott City, MD. Prepared for U.S. Environmental Protection Agency, Office of Wetlands, Oceans and Watersheds and Region V. October 1998.

May, C.W., R.R. Horner, J.R. Karr, B.W. Mar, E.G. Welch. 1997. Effects of Urbanization on Small Streams in the Puget Sound Lowland Ecoregion. *Watershed Protection Techniques* 2(4): 483-493.

Nowak, D. J., and E. J. Greenfield, 2012. Trees and Impervious Cover in the United States. *Landscape and Urban Planning* 107 (2012): 21-30.

http://www.nrs.fs.fed.us/pubs/jrnl/2012/nrs_2012_nowak_002.pdf

Rowe, A., 2012. Green Infrastructure Practices: An Introduction to Permeable Pavement. Rutgers NJAES Cooperative Extension, FS1177, pp. 4.

<http://njaes.rutgers.edu/pubs/publication.asp?pid=FS1177>

Schueler, T. 1994. The Importance of Imperviousness. *Watershed Protection Techniques* 1(3): 100-111.

United States Environmental Protection Agency (USEPA), 2013. Watershed Assessment, Tracking, and Environmental Results, New Jersey Water Quality Assessment Report.

http://ofmpub.epa.gov/waters10/attains_state.control?p_state=NJ

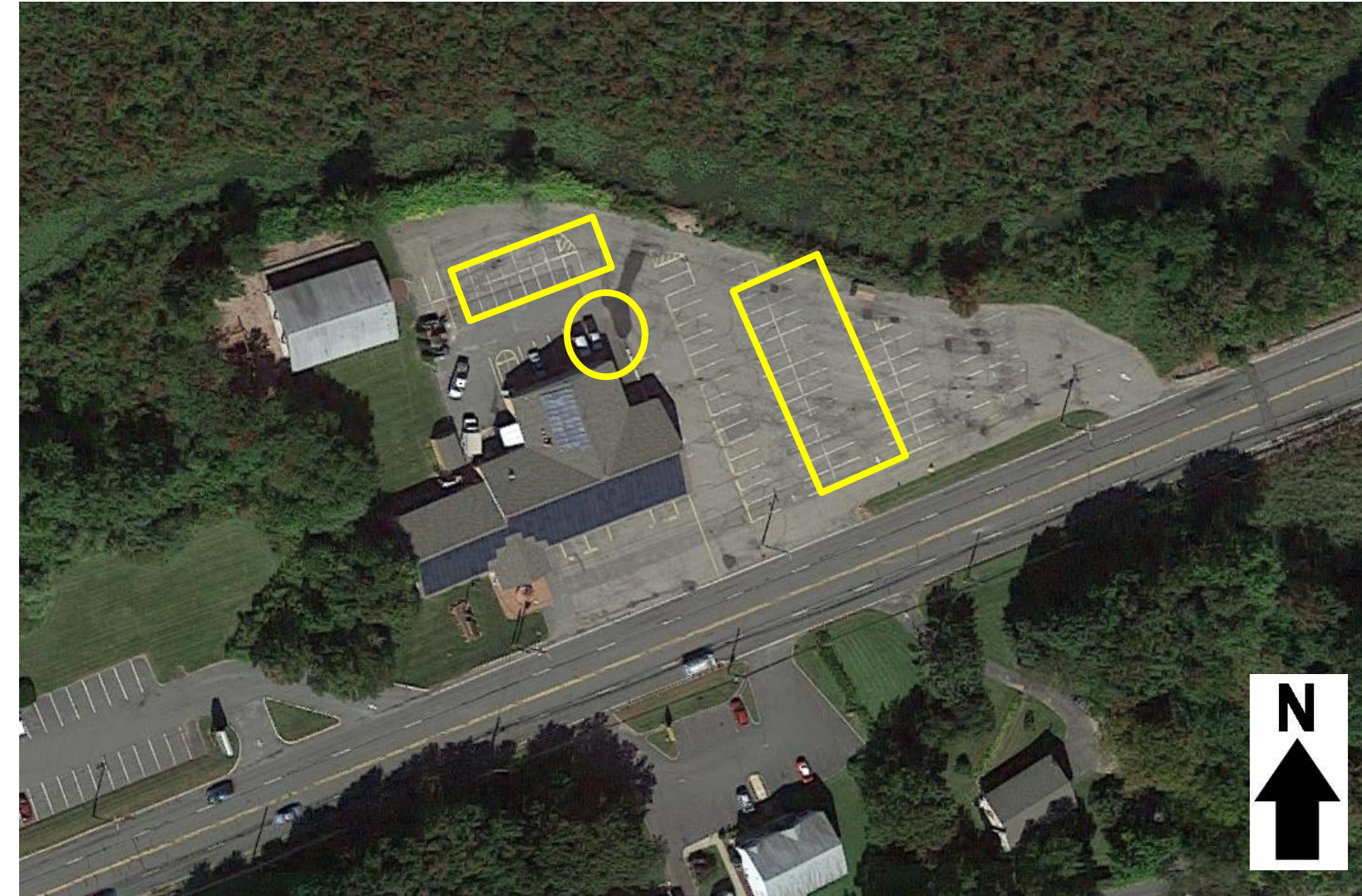
Appendix A

Examples of Impervious Cover Reduction Action Plan Projects Concept Plans and Detailed Green Infrastructure Information Sheets

Mount Olive Township Impervious Cover Assessment

Budd Lake Fire Department, 378 US-46

PROJECT LOCATION:



SITE PLAN:



A



B



- 1 POROUS PAVEMENT:** There are several types of permeable pavement systems including porous asphalt, pervious concrete, permeable pavers, and grass pavers. These surfaces are hard and support vehicle traffic but also allow water to infiltrate through the surface. They have an underlying stone layer to store stormwater runoff and allow it to slowly seep into the ground.
- 2 RAINWATER HARVESTING SYSTEM:** These systems capture rainwater, mainly from rooftops, in cisterns or rain barrels. A cistern can be installed along the northeast corner of the building. The water can then be used for watering gardens, washing vehicles, or for other non-potable uses.

1 POROUS PAVEMENT



2 RAINWATER HARVESTING SYSTEM



Budd Lake Fire Department
Green Infrastructure Information Sheet

| | |
|--|--|
| <p>Location: 378 US-46 Budd Lake, NJ 07828</p> | <p>Municipality: Mount Olive Township</p> |
| <p>Green Infrastructure Description: porous pavement rain harvesting system (rain barrel/cistern)</p> | <p>Subwatershed: Raritan River South Branch</p> <p>Targeted Pollutants: total nitrogen (TN), total phosphorus (TP), total suspended solids (TSS) in surface runoff</p> |
| <p>Mitigation Opportunities: recharge potential: yes stormwater peak reduction potential: yes total suspended solids removal potential: yes</p> | <p>Stormwater Captured and Treated Per Year: cistern: 132,797 gal. porous pavement #1: 473,035 gal. porous pavement #2: 160,866 gal.</p> |
| <p>Existing Conditions and Issues: The Budd Lake Fire Department is located at the forefront of the South Branch Raritan River making it a vital site to reduce impervious surfaces and stormwater runoff. The expansive parking lot is all impervious asphalt which means that the rain that falls on the asphalt will go straight to the river along with the asphalt sediment and other solids that wash off with it. There are three connected downspouts from the building that go straight into the ground and are directed either into the sewer system or straight to the river. The existing conditions of the site result in a significant area of impervious surfaces that contribute to stormwater runoff volumes and nonpoint source pollution to local waterways.</p> | |
| <p>Proposed Solution(s): To reduce the amount of impervious surfaces, areas of porous asphalt are proposed within the northern and eastern sides of the parking lot to allow for water to infiltrate the surface. This infiltration will consequently treat and filter the water as it slowly releases into the South Branch Raritan River. Secondly, a cistern is proposed to capture rain from the roof by redirecting the downspouts. The water captured can then be reused for other purposes.</p> | |
| <p>Anticipated Benefits: Porous pavement allows stormwater to infiltrate through to soil layers which will promote groundwater recharge as well as intercept and filter stormwater runoff. The porous pavement system will achieve the same level of pollutant load reduction for TN, TP, and TSS as the bioretention system.</p> <p>Cisterns can harvest stormwater which can be used for watering plants, or other purposes which cuts back on the use of potable water for nondrinking purposes. Since the rainwater harvesting system would be designed to capture the first 1.25 inches of rain, it would reduce the pollutant loading by 90% during the periods it is operational (i.e., it would not be used in the winter when there is a chance of freezing).</p> | |
| <p>Possible Funding Sources: mitigation funds from local developers NJDEP grant programs</p> | |

Budd Lake Fire Department
Green Infrastructure Information Sheet

Mount Olive Township
local social and community groups

Partners/Stakeholders:

Mount Olive Township
Budd Lake Fire Department
local community groups
residents and parishioners
Rutgers Cooperative Extension

Estimated Cost:

The porous asphalt in one area would cover 3,242 square feet and have a 2-foot stone reservoir under the surface. At \$25 per square foot, the cost of the porous asphalt system would be \$81,050.

The other porous asphalt area would cover 6,174 square feet and have a 1-foot stone reservoir under the surface. At \$20 per square foot, the cost of the porous asphalt system would be \$123,480.

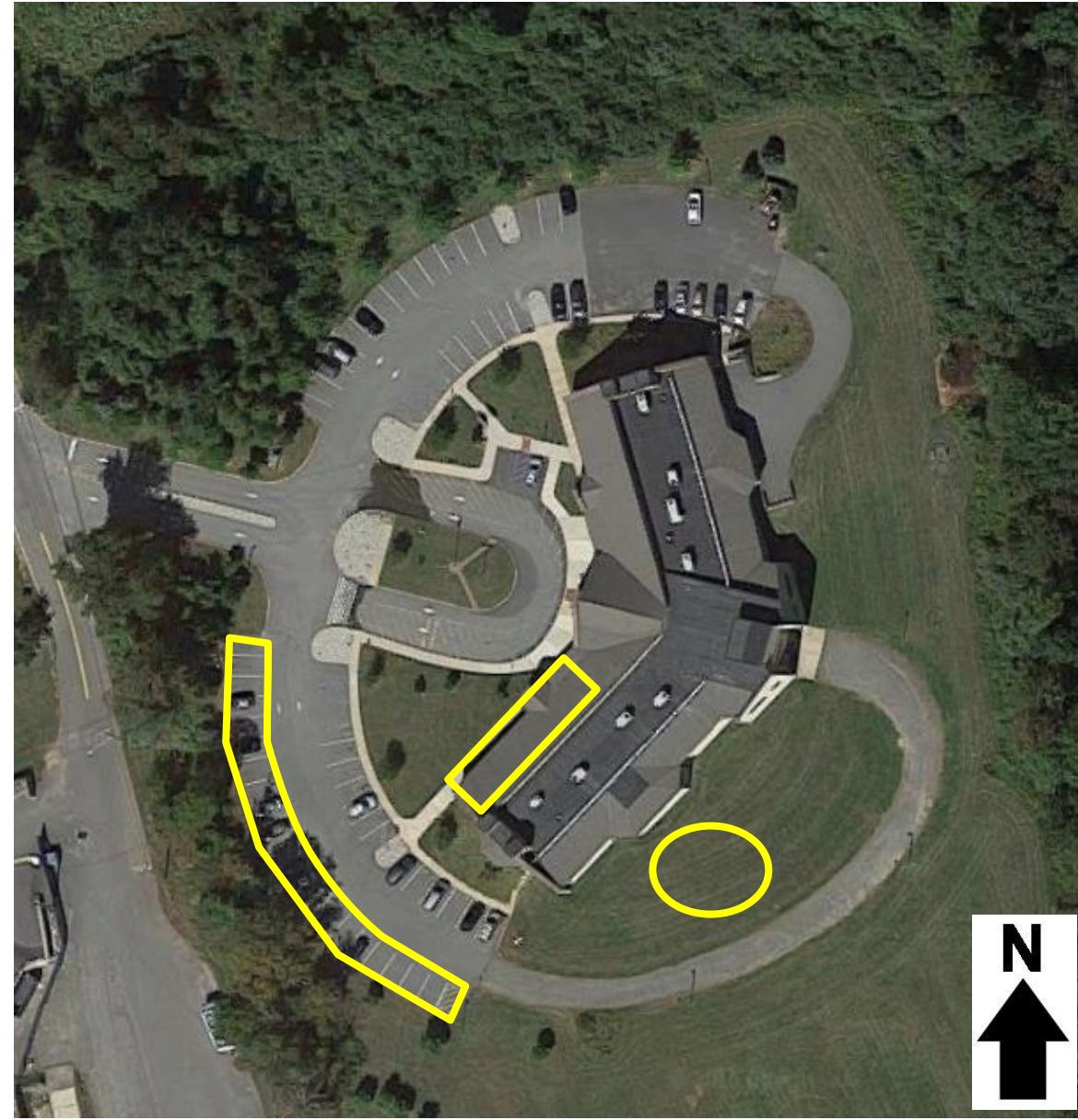
The cistern would be 8,384 gallons, can capture approximately 132,797 gallons of annual runoff, and cost approximately \$16,768 to purchase and install.

The total cost of the project will thus be approximately \$221,298.

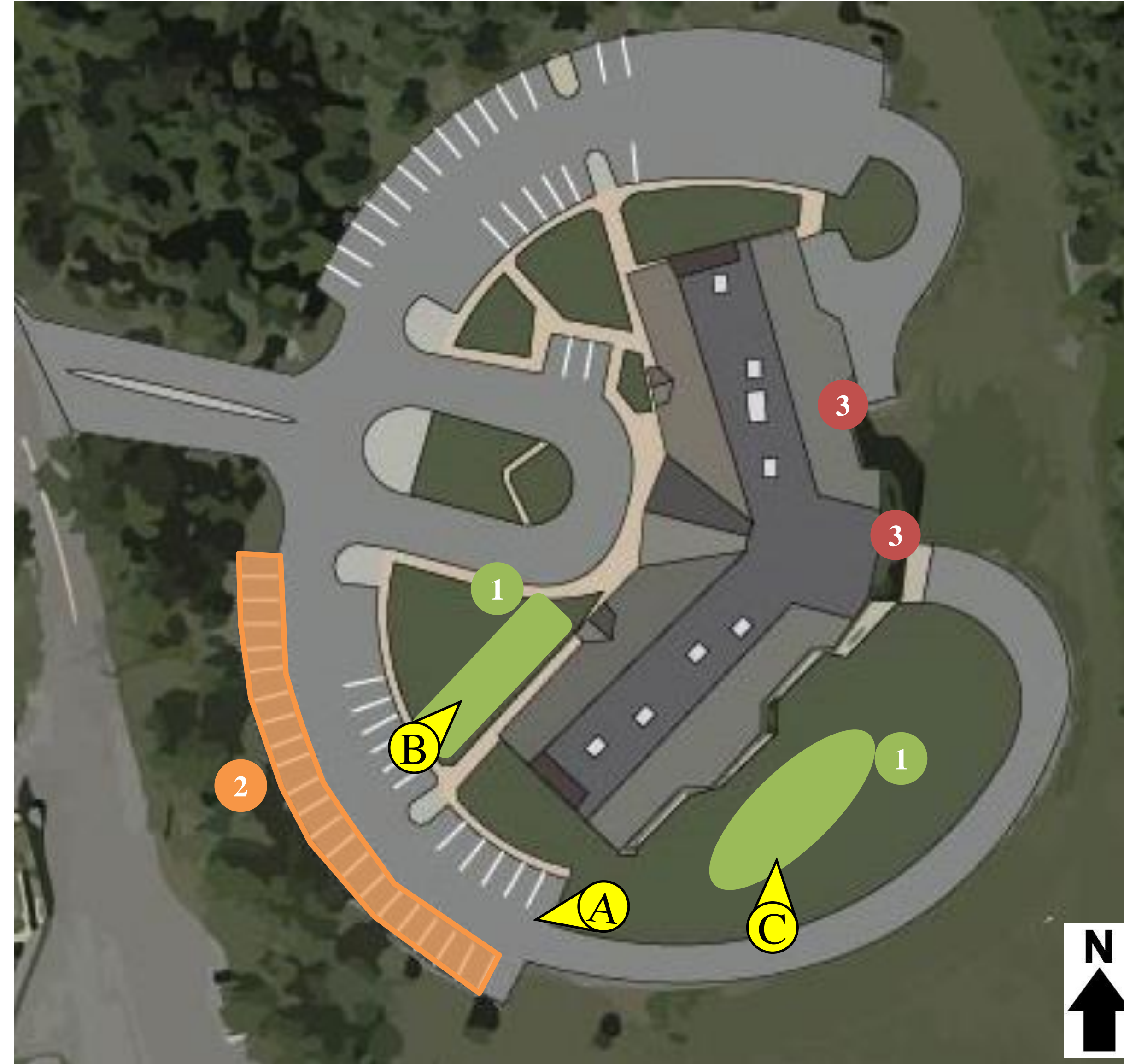
Mount Olive Township Impervious Cover Assessment

Mount Olive Public Library, 202 Flanders-Drakestown Road

PROJECT LOCATION:



SITE PLAN:



A

B

C

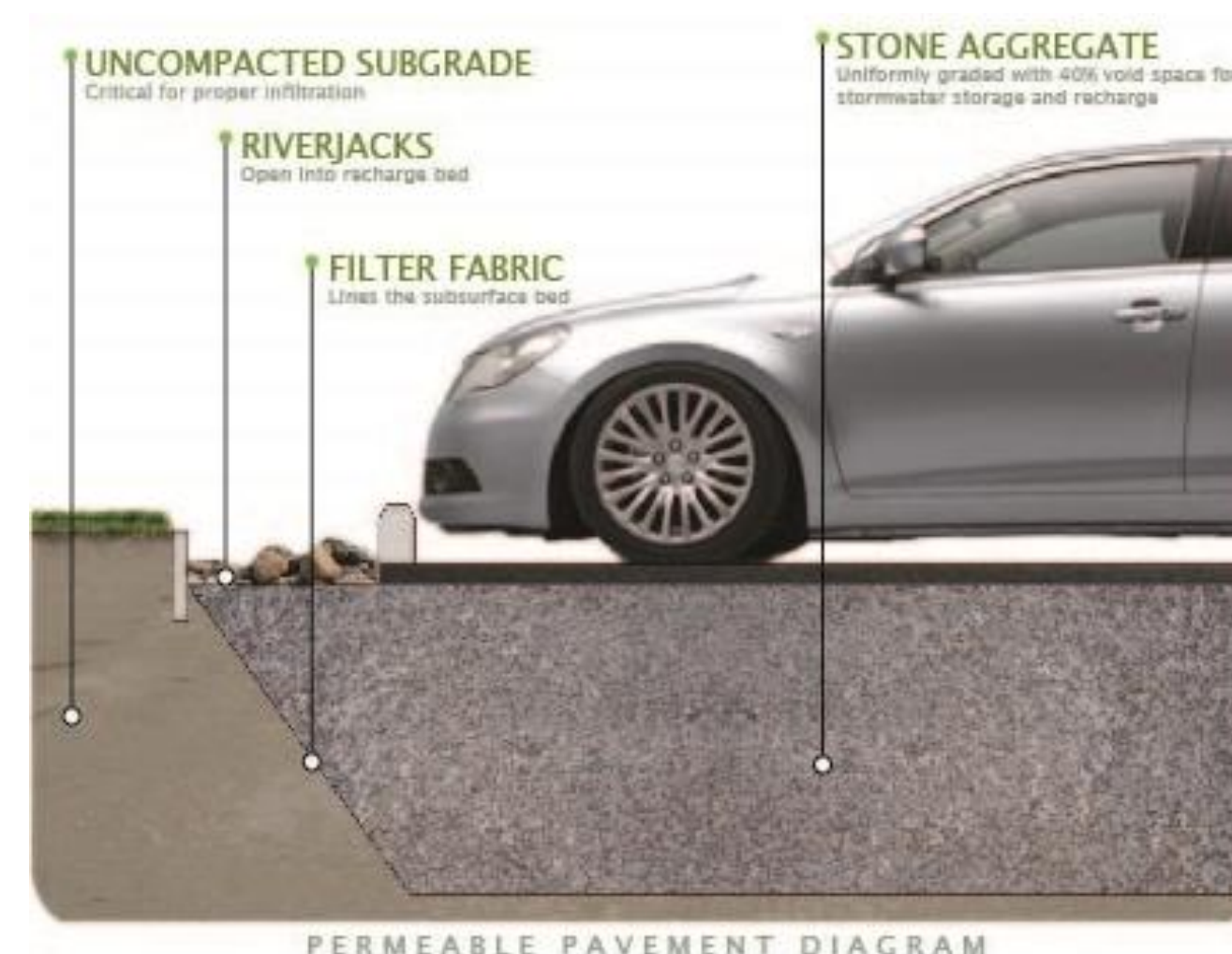


- 1 **BIORETENTION SYSTEMS:** These are landscaped features that are designed to capture, treat, and infiltrate stormwater runoff. These systems can easily be incorporated into existing landscapes, improving aesthetics and creating wildlife habitat while managing stormwater runoff. Two bioretention systems can be installed at the library.
- 2 **POROUS PAVEMENT:** There are several types of permeable pavement systems including porous asphalt, pervious concrete, permeable pavers, and grass pavers. These surfaces are hard and support vehicle traffic but also allow water to infiltrate through the surface. Parking spaces southwest of the library can be replaced with porous asphalt.
- 3 **DISCONNECTED DOWNSPOUTS:** This is often referred to as simple disconnection. A downspout is simply disconnected and prevented from draining directly to the roadway or storm sewer system and directed to discharge water to a pervious area (i.e., lawn).

1 BIORETENTION SYSTEM



2 POROUS PAVEMENT



3 DISCONNECTED DOWNSPOUTS



Mount Olive Public Library
Green Infrastructure Information Sheet

| | |
|--|---|
| <p>Location: 202 Flanders-Drakestown Road Flanders, NJ 07836</p> | <p>Municipality: Mount Olive Township</p> |
| <p>Green Infrastructure Description: bioretention system (rain garden) disconnecting downspouts porous pavement</p> | <p>Subwatershed: Raritan River South Branch</p> |
| <p>Mitigation Opportunities: recharge potential: yes stormwater peak reduction potential: yes total suspended solids removal potential: yes</p> | <p>Targeted Pollutants: total nitrogen (TN), total phosphorus (TP), total suspended solids (TSS) in surface runoff</p> |
| <p>Stormwater Captured and Treated Per Year: bioretention system # 1: 154,378 gal. bioretention system # 2: 103,049 gal. porous asphalt: 357,740 gal.</p> | |
| <p>Existing Conditions and Issues: The downspouts on the front and back of the building are connected to the ground and therefore lead water from the roof directly into the sewer system. As for the water that comes in contact with the ground, the sloping of the building downwards to the parking lot has caused soil erosion. This erosion is especially prominent in the soil south of the entrance as the volume and velocity of stormwater runoff carries sediment to the catch basins. There are also islands of aggregate at the bottom of the slope on the edge of the parking lot to seemingly catch excessive stormwater runoff. On the eastern side of the building there is a detention basin as well as a large lawn area in the back of the site where there is an opportunity to implement green infrastructure to reduce sheet runoff.</p> | |
| <p>Proposed Solution(s): Disconnecting a downspout from the ground and redirecting it into a rain garden on the southern side of the main entrance will help remediate and stabilize soil as well as utilize rain that falls on the roof for irrigation. It can also provide a landscaping opportunity that can frame and highlight the entrance of the library. Since the parking lot is also at the bottom of a slope, there is an opportunity to capture stormwater runoff if porous pavement is implemented. On the eastern side of the building, a rain garden can be installed which can reduce the sheet runoff across the expansive lawn as well as be used in educational programs.</p> | |
| <p>Anticipated Benefits: Since the bioretention systems would be designed to capture, treat, and infiltrate the entire 2-year design storm (3.5 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 and aesthetic appeal to the local residents Mount Olive Township.</p> <p>Porous pavement allows stormwater to infiltrate through to soil layers which will promote groundwater recharge as well as intercept and filter stormwater runoff. The porous pavement system will achieve the same level of pollutant load reduction for TN, TP, and TSS as the bioretention system.</p> | |

Mount Olive Public Library
Green Infrastructure Information Sheet

Possible Funding Sources:

mitigation funds from local developers
NJDEP grant programs
Mount Olive Municipality
local social and community groups

Partners/Stakeholders:

Mount Olive Township
Mount Olive Public Library
local community groups
residents and patrons
students and parents
Rutgers Cooperative Extension

Estimated Cost:

The rain gardens that would capture the runoff from the roof would be 1,500 square feet and 1,000 square feet. At \$5 per square foot, the estimated cost of the rain gardens are \$7,500 and \$5,000, respectively.

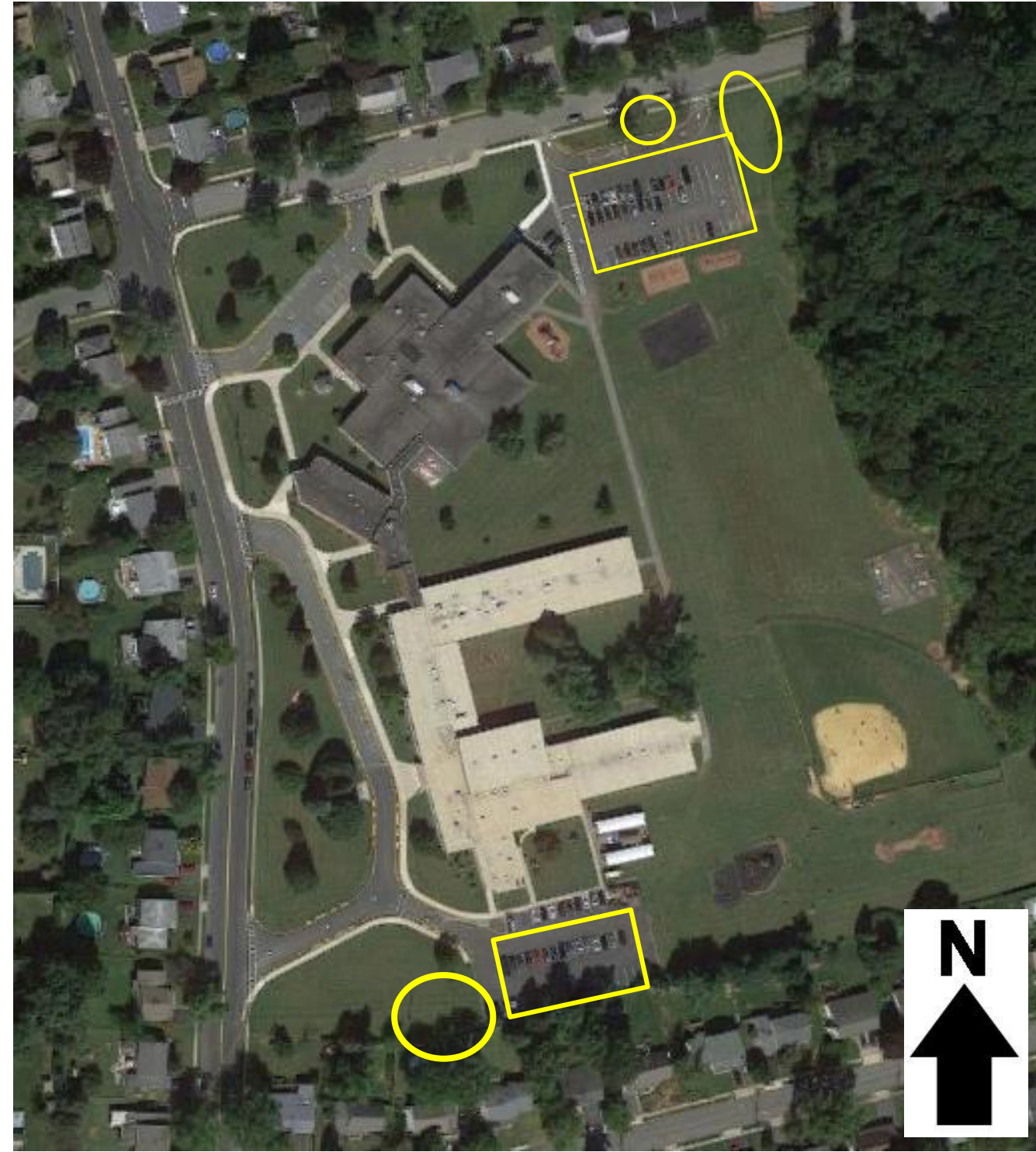
The porous asphalt would cover 2,425 square feet and have a 2-foot stone reservoir under the surface. At \$25 per square foot, the cost of the porous asphalt system would be \$60,625.

The total cost of the project will thus be approximately \$73,125.

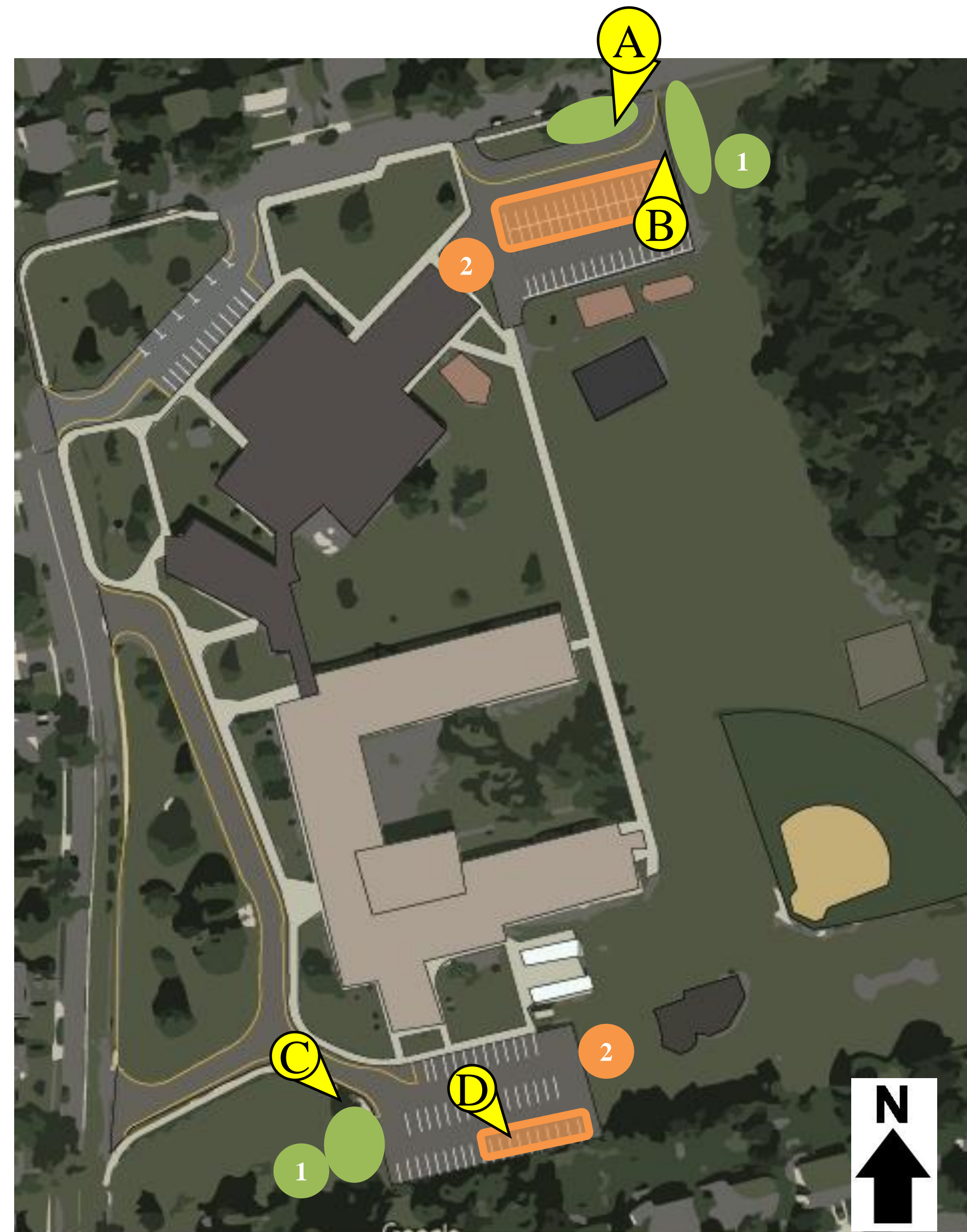
Mount Olive Township Impervious Cover Assessment

Mountain View Elementary School, 118 Clover Hill Drive

PROJECT LOCATION:



SITE PLAN:



1 BIORETENTION SYSTEMS These are landscaped features that are designed to capture, treat, and infiltrate stormwater runoff. Three areas were identified where bioretention systems can be installed at Mountain View Elementary School.

2 POROUS PAVEMENT: These surfaces are hard and support vehicle traffic but also allow water to infiltrate through the surface. They have an underlying stone layer to store stormwater runoff and allow it to slowly seep into the ground. Parking spaces can be replaced with porous asphalt

1 BIORETENTION SYSTEM



2 POROUS PAVEMENT



A



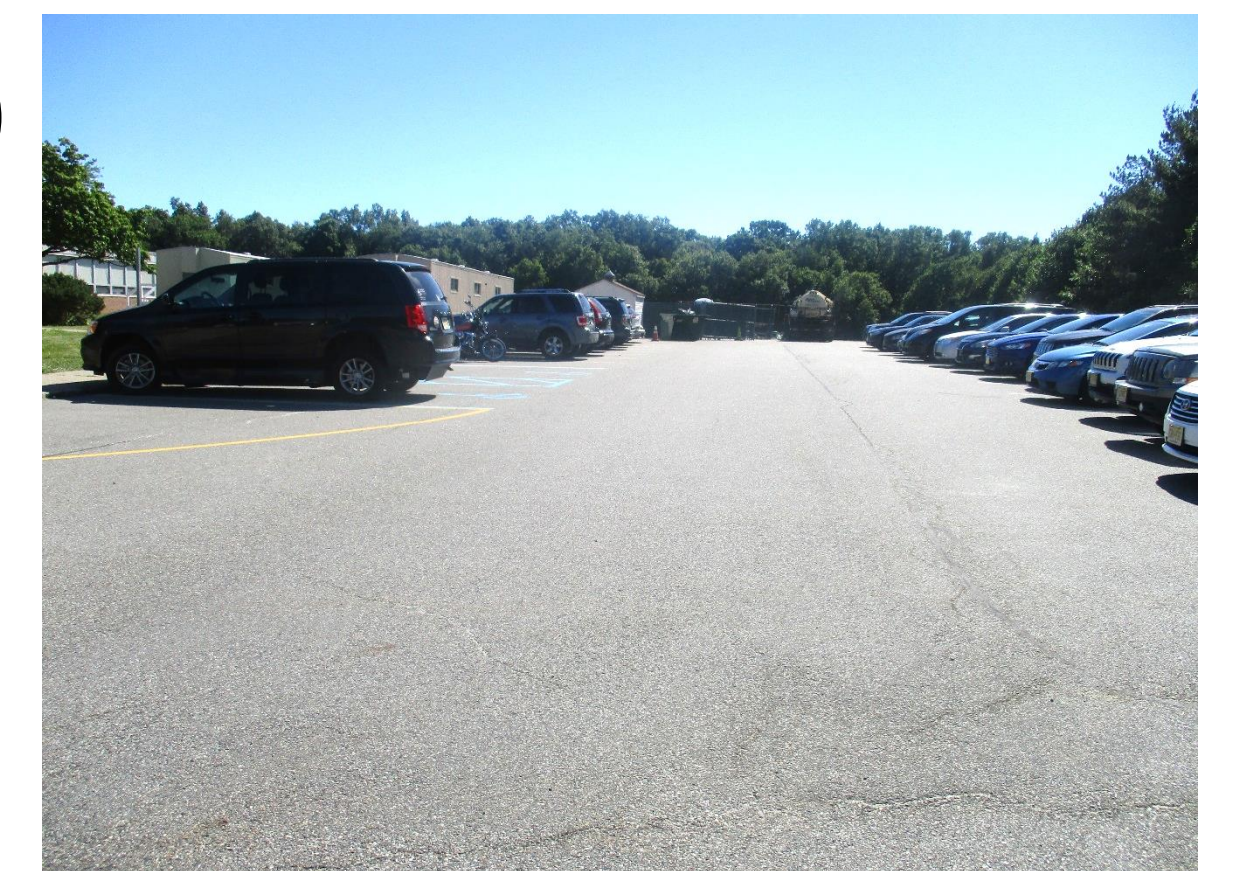
B



C



D



Mountain View Elementary School
Green Infrastructure Information Sheet

| | |
|--|--|
| <p>Location: 118 Clover Hill Drive Mount Olive Township, NJ 07828</p> | <p>Municipality: Mount Olive Township</p> |
| <p>Green Infrastructure Description: bioretention system (rain garden) porous pavement</p> | <p>Subwatershed: Drakes Brook</p> <p>Targeted Pollutants: total nitrogen (TN), total phosphorus (TP), total suspended solids (TSS) in surface runoff</p> |
| <p>Mitigation Opportunities: recharge potential: yes stormwater peak reduction potential: yes total suspended solids removal potential: yes</p> | <p>Stormwater Captured and Treated Per Year: bioretention system # 1: 235,097 gal. bioretention system # 2: 105,759 gal. bioretention system # 3: 60,709 gal. porous pavement # 1: 382,284 gal. porous pavement # 2: 124,753 gal.</p> |
| <p>Existing Conditions and Issues: Mountain View Elementary School contains three parking lots as well as a drive-by/drop off area paved with impervious asphalt. The stormwater runoff from the parking eventually drains into the street into a catch basin or towards the playground. The water draining from the parking lot can carry pollutants into the sewer system and eventually to our local waterways, contributing to nonpoint source pollution.</p> | |
| <p>Proposed Solution(s): There are three rain gardens and two areas of porous pavement that are proposed to capture stormwater primarily draining from the parking lots. The first rain garden would be located on the southern side of the site and will capture runoff from half the parking lot that is sloped towards it. The other half of the parking lot can be treated by implementing porous asphalt in the parking spaces. The northeastern parking lot can be treated with porous pavement which can capture approximately half of the parking lot volume. The other half can be captured by two rain gardens flanking the parking lot exit. Treating the water and transferring it directly to groundwater helps reduce flooding and also reduces pollutants within New Jersey waterways.</p> | |
| <p>Anticipated Benefits: Since the bioretention systems would be designed to capture, treat, and infiltrate the entire 2-year design storm (3.5 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 and aesthetic appeal to the local residents Mount Olive Township.</p> <p>Porous pavement allows stormwater to infiltrate through to soil layers which will promote groundwater recharge as well as intercept and filter stormwater runoff. The porous pavement system will achieve the same level of pollutant load reduction for TN, TP, and TSS as the bioretention system.</p> | |
| <p>Possible Funding Sources: mitigation funds from local developers</p> | |

Mountain View Elementary School
Green Infrastructure Information Sheet

NJDEP grant programs
Mount Olive Township Municipality
local social and community groups
PTA

Partners/Stakeholders:

Mount Olive Township Municipality
Mountain View Elementary School
local community groups
Board of Education
students and parents
Rutgers Cooperative Extension

Estimated Cost:

Rain garden #1 would need to be approximately 2,250 square feet. At \$5 per square foot, the estimated cost is \$11,250.

Rain garden #2 would need to be approximately 1,015 square feet. At \$5 per square foot, the estimated cost is \$5,075.

Rain garden #3 would need to be approximately 580 square feet. At \$5 per square foot, the estimated cost is \$2,900.

Porous asphalt #1 would cover 5,240 square feet and have a 1-foot stone reservoir under the surface. At \$20 per square foot, the cost of the porous asphalt system would be \$104,800.

Porous asphalt #2 would cover 1,710 square feet and have a 1-foot stone reservoir under the surface. At \$20 per square foot, the cost of the porous asphalt system would be \$34,200.

The total cost of the project will thus be approximately \$158,225.