



Draft

**Impervious Cover Assessment
for
Dunellen Borough, Middlesex County, New Jersey**

*Prepared for Dunellen Borough by the
Rutgers Cooperative Extension Water Resources Program*

February 1, 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

Dunellen Borough Impervious Cover Analysis

Located in Middlesex County in central New Jersey, Dunellen Borough covers approximately 1.06 square miles. Figures 3 and 4 illustrate that Dunellen Borough is dominated by urban land uses. A total of 93.8% of the municipality's land use is classified as urban. Of the urban land in Dunellen Borough, medium 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 Dunellen Borough 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 Dunellen Borough. Based upon the 2007 NJDEP land use/land cover data, approximately 39.8% of Dunellen Borough has impervious cover. This level of impervious cover suggests that the streams in Dunellen Borough are likely non-supporting streams.

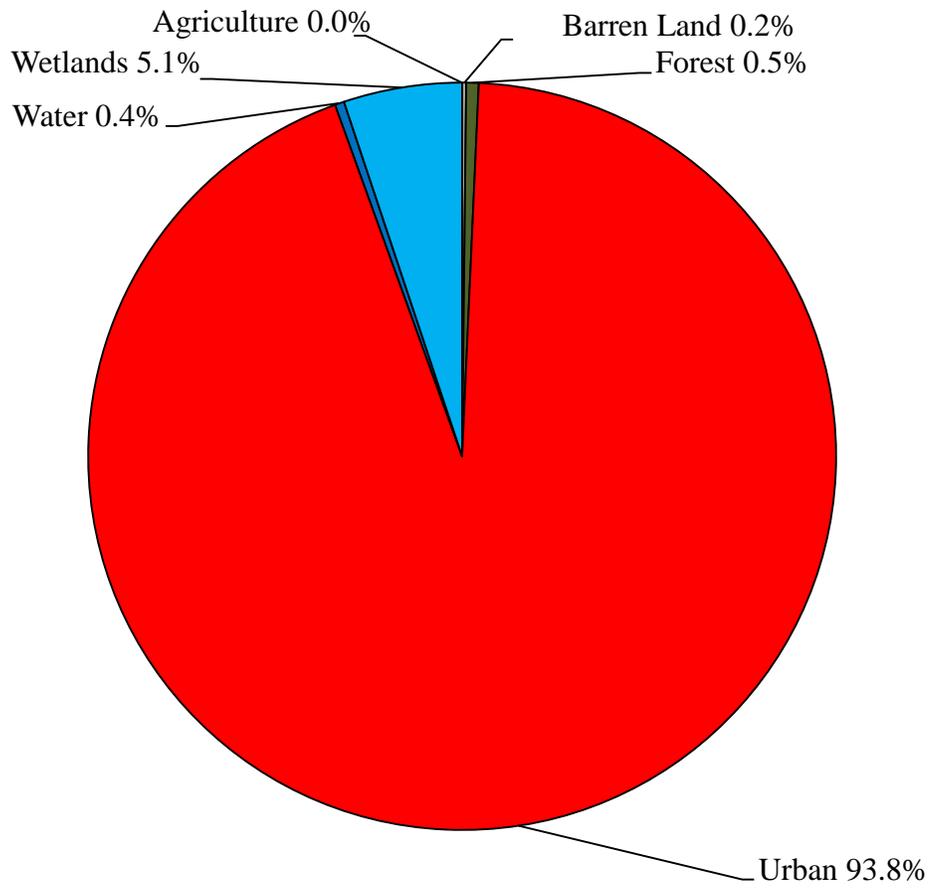


Figure 3: Pie chart illustrating the land use in Dunellen Borough

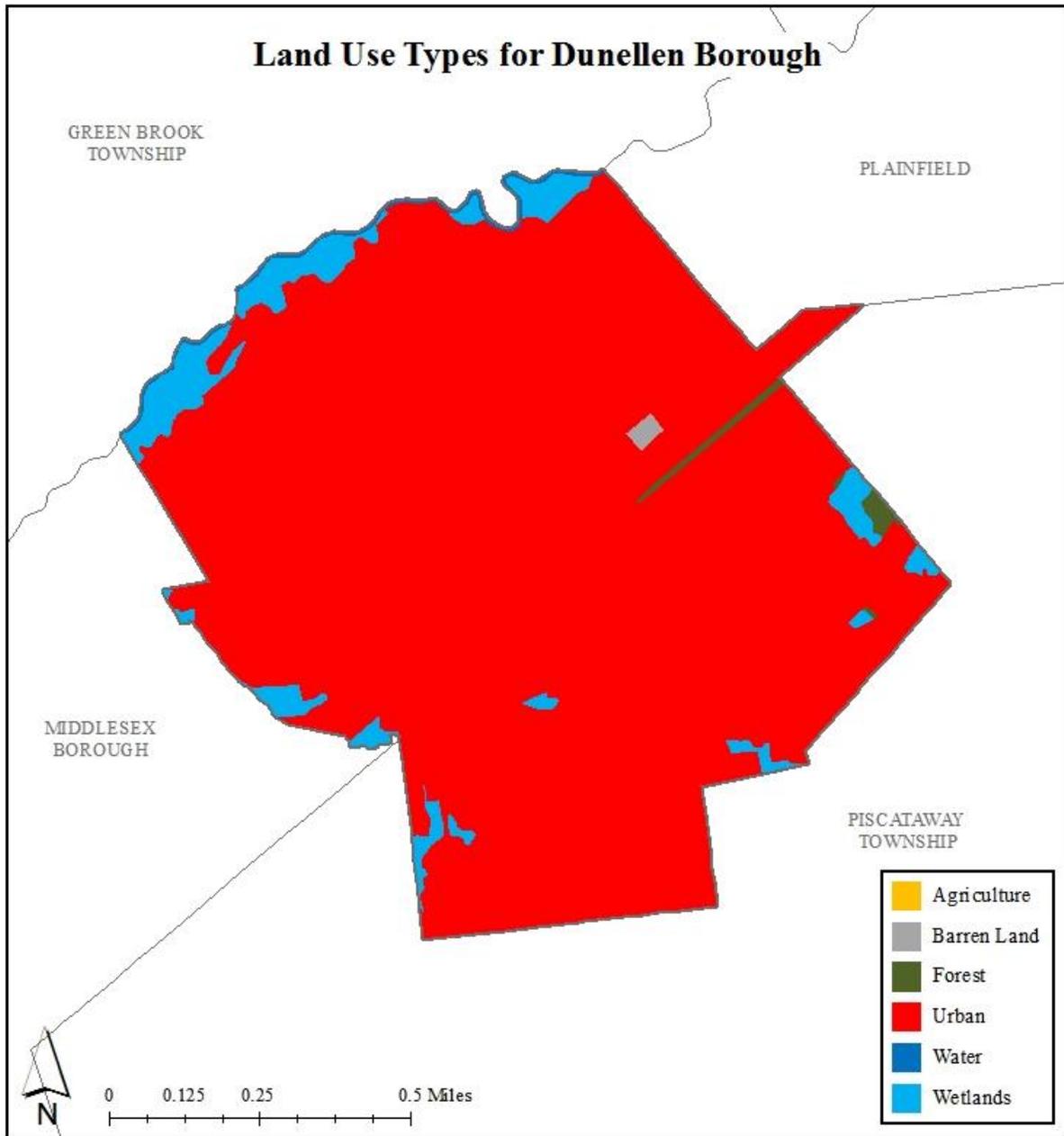


Figure 4: Map illustrating the land use in Dunellen Borough

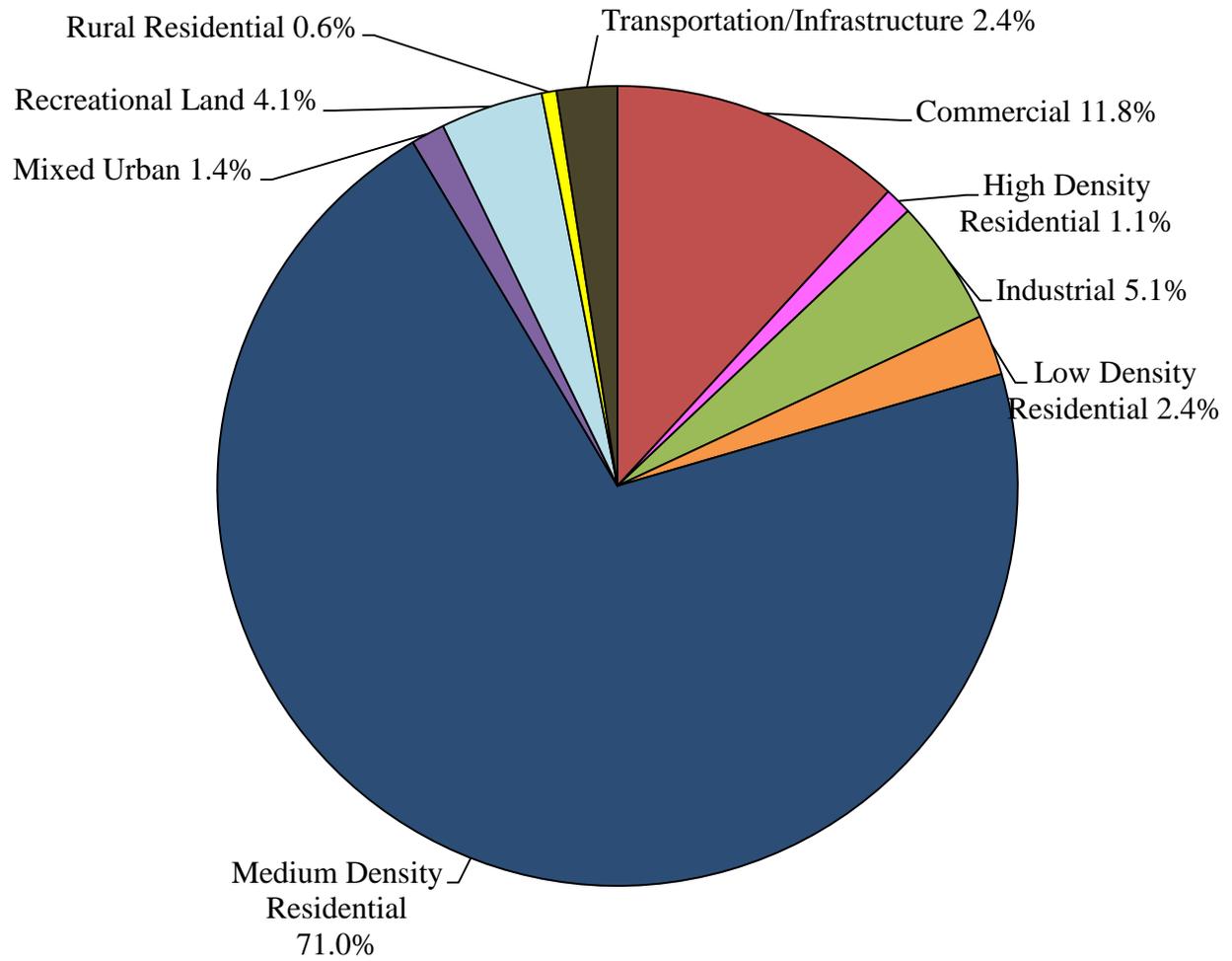


Figure 5: Pie chart illustrating the various types of urban land use in Dunellen Borough

Water resources are typically managed on a watershed/subwatershed basis; therefore an impervious cover analysis was performed for each Raritan River subwatershed within Dunellen Borough (Table 1 and Figure 6). On a subwatershed basis, impervious cover ranges from 34.8% in the Bound Brook subwatershed to 39.8% in the Green 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 Dunellen Borough, Middlesex 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 (5.1 inches of rain), and the 100-year design storm (8.6 inches of rain). These runoff volumes are summarized in Table 2. A substantial amount of rainwater drains from impervious surfaces in Dunellen Borough. For example, if the stormwater runoff from one water quality storm (1.25 inches of rain) in the Green Brook subwatershed was harvested and purified, it could supply water to 83 homes for one year¹.

¹ Assuming 300 gallons per day per home

Table 1: Impervious cover analysis by subwatershed for Dunellen Borough

Subwatershed	Total Area		Land Use Area		Water Area		Impervious Cover		
	(ac)	(mi ²)	(ac)	(mi ²)	(ac)	(mi ²)	(ac)	(mi ²)	(%)
Bound Brook	0.23	0.00	0.23	0.00	0.00	0.00	0.08	0.00	34.8%
Green Brook	679.7	1.06	677.0	1.06	2.71	0.00	269.2	0.42	39.8%
Total	680.0	1.06	677.3	1.06	2.71	0.00	269.3	0.42	39.8%

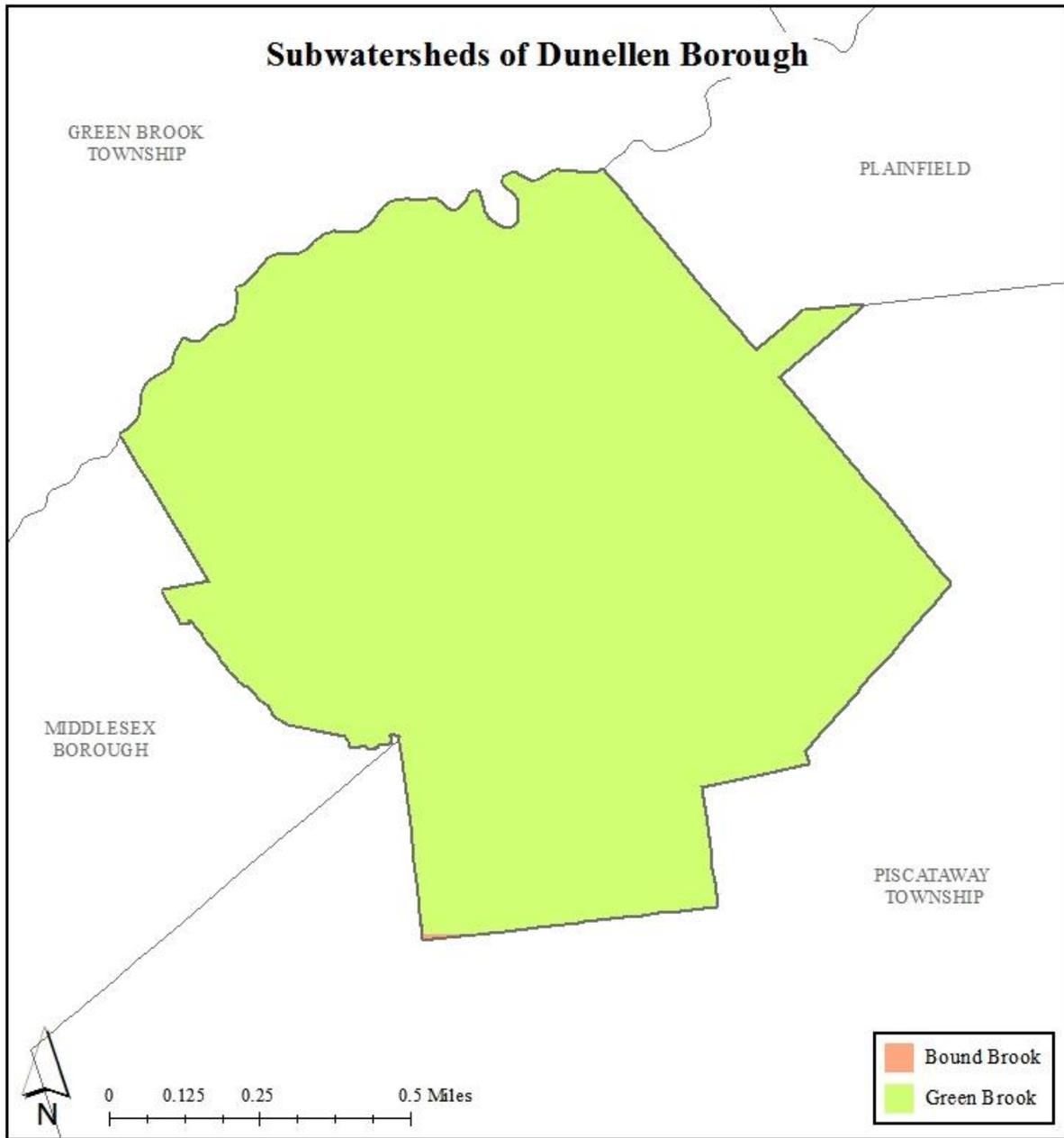


Figure 6: Map of the subwatersheds in Dunellen Borough

Table 2: Stormwater runoff volumes from impervious surfaces by subwatershed in Dunellen Borough

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 (5.1") (MGal)	Total Runoff Volume for the 100-Year Design Storm (8.6") (MGal)
Bound Brook	0.0	0.1	0.0	0.0	0.0
Green Brook	9.1	321.6	24.1	37.3	62.9
Total	9.1	321.7	24.1	37.3	62.9

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

Subwatershed	Recommended Impervious Area Reduction (10%) (ac)	Annual Runoff Volume Reduction ² (MGal)
Bound Brook	0.0	0.0
Green Brook	26.9	30.6
Total	26.9	30.6

² Annual Runoff Volume Reduction =

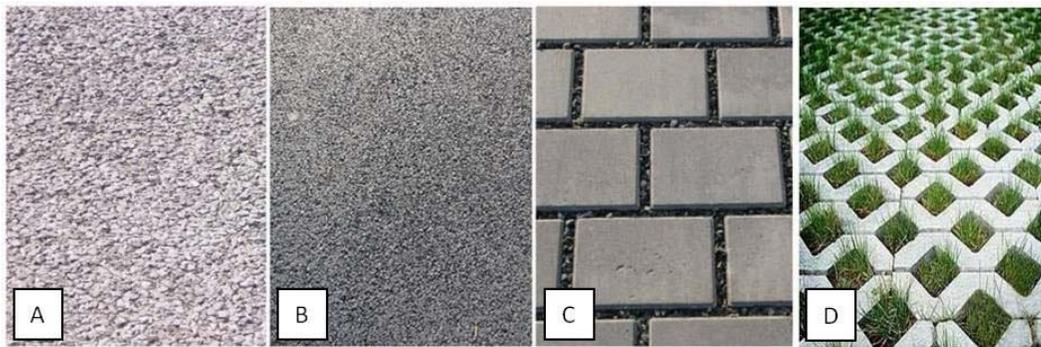
Acres of impervious cover x 43,560 ft²/ac x 44 in x (1 ft/12 in) x 0.95 x (7.48 gal/ft³) x (1 MGal/1,000,000 gal)

All 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 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 Dunellen Borough

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 Dunellen Borough, 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

Dunellen Borough can reduce flooding and improve its waterways by better managing stormwater runoff from impervious surfaces. This impervious cover assessment is the first step toward better managing stormwater runoff. The next step is to develop an action plan to eliminate, reduce, or disconnect impervious surfaces where possible and practical. Many of the highly effective disconnection practices are inexpensive. The entire community can be engaged in implementing these disconnection practices.

References

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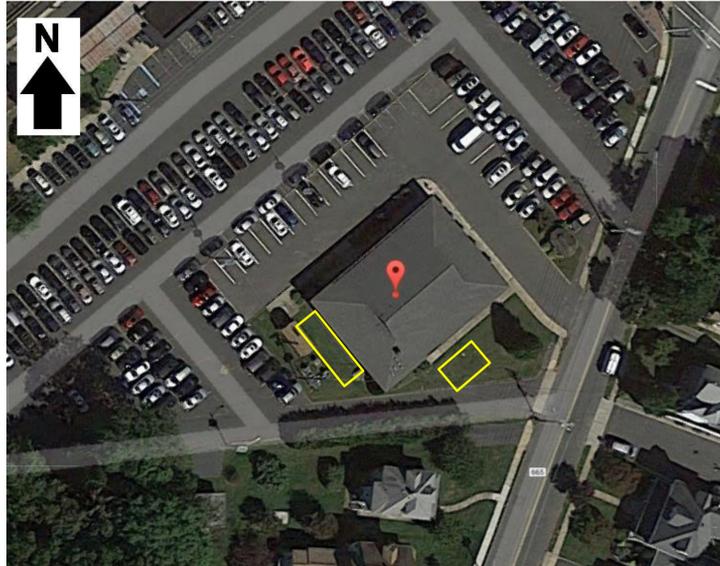
Appendix A

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

Dunellen Borough Impervious Cover Assessment

Dunellen Public Library, 100 New Market Road

PROJECT LOCATION:



SITE PLAN:



A



B



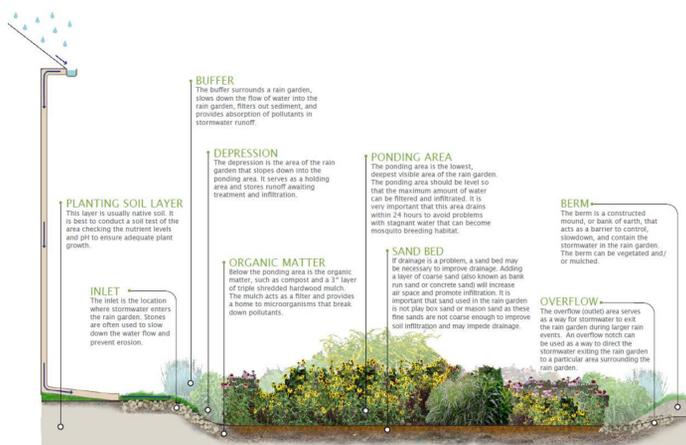
C



1 BIORETENTION SYSTEM: Downspout disconnection and redirection could be used on the southeast side of the library to allow stormwater runoff from the roof to enter into a bioretention system. A second bioretention system could be installed to capture roof runoff from the southwest side of the library. The bioretention systems will reduce sediment and nutrient loading to the local waterway. These systems can also provide habitat for birds, butterflies, and pollinators.

EDUCATIONAL PROGRAM: The RCE Water Resources Program's *Stormwater Management in Your Backyard* program can be delivered at Dunellen Borough Library to educate community members about stormwater management and engage them in designing and building the bioretention system.

1 BIORETENTION SYSTEM



EDUCATIONAL PROGRAM



Dunellen Public Library
Green Infrastructure Information Sheet

<p>Location: 100 New Market Road Dunellen, NJ 08812</p>	<p>Municipality: Dunellen Borough</p>
<p>Green Infrastructure Description: bioretention systems educational program</p>	<p>Subwatershed: Green Brook</p>
<p>Mitigation Opportunities: recharge potential: yes stormwater peak reduction potential: yes TSS removal potential: yes</p>	<p>Targeted Pollutants: total nitrogen (TN), total phosphorous (TP), and total suspended solids (TSS) in surface runoff</p> <p>Stormwater Captured and Treated Per Year: bioretention system SE: 26,800 gal. bioretention system SW: 36,500 gal.</p>
<p>Existing Conditions and Issues: This site contains several impervious surfaces including driveways, walkways, parking areas, and a building. These impervious surfaces are directly connected to a storm sewer system. The Dunellen Public Library shares a parking lot with the NJ Transit station of Dunellen along South Washington Avenue and New Market Road. There are numerous parking islands and "no parking" areas within this lot. The library is surrounded by walkways, except for the southern and eastern faces of the building. Some of the pavement on the walkways and driveways is eroded. There are bushes on all sides, except for the southwestern face of the building. There are downspouts on the eastern and western faces of the building. One downspout on the eastern side of the building is connected to the street. There is an existing garden on the eastern side of the building. There appears to be a minor gully along the southwestern edge of the building. This gully may be the result of an underground utility or excavation. There is no gutter-downspout system bringing water to this area.</p>	
<p>Proposed Solution(s): A bioretention system could be installed along the southeastern turf grass area to capture the eastern portion of the roof's runoff. A portion of the existing gardens could be converted to a rain garden, or this garden could be placed entirely on the existing turf grass. A second bioretention system could be placed along the southwestern edge of the building. This system would require a downspout extended from the gutter system and should be set back from the building and the nearby shed.</p>	
<p>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 wildlife habitat and aesthetic appeal. The bioswale would reduce TN by 30%, TP by 60%, and TSS by 90%. Rutgers Cooperative Extension could present</p>	

Dunellen Public Library
Green Infrastructure Information Sheet

the *Stormwater Management in Your Backyard* program to community members and include them in the planting of the bioswale and bioretention system. This may also be used as a demonstration project for the Dunellen Borough Department of Public Works staff to launch educational programming.

Possible Funding Sources:

mitigation funds from local developers
NJDEP grant programs
Dunellen Borough
Dunellen Public Library
local social and community groups

Partners/Stakeholders:

Dunellen Borough
Dunellen Public Library
local social and community groups
local residents
Rutgers Cooperative Extension

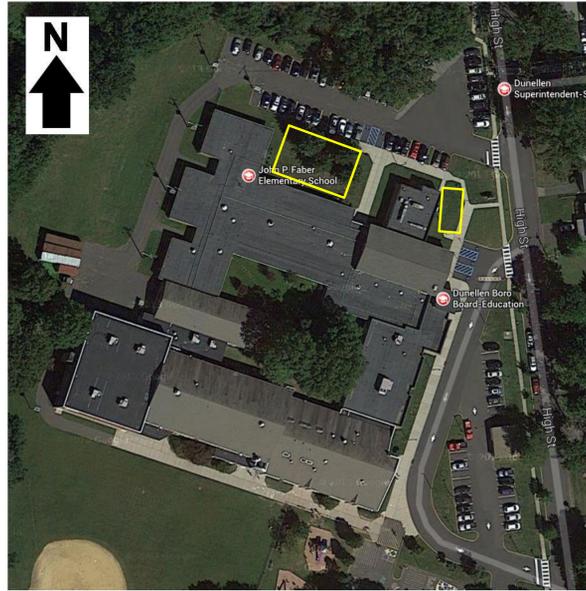
Estimated Cost:

The bioretention system would need to be approximately 260 square feet. At \$5 per square foot, the estimated cost of this bioretention system is \$1,300. The bioswale would need to be approximately 280 square feet. At \$5 per square foot, the estimated cost of the bioswale is \$1,400. The total cost of the project would be approximately \$2,700.

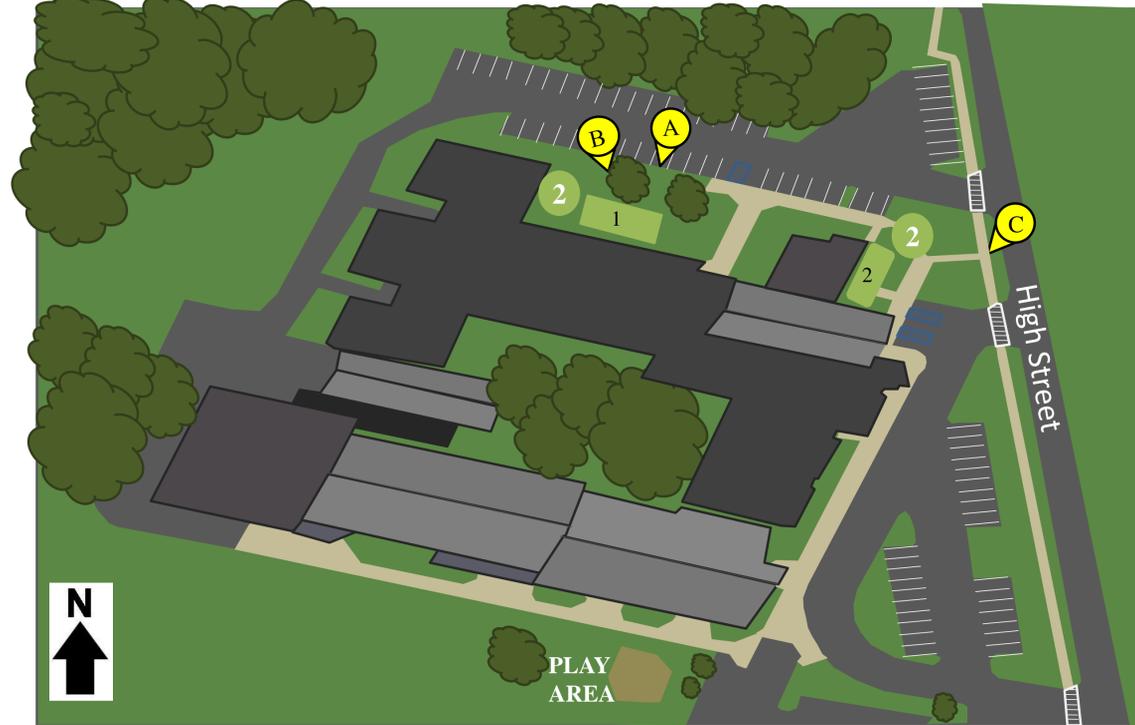
Dunellen Borough Impervious Cover Assessment

John P. Faber Elementary School, High and Lehigh Streets

PROJECT LOCATION:



SITE PLAN:



A



B



C



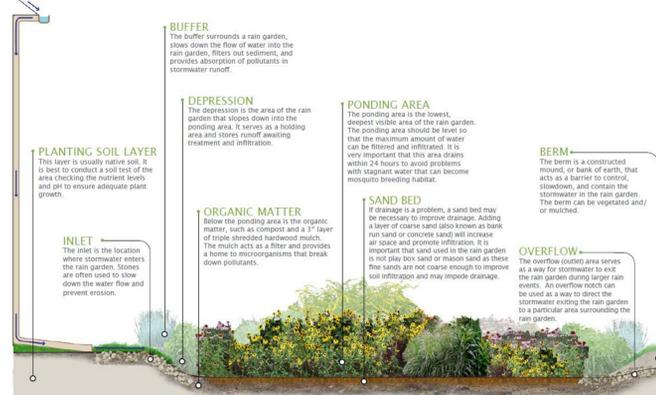
1 EDUCATIONAL PROGRAM: The RCE Water Resources Program's *Stormwater Management in Your Schoolyard* program can be delivered at John P. Faber Elementary School to educate the students about stormwater management and engage them in designing and building the bioretention systems.

2 BIORETENTION SYSTEM: Downspout disconnection and redirection could be used to allow stormwater runoff from the roof to enter into the bioretention systems. The bioretention systems will reduce sediment and nutrient loading to the local waterway.

1 EDUCATIONAL PROGRAM



2 BIORETENTION SYSTEM



John P. Faber Elementary School
Green Infrastructure Information Sheet

<p>Location: 400 High Street Dunellen, NJ 08812</p>	<p>Municipality: Dunellen Borough</p>
<p>Green Infrastructure Description: bioretention systems (rain gardens) educational program</p>	<p>Subwatershed: Green Brook</p>
<p>Mitigation Opportunities: recharge potential: yes stormwater peak reduction potential: yes TSS removal potential: yes</p>	<p>Targeted Pollutants: total nitrogen (TN), total phosphorous (TP), and total suspended solids (TSS) in surface runoff</p> <p>Stormwater Captured and Treated Per Year: bioretention system #1: 104,200 gal. bioretention system #2: 52,100 gal.</p>
<p>Existing Conditions and Issues: This site contains several impervious surfaces including driveways, walkways, parking areas, a shed, and a school complex. These impervious surfaces are directly connected to a storm sewer system. The school complex is sizable, and there is ample space on its lawns for green infrastructure. The parking/road surface is in good condition, and it generally seems to be graded to the north. Light poles line the sidewalks near the school, and the storm sewer system extends inward from the street. Several faces of the school complex appear to lack downspouts, but there are directly connected downspouts along the southern edge of the building. The northernmost courtyard of the school contains four downspouts which appear to be disconnected.</p>	
<p>Proposed Solution(s): Two bioretention systems could be installed at this site to treat runoff from the school complex's roof and enhance the site's aesthetic quality. The first system could be installed in the northernmost courtyard to the west of the walkway. The second system could be installed in the northeastern turf grass area nearest to the building. An educational program could also be implemented at this site.</p>	
<p>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 wildlife habitat and aesthetic appeal. Rutgers Cooperative Extension could present the <i>Stormwater Management in Your Schoolyard</i> 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 Dunellen Department of Public Works staff to launch educational programming.</p>	

John P. Faber Elementary School
Green Infrastructure Information Sheet

Possible Funding Sources:

mitigation funds from local developers
NJDEP grant programs
Dunellen Borough
John P. Faber Elementary School
local social and community groups

Partners/Stakeholders:

Dunellen Borough
faculty, staff, students, and parents
local social and community groups (Boy Scouts, Girl Scouts, parent-teacher associations)
local residents
Rutgers Cooperative Extension

Estimated Cost:

Bioretention system #1 would need to be approximately 1,000 square feet. At \$5 per square foot, the estimated cost of this bioretention system is \$5,000. Four downspouts would be routed to this system which adds \$1,000 to its cost. Bioretention system #2 would need to be 500 square feet. At \$5 per square foot, the estimated cost of this bioretention system is \$2,500. Three downspouts would be routed to this system which adds \$750 to its cost. The total cost of the project will thus be approximately \$9,250.

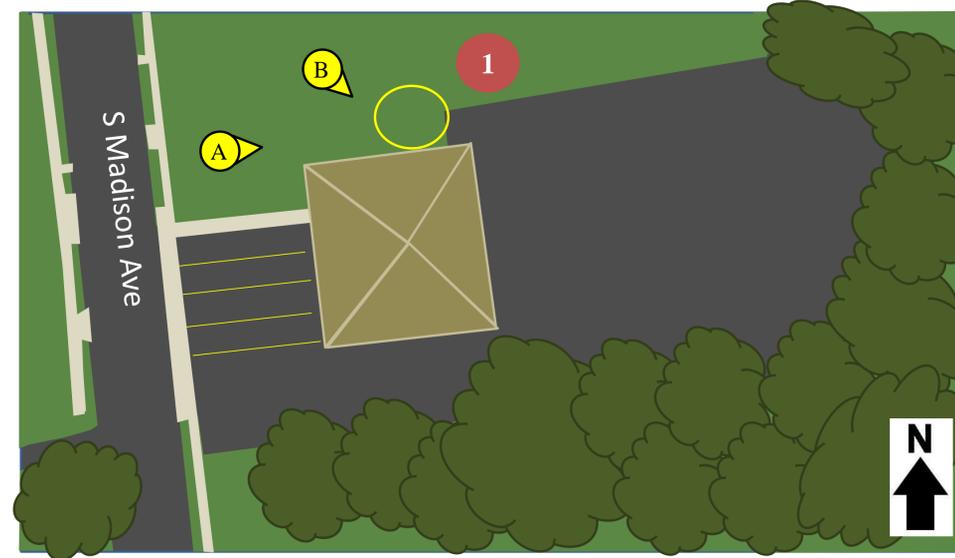
Dunellen Borough Impervious Cover Assessment

Dunellen Fire Department, 231 South Madison Avenue

PROJECT LOCATION:



SITE PLAN:



A



B



1 RAINWATER HARVESTING SYSTEM: Rainwater could be harvested from the roof of the building and stored in a cistern. The water could be used to wash the fire and rescue vehicles.

1 RAINWATER HARVESTING SYSTEM



Dunellen Fire Department
Green Infrastructure Information Sheet

<p>Location: 231 South Madison Avenue Dunellen, NJ 08812</p>	<p>Municipality: Dunellen Borough</p>
<p>Green Infrastructure Description: rainwater harvesting system (cistern)</p>	<p>Subwatershed: Green Brook</p>
<p>Mitigation Opportunities: recharge potential: yes stormwater peak reduction potential: yes TSS removal potential: yes</p>	<p>Targeted Pollutants: total nitrogen (TN), total phosphorous (TP), and total suspended solids (TSS) in surface runoff</p>
<p>Existing Conditions and Issues: This site contains several impervious surfaces including a driveway, a parking area, and a firehouse. These impervious surfaces are directly connected to a storm sewer system. The Dunellen Fire Department is adjacent to the Bonygutt Brook on South Madison Avenue. The firehouse's driveway and parking area combined is the largest impervious surface at this site. A street view of this site shows the paved surface of the lot graded to the north away from the brook. The driveway is graded into the street, which is managed by a catch basin directly in front of the firehouse. There are four disconnected downspouts releasing stormwater from the firehouse's roof onto the grass to the north of the building. There is one downspout directly connected to the pavement in front of the building, and it seems that there are at least five additional directly connected downspouts based on aerial imagery.</p>	<p>Stormwater Captured and Treated Per Year: cistern: 80,200 gal.</p>
<p>Proposed Solution(s): A 5,000 gallon cistern could be installed in the turf grass to the north of the firehouse to manage its stormwater. The gutter-downspout system on this building could be modified to flow into this cistern. The water collected by this cistern could be used for watering plants and washing fire trucks and other vehicles.</p>	
<p>Anticipated Benefits: A rainwater harvesting system will harvest rainwater from the roof of the building and store it in cisterns, which can be used for watering plants and washing fire trucks and other vehicles.</p>	
<p>Possible Funding Sources: mitigation funds from local developers NJDEP grant programs Dunellen Borough Dunellen Fire Department local social and community groups</p>	

Dunellen Fire Department
Green Infrastructure Information Sheet

Partners/Stakeholders:

Dunellen Borough
Dunellen Fire Department
local social and community groups
local residents
Rutgers Cooperative Extension

Estimated Cost:

The cistern would be 5,000 gallons and cost approximately \$10,000 to purchase and install. All of the building's downspouts would need to be disconnected/routed to this cistern, adding an additional \$2,500 to the cost (assuming that there are ten downspouts on the building). The total cost of the project will be approximately \$12,500.