



**Draft**

**Impervious Cover Reduction Action Plan  
for  
Dunellen Borough, Middlesex County, New Jersey**

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

September 22, 2015



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### Attachment: Climate Resilient Green Infrastructure

- a. Overview Map of the Project
- b. Green Infrastructure Sites
- c. Proposed Green Infrastructure Concepts
- d. Summary of Existing Conditions
- e. Summary of Proposed Green Infrastructure Practices

## **Introduction**

Located in Middlesex County in central New Jersey, Dunellen Borough covers approximately 1.06 square miles. Figures 1 and 2 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 3).

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.<sup>1</sup>

## **Methodology**

Dunellen Borough contains portions of two subwatersheds (Figure 4). For this impervious cover reduction action plan, projects have been identified in each of these watersheds. Initially, aerial imagery was used to identify potential project sites that contain extensive impervious cover. Field visits were then conducted at each of these potential project sites to determine if a viable option exists to reduce impervious cover or to disconnect impervious surfaces from draining directly to the local waterway or storm sewer system. During the site visit, appropriate green infrastructure practices for the site were determined. Sites that already had stormwater management practices in place were not considered.

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<sup>1</sup> 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

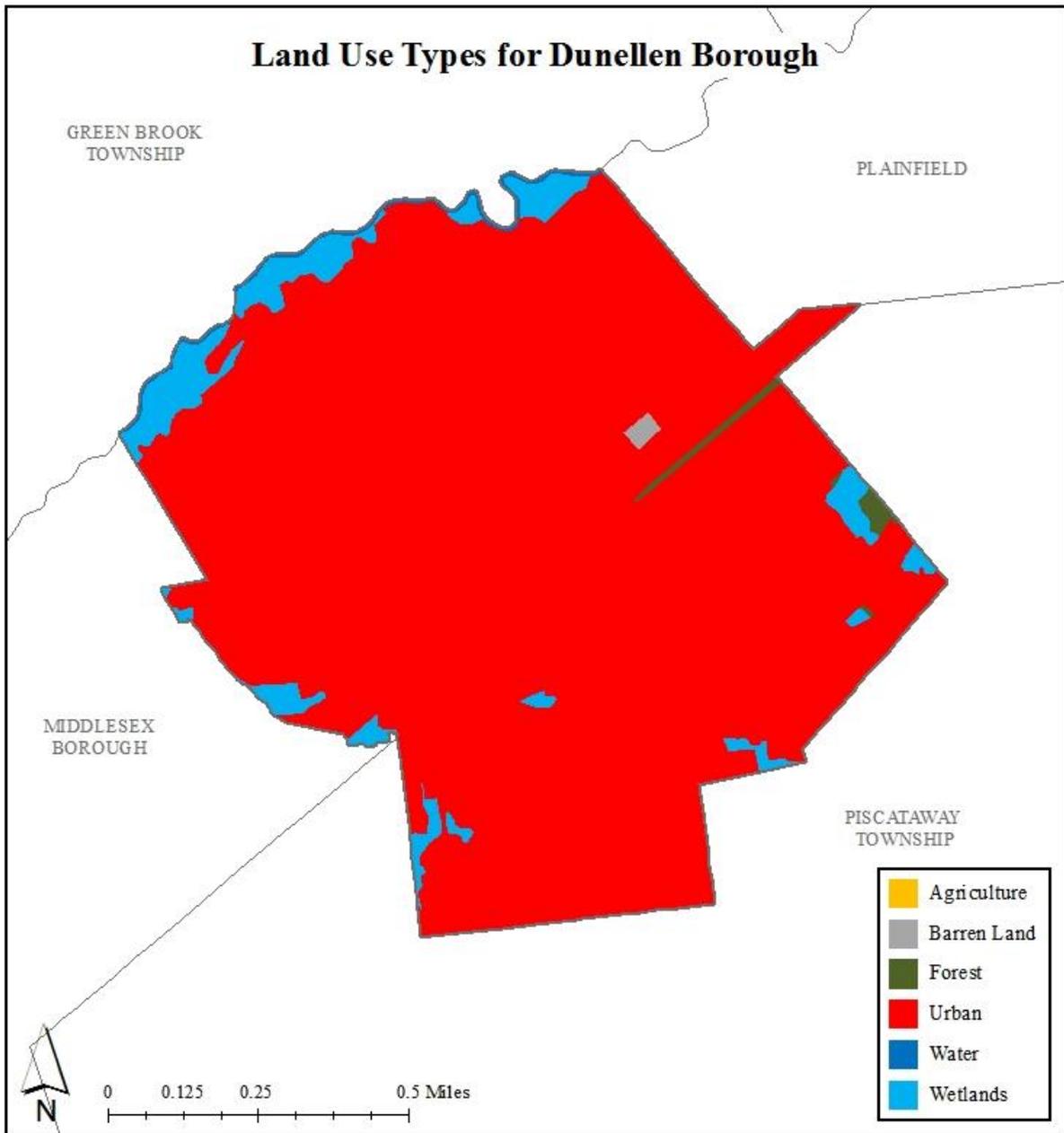


Figure 1: Map illustrating the land use in Dunellen Borough

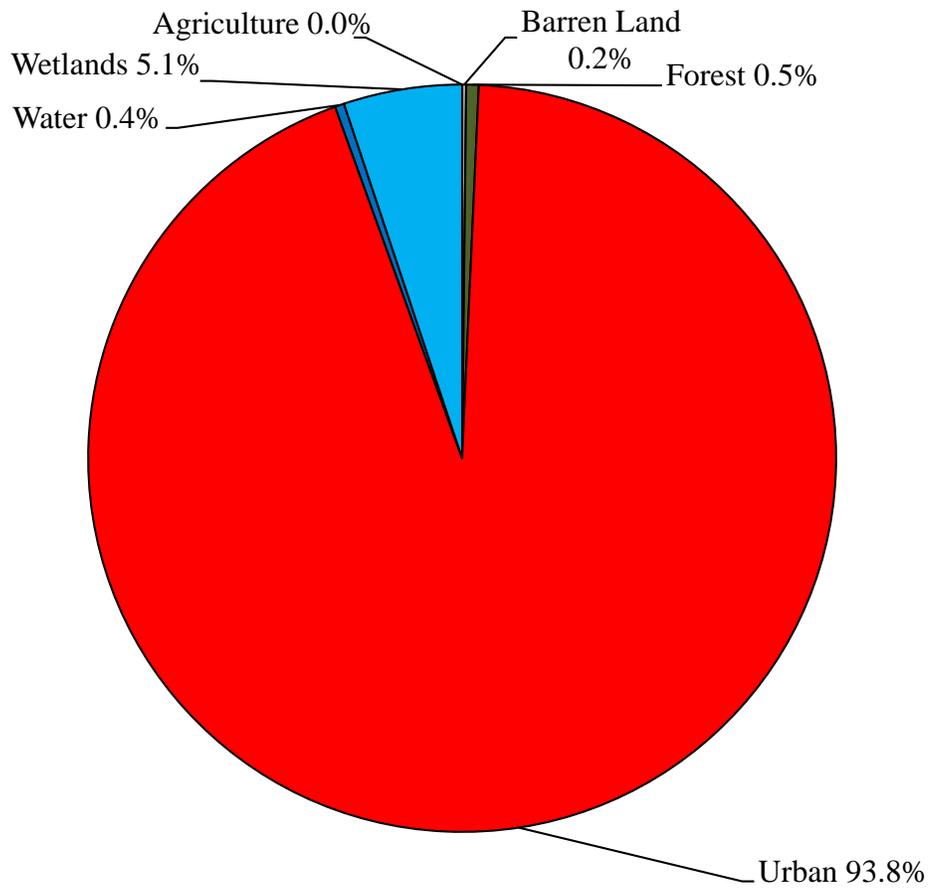


Figure 2: Pie chart illustrating the land use in Dunellen Borough

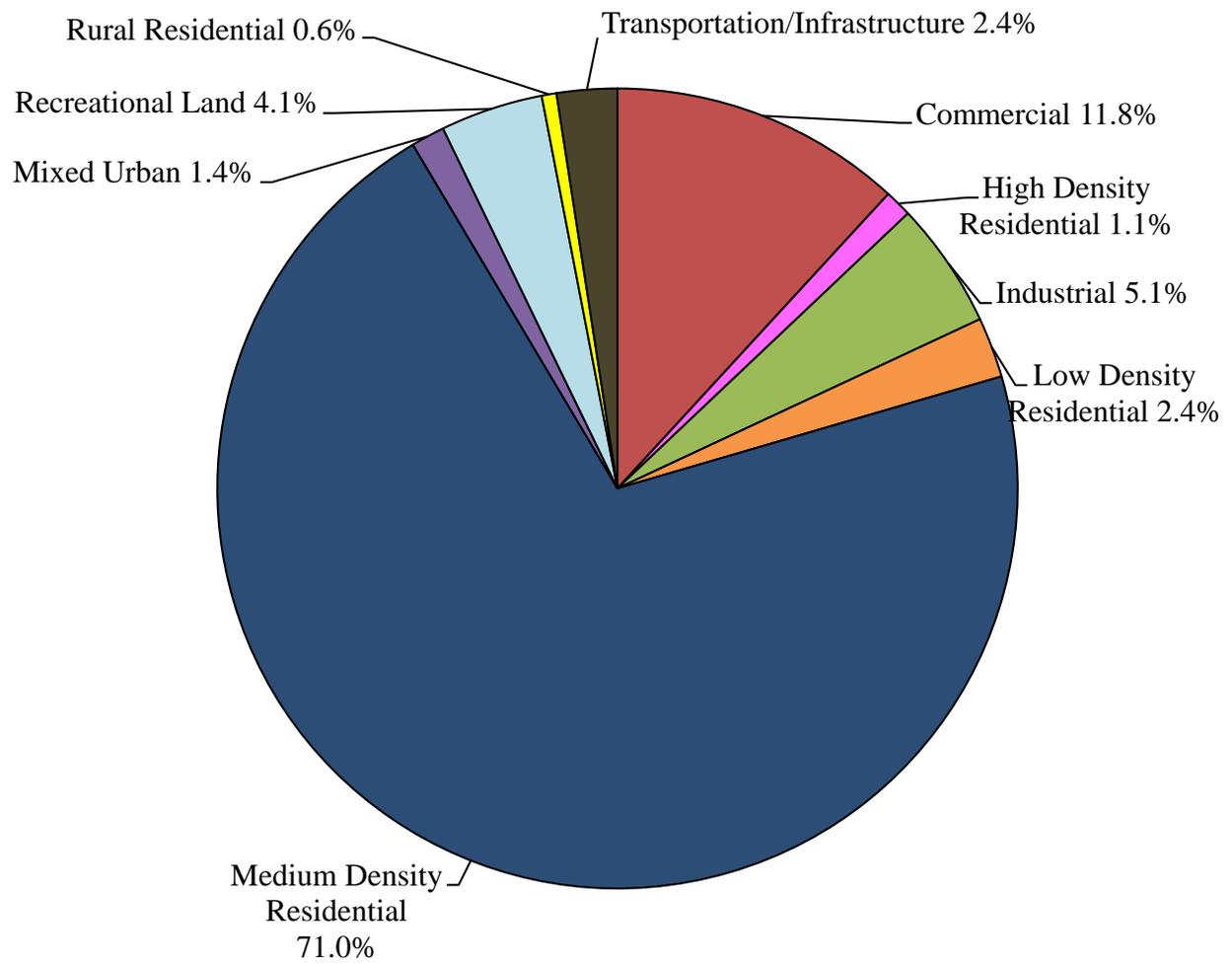


Figure 3: Pie chart illustrating the various types of urban land use in Dunellen Borough

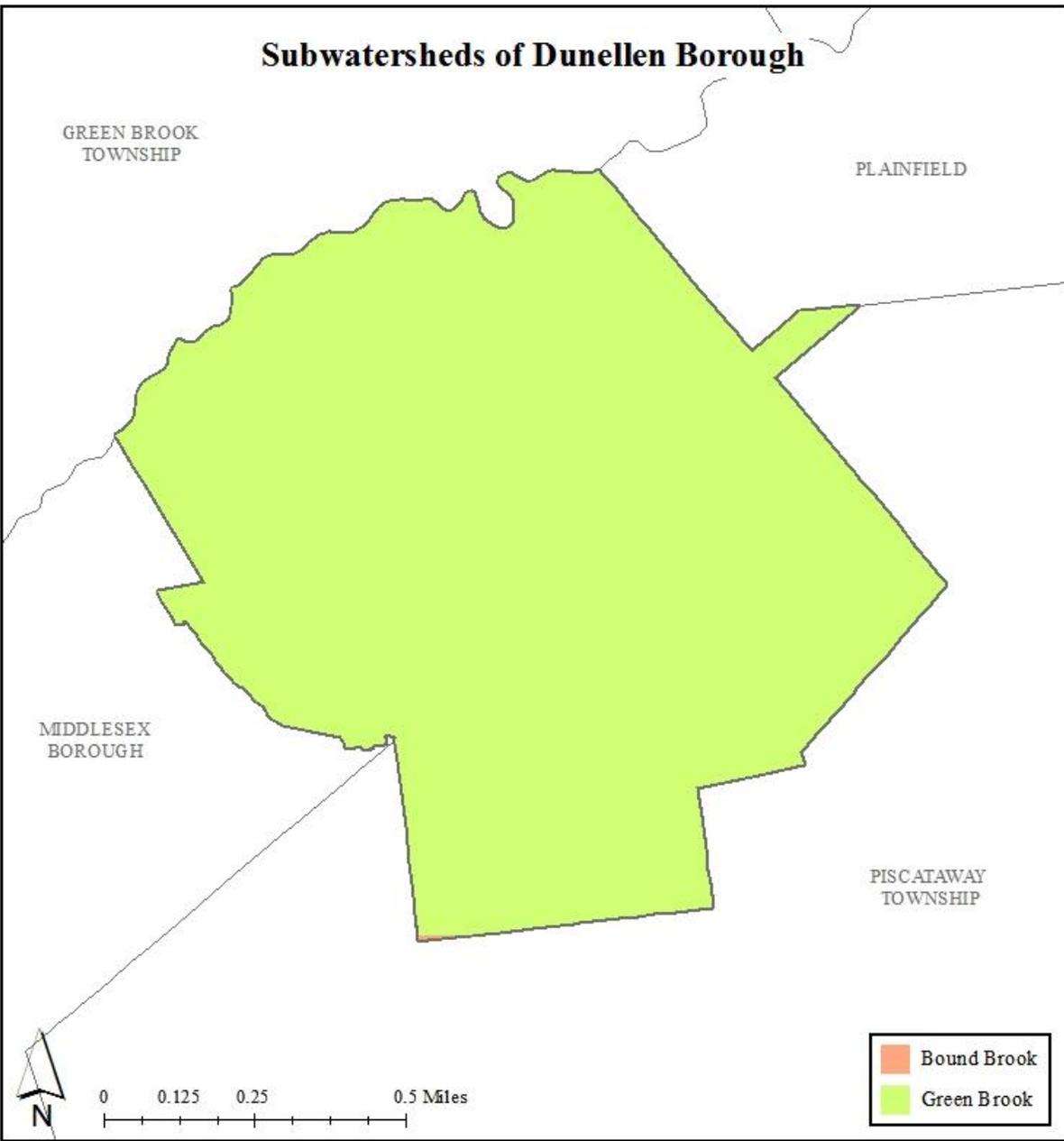


Figure 4: Map of the subwatersheds in Dunellen Borough

For each potential project site, specific aerial loading coefficients for commercial land use were used to determine the annual runoff loads for total phosphorus (TP), total nitrogen (TN), and total suspended solids (TSS) from impervious surfaces (Table 1). These are the same aerial loading coefficients that NJDEP uses in developing total maximum daily loads (TMDLs) for impaired waterways of the state. The percentage of impervious cover for each site was extracted from the 2007 NJDEP land use/land cover database. For impervious areas, runoff volumes were determined for the water quality design storm (1.25 inches of rain over two-hours) and for the annual rainfall total of 44 inches.

Preliminary soil assessments were conducted for each potential project site identified in Dunellen Borough using the United States Department of Agriculture Natural Resources Conservation Service Web Soil Survey, which utilizes regional and statewide soil data to predict soil types in an area. Several key soil parameters were examined (e.g., natural drainage class, saturated hydraulic conductivity of the most limiting soil layer ( $K_{sat}$ ), depth to water table, and hydrologic soil group) to evaluate the suitability of each site's soil for green infrastructure practices. In cases where multiple soil types were encountered, the key soil parameters were examined for each soil type expected at a site.

For each potential project site, drainage areas were determined for each of the green infrastructure practices proposed at the site. These green infrastructure practices were designed to manage the 2-year design storm, enabling these practices to capture 95% of the annual rainfall. Runoff volumes were calculated for each proposed green infrastructure practice. The reduction in TSS loading was calculated for each drainage area for each proposed green infrastructure practice using the aerial loading coefficients in Table 1. The maximum volume reduction in stormwater runoff for each green infrastructure practice for a storm was determined by calculating the volume of runoff captured from the 2-year design storm. For each green infrastructure practice, peak discharge reduction potential was determined through hydrologic modeling in HydroCAD. For each green infrastructure practice, a cost estimate is provided. These costs are based upon the square footage of the green infrastructure practice and the real cost of green infrastructure practice implementation in New Jersey.

Table 1: Aerial Loading Coefficients<sup>2</sup>

| <b>Land Cover</b>                | <b>TP load<br/>(lbs/acre/yr)</b> | <b>TN load<br/>(lbs/acre/yr)</b> | <b>TSS load<br/>(lbs/acre/yr)</b> |
|----------------------------------|----------------------------------|----------------------------------|-----------------------------------|
| High, Medium Density Residential | 1.4                              | 15                               | 140                               |
| Low Density, Rural Residential   | 0.6                              | 5                                | 100                               |
| Commercial                       | 2.1                              | 22                               | 200                               |
| Industrial                       | 1.5                              | 16                               | 200                               |
| Urban, Mixed Urban, Other Urban  | 1.0                              | 10                               | 120                               |
| Agriculture                      | 1.3                              | 10                               | 300                               |
| Forest, Water, Wetlands          | 0.1                              | 3                                | 40                                |
| Barrenland/Transitional Area     | 0.5                              | 5                                | 60                                |

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<sup>2</sup> New Jersey Department of Environmental Protection (NJDEP), Stormwater Best Management Practice Manual, 2004.

## **Green Infrastructure Practices**

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 practices 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<sup>3</sup>. A wide range of green infrastructure practices have been evaluated for the potential project sites in Dunellen Borough. Each practice is discussed below.

### ***Disconnected downspouts***

This is often referred to as simple disconnection. A downspout is simply disconnected, prevented from draining directly to the roadway or storm sewer system, and directed to discharge water to a pervious area (i.e., lawn).



### ***Pervious pavements***

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.



<sup>3</sup> 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](http://ofmpub.epa.gov/waters10/attains_state.control?p_state=NJ)

### ***Bioretention systems/rain gardens***

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 a wildlife habitat while managing stormwater runoff. Bioretention systems also can be used in soils that do not quickly infiltrate by incorporating an underdrain into the system.



### ***Downspout planter boxes***

These are wooden boxes with plants installed at the base of a downspout that provide an opportunity to beneficially reuse rooftop runoff.



### ***Rainwater harvesting systems (cistern or rain barrel)***

These systems capture rainwater, mainly from rooftops, in cisterns or rain barrels. The water can then be used for watering gardens, washing vehicles, or for other non-potable uses.



### ***Bioswale***

Bioswales are landscape features that convey stormwater from one location to another while removing pollutants and providing water an opportunity to infiltrate.



### ***Stormwater planters***

Stormwater planters are vegetated structures that are built into the sidewalk to intercept stormwater runoff from the roadway or sidewalk. Many of these planters are designed to allow the water to infiltrate into the ground while others are designed simply to filter the water and convey it back into the stormwater sewer system.



### ***Tree filter boxes***

These are pre-manufactured concrete boxes that contain a special soil mix and are planted with a tree or shrub. They filter stormwater runoff but provide little storage capacity. They are typically designed to quickly filter stormwater and then discharge it to the local sewer system.



### **Potential Project Sites**

Attachment 1 contains information on potential project sites where green infrastructure practices could be installed. The recommended green infrastructure practice and the drainage area that the green infrastructure practice can treat are identified for each potential project site. For each practice, the recharge potential, TSS removal potential, maximum volume reduction potential per storm, and the peak reduction potential are provided. This information is also provided so that proposed development projects that cannot satisfy the New Jersey stormwater management requirements for major development can use one of the identified projects to offset a stormwater management deficit.<sup>4</sup>

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<sup>4</sup> New Jersey Administrative Code, N.J.A.C. 7:8, Stormwater Management, Statutory Authority: N.J.S.A. 12:5-3, 13:1D-1 et seq., 13:9A-1 et seq., 13:19-1 et seq., 40:55D-93 to 99, 58:4-1 et seq., 58:10A-1 et seq., 58:11A-1 et seq. and 58:16A-50 et seq., *Date last amended: April 19, 2010.*

## **Conclusion**

This impervious cover reduction action plan is meant to provide the municipality with a blueprint for implementing green infrastructure practices that will reduce the impact of stormwater runoff from impervious surfaces. These projects can be implemented by a wide variety of people such as boy scouts, girl scouts, school groups, faith-based groups, social groups, watershed groups, and other community groups.

Additionally, development projects that are in need of providing off-site compensation for stormwater impacts can use the projects in this plan as a starting point. The municipality can quickly convert this impervious cover reduction action plan into a stormwater mitigation plan and incorporate it into the municipal stormwater control ordinance.

**a. Overview Map of the Project**

# DUNELLEN: CLIMATE RESILIENT GREEN INFRASTRUCTURE FOR THE RARITAN BASIN



## **b. Green Infrastructure Sites**

## DUNELLEN: GREEN INFRASTRUCTURE SITES



### SITES WITHIN THE GREEN BROOK SUBWATERSHED:

1. Community Bible Church
2. Dunellen Borough Library
3. Dunellen Fire Department
4. Dunellen High School & Middle School
5. Dunellen Knights of Columbus
6. Dunellen Municipal Building
7. Footprints Christian Preschool
8. John P. Faber Elementary School
9. Saint Francis Church
10. US Post Office
11. Veterans of Foreign Wars

**c. Proposed Green Infrastructure Concepts**

# COMMUNITY BIBLE CHURCH



**Subwatershed:** Green Brook  
**Site Area:** 45,292 sq. ft.  
**Address:** 254 New Market Road  
Dunellen, NJ 08812  
**Block and Lot:** Block 73, Lot 1

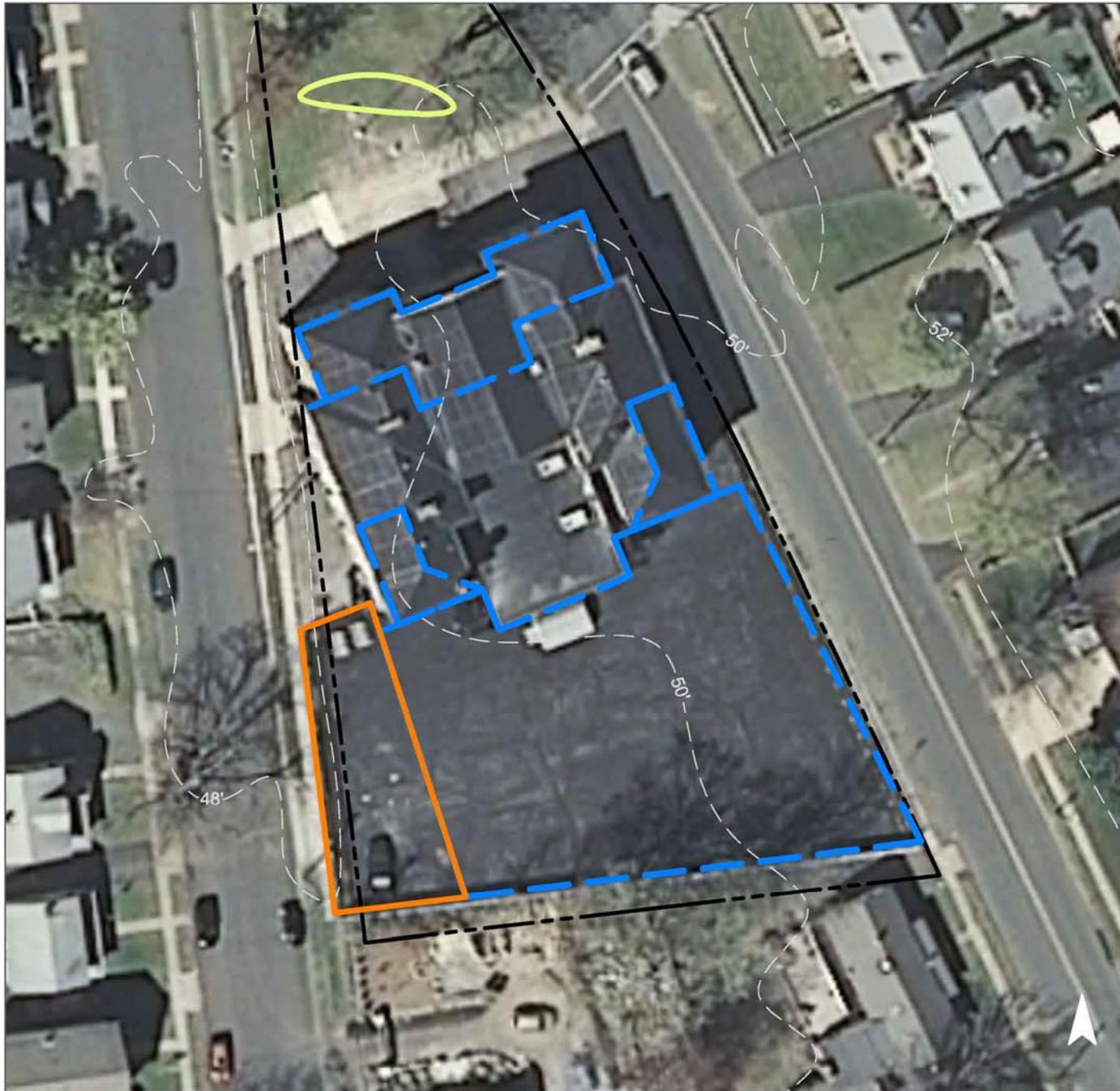


Community Bible Church has a roof with disconnected downspouts and a large paved area. A bioretention system can be built at the front of the building to capture, treat and infiltrate runoff. The large paved area and some roof runoff can also be treated with pervious pavement. A preliminary soil assessment for this site suggests that soils have suitable drainage characteristics for green infrastructure.

| Impervious Cover |         | Existing Loads from Impervious Cover (lbs/yr) |      |       | Runoff Volume from Impervious Cover (Mgal) |                               |
|------------------|---------|---|------|-------|--|-------------------------------|
| %                | sq. ft. | TP  | TN   | TSS   | For the 1.25" Water Quality Storm          | For an Annual Rainfall of 44" |
| 79               | 35,632  | 1.7   | 18.0 | 163.6 | 0.028                                      | 0.98                          |

| Recommended Green Infrastructure Practices | Recharge Potential (Mgal/yr) | TSS Removal Potential (lbs/yr) | Maximum Volume Reduction Potential (gal/storm) | Peak Discharge Reduction Potential (cu. ft./second) | Estimated Size (sq. ft.) | Estimated Cost |
|--|------------------------------|--------------------------------|--|---|--------------------------|----------------|
| Bioretention systems                       | 0.072                        | 12                             | 5,258  | 0.20  | 688                      | \$3,483        |
| Pervious pavements                         | 0.479                        | 80                             | 35,178   | 1.32  | 3,250                    | \$81,250       |

# GREEN INFRASTRUCTURE RECOMMENDATIONS



## Community Bible Church

-  pervious pavements
-  bioretention / rain gardens
-  drainage areas
-  property line
-  2012 Aerial: NJOIT, OGIS



# DUNELLEN BOROUGH LIBRARY



**Subwatershed:** Green Brook  
**Site Area:** 117,469 sq. ft.  
**Address:** 100 New Market Road  
 Dunellen, NJ 08812  
**Block and Lot:** Block 70, Lot 13.01



The parking lot runoff can be treated with strategic use of pervious pavement. Half of the roof runoff can be managed with a rain garden on the street side, while the other half can be captured by the pervious pavement. A preliminary soil assessment for this site suggests that soils have suitable drainage characteristics for green infrastructure.

| Impervious Cover |         | Existing Loads from Impervious Cover (lbs/yr) |      |       | Runoff Volume from Impervious Cover (Mgal) |                               |
|------------------|---------|---|------|-------|--|-------------------------------|
| %                | sq. ft. | TP  | TN   | TSS   | For the 1.25" Water Quality Storm          | For an Annual Rainfall of 44" |
| 83               | 97,371  | 4.7   | 49.2 | 447.1 | 0.076                                      | 2.67                          |

| Recommended Green Infrastructure Practices | Recharge Potential (Mgal/yr) | TSS Removal Potential (lbs/yr) | Maximum Volume Reduction Potential (gal/storm) | Peak Discharge Reduction Potential (cu. ft./second) | Estimated Size (sq. ft.) | Estimated Cost |
|--|------------------------------|--------------------------------|--|---|--------------------------|----------------|
| Bioretention systems                       | 0.086                        | 14                             | 6,306  | 0.24  | 825                      | \$4,125        |
| Pervious pavements                         | 0.912                        | 153                            | 66,916   | 2.52  | 6,300                    | \$157,500      |

# GREEN INFRASTRUCTURE RECOMMENDATIONS



## Dunellen Borough Library

-  disconnected downspouts
-  pervious pavements
-  bioretention / rain gardens
-  drainage areas
-  property line
-  2012 Aerial: NJOIT, OGIS



# DUNELLEN FIRE DEPARTMENT



**Subwatershed:** Green Brook  
**Site Area:** 55,731 sq. ft.  
**Address:** 231 South Madison Avenue  
 Dunellen, NJ 08812  
**Block and Lot:** Block 64, Lot 37



Roof runoff flows into a catch basin at the street and into an adjacent creek. The paved area can be treated with strips of pervious pavement to capture this runoff. Some downspouts can also be routed into a cistern to harvest stormwater and wash the fire trucks. A preliminary soil assessment for this site suggests that soils have suitable drainage characteristics for green infrastructure.

| Impervious Cover |         | Existing Loads from Impervious Cover (lbs/yr) |      |       | Runoff Volume from Impervious Cover (Mgal) |                               |
|------------------|---------|---|------|-------|--|-------------------------------|
| %                | sq. ft. | TP  | TN   | TSS   | For the 1.25" Water Quality Storm          | For an Annual Rainfall of 44" |
| 75               | 41,593  | 2.0   | 21.0 | 191.0 | 0.032                                      | 1.14                          |

| Recommended Green Infrastructure Practices | Recharge Potential (Mgal/yr) | TSS Removal Potential (lbs/yr) | Maximum Volume Reduction Potential (gal/storm) | Peak Discharge Reduction Potential (cu. ft./second) | Estimated Size (sq. ft.) | Estimated Cost |
|--|------------------------------|--------------------------------|--|---|--------------------------|----------------|
| Pervious pavements                         | 0.831                        | 139                            | 60,947   | 2.29  | 5,800                    | \$145,000      |
| Rainwater harvesting systems               | 0.086                        | 14                             | 5,000  | 0.24  | 5,000 (gal)              | \$10,000       |

# GREEN INFRASTRUCTURE RECOMMENDATIONS



## Dunellen Fire Department

-  pervious pavements
-  rainwater harvesting
-  drainage areas
-  property line
-  2012 Aerial: NJOIT, OGIS



# DUNELLEN HIGH SCHOOL AND MIDDLE SCHOOL



**Subwatershed:** Green Brook  
**Site Area:** 94,903 sq. ft.  
**Address:** 411 1st Street  
Dunellen, NJ 08812  
**Block and Lot:** Block 29, Lot 1

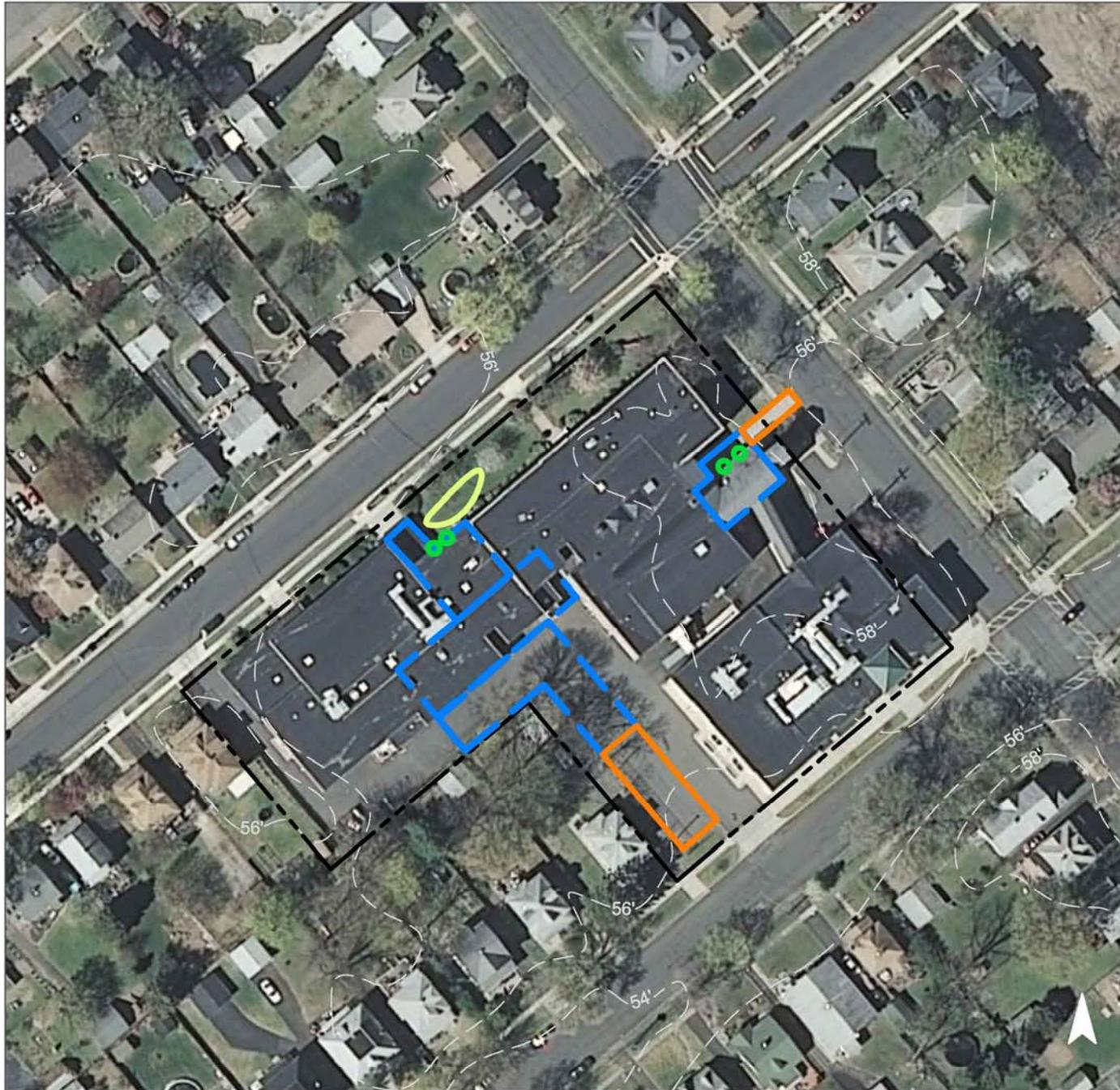


Disconnected downspouts primarily flow directly into street-side storm drains. Porous pavement can be used to capture this runoff. Connected downspouts at the front of the high school can be disconnected into a rain garden. A preliminary soil assessment for this site suggests that soils have suitable drainage characteristics for green infrastructure.

| Impervious Cover |         | Existing Loads from Impervious Cover (lbs/yr) |      |       | Runoff Volume from Impervious Cover (Mgal) |                               |
|------------------|---------|---|------|-------|--|-------------------------------|
| %                | sq. ft. | TP  | TN   | TSS   | For the 1.25" Water Quality Storm          | For an Annual Rainfall of 44" |
| 87               | 82,984  | 4.0   | 41.9 | 381.0 | 0.065                                      | 2.28                          |

| Recommended Green Infrastructure Practices | Recharge Potential (Mgal/yr) | TSS Removal Potential (lbs/yr) | Maximum Volume Reduction Potential (gal/storm) | Peak Discharge Reduction Potential (cu. ft./second) | Estimated Size (sq. ft.) | Estimated Cost |
|--|------------------------------|--------------------------------|--|---|--------------------------|----------------|
| Bioretention systems                       | 0.065                        | 11                             | 4,780  | 0.18  | 625                      | \$3,125        |
| Pervious pavements                         | 0.367                        | 62                             | 26,958   | 1.01  | 2,650                    | \$66,250       |

# GREEN INFRASTRUCTURE RECOMMENDATIONS



## Dunellen High School And Middle School

-  disconnected downspouts
-  pervious pavements
-  bioretention / rain gardens
-  drainage areas
-  property line
-  2012 Aerial: NJOIT, OGIS



# DUNELLEN KNIGHTS OF COLUMBUS



**Subwatershed:** Green Brook  
**Site Area:** 17,879 sq. ft.  
**Address:** 512 South Avenue  
Dunellen, NJ 08812  
**Block and Lot:** Block 67, Lot 1



With the exception of the entrance overhang, downspouts currently connect roof runoff directly into the underground sewer system. Downspouts adjacent to the sidewalk can be disconnected into planter boxes, while downspouts by the parking lot can be disconnected into pervious pavement. A preliminary soil assessment for this site suggests that soils have suitable drainage characteristics for green infrastructure.

| Impervious Cover |         | Existing Loads from Impervious Cover (lbs/yr) |     |      | Runoff Volume from Impervious Cover (Mgal) |                               |
|------------------|---------|---|-----|------|--|-------------------------------|
| %                | sq. ft. | TP  | TN  | TSS  | For the 1.25" Water Quality Storm          | For an Annual Rainfall of 44" |
| 70               | 12,515  | 0.6   | 6.3 | 57.5 | 0.010                                      | 0.34                          |

| Recommended Green Infrastructure Practices | Recharge Potential (Mgal/yr) | TSS Removal Potential (lbs/yr) | Maximum Volume Reduction Potential (gal/storm) | Peak Discharge Reduction Potential (cu. ft./second) | Estimated Size (sq. ft.) | Estimated Cost |
|--|------------------------------|--------------------------------|--|---|--------------------------|----------------|
| Downspout planter boxes                    | 0.022                        | 4                              | N/A  | N/A   | 48                       | \$4,000        |
| Pervious pavements                         | 0.183                        | 31                             | 13,419   | 0.50  | 1,750                    | \$43,750       |

# GREEN INFRASTRUCTURE RECOMMENDATIONS



## Dunellen Knights of Columbus

-  disconnected downspouts
-  pervious pavements
-  downspout planter boxes
-  drainage areas
-  property line
-  2012 Aerial: NJOIT, OGIS



# DUNELLEN MUNICIPAL BUILDING



**Subwatershed:** Green Brook  
**Site Area:** 24,103 sq. ft.  
**Address:** 355 North Avenue  
Dunellen, NJ 08812  
**Block and Lot:** Block 66, Lot 1

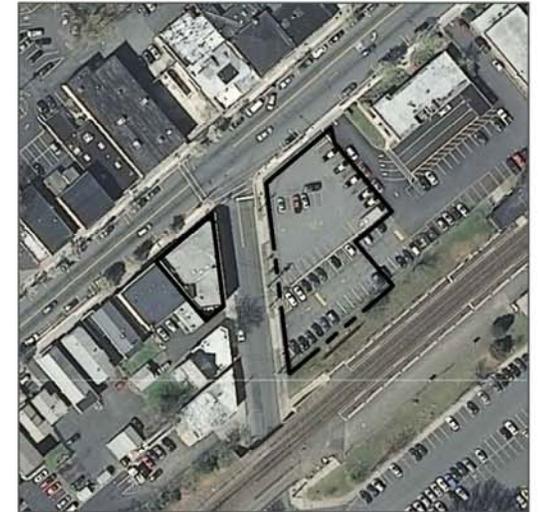
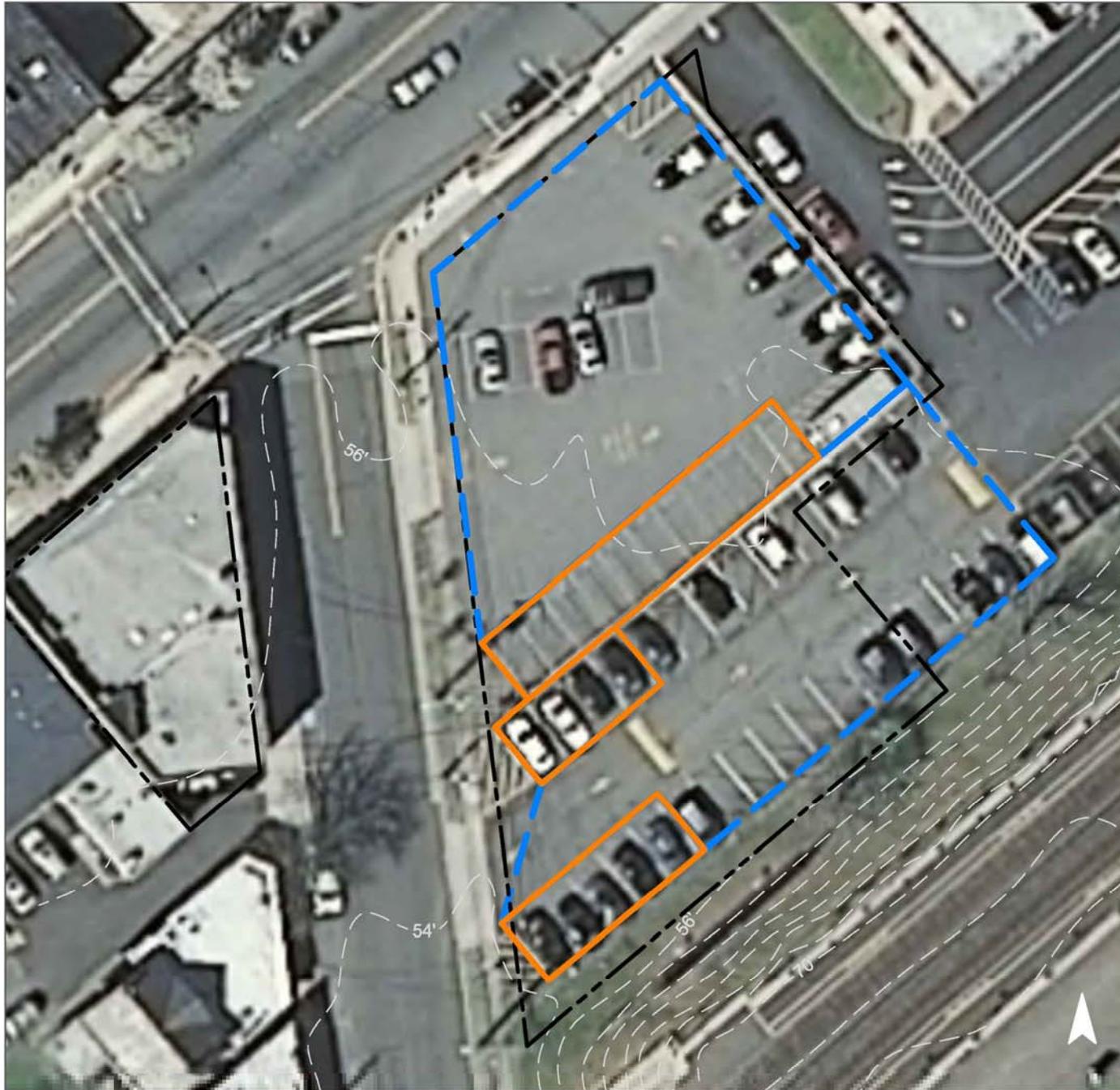


The building itself has internal drainage, however adjacent parking lots can be partially repaved with pervious pavement to capture and infiltrate parking lot runoff. A preliminary soil assessment for this site suggests that soils have suitable drainage characteristics for green infrastructure.

| Impervious Cover |         | Existing Loads from Impervious Cover (lbs/yr) |      |       | Runoff Volume from Impervious Cover (Mgal) |                               |
|------------------|---------|---|------|-------|--|-------------------------------|
| %                | sq. ft. | TP  | TN   | TSS   | For the 1.25" Water Quality Storm          | For an Annual Rainfall of 44" |
| 95               | 22,898  | 1.1   | 11.6 | 105.1 | 0.018                                      | 0.63                          |

| Recommended Green Infrastructure Practices | Recharge Potential (Mgal/yr) | TSS Removal Potential (lbs/yr) | Maximum Volume Reduction Potential (gal/storm) | Peak Discharge Reduction Potential (cu. ft./second) | Estimated Size (sq. ft.) | Estimated Cost |
|--|------------------------------|--------------------------------|--|---|--------------------------|----------------|
| Pervious pavements                         | 0.519                        | 87                             | 38,066   | 1.43  | 3,500                    | \$87,500       |

# GREEN INFRASTRUCTURE RECOMMENDATIONS



## Dunellen Municipal Building

-  pervious pavements
-  drainage areas
-  property line
-  2012 Aerial: NJOIT, OGIS



# FOOTPRINTS CHRISTIAN PRESCHOOL



**Subwatershed:** Green Brook  
**Site Area:** 28,622 sq. ft.  
**Address:** 264 New Market Road  
Dunellen, NJ 08812  
**Block and Lot:** Block 73, Lot 4

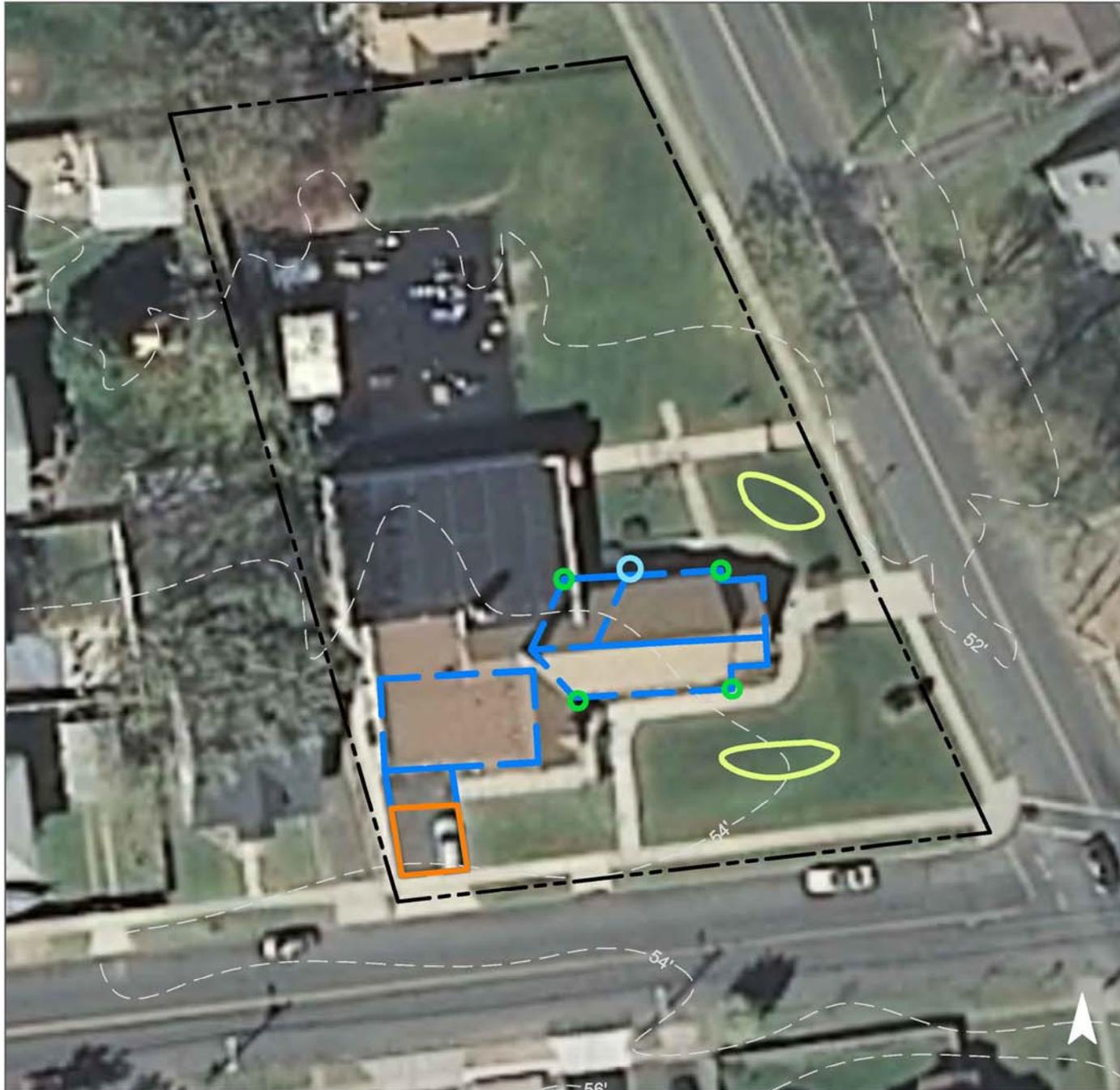


Two bioretention systems can be implemented on either side of the main entrance. A rain barrel can be used to water both existing and proposed gardens. The paved driveway can also be redone with pervious pavement. A preliminary soil assessment for this site suggests that soils have suitable drainage characteristics for green infrastructure.

| Impervious Cover |         | Existing Loads from Impervious Cover (lbs/yr) |     |      | Runoff Volume from Impervious Cover (Mgal) |                               |
|------------------|---------|---|-----|------|--|-------------------------------|
| %                | sq. ft. | TP  | TN  | TSS  | For the 1.25" Water Quality Storm          | For an Annual Rainfall of 44" |
| 59               | 16,762  | 0.8   | 8.5 | 77.0 | 0.013                                      | 0.46                          |

| Recommended Green Infrastructure Practices | Recharge Potential (Mgal/yr) | TSS Removal Potential (lbs/yr) | Maximum Volume Reduction Potential (gal/storm) | Peak Discharge Reduction Potential (cu. ft./second) | Estimated Size (sq. ft.) | Estimated Cost |
|--|------------------------------|--------------------------------|--|---|--------------------------|----------------|
| Bioretention systems                       | 0.035                        | 6                              | 2,558  | 0.10  | 335                      | \$1,675        |
| Pervious pavements                         | 0.036                        | 6                              | 2,678  | 0.10  | 250                      | \$6,250        |
| Rainwater harvesting systems               | 0.008                        | 1                              | 550  | 0.02  | 550 (gal)                | \$1,100        |

# GREEN INFRASTRUCTURE RECOMMENDATIONS



## Footprints Christian Preschool

-  disconnected downspouts
-  pervious pavements
-  bioretention / rain gardens
-  rainwater harvesting
-  drainage areas
-  property line
-  2012 Aerial: NJOIT, OGIS



# JOHN P. FABER ELEMENTARY SCHOOL



**Subwatershed:** Green Brook  
**Site Area:** 411,376 sq. ft.  
**Address:** High Street & Lehigh Street  
 Dunellen, NJ 08812  
**Block and Lot:** Block 56, Lot 1

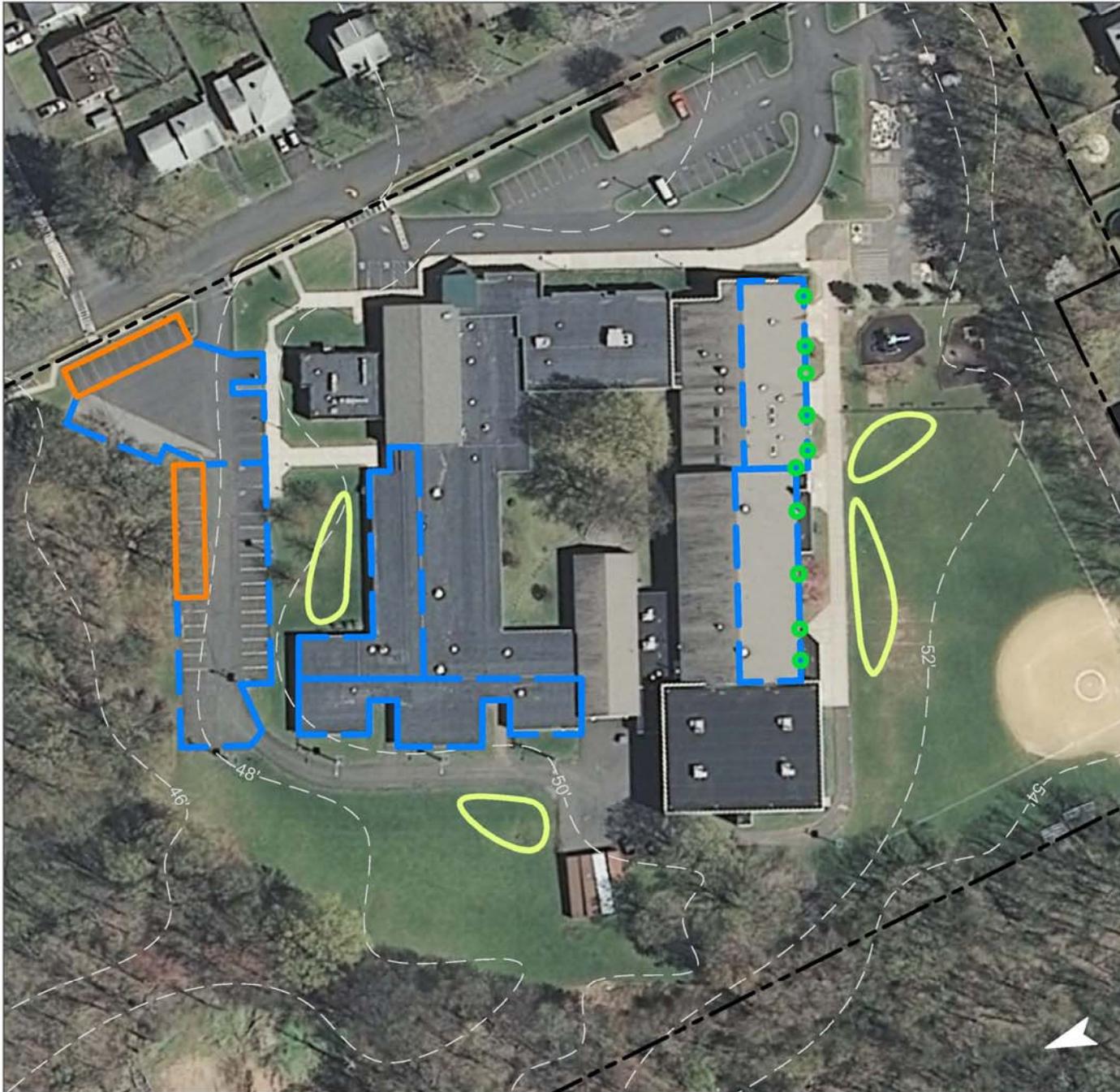


Bioretention systems can capture, treat and infiltrate rooftop runoff at several locations. There are also opportunities for pervious pavement to capture the parking lot runoff. A preliminary soil assessment for this site suggests that soils have suitable drainage characteristics for green infrastructure.

| Impervious Cover |         | Existing Loads from Impervious Cover (lbs/yr) |      |       | Runoff Volume from Impervious Cover (Mgal) |                               |
|------------------|---------|---|------|-------|--|-------------------------------|
| %                | sq. ft. | TP  | TN   | TSS   | For the 1.25" Water Quality Storm          | For an Annual Rainfall of 44" |
| 44               | 180,045 | 8.7   | 90.9 | 826.7 | 0.140                                      | 4.94                          |

| Recommended Green Infrastructure Practices | Recharge Potential (Mgal/yr) | TSS Removal Potential (lbs/yr) | Maximum Volume Reduction Potential (gal/storm) | Peak Discharge Reduction Potential (cu. ft./second) | Estimated Size (sq. ft.) | Estimated Cost |
|--|------------------------------|--------------------------------|--|---|--------------------------|----------------|
| Bioretention systems                       | 0.585                        | 98                             | 42,943   | 1.61  | 5,615                    | \$28,075       |
| Pervious pavements                         | 0.492                        | 82                             | 36,136   | 1.36  | 3,250                    | \$81,250       |

# GREEN INFRASTRUCTURE RECOMMENDATIONS



## John P. Faber Elementary School

-  disconnected downspouts
-  pervious pavements
-  bioretention / rain gardens
-  drainage areas
-  property line
-  2012 Aerial: NJOIT, OGIS



# SAINT FRANCIS CHURCH



**Subwatershed:** Green Brook  
**Site Area:** 44,992 sq. ft.  
**Address:** 400 New Market Road  
Dunellen, NJ 08812  
**Block and Lot:** Block 62, Lot 21

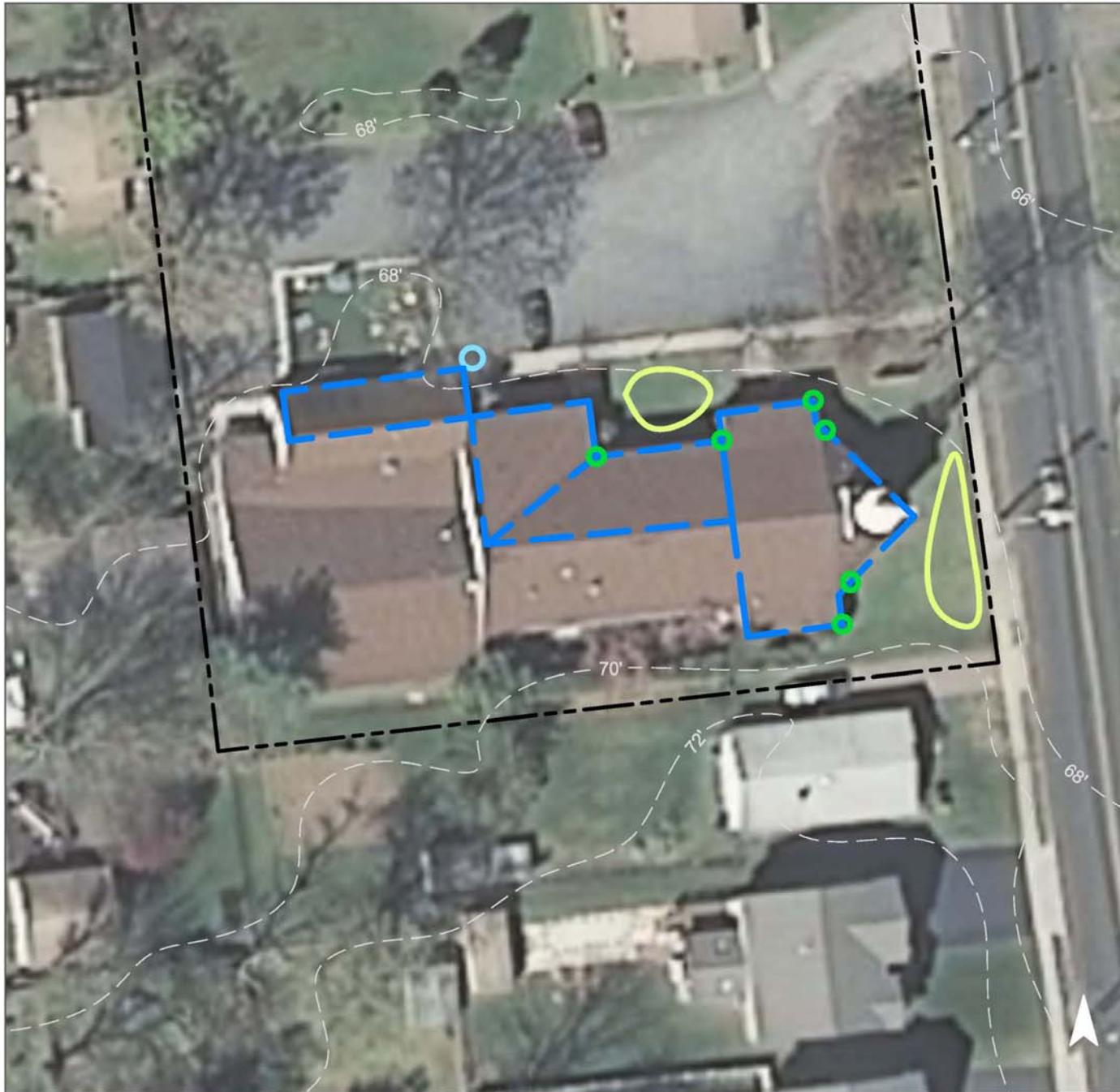


Roof runoff currently flows through both connected and disconnected downspouts. Two rain gardens can be used to capture, treat and infiltrate this runoff. One downspout can also be disconnected into a rain barrel to water the landscaping. A preliminary soil assessment for this site suggests that soils have suitable drainage characteristics for green infrastructure.

| Impervious Cover |         | Existing Loads from Impervious Cover (lbs/yr) |      |      | Runoff Volume from Impervious Cover (Mgal) |                               |
|------------------|---------|---|------|------|--|-------------------------------|
| %                | sq. ft. | TP  | TN   | TSS  | For the 1.25" Water Quality Storm          | For an Annual Rainfall of 44" |
| 45               | 20,439  | 1.0   | 10.3 | 93.8 | 0.016                                      | 0.56                          |

| Recommended Green Infrastructure Practices | Recharge Potential (Mgal/yr) | TSS Removal Potential (lbs/yr) | Maximum Volume Reduction Potential (gal/storm) | Peak Discharge Reduction Potential (cu. ft./second) | Estimated Size (sq. ft.) | Estimated Cost |
|--|------------------------------|--------------------------------|--|---|--------------------------|----------------|
| Bioretention systems                       | 0.076                        | 13                             | 5,543  | 0.21  | 725                      | \$3,625        |
| Rainwater harvesting systems               | 0.034                        | 6                              | 800  | 0.09  | 800 (gal)                | \$1,600        |

# GREEN INFRASTRUCTURE RECOMMENDATIONS



## Saint Francis Church

-  disconnected downspouts
-  bioretention / rain gardens
-  rainwater harvesting
-  drainage areas
-  property line
-  2012 Aerial: NJOIT, OGIS



# US POST OFFICE



**Subwatershed:** Green Brook  
**Site Area:** 11,153 sq. ft.  
**Address:** 311 North Avenue  
Dunellen, NJ 08812  
**Block and Lot:** Block 69, Lot 2.01



The mail truck parking area has some pooling and erosion concerns and runoff currently flows into the road. Pervious pavement can be used to capture and infiltrate this runoff. The building has internal drainage. A preliminary soil assessment for this site suggests that soils have suitable drainage characteristics for green infrastructure.

| Impervious Cover |         | Existing Loads from Impervious Cover (lbs/yr) |     |      | Runoff Volume from Impervious Cover (Mgal) |                               |
|------------------|---------|---|-----|------|--|-------------------------------|
| %                | sq. ft. | TP  | TN  | TSS  | For the 1.25" Water Quality Storm          | For an Annual Rainfall of 44" |
| 95               | 10,595  | 0.5   | 5.4 | 48.6 | 0.008                                      | 0.29                          |

| Recommended Green Infrastructure Practices | Recharge Potential (Mgal/yr) | TSS Removal Potential (lbs/yr) | Maximum Volume Reduction Potential (gal/storm) | Peak Discharge Reduction Potential (cu. ft./second) | Estimated Size (sq. ft.) | Estimated Cost |
|--|------------------------------|--------------------------------|--|---|--------------------------|----------------|
| Pervious pavements                         | 0.081                        | 14                             | 5,924  | 0.22  | 550                      | \$13,750       |

# GREEN INFRASTRUCTURE RECOMMENDATIONS



## US Post Office

-  pervious pavements
-  drainage areas
-  property line
-  2012 Aerial: NJOIT, OGIS



# VETERANS OF FOREIGN WARS



**Subwatershed:** Green Brook  
**Site Area:** 12,862 sq. ft.  
**Address:** 201 Prospect Avenue  
Dunellen, NJ 08812  
**Block and Lot:** Block 63, Lot 34

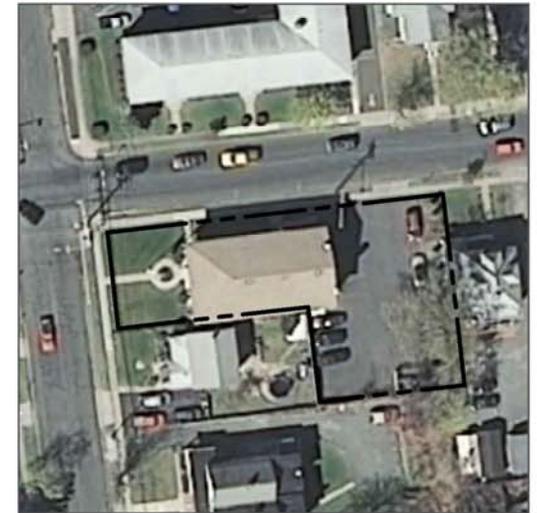
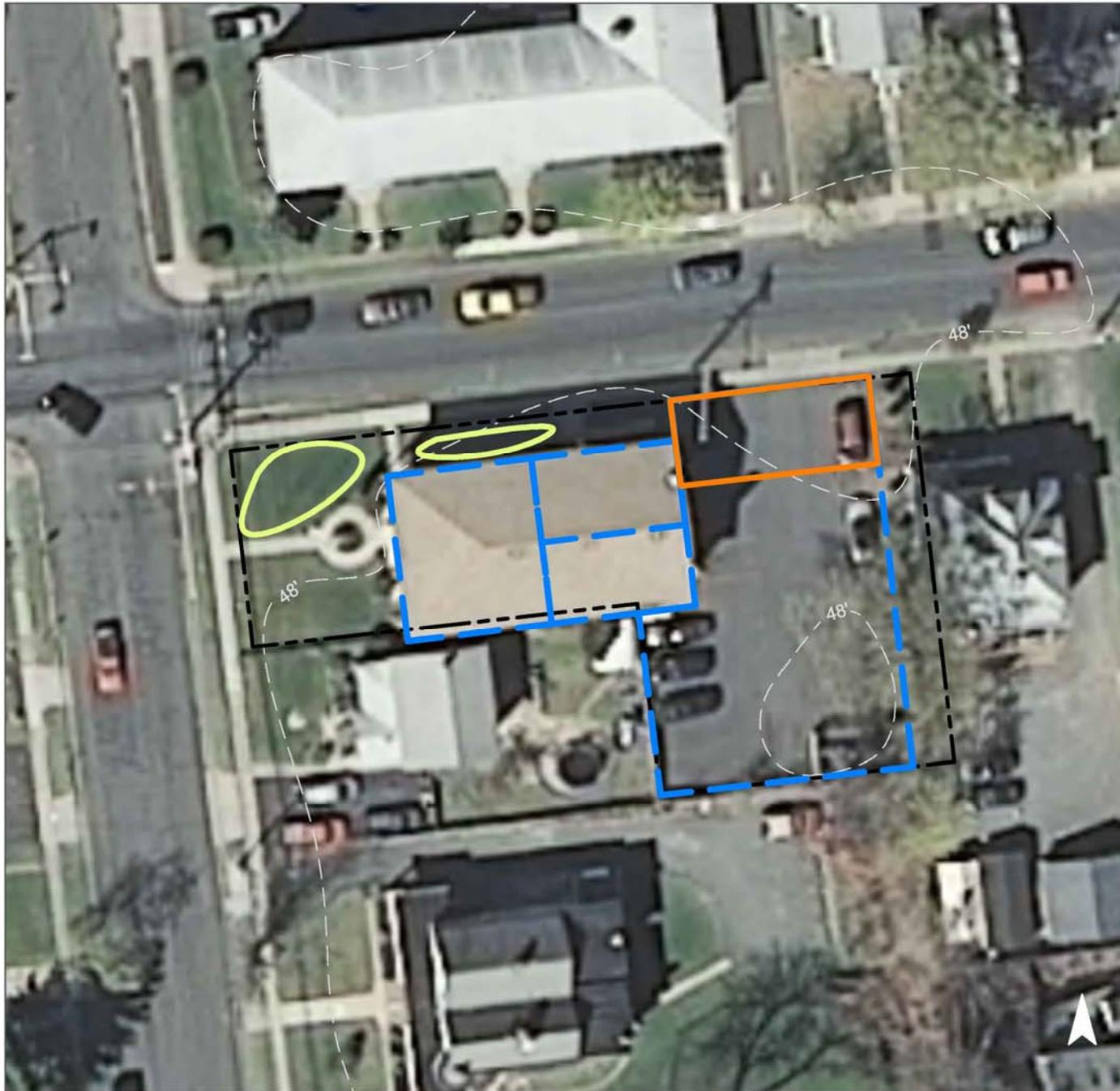


Parking lot runoff currently flows toward the street. The parking lot can be partially redone with pervious pavement to capture this runoff as well as some of the roof runoff. The building has disconnected downspouts, which can also be directed into two bioretention systems in order to capture, treat and infiltrate runoff. A preliminary soil assessment for this site suggests that soils have suitable drainage characteristics for green infrastructure.

| Impervious Cover |         | Existing Loads from Impervious Cover (lbs/yr) |     |      | Runoff Volume from Impervious Cover (Mgal) |                               |
|------------------|---------|---|-----|------|--|-------------------------------|
| %                | sq. ft. | TP  | TN  | TSS  | For the 1.25" Water Quality Storm          | For an Annual Rainfall of 44" |
| 72               | 9,315   | 0.4   | 4.7 | 42.8 | 0.007                                      | 0.26                          |

| Recommended Green Infrastructure Practices | Recharge Potential (Mgal/yr) | TSS Removal Potential (lbs/yr) | Maximum Volume Reduction Potential (gal/storm) | Peak Discharge Reduction Potential (cu. ft./second) | Estimated Size (sq. ft.) | Estimated Cost |
|--|------------------------------|--------------------------------|--|---|--------------------------|----------------|
| Bioretention systems                       | 0.063                        | 11                             | 4,645  | 0.17  | 608                      | \$3,038        |
| Pervious pavements                         | 0.174                        | 29                             | 12,768   | 0.48  | 1,200                    | \$30,000       |

# GREEN INFRASTRUCTURE RECOMMENDATIONS



## Veterans of Foreign Wars

-  pervious pavements
-  bioretention / rain gardens
-  drainage areas
-  property line
-  2012 Aerial: NJOIT, OGIS



**d. Summary of Existing Conditions**

**Summary of Existing Site Conditions**

| Subwatershed/Site Name/Total Site Info/GI Practice                  | Area (ac)    | Area (SF)      | Block | Lot  | Existing Annual Loads |              |                | I.C. % | I.C. Area (ac) | I.C. Area (SF) | Runoff Volumes from I.C.                        |               |
|---|--------------|----------------|-------|------|-----------------------|--------------|----------------|--------|----------------|----------------|---|---------------|
|   |              |                |       |      | TP (lb/yr)            | TN (lb/yr)   | TSS (lb/yr)    |        |                |                | Water Quality Storm (1.25" over 2-hours) (Mgal) | Annual (Mgal) |
|   |              |                |       |      |                       |              |                |        |                |                |   |               |
| <b>GREEN BROOK SUBWATERSHED</b>                                     | <b>19.84</b> | <b>864,382</b> |       |      | <b>25.6</b>           | <b>267.8</b> | <b>2,434.1</b> |        | <b>12.17</b>   | <b>530,149</b> | <b>0.413</b>                                    | <b>14.54</b>  |
| <b>Community Bible Church<br/>Total Site Info</b>                   | 1.04         | 45,292         | 73    | 1    | 1.7                   | 18.0         | 163.6          | 79     | 0.82           | 35,632         | 0.028   | 0.98          |
| <b>Dunellen Borough Library<br/>Total Site Info</b>                 | 2.70         | 117,469        | 70    | 13   | 4.7                   | 49.2         | 447.1          | 83     | 2.24           | 97,371         | 0.076   | 2.67          |
| <b>Dunellen Fire Department<br/>Total Site Info</b>                 | 1.28         | 55,731         | 64    | 37   | 2.0                   | 21.0         | 191.0          | 75     | 0.95           | 41,593         | 0.032   | 1.14          |
| <b>Dunellen High School &amp; Middle School<br/>Total Site Info</b> | 2.18         | 94,903         | 29    | 1    | 4.0                   | 41.9         | 381.0          | 87     | 1.91           | 82,984         | 0.065   | 2.28          |
| <b>Dunellen Knights of Columbus<br/>Total Site Info</b>             | 0.41         | 17,879         | 67    | 1    | 0.6                   | 6.3          | 57.5           | 70     | 0.29           | 12,515         | 0.010   | 0.34          |
| <b>Dunellen Municipal Building<br/>Total Site Info</b>              | 0.55         | 24,103         | 66    | 1    | 1.1                   | 11.6         | 105.1          | 95     | 0.53           | 22,898         | 0.018   | 0.63          |
| <b>Footprints Christian Preschool<br/>Total Site Info</b>           | 0.66         | 28,622         | 73    | 3    | 0.8                   | 8.5          | 77.0           | 59     | 0.38           | 16,762         | 0.013   | 0.46          |
| <b>John P. Faber Elementary School<br/>Total Site Info</b>          | 9.44         | 411,376        | 56    | 1    | 8.7                   | 90.9         | 826.7          | 44     | 4.13           | 180,045        | 0.140   | 4.94          |
| <b>Saint Francis Church<br/>Total Site Info</b>                     | 1.03         | 44,992         | 62    | 21   | 1.0                   | 10.3         | 93.8           | 45     | 0.47           | 20,439         | 0.016   | 0.56          |
| <b>US Post Office<br/>Total Site Info</b>                           | 0.26         | 11,153         | 69    | 2.01 | 0.5                   | 5.4          | 48.6           | 95     | 0.24           | 10,595         | 0.008   | 0.29          |
| <b>Veterans of Foreign Wars<br/>Total Site Info</b>                 | 0.30         | 12,862         | 63    | 34   | 0.4                   | 4.7          | 42.8           | 72     | 0.21           | 9,315          | 0.007   | 0.26          |

**e. Summary of Proposed Green Infrastructure Practices**

**Summary of Proposed Green Infrastructure Practices**

| Subwatershed/Site Name/Total Site Info/GI Practice | Potential Management Area |             | Recharge Potential (Mgal/yr) | TSS Removal Potential (lbs/yr) | Max Volume Reduction Potential (gal/storm) | Peak Discharge Reduction Potential (cfs) | Size of BMP (SF) | Unit Cost (\$) | Unit | Total Cost (\$)  | I.C. Treated % |
|--|---------------------------|-------------|------------------------------|--------------------------------|--|--|------------------|----------------|------|------------------|----------------|
|  | Area (SF)                 | Area (ac)   |                              |                                |  |  |                  |                |      |                  |                |
| <b>GREEN BROOK SUBWATERSHED</b>                    | <b>199,840</b>            | <b>4.59</b> | <b>5.207</b>                 | <b>872</b>                     | <b>377,373</b>                             | <b>14.29</b>                             | <b>44,318</b>    |                |      | <b>\$776,300</b> | <b>37.7%</b>   |
| <b>1 Community Bible Church</b>                    |                           |             |                              |                                |  |  |                  |                |      |                  |                |
| Bioretention systems/ rain gardens                 | 2,750                     | 0.06        | 0.072                        | 12                             | 5,258                                      | 0.20                                     | 688              | 5              | SF   | \$3,438          | 7.7%           |
| Pervious pavements                                 | 18,400                    | 0.42        | 0.479                        | 80                             | 35,178                                     | 1.32                                     | 3,250            | 25             | SF   | \$81,250         | 51.6%          |
| <b>Total Site Info</b>                             | <b>21,150</b>             | <b>0.49</b> | <b>0.551</b>                 | <b>92</b>                      | <b>40,437</b>                              | <b>1.52</b>                              | <b>3,938</b>     |                |      | <b>\$84,688</b>  | <b>59.4%</b>   |
| <b>2 Dunellen Borough Library</b>                  |                           |             |                              |                                |  |  |                  |                |      |                  |                |
| Bioretention systems/ rain gardens                 | 3,300                     | 0.08        | 0.086                        | 14                             | 6,306                                      | 0.24                                     | 825              | 5              | SF   | \$4,125          | 3.4%           |
| Pervious pavements                                 | 35,000                    | 0.80        | 0.912                        | 153                            | 66,916                                     | 2.52                                     | 6,300            | 25             | SF   | \$157,500        | 35.9%          |
| <b>Total Site Info</b>                             | <b>38,300</b>             | <b>0.88</b> | <b>0.998</b>                 | <b>167</b>                     | <b>73,222</b>                              | <b>2.76</b>                              | <b>7,125</b>     |                |      | <b>\$161,625</b> | <b>39.3%</b>   |
| <b>3 Dunellen Fire Department</b>                  |                           |             |                              |                                |  |  |                  |                |      |                  |                |
| Pervious pavements                                 | 31,880                    | 0.73        | 0.831                        | 139                            | 60,947                                     | 2.29                                     | 5,800            | 25             | SF   | \$145,000        | 76.6%          |
| Rainwater harvesting systems                       | 3,300                     | 0.08        | 0.086                        | 14                             | 5,000                                      | 0.24                                     | 5,000            | 2              | gal  | \$10,000         | 7.9%           |
| <b>Total Site Info</b>                             | <b>35,180</b>             | <b>0.81</b> | <b>0.917</b>                 | <b>153</b>                     | <b>65,947</b>                              | <b>2.53</b>                              | <b>10,800</b>    |                |      | <b>\$155,000</b> | <b>84.6%</b>   |
| <b>4 Dunellen High School &amp; Middle School</b>  |                           |             |                              |                                |  |  |                  |                |      |                  |                |
| Bioretention systems/ rain gardens                 | 2,500                     | 0.06        | 0.065                        | 11                             | 4,780                                      | 0.18                                     | 625              | 5              | SF   | \$3,125          | 3.0%           |
| Pervious pavements                                 | 14,100                    | 0.32        | 0.367                        | 62                             | 26,958                                     | 1.01                                     | 2,650            | 25             | SF   | \$66,250         | 17.0%          |
| <b>Total Site Info</b>                             | <b>16,600</b>             | <b>0.38</b> | <b>0.433</b>                 | <b>72</b>                      | <b>31,738</b>                              | <b>1.19</b>                              | <b>3,275</b>     |                |      | <b>\$69,375</b>  | <b>20.0%</b>   |
| <b>5 Dunellen Knights of Columbus</b>              |                           |             |                              |                                |  |  |                  |                |      |                  |                |
| Downspout planter boxes                            | 860                       | 0.02        | 0.022                        | 4                              | n/a  | n/a                                      | 48               | 1000           | SF   | \$4,000          | 6.9%           |
| Pervious pavements                                 | 7,020                     | 0.16        | 0.183                        | 31                             | 13,419                                     | 0.50                                     | 1,750            | 25             | SF   | \$43,750         | 56.1%          |
| <b>Total Site Info</b>                             | <b>7,880</b>              | <b>0.18</b> | <b>0.205</b>                 | <b>34</b>                      | <b>13,419</b>                              | <b>0.50</b>                              | <b>1,798</b>     |                |      | <b>\$47,750</b>  | <b>63.0%</b>   |
| <b>6 Dunellen Municipal Building</b>               |                           |             |                              |                                |  |  |                  |                |      |                  |                |
| Pervious pavements                                 | 19,910                    | 0.46        | 0.519                        | 87                             | 38,066                                     | 1.43                                     | 3,500            | 25             | SF   | \$87,500         | 87.0%          |
| <b>Total Site Info</b>                             | <b>19,910</b>             | <b>0.46</b> | <b>0.519</b>                 | <b>87</b>                      | <b>38,066</b>                              | <b>1.43</b>                              | <b>3,500</b>     |                |      | <b>\$87,500</b>  | <b>87.0%</b>   |
| <b>7 Footprints Christian Preschool</b>            |                           |             |                              |                                |  |  |                  |                |      |                  |                |
| Bioretention systems/ rain gardens                 | 1,340                     | 0.03        | 0.035                        | 6                              | 2,558                                      | 0.10                                     | 335              | 5              | SF   | \$1,675          | 8.0%           |
| Pervious pavements                                 | 1,400                     | 0.03        | 0.036                        | 6                              | 2,678                                      | 0.10                                     | 250              | 25             | SF   | \$6,250          | 8.4%           |
| Rainwater harvesting systems                       | 290                       | 0.01        | 0.008                        | 1                              | 550  | 0.02                                     | 550              | 2              | gal  | \$1,100          | 1.7%           |
| <b>Total Site Info</b>                             | <b>3,030</b>              | <b>0.07</b> | <b>0.079</b>                 | <b>13</b>                      | <b>5,786</b>                               | <b>0.22</b>                              | <b>1,135</b>     |                |      | <b>\$9,025</b>   | <b>18.1%</b>   |

**Summary of Proposed Green Infrastructure Practices**

| Subwatershed/Site Name/Total Site Info/GI Practice | Potential Management Area |             | Recharge Potential (Mgal/yr) | TSS Removal Potential (lbs/yr) | Max Volume Reduction Potential (gal/storm) | Peak Discharge Reduction Potential (cfs) | Size of BMP (SF) | Unit Cost (\$) | Unit | Total Cost (\$)  | I.C. Treated % |
|--|---------------------------|-------------|------------------------------|--------------------------------|--|--|------------------|----------------|------|------------------|----------------|
|  | Area (SF)                 | Area (ac)   |                              |                                |  |  |                  |                |      |                  |                |
| <b>8 John P. Faber Elementary School</b>           |                           |             |                              |                                |  |  |                  |                |      |                  |                |
| Bioretention systems/ rain gardens                 | 22,460                    | 0.52        | 0.585                        | 98                             | 42,943                                     | 1.61                                     | 5,615            | 5              | SF   | \$28,075         | 12.5%          |
| Pervious pavements                                 | 18,900                    | 0.43        | 0.492                        | 82                             | 36,136                                     | 1.36                                     | 3,250            | 25             | SF   | \$81,250         | 10.5%          |
| <b>Total Site Info</b>                             | <b>41,360</b>             | <b>0.95</b> | <b>1.078</b>                 | <b>180</b>                     | <b>79,079</b>                              | <b>2.97</b>                              | <b>8,865</b>     |                |      | <b>\$109,325</b> | <b>23.0%</b>   |
| <b>9 Saint Francis Church</b>                      |                           |             |                              |                                |  |  |                  |                |      |                  |                |
| Bioretention systems/ rain gardens                 | 2,900                     | 0.07        | 0.076                        | 13                             | 5,543                                      | 0.21                                     | 725              | 5              | SF   | \$3,625          | 14.2%          |
| Rainwater harvesting systems                       | 1,320                     | 0.03        | 0.034                        | 6                              | 800  | 0.09                                     | 800              | 2              | gal  | \$1,600          | 6.5%           |
| <b>Total Site Info</b>                             | <b>4,220</b>              | <b>0.10</b> | <b>0.110</b>                 | <b>18</b>                      | <b>6,343</b>                               | <b>0.30</b>                              | <b>1,525</b>     |                |      | <b>\$5,225</b>   | <b>20.6%</b>   |
| <b>10 US Post Office</b>                           |                           |             |                              |                                |  |  |                  |                |      |                  |                |
| Pervious pavements                                 | 3,100                     | 0.07        | 0.081                        | 14                             | 5,924                                      | 0.22                                     | 550              | 25             | SF   | \$13,750         | 29.3%          |
| <b>Total Site Info</b>                             | <b>3,100</b>              | <b>0.07</b> | <b>0.081</b>                 | <b>14</b>                      | <b>5,924</b>                               | <b>0.22</b>                              | <b>550</b>       |                |      | <b>\$13,750</b>  | <b>29.3%</b>   |
| <b>11 Veterans of Foreign Wars</b>                 |                           |             |                              |                                |  |  |                  |                |      |                  |                |
| Bioretention systems/ rain gardens                 | 2,430                     | 0.06        | 0.063                        | 11                             | 4,645                                      | 0.17                                     | 608              | 5              | SF   | \$3,038          | 26.1%          |
| Pervious pavements                                 | 6,680                     | 0.15        | 0.174                        | 29                             | 12,768                                     | 0.48                                     | 1,200            | 25             | SF   | \$30,000         | 71.7%          |
| <b>Total Site Info</b>                             | <b>9,110</b>              | <b>0.21</b> | <b>0.237</b>                 | <b>40</b>                      | <b>17,413</b>                              | <b>0.65</b>                              | <b>1,808</b>     |                |      | <b>\$33,038</b>  | <b>97.8%</b>   |