



**Draft**

**Impervious Cover Reduction Action Plan  
for  
Mendham Borough, Morris County, New Jersey**

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

June 19, 2020

## ACKNOWLEDGEMENTS:

This document has been prepared by the Rutgers Cooperative Extension Water Resources Program, with funding and direction from the New Jersey Highlands Water Protection and Planning Council and the New Jersey Agricultural Experiment Station, to highlight green infrastructure opportunities within Mendham Borough. We would like to thank the New Jersey Highlands Water Protection and Planning Council, the New Jersey Agricultural Experiment Station, and Mendham Borough for their input and support in creating this document.



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## **Introduction**

Located in Morris County, New Jersey, Mendham Borough covers approximately 6.00 square miles. Figures 1 and 2 illustrate that Mendham Borough is dominated by urban land use. A total of 56.1% of the municipality's land use is classified as urban. Of the urban land in Mendham Borough, rural residential is the dominant land use (Figure 3).

The New Jersey Department of Environmental Protection's (NJDEP) 2015 land use/land cover geographical information system (GIS) data layer categorizes Mendham 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 Mendham Borough. Based upon the 2015 NJDEP land use/land cover data, approximately 10.7% of Mendham Borough has impervious cover. This level of impervious cover suggests that the streams in Mendham Borough likely range from sensitive to impacted streams. <sup>1</sup>

## **Methodology**

Mendham Borough contains portions of three subwatersheds (Figure 4). For this impervious cover reduction action plan, projects have been identified in two 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> Schuler, T.R., L. Fraley-McNeal, and K. Cappiella. 2009. Is Impervious Cover Still Important? Review of Recent Research. *Journal of Hydrologic Engineering* 14 (4): 309-315.

# Land Use Types for Mendham Borough

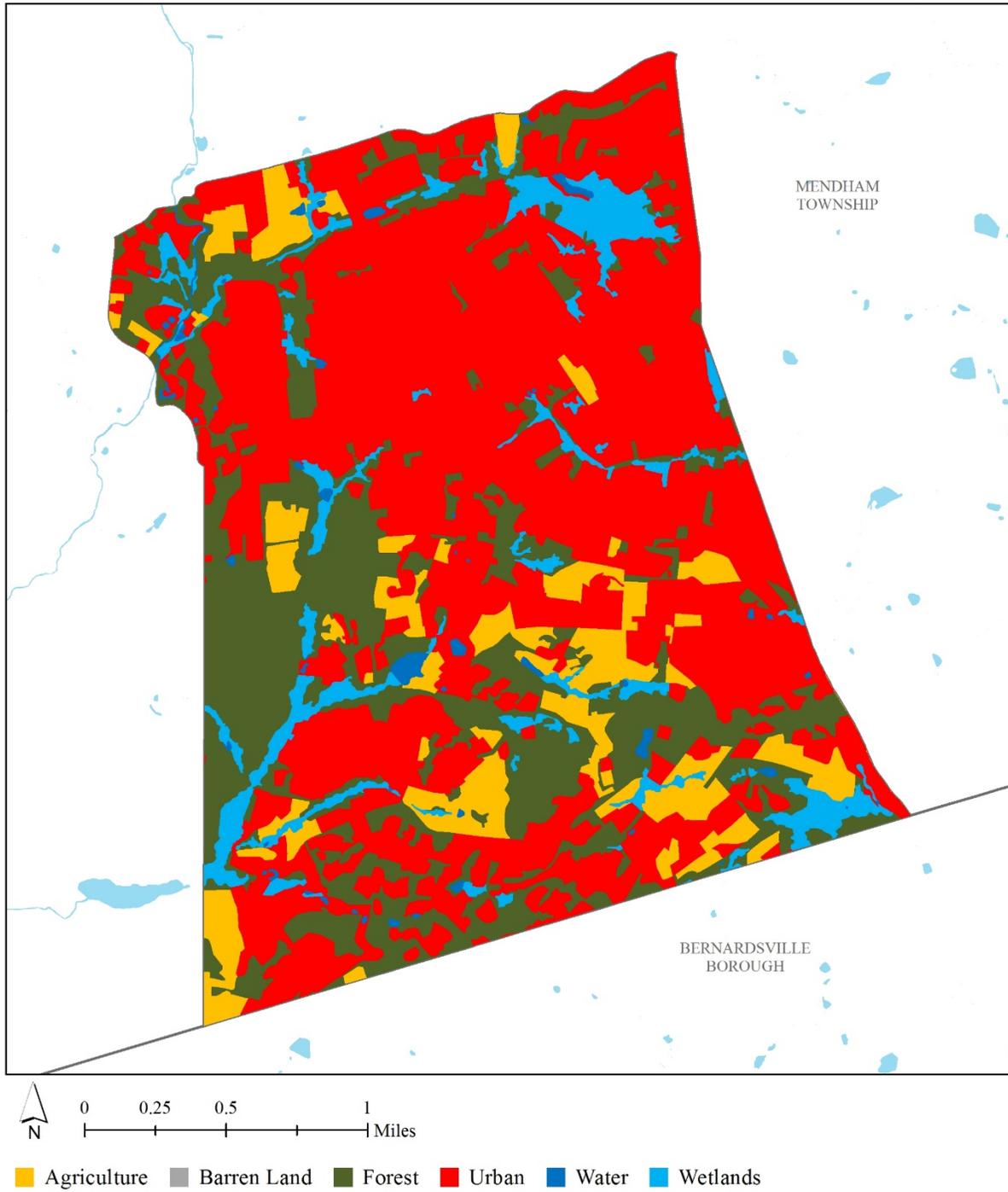


Figure 1: Map illustrating the land use in Mendham Borough

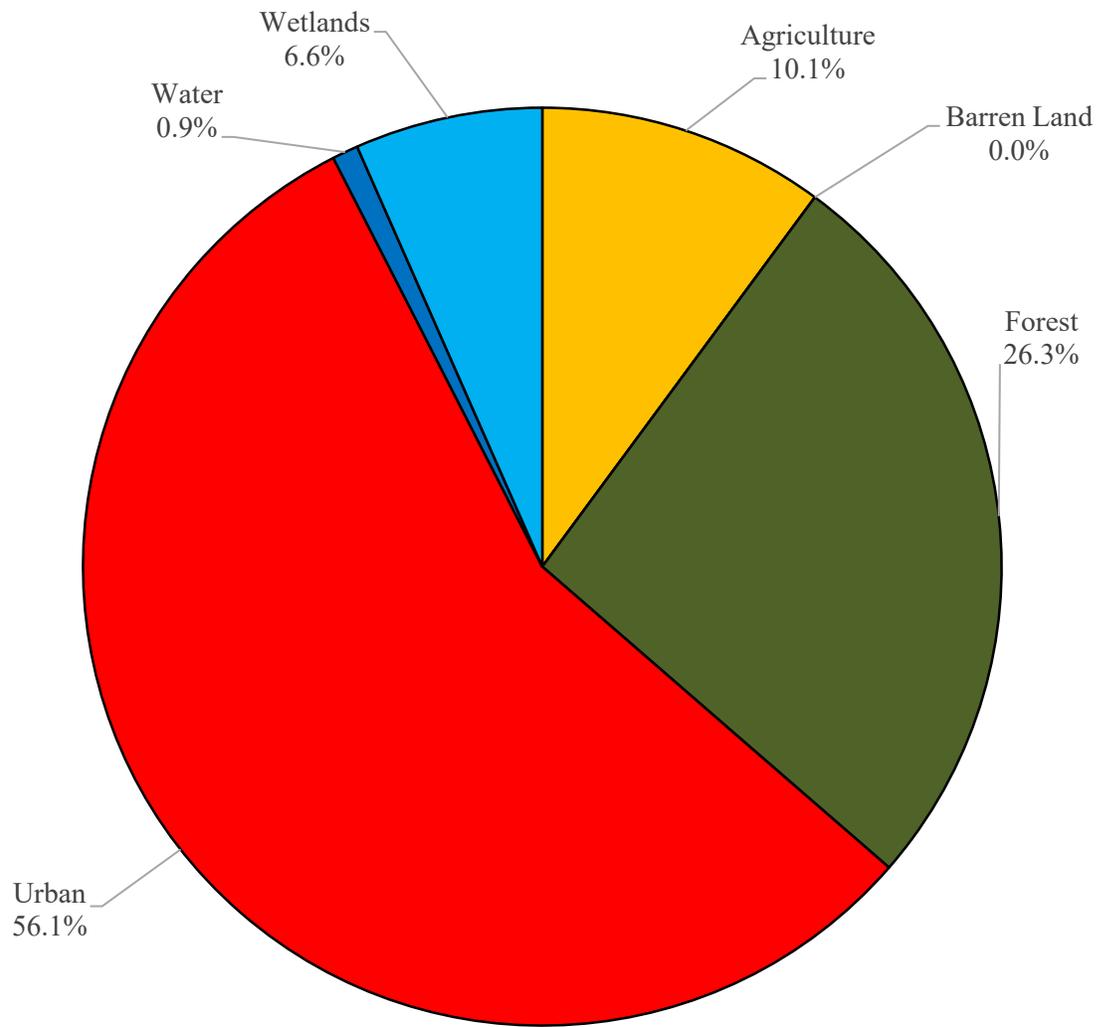


Figure 2: Pie chart illustrating the land use in Mendham Borough

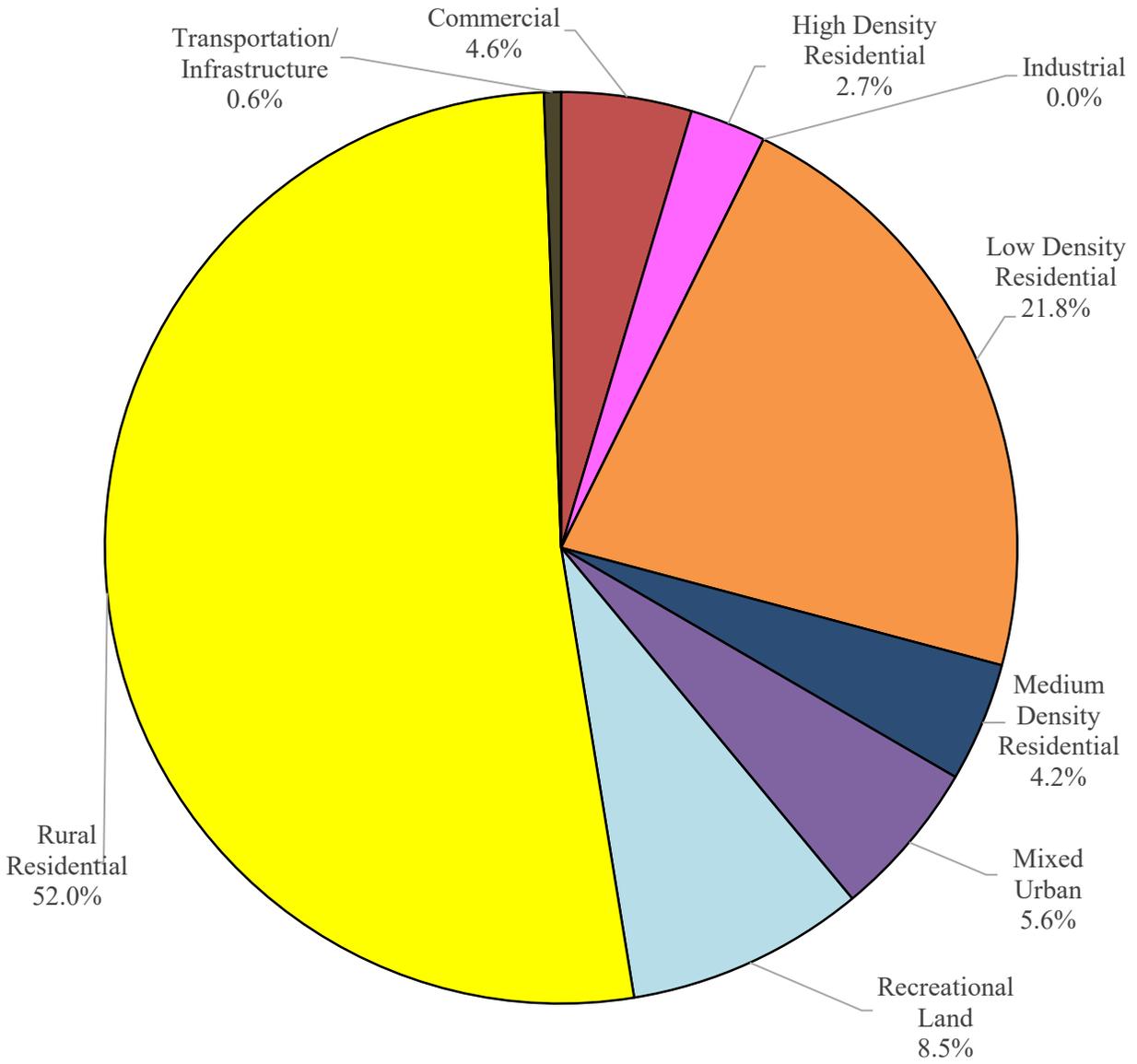


Figure 3: Pie chart illustrating the various types of urban land use in Mendham Borough

### Subwatersheds of Mendham Borough

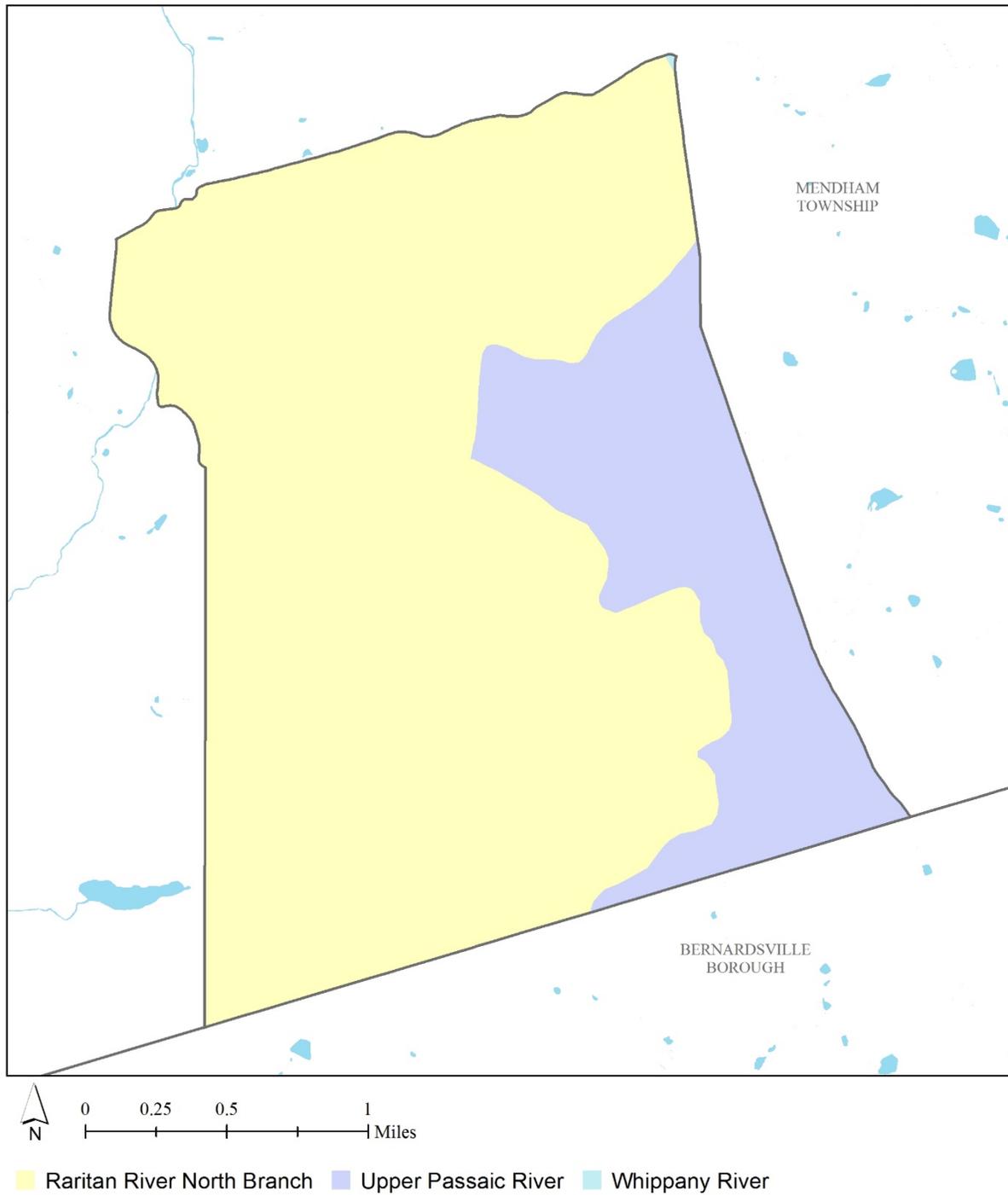


Figure 4: Map of the subwatersheds in Mendham Borough

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 2015 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 Mendham 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 (lbs/acre/yr)</b>	<b>TN load (lbs/acre/yr)</b>	<b>TSS load (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 principle, 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 Mendham 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 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**

Appendix A contains information on potential project sites where green infrastructure practices could be installed as well as information on existing site conditions. The recommended green infrastructure practices and the drainage area that the green infrastructure practices can treat are identified for each potential project site. For each practice, the recharge potential, TSS removal potential, maximum volume reduction potential per storm, the peak reduction potential, and estimated costs 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.

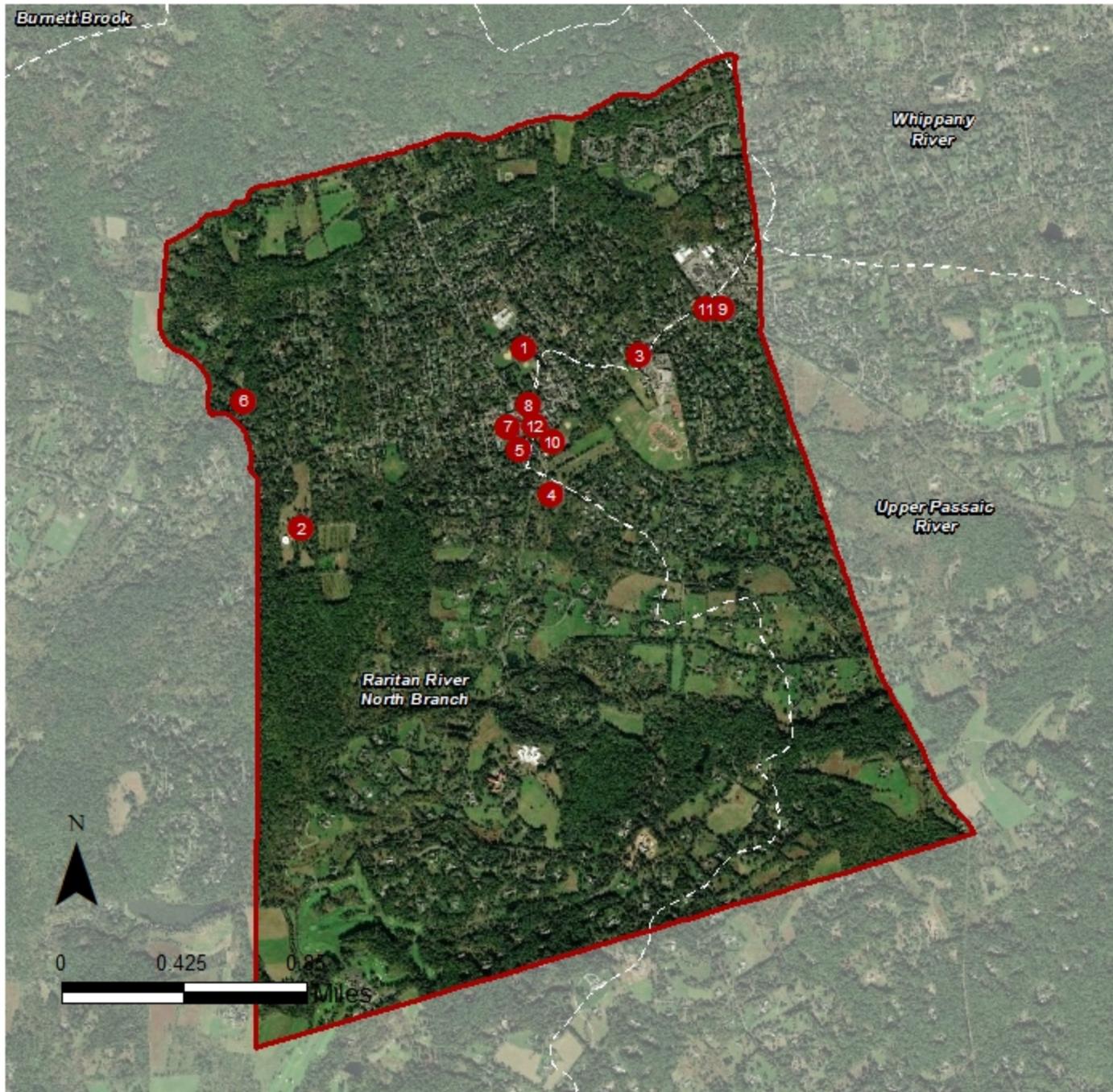
Additionally, development projects that are in need of providing off-site compensation for stormwater impacts can use the projects in this plan as a starting point. The municipality can quickly convert this impervious cover reduction action plan into a stormwater mitigation plan and incorporate it into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



## **Appendix A: Climate Resilient Green Infrastructure**

### **a. Green Infrastructure Sites**

# MENDHAM BOROUGH: GREEN INFRASTRUCTURE SITES



## SITES WITHIN THE RARITAN RIVER NORTH BRANCH SUBWATERSHED

1. Borough Park
2. Daytop Preparatory School
3. Grace Lutheran Church
4. Hilltop Presbyterian Church
5. Mendham Borough Library
6. Mendham Borough Public Works Garage
7. Mendham Recreation Department
8. St. Mark's Episcopal Church

## SITES WITHIN THE UPPER PASSAIC RIVER SUBWATERSHED

9. Atlantic Cardiology Group, LLP
10. Hilltop Elementary School
11. Mendham Post Office
12. Nails of Mendham & Grand Bazaar

## **b. Proposed Green Infrastructure Concepts**

# BOROUGH PARK



**Subwatershed:** Raritan River North Branch  
**Site Area:** 623,697 sq. ft.  
**Address:** 24 East Main Street  
Mendham, NJ 07945  
**Block and Lot:** Block 601, Lot 16

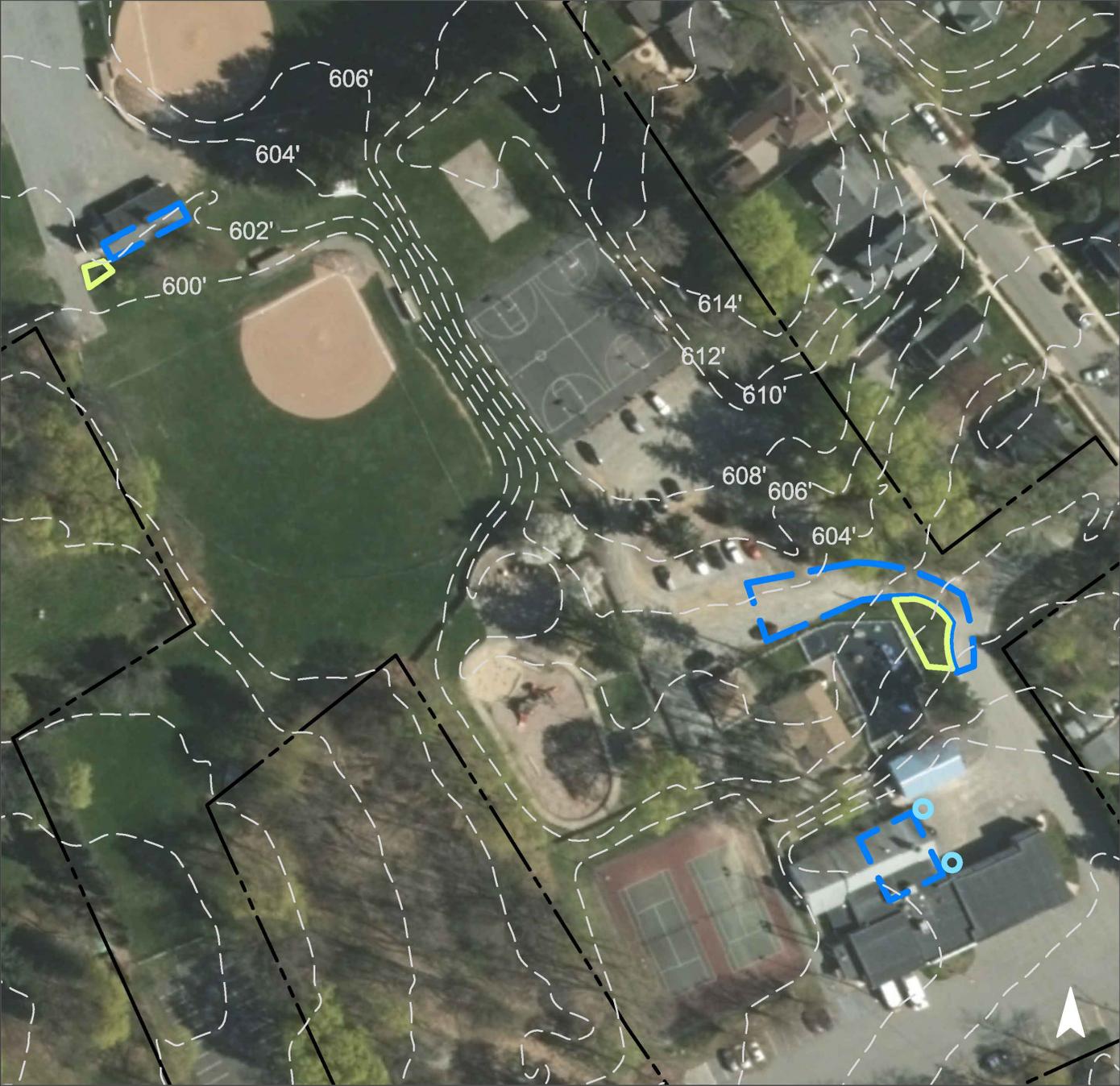


Bioretention systems can be installed near the building by the baseball fields and also along the driveway to the parking area to capture, treat and infiltrate runoff from the rooftop and parking lot. Additionally, cisterns can be installed near the Mendham Fire Department building to capture rooftop runoff and provide water for washing vehicles. A preliminary soil assessment suggests that more soil testing would be required before determining the soil’s suitability 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"
34	209,088	10.1	105.6	960.0	0.163	5.73

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	0.118	20	8,660	0.33	1,135	\$5,675
Rainwater harvesting	0.045	8	1,340	0.05	1,340 (gal)	\$2,680

# GREEN INFRASTRUCTURE RECOMMENDATIONS



## Borough Park

-  bioretention system
-  rainwater harvesting
-  drainage area
-  property line
-  2015 Aerial: NJOIT, OGIS



# DAYTOP PREPARATORY SCHOOL



**Subwatershed:** Raritan River North Branch

**Site Area:** 1,167,548 sq. ft.

**Address:** 80 West Main Street  
Mendham, NJ 07945

**Block and Lot:** Block 1801, Lot 5

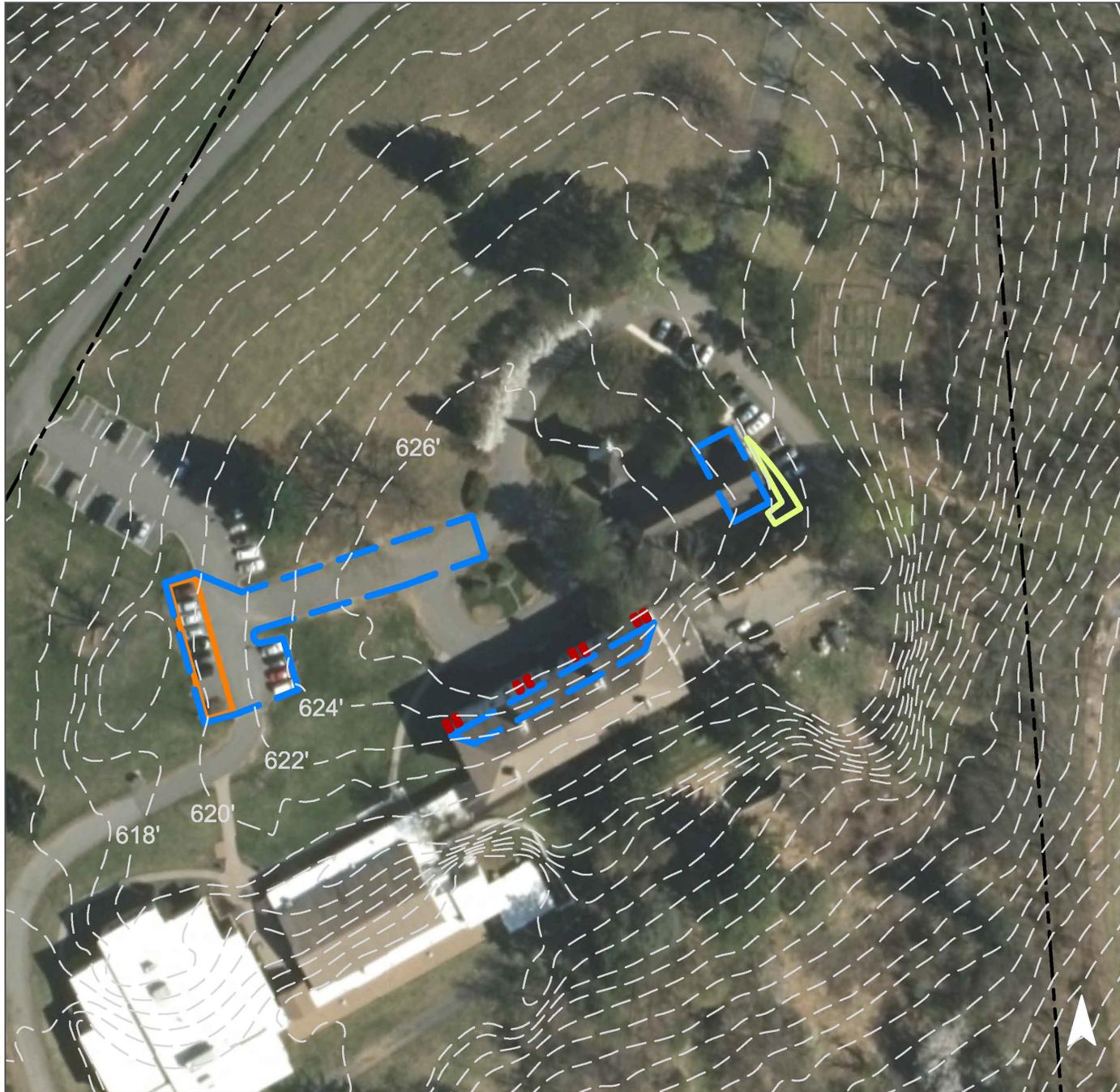


A rain garden can be installed to capture, treat, and filter runoff from the rooftop of the easternmost building on the property. Pervious pavement can be installed in the parking spaces to infiltrate the water from the driveway, and downspout planter boxes can be installed along the front of the school. A preliminary soil assessment suggests that the 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"
17	193,923	9.3	97.9	890.4	0.151	5.32

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 system	0.036	6	2,680	0.10	350	\$1,750
Pervious pavement	0.236	40	17,340	0.65	1,620	\$40,500
Planter boxes	n/a	6	n/a	n/a	8 (boxes)	\$8,000

# GREEN INFRASTRUCTURE RECOMMENDATIONS



## Daytop Preparatory School

-  bioretention system
-  pervious pavement
-  planter box
-  drainage area
-  property line
-  2015 Aerial: NJOIT, OGIS



# GRACE LUTHERAN CHURCH



**Subwatershed:** Raritan River North Branch

**Site Area:** 85,651 sq. ft.

**Address:** 65 East Main Street  
Mendham, NJ 07945

**Block and Lot:** Block 1401, Lot 68

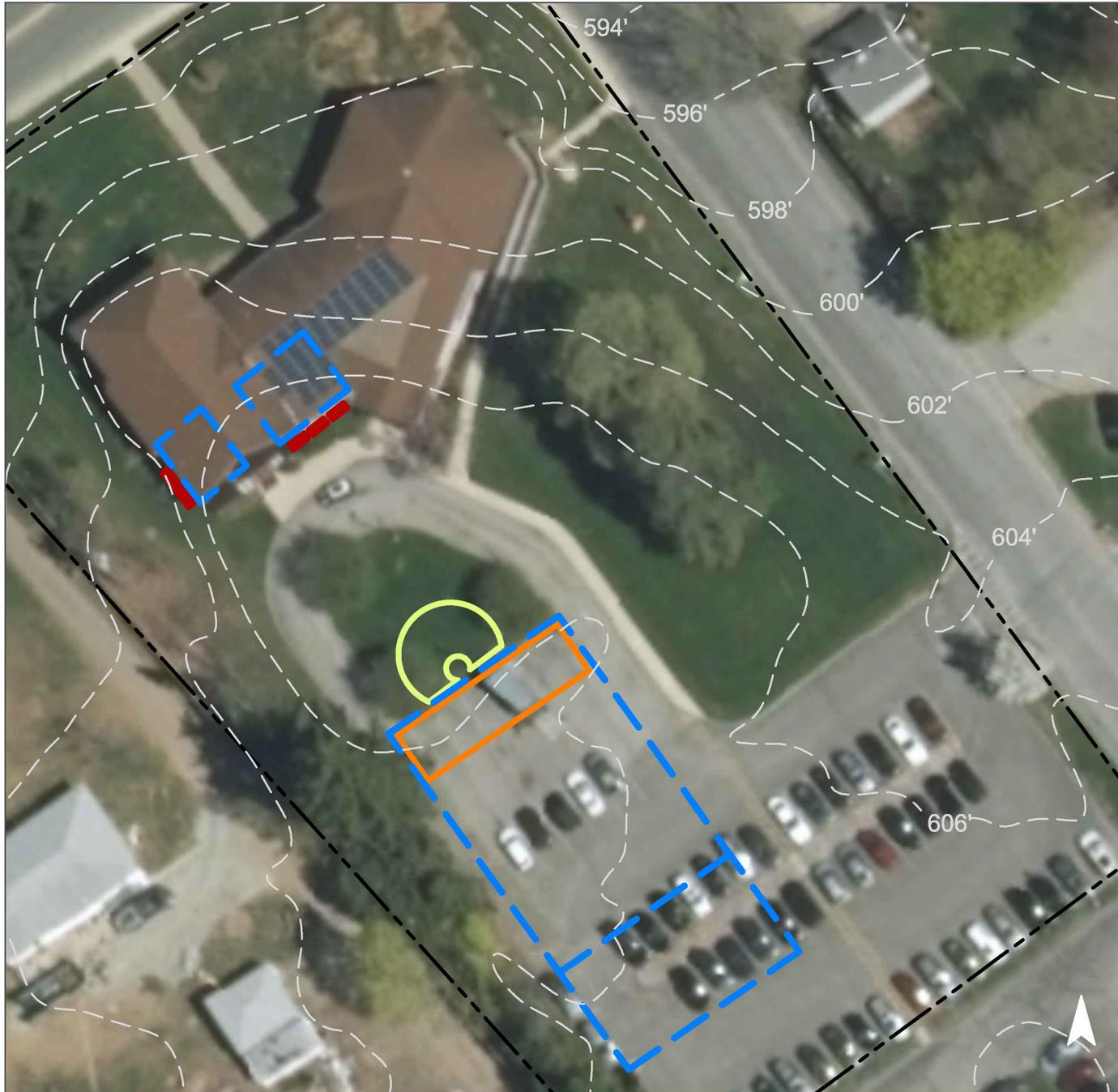


Downspout planter boxes can be installed along the front of the building to treat the rooftop runoff. Additionally, a rain garden and pervious pavement can be installed in the parking lot island and parking spaces, respectively, to capture and infiltrate stormwater runoff from the parking lot. A preliminary soil assessment suggests that the 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"
68	58,610	2.8	29.6	269.1	0.046	1.61

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 system	0.068	11	4,970	0.19	650	\$3,250
Pervious pavement	0.164	27	12,040	0.45	1,125	\$28,125
Planter boxes	n/a	4	n/a	n/a	5 (boxes)	\$5,000

# GREEN INFRASTRUCTURE RECOMMENDATIONS



**Grace Lutheran Church**

-  bioretention system
-  pervious pavement
-  planter box
-  drainage area
-  property line
-  2015 Aerial: NJOIT, OGIS



# HILLTOP PRESBYTERIAN CHURCH



**Subwatershed:** Raritan River North Branch

**Site Area:** 100,931 sq. ft.

**Address:** 20 Hilltop Road  
Mendham, NJ 07945

**Block and Lot:** Block 1501, Lot 31

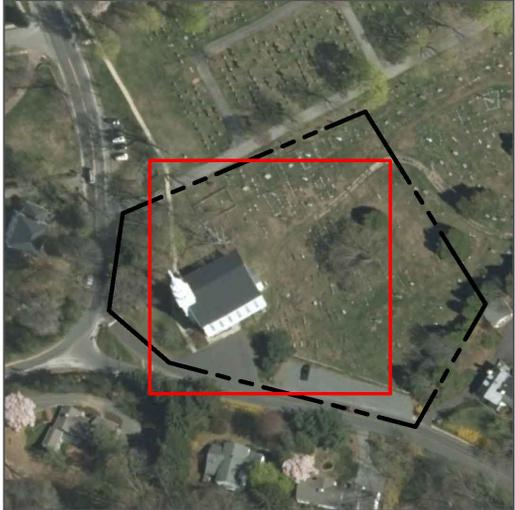
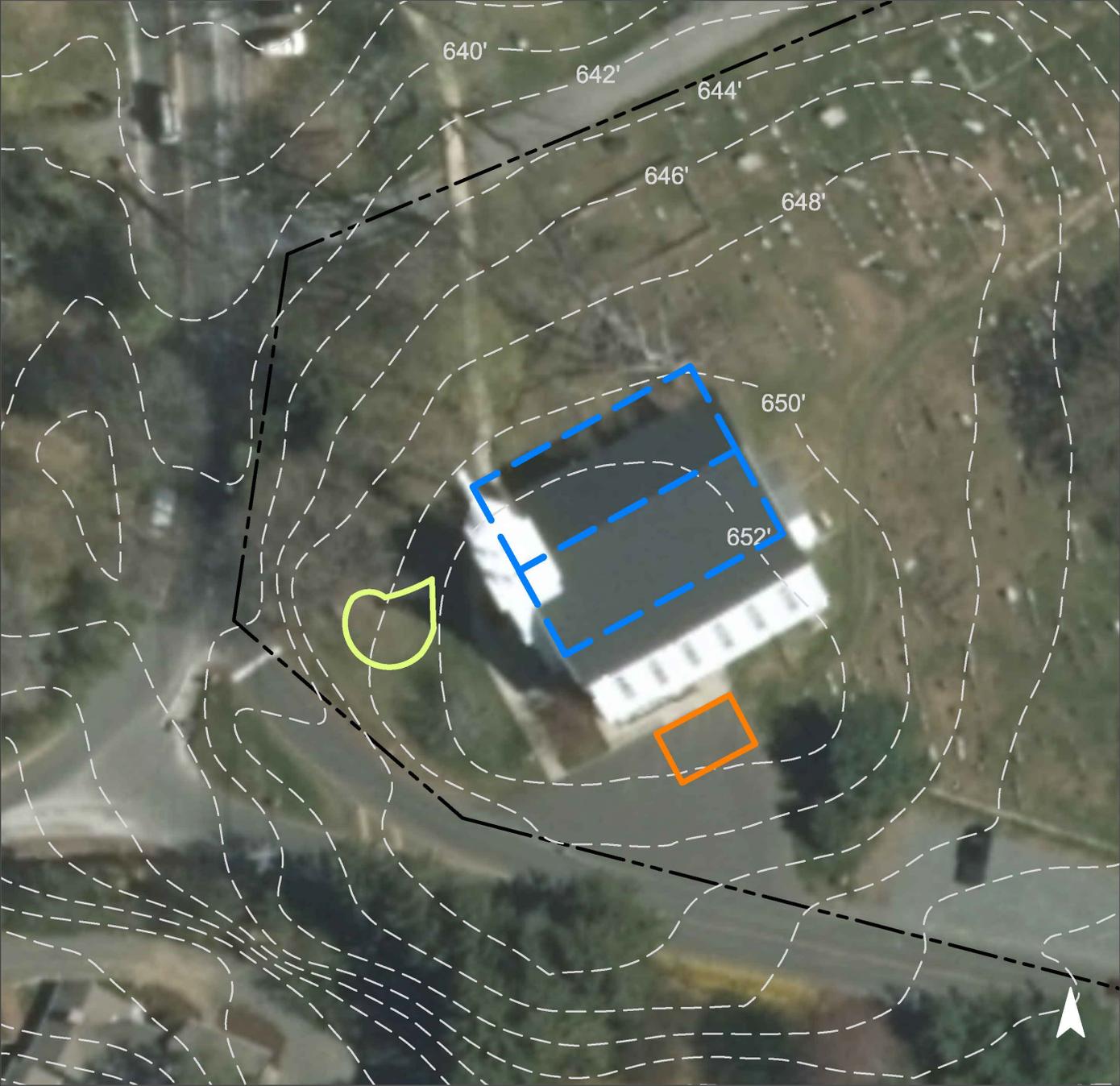


A small section of pervious pavement in parking spaces near the entrance can capture rooftop runoff and help prevent pooling in the adjacent street. Additionally, a rain garden can be installed in front of the building to capture, treat, and infiltrate runoff from the roof. A preliminary soil assessment suggests that the 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"
33	32,966	1.6	16.6	151.4	0.026	0.90

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 system	0.065	11	4,780	0.18	650	\$3,250
Pervious pavement	0.065	11	4,780	0.18	445	\$11,125

# GREEN INFRASTRUCTURE RECOMMENDATIONS



**Hilltop Presbyterian Church**

-  bioretention system
-  pervious pavement
-  drainage area
-  property line
-  2015 Aerial: NJOIT, OGIS



# MENDHAM BOROUGH LIBRARY



**Subwatershed:** Raritan River North Branch

**Site Area:** 18,324 sq. ft.

**Address:** 10 Hilltop Road  
Mendham, NJ 07945

**Block and Lot:** Block 1501, Lot 37



The rooftop drainage area can be treated by the installation of downspout planter boxes around the building near downspouts. A preliminary soil assessment suggests that the 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"
74	13,553	0.7	6.8	62.2	0.011	0.37

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
Planter boxes	n/a	2	n/a	n/a	3 (boxes)	\$3,000

# GREEN INFRASTRUCTURE RECOMMENDATIONS



## Mendham Borough Library

-  planter box
-  drainage area
-  property line
-  2015 Aerial: NJOIT, OGIS



# MENDHAM BOROUGH PUBLIC WORKS GARAGE



**Subwatershed:** Raritan River North Branch

**Site Area:** 658,388 sq. ft.

**Address:** 37 Ironia Road  
Mendham, NJ 07945

**Block and Lot:** Block 201, Lot 6



Two cisterns can be installed adjacent to the building to treat the building's drainage area. A preliminary soil assessment suggests that more soil testing would be required before determining the soil's suitability 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"
14	89,604	4.3	45.3	411.4	0.070	2.46

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
Rainwater harvesting	0.067	11	2,000	0.07	2,000 (gal)	\$4,000

# GREEN INFRASTRUCTURE RECOMMENDATIONS



## Mendham Borough Public Works Garage

-  rainwater harvesting
-  drainage area
-  property line
-  2015 Aerial: NJOIT, OGIS



# MENDHAM RECREATION DEPARTMENT



**Subwatershed:** Raritan River North Branch

**Site Area:** 8,097 sq. ft.

**Address:** 2 West Main Street  
Mendham, NJ 07945

**Block and Lot:** Block 1902, Lot 24

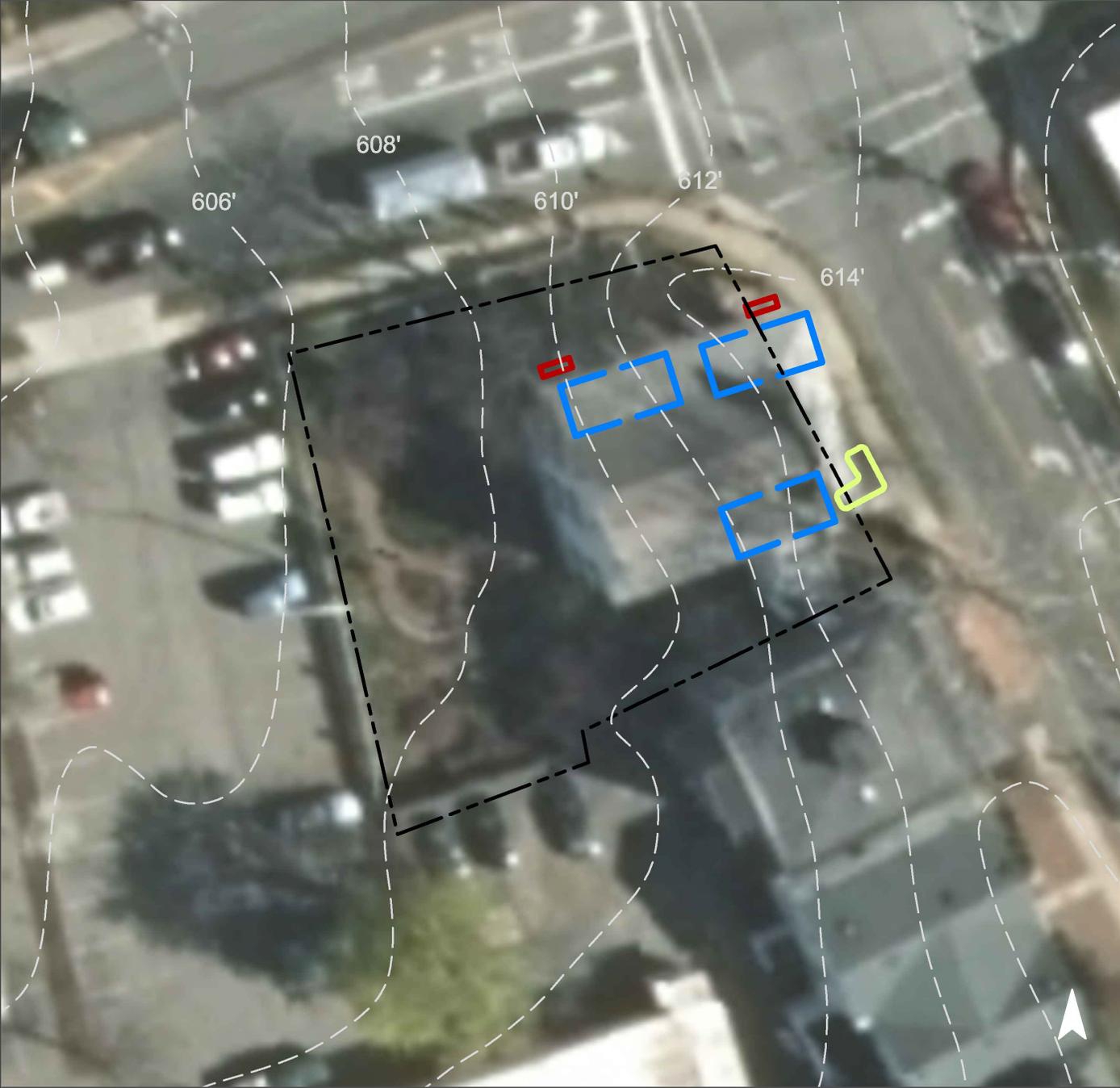


A section of the rooftop runoff can be treated with a small rain garden, and two additional sections of the roof can be treated with two downspout planter boxes. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

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"
84	6,778	0.3	3.4	31.1	0.005	0.19

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 system	0.005	1	380	0.01	55	\$275
Planter boxes	n/a	2	n/a	n/a	2 (boxes)	\$2,000

# GREEN INFRASTRUCTURE RECOMMENDATIONS



## Mendham Recreation Department

-  bioretention system
-  planter box
-  drainage area
-  property line
-  2015 Aerial: NJOIT, OGIS



# ST. MARK'S EPISCOPAL CHURCH



**Subwatershed:** Raritan River North Branch

**Site Area:** 32,559 sq. ft.

**Address:** 9 East Main Street  
Mendham, NJ 07945

**Block and Lot:** Block 1501, Lot 4

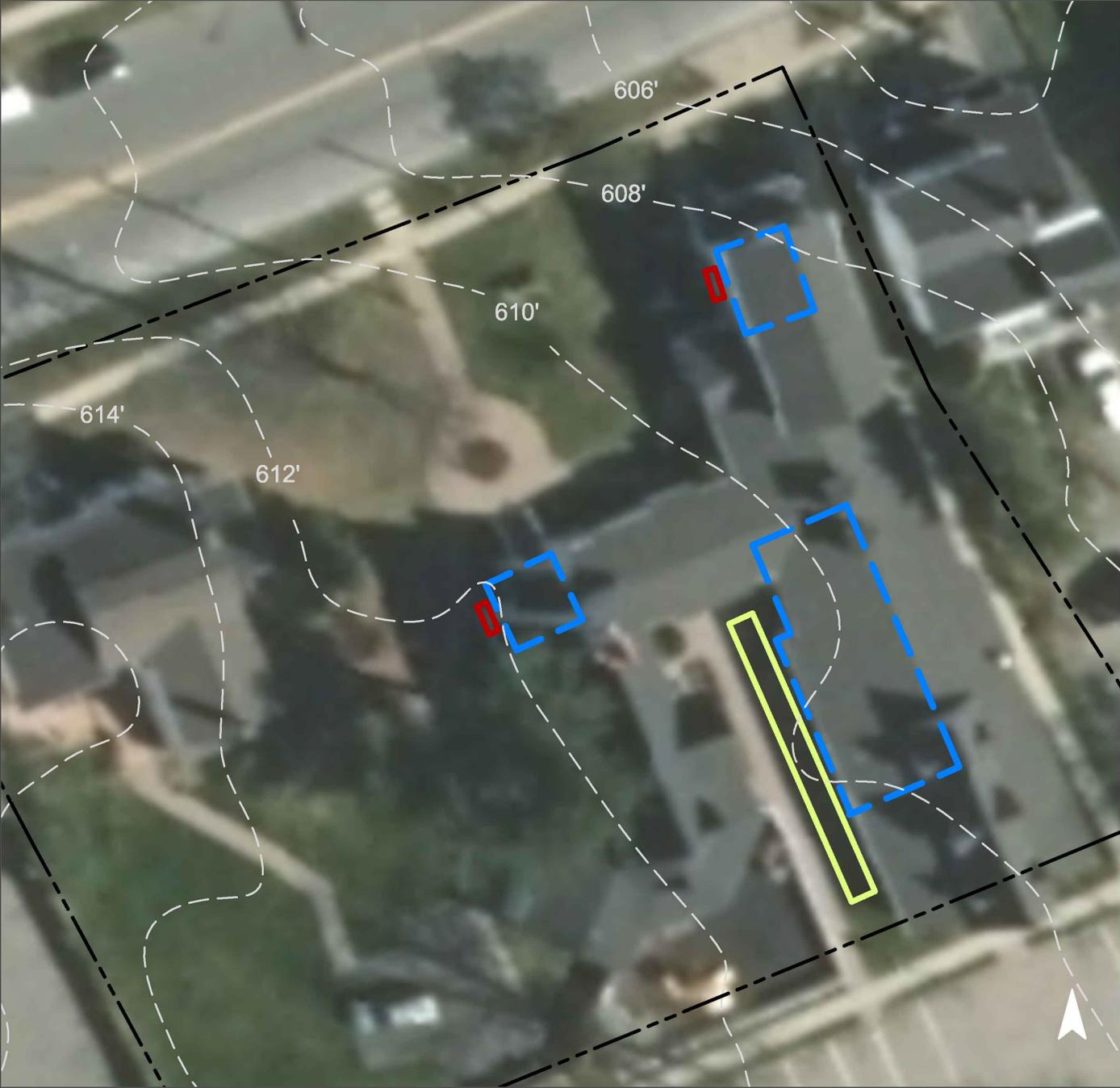


A rain garden can be installed near the rear entrance of the building to capture, treat, and infiltrate the water from five nearby connected downspouts. Two downspout planter boxes can be installed to capture rooftop runoff from different sections of the building. A preliminary soil assessment suggests that the 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	24,471	1.2	12.4	112.4	0.019	0.67

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 system	0.031	5	2,300	0.09	300	\$1,500
Planter boxes	n/a	1	n/a	n/a	2	\$2,000

# GREEN INFRASTRUCTURE RECOMMENDATIONS



## St. Mark's Episcopal Church

-  bioretention system
-  planter box
-  drainage area
-  property line
-  2015 Aerial: NJOIT, OGIS



# ATLANTIC CARDIOLOGY GROUP, LLP



**Subwatershed:** Upper Passaic River

**Site Area:** 104,400 sq. ft.

**Address:** 8 Tempe Wick Road  
Mendham, NJ 07945

**Block and Lot:** Block 2701, Lots 9,10,11

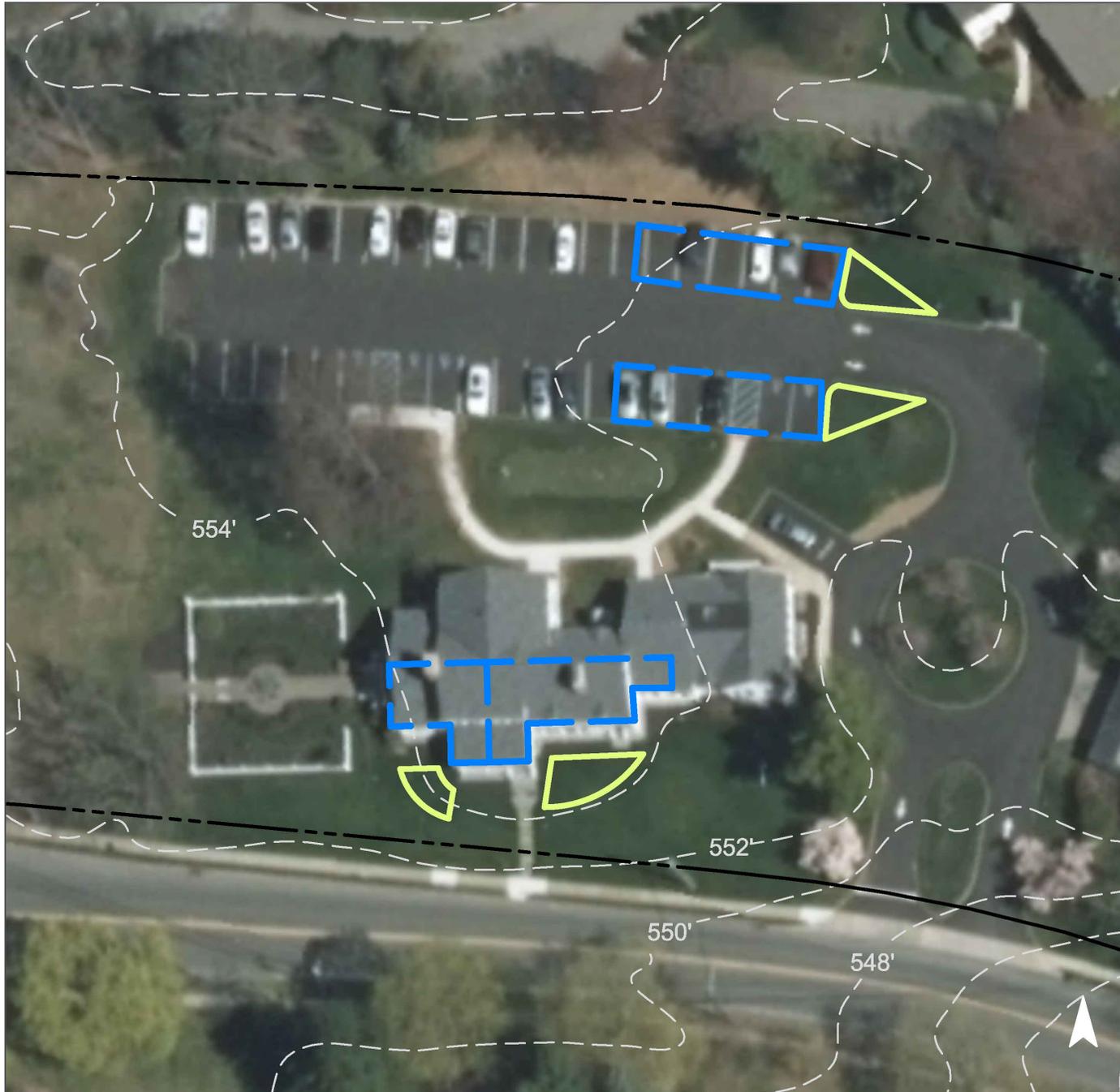


Rain gardens can be installed throughout the property to capture, treat, and infiltrate stormwater runoff from both the rooftop and the parking lot areas. A preliminary soil assessment suggests that more soil testing would be required before determining the soil's suitability for green infrastructure.

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"
69	71,602	3.5	36.2	328.8	0.056	1.96

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	0.109	18	8,030	0.30	1,050	\$5,250

# GREEN INFRASTRUCTURE RECOMMENDATIONS



## Atlantic Cardiology Group, LLP

-  bioretention system
-  drainage area
-  property line
-  2015 Aerial: NJOIT, OGIS



# HILLTOP ELEMENTARY SCHOOL



**Subwatershed:** Upper Passaic River

**Site Area:** 514,676 sq. ft.

**Address:** 12 Hilltop Road  
Mendham, NJ 07945

**Block and Lot:** Block 1501, Lot 35

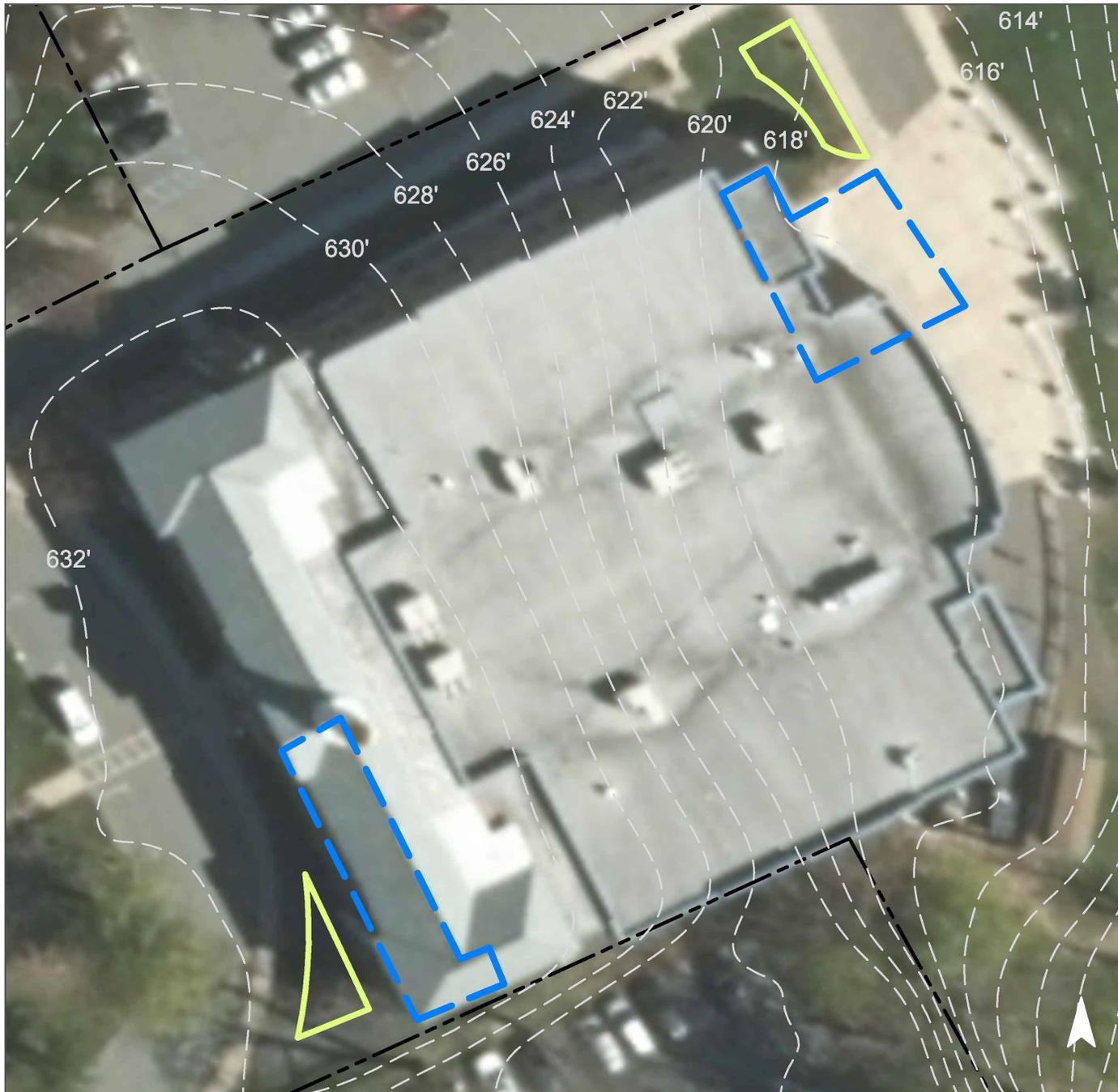


Two rain gardens can be installed in the front and back of the building in the turfgrass areas to help infiltrate the water from the nearby downspouts. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

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"
18	91,769	4.4	46.3	421.3	0.072	2.52

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	0.085	14	6,250	0.23	815	\$4,075

# GREEN INFRASTRUCTURE RECOMMENDATIONS



## Hilltop Elementary School

-  bioretention system
-  drainage area
-  property line
-  2015 Aerial: NJOIT, OGIS



# MENDHAM POST OFFICE



**Subwatershed:** Upper Passaic River

**Site Area:** 36,879 sq. ft.

**Address:** 2 Tempe Wick Road  
Mendham, NJ 07945

**Block and Lot:** Block 2701, Lot 1

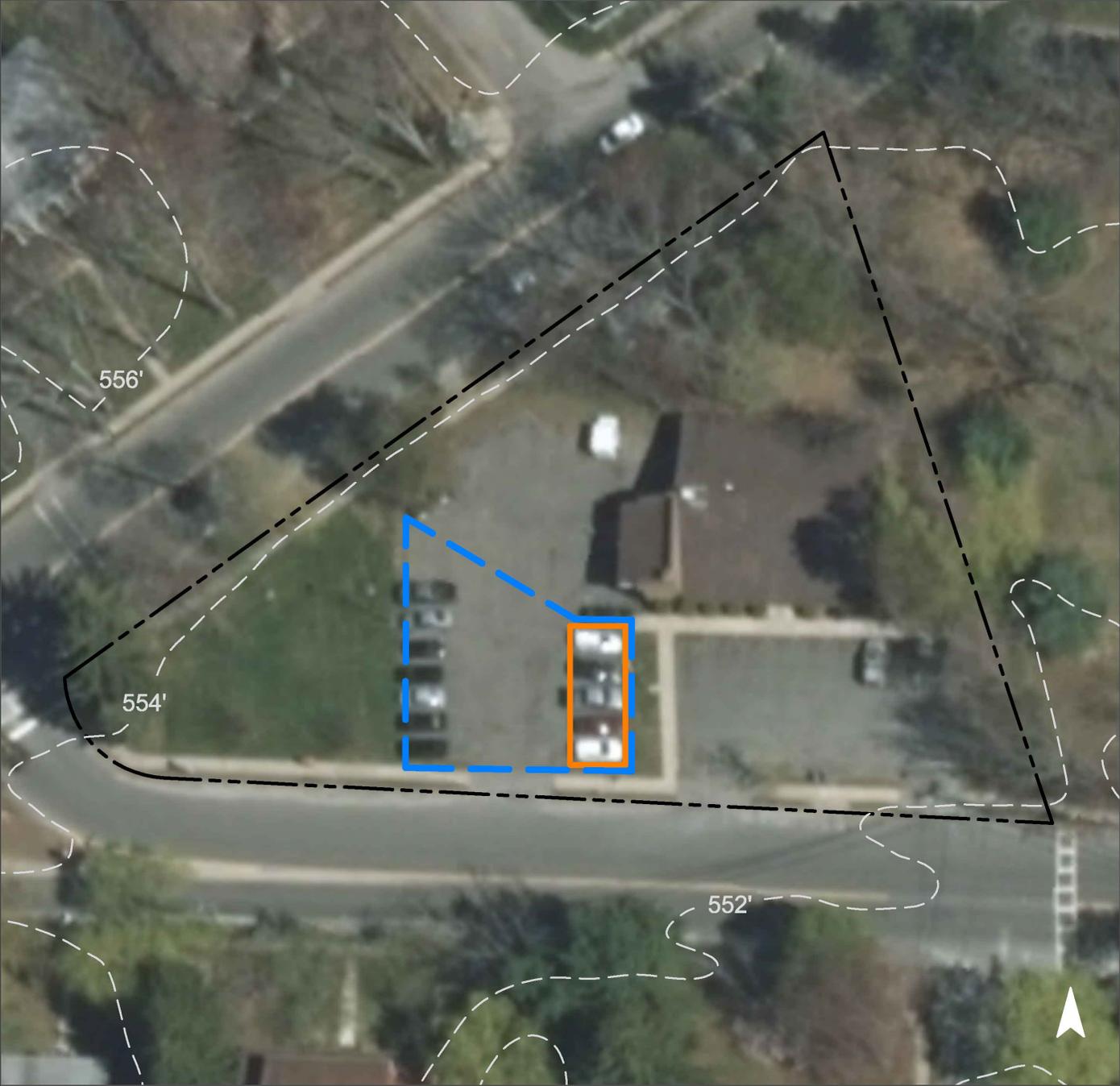


· Pervious pavement can be installed in parking spaces to treat runoff from the parking lot. A preliminary soil assessment suggests that more soil testing would be required before determining the soil's suitability for green infrastructure.

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"
69	25,330	1.2	12.8	116.3	0.020	0.69

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 pavement	0.118	20	8,670	0.33	810	\$20,250

# GREEN INFRASTRUCTURE RECOMMENDATIONS



## Mendham Post Office

-  pervious pavement
-  drainage area
-  property line
-  2015 Aerial: NJOIT, OGIS



# NAILS OF MENDHAM & GRAND BAZAAR



**Subwatershed:** Upper Passaic River

**Site Area:** 18,120 sq. ft.

**Address:** 6 Hilltop Road  
Mendham, NJ 07945

**Block and Lot:** Block 1501, Lot 41

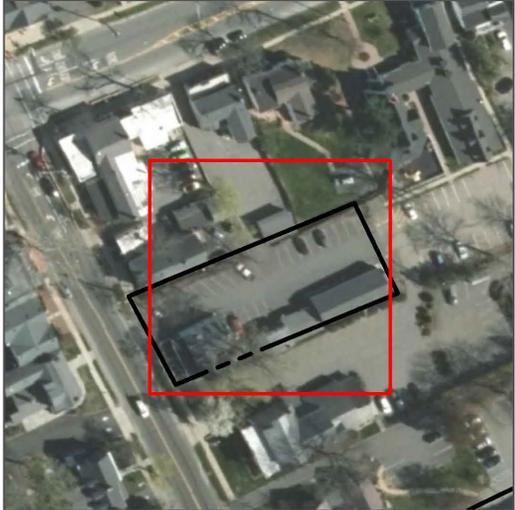
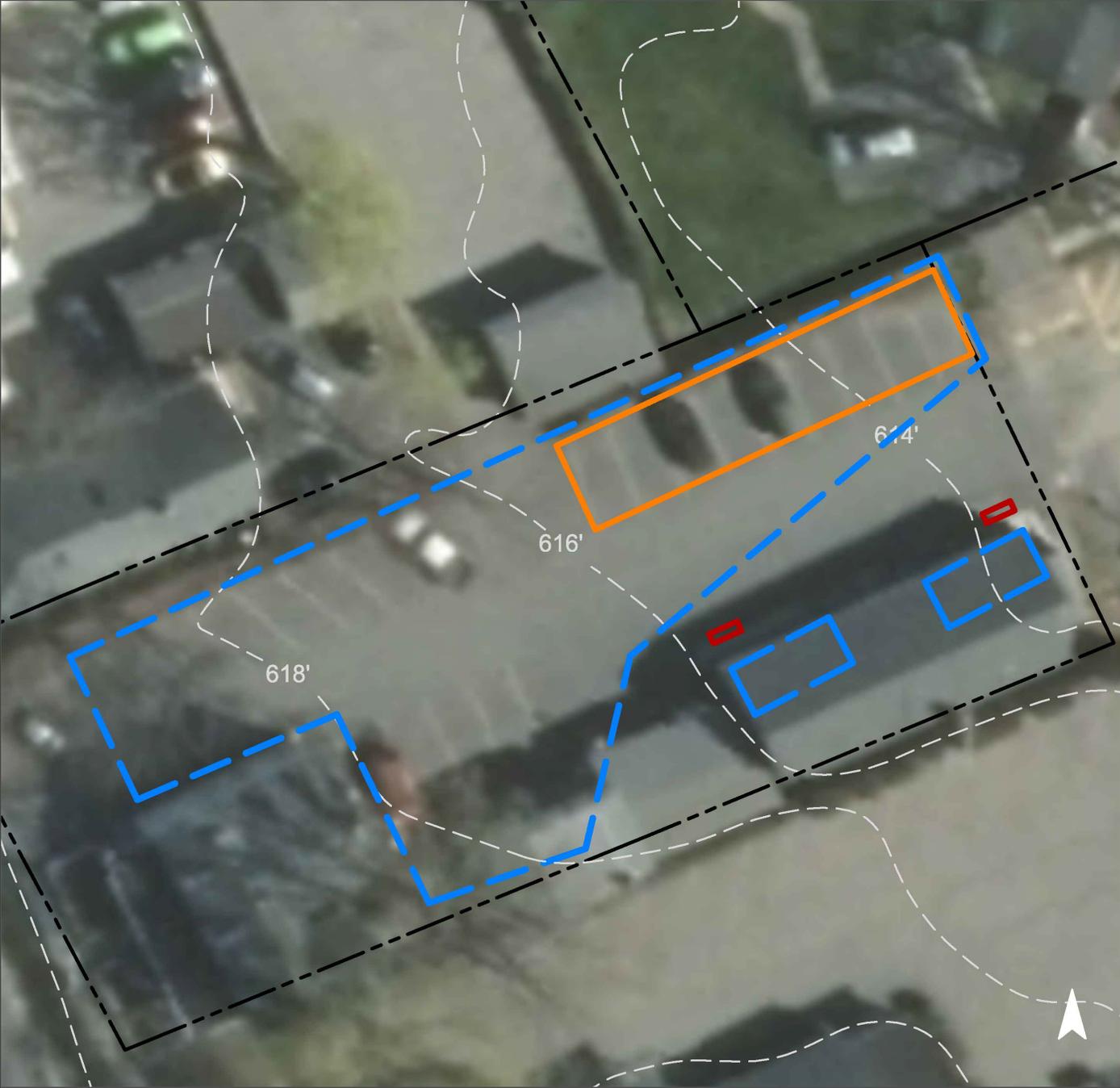


Pervious pavement can be installed to decrease the pooling and erosion caused by the pitch of the pavement and the downspouts leading to the northeast corner of the parking lot. Downspout planter boxes can also be installed to capture runoff from the rooftop. A preliminary soil assessment suggests that the 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	14,252	0.7	7.2	65.4	0.011	0.39

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 pavement	0.213	36	15,630	0.59	1,460	\$36,500
Planter boxes	n/a	4	n/a	n/a	2 (boxes)	\$2,000

# GREEN INFRASTRUCTURE RECOMMENDATIONS



## Nails of Mendham & Grand Bazaar

-  pervious pavement
-  planter box
-  drainage area
-  property line
-  2015 Aerial: NJOIT, OGIS





### **c. Summary of Existing Conditions**



**Summary of Existing Conditions**

Subwatershed/Site Name/Total Site Info/GI Practice	Area (ac)	Area (SF)	Block	Lot	I.C. %	I.C. Area (ac)	I.C. Area (SF)	Existing Annual Loads (Commercial)			Runoff Volumes from I.C.		Runoff Volumes from I.C.	
								TP (lb/yr)	TN (lb/yr)	TSS (lb/yr)	Water Quality Storm (1.25" over 2-hours) (cu.ft.)	Annual (cu.ft.)	Water Quality Storm (1.25" over 2-hours) (Mgal)	Annual (Mgal)
<b>Raritan River North Branch Sites</b>	<b>61.87</b>	<b>2,695,195</b>				<b>14.44</b>	<b>628,993</b>	<b>30.3</b>	<b>317.7</b>	<b>2,887.9</b>	<b>65,520</b>	<b>2,306,307</b>	<b>0.490</b>	<b>17.25</b>
1 <b>Borough Park Total Site Info</b>	14.32	623,697	601	16	34	4.80	209,088	10.1	105.6	960.0	21,780	766,656	0.163	5.73
2 <b>Daytop Preparatory School Total Site Info</b>	26.80	1,167,548	1801	5	17	4.45	193,923	9.3	97.9	890.4	20,200	711,051	0.151	5.32
3 <b>Grace Lutheran Church Total Site Info</b>	1.97	85,651	1401	68	68	1.35	58,610	2.8	29.6	269.1	6,105	214,905	0.046	1.61
4 <b>Hilltop Presbyterian Church Total Site Info</b>	2.32	100,931	1501	31	33	0.76	32,966	1.6	16.6	151.4	3,434	120,877	0.026	0.90
5 <b>Mendham Borough Library Total Site Info</b>	0.42	18,324	1501	37	74	0.31	13,553	0.7	6.8	62.2	1,412	49,693	0.011	0.37
6 <b>Mendham Borough Public Works Garage Total Site Info</b>	15.11	658,388	201	6	14	2.06	89,604	4.3	45.3	411.4	9,334	328,548	0.070	2.46
7 <b>Mendham Recreation Department Total Site Info</b>	0.19	8,097	1902	24	84	0.16	6,778	0.3	3.4	31.1	706	24,851	0.005	0.19
8 <b>St. Mark's Episcopal Church Total Site Info</b>	0.75	32,559	1501	4	75	0.56	24,471	1.2	12.4	112.4	2,549	89,726	0.019	0.67
<b>Upper Passaic River Sites</b>	<b>15.47</b>	<b>674,076</b>				<b>4.66</b>	<b>202,952</b>	<b>9.8</b>	<b>102.5</b>	<b>931.8</b>	<b>21,141</b>	<b>744,158</b>	<b>0.158</b>	<b>5.57</b>
9 <b>Atlantic Cardiology Group, LLP Total Site Info</b>	2.40	104,400	2701	9, 10, 11	69	1.64	71,602	3.5	36.2	328.8	7,459	262,540	0.056	1.96
10 <b>Hilltop Elementary School Total Site Info</b>	11.82	514,676	1501	35	18	2.11	91,769	4.4	46.3	421.3	9,559	336,485	0.072	2.52
11 <b>Mendham Post Office</b>														
14 <b>Nails of Mendham Total Site Info</b>	0.42	18,120	1501	41	79	0.33	14,252	0.7	7.2	65.4	1,485	52,256	0.011	0.39



#### **d. 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	Total Cost (\$)	I.C. Treated %
	Area (SF)	Area (ac)							
<b>Raritan River North Branch Sites</b>	<b>38,675</b>	<b>0.89</b>	<b>0.901</b>	<b>166</b>	<b>61,270</b>	<b>2.30</b>		<b>\$122,130</b>	<b>6.1%</b>
<b>1 Borough Park</b>									
Bioretention systems	4,530	0.10	0.118	20	8,660	0.33	1,135	\$5,675	2.2%
Rainwater harvesting	1,720	0.04	0.045	8	1,340	0.05	1,340	\$2,680	0.8%
<b>Total Site Info</b>	<b>6,250</b>	<b>0.14</b>	<b>0.163</b>	<b>27</b>	<b>10,000</b>	<b>0.38</b>		<b>\$8,355</b>	<b>3.0%</b>
<b>2 Daytop Preparatory School</b>									
Bioretention system	1,400	0.03	0.036	6	2,680	0.10	350	\$1,750	0.7%
Pervious pavement	9,070	0.21	0.236	40	17,340	0.65	1,620	\$40,500	4.7%
Planter boxes	1,720	0.04	n/a	6	n/a	n/a	8	\$8,000	0.9%
<b>Total Site Info</b>	<b>12,190</b>	<b>0.28</b>	<b>0.273</b>	<b>52</b>	<b>20,020</b>	<b>0.75</b>		<b>\$50,250</b>	<b>6.3%</b>
<b>3 Grace Lutheran Church</b>									
Bioretention system	2,600	0.06	0.068	11	4,970	0.19	650	\$3,250	4.4%
Pervious pavement	6,300	0.14	0.164	27	12,040	0.45	1,125	\$28,125	10.7%
Planter boxes	1,075	0.02	n/a	4	n/a	n/a	5	\$5,000	1.8%
<b>Total Site Info</b>	<b>9,975</b>	<b>0.23</b>	<b>0.232</b>	<b>43</b>	<b>17,010</b>	<b>0.64</b>		<b>\$36,375</b>	<b>17.0%</b>
<b>4 Hilltop Presbyterian Church</b>									
Bioretention system	2,500	0.06	0.065	11	4,780	0.18	650	\$3,250	7.6%
Pervious pavement	2,500	0.06	0.065	11	4,780	0.18	445	\$11,125	7.6%
<b>Total Site Info</b>	<b>5,000</b>	<b>0.11</b>	<b>0.130</b>	<b>22</b>	<b>9,560</b>	<b>0.36</b>		<b>\$14,375</b>	<b>15.2%</b>
<b>5 Mendham Borough Library</b>									
Planter boxes	645	0.01	n/a	2	n/a	n/a	3	\$3,000	4.8%
<b>Total Site Info</b>	<b>645</b>	<b>0.01</b>	<b>0.000</b>	<b>2</b>	<b>0</b>	<b>0.00</b>		<b>\$3,000</b>	<b>4.8%</b>
<b>6 Mendham Borough Public Works Garage</b>									
Rainwater harvesting	2,570	0.06	0.067	11	2,000	0.07	2,000	\$4,000	2.9%
<b>Total Site Info</b>	<b>2,570</b>	<b>0.06</b>	<b>0.067</b>	<b>11</b>	<b>2,000</b>	<b>0.07</b>		<b>\$4,000</b>	<b>2.9%</b>
<b>7 Mendham Recreation Department</b>									
Bioretention system	200	0.00	0.005	1	380	0.01	55	\$275	3.0%
Planter boxes	430	0.01	n/a	2	n/a	n/a	2	\$2,000	6.3%
<b>Total Site Info</b>	<b>630</b>	<b>0.01</b>	<b>0.005</b>	<b>2</b>	<b>380</b>	<b>0.01</b>		<b>\$2,275</b>	<b>9.3%</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	Total Cost (\$)	I.C. Treated %
	Area (SF)	Area (ac)							
<b>8 St. Mark's Episcopal Church</b>									
Bioretention system	1,200	0.03	0.031	5	2,300	0.09	300	\$1,500	4.9%
Planter boxes	215	0.00	n/a	1	n/a	n/a	2	\$2,000	0.9%
<b>Total Site Info</b>	<b>1,415</b>	<b>0.03</b>	<b>0.031</b>	<b>6</b>	<b>2,300</b>	<b>0.09</b>		<b>\$3,500</b>	<b>5.8%</b>
<b>Upper Passaic River Sites</b>	<b>21,237</b>	<b>0.49</b>	<b>0.526</b>	<b>92</b>	<b>38,580</b>	<b>1.45</b>	<b>0</b>	<b>\$68,075</b>	<b>10.5%</b>
<b>9 Atlantic Cardiology Group, LLP</b>									
Bioretention systems	4,200	0.10	0.109	18	8,030	0.30	1,050	\$5,250	5.9%
<b>Total Site Info</b>	<b>4,200</b>	<b>0.10</b>	<b>0.109</b>	<b>18</b>	<b>8,030</b>	<b>0.30</b>		<b>\$5,250</b>	<b>5.9%</b>
<b>10 Hilltop Elementary School</b>									
Bioretention systems	3,265	0.07	0.085	14	6,250	0.23	815	\$4,075	3.6%
<b>Total Site Info</b>	<b>3,265</b>	<b>0.07</b>	<b>0.085</b>	<b>14</b>	<b>6,250</b>	<b>0.23</b>		<b>\$4,075</b>	<b>3.6%</b>
<b>11 Mendham Post Office</b>									
Pervious pavement	4,535	0.10	0.118	20	8,670	0.33	810	\$20,250	17.9%
<b>Total Site Info</b>	<b>4,535</b>	<b>0.10</b>	<b>0.118</b>	<b>20</b>	<b>8,670</b>	<b>0.33</b>		<b>\$20,250</b>	<b>17.9%</b>
<b>14 Nails of Mendham</b>									
Pervious pavement	8,175	0.19	0.213	36	15,630	0.59	1,460	\$36,500	57.4%
Planter boxes	1,062	0.02	n/a	4	n/a	n/a	2	\$2,000	7.5%
<b>Total Site Info</b>	<b>9,237</b>	<b>0.21</b>	<b>0.213</b>	<b>40</b>	<b>15,630</b>	<b>0.59</b>		<b>\$38,500</b>	<b>64.8%</b>