RUTGERS
New Jersey Agricultural
Experiment Station

Draft

Impervious Cover Reduction Action Plan
for
Readington Township, Hunterdon County, New Jersey

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

November 16, 2015

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Introduction

Located in Hunterdon County in central New Jersey, Readington Township covers approximately 47.8 square miles. Figures 1 and 2 illustrate that Readington Township is dominated by urban land uses. Approximately 34.5% of the municipality's land use is classified as urban. Of the urban land in Readington Township, rural residential development 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 Readington Township into many unique land use areas, assigning a percent impervious cover for each delineated area. These impervious cover values were used to estimate the impervious coverage for Readington Township. Based upon the 2007 NJDEP land use/land cover data, approximately 5.7% of Readington Township has impervious cover. This level of impervious cover suggests that the streams in Readington Township are likely sensitive streams.[1]

Methodology

Readington Township contains portions of seven 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.

[1] 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

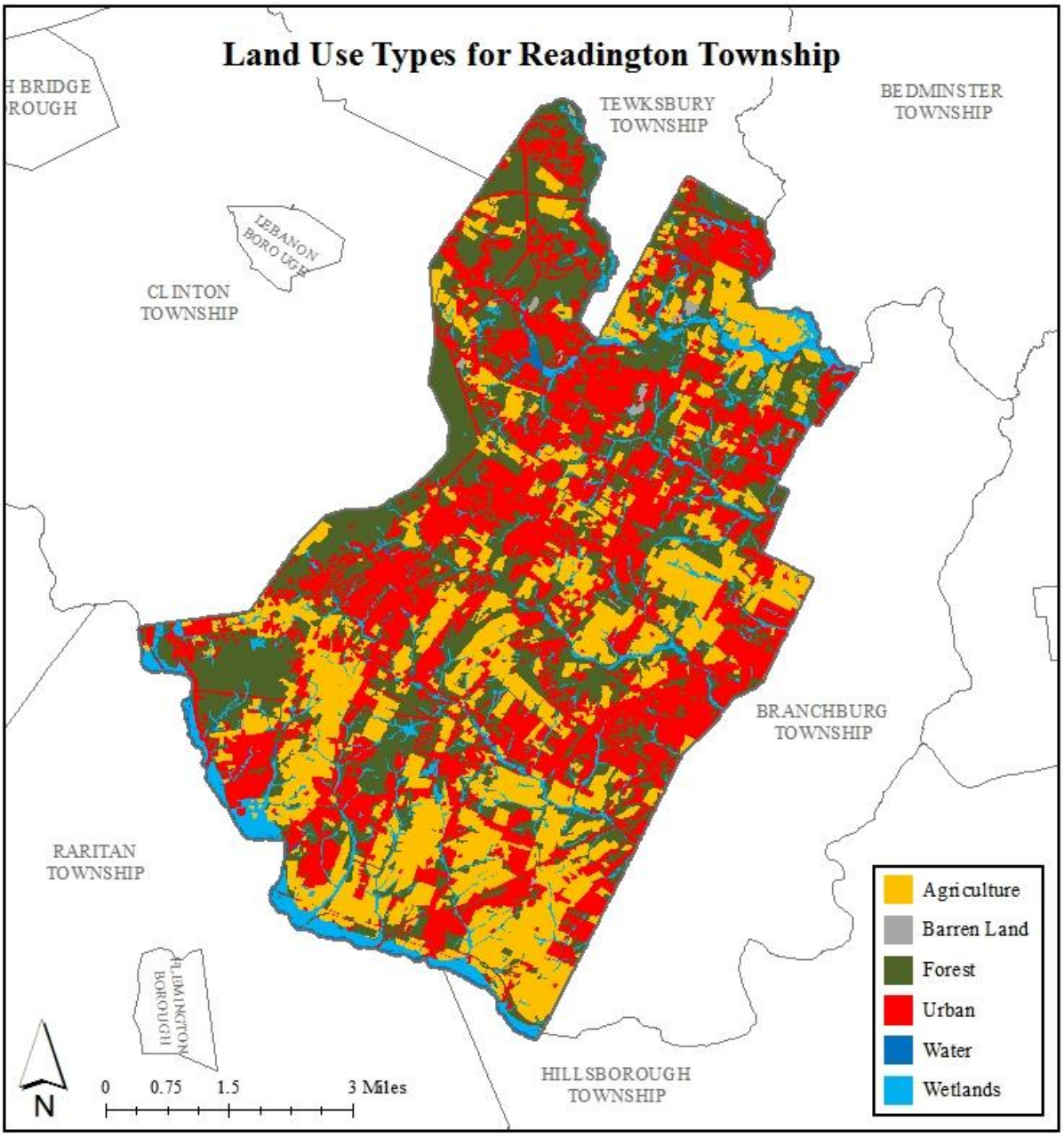


Figure 1: Map illustrating the land use in Readington Township

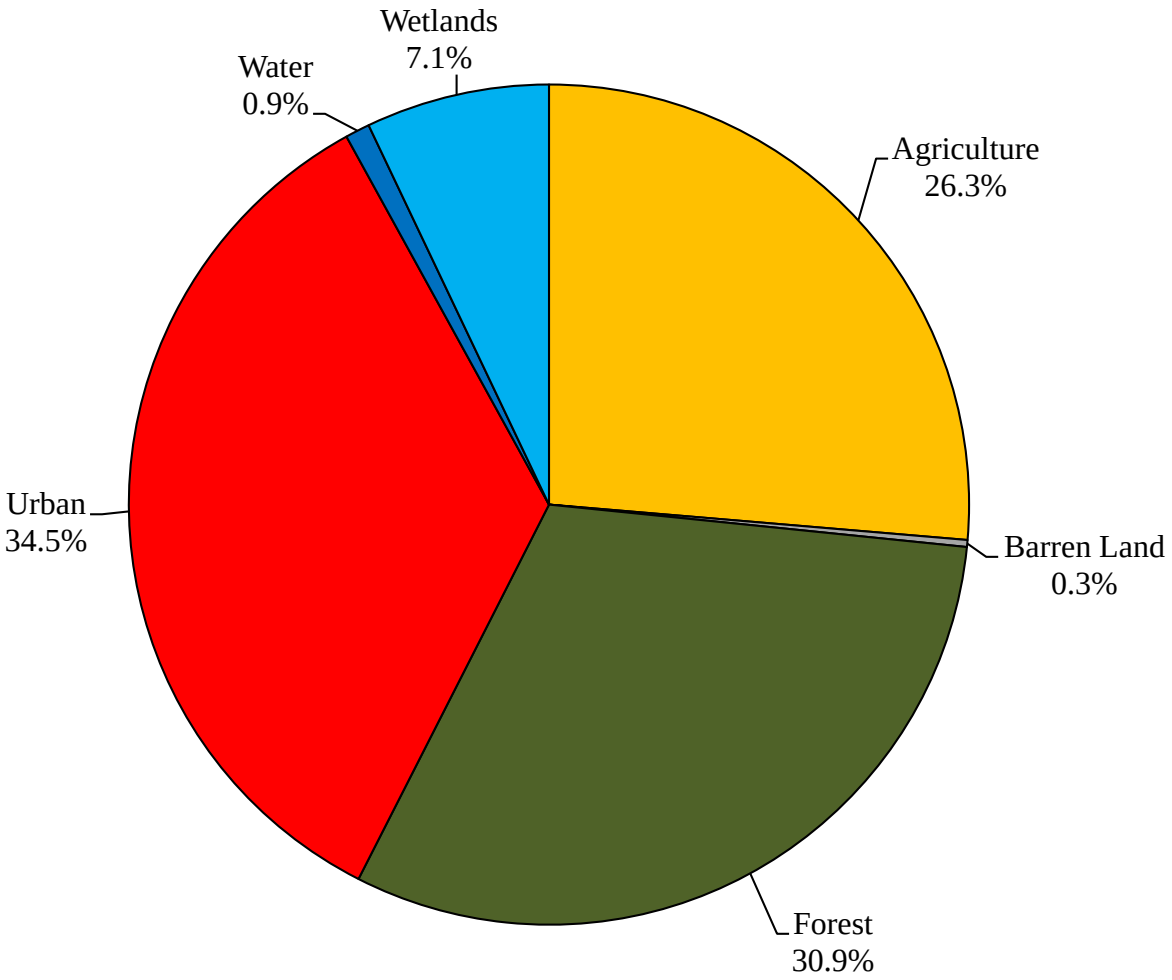


Figure 2: Pie chart illustrating the land use in Readington Township

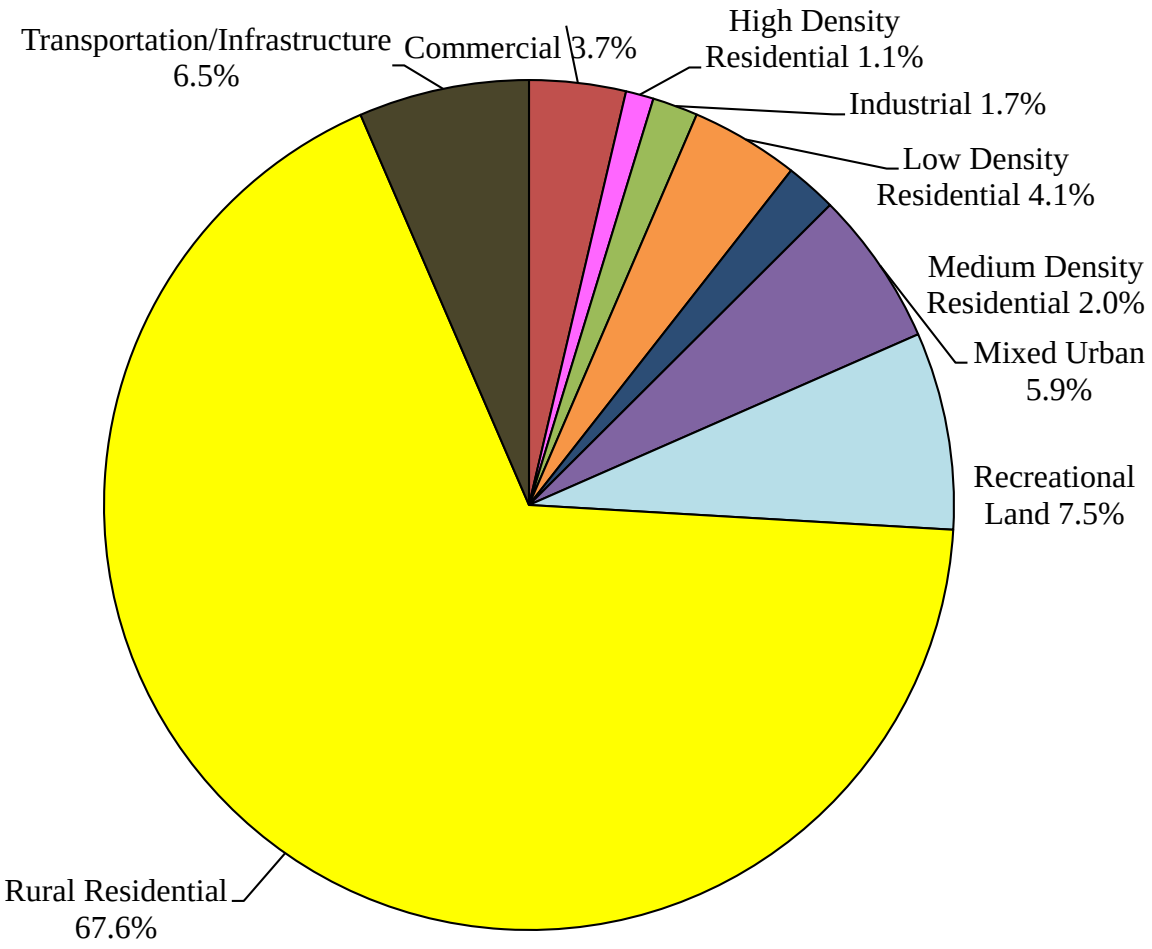


Figure 3: Pie chart illustrating the various types of urban land use in Readington Township

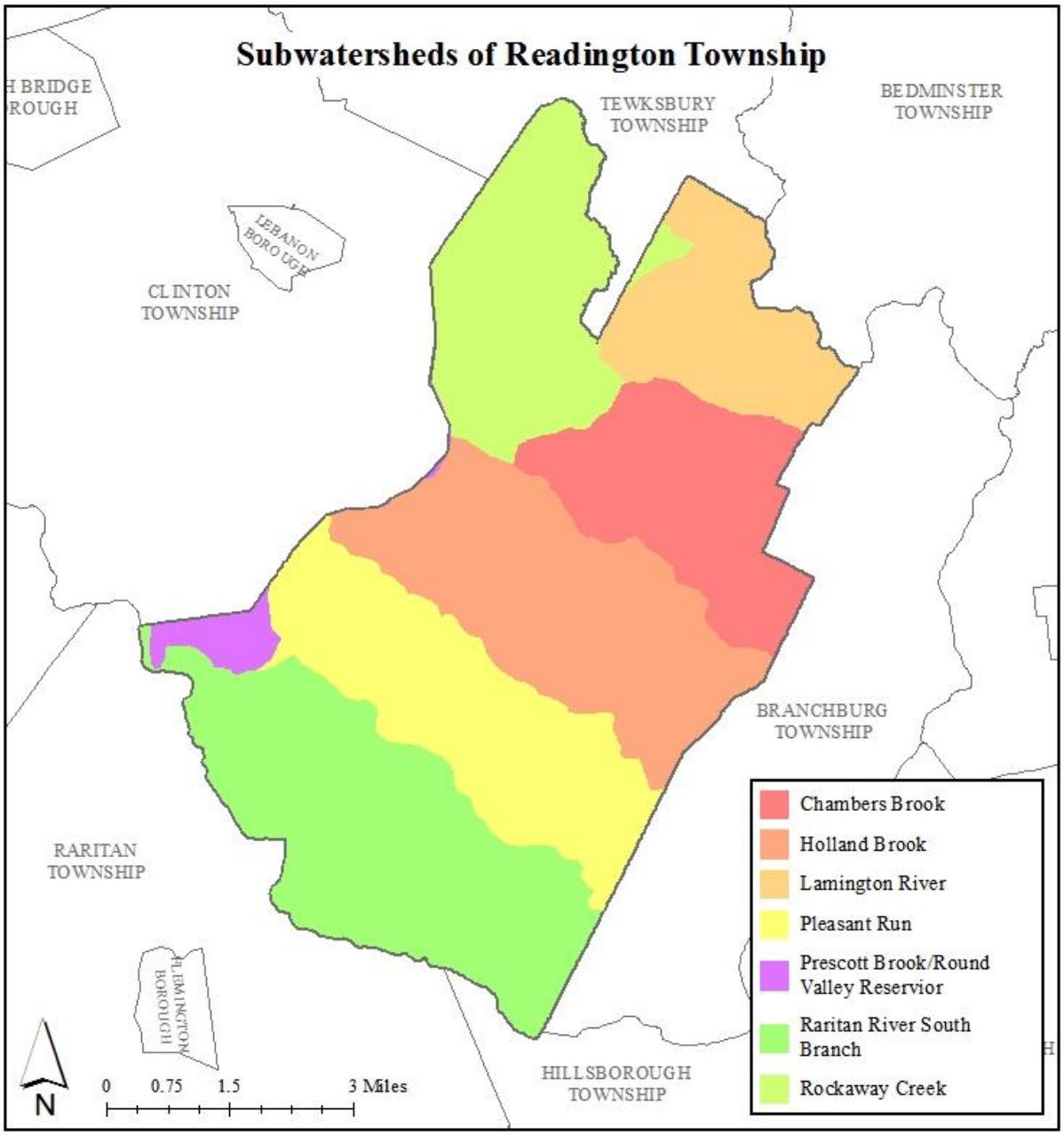


Figure 4: Map of the subwatersheds in Readington Township

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 Readington Township 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[2]

Land Cover	TP load (lbs/acre/yr)	TN load (lbs/acre/yr)	TSS load (lbs/acre/yr)
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

[2] 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[3]. A wide range of green infrastructure practices have been evaluated for the potential project sites in Readington Township. Each practice is discussed below.

Disconnected downspouts

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

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.




[3] 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

Bioretention systems/rain gardens

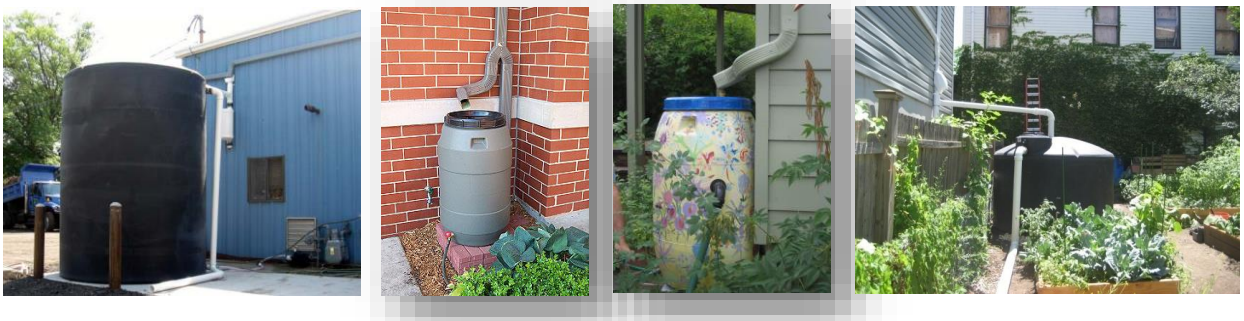
These are landscaped features that are designed to capture, treat, and infiltrate stormwater runoff. These systems can easily be incorporated into existing landscapes, improving aesthetics and creating a wildlife habitat while managing stormwater runoff. Bioretention systems also can be used in soils 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. [4]

[4] 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*.

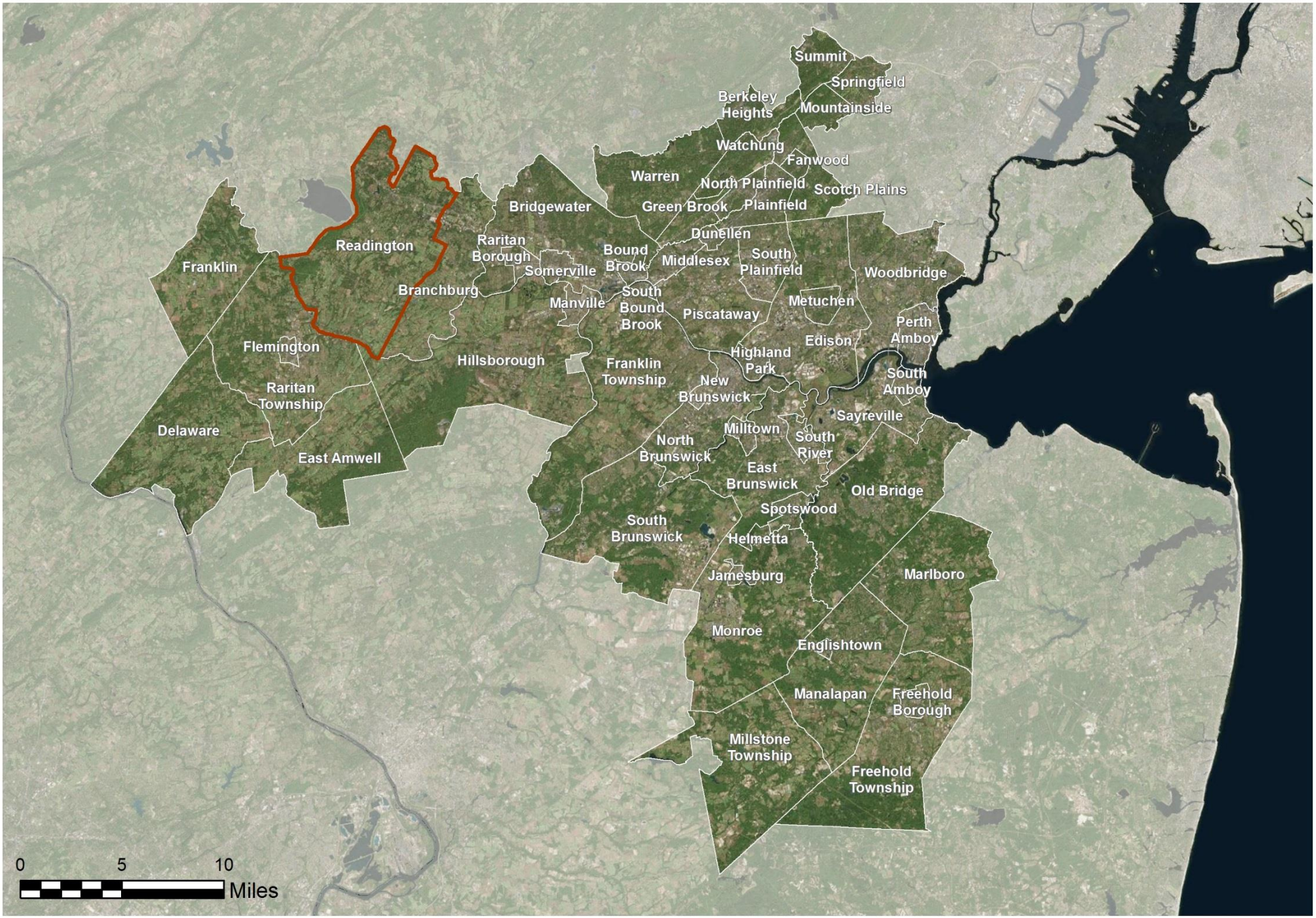
Conclusion

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.

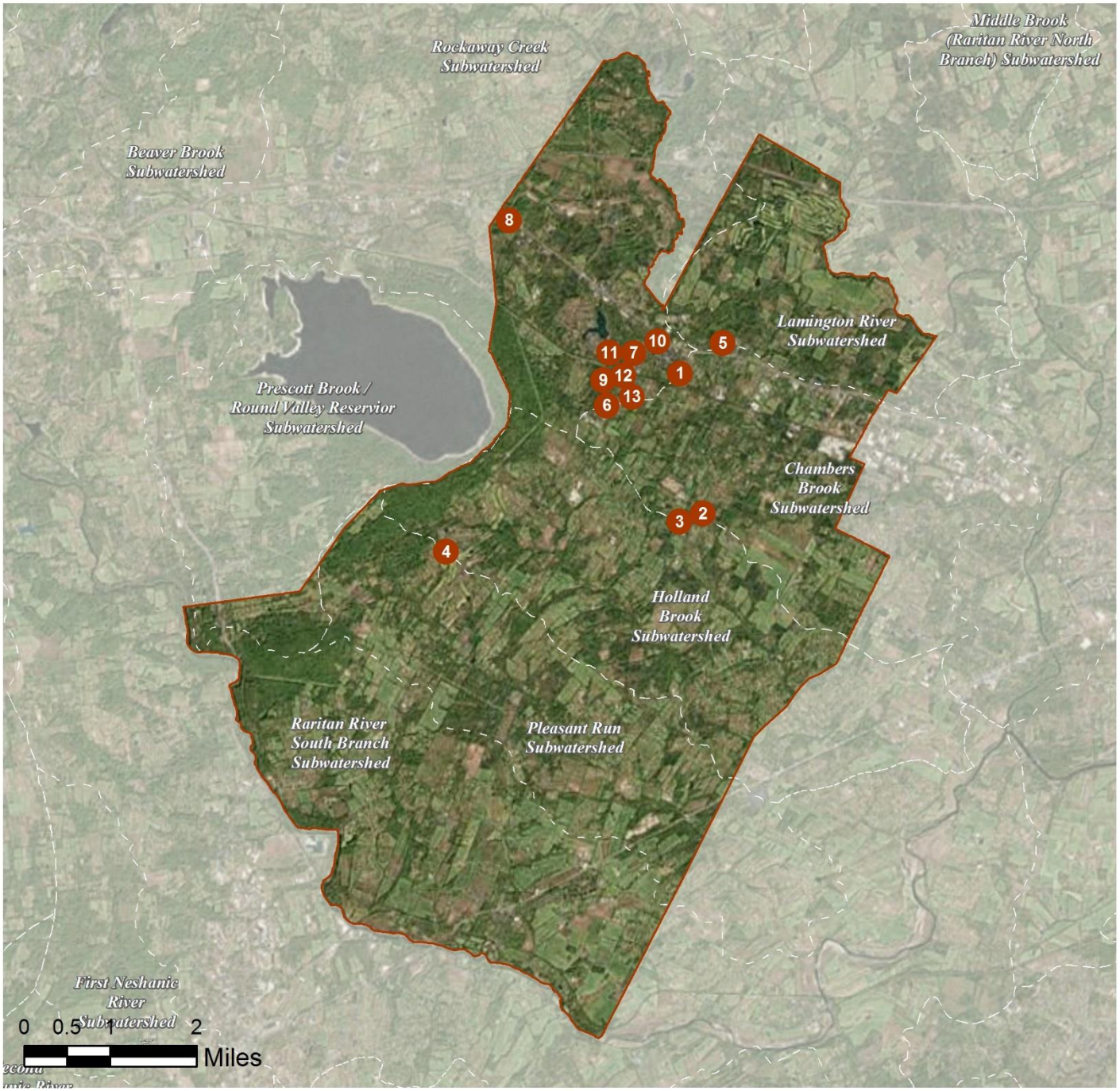
a. Overview Map of the Project

READINGTON: CLIMATE RESILIENT GREEN INFRASTRUCTURE FOR THE RARITAN BASIN



b. Green Infrastructure Sites

READINGTON: GREEN INFRASTRUCTURE SITES



SITES WITHIN THE CHAMBERS BROOK SUBWATERSHED:

1. Whitehouse School

SITES WITHIN THE HOLLAND BROOK SUBWATERSHED:

2. Holland Brook School
3. Readington Middle School
4. Stanton Ridge Golf & Country Club

SITES WITHIN THE LAMINGTON RIVER SUBWATERSHED:

5. Whitehouse United Methodist Church

SITES WITHIN THE ROCKAWAY CREEK SUBWATERSHED:

6. Our Lady of Lourdes
7. Readington Township Library
8. Spinning Wheel Diner
9. US Post Office
10. Whitehouse Mall
11. Whitehouse Rescue Squad
12. Whitehouse Station Fire Company
13. Whitehouse Veterinary Hospital

c. Proposed Green Infrastructure Concepts

WHITEHOUSE SCHOOL

Subwatershed: Chambers Brook

Site Area: 279,683 sq. ft.

Address: 50 Whitehouse Avenue
Whitehouse Station, NJ 08889

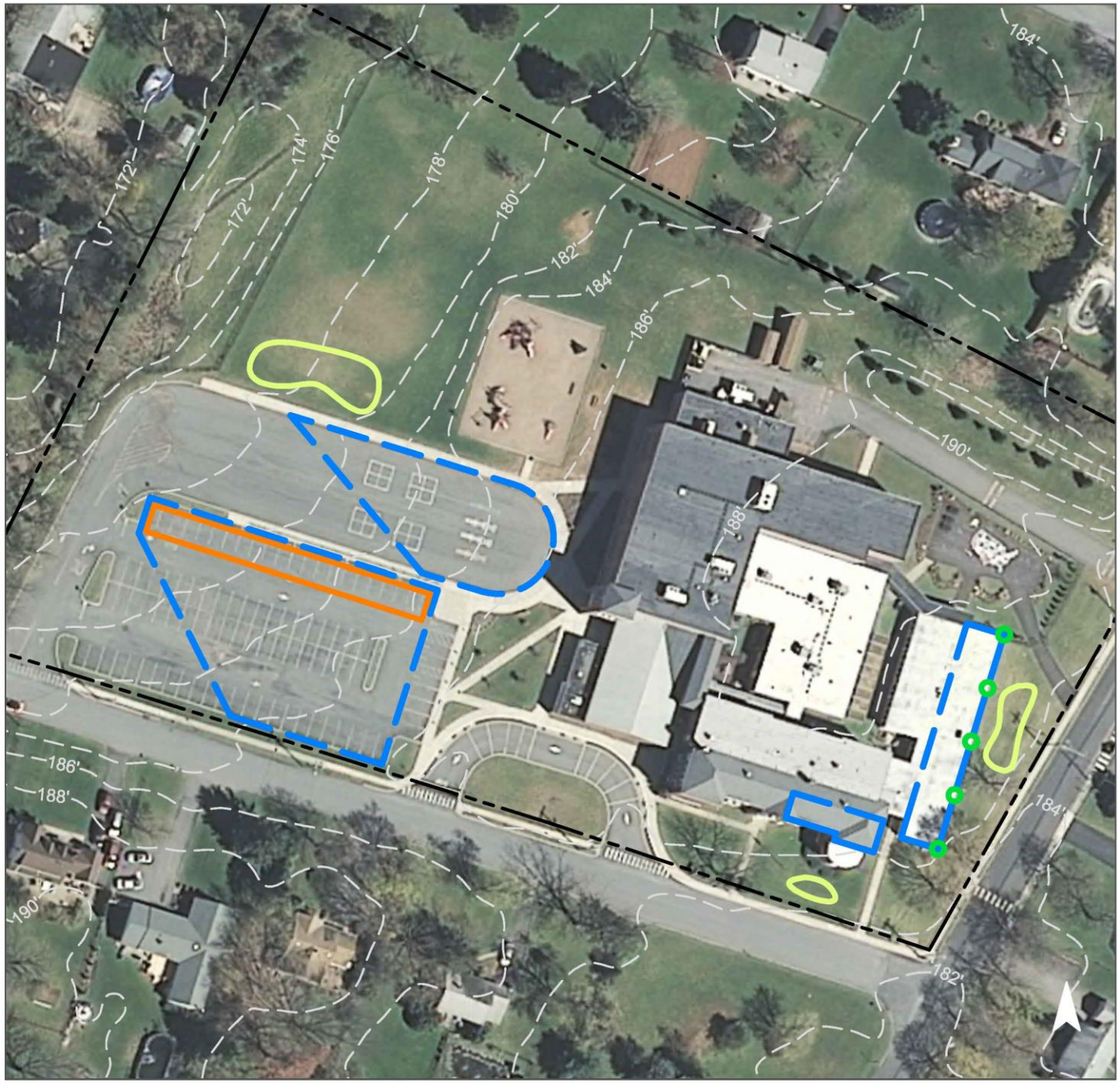
Block and Lot: Block 35, Lot 14

On the east side of the school a bioretention system can be installed to capture, treat, and infiltrate roof runoff by disconnecting and redirecting the nearby downspouts. A second rain garden can be built on the south side to treat roof runoff as well. Runoff from the play area can be captured by making curb cuts and constructing a rain garden in the turf grass area adjacent to it. Parking spaces can be replaced with pervious pavement to infiltrate additional stormwater. 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"
51	141,404	6.8	71.4	649.2	0.110	3.88

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	0.368	62	27,870	1.05	3,553	$17,765
Pervious pavements	0.495	83	37,505	1.41	3,564	$89,100

GREEN INFRASTRUCTURE RECOMMENDATIONS



Whitehouse School

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

0 50' 100'

HOLLAND BROOK SCHOOL

Subwatershed: Holland Brook

Site Area: 2,050,634 sq. ft.

Address: 52 Readington Road
Whitehouse Station, NJ 08889

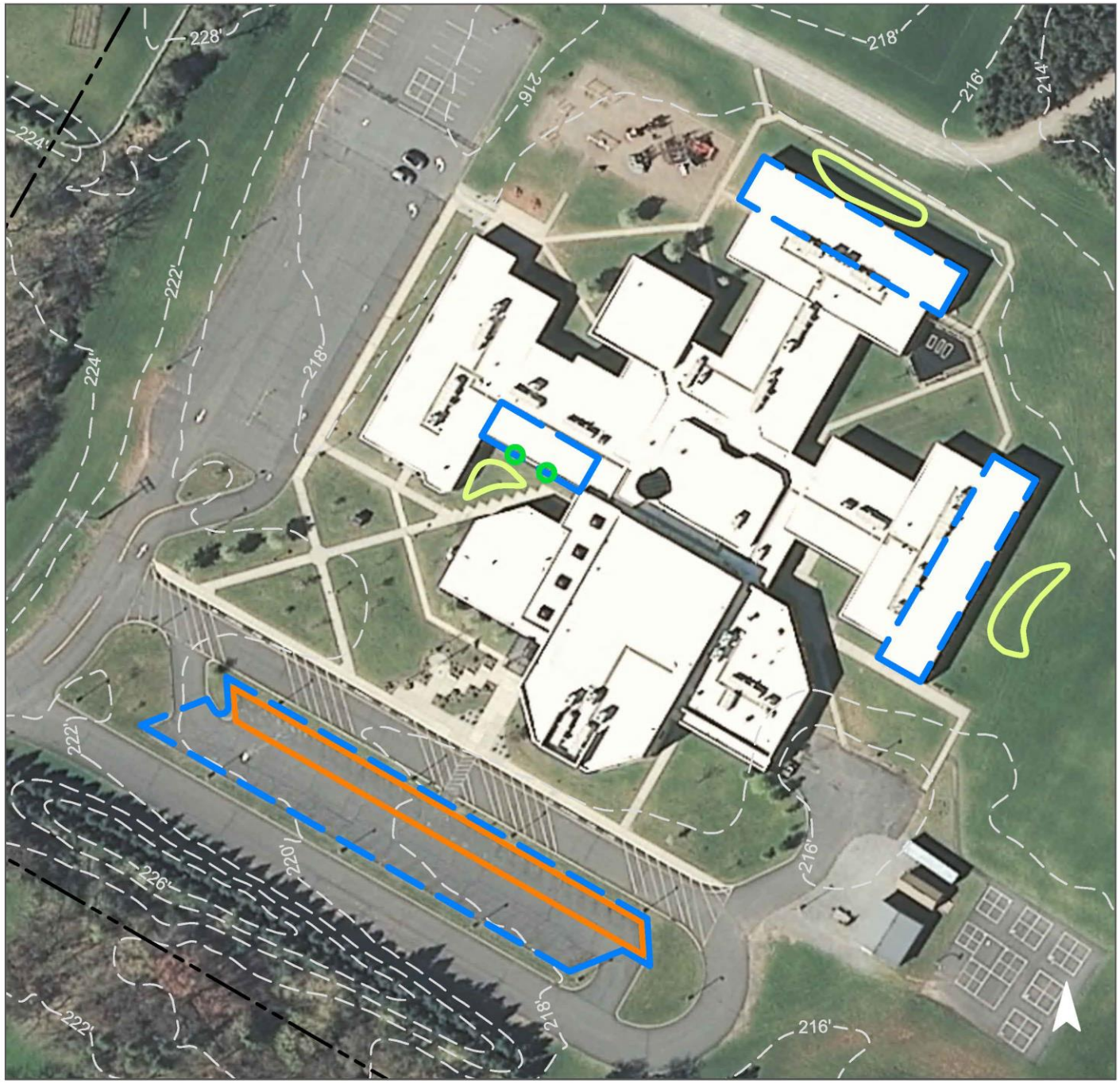
Block and Lot: Block 48, Lot 21.28

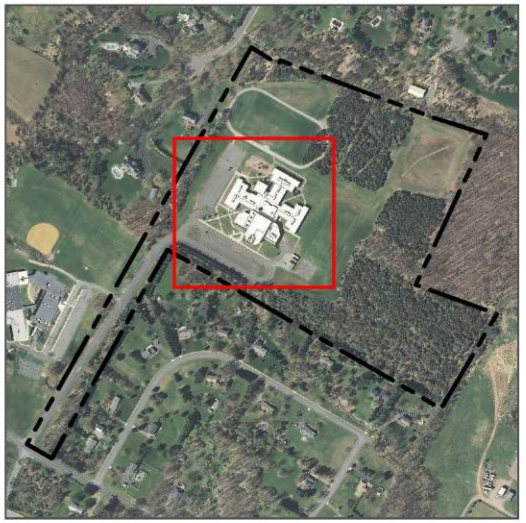
The school's stormwater appears to drain primarily through connected downspouts with some disconnected downspouts flowing into turf grass. There are multiple locations where rain gardens can be installed to capture, treat, and infiltrate roof runoff by disconnecting and redirecting downspouts. Runoff from the parking lot can be infiltrated by using pervious pavement. 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"
12	255,485	12.3	129.0	1,173.0	0.199	7.01

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	0.302	51	22,896	0.86	2,925	$14,625
Pervious pavements	0.440	74	33,361	1.25	5,550	$138,750

GREEN INFRASTRUCTURE RECOMMENDATIONS





Holland Brook School

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

0 50' 100'

READINGTON MIDDLE SCHOOL

Subwatershed: Holland Brook

Site Area: 947,054 sq. ft.

Address: 48 Readington Road
Whitehouse Station, NJ 08889

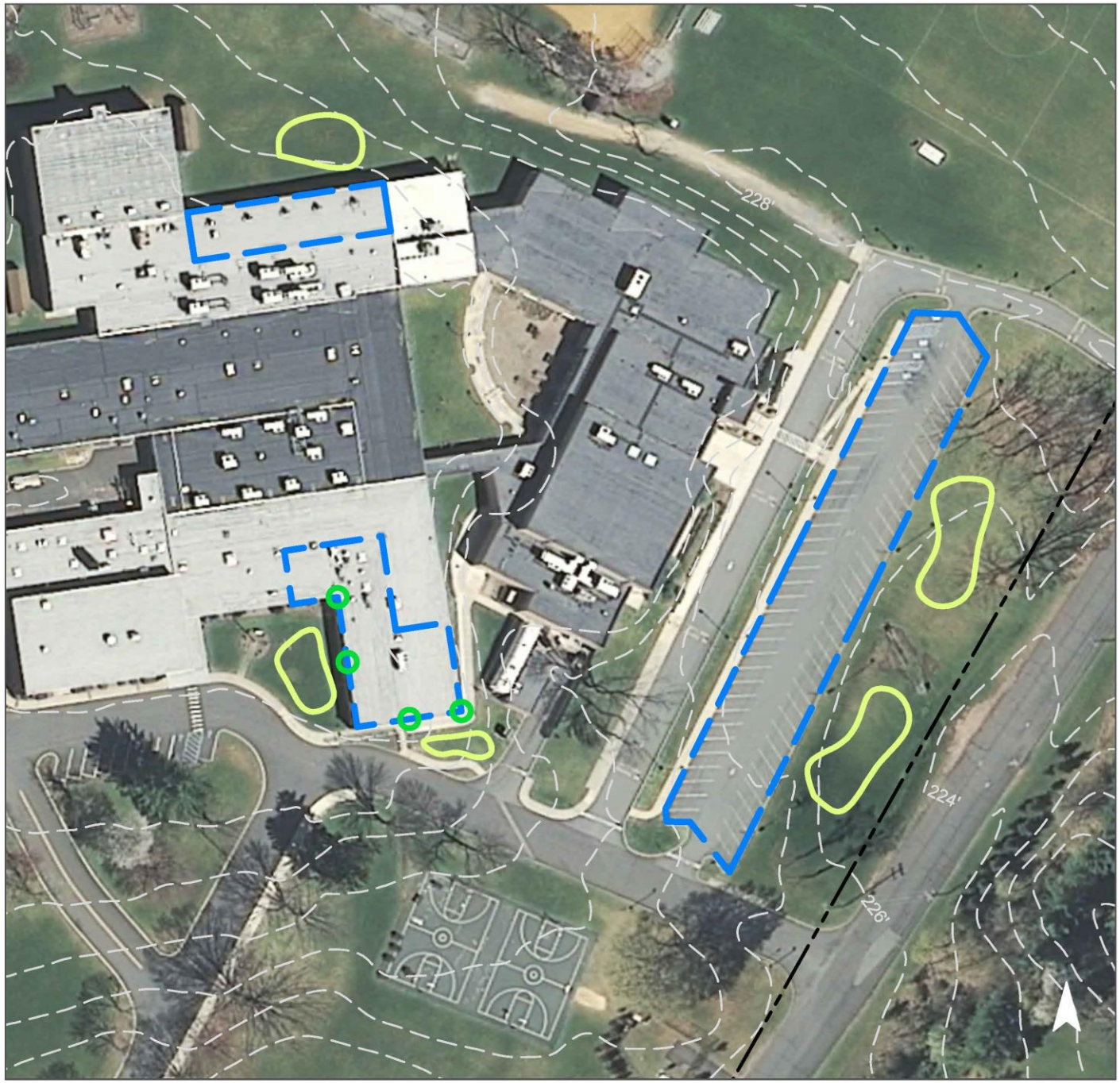
Block and Lot: Block 48, Lot 21.01

There are several locations where rain gardens can be installed to capture, treat, and infiltrate roof runoff. The parking lot runoff can be treated by creating curb cuts to direct rainwater into rain gardens using the detention basin as an overflow. 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"
31	295,795	14.3	149.4	1,358.1	0.230	8.11

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	0.870	146	65,899	2.47	8,100	$40,500

GREEN INFRASTRUCTURE RECOMMENDATIONS



Readington Middle School

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

0 50' 100'

STANTON RIDGE GOLF & COUNTRY CLUB

Subwatershed: Holland Brook

Site Area: 2,037,878 sq. ft.

Address: 25 Club House Drive
Whitehouse Station, NJ 08889

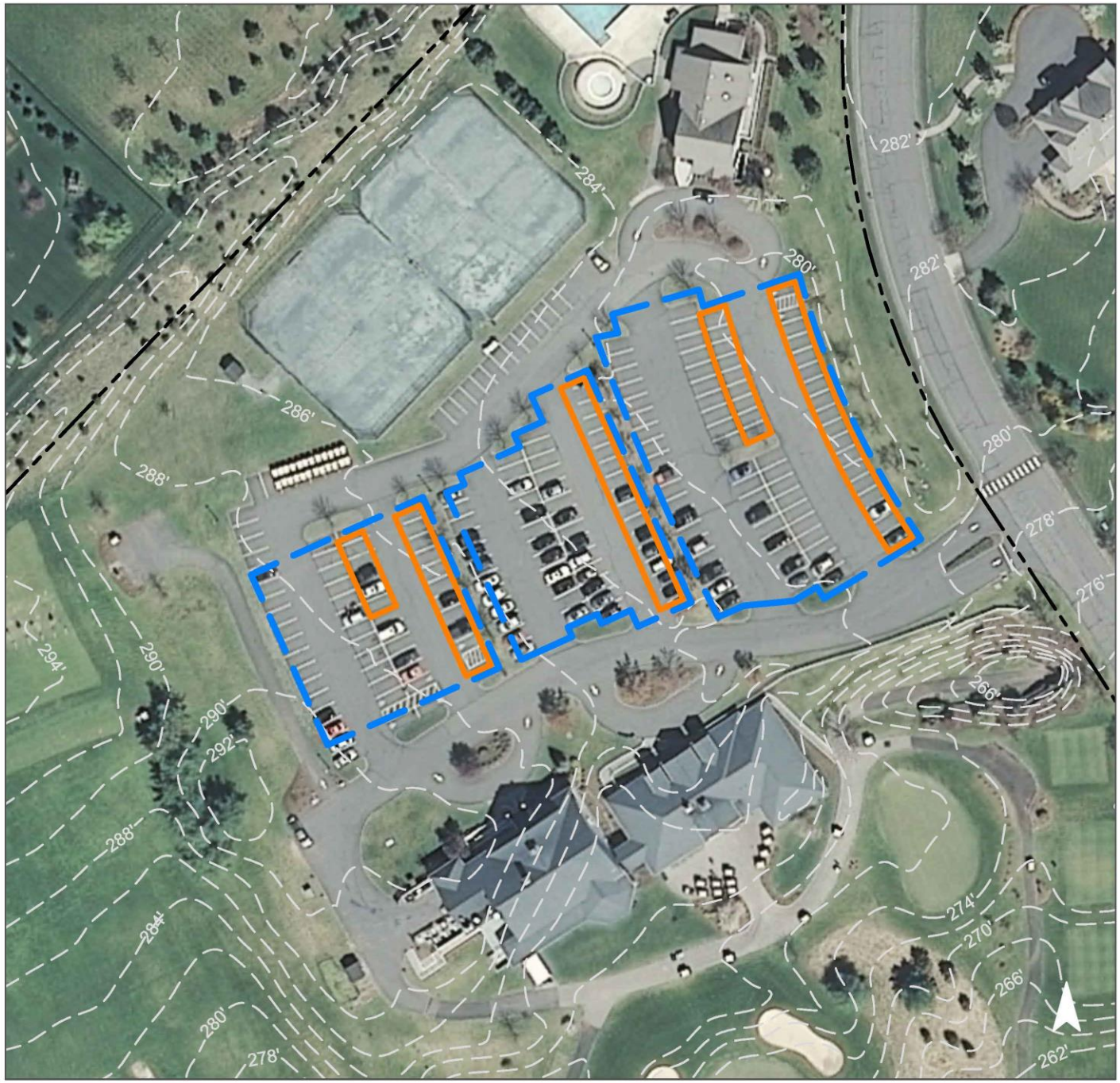
Block and Lot: Block 51, Lot 21.28

The country club's parking lot runoff flows toward the northeast and into catch basins along the way. Strips of pervious pavement can replace the existing asphalt to capture this runoff and allow it to infiltrate. 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"
9	187,911	9.1	94.9	862.8	0.146	5.15

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	1,529	256	115,873	4.35	11,100	$277,500

GREEN INFRASTRUCTURE RECOMMENDATIONS



Stanton Ridge Golf & Country Club

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

0 50' 100'

WHITEHOUSE UNITED METHODIST CHURCH

Subwatershed: Lamington River

Site Area: 104,744 sq. ft.

Address: 73 Old Highway 28
Whitehouse Station, NJ 08889

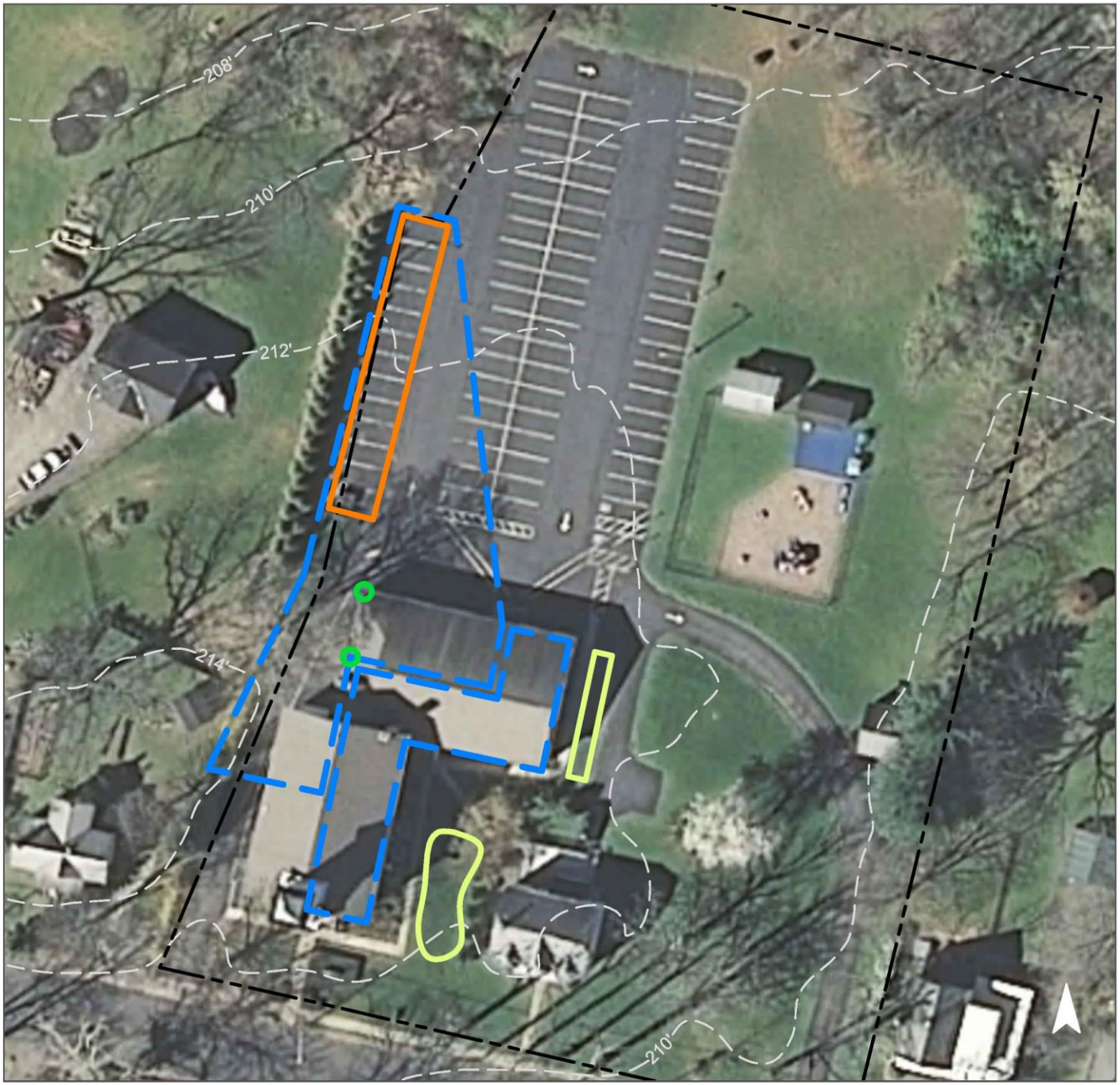
Block and Lot: Block 13, Lot 36

The church's stormwater comes from the roof which flows down primarily disconnected downspouts, and the parking lot that drains into the neighboring woods. Bioretention systems can be installed on the south and east sides of the building to capture, treat, and infiltrate roof runoff. The parking lot runoff can be captured by replacing parking spaces with pervious pavement. 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"
41	43,401	2.1	21.9	199.3	0.034	1.19

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 systems	0.121	20	9,200	0.35	1,165	$5,825
Pervious pavements	0.291	49	22,006	0.83	2,150	$53,750

GREEN INFRASTRUCTURE RECOMMENDATIONS



Whitehouse United Methodist Church

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

0 30' 60'

OUR LADY OF LOURDES

Subwatershed: Rockaway Creek

Site Area: 332,360 sq. ft.

Address: 390 County Road 523
Whitehouse Station, NJ 08889

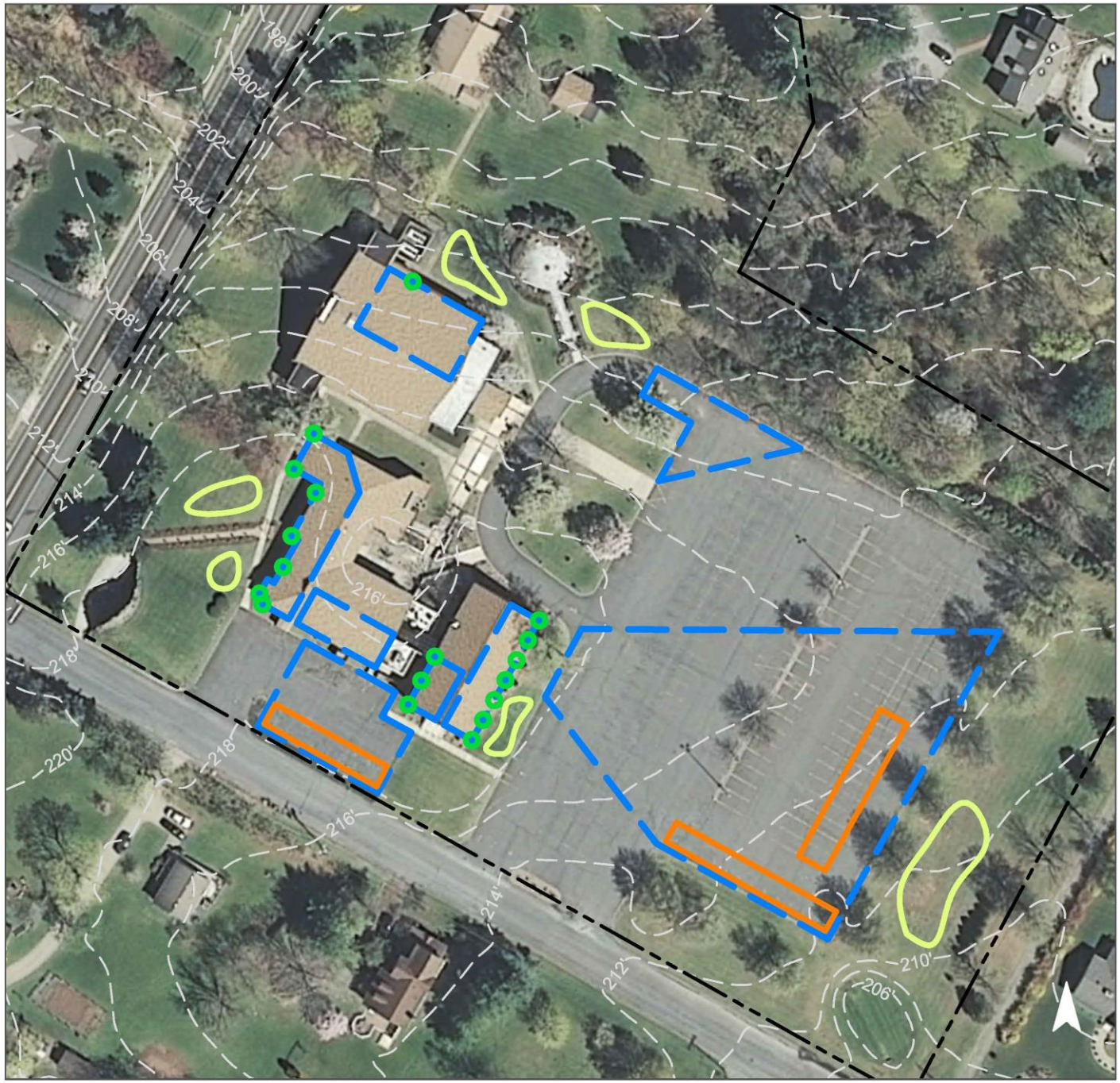
Block and Lot: Block 28, Lot 10

The parking lot runoff currently drains into a detention basin at the south end. Parking spaces can be replaced with pervious pavement to capture and infiltrate stormwater. Additional runoff from the parking lot can be captured, treated, and infiltrated by installing rain gardens. The roof runoff flows down connected downspouts, which can be disconnected into rain gardens. 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"
49	161,446	7.8	81.5	741.3	0.126	4.43

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	0.606	101	45,912	1.72	5,815	$29,075
Pervious pavements	0.752	126	56,975	2.14	5,210	$130,250

GREEN INFRASTRUCTURE RECOMMENDATIONS



Our Lady of Lourdes

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

0 50' 100'

READINGTON TOWNSHIP LIBRARY

Subwatershed: Rockaway Creek

Site Area: 94,573 sq. ft.

Address: 255 Main Street
Whitehouse Station, NJ 08889

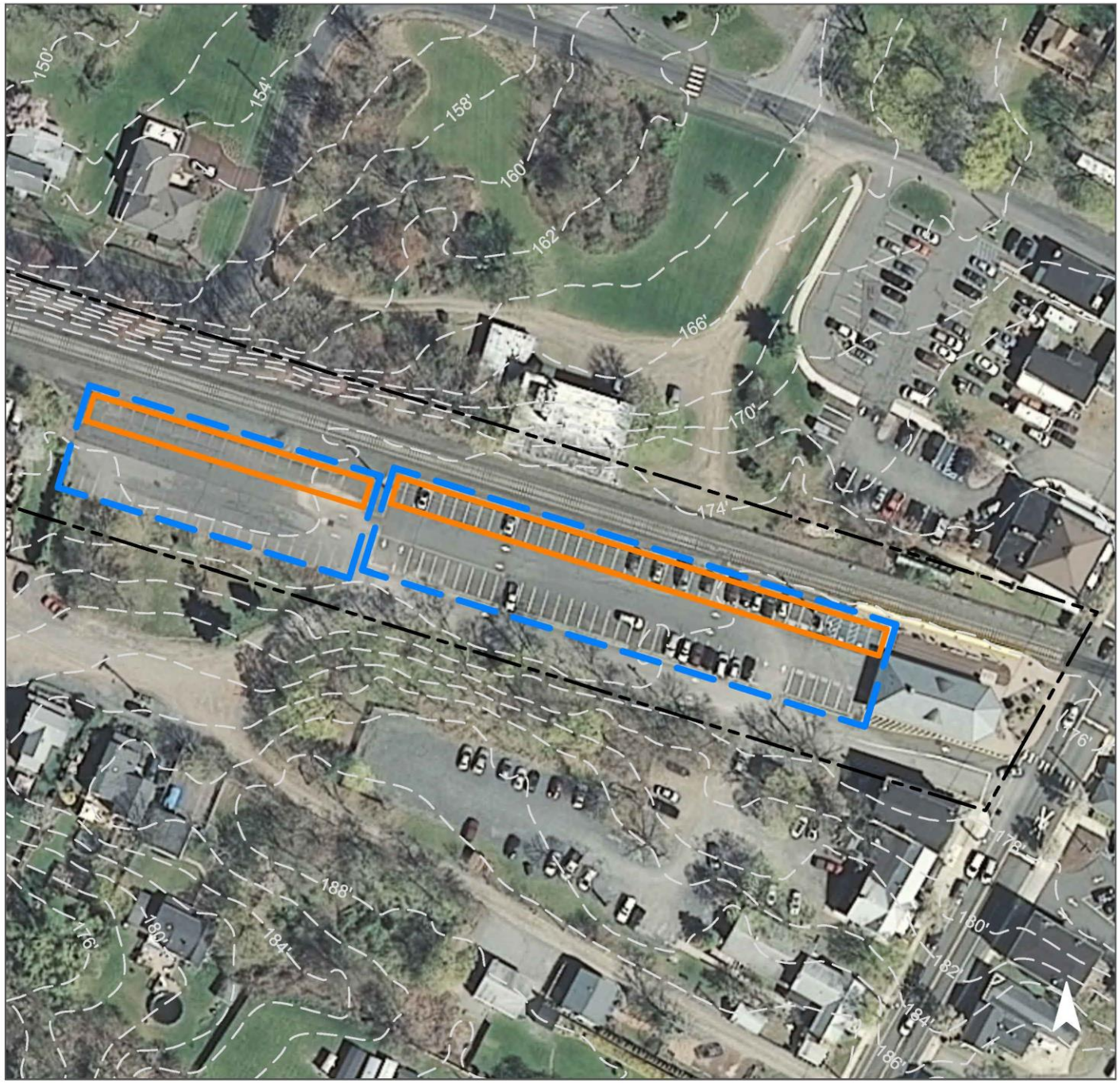
Block and Lot: Block 22, Lot 100, 102

The library runoff drains into connected downspouts. The runoff from the parking lot flows primarily toward the railroad tracks although some is caught by catch basins. Parking spaces can be replaced with pervious pavement to capture and infiltrate stormwater. 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"
69	64,953	3.1	32.8	298.2	0.051	1.78

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	0.898	150	68,001	2.55	9,450	$236,250

GREEN INFRASTRUCTURE RECOMMENDATIONS



Readington Township Library

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

0 50' 100'

SPINNING WHEEL DINER

Subwatershed: Rockaway Creek

Site Area: 179,075 sq. ft.

Address: 283 Us Highway 22
Whitehouse Station, NJ 08889

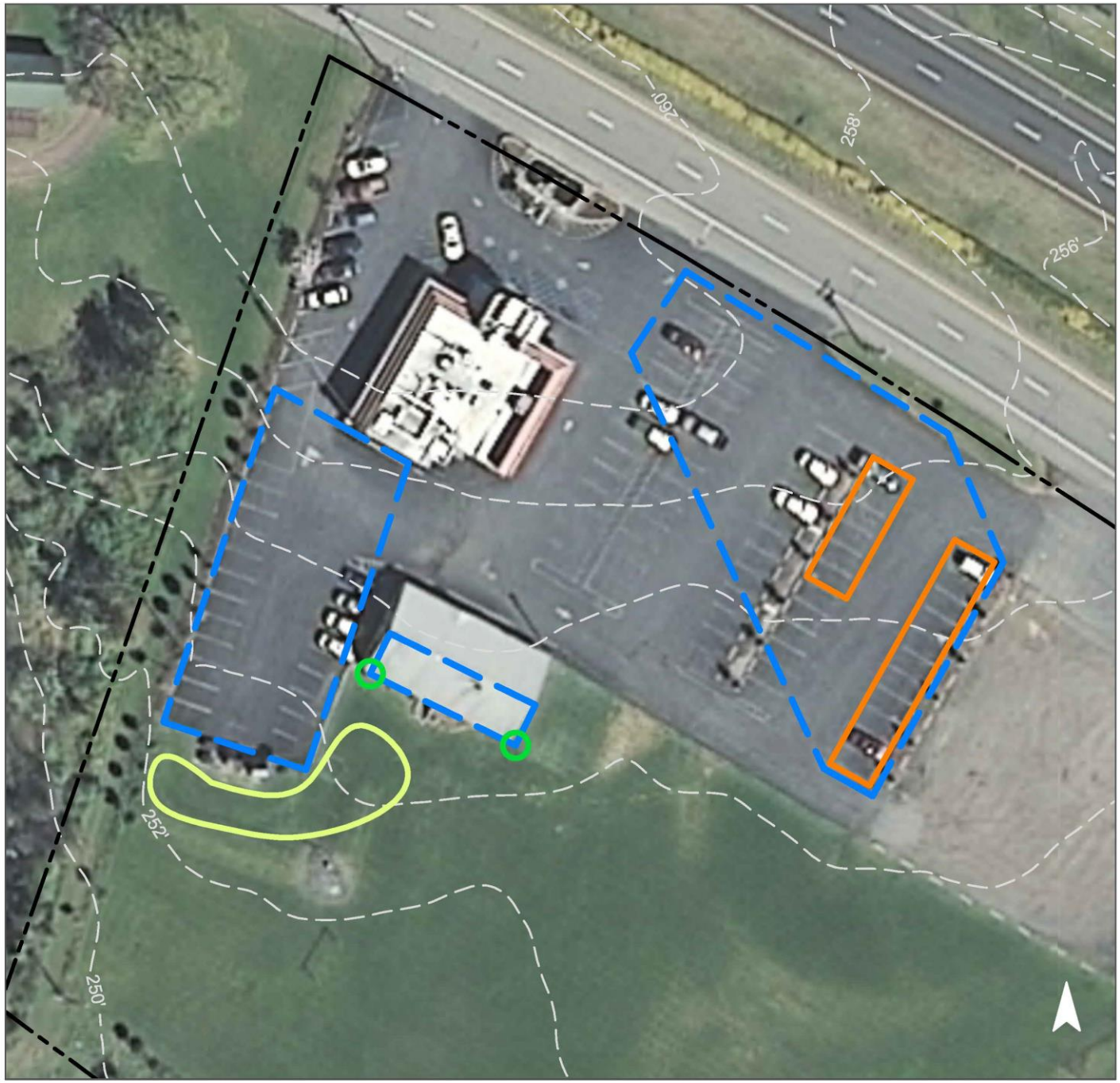
Block and Lot: Block 20, Lot 2,3

The diner's stormwater primarily comes from the parking lot, which flows into the surrounding field and gravel area at the east end. The runoff from the east area can be captured by replacing parking spaces with pervious pavement. Runoff from the southeast area can be captured, treated, and infiltrated by installing a bioretention system. 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"
44	79,002	3.8	39.9	362.7	0.062	2.17

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	0.234	39	17,765	0.67	2,250	$11,250
Pervious pavements	0.394	66	29,883	1.12	2,780	$69,500

GREEN INFRASTRUCTURE RECOMMENDATIONS



Spinning Wheel Diner

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

0 30' 60'

US POST OFFICE

Subwatershed: Rockaway Creek

Site Area: 122,167 sq. ft.

Address: 273 Main Street
Whitehouse Station, NJ 08889

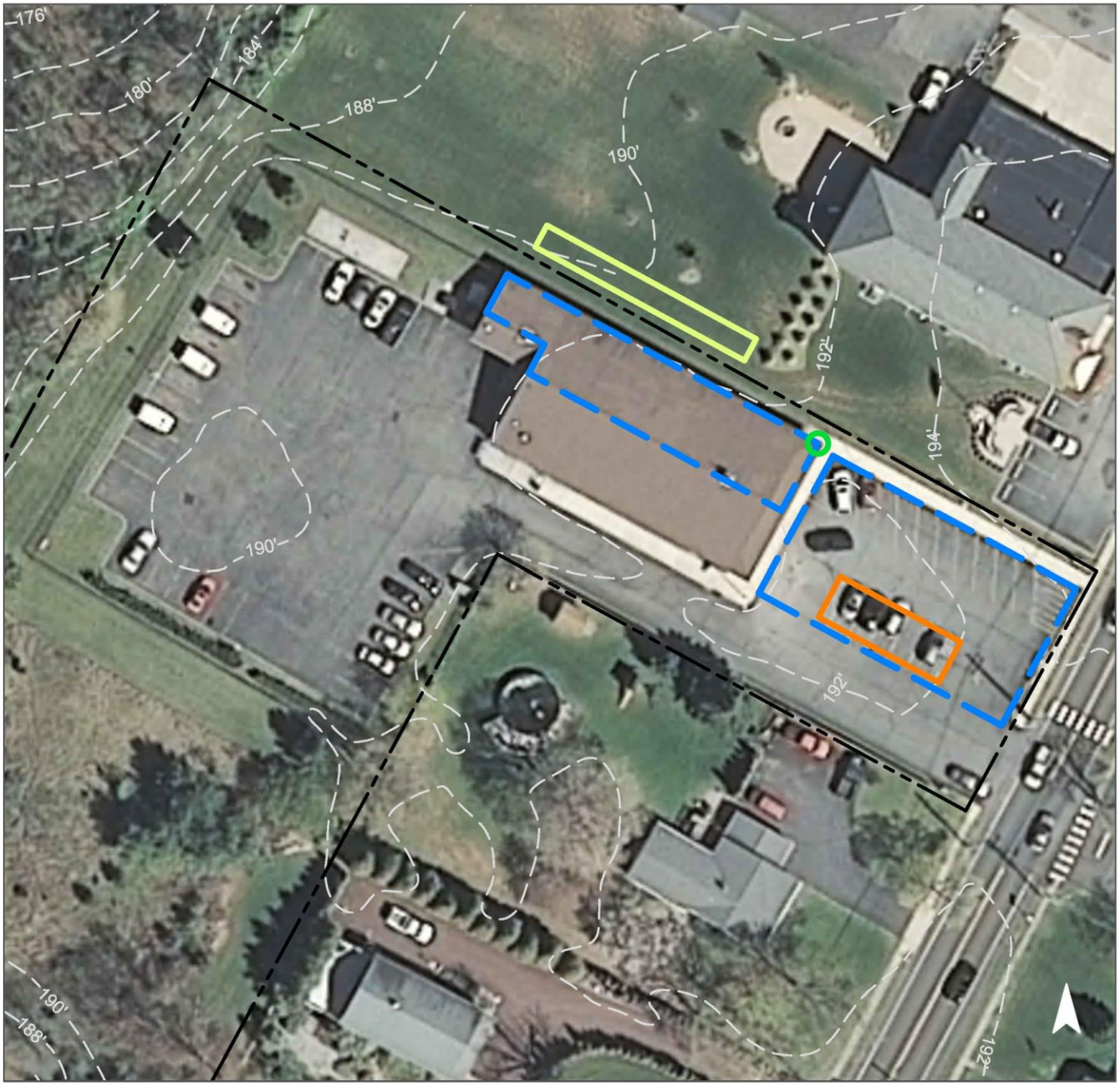
Block and Lot: Block 22, Lot 42

The parking lots drain to catch basins. The rooftop runoff from the north side can be treated by adding gutters and directing water into a rain garden on the fire department's property if permission was granted. The south side roof runoff can be treated by replacing the sidewalk with pervious pavement. Parking spaces can be replaced with pervious pavement to capture and infiltrate stormwater. 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"
40	48,699	2.3	24.6	223.6	0.038	1.34

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
Bioretention systems	0.094	16	7,143	0.27	900	$4,500
Pervious pavements	0.173	29	13,105	0.49	975	$24,375

GREEN INFRASTRUCTURE RECOMMENDATIONS



US Post Office

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

0 30' 60'

WHITEHOUSE MALL

Subwatershed: Rockaway Creek

Site Area: 445,131 sq. ft.

Address: 531 U.S. 22
Whitehouse Station, NJ 08889

Block and Lot: Block 34, Lot 1, 31, 33

Parking spaces can be replaced with pervious pavement to capture and infiltrate stormwater. 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"
72	320,713	15.5	162.0	1,472.5	0.250	8.80

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	2.617	438	198,287	7.44	24,180	$604,500

GREEN INFRASTRUCTURE RECOMMENDATIONS

Whitehouse Mall

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

0 50' 100'

WHITEHOUSE RESCUE SQUAD

Subwatershed: Rockaway Creek

Site Area: 39,364 sq. ft.

Address: 269 Main Street
Whitehouse Station, NJ 08889

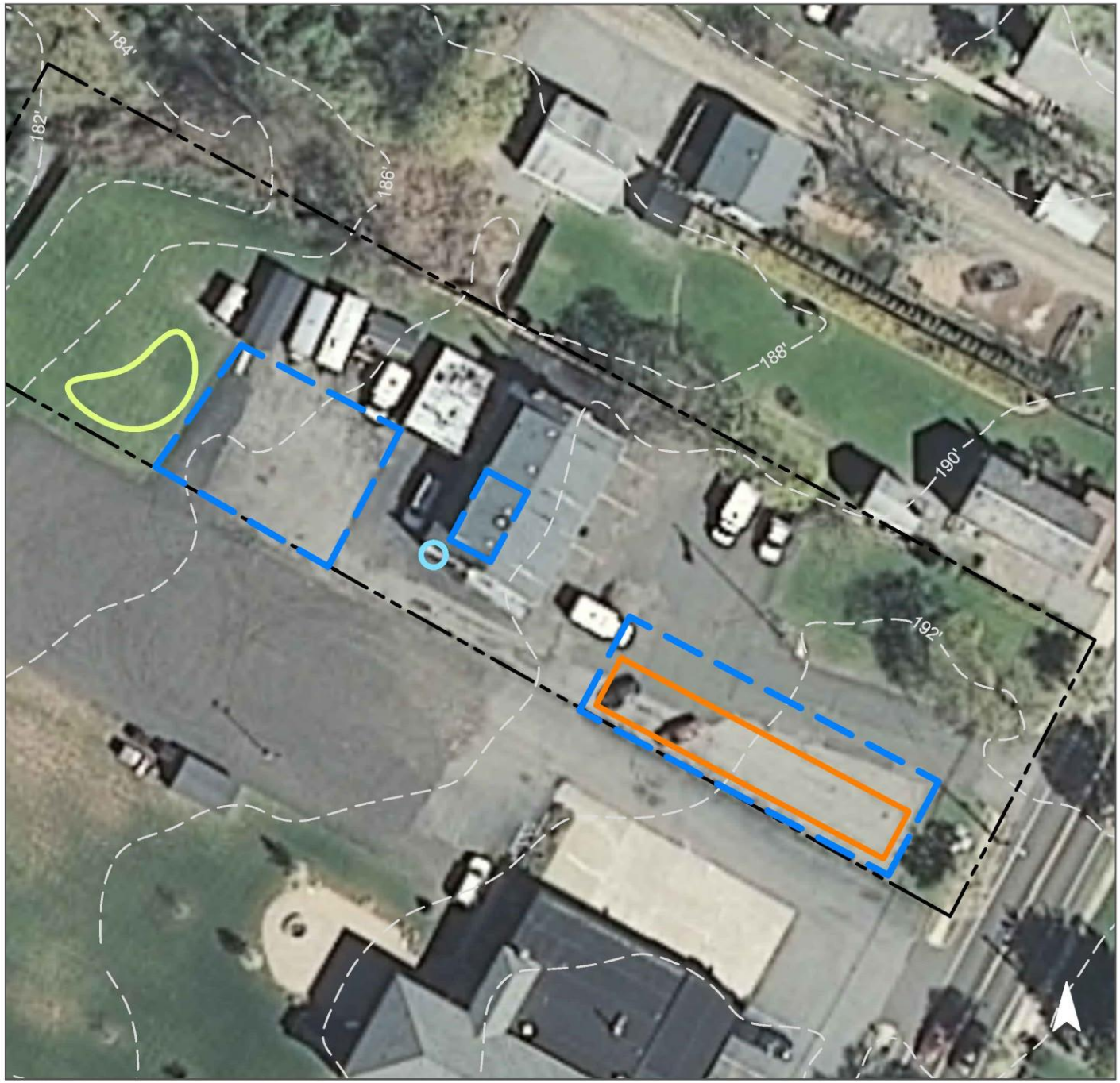
Block and Lot: Block 22, Lot 49

The rescue squad's stormwater comes from its paved areas, which drain toward the northwest turf grass area. The rooftop runoff flows down disconnected downspouts. The paved runoff in the front can be infiltrated by replacing parking spaces with pervious pavement. The runoff from the building can be harvested inside a cistern, which can be used for washing vehicles. A bioretention system can be constructed in the turf grass behind the building to capture, treat, and infiltrate runoff. 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"
70	27,519	1.3	13.9	126.3	0.021	0.75

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	0.081	14	6,119	0.23	775	$3,875
Pervious pavements	0.104	17	7,899	0.30	1,870	$46,750
Rainwater harvesting systems	0.010	2	375	0.03	375 (gal)	$750

GREEN INFRASTRUCTURE RECOMMENDATIONS



Whitehouse Rescue Squad

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

0 25' 50'

WHITEHOUSE STATION FIRE COMPANY

Subwatershed: Rockaway Creek

Site Area: 79,776 sq. ft.

Address: 271 Main Street
Whitehouse Station, NJ 08889

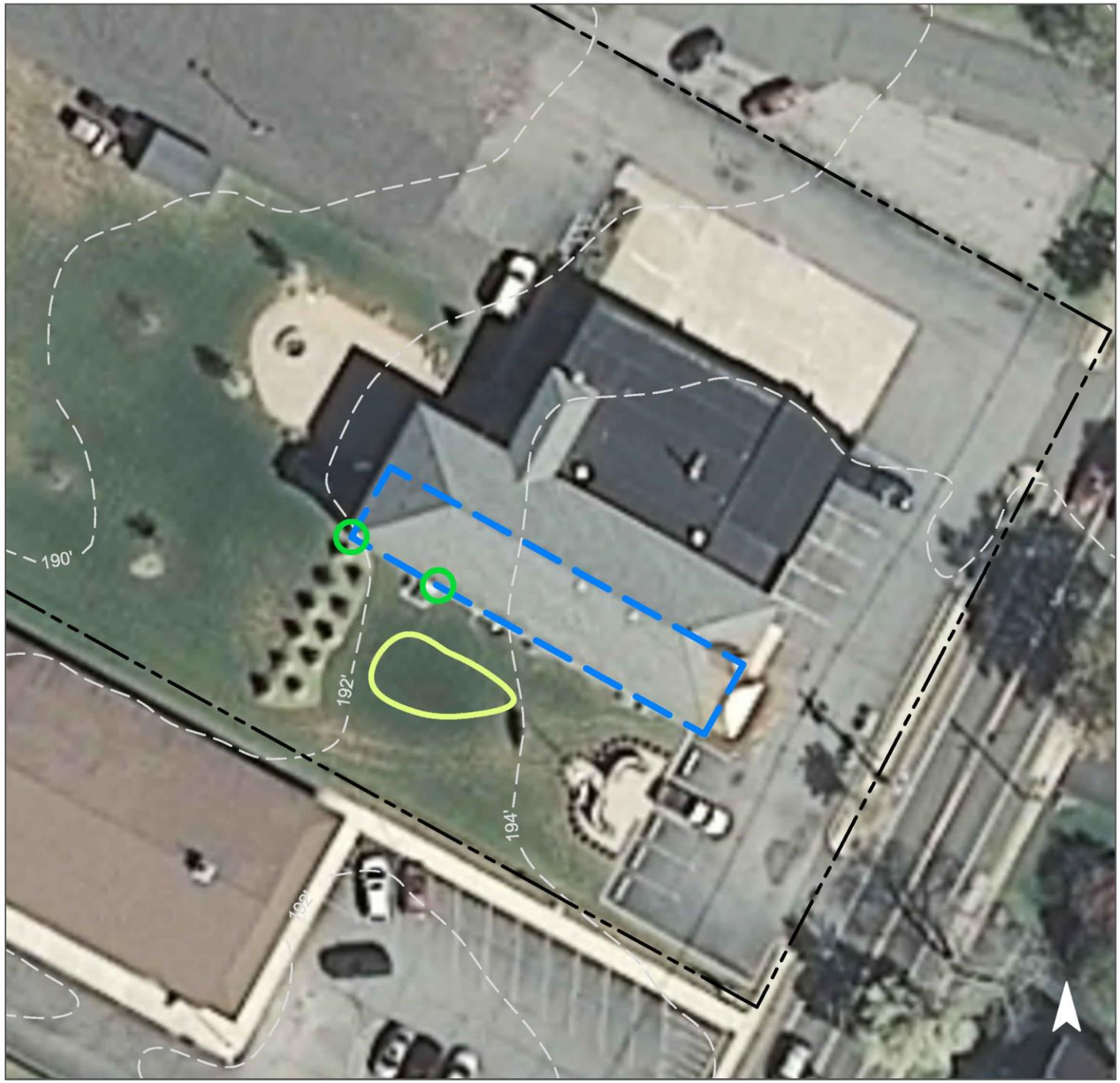
Block and Lot: Block 22, Lot 47

The fire station primarily has internal drainage with connected downspouts on the south and east sides. The paved areas drain either toward the street, the northern turf grass and wooded area, or to the neighboring rescue squad. A bioretention system can be built on the south face where the nearby downspouts can be disconnected and redirected into it to capture, treat and infiltrate roof runoff. 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"
42	33,843	1.6	17.1	155.4	0.026	0.93

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	0.058	10	4,391	0.16	550	$2,750

GREEN INFRASTRUCTURE RECOMMENDATIONS



Whitehouse Station Fire Company

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

0 20' 40'

WHITEHOUSE VETERINARY HOSPITAL

Subwatershed: Rockaway Creek

Site Area: 14,016 sq. ft.

Address: 274 Main Street
Whitehouse Station, NJ 08889

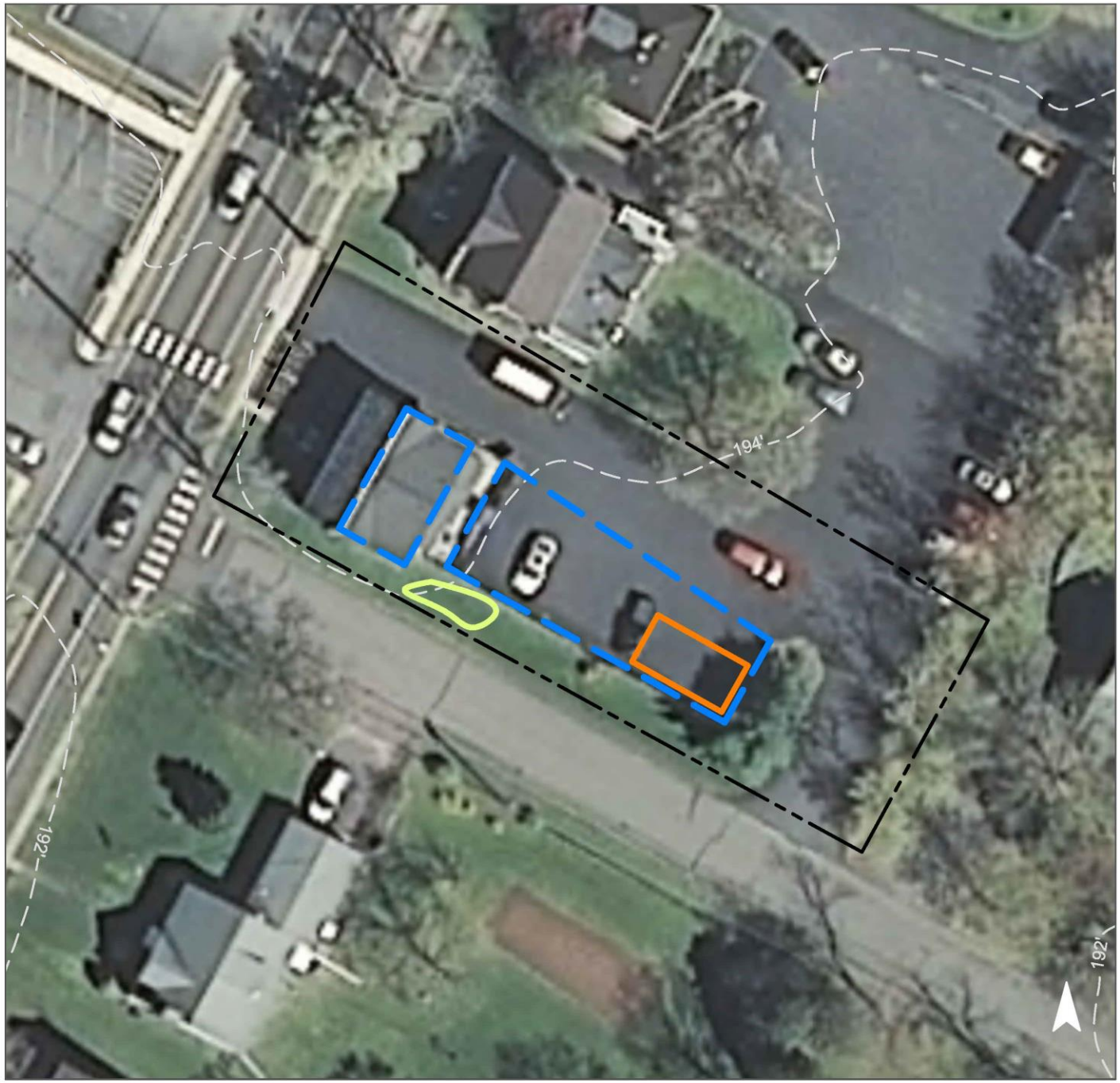
Block and Lot: Block 29, Lot 10

The runoff from the building flows down disconnected downspouts onto the driveway and turf grass. The parking lot and driveway runoff drain into the roadways. A bioretention system can be constructed on the south face to capture, treat, and infiltrate rooftop runoff. Parking spaces can be replaced with pervious pavement to capture and infiltrate stormwater. 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"
92	12,914	0.6	6.5	59.3	0.010	0.35

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	0.018	3	1,399	0.05	150	$750
Pervious pavements	0.061	10	4,600	0.17	380	$9,500

GREEN INFRASTRUCTURE RECOMMENDATIONS



Whitehouse Veterinary Hospital

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

0 20' 40'

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 TP (lb/yr)	Existing Annual Loads TN (lb/yr)	Existing Annual Loads TSS (lb/yr)	I.C. %	I.C. Area (ac)	I.C. Area (SF)	Runoff Volumes from I.C. Water Quality Storm (1.25" over 2-hours) (Mgal)	Runoff Volumes from I.C. Annual (Mgal)
CHAMBERS BROOK SUBWATERSHED	**6.42**	**279,683**			**6.8**	**71.4**	**649.2**		**3.25**	**141,404**	**0.110**	**3.88**
Whitehouse School												
Total Site Info	6.42	279,683	35	14	6.8	71.4	649.2	51	3.25	141,404	0.110	3.88
HOLLAND BROOK SUBWATERSHED	**115.60**	**5,035,566**			**35.6**	**373.3**	**3,393.9**		**16.97**	**739,191**	**0.576**	**20.27**
Holland Brook School												
Total Site Info	47.08	2,050,634	48	21.28	12.3	129.0	1,173.0	12	5.87	255,485	0.199	7.01
Readington Middle School												
Total Site Info	21.74	947,054	48	21.01	14.3	149.4	1,358.1	31	6.79	295,795	0.230	8.11
Stanton Ridge Golf & Country Club												
Total Site Info	46.78	2,037,878	51	21.28	9.1	94.9	862.8	9	4.31	187,911	0.146	5.15
LAMINGTON RIVER SUBWATERSHED	**2.40**	**104,744**			**2.1**	**21.9**	**199.3**		**1.00**	**43,401**	**0.034**	**1.19**
Whitehouse United Methodist Church												
Total Site Info	2.40	104,744	13	36	2.1	21.9	199.3	41	1.00	43,401	0.034	1.19
ROCKAWAY CREEK SUBWATERSHED	**29.99**	**1,306,462**			**36.1**	**378.3**	**3,439.3**		**17.20**	**749,089**	**0.584**	**20.55**
Our Lady of Lourdes												
Total Site Info	7.63	332,360	28	10	7.8	81.5	741.3	49	3.71	161,446	0.126	4.43
Readington Township Library												
Total Site Info	2.17	94,573	22	100, 102	3.1	32.8	298.2	69	1.49	64,953	0.051	1.78
Spinning Wheel Diner												
Total Site Info	4.11	179,075	20	2,3	3.8	39.9	362.7	44	1.81	79,002	0.062	2.17
US Post Office												
Total Site Info	2.80	122,167	22	42	2.3	24.6	223.6	40	1.12	48,699	0.038	1.34

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)
Whitehouse Mall												
Total Site Info	10.22	445,131	34	1,31,33	15.5	162.0	1,472.5	72	7.36	320,713	0.250	8.80
Whitehouse Rescue Squad												
Total Site Info	0.90	39,364	22	49	1.3	13.9	126.3	70	0.63	27,519	0.021	0.75
Whitehouse Station Fire Company												
Total Site Info	1.83	79,776	22	47	1.6	17.1	155.4	42	0.78	33,843	0.026	0.93
Whitehouse Veterinary Hospital												
Total Site Info	0.32	14,016	29	10	0.6	6.5	59.3	92	0.30	12,914	0.010	0.35

e. Summary of Proposed Green Infrastructure Practices

Summary of Proposed Green Infrastructure Practices

	Subwatershed/Site Name/Total Site Info/GI Practice	Potential Management Area Area (SF)	Potential Management Area Area (ac)	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 %
	CHAMBERS BROOK SUBWATERSHED	**33,120**	**0.76**	**0.863**	**144**	**65,375**	**2.46**	**7,117**			**$106,865**	**23.4%**
1	**Whitehouse School**											
	Bioretention systems/rain gardens	14,120	0.32	0.368	62	27,870	1.05	3,553	5	SF	$17,765	10.0%
	Pervious pavements	19,000	0.44	0.495	83	37,505	1.41	3,564	25	SF	$89,100	13.4%
	Total Site Info	**33,120**	**0.76**	**0.863**	**144**	**65,375**	**2.46**	**7,117**			**$106,865**	**23.4%**
	HOLLAND BROOK SUBWATERSHED	**120,585**	**2.77**	**3.142**	**526**	**238,029**	**8.93**	**27,675**			**$471,375**	**16.3%**
2	**Holland Brook School**											
	Bioretention systems/rain gardens	11,600	0.27	0.302	51	22,896	0.86	2,925	5	SF	$14,625	4.5%
	Pervious pavements	16,900	0.39	0.440	74	33,361	1.25	5,550	25	SF	$138,750	6.6%
	Total Site Info	**28,500**	**0.65**	**0.743**	**124**	**56,257**	**2.11**	**8,475**			**$153,375**	**11.2%**
3	**Readington Middle School**											
	Bioretention systems/rain gardens	33,385	0.77	0.870	146	65,899	2.47	8,100	5	SF	$40,500	11.3%
	Total Site Info	**33,385**	**0.77**	**0.870**	**146**	**65,899**	**2.47**	**8,100**			**$40,500**	**11.3%**
4	**Stanton Ridge Golf & Country Club**											
	Pervious pavements	58,700	1.35	1.529	256	115,873	4.35	11,100	25	SF	$277,500	31.2%
	Total Site Info	**58,700**	**1.35**	**1.529**	**256**	**115,873**	**4.35**	**11,100**			**$277,500**	**31.2%**
	LAMINGTON RIVER SUBWATERSHED	**15,810**	**0.36**	**0.412**	**69**	**31,206**	**1.18**	**3,315**			**$59,575**	**36.4%**
5	**Whitehouse United Methodist Church**											
	Bioretention systems/rain gardens	4,660	0.11	0.121	20	9,200	0.35	1,165	5	SF	$5,825	10.7%
	Pervious pavements	11,150	0.26	0.291	49	22,006	0.83	2,150	25	SF	$53,750	25.7%
	Total Site Info	**15,810**	**0.36**	**0.412**	**69**	**31,206**	**1.18**	**3,315**			**$59,575**	**36.4%**

Summary of Proposed Green Infrastructure Practices

	Subwatershed/Site Name/Total Site Info/GI Practice	Potential Management Area Area (SF)	Potential Management Area Area (ac)	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 %
	ROCKAWAY CREEK SUBWATERSHED	**234,190**	**5.38**	**6.102**	**1,021**	**461,854**	**17.34**	**55,660**			**$1,173,325**	**31.3%**
6	**Our Lady of Lourdes**											
	Bioretention systems/rain gardens	23,260	0.53	0.606	101	45,912	1.72	5,815	5	SF	$29,075	14.4%
	Pervious pavements	28,865	0.66	0.752	126	56,975	2.14	5,210	25	SF	$130,250	17.9%
	Total Site Info	**52,125**	**1.20**	**1.358**	**227**	**102,887**	**3.86**	**11,025**			**$159,325**	**32.3%**
7	**Readington Township Library**											
	Pervious pavements	34,450	0.79	0.898	150	68,001	2.55	9,450	25	SF	$236,250	53.0%
	Total Site Info	**34,450**	**0.79**	**0.898**	**150**	**68,001**	**2.55**	**9,450**			**$236,250**	**53.0%**
8	**Spinning Wheel Diner**											
	Bioretention systems/rain gardens	9,000	0.21	0.234	39	17,765	0.67	2,250	5	SF	$11,250	11.4%
	Pervious pavements	15,140	0.35	0.394	66	29,883	1.12	2,780	25	SF	$69,500	19.2%
	Total Site Info	**24,140**	**0.55**	**0.629**	**105**	**47,648**	**1.79**	**5,030**			**$80,750**	**30.6%**
9	**US Post Office**											
	Bioretention systems/rain gardens	3,620	0.08	0.094	16	7,143	0.27	900	5	SF	$4,500	7.4%
	Pervious pavements	6,640	0.15	0.173	29	13,105	0.49	975	25	SF	$24,375	13.6%
	Total Site Info	**10,260**	**0.24**	**0.267**	**45**	**20,248**	**0.76**	**1,875**			**$28,875**	**21.1%**
10	**Whitehouse Mall**											
	Pervious pavements	100,450	2.31	2.617	438	198,287	7.44	24,180	25	SF	$604,500	31.3%
	Total Site Info	**100,450**	**2.31**	**2.617**	**438**	**198,287**	**7.44**	**24,180**			**$604,500**	**31.3%**
11	**Whitehouse Rescue Squad**											
	Bioretention systems/rain gardens	3,100	0.07	0.081	14	6,119	0.23	775	5	SF	$3,875	11.3%
	Pervious pavements	4,000	0.09	0.104	17	7,899	0.30	1,870	25	SF	$46,750	14.5%
	Rainwater harvesting systems	400	0.01	0.010	2	375	0.03	375	2	gal	$750	1.5%
	Total Site Info	**7,500**	**0.17**	**0.195**	**33**	**14,393**	**0.56**	**3,020**			**$51,375**	**27.3%**
12	**Whitehouse Station Fire Company**											
	Bioretention systems/rain gardens	2,225	0.05	0.058	10	4,391	0.16	550	5	SF	$2,750	6.6%
	Total Site Info	**2,225**	**0.05**	**0.058**	**10**	**4,391**	**0.16**	**550**			**$2,750**	**6.6%**

Summary of Proposed Green Infrastructure Practices

	Subwatershed/Site Name/Total Site Info/GI Practice	Potential Management Area		Recharge Potential	TSS Removal Potential	Max Volume Reduction Potential	Peak Discharge Reduction Potential	Size of BMP	Unit Cost	Unit	Total Cost	I.C. Treated
		Area (SF)	Area (ac)	(Mgal/yr)	(lbs/yr)	(gal/storm)	(cfs)	(SF)	($)		($)	%
13	**Whitehouse Veterinary Hospital**											
	Bioretention systems/rain gardens	710	0.02	0.018	3	1,399	0.05	150	5	SF	$750	5.5%
	Pervious pavements	2,330	0.05	0.061	10	4,600	0.17	380	25	SF	$9,500	18.0%
	Total Site Info	**3,040**	**0.07**	**0.079**	**13**	**5,999**	**0.22**	**530**			**$9,500**	**23.5%**