



**Impervious Cover Reduction Action Plan
for
Byram Township, Sussex County, New Jersey**

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

December 9, 2016



Table of Contents

Introduction	1
Methodology	1
Green Infrastructure Practices	8
Potential Project Sites	10
Conclusion	11

Attachment: Climate Resilient Green Infrastructure

- a. Green Infrastructure Sites
- b. Proposed Green Infrastructure Concepts
- c. Detention Basin Retrofit: Stanhope Sparta Road
- d. Hydrologic Analysis Areas
- e. Summary of Existing Conditions
- f. Summary of Proposed Green Infrastructure Practices

Introduction

Located in Sussex County in Northern New Jersey, Byram Township covers approximately 22.7 square miles south of Lafayette. Figures 1 and 2 illustrate that Byram Township is dominated by forest land uses. A total of 17.4% of the municipality's land use is classified as urban. Of the urban land in Byram Township, 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 Byram 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 Byram Township. Based upon the 2007 NJDEP land use/land cover data, approximately 3.8% of Byram Township has impervious cover. This level of impervious cover suggests that the streams in Byram Township are likely sensitive streams.¹

Methodology

Byram 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

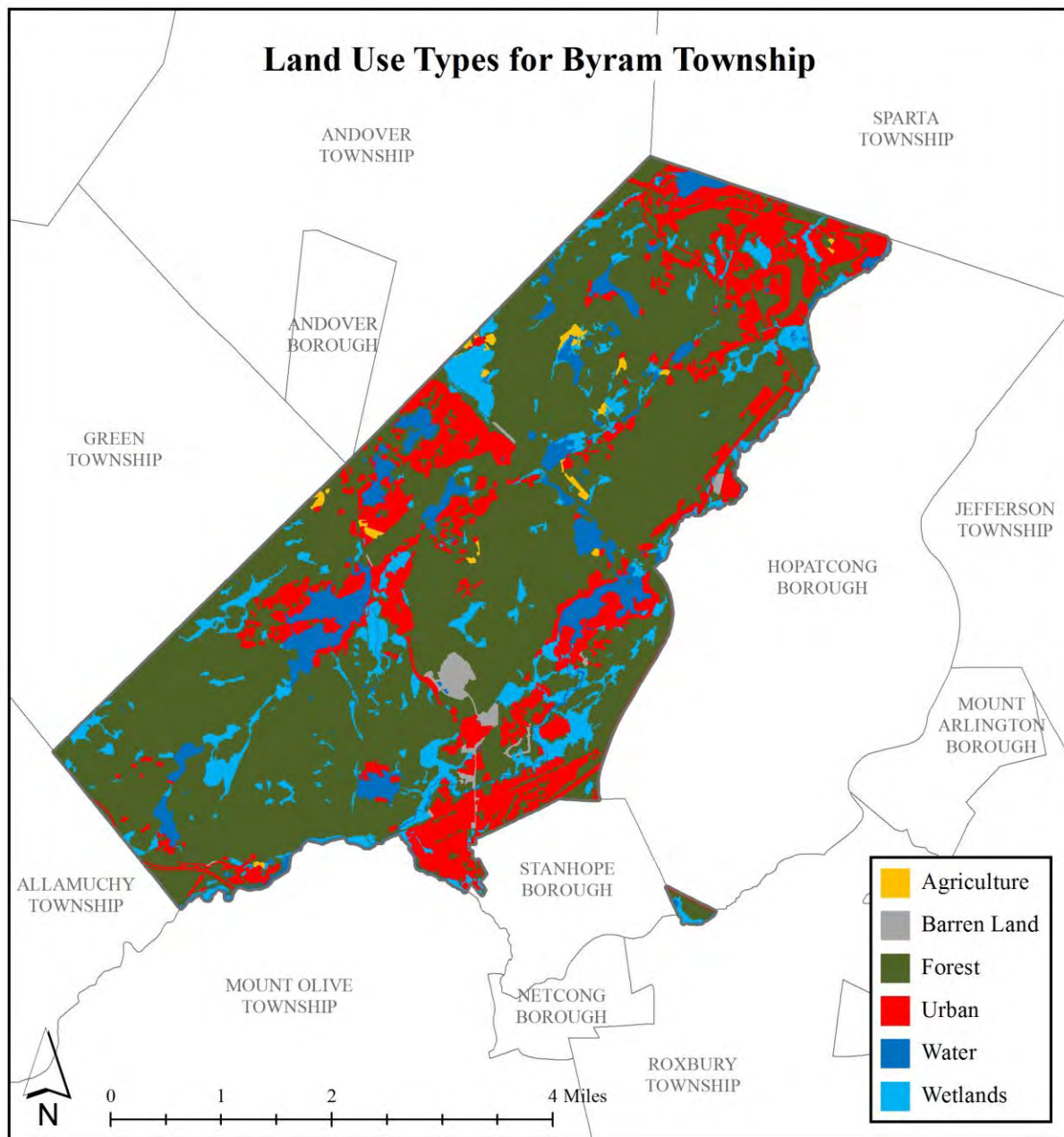


Figure 1: Map illustrating the land use in Byram Township

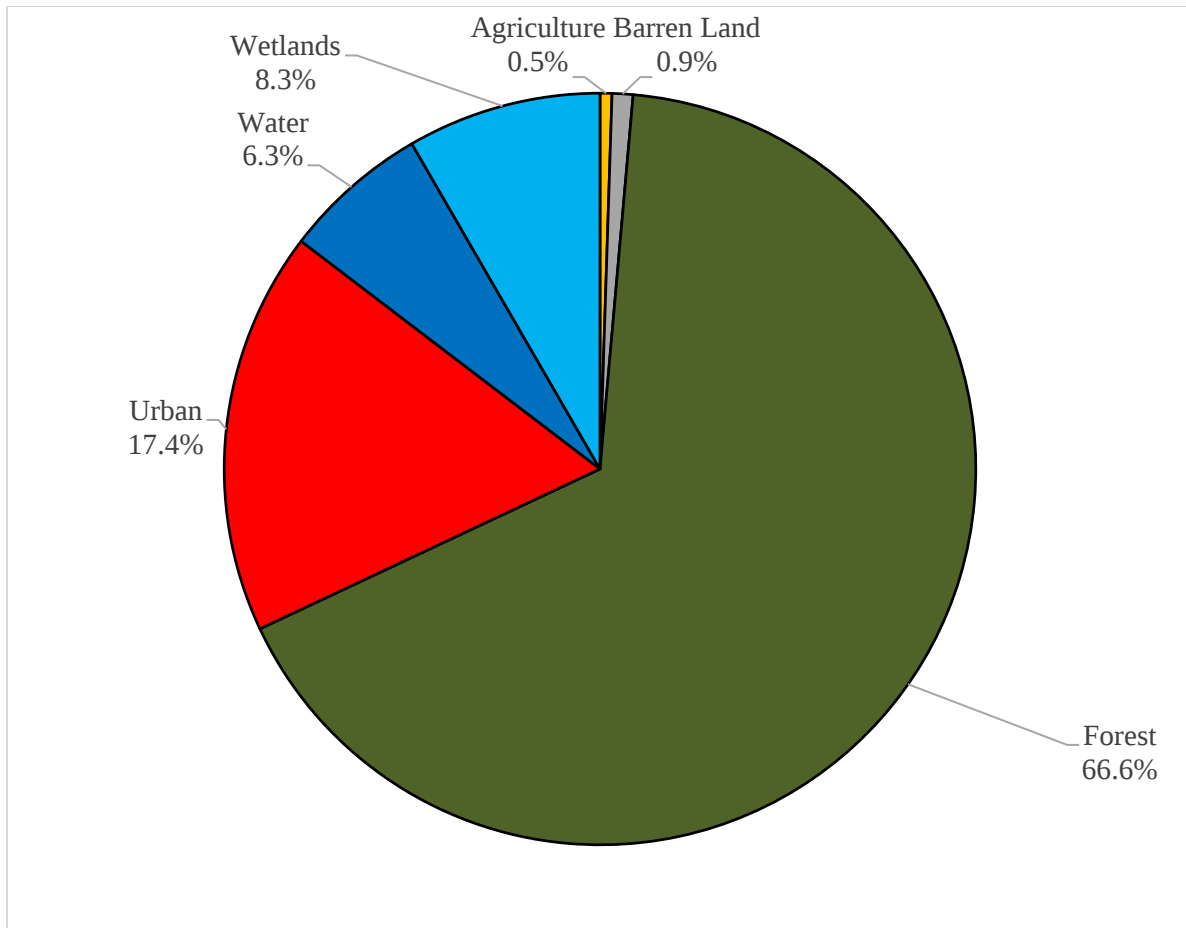


Figure 2: Pie chart illustrating the land use in Byram Township

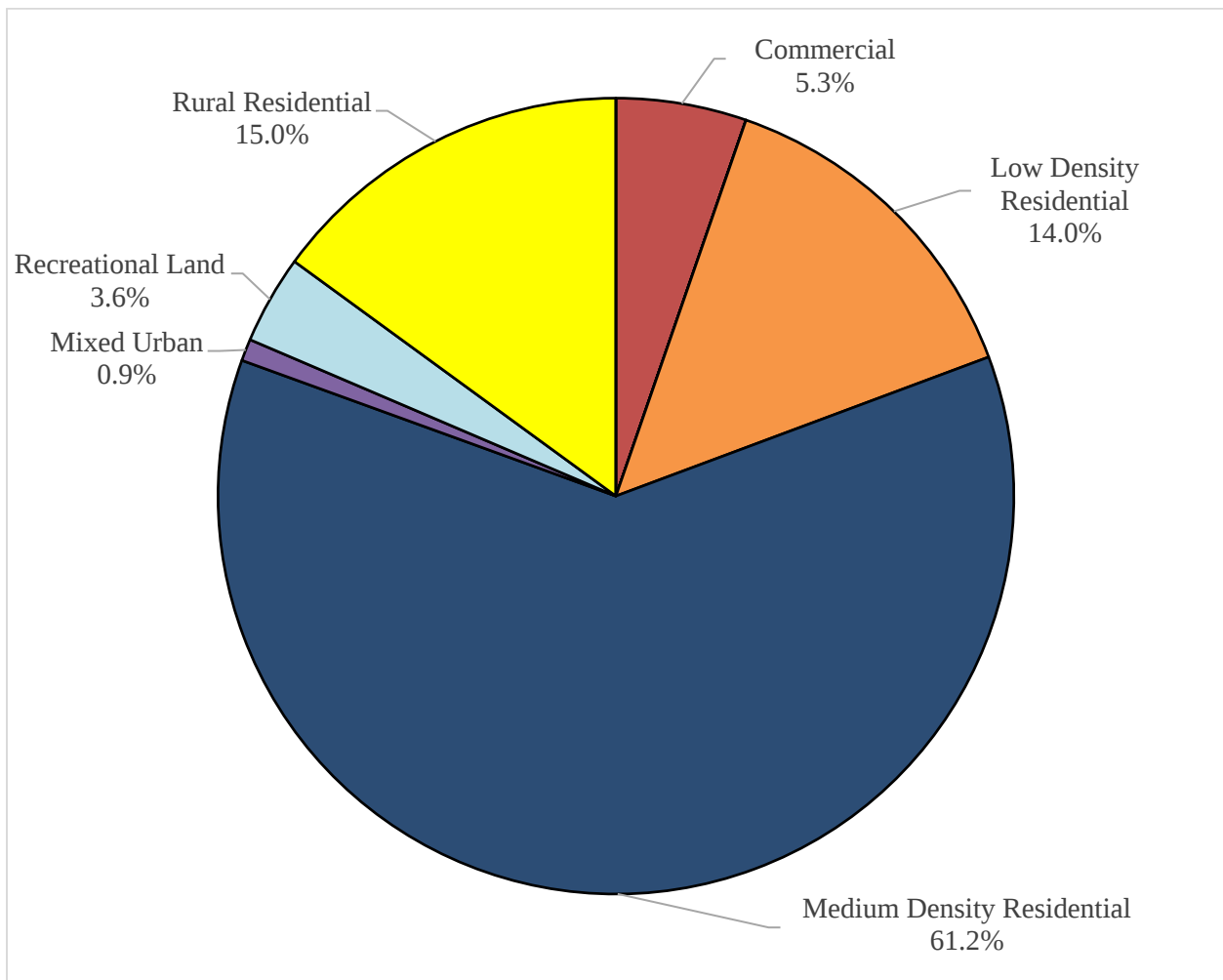


Figure 3: Pie chart illustrating the various types of urban land use in Byram Township

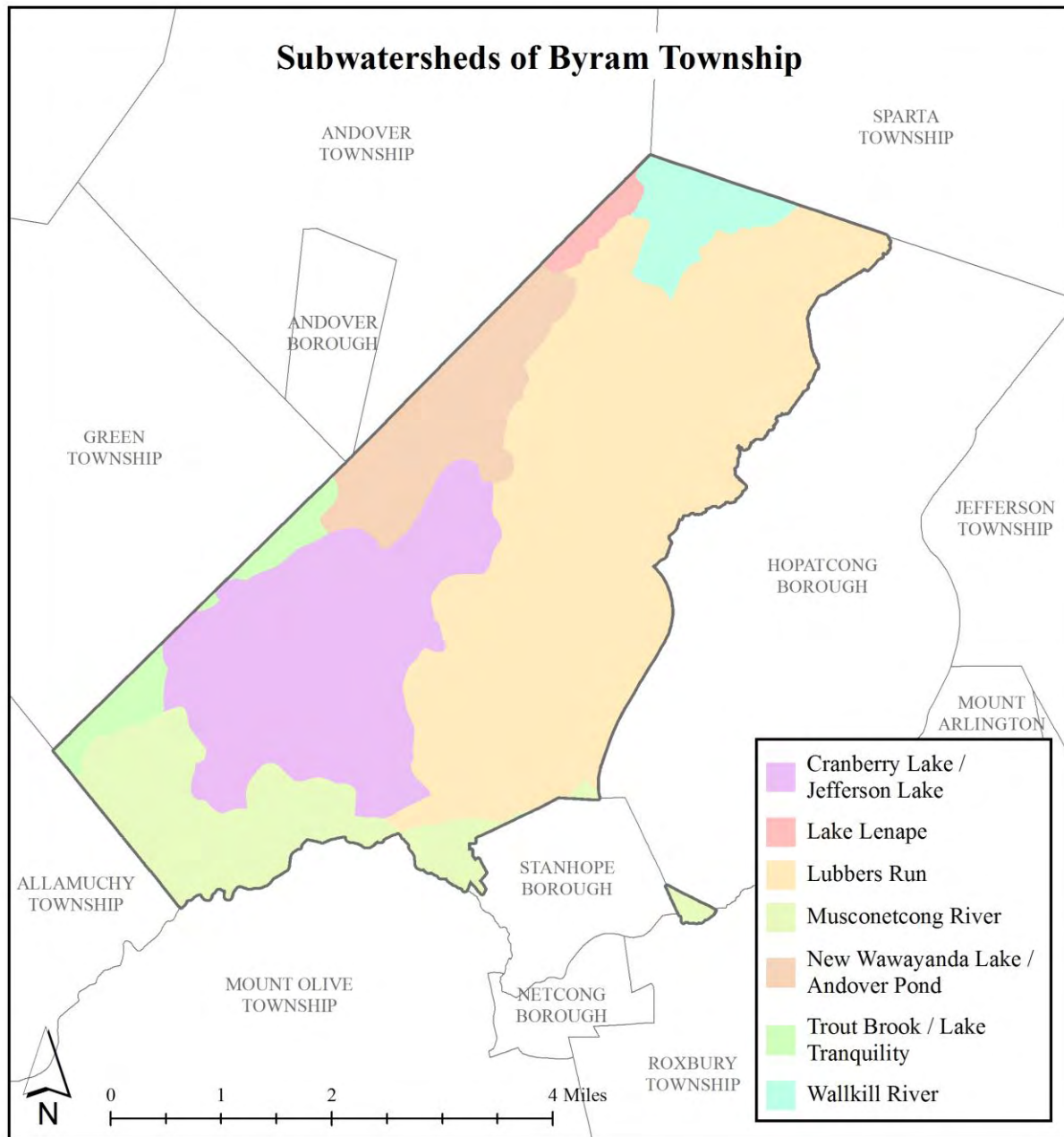


Figure 4: Map of the subwatersheds in Byram Township

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 Byram 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 Coefficients²

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 benefits³. A wide range of green infrastructure practices have been evaluated for the potential project sites in Byram. 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.



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.



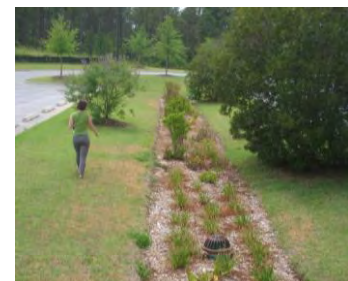
Rainwater harvesting systems (cistern or rain barrel)

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.*

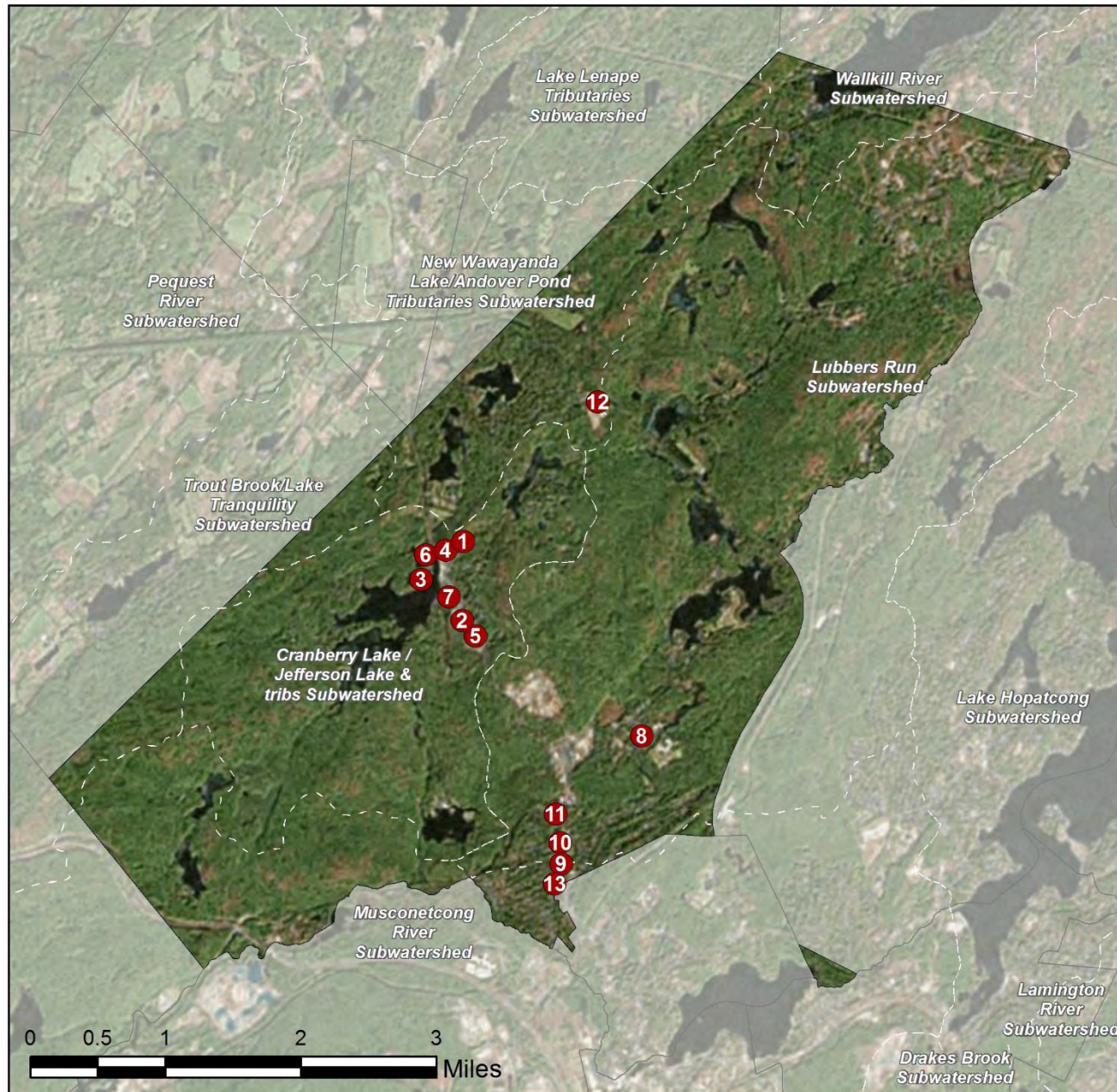
Conclusion

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. Green Infrastructure Sites

BYRAM TOWNSHIP: GREEN INFRASTRUCTURE SITES



SITES WITHIN THE CRANBERRY LAKE / JEFFERSON LAKE SUBWATERSHED:

1. 2 Tamarack Road
2. Byram Township Volunteer Firehouse
3. Cranberry Lake Community Club
4. Cranberry Market & Deli
5. Lakeland Emergency Squad
6. Sparta Medical Associates
7. Stonewood Tavern

SITES WITHIN THE LUBBERS RUN SUBWATERSHED:

8. Byram Municipal Court / Byram Township Hall
9. Byram Pizza
10. Dunkin Donuts
11. Santander Bank

SITES WITHIN THE LUBBERS RUN / NEW WAWAYANDA LAKE SUBWATERSHED:

12. C.O. Johnson Park

SITES WITHIN THE MUSCONETCONG RIVER SUBWATERSHED:

13. Classic Bagel & Deli

b. Proposed Green Infrastructure Concepts

2 TAMARACK ROAD



Subwatershed: Cranberry Lake

Site Area: 74,598 sq. ft.

Address: 2 Tamarack Road
Byram, NJ 07821

Block and Lot: Block 212, Lot 5

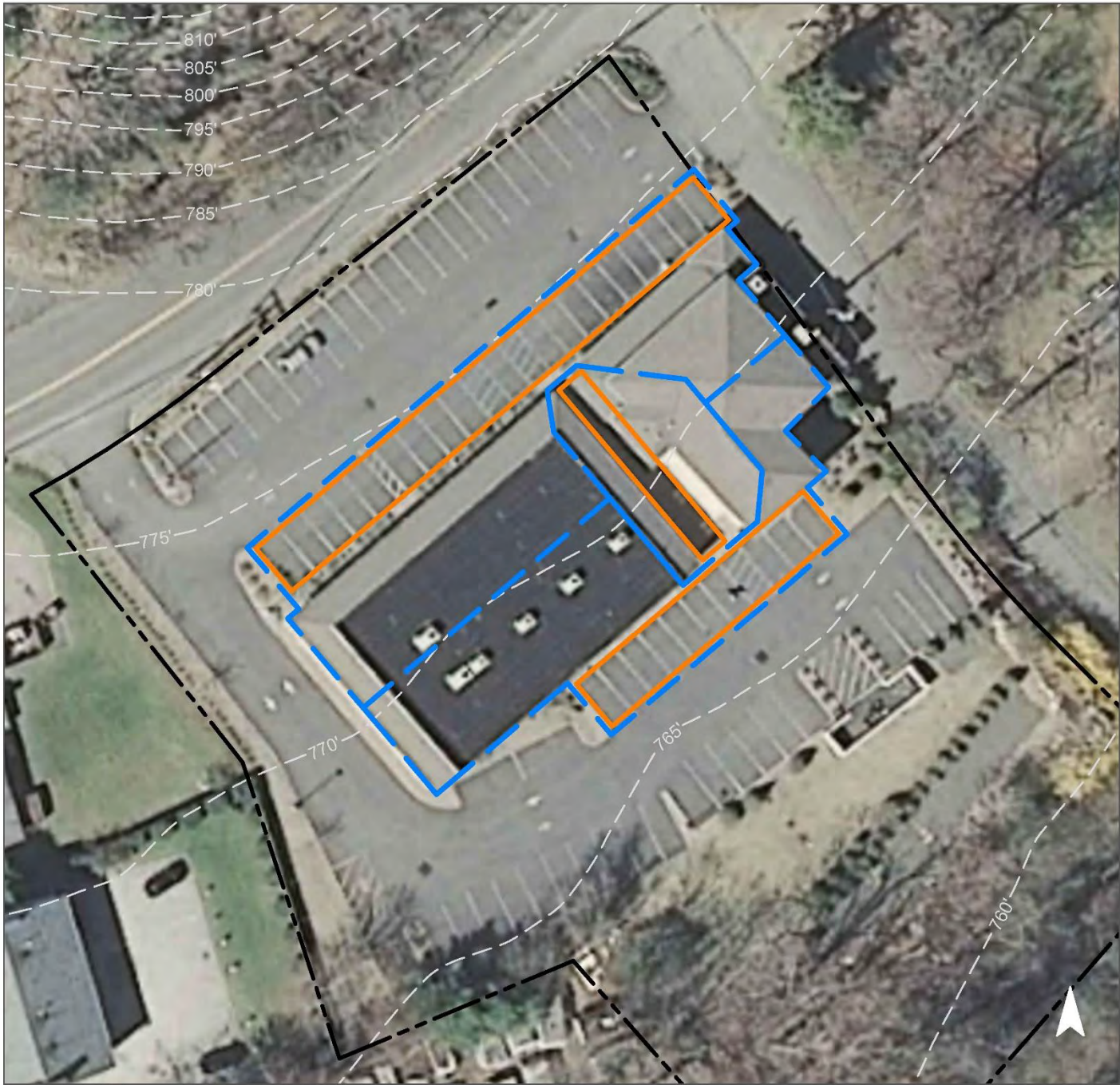


Large quantities of stormwater runoff are being generated by the parking lot and rooftop. Replacing some of the parking spaces with porous asphalt allows for a majority of this runoff to be captured and infiltrated. Stormwater runoff from the rooftop can also be managed by disconnecting the existing downspouts and replacing the pathway between the two buildings with grass pavers. 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"
71	52,853	2.5	26.7	242.7	0.041	1.45

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	0.539	90	38,290	0.478	5,800	\$145,000

GREEN INFRASTRUCTURE RECOMMENDATIONS



2 Tamarack Road

-  pervious pavement
-  drainage area
-  property line
-  2012 Aerial: NJOIT, OGIS



BYRAM TOWNSHIP VOLUNTEER FIREHOUSE



Subwatershed: Cranberry Lake

Site Area: 56,060 sq. ft.

Address: 255 Route 206
Byram, NJ 07821

Block and Lot: Block 212, Lot 7



The area north of the building used for parking can be replaced with porous asphalt to capture and infiltrate stormwater. A cistern can be implemented alongside the northern end of the building. The cistern will collect and manage stormwater runoff from the rooftop. The water collected can be used to wash the firetrucks or to water nearby vegetation. 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"
75	42,045	2.0	21.2	193.0	0.033	1.15

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 pavement	0.461	77	45,800	1.72	5,000	\$125,000
Rainwater harvesting	0.094	16	3,000	0.25	3,000 (gal)	\$6,000

GREEN INFRASTRUCTURE RECOMMENDATIONS



**Byram Township
Volunteer Firehouse**

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



CRANBERRY LAKE COMMUNITY CLUB



Subwatershed: Cranberry Lake

Site Area: 230,669 sq. ft.

Address: 268 Route 206
Byram, NJ 07821

Block and Lot: Block 214.03, Lot 1



The parking spaces are currently receiving stormwater runoff of the parking lot. The parking spots can be replaced with porous asphalt to capture and infiltrate this 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"
23	52,888	2.5	26.7	242.8	0.041	1.45

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	0.569	95	40,414	1.52	9,915	\$247,875

GREEN INFRASTRUCTURE RECOMMENDATIONS



Cranberry Lake Community Club

-  pervious pavement
-  drainage area
-  property line
-  2012 Aerial: NJOIT, OGIS



CRANBERRY MARKET & DELI



Subwatershed: Cranberry Lake

Site Area: 17,274 sq. ft.

Address: 274 Route 206
Byram, NJ 07821

Block and Lot: Block 216, Lot 2.03

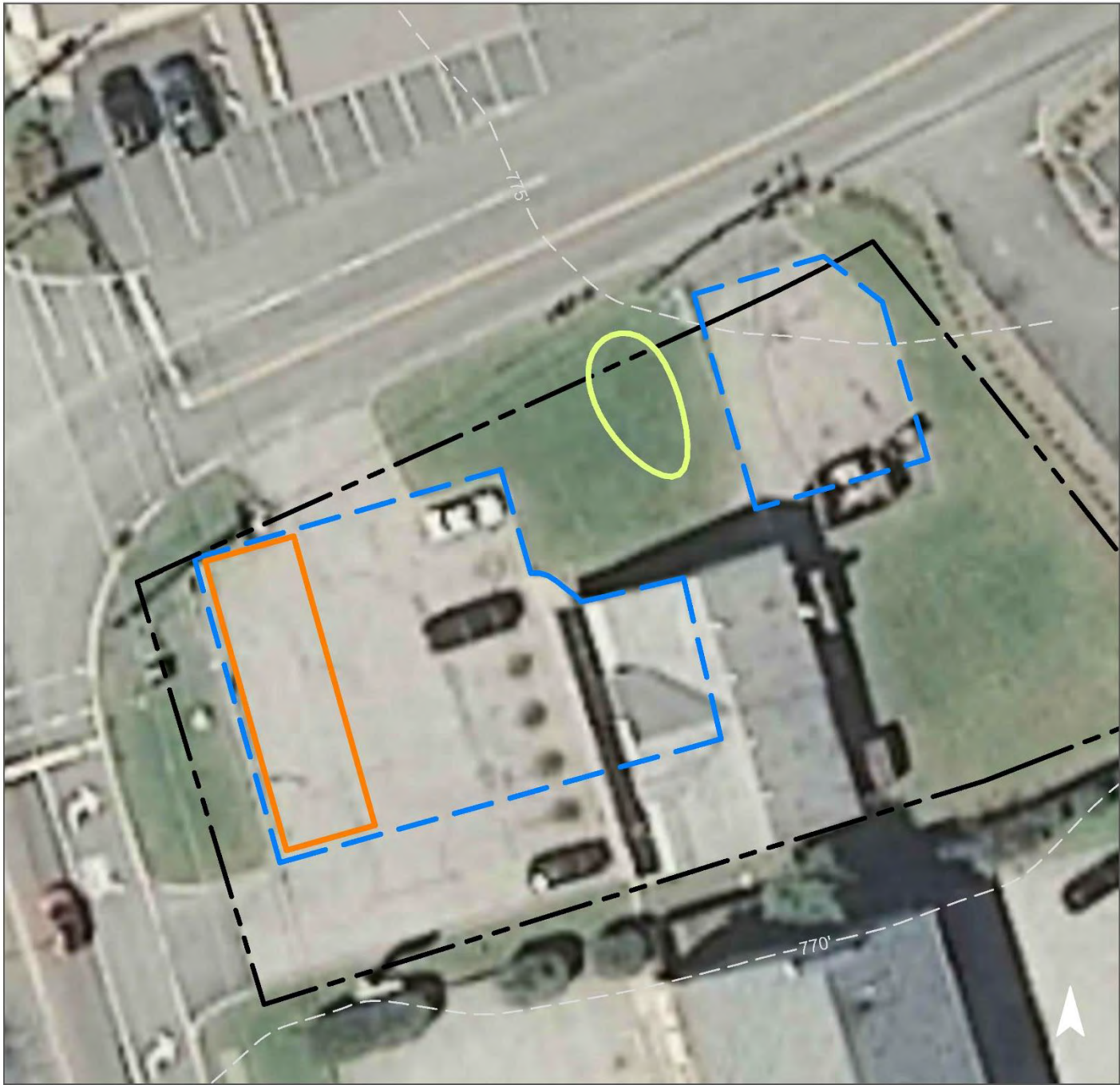


Parking spots in front of the building can be replaced with porous asphalt to capture and infiltrate stormwater from the parking lot and rooftop. A bioretention system can be implemented in the grassy area behind the building to manage stormwater runoff from the parking lot behind the building. A preliminary 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	12,955	0.6	6.5	59.5	0.010	0.36

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	0.039	7	2,738	0.10	400	\$2,000
Pervious pavement	0.126	21	8,931	0.34	1,100	\$27,500

GREEN INFRASTRUCTURE RECOMMENDATIONS



Cranberry Market & Deli

-  bioretention system
-  pervious pavement
-  drainage area
-  property line
-  2012 Aerial: NJOIT, OGIS



LAKELAND EMERGENCY SQUAD



Subwatershed: Cranberry Lake

Site Area: 18,243 sq. ft.

Address: 221 Route 206
Byram, NJ 07821

Block and Lot: Block 212, Lot 10



Stormwater runoff from the parking lot and street is being directed to the woody area alongside the street. An invasive tree in this area can be removed to implement a bioswale capable of managing this runoff. A bioretention system can be implemented along the south side of the building 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"
75	13,682	0.7	6.9	62.8	0.011	0.38

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	0.023	4	1,668	0.06	165	\$825
Bioswale	0.060	10	4,256	0.16	380	\$1,900

GREEN INFRASTRUCTURE RECOMMENDATIONS



Lakeland Emergency Squad

-  bioretention system
-  bioswale
-  drainage area
-  property line
-  2012 Aerial: NJOIT, OGIS



SPARTA MEDICAL ASSOCIATES

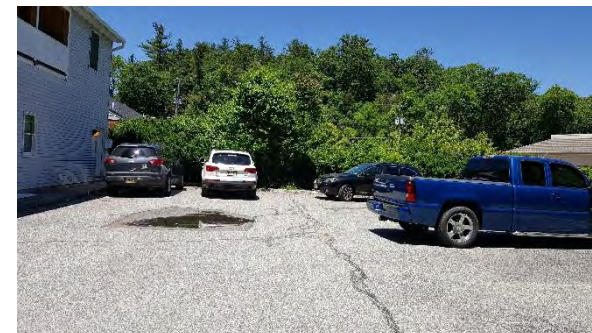
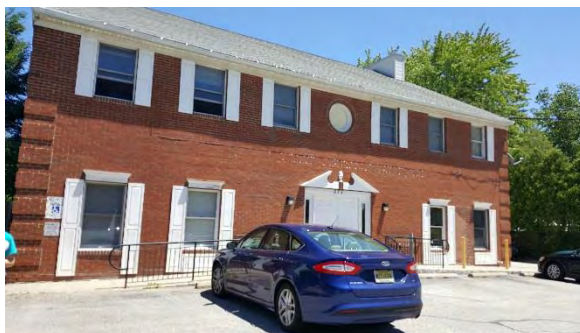


Subwatershed: Cranberry Lake

Site Area: 20,336 sq. ft.

Address: 272 Route 206
Byram, NJ 07860

Block and Lot: Block 216, Lot 0

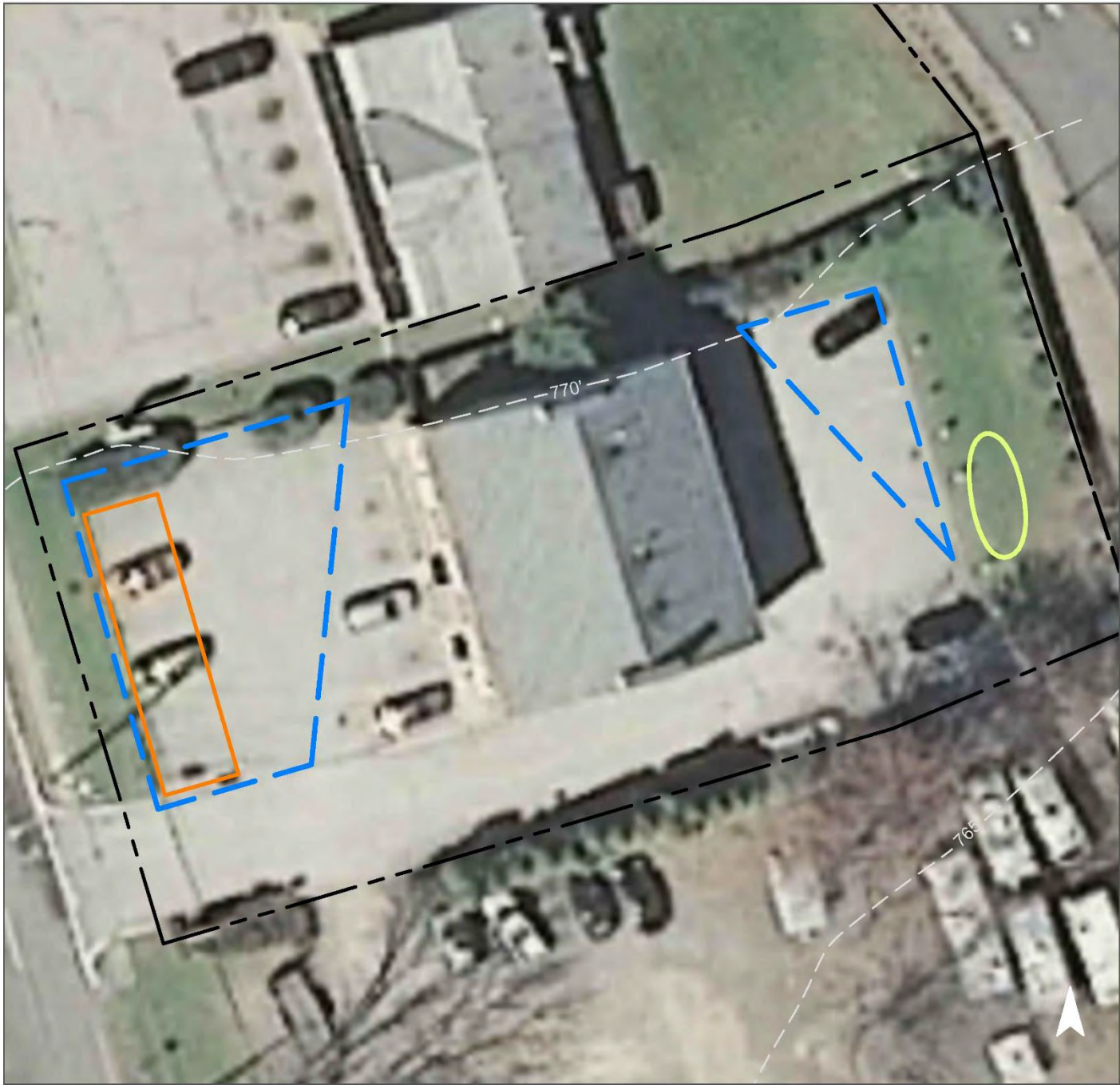


Parking spots in front of the building can be replaced with porous asphalt to capture and infiltrate stormwater from the parking lot in front of the building. A bioretention system can be implemented in the grassy area behind the building to manage stormwater runoff from the parking lot behind the building. 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	15,239	0.7	7.7	70.0	0.012	0.42

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	0.020	3	1,400	0.05	200	\$1,000
Pervious pavement	0.078	13	5,550	0.21	900	\$22,500

GREEN INFRASTRUCTURE RECOMMENDATIONS



Sparta Medical Associates

-  bioretention system
-  pervious pavement
-  drainage area
-  property line
-  2012 Aerial: NJOIT, OGIS



STONEWOOD TAVERN



Subwatershed: Cranberry Lake

Site Area: 36,114 sq. ft.

Address: 239 Route 206
Byram, NJ 07821

Block and Lot: Block 212, Lot 5

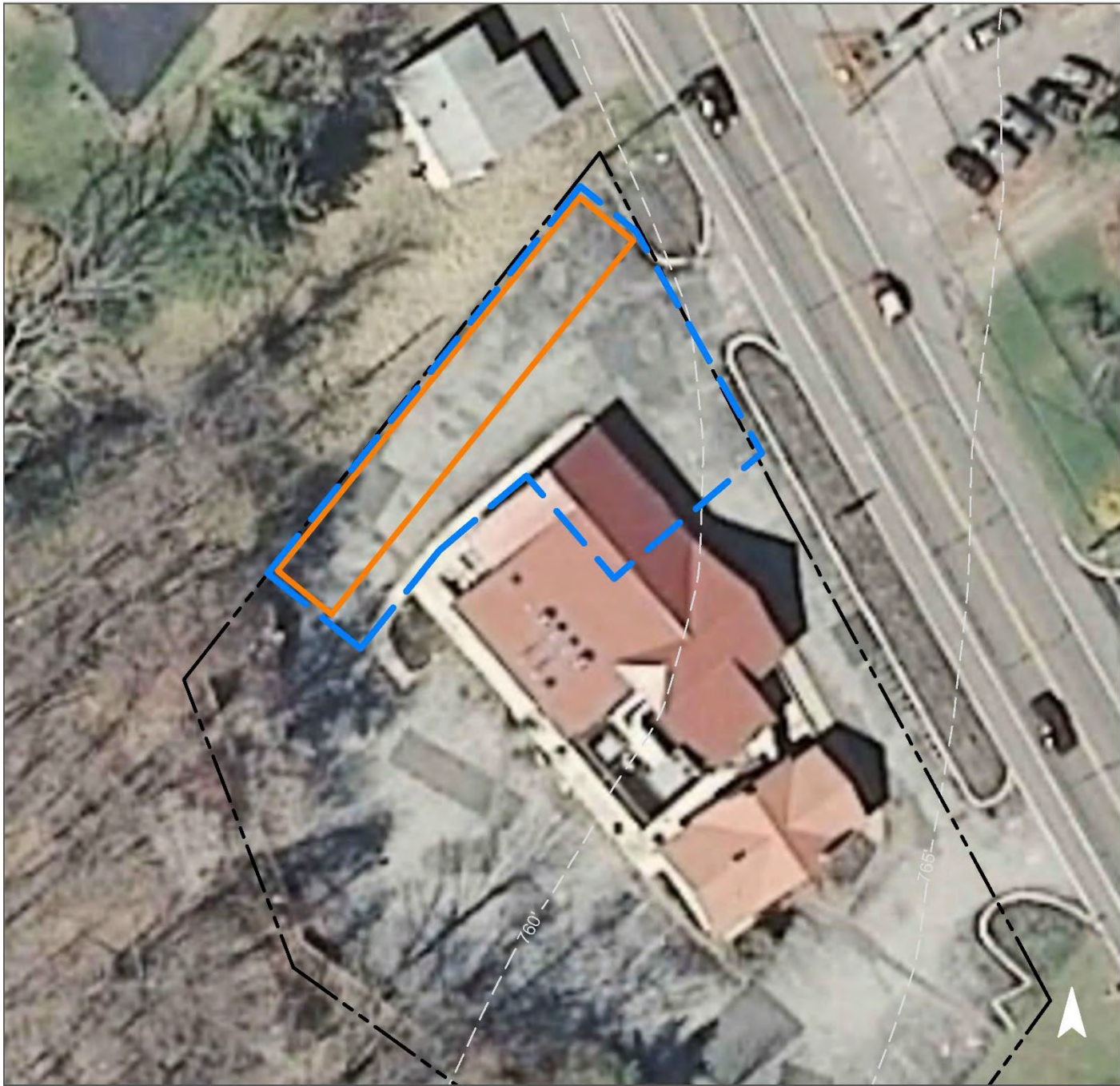


Stormwater runoff from the parking lot and roof can be managed by replacing parking spaces with porous asphalt along the northern edge of the lot. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

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"
89	32,120	1.5	16.2	147.5	0.025	0.88

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
Pervious pavement	0.172	29	12,245	0.39	2,250	\$56,250

GREEN INFRASTRUCTURE RECOMMENDATIONS



Stonewood Tavern

-  pervious pavement
-  drainage area
-  property line
-  2012 Aerial: NJOIT, OGIS



Byram Municipal Court / Byram Township Hall



Subwatershed: Lubbers Run

Site Area: 958,373 sq. ft.

Address: 10 Mansfield Drive,
Byram, NJ 07874

Block and Lot: Block 365, Lot 16.01

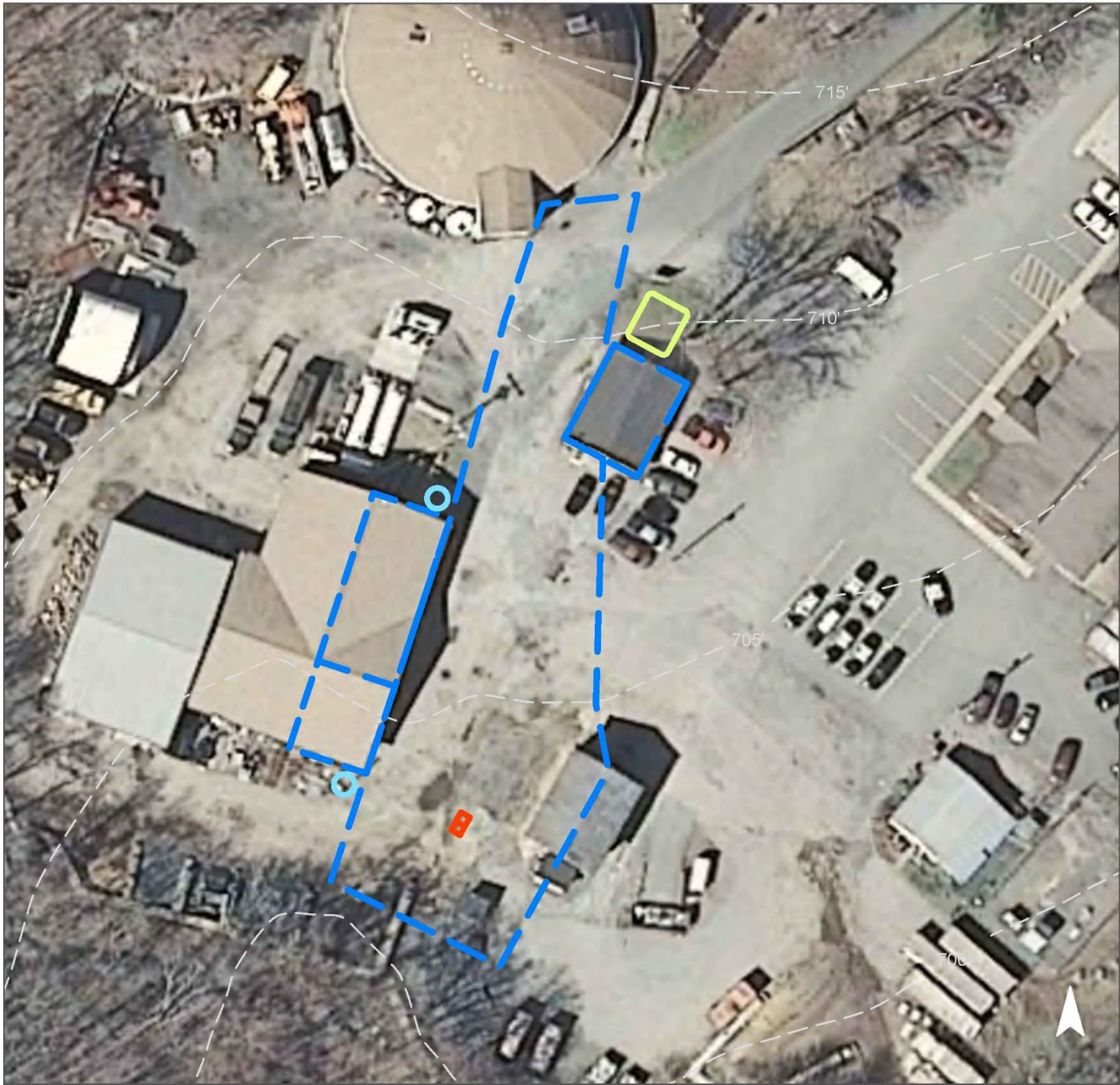


A rain garden can be installed adjacent to the building to manage rooftop runoff. Rainwater can be harvested by installing two cisterns to the west garage building. The water can then be used for washing vehicles or for other non-potable uses. Two sedimentation chambers can be installed near the garage to capture sediment from the site. 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"
13.41	128,553	6.2	64.9	590.2	0.100	3.53

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	0.035	6	2,102	0.07	335	\$1,675
Rainwater harvesting	0.087	15	6,000	0.23	6,000	\$12,000
Sedimentation chamber	n/a	425	n/a	n/a	32	\$8,000

GREEN INFRASTRUCTURE RECOMMENDATIONS



**Byram Municipal Court /
Byram Township Hall**

-  bioretention system
-  rainwater harvesting
-  sedimentation chamber
-  drainage area
-  property line
-  2012 Aerial: NJOIT, OGIS



BYRAM PIZZA



Subwatershed: Lubbers Run

Site Area: 40,027 sq. ft.

Address: 17 Route 206
Byram, NJ 07874

Block and Lot: Block 27, Lot 380.01



Stormwater runoff generated from the parking lot can be managed by replacing the parking spaces with porous asphalt. 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"
81	32,490	1.6	16.4	149.2	0.025	0.89

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	0.360	60	25,529	0.81	3,500	\$87,500

GREEN INFRASTRUCTURE RECOMMENDATIONS



Byram Pizza

-  pervious pavement
-  drainage area
-  property line
-  2012 Aerial: NJOIT, OGIS



DUNKIN' DONUTS



Subwatershed: Lubbers Run

Site Area: 54,941 sq. ft.

Address: 25 Route 206
Byram, NJ 07874

Block and Lot: Block 29, Lot 201

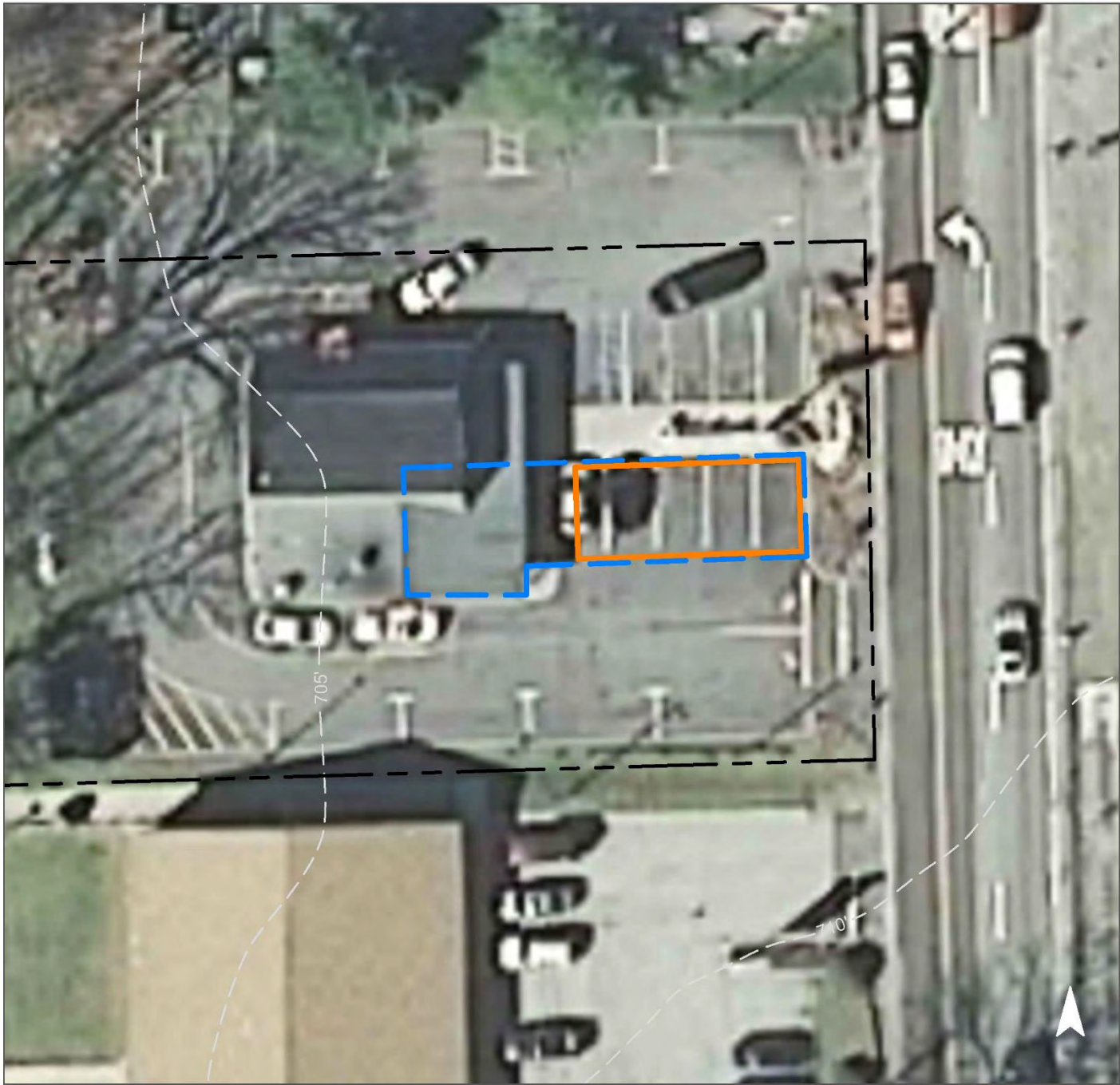


Parking spaces in the southern parking area can be replaced by porous asphalt to capture, treat, and infiltrate stormwater runoff. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

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"
85	46,700	2.3	23.6	214.4	0.036	1.28

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
Pervious pavement	0.044	7	3,142	0.12	800	\$20,000

GREEN INFRASTRUCTURE RECOMMENDATIONS



Dunkin' Donuts

-  pervious pavement
-  drainage area
-  property line
-  2012 Aerial: NJOIT, OGIS



SANTANDER BANK



Subwatershed: Lubbers Run

Site Area: 52,530 sq. ft.

Address: 2 Waterloo Road
Byram, NJ 07874

Block and Lot: Block 36, Lot 40

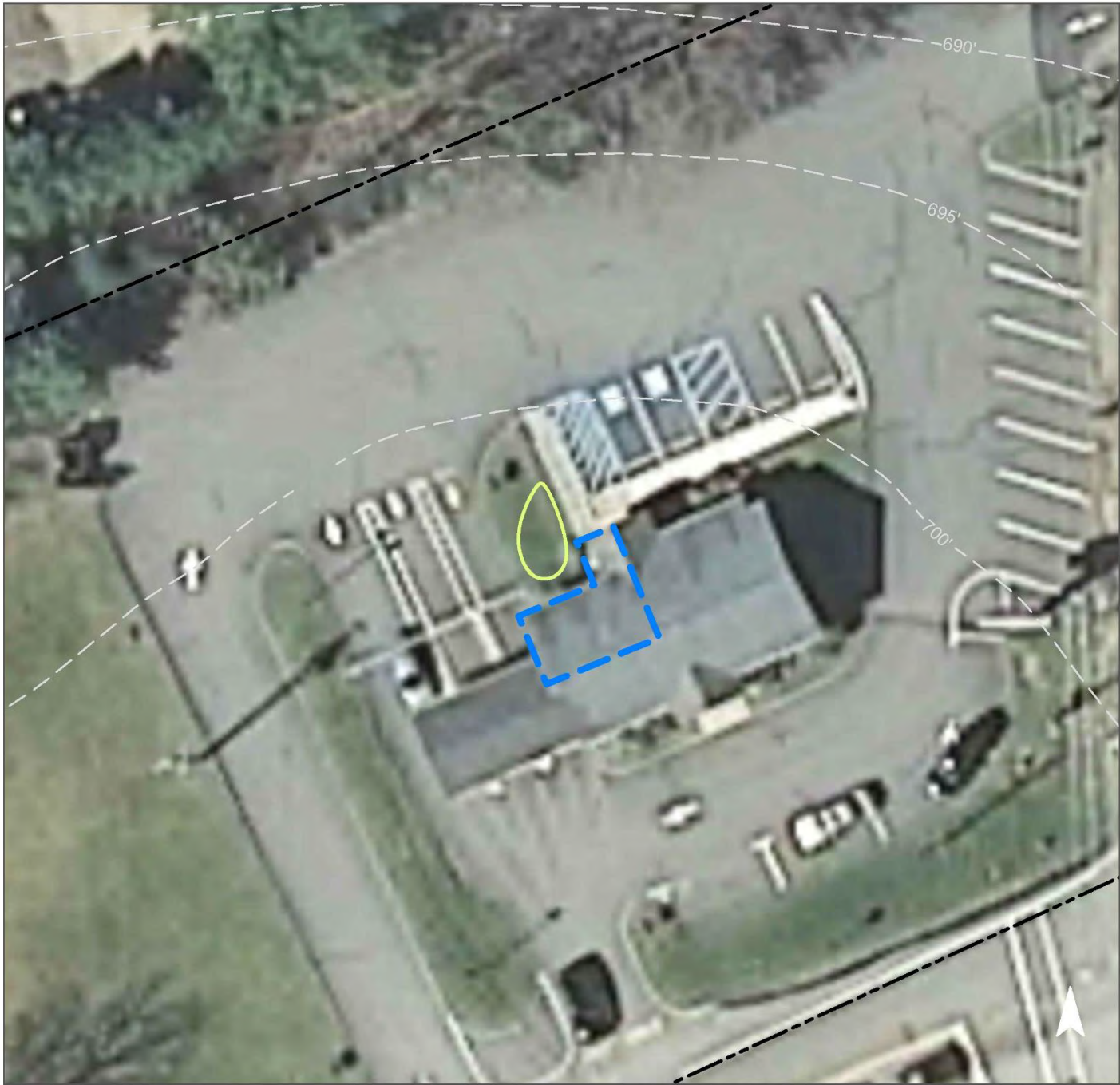


A bioretention system can be implemented in the grassy area behind the building. These are landscaped features that are designed to capture, treat, and infiltrate stormwater runoff while also creating wildlife habitats. Stormwater runoff from the rooftop can be directed into this system.

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"
85	44,650	2.2	22.6	205.0	0.035	1.22

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	0.010	2	725	0.03	100	\$500

GREEN INFRASTRUCTURE RECOMMENDATIONS



Santander Bank

-  bioretention system
-  drainage area
-  property line
-  2012 Aerial: NJOIT, OGIS



C.O. JOHNSON PARK



Subwatershed: Lubbers Run/New Wawayanda Lake

Site Area: 2,211,988 sq. ft.

Address: 130 Roseville Road
Byram, NJ 07821

Block and Lot: Block 351, Lot 1



The grassy area adjacent to the tennis court is being eroded by the stormwater runoff generated by the parking lot. A bioretention system can be implemented in this area to capture runoff from the parking lot and tennis court. The inlets will direct runoff into the system in a controlled manner to minimize erosion. The parking space areas can be replaced with grass pavers to allow infiltration of additional 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"
5	113,735	5.5	57.4	522.2	0.089	3.12

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	0.244	41	17,294	0.65	2340	\$11,700
Pervious pavement	0.771	129	54,731	2.06	16,830	\$387,090

GREEN INFRASTRUCTURE RECOMMENDATIONS



C.O. Johnson Park

-  bioretention system
-  pervious pavement
-  drainage area
-  property line
-  2012 Aerial: NJOIT, OGIS



CLASSIC BAGEL & DELI



Subwatershed: Musconetcong River

Site Area: 29,013 sq. ft.

Address: 13 Route 206
Byram, NJ 07874

Block and Lot: Block 27, Lot 380.02

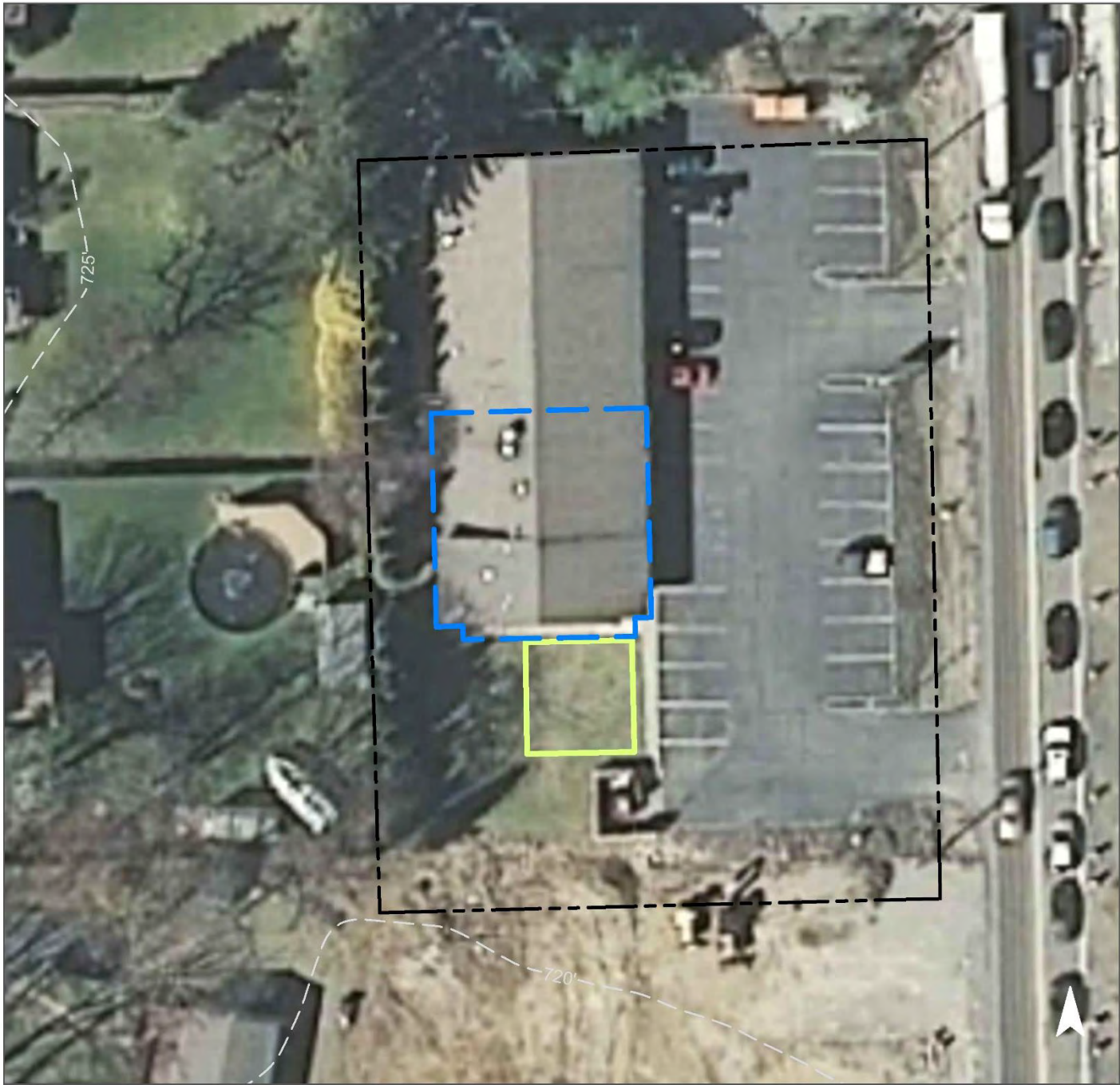


Stormwater runoff from the rooftop is currently being directed to the Municipal Separate Storm Sewer System (MS4.) A bioretention system can be implemented in the grassy area adjacent to the building. Bioretention systems are landscape features designed to capture, treat, and infiltrate stormwater runoff. 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"
75	21,619	1.0	10.9	99.3	0.017	0.59

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	0.086	14	6,104	0.23	800	\$4,000

GREEN INFRASTRUCTURE RECOMMENDATIONS



Classic Bagel & Deli

-  bioretention system
-  drainage area
-  property line
-  2012 Aerial: NJOIT, OGIS



c. Detention Basin Retrofit: Stanhope Sparta Road

DETENTION BASIN RETROFIT: STANHOPE SPARTA ROAD



Subwatershed: Lubber's Run

Site Area: 186100 sq. ft.

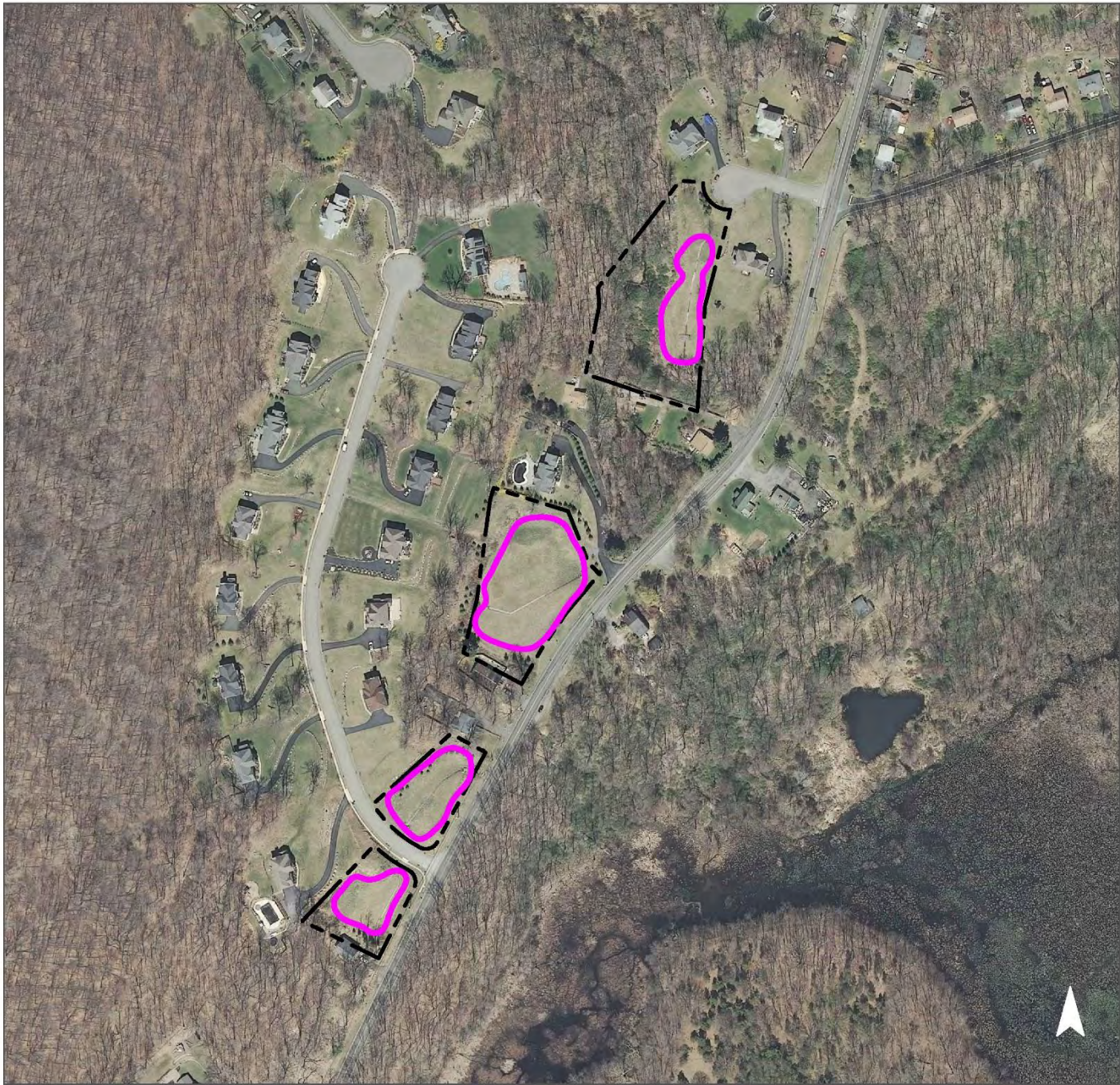
Address: Stanhope Sparta Rd &
Ascot Ln
Byram, NJ 07874

Block and Lot: Block 337.10; 337.11
Lot 32.01; 32.18,32.19,32.24

Detention basins within this development area can be retrofitted. The existing basins each have one inlet and outlet and are lined with a concrete flow channel. These channels can be removed and the basin naturalized to promote infiltration rather than just detention of the water.



GREEN INFRASTRUCTURE RECOMMENDATIONS



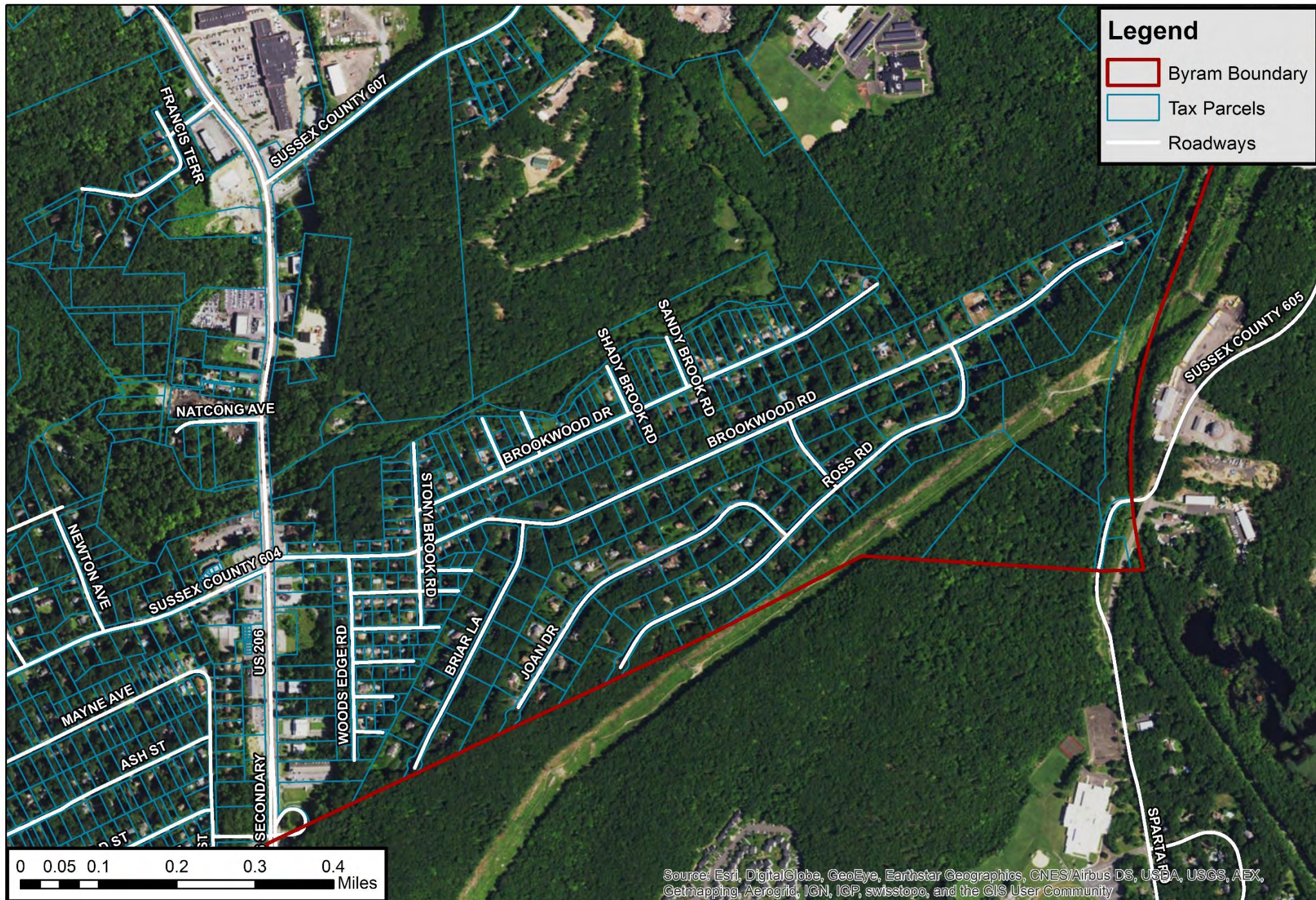
**Detention Basin Retrofit:
Stanhope Sparta Road**

-  detention basin retrofit
-  property line
-  2012 Aerial: NJOIT, OGIS

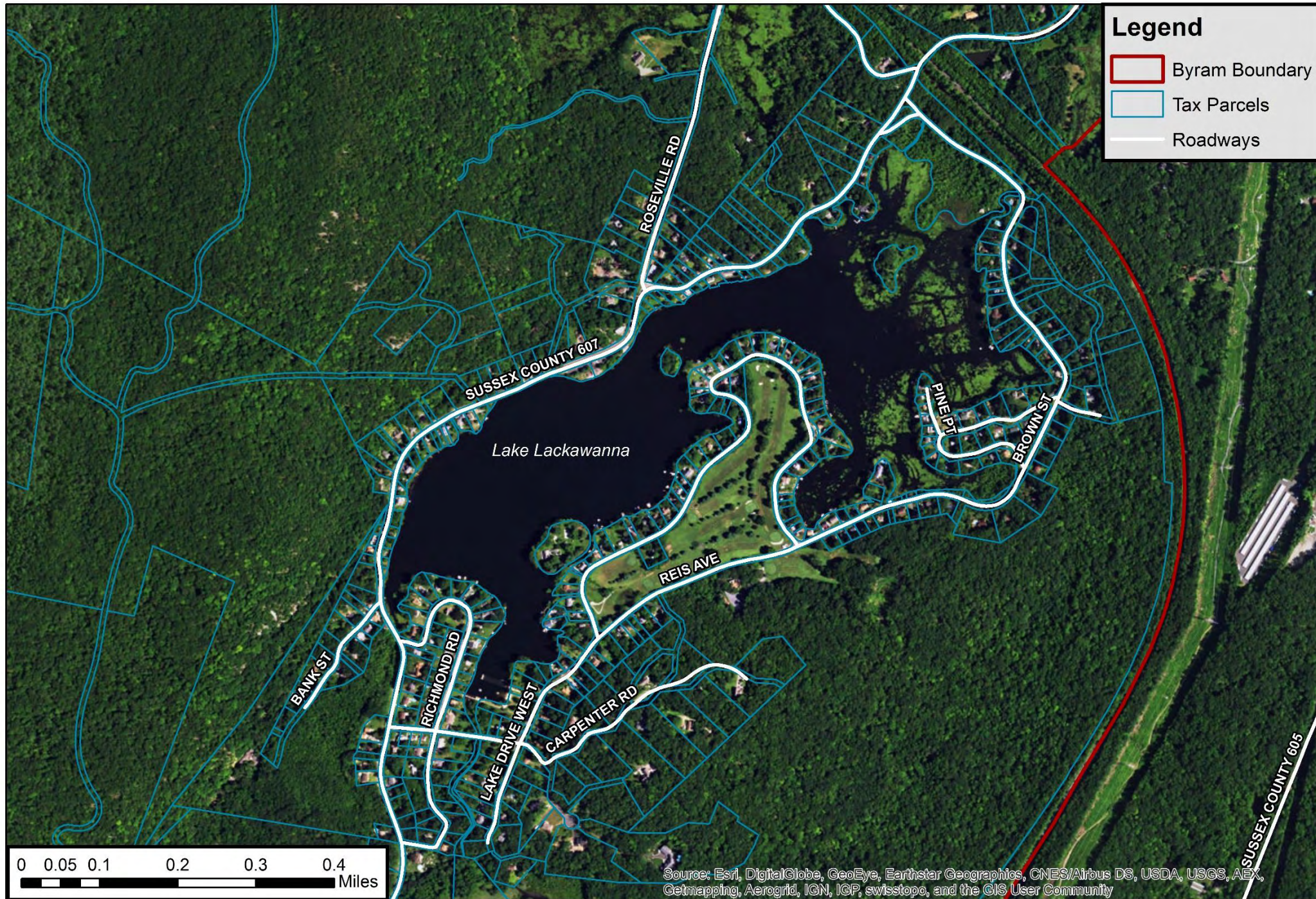


d. Hydrologic Analysis Areas

BROOKWOOD ROAD DEVELOPMENT



LAKE LACKAWANNA DEVELOPMENT



e. 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)
CRANBERRY LAKE SUBWATERSHED	10.41	453,294			10.7	112.0	1,018.3		5.09	221,783	0.173	6.08
2 Tamarack Road Total Site Info	1.71	74,598	212	5	2.5	26.7	242.7	71	1.21	52,853	0.041	1.45
Byram Township Volunteer Firehouse Total Site Info	1.29	56,060	212	7	2.0	21.2	193.0	75	0.97	42,045	0.033	1.15
Cranberry Lake Community Club Total Site Info	5.30	230,669	214.03	1	2.5	26.7	242.8	23	1.21	52,888	0.041	1.45
Cranberry Market & Deli Total Site Info	0.40	17,274	216	2.03	0.6	6.5	59.5	75	0.30	12,955	0.010	0.36
Lakeland Emergency Squad Total Site Info	0.42	18,243	212	10	0.7	6.9	62.8	75	0.31	13,682	0.011	0.38
Sparta Medical Associates Total Site Info	0.47	20,336	216	0	0.7	7.7	70.0	75	0.35	15,239	0.012	0.42
Stonewood Tavern Total Site Info	0.83	36,114	212	5	1.5	16.2	147.5	89	0.74	32,120	0.025	0.88
LUBBERS RUN SUBWATERSHED	25.39	1,105,871			12.2	127.5	1,158.8		5.79	252,393	0.197	6.92
Byram Municipal Court / Byram Township Hall Total Site Info	22.00	958,373	365	16.01	6.2	64.9	590.2	13.41	2.95	128,553	0.100	3.53
Byram Pizza Total Site Info	0.92	40,027	27	380.01	1.6	16.4	149.2	81	0.75	32,490	0.025	0.89
Dunkin' Donuts Total Site Info	1.26	54,941	29	201	2.3	23.6	214.4	85	1.07	46,700	0.036	1.28
Santander Bank Total Site Info	1.21	52,530	36	40	2.2	22.6	205.0	85	1.03	44,650	0.035	1.22

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)
LUBBERS RUN/NEW WAWAYANDA LAKE SUBWATERSHED	50.78	2,211,988			5.5	57.4	522.2		2.61	113,735	0.089	3.12
CO Johnson Park Total Site Info	50.78	2,211,988	351	1	5.5	57.4	522.2	5	2.61	113,735	0.089	3.12
MUSCONETCONG RIVER SUBWATERSHED	0.67	29,013			1.0	10.9	99.3		0.50	21,619	0.017	0.59
Classic Bagel & Deli Total Site Info	0.67	29,013	27	381.02	1.0	10.9	99.3	75	0.50	21,619	0.017	0.59

f. 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)									
CRANBERRY LAKE SUBWATERSHED	83,760	1.92	2.182	365	164,293	5.58	29,110			\$635,850	37.8%
12 Tamarack Road											
Pervious pavement	20,700	0.48	0.539	90	38,290	0.78	5,800	25	SF	\$145,000	39.2%
Total Site Info	20,700	0.48	0.539	90	38,290	0.78	5,800			\$145,000	39.2%
2 Byram Township Volunteer Firehouse											
Pervious pavement	17,700	0.41	0.461	77	45,800	1.72	5,000	25	SF	\$125,000	42.1%
Rainwater harvesting	3,600	0.08	0.094	16	3,000	0.25	3,000	2	Gal	\$6,000	8.6%
Total Site Info	21,300	0.49	0.555	93	48,800	1.97	8,000			\$131,000	50.7%
3 Cranberry Lake Community Club											
Pervious pavement	21,850	0.50	0.569	95	40,414	1.52	9,915	25	SF	\$247,875	41.3%
Total Site Info	21,850	0.50	0.569	95	40,414	1.52	9,915			\$247,875	41.3%
4 Cranberry Market & Deli											
Bioretention system	1,500	0.03	0.039	7	2,738	0.10	400	5	SF	\$2,000	11.6%
Pervious pavement	4,830	0.11	0.126	21	8,931	0.34	1,100	25	SF	\$27,500	37.3%
Total Site Info	6,330	0.15	0.165	28	11,669	0.44	1,500			\$29,500	48.9%
5 Lakeland Emergency Squad											
Bioretention system	900	0.02	0.023	4	1,668	0.06	165	5	SF	\$825	6.6%
Bioswale	2,300	0.05	0.060	10	4,256	0.16	380	5	SF	\$1,900	16.8%
Total Site Info	3,200	0.07	0.083	14	5,924	0.22	545			\$2,725	23.4%
6 Sparta Medical Associates											
Bioretention system	760	0.02	0.020	3	1,400	0.05	200	5	SF	\$1,000	5.0%
Pervious pavement	3,000	0.07	0.078	13	5,550	0.21	900	25	SF	\$22,500	19.7%
Total Site Info	3,760	0.09	0.098	16	6,950	0.26	1,100			\$23,500	24.7%
7 Stonewood Tavern											
Pervious pavement	6,620	0.15	0.172	29	12,245	0.39	2,250	25	SF	\$56,250	20.6%
Total Site Info	6,620	0.15	0.172	29	12,245	0.39	2,250			\$56,250	20.6%

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)									
LUBBERS RUN SUBWATERSHED	38,575	0.89	0.536	514	37,497	1.26	10,767			\$129,675	64.6%
8 Byram Municipal Court / Byram Township Hall											
Bioretention system	1,340	0.03	0.035	6	2,102	0.07	335	5	SF	\$1,675	1.0%
Rainwater harvesting	3,325	0.08	0.087	15	6,000	0.23	6,000	2	gal	\$12,000	2.6%
Sedimentation chamber	18,010	0.41	n/a	425	n/a	n/a	32	4,000	box	\$8,000	14.0%
Total Site Info	22,675	0.52	0.12	445	8,102	0.30	6,367			\$21,675	17.6%
9 Byram Pizza											
Pervious pavement	13,800	0.32	0.360	60	25,529	0.81	3,500	25	SF	\$87,500	42.5%
Total Site Info	13,800	0.32	0.360	60	25,529	0.81	3,500			\$87,500	42.5%
10 Dunkin' Donuts											
Pervious pavement	1,700	0.04	0.044	7	3,142	0.12	800	25	SF	\$20,000	3.6%
Total Site Info	1,700	0.04	0.044	7	3,142	0.12	800			\$20,000	3.6%
11 Santander Bank											
Bioretention system	400	0.01	0.010	2	725	0.03	100	5	SF	\$500	0.9%
Total Site Info	400	0.01	0.010	2	725	0.03	100			\$500	0.9%
LUBBERS RUN/NEW WAWAYANDA LAKE SUBWATERSHED	38,940	0.89	1.015	170	72,025	2.71	19,170			\$398,790	34.2%
12 CO Johnson Park											
Bioretention system	9,350	0.21	0.244	41	17,294	0.65	2,340	5	SF	\$11,700	8.2%
Pervious pavement	29,590	0.68	0.771	129	54,731	2.06	16,830	23	SF	\$387,090	26.0%
Total Site Info	38,940	0.89	1.015	170	72,025	2.71	19,170			\$398,790	34.2%
MUSCONETCONG RIVER SUBWATERSHED	3,300	0.08	0.086	14	6,104	0.23	800			\$4,000	15.3%
13 Classic Bagel & Deli											
Bioretention system	3,300	0.08	0.086	14	6,104	0.23	800	5	SF	\$4,000	15.3%
Total Site Info	3,300	0.08	0.086	14	6,104	0.23	800			\$4,000	15.3%