RUTGERS
New Jersey Agricultural
Experiment Station

Draft

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

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

October 6, 2015

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Introduction

Located in Hunterdon County in central New Jersey, Franklin Township covers approximately 23.2 square miles. Figures 1 and 2 illustrate that Franklin Township is dominated by agriculture land uses. A total of 17.5% of the municipality's land use is classified as urban. Of the urban land in Franklin Township, rural 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 Franklin 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 Franklin Township. Based upon the 2007 NJDEP land use/land cover data, approximately 2.9% of Franklin Township has impervious cover. This level of impervious cover suggests that the streams in Franklin Township are likely sensitive streams.[1]

Methodology

Franklin Township contains portions of six 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

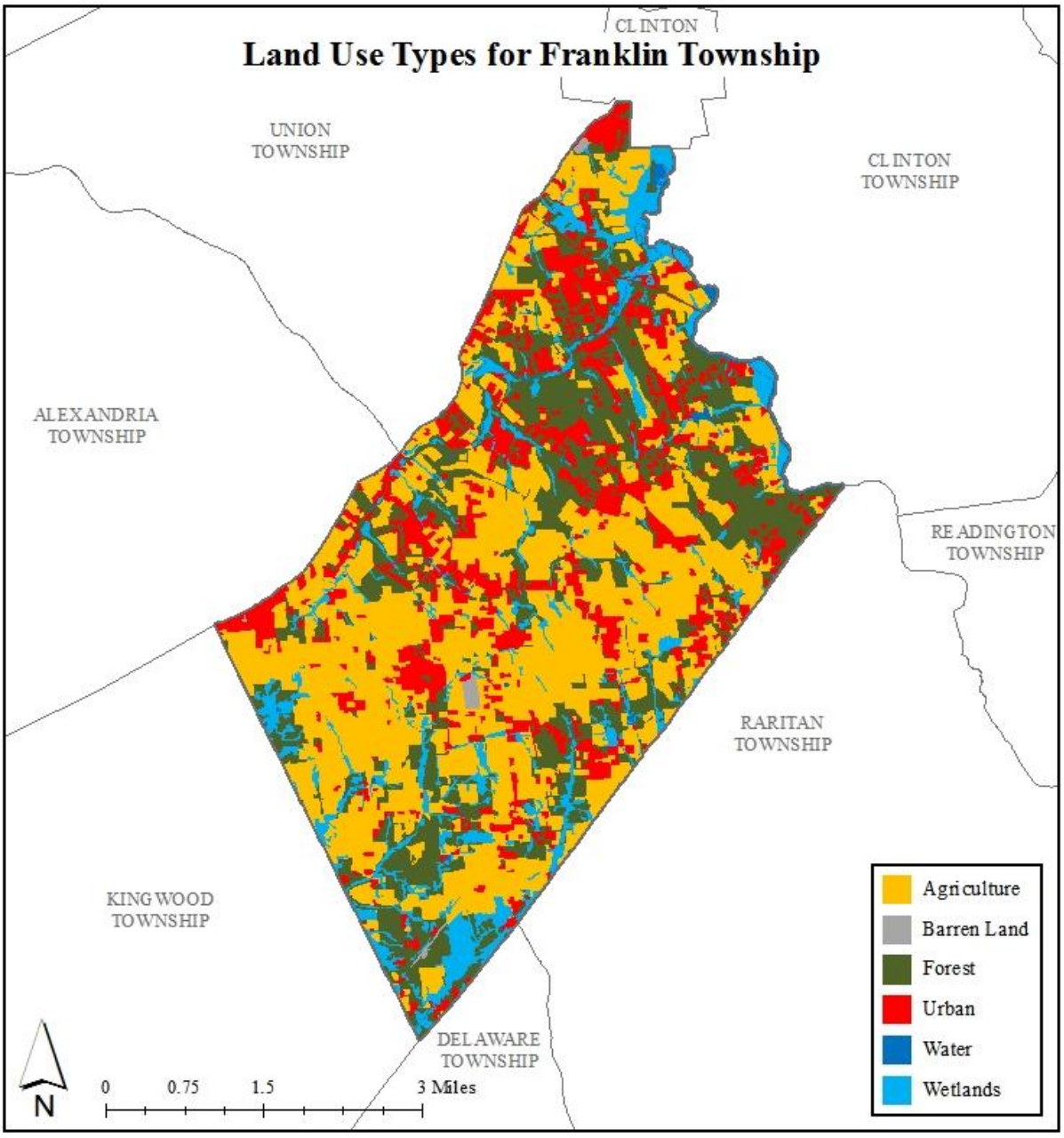


Figure 1: Map illustrating the land use in Franklin Township

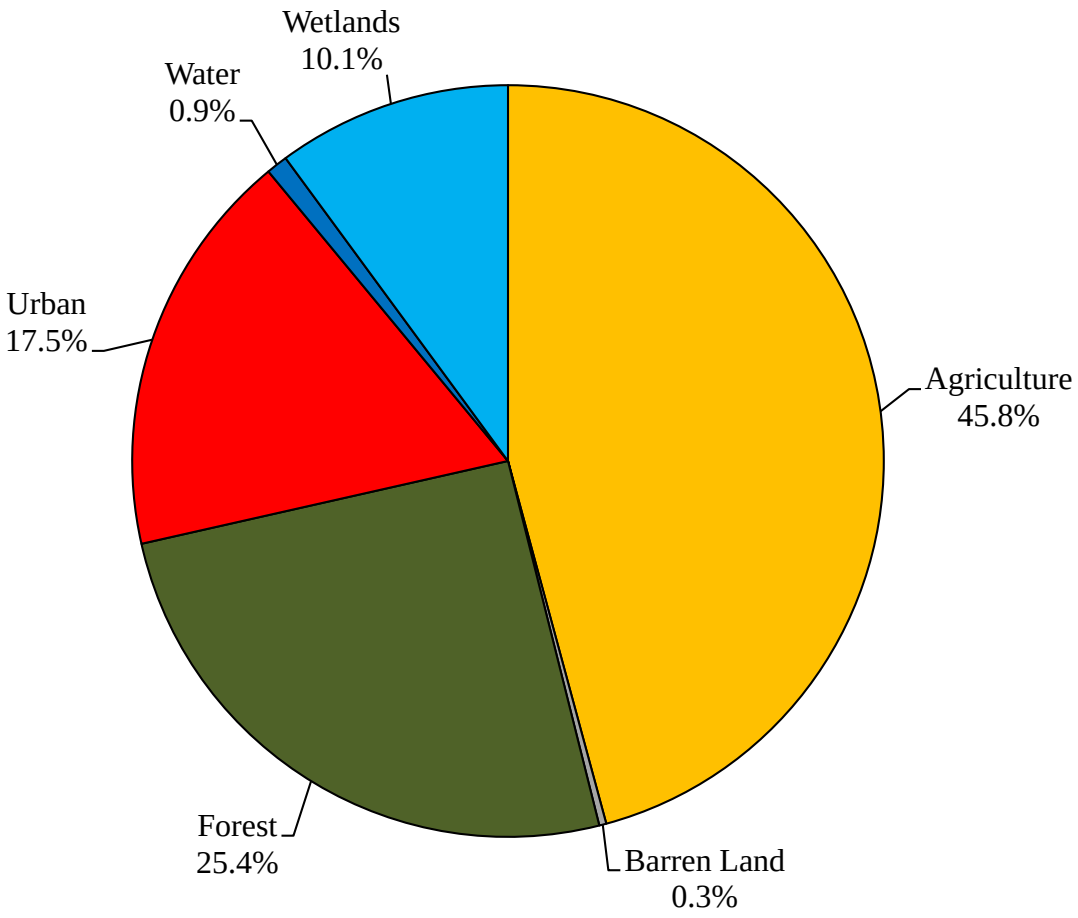


Figure 2: Pie chart illustrating the land use in Franklin Township

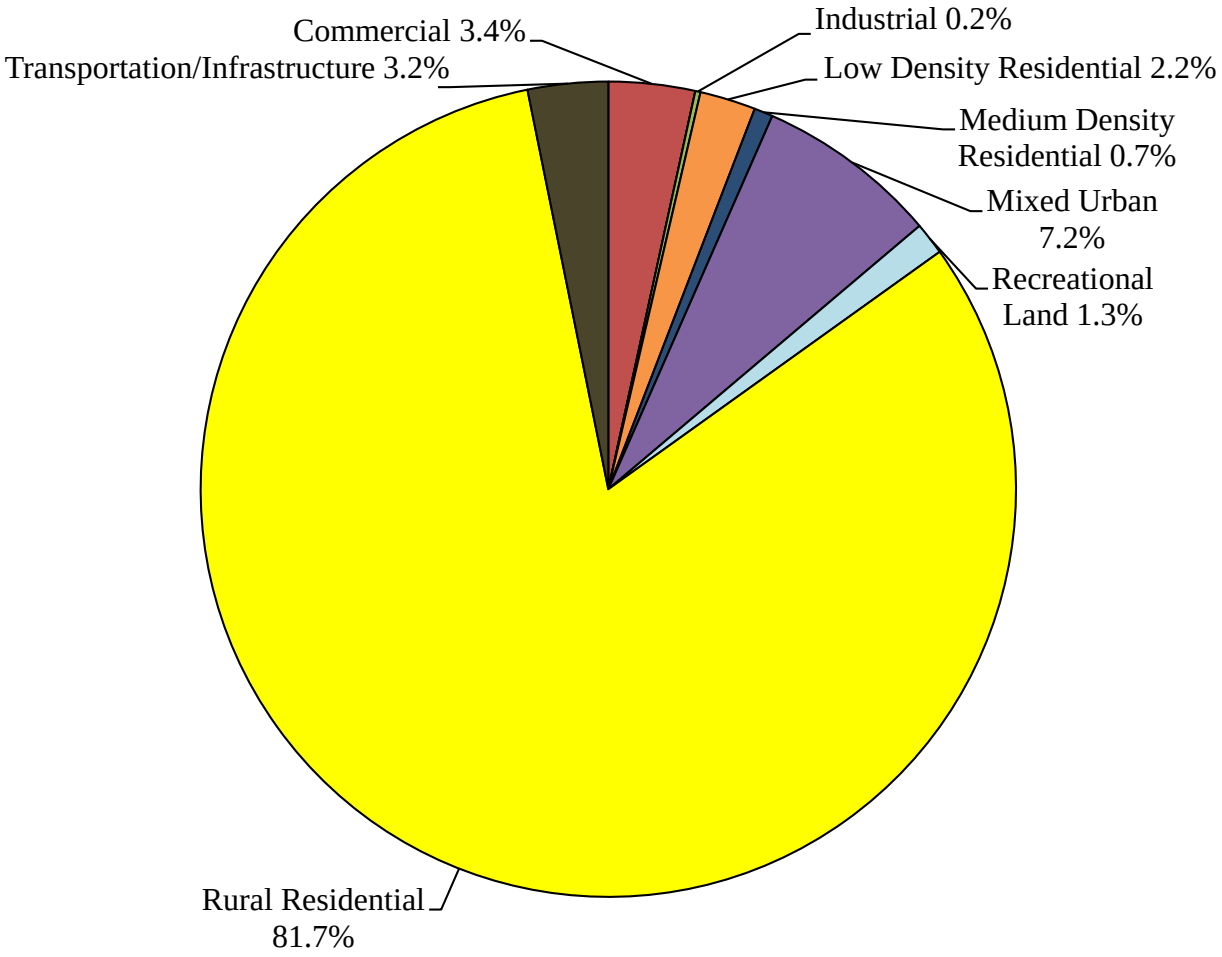


Figure 3: Pie chart illustrating the various types of urban land use in Franklin Township

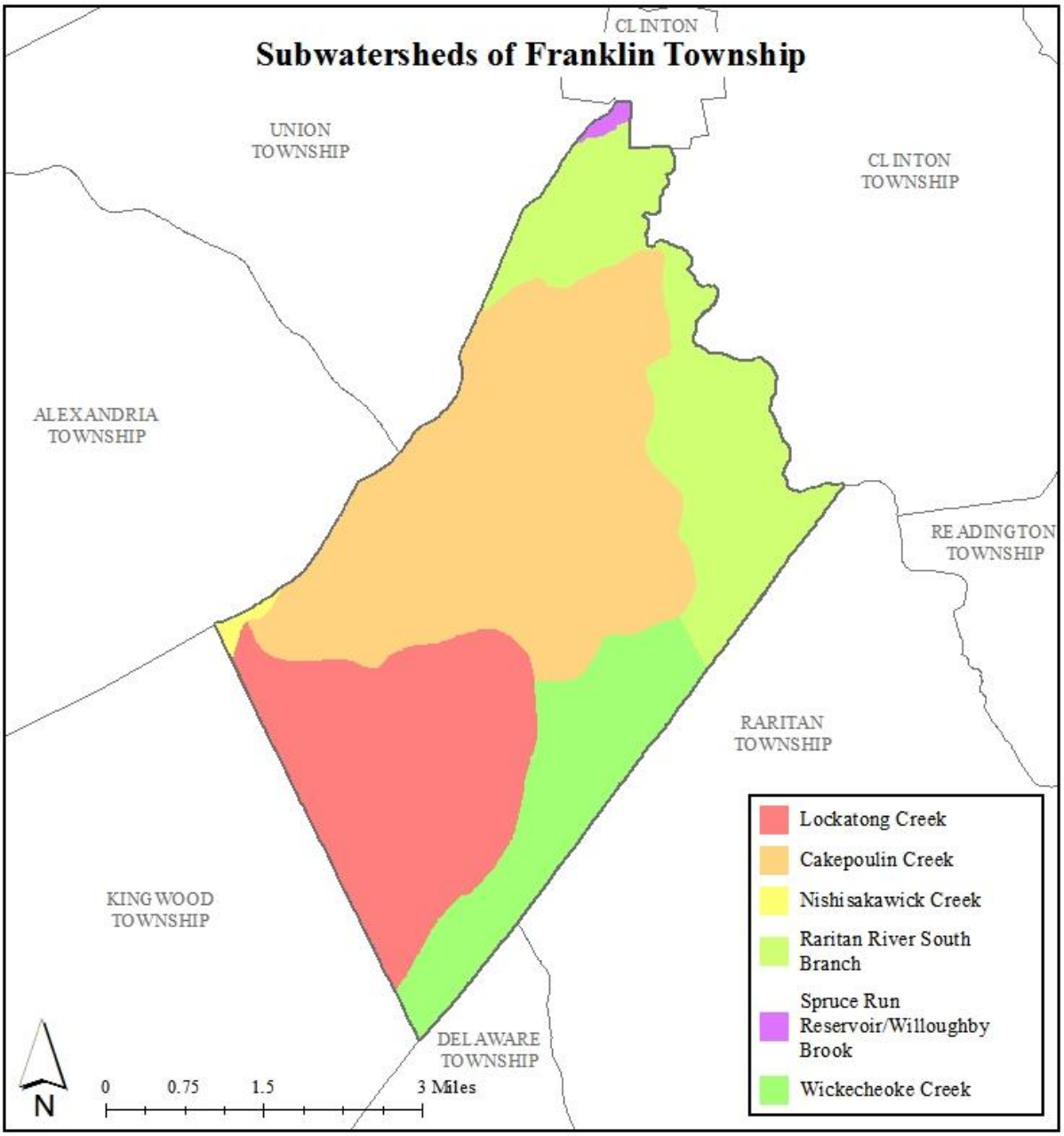


Figure 4: Map of the subwatersheds in Franklin Township

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 Franklin 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 Franklin 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*.

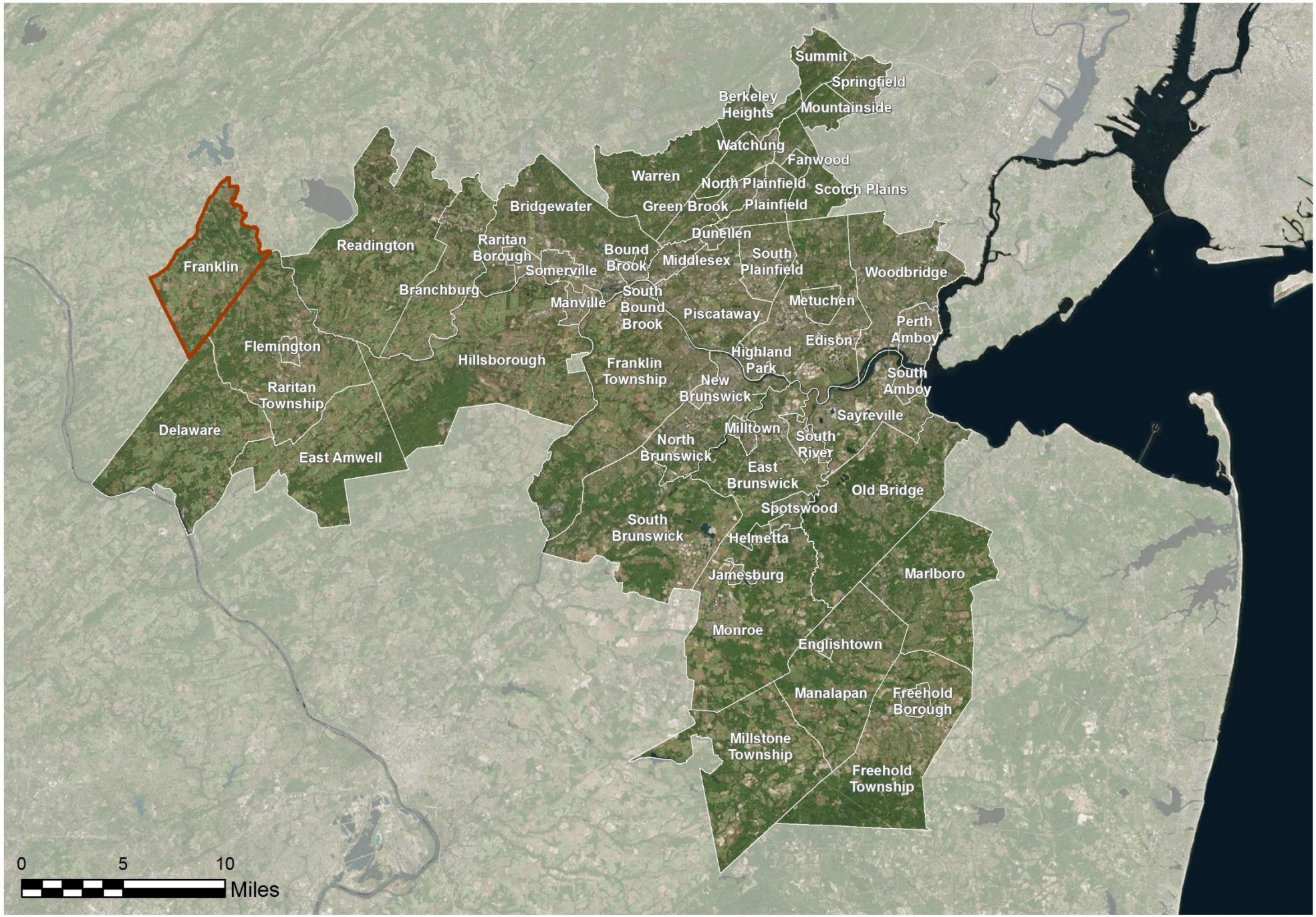
Conclusion

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

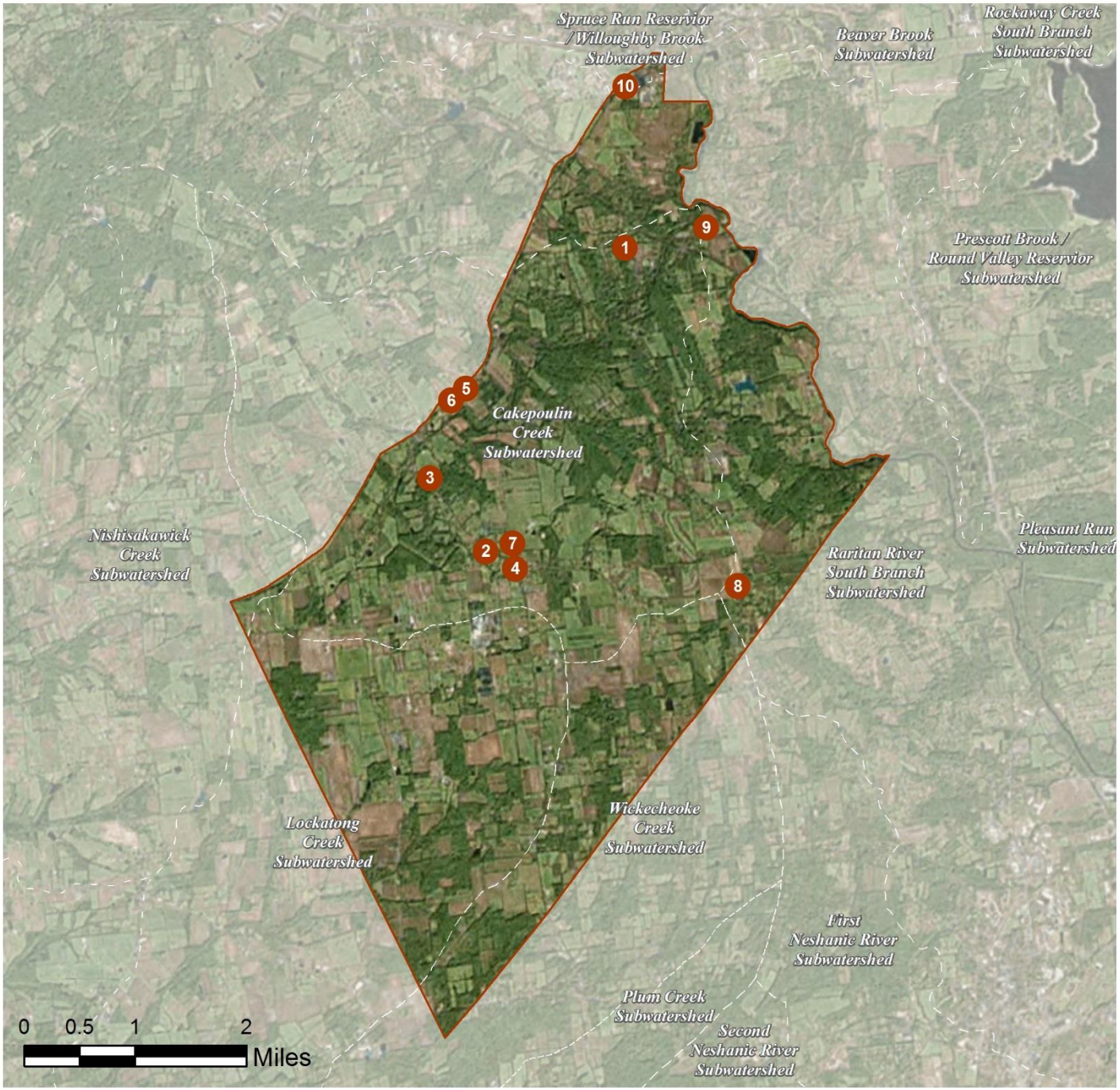
a. Overview Map of the Project

FRANKLIN TOWNSHIP: CLIMATE RESILIENT GREEN INFRASTRUCTURE FOR THE RARITAN BASIN



b. Green Infrastructure Sites

FRANKLIN TOWNSHIP: GREEN INFRASTRUCTURE SITES



SITES WITHIN THE CAKEPOULIN CREEK SUBWATERSHED:

1. Franklin Township Police Department
2. Franklin Township School
3. Quakertown Fire Company
4. Quakertown United Methodist Church
5. Saint Catherine of Siena Church
6. US Post Office: Pittstown Road
7. US Post Office: White Bridge Road

SITES WITHIN THE RARITAN RIVER SOUTH BRANCH SUBWATERSHED:

8. Cherryville Baptist Church
9. Faith Chapel Wesleyan Church

SITES WITHIN THE SPRUCE RUN RESERVOIR/WILLOUGHBY BROOK SUBWATERSHED:

10. Crossroads Christian Academy

c. Proposed Green Infrastructure Concepts

FRANKLIN TOWNSHIP POLICE DEPARTMENT

Subwatershed: Cakepoulin Creek

Site Area: 88,486 sq. ft.

Address: 202 Sidney Road
Pittstown, NJ 08867

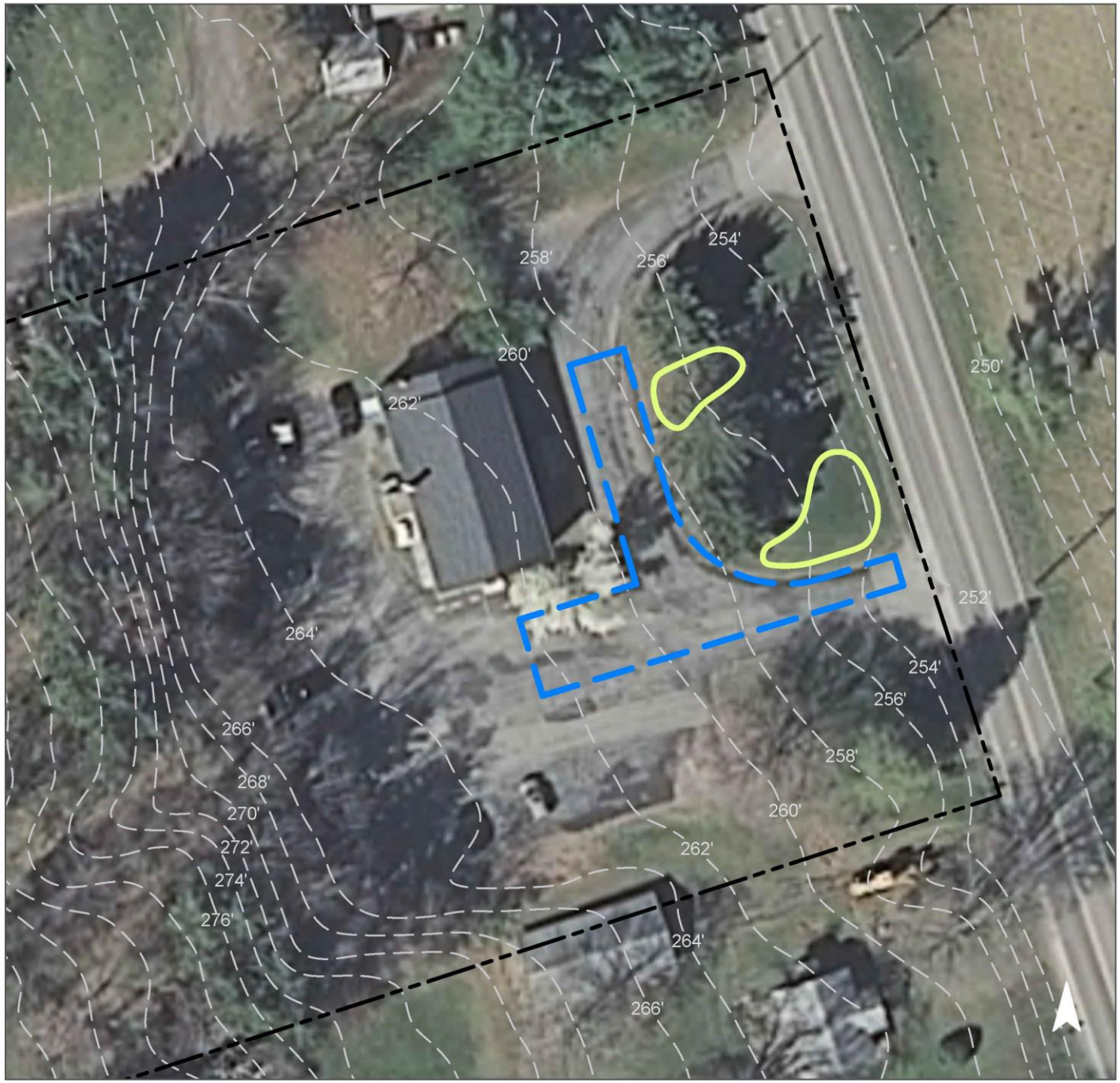
Block and Lot: Block 40, Lot 16

Rain gardens can capture, treat, 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"
39	34,192	1.6	17.3	157.0	0.027	0.94

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention systems	0.102	17	7,719	0.29	444	$2,220

GREEN INFRASTRUCTURE RECOMMENDATIONS



Franklin Township Police Department

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

0 25' 50'

FRANKLIN TOWNSHIP SCHOOL

Subwatershed: Cakepoulin Creek

Site Area: 631,311 sq. ft.

Address: 226 Quakertown Road
Quakertown, NJ 08868

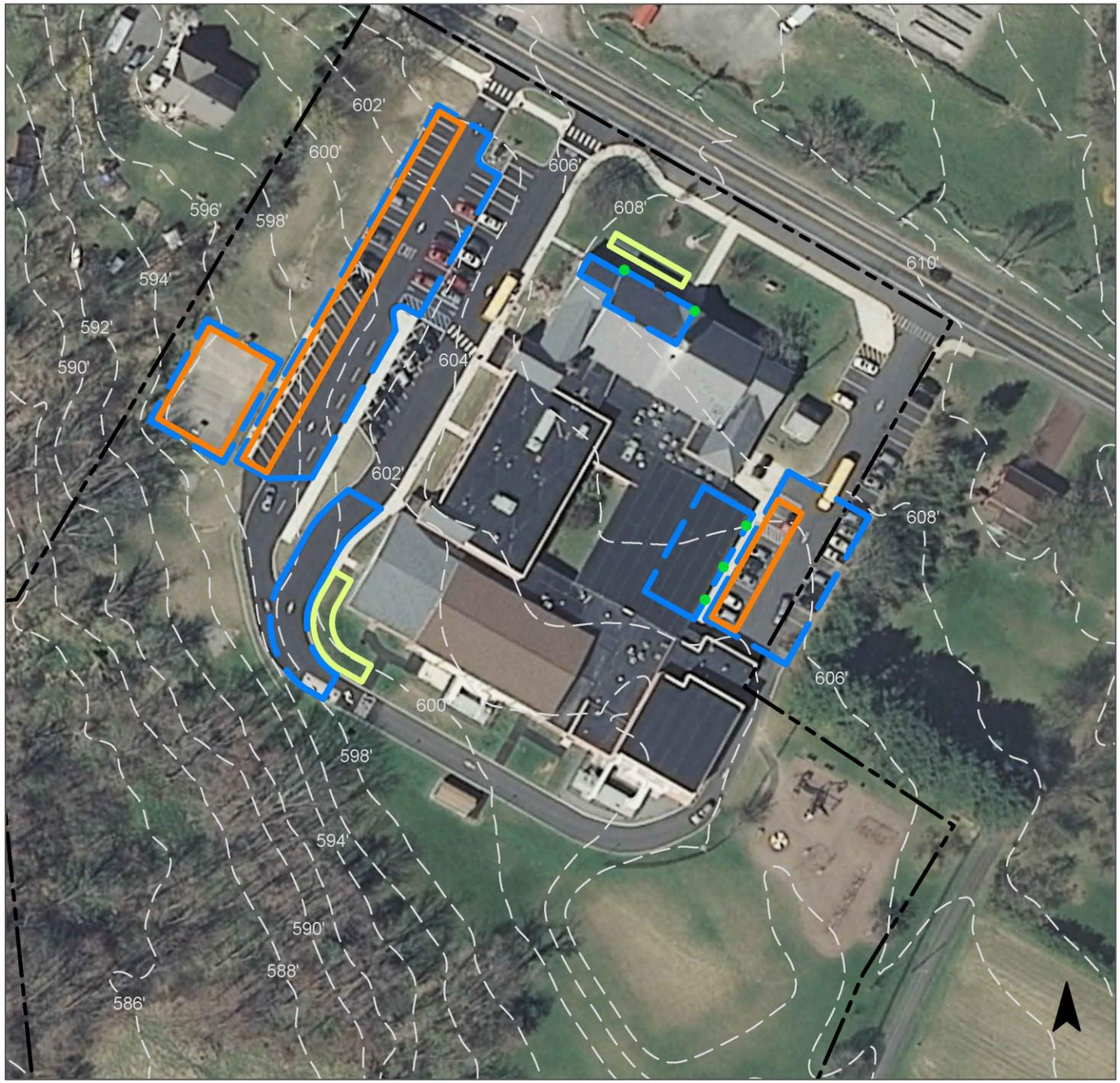
Block and Lot: Block 37, Lot 7

Rows of parking spaces on the east and west sides of the school can be replaced with pervious pavement to capture and infiltrate stormwater runoff. Rain gardens can also capture, treat, and infiltrate roof runoff from near by downspouts and from driveway 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"
17	108,702	5.2	54.9	499.1	0.085	2.98

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention systems	0.133	22	10,076	0.38	1,483	$7,415
Pervious pavements	0.656	110	49,727	1.87	9,551	$238,775

GREEN INFRASTRUCTURE RECOMMENDATIONS



Franklin Township School

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

0 50' 100'

QUAKERTOWN FIRE COMPANY

Subwatershed: Cakepoulin Creek

Site Area: 96,506 sq. ft.

Address: 67 Quakertown Road
Pittstown, NJ 08867

Block and Lot: Block 28, Lot 13

An existing swale can be converted into a bioswale to convey stormwater while removing pollutants, and providing water a chance to infiltrate. A cistern can be installed to harvest rainwater from the garage located northeast of the main building to be used to wash service vehicles. 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	39,181	1.9	19.8	179.9	0.031	1.07

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
Bioswales	0.085	14	6,433	0.24	3,153	$15,765
Rainwater harvesting systems	0.081	14	2,920	0.23	2,920 (gal)	$5,840

GREEN INFRASTRUCTURE RECOMMENDATIONS

Quakertown Fire Co.

- disconnected downspouts
- rainwater harvesting
- bioswales
- drainage areas
- property line
- 2012 Aerial: NJOIT, OGIS

0 50' 100'

QUAKERTOWN UNITED METHODIST CHURCH

Subwatershed: Cakepoulin Creek

Site Area: 62,681 sq. ft.

Address: 1187 Croton Road
Quakertown, NJ 08868

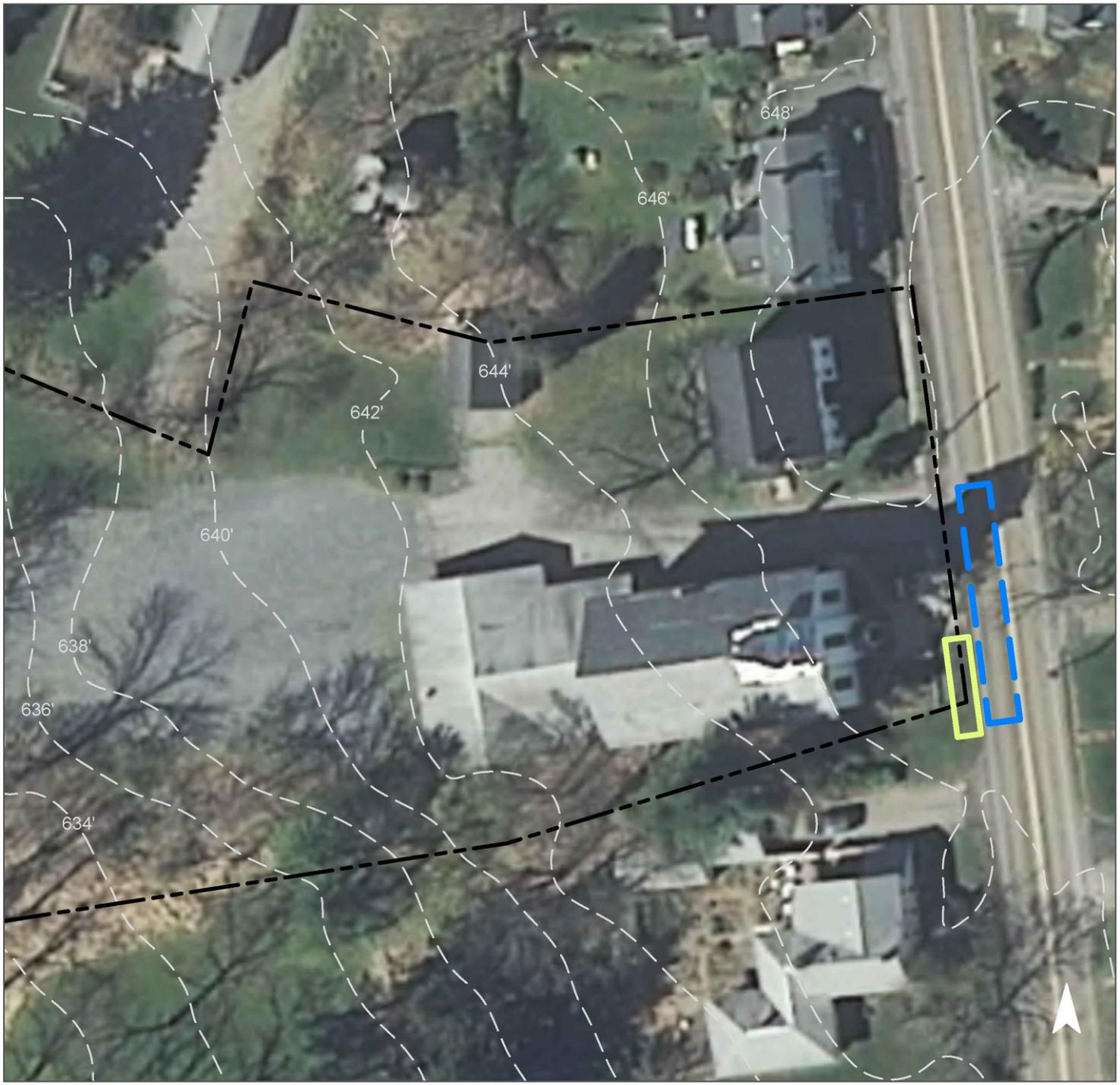
Block and Lot: Block 37, Lot 25

The parking lot is currently gravel and should remain pervious. A rain garden can be built in front of the church to capture, treat, and infiltrate stormwater from the road. 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"
12	7,470	0.4	3.8	34.3	0.006	0.20

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	0.021	3	1,571	0.06	250	$1,250

GREEN INFRASTRUCTURE RECOMMENDATIONS



Quakertown United Methodist Church

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

0 25' 50'

SAINT CATHERINE OF SIENA CHURCH

Subwatershed: Cakepoulin Creek

Site Area: 278,601 sq. ft.

Address: 2 White Bridge Road
Pittstown, NJ 08868

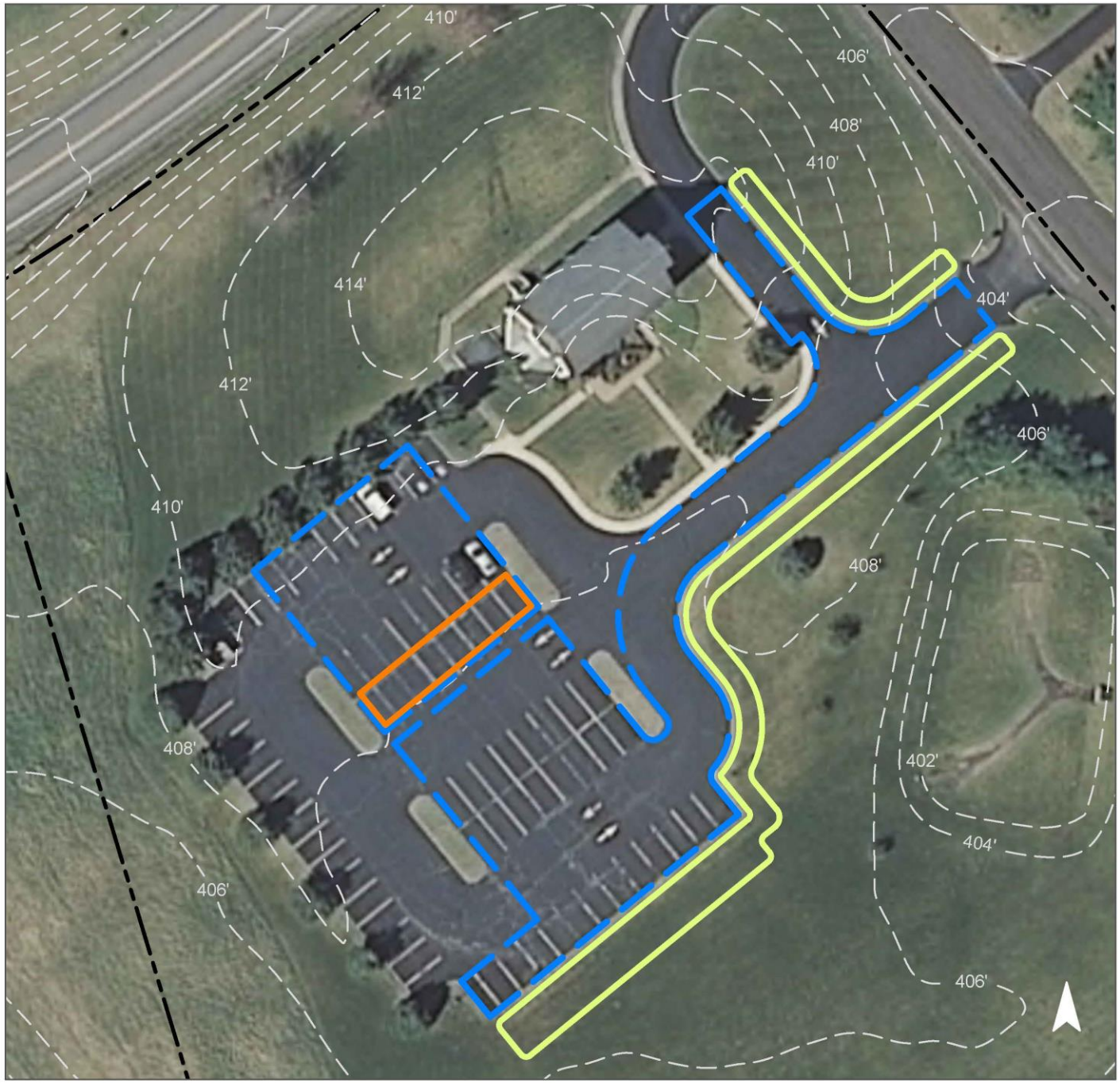
Block and Lot: Block 26, Lot 17.02

Rain gardens along the entrance way and to the south of the parking lot can capture, treat, and infiltrate stormwater. Parking spaces can be converted into pervious pavement to infiltrate additional 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"
22	62,209	3.0	31.4	285.6	0.048	1.71

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	0.432	72	32,740	1.23	5,621	$28,105
Pervious pavements	0.166	28	12,551	0.47	1,184	$29,600

GREEN INFRASTRUCTURE RECOMMENDATIONS



Saint Catherine of Siena Church

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

0 30' 60'

US POST OFFICE: PITTSTOWN ROAD

Subwatershed: Cakepoulin Creek

Site Area: 306,034 sq. ft.

Address: 313 Pittstown Road
Franklin, NJ 08867

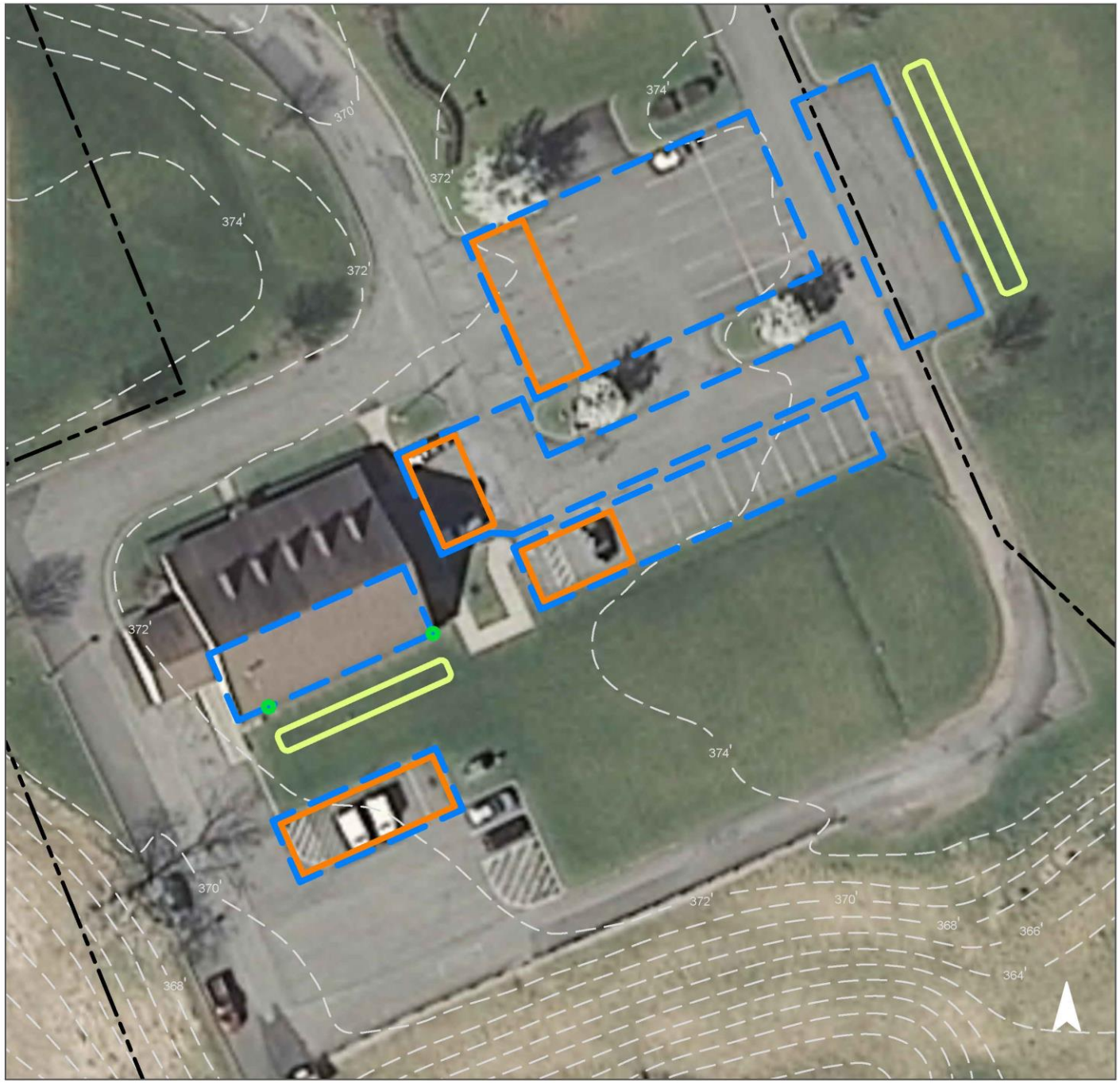
Block and Lot: Block 26, Lot 17.08

Parking spaces can be replaced with pervious pavement to infiltrate stormwater. Rain gardens can be installed to capture, treat, and infiltrate roof and parking lot runoff. 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"
20	62,091	3.0	31.4	285.1	0.048	1.7

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	0.108	18	8,161	0.31	1,070	$5,350
Pervious pavements	0.346	58	26,195	0.98	3,240	$81,000

GREEN INFRASTRUCTURE RECOMMENDATIONS



US Post Office: Pittstown Road

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

0 25' 50'

US POST OFFICE: WHITE BRIDGE ROAD

Subwatershed: Cakepoulin Creek

Site Area: 93,056 sq. ft.

Address: 289 White Bridge Road
Quakertown, NJ 08868

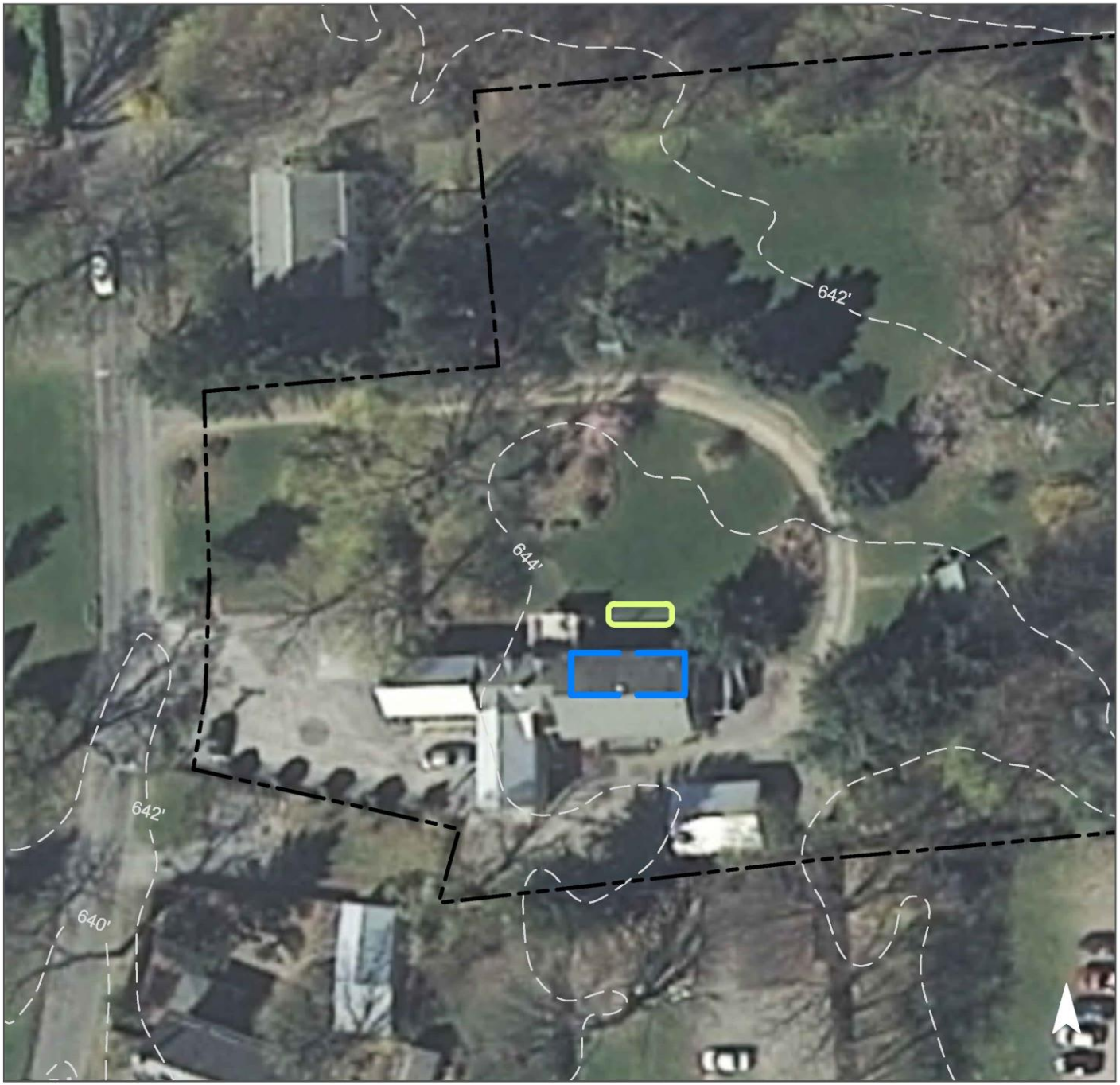
Block and Lot: Block 29, Lot 4.01

The parking lot is currently made of gravel and should remain pervious. A rain garden can be built 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"
12	11,018	0.5	5.6	50.6	0.009	0.30

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	0.013	2	1,002	0.04	136	$680

GREEN INFRASTRUCTURE RECOMMENDATIONS



US Post Office: White Bridge Road

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

0 25' 50'

CHERRYVILLE BAPTIST CHURCH

Subwatershed: Raritan River South Branch

Site Area: 220,500 sq. ft.

Address: 594 Cherryville Road Flemington, NJ 08822

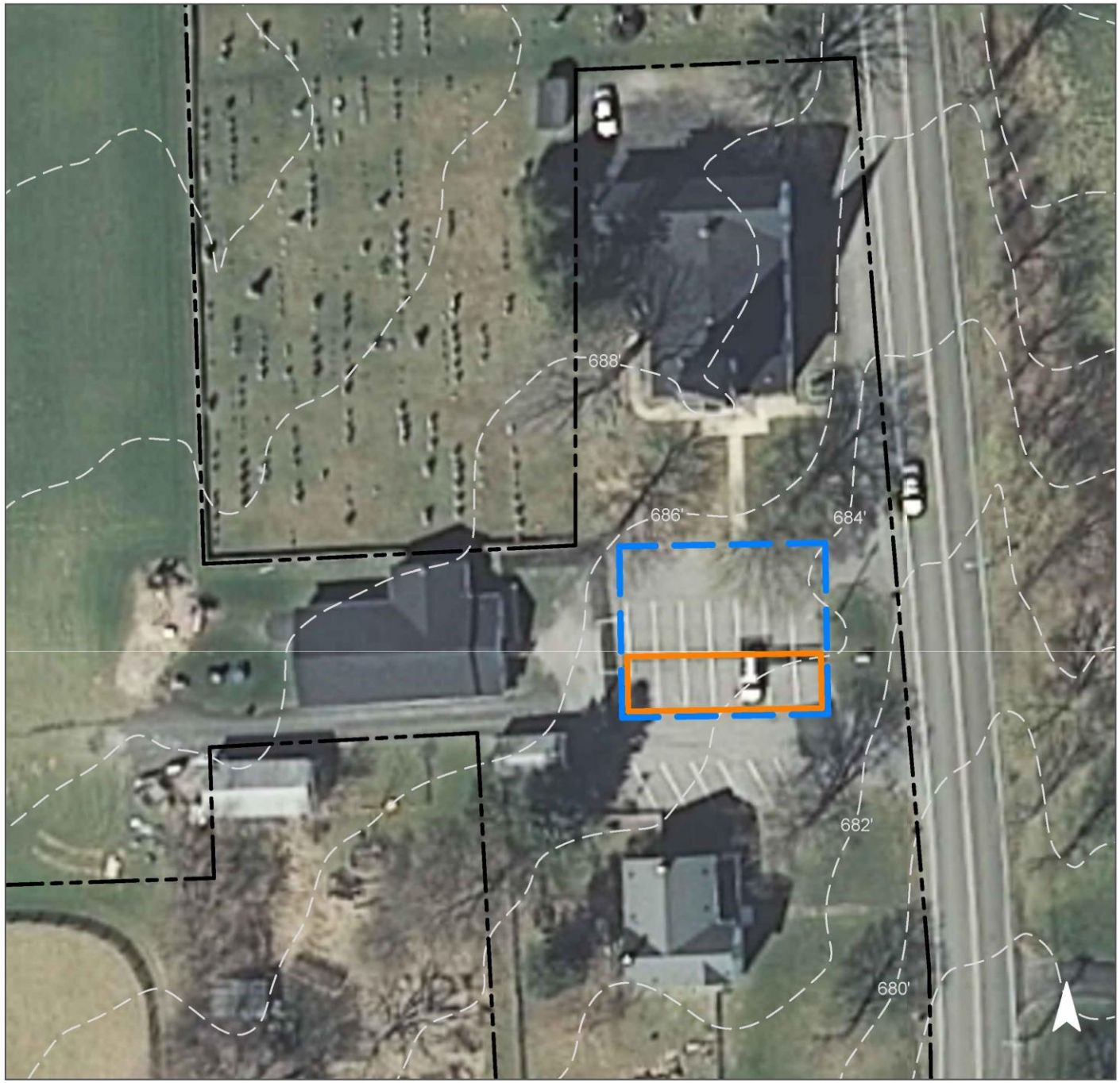
Block and Lot: Block 30, Lot 19

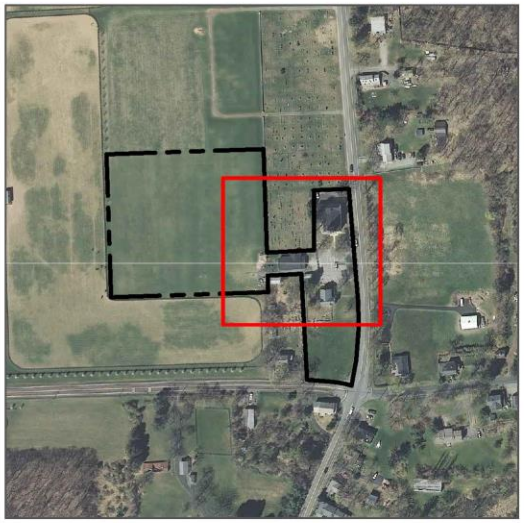
Parking spaces in the middle section of the parking lot can be replaced with porous asphalt to infiltrate stormwater. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

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"
11	23,784	1.1	12.0	109.2	0.019	0.65

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	0.098	16	7,465	0.28	1,143	$28,575

GREEN INFRASTRUCTURE RECOMMENDATIONS





Cherryville Baptist Church

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

0 20' 40'

FAITH CHAPEL WESLEYAN CHURCH

Subwatershed: **Raritan River South Branch**

Site Area: **889,556 sq. ft.**

Address: **43 Lower Landsdown Road Annandale, NJ 08801**

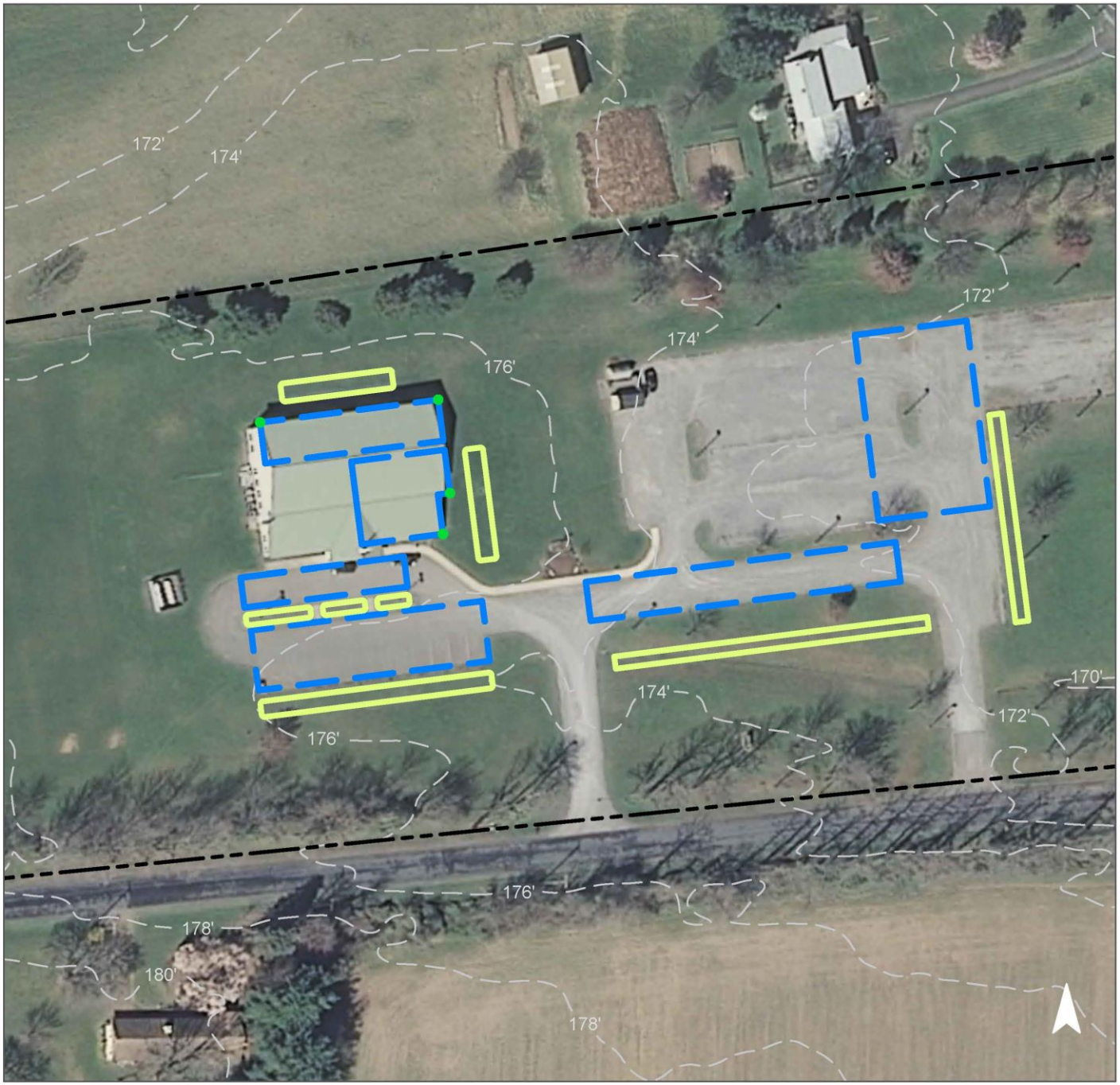
Block and Lot: **Block 8, Lot 1.02**

All downspouts are currently directly connected. Several rain gardens can be installed to capture, treat, and infiltrate roof and parking lot runoff. Two existing bioswales can serve as overflow points. 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"
10	92,072	4.4	46.5	422.7	0.072	2.53

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 systems	0.749	125	56,751	2.13	6,752	$33,760

GREEN INFRASTRUCTURE RECOMMENDATIONS



Faith Chapel Wesleyan Church

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

0 50' 100'

CROSSROADS CHRISTIAN ACADEMY

Subwatershed: **Spruce Run Reservoir/ Willoughby Brook**

Site Area: **962,917 sq. ft.**

Address: **9 Pittstown Road Clinton, NJ 08809**

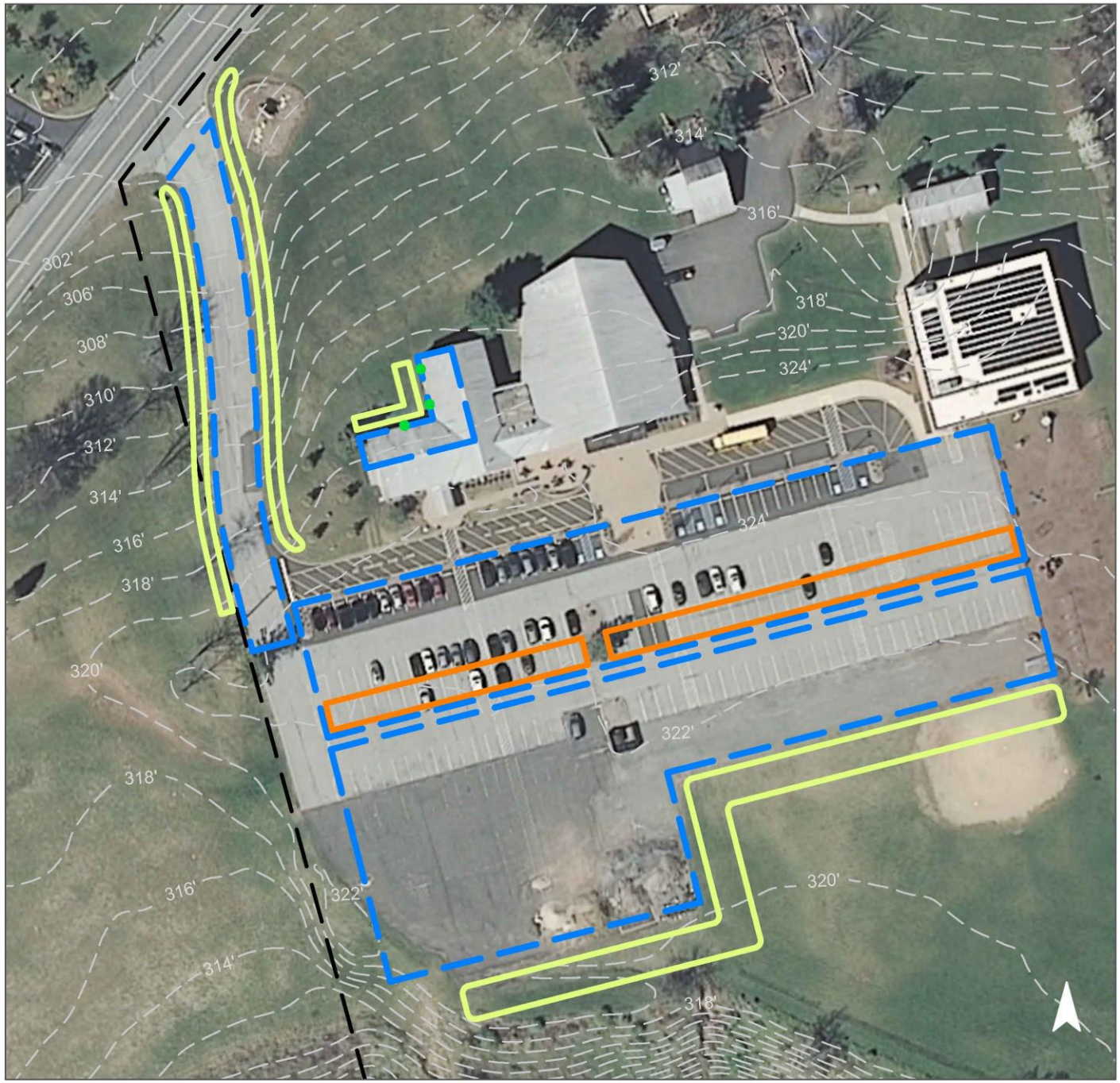
Block and Lot: **Block 5, Lot 25**

Rain gardens can be installed along the entrance driveway, the building and south of the parking lot to capture, treat, and infiltrate stormwater. Parking spaces can also be replaced with pervious pavement to infiltrate runoff. 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"
24	231,384	11.2	116.9	1,062.4	0.180	6.35

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	1.641	275	124,318	4.67	14,562	$72,810
Pervious pavements	1.101	184	83,417	3.13	8,058	$201,450

GREEN INFRASTRUCTURE RECOMMENDATIONS



Crossroads Christian Academy

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

0 50' 100'

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)
CAKEPOULIN CREEK SUBWATERSHED	**35.74**	**1,556,675**			**15.7**	**164.1**	**1,491.6**		**7.46**	**324,864**	**0.253**	**8.91**
Franklin Township Police Department												
Total Site Info	2.03	88,486	16	40	1.6	17.3	157.0	39	0.78	34,192	0.027	0.94
Franklin Township School												
Total Site Info	14.49	631,311	37	7	5.2	54.9	499.1	17	2.50	108,702	0.085	2.98
Quakertown Fire Company												
Total Site Info	2.22	96,506	28	13	1.9	19.8	179.9	41	0.90	39,181	0.031	1.07
Quakertown United Methodist Church												
Total Site Info	1.44	62,681	37	25	0.4	3.8	34.3	12	0.17	7,470	0.006	0.20
Saint Catherine of Siena Church												
Total Site Info	6.40	278,601	26	17.02	3.0	31.4	285.6	22	1.43	62,209	0.048	1.71
US Post Office: Pittstown Road												
Total Site Info	7.03	306,034	26	17.08	3.0	31.4	285.1	20	1.43	62,091	0.048	1.70
US Post Office: White Bridge Road												
Total Site Info	2.14	93,056	29	4.01	0.5	5.6	50.6	12	0.25	11,018	0.009	0.30
RARITAN RIVER SOUTH BRANCH SUBWATERSHED	**25.48**	**1,110,056**			**5.6**	**58.5**	**531.9**		**2.66**	**115,856**	**0.090**	**3.18**
Cherryville Baptist Church												
Total Site Info	5.06	220,500	30	19	1.1	12.0	109.2	11	0.55	23,784	0.019	0.65
Faith Chapel Wesleyan Church												
Total Site Info	20.42	889,556	8	1.02	4.4	46.5	422.7	10	2.11	92,072	0.072	2.53

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)
SPRUCE RUN RESERVIOR/WILLOUGHBY BROOK SUBWATERSHED	**22.11**	**962,917**			**11.2**	**116.9**	**1,062.4**		**5.31**	**231,384**	**0.180**	**6.35**
Crossroads Christian Academy												
Total Site Info	22.11	962,917	5	25	11.2	116.9	1,062.4	24	5.31	231,384	0.180	6.35

e. Summary of Proposed Green Infrastructure Practices

Summary of Proposed Green Infrstructure 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 %
	CAKEPOULIN CREEK SUBWATERSHED	**82,242**	**1.89**	**2.143**	**359**	**159,095**	**6.10**	**29,052**			**$416,000**	**25.3%**
1	**Franklin Township Police Department**											
	Bioretention systems/rain gardens	3,910	0.09	0.102	17	7,719	0.29	444	5	SF	$2,220	11.4%
	Total Site Info	**3,910**	**0.09**	**0.102**	**17**	**7,719**	**0.29**	**444**			**$2,220**	**11.4%**
2	**Franklin Township School**											
	Bioretention systems/rain gardens	5,106	0.12	0.133	22	10,076	0.38	1,483	5	SF	$7,415	4.7%
	Pervious pavements	25,190	0.58	0.656	110	49,727	1.87	9,551	25	SF	$238,775	23.2%
	Total Site Info	**30,296**	**0.70**	**0.789**	**132**	**59,803**	**2.25**	**11,034**			**$246,190**	**27.9%**
3	**Quakertown Fire Company**											
	Bioswales	3,260	0.07	0.085	14	6,433	0.24	3,153	5	SF	$15,765	8.3%
	Rainwater harvesting systems	3,123	0.07	0.081	14	2,920	0.23	2,920	2	gal	$5,840	8.0%
	Total Site Info	**6,383**	**0.15**	**0.166**	**28**	**9,353**	**0.47**	**6,073**			**$21,605**	**16.3%**
4	**Quakertown United Methodist Church**											
	Bioretention systems/rain gardens	797	0.02	0.021	3	1,571	0.06	250	5	SF	$1,250	10.7%
	Total Site Info	**797**	**0.02**	**0.021**	**3**	**1,571**	**0.06**	**250**			**$1,250**	**10.7%**
5	**Saint Catherine of Siena Church**											
	Bioretention systems/rain gardens	16,587	0.38	0.432	72	32,740	1.23	5,621	5	SF	$28,105	26.7%
	Pervious pavements	6,357	0.15	0.166	28	12,551	0.47	1,184	25	SF	$29,600	10.2%
	Total Site Info	**22,944**	**0.53**	**0.598**	**100**	**45,291**	**1.70**	**6,805**			**$57,705**	**36.9%**
6	**US Post Office: Pittstown Road**											
	Bioretention systems/rain gardens	4,135	0.09	0.108	18	8,161	0.31	1,070	5	SF	$5,350	6.7%
	Pervious pavements	13,270	0.30	0.346	58	26,195	0.98	3,240	25	SF	$81,000	21.4%
	Total Site Info	**17,405**	**0.40**	**0.453**	**76**	**34,356**	**1.29**	**4,310**			**$86,350**	**28.0%**
7	**US Post Office: White Bridge Road**											
	Bioretention systems/rain gardens	507	0.01	0.013	2	1,002	0.04	136	5	SF	$680	4.6%
	Total Site Info	**507**	**0.01**	**0.013**	**2**	**1,002**	**0.04**	**136**			**$680**	**4.6%**

Summary of Proposed Green Infrstructure 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 %
	RARITAN RIVER SOUTH BRANCH SUBWATERSHED	**32,530**	**0.75**	**0.848**	**142**	**64,216**	**2.41**	**7,895**			**$62,335**	**28.1%**
8	**Cherryville Baptist Church**											
	Pervious pavements	3,780	0.09	0.098	16	7,465	0.28	1,143	25	SF	$28,575	15.9%
	Total Site Info	**3,780**	**0.09**	**0.098**	**16**	**7,465**	**0.28**	**1,143**			**$28,575**	**15.9%**
9	**Faith Chapel Wesleyan Church**											
	Bioretention systems/rain gardens	28,750	0.66	0.749	125	56,751	2.13	6,752	5	SF	$33,760	31.2%
	Total Site Info	**28,750**	**0.66**	**0.749**	**125**	**56,751**	**2.13**	**6,752**			**$33,760**	**31.2%**
	SPRUCE RUN RESERVIOR/WILLOUGHBY BROOK SUBWATERSHED	**105,236**	**2.42**	**2.742**	**459**	**207,735**	**7.80**	**22,620**			**$274,260**	**45.5%**
10	**Crossroads Christian Academy**											
	Bioretention systems/rain gardens	62,979	1.45	1.641	275	124,318	4.67	14,562	5	SF	$72,810	27.2%
	Pervious pavements	42,257	0.97	1.101	184	83,417	3.13	8,058	25	SF	$201,450	18.3%
	Total Site Info	**105,236**	**2.42**	**2.742**	**459**	**207,735**	**7.80**	**22,620**			**$274,260**	**45.5%**