RUTGERS
New Jersey Agricultural
Experiment Station

Draft

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

Prepared for East Amwell 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, East Amwell Township covers approximately 28.6 square miles. Figures 1 and 2 illustrate that East Amwell Township is dominated by agricultural land uses. A total of 16.9% of the municipality's land use is classified as urban. Of the urban land in East Amwell 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 East Amwell 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 East Amwell Township. Based upon the 2007 NJDEP land use/land cover data, approximately 2.5% of East Amwell Township has impervious cover. This level of impervious cover suggests that the streams in East Amwell Township are likely sensitive streams[1]

Methodology

East Amwell Township contains portions of eight 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

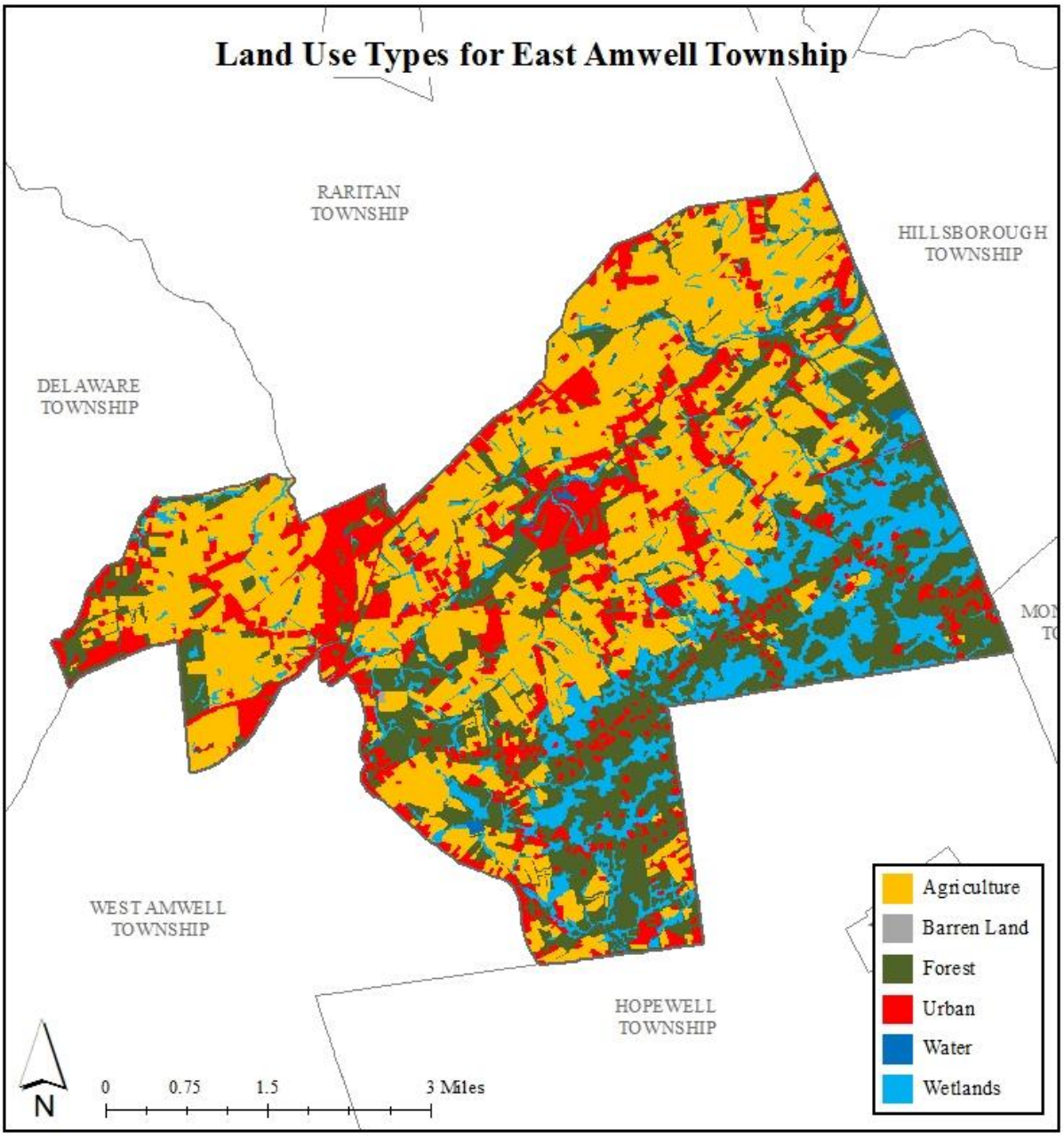


Figure 1: Map illustrating the land use in East Amwell Township

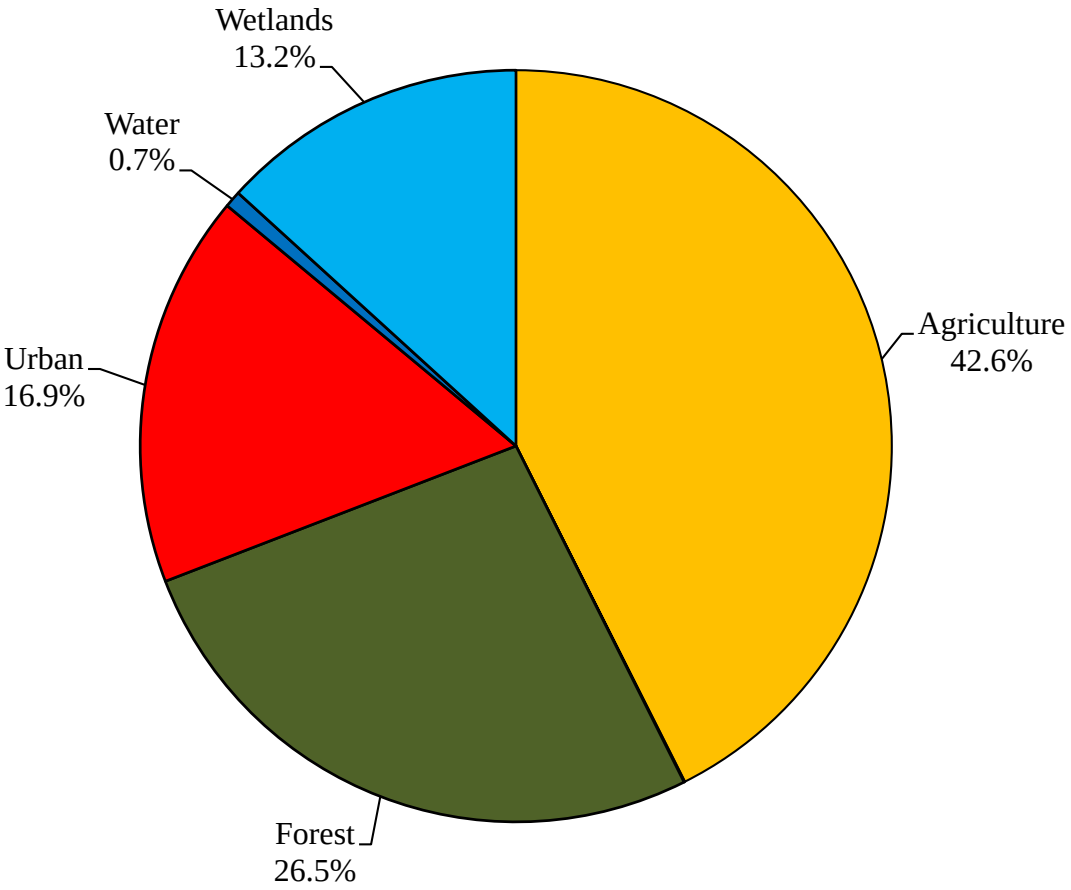


Figure 2: Pie chart illustrating the land use in East Amwell Township

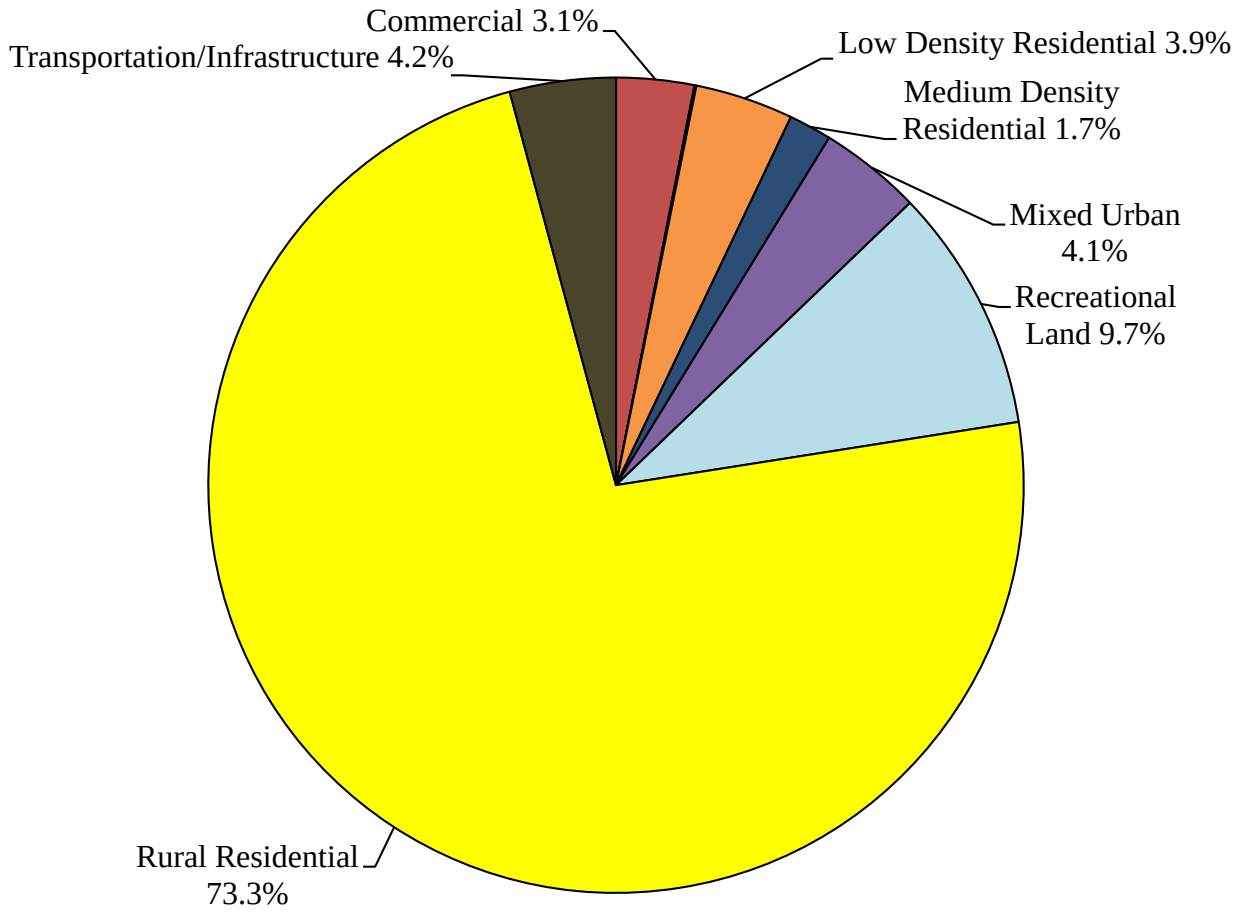


Figure 3: Pie chart illustrating the various types of urban land use in East Amwell Township

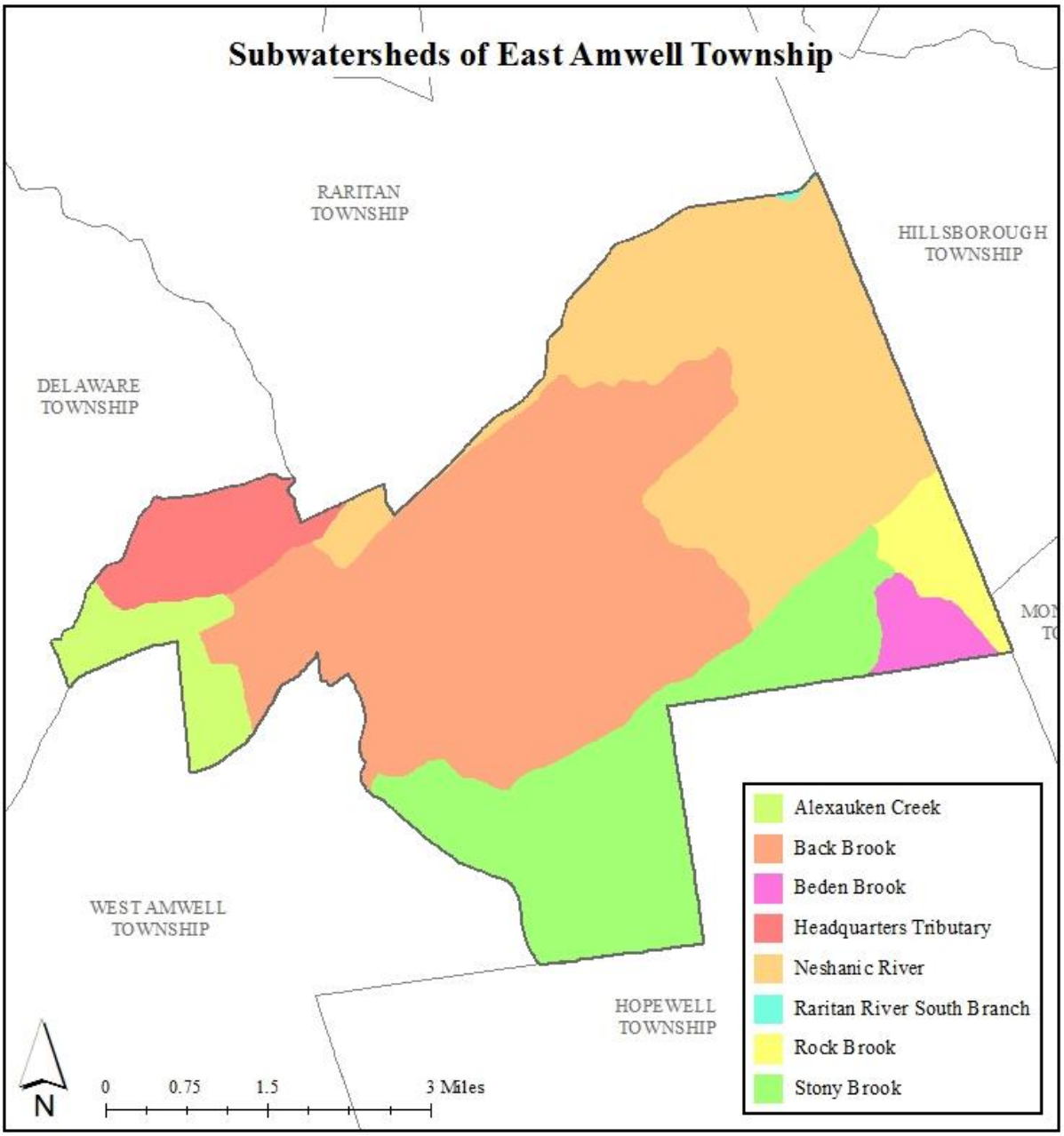


Figure 4: Map of the subwatersheds in East Amwell Township

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 East Amwell 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 East Amwell 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*.

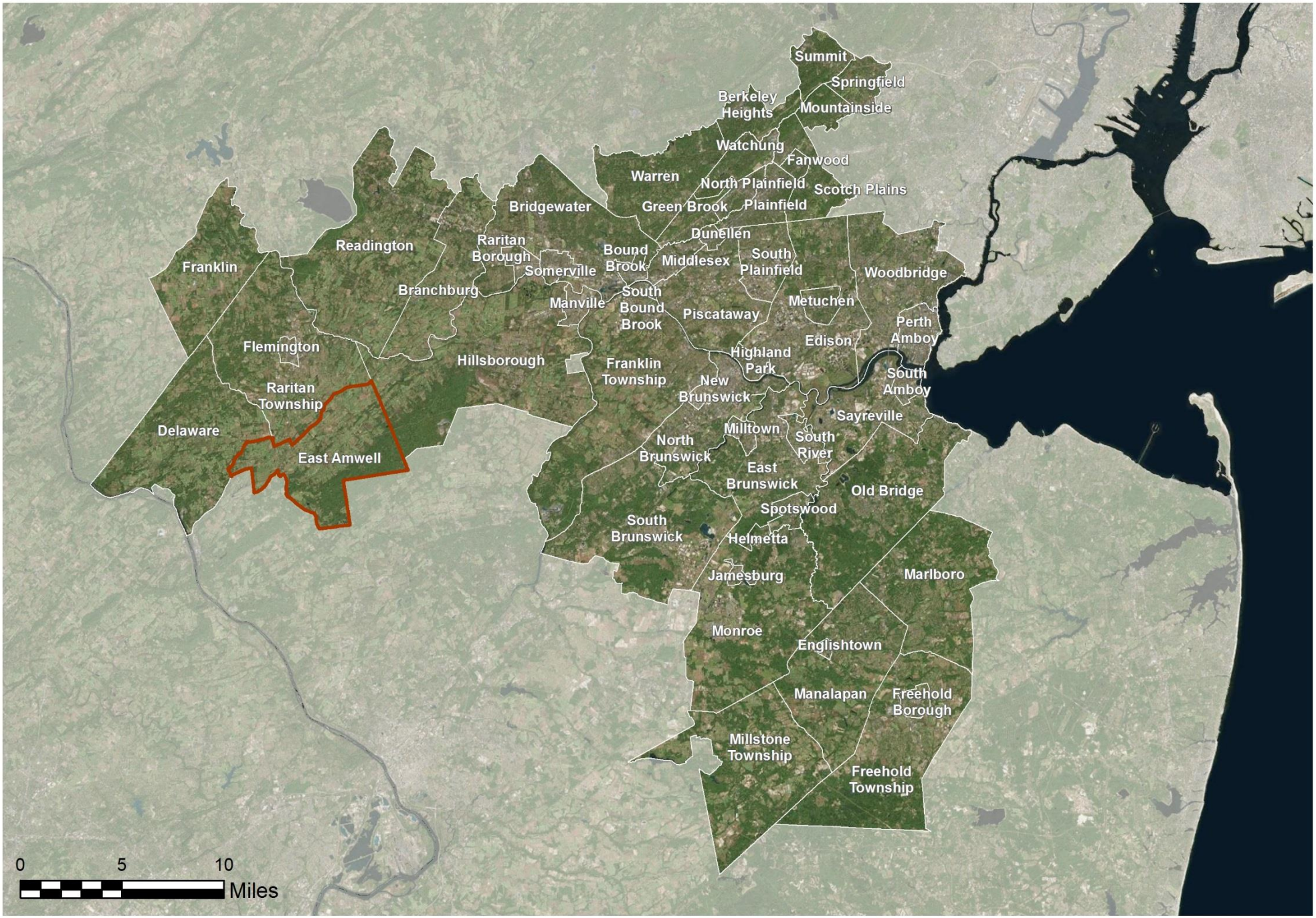
Conclusion

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

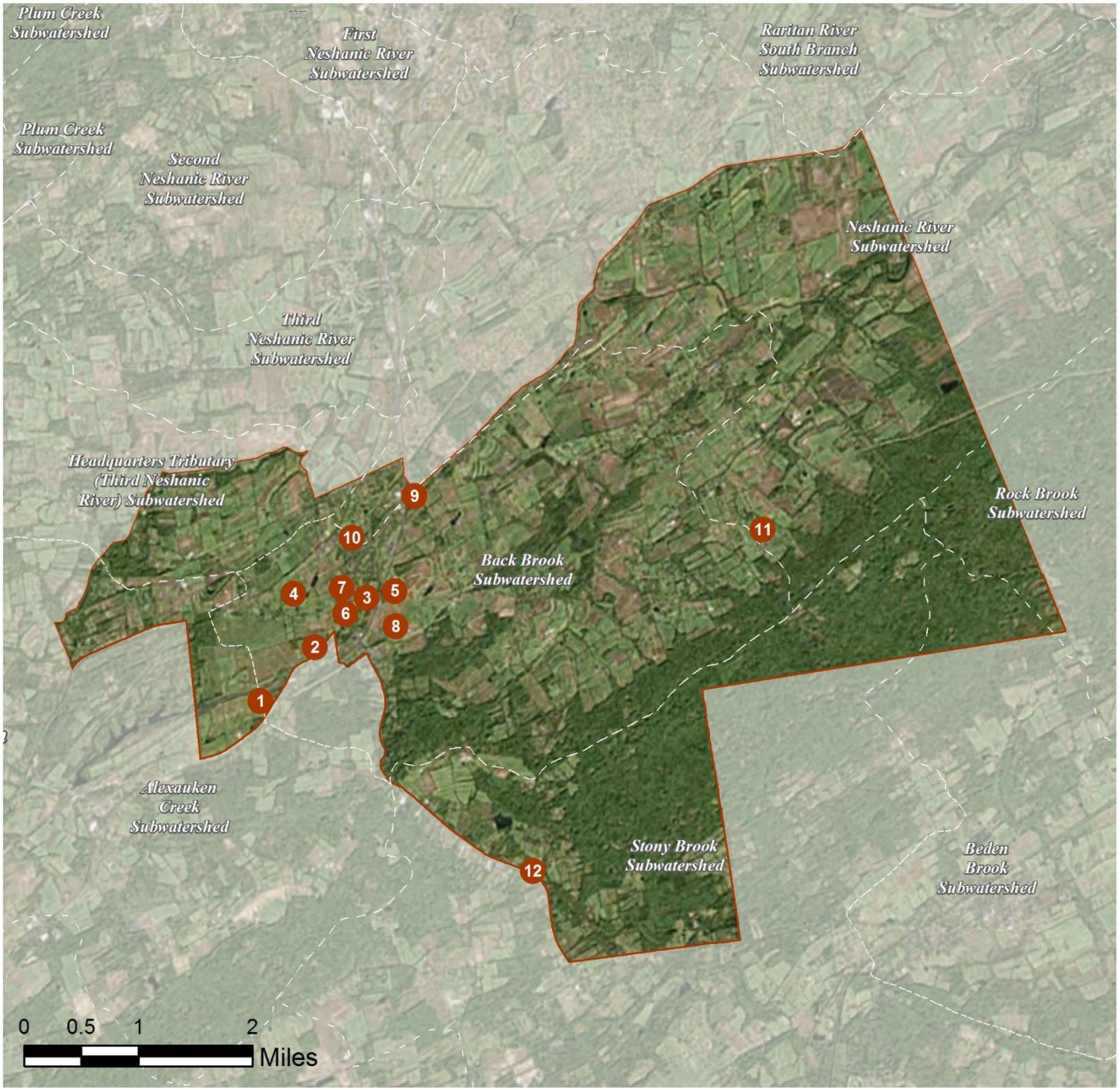
a. Overview Map of the Project

EAST AMWELL: CLIMATE RESILIENT GREEN INFRASTRUCTURE FOR THE RARITAN BASIN



b. Green Infrastructure Sites

EAST AMWELL: GREEN INFRASTRUCTURE SITES



SITES WITHIN THE ALEXAUKEN CREEK/BACK BROOK SUBWATERSHED:

1. Hunterdon County Fairgrounds

SITES WITHIN THE BACK BROOK SUBWATERSHED:

2. Amwell Valley Ambulance Corps
3. Amwell Valley Fire
4. Biamonte Stables
5. East Amwell Township Elementary School
6. Hunterdon County Library & East Amwell Post Office
7. Kirkpatrick Presbyterian Church
8. Planeta Stables
9. United First Presbyterian Church

SITES WITHIN THE NESHANIC RIVER SUBWATERSHED:

10. Marion F Clawson Memorial Park
11. Toy Box Farm

SITES WITHIN THE STONY BROOK SUBWATERSHED:

12. Linvale United Methodist Church

c. Proposed Green Infrastructure Concepts

HUNTERDON COUNTY FAIRGROUNDS

Subwatershed: **Alexauken Creek and Back Brook**

Site Area: **3,900,547 sq. ft.**

Address: **1207 Route 179 Lambertville, NJ 08530**

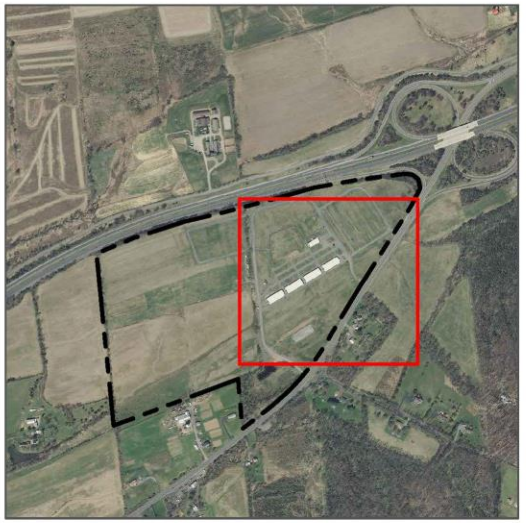
Block and Lot: **Block 8.02, Lot 25.01**

Stormwater currently drains directly into a nearby creek. A rain garden adjacent to the roadway can capture, treat, and infiltrate this runoff before it enters the creek. 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	185,510	8.9	93.7	851.7	0.145	5.09

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	1.080	181	81,839	3.07	9,770	$48,850

GREEN INFRASTRUCTURE RECOMMENDATIONS



Hunterdon County Fair Grounds

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

0 100' 200'

AMWELL VALLEY AMBULANCE CORPS

Subwatershed: **Back Brook**

Site Area: **86,996 sq. ft.**

Address: **1141 Old York Road**
Ringoes, NJ 08551

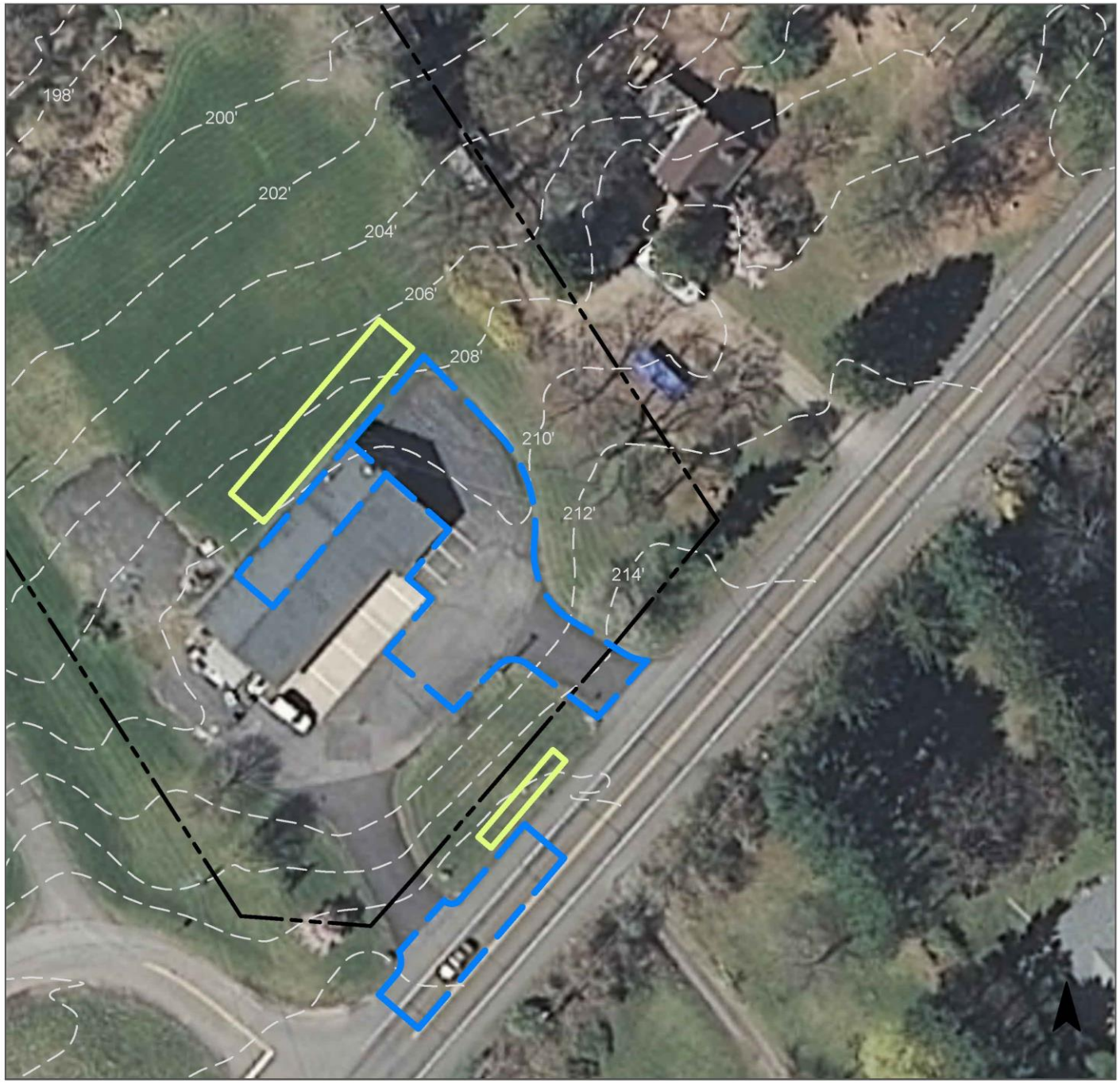
Block and Lot: **Block 8, Lot 24.01**

The installation of rain gardens adjacent to the parking lot and roadway can 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"
37	32,285	1.6	16.3	148.2	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
Bioretention systems	0.257	43	19,463	0.73	1,836	$9,180

GREEN INFRASTRUCTURE RECOMMENDATIONS



Amwell Valley Ambulance Corps

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

0 30' 60'

AMWELL VALLEY FIRE

Subwatershed: **Back Brook**

Site Area: **169,914 sq. ft.**

Address: **22 County Road 579**
Ringoes, NJ 08551

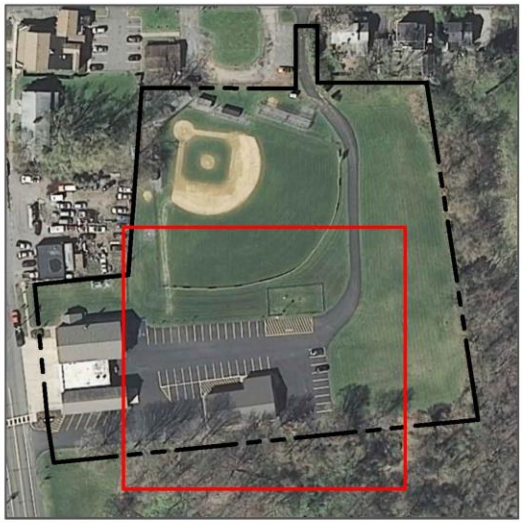
Block and Lot: **Block 27.01, Lot 19**

Parking spaces can 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"
35	59,302	2.9	30.0	272.3	0.046	1.63

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Pervious pavements	0.161	27	12,207	0.46	6,186	$154,650

GREEN INFRASTRUCTURE RECOMMENDATIONS



Amwell Valley Fire

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

0 20' 40'

BIAMONTE STABLES

Subwatershed: Back Brook

Site Area: 2,748,150 sq. ft.

Address: 20 Boss Road
East Amwell, NJ 08551

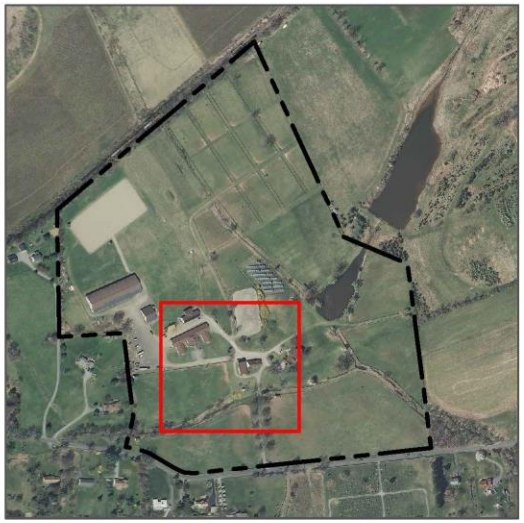
Block and Lot: Block 11, Lot 3

Installing rain gardens adjacent to the lodge can infiltrate and treat roof runoff. A third rain garden on the south side of the barn can help infiltrate additional stormwater runoff. A preliminary soil assessment for the two rain gardens adjacent to the lodge suggests that the soils have suitable drainage characteristics for green infrastructure. However, for the rain garden across from the barn, 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"
3	95,130	4.6	48.0	436.8	0.074	2.61

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention systems	0.146	25	11,093	0.42	1,391	$6,955

GREEN INFRASTRUCTURE RECOMMENDATIONS



Biamonte Stables

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

0 50' 100'

EAST AMWELL TOWNSHIP ELEMENTARY

Subwatershed: **Back Brook**

Site Area: **950,075 sq. ft.**

Address: **43 Wertsville Road**
Ringoes, NJ 08551

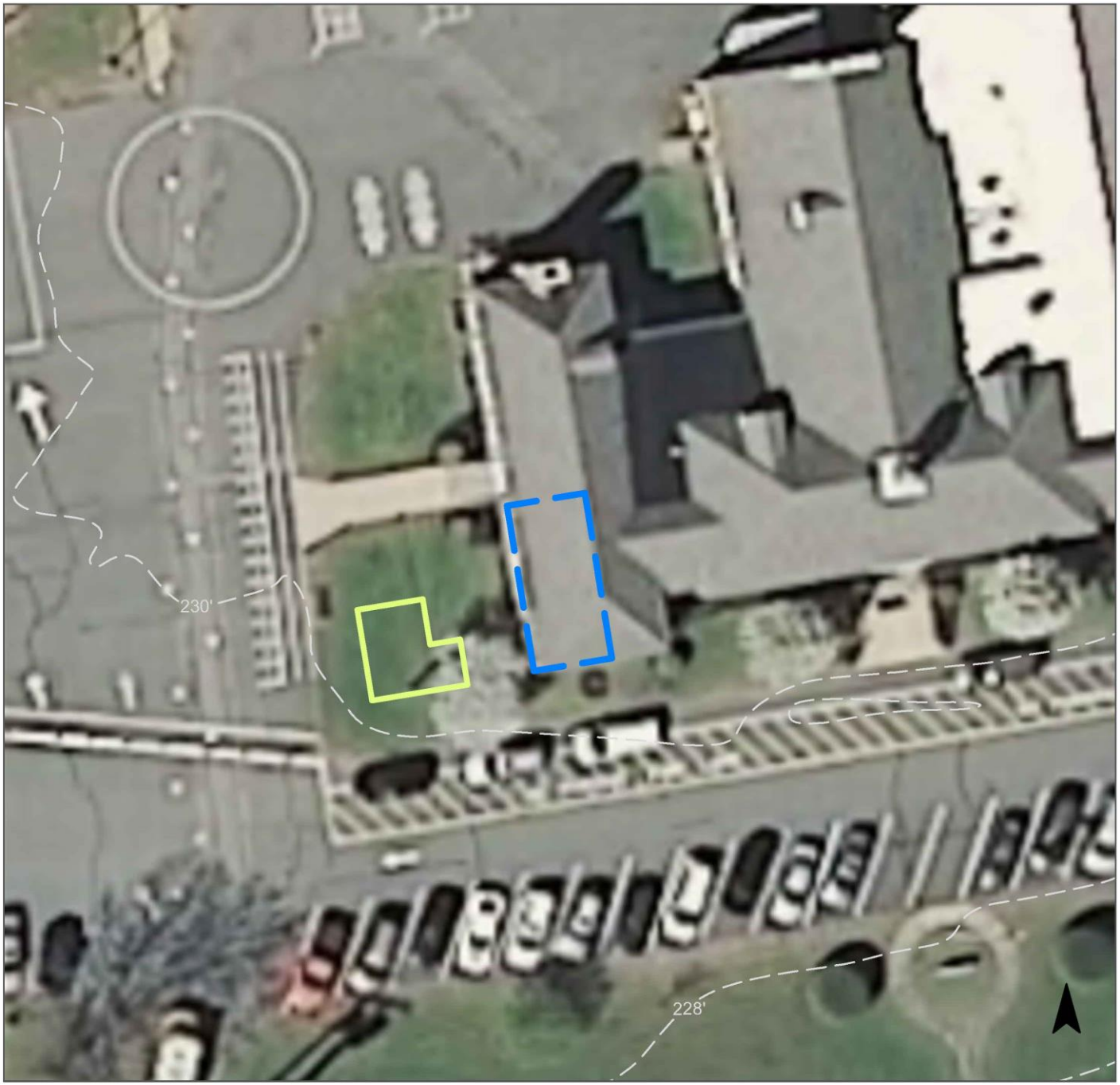
Block and Lot: **Block 16.01, Lot 35**

In the initial impervious cover assessment for East Amwell Township, a potential rain garden site was identified adjacent to the west entrance of the building. The rain garden has been installed to capture, treat, and infiltrate roof runoff.

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"
19	177,272	8.5	89.5	813.9	0.138	4.86

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	288	$1,440

GREEN INFRASTRUCTURE RECOMMENDATIONS



East Amwell Township Elementary School

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

0 15' 30'

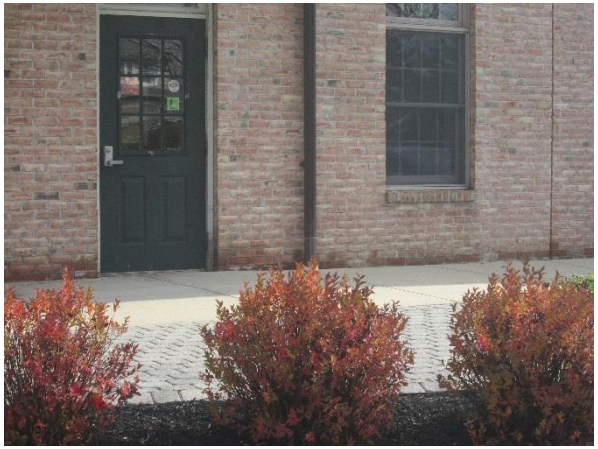
HUNTERDON COUNTY LIBRARY & EAST AMWELL POST OFFICE

Subwatershed: **Back Brook**

Site Area: **66,515 sq. ft.**

Address: **1108 Old York Road**
Ringoes, NJ 08551

Block and Lot: **Block 10, Lot 1**

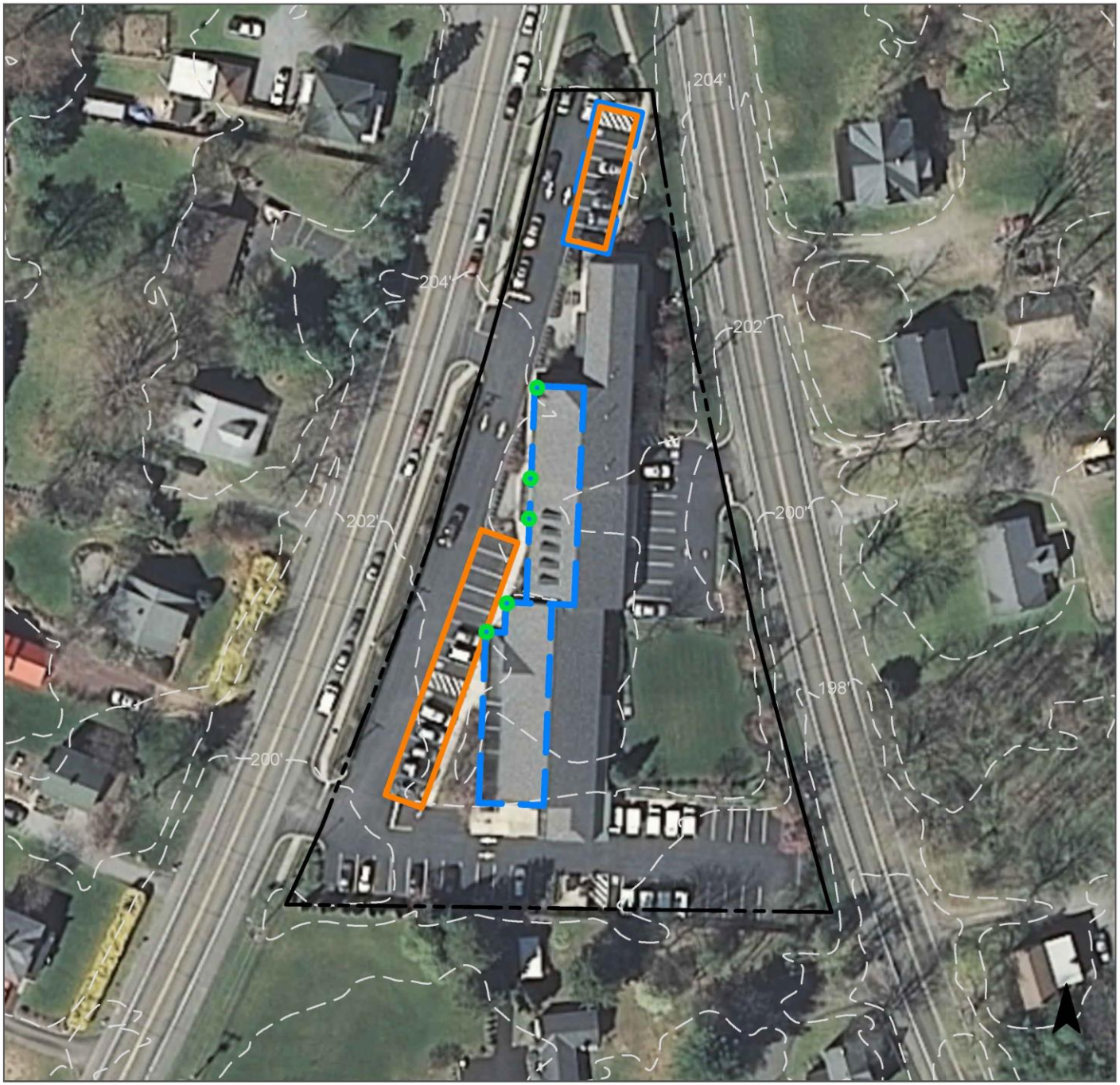


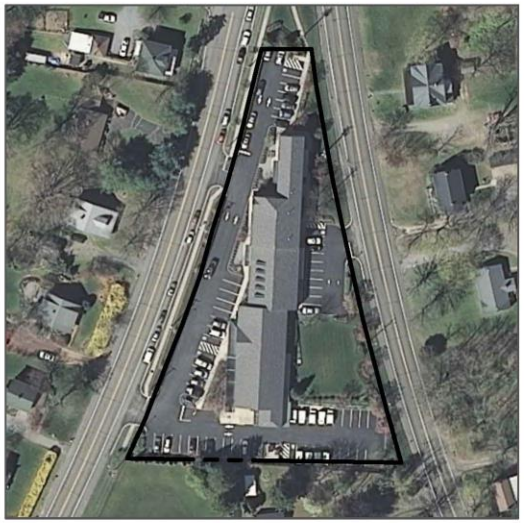
Parking spaces can be replaced with pervious pavement to provide stormwater an opportunity to infiltrate. Downspouts can be disconnected, allowing the roof runoff to also be infiltrated. A preliminary soil assessment of this site suggests that the soils have suitable drainage characteristics for green 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	56,402	2.7	28.5	259.0	0.044	1.55

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	0.212	36	16,082	0.60	4,407	$110,175

GREEN INFRASTRUCTURE RECOMMENDATIONS





Hunterdon County Library & East Amwel Post Office

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

0 40' 80'

KIRKPATRICK PRESBYTERIAN CHURCH

Subwatershed: **Back Brook**

Site Area: **907,054 sq. ft.**

Address: **37 John Ringo Road**
Ringoes, NJ 08851

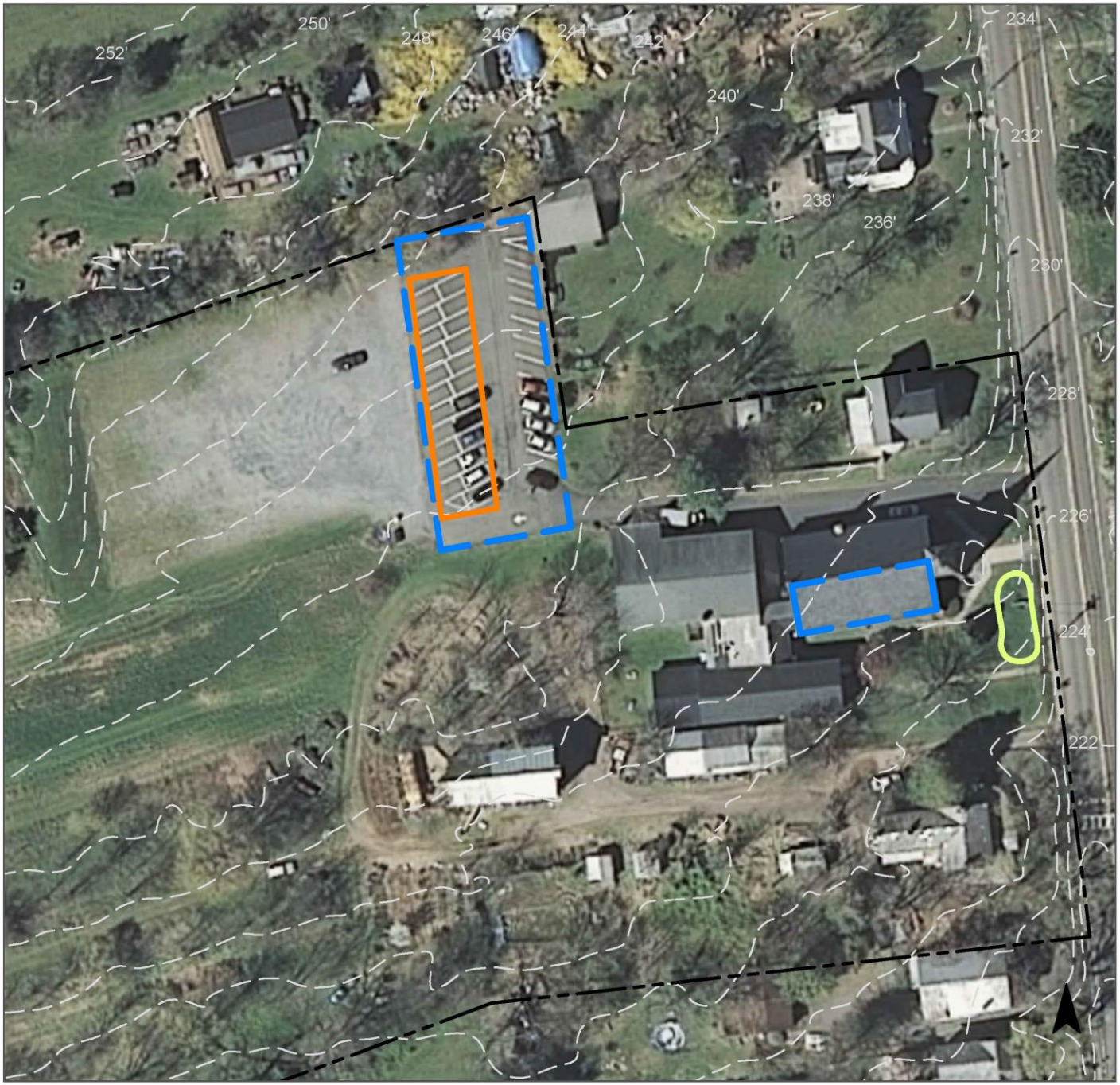
Block and Lot: **Block 11, Lot 4;22;21**

The site currently has a gravel parking lot, which should remain pervious. Traditional parking spaces can be replaced with pervious pavement to infiltrate additional stormwater. A rain garden can also be installed to capture, treat, and 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"
8	75,107	3.6	37.9	344.8	0.059	2.06

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	0.048	8	3,635	0.14	760	$3,800
Pervious pavements	0.295	49	22,320	0.84	3,774	$94,350

GREEN INFRASTRUCTURE RECOMMENDATIONS



Kirkpatrick Presbyterian Church

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

0 40' 80'

PLANETA STABLES

Subwatershed: **Back Brook**

Site Area: **2,673,024 sq. ft.**

Address: **46 Wertsville Road**
East Amwell, NJ 08551

Block and Lot: **Block 27, Lot 33**

Cisterns can be installed at the large barn to harvest rainwater for use by the stables. These systems not only collect water that can be used to wash horses and equipment, but also help slow the rate of stormwater runoff, leading to a decrease in flooding and erosion. A rain garden can also be installed 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"
3	73,780	3.6	37.3	338.8	0.057	2.02

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	0.019	3	1,466	0.05	509	$2,545
Rainwater harvesting systems	0.336	56	15,000	0.96	15,000 (gal)	$30,000

GREEN INFRASTRUCTURE RECOMMENDATIONS

Planeta Stables

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

0 30' 60'

UNITED FIRST PRESBYTERIAN CHURCH

Subwatershed: **Back Brook**

Site Area: **52,387 sq. ft.**

Address: **1000 Old York Road**
Ringoes, NJ 08551

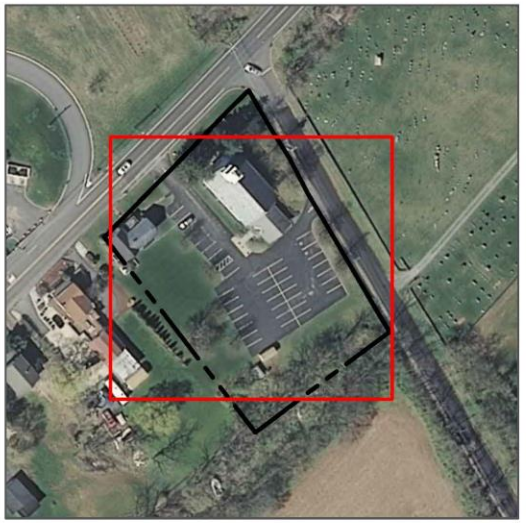
Block and Lot: **Block 16.01, Lot 25**

Two rain gardens can be installed 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"
43	22,573	1.1	11.4	103.6	0.018	0.62

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	0.167	28	12,634	0.47	938	$4,690

GREEN INFRASTRUCTURE RECOMMENDATIONS



United First Presbyterian Church

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

0 20' 40'

MARION F. CLAWSON MEMORIAL PARK

Subwatershed: Neshanic River

Site Area: 1,058,500 sq. ft.

Address: 179 South Old York Road & Fox Hunt Road Ringoes, NJ 08551

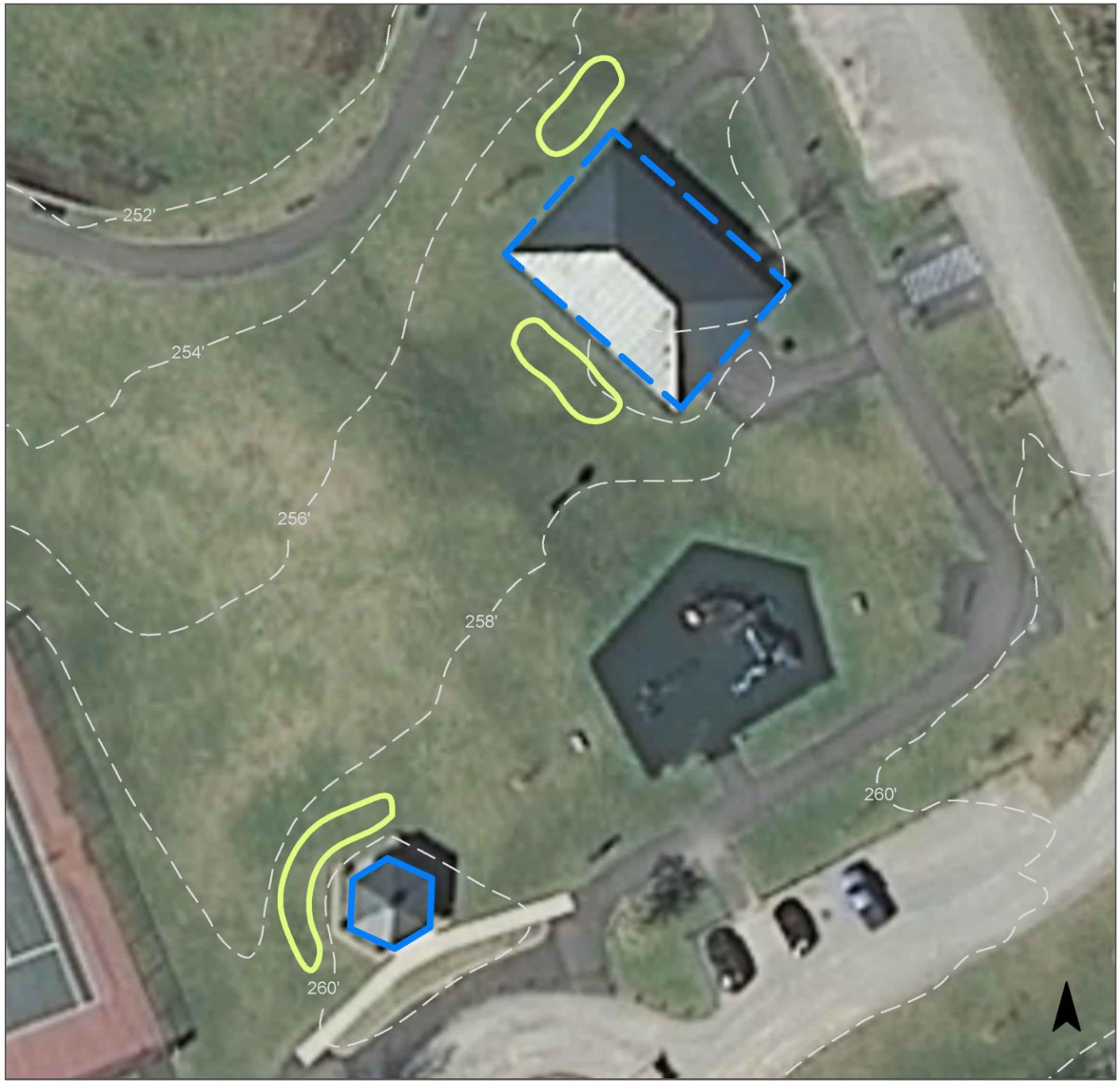
Block and Lot: Block 14, Lot 15

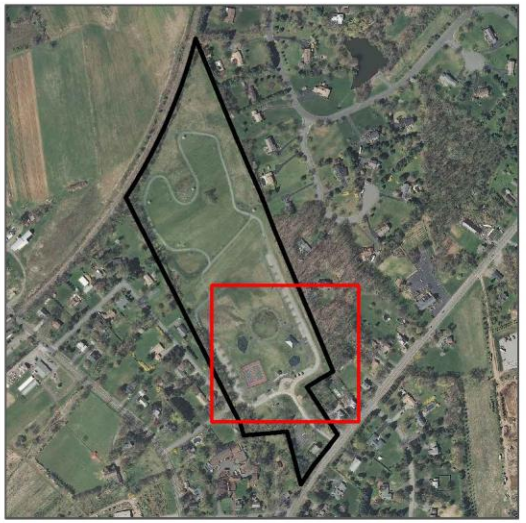
Rain gardens can be built to capture, treat, and infiltrate roof runoff. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

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"
10	107,780	5.2	54.4	494.9	0.084	2.96

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention systems	0.068	11	5,184	0.19	1,021	$5,105

GREEN INFRASTRUCTURE RECOMMENDATIONS





Marion F. Clawson Memorial Park

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

0 20' 40'

TOY BOX FARM

Subwatershed: Neshanic River

Site Area: 1,311,917 sq. ft.

Address: 323 Rileyville Road
Ringoes, NJ 08551

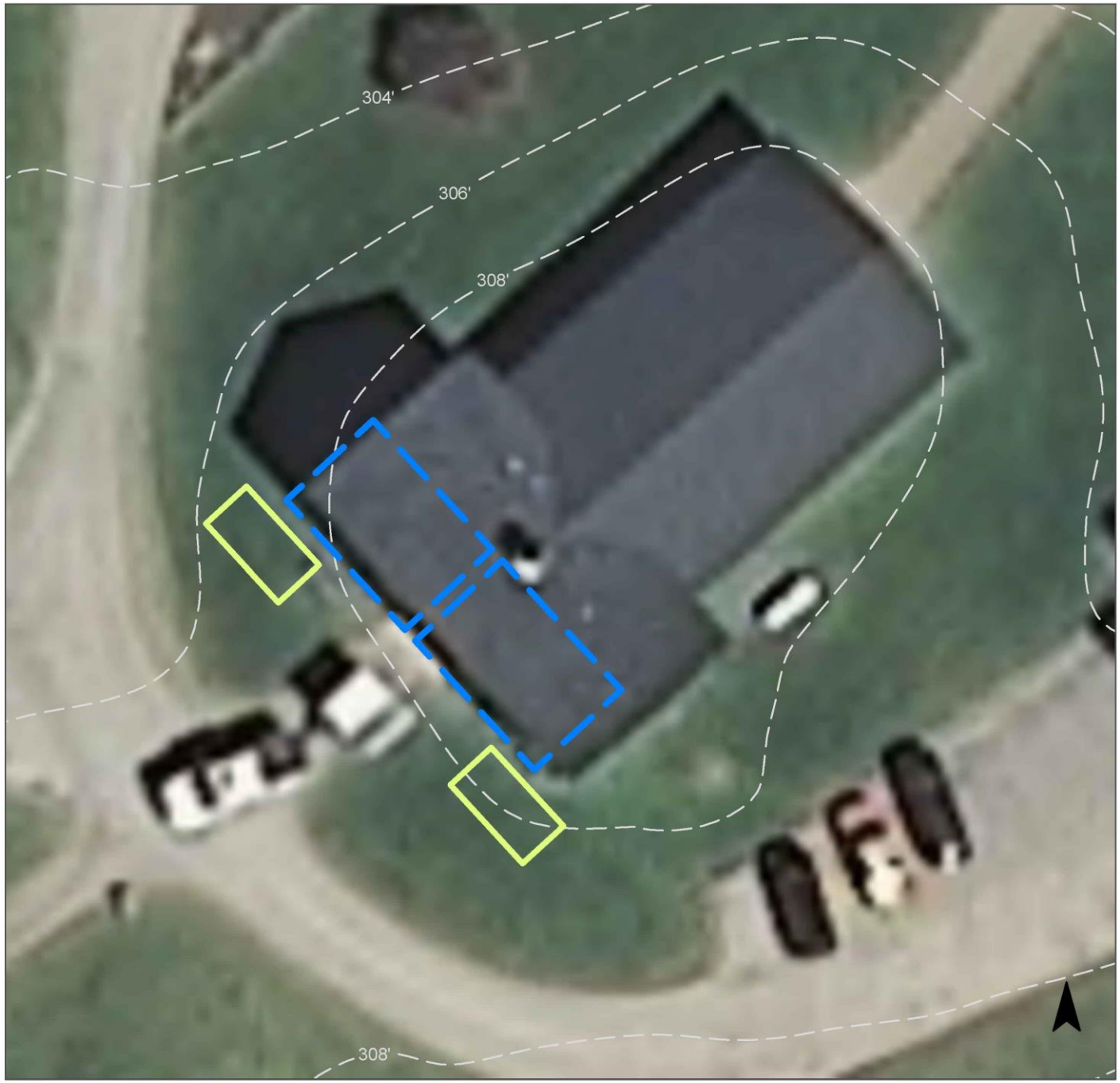
Block and Lot: Block 34, Lot 5

The installation of rain gardens adjacent to the building can infiltrate and treat roof 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"
3	42,965	2.1	21.7	197.3	0.033	1.18

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	0.009	2	703	0.03	204	$1,020

GREEN INFRASTRUCTURE RECOMMENDATIONS



Toy Box Farm

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

0 10' 20'

LINVALE UNITED METHODIST CHURCH

Subwatershed: Stony Brook

Site Area: 18,301 sq. ft.

Address: State Highway 31 North & Linvale Road Ringoes, NJ 08551

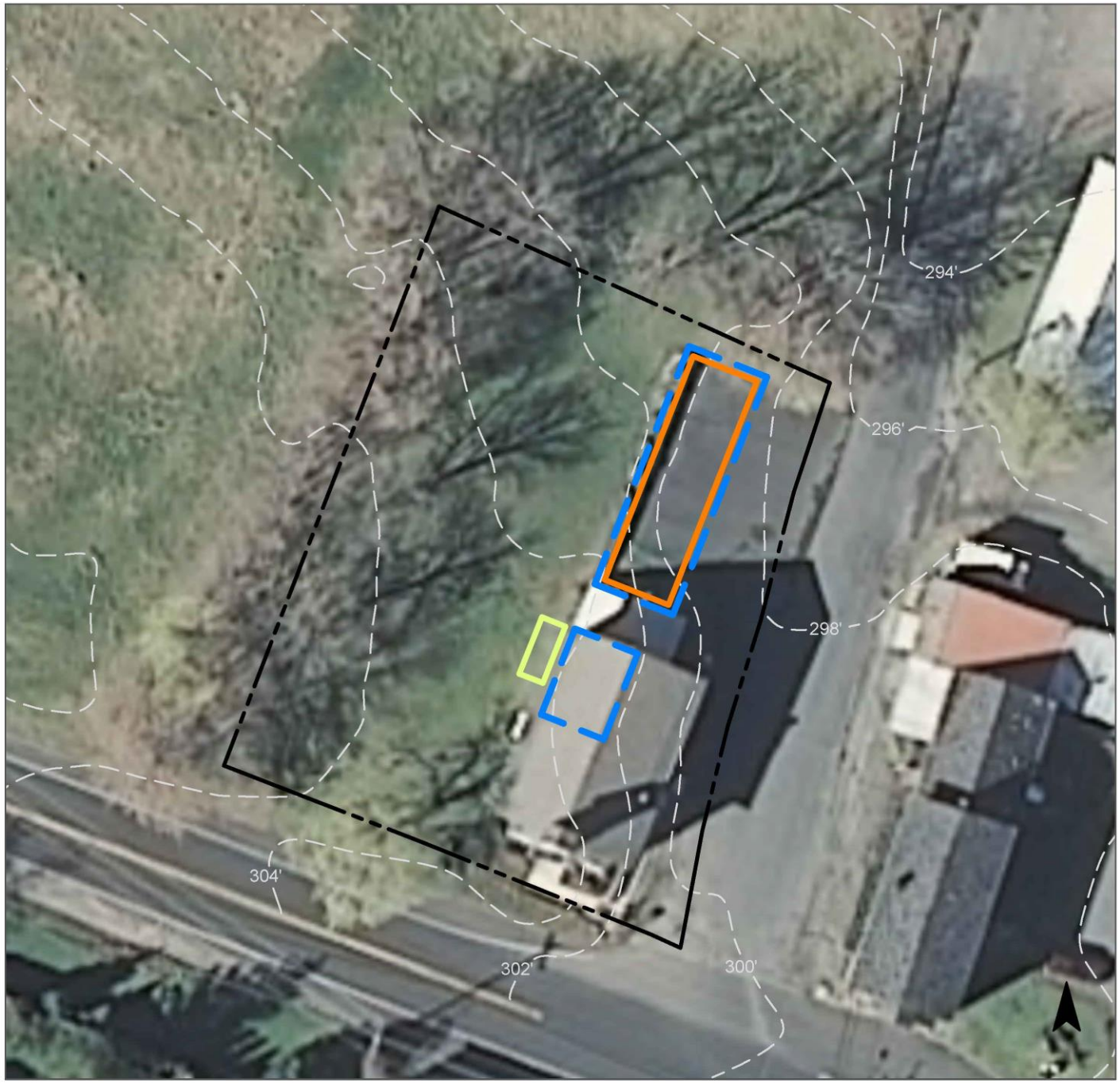
Block and Lot: Block 30, Lot 18

Parking spaces can be replaced with pervious pavement to infiltrate stormwater. A rain garden can be installed adjacent to 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"
40	7,321	0.4	3.7	33.6	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	0.011	2	845	0.03	105	$525
Pervious pavements	0.038	6	2,910	0.11	1,133	$28,325

GREEN INFRASTRUCTURE RECOMMENDATIONS



Linvale United Methodist Church

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

0 10' 20'

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)
ALEXAUKEN CREEK/BACK BROOK SUBWATERSHED	**89.54**	**3,900,547**			**8.9**	**93.7**	**851.7**		**4.26**	**185,510**	**0.145**	**5.09**
Hunterdon County Fairgrounds												
Total Site Info	89.54	3,900,547	8.02	25.01	8.9	93.7	851.7	5	4.26	185,510	0.145	5.09
BACK BROOK SUBWATERSHED	**175.71**	**7,654,115**			**28.5**	**298.9**	**2,717.4**		**13.59**	**591,851**	**0.461**	**16.23**
Amwell Valley Ambulance Corps												
Total Site Info	2.00	86,996	8	24.01	1.6	16.3	148.2	37	0.74	32,285	0.025	0.89
Amwell Valley Fire												
Total Site Info	3.90	169,914	27.01	19	2.9	30.0	272.3	35	1.36	59,302	0.046	1.63
Biamonte Stables												
Total Site Info	63.09	2,748,150	11	3	4.6	48.0	436.8	3	2.18	95,130	0.074	2.61
East Amwell Township Elementary School												
Total Site Info	21.81	950,075	16.01	35	8.5	89.5	813.9	19	4.07	177,272	0.138	4.86
Hunterdon County Library & East Amwell Post Office												
Total Site Info	1.53	66,515	10	1	2.7	28.5	259.0	85	1.29	56,402	0.044	1.55
Kirkpatrick Presbyterian Church												
Total Site Info	20.82	907,054	11	4,22,21	3.6	37.9	344.8	8	1.72	75,107	0.059	2.06
Planeta Stables												
Total Site Info	61.36	2,673,024	27	33	3.6	37.3	338.8	3	1.69	73,780	0.057	2.02
United First Presbyterian Church												
Total Site Info	1.20	52,387	16.01	25	1.1	11.4	103.6	43	0.52	22,573	0.018	0.62
NESHANIC RIVER SUBWATERSHED	**54.42**	**2,370,416**			**7.3**	**76.1**	**692.1**		**3.46**	**150,745**	**0.117**	**4.13**
Marion F. Clawson Memorial Park												
Total Site Info	24.30	1,058,500	14	15	5.2	54.4	494.9	10	2.47	107,780	0.084	2.96

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)
Toy Box Farm												
Total Site Info	30.12	1,311,917	34	5	2.1	21.7	197.3	3	0.99	42,965	0.033	1.18
STONY BROOK SUBWATERSHED	**0.42**	**18,301**			**0.4**	**3.7**	**33.6**		**0.17**	**7,321**	**0.006**	**0.20**
Linvale United Methodist Church												
Total Site Info	0.42	18,301	30	18	0.4	3.7	33.6	40	0.17	7,321	0.006	0.20

e. Summary of Proposed Green Infrastructure Practices

Summary of Proposed Green Infrastructure Practices

	Subwatershed/Site Name/Total Site Info/GI Practice	Potential Management Area		Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Max Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cfs)	Size of BMP (SF)	Unit Cost ($)	Unit	Total Cost ($)	I.C. Treated %
		Area (SF)	Area (ac)									
	ALEXAUKEN CREEK/BACK BROOK SUBWATERSHED	**41,460**	**0.95**	**1.080**	**181**	**81,839**	**3.07**	**9,770**			**$48,850**	**22.3%**
1	**Hunterdon County Fairgrounds**											
	Bioretention systems/rain gardens	41,460	0.95	1.080	181	81,839	3.07	9,770	5	SF	$48,850	22.3%
	Total Site Info	**41,460**	**0.95**	**1.080**	**181**	**81,839**	**3.07**	**9,770**			**$48,850**	**22.3%**
	BACK BROOK SUBWATERSHED	**63,511**	**1.46**	**1.655**	**277**	**114,902**	**4.71**	**35,089**			**$417,785**	**10.7%**
2	**Amwell Valley Ambulance Corps**											
	Bioretention systems/rain gardens	9,861	0.23	0.257	43	19,463	0.73	1,836	5	SF	$9,180	30.5%
	Total Site Info	**9,861**	**0.23**	**0.257**	**43**	**19,463**	**0.73**	**1,836**			**$9,180**	**30.5%**
3	**Amwell Valley Fire**											
	Pervious pavements	6,186	0.14	0.161	27	12,207	0.46	6,186	25	SF	$154,650	10.4%
	Total Site Info	**6,186**	**0.14**	**0.161**	**27**	**12,207**	**0.46**	**6,186**			**$154,650**	**10.4%**
4	**Biamonte Stables**											
	Bioretention systems/rain gardens	5,618	0.13	0.146	25	11,093	0.42	1,391	5	SF	$6,955	5.9%
	Total Site Info	**5,618**	**0.13**	**0.146**	**25**	**11,093**	**0.42**	**1,391**			**$6,955**	**5.9%**
5	**East Amwell Township Elementary School**											
	Bioretention systems/rain gardens	507	0.01	0.013	2	1,002	0.04	288	5	SF	$1,440	0.3%
	Total Site Info	**507**	**0.01**	**0.013**	**2**	**1,002**	**0.04**	**288**			**$1,440**	**0.3%**
6	**Hunterdon County Library & East Amwell Post Office**											
	Pervious pavements	8,147	0.19	0.212	36	16,082	0.60	4,407	25	SF	$110,175	14.4%
	Total Site Info	**8,147**	**0.19**	**0.212**	**36**	**16,082**	**0.60**	**4,407**			**$110,175**	**14.4%**
7	**Kirkpatrick Presbyterian Church**											
	Bioretention systems/rain gardens	1,840	0.04	0.048	8	3,635	0.14	760	5	SF	$3,800	2.4%
	Pervious pavements	11,309	0.26	0.295	49	22,320	0.84	3,774	25	SF	$94,350	15.1%
	Total Site Info	**13,149**	**0.30**	**0.343**	**57**	**25,955**	**0.98**	**4,534**			**$98,150**	**17.5%**
8	**Planeta Stables**											
	Bioretention systems/rain gardens	742	0.02	0.019	3	1,466	0.05	509	5	SF	$2,545	1.0%
	Rainwater harvesting systems	12,900	0.30	0.336	56	15,000	0.96	15,000	2	gal	$30,000	17.5%
	Total Site Info	**13,642**	**0.31**	**0.355**	**60**	**16,466**	**1.01**	**15,509**			**$32,545**	**18.5%**

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)									
9	**United First Presbyterian Church**											
	Bioretention systems/rain gardens	6,401	0.15	0.167	28	12,634	0.47	938	5	SF	$4,690	28.4%
	Total Site Info	**6,401**	**0.15**	**0.167**	**28**	**12,634**	**0.47**	**938**			**$4,690**	**28.4%**
	NESHANIC RIVER SUBWATERSHED	**2,982**	**0.07**	**0.078**	**13**	**5,887**	**0.22**	**1,225**			**$6,125**	**2.0%**
10	**Marion F. Clawson Memorial Park**											
	Bioretention systems/rain gardens	2,626	0.06	0.068	11	5,184	0.19	1,021	5	SF	$5,105	2.4%
	Total Site Info	**2,626**	**0.06**	**0.068**	**11**	**5,184**	**0.19**	**1,021**			**$5,105**	**2.4%**
11	**Toy Box Farm**											
	Bioretention systems/rain gardens	356	0.01	0.009	2	703	0.03	204	5	SF	$1,020	0.8%
	Total Site Info	**356**	**0.01**	**0.009**	**2**	**703**	**0.03**	**204**			**$1,020**	**0.8%**
	STONY BROOK SUBWATERSHED	**1,901**	**0.04**	**0.050**	**8**	**3,755**	**0.14**	**1,238**			**$28,850**	**26.0%**
12	**Linvale United Methodist Church**											
	Bioretention systems/rain gardens	428	0.01	0.011	2	845	0.03	105	5	SF	$525	5.8%
	Pervious pavements	1,473	0.03	0.038	6	2,910	0.11	1,133	25	SF	$28,325	20.1%
	Total Site Info	**1,901**	**0.04**	**0.050**	**8**	**3,755**	**0.14**	**1,238**			**$28,850**	**26.0%**