RUTGERS
New Jersey Agricultural
Experiment Station

Impervious Cover Reduction Action Plan
for
Salem City, Salem County, New Jersey

Prepared for Salem City by the
Rutgers Cooperative Extension Water Resources Program

August 10, 2016

WILLIAM PENN
FOUNDATION

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Introduction

Located in Salem County in southern New Jersey, Salem City covers approximately 2.72 square miles. Figures 1 and 2 illustrate that Salem City is dominated by forest land uses. A total of 50.0% of the municipality's land use is classified as urban. Of the urban land in Salem City, medium density residential is the dominant land use (Figure 3).

The New Jersey Department of Environmental Protection's (NJDEP) 2012 land use/land cover geographical information system (GIS) data layer categorizes Salem City 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 Salem City. Based upon the 2012 NJDEP land use/land cover data, approximately 21.5% of Salem City has impervious cover. This level of impervious cover suggests that the streams in Salem City are likely impacted streams.[1]

Methodology

Salem City contains portions of two 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

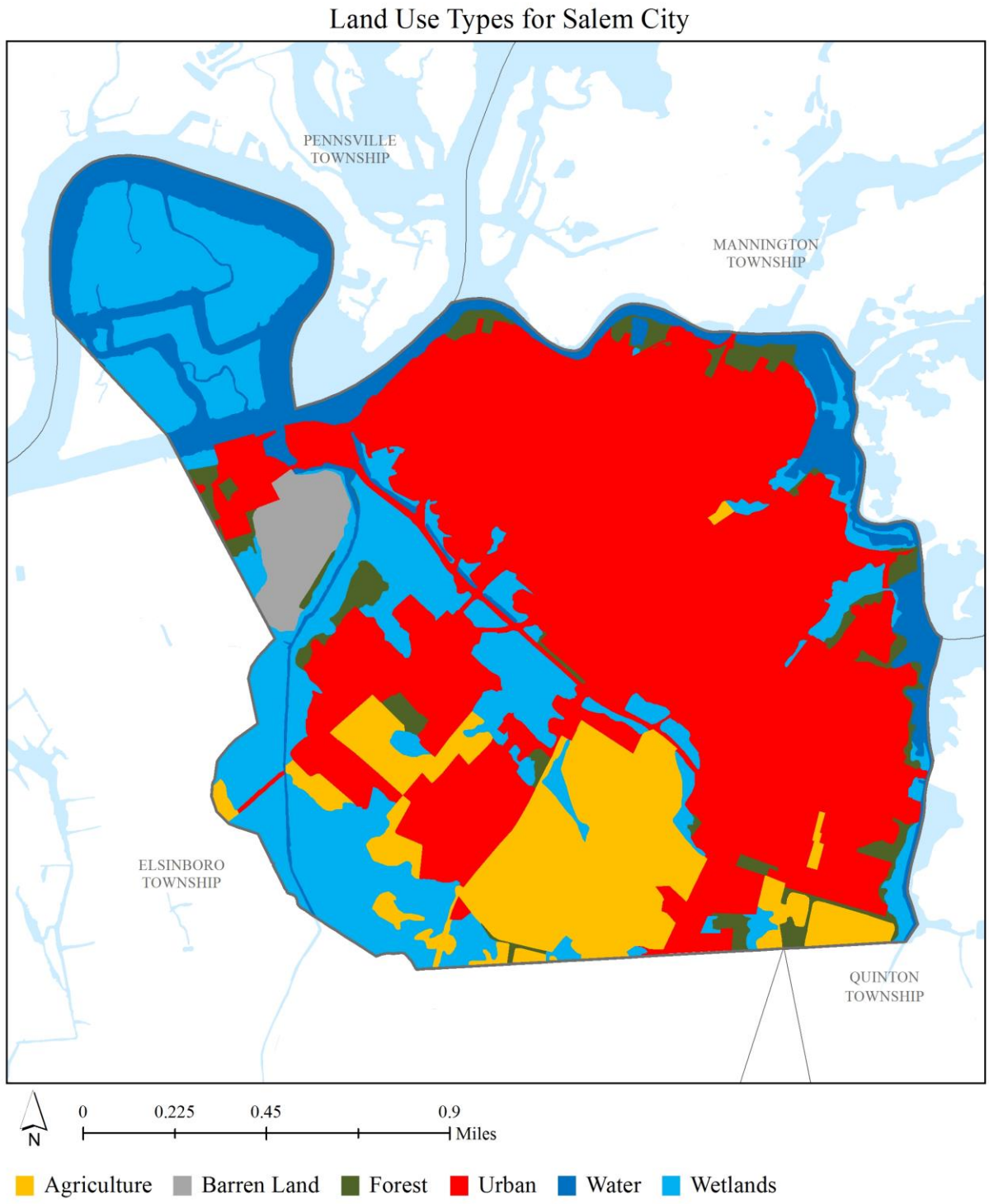


Figure 1: Map illustrating the land use in Salem City

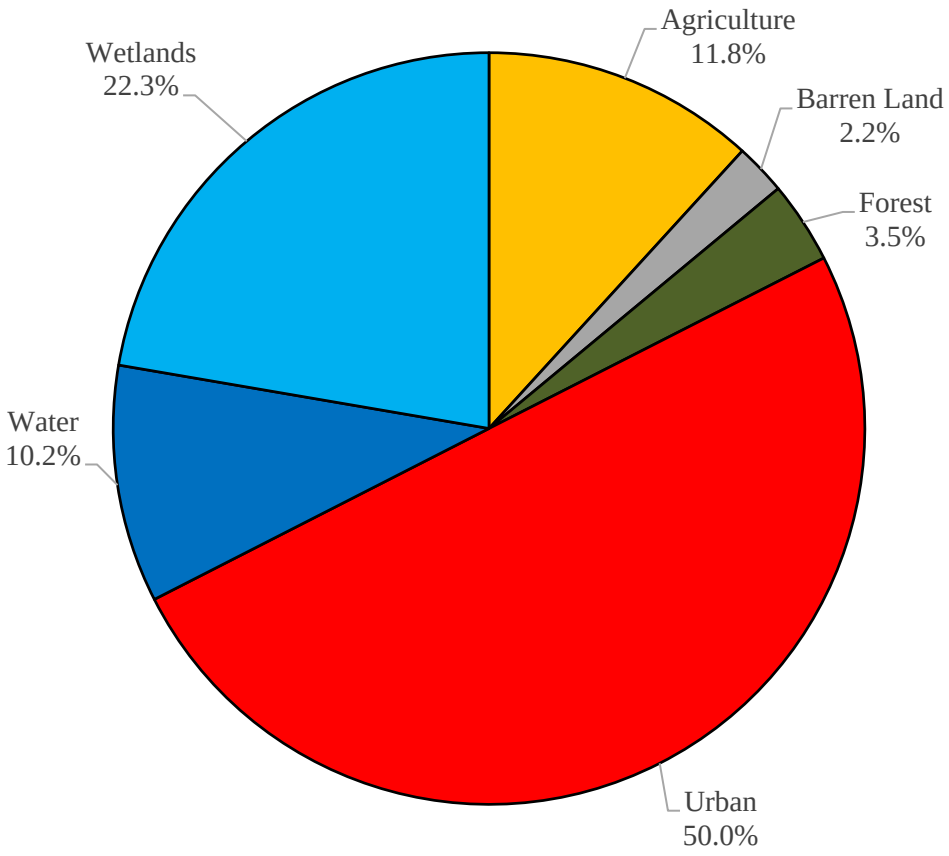


Figure 2: Pie chart illustrating the land use in Salem City

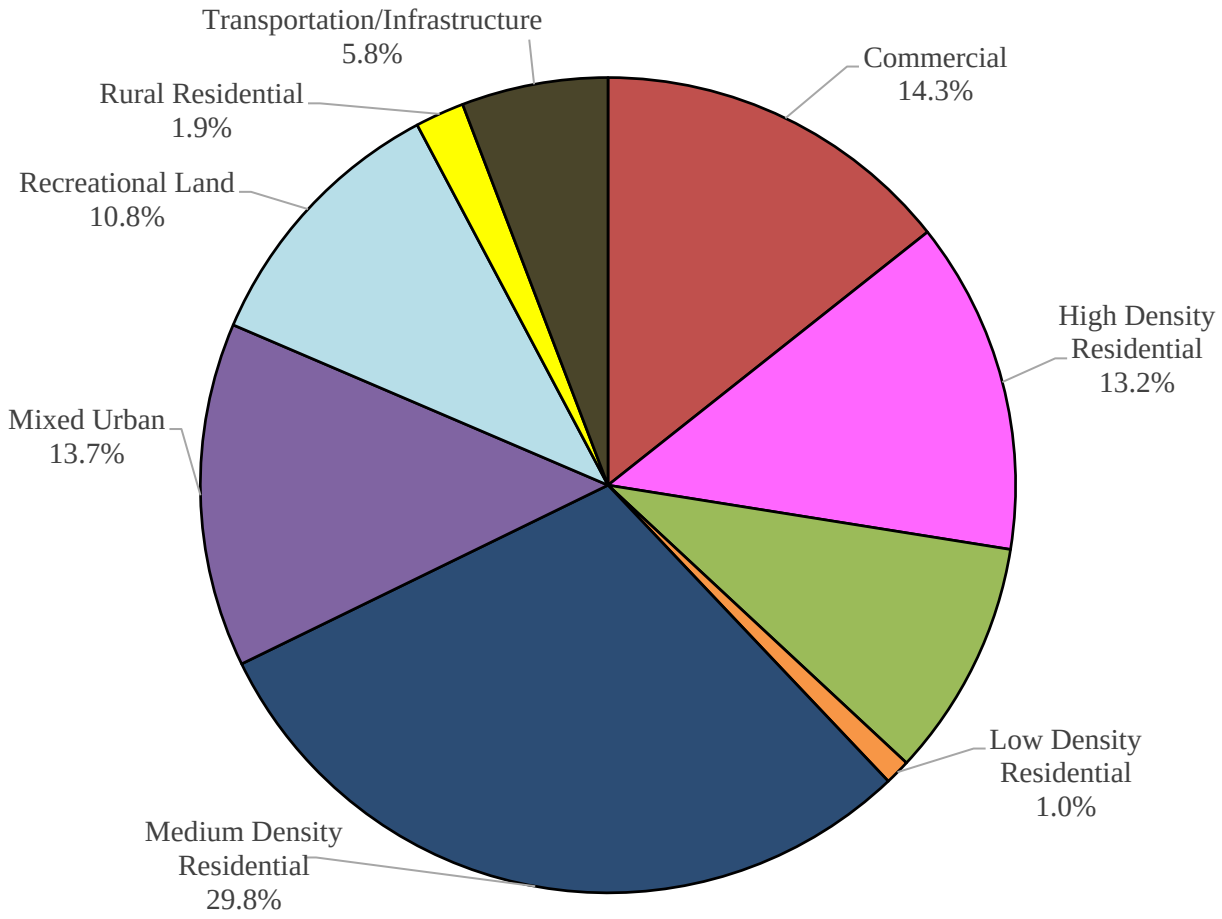


Figure 3: Pie chart illustrating the various types of urban land use in Salem City

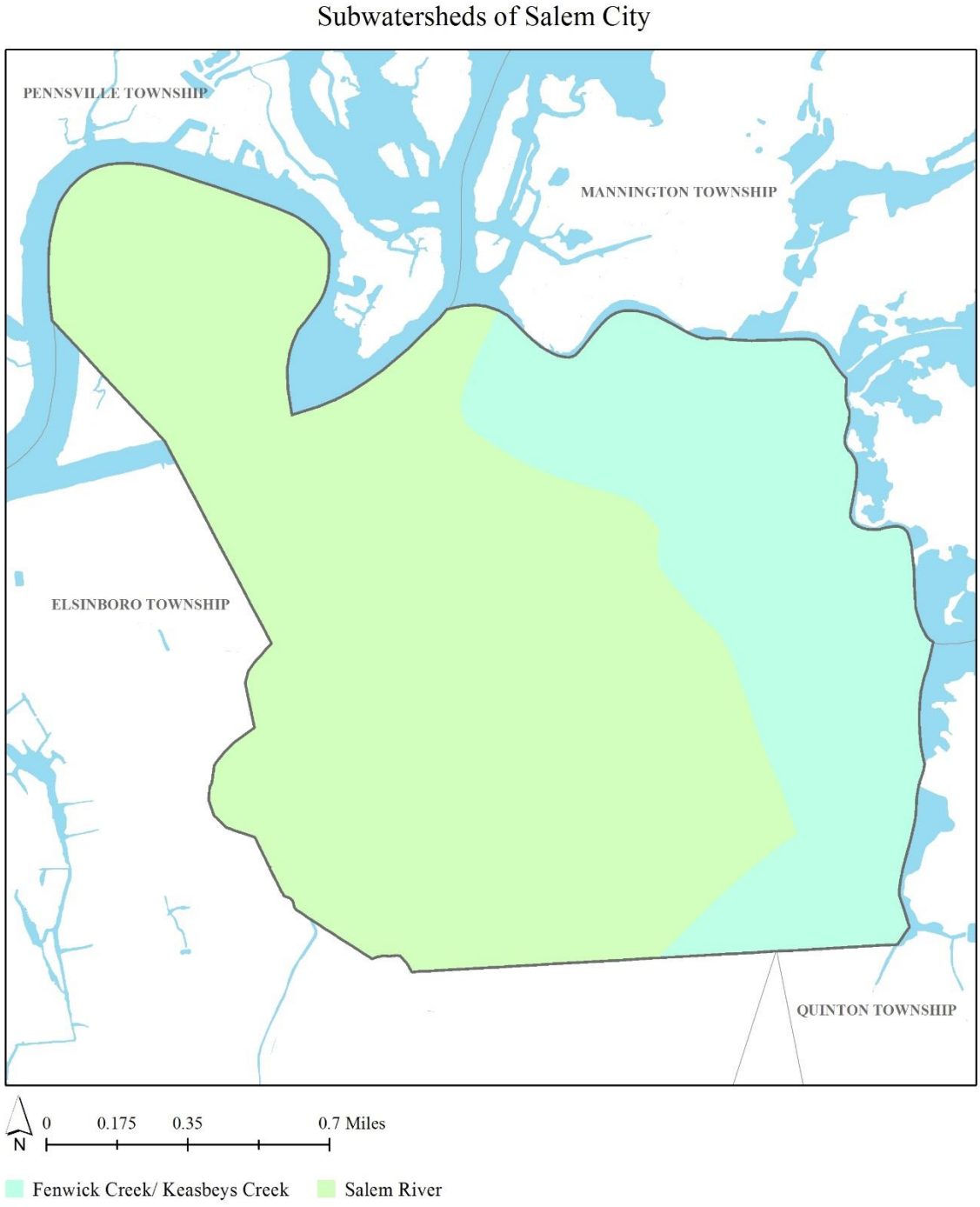


Figure 4: Map of the subwatersheds in Salem City

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 2012 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 Salem City 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 Salem City. 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

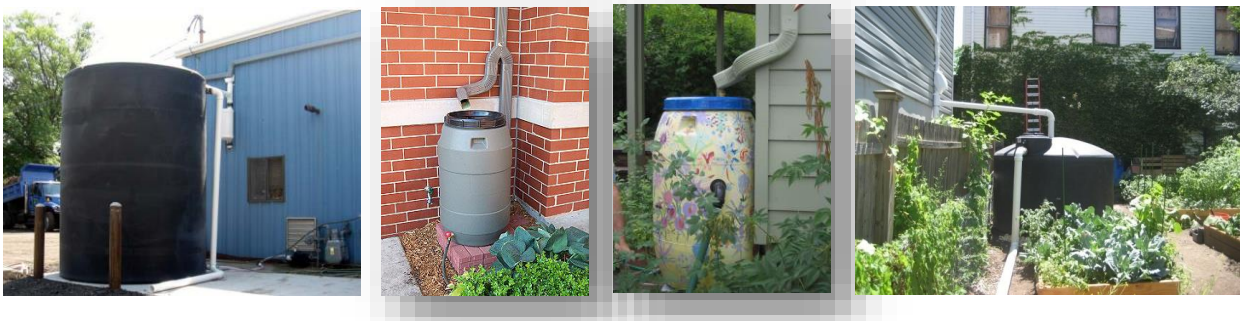
These are landscaped features that are designed to capture, treat, and infiltrate stormwater runoff. These systems can easily be incorporated into existing landscapes, improving aesthetics and creating wildlife habitat while managing stormwater runoff. Bioretention systems also can be used in soils that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

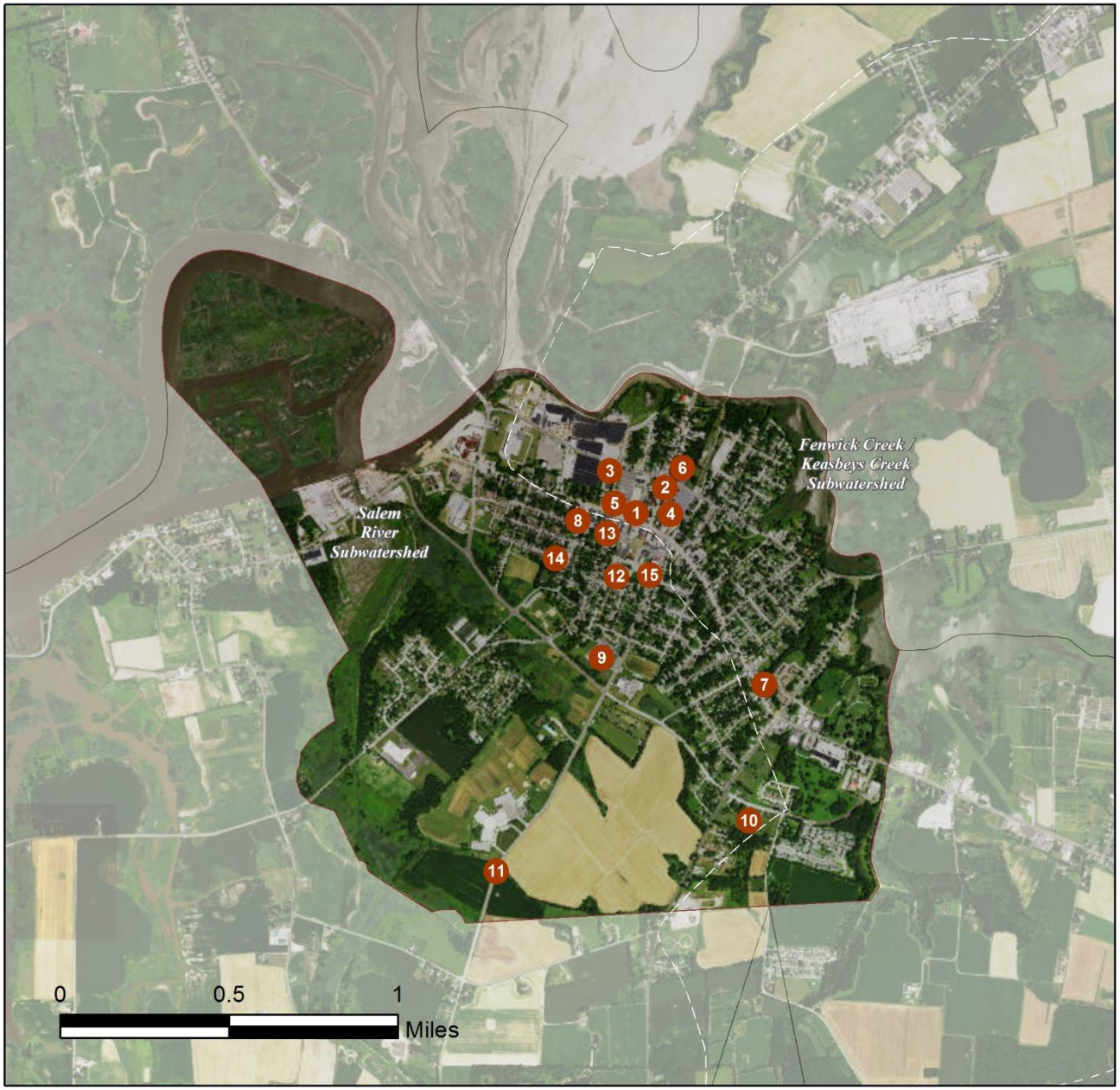
Conclusion

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

SALEM CITY: GREEN INFRASTRUCTURE SITES



SITES WITHIN THE FENWICK CREEK/ KEASBEYS CREEK SUBWATERSHED:

1. First Baptist Church
2. First Presbyterian Church
3. Liberty Fire Company
4. Salem County Courthouse
5. Salem Post Office
6. St. John's Episcopal Church
7. Washington Fire Company

SITES WITHIN THE SALEM RIVER SUBWATERSHED:

8. Broadway United Methodist Church
9. John Fenwick Elementary School
10. Mount Zion Baptist Church
11. Salem High School
12. Salem Middle School
13. Salem Police Department
14. St. Mary's Regional School
15. Union Fire Company No. 21

b. Proposed Green Infrastructure Concepts

FIRST BAPTIST CHURCH

Subwatershed: Fenwick Creek/ Keasbeys Creek

Site Area: 22,365 sq. ft.

Address: 130 West Broadway Salem, NJ 08079

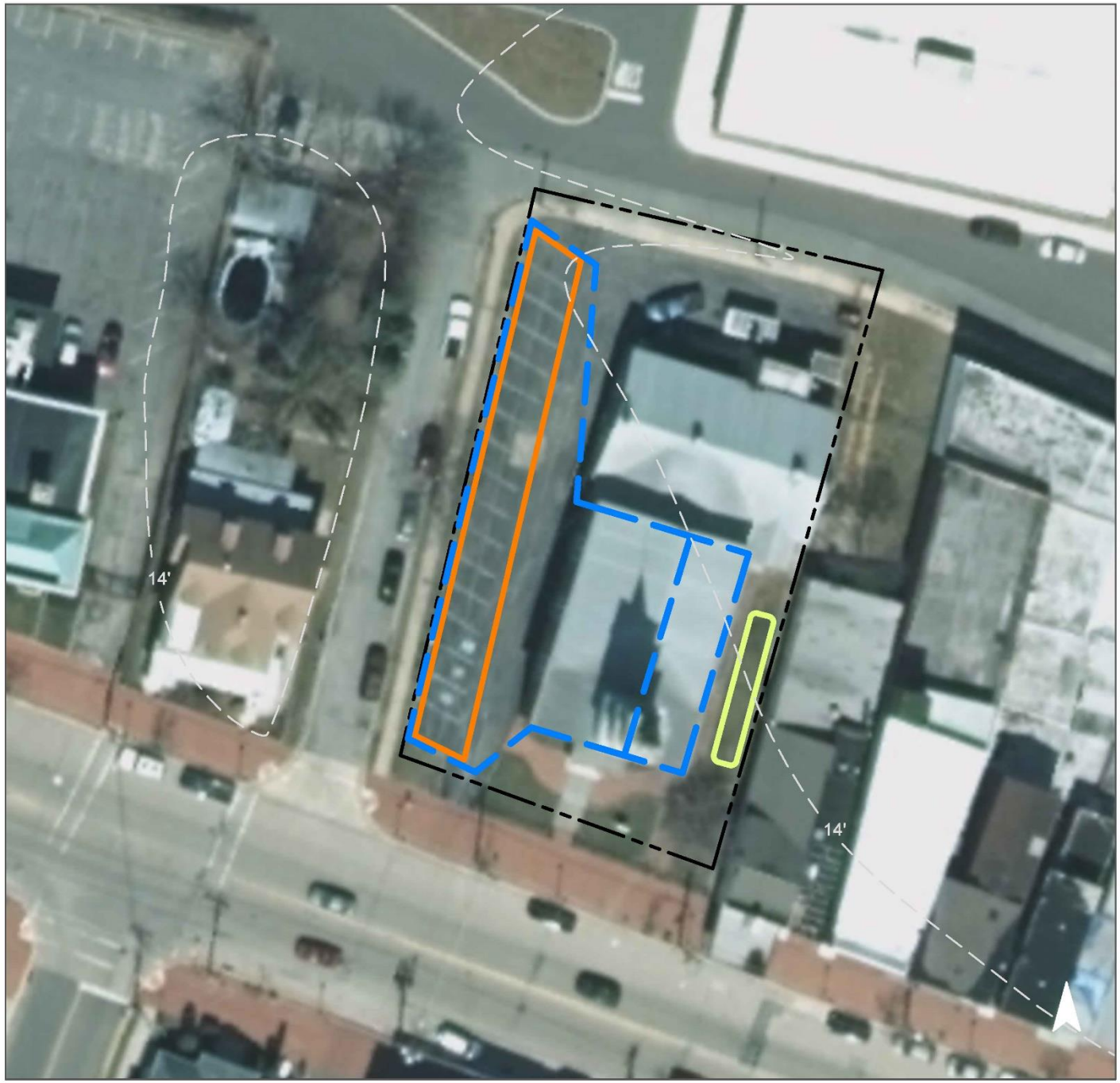
Block and Lot: Block 13, Lot 39

Bioretention systems and pervious pavement can collect and filter stormwater from the roof of the building. These practices can be implemented to reduce stormwater runoff by letting the water infiltrate into the ground. 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	19,010	0.9	9.6	87.3	0.015	0.52

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention system	0.050	8	3,680	0.14	385	$1,925
Pervious pavement	0.218	36	15,985	0.60	2,895	$72,375

GREEN INFRASTRUCTURE RECOMMENDATIONS



First Baptist Church

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

0 50' 100'

FIRST PRESBYTERIAN CHURCH

Subwatershed: Fenwick Creek/ Keasbeys Creek

Site Area: 77,653 sq. ft.

Address: 88 Market Street Salem, NJ 08079

Block and Lot: Block 27, Lot 6,1

A bioretention system north of the building can help capture the water from the roof of the building and serve as a way to manage stormwater runoff as well serve as a method of landscaping. A large area of porous asphalt can also be installed in the parking lot to infiltrate parking lot 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"
80	58,334	2.8	29.5	267.9	0.045	1.60

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	0.048	8	3,486	0.13	365	$1,825
Pervious pavement	0.464	78	34,079	1.28	3,565	$89,125

GREEN INFRASTRUCTURE RECOMMENDATIONS

First Presbyterian Church

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

0 50' 100'

LIBERTY FIRE COMPANY

Subwatershed: Fenwick Creek/ Keasbeys Creek

Site Area: 37,102 sq. ft.

Address: 75 5th Street Salem, NJ 08079

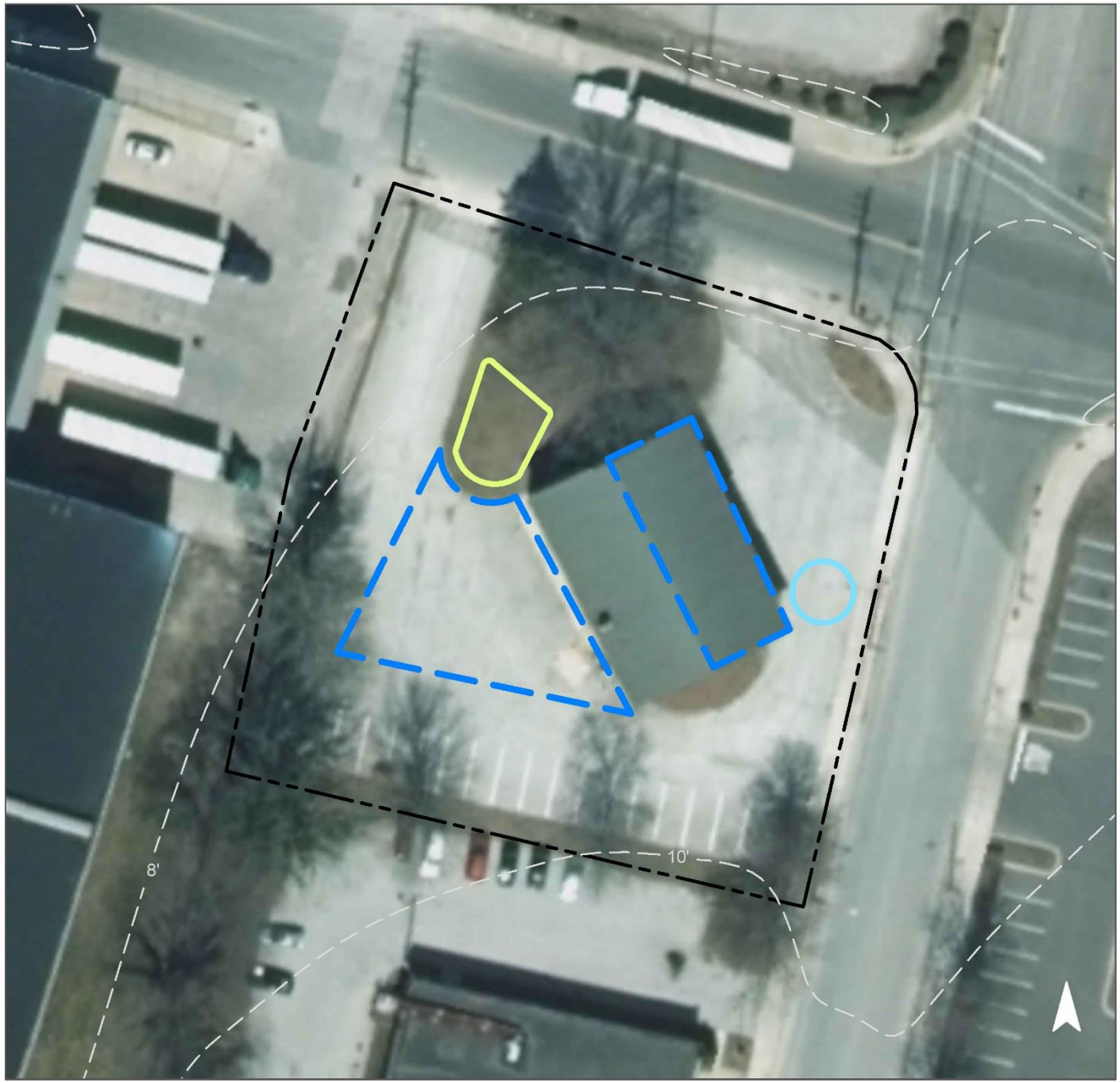
Block and Lot: Block 12, Lot 3

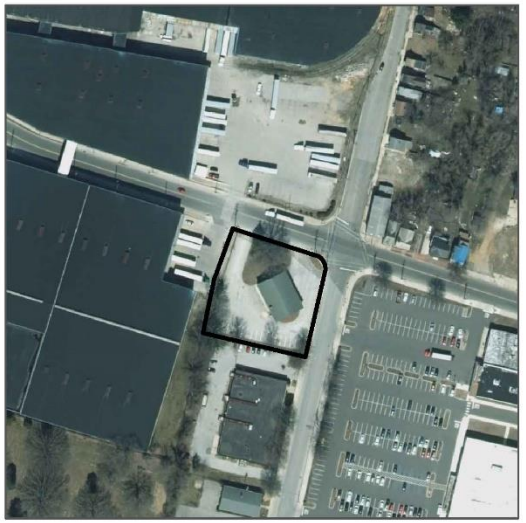
A bioretention system in the turfgrass can infiltrate parking lot runoff, and a cistern can capture water from the roof of the building. The rainwater may be reused for the fire company's operations. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green 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"
86	31,841	1.5	16.1	146.2	0.025	0.87

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	0.102	17	7,502	0.28	785	$3,925
Rainwater harvesting	0.058	10	4,264	0.16	2,000 (gal)	$4,000

GREEN INFRASTRUCTURE RECOMMENDATIONS





Liberty Fire Company

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

0 50' 100'

SALEM COUNTY COURTHOUSE

Subwatershed: Fenwick Creek/ Keasbeys Creek

Site Area: 108,735 sq. ft.

Address: 92 Market Street Salem, NJ 08079

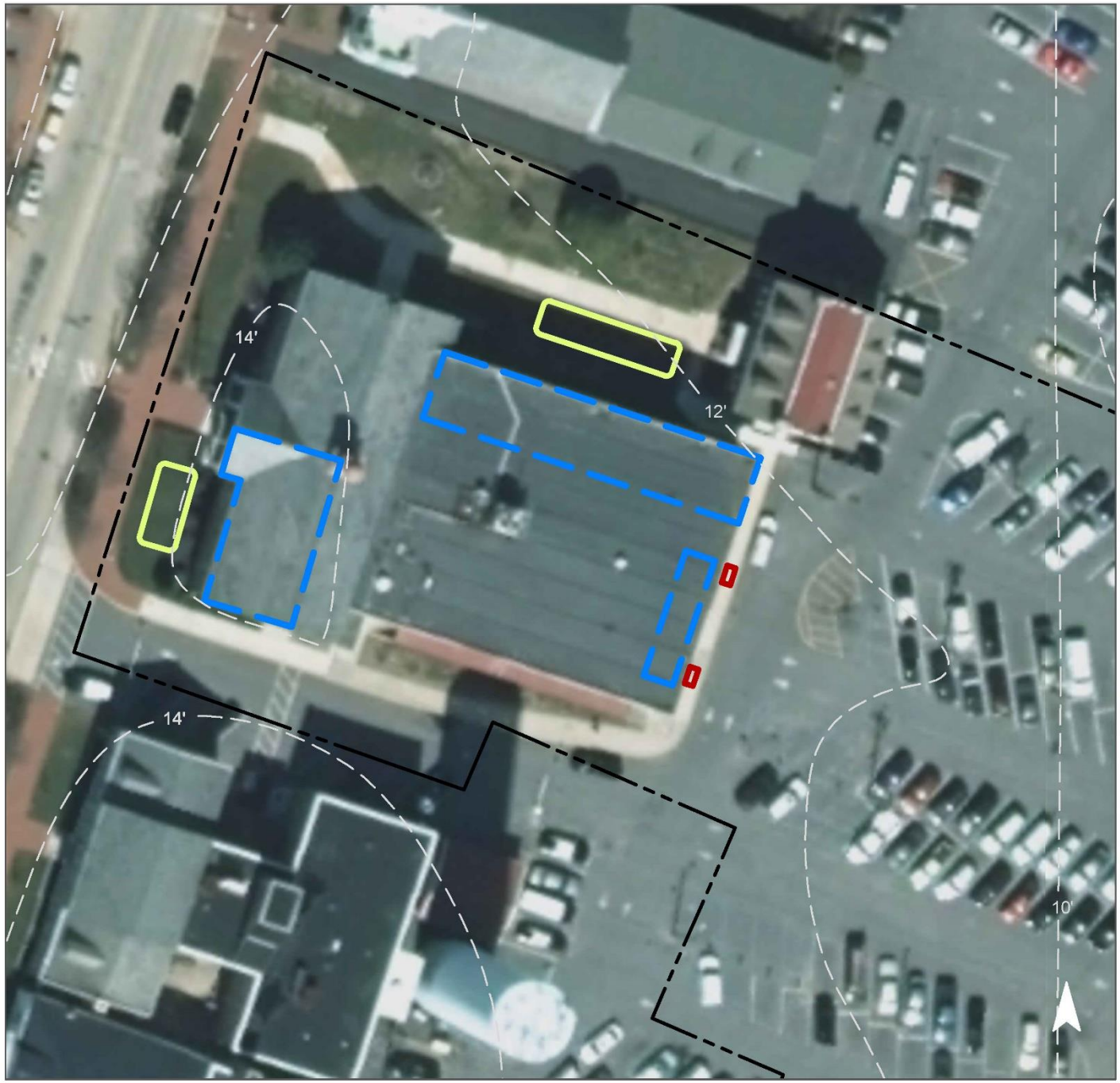
Block and Lot: Block 27, Lot 42

Bioretention systems on the north and west sides of the building can collect and filter stormwater from the roof of the building. Downspout planter boxes on the southeast side can also collect water from drainage pipe and can be used to irrigate landscaping. These practices can be implemented to reduce 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"
90	97,409	4.7	49.2	447.2	0.076	2.67

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention systems	0.111	19	4,256	0.16	855	$4,275
Planter boxes	n/a	2	n/a	n/a	24	$2,000

GREEN INFRASTRUCTURE RECOMMENDATIONS



Salem County Courthouse

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

0 50' 100'

SALEM POST OFFICE

Subwatershed: Fenwick Creek/ Keasbeys Creek

Site Area: 23,220 sq. ft.

Address: 120 West Broadway Salem, NJ 08079

Block and Lot: Block 13, Lot 35

By replacing parking spaces with pervious pavement, the parking lot may capture rainfall and allow it to be filtered and infiltrated into the ground. 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	19,737	1.0	10.0	90.6	0.015	0.54

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	0.253	42	18,565	0.70	1,945	$44,625

GREEN INFRASTRUCTURE RECOMMENDATIONS

Salem Post Office

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

0 50' 100'

ST. JOHN'S EPISCOPAL CHURCH

Subwatershed: Fenwick Creek/ Keasbeys Creek

Site Area: 145,406 sq. ft.

Address: 76 Market Street Salem, NJ 08079

Block and Lot: Block 16, Lot 21,22,23,24,25

A bioretention system on the south side of the building and pervious pavement in the parking lot can collect and filter stormwater from the roof of the building. These practices can be implemented to reduce stormwater runoff into the catch basins by letting the water infiltrate into the ground. 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"
31	45,563	2.2	23.0	209.2	0.036	1.25

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	0.058	10	4,256	0.16	445	$2,225
Pervious pavement	0.504	84	37,011	0.84	5,105	$127,625

GREEN INFRASTRUCTURE RECOMMENDATIONS

St. John's Episcopal Church

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

0 100' 200'

WASHINGTON FIRE COMPANY

Subwatershed: Fenwick Creek/ Keasbeys Creek

Site Area: 14,054 sq. ft.

Address: 374 East Broadway Salem, NJ 08079

Block and Lot: Block 42, Lot 36

Pervious pavement south of the building can capture the water that is in the parking lot, and a cistern on the southeast side of the building can capture water from the roof of the building. The collected rainwater may be reused for the fire company's operations. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
70	9,802	0.5	5.0	45.0	0.008	0.27

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	0.184	31	13,524	0.51	1,415	$35,375
Rainwater harvesting	0.021	4	1,541	0.06	1,000 (gal)	$2,000

GREEN INFRASTRUCTURE RECOMMENDATIONS

Washington Fire Company

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

0 30' 60'

BROADWAY UNITED METHODIST CHURCH

Subwatershed: Salem River

Site Area: 29,811 sq. ft.

Address: 115 West Broadway
Salem, NJ 08079

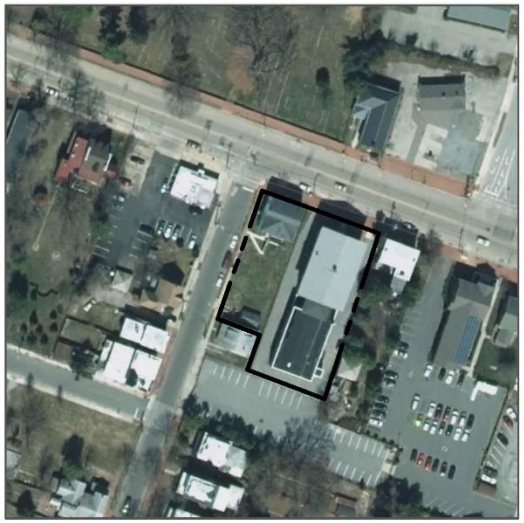
Block and Lot: Block 59, Lot 6,7

Downspout planter boxes on the east and west sides of the building can capture rainwater from the roof. The harvested rainwater can be utilized to irrigate landscaping as well as reduce 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	25,339	1.2	12.8	116.3	0.020	0.69

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Planter boxes	n/a	3	n/a	n/a	48	$4,000

GREEN INFRASTRUCTURE RECOMMENDATIONS



Broadway United Methodist Church

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

0 50' 100'

JOHN FEWICK ELEMENTARY SCHOOL

Subwatershed: Salem River

Site Area: 381,920 sq. ft.

Address: 183 Smith Street
Salem, NJ 08079

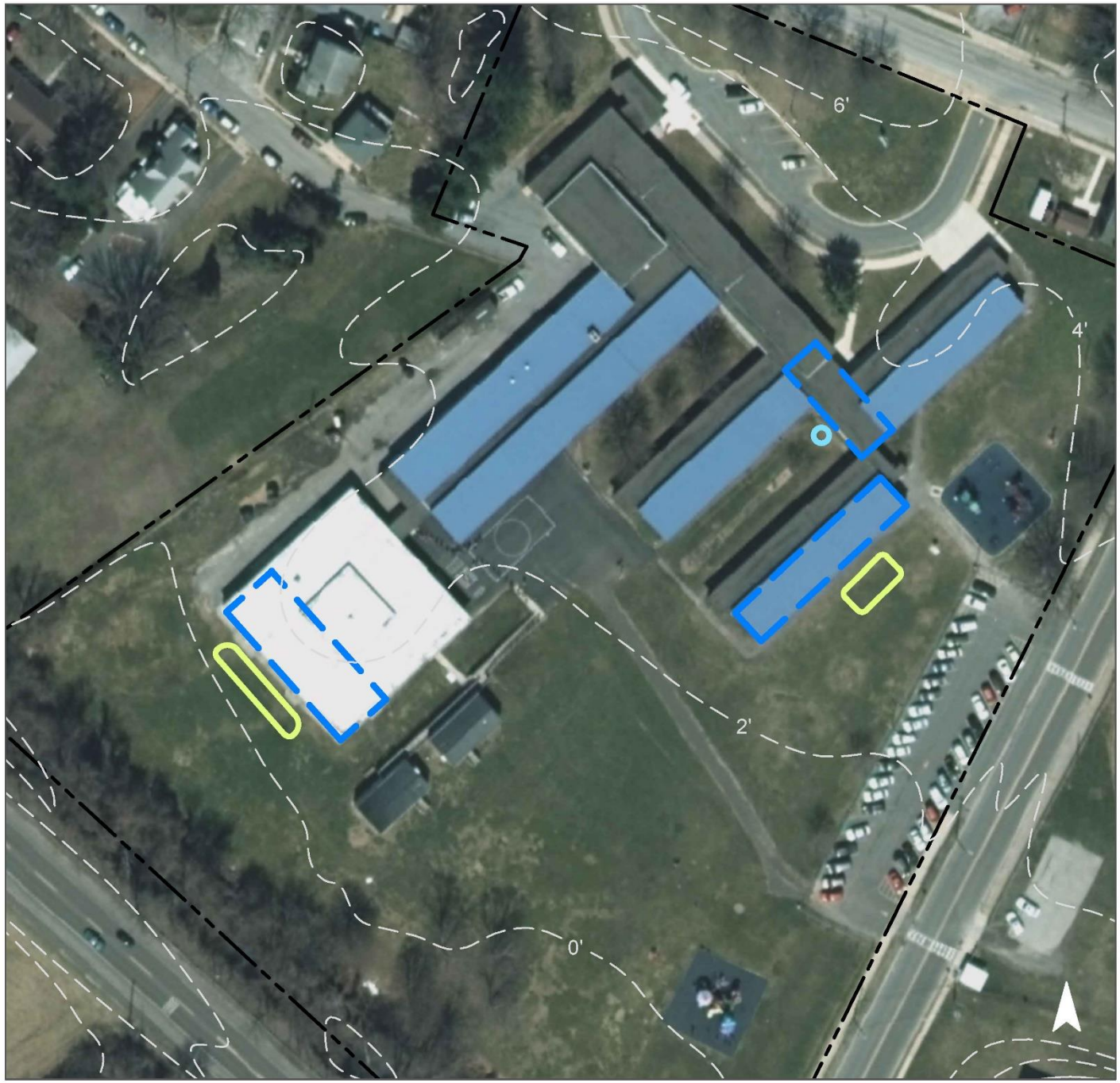
Block and Lot: Block 83, Lot 6

Bioretention systems may be installed to reduce stormwater runoff and can be used as landscaping for the school. A cistern near the mobile classroom can capture rainwater that can be reused for irrigation or classroom functions. 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"
36	138,002	6.7	69.7	633.6	0.108	3.78

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention systems	0.094	16	6,934	0.26	725	$3,625
Rainwater harvesting	0.054	9	3,949	0.15	2,000 (gal)	$4,000

GREEN INFRASTRUCTURE RECOMMENDATIONS



John Fenwick Elementary School

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

0 100' 200'

MOUNT ZION BAPTIST CHURCH

Subwatershed: Salem River

Site Area: 180,376 sq. ft.

Address: 437 Grieves Parkway
Salem, NJ 08079

Block and Lot: Block 91, Lot 2

Rain gardens can be installed on the north and east side of the building to capture, filter, 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"
34	61,975	3.0	31.3	284.5	0.048	1.70

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	0.076	13	5,595	0.21	585	$4,000

GREEN INFRASTRUCTURE RECOMMENDATIONS

Mount Zion Baptist Church

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

0 80' 160'

SALEM HIGH SCHOOL

Subwatershed: Salem River

Site Area: 4,095,049 sq. ft.

Address: 219 Walnut Street
Salem, NJ 08079

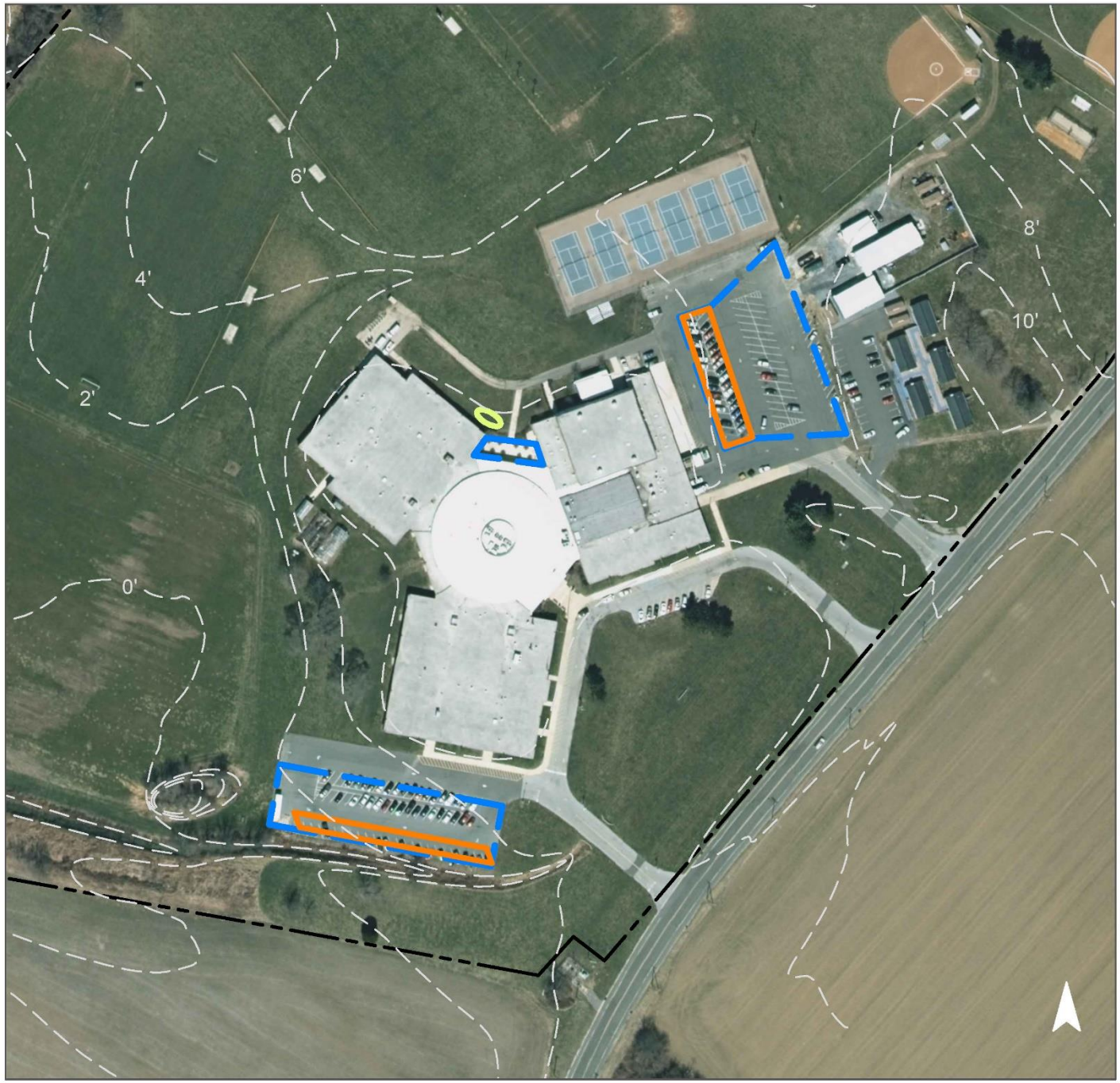
Block and Lot: Block 96,114 Lot 3,1

A rain garden on the north side of the building and porous asphalt in the southern parking lot can collect and filter stormwater from the roof of the building and surrounding parking lots. These practices can be implemented to reduce stormwater runoff into the catch basins by allowing the water to infiltrate into the ground. 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	399,798	19.3	201.9	1835.6	0.312	10.97

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	0.052	9	3,785	0.14	400	$2,000
Pervious pavement	1.467	246	107,637	4.05	11,260	$281,500

GREEN INFRASTRUCTURE RECOMMENDATIONS



Salem High School

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

0 200' 400'

SALEM MIDDLE SCHOOL

Subwatershed: Salem River

Site Area: 120,315 sq. ft.

Address: 51 New Market Street
Salem, NJ 08079

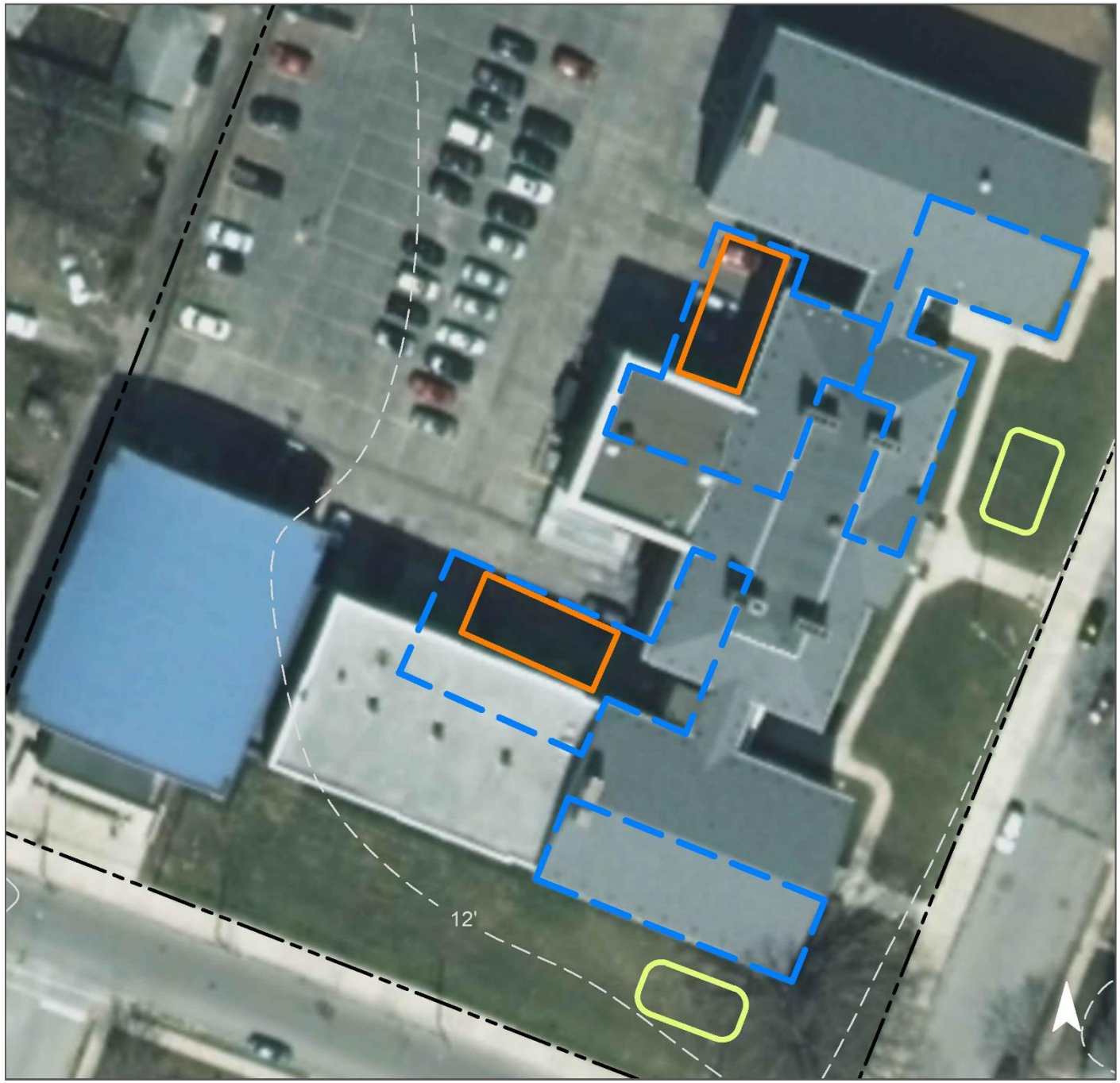
Block and Lot: Block 58, Lot 1

Rain gardens on the east and south side of the building can collect and filter stormwater from the roof of the building. Sections of porous asphalt can be installed in the parking lot to infiltrate roof runoff as well. 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"
95	114,299	5.5	57.7	524.8	0.089	3.13

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	0.156	26	11,422	0.43	1,195	$5,975
Pervious pavement	0.217	16	15,910	0.60	1,665	$41,625

GREEN INFRASTRUCTURE RECOMMENDATIONS



Salem Middle School

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

0 50' 100'

SALEM POLICE DEPARTMENT

Subwatershed: Salem River

Site Area: 13,312 sq. ft.

Address: 129 West Broadway
Salem, NJ 08079

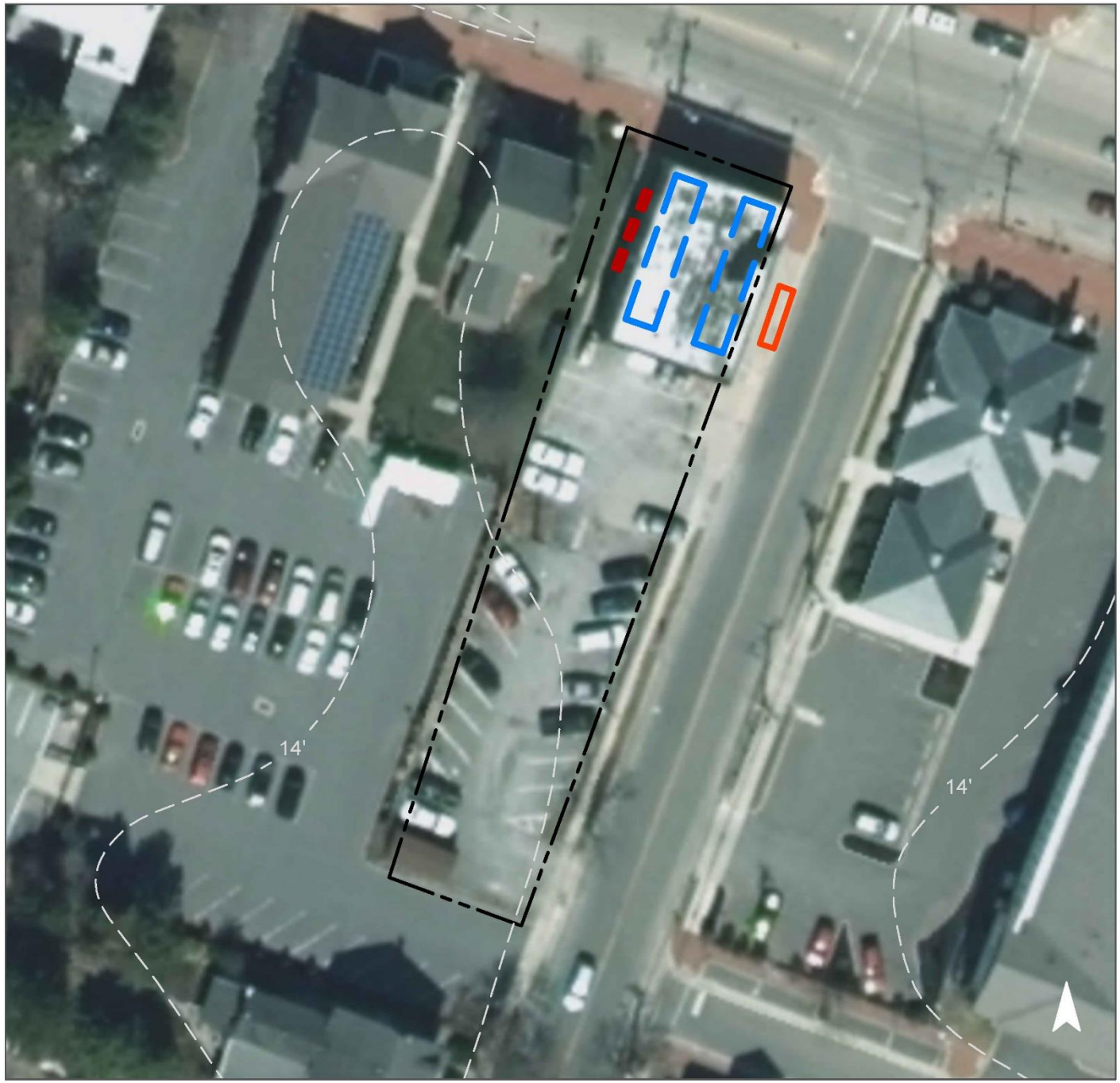
Block and Lot: Block 59, Lot 1, 1.01

Downspout planter boxes on the east side and stormwater planters on the west side of the building can capture rainwater from the roof to be used to irrigate landscaping as well as reduce stormwater runoff into the sewers. 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	11,315	0.5	5.7	52.0	0.009	0.31

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Planter boxes	n/a	2	n/a	n/a	36	$3,000
Stormwater planter	0.013	2	957	0.04	100	$10,000

GREEN INFRASTRUCTURE RECOMMENDATIONS



Salem Police Department

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

0 50' 100'

ST. MARY'S REGIONAL SCHOOL

Subwatershed: Salem River

Site Area: 39,126 sq. ft.

Address: 150 Thompson Street
Salem, NJ 08079

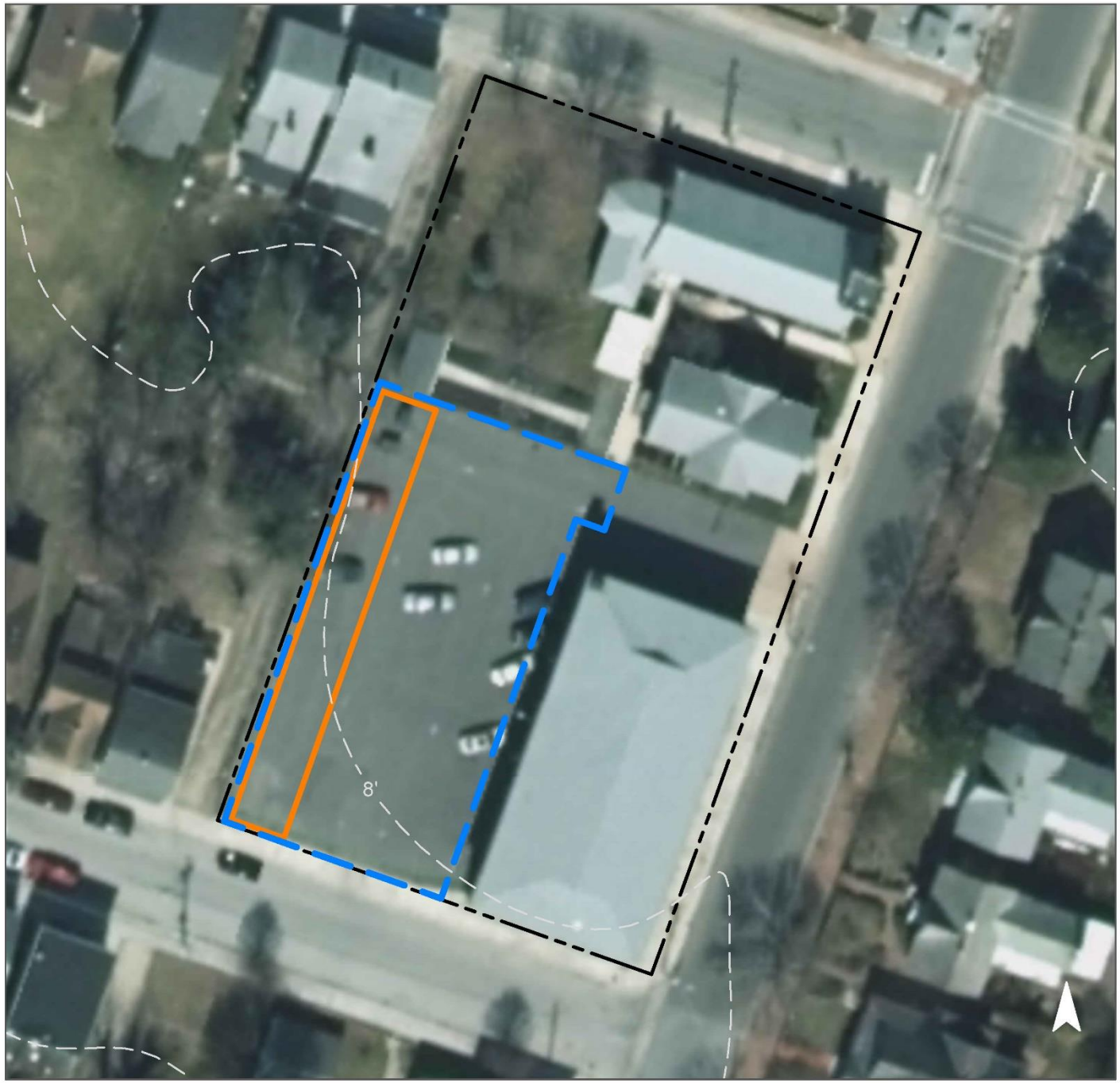
Block and Lot: Block 56, Lot 28

Pervious pavement within the parking lot of the site can collect stormwater from the parking lot to reduce the volume of rainwater going into the sewer system. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
85	33,257	1.6	16.8	152.7	0.026	0.91

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	0.356	60	13,304	1.18	2,735	$68,375

GREEN INFRASTRUCTURE RECOMMENDATIONS



St. Mary's Regional School

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

0 50' 100'

UNION FIRE COMPANY No. 21

Subwatershed: Salem River

Site Area: 20,035 sq. ft.

Address: 21 Walnut Street
Salem, NJ 08079

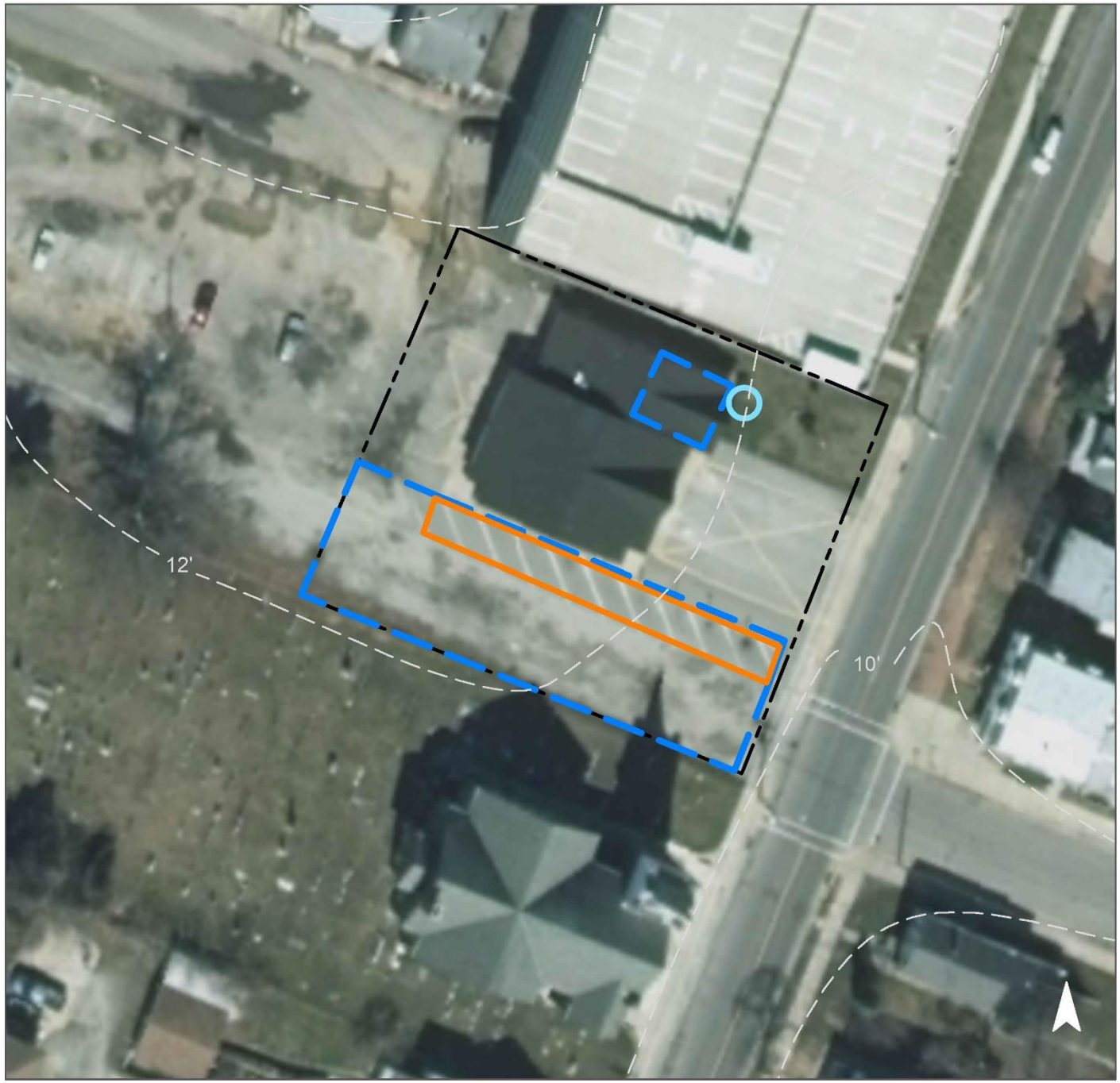
Block and Lot: Block 63, Lot 1

Pervious pavement can capture stormwater from the parking lot, and a cistern can capture stormwater from the roof of the building which can then be used for the needs of the fire company. 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"
94	18,843	0.9	9.5	86.5	0.015	0.52

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Pervious pavement	0.184	31	13,516	0.51	1,510	$37,750
Rainwater harvesting	0.015	3	1,100	0.04	500 (gal)	$1,000

GREEN INFRASTRUCTURE RECOMMENDATIONS



Union Fire Company No. 21

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

0 50' 100'

c. 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)
FENWICK CREEK/KEASBEYS CREEK SUBWATERSHED	**9.72**	**423,535**			**13.6**	**142.3**	**1,293.4**		**6.47**	**281,705**	**0.219**	**7.73**
First Bapist Church												
Total Site Info	0.51	22,365	13	39	0.9	9.6	87.3	85	0.44	19,010	0.015	0.52
First Presbyterian Church												
Total Site Info	1.67	72,653	27	6,1	2.8	29.5	267.9	80	1.34	58,342	0.045	1.60
Liberty Fire Company												
Total Site Info	0.85	37,102	12	3	1.5	16.1	146.2	86	0.73	31,841	0.025	0.87
Salem County Courthouse												
Total Site Info	2.50	108,735	27	42	4.7	49.2	447.2	90	2.24	97,409	0.076	2.67
Salem Post Office												
Total Site Info	0.53	23,220	13	35	1.0	10.0	90.6	85	0.45	19,737	0.015	0.54
St. John's Episcopal Chuch												
Total Site Info	3.34	145,406	16	1,22,23,24,2	2.2	23.0	209.2	31	1.05	45,563	0.036	1.25
Washington Fire Company												
Total Site Info	0.32	14,054	42	36	0.5	5.0	45.0	70	0.23	9,802	0.008	0.27
SALEM RIVER SUBWATERSHED	**112.03**	**4,879,942**			**38.7**	**405.5**	**3,686.1**		**18.43**	**802,828**	**0.626**	**22.02**
Boadway United Methodist Church												
Total Site Info	0.68	29,811	59	6,7	1.2	12.8	116.3	85	0.58	25,339	0.020	0.69
John Fenwick Elementary School												
Total Site Info	8.77	381,920	83	6	6.7	69.7	633.6	36	3.17	138,002	0.108	3.78
Mount Zion Baptist Church												
Total Site Info	4.14	180,376	91	2	3.0	31.3	284.5	34	1.42	61,975	0.048	1.70
Salem High School												
Total Site Info	94.01	4,095,049	96,114	3,1	19.3	201.9	1,835.6	10	9.18	399,798	0.312	10.97

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)
Salem Middle School												
Total Site Info	2.76	120,315	58	1	5.5	57.7	524.8	95	2.62	114,299	0.089	3.13
Salem Police Department												
Total Site Info	0.31	13,312	59	1,1.01	0.5	5.7	52.0	85	0.26	11,315	0.009	0.31
St. Mary's Regional School												
Total Site Info	0.90	39,126	56	28	1.6	16.8	152.7	85	0.76	33,257	0.026	0.91
Union Fire Company No. 21												
Total Site Info	0.46	20,035	63	1	0.9	9.5	86.5	94	0.43	18,843	0.015	0.52

d. Summary of Proposed Green Infrastructure Practices

Summary of Proposed Green Infrastructure Practices

	Subwatershed/Site Name/Total Site Info/GI Practice	Potential Management Area Area (SF)	Potential Management Area Area (ac)	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Max Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cfs)	Size of BMP (SF)	Unit Cost ($)	Unit	Total Cost ($)	I.C. Treated %
	FENWICK CREEK/KEASBEYS CREEK SUBWATERS	**79,970**	**1.84**	**2.072**	**349**	**152,068**	**5.72**	**20,784**			**$395,300**	**18.9%**
1	**First Bapist Church**											
	Bioretention system	1,925	0.04	0.050	8	3,680	0.14	385	5	SF	$1,925	10.1%
	Pervious pavement	8,360	0.19	0.218	36	15,985	0.60	2,895	25	SF	$72,375	44.0%
	Total Site Info	**10,285**	**0.24**	**0.268**	**45**	**19,665**	**0.74**	**3,280**			**$74,300**	**54.1%**
2	**First Presbyterian Church**											
	Bioretention system	1,825	0.04	0.048	8	3,486	0.13	365	5	SF	$1,825	3.1%
	Pervious pavement	17,825	0.41	0.464	78	34,079	1.28	3,565	25	SF	$89,125	30.6%
	Total Site Info	**19,650**	**0.45**	**0.512**	**86**	**37,565**	**1.41**	**3,930**			**$90,950**	**33.7%**
3	**Liberty Fire Company**											
	Bioretention system	3,925	0.09	0.102	17	7,502	0.28	785	5	SF	$3,925	12.3%
	Rainwater harvesting	2,230	0.05	0.058	10	4,264	0.16	2,000	2	gal	$4,000	7.0%
	Total Site Info	**6,155**	**0.14**	**0.160**	**27**	**11,766**	**0.44**	**2,785**			**$7,925**	**19.3%**
4	**Salem County Courthouse**											
	Bioretention systems	4,275	0.10	0.111	19	8,176	0.31	855	5	SF	$4,275	4.4%
	Planter boxes	430	0.01	n/a	2	n/a	n/a	24	1,000	box	$2,000	0.2%
	Total Site Info	**4,705**	**0.11**	**0.111**	**20**	**8,176**	**0.31**	**879**			**$6,275**	**4.5%**
5	**Salem Post Office**											
	Pervious pavement	9,710	0.22	0.253	42	18,565	0.70	1,945	25	SF	$48,625	49.2%
	Total Site Info	**9,710**	**0.22**	**0.253**	**42**	**18,565**	**0.70**	**1,945**			**$48,625**	**49.2%**
6	**St. John's Episcopal Chuch**											
	Bioretention system	2,225	0.05	0.058	10	4,256	0.16	445	5	SF	$2,225	4.9%
	Pervious pavement	19,360	0.44	0.504	84	37,011	1.39	5,105	25	SF	$127,625	42.5%
	Total Site Info	**21,585**	**0.50**	**0.562**	**94**	**41,267**	**1.55**	**5,550**			**$129,850**	**47.4%**
7	**Washington Fire Company**											
	Pervious pavement	7,075	0.16	0.184	31	13,524	0.51	1,415	25	SF	$35,375	72.2%
	Rainwater harvesting	805	0.02	0.021	4	1,541	0.06	1,000	2	gal	$2,000	8.2%
	Total Site Info	**7,880**	**0.18**	**0.205**	**34**	**15,065**	**0.57**	**2,415**			**$37,375**	**80.4%**

Summary of Proposed Green Infrastructure Practices

	Subwatershed/Site Name/Total Site Info/GI Practice	Potential Management Area Area (SF)	Potential Management Area Area (ac)	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Max Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cfs)	Size of BMP (SF)	Unit Cost ($)	Unit	Total Cost ($)	I.C. Treated %
	SALEM RIVER SUBWATERSHED	**104,515**	**2.39**	**2.684**	**454**	**202,110**	**7.61**	**22,759**			**$499,850**	**2.1%**
8	**Boadway United Methodist Church**											
	Planter boxes	860	0.02	n/a	3	n/a	n/a	48	1,000	box	$4,000	0.3%
	Total Site Info	**860**	**0.02**	n/a	**3**	n/a	n/a	**48**			**$4,000**	**0.3%**
9	**John Fenwick Elementary School**											
	Bioretention systems	3,625	0.08	0.094	16	6,934	0.26	725	5	SF	$3,625	2.6%
	Rainwater harvesting	2,065	0.05	0.054	9	3,949	0.15	2,000	2	gal	$4,000	1.5%
	Total Site Info	**5,690**	**0.13**	**0.148**	**25**	**10,883**	**0.41**	**2,725**			**$7,625**	**4.1%**
10	**Mount Zion Baptist Church**											
	Bioretention systems	2,925	0.07	0.076	13	5,595	0.21	585	5	SF	$4,000	4.7%
	Total Site Info	**2,925**	**0.07**	**0.076**	**13**	**5,595**	**0.21**	**585**			**$4,000**	**4.7%**
11	**Salem High School**											
	Bioretention system	1,980	0.05	0.052	9	3,785	0.14	400	5	SF	$2,000	0.5%
	Pervious pavement	56,300	1.29	1.467	246	107,637	4.05	11,260	25	SF	$281,500	14.1%
	Total Site Info	**58,280**	**1.34**	**1.519**	**254**	**111,422**	**4.19**	**11,660**			**$283,500**	**14.6%**
12	**Salem Middle School**											
	Bioretention systems	5,975	0.14	0.156	26	11,422	0.43	1,195	5	SF	$5,975	5.2%
	Pervious pavement	8,320	0.19	0.217	36	15,910	0.60	1,665	25	SF	$41,625	7.3%
	Total Site Info	**14,295**	**0.33**	**0.372**	**62**	**27,332**	**1.03**	**2,860**			**$47,600**	**12.5%**
13	**Salem Police Department**											
	Planter boxes	645	0.01	n/a	2	n/a	n/a	36	1,000	box	$36,000	0.2%
	Stormwater planter	500	0.01	0.013	2	957	0.04	100	100	SF	$10,000	4.4%
	Total Site Info	**1,145**	**0.02**	**0.013**	**4**	**957**	**0.04**	**136**			**$46,000**	**4.6%**
14	**St. Mary's Regional School**											
	Pervious pavement	13,675	0.31	0.356	60	31,304	1.18	2,735	25	SF	$68,375	41.1%
	Total Site Info	**13,675**	**0.31**	**0.356**	**60**	**31,304**	**1.18**	**2,735**			**$68,375**	**41.1%**
15	**Union Fire Company No. 21**											
	Pervious pavement	7,070	0.16	0.184	31	13,516	0.51	1,510	25	SF	$37,750	37.5%
	Rainwater harvesting	575	0.01	0.015	3	1,100	0.04	500	2	gal	$1,000	3.1%
	Total Site Info	**7,645**	**0.18**	**0.199**	**33**	**14,616**	**0.55**	**2,010**			**$38,750**	**40.6%**