RUTGERS
New Jersey Agricultural Experiment Station

Draft

Impervious Cover Reduction Action Plan for Newark, Essex County, New Jersey – Volume 1

Prepared for the City of Newark by the Rutgers Cooperative Extension Water Resources Program

April 16, 2018

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Introduction

Located in Essex County in northern New Jersey, Newark covers approximately 26.22 square miles. Figures 1 and 2 illustrate that Newark is dominated by urban land uses. A total of 86.8% of the municipality's land use is classified as urban. Of the urban land in Newark, high 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 Newark 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 Newark. Based upon the 2012 NJDEP land use/land cover data, approximately 63.2% of Newark has impervious cover. This level of impervious cover suggests that the streams in Newark are likely non-supporting streams. [1]

Methodology

Newark 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.

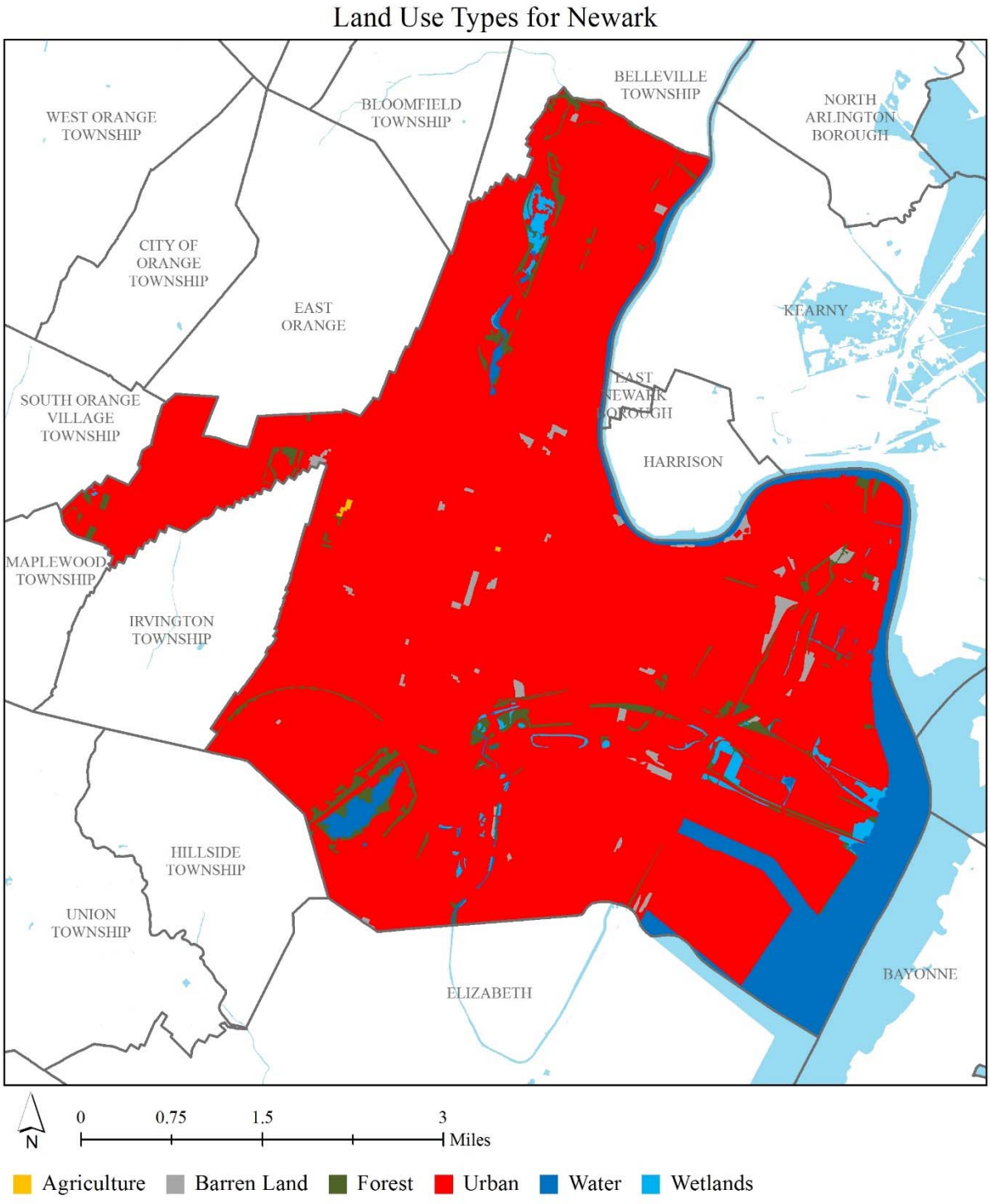


Figure 1: Map illustrating the land use in Newark

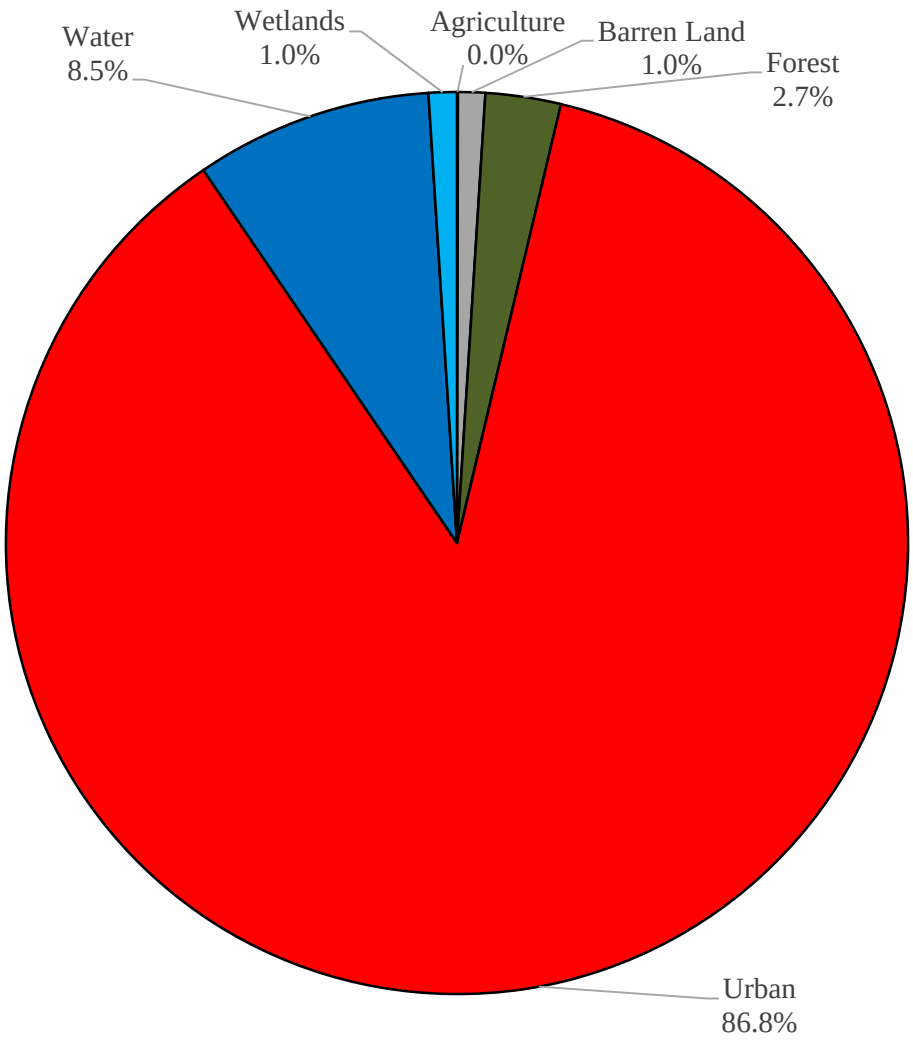


Figure 2: Pie chart illustrating the land use in Newark

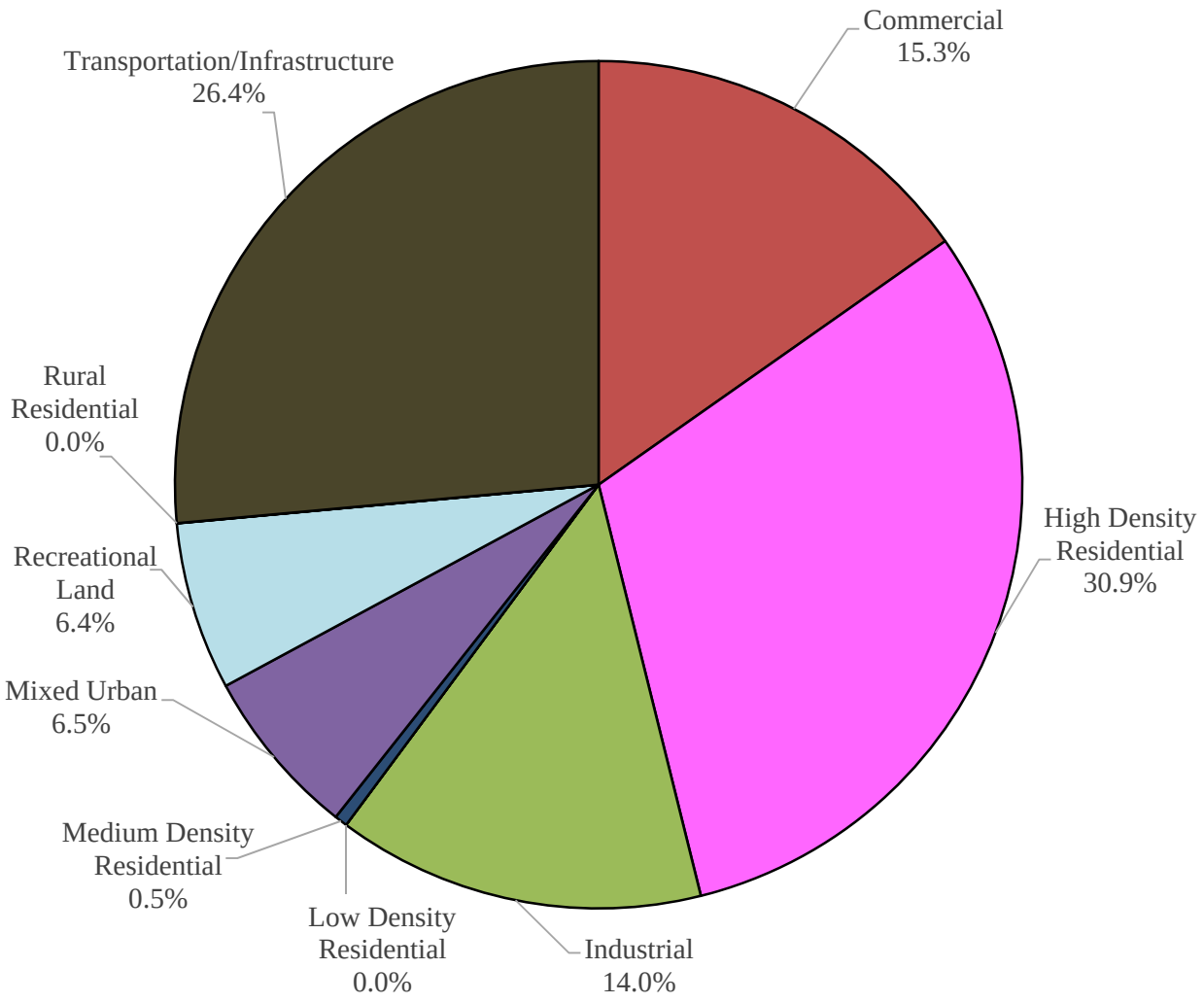


Figure 3: Pie chart illustrating the various types of urban land use in Newark

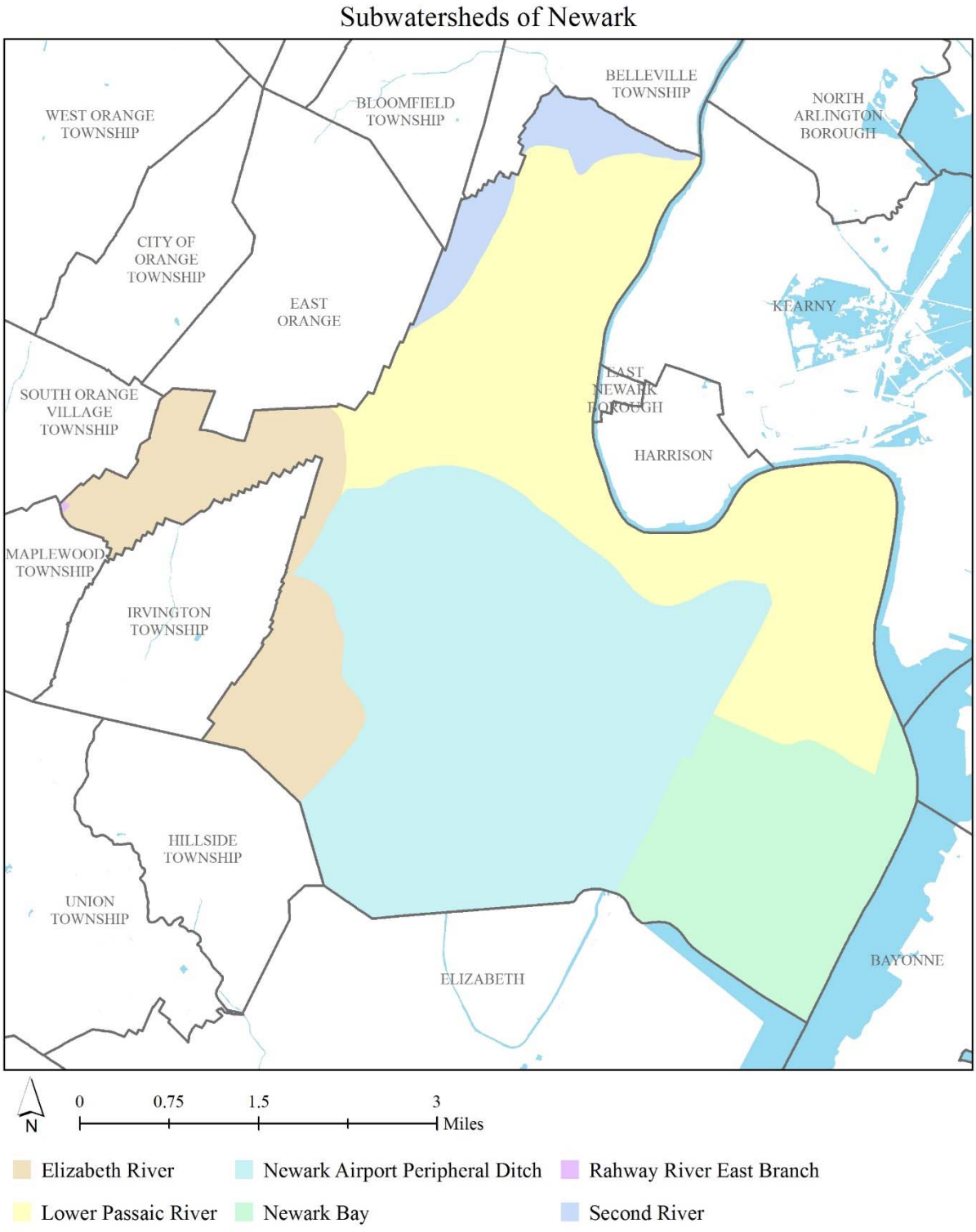


Figure 4: Map of the subwatersheds in Newark

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 Newark 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 Newark. 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

Appendix A contains information on potential project sites where green infrastructure practices could be installed as well as information on existing site conditions. The recommended green infrastructure practices and the drainage area that the green infrastructure practices can treat are identified for each potential project site. For each practice, the recharge potential, TSS removal potential, maximum volume reduction potential per storm, the peak reduction potential, and estimated costs 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

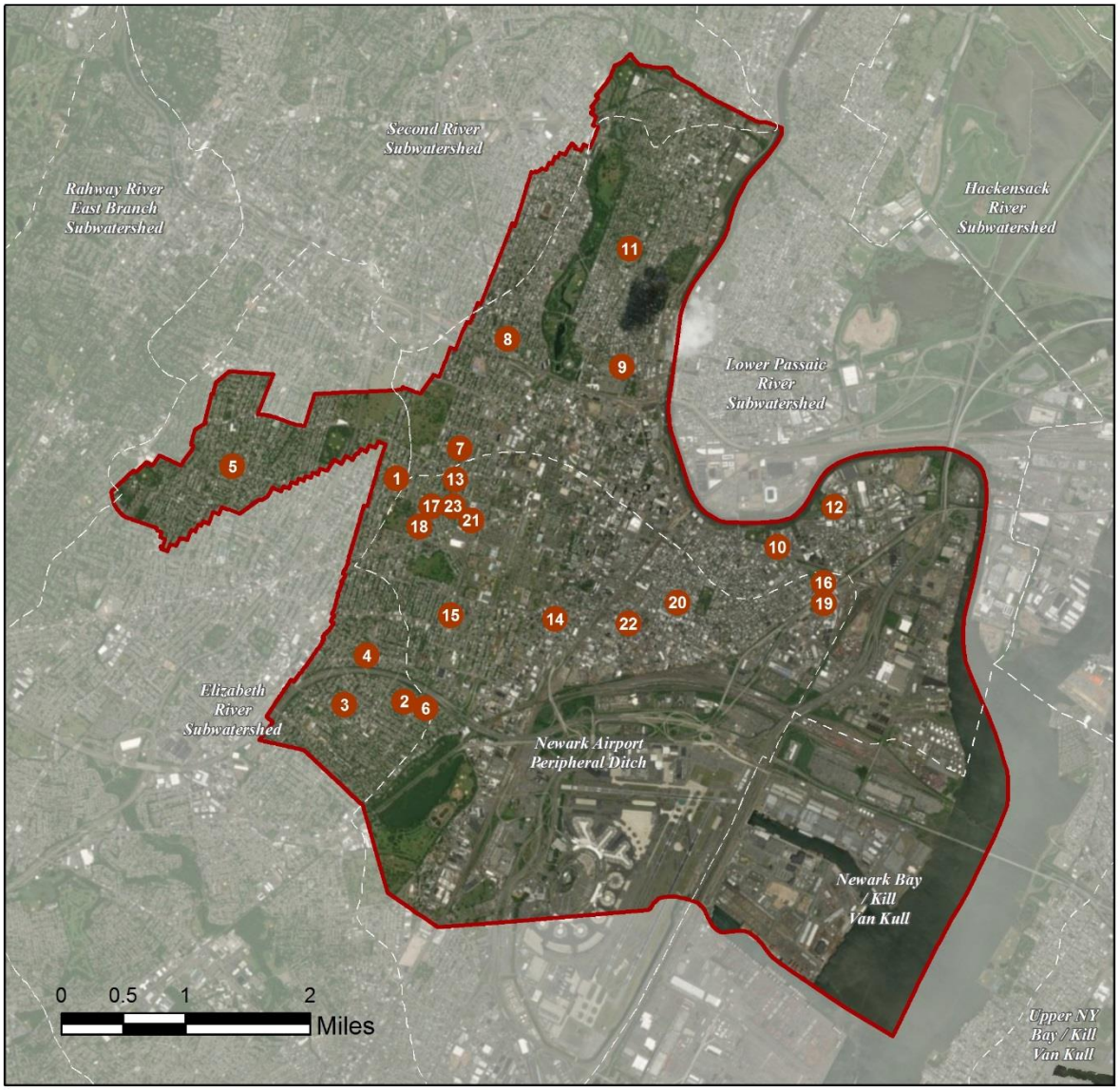
This impervious cover reduction action plan is meant to provide the municipality with a blueprint for implementing green infrastructure practices that will reduce the impact of stormwater runoff from impervious surfaces. These projects can be implemented by a wide variety of people such as boy scouts, 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.

Appendix A: Climate Resilient Green Infrastructure

a. Green Infrastructure Sites

NEWARK: GREEN INFRASTRUCTURE SITES - VOLUME 1



SITES WITHIN THE ELIZABETH RIVER SUBWATERSHED

1. 590-596 15th Avenue Community Garden
2. Art of Survival Garden
3. George Washington Carver Elementary School
4. Hawthorne Avenue Elementary School
5. HOV Healthy Haven Garden
6. Peshine Avenue Elementary School

SITES WITHIN LOWER PASSAIC RIVER SUBWATERSHED

7. 13th Avenue School
8. 391 7th Avenue West Community Garden
9. MLK Boulevard Vacant Lot and Sidewalk
10. Newark Police Station 3rd Precinct
11. Robert Treat Academy Charter School
12. Terrell Homes

SITES WITHIN THE NEWARK AIRPORT PERIPHERAL DITCH SUBWATERSHED

13. 293 South 7th Street Community Garden
14. 40 Astor Street Community Garden
15. 616 Bergen Street Community Garden
16. Aerofarms
17. Harriet Tubman Elementary School
18. Harriet Tubman Elementary School Living Laboratory Garden
19. Ironbound Recreation Center
20. Nasto's Ice Cream
21. Revival Temple Community Garden
22. South Street Academy
23. St. Ann's Church

b. Proposed Green Infrastructure Concepts

590 & 596 15th Avenue Community Garden

Subwatershed: Elizabeth River

Site Area: 4,123 sq. ft.

Address: 590-596 15th Avenue
Newark, NJ 07103

Block and Lot: Block 327, Lot 24,27

Two cisterns can be installed to capture roof runoff from two buildings adjacent to the gardens. The water can then be used to water the garden or for other non-potable uses. 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"
5	200	0.0	0.1	0.9	0.000	0.01

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Rainwater harvesting	0.021	4	650	0.06	650 (gal)	$1,300

GREEN INFRASTRUCTURE RECOMMENDATIONS

590 & 596 15th Avenue Community Garden

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

0 15' 30'

Art of Survival Garden

Subwatershed: Elizabeth River

Site Area: 4,858 sq. ft.

Address: 367 Seymour Avenue
Newark, NJ 07112

Block and Lot: Block 3603, Lot 7,8

A cistern can be installed to capture roof runoff from buildings adjacent to the gardens. The water can then be used to water the garden or for other non-potable uses. Two stormwater planters can be installed in the sidewalk to capture, treat, and infiltrate runoff from the road. 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"
5	250	0.0	0.1	1.1	0.000	0.01

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Rainwater harvesting	0.011	2	325	0.03	325 (gal)	$650
Stormwater planters	0.013	2	950	0.04	120	$45,000

GREEN INFRASTRUCTURE RECOMMENDATIONS

Art of Survival Garden

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

0 15' 30'

George Washington Carver Elementary School

Subwatershed: Elizabeth River

Site Area: 133,990 sq. ft.

Address: 333 Clinton Place
Newark, NJ 07112

Block and Lot: Block 3050, Lot 1

The basketball court and playground area can be converted into porous pavement in part or in full to capture and infiltrate runoff during storm events. 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"
95	127,291	6.1	64.3	584.4	0.099	3.49

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	0.964	161	73,030	2.74	6,600	$165,000

GREEN INFRASTRUCTURE RECOMMENDATIONS

George Washington Carver Elementary School

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

0 30' 60'

Hawthorne Avenue Elementary School

Subwatershed: Elizabeth River

Site Area: 59,335 sq. ft.

Address: 428 Hawthorne Avenue
Newark, NJ 07108

Block and Lot: Block 3045, Lot 1

Three rain gardens can be installed around the school to capture, treat, and infiltrate runoff from the roof and also can serve as demonstration projects. A section of pavement in the back of the building can be converted to porous paving to capture and infiltrate runoff during storm events. 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"
95	56,148	2.7	28.4	257.8	0.044	1.54

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
Bioretention systems	0.151	25	11,450	0.50	1,450	$7,250
Pervious pavement	0.089	15	6,710	0.30	1,250	$31,250

GREEN INFRASTRUCTURE RECOMMENDATIONS

Hawthorne Avenue Elementary School

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

0 30' 60'

HOV Healthy Haven Garden

Subwatershed: Elizabeth River

Site Area: 3,036 sq. ft.

Address: 1068 18th Avenue
Newark, NJ 07106

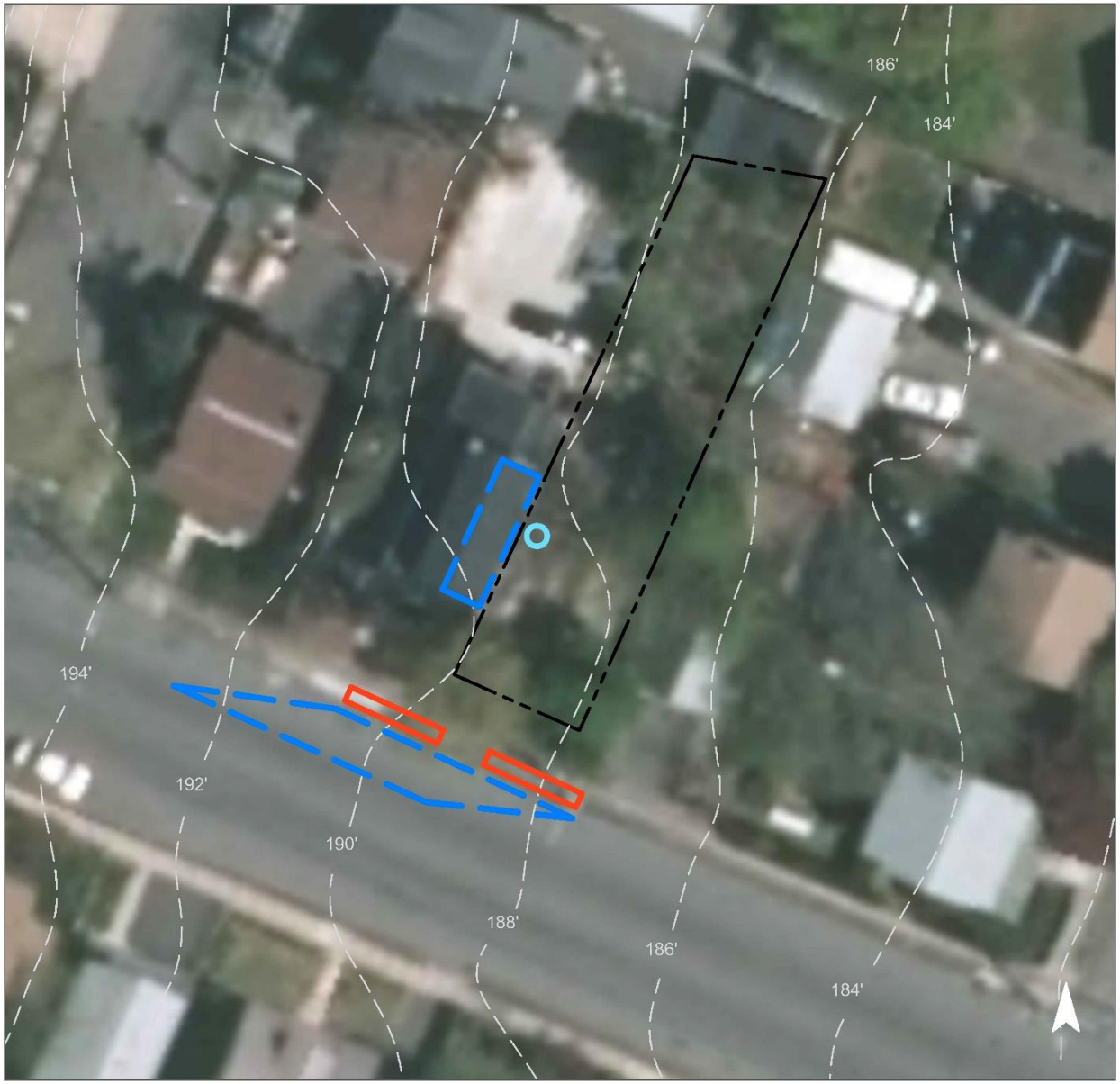
Block and Lot: Block 4108, Lot 45

A cistern attached to a downspout of an adjacent building can capture and slowly release rainwater during storms, and the water can then be used for watering the garden or for other non-potable uses. Two stormwater planters can be installed in the sidewalk to capture, treat, and infiltrate runoff from the road. 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"
5	150	0.0	0.1	0.7	0.000	0.00

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
Rainwater harvesting	0.006	1	200	0.02	200 (gal)	$400
Stormwater planters	0.013	2	950	0.04	120	$45,000

GREEN INFRASTRUCTURE RECOMMENDATIONS



HOV Healthy Haven Garden

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

0 15' 30'

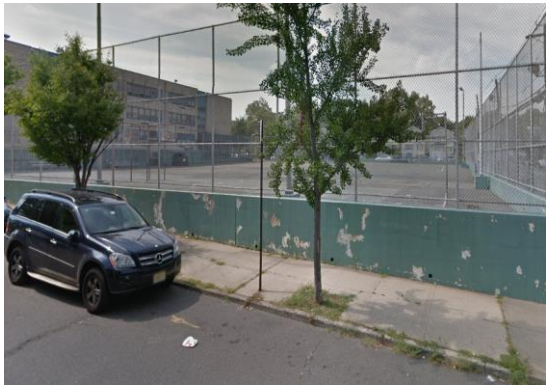
Peshine Academy Elementary School

Subwatershed: Elizabeth River

Site Area: 90,635 sq. ft.

Address: 433 Peshine Avenue
Newark, NJ 07112

Block and Lot: Block 3583
Lot 25-38,42

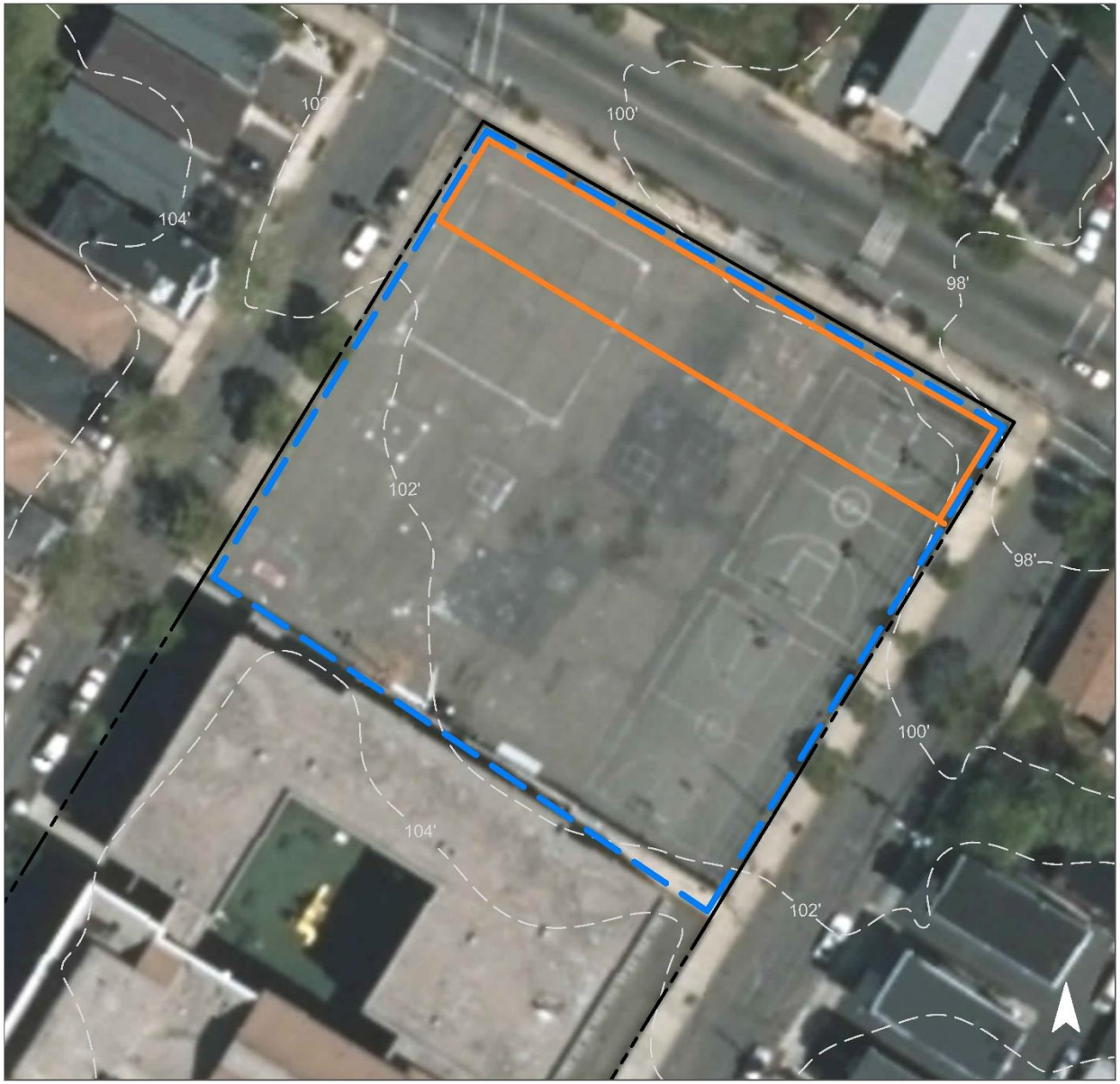


The basketball court and playground area can be converted into porous pavement in part or in full to capture and infiltrate runoff during storm events. A preliminary soil assessment suggests that more soil testing would be required before determining the soil's suitability for green infrastructure.

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"
94	85,426	4.1	43.1	392.2	0.067	2.34

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Pervious pavement	0.905	152	68,590	3.02	6,200	$155,000

GREEN INFRASTRUCTURE RECOMMENDATIONS



Peshine Academy Elementary School

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

0 25' 50'

13th Avenue School

Subwatershed: Lower Passaic River

Site Area: 129,937 sq. ft.

Address: 359 13th Avenue
Newark, NJ 07103

Block and Lot: Block 1798, Lot 9-60

The parking spaces can be converted into porous pavement to capture and infiltrate runoff from the large paved areas during storm events. 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"
100	129,937	6.3	65.6	596.6	0.101	3.56

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	0.769	129	58,230	2.56	6,850	$171,250

GREEN INFRASTRUCTURE RECOMMENDATIONS

13th Avenue School

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

0 25' 50'

391 7th Avenue West Community Garden

Subwatershed: Lower Passaic River

Site Area: 1,001 sq. ft.

Address: 391 7th Avenue West
Newark, NJ 07107

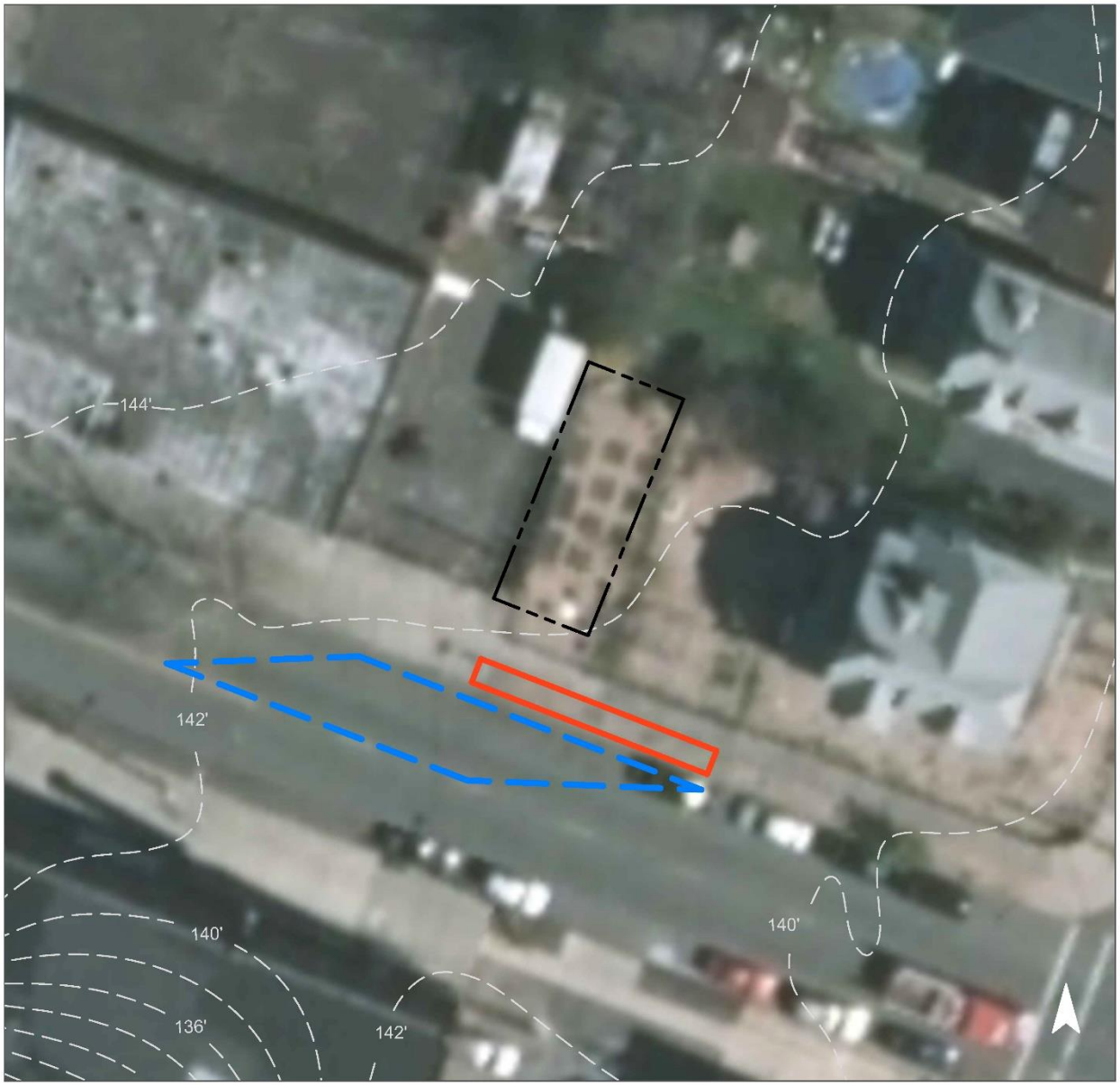
Block and Lot: Block 1918, Lot 79

A stormwater planter can be installed in the sidewalk to capture, treat, and infiltrate runoff from the road. 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"
5	50	0.0	0.0	0.2	0.000	0.00

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
Stormwater planter	0.026	4	1,970	0.09	250	$93,750

GREEN INFRASTRUCTURE RECOMMENDATIONS



391 7th Avenue West Community Garden

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

0 15' 30'

MLK Jr. Boulevard Vacant Lot and Sidewalk

Subwatershed: Lower Passaic River

Site Area: 56,113 sq. ft.

Address: 87 Dr. Martin Luther King Jr. Blvd. Newark, NJ 07104

Block and Lot: Block 479 Lot 4,6.8, 10,11

Stormwater planters can be installed in the sidewalks around the lot to capture, treat, and infiltrate runoff from the streets. A rain garden can be installed at the northeast corner of the lot to capture, treat, and infiltrate runoff from the adjacent rooftop of the church. A preliminary soil assessment suggests that more soil testing would be required before determining the soil's suitability for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
12	6,894	0.3	3.5	31.7	0.005	0.19

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention system	0.044	7	3,360	0.15	425	$2,125
Stormwater planters	0.182	31	13,820	0.61	1,750	$656,250

GREEN INFRASTRUCTURE RECOMMENDATIONS

MLK Jr. Boulevard Vacant Lot and Sidewalk

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

0 30' 60'

Newark Police Station 3rd Precinct

Subwatershed: Lower Passaic River

Site Area: 10,177 sq. ft.

Address: 649 Market Street
Newark, NJ 07105

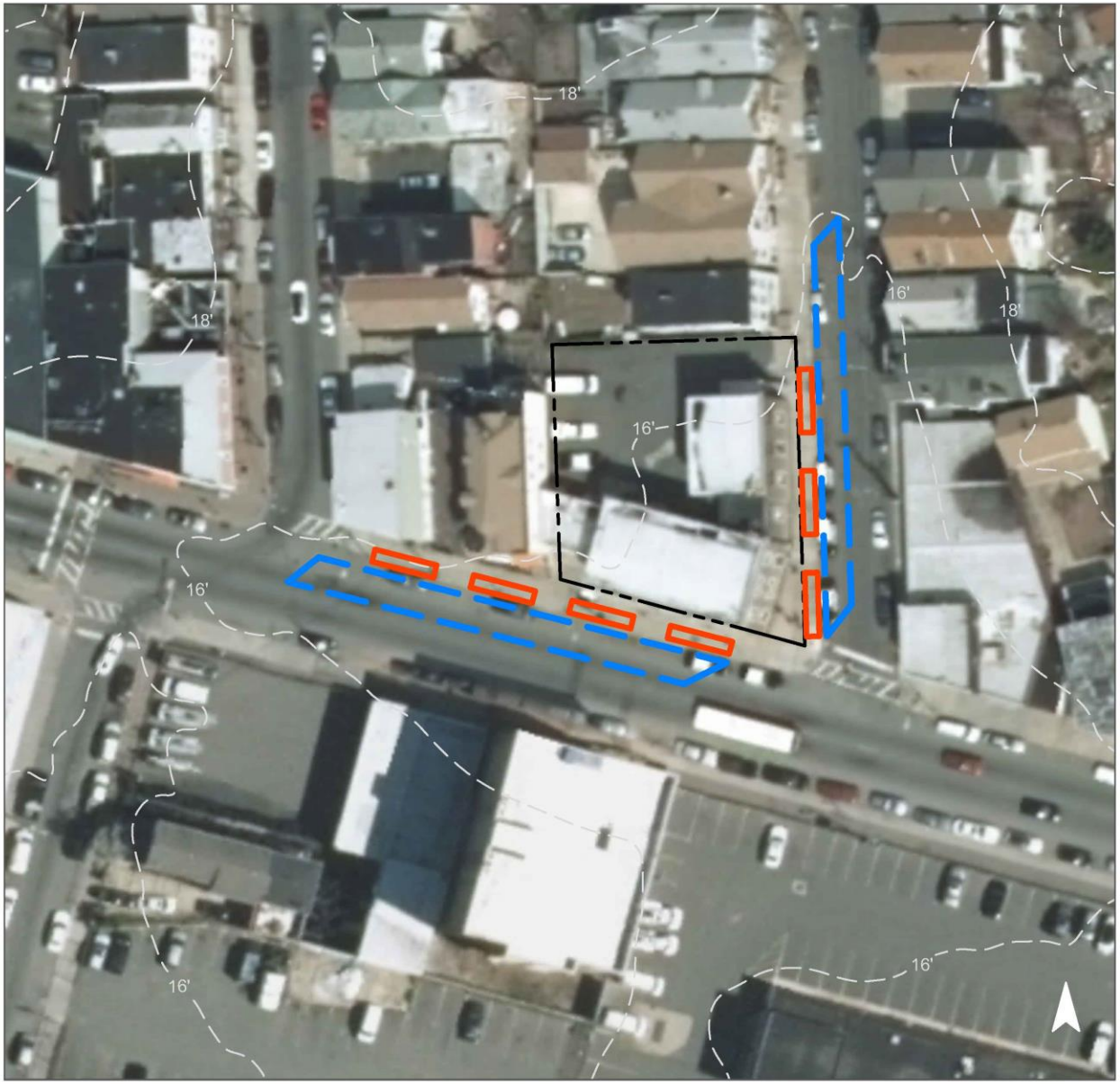
Block and Lot: Block 2012, Lot 29

Stormwater planters can be placed along the sidewalk to capture, treat, and infiltrate stormwater runoff from the road. 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"
95	9,654	0.5	4.9	44.3	0.008	0.26

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
Stormwater planters	0.091	15	6,910	0.30	875	$328,125

GREEN INFRASTRUCTURE RECOMMENDATIONS



Newark Police Station
3rd Precinct

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

0 30' 60'

Robert Treat Academy Charter School

Subwatershed: Lower Passaic River

Site Area: 55,061 sq. ft.

Address: 443 Clifton Avenue
Newark, NJ 07104

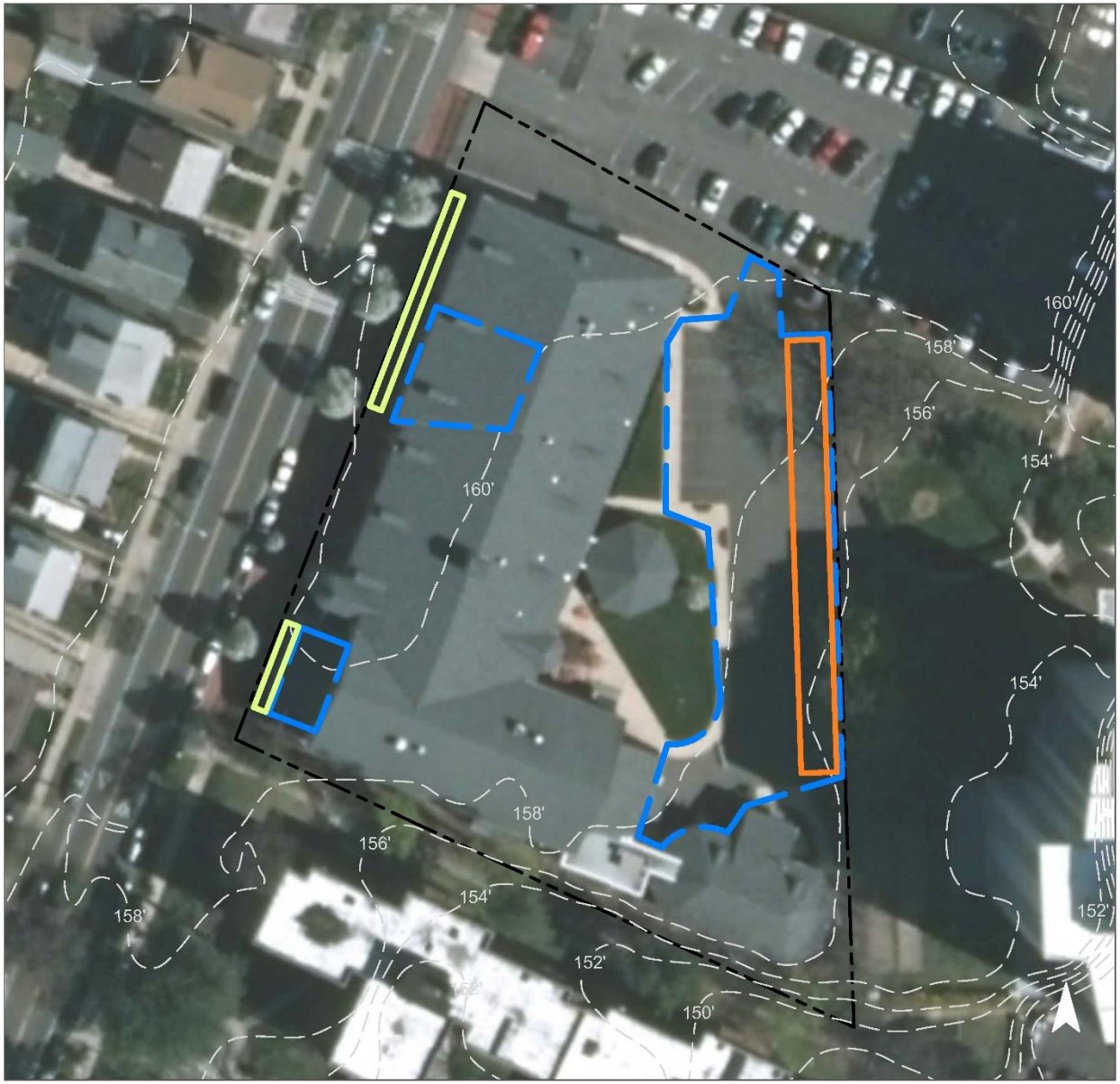
Block and Lot: Block 609, Lot 28.01, 84

Rain gardens can be installed along the front of the school to capture stormwater from the rooftop by redirecting downspouts into them. Two sections of parking spaces can be converted to pervious pavement to capture and infiltrate 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"
89	49,257	2.4	24.9	226.2	0.038	1.35

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention systems	0.066	11	4,980	0.22	630	$3,150
Pervious pavement	0.302	51	22,900	1.01	3,125	$78,125

GREEN INFRASTRUCTURE RECOMMENDATIONS



Robert Treat Academy Charter School

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

0 30' 60'

Terrell Homes

Subwatershed: **Lower Passaic River**

Site Area: **499,588 sq. ft.**

Address: **27 Riverview Terrace**
Newark, NJ 07105

Block and Lot: **Block 2442, Lot 1**

Sections of the courtyard areas can be converted to pervious pavement to capture and infiltrate runoff from paved areas and rooftops. There are several other paved areas on this site that could be depaved, and some of these areas can be converted into rain gardens to capture runoff from the rooftops. 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"
77	387,129	18.7	195.5	1,777.5	0.302	10.62

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	0.449	75	34,050	1.50	4,325	$21,625
Pervious pavement	0.766	128	58,040	2.55	5,250	$131,250

GREEN INFRASTRUCTURE RECOMMENDATIONS

Terrell Homes

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

0 50' 100'

293 South 7th Street Community Garden

Subwatershed: Newark Airport Peripheral Ditch

Site Area: 1,728 sq. ft.

Address: 293 South 7th Street Newark, NJ 07103

Block and Lot: Block 269, Lot 15

A cistern can be installed to capture runoff from a roof on the nearby property, and the water can then be used for non-potable purposes. 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"
5	85	0.0	0.0	0.4	0.000	0.00

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
Rainwater harvesting	0.018	3	550	0.06	550 (gal)	$1,100

GREEN INFRASTRUCTURE RECOMMENDATIONS

293 South 7th Street Community Garden

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

0 15' 30'

40 Astor Street Community Garden

Subwatershed: Newark Airport Peripheral Ditch

Site Area: 921 sq. ft.

Address: 40 Astor Street Newark, NJ 07114

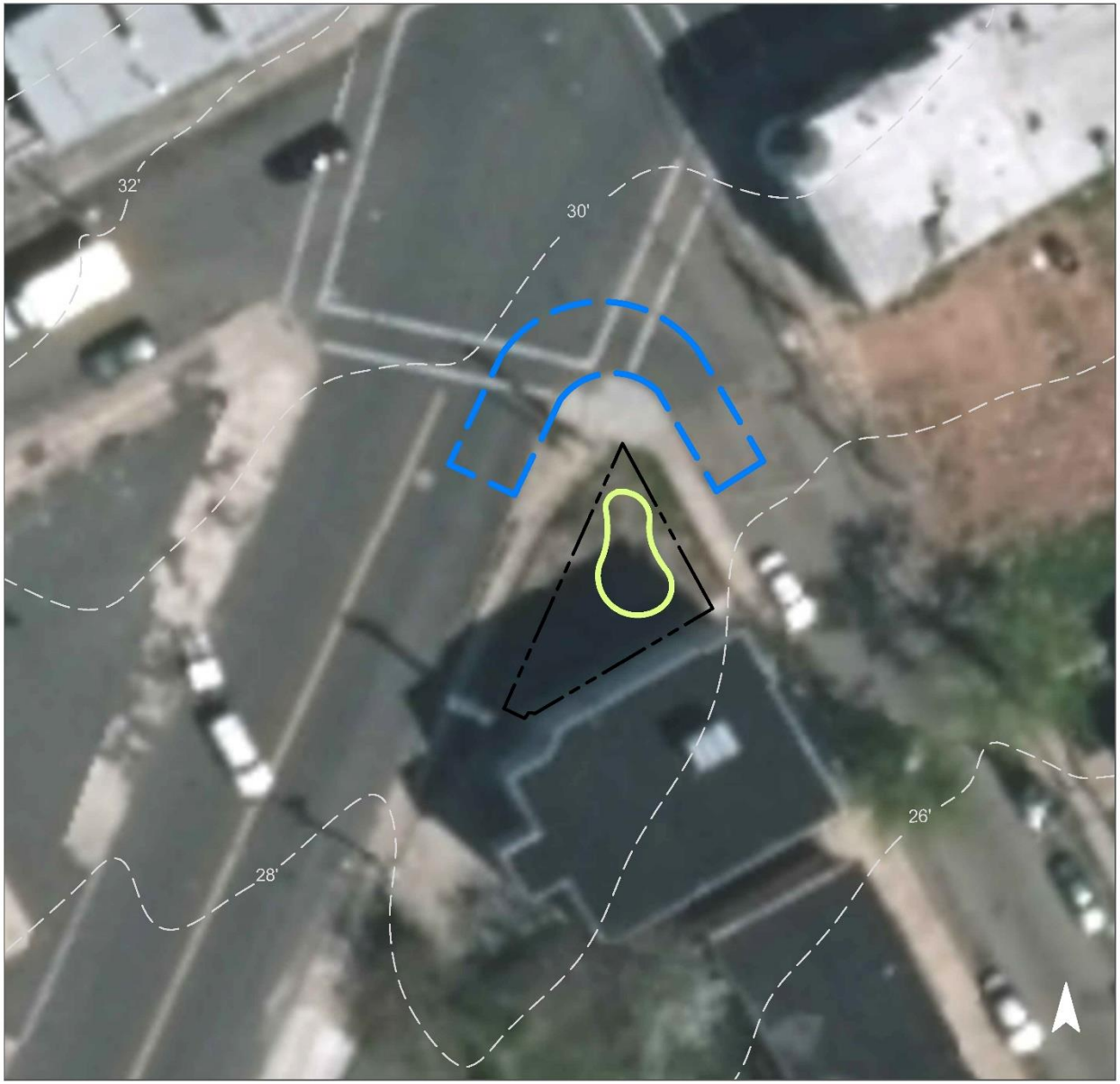
Block and Lot: Block 2808, Lot 10

A rain garden can be installed to capture, treat, and infiltrate runoff from the intersection. 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"
5	45	0.0	0.0	0.2	0.000	0.00

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	0.026	4	1,970	0.09	250	$1,250

GREEN INFRASTRUCTURE RECOMMENDATIONS



40 Astor Street Community Garden

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

0 15' 30'

616 Bergen Street Community Garden

Subwatershed: Newark Airport Peripheral Ditch

Site Area: 2,026 sq. ft.

Address: 616 Bergen Street Newark, NJ 07108

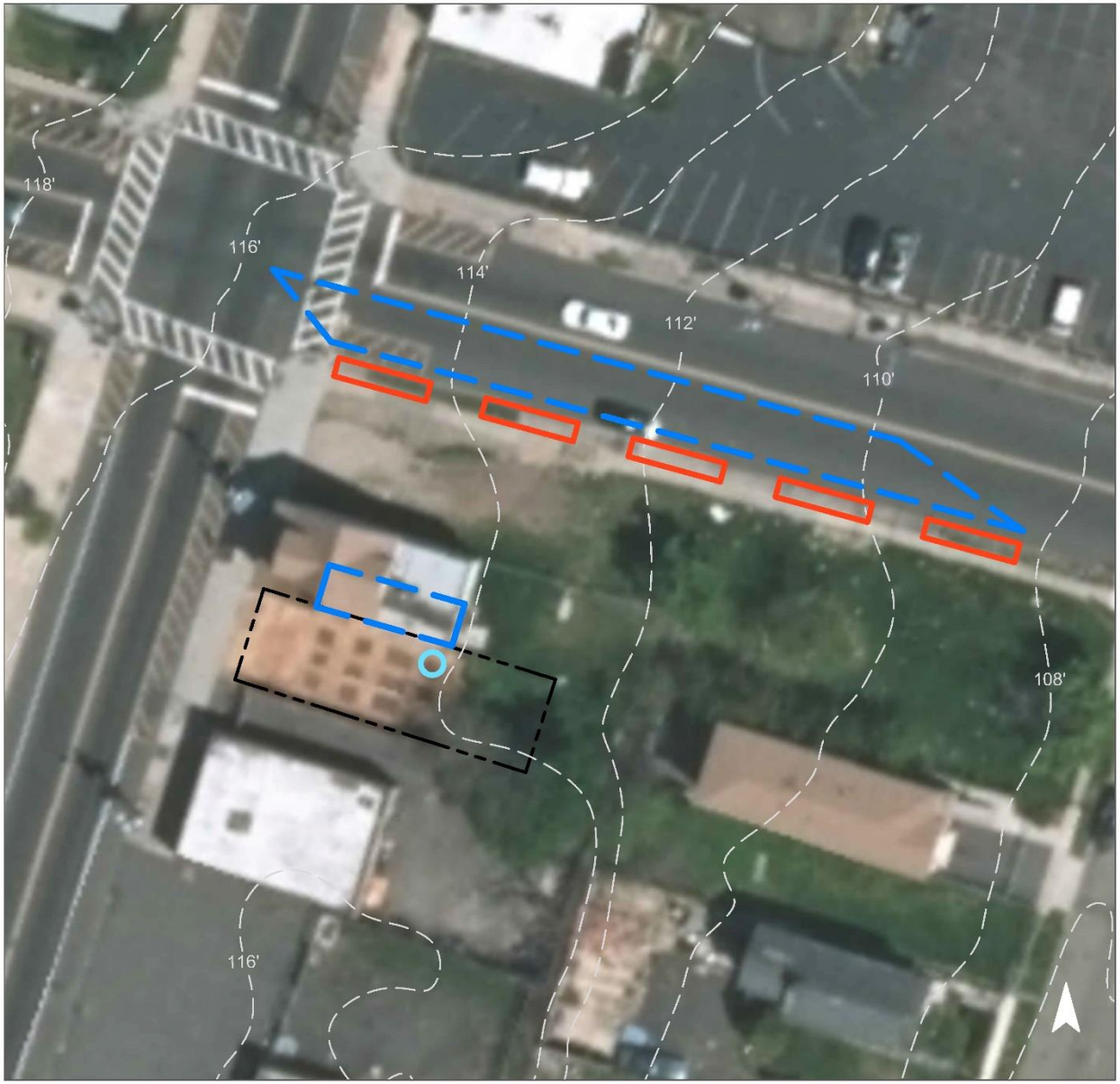
Block and Lot: Block 2685, Lot 1

A cistern can be installed to capture runoff from a roof on the nearby property, and the water can be used for non-potable purposes such as watering the garden. Stormwater planters can be installed along the street to capture, treat, and infiltrate runoff from the road. 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"
5	100	0.0	0.1	0.5	0.000	0.00

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
Rainwater harvesting	0.011	2	325	0.04	325 (gal)	$650
Stormwater planters	0.065	11	4,940	0.22	625	$234,375

GREEN INFRASTRUCTURE RECOMMENDATIONS



616 Bergen Street
Community Garden

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

0 20' 40'

Aerofarms

Subwatershed: Newark Airport Peripheral Ditch

Site Area: 123,332 sq. ft.

Address: 212 Rome Street Newark, NJ 07105

Block and Lot: Block 2052;2487 Lot 30;38

A section of the parking lot can be converted into pervious pavement to capture and infiltrate parking lot runoff. Cisterns can be installed to capture runoff from the greenhouse, and the water can then be reused for non-potable purposes. 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"
85	105,216	5.1	53.1	483.1	0.82	2.89

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Pervious pavement	0.371	62	28,130	1.06	2,550	$63,750
Rainwater harvesting	0.109	18	3,300	0.31	3,300 (gal)	$6,600

GREEN INFRASTRUCTURE RECOMMENDATIONS

Aerofarms

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

0 50' 100'

Harriet Tubman Elementary School

Subwatershed: Newark Airport Peripheral Ditch

Site Area: 43,218 sq. ft.

Address: 504 South 10th Avenue Newark, NJ 07103

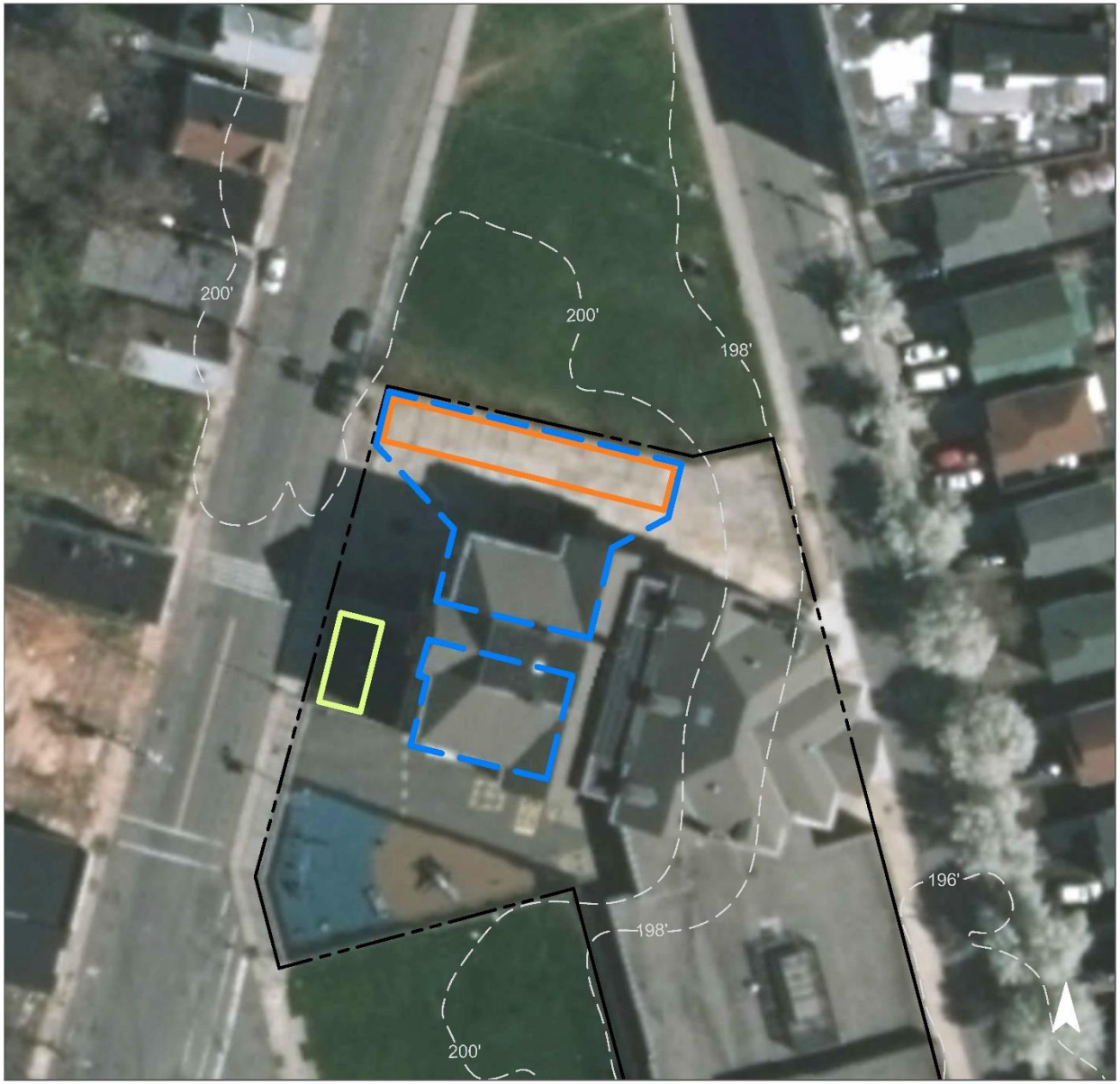
Block and Lot: Block 305, Lot 8-15

A section of the parking lot can be converted into pervious pavement to capture and infiltrate parking lot runoff. A section of the turfgrass area in front of the school can be converted to a rain garden to capture, treat, and infiltrate runoff from the roof. 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"
97	41,845	2.0	21.1	192.1	0.033	1.15

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention system	0.043	7	3,250	0.14	420	$2,100
Pervious pavement	0.117	20	8,890	0.39	1,800	$45,000

GREEN INFRASTRUCTURE RECOMMENDATIONS



Harriet Tubman Elementary School

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

0 25' 50'

Harriet Tubman Elementary School Living Laboratory Garden

Subwatershed: Newark Airport Peripheral Ditch

Site Area: 8,293 sq. ft.

Address: South 10th St & Blum St Newark, NJ 07103

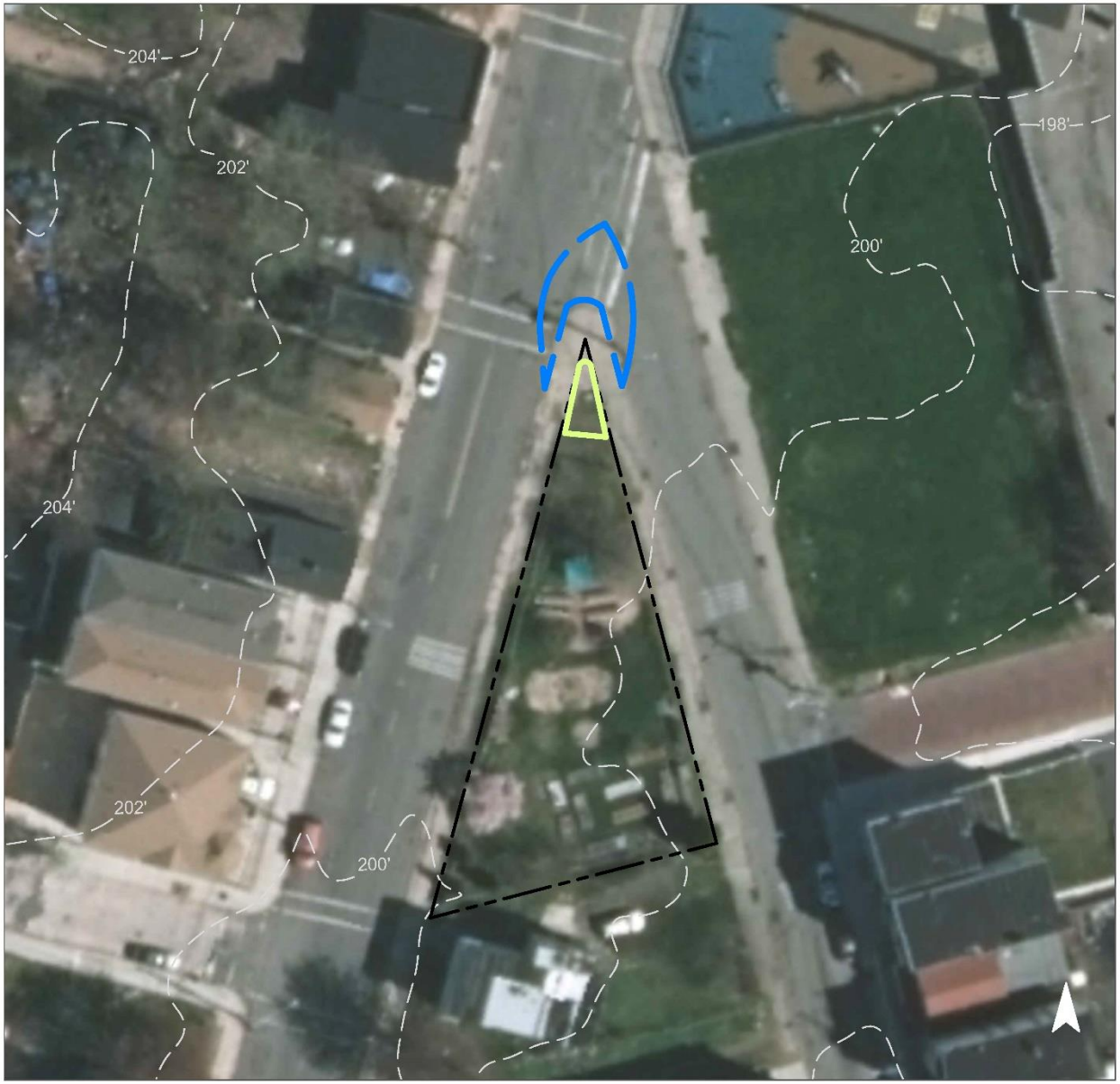
Block and Lot: Block 307.01 Lot 48, 50

A rain garden can be installed at the fork in the road to capture, treat, and infiltrate runoff from the road and also serve as a demonstration garden for students. 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"
25	2,095	0.1	1.1	9.6	0.002	0.06

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 system	0.021	3	1,580	0.07	200	$1,000

GREEN INFRASTRUCTURE RECOMMENDATIONS



Harriet Tubman Elementary School Living Lab Garden

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

0 25' 50'

Ironbound Recreation Center

Subwatershed: Newark Airport Peripheral Ditch

Site Area: 469,954 sq. ft.

Address: 226 Rome Street Newark, NJ 07105

Block and Lot: Block 2052, Lot 1

The sidewalk area can be converted to pervious pavement to capture and infiltrate runoff from the parking lot and roof. A rain garden can be installed in the turfgrass area on the east side of the building to capture and infiltrate runoff from the roof. 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"
59	275,780	13.3	139.3	1,266.2	0.215	7.56

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
Rainwater harvesting	0.096	16	7,300	0.32	925	$4,625
Pervious pavement	0.651	109	49,350	2.17	8,300	$207,500

GREEN INFRASTRUCTURE RECOMMENDATIONS

Ironbound Recreation Center

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

0 30' 60'

Nasto's Ice Cream

Subwatershed: Newark Airport Peripheral Ditch

Site Area: 7,213 sq. ft.

Address: 236 Jefferson Street Newark, NJ 07105

Block and Lot: Block 957, Lot 6

Stormwater planters can be planted on the street near the property to capture, treat, and infiltrate runoff from the streets. 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"
100	7,213	0.3	3.6	33.1	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
Stormwater planters	0.023	4	1,780	0.08	225	$84,375

GREEN INFRASTRUCTURE RECOMMENDATIONS

Nasto's Ice Cream

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

0 15' 30'

Revival Temple Community Garden

Subwatershed: Newark Airport Peripheral Ditch

Site Area: 16,950 sq. ft.

Address: 93 16th Avenue Newark, NJ 07103

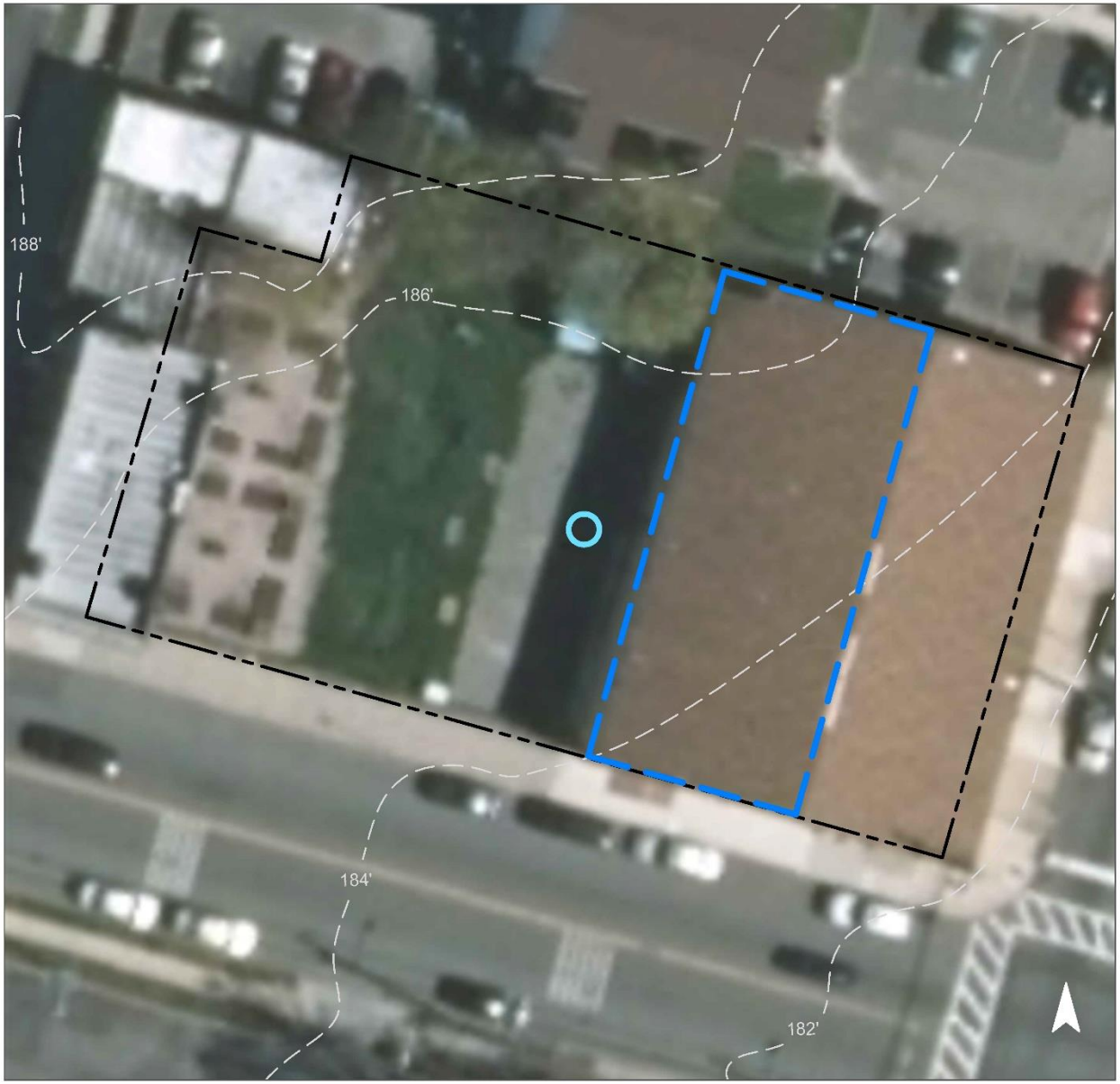
Block and Lot: Block 293 Lot 26,29,31,32

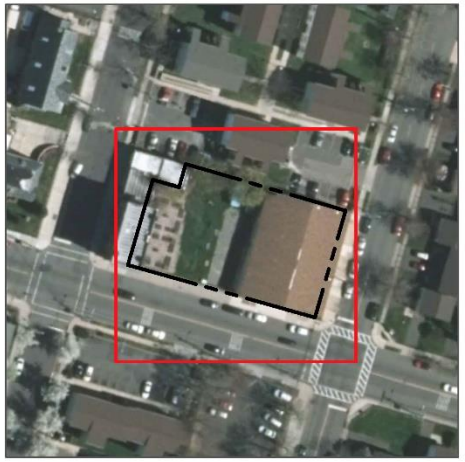
A cistern can be installed to capture the runoff from the roof of the building. The water can then be used for non-portable purposes such as watering the garden. A preliminary soil assessment suggests that more soil testing would be required before determining the soil's suitability for green infrastructure.

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"
50	8,475	0.4	4.3	38.9	0.007	0.23

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
Rainwater harvesting	0.109	18	3,300	0.36	3,300 (gal)	$6,600

GREEN INFRASTRUCTURE RECOMMENDATIONS





Revival Temple Community Garden

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

0 15' 30'

South Street Academy

Subwatershed: **Newark Airport Peripheral Ditch**

Site Area: **28,093 sq. ft.**

Address: **151 South Street Newark, NJ 07114**

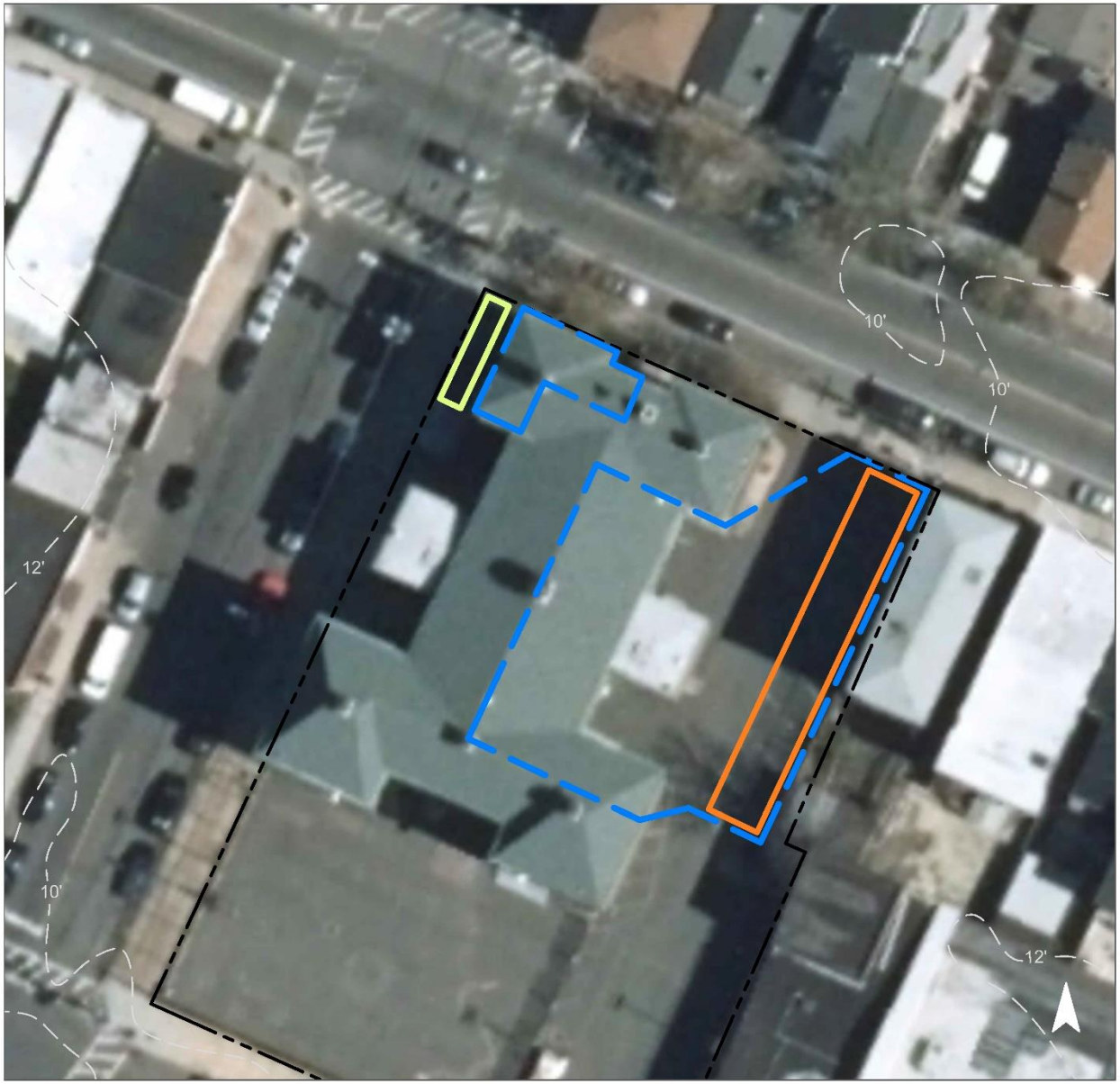
Block and Lot: **Block 1163, Lot 1,32**

A rain garden can be installed in an existing courtyard at the northwest corner of the building to capture, treat, and infiltrate runoff from the roof of the building. A section of pervious pavement can be installed in parking spaces to capture and infiltrate runoff from the parking lot and rooftop. 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"
100	28,092	1.4	14.2	129.0	0.022	0.77

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	0.019	3	1,430	0.06	180	$900
Pervious pavement	0.189	32	14,310	0.63	1,850	$46,250

GREEN INFRASTRUCTURE RECOMMENDATIONS



South Street Academy

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

0 20' 40'

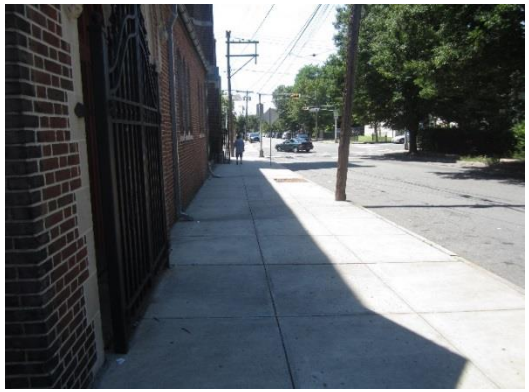
St. Ann's Church

Subwatershed: Newark Airport Peripheral Ditch

Site Area: 32,813 sq. ft.

Address: 106 16th Avenue Newark, NJ 07103

Block and Lot: Block 292, Lot 26.01



A combination of stormwater planters and pervious pavement sections can be installed around the perimeter of the site to manage runoff from the site and streets. The stormwater planters will capture, treat, and infiltrate the runoff, and the pervious pavement will allow runoff to infiltrate. There are also opportunities for rain gardens to capture additional rooftop 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"
85	27,891	1.3	14.1	128.1	0.022	0.76

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	0.042	7	3,220	0.14	410	$2,050
Pervious pavement	0.593	99	44,950	1.98	3,490	$87,250
Stormwater planters	0.130	22	9,870	0.43	1,250	$468,750

GREEN INFRASTRUCTURE RECOMMENDATIONS

St. Ann's Church

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

0 25' 50'

c. Summary of Existing Conditions

Summary of Existing Conditions

	Subwatershed/Site Name/Total Site Info/GI Practice	Area (ac)	Area (SF)	Block	Lot	I.C. %	I.C. Area (SF)	Existing Annual Loads (Commercial) TP (lb/yr)	TN (lb/yr)	TSS (lb/yr)	Runoff Volumes from I.C. Water Quality Storm (1.25" over 2-hours) (cu.ft.)	Annual (cu.ft.)	Runoff Volumes from I.C. Water Quality Storm (1.25" over 2-hours) (Mgal)	Annual (Mgal)
	ELIZABETH RIVER SUBWATERSHED	**6.79**	**295,978**				**269,465**	**13.0**	**136.1**	**1,237.2**	**28,069**	**988,039**	**0.210**	**7.39**
1	**590-596 15th Avenue Community Garden**													
	Total Site Info	0.09	4,123	327	24,27	5	200	0.0	0.1	0.9	21	733	0.000	0.01
2	**Art of Survival Garden**													
	Total Site Info	0.11	4,858	3603	7,8	5	250	0.0	0.1	1.1	26	917	0.000	0.01
3	**George Washington Carver Elementary School**													
	Total Site Info	3.08	133,990	3050	1	95	127,291	6.1	64.3	584.4	13,259	466,734	0.099	3.49
4	**Hawthorne Avenue Elementary School**													
	Total Site Info	1.36	59,335	3045	1	95	56,148	2.7	28.4	257.8	5,849	205,877	0.044	1.54
5	**HOV Healthy Haven Garden**													
	Total Site Info	0.07	3,036	4108	45	5	150	0.0	0.1	0.7	16	550	0.000	0.00
6	**Peshine Academy Elementary School**													
	Total Site Info	2.08	90,635	3583	25 - 38,42	94	85,426	4.1	43.1	392.2	8,899	313,228	0.067	2.34
	LOWER PASSAIC RIVER SUBWATERSHED	**17.26**	**751,877**				**582,921**	**28.1**	**294.4**	**2,676.4**	**60,721.0**	**2,137,377.5**	**0.5**	**16.0**
7	**13th Avenue School**													
	Total Site Info	2.98	129,937	1798	9 - 60	100	129,937	6.3	65.6	596.6	13,535	476,435	0.101	3.56
8	**391 7th Avenue West Community Garden**													
	Total Site Info	0.02	1,001	1918	79	5	50	0.0	0.0	0.2	5	183	0.000	0.00
9	**MLK Jr. Boulevard Vacant Lot and Sidewalk**													
	Total Site Info	1.29	56,113	479	4,6,8,10,11	12	6,894	0.3	3.5	31.7	718	25,279	0.005	0.19
10	**Newark Police Station 3rd Precinct**													
	Total Site Info	0.23	10,177	2012	29	95	9,654	0.5	4.9	44.3	1,006	35,398	0.008	0.26
11	**Robert Treat Academy Charter School**													
	Total Site Info	1.26	55,061	609	28.01,84	89	49,257	2.4	24.9	226.2	5,131	180,610	0.038	1.35
12	**Terrell Homes**													
	Total Site Info	11.47	499,588	2442	1	77	387,129	18.7	195.5	1,777.5	40,326	1,419,473	0.302	10.62
	NEWARK AIRPORT PERIPHERAL DITCH SUBWATERSHED	**16.86**	**734,540**				**496,837.40**	**23.95**	**250.93**	**2,281.16**	**51,753.90**	**1,821,737.15**	**0.39**	**13.63**
13	**293 South 7th Street Community Garden**													
	Total Site Info	0.04	1,728	269	15	5	85	0.0	0.0	0.4	9	312	0.000	0.00

Summary of Existing Conditions

	Subwatershed/Site Name/Total Site Info/GI Practice	Area (ac)	Area (SF)	Block	Lot	I.C. %	I.C. Area (SF)	Existing Annual Loads (Commercial) TP (lb/yr)	TN (lb/yr)	TSS (lb/yr)	Runoff Volumes from I.C. Water Quality Storm (1.25" over 2-hours) (cu.ft.)	Annual (cu.ft.)	Runoff Volumes from I.C. Water Quality Storm (1.25" over 2-hours) (Mgal)	Annual (Mgal)
14	**40 Astor Street Community Garden**													
	Total Site Info	0.02	921	2808	10	5	45	0.0	0.0	0.2	5	165	0.000	0.00
15	**616 Bergen Street Community Garden**													
	Total Site Info	0.05	2,026	2685	1	5	100	0.0	0.1	0.5	10	367	0.000	0.00
16	**Aerofarms**													
	Total Site Info	2.83	123,332	2052;2487	30;38	85	105,216	5.1	53.1	483.1	10,960	385,792	0.082	2.89
17	**Harriet Tubman Elementary School**													
	Total Site Info	0.99	43,218	305	8-15	97	41,845	2.0	21.1	192.1	4,359	153,432	0.033	1.15
18	**Harriet Tubman Elementary School Living Laboratory Garden**													
	Total Site Info	0.19	8,293	307.01	48,50	25	2,095	0.1	1.1	9.6	218	7,683	0.002	0.06
19	**Ironbound Recreation Center**													
	Total Site Info	10.79	469,954	2052	1	59	275,780	13.3	139.3	1,266.2	28,727	1,011,194	0.215	7.56
20	**Nasto's Ice Cream**													
	Total Site Info	0.17	7,213	957	6	100	7,213	0.3	3.6	33.1	751	26,448	0.006	0.20
21	**Revival Temple Community Garden**													
	Total Site Info	0.39	16,950	293	26,29,31,32	50	8,475	0.4	4.3	38.9	883	31,075	0.007	0.23
22	**South Street Academy**													
	Total Site Info	0.64	28,093	1163	1,32	100	28,092	1.4	14.2	129.0	2,926	103,004	0.022	0.77
23	**St. Ann's Church**													
	Total Site Info	0.75	32,813	292	26.01	85	27,891	1.3	14.1	128.1	2,905	102,266	0.022	0.76

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	Unit Cost ($/unit)	Unit	Total Cost ($)	I.C. Treated %
	ELIZABETH RIVER SUBWATERSHED	**83,365**	**1.91**	**2.172**	**364**	**162,855**	**6.75**				**$450,850**	**30.9%**
1	**590-596 15th Avenue Community Garden**											
	Rainwater harvesting	815	0.02	0.021	4	650	0.06	650	$2	gal	$1,300	407.5%
	Total Site Info	**815**	**0.02**	**0.021**	**4**	**650**	**0.06**				**$1,300**	**407.5%**
2	**Art of Survival Garden**											
	Rainwater harvesting	415	0.01	0.011	2	325	0.03	325	$2	gal	$650	166.0%
	Stormwater planter	480	0.01	0.013	2	950	0.04	120	$375	SF	$45,000	192.0%
	Total Site Info	**895**	**0.02**	**0.023**	**4**	**1,275**	**0.07**				**$45,650**	**358.0%**
3	**George Washington Carver Elementary School**											
	Pervious pavement	37,000	0.85	0.964	161	73,030	2.74	6,600	$25	SF	$165,000	29.1%
	Total Site Info	**37,000**	**0.85**	**0.964**	**161**	**73,030**	**2.74**				**$165,000**	**29.1%**
4	**Hawthorne Avenue Elementary School**											
	Bioretention system	5,800	0.13	0.151	25	11,450	0.50	1,450	$5	SF	$7,250	10.3%
	Pervious pavement	3,400	0.08	0.089	15	6,710	0.30	1,250	$25	SF	$31,250	6.1%
	Total Site Info	**9,200**	**0.21**	**0.240**	**40**	**18,160**	**0.80**				**$38,500**	**16.4%**
5	**HOV Healthy Haven Garden**											
	Rainwater harvesting	225	0.01	0.006	1	200	0.02	200	$2	gal	$400	150.0%
	Stormwater planter	480	0.01	0.013	2	950	0.04	120	$375	SF	$45,000	320.0%
	Total Site Info	**705**	**0.02**	**0.018**	**3**	**1,150**	**0.06**				**$45,400**	**470.0%**
6	**Peshine Academy Elementary School**											
	Pervious pavement	34,750	0.80	0.905	152	68,590	3.02	6,200	$25	SF	$155,000	40.7%
	Total Site Info	**34,750**	**0.80**	**0.905**	**152**	**68,590**	**3.02**				**$155,000**	**40.7%**
	LOWER PASSAIC RIVER SUBWATERSHED	**103,475**	**2.38**	**2.696**	**451**	**204,260**	**8.99**				**$1,485,650**	**17.8%**
7	**13th Avenue School**											
	Pervious pavement	29,500	0.68	0.769	129	58,230	2.56	6,850	$25	SF	$171,250	22.7%
	Total Site Info	**29,500**	**0.68**	**0.769**	**129**	**58,230**	**2.56**				**$171,250**	**22.7%**
8	**391 7th Avenue West Community Garden**											
	Stormwater planter	1,000	0.02	0.026	4	1,970	0.09	250	$375	SF	$93,750	2000.0%
	Total Site Info	**1,000**	**0.02**	**0.026**	**4**	**1,970**	**0.09**				**$93,750**	**2000.0%**
9	**MLK Jr. Boulevard Vacant Lot and Sidewalk**											
	Bioretention system	1,700	0.04	0.044	7	3,360	0.15	425	$5	SF	$2,125	24.7%
	Stormwater planter	7,000	0.16	0.182	31	13,820	0.61	1,750	$375	SF	$656,250	101.5%
	Total Site Info	**8,700**	**0.20**	**0.227**	**38**	**17,180**	**0.76**				**$658,375**	**126.2%**
10	**Newark Police Station 3rd Precinct**											
	Stormwater planter	3,500	0.08	0.091	15	6,910	0.30	875	$375	SF	$328,125	36.3%
	Total Site Info	**3,500**	**0.08**	**0.091**	**15**	**6,910**	**0.30**				**$328,125**	**36.3%**

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	Unit Cost ($/unit)	Unit	Total Cost ($)	I.C. Treated %
		Area (SF)	Area (ac)									
11	**Robert Treat Academy Charter School**											
	Bioretention system	2,525	0.06	0.066	11	4,980	0.22	630	$5	SF	$3,150	5.1%
	Pervious pavement	11,600	0.27	0.302	51	22,900	1.01	3,125	$25	SF	$78,125	23.5%
	Total Site Info	**14,125**	**0.32**	**0.368**	**62**	**27,880**	**1.23**				**$81,275**	**28.7%**
12	**Terrell Homes**											
	Bioretention system	17,250	0.40	0.449	75	34,050	1.50	4,325	$5	SF	$21,625	4.5%
	Pervious pavement	29,400	0.67	0.766	128	58,040	2.55	5,250	$25	SF	$131,250	7.6%
	Total Site Info	**46,650**	**1.07**	**1.215**	**203**	**92,090**	**4.05**				**$152,875**	**12.1%**
	NEWARK AIRPORT PERIPHERAL DITCH SUBWATERSHED	**101,195**	**2.32**	**2.637**	**441**	**188,445**	**8.55**				**$1,264,125**	**20.4%**
13	**293 South 7th Street Community Garden**											
	Rainwater harvesting	700	0.02	0.018	3	550	0.06	550	$2	gal	$1,100	823.5%
	Total Site Info	**700**	**0.02**	**0.018**	**3**	**550**	**0.06**				**$1,100**	**823.5%**
14	**40 Astor Street Community Garden**											
	Bioretention system	1,000	0.02	0.026	4	1,970	0.09	250	$5	SF	$1,250	2222.2%
	Total Site Info	**1,000**	**0.02**	**0.026**	**4**	**1,970**	**0.09**				**$1,250**	**2222.2%**
15	**616 Bergen Street Community Garden**											
	Rainwater harvesting	420	0.01	0.011	2	325	0.04	325	$2	gal	$650	420.0%
	Stormwater planter	2,500	0.06	0.065	11	4,940	0.22	625	$375	SF	$234,375	5555.6%
	Total Site Info	**2,920**	**0.07**	**0.076**	**13**	**5,265**	**0.26**				**$235,025**	**5975.6%**
16	**Aerofarms**											
	Pervious pavement	14,250	0.33	0.371	62	28,130	1.06	2,550	$25	SF	$63,750	13.5%
	Rainwater harvesting	4,200	0.10	0.109	18	3,300	0.31	3,300	$2	gal	$6,600	4200.0%
	Total Site Info	**18,450**	**0.42**	**0.481**	**80**	**31,430**	**1.37**				**$70,350**	**4213.5%**
17	**Harriet Tubman Elementary School**											
	Bioretention system	1,650	0.04	0.043	7	3,250	0.14	420	$5	SF	$2,100	3.9%
	Pervious pavement	4,500	0.10	0.117	20	8,890	0.39	1,800	$25	SF	$45,000	10.8%
	Total Site Info	**6,150**	**0.14**	**0.160**	**27**	**12,140**	**0.53**				**$47,100**	**14.7%**
18	**Harriet Tubman Elementary School Living Laboratory Garden**											
	Bioretention system	800	0.02	0.021	3	1,580	0.07	200	$5	SF	$1,000	38.2%
	Total Site Info	**800**	**0.02**	**0.021**	**3**	**1,580**	**0.07**				**$1,000**	**38.2%**
19	**Ironbound Recreation Center**											
	Bioretention system	3,700	0.08	0.096	16	7,300	0.32	925	$5	SF	$4,625	1.3%
	Pervious pavement	25,000	0.57	0.651	109	49,350	2.17	8,300	$25	SF	$207,500	9.1%
	Total Site Info	**28,700**	**0.66**	**0.748**	**125**	**56,650**	**2.49**				**$212,125**	**10.4%**
20	**Nasto's Ice Cream**											
	Stormwater planter	900	0.02	0.023	4	1,780	0.08	225	$375	SF	$84,375	12.5%
	Total Site Info	**900**	**0.02**	**0.023**	**4**	**1,780**	**0.08**				**$84,375**	**12.5%**
21	**Revival Temple Community Garden**											

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	Unit Cost ($/unit)	Unit	Total Cost ($)	I.C. Treated %
	Rainwater harvesting	4,200	0.10	0.109	18	3,300	0.36	3,300	$2	gal	$6,600	49.6%
	Total Site Info	**4,200**	**0.10**	**0.109**	**18**	**3,300**	**0.36**				**$6,600**	**49.6%**
22	**South Street Academy**											
	Bioretention system	725	0.02	0.019	3	1,430	0.06	180	$5	SF	$900	2.6%
	Pervious pavement	7,250	0.17	0.189	32	14,310	0.63	1,850	$25	SF	$46,250	25.8%
	Total Site Info	**7,975**	**0.18**	**0.208**	**35**	**15,740**	**0.69**				**$47,150**	**28.4%**
23	**St. Ann's Church**											
	Bioretention system	1,630	0.04	0.042	7	3,220	0.14	410	$5	SF	$2,050	5.8%
	Pervious pavement	22,770	0.52	0.593	99	44,950	1.98	3,490	$25	SF	$87,250	81.6%
	Stormwater planter	5,000	0.11	0.130	22	9,870	0.43	1,250	$375	SF	$468,750	17.9%
	Total Site Info	**29,400**	**0.67**	**0.766**	**128**	**58,040**	**2.55**				**$558,050**	**105.4%**

RUTGERS
New Jersey Agricultural
Experiment Station

Draft

Impervious Cover Reduction Action Plan for Newark, Essex County, New Jersey – Volume 2

Prepared for the City of Newark by the
Rutgers Cooperative Extension Water Resources Program

April 16, 2018

Table of Contents

Introduction

Located in Essex County in northern New Jersey, Newark covers approximately 26.22 square miles. Figures 1 and 2 illustrate that Newark is dominated by urban land uses. A total of 86.8% of the municipality's land use is classified as urban. Of the urban land in Newark, high 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 Newark 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 Newark. Based upon the 2012 NJDEP land use/land cover data, approximately 63.2% of Newark has impervious cover. This level of impervious cover suggests that the streams in Newark are likely non-supporting streams. [1]

Methodology

Newark 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.

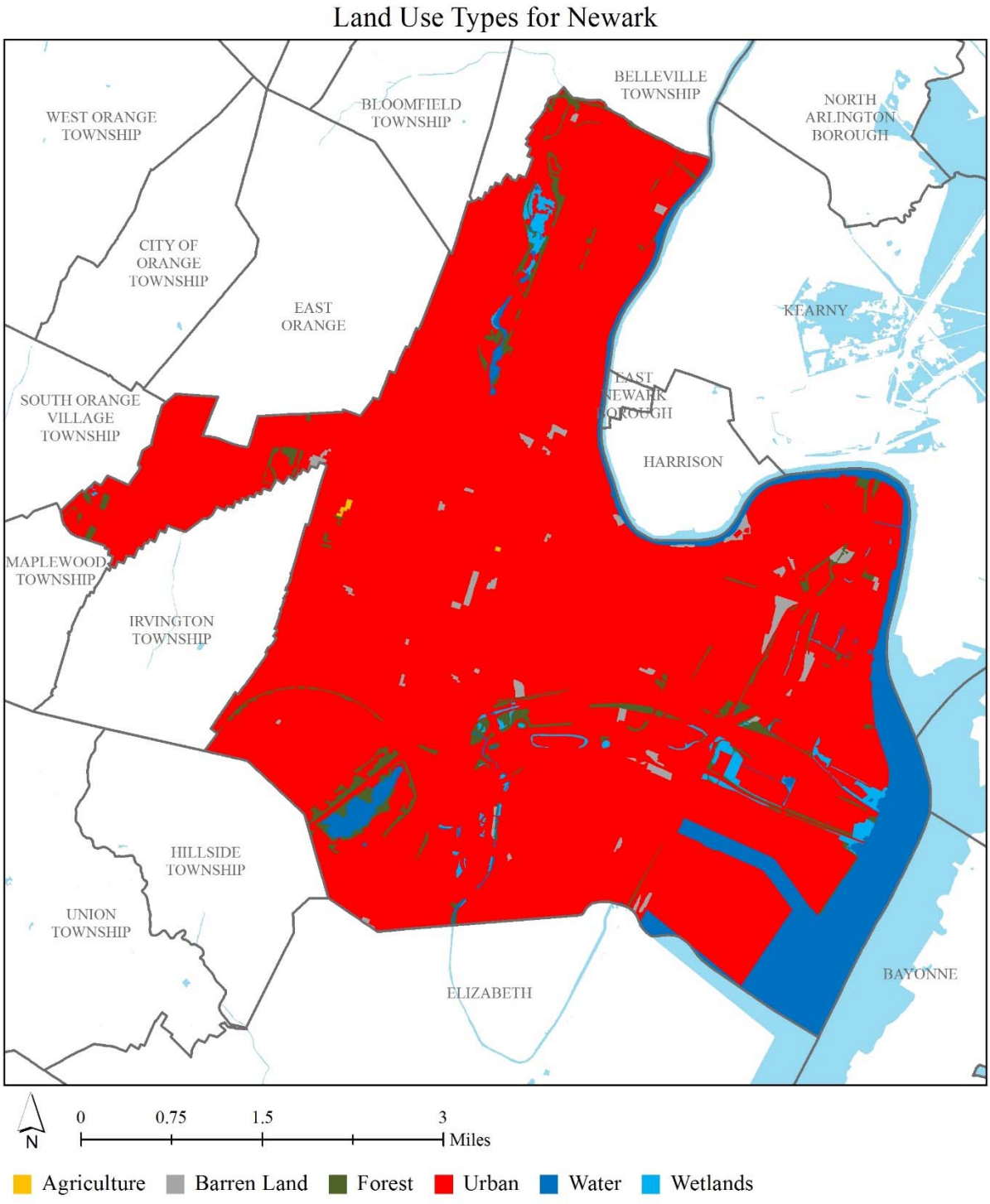


Figure 1: Map illustrating the land use in Newark

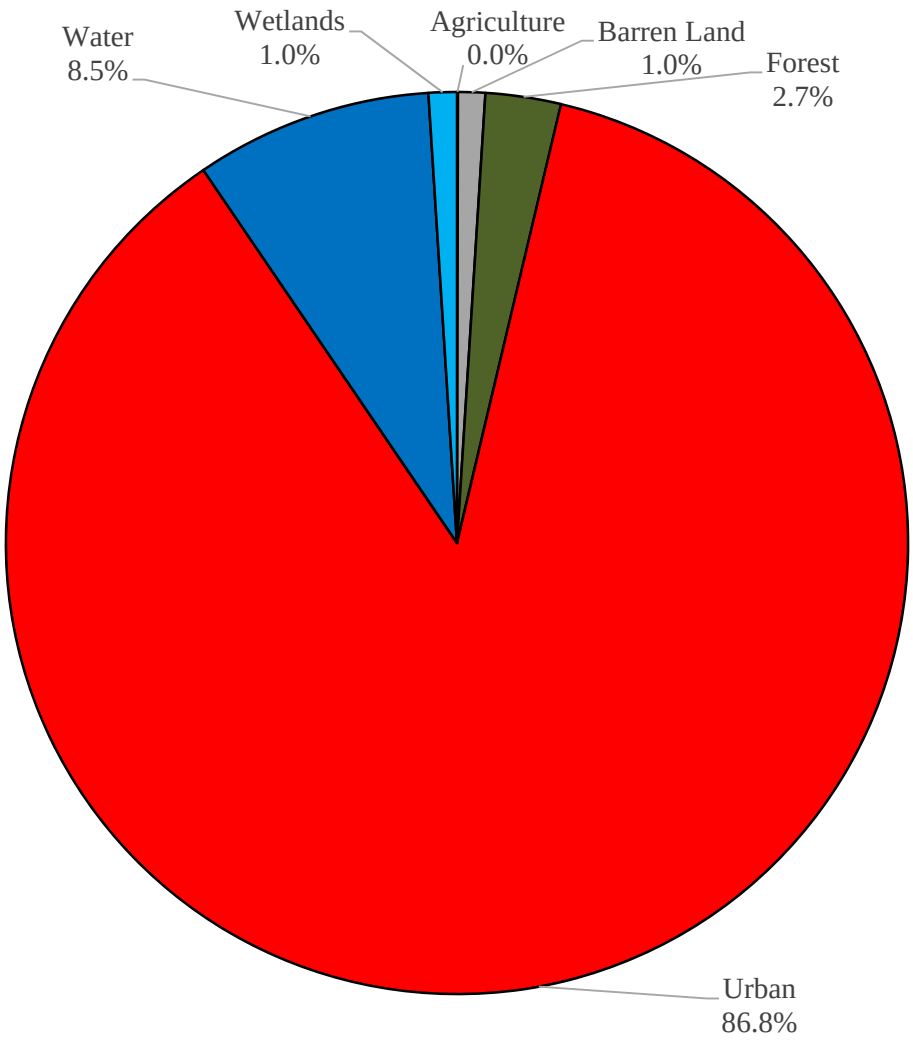


Figure 2: Pie chart illustrating the land use in Newark

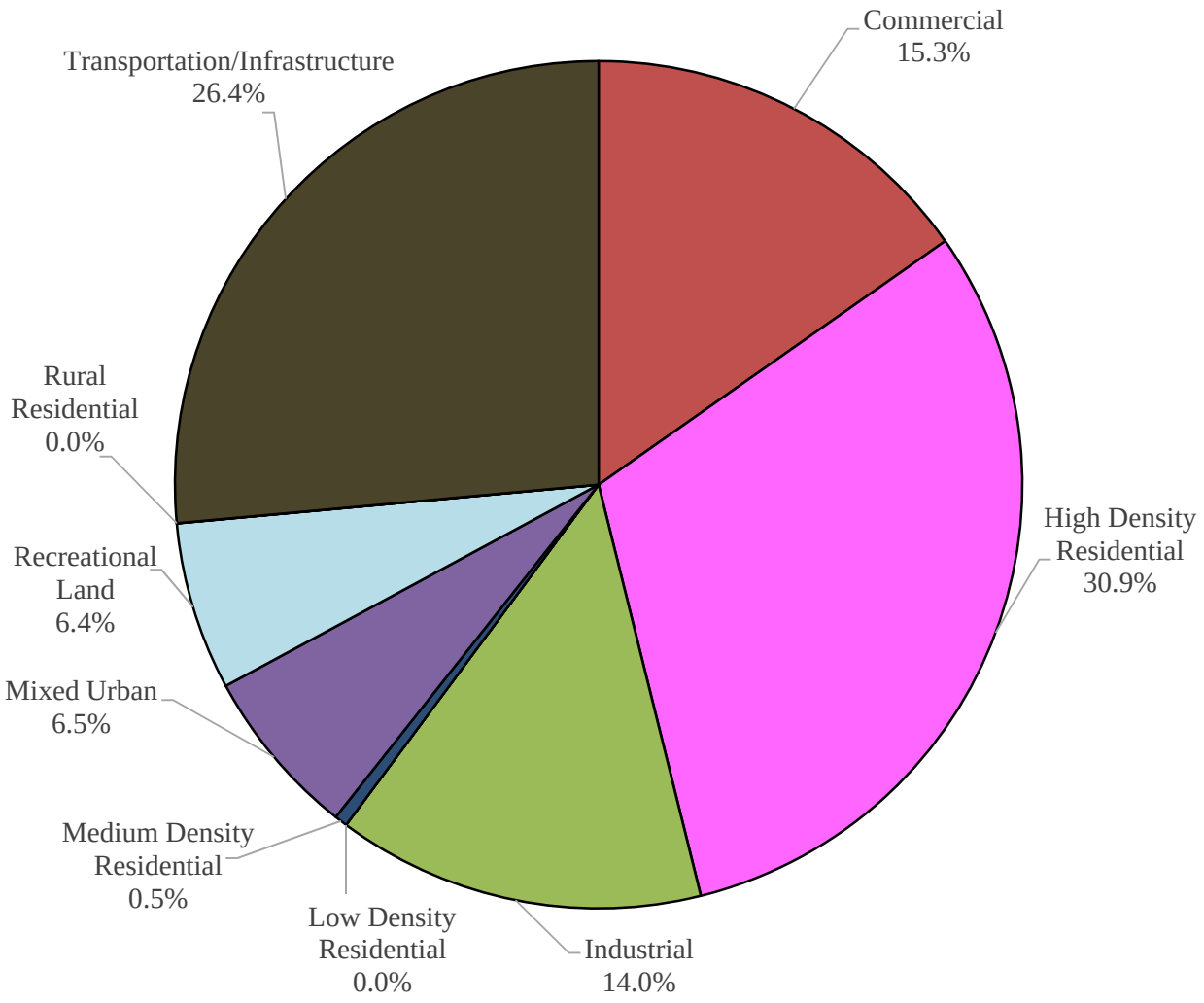


Figure 3: Pie chart illustrating the various types of urban land use in Newark

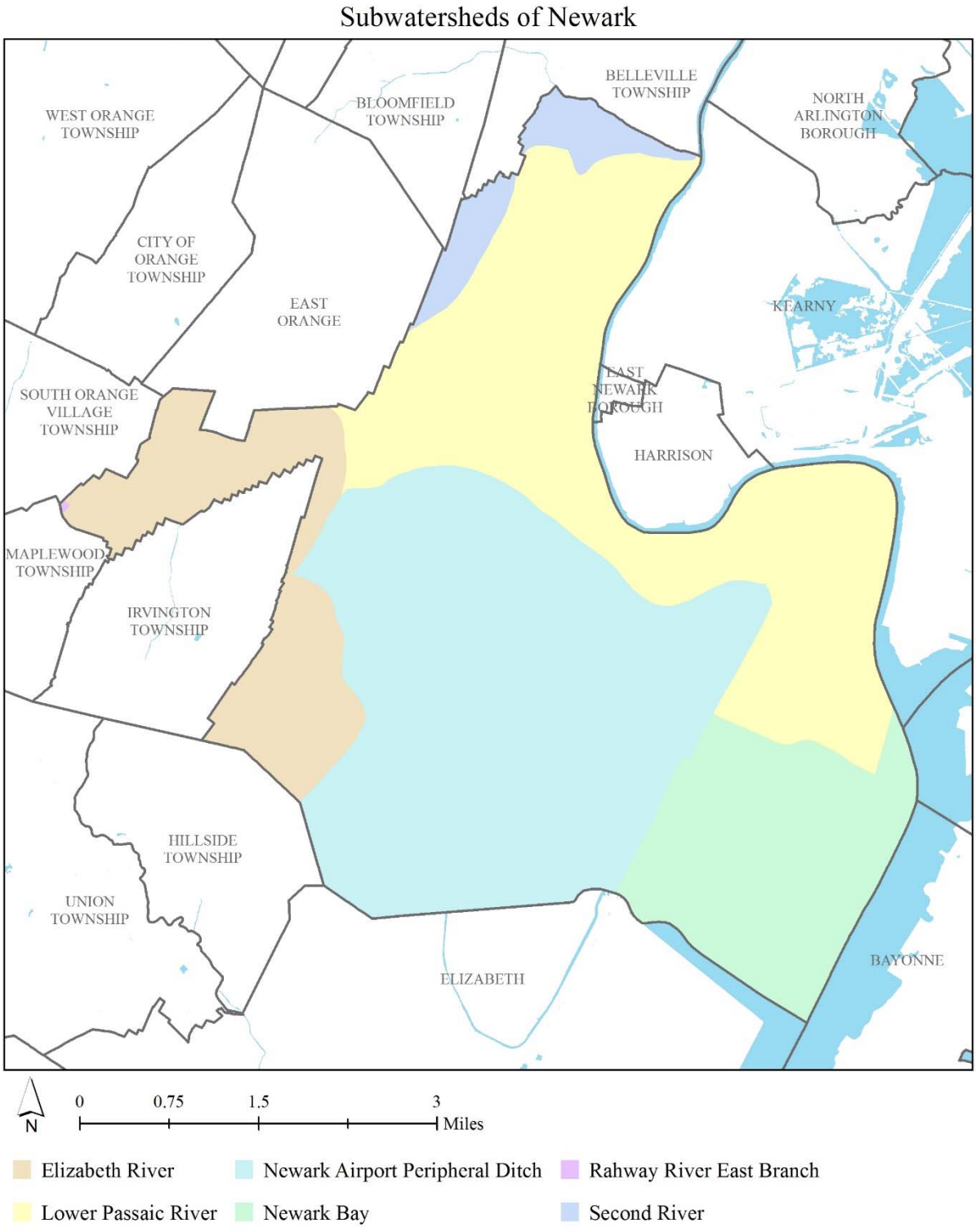


Figure 4: Map of the subwatersheds in Newark

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 Newark 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 Newark. 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

Appendix A contains information on potential project sites where green infrastructure practices could be installed as well as information on existing site conditions. The recommended green infrastructure practices and the drainage area that the green infrastructure practices can treat are identified for each potential project site. For each practice, the recharge potential, TSS removal potential, maximum volume reduction potential per storm, the peak reduction potential, and estimated costs 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

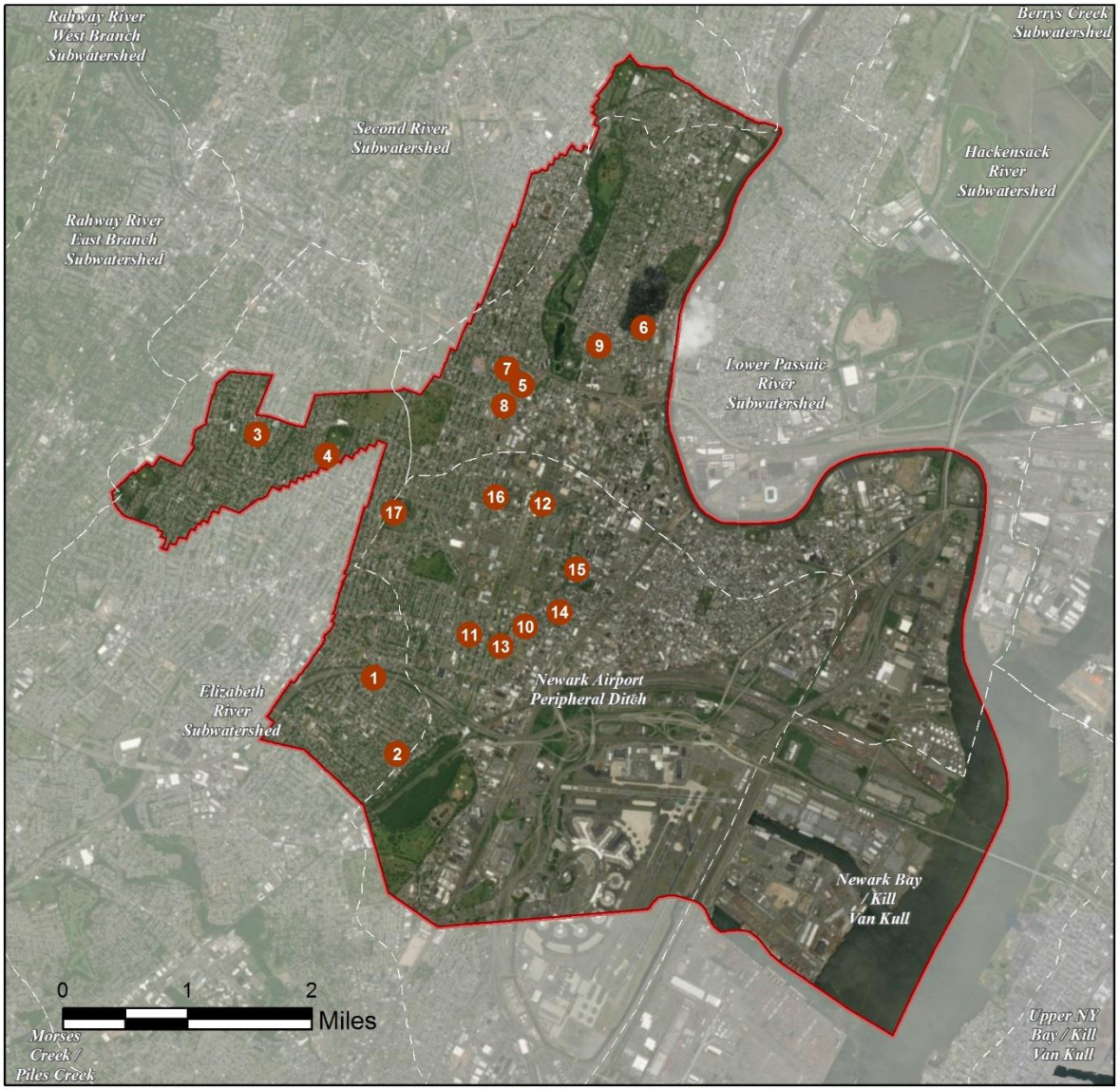
This impervious cover reduction action plan is meant to provide the municipality with a blueprint for implementing green infrastructure practices that will reduce the impact of stormwater runoff from impervious surfaces. These projects can be implemented by a wide variety of people such as boy scouts, 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.

Appendix A: Climate Resilient Green Infrastructure

a. Green Infrastructure Sites

NEWARK: GREEN INFRASTRUCTURE SITES - VOLUME 2



SITES WITHIN THE ELIZABETH RIVER SUBWATERSHED

1. 67 Goodwin Avenue Community Garden
2. Al Maidah Natural Community Garden
3. HOV Community Garden
4. Vailsburg Park

SITES WITHIN LOWER PASSAIC RIVER SUBWATERSHED

5. 298 Sussex Avenue Community Garden
6. Garden of Worker Bees
7. Sussex Avenue Elementary School
8. The Garden of Hope
9. The People's Garden

SITES WITHIN THE NEWARK AIRPORT PERIPHERAL DITCH SUBWATERSHED

10. 40 1/2 Elizabeth Avenue Community Garden
11. Clinton Avenue and Badger Avenue Traffic Triangle
12. Greater Newark Conservancy
13. Malcolm X Shabazz High School
14. Pocket Park
15. Science & Sustainability Community Garden
16. Ujmiaa Community Garden
17. West Side Park

b. Proposed Green Infrastructure Concepts

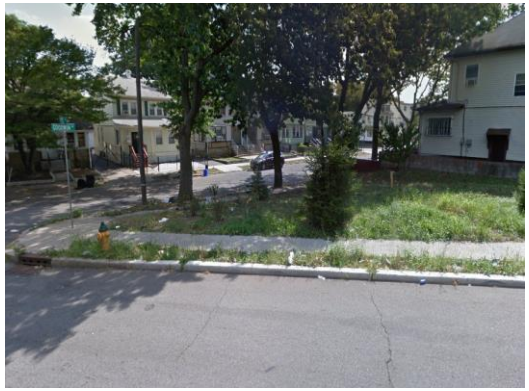
67 Goodwin Avenue Community Garden

Subwatershed: Elizabeth River

Site Area: 2,423 sq. ft.

Address: 67 Goodwin Avenue
Newark, NJ 07112

Block and Lot: Block 3620, Lot 4

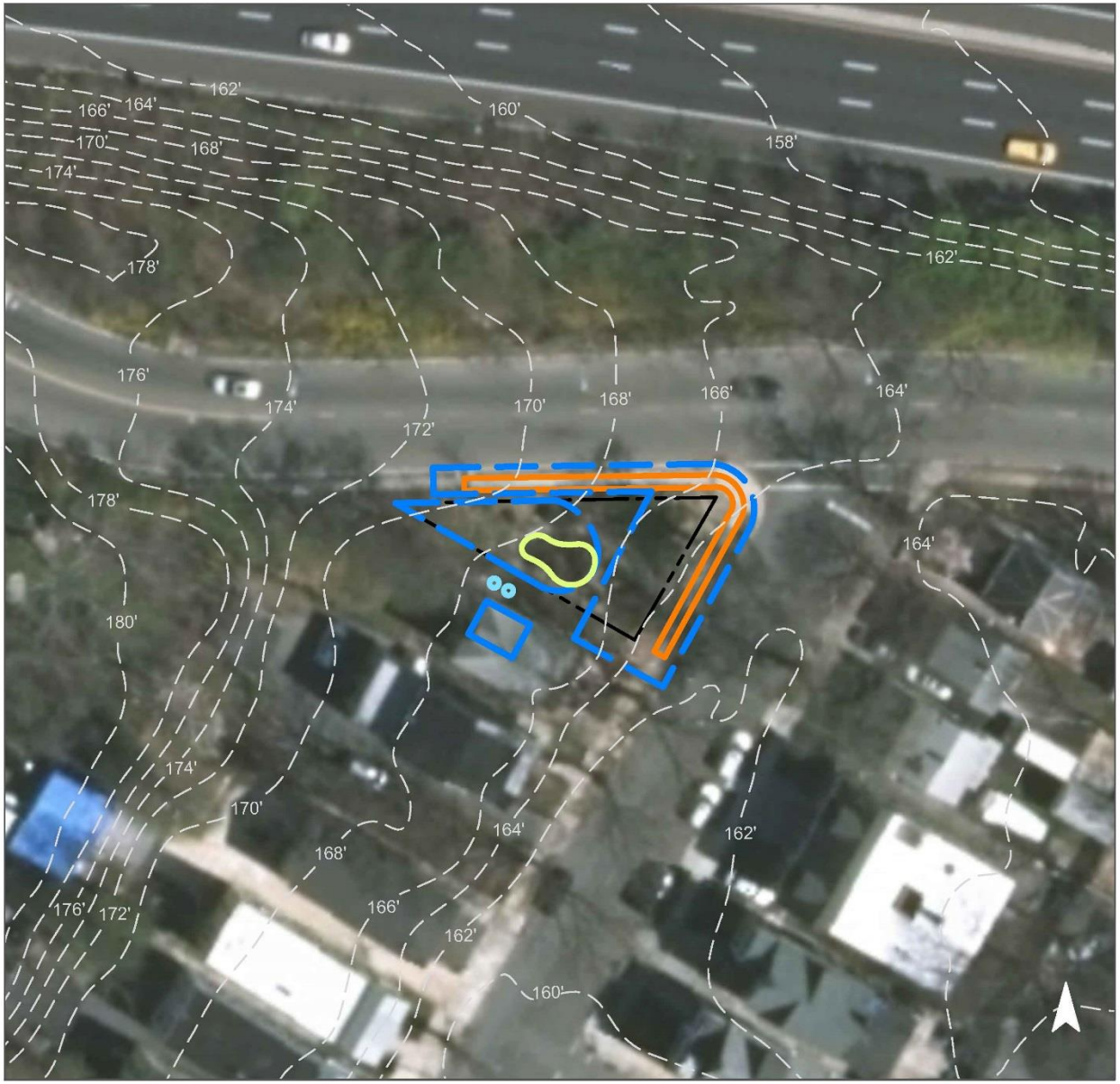


A rain garden was installed to capture runoff from the sidewalk and any flooding from the grass area. A section of porous pavement was installed to replace the concrete sidewalk to capture and infiltrate stormwater. Two rain barrels were installed to capture the rooftop runoff from the adjacent building, which can be used to water the rain garden.

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"
55	1,333	0.1	0.7	6.1	0.001	0.04

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	0.026	4	1,975	0.07	250	$1,250
Pervious pavement	0.073	12	5,558	0.21	595	$14,875
Rainwater harvesting	0.005	1	110	0.01	110 (gal)	$220

GREEN INFRASTRUCTURE RECOMMENDATIONS



67 Goodwin Avenue Community Garden

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

0 25' 50'

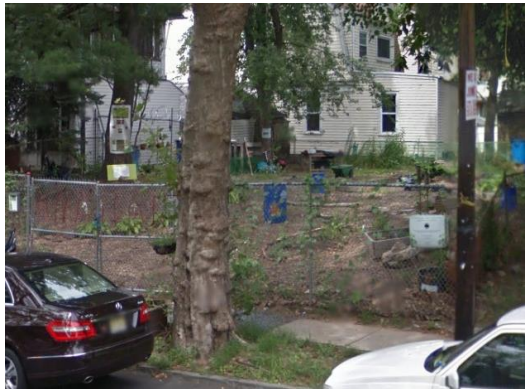
Al Maidah Natural Community Garden

Subwatershed: Elizabeth River

Site Area: 3,844 sq. ft.

Address: 49 Lyons Avenue
Newark, NJ 07112

Block and Lot: Block 3647, Lot 5



Two cisterns were installed to collect rainwater from a neighboring building. The captured rainwater can be used for watering the garden or other non-potable purposes.

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"
45	1,730	0.1	0.9	7.9	0.001	0.05

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
Rainwater harvesting	0.004	1	299	0.01	600 (gal)	$1,200

GREEN INFRASTRUCTURE RECOMMENDATIONS

Al Maidah Natural Community Garden

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

0 25' 50'

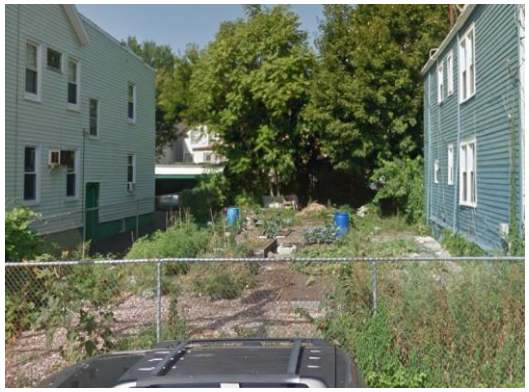
HOV Community Garden

Subwatershed: Elizabeth River

Site Area: 3,752 sq. ft.

Address: 69 Norwood Street
Newark, NJ 07107

Block and Lot: Block 4066, Lot 60

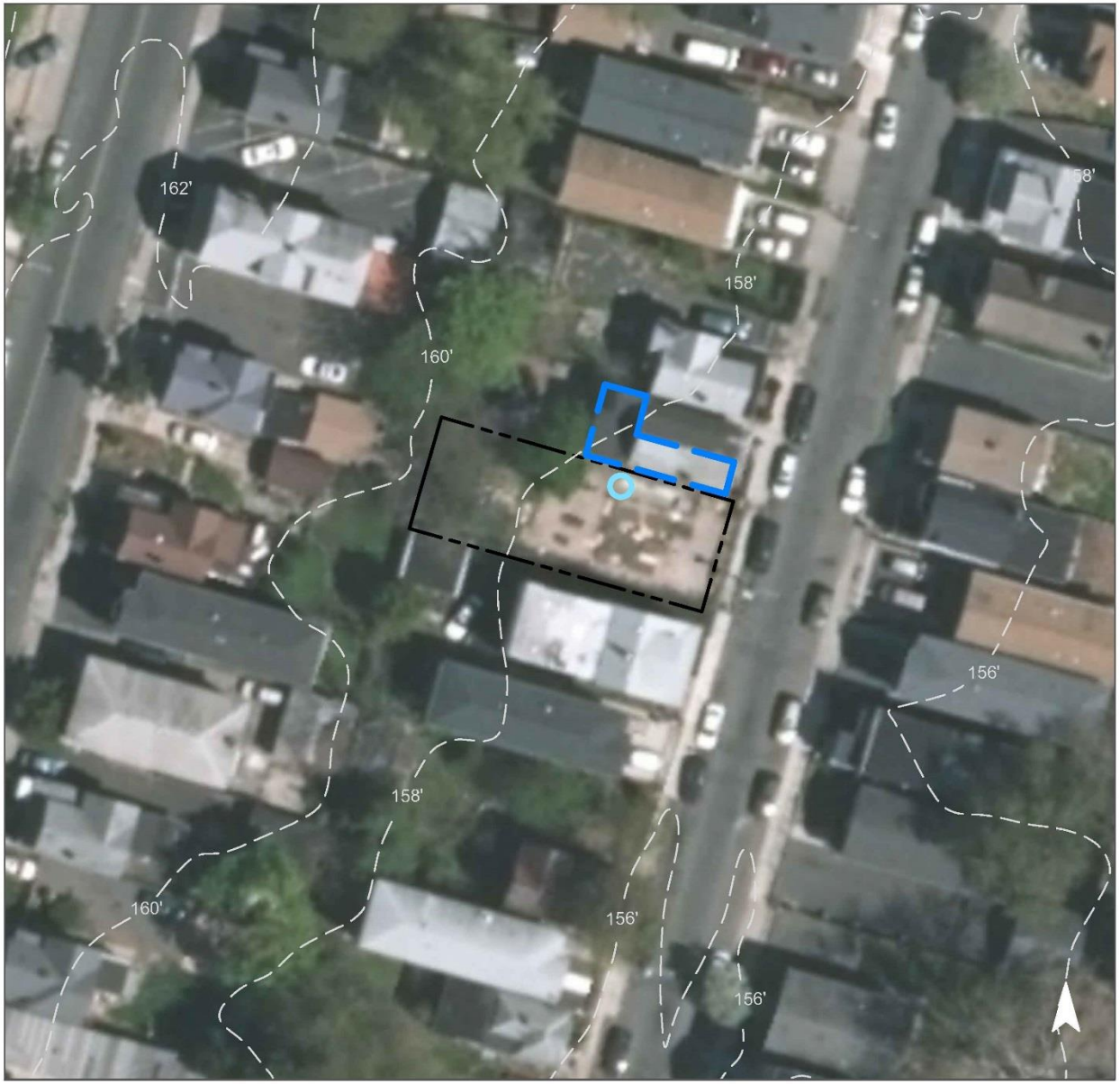


A cistern was installed to collect rainwater from a neighboring building. The captured rainwater can be used for watering the garden or other non-potable purposes.

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"
45	1,689	0.1	0.9	7.8	0.001	0.05

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
Rainwater harvesting	0.018	3	600	.02	600 (gal)	$1,200

GREEN INFRASTRUCTURE RECOMMENDATIONS



HOV Community Garden

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

0 25' 50'

Vailsburg Park

Subwatershed: Elizabeth River

Site Area: 2,551,050 sq. ft.

Address: 112 South Munn Avenue
Newark, NJ 07106

Block and Lot: Block 4020, Lot 1

A rain garden was installed to capture, treat, and infiltrate runoff from the road, and serve as a green infrastructure demonstration project.

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	1,084,200	52.3	547.6	4,978.0	0.845	29.74

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	0.042	7	3,157	0.14	400	$2,000

GREEN INFRASTRUCTURE RECOMMENDATIONS

Vailsburg Park

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

0 25' 50'

298 Sussex Avenue Community Garden

Subwatershed: Lower Passaic River

Site Area: 4,737 sq. ft.

Address: 298 Sussex Avenue
Newark, NJ 07107

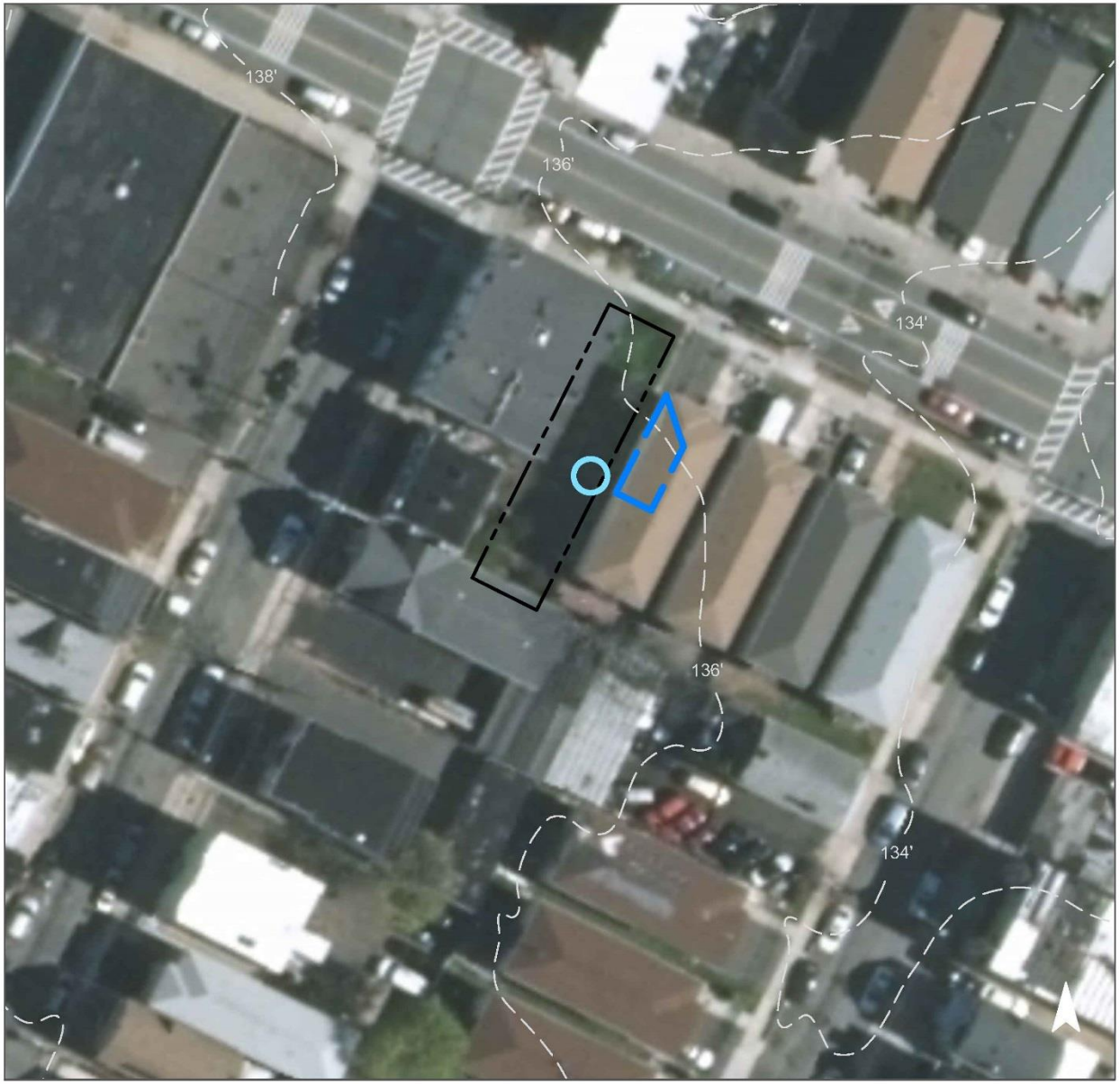
Block and Lot: Block 1878, Lot 3

A cistern was installed to collect rainwater from a neighboring building. The captured rainwater can be used for watering the garden or other non-potable purposes.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
75	3,553	0.2	1.8	16.3	0.003	0.10

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
Rainwater harvesting	0.009	2	688	0.03	1,550 (gal)	$3,100

GREEN INFRASTRUCTURE RECOMMENDATIONS



298 Sussex Avenue Community Garden

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

0 25' 50'

Garden of Worker Bees

Subwatershed: Lower Passaic River

Site Area: 3,574 sq. ft.

Address: 179 Broadway
Newark, NJ 07104

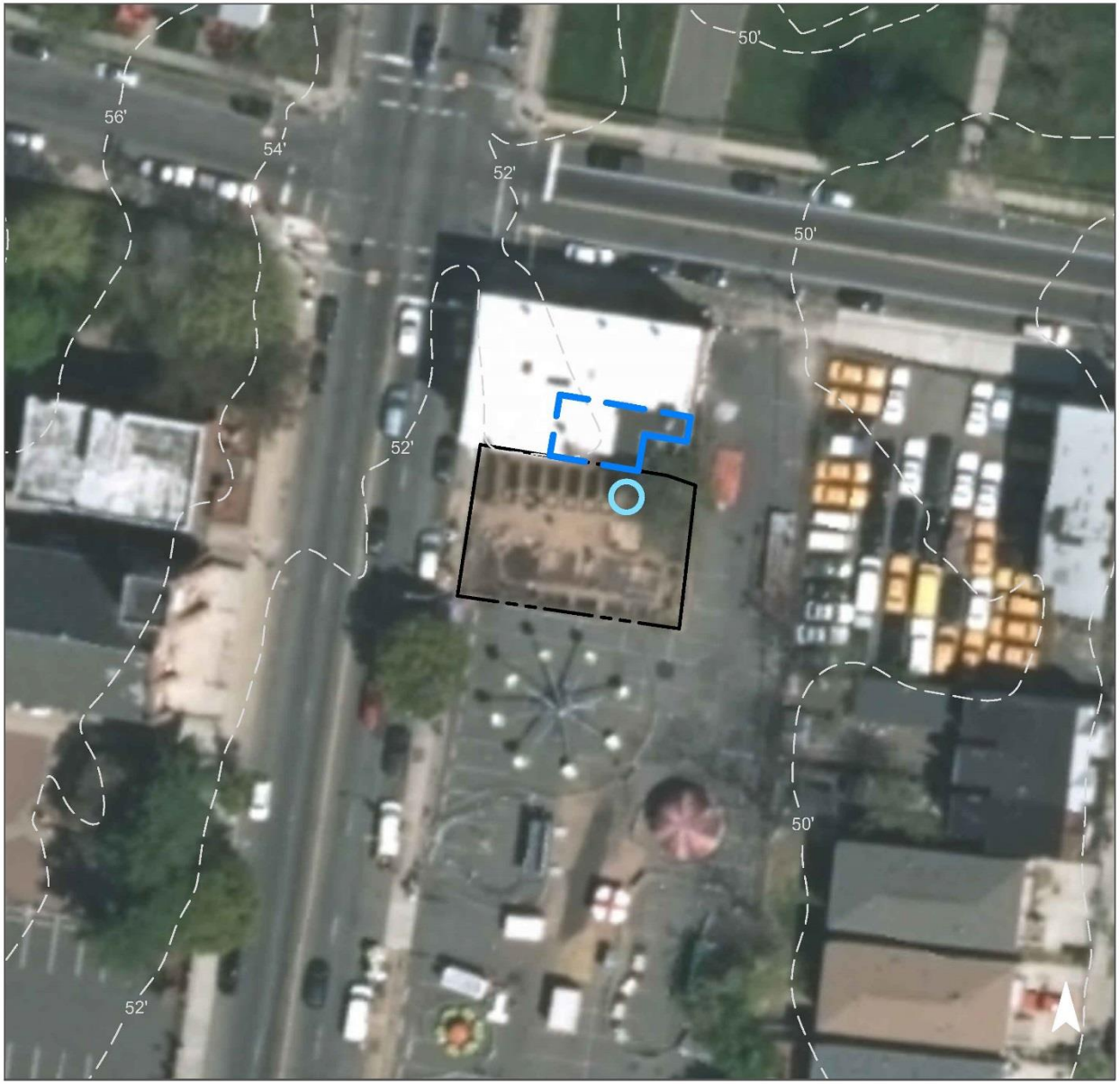
Block and Lot: Block 441, Lot 59,60, 63

A cistern was installed to collect rainwater from a neighboring building. The captured rainwater can be used for watering the garden or other non-potable purposes.

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	3,395	0.2	1.7	15.6	0.003	0.09

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
Rainwater harvesting	0.018	3	800	0.03	800 (gal)	$1,600

GREEN INFRASTRUCTURE RECOMMENDATIONS



Garden of Worker Bees

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

0 25' 50'

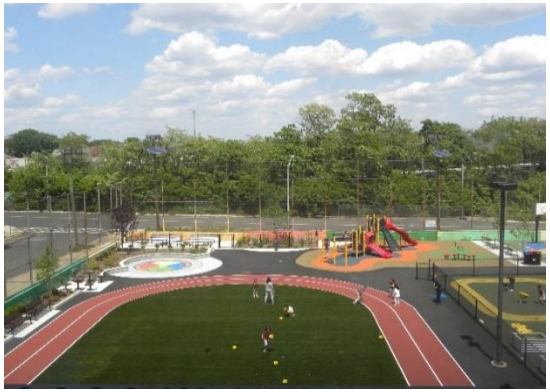
Sussex Avenue Elementary School

Subwatershed: Lower Passaic River

Site Area: 62,388 sq. ft.

Address: 307 Sussex Avenue
Newark, NJ 07107

Block and Lot: Block 1885, Lot 32

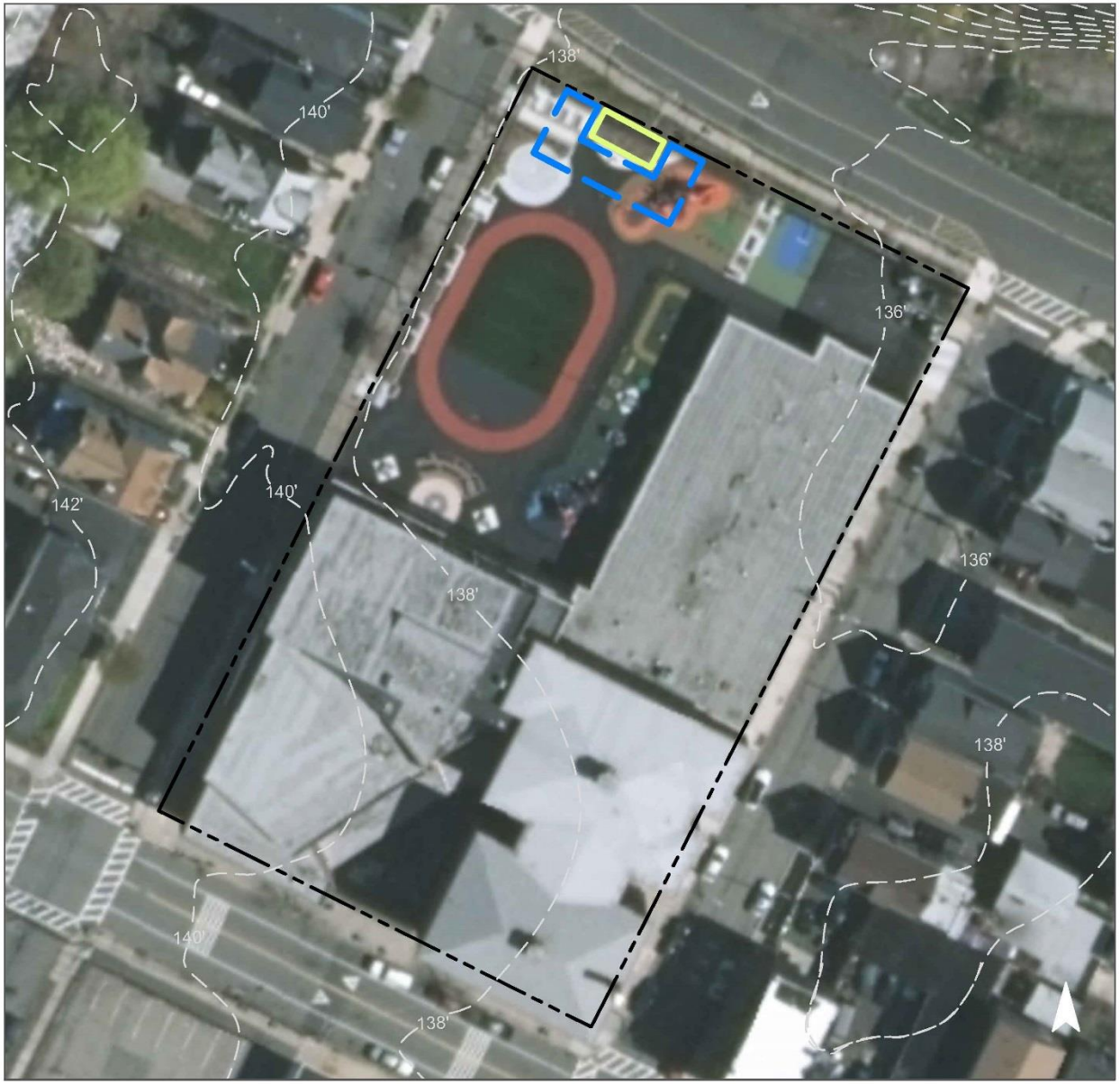


A rain garden was installed to capture, treat, and infiltrate the stormwater runoff from the surrounding paved playground area. The garden also serves as a green infrastructure demonstration project for the students.

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	59,268	2.9	29.9	272.1	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
Bioretention system	0.031	5	2,371	0.10	300	$1,500

GREEN INFRASTRUCTURE RECOMMENDATIONS



Sussex Avenue Elementary School

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

0 30' 60'

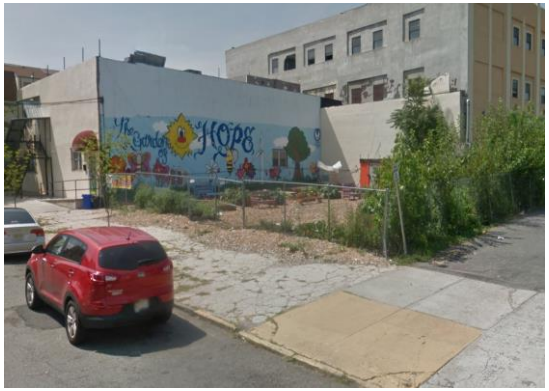
The Garden of Hope

Subwatershed: Lower Passaic River

Site Area: 5,192 sq. ft.

Address: 3-5 Fairmount Avenue
Newark, NJ 07107

Block and Lot: Block 1843, Lot 5,7

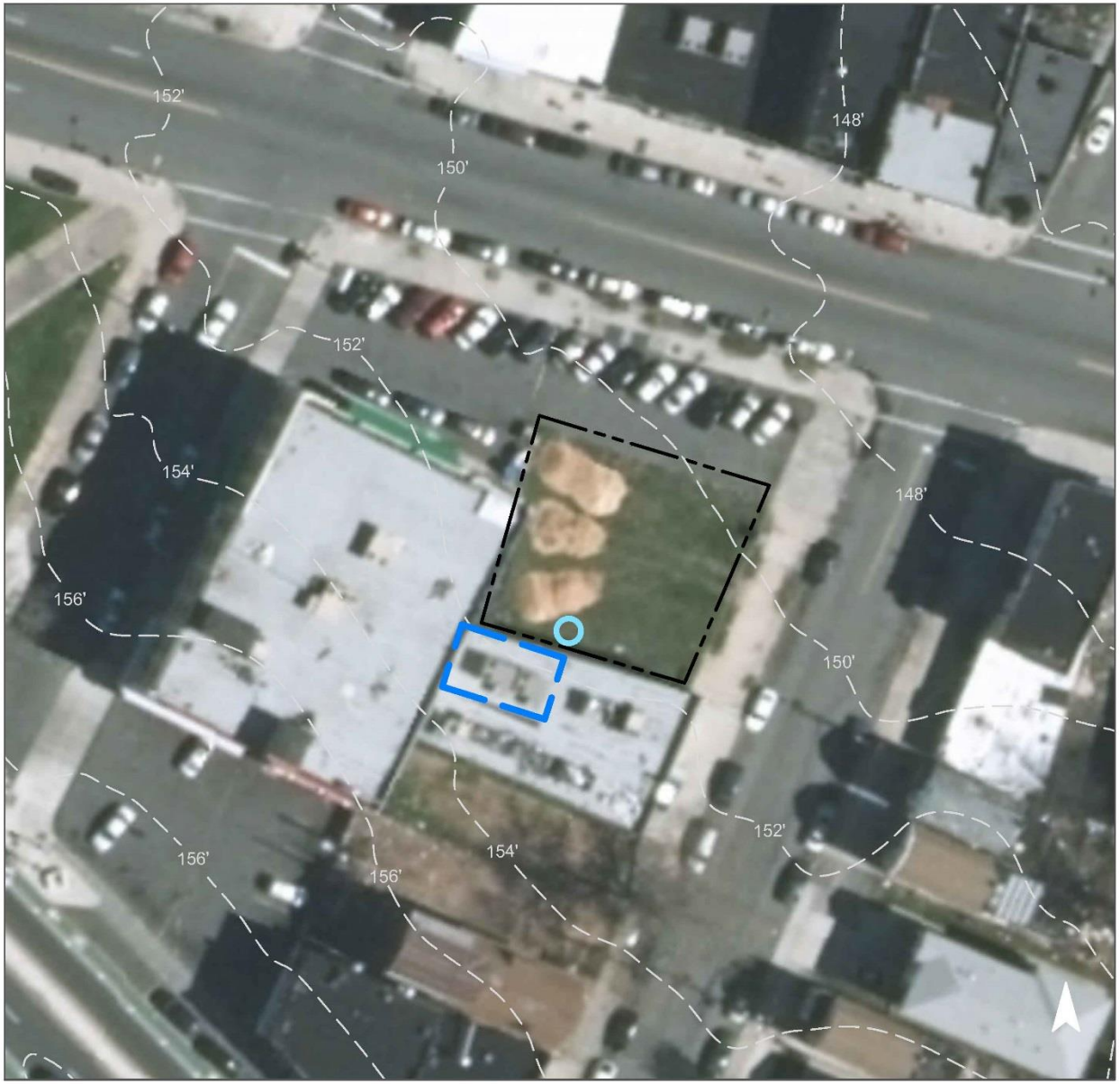


A cistern was installed to collect rainwater from a neighboring building. The captured rainwater can be used for watering the garden or other non-potable purposes.

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	4,673	0.2	2.4	21.5	0.004	0.13

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
Rainwater harvesting	0.018	3	600	0.06	600 (gal)	$1,200

GREEN INFRASTRUCTURE RECOMMENDATIONS



The Garden of Hope

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

0 25' 50'

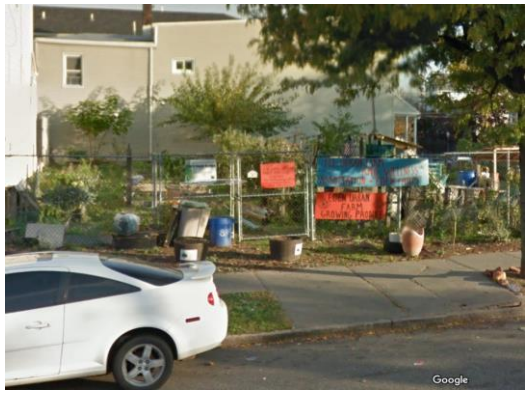
40½ Elizabeth Avenue Community Garden

Subwatershed: Newark Airport Peripheral Ditch

Site Area: 1,477 sq. ft.

Address: 40½ Elizabeth Avenue Newark, NJ 07108

Block and Lot: Block 2801, Lot 54

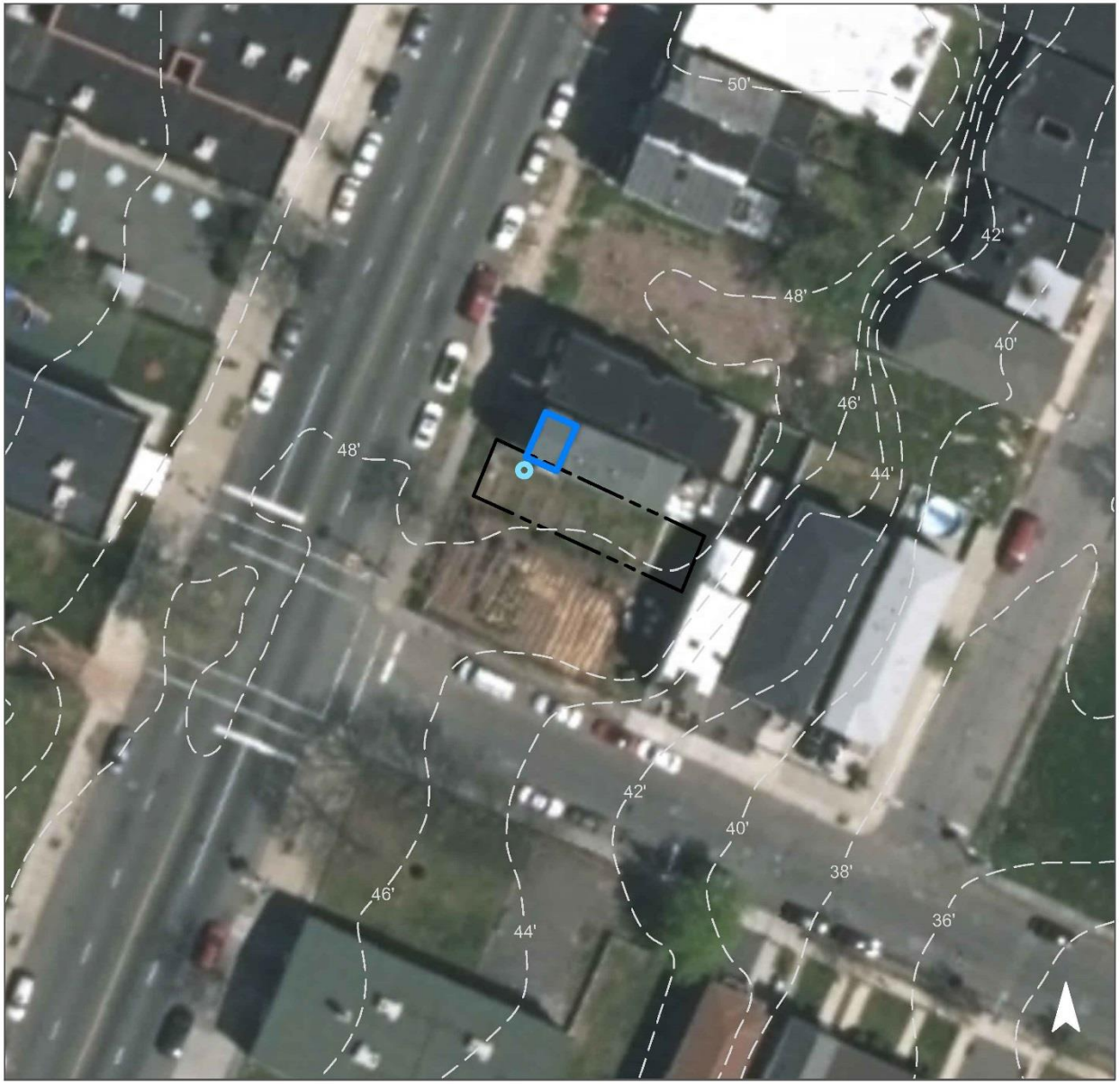


Rain barrels were installed to collect rainwater from a neighboring building. The captured rainwater can be used for watering the garden or other non-potable purposes.

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	591	0.0	0.3	2.7	0.000	0.02

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
Rainwater harvesting	0.005	1	135	0.02	135 (gal)	$270

GREEN INFRASTRUCTURE RECOMMENDATIONS



40 ½ Elizabeth Avenue Community Garden

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

0 25' 50'

Clinton Avenue and Badger Avenue Traffic Triangle

Subwatershed: Newark Airport Peripheral Ditch

Site Area: 847 sq. ft.

Address: Clinton Avenue Newark, NJ 07108

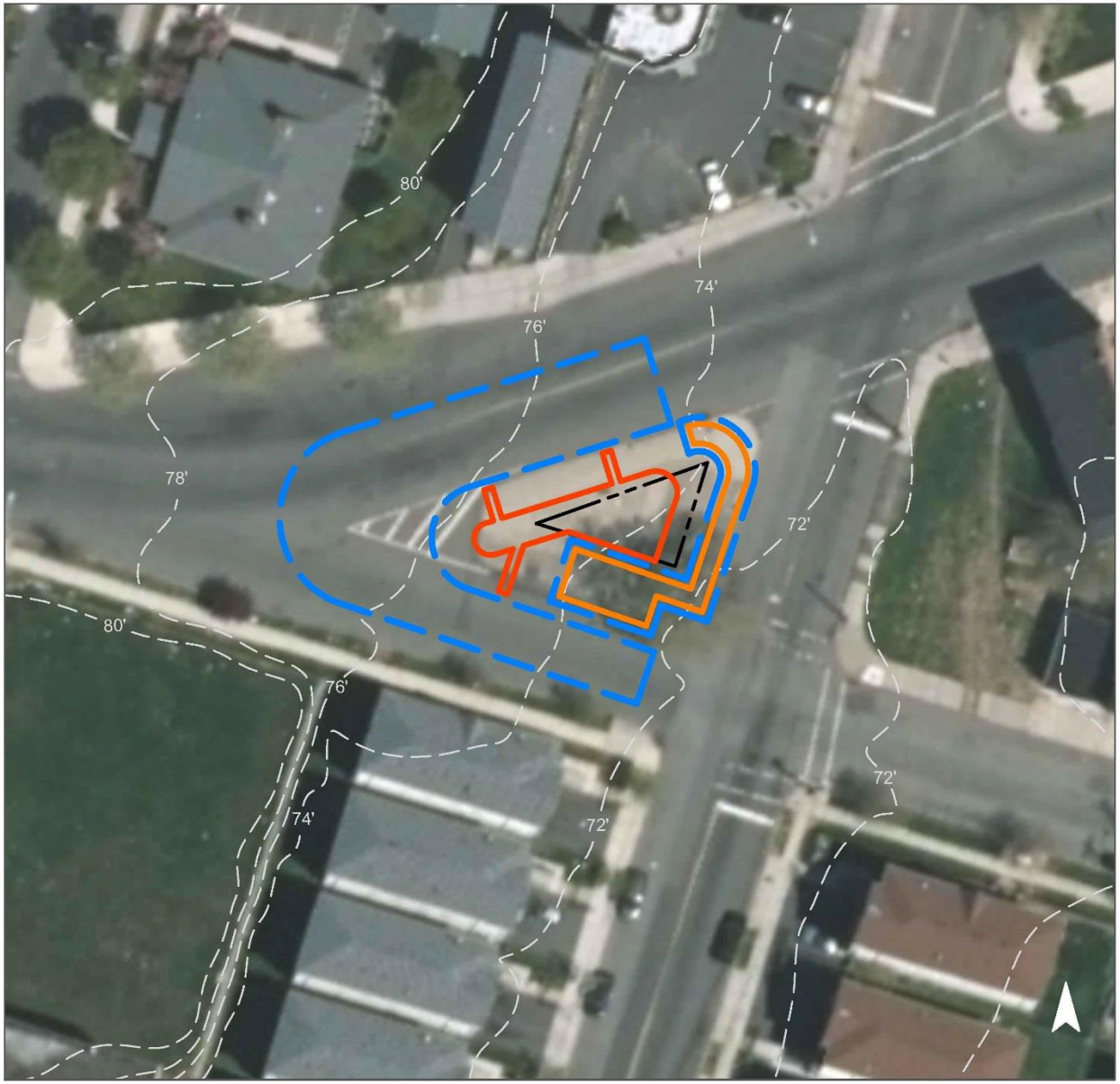
Block and Lot: Block 2682, Lot 1

The traffic triangle was replaced with porous pavers, pervious concrete, and stormwater planters to capture, treat, and infiltrate stormwater from Clinton Avenue and Badger Avenue.

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	720	0.0	0.4	3.3	0.001	0.02

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
Pervious pavement	0.042	7	3,216	0.14	1,000	$25,000
Stormwater planter	0.168	28	12,716	0.56	1,145	$429,375

GREEN INFRASTRUCTURE RECOMMENDATIONS



Clinton Avenue and Badger Avenue Triangle

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

0 25' 50'

Greater Newark Conservancy

Subwatershed: Newark Airport Peripheral Ditch

Site Area: 44,945 sq. ft.

Address: 32 Prince Street Newark, NJ 07103

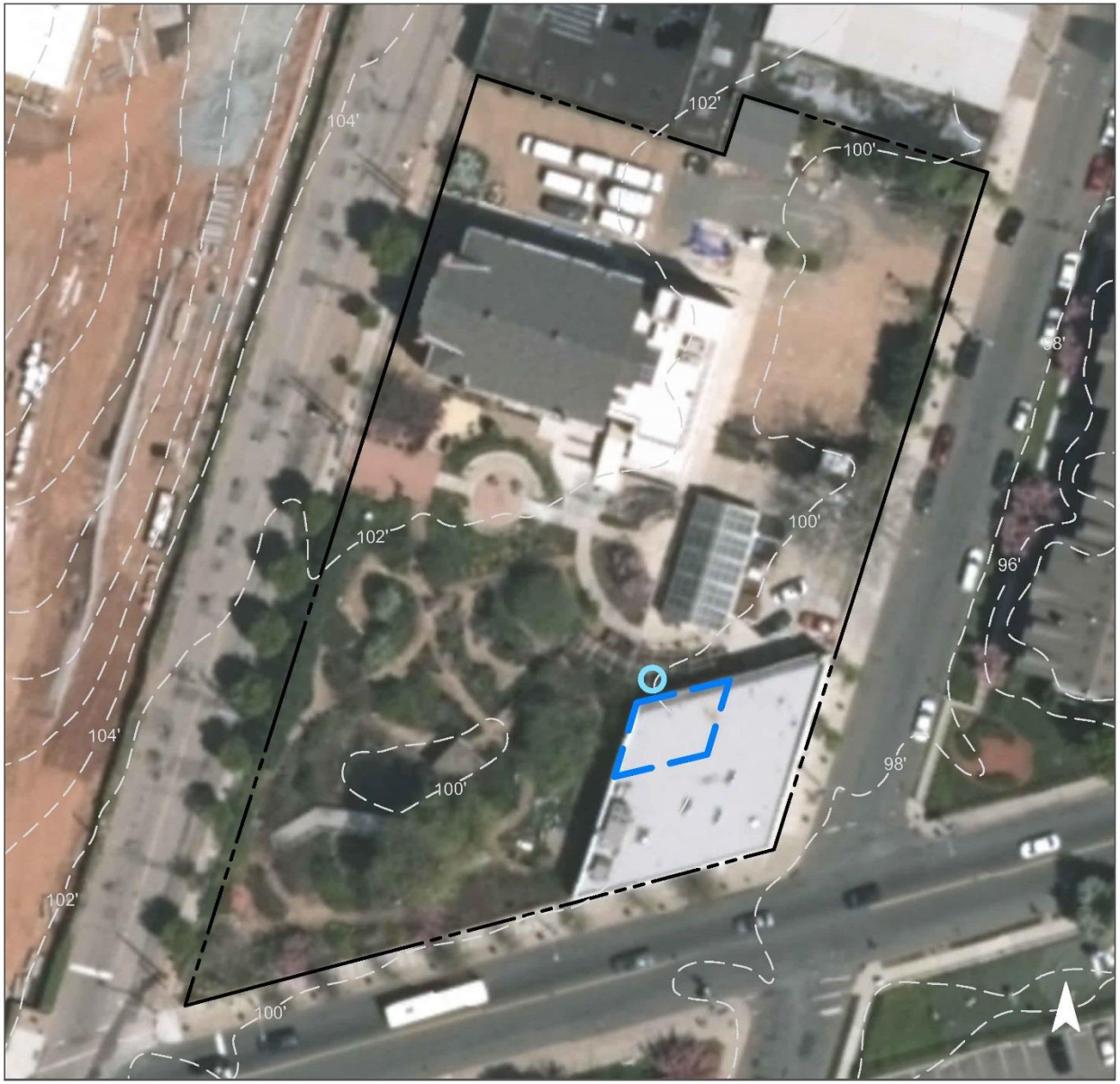
Block and Lot: Block 235, Lot 21, 22, 25, 38, 40, 41, 42, 43, 44, 45, 46, 47

A cistern was installed to collect rainwater from a neighboring building. The captured rainwater can be used for watering the garden or other non-potable purposes.

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	35,956	1.7	18.2	165.1	0.028	0.99

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
Rainwater harvesting	0.025	4	650	0.08	650 (gal)	$1,300

GREEN INFRASTRUCTURE RECOMMENDATIONS



Greater Newark Conservancy

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

0 30' 60'

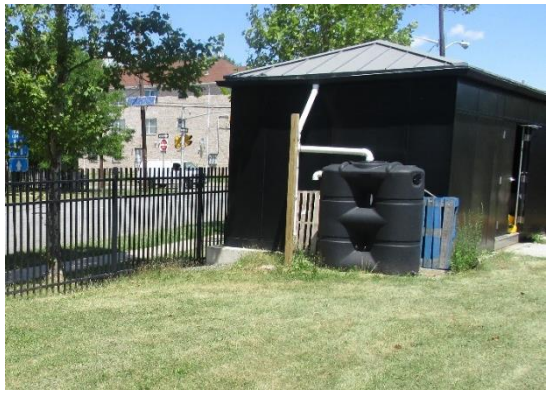
Malcom X Shabazz High School

Subwatershed: Newark Airport Peripheral Ditch

Site Area: 1,395,857 sq. ft.

Address: 80 Johnson Avenue Newark, NJ 07108

Block and Lot: Block 2696, Lot 1

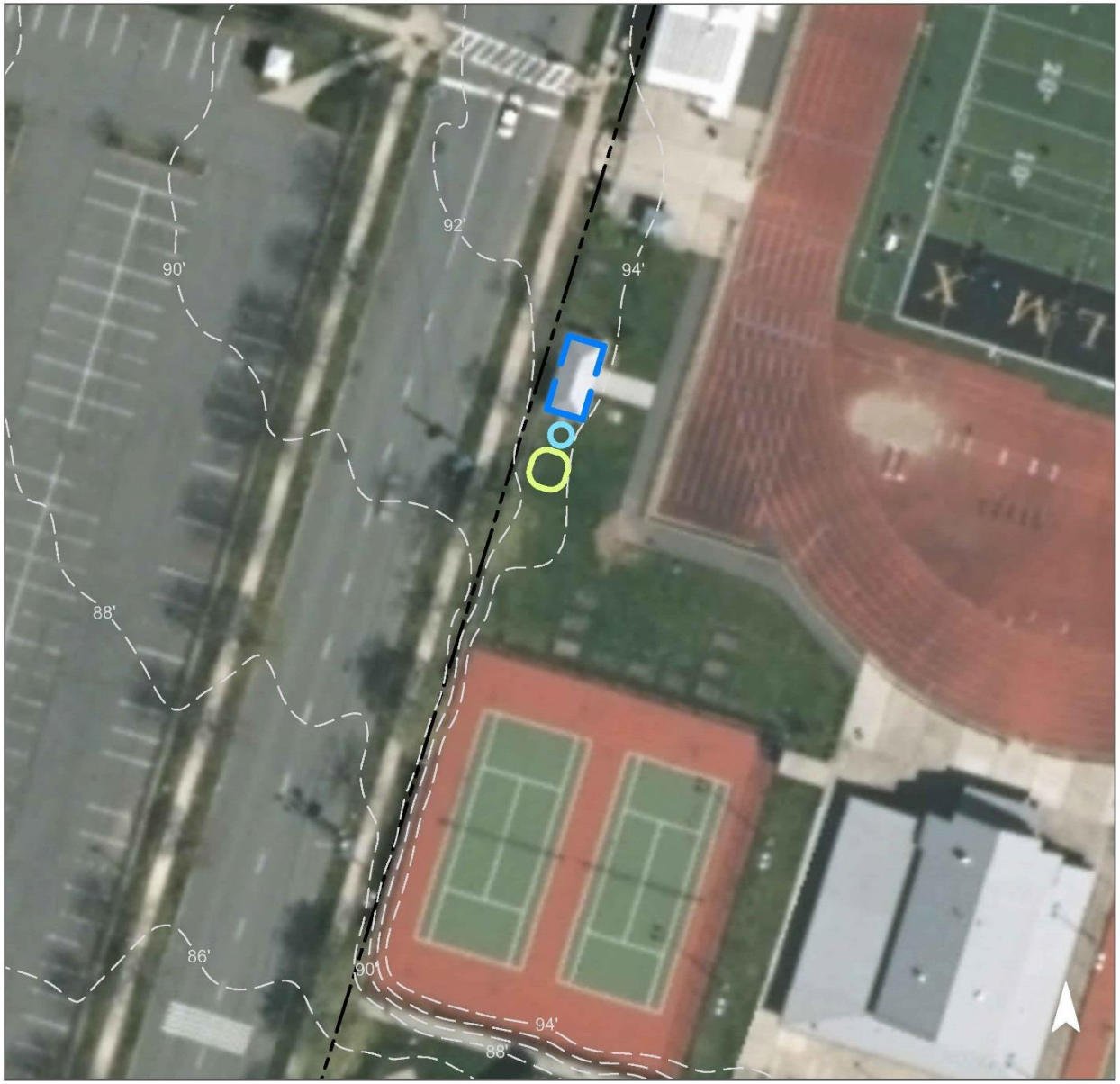


A rain barrel was installed to collect rainwater from a neighboring building. The captured rainwater can be used for watering the garden or other non-potable purposes. A rain garden was installed next to the cistern to also capture, treat, and infiltrate roof runoff and overflow from the system.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
80	1,116,686	53.8	564.0	5,127.1	0.870	30.63

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
Bioretention system	0.008	1	590	0.03	185	$925
Rainwater harvesting					500 (gal)	$1,000

GREEN INFRASTRUCTURE RECOMMENDATIONS



Malcom X Shabazz High School

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

0 25' 50'

Pocket Park

Subwatershed: Newark Airport Peripheral Ditch

Site Area: 2,217 sq. ft.

Address: 35 Murray Street Newark, NJ 07114

Block and Lot: Block 2811, Lot 9

A rain garden was installed to capture, treat, and infiltrate stormwater runoff from the parking lot.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
75	1,663	0.1	0.8	7.6	0.001	0.05

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	0.021	3	1,578	0.07	200	$1,000

GREEN INFRASTRUCTURE RECOMMENDATIONS

Pocket Park

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

0 25' 50'

Science & Sustainability Community Garden

Subwatershed: Newark Airport Peripheral Ditch

Site Area: 3,694sq. ft.

Address: 483 Washington Street Newark, NJ 07102

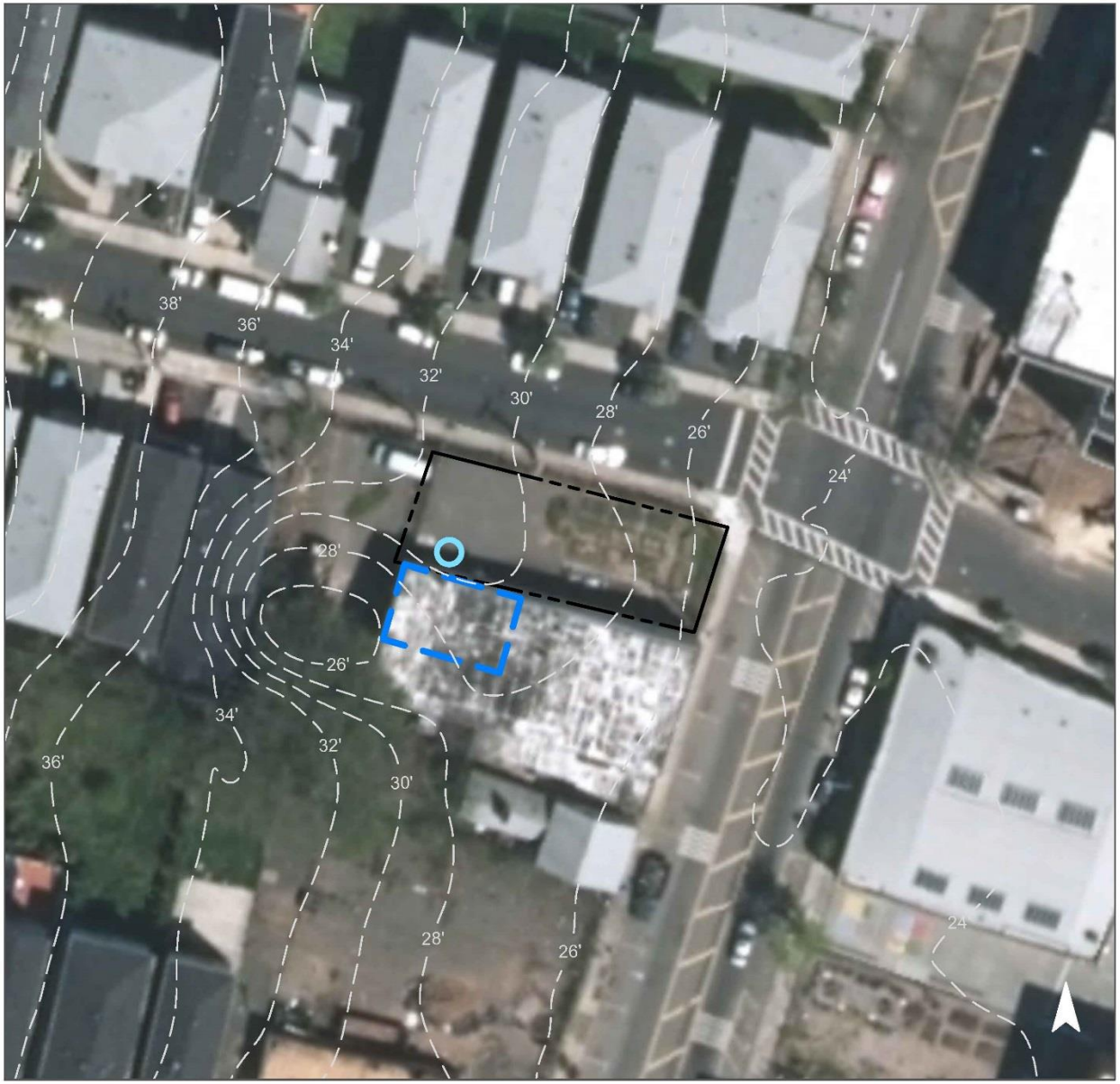
Block and Lot: Block 121, Lot 36,37

A cistern was installed to collect rainwater from a neighboring building. The captured rainwater can be used for watering the garden or other non-potable purposes.

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	3,509	0.2	1.8	16.1	0.003	0.10

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
Rainwater harvesting	0.026	4	800	0.09	800 (gal)	$1,600

GREEN INFRASTRUCTURE RECOMMENDATIONS



Science & Sustainability Community Garden

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

0 25' 50'

The People's Garden

Subwatershed: Newark Airport Peripheral Ditch

Site Area: 5,035 sq. ft.

Address: 86 Garside Avenue Newark, NJ 07104

Block and Lot: Block 490, Lot 48.02, 72

A cistern was installed to collect rainwater from a neighboring building. The captured rainwater can be used for watering the garden or other non-potable purposes.

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"
55	2,769	0.1	1.4	12.7	0.002	0.08

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
Rainwater harvesting	0.031	5	1,000	0.10	1,000 (gal)	$2,000

GREEN INFRASTRUCTURE RECOMMENDATIONS

The People's Garden

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

0 10' 20'

Ujmiaa Community Garden

Subwatershed: Newark Airport Peripheral Ditch

Site Area: 13,532 sq. ft.

Address: 300 Morris Avenue Newark, NJ 07103

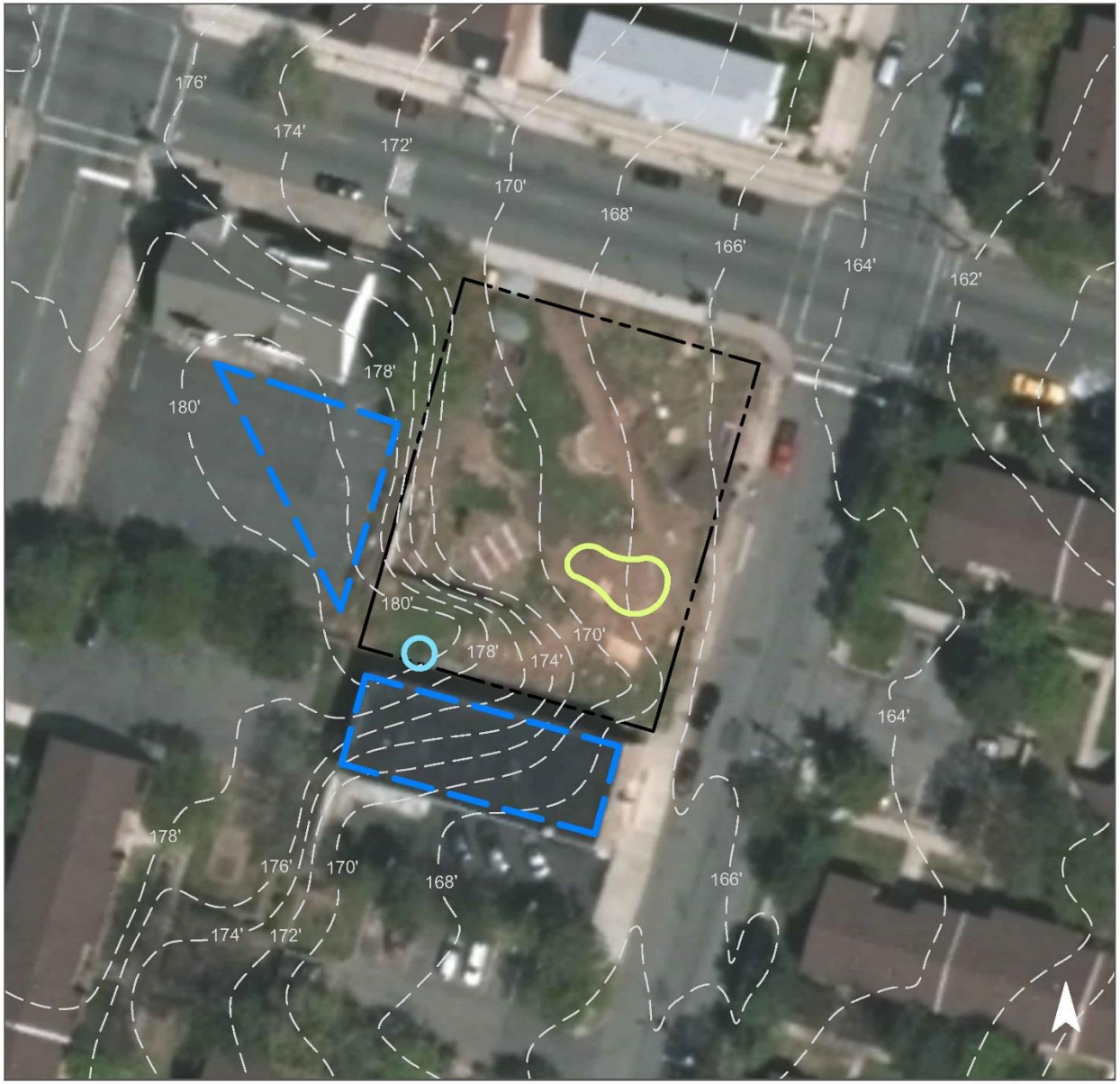
Block and Lot: Block 246, Lot 7,8, 9,10

A rain garden was installed to capture, treat, and infiltrate runoff from an adjacent parking lot. A cistern was installed to collect rooftop runoff from the building to the south. The captured rainwater can be used to water the garden or for other non-potable uses.

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	4,552	0.2	2.3	20.9	0.004	0.12

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention system	0.052	9	3,949	0.17	500	$2,500
Rainwater harvesting	0.065	11	800	0.04	800 (gal)	$1,600

GREEN INFRASTRUCTURE RECOMMENDATIONS



Ujmiaa Community Garden

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

0 25' 50'

West Side Park

Subwatershed: Newark Airport Peripheral Ditch

Site Area: 2,729,922 sq. ft.

Address: 600 South 17th Street Newark, NJ 07103

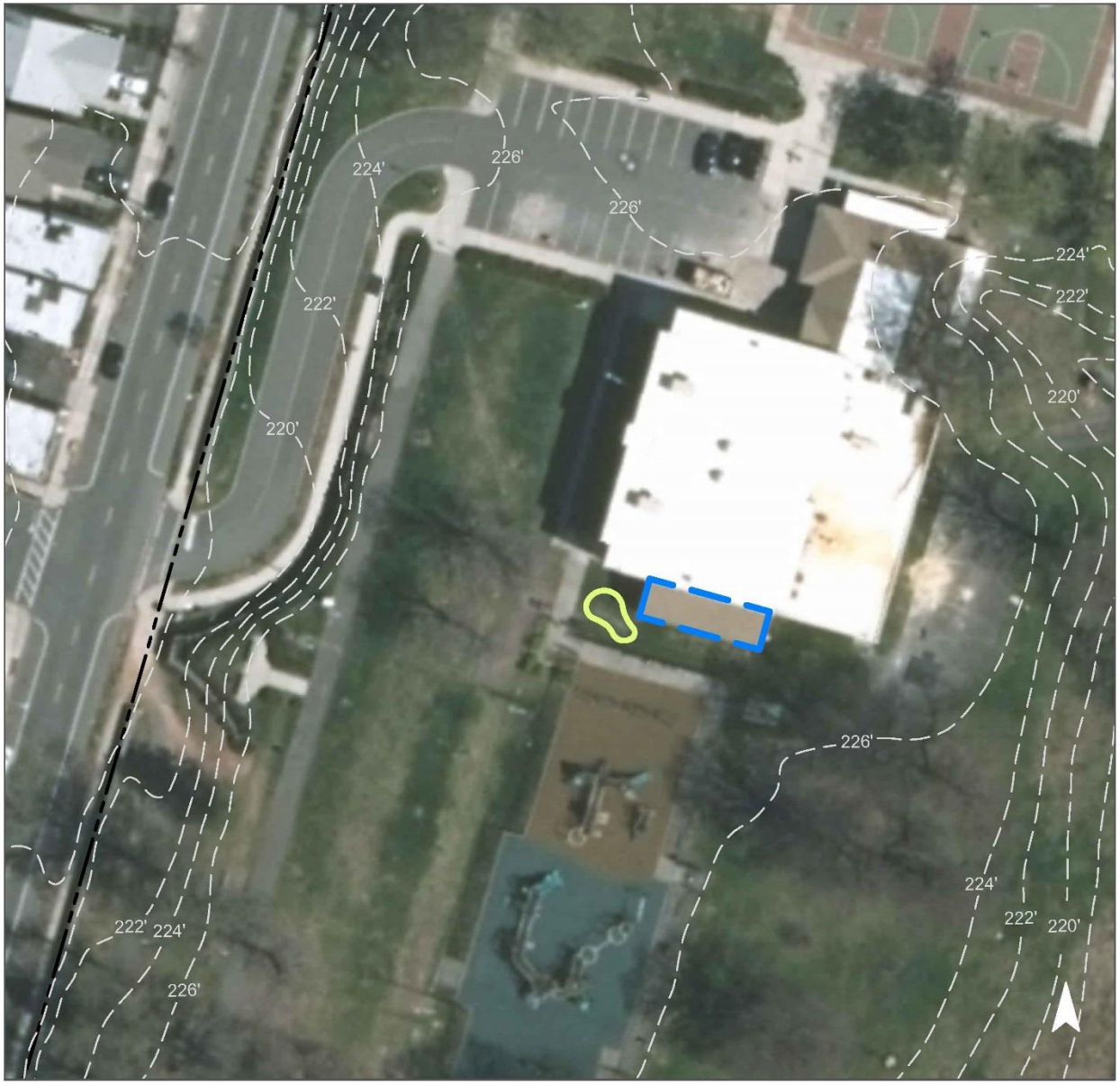
Block and Lot: Block 324, Lot 1

A rain garden was installed to capture, treat, and infiltrate rooftop 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"
50	1,364,958	65.8	689.4	6,267.0	1.064	37.44

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention system	0.020	3	1,481	0.07	200	$1,000

GREEN INFRASTRUCTURE RECOMMENDATIONS



West Side Park

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

0 30' 60'

c. Summary of Existing Conditions

	Subwatershed/Site Name/Total Site Info/GI Practice	Area (ac)	Area (SF)	Block	Lot	I.C. %	I.C. Area (SF)	Existing Annual Loads (Commercial)			Runoff Volumes from I.C.		Runoff Volumes from I.C.	
								TP (lb/yr)	TN (lb/yr)	TSS (lb/yr)	Water Quality Storm (1.25" over 2-hours) (cu.ft.)	Annual (cu.ft.)	Water Quality Storm (1.25" over 2-hours) (Mgal)	Annual (Mgal)
	ELIZABETH RIVER SUBWATERSHED	**58.79**	**2,561,070**			**43**	**1,088,951**	**52.5**	**550.0**	**4999.8**	**113432**	**3992821**	**0.848**	**29.87**
1	**67 Goodwin Avenue Community Garden**													
	Total Site Info	0.06	2,423	3620	4	55	1,333	0.1	0.7	6.1	139	4,887	0.001	0.04
2	**Al Maidah Natural Community Garden**													
	Total Site Info	0.09	3,844	3647	5	45	1,730	0.1	0.9	7.9	180	6,342	0.001	0.05
3	**HOV Community Garden**													
	Total Site Info	0.09	3,752	4066	60	45	1,689	0.1	0.9	7.8	176	6,191	0.001	0.05
4	**Vailsburg Park**													
	Total Site Info	58.56	2,551,050	4020	1	43	1,084,200	52.3	547.6	4,978.0	112,938	3,975,400	0.845	29.74
	LOWER PASSAIC RIVER SUBWATERSHED	**1.86**	**80,926**			**91**	**73,659**	**3.6**	**37.2**	**338.2**	**7673**	**270083**	**0.057**	**2.02**
5	**298 Sussex Avenue Community Garden**													
	Total Site Info	0.11	4,737	1878	3	75	3,553	0.2	1.8	16.3	370	13,027	0.003	0.10
6	**Garden of Worker Bees**													
	Total Site Info	0.08	3,574	441	59,60,63	95	3,395	0.2	1.7	15.6	354	12,450	0.003	0.09
7	**Sussex Avenue Elementary School**													
	Total Site Info	1.43	62,388	1885	32	95	59,268	2.9	29.9	272.1	6,174	217,317	0.046	1.63
8	**The Garden of Hope**													
	Total Site Info	0.12	5,192	1843	5,7	90	4,673	0.2	2.4	21.5	487	17,135	0.004	0.13
9	**The People's Garden**													
	Total Site Info	0.12	5,035	490	48.02,72	55	2,769	0.1	1.4	12.7	288	10,154	0.002	0.08
	NEWARK AIRPORT PERIPHERAL DITCH	**96.25**	**4,192,492**			**60**	**2,528,636**	**121.9**	**1277.1**	**11609.9**	**263400**	**9271664**	**1.970**	**69.35**
10	**40 1/2 Elizabeth Avenue Community Garden**													
	Total Site Info	0.03	1,477	2801	54	40	591	0.0	0.3	2.7	62	2,166	0.000	0.02
11	**Clinton Avenue and Badger Avenue Traffic Triangle**													
	Total Site Info	0.02	847	2682	1	85	720	0.0	0.4	3.3	75	2,640	0.001	0.02
12	**Greater Newark Conservancy**													
	Total Site Info	1.03	44,945	235	21,22,25,38,40,41,42,43,44,45,46,47	80	35,956	1.7	18.2	165.1	3,745	131,840	0.028	0.99
13	**Malcom X Shabazz High School**													
	Total Site Info	32.04	1,395,857	2696	1	80	1,116,686	53.8	564.0	5,127.1	116,321	4,094,515	0.870	30.63
14	**Pocket Park**													
	Total Site Info	0.05	2,217	2811	9	75	1,663	0.1	0.8	7.6	173	6,098	0.001	0.05
15	**Science & Sustainability Community Garden**													
	Total Site Info	0.08	3,694	121	36,37	95	3,509	0.2	1.8	16.1	366	12,867	0.003	0.10
16	**Ujmiaa Community Garden**													
	Total Site Info	0.31	13,532	246	7,8,9,10	34	4,552	0.2	2.3	20.9	474	16,692	0.004	0.12

	Subwatershed/Site Name/Total Site Info/GI Practice	Area (ac)	Area (SF)	Block	Lot	I.C. %	I.C. Area (SF)	Existing Annual Loads (Commercial) TP (lb/yr)	TN (lb/yr)	TSS (lb/yr)	Runoff Volumes from I.C. Water Quality Storm (1.25" over 2-hours) (cu.ft.)	Annual (cu.ft.)	Runoff Volumes from I.C. Water Quality Storm (1.25" over 2-hours) (Mgal)	Annual (Mgal)
17	**West Side Park**													
	Total Site Info	62.67	2,729,922	342	1	50	1,364,958	65.8	689.4	6,267.0	142,183	5,004,846	1.064	37.44

d. 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	TSS Removal Potential	Max Volume Reduction Potential	Peak Discharge Reduction Potential	Size of BMP	Unit Cost	Unit	Total Cost	I.C. Treated
		Area (SF)	Area (ac)	(Mgal/yr)	(lbs/yr)	(gal/storm)	(cfs)		($/unit)		($)	%
	ELIZABETH RIVER SUBWATERSHED	**6,465**	**0.15**	**0.168**	**28**	**11698**	**0.46**				**$20,745**	**0.6%**
1	**67 Goodwin Avenue Community Garden**											
	Bioretention system	1,000	0.02	0.026	4	1,975	0.07	250	$5	SF	$1,250	75.0%
	Pervious pavement	2,815	0.06	0.073	12	5,558	0.21	595	$25	SF	$14,875	211.2%
	Rainwater harvesting	200	0.00	0.005	1	110	0.01	110	$2	gal	$220	15.0%
	Total Site Info	**4,015**	**0.09**	**0.105**	**18**	**7,642**	**0.29**				**$16,345**	**301.2%**
2	**Al Maidah Natural Community Garden**											
	Rainwater harvesting	150	0.00	0.004	1	299	0.01	600	$2	gal	$1,200	8.7%
	Total Site Info	**150**	**0.00**	**0.004**	**1**	**299**	**0.01**				**$1,200**	**8.7%**
3	**HOV Community Garden**											
	Rainwater harvesting	700	0.02	0.018	3	600	0.02	600	$2	gal	$1,200	41.5%
	Total Site Info	**700**	**0.02**	**0.018**	**3**	**600**	**0.02**				**$1,200**	**41.5%**
4	**Vailsburg Park**											
	Bioretention system	1,600	0.04	0.042	7	3,157	0.14	400	$5	SF	$2,000	0.1%
	Total Site Info	**1,600**	**0.04**	**0.042**	**7**	**3,157**	**0.14**				**$2,000**	**0.1%**
	LOWER PASSAIC RIVER SUBWATERSHED	**4,150**	**0.10**	**0.108**	**18**	**5459**	**0.28**				**$5,901**	**5.6%**
5	**298 Sussex Avenue Community Garden**											
	Rainwater harvesting	350	0.01	0.009	2	688	0.03	1,550	$2	gal	$3,100	9.9%
	Total Site Info	**350**	**0.01**	**0.009**	**2**	**688**	**0.03**				**$3,100**	**9.9%**
6	**Garden of Worker Bees**											
	Rainwater harvesting	700	0.02	0.018	3	800	0.03	800	$2	gal	$1,600	20.6%
	Total Site Info	**700**	**0.02**	**0.018**	**3**	**800**	**0.03**				**$1,600**	**20.6%**
7	**Sussex Avenue Elementary School**											
	Bioretention system	1,200	0.03	0.031	5	2,371	0.10	300	$5	SF	$1,500	2.0%
	Total Site Info	**1,200**	**0.03**	**0.031**	**5**	**2,371**	**0.10**				**$1,500**	**2.0%**
8	**The Garden of Hope**											
	Rainwater harvesting	700	0.02	0.018	3	600	0.02	600	$2	gal	$1,200	15.0%
	Total Site Info	**700**	**0.02**	**0.018**	**3**	**600**	**0.02**				**$1,200**	**15.0%**
9	**The People's Garden**											
	Rainwater harvesting	1,200	0.03	0.031	5	1,000	0.10	1,000	$2	gal	$2,000	43.3%
	Total Site Info	**1,200**	**0.03**	**0.031**	**5**	**1,000**	**0.10**				**$2,000**	**43.3%**
	NEWARK AIRPORT PERIPHERAL DITCH	**16,570**	**0.38**	**0.432**	**72**	**25916**	**1.16**				**$464,645**	**0.7%**
10	**40 1/2 Elizabeth Avenue Community Garden**											
	Rainwater harvesting	175	0.00	0.005	1	135	0.01	135	$2	gal	$270	29.6%
	Total Site Info	**175**	**0.00**	**0.005**	**1**	**135**	**0.01**				**$270**	**29.6%**

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	Unit Cost ($/unit)	Unit	Total Cost ($)	I.C. Treated %
11	**Clinton Avenue and Badger Avenue Traffic Triangle**											
	Pervious pavement	1,630	0.04	0.042	7	3,216	0.14	1,000	$25	SF	$25,000	226.4%
	Stormwater planter	6,440	0.15	0.168	28	12,716	0.56	1,145	$375	SF	$429,375	894.6%
	Total Site Info	**8,070**	**0.19**	**0.210**	**35**	**15,932**	**0.70**				**$454,375**	**1121.0%**
12	**Greater Newark Conservancy**											
	Rainwater harvesting	975	0.02	0.025	4	650	0.03	650	$2	gal	$1,300	2.7%
	Total Site Info	**975**	**0.02**	**0.025**	**4**	**650**	**0.03**				**$1,300**	**2.7%**
13	**Malcom X Shabazz High School**											
	Bioretention system							185	$5	SF	$925	
	Rainwater harvesting	300	0.01	0.008	1	590	0.03	500	$2	gal	$1,000	0.0%
	Total Site Info	**300**	**0.01**	**0.008**	**1**	**590**	**0.03**				**$1,000**	**0.0%**
14	**Pocket Park**											
	Bioretention system	800	0.02	0.021	3	1,578	0.07	200	$5	SF	$1,000	48.1%
	Total Site Info	**800**	**0.02**	**0.021**	**3**	**1,578**	**0.07**				**$1,000**	**48.1%**
15	**Science & Sustainability Community Garden**											
	Rainwater harvesting	1,000	0.02	0.026	4	800	0.04	800	$2	gal	$1,600	28.5%
	Total Site Info	**1,000**	**0.02**	**0.026**	**4**	**800**	**0.04**				**$1,600**	**28.5%**
16	**Ujmiaa Community Garden**											
	Bioretention system	2,000	0.05	0.052	9	3,949	0.17	500	$5	SF	$2,500	43.9%
	Rainwater harvesting	2,500	0.06	0.065	11	800	0.04	800	$2	gal	$1,600	54.9%
	Total Site Info	**4,500**	**0.10**	**0.117**	**20**	**4,749**	**0.21**				**$4,100**	**98.8%**
17	**West Side Park**											
	Bioretention system	750	0.02	0.020	3	1,481	0.07	200	$5	SF	$1,000	0.1%
	Total Site Info	**750**	**0.02**	**0.020**	**3**	**1,481**	**0.07**				**$1,000**	**0.1%**

Draft

Impervious Cover Reduction Action Plan for Newark, Essex County, New Jersey – Volume 3

Prepared for the City of Newark by the Rutgers Cooperative Extension Water Resources Program

April 16, 2018

Table of Contents

Introduction

Located in Essex County in northern New Jersey, Newark covers approximately 26.22 square miles. Figures 1 and 2 illustrate that Newark is dominated by urban land uses. A total of 86.8% of the municipality's land use is classified as urban. Of the urban land in Newark, high 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 Newark 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 Newark. Based upon the 2012 NJDEP land use/land cover data, approximately 63.2% of Newark has impervious cover. This level of impervious cover suggests that the streams in Newark are likely non-supporting streams. [1]

Methodology

Newark 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.

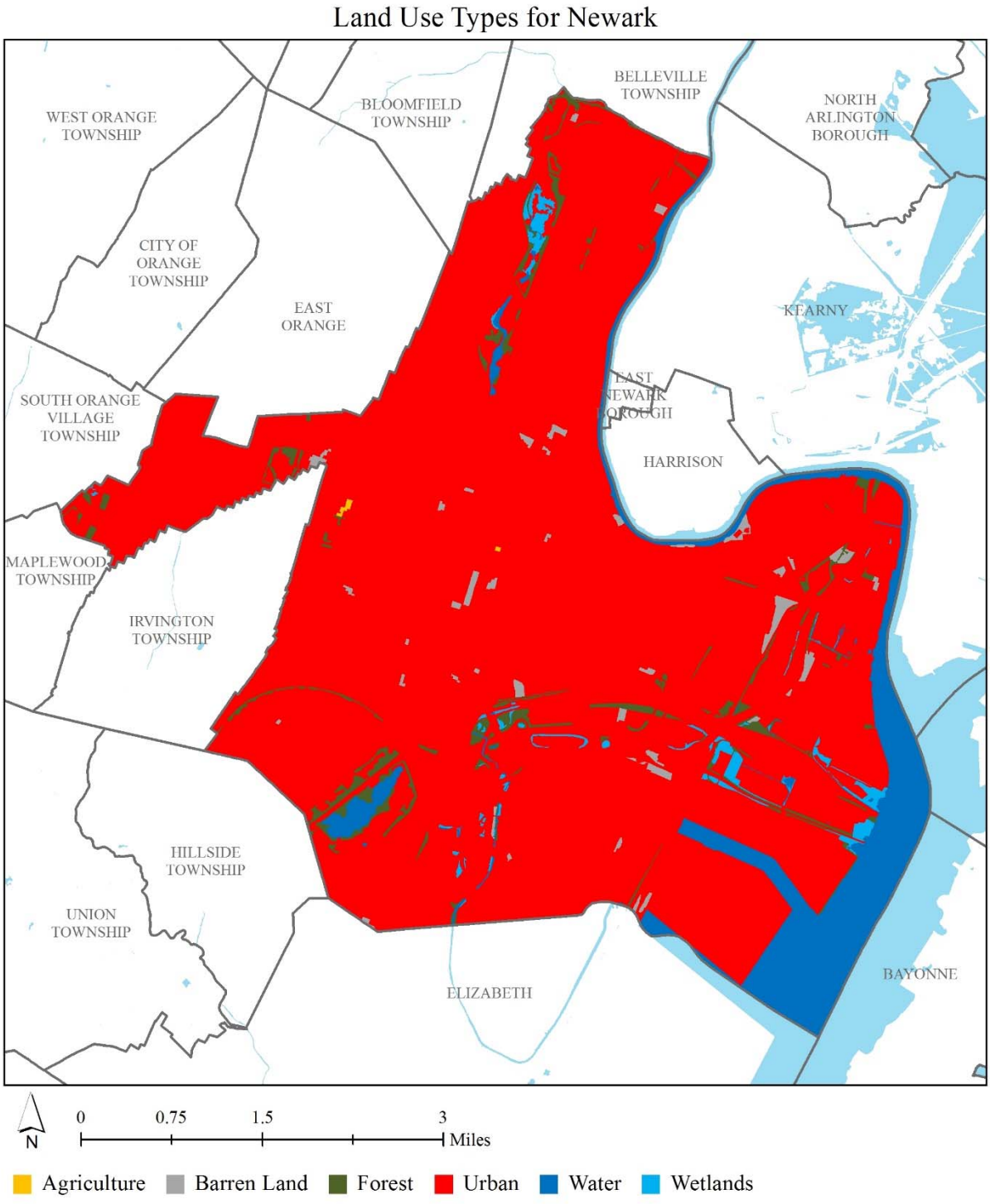


Figure 1: Map illustrating the land use in Newark

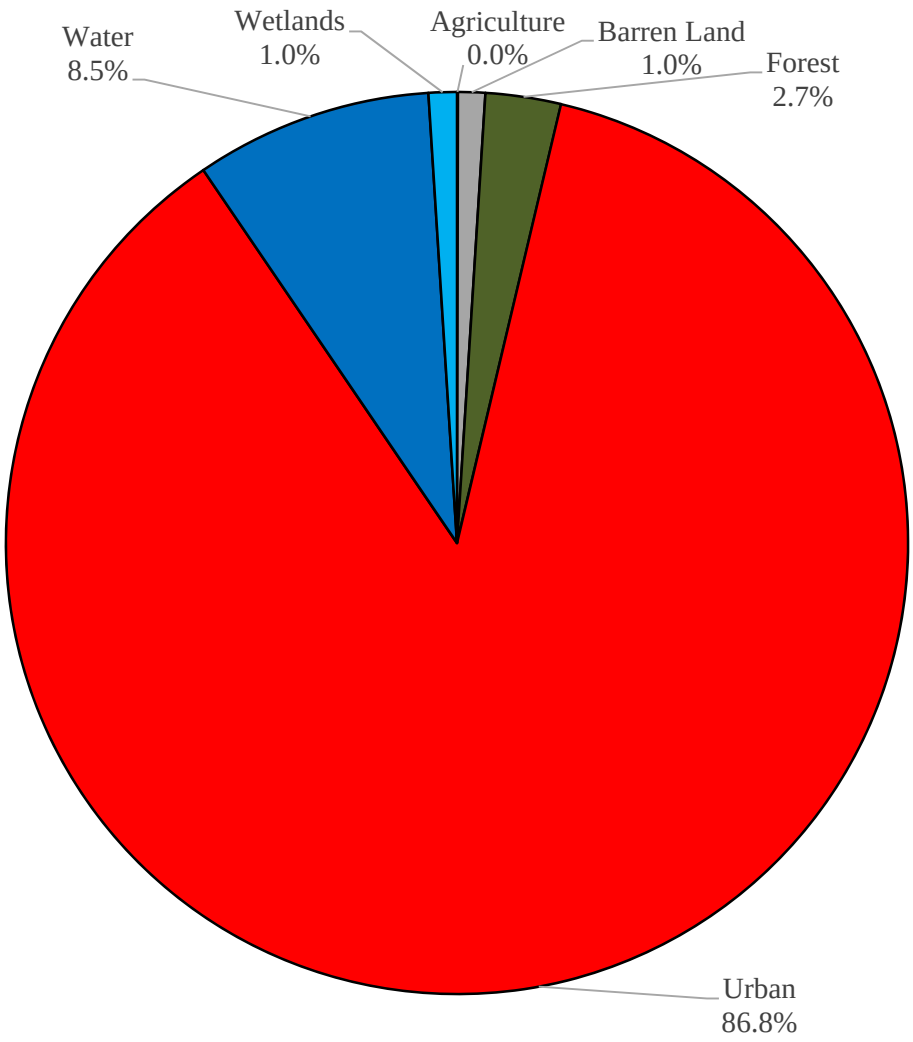


Figure 2: Pie chart illustrating the land use in Newark

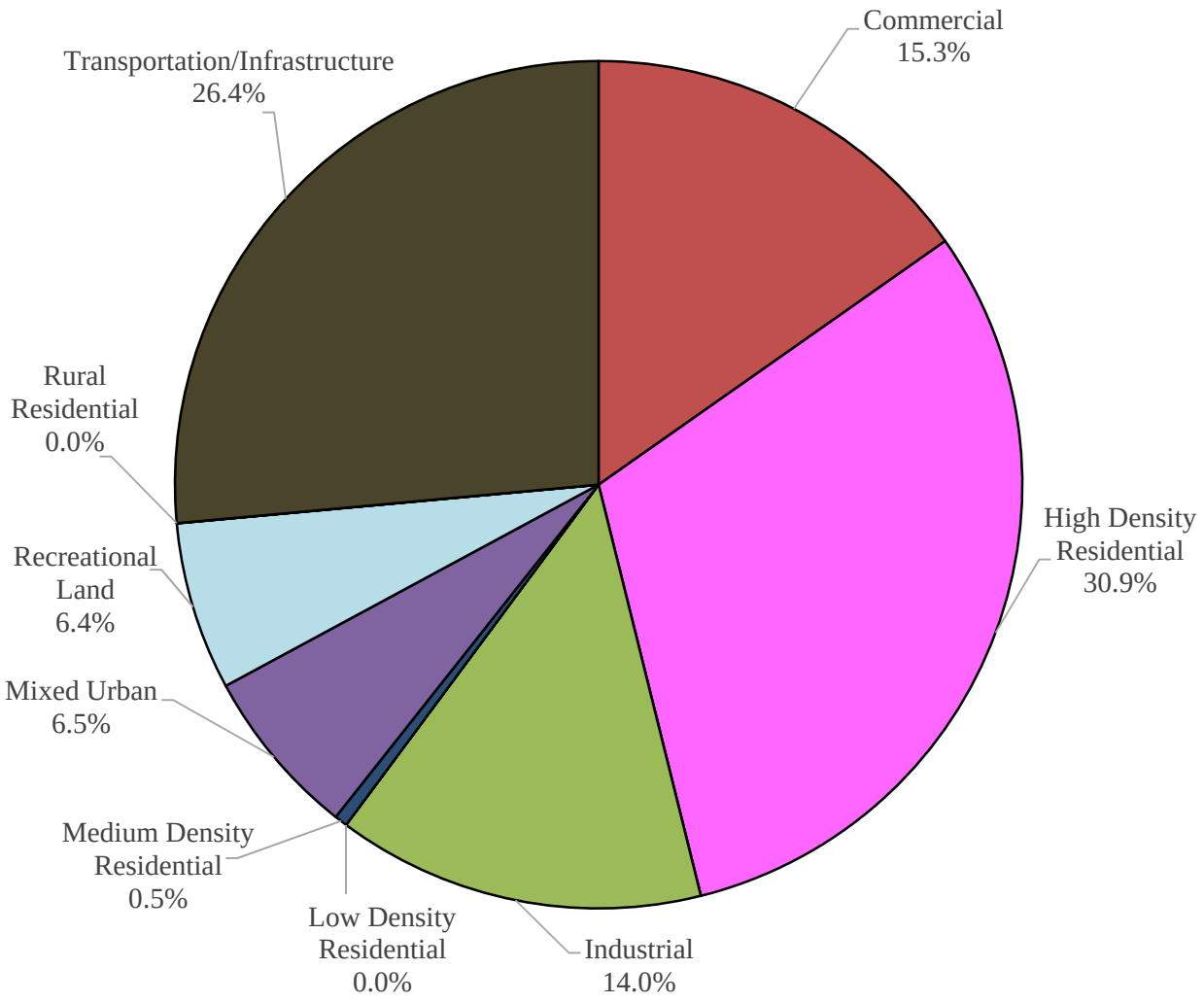


Figure 3: Pie chart illustrating the various types of urban land use in Newark

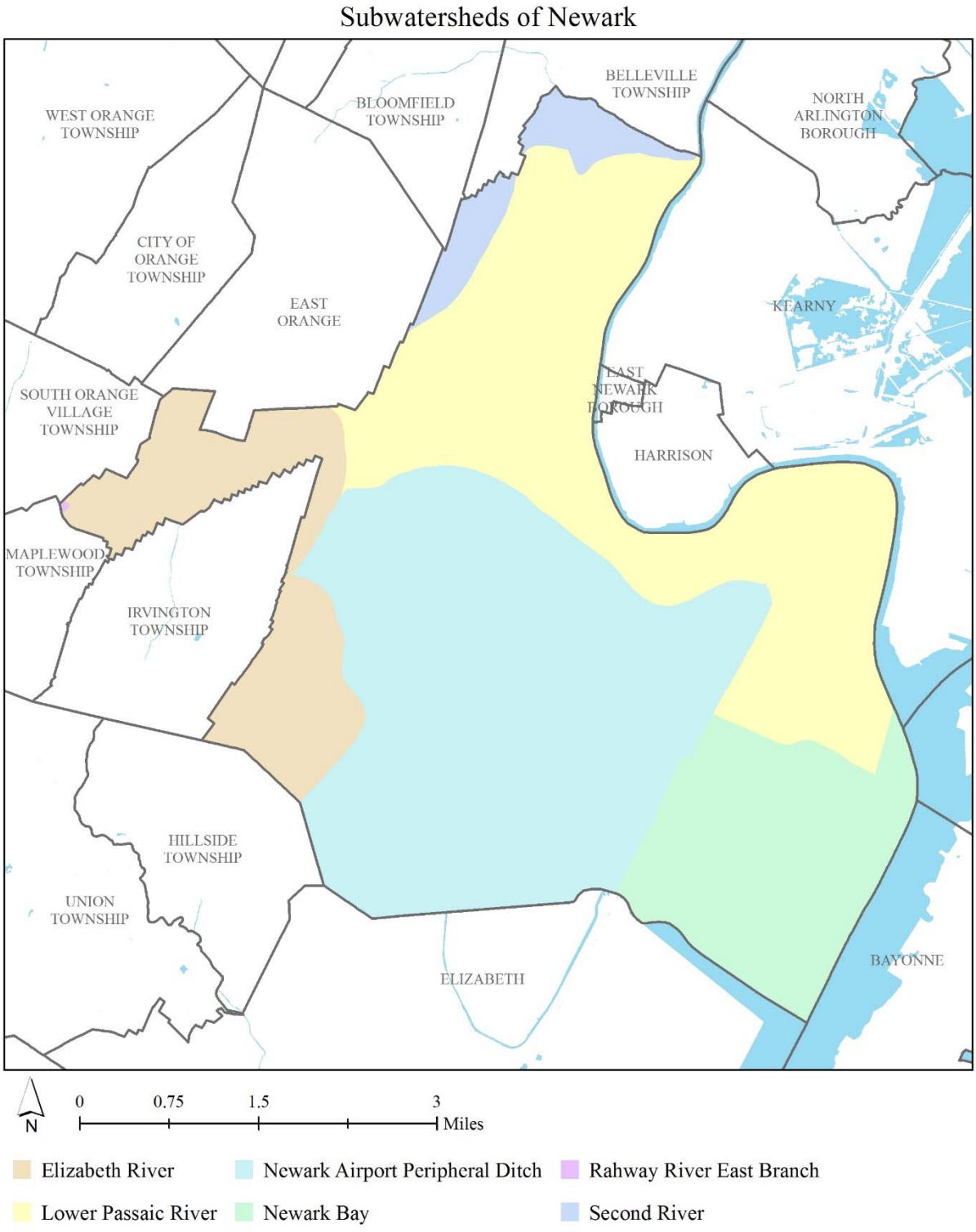


Figure 4: Map of the subwatersheds in Newark

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 Newark 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 Newark. 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

Appendix A contains information on potential project sites where green infrastructure practices could be installed as well as information on existing site conditions. The recommended green infrastructure practices and the drainage area that the green infrastructure practices can treat are identified for each potential project site. For each practice, the recharge potential, TSS removal potential, maximum volume reduction potential per storm, the peak reduction potential, and estimated costs 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.

Appendix A: Climate Resilient Green Infrastructure

a. Green Infrastructure Sites

NEWARK: GREEN INFRASTRUCTURE SITES - VOLUME 3

SITES WITHIN THE ELIZABETH RIVER SUBWATERSHED

1. 14th Avenue Community Garden
2. Ivy Hill Park

SITES WITHIN LOWER PASSAIC RIVER SUBWATERSHED

3. Hawkins Street & Horatio Street Apartments
4. John F Kennedy School
5. NJCRI Aids Research Remembrance Garden
6. North Star Academy Elementary School 4
7. Riverfront Park
8. Traffic Traingle at Market, Mott and Ferry St
9. Urban Leage of Essex County
10. Washington Park

SITES WITHIN THE NEWARK AIRPORT PERIPHERAL DITCH SUBWATERSHED

11. Central High School
12. Kretchmer Homes
13. Mediterranean Manor
14. Newark Leadership Academy
15. Wanda Upshaw Meditation Garden

b. Proposed Green Infrastructure Concepts

14th Avenue Community Garden

Subwatershed: Elizabeth River

Site Area: 1,419 sq. ft.

Address: 316 14th Avenue
Newark, NJ 07103

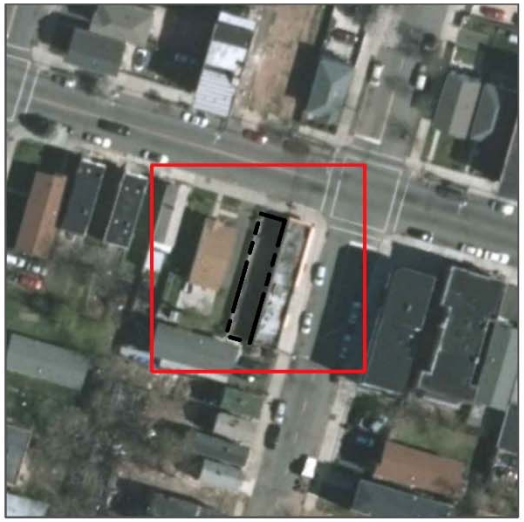
Block and Lot: Block 327, Lot 9

A stormwater planter can be installed in the sidewalk to capture, treat, and infiltrate stormwater runoff from the side of the road. The planter can also serve as a demonstration project. 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"
5	70	<0.0	<0.0	0.3	<0.000	<0.00

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
Stormwater planter	0.008	1	630	0.02	80	$30,000

GREEN INFRASTRUCTURE RECOMMENDATIONS



14th Avenue Community Garden

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

0 10' 20'

Ivy Hill Park

Subwatershed: Elizabeth River

Site Area: 812,236 sq. ft.

Address: 149 - 253 Mount Vernon Place
Newark, NJ 07106

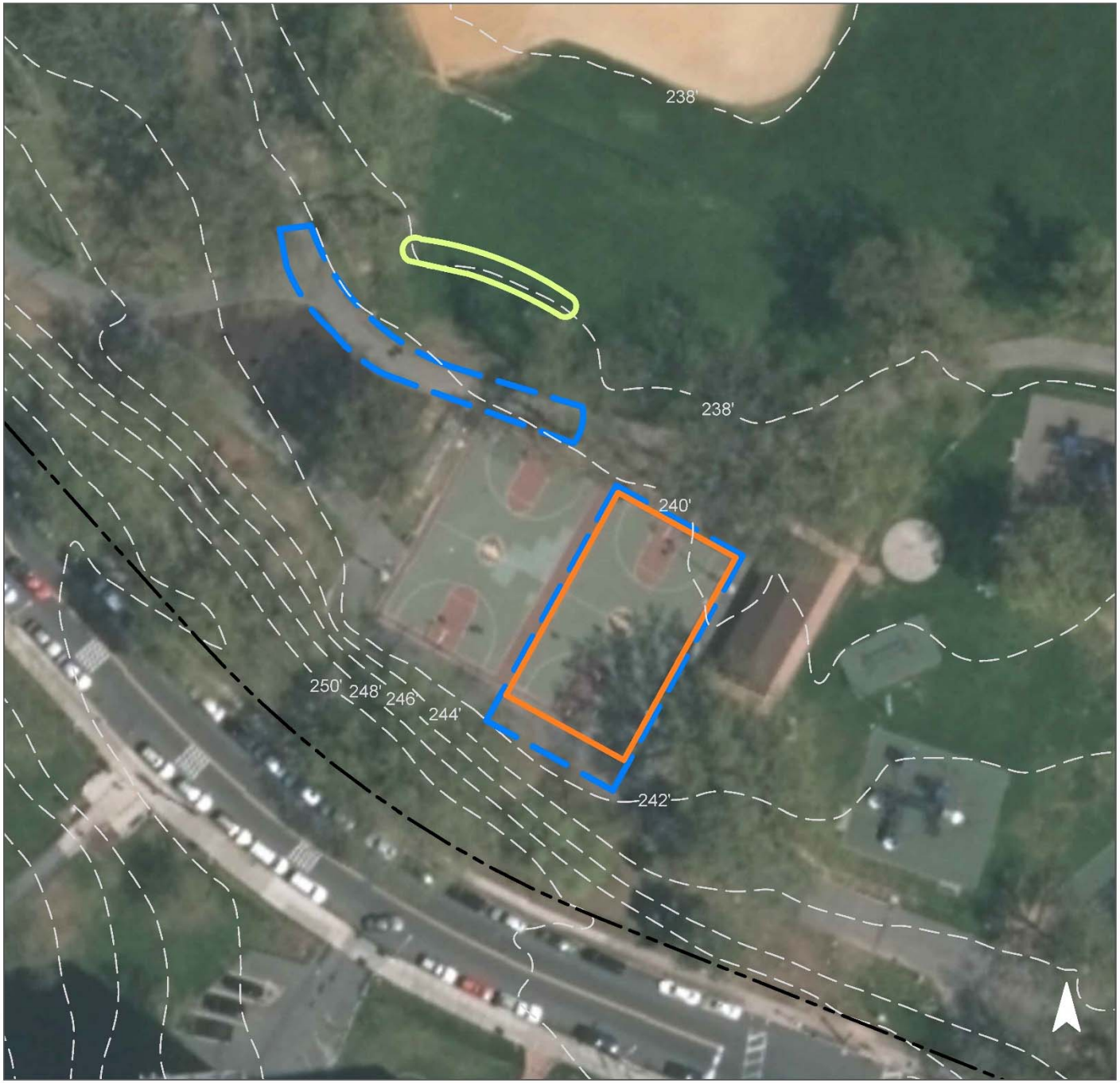
Block and Lot: Block 4274.01, Lot 2

A rain garden can be installed between the basketball courts and baseball field to infiltrate water flowing off the basketball court and sidewalk, where it has currently eroded the turfgrass. One basketball court can be converted to porous pavement to infiltrate water as it falls onto the court. 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"
16	133,997	6.5	67.7	615.2	0.104	3.68

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	3,950	0.15	650	$3,250
Pervious pavement	0.156	26	11,840	0.45	4,800	$120,000

GREEN INFRASTRUCTURE RECOMMENDATIONS



Ivy Hill Park

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

0 30' 60'

Hawkins Street & Horatio Street Apartments

Subwatershed: Lower Passaic River

Site Area: 424,612 sq. ft.

Address: 39 – 53 Horatio Street
Newark, NJ 07105

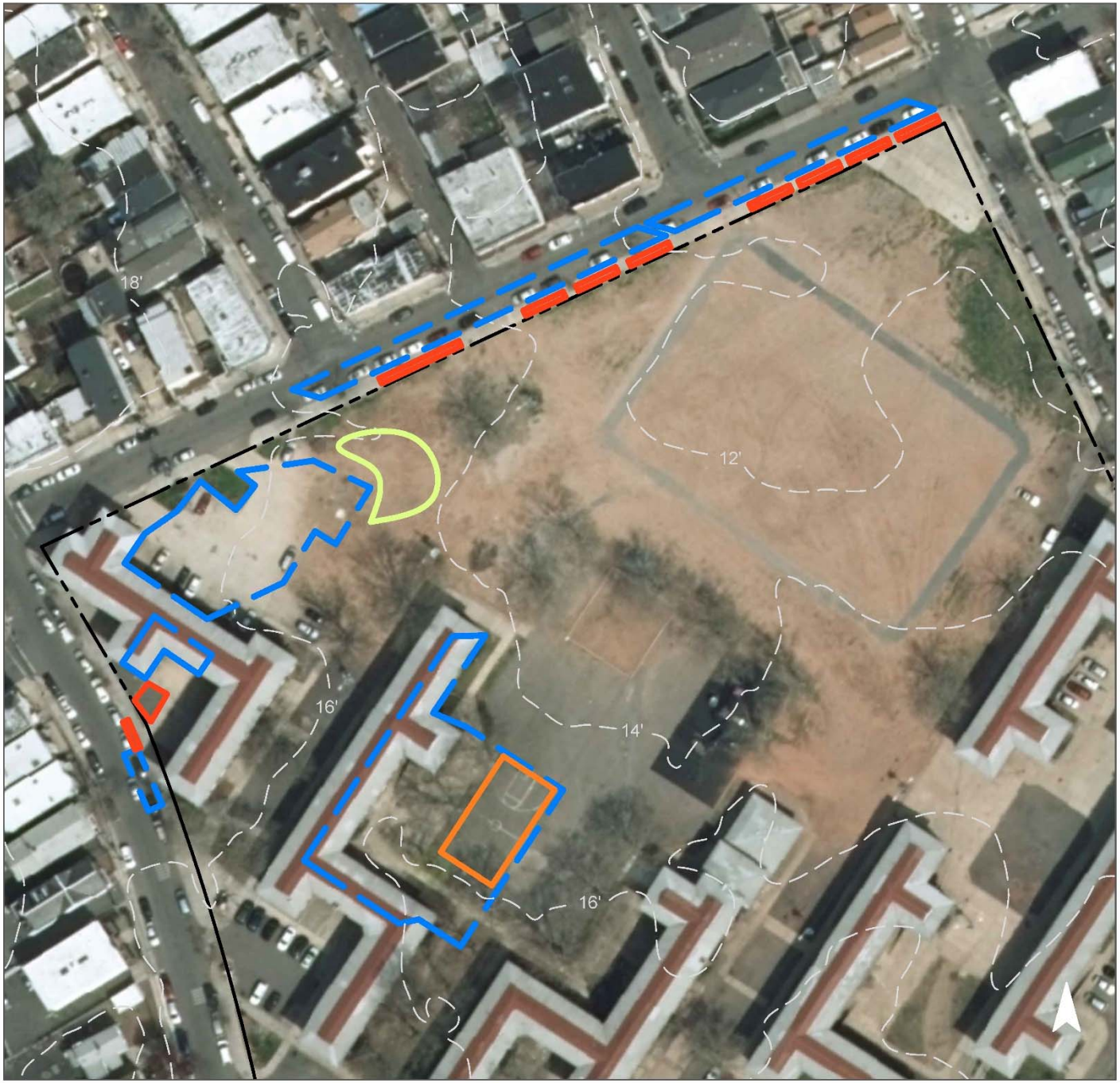
Block and Lot: Block 2384, Lot 1

A rain garden can be installed in the grass area adjacent to the parking lot to capture, treat, and infiltrate runoff from the parking lot that appears to pool in the area. Stormwater planters can be installed on the west side of the buildings to capture, treat, and infiltrate stormwater runoff from the roof as well as along Horatio Street. The basketball court can be converted to porous pavement to capture and infiltrate runoff from the roof and surrounding paved area. 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"
67	285,604	13.8	144.2	1,311.3	0.223	7.83

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	0.229	38	17,370	0.65	2,200	$11,000
Pervious pavement	0.412	69	31,190	1.17	3,000	$75,000
Stormwater planters	0.148	25	11,210	0.42	1,420	$532,500

GREEN INFRASTRUCTURE RECOMMENDATIONS



Hawkins Street & Horatio Street Apartments

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

0 50' 100'

John F. Kennedy School

Subwatershed: Lower Passaic River

Site Area: 49,188 sq. ft.

Address: 311 South 10th Street
Newark, NJ 07103

Block and Lot: Block 1783, Lots
10,17,18,20,63,66,68,70

A cistern can be installed to capture roof runoff from a shade structure in the school garden. The water can then be used for non-potable purposes such as watering the garden or washing vehicles. 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"
81	39,857	1.9	20.1	183.0	0.031	1.09

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
Rainwater harvesting	0.007	1	200	0.01	200 (gal)	$400

GREEN INFRASTRUCTURE RECOMMENDATIONS

John F. Kennedy School

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

0 15' 30'

NJCRI AIDS Research Remembrance Garden

Subwatershed: Lower Passaic River

Site Area: 26,092 sq. ft.

Address: 393 Central Avenue
Newark, NJ 07103

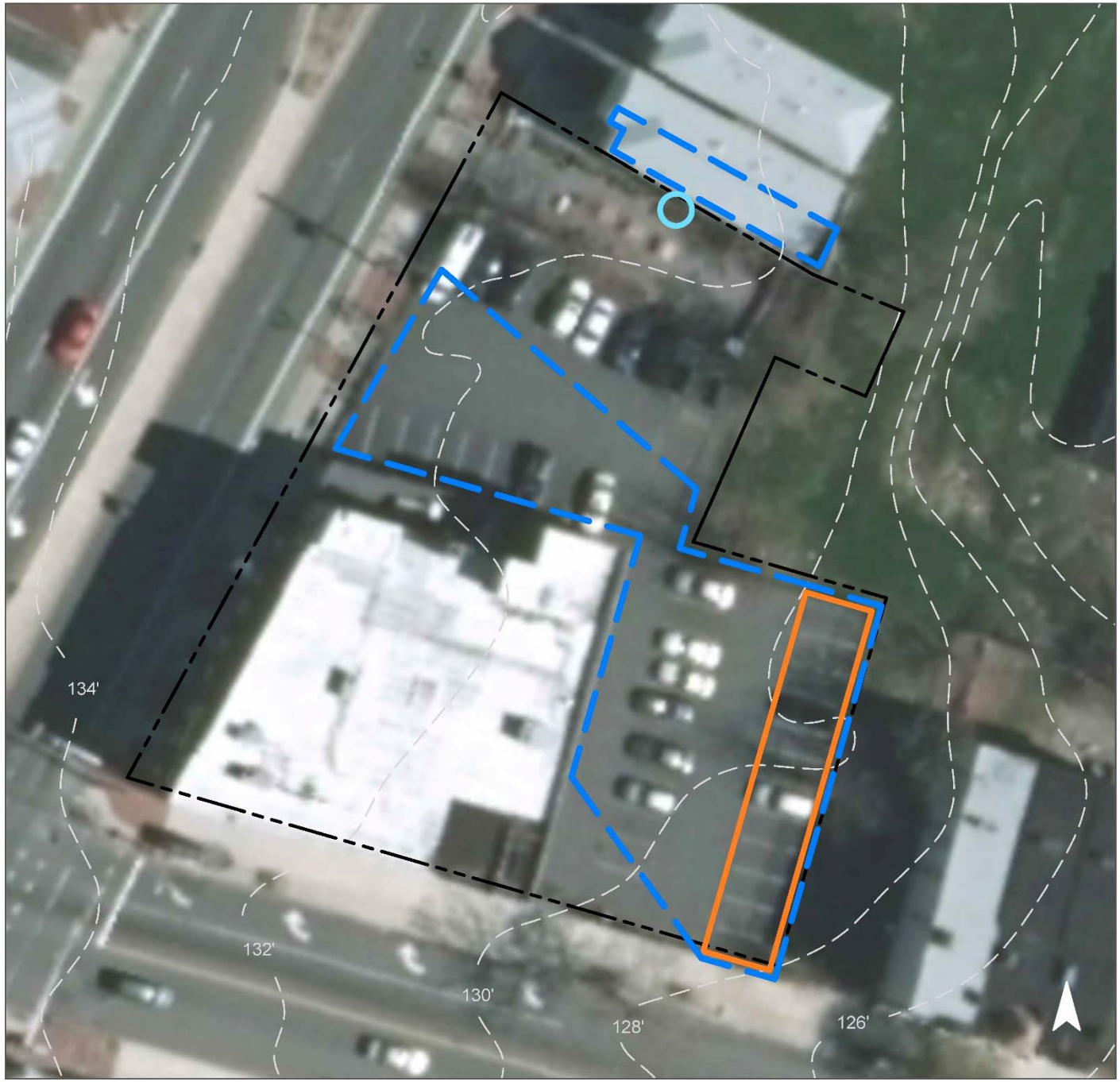
Block and Lot: Block 1845, Lot 9,10, 15, 16, 17, 18, 19

A cistern can be installed to capture stormwater runoff from the building adjacent to the garden. This water can then be used for watering the garden or other non-potable purposes. A section of parking spaces can be converted to porous pavement to capture and infiltrate runoff from the parking lot. 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"
88	23,000	1.1	11.6	105.6	0.018	0.63

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 pavement	0.234	39	17,770	0.67	1,760	$44,000
Rainwater harvesting	0.018	3	550	0.02	550 (gal)	$1,100

GREEN INFRASTRUCTURE RECOMMENDATIONS



NJCRI AIDS Remembrance Research Garden

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

0 20' 40'

North Star Academy Elementary School 4

Subwatershed: Lower Passaic River

Site Area: 85,660 sq. ft.

Address: 108 South 9th Street
Newark, NJ 07107

Block and Lot: Block 1828, Lot 9

The basketball courts can be converted to porous pavement to capture and infiltrate runoff from the parking lot area. A section of paved road behind the dumpsters can be depaved and converted to a stormwater planter to capture, treat, and infiltrate runoff from the paved area. 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"
99	85,196	4.1	43.0	391.2	0.066	2.34

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Pervious pavement	0.602	101	45,600	1.71	7,000	$175,000
Stormwater planter	0.010	2	790	0.03	100	$37,500

GREEN INFRASTRUCTURE RECOMMENDATIONS

North Star Academy Elementary School 4

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

0 30' 60'

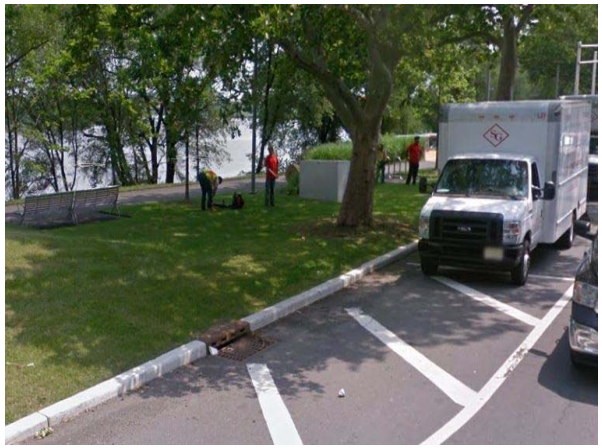
Riverfront Park

Subwatershed: **Lower Passaic River**

Site Area: **1,289,578 sq. ft.**

Address: **671 Raymond Boulevard Newark, NJ 07105**

Block and Lot: **Blocks 2005; 2025; 2026; 2027; 2028; 2442, Lots 1; 1, 2, 20; 1, 7, 19, 22; 1, 2; 1, 2; 2**



A stormwater planter can be installed along the road to capture, treat, and infiltrate runoff before it enters the catch basin. A rain garden can be installed to capture, treat, and infiltrate runoff from the path before entering a catch basin. 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"
27	348,542	16.8	176.0	1,600.3	0.272	9.56

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	0.021	3	1,580	0.06	200	$1,000
Stormwater planter	0.063	10	4,730	0.18	600	$225,000

GREEN INFRASTRUCTURE RECOMMENDATIONS

Riverfront Park

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

0 30' 60'

Traffic Triangle at Market, Mott, and Ferry Streets

Subwatershed: Lower Passaic River

Site Area: 21,488 sq. ft.

Address: 690 – 706 Market Street
Newark, NJ 07105

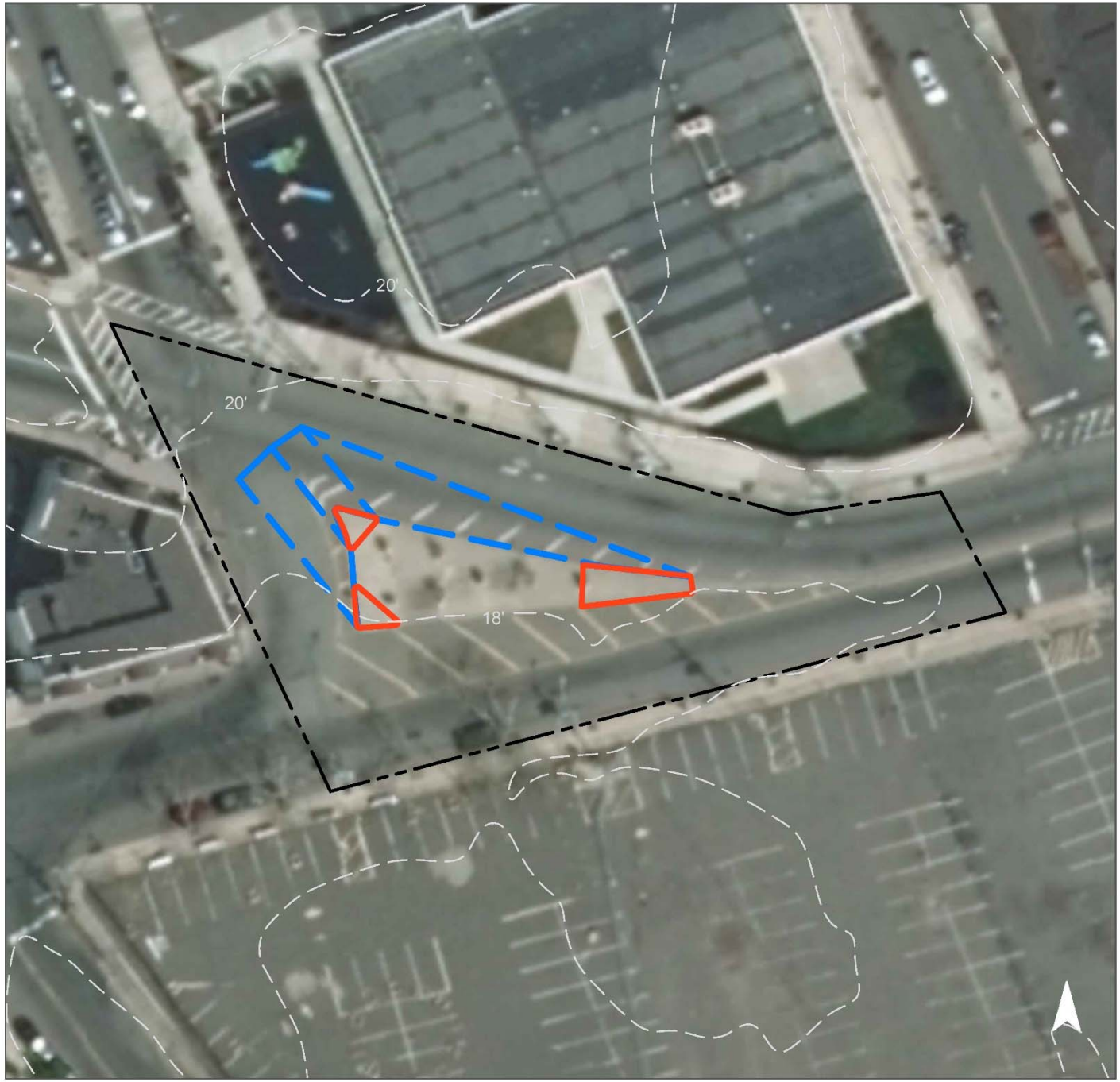
Block and Lot: Block N/A, Lot N/A

Stormwater planters can be installed at the corners of the triangle to capture, treat, and infiltrate the stormwater runoff from the surrounding road area. 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"
96	20,657	1.0	10.4	94.8	0.016	0.57

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
Stormwater planters	0.066	11	5,030	0.19	650	$243,750

GREEN INFRASTRUCTURE RECOMMENDATIONS



Traffic Triangle at Market, Mott, and Ferry Streets

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

0 25' 50'

Urban League of Essex County

Subwatershed: Lower Passaic River

Site Area: 25,075 sq. ft.

Address: 508 Central Avenue
Newark, NJ 07107

Block and Lot: Block 1829, Lots 1, 2, 3, 68

A cistern can be installed near the existing downspout to capture runoff from the rooftop. Any overflow from the system can be directed into rain gardens placed in existing landscaped areas. A section of parking spaces can be converted to pervious pavement to capture runoff from the parking lot. 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"
95	23,700	1.1	12.0	108.8	0.018	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
Bioretention systems	0.010	2	790	0.03	100	$500
Pervious pavement	0.091	15	6,910	0.26	640	$16,000
Rainwater harvesting	0.010	2	325	0.01	325 (gal)	$650

GREEN INFRASTRUCTURE RECOMMENDATIONS

Urban League of Essex County

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

0 20' 40'

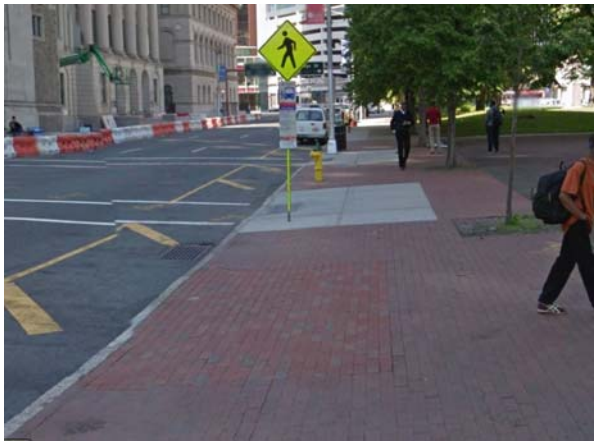
Washington Park

Subwatershed: Lower Passaic River

Site Area: 146,000 sq. ft.

Address: 515 Broad Street
Newark, NJ 07102

Block and Lot: Block 23, Lot 1

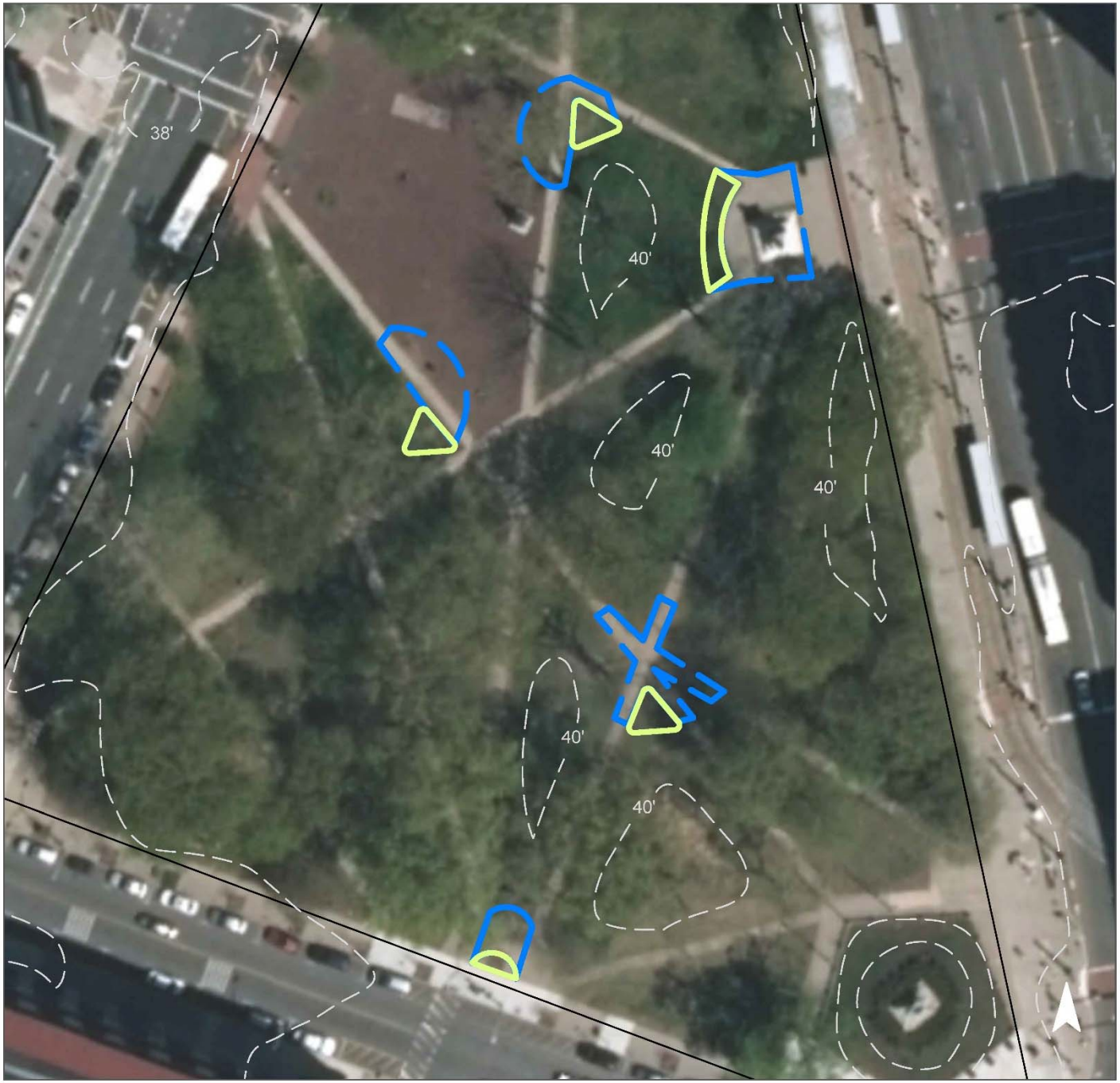


Rain gardens can be installed throughout the park around catch basins to capture, treat, and infiltrate runoff before entering the catch basins. A preliminary soil assessment suggests that more soil testing would be required before determining the soil's suitability for green infrastructure.

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	14,600	0.7	7.4	67.0	0.011	0.40

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	0.106	18	8,000	0.30	1,025	$5,125

GREEN INFRASTRUCTURE RECOMMENDATIONS



Washington Park

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

0 30' 60'

Central High School

Subwatershed: Newark Airport Peripheral Ditch

Site Area: 271,996 sq. ft.

Address: 246 18th Avenue
Newark, NJ 07108

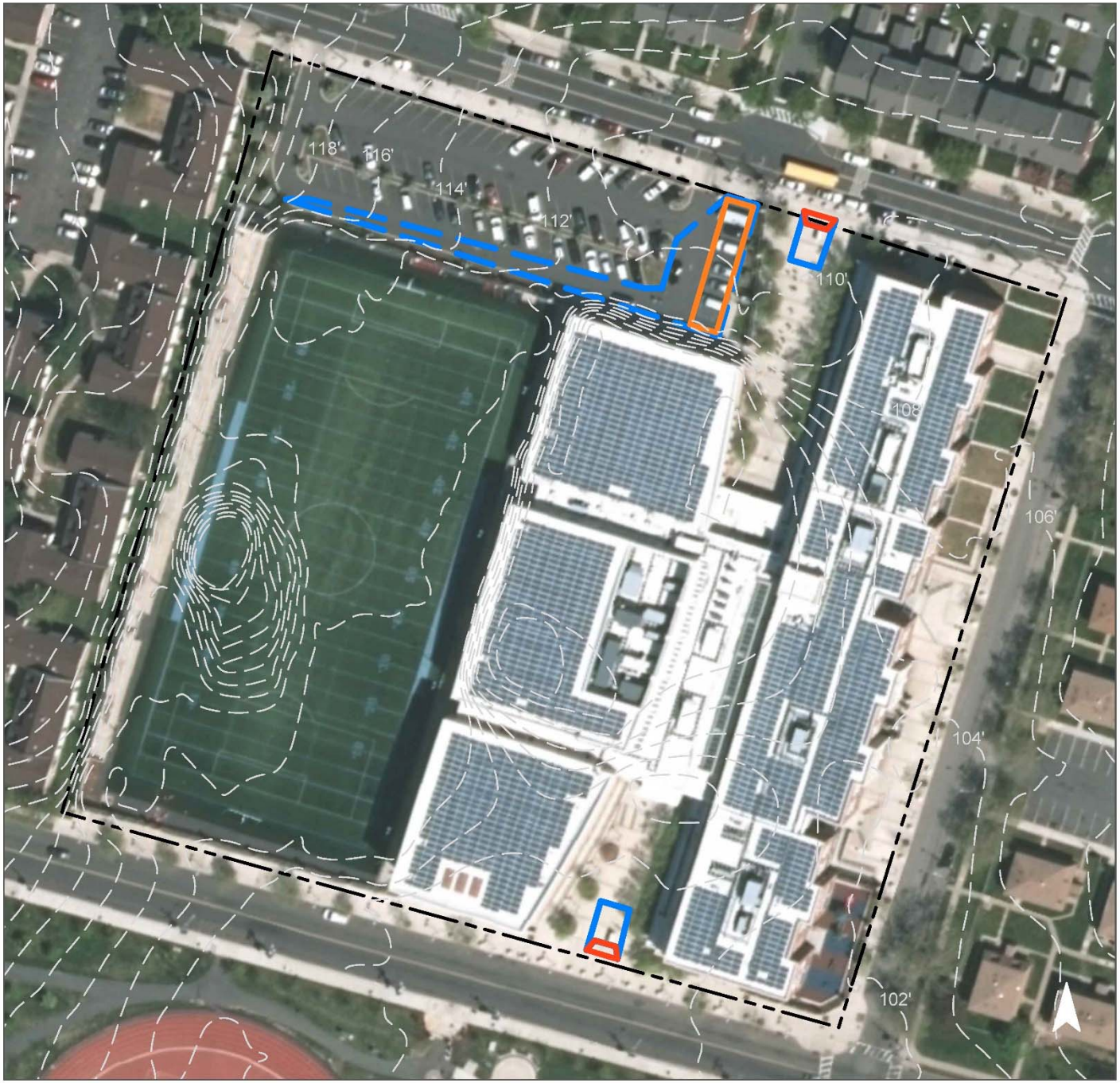
Block and Lot: Blocks 2547; 2549, Lots 57, 58; 1

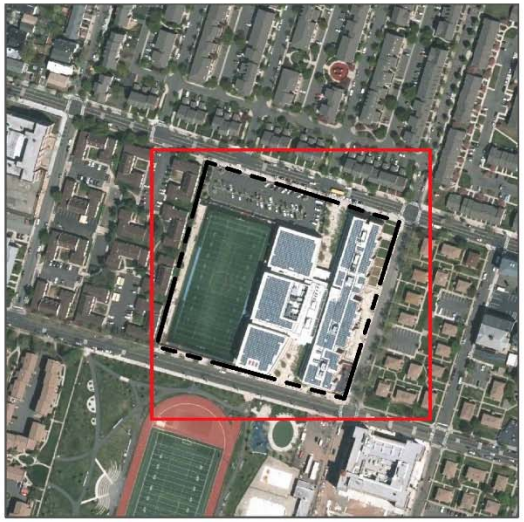
A stormwater planter can be installed near the sign by each entrance to capture, treat, and infiltrate stormwater runoff from the sidewalk. A section of parking spaces can be converted to porous pavement to capture and infiltrate runoff from the parking lot. A preliminary soil assessment suggests that 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"
87	235,820	11.4	119.1	1,082.7	0.184	6.47

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	0.156	26	11,840	0.45	1,550	$38,750
Stormwater planters	0.028	5	2,130	0.08	270	$101,250

GREEN INFRASTRUCTURE RECOMMENDATIONS





Central High School

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

0 50' 100'

Kretchmer Homes

Subwatershed: Newark Airport Peripheral Ditch

Site Area: 390,312 sq. ft.

Address: 71 Ludlow Street
Newark, NJ 07114

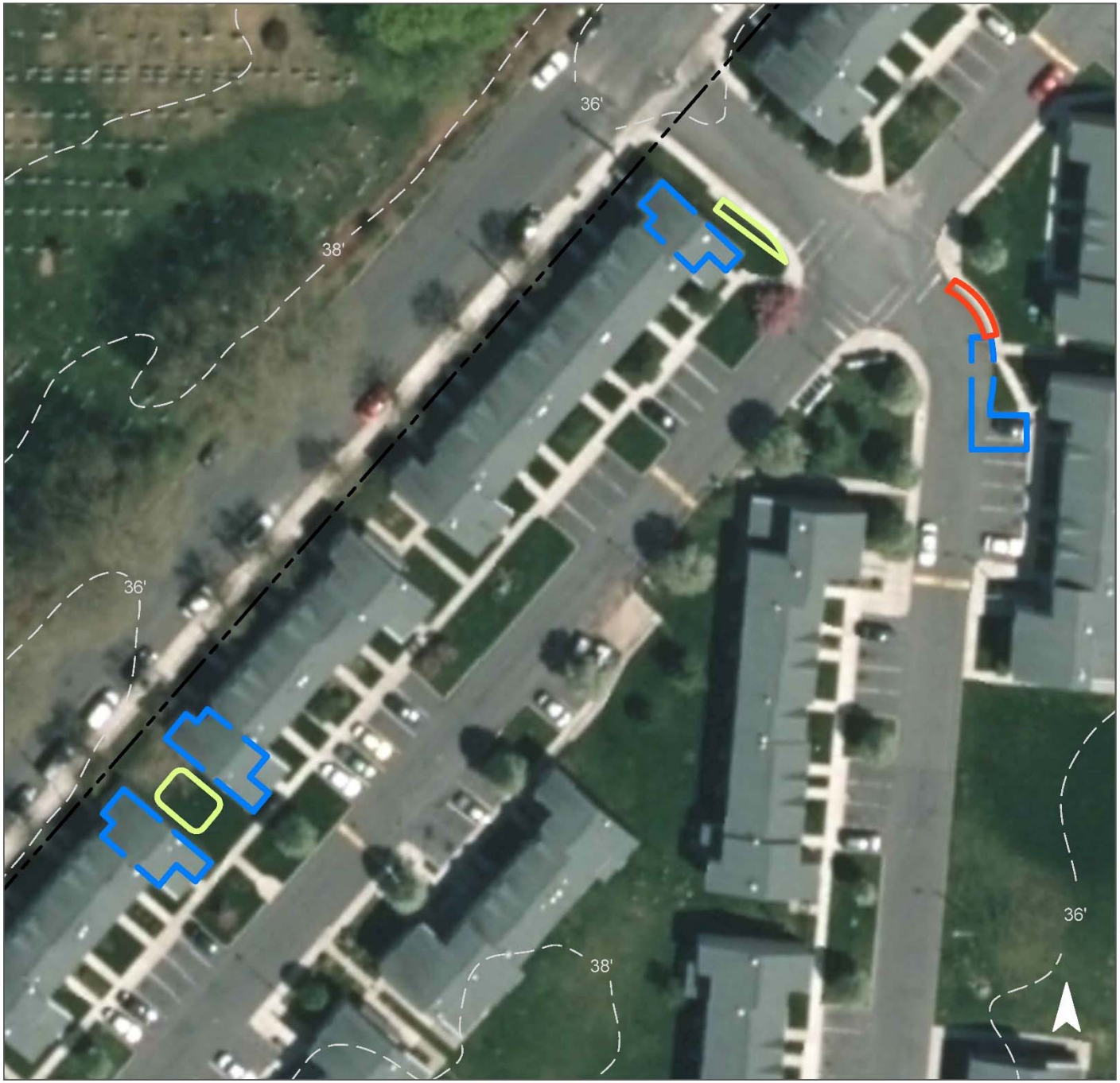
Block and Lot: Block 3764, Lot 1.01

A stormwater planter can be installed to capture, treat, and infiltrate runoff from the road before it reaches a catch basin. Rain gardens can be installed in the turfgrass areas to capture, treat, and infiltrate 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"
60	234,233	11.3	118.3	1,075.4	0.183	6.42

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention systems	0.055	9	4,140	0.16	520	$2,600
Stormwater planter	0.014	2	1,020	0.04	130	$48,750

GREEN INFRASTRUCTURE RECOMMENDATIONS



Kretchmer Homes

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

0 30' 60'

Mediterranean Manor

Subwatershed: Newark Airport Peripheral Ditch

Site Area: 14,766 sq. ft.

Address: 255 Jefferson Street
Newark, NJ 07105

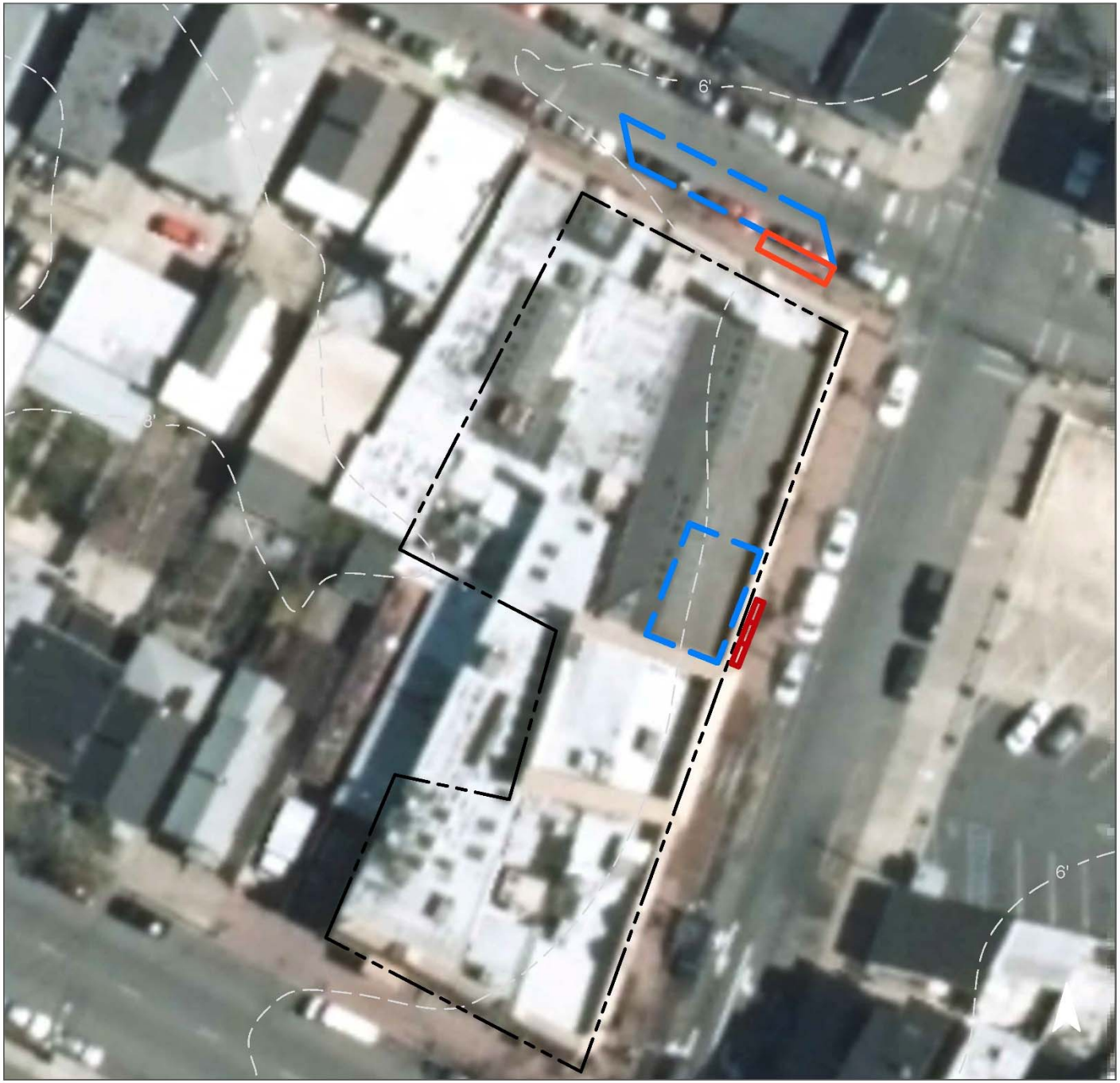
Block and Lot: Block 947, Lot 36

A stormwater planter can be installed to capture, treat, and infiltrate runoff from the roof before it reaches a catchbasin. Downspout planter boxes can be installed near the entrance to filter the stormwater from the roof and serve as a demonstration project. 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"
98	14,500	0.7	7.3	66.6	0.011	0.40

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	3	$3,000
Stormwater planter	0.010	2	790	0.03	100	$37,500

GREEN INFRASTRUCTURE RECOMMENDATIONS



Mediterranean Manor

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

0 20' 40'

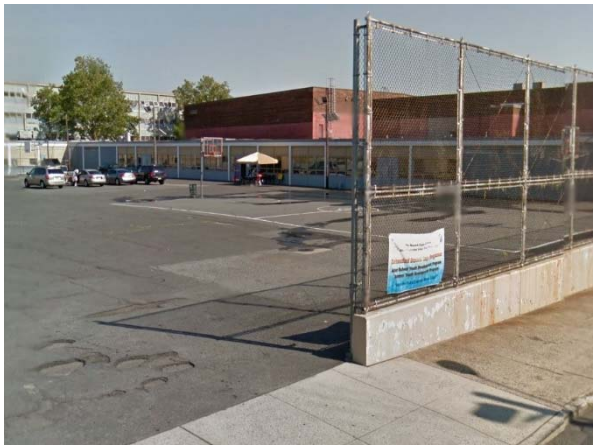
Newark Leadership Academy

Subwatershed: Newark Airport Peripheral Ditch

Site Area: 176,140 sq. ft.

Address: 301 West Kinney Street Newark, NJ 07103

Block and Lot: Blocks 2518; 2519, Lots 24; 27



The basketball court can be converted to porous pavement to capture and infiltrate runoff from the surrounding parking lot area. Stormwater planters can be installed near the main entrance to serve as a demonstration project and to capture, treat, and infiltrate runoff from the road. 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"
89	157,377	7.6	79.5	722.6	0.123	4.32

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	0.912	153	69,090	2.60	6,350	$158,750
Stormwater planters	0.031	5	2,370	0.09	300	$112,500

GREEN INFRASTRUCTURE RECOMMENDATIONS

Newark Leadership Academy

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

0 50' 100'

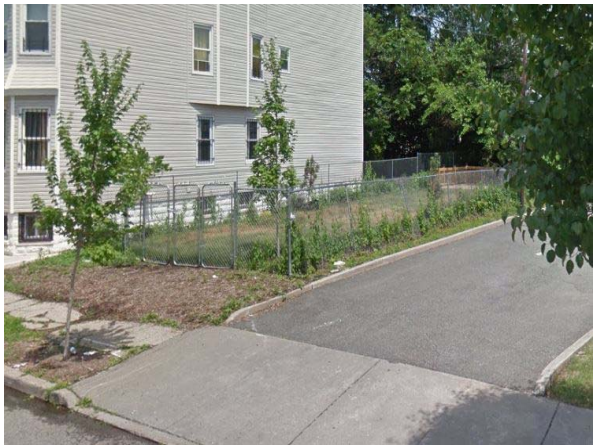
Wanda Upshaw Meditation Garden

Subwatershed: Newark Airport Peripheral Ditch

Site Area: 2,508 sq. ft.

Address: 454 South 13th Street Newark, NJ 07103

Block and Lot: Block 285, Lot 42

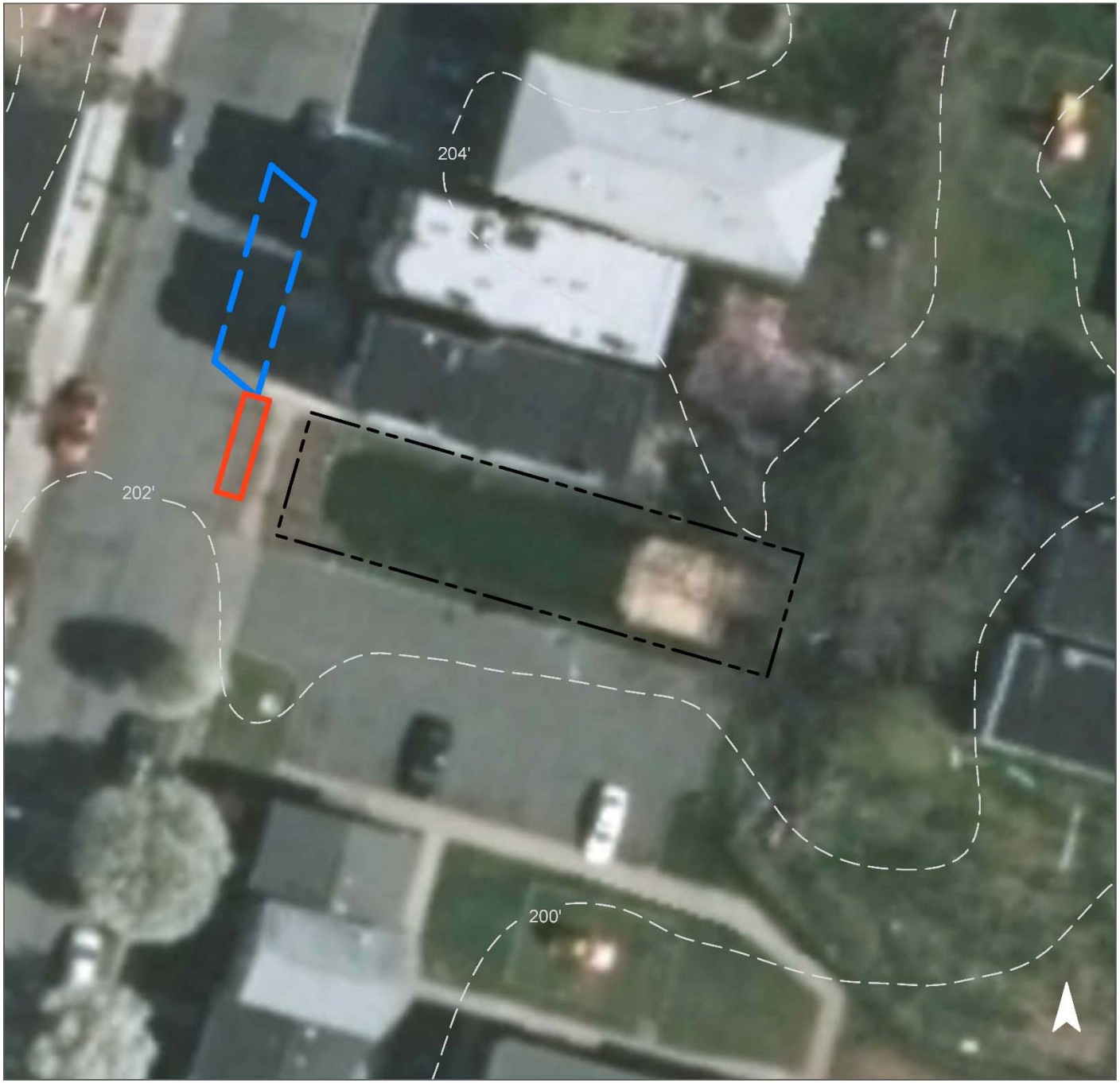


A stormwater planter can be installed along the sidewalk to improve pollinator habitat and capture, treat, and infiltrate runoff from the road. A preliminary soil assessment suggests that more soil testing would be required before determining the soil's suitability for green infrastructure.

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"
40	1,003	0.1	1.3	11.5	0.002	0.07

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
Stormwater planter	0.010	2	790	0.03	100	$37,500

GREEN INFRASTRUCTURE RECOMMENDATIONS



Wanda Upshaw Meditation Garden

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

0 15' 30'

c. Summary of Existing Conditions

Summary of Existing Conditions

	Subwatershed/Site Name/Total Site Info/GI Practice	Area (ac)	Area (SF)	Block	Lot	I.C. %	I.C. Area (ac)	I.C. Area (SF)	Existing Annual Loads (Commercial) TP (lb/yr)	TN (lb/yr)	TSS (lb/yr)	Runoff Volumes from I.C. Water Quality Storm (1.25" over 2-hours) (cu.ft.)	Annual (cu.ft.)	Runoff Volumes from I.C. Water Quality Storm (1.25" over 2-hours) (Mgal)	Annual (Mgal)
	ELIZABETH RIVER SUBWATERSHED	**24.92**	**1,085,651**				**8.49**	**369,887**	**17.8**	**186.8**	**1,698.3**	**38,530**	**1,356,252**	**0.288**	**10.14**
1	**14th Avenue Community Garden**														
	Total Site Info	0.03	1,419	327	9	5	0.00	70	0.0	0.0	0.3	7	257	0.000	0.00
2	**Ivy Hill Park**														
	Total Site Info	18.65	812,236	4274.01	2	16	3.08	133,997	6.5	67.7	615.2	13,958	491,322	0.104	3.68
	PASSAIC RIVER SUBWATERSHED	**47.47**	**2,067,692**				**19.31**	**841,156**	**40.6**	**424.8**	**3,862.1**	**87,620**	**3,084,240**	**0.655**	**23.07**
3	**Hawkins Street & Horatio Street Apartments**														
	Total Site Info	9.75	424,612	2384	1	67	6.56	285,604	13.8	144.2	1,311.3	29,750	1,047,216	0.223	7.83
4	**John F. Kennedy School**														
	Total Site Info	1.13	49,188	1783	10,17,18,20, 63,66,68,70	81	0.91	39,857	1.9	20.1	183.0	4,152	146,144	0.031	1.09
5	**NJCRI AIDS Research Remembrance Garden**														
	Total Site Info	0.60	26,092	1845	9, 10, 15, 16, 17, 18, 19	88	0.53	23,000	1.1	11.6	105.6	2,396	84,333	0.018	0.63
6	**North Star Academy Elementary School 4**														
	Total Site Info	1.97	85,660	1828	9	99	1.96	85,196	4.1	43.0	391.2	8,875	312,384	0.066	2.34
7	**Riverfront Park**														
	Total Site Info	29.60	1,289,578	2005; 2025; 2026; 2027; 2028; 2442	1; 1,2,20; 1,7,19,22; 1,2; 1,2; 2	27	8.00	348,542	16.8	176.0	1,600.3	36,306	1,277,989	0.272	9.56
8	**Traffic Triangle at Market, Mott, and Ferry Streets**														
	Total Site Info	0.49	21,488	N/A	N/A	96	0.47	20,657	1.0	10.4	94.8	2,152	75,741	0.016	0.57
9	**Urban Leage of Essex County**														
	Total Site Info	0.58	25,075	1829	1, 2, 3, 68	95	0.54	23,700	1.1	12.0	108.8	2,469	86,900	0.018	0.65
10	**Washington Park**														
	Total Site Info	3.35	146,000	23	1	10	0.34	14,600	0.7	7.4	67.0	1,521	53,533	0.011	0.40
	NEWARK AIRPORT PERIPHERAL DITCH	**19.61**	**854,218**				**14.79**	**644,439**	**31.1**	**325.5**	**2,958.9**	**67,129**	**2,362,942**	**0.502**	**17.67**
11	**Central High School**														
	Total Site Info	6.24	271,996	2547; 2549	57, 58; 1	87	5.41	235,820	11.4	119.1	1,082.7	24,565	864,673	0.184	6.47
12	**Kretchmer Homes**														
	Total Site Info	8.96	390,312	3764	1.01	60	5.38	234,233	11.3	118.3	1,075.4	24,399	858,854	0.183	6.42
13	**Mediterranean Manor**														
	Total Site Info	0.34	14,766	947	36	98	0.33	14,500	0.7	7.3	66.6	1,510	53,167	0.011	0.40
14	**Newark Leadership Academy**														
	Total Site Info	4.04	176,140	2518; 2519	24; 27	89	3.61	157,377	7.6	79.5	722.6	16,393	577,051	0.123	4.32

Summary of Existing Conditions

	Subwatershed/Site Name/Total Site Info/GI Practice	Area (ac)	Area (SF)	Block	Lot	I.C. %	I.C. Area (ac)	I.C. Area (SF)	Existing Annual Loads (Commercial) TP (lb/yr)	TN (lb/yr)	TSS (lb/yr)	Runoff Volumes from I.C. Water Quality Storm (1.25" over 2-hours) (cu.ft.)	Runoff Volumes from I.C. Annual (cu.ft.)	Runoff Volumes from I.C. Water Quality Storm (1.25" over 2-hours) (Mgal)	Runoff Volumes from I.C. Annual (Mgal)
15	**Wanda Upshaw Meditation Garden**														
	Total Site Info	0.02	2,508	285	42	40	0.06	1,003	0.1	1.3	11.5	261	9,198	0.002	0.07

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	Unit Cost ($/unit)	Unit	Total Cost ($)	I.C. Treated %
	ELIZABETH RIVER SUBWATERSHED	**9,400**	**0.22**	**0.245**	**41**	**18,550**	**0.70**				**$254,500**	**2.5%**
1	**14th Avenue Community Garden**											
	Stormwater planter	320	0.01	0.008	1	630	0.02	80	$375	SF	$30,000	457.1%
	Total Site Info	**320**	**0.01**	**0.008**	**1**	**630**	**0.02**				**$30,000**	**457.1%**
2	**Ivy Hill Park**											
	Bioretention system	2,000	0.05	0.052	9	3,950	0.15	650	$5	SF	$3,250	1.5%
	Pervious pavement	6,000	0.14	0.156	26	11,840	0.45	4,800	$25	SF	$120,000	4.5%
	Total Site Info	**8,000**	**0.18**	**0.208**	**35**	**15,790**	**0.60**				**$123,250**	**6.0%**
	PASSAIC RIVER SUBWATERSHED	**77,810**	**1.79**	**2.027**	**339**	**152,045**	**5.71**				**$1,368,525**	**9.3%**
3	**Hawkins Street & Horatio Street Apartments**											
	Bioretention system	8,800	0.20	0.229	38	17,370	0.65	2,200	$5	SF	$11,000	3.1%
	Pervious pavement	15,800	0.36	0.412	69	31,190	1.17	3,000	$25	SF	$75,000	5.5%
	Stormwater planters	5,680	0.13	0.148	25	11,210	0.42	1,420	$375	SF	$532,500	2.0%
	Total Site Info	**30,280**	**0.70**	**0.789**	**132**	**59,770**	**2.24**				**$618,500**	**10.6%**
4	**John F. Kennedy School**											
	Rainwater harvesting	255	0.01	0.007	1	200	0.01	200	$2	gal	$400	0.6%
	Total Site Info	**255**	**0.01**	**0.007**	**1**	**200**	**0.01**				**$400**	**0.6%**
5	**NJCRI AIDS Research Remembrance Garden**											
	Pervious pavement	9,000	0.21	0.234	39	17,770	0.67	1,760	$25	SF	$44,000	39.1%
	Rainwater harvesting	675	0.02	0.018	3	550	0.02	550	$2	gal	$1,100	2.9%
	Total Site Info	**9,675**	**0.22**	**0.252**	**42**	**18,320**	**0.69**				**$45,100**	**42.1%**
6	**North Star Academy Elementary School 4**											
	Pervious pavement	23,100	0.53	0.602	101	45,600	1.71	7,000	$25	SF	$175,000	27.1%
	Stormwater planter	400	0.01	0.010	2	790	0.03	100	$375	SF	$37,500	0.5%
	Total Site Info	**23,500**	**0.54**	**0.612**	**103**	**46,390**	**1.74**				**$212,500**	**27.6%**
7	**Riverfront Park**											
	Bioretention system	800	0.02	0.021	3	1,580	0.06	200	$5	SF	$1,000	0.2%
	Stormwater planter	2,400	0.06	0.063	10	4,730	0.18	600	$375	SF	$225,000	0.7%
	Total Site Info	**3,200**	**0.07**	**0.083**	**14**	**6,310**	**0.24**				**$226,000**	**0.9%**
8	**Traffic Triangle at Market, Mott, and Ferry Streets**											
	Stormwater planter	2,550	0.06	0.066	11	5,030	0.19	650	$375	SF	$243,750	12.3%
	Total Site Info	**2,550**	**0.06**	**0.066**	**11**	**5,030**	**0.19**				**$243,750**	**12.3%**

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	Unit Cost ($/unit)	Unit	Total Cost ($)	I.C. Treated %
9	**Urban Leage of Essex County**											
	Bioretention systems	400	0.01	0.010	2	790	0.03	100	$5	SF	$500	1.7%
	Pervious pavement	3,500	0.08	0.091	15	6,910	0.26	640	$25	SF	$16,000	14.8%
	Rainwater harvesting	400	0.01	0.010	2	325	0.01	325	$2	gal	$650	1.7%
	Total Site Info	**4,300**	**0.10**	**0.112**	**19**	**8,025**	**0.30**				**$17,150**	**18.1%**
10	**Washington Park**											
	Bioretention systems	4,050	0.09	0.106	18	8,000	0.30	1,025	$5	SF	$5,125	27.7%
	Total Site Info	**4,050**	**0.09**	**0.106**	**18**	**8,000**	**0.30**				**$5,125**	**27.7%**
	NEWARK AIRPORT PERIPHERAL DITCH	**40,780**	**0.94**	**1.047**	**177**	**79,310**	**2.99**				**$453,100**	**6.3%**
11	**Central High School**											
	Pervious pavement	6,000	0.14	0.156	26	11,840	0.45	1,550	$25	SF	$38,750	2.5%
	Stormwater planters	1,080	0.02	0.028	5	2,130	0.08	270	$375	SF	$101,250	0.5%
	Total Site Info	**1,080**	**0.02**	**0.028**	**5**	**2,130**	**0.08**				**$101,250**	**0.5%**
12	**Kretchmer Homes**											
	Bioretention systems	2,100	0.05	0.055	9	4,140	0.16	520	$5	SF	$2,600	0.9%
	Stormwater planter	520	0.01	0.014	2	1,020	0.04	130	$375	SF	$48,750	0.2%
	Total Site Info	**2,100**	**0.05**	**0.055**	**9**	**4,140**	**0.16**				**$2,600**	**0.9%**
13	**Mediterranean Manor**											
	Planter boxes	600	0.01	n/a	2	n/a	n/a	3	$1,000	box	$3,000	4.1%
	Stormwater planter	400	0.01	0.010	2	790	0.03	100	$375	SF	$37,500	2.8%
	Total Site Info	**1,000**	**0.02**	**0.010**	**4**	**790**	**0.03**				**$40,500**	**6.9%**
14	**Newark Leadership Academy**											
	Pervious pavement	35,000	0.80	0.912	153	69,090	2.60	6,350	$25	SF	$158,750	22.2%
	Stormwater planters	1,200	0.03	0.031	5	2,370	0.09	300	$375	SF	$112,500	0.8%
	Total Site Info	**36,200**	**0.83**	**0.943**	**158**	**71,460**	**2.69**				**$271,250**	**23.0%**
15	**Wanda Upshaw Meditation Garden**											
	Stormwater planter	400	0.01	0.010	2	790	0.03	100	$375	SF	$37,500	15.9%
	Total Site Info	**400**	**0.01**	**0.010**	**2**	**790**	**0.03**				**$37,500**	**15.9%**

Draft

Impervious Cover Reduction Action Plan for Newark, Essex County, New Jersey – Volume 4

Prepared for the City of Newark by the Rutgers Cooperative Extension Water Resources Program

April 16, 2018

Table of Contents

Introduction

Located in Essex County in northern New Jersey, Newark covers approximately 26.22 square miles. Figures 1 and 2 illustrate that Newark is dominated by urban land uses. A total of 86.8% of the municipality's land use is classified as urban. Of the urban land in Newark, high 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 Newark 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 Newark. Based upon the 2012 NJDEP land use/land cover data, approximately 63.2% of Newark has impervious cover. This level of impervious cover suggests that the streams in Newark are likely non-supporting streams. [1]

Methodology

Newark 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.

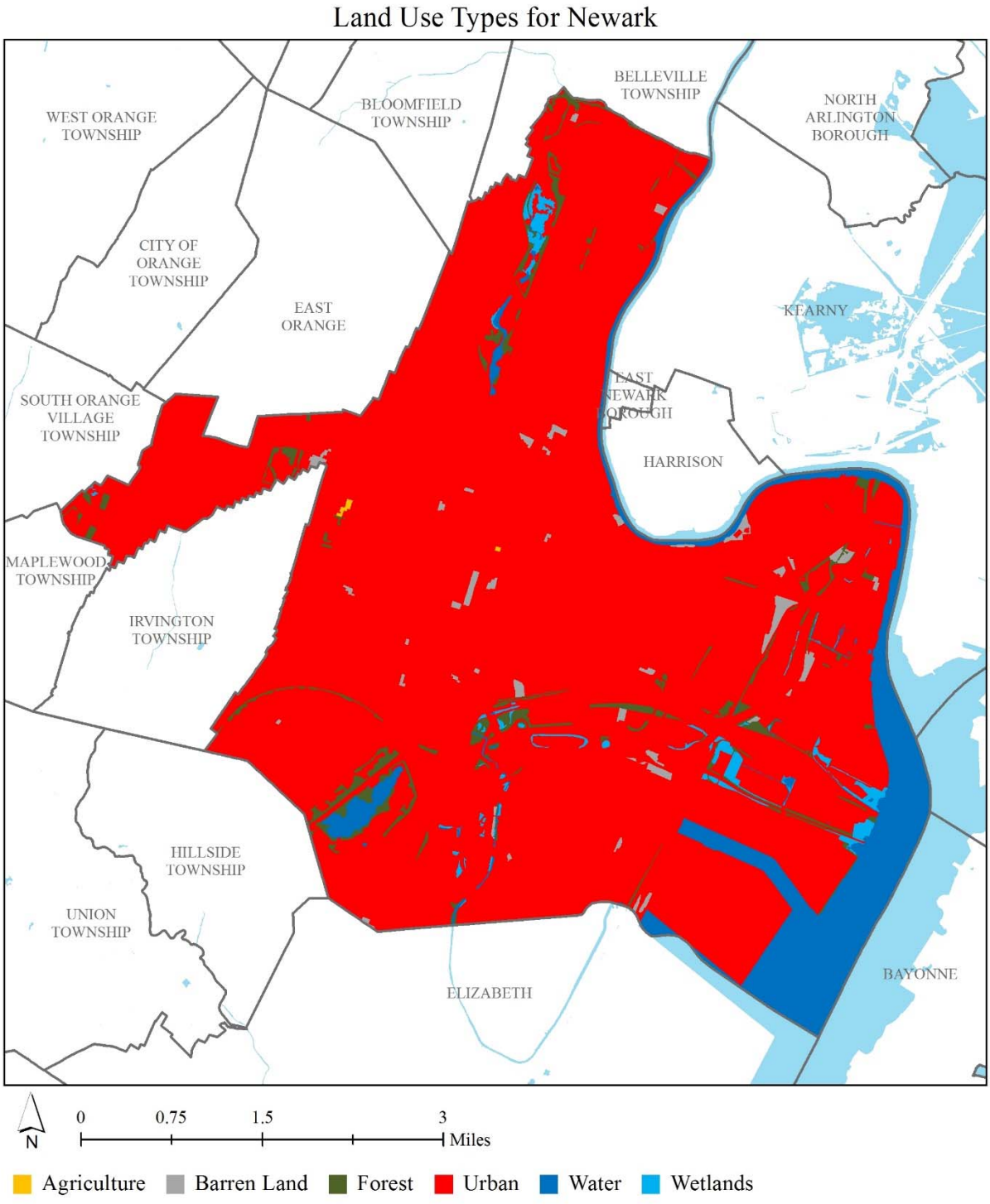


Figure 1: Map illustrating the land use in Newark

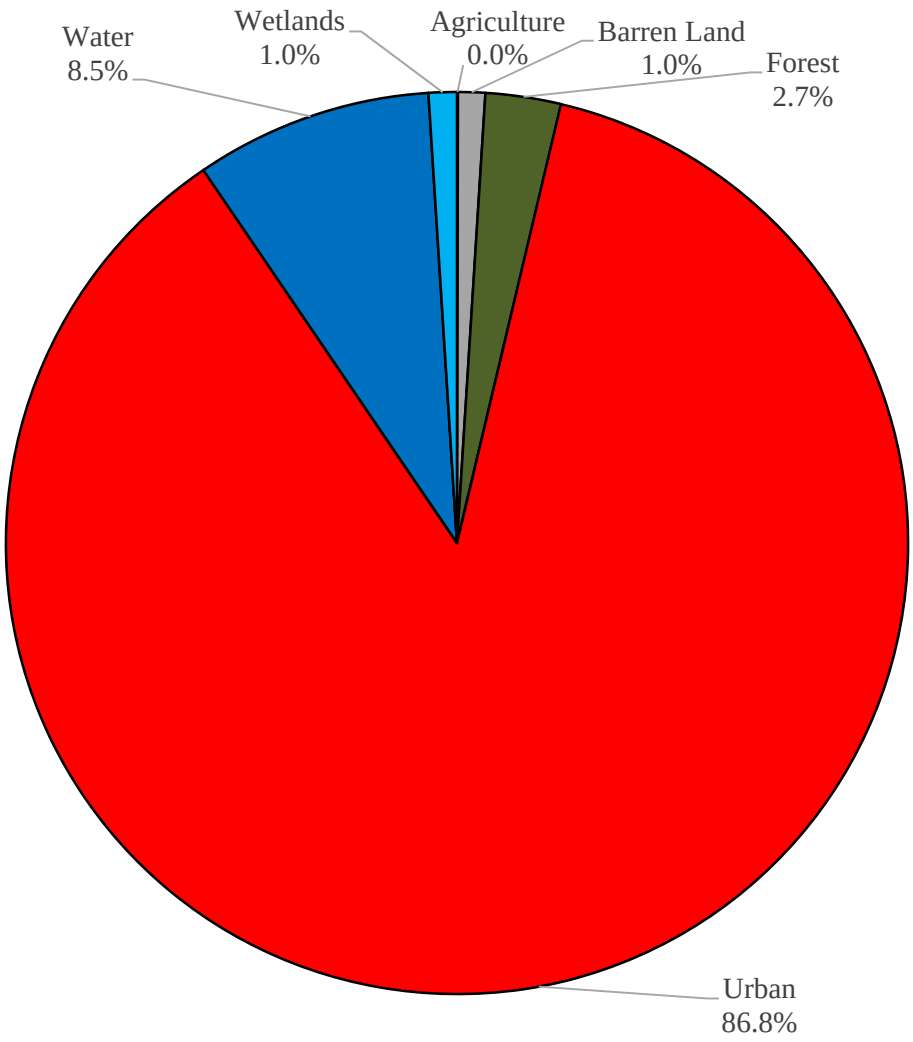


Figure 2: Pie chart illustrating the land use in Newark

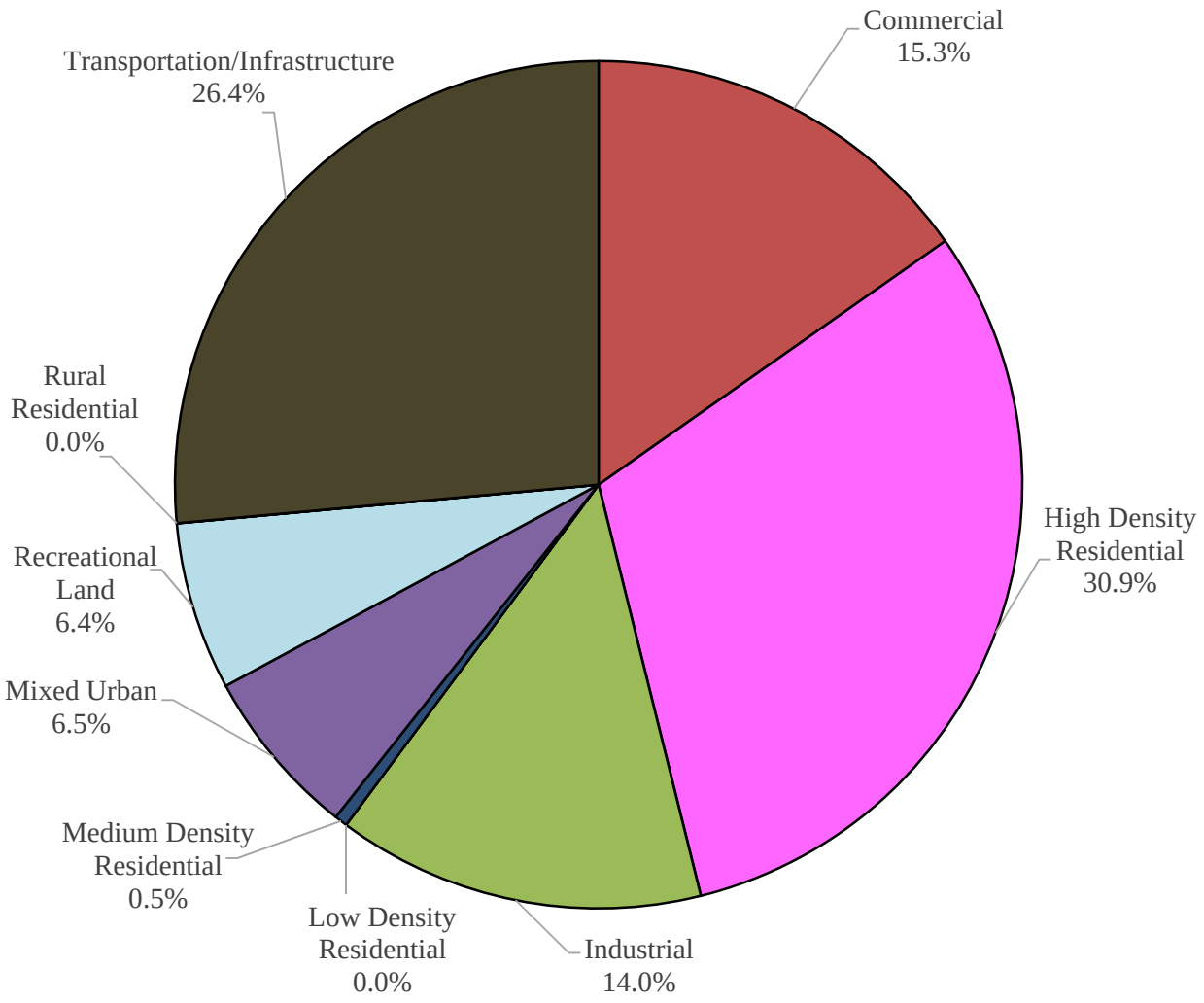


Figure 3: Pie chart illustrating the various types of urban land use in Newark

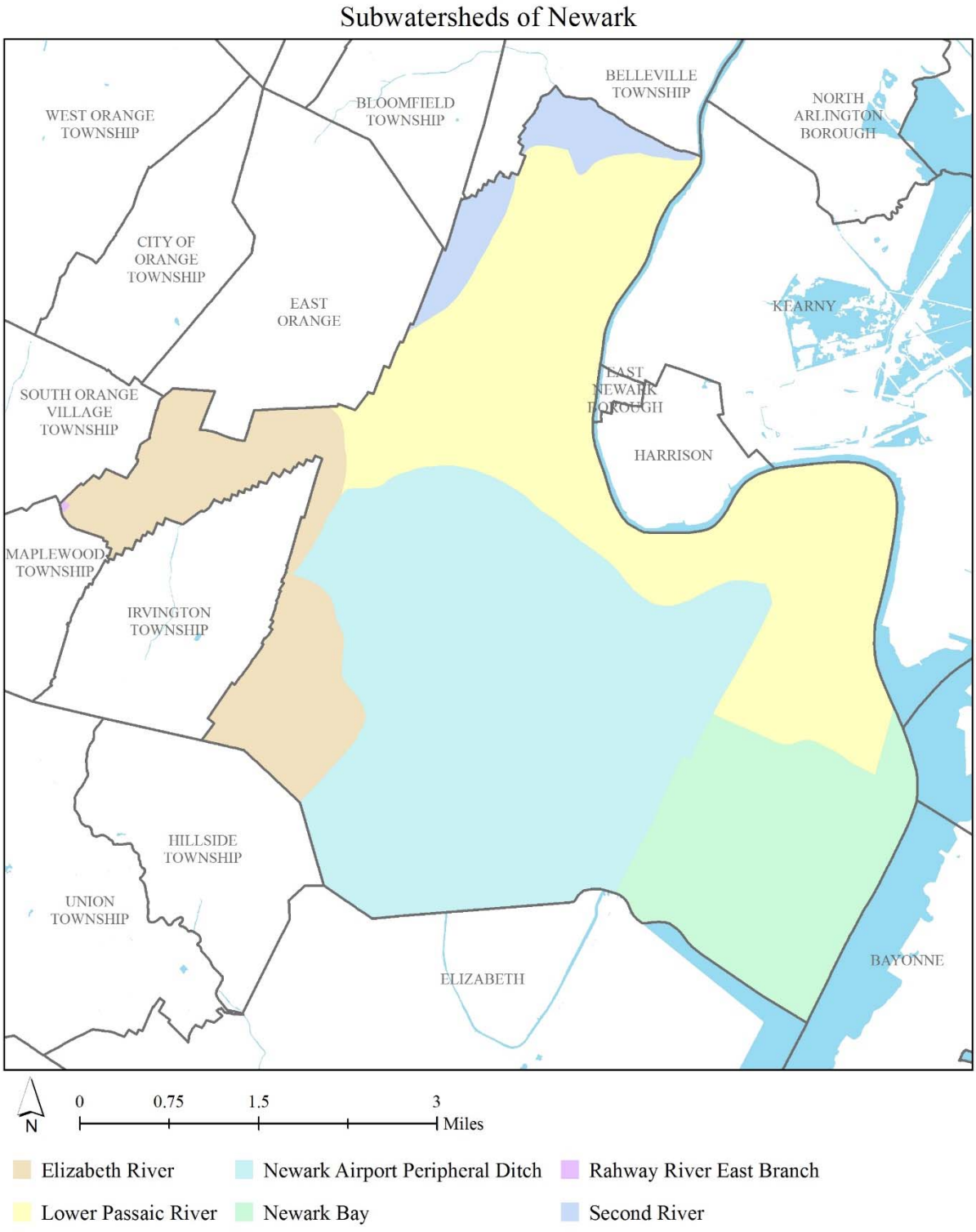


Figure 4: Map of the subwatersheds in Newark

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 Newark 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 Newark. 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

Appendix A contains information on potential project sites where green infrastructure practices could be installed as well as information on existing site conditions. The recommended green infrastructure practices and the drainage area that the green infrastructure practices can treat are identified for each potential project site. For each practice, the recharge potential, TSS removal potential, maximum volume reduction potential per storm, the peak reduction potential, and estimated costs 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

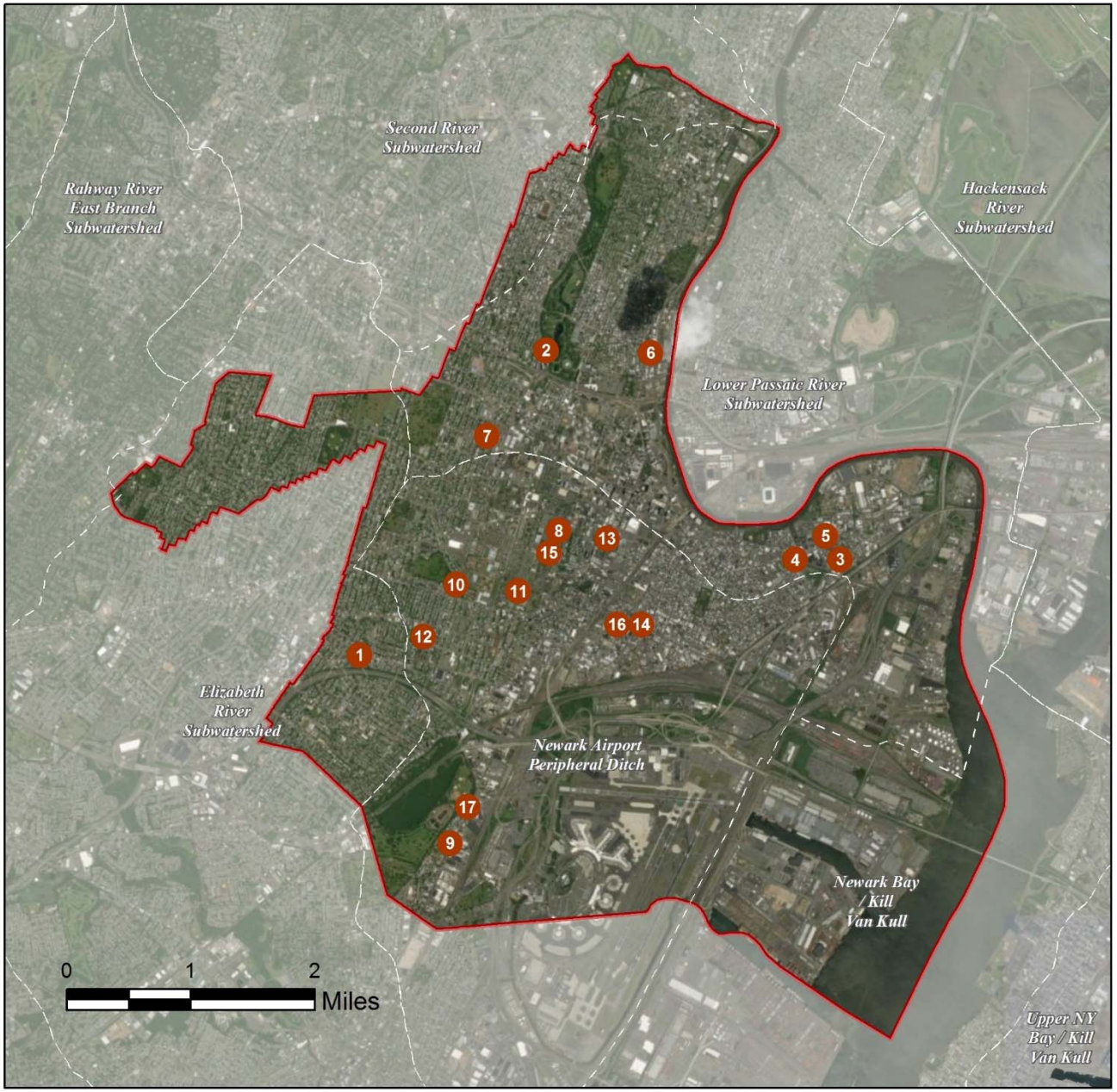
This impervious cover reduction action plan is meant to provide the municipality with a blueprint for implementing green infrastructure practices that will reduce the impact of stormwater runoff from impervious surfaces. These projects can be implemented by a wide variety of people such as boy scouts, 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.

Appendix A: Climate Resilient Green Infrastructure

a. Green Infrastructure Sites

NEWARK: GREEN INFRASTRUCTURE SITES - VOLUME 4



SITES WITHIN THE ELIZABETH RIVER SUBWATERSHED

1. Hawthorne Hawks Healthy Harvest Farm

SITES WITHIN THE LOWER PASSAIC RIVER SUBWATERSHED

2. 241 First Street
3. Christie Street
4. Down Bottom Farm Market & Garden
5. Hawkins Street School
6. Mount Pleasant Avenue Neighborhood
7. Rutgers School of Health Professions Vacant Lot

SITES WITHIN THE NEWARK AIRPORT PERIPHERAL DITCH SUBWATERSHED

8. Court Street Urban Farm
9. Foster Street
10. James C White Manor Senior Housing Community Garden
11. Jesse Allen Park
12. Mildred Helms Park
13. Newark Educators Community Charter School
14. Pennington Court Housing
15. Quitman Street Community School
16. South Street Academy
17. Traffic Triangle at Dayton Street and Frelinghuysen Avenue

b. Proposed Green Infrastructure Concepts

Hawthorne Hawks Healthy Harvest Farm

Subwatershed: **Elizabeth River**

Site Area: **109,482 sq. ft.**

Address: **446 Hawthorne Avenue Newark, NJ 07112**

Block and Lot: **Block 3058, Lots 1, 2, 4, 6-10, 12-14, 16, 17, 18, 20, 21, 27, 28, 30, 32- 43, 45, 47**

Stormwater planters can be installed along the southwest corner of the block to capture, treat, and infiltrate stormwater runoff from the street. The plants can also serve as pollinator plants which will draw more pollinators to the farm. 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"
5	5,474	0.3	2.8	25.1	0.004	0.15

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Stormwater planters	0.031	5	2,266	0.09	300	$112,500

GREEN INFRASTRUCTURE RECOMMENDATIONS

Hawthorne Hawks
Healthy Harvest Farm

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

0 30' 60'

241 First Street

Subwatershed: **Lower Passaic River**

Site Area: **483 sq. ft.**

Address: **241 First Street**
Newark, NJ 07107

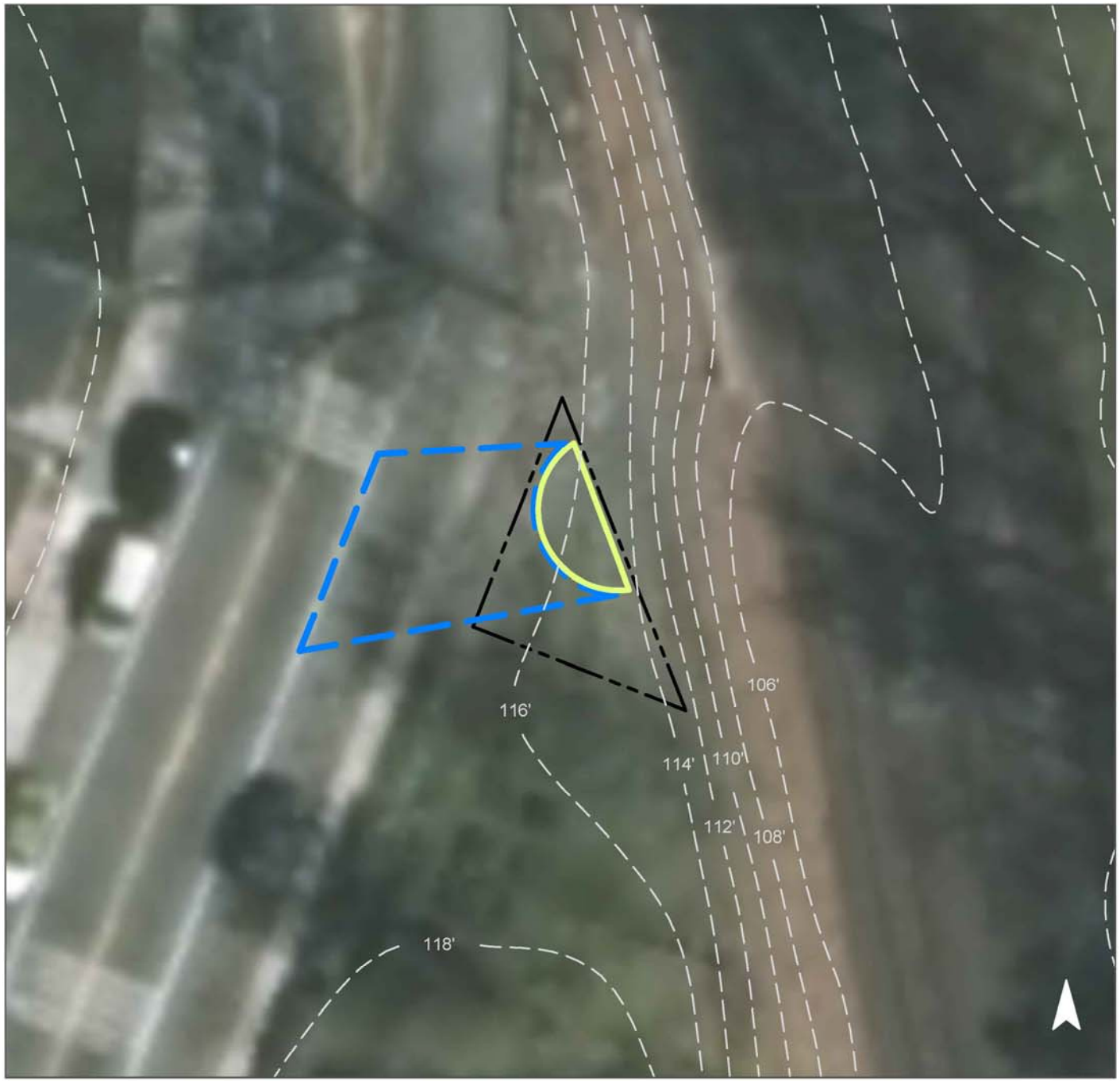
Block and Lot: **Block 1913.01, Lot 49**

A rain garden can be installed to capture, treat, and infiltrate stormwater runoff from the road. 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"
40	193	0.0	0.1	0.9	0.000	0.01

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention system	0.013	2	942	0.04	125	$625

GREEN INFRASTRUCTURE RECOMMENDATIONS



241 First Street

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

0 10' 20'

Christie Street

Subwatershed: **Lower Passaic River**

Site Area: **77,355 sq. ft.**

Address: **168 Christie Street**
Newark, NJ 07105

Block and Lot: **Block N/A, Lot N/A**

Stormwater planters can be installed at various locations along the street to capture, treat, and infiltrate stormwater runoff from the street. 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"
98	75,729	3.7	38.2	347.7	0.059	2.08

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
Stormwater planter	0.052	9	3,777	0.14	400	$150,000

GREEN INFRASTRUCTURE RECOMMENDATIONS

Christie Street

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

0 30' 60'

Down Bottom Farm Market & Garden

Subwatershed: Lower Passaic River

Site Area: 61,953 sq. ft.

Address: 377 Ferry Street
Newark, NJ 07105

Block and Lot: Block 2487, Lot 1.02

A cistern can be installed to capture stormwater runoff from the top of the shipping container on site and the water can then be used for irrigation, washing vehicles, or other non-potable purposes. A stormwater planter can be installed in the sidewalk to capture, treat, and infiltrate stormwater runoff from the road. 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"
93	57,657	2.8	29.1	264.7	0.045	1.58

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
Rainwater harvesting	0.010	2	500	0.03	500 (gal)	$1,000
Stormwater planter	0.010	2	755	0.03	100	$37,500

GREEN INFRASTRUCTURE RECOMMENDATIONS

Down Bottom Farmers Market & Garden

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

0 20' 40'

Hawkins Street School

Subwatershed: Lower Passaic River

Site Area: 68,803 sq. ft.

Address: 8 Hawkins Street
Newark, NJ 07105

Block and Lot: Block 2483, Lot 1, 4, 5, 6, 7, 8, 12

A rain garden can be installed to capture, treat, and infiltrate stormwater runoff from the roof. A cistern can be installed to capture stormwater runoff from the roof of the shed and the water can then be used for washing vehicles or other non-potable purposes. 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"
90	61,880	3.0	31.3	284.1	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 system	0.044	7	3,209	0.12	425	$2,125
Rainwater harvesting	0.021	3	325	0.06	625 (gal)	$1,250

GREEN INFRASTRUCTURE RECOMMENDATIONS

Hawkins Street School

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

0 30' 60'

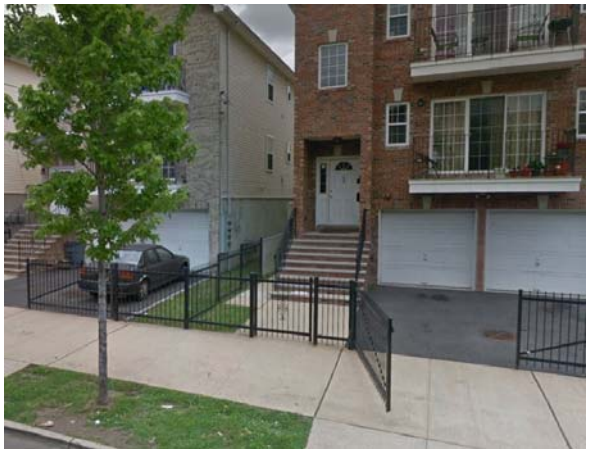
Mount Pleasant Avenue Neighborhood

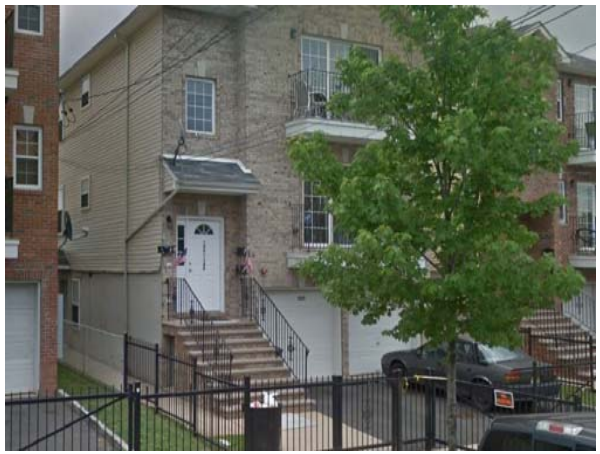
Subwatershed: Lower Passaic River

Site Area: 36,301 sq. ft.

Address: 147 Mount Pleasant Avenue
Newark, NJ 07104

Block and Lot: Block N/A, Lot N/A



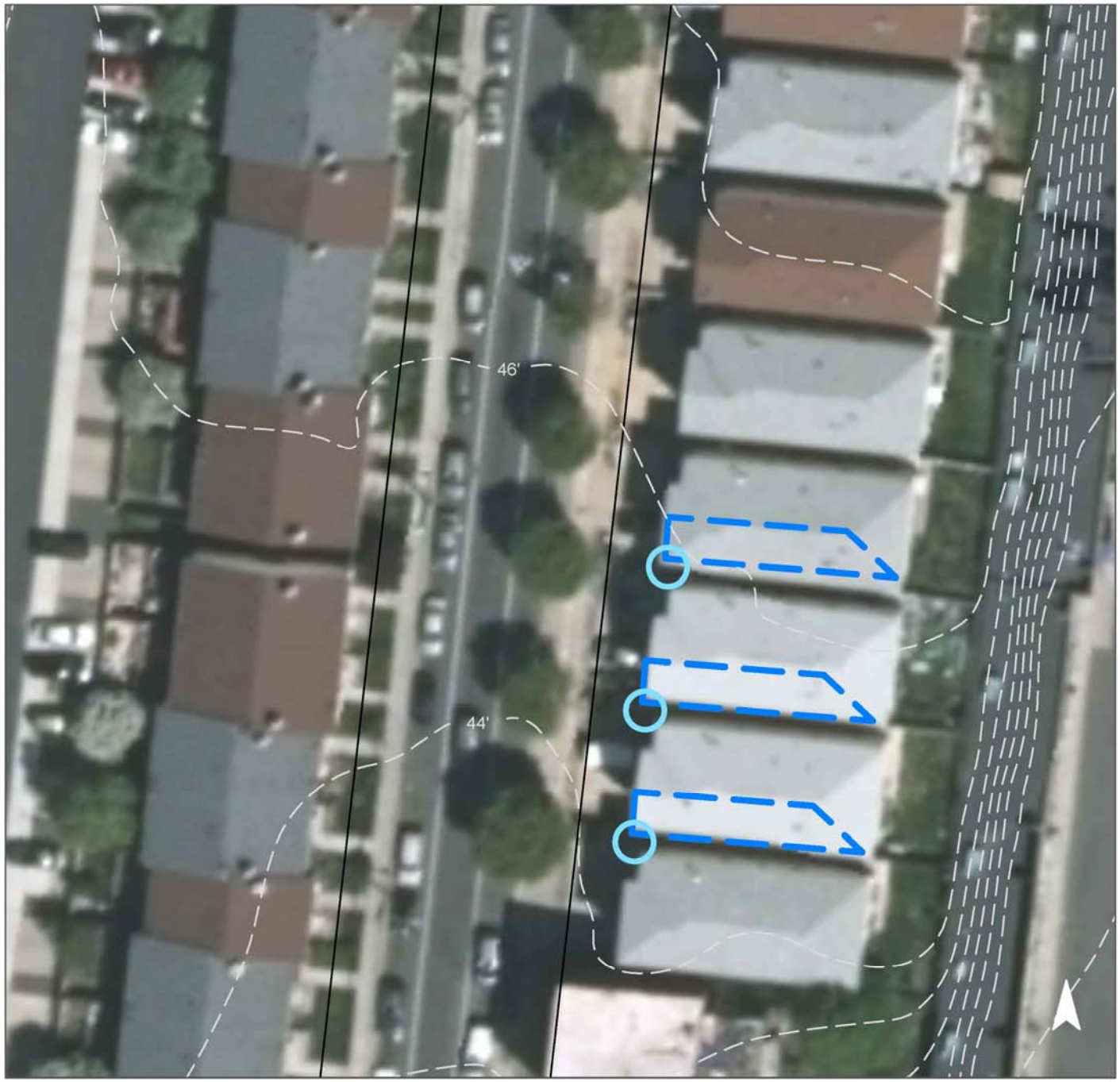


Cisterns can be installed to capture rooftop stormwater runoff from homes along the street. This water can then be used to wash cars, water lawns, and for other non-potable purposes. A preliminary soil assessment suggests that more soil testing would be required before determining the soil's suitability 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"
81	29,302	1.4	14.8	134.5	0.023	0.80

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Rainwater harvesting	0.047	8	1,500	0.13	1,500 (gal)	$3,000

GREEN INFRASTRUCTURE RECOMMENDATIONS



Mount Pleasant Avenue Neighborhood

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

0 20' 40'

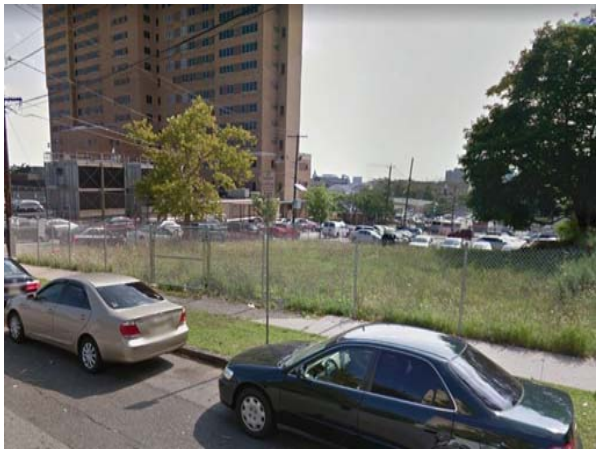
Rutgers School of Health Professions Vacant Lot

Subwatershed: Lower Passaic River

Site Area: 9,829 sq. ft.

Address: 115 12th Avenue
Newark, NJ 07103

Block and Lot: Block 259, Lot 21

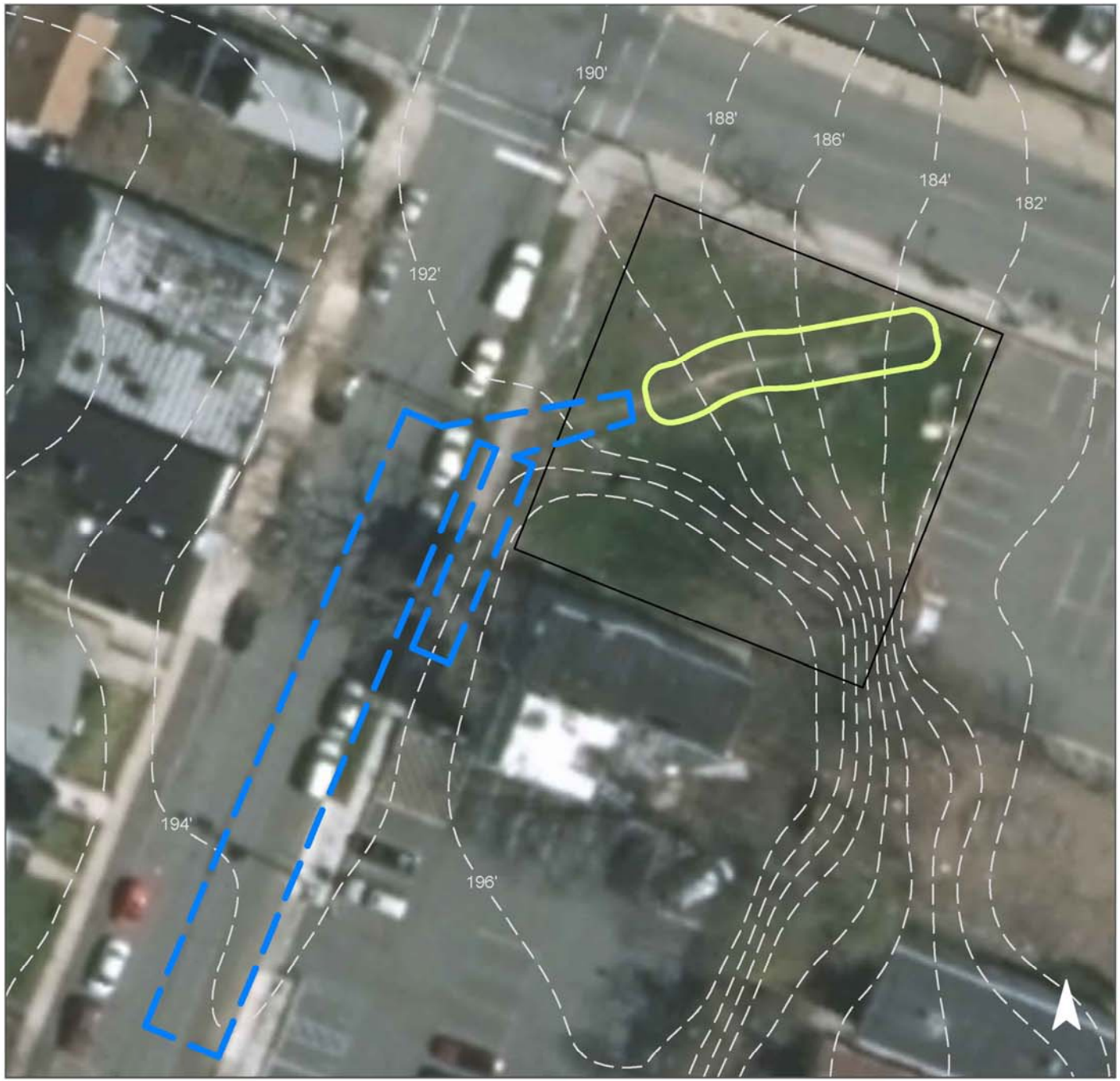


A tiered rain garden can be installed to capture, treat, and infiltrate stormwater runoff from the street. Currently the runoff sheet flows over the empty lot. A preliminary soil assessment suggests that more soil testing would be required before determining the soil's suitability for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
75	7,372	0.4	3.7	33.8	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 system	0.119	20	8.639	0.33	1,145	$5,725

GREEN INFRASTRUCTURE RECOMMENDATIONS



Rutgers School of Health Professions Vacant Lot

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

0 20' 40'

Court Street Urban Farm

Subwatershed: Newark Airport Peripheral Ditch

Site Area: 61,752 sq. ft.

Address: 138 Court Street
Newark, NJ 07103

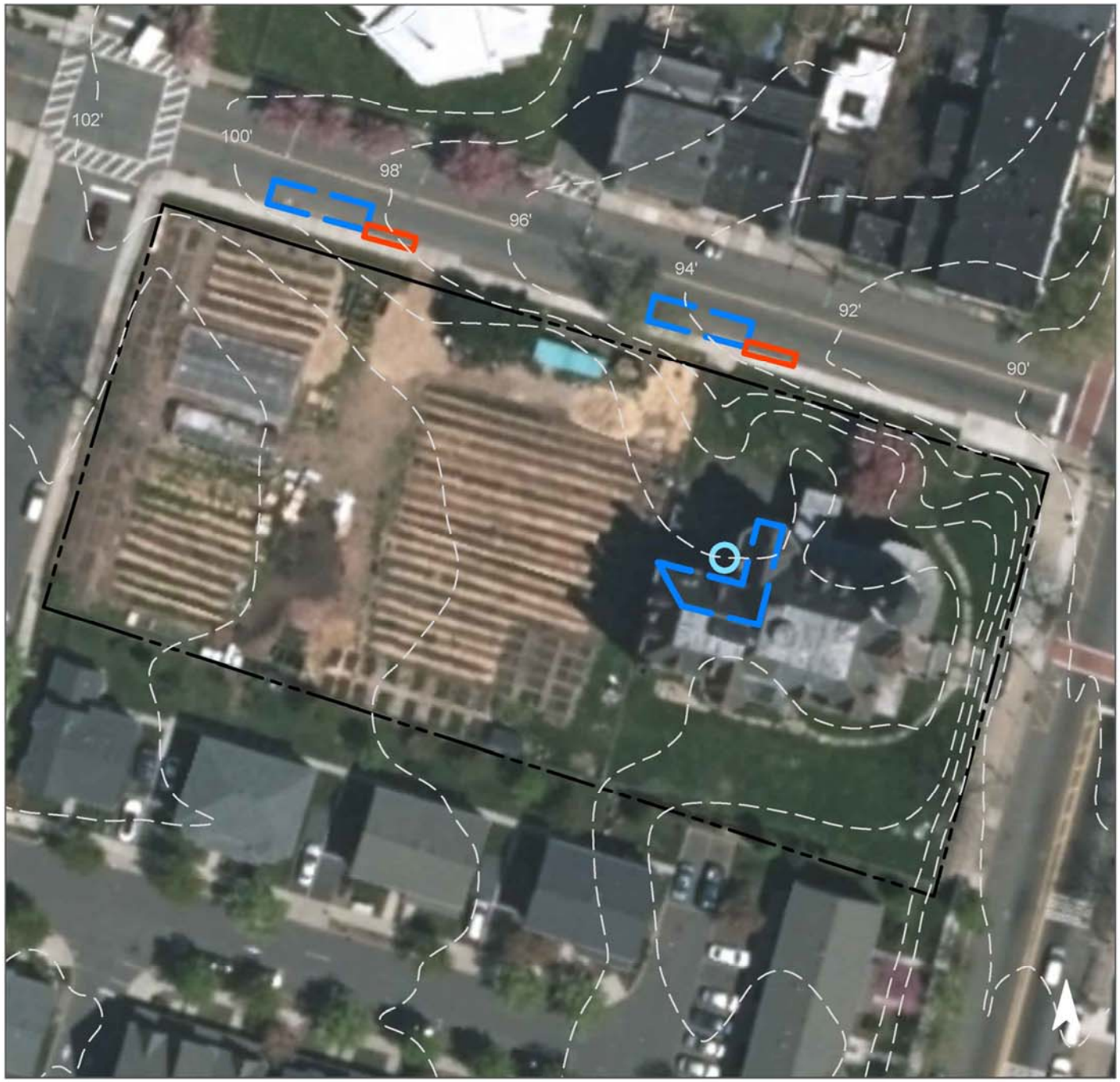
Block and Lot: Block 2508, Lots 18, 19, 20, 21, 22, 29, 34, 43, 46, 47, 52

A cistern can be installed on the building to capture stormwater runoff from the roof. The water can then be used for watering the farm or other non-potable uses. 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"
28	17,356	0.8	8.8	79.7	0.014	0.48

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
Rainwater harvesting	0.021	3	625	0.06	625 (gal)	$1,250
Stormwater planters	0.021	3	1,511	0.06	200	$75,000

GREEN INFRASTRUCTURE RECOMMENDATIONS



Court Street Urban Farm

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

0 30' 60'

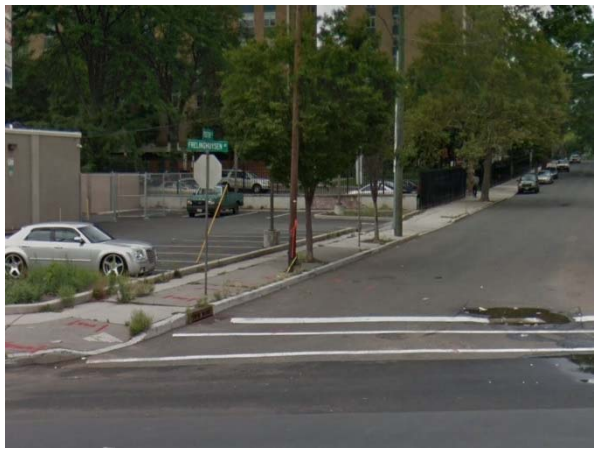
Foster Street

Subwatershed: Newark Airport Peripheral Ditch

Site Area: 34,429 sq. ft.

Address: 1 Foster Street
Newark, NJ 07114

Block and Lot: Block 3745, Lot 27

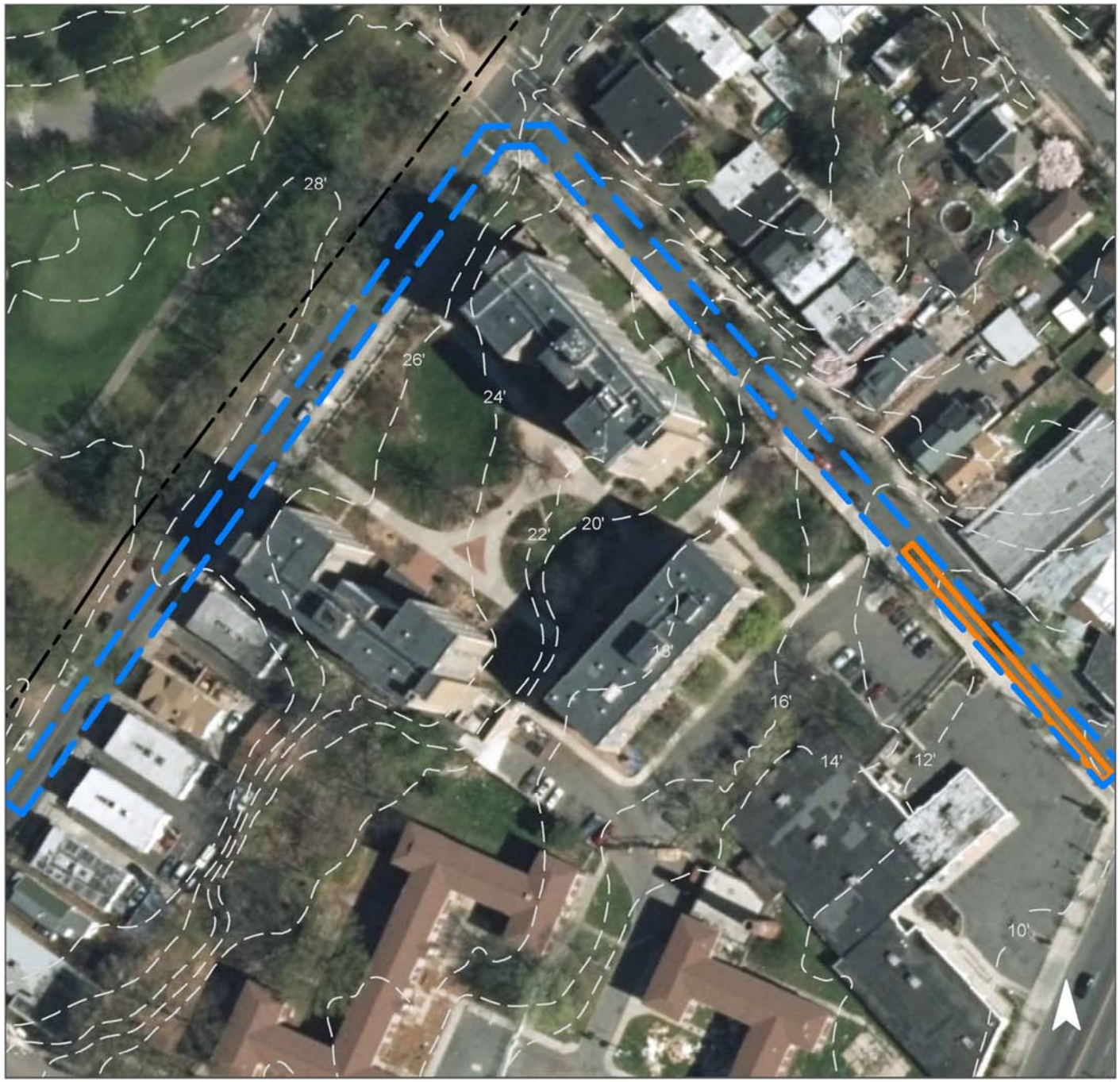


A section of parking spaces on the side of the road can be converted to pervious pavement to capture and infiltrate stormwater runoff from the surrounding road. A preliminary soil assessment suggests that more soil testing would be required before determining the soil's suitability for green infrastructure.

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"
93	31,869	1.5	16.1	146.3	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
Pervious pavement	0.756	126	54,724	2.06	16,000	$400,000

GREEN INFRASTRUCTURE RECOMMENDATIONS



Foster Street

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

0 50' 100'

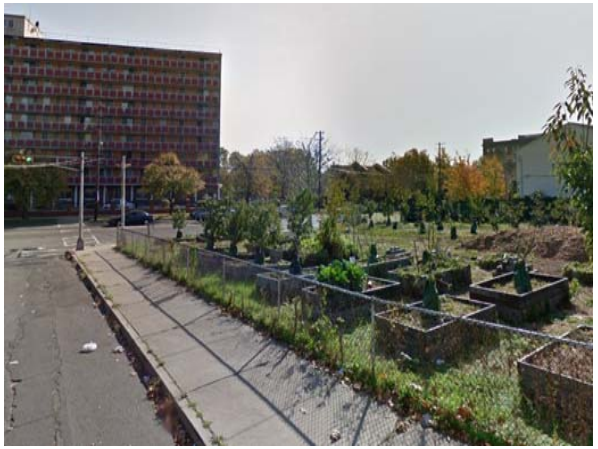
James C. White Manor Senior Housing Community Garden

Subwatershed: Newark Airport Peripheral Ditch

Site Area: 10,028 sq. ft.

Address: 517 Bergen Street
Newark, NJ 07108

Block and Lot: Block 2658, Lots 1, 3, 4, 47



A stormwater planter can be installed in the sidewalk to capture, treat, and infiltrate stormwater runoff from the street. 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	3,510	0.2	1.8	16.1	0.003	0.10

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
Stormwater planter	0.010	2	755	0.03	100	$37,500

GREEN INFRASTRUCTURE RECOMMENDATIONS

James C. White Manor Senior Housing Community Garden

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

0 20' 40'

Jesse Allen Park

Subwatershed: Newark Airport Peripheral Ditch

Site Area: 345,452 sq. ft.

Address: 86 Muhammad Ali Avenue
Newark, NJ 07108

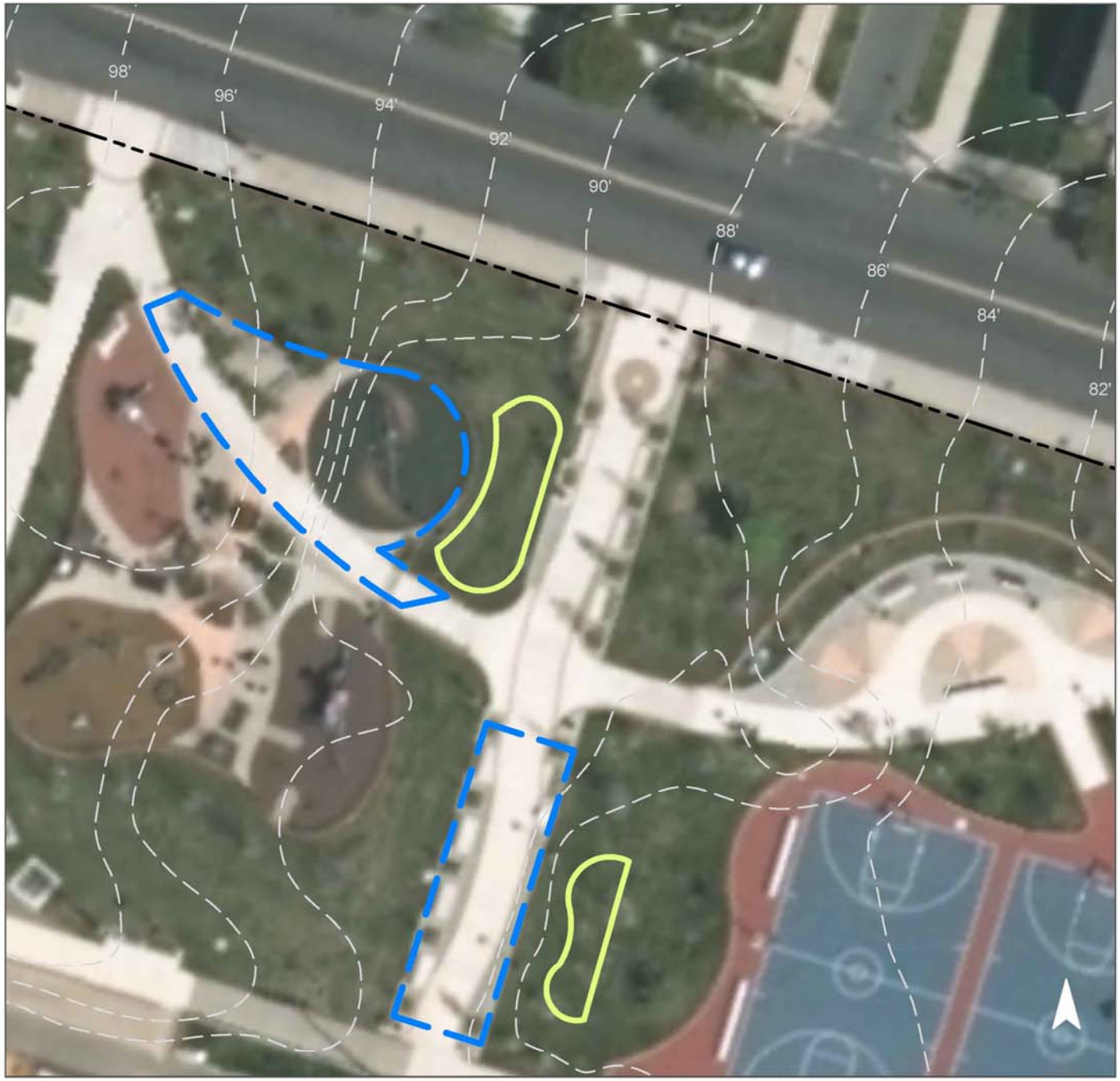
Block and Lot: Block 2583, Lot 44

Rain gardens can be installed in the turfgrass areas to capture, treat, and infiltrate the stormwater runoff from the sidewalks in the park. 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"
18	62,362	3.0	31.5	286.3	0.049	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	0.135	23	9,814	0.37	1,300	$6,500

GREEN INFRASTRUCTURE RECOMMENDATIONS



Jesse Allen Park

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

0 X' X'

Mildred Helms Park

Subwatershed: Newark Airport Peripheral Ditch

Site Area: 137,908 sq. ft.

Address: 534 Clinton Avenue
Newark, NJ 07108

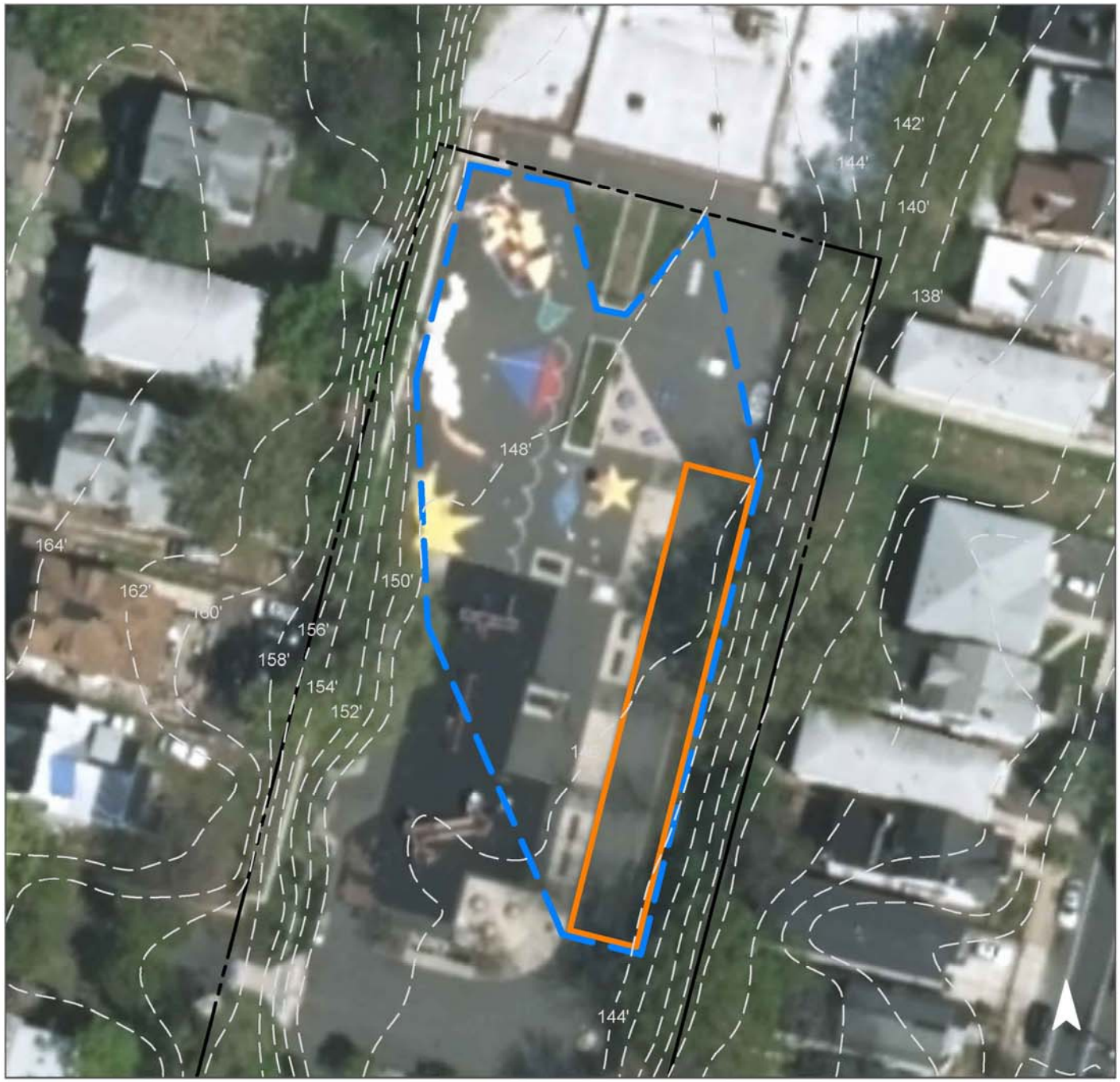
Block and Lot: Block 3024, Lot 99

A section of the paved area within the park can be converted to porous pavement to capture and infiltrate stormwater runoff from the playground area. 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"
40	55,164	2.7	27.9	253.3	0.043	1.51

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	0.511	85	36,989	1.39	3,500	$87,500

GREEN INFRASTRUCTURE RECOMMENDATIONS



Mildred Helms Park

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

0 25' 50'

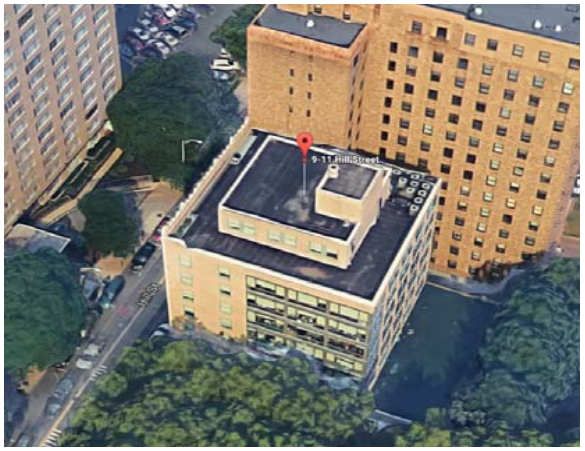
Newark Educators Community Charter School

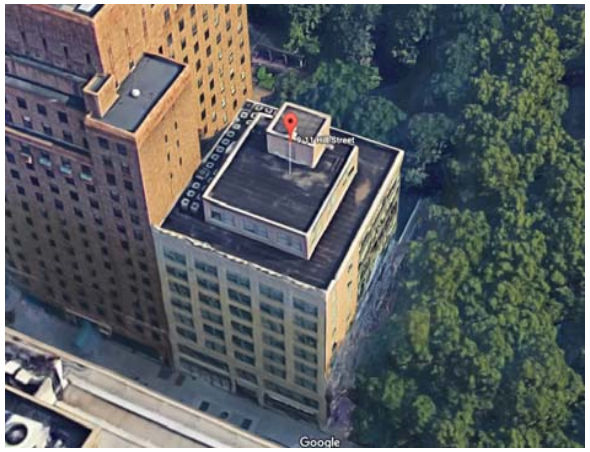
Subwatershed: Newark Airport Peripheral Ditch

Site Area: 9,216 sq. ft.

Address: 9-11 Hill Street
Newark, NJ 07102

Block and Lot: Block 93, Lot 44



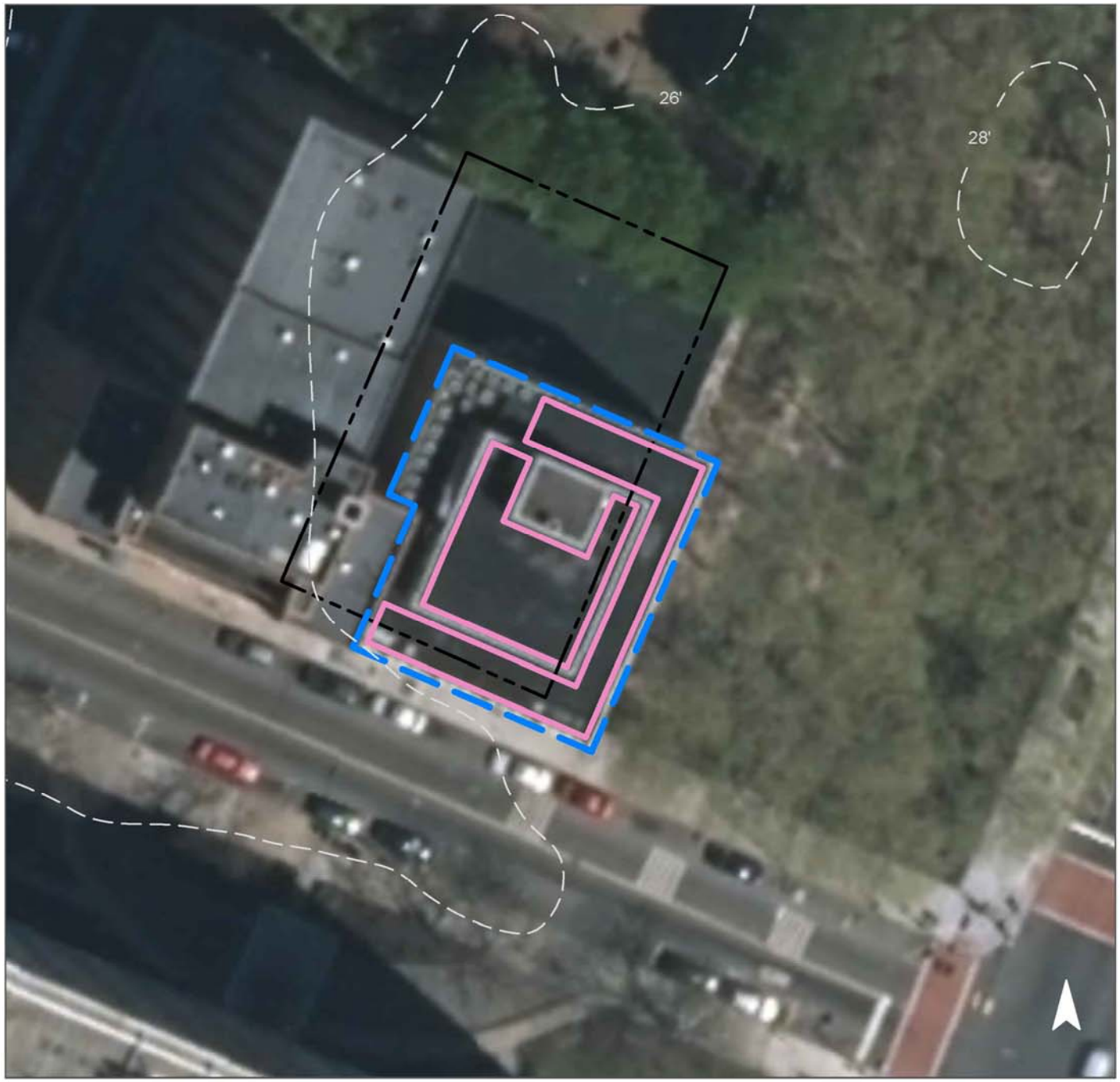


A green roof can be installed on the roof to capture stormwater on the roof and serve as a demonstration project. A preliminary soil assessment suggests that more soil testing would be required before determining the soil's suitability for green infrastructure.

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"
85	7,833	0.4	4.0	36.0	0.006	0.21

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
Green roof	0.156	26	11,796	0.52	3,145	$142,248.35

GREEN INFRASTRUCTURE RECOMMENDATIONS



Newark Educators Community Charter School

- green roof
- drainage area
- property line
- 2015 Aerial: NJOIT, OGIS

0 20' 40'

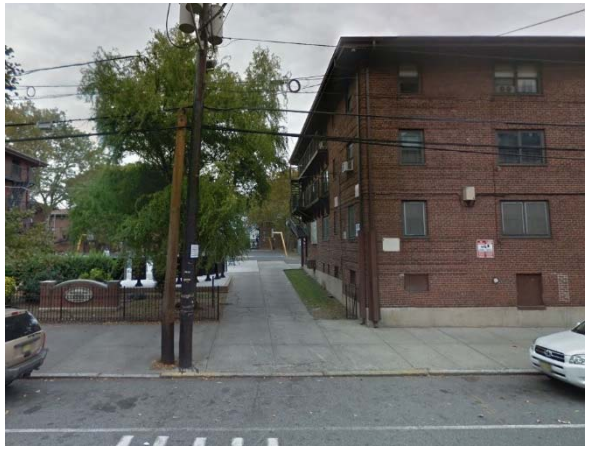
Pennington Court Housing

Subwatershed: Newark Airport Peripheral Ditch

Site Area: 199,406 sq. ft.

Address: 32 Dawson Street
Newark, NJ 07105

Block and Lot: Block 930; 931, Lot 1



A basketball court can be converted to pervious pavement to capture and infiltrate runoff from the roof of the building and the surrounding paved area. Rain gardens can be installed into depaved areas to capture, treat, and infiltrate stormwater runoff from the roof. 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"
95	189,436	9.1	95.7	869.8	0.148	5.20

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	0.041	7	2,947	0.11	395	$1,975
Pervious pavement	0.602	101	43,586	1.64	4,500	$112,500

GREEN INFRASTRUCTURE RECOMMENDATIONS

Pennington Court Housing

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

0 30' 60'

Quitman Street Community School

Subwatershed: Newark Airport Peripheral Ditch

Site Area: 280,811 sq. ft.

Address: 21 Quitman Street
Newark, NJ 07103

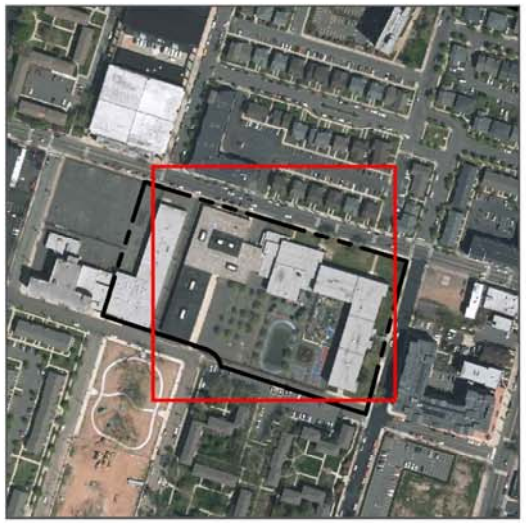
Block and Lot: Block 2531, Lot 1

A rain garden can be installed to capture, treat, and infiltrate stormwater runoff from the playground area. The track area can be converted to porous pavement to capture and infiltrate stormwater runoff from the surrounding paved area. 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"
87	245,181	11.8	123.8	1,125.7	0.191	6.72

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	0.022	4	1,623	0.06	215	$1,075
Pervious pavement	0.549	92	39,734	1.49	3,760	$94,000

GREEN INFRASTRUCTURE RECOMMENDATIONS



Quitman Street Community School

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

0 50' 100'

South Street Academy

Subwatershed: Newark Airport Peripheral Ditch

Site Area: 28,093 sq. ft.

Address: 151 South Street
Newark, NJ 07114

Block and Lot: Block 1163, Lot 1, 32

A rain garden can be installed to capture, treat, and infiltrate stormwater runoff from the roof. The basketball court can be converted to porous pavement to capture and infiltrate stormwater runoff from the roof and surrounding blacktop area. 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"
100	28,092	1.4	14.2	129.0	0.022	0.77

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	0.028	5	2,035	0.08	270	$1,350
Pervious pavement	0.197	33	14,249	0.54	3,400	$85,000

GREEN INFRASTRUCTURE RECOMMENDATIONS

South Street Academy

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

0 20' 40'

Traffic Triangle at Dayton Street and Frelinghuysen Avenue

Subwatershed: Newark Airport Peripheral Ditch

Site Area: 1,304 sq. ft.

Address: Dayton Street & Frelinhuysen Avenue Newark, NJ 07114

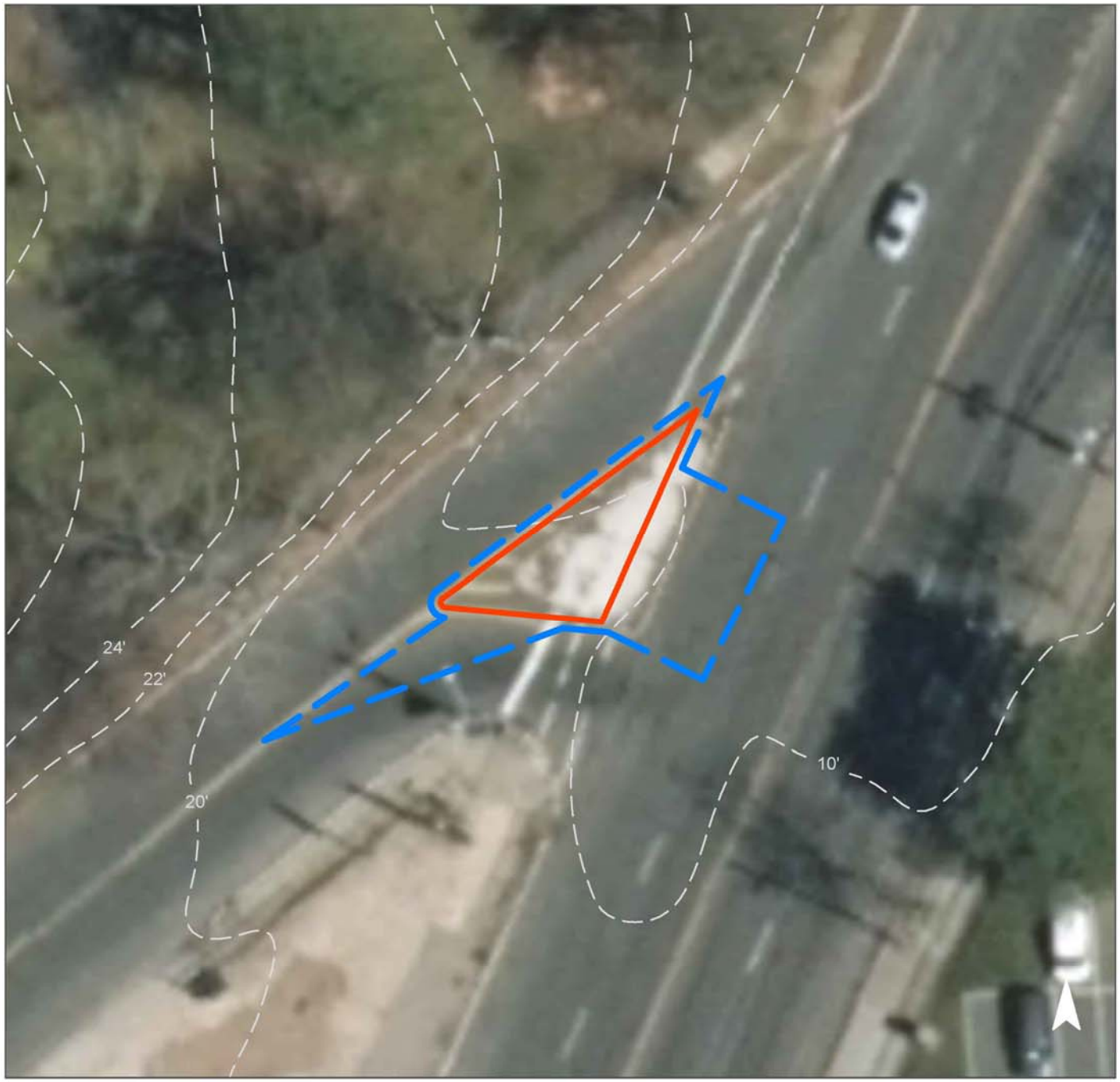
Block and Lot: Block N/A, Lot N/A

The triangle can be depaved and converted into a stormwater planter to capture, treat, and infiltrate stormwater runoff from the surrounding road. 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"
95	1,239	0.1	0.6	5.7	0.001	0.03

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
Stormwater planter	0.055	9	3,964	0.15	750	$281,250

GREEN INFRASTRUCTURE RECOMMENDATIONS



Traffic Triangle at Dayton Street and Frelinghuysen Avenue

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

0 15' 30'

c. Summary of Existing Conditions

Summary of Existing Conditions

	Subwatershed/Site Name/Total Site Info/GI Practice	Area (ac)	Area (SF)	Block	Lot	I.C. %	I.C. Area (ac)	I.C. Area (SF)	Existing Annual Loads (Commercial)			Runoff Volumes from I.C.		Runoff Volumes from I.C.	
									TP (lb/yr)	TN (lb/yr)	TSS (lb/yr)	Water Quality Storm (1.25" over 2-hours) (cu.ft.)	Annual (cu.ft.)	Water Quality Storm (1.25" over 2-hours) (Mgal)	Annual (Mgal)
	ELIZABETH RIVER SUBWATERSHED	**2.51**	**109,482**				**0.13**	**5,474**	**0.3**	**2.8**	**25.1**	**570**	**20,072**	**0.004**	**0.15**
1	**Hawthorne Hawks Healthy Harvest Farm**														
	Total Site Info	2.51	109,482	3058	,27,28,30,32	5	0.13	5,474	0.3	2.8	25.1	570	20,072	0.004	0.15
	LOWER PASSAIC RIVER SUBWATERSHED	**6**	**254,724**				**5.33**	**232,133**	**11.2**	**117.2**	**1,065.8**	**24,180**	**851,153**	**0.181**	**6.37**
2	**241 First Street**														
	Total Site Info	0.01	483	1913.01	49	40	0.00	193	0.0	0.1	0.9	20	708	0.000	0.01
3	**Christie Street**														
	Total Site Info	1.78	77,355	N/A	N/A	98	1.74	75,729	3.7	38.2	347.7	7,888	277,673	0.059	2.08
4	**Down Bottom Farm Market & Garden**														
	Total Site Info	1.42	61,953	2487	1.02	93	1.32	57,657	2.8	29.1	264.7	6,006	211,408	0.045	1.58
5	**Hawkins Street School**														
	Total Site Info	1.58	68,803	2483	l,4,5,6,7,8,1	90	1.42	61,880	3.0	31.3	284.1	6,446	226,893	0.048	1.70
6	**Mount Pleasant Avenue Neighborhood**														
	Total Site Info	0.83	36,301	N/A	N/A	81	0.67	29,302	1.4	14.8	134.5	3,052	107,441	0.023	0.80
7	**Rutgers School of Health Professions Vacant Lot**														
	Total Site Info	0.23	9,829	259	21	75	0.17	7,372	0.4	3.7	33.8	768	27,031	0.006	0.20
	NEWARK AIRPORT PERIPHERAL DITCH SUBWAT	**25.45**	**1,108,399**				**14.74**	**642,043**	**31.0**	**324.3**	**2,947.9**	**66,879**	**2,354,156**	**0.500**	**17.61**
8	**Court Street Urban Farm**														
	Total Site Info	1.42	61,752	2508	1,22,29,34,4	28	0.40	17,356	0.8	8.8	79.7	1,808	63,640	0.014	0.48
9	**Foster Street**														
	Total Site Info	0.79	34,429	3745	27	93	0.73	31,869	1.5	16.1	146.3	3,320	116,853	0.025	0.87
10	**James C White Manor Senior Housing Community Garden**														
	Total Site Info	0.23	10,028	2658	1,3,4,47	35	0.08	3,510	0.2	1.8	16.1	366	12,870	0.003	0.10
11	**Jesse Allen Park**														
	Total Site Info	7.93	345,452	2583	44	18	1.43	62,362	3.0	31.5	286.3	6,496	228,660	0.049	1.71
12	**Mildred Helms Park**														
	Total Site Info	3.17	137,908	3024	99	40	1.27	55,164	2.7	27.9	253.3	5,746	202,269	0.043	1.51
13	**Newark Educators Community Charter School**														
	Total Site Info	0.21	9,216	93	44	85	0.18	7,833	0.4	4.0	36.0	816	28,721	0.006	0.21
14	**Pennington Court Housing**														
	Total Site Info	4.58	199,406	930; 931	1	95	4.35	189,436	9.1	95.7	869.8	19,733	694,599	0.148	5.20

Summary of Existing Conditions

	Subwatershed/Site Name/Total Site Info/GI Practice	Area (ac)	Area (SF)	Block	Lot	I.C. %	I.C. Area (ac)	I.C. Area (SF)	Existing Annual Loads (Commercial) TP (lb/yr)	TN (lb/yr)	TSS (lb/yr)	Runoff Volumes from I.C. Water Quality Storm (1.25" over 2-hours) (cu.ft.)	Runoff Volumes from I.C. Annual (cu.ft.)	Runoff Volumes from I.C. Water Quality Storm (1.25" over 2-hours) (Mgal)	Runoff Volumes from I.C. Annual (Mgal)
15	**Quitman Street Community School**														
	Total Site Info	6.45	280,811	2531	1	87	5.63	245,181	11.8	123.8	1,125.7	25,540	898,998	0.191	6.72
16	**South Street Academy**														
	Total Site Info	0.64	28,093	1163	1, 32	100	0.64	28,092	1.4	14.2	129.0	2,926	103,004	0.022	0.77
17	**Traffic Triangle at Dayton Street and Frelinghuysen Avenue**														
	Total Site Info	0.03	1,304	N/A	N/A	95	0.03	1,239	0.1	0.6	5.7	129	4,542	0.001	0.03

d. 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	TSS Removal Potential	Max Volume Reduction Potential	Peak Discharge Reduction Potential	Size of BMP	Unit Cost	Unit	Total Cost	I.C. Treated
		Area (SF)	Area (ac)	(Mgal/yr)	(lbs/yr)	(gal/storm)	(cfs)		($/unit)		($)	%
	ELIZABETH RIVER SUBWATERSHED	**1,200**	**0.03**	**0.031**	**5**	**2,266**	**0.09**				**$112,500**	**21.9%**
1	**Hawthorne Hawks Healthy Harvest Farm**											
	Stormwater planters	1,200	0.03	0.031	5	2,266	0.09	300	$375	SF	$112,500	21.9%
	Total Site Info	**1,200**	**0.03**	**0.031**	**5**	**2,266**	**0.09**				**$112,500**	**21.9%**
	LOWER PASSAIC RIVER SUBWATERSHED	**12,180**	**0.28**	**0.317**	**53**	**19,949**	**0.88**				**$201,225**	**5.2%**
2	**241 First Street**											
	Bioretention system	500	0.01	0.013	2	942	0.04	125	$5	SF	$625	259.1%
	Total Site Info	**500**	**0.01**	**0.013**	**2**	**942**	**0.04**				**$625**	**259.1%**
3	**Christie Street**											
	Stormwater planter	2,000	0.05	0.052	9	3,777	0.14	400	$375	SF	$150,000	2.6%
	Total Site Info	**2,000**	**0.05**	**0.052**	**9**	**3,777**	**0.14**				**$150,000**	**2.6%**
4	**Down Bottom Farm Market & Garden**											
	Rainwater harvesting	400	0.01	0.010	2	500	0.03	500	$2	gal	$1,000	0.7%
	Stormwater planter	400	0.01	0.010	2	755	0.03	100	$375	SF	$37,500	0.7%
	Total Site Info	**800**	**0.02**	**0.021**	**3**	**1,255**	**0.06**				**$38,500**	**1.4%**
5	**Hawkins Street School**											
	Bioretention system	1,700	0.04	0.044	7	3,209	0.12	425	$5	SF	$2,125	2.7%
	Rainwater harvesting	800	0.02	0.021	3	625	0.06	625	$2	gal	$1,250	1.3%
	Total Site Info	**2,500**	**0.06**	**0.065**	**11**	**3,834**	**0.18**				**$3,375**	**4.0%**
6	**Mount Pleasant Avenue Neighborhood**											
	Rainwater harvesting	1,800	0.04	0.047	8	1,500	0.13	1,500	$2	gal	$3,000	6.1%
	Total Site Info	**1,800**	**0.04**	**0.047**	**8**	**1,500**	**0.13**				**$3,000**	**6.1%**
7	**Rutgers School of Health Professions Vacant Lot**											
	Bioretention system	4,580	0.11	0.119	20	8,639	0.33	1,145	$5	SF	$5,725	62.1%
	Total Site Info	**4,580**	**0.11**	**0.119**	**20**	**8,639**	**0.33**				**$5,725**	**62.1%**
	NEWARK AIRPORT PERIPHERAL DITCH SUBWATERSHED	**119,105**	**2.73**	**3.103**	**520**	**212,556**	**8.04**				**$1,327,148**	**18.6%**
8	**Court Street Urban Farm**											
	Rainwater harvesting	800	0.02	0.021	3	625	0.06	625	$2	gal	$1,250	4.6%
	Stormwater planters	800	0.02	0.021	3	1,511	0.06	200	$375	SF	$75,000	4.6%
	Total Site Info	**1,600**	**0.04**	**0.042**	**7**	**2,136**	**0.12**				**$76,250**	**9.2%**
9	**Foster Street**											
	Pervious pavement	29,000	0.67	0.756	126	54,724	2.06	16,000	$25	SF	$400,000	91.0%
	Total Site Info	**29,000**	**0.67**	**0.756**	**126**	**54,724**	**2.06**				**$400,000**	**91.0%**
10	**James C White Manor Senior Housing Community Garden**											
	Stormwater planter	400	0.01	0.010	2	755	0.03	100	$375	SF	$37,500	11.4%
	Total Site Info	**400**	**0.01**	**0.010**	**2**	**755**	**0.03**				**$37,500**	**11.4%**
11	**Jesse Allen Park**											

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	Unit Cost ($/unit)	Unit	Total Cost ($)	I.C. Treated %
	Bioretention systems	5,200	0.12	0.135	23	9,814	0.37	1,300	$5	SF	$6,500	8.3%
	Total Site Info	**5,200**	**0.12**	**0.135**	**23**	**9,814**	**0.37**				**$6,500**	**8.3%**
12	**Mildred Helms Park**											
	Pervious pavement	19,600	0.45	0.511	85	36,989	1.39	3,500	$25	SF	$87,500	35.5%
	Total Site Info	**19,600**	**0.45**	**0.511**	**85**	**36,989**	**1.39**				**$87,500**	**35.5%**
13	**Newark Educators Community Charter School**											
	Green roof	6,000	0.14	0.156	26	n/a	n/a	3,145	$45	box	$142,248	76.6%
	Total Site Info	**6,000**	**0.14**	**0.156**	**26**	**0**	**0.00**				**$142,248**	**76.6%**
14	**Pennington Court Housing**											
	Bioretention systems	1,560	0.04	0.041	7	2,947	0.11	395	$5	SF	$1,975	0.8%
	Pervious pavement	23,100	0.53	0.602	101	43,586	1.64	4,500	$25	SF	$112,500	12.2%
	Total Site Info	**24,660**	**0.57**	**0.643**	**108**	**46,533**	**1.75**				**$114,475**	**13.0%**
15	**Quitman Street Community School**											
	Bioretention system	860	0.02	0.022	4	1,623	0.06	215	$5	SF	$1,075	0.4%
	Pervious pavement	21,055	0.48	0.549	92	39,734	1.49	3,760	$25	SF	$94,000	8.6%
	Total Site Info	**21,915**	**0.50**	**0.571**	**96**	**41,357**	**1.55**				**$95,075**	**8.9%**
16	**South Street Academy**											
	Bioretention system	1,080	0.02	0.028	5	2,035	0.08	270	$5	SF	$1,350	3.8%
	Pervious pavement	7,550	0.17	0.197	33	14,249	0.54	3,400	$25	SF	$85,000	26.9%
	Total Site Info	**8,630**	**0.20**	**0.225**	**38**	**16,284**	**0.62**				**$86,350**	**30.7%**
17	**Traffic Triangle at Dayton Street and Frelinghuysen Avenue**											
	Stormwater planter	2,100	0.05	0.055	9	3,964	0.15	750	$375	SF	$281,250	169.5%
	Total Site Info	**2,100**	**0.05**	**0.055**	**9**	**3,964**	**0.15**				**$281,250**	**169.5%**