GREEN INFRASTRUCTURE FEASIBILITY STUDY

BAYONNE

RUTGERS
New Jersey Agricultural Experiment Station

PASSAIC VALLEY SEWERAGE COMMISSION
"Protecting Public Health and the Environment"

ACKNOWLEDGEMENTS

Designed to highlight green infrastructure opportunities within the City of Bayonne, this document has been prepared by the Rutgers Cooperative Extension Water Resources Program with funding and direction by the Passaic Valley Sewerage Commission and the New Jersey Agricultural Experiment Station.

We would like to thank the Passaic Valley Sewerage Commission, the New Jersey Agricultural Experiment Station, and the City of Bayonne for their input and support in creating this document.

RUTGERS
New Jersey Agricultural Experiment Station

PASSAIC VALLEY SEWERAGE COMMISSION
"Protecting Public Health and the Environment"

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INTRODUCTION

In 2013, the Passaic Valley Sewerage Commission (PVSC) began a new initiative to assist the 48 municipalities within its jurisdiction to manage flooding and eliminate combined sewer overflows. With municipalities spread across five counties, PVSC is dedicated to leading efforts throughout the PVSC Sewerage District by using green infrastructure to intercept stormwater runoff, reduce combined sewer overflows (CSOs), manage existing water infrastructure, and minimize frequent flooding events. To help with this effort, PVSC has entered into a partnership with the Rutgers Cooperative Extension (RCE) Water Resources Program.

Bayonne is a community with a combined sewer system which carries both wastewater and stormwater in the same pipes. During heavy rain or snow melt, combined sewer systems often cannot manage all of the water and overflow, causing a combined sewer overflow (CSO) event. When overflows or CSO events occur, stormwater that has been mixed with untreated wastewater is discharged into local waterways, carrying with it many contaminants. By using cost-effective green infrastructure practices, Bayonne can begin to reduce the negative impacts of stormwater runoff and pressure on the local infrastructure, while also increasing resiliency to CSO events and protecting the health of our waterways.

This feasibility study is intended to be used as a guide for the community of Bayonne to begin implementing green infrastructure practices while demonstrating to residents and local leaders the benefits of and opportunities for better managing stormwater runoff.

Rutgers University professor, Tobiah Horton, reviews a rain garden design with a homeowner.

Source: Gordon Terminal

Source: Bayonne Organization

Source: City of Bayonne

BAYONNE

Located in Hudson County, the City of Bayonne covers approximately 11 square miles with a population of 63,722 as of the 2010 US Census. To the west of the city is the Newark Bay, and to the east of the town is the Upper Bay of the Hudson River.

The town has a combined sewer system with a total of 23 combined sewer overflow (CSO) points. This means that in the event of a heavy storm, much of the town's runoff and wastewater travels into adjacent water bodies untreated. By evaluating the feasibility of green infrastructure, Bayonne can identify cost-effective ways to help mitigate water quality and local flooding issues.

WHAT IS STORMWATER?

When rainfall hits the ground, it can soak into the ground or flow across the surface. When rainfall flows across a surface, it is called "stormwater" runoff. Pervious surfaces allow stormwater to readily soak into the soil and recharge groundwater. An impervious surface can be any material that has been placed over soil that prevents water from soaking into the ground. Impervious surfaces include paved roadways, parking lots, sidewalks, and rooftops. As impervious areas increase, so does the amount of stormwater runoff. New Jersey has many problems due to stormwater runoff from impervious surfaces, including:

- POLLUTION: According to the 2010 New Jersey Water Quality Assessment Report, 90% of the assessed waters in New Jersey are impaired. Urban-related stormwater runoff is listed as the most probable source of impairment (USEPA, 2013). As stormwater flows over the ground, it picks up pollutants, including animal waste, excess fertilizers, pesticides and other toxic substances. These pollutants are carried to waterways.
- FLOODING: Over the past decade, the state has seen an increase in flooding. Communities around the state have been affected by these floods. The amount of damage caused also has increased greatly with this trend, costing billions of dollars over this time span.
- EROSION: Increased stormwater runoff causes an increase in stream velocity. The increased velocity after storm events erodes stream banks and shorelines, degrading water quality. This erosion can damage local roads and bridges and cause harm to wildlife.

local reservoir


purple coneflower


pervious pavers

To protect and repair our waterways, reduce flooding, and stop erosion, stormwater runoff has to be better managed. Impervious surfaces need to be disconnected with green infrastructure to prevent stormwater runoff from flowing directly into New Jersey's waterways. Disconnection redirects runoff from paving and rooftops to pervious areas in the landscape.

A community garden that harvests and recycles rainwater

Rain barrel workshop participants

A rain garden after planting

WHAT IS GREEN INFRASTRUCTURE?

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 principle, 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 technologies 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 (USEPA, 2013).

GLOSSARY OF GREEN INFRASTRUCTURE TERMINOLOGY

A ***DISCONNECTED:***

Disconnected refers to channeling water from gutters and pipes that collect runoff to somewhere other than a sewer drain where it can be filtered.

B ***DEPAVING:***

Depaving is the process of removing hardscape such as asphalt or concrete.

C ***INFILTRATION:***

Infiltration occurs when water on the ground's surface is absorbed into the soil below. Plants promote infiltration.

D ***IMPERVIOUS SURFACE:***

An impervious surface is one that water cannot penetrate.

E ***RUNOFF:***

Runoff is water from precipitation that flows across land and paved surfaces before entering local waterways or sewer systems.

A

B

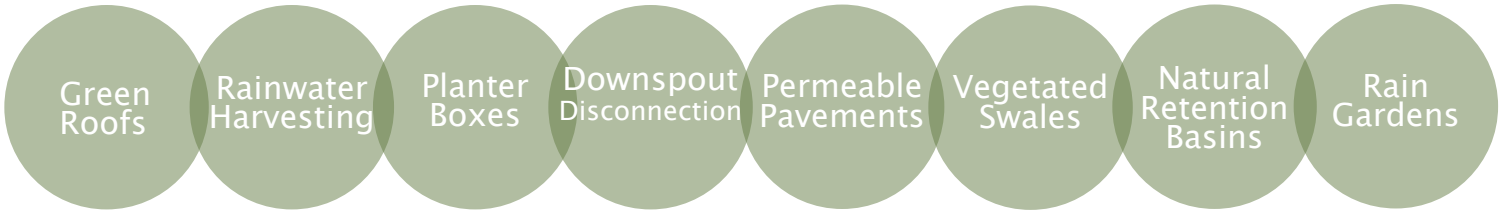
C

D

E

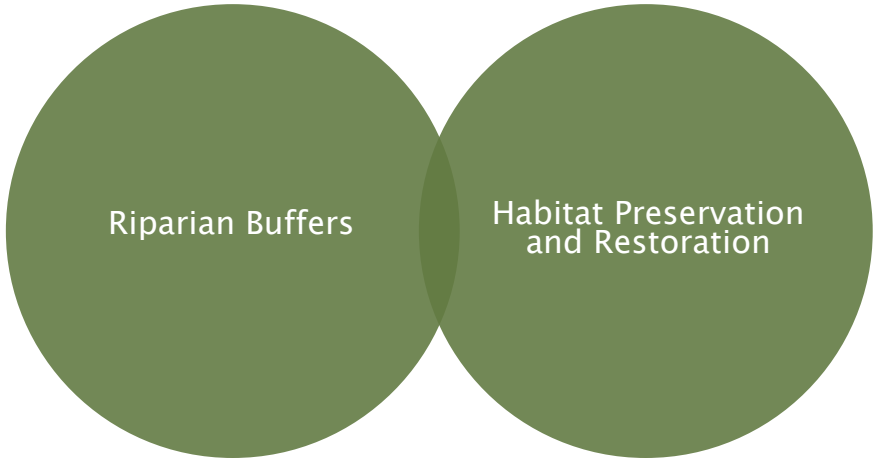
GREEN INFRASTRUCTURE STRATEGIES

SITE



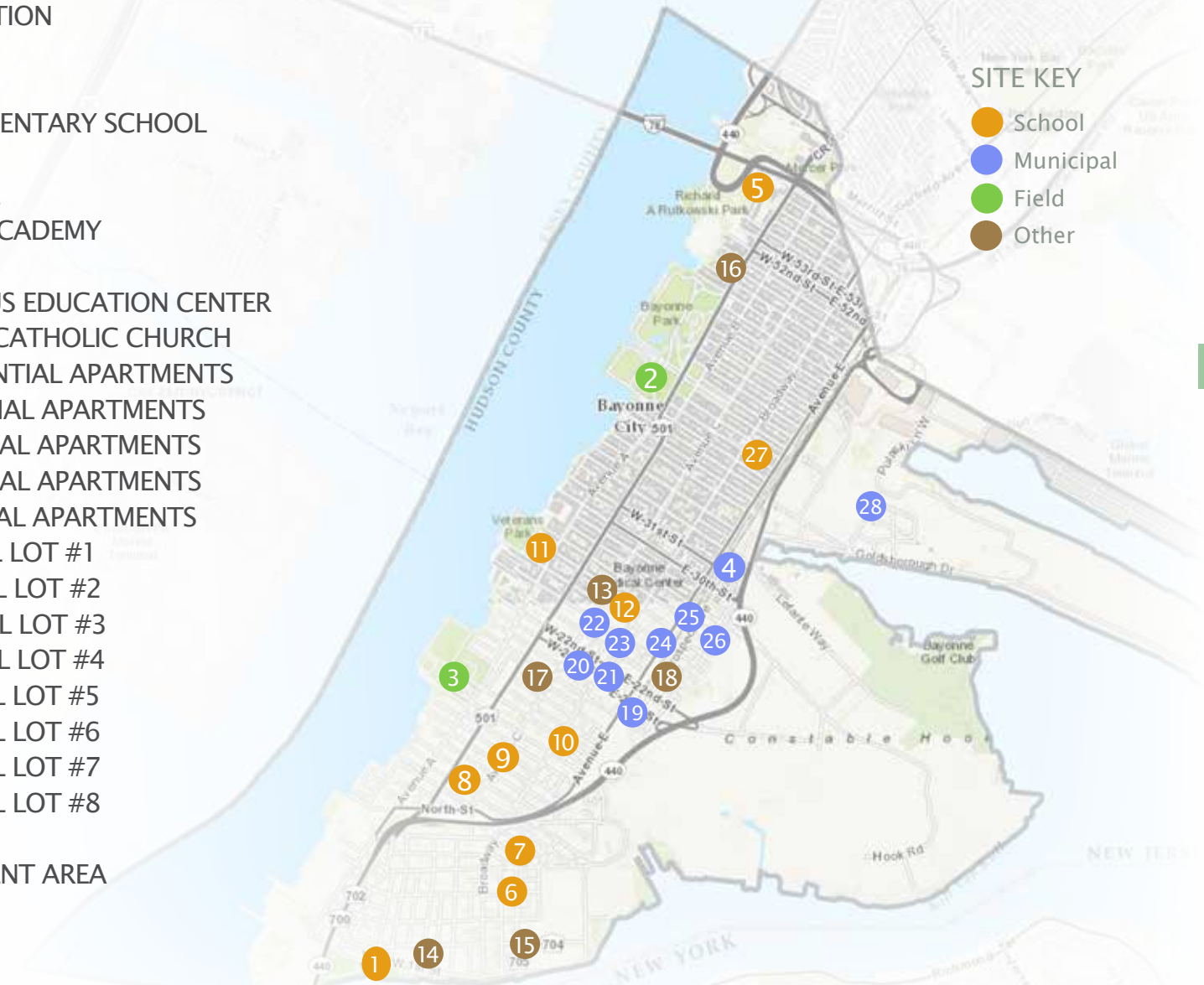
NEIGHBORHOOD

WATERSHED



POTENTIAL PROJECT SITES

1. KILL VAN KULL PARK
2. BAYONNE PARK
3. CITY PARK
4. 34TH ST. LIGHT RAIL STATION
5. MARIST HIGH SCHOOL
6. SAINT ANDREW SCHOOL
7. MARY J. DONOHOE ELEMENTARY SCHOOL
8. HOLY FAMILY ACADEMY
9. JOHN M. BAILEY SCHOOL
10. ALL SAINTS CATHOLIC ACADEMY
11. BAYONNE HIGH SCHOOL
12. SAINT HENRY'S RELIGIOUS EDUCATION CENTER
13. SAINT HENRY'S ROMAN CATHOLIC CHURCH
14. WEST 1ST STREET RESIDENTIAL APARTMENTS
15. LORD AVENUE RESIDENTIAL APARTMENTS
16. WEST 49TH ST. RESIDENTIAL APARTMENTS
17. WEST 23RD ST. RESIDENTIAL APARTMENTS
18. EAST 26TH ST. RESIDENTIAL APARTMENTS
19. EAST 21ST ST. MUNICIPAL LOT #1
20. WEST 21ST ST. MUNICIPAL LOT #2
21. WEST 22ND ST. MUNICIPAL LOT #3
22. WEST 23RD ST. MUNICIPAL LOT #4
23. EAST 24TH ST. MUNICIPAL LOT #5
24. EAST 24TH ST. MUNICIPAL LOT #6
25. EAST 26TH ST. MUNICIPAL LOT #7
26. EAST 26TH ST. MUNICIPAL LOT #8
27. HORACE MANN SCHOOL
28. BAYONNE REDEVELOPMENT AREA

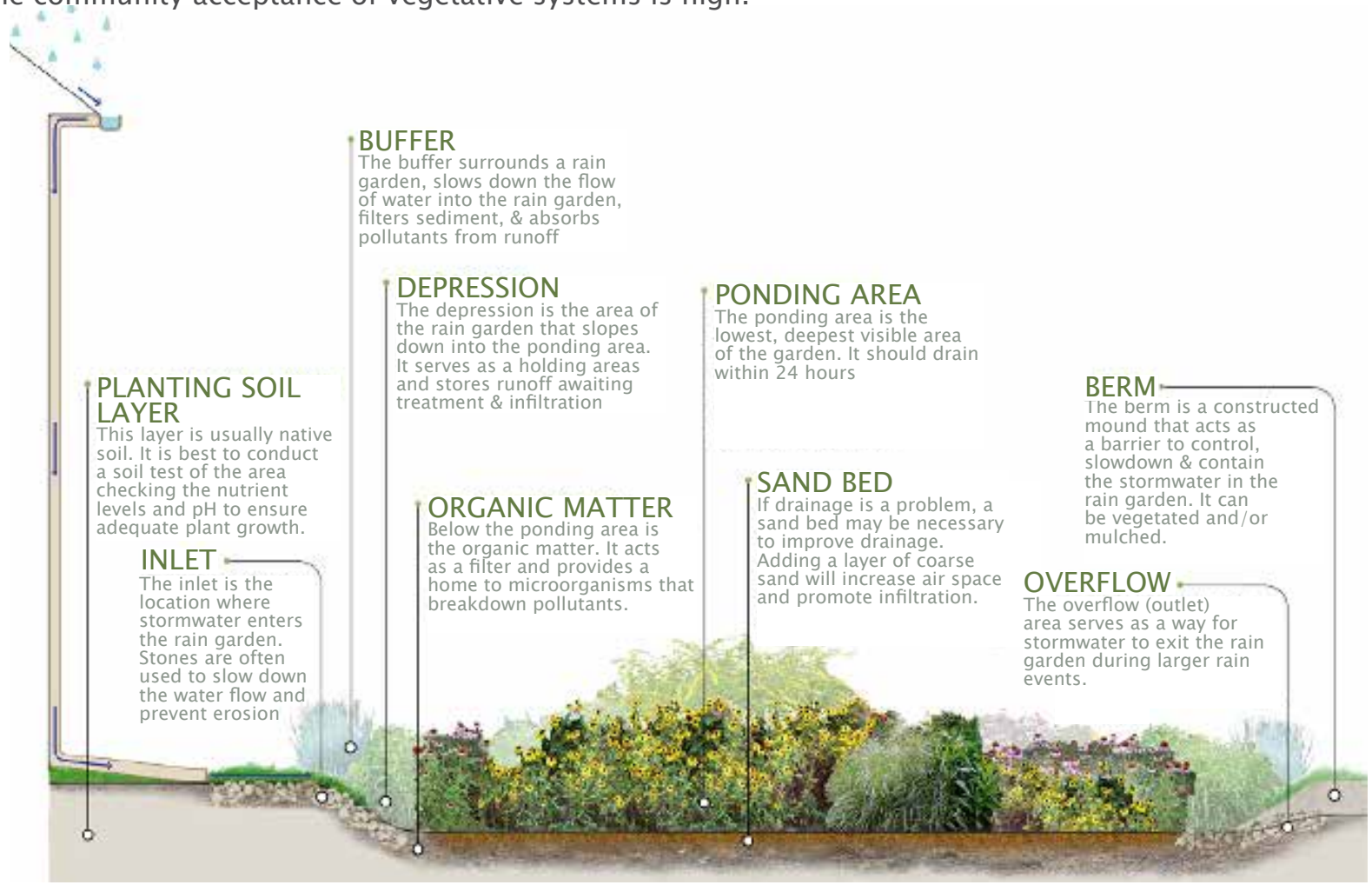



STATE OF
NEW JERSEY
DEPARTMENT OF
ENVIRONMENTAL
PROTECTION

GREEN INFRASTRUCTURE SYSTEMS

VEGETATED SYSTEMS

Vegetative systems primarily focus on reducing water quality impacts and less on reducing flooding. These systems are typically located close to the sources of runoff and can manage the smaller storms of several inches. The main treatment mechanisms are infiltration, filtration, and evapotranspiration. These systems do an excellent job at removing total suspended solids, nutrients and pathogens. Construction costs for vegetated systems are typically low to moderate when compared to other green infrastructure practices. Since these systems often can be incorporated into existing landscapes and enhance aesthetics, the community acceptance of vegetative systems is high.



RAIN GARDEN DIAGRAM

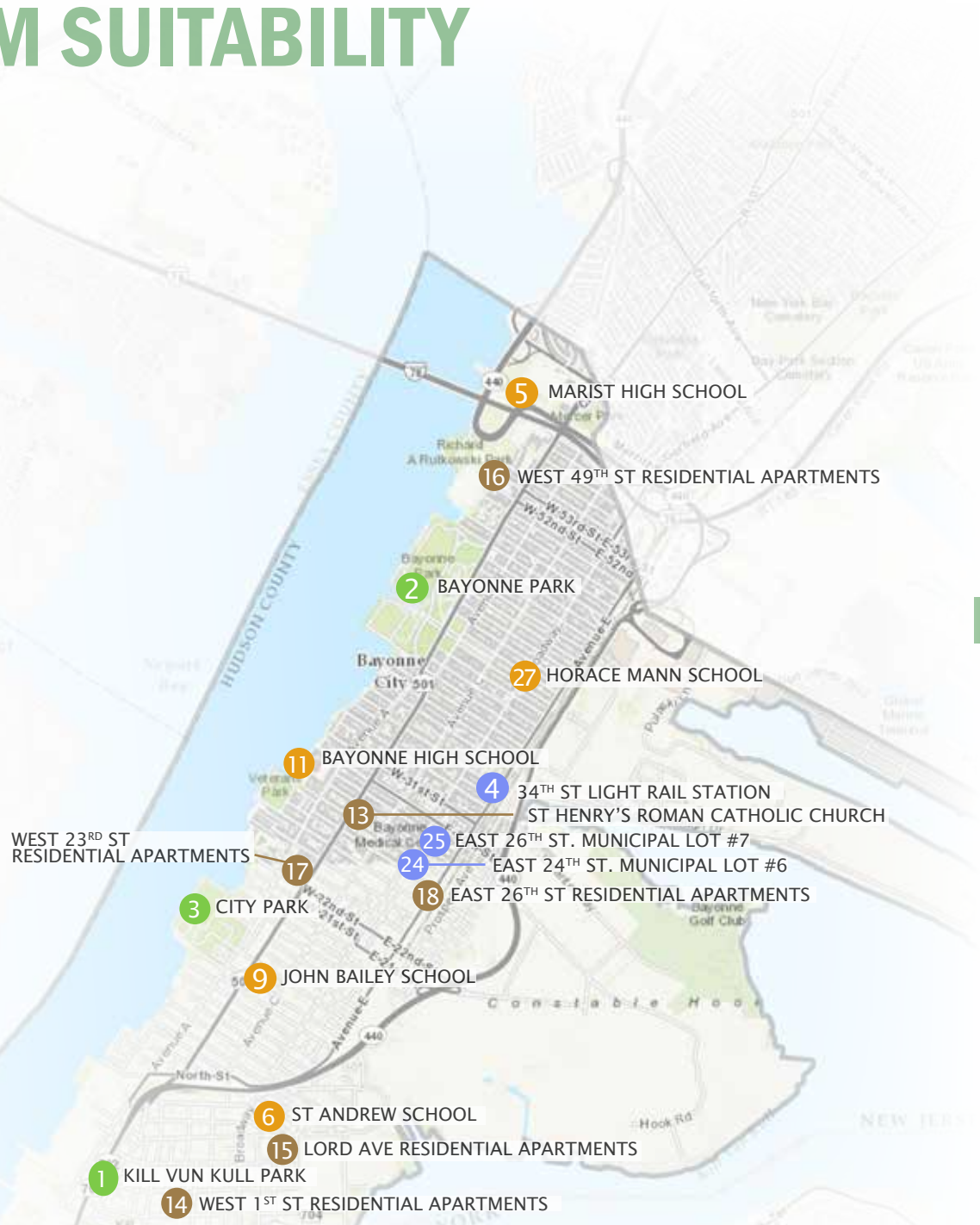
VEGETATED SYSTEM SUITABILITY

Rain gardens are shallow landscaped depressions designed to capture, treat, and infiltrate stormwater runoff. Rain gardens can be readily installed throughout a community to begin re-establishing the natural processes of the landscape. Rain gardens:

- Capture stormwater runoff, reducing soil erosion and sedimentation and the amount of water that flows to our streams and waterways during rain storms
- Protect water quality by filtering out and breaking down pollutants
- Infiltrate runoff and recharge groundwater supplies by providing base flow to nearby streams and waterways
- Enhance and increase green space and vegetated cover

Rain gardens are a simple way communities can begin to reduce stormwater runoff, manage flows to sewer systems, and protect water resources. Rain gardens can be placed in strategic locations to capture runoff from rooftops and paved areas, including:

- Homes
- Schools
- Churches
- Parking areas
- Community gardens



VEGETATED SYSTEM SUITABILITY: EXAMPLE PROJECT SITE

CITY PARK

181 West 16th Street
Bayonne NJ, 07002

VEGETATED SYSTEM SUITABILITY: EXAMPLE PROJECT SITE



The site is City Park located at 181 West 16th Street. Near the west end of the tennis courts and the southeast of the boat ramp parking lot there is ponded water near the west end of the tennis courts and the southeast of the boat ramp parking lot. There is a paved path that experiences ponding in the center of the park. Adjacent to it is a grassed area with an inlet. This area is appropriate to drain the ponded water via a rain garden.

RAINWATER HARVESTING SYSTEMS

Rainwater harvesting systems focus on the conservation, capture, storage and reuse of rainwater. These systems are located close to residential and commercial buildings. Construction costs are low to moderate, depending on the size of the system, compared to other green infrastructure practices. Since these systems can be easily incorporated into the built landscape, the community acceptance of rainwater harvesting systems is moderate to high. Rainwater harvesting systems include rain barrels and cisterns.

RAIN BARREL DIAGRAM

INLET
Rainwater collected in gutters is released into the barrel here

OVERFLOW OUTLET
Releases water when the rain barrel reaches capactiy

SPIGOT
Valve that opens and closes barrel's water flow

RAINWATER HARVESTING SYSTEMS SUITABILITY

Typical rainwater harvesting systems can store up to 5,000 gallons of water. Harvesting during the rainy months of spring and summer provides a source of water during hot and dry periods between rain storms. Instead of using potable water, residents can save money using the rainwater stored in a rain barrel or cistern. This also reduces the demand on drinking water supplies and related infrastructure.

Rain barrels and cisterns are an effective rainwater harvesting tool and can be an important element in a community-wide green infrastructure program. For every inch of rain that falls on an eight hundred square foot roof (20' x 40'), nearly 500 gallons of water can be collected. Over an entire year, water draining from this rooftop will total over 20,000 gallons. This sustainable practice reduces the impact a building has on the environment by harvesting stormwater runoff from rooftops and decreasing flow to sewer systems. Rain barrels and cisterns provide an alternative source of water for gardens, lawns, and landscaping by reducing the use of potable water supplies.

RAINWATER HARVESTING SYSTEM SUITABILITY: EXAMPLE PROJECT SITE

RAINWATER HARVESTING SYSTEM SUITABILITY: EXAMPLE PROJECT SITE



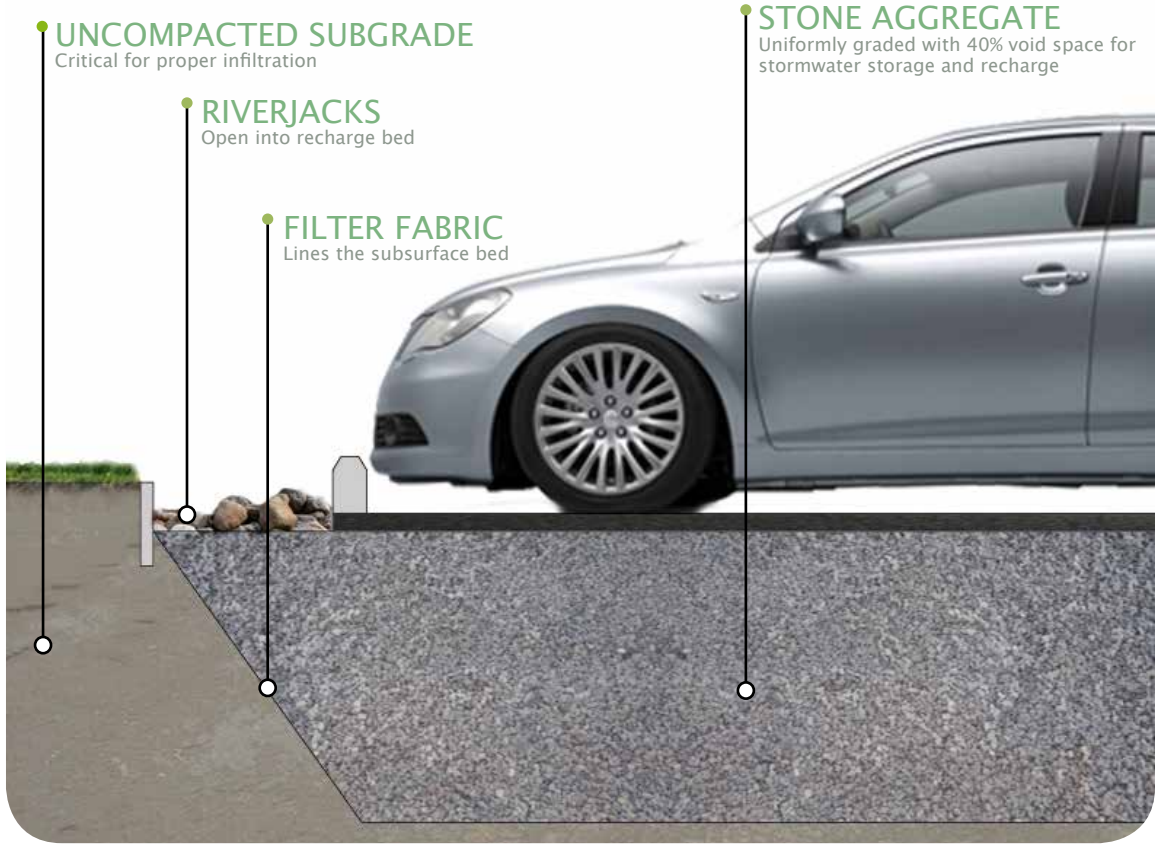
The site is at the residential apartments located at 80 West 23rd Street. There are six grassed areas in the complex which have the potential to be transformed into rain gardens. One of these areas is located in the center of the complex with an existing inlet and is near a tool shed. This tool shed has external downspouts that can be disconnected and divert stormwater into a rain barrel or cistern. The parking lots are in need of repair; pervious pavement should be considered.

STORAGE, QUANTITY, & INFILTRATION SYSTEMS

Storage, quantity, and infiltration systems primarily focus on storage. These systems are typically located close to runoff sources within residential, commercial, and industrial landscapes. The main treatment mechanism is reducing peak flows of stormwater by storing it before it becomes runoff. Construction costs for storage, quantity, and infiltration are moderate to high when compared to other green infrastructure practices because they require more space and infrastructure and are more laborious to install. Since these systems can be seamlessly incorporated into the built environment and can manage a large quantity of water, the community acceptance of storage, quantity, and infiltration systems is high.

PERMEABLE PAVEMENT

- Underlying stone reservoir
- Porous asphalt and pervious concrete are manufactured without “fine” materials to allow infiltration
- Grass pavers are concrete interlocking blocks with open areas to allow grass to grow
- Ideal application for porous pavement is to treat a low traffic or overflow parking area



PERMEABLE PAVEMENT DIAGRAM

STORAGE, QUANTITY, & INFILTRATION SYSTEM SUITABILITY

Pervious paving systems are paved areas that produce less stormwater runoff than areas paved with conventional paving. These systems include:

- Permeable pavers
- Porous asphalt
- Pervious concrete

The paving material is placed over a bed of uniformly graded stone. The paving materials allow water to pass through and then infiltrate into the pore spaces of the underlying stone bed. The stored runoff then infiltrates over time into the uncompacted subgrade soils.

Stormwater planters are small, contained vegetated systems that collect and treat stormwater using a prepared soil media and mulch. These systems serve as small bioretention facilities filtering stormwater through layers of mulch, soil, and plant root systems. Treated stormwater can then be infiltrated into existing surrounding soils as groundwater (infiltration planter), or if infiltration is not appropriate, drainage pipes can discharge filtered stormwater into traditional storm sewer infrastructure (flow-through planter).

STORAGE, QUANTITY, & INFILTRATION SYSTEM SUITABILITY: EXAMPLE PROJECT SITE

142 West 1st Street
Bayonne, NJ 07002

STORAGE, QUANTITY, & INFILTRATION SYSTEM SUITABILITY: EXAMPLE PROJECT SITE



The site is at Kill Van Kull Park located at 142 West 1st Street. The eastern parking lot is deteriorated, and water flows towards the southeast into a catch basin that discharges directly to the bay. The lot can be repaved with pervious pavement. The western side of the park has a turf area between a walking path and the bay; the area can be converted into a riparian buffer. On the eastern side of the basketball court there is a considerable amount of ponded water. The area can be repaved with pervious pavement.


TREE
PLANTING

COMMUNITY ENGAGEMENT & EDUCATION

BUILD-A-RAIN BARREL WORKSHOP

With the Build a Rain Barrel Workshop, community members participate in a short presentation on stormwater management and water conservation and then learn how to build their own rain barrel. Workshop participants work with trained experts to convert 55 gallon plastic food-grade drums into rain barrels. They are quickly able to take an active role in recycling rainwater by installing a rain barrel at their house! Harvesting rainwater has many benefits including saving water, saving money, and preventing basement flooding. By collecting rainwater, homeowners are helping to reduce flooding and pollution in local waterways. When rainwater flows across hard surfaces like rooftops, driveways, roadways, parking lots, and compacted lawns, it carries pollution to our local waterways. Harvesting the rainwater in a rain barrel is just one of the ways homeowners can reduce the amount of rainwater draining from their property and help reduce neighborhood flooding problems.

STORMWATER MANAGEMENT IN YOUR SCHOOLYARD

The *Stormwater Management in Your Schoolyard* program provides educational lectures, hands-on activities, and community-level outreach for students on the topics of water quality issues and stormwater management practices such as rain gardens and rain barrels. Program objectives include the exploration of various aspects of the natural environment on school grounds, the detailed documentation of findings related to these explorations, and the communication of these findings to the school community. As part of this program, several New Jersey State Core Curriculum Content Standards for science (5.1, 5.3, and 5.4), twenty-first century life and careers (9.1, 9.3, and 9.4), and social studies (6.3) are addressed. Every school is unique in its need for stormwater management, so each school's *Stormwater Management in Your Schoolyard* program can be delivered in a variety of ways. This program can be tailored for grades K-8 or 9-12 and can be offered to meet a variety of schedules.




MAINTENANCE PROCEDURES

MAINTAINING BAYONNE'S GREEN INFRASTRUCTURE SYSTEMS

1. VEGETATED SYSTEMS
   - Rain Garden
   - Stormwater Planter
   - Bioswale

2. RAINWATER HARVESTING
   - Rain Barrel
   - Cistern

3. STORAGE, QUANTITY, AND INFILTRATION
   - Porous Asphalt & Concrete
   - Underground Detention

VEGETATED SYSTEM MAINTENANCE

RAIN GARDEN:

Weekly

- Water
- Weed
- Inspect for invasive plants, plant health, excessive sediment, and movement of sediment within the rain garden
- Observe the rain garden during rain events and note any successes (Example of success: stormwater runoff picks up oil and grease from the parking lot, flows through a curb cut, and into a rain garden; the rain garden traps the nonpoint source pollutants before they reach the nearby waterway)

Annually

- Mulch in the spring to retain a 3-inch mulch layer in the garden
- Prune during dormant season to improve plant health
- Remove sediment
- Plant
- Test the soil (every 3 years)
- Harvest plants to use in other parts of the landscape
- Clean debris from gutters connected to rain garden
- Replace materials (such as river rock and landscape fabric) where needed

STORMWATER PLANTER

- Very similar maintenance regime to rain gardens

BIOSWALE

- Very similar maintenance regime to rain gardens

RAINWATER HARVESTING SYSTEM MAINTENANCE

RAIN BARREL:

- Keep screen on top and a garden hose attached to the overflow to prevent mosquitoes; change screen every two years
- Remove debris from screen after storms
- Disconnect the barrel in winter; store inside or outside with a cover
- Clean out with long brush and water/dilute bleach solution (~3%)

CISTERN:

- In the fall, prepare your cistern for the winter by diverting flow so that no water can enter and freeze within the tank
- Weekly check: Check for leaks, clogs, obstructions, holes, and vent openings where animals, insects, and rodents may enter; repair leaks with sealant; drain the first flush diverter/ roof washer after every rainfall event
- Monthly check: Check roof and roof catchments to make sure no debris is entering the gutter and downspout directed into the cistern; keep the roof, gutters, and leader inlets clear of leaves; inspect the first flush filter and all of its attachments, making any necessary replacements; inspect cistern cover, screen, overflow pipe, sediment trap, and other accessories while making any necessary replacements

STORAGE, QUANTITY, & INFILTRATION SYSTEM MAINTENANCE

POROUS ASPHALT & CONCRETE:

- Materials cost is ~20-25% more than traditional asphalt or concrete
- Long-term maintenance is required by routine quarterly vacuum sweeping
- Sweeping cost may be off-set by reduced deicing costs
- Asphalt repairs can be made with standard asphalt not to exceed 10% of surface area
- Concrete repairs can be made with standard concrete not to exceed 10% of the surface area

UNDERGROUND DETENTION:

- Periodic inspections of the inlet and outlet areas to ensure correct operation of system
- Clean materials trapped on grates protecting catch basins and inlet area monthly
- Primary maintenance concerns are removal of floatables that become trapped and removal of accumulating sediments within the system; this should be done at least on an annual basis
- Proprietary traps and filters associated with stormwater storage units should be maintained as recommended by the manufacturer
- Any structural repairs required to inlet and outlet areas should be addressed in a timely manner on an as needed basis
- Local authorities may require annual inspection or require that they carry out inspections and maintenance




POTENTIAL PROJECT SITES

BAYONNE PARK

Devlin Drive
Bayonne, NJ 07002



The site is Bayonne Park located at Devlin Drive. There is a large depressed island with trees near the entrance to the park. Crowned roads currently direct stormwater to inlets located on the perimeter of the island. Curb cuts would allow stormwater runoff from the roads to drain into the island to infiltrate, and a raised inlet can act as an overflow. On the south side of the park is a large grassed area that can be converted to a rain garden.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

- [x] rain gardens
- [x] curb cuts
- [ ] stormwater planters
- [ ] rain barrels
- [ ] buffers
- [ ] cisterns
- [ ] pervious pavement
- [ ] bioswales
- [ ] depaving

34TH STREET LIGHT RAIL STATION

291 Prospect Avenue
Bayonne, NJ 07002



The site is the 34th Street Light Rail Station located at 291 Prospect Avenue. Along the northeastern section of the parking lot is a drainage ditch that has no vegetation and is filled with litter. The ditch can be vegetated and re-graded. In the southwest section there is a large grassed island in the center of the parking lot. A portion of this area is free of trees and utilities and is suitable for a rain garden.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

- [x] rain gardens
- [ ] curb cuts
- [ ] stormwater planters
- [ ] rain barrels
- [ ] buffers
- [ ] cisterns
- [ ] pervious pavement
- [x] bioswales
- [ ] depaving

34TH STREET LIGHT RAIL STATION

291 Prospect Avenue
Bayonne, NJ 07002

MARIST HIGH SCHOOL

1241 John F Kennedy Boulevard
Bayonne, NJ 07002



The site is Marist High School located at Leo Sylvious Drive. In the northwestern corner of the rear parking lot the soil is compacted, water is ponding, and there is sediment accumulation. By paving the area with pervious pavement, infiltration can be increased. On the northern side of the building is a grassed area where stormwater drains into a storm drain. A rain garden can be built in the grassed area, and a curb cut can direct water from the road to the garden.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

- [x] rain gardens
- [x] curb cuts
- [ ] stormwater planters
- [ ] rain barrels
- [ ] buffers
- [ ] cisterns
- [x] pervious pavement
- [ ] bioswales
- [ ] depaving


La Tourette Pl
Broadway
W 4th St
Story Ct
Broadway
E 4th St
E 4th St
Lord Ave

The site is the Saint Andrew School located at 9 East 4th Street. The parking lot is a large, impervious area. Approximately a quarter of the area is crowned, sloping from west to east. It is possible to capture this runoff in a rain garden via curb cuts. At the entrance of the parking lot on the west side, stormwater drains to the road. A rain garden can be implemented here to intercept runoff before reaching the road.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

- [x] rain gardens
- [x] curb cuts
- [ ] stormwater planters
- [ ] rain barrels
- [ ] buffers
- [ ] cisterns
- [ ] pervious pavement
- [ ] bioswales
- [ ] depaving

MARY J. DONOHOE ELEMENTARY SCHOOL

20 Dodge Street
Bayonne, NJ 07002

The site is Mary J. Donohoe Elementary School located at 20 Dodge Street. The school has all internal downspouts and has no grassed areas on the lot. The recess area to the west is all blacktop; the area can be repaved as pervious pavement. Sidewalks can be replaced with pervious concrete. Stormwater planters could be installed along the street.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

- ☐ rain gardens
- ☐ rain barrels
- ☑ pervious pavement
- ☐ curb cuts
- ☐ buffers
- ☐ bioswales
- ☑ stormwater planters
- ☐ cisterns
- ☐ depaving

HOLY FAMILY ACADEMY

239 Avenue A
Bayonne, NJ 07002

The site is Holy Family Academy located at 239 Avenue A. There is a catch basin near the parking lot entrance which is backed up and causing flooding at the lower end of the entrance road. The catch basin should be repaired. The parking lot can be repaved with pervious pavement to aid in infiltration.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

- ☐ rain gardens
- ☐ rain barrels
- ☑ pervious pavement
- ☐ curb cuts
- ☐ buffers
- ☐ bioswales
- ☐ stormwater planters
- ☐ cisterns
- ☐ depaving


W 10th St
501
W 11th St
12th St
Enrico's Restaurant and Pizzar...
Avenue C
Little Food Cafe
John M Bailey Elementary School
W 10th St
JF Kennedy Blvd
Delicous Deli and Grocery
W 11th St
BCB Bancorp Inc
W 9th St
W 10th St
8th St
© 2013 Nokia © 2013 Microsoft Co

The site is John M. Bailey School located at 87 West 10th Street. There are downspouts that are disconnected onto a lawn area. This has the potential to create erosion over time. A rain garden can be implemented to capture the roof runoff and prevent erosion.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

- [x] rain gardens
- [ ] curb cuts
- [ ] stormwater planters
- [ ] rain barrels
- [ ] buffers
- [ ] cisterns
- [ ] pervious pavement
- [ ] bioswales
- [ ] depaving


W 15th St
W 13th St
W 14th St
Avenue C
Party Time Deli
Enrico's Restaurant and Pizzar...
Broadway
E 14th
W 12th St
W 11th St
Pizza and Penne Wild Wood Fired
Chicken Station

The site is All Saints Catholic Academy at 17 West 13th Street. There is a paved basketball court that drains to a catch basin. The court can be repaved with pervious pavement.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

- ☐ rain gardens
- ☐ rain barrels
- ☑ pervious pavement
- ☐ curb cuts
- ☐ buffers
- ☐ bioswales
- ☐ stormwater planters
- ☐ cisterns
- ☐ depaving

BAYONNE HIGH SCHOOL

667 Avenue A
Bayonne, NJ 07002



The site is at Bayonne High School located at 667 Avenue A. The parking lot behind the school drains on a slope that spills onto a sidewalk. The parking lot itself is eroded, especially where the water travels. When it is replaced, pervious pavement should be considered. Steep bioswales with check dams would also help to reduce erosion. On the northeast corner of the tennis court, the parking lot is accumulating sediment. A curb cut could direct water into a potential rain garden.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

- [x] rain gardens
- [x] curb cuts
- [ ] stormwater planters
- [ ] rain barrels
- [ ] buffers
- [ ] cisterns
- [x] pervious pavement
- [x] bioswales
- [ ] depaving


W 28th St
W 29th St
Avenue C
27th St
W 28th St
W 27th St
Avenue C
W 28th St

The site is St. Henry's Religious Education Center located at 621 Avenue C. On both sides of the site is a parking lot which is extended onto the grassed areas in the front of the building. This area is compacted earth. The lot can be paved with pervious pavement which will allow for more infiltration with less sediment runoff.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

- ☐ rain gardens
- ☐ rain barrels
- ☑ pervious pavement
- ☐ curb cuts
- ☐ buffers
- ☐ bioswales
- ☐ stormwater planters
- ☐ cisterns
- ☐ depaving


W 29th St
Ellies
Homestyle Deli
Shah Nagendra MD
501
27th St
Avenue C
Fasolino Foods
nnedy Blvd
W 27th St
W 28th St
Bayonne City Empl FCU
Pamrapo
Savings Bank Sla



The site is St. Henry's Roman Catholic Church located at 69 West 28th Street. On the northwestern side of the building there is a connected downspout near a grassed area. The downspout could be disconnected into a rain garden, however there is a manhole that needs to be marked out. On the southern side of the building is a connected downspout. This also has potential to be disconnected into a rain garden.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

- [x] rain gardens
- [ ] curb cuts
- [ ] stormwater planters
- [ ] rain barrels
- [ ] buffers
- [ ] cisterns
- [ ] pervious pavement
- [ ] bioswales
- [ ] depaving


W 2nd St
Trask Ave
Terrace
W 1st St
Hudson River Ave
Islandview Ct
Seaview Ct
Zabriskie Ave
Veterans Way
Kill van Kull Park
Avenue C



The site is at the residential apartments located at 105 West 1st Street. All of the downspouts are directly connected. Some can be disconnected to create rain gardens in twelve potential locations. There is a central area that is paved and appears to no longer be used frequently. This area can be depaved, and tree planter boxes, rain barrels, and rain gardens can be implemented. On the northeast side of the site is a strip of impervious pavement that can be replaced with pervious pavement.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

- [x] rain gardens
- [x] rain barrels
- [x] pervious pavement
- [ ] curb cuts
- [ ] buffers
- [ ] bioswales
- [x] stormwater planters
- [ ] cisterns
- [x] depaving


Marion Ct
W 2nd St
Kelly Pkwy
Broadway
Lord Ave
E 2nd St
704
E 2nd St
Lexington Ave
W 1st St
E 1st St
Kill van Kull Park



The site is at the residential apartments located at 32 Lord Avenue. In the center of the site is a large impervious surface that appears to be unused. The area should be depaved and can be turned into green space with tree planter boxes and rain gardens. There are multiple areas where downspouts can be disconnected and flow directed to rain gardens, such as in the northwestern area of the building, the north area, and in the southern area of the complex. On the east side of the apartments, downspouts can be disconnected into tree planter boxes.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

- [x] rain gardens
- [ ] curb cuts
- [x] stormwater planters
- [ ] rain barrels
- [ ] buffers
- [ ] cisterns
- [ ] pervious pavement
- [ ] bioswales
- [x] depaving

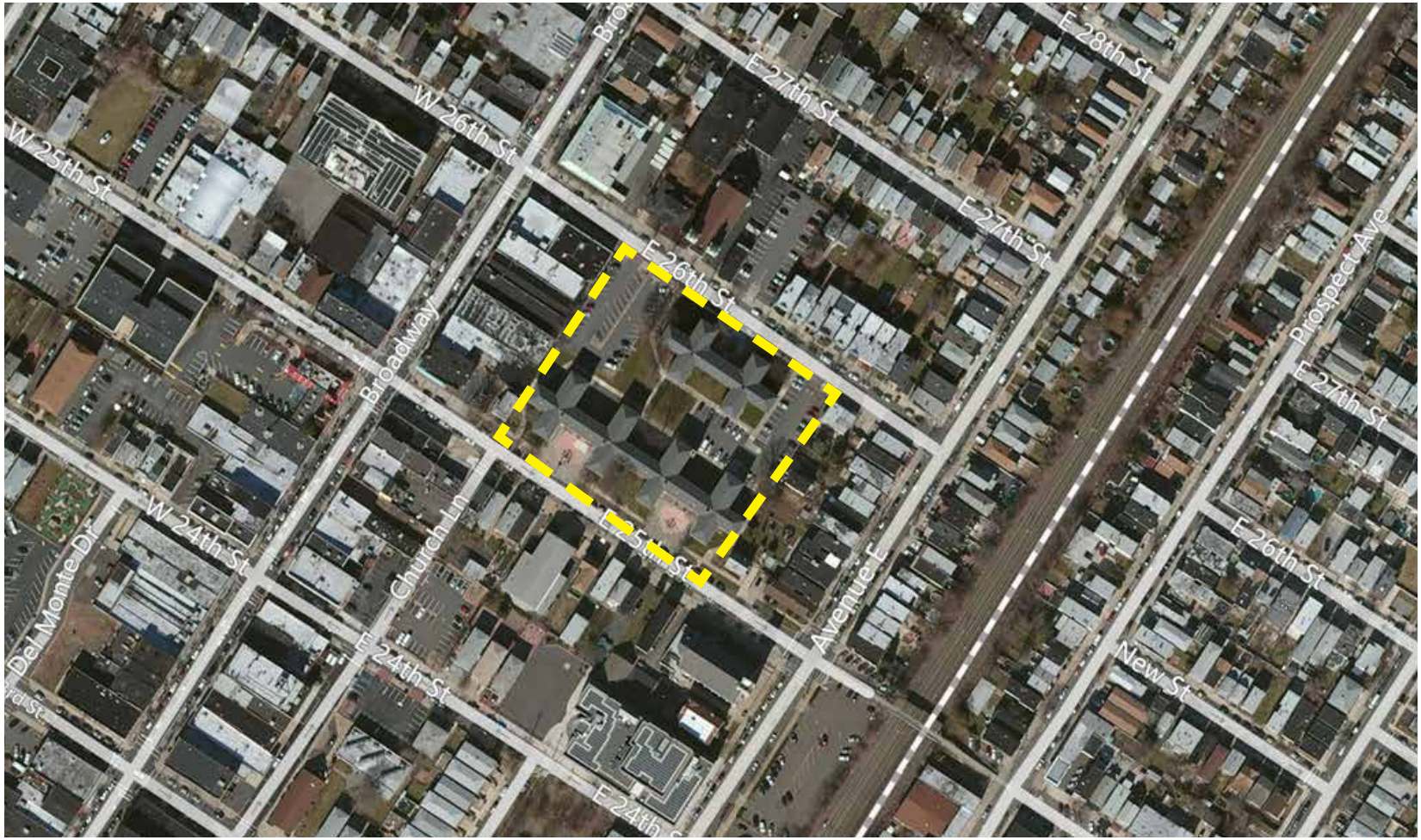

W 51st St
52nd St
Bergen Ct
Hudson Ct
Pamrapo Ct
W 49th St
W 48th St
JF Kennedy Blvd



The site is the residential apartments located at 161 West 49th Street. In both parking lots adjacent to West 49th Street there is a strip of grassed area on the west side. Runoff flows along the side of the grassed area to a catch basin. Curb cuts can be made to direct the runoff to a stormwater planter or rain garden before it reaches the catch basin. On the west side of the complex there is an area with a downspout that discharges to a grassed area where a rain garden can be implemented. There is a similar area in the center of the complex.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

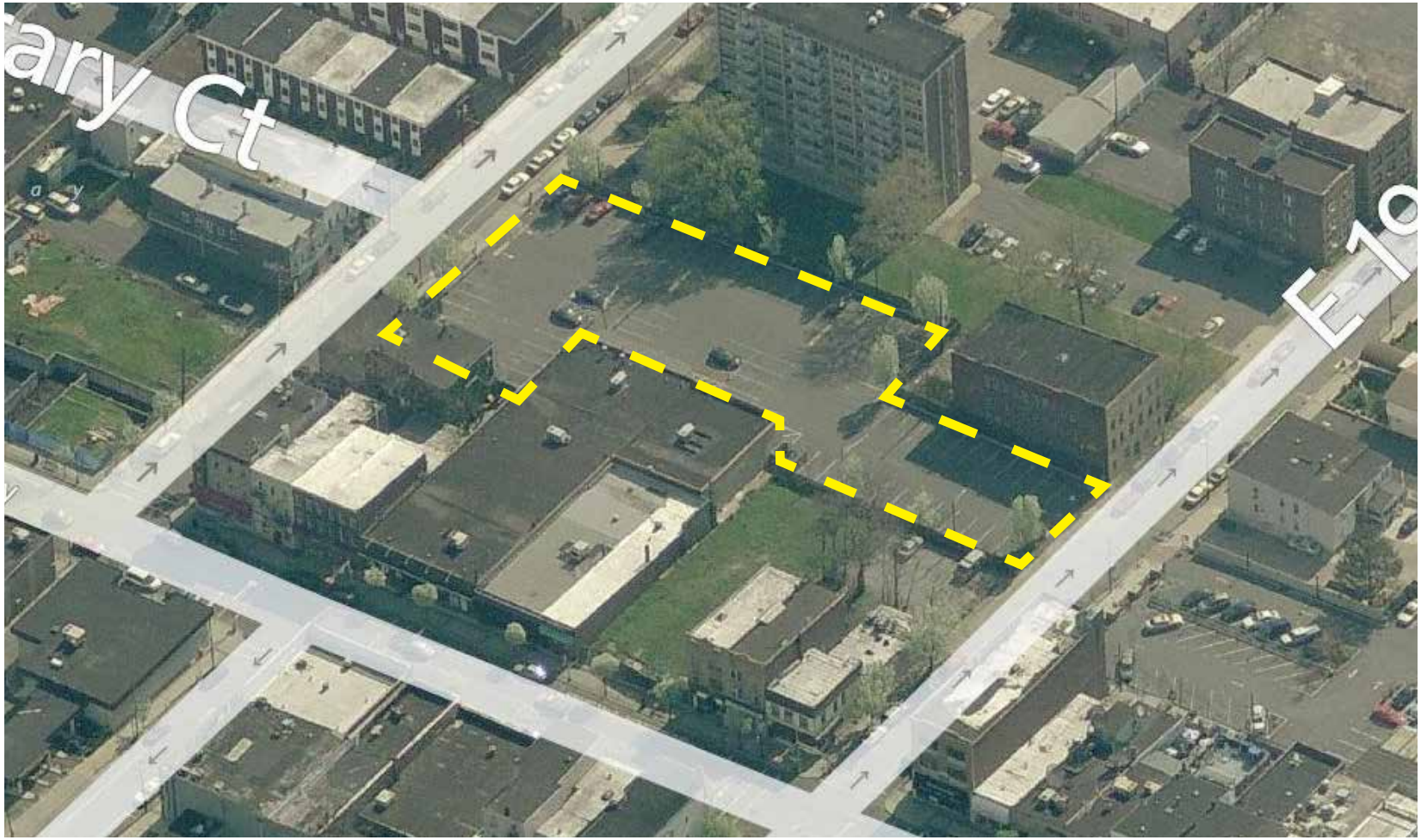
- [x] rain gardens
- [x] curb cuts
- [x] stormwater planters
- [ ] rain barrels
- [ ] buffers
- [ ] cisterns
- [ ] pervious pavement
- [ ] bioswales
- [ ] depaving


W 26th St
E 27th St
E 28th St
W 25th St
E 26th St
Broadway
Prospect Ave
E 27th St
W 24th St
Church Ln
E 25th St
Avenue E
E 26th St
Del Monte Dr
E 24th St
New St
E 24th St

The site is at the residential apartments located at 50 East 26th Street. At the back of the southern most parking lot there is sediment buildup in the southeastern corner, and there are downspouts that can be disconnected into a planter box or a rain garden. The parking lot drains along the eastern curb to a catch basin; curb cuts can convey water to a stormwater planter. In the front of the building there is a large grassed area with a downspout that can be disconnected into a rain garden. Alongside East 25th Street is a grassed area; curb cuts can be created along with a stormwater planter to increase infiltration. Along the north side of the complex is a suitable area for curb cuts into a planter box. Adjacent to 26th Street, a bioswale can be constructed.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

- [x] rain gardens
- [x] curb cuts
- [x] stormwater planters
- [ ] rain barrels
- [ ] buffers
- [ ] cisterns
- [ ] pervious pavement
- [x] bioswales
- [ ] depaving



EAST 21ST STREET MUNICIPAL LOT #1

East 21st Street
Bayonne, NJ 07002


This site is Municipal Parking Lot #1 located on East 21st Street. The parking lot has entrances on both East 19th Street and East 21st Street and contains both public and private (Bayonne Renal Center) parking. The majority of the site drains to the sidewalk along East 21st Street, directly channeling stormwater to the street and nearby sewer drains. Due to its size, this site is not an ideal location for tree islands or other plantings within the lot; however, much can be done along the sidewalk and entrances of the lot to help prevent stormwater from draining directly to the street. Porous asphalt can be used along the East 21st Street entrance and the first row of parking spots. This will capture rainwater and allow it to infiltrate instead of directly draining from the site. The sidewalk along the East 21st Street entrance can also be replaced with porous concrete.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

☐ rain gardens	☐ curb cuts	☐ stormwater planters
☐ rain barrels	☐ buffers	☐ cisterns
☑ pervious pavement	☐ bioswales	☐ depaving

WEST 21ST STREET MUNICIPAL LOT #2

West 21st Street
Bayonne, NJ 07002



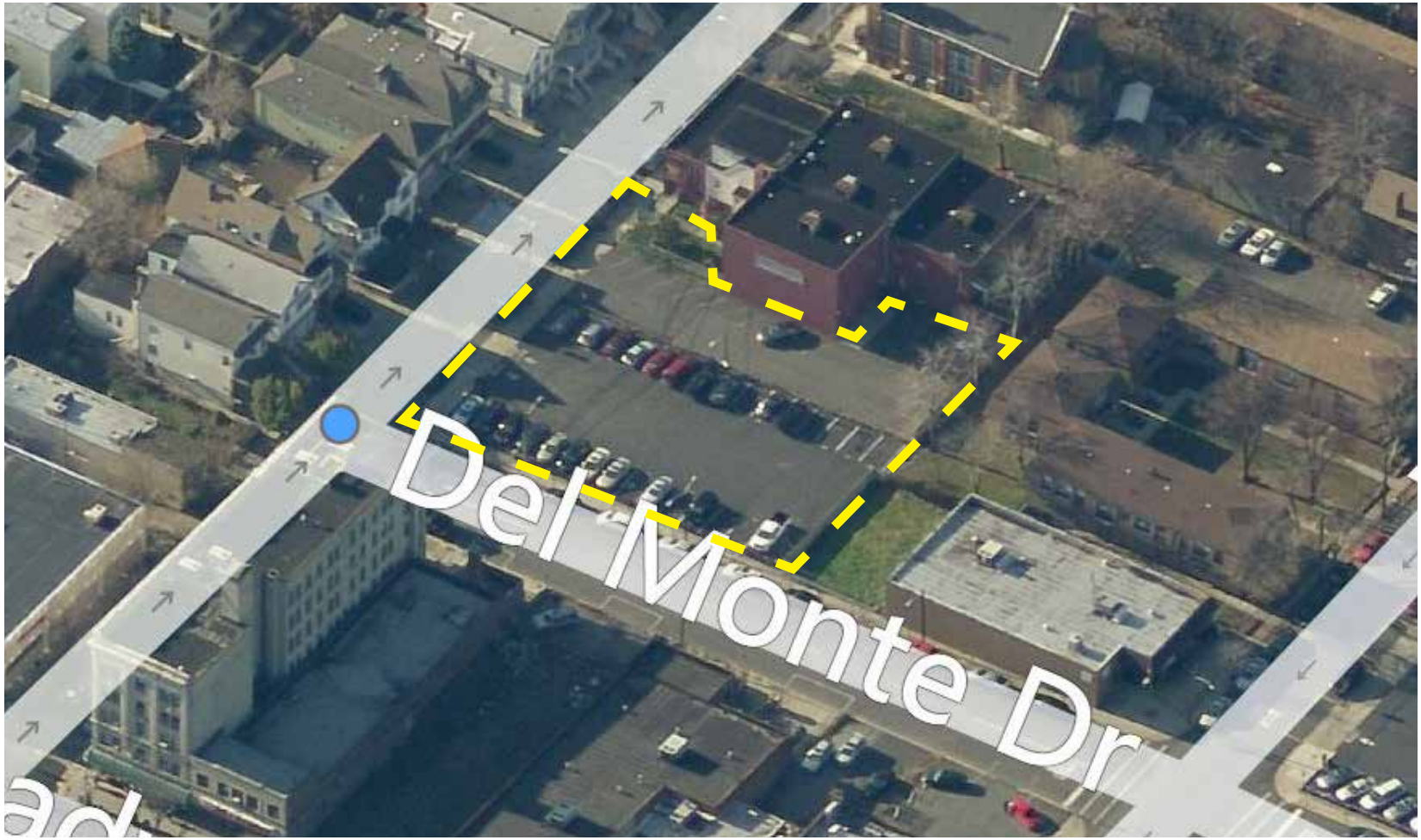
This site is Municipal Parking Lot #2 located on West 21st Street. The majority of the site drains to the sidewalk along West 21st Street, directly channeling stormwater to the street and nearby sewer drains. Due to its size, this site is not an ideal location for tree islands or other plantings within the lot; however, much can be done along the sidewalk and entrances of the lot to help prevent stormwater from draining directly to the street. Porous asphalt can be used along West 21st Street entrance and the first row of parking spots. This will capture rainwater and allow it to infiltrate instead of directly draining from the site. Similarly, the sidewalk along the West 21st Street entrance can also be replaced with porous concrete. A designed streetscape containing trees and other plantings can also be implemented as a measure to help decrease the stormwater runoff from the site.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

- ☐ rain gardens
- ☐ rain barrels
- ☑ pervious pavement
- ☐ curb cuts
- ☐ buffers
- ☐ bioswales
- ☑ stormwater planters
- ☐ cisterns
- ☐ depaving

WEST 21ST STREET MUNICIPAL LOT #2

West 21st Street
Bayonne, NJ 07002



WEST 22ND STREET MUNICIPAL LOT #3

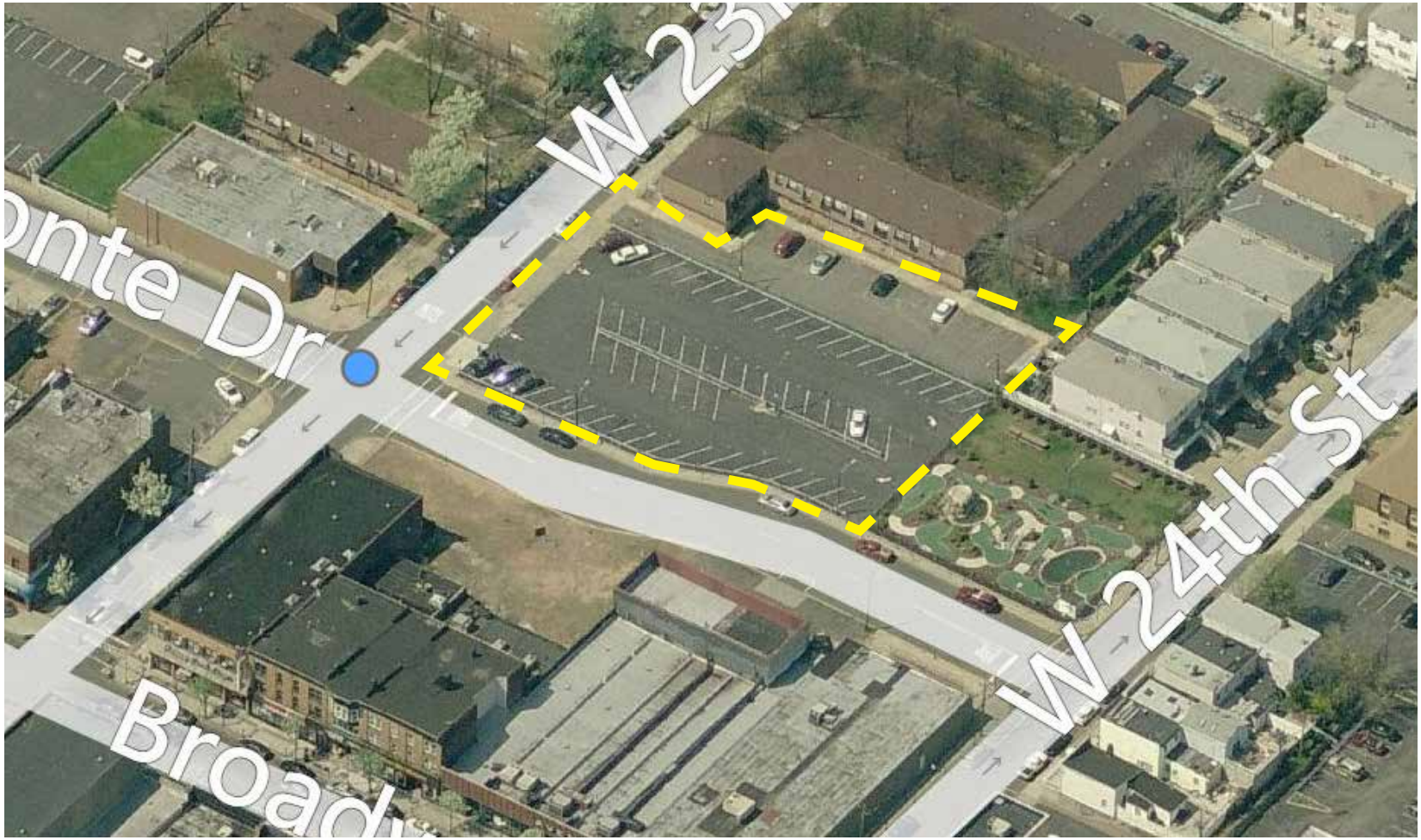
West 22nd Street & Delmonte Drive
Bayonne, NJ 07002



This site is Municipal Parking Lot #3 located on West 22nd Street. The parking lot is on the corner of West 22nd Street and Delmont Drive, with an entrance on West 22nd Street. The western end of the lot is private parking with its own entrance to West 22nd Street. The majority of the lot drains to the southern corner of the site where a pipe then channels water from the lot to the street (corner of West 22nd Street and Delmont Drive). The site has more space than is being utilized; therefore, it may be feasible to put plantings along the center of the lot to help catch rainwater or to shift the parking spaces along Delmont Drive further west allowing for the eastern edge of the lot to be converted to porous asphalt.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

- ☐ rain gardens
- ☐ curb cuts
- ☑ stormwater planters
- ☐ rain barrels
- ☐ buffers
- ☐ cisterns
- ☑ pervious pavement
- ☐ bioswales
- ☐ depaving



WEST 23RD STREET MUNICIPAL LOT #4

West 23rd Street & Delmonte Drive
Bayonne, NJ 07002

This site is Municipal Parking Lot #4 located on West 23rd Street. The parking lot is on the corner of West 23rd Street and Delmont Drive, with an entrance on West 23rd Street. The western end of the lot is private parking with its own entrance to West 23rd Street. The majority of the lot drains to the southern corner of the site where a pipe then channels water from the lot to the local sewer system. Porous asphalt can be used along the entrance and southern corner of the site to help decrease stormwater runoff. Due to the size of the sidewalk at the entrance of the site, a designed streetscape with trees and other plantings can be used to help decrease the amount of water that drains from the site.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

- ☐ rain gardens
- ☐ rain barrels
- ☑ pervious pavement
- ☐ curb cuts
- ☐ buffers
- ☐ bioswales
- ☑ stormwater planters
- ☐ cisterns
- ☐ depaving

WEST 23RD STREET MUNICIPAL LOT #4

West 23rd Street & Delmonte Drive
Bayonne, NJ 07002

EAST 24th STREET MUNICIPAL LOT #6

East 24th Street & Church Lane
Bayonne, NJ 07002

This site is Municipal Parking Lot #6 located on East 24th Street. The parking lot is on the southern corner of East 24th Street and Church Lane, with an entrance on East 24th Street. The majority of the site drains directly to the sidewalk along the East 24th Street side of the parking lot. Porous asphalt can be used along the entrance and exit of the site to help decrease stormwater runoff. In addition, due to the size of the sidewalk at the entrance of the site, a designed streetscape with trees and other plantings can be used to help decrease the amount of water that drains from the site and into the street.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

- ☐ rain gardens
- ☐ rain barrels
- ☑ pervious pavement
- ☐ curb cuts
- ☐ buffers
- ☐ bioswales
- ☑ stormwater planters
- ☐ cisterns
- ☐ depaving

EAST 24th STREET MUNICIPAL LOT #6

East 24th Street & Church Lane
Bayonne, NJ 07002

EAST 24th STREET MUNICIPAL LOT #7

East 24th Street & Church Lane
Bayonne, NJ 07002



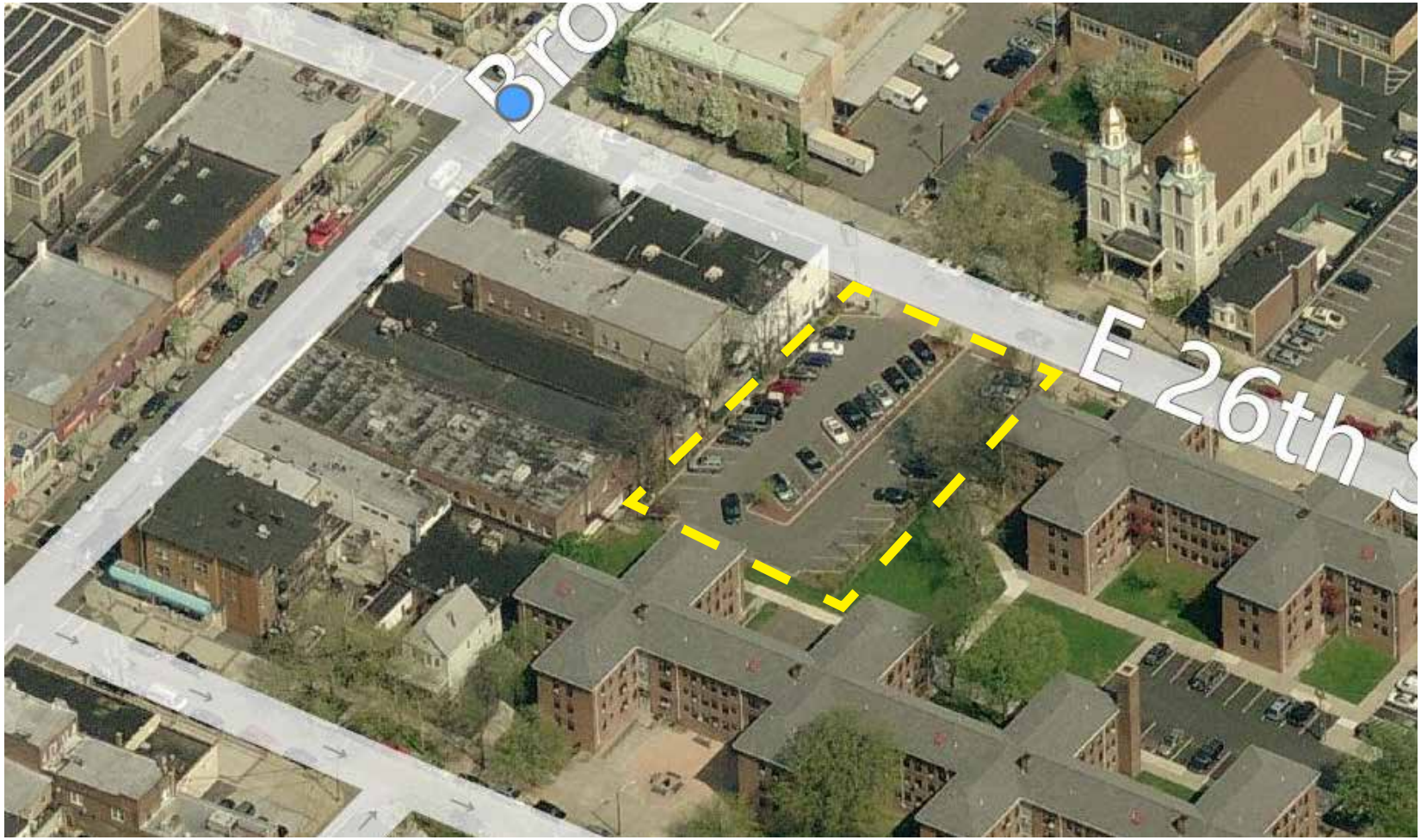
This site is Municipal Parking Lot #7 located on East 24th Street. The parking lot is on the eastern corner of East 24th Street and Church Lane, with an entrance and exit on Church Lane. The majority of the lot drains to the southern corner of the site where a pipe then channels water from the lot to the local sewer system. There is a pre-exisiting green space in the corner containing two trees. Curb cut outs can be made here to allow water draining from the site to drain to the green space. Multiple rain gardens can be constructed in this space allowing water to infiltrate before draining from the site. An existing drain, part of a pre-existing bioswale, can be elevated and used as an overflow for the rain garden.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

- [x] rain gardens
- [x] curb cuts
- [ ] stormwater planters
- [ ] rain barrels
- [ ] buffers
- [ ] cisterns
- [ ] pervious pavement
- [ ] bioswales
- [ ] depaving

EAST 24th STREET MUNICIPAL LOT #7

East 24th Street & Church Lane
Bayonne, NJ 07002



EAST 26th STREET MUNICIPAL LOT #8

East 26th Street
Bayonne, NJ 07002



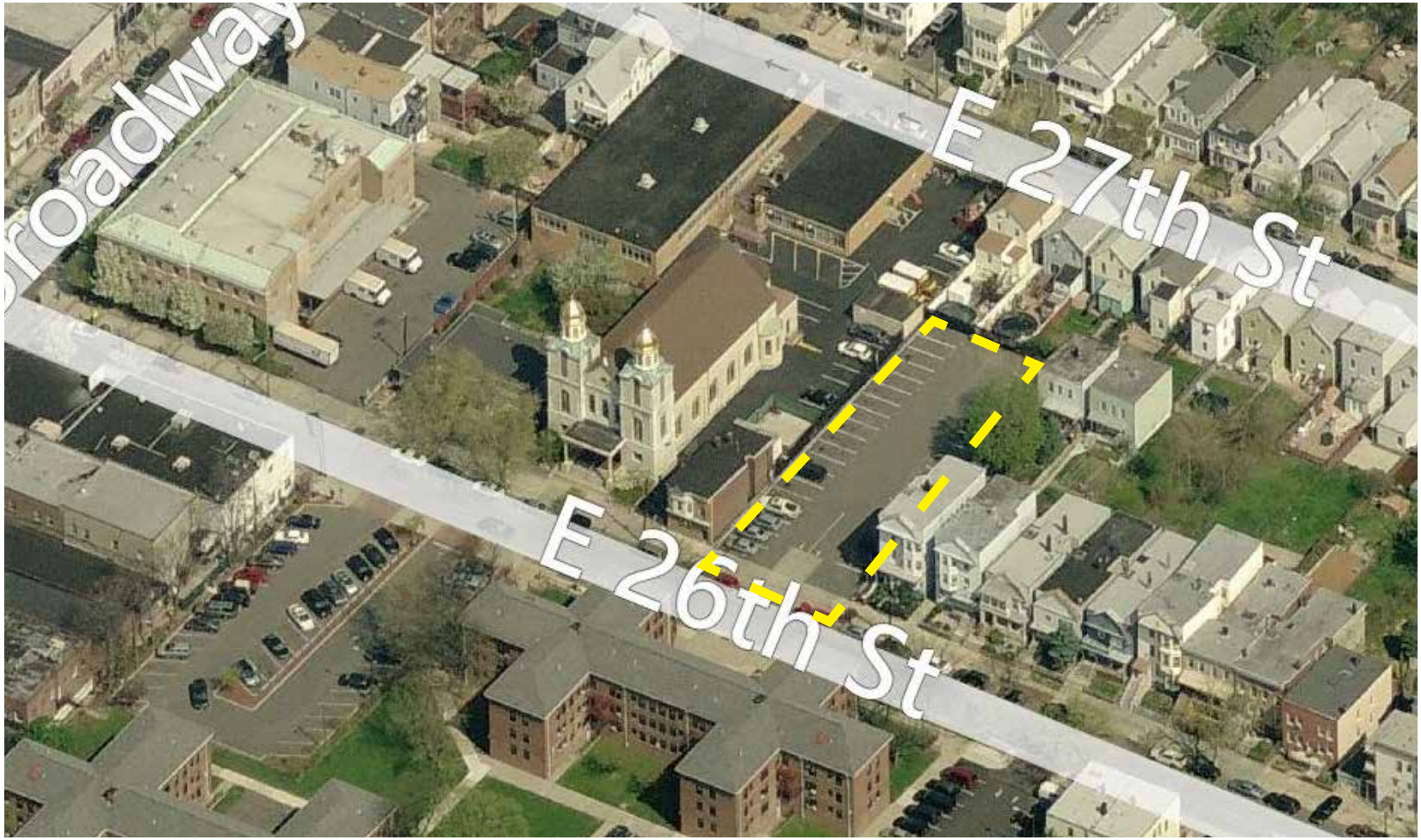
This site is Municipal Parking Lot #8 located on East 26th Street. The majority of the lot drains to the center of the site and then to the sidewalk along East 26th street. Porous asphalt can be used along the entrance and exit of the site to help decrease stormwater runoff. Due to the size of the sidewalk at the entrance of the site, a designed streetscape with trees and other plantings can be used to help decrease the amount of water that drains from the site. Curb cuts can be made along the grassy median in the parking lot, allowing for the construction of a rain garden. Similarly, curb cuts can be made along the southeastern edge of the site allowing for the construction of a rain garden. A drain currently located in the eastern corner of the site can be used as an overflow for the rain garden.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

- [x] rain gardens
- [x] curb cuts
- [x] stormwater planters
- [ ] rain barrels
- [ ] buffers
- [ ] cisterns
- [x] pervious pavement
- [ ] bioswales
- [ ] depaving

EAST 26th STREET MUNICIPAL LOT #8

East 26th Street
Bayonne, NJ 07002



EAST 26th STREET MUNICIPAL LOT #9

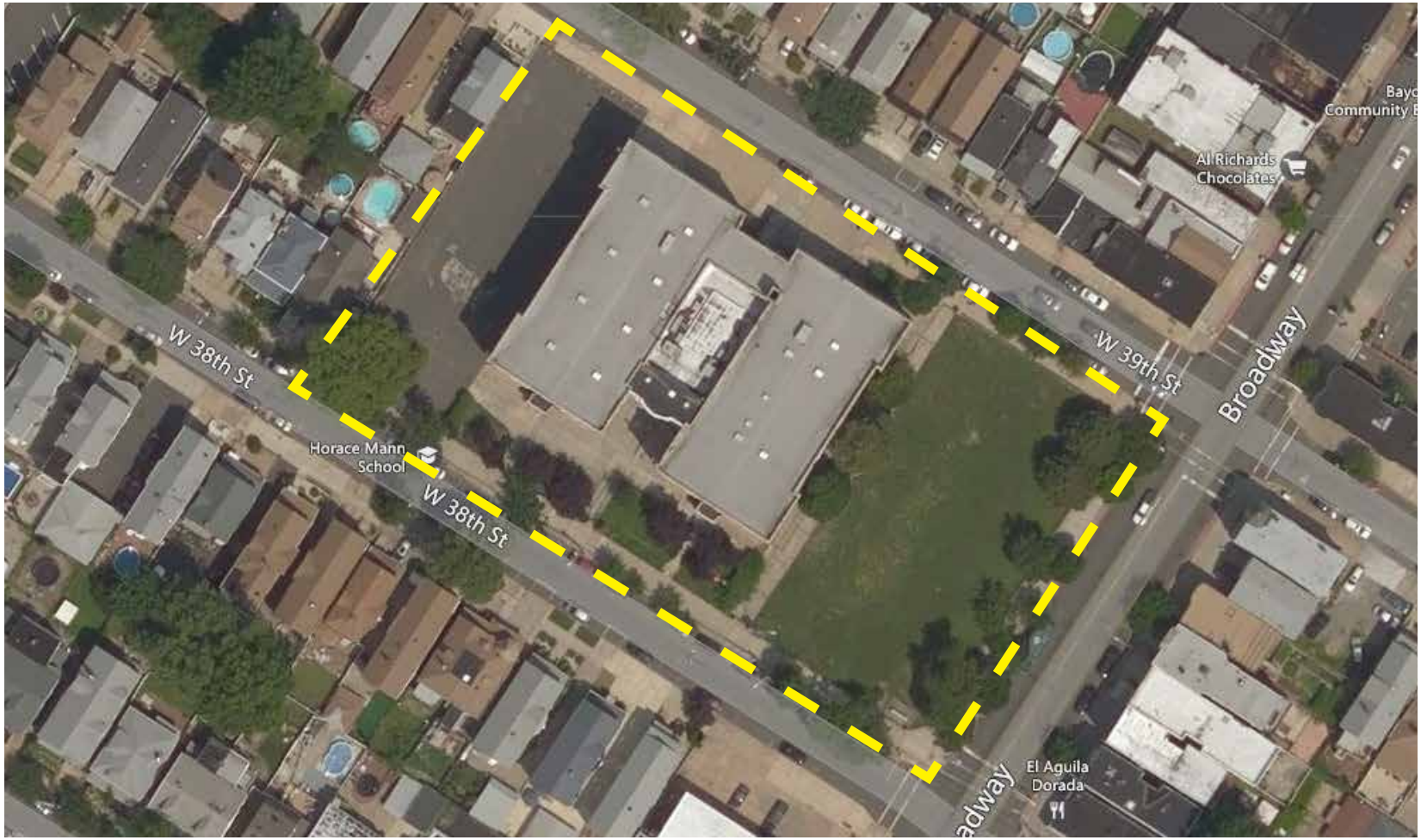
East 26th Street
Bayonne, NJ 07002



This site is Municipal Parking Lot #9 located on East 26th Street. The majority of the lot drains to the sidewalk along East 26th street. Porous asphalt can be used along the entrance and exit of the site to help decrease stormwater runoff. Similarly, the sidewalks can be converted to porous concrete allowing stormwater to infiltrate rather than drain from the site. Due to the size of the sidewalk at the entrance of the site, a designed streetscape with trees and other plantings can be used to help decrease the amount of water that drains from the site.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

- ☐ rain gardens
- ☐ curb cuts
- ☑ stormwater planters
- ☐ rain barrels
- ☐ buffers
- ☐ cisterns
- ☑ pervious pavement
- ☐ bioswales
- ☐ depaving



HORACE MANN SCHOOL

25 West 38th Street
Bayonne, NJ 07002



The site is Horace Mann School located at 25 West 38th Street. Downspouts along 38th Street are piped under the sidewalk and discharge at the gutter in the street. They can be disconnected to a rain garden or cistern in the open lawn areas of the property. Enhanced tree pits allow stormwater storage and infiltration in street tree plantings. They can be implemented along the 39th Street sidewalk where few trees currently exist.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

- [x] rain gardens
- [ ] curb cuts
- [ ] stormwater planters
- [ ] rain barrels
- [ ] buffers
- [x] cisterns
- [ ] pervious pavement
- [ ] bioswales
- [ ] depaving

BAYONNE REDEVELOPMENT AREAS



Bayonne has several sites of planned redevelopment. Green infrastructure, water quality, and sustainable stormwater best management practices should be prioritized in all new development.

Site 1	236 West 1st Street
Site 2	186 West 21st Street
Site 3	Avenue E between 21st Street–3rd Street
Site 4	Goldsborough Drive/Waterfront

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

- ☑ rain gardens
- ☑ rain barrels
- ☑ pervious pavement
- ☑ curb cuts
- ☑ buffers
- ☑ bioswales
- ☑ stormwater planters
- ☑ cisterns
- ☑ depaving

RUTGERS
New Jersey Agricultural Experiment Station

PASSAIC VALLEY SEWERAGE COMMISSION

"Protecting Public Health and the Environment"