GREEN INFRASTRUCTURE FEASIBILITY STUDY

PATERSON

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 Paterson, 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 Paterson for their input and support in creating this document.

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New Jersey Agricultural Experiment Station

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TABLE OF CONTENTS

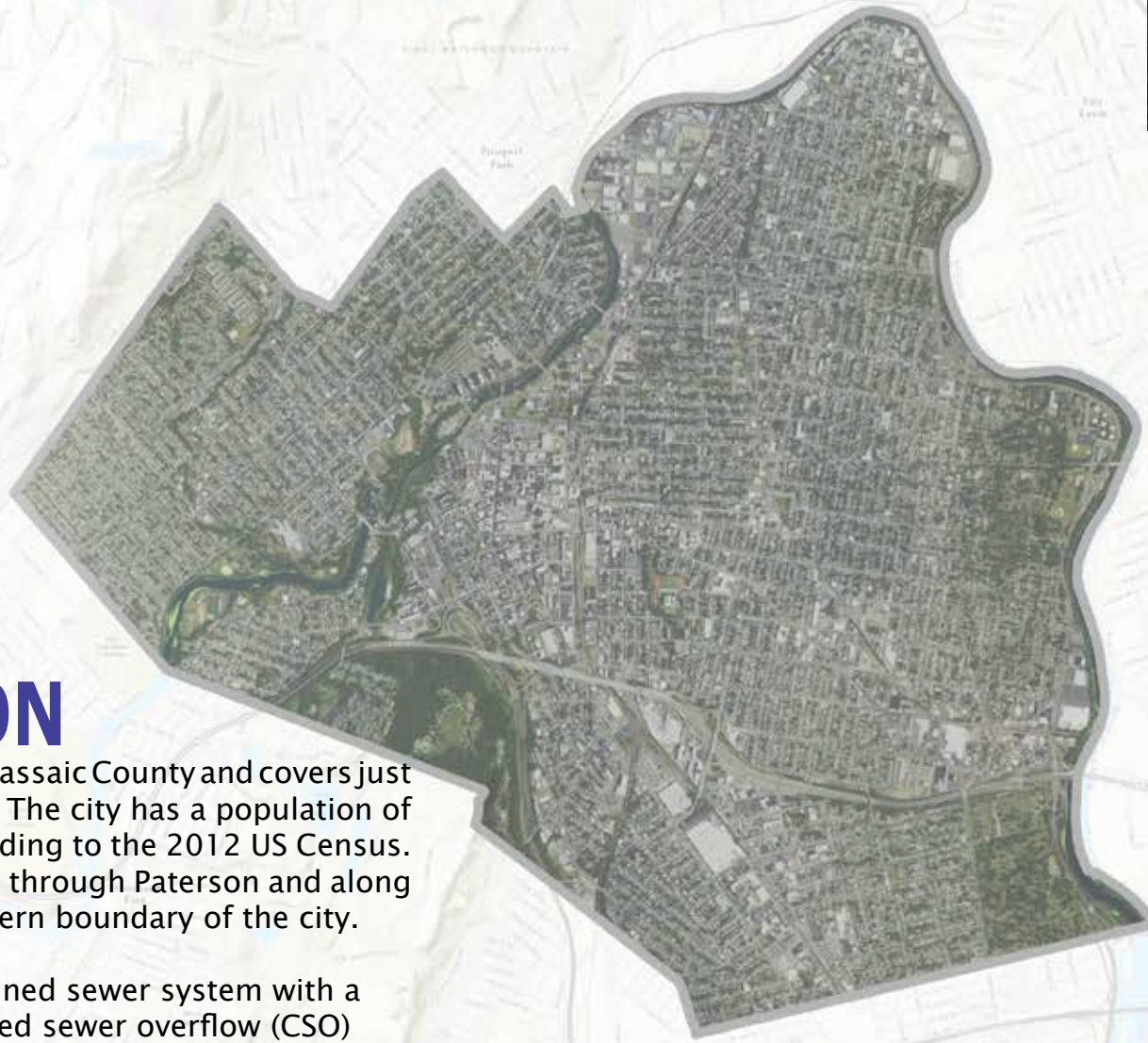
INTRODUCTION

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.

Paterson 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, Paterson 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 Paterson 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.



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PATERSON

Paterson is located in Passaic County and covers just under 9 square miles. The city has a population of 145,219 people according to the 2012 US Census. The Passaic River runs through Paterson and along the northern and eastern boundary of the city.

The town has a combined sewer system with a total of seven 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, Paterson 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.

A 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

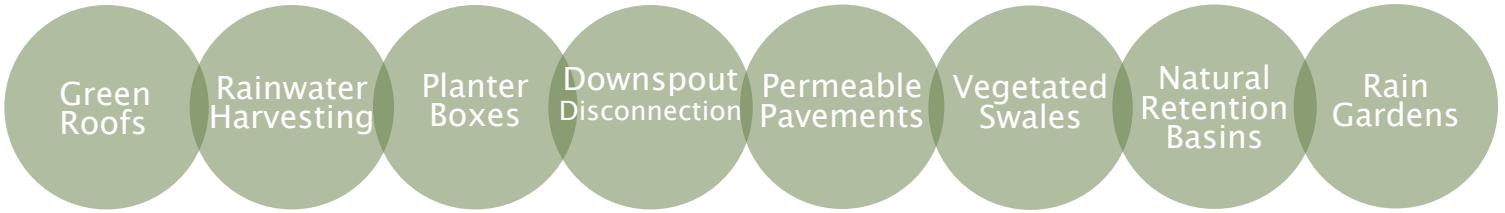
RUNOFF:

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


A
B
C
Rain Garden
D
E

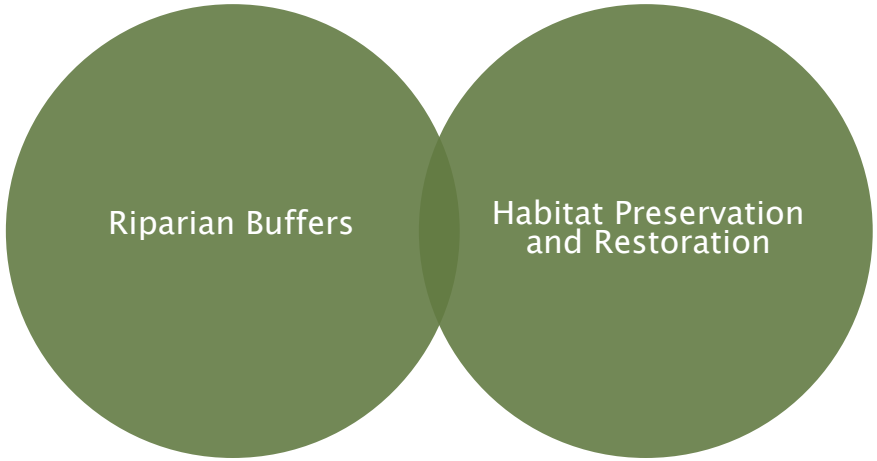
GREEN INFRASTRUCTURE STRATEGIES

SITE



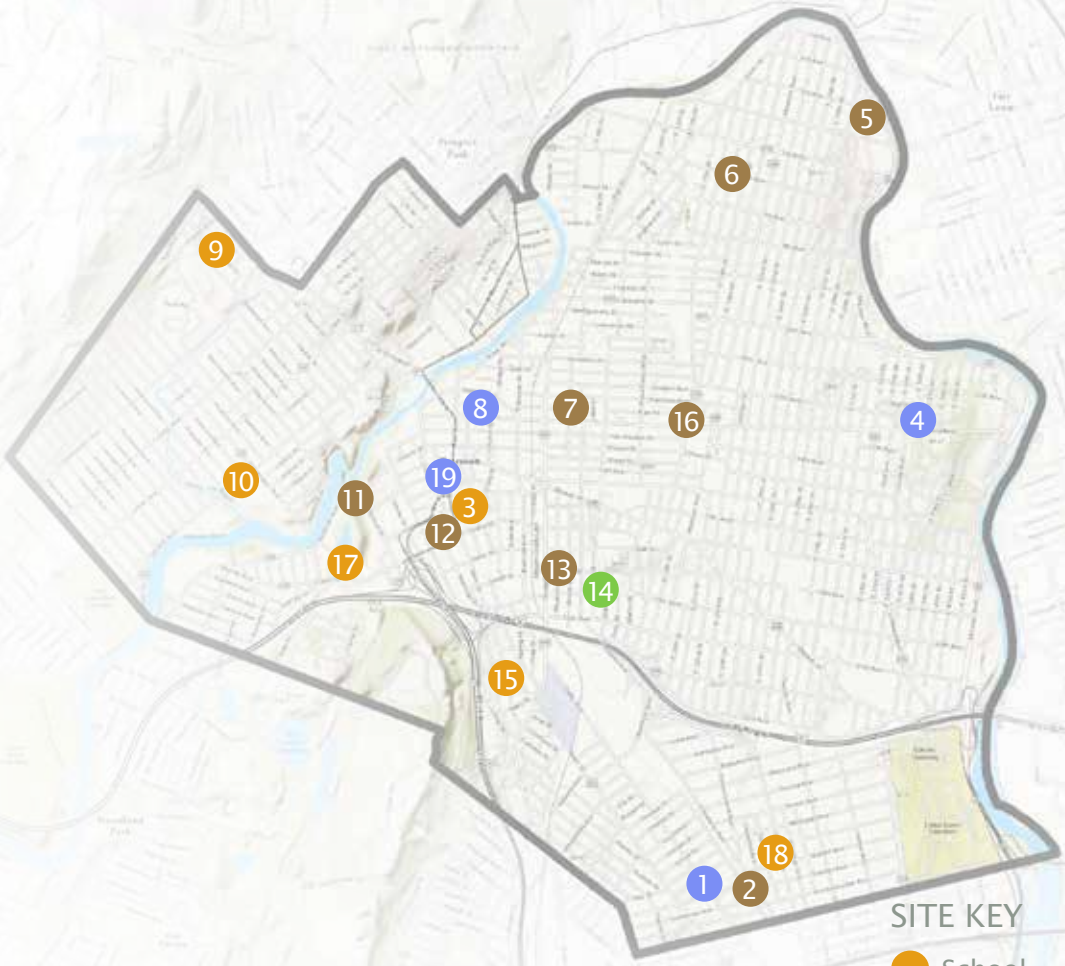
NEIGHBORHOOD

WATERSHED



POTENTIAL PROJECT SITES
WITHIN STUDY AREA

1. PATERSON BOARD OF EDUCATION
2. FARMER'S MARKET
3. NEW JERSEY JUDICIARY
4. DEPARTMENT OF PUBLIC WORKS
5. COMMERCIAL PARKING LOT
6. ABUNDANT LIFE WORSHIP CENTER
7. PATERSON PUBLIC LIBRARY
8. PATERSON MUNICIPAL COURT
9. ST. GERARD ELEMENTARY SCHOOL
10. JFK HIGH SCHOOL
11. PATERSON MUSEUM
12. CATHEDRAL OF ST. JOHN THE BAPTIST
13. ST. ANTHONY'S RC CHURCH
14. GOVERNOR RESIDENTIAL APARTMENTS
15. PATERSON SCHOOL #8
16. ST. PAUL'S EPISCOPAL CHURCH
17. INTERNATIONAL HIGH SCHOOL
18. PATERSON CHARTER SCHOOL
19. PASSAIC COUNTY COURT HOUSE

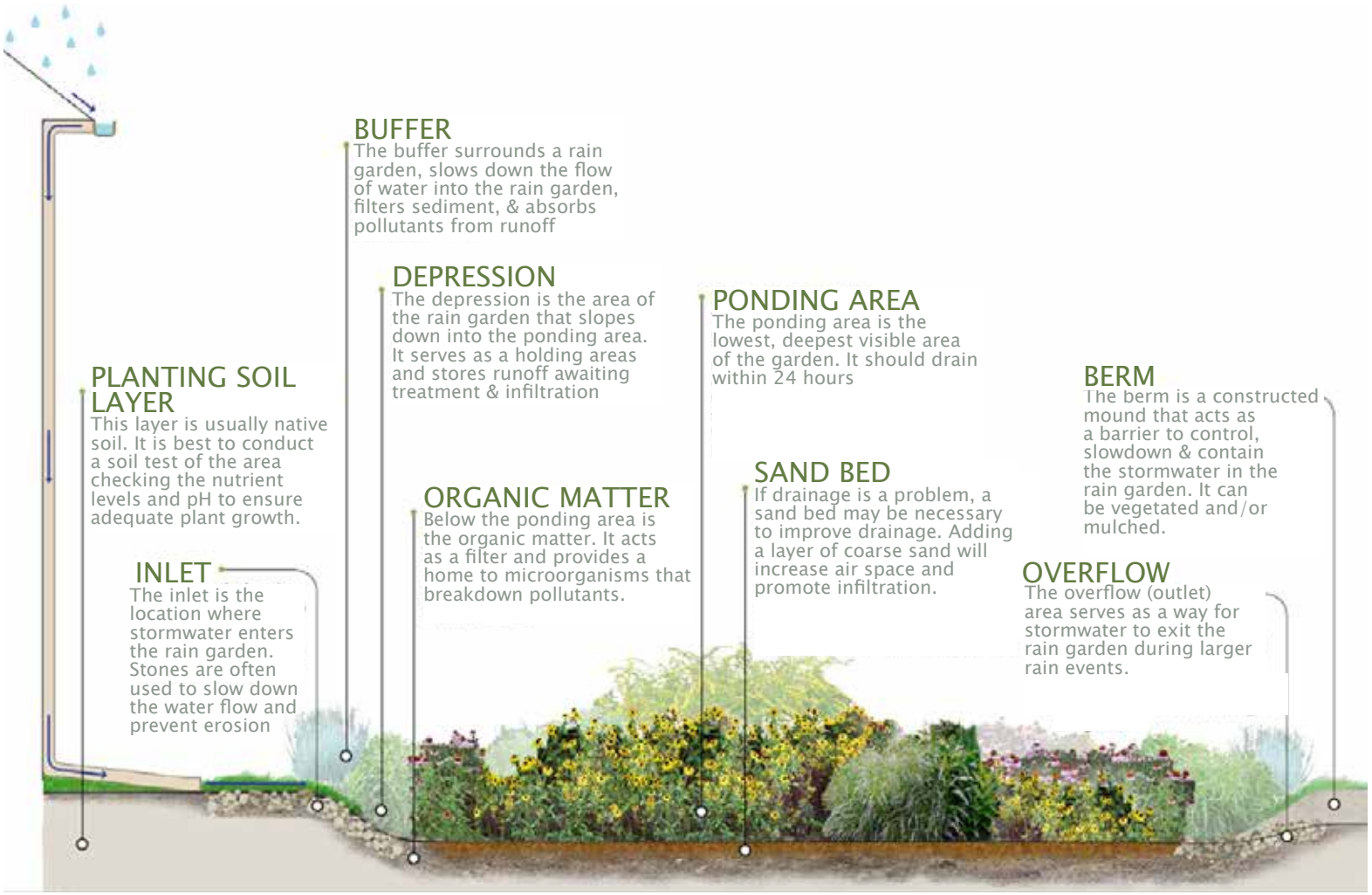



STATE OF
NEW JERSEY
DEPARTMENT OF
ENVIRONMENTAL
PROTECTION

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 in existing landscapes and enhance aesthetics, the community acceptance of vegetative systems is high.



RAIN GARDEN DIAGRAM

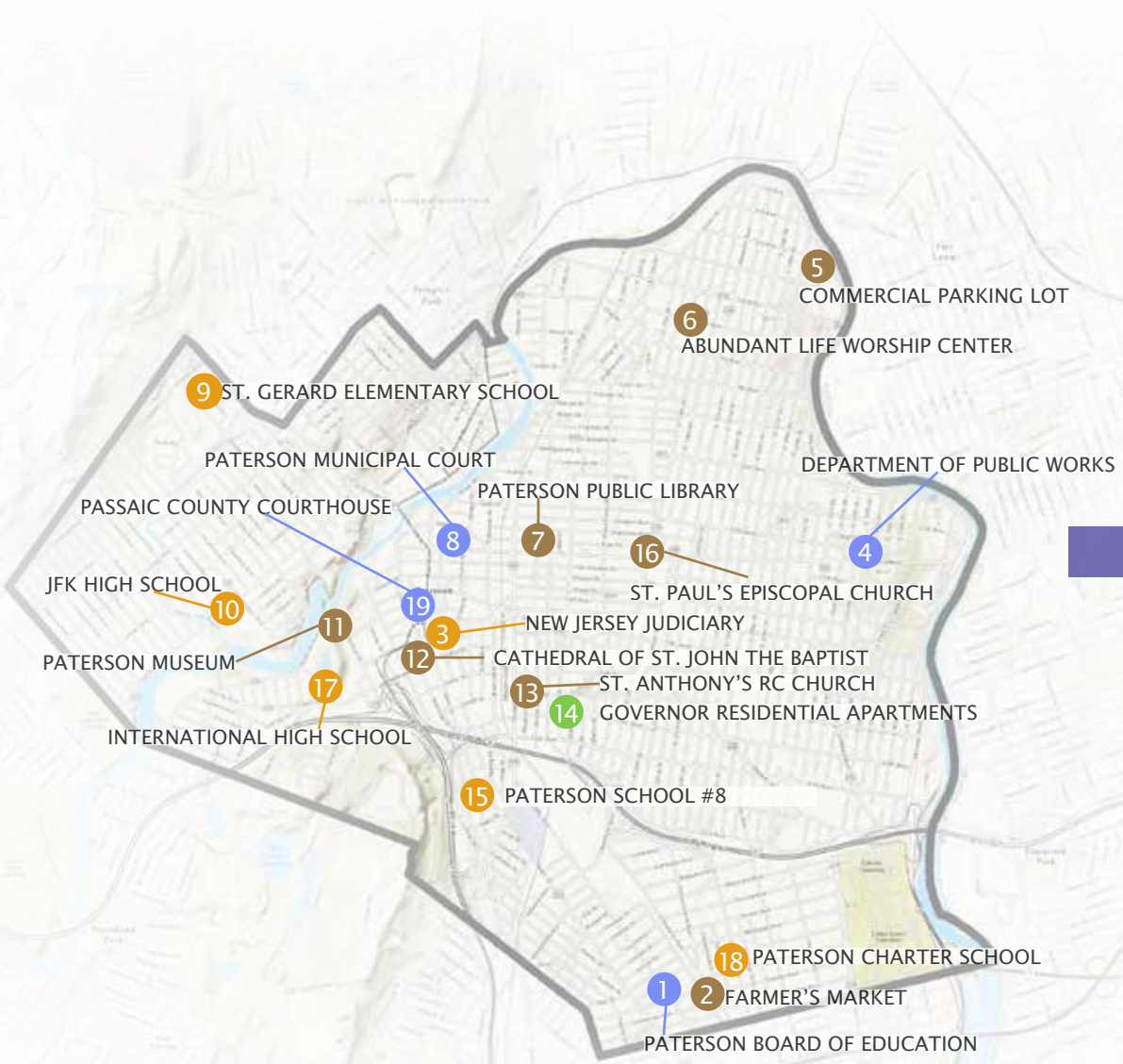
VEGETATED SYSTEM SUITABILITY

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 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

443 Getty Avenue
Paterson, NJ 07503

VEGETATED SYSTEM SUITABILITY: EXAMPLE PROJECT SITE

The site is the Paterson Board of Education located at 443 Getty Avenue. The site is freshly paved. The slope of the lot is from west to east and drains into another adjacent parking lot. There are no external downspouts on the building. There is a single strip of plantings along the building that can be converted to planters with curb cuts to harvest rain water.

RAINWATER HARVESTING SYSTEMS

Rainwater harvesting systems focus on conservation, capture, storage and reuse of rain water. 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

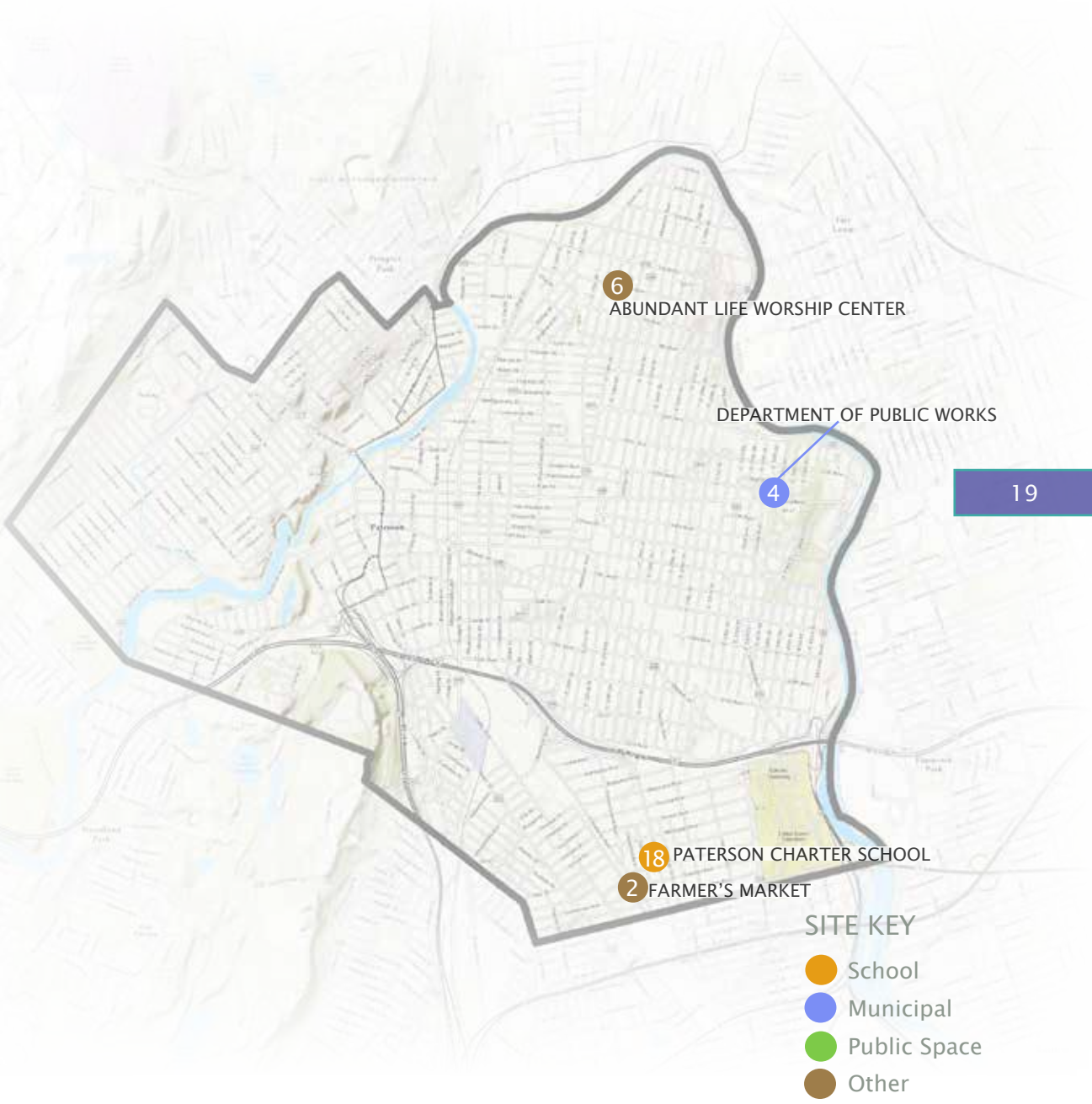
OVERFLOW OUTLET
Releases water when the rain barrel reaches capactiy

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 rainy months in spring and summer provides a source of water during hot, 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 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 running off of 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, decreasing flow to sewer systems. Rain barrels and cisterns provide an alternative source of water for gardens, lawns, and landscaping reducing the use of potable water supplies.



RAINWATER HARVESTING SYSTEM SUITABILITY: EXAMPLE PROJECT SITE

FARMER'S MARKET

287 East Railway Avenue
Paterson, NJ 07503

RAINWATER HARVESTING SYSTEM SUITABILITY: EXAMPLE PROJECT SITE

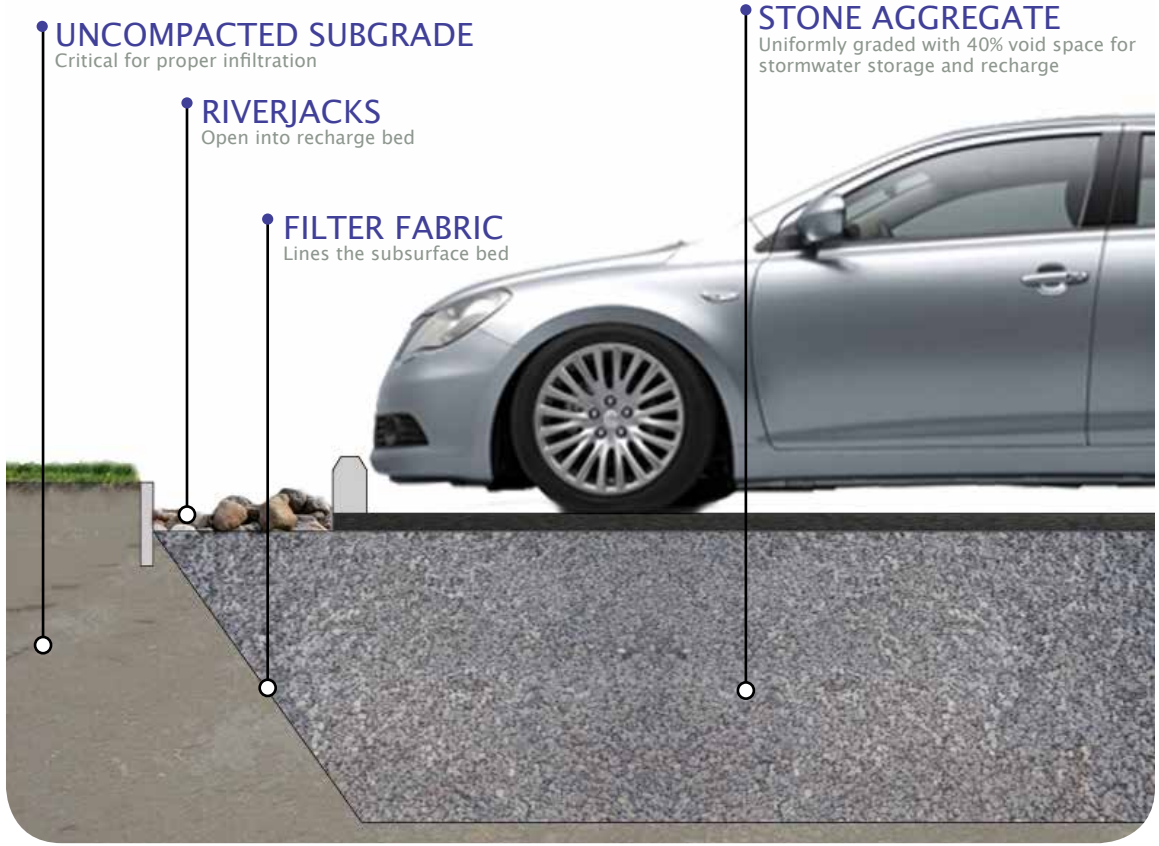
The site the farmers market located at 287 East Railway Avenue. The area is mostly paved and in good condition. The lot slopes slightly eastward and drains to the adjacent road. There are no storm drains on the lot. There is a downspout that discharges from the north west most building to the sidewalk, perhaps a rain barrel can collect the water. Under the stalls, areas are paved but it appears they see heavy vendor traffic.

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

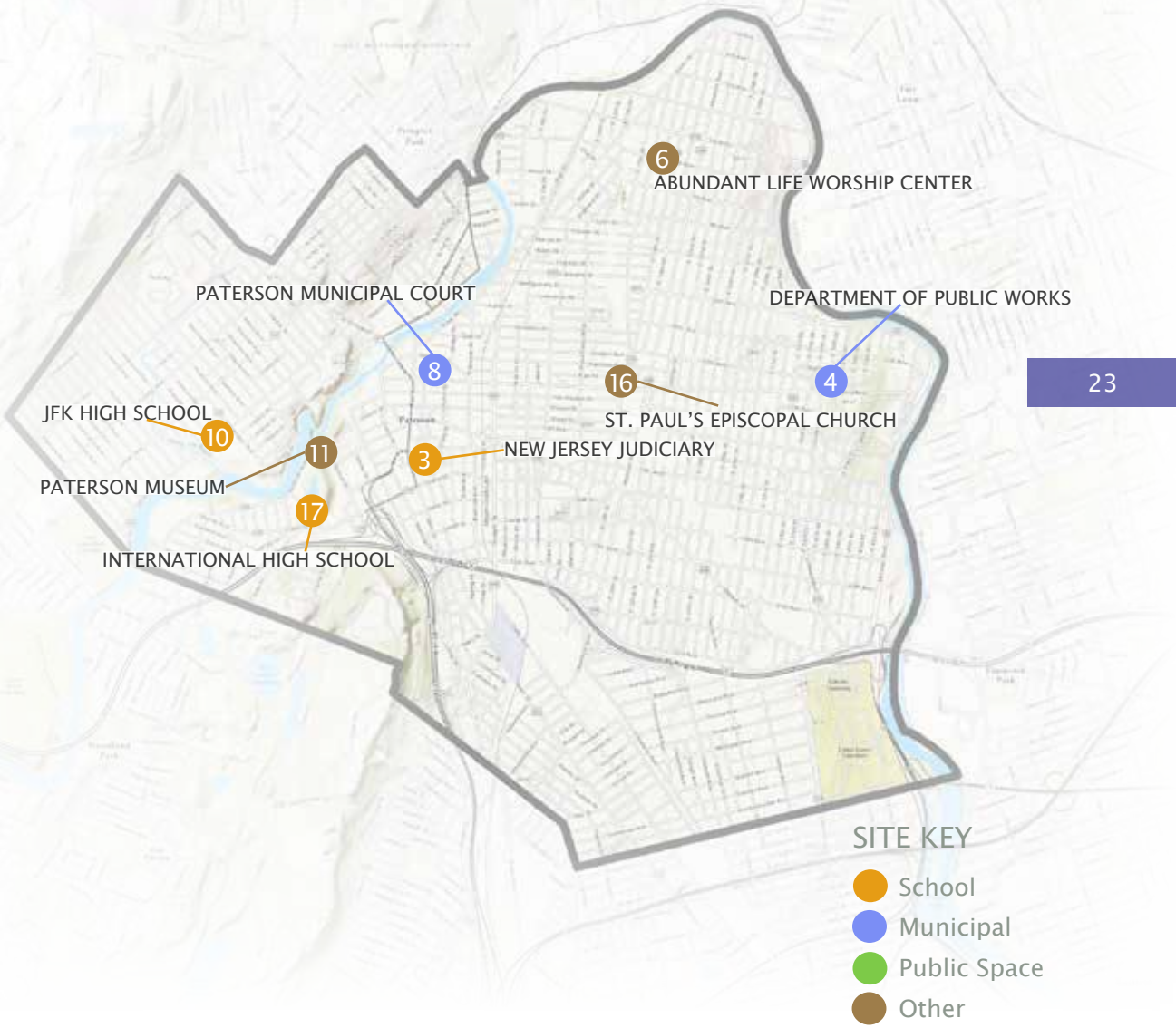
Pervious paving systems are paved areas that produce less stormwater runoff than areas paved with conventional paving. These systems include:

- Permeable pavers
- Porous asphalt
- Pervious concrete

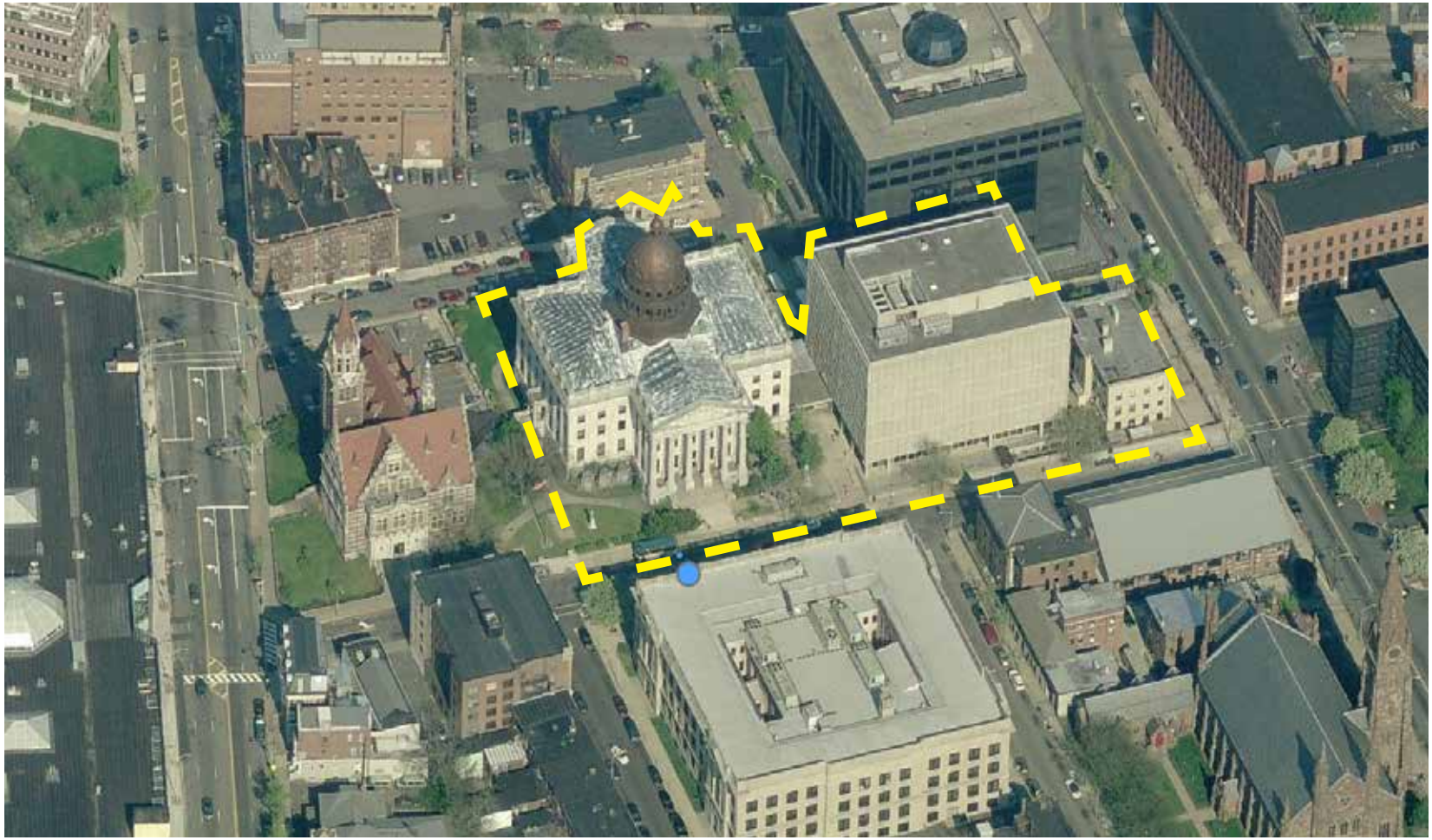
The paving material is placed over a bed of uniformly graded stone. The paving materials allow water to pass through and then infiltrate into the pore spaces of the underlying stone bed. The stored runoff then infiltrates over time into the uncompacted subgrade soils.

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 p lanter) 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



77 Hamilton Street
Paterson, NJ 07505

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

The site is the New Jersey Judiciary located at 77 Hamilton Street. The site slopes from southwest to northeast. The site has no external downspouts. There is a patio on the north side of the building that can be converted to pervious pavement.


TREE
PLANTING

COMMUNITY ENGAGEMENT & EDUCATION

BUILD A RAIN BARREL WORKSHOP



With the Build-a-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 drains from hard surfaces like rooftops, driveways, roadways, parking lots, and compacted lawns, it carries pollution to our local waterways. Harvesting the rain water in a rain barrel is just one of the ways homeowners can reduce rain water from 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), 21st 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 offeredto meet a variety of schedules.




MAINTENANCE PROCEDURES

MAINTAINING PATERSON'S GREEN INFRASTRUCTURE SYSTEMS

1. VEGETATED SYSTEMS
   - Rain Gardens
   - Stormwater Planters
   - Bioswales

2. RAINWATER HARVESTING
   - Rain Barrels
   - Cisterns

3. STORAGE, QUANTITY, AND INFILTRATION
   - Pervious Pavements

4. COMBINATION OF STRATEGY TYPES

VEGETATED SYSTEM MAINTENANCE

RAIN GARDEN:

Weekly

- Watering
- Weeding
- Inspecting for invasive plants, plant health, excessive sediment, and movement of sediment within the rain garden
- Observing 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

- Mulching in the spring to retain a 3 inch mulch layer in the garden
- Pruning during dormant season to improve plant health
- Removing sediment
- Planting
- Soil testing (every 3 years)
- Harvesting plants to use in other parts of the landscape
- Cleaning debris from gutters connected to rain garden
- Replacing 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 no water can enter and freeze within the barrel
- Weekly check: Check for leaks, clogs and other obstructions, for holes and vent openings where animals, insects and rodents may enter, repair leaks with sealant, and rain 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, make any necessary replacements, inspect cistern cover, screen, overflow pipe, sediment trap and other accessories. Make 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



The site is the Department of Public Works located within East Side Park at 800 Broadway. The land slopes westward and northwest. The southernmost building has a downspout that has erosion underneath it. A cistern or downspout planter can be installed underneath it. The road near the building is in disrepair and can be repaved with a pervious surface. Also, in the playground area westward of the building, rain gardens can be installed to collect runoff from paved surfaces. At the site there are downspouts that discharge to concrete, and a cistern may be installed beneath them.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

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


The site is a commercial parking lot located at 284 4th Avenue. The site slopes heavily to the east, and there is a dropoff at the end of the parking lot to the road. There is a creek next to the road which the area drains directly to. There is a series of islands at the end of the parking lot which can be converted to rain gardens or bioswales with curb cuts to capture runoff before it reaches the waterway.

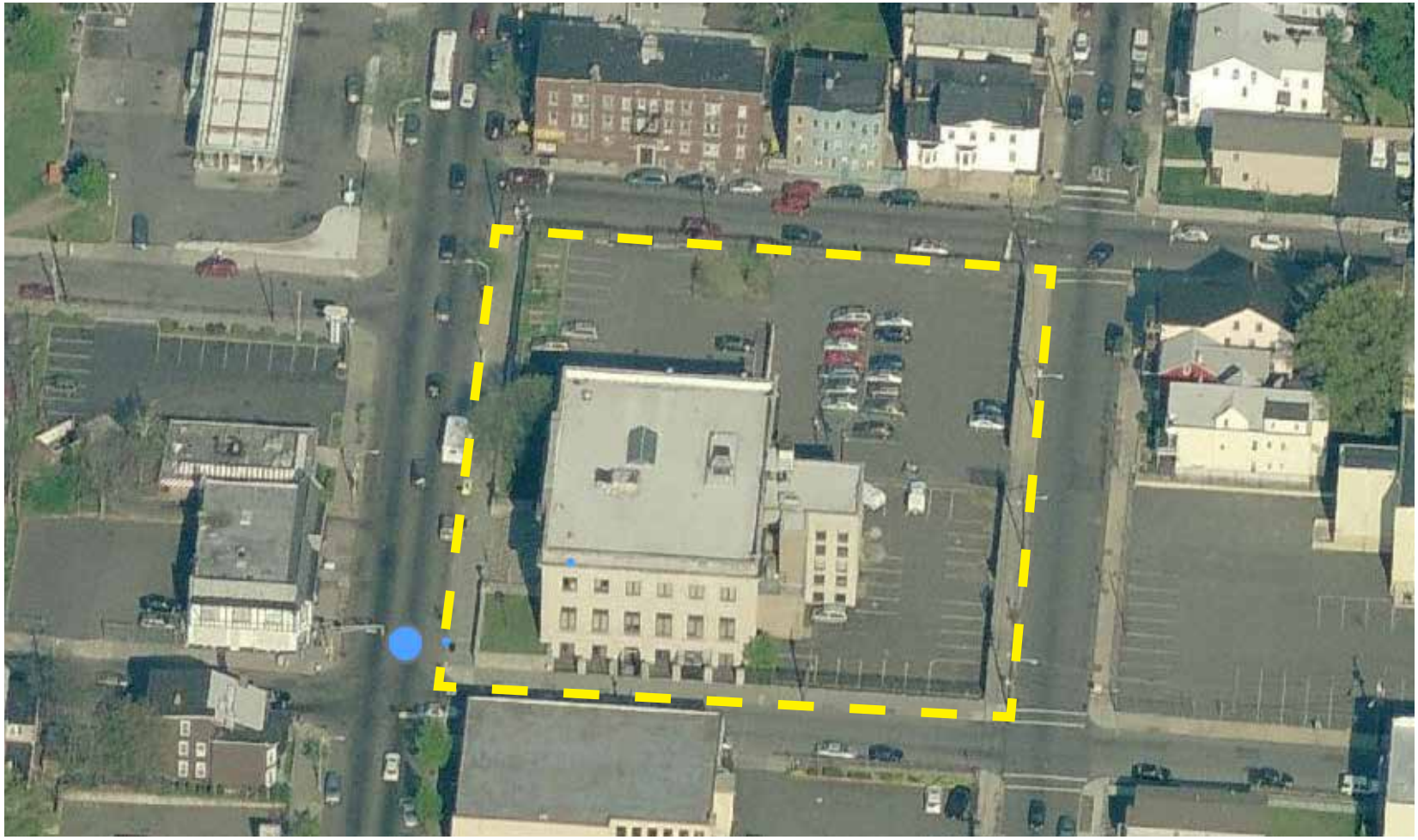
SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

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

The site is the Abundant Life Worship Center located at 243 East 18th Street. The site slopes to the west, and in the front (west) of the building there are downspouts that discharge to lawn areas. By adding a rain garden, runoff can be intercepted before it reaches the road and storm drains. In the rear of the building is a parking lot that appears to require replacement soon; pervious pavement should be considered. There is a downspout in the back of the building that can be connected to a rain barrel, cistern, or possibly a downspout planter.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

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





The site is the Paterson Public Library located at 250 Broadway. The majority of the area is paved, and it is in good condition. There are no exterior downspouts on the building. There is a small island of grass on the east side of the building and parking lot. This area has a slope from the west running into it, and then it slopes down to the south. A bioswale and/or rain garden could be implemented here to help slow and direct stormwater.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

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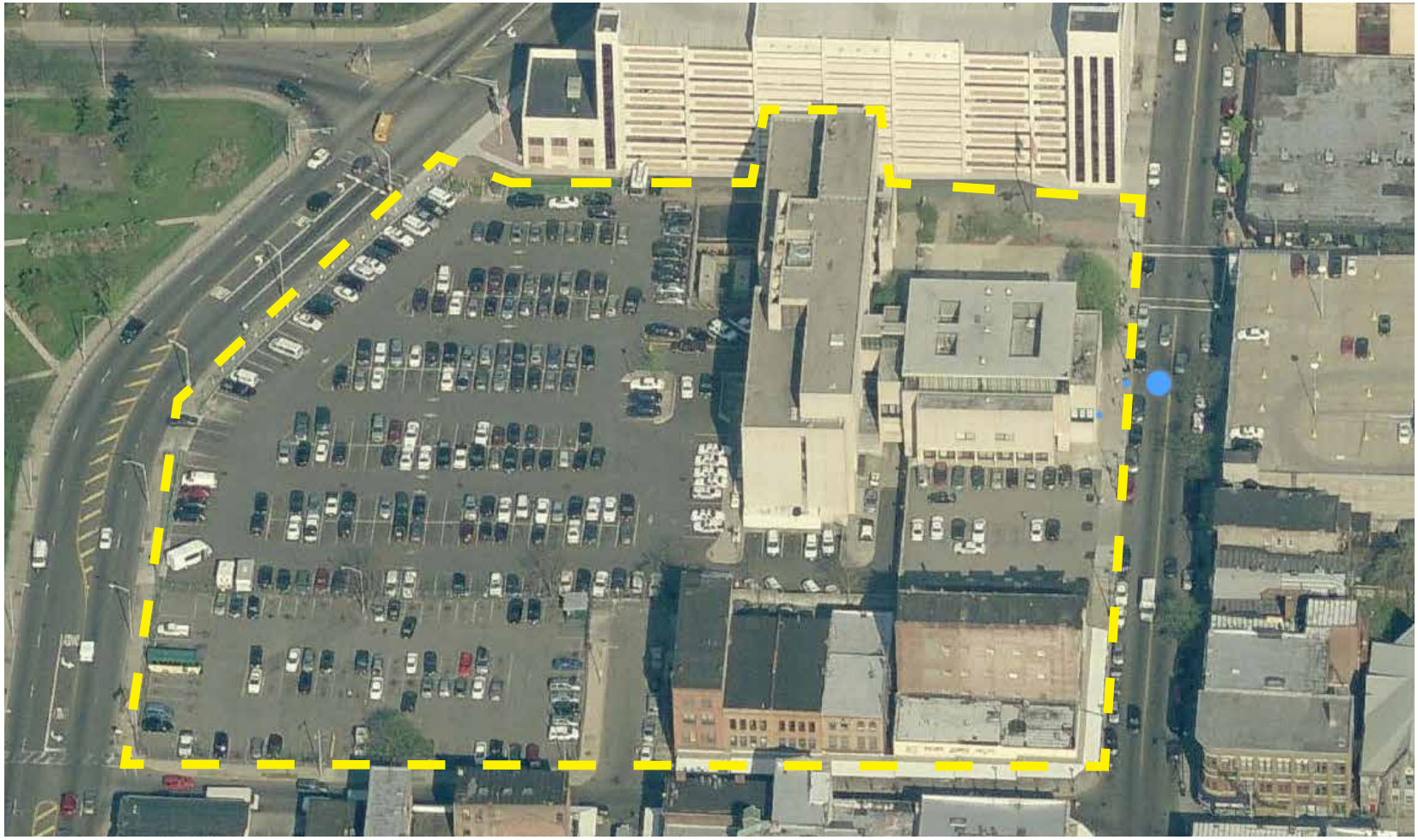
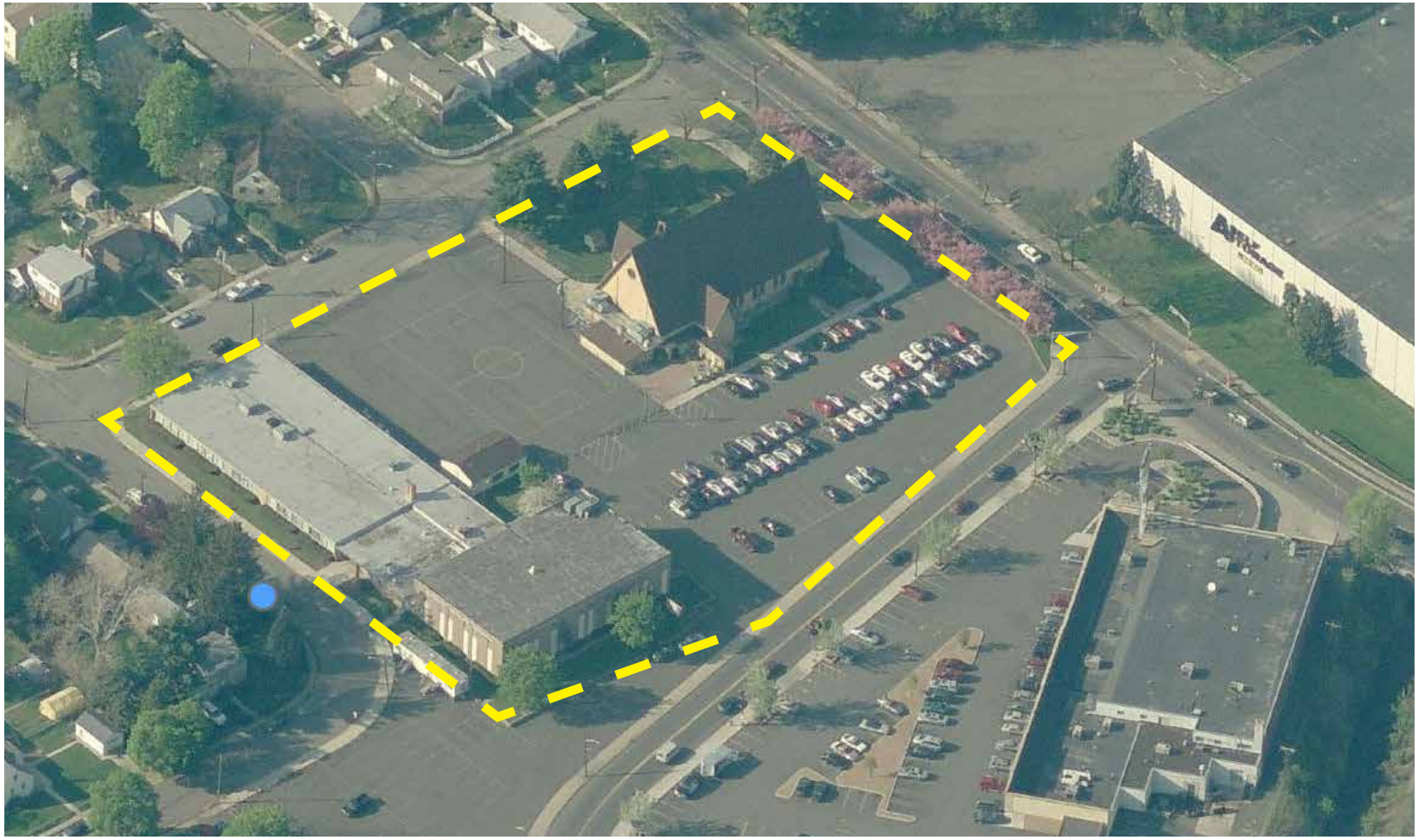



The site is the Paterson Municipal Court located at 111 Broadway. The site slopes from the north to south. The building has no external downspouts. There is an area of grass with a storm drain in it; a bioswale or rain garden can be implemented to capture sidewalk runoff before it reaches the drain. The rear parking lot of the building was inaccessible.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

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





The site is St. Gerard Elementary School located at 16 Carrelton Drive. The site slopes from northwest to southeast. The parking lot in between the school and church is freshly paved. The school has no external downspouts. On the north side of the church is a downspout that drains to grass; a rain garden can be installed beneath it. There is a downspout on the south side of the building as well that could connect to a rain garden.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

- [x] rain gardens
- [ ] curb cuts
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- [ ] cisterns
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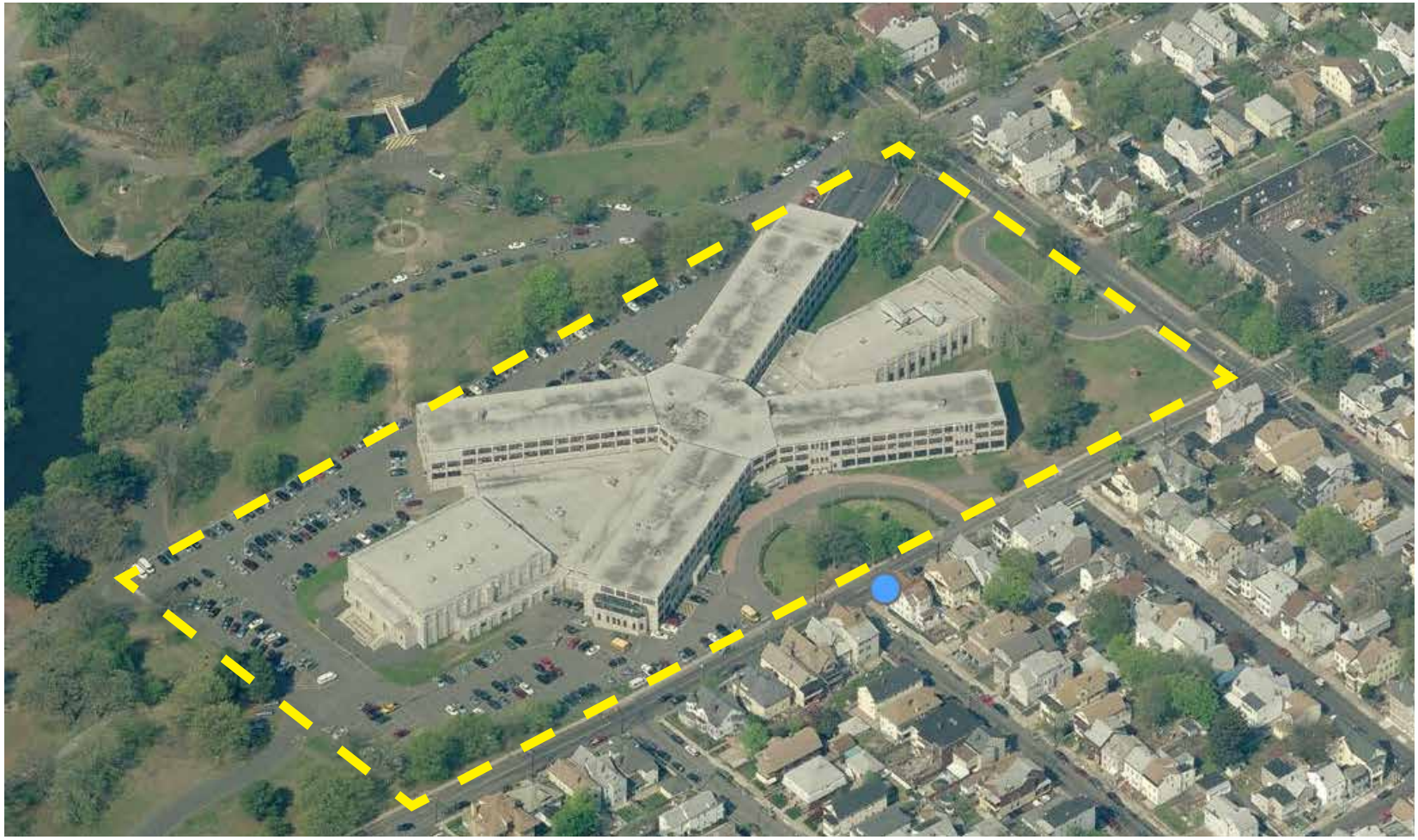

nue

97 Preakness Avenue
Paterson, NJ 07522

The site is JFK High School located at 97 Preakness Avenue. The site slopes towards the south where all the stormwater flows directly into the Passaic River. The school has no external downspouts. There are large areas of parking that could be repaved soon; pervious pavement should be considered. There is a park adjacent to the school with many resident geese; a riparian buffer would help to deter the geese and filter runoff. In the adjacent park a bioswale could be implemented to slow and filter runoff entering the waterway.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

- [x] rain gardens
- [ ] curb cuts
- [ ] stormwater planters
- [ ] rain barrels
- [x] buffers
- [ ] cisterns
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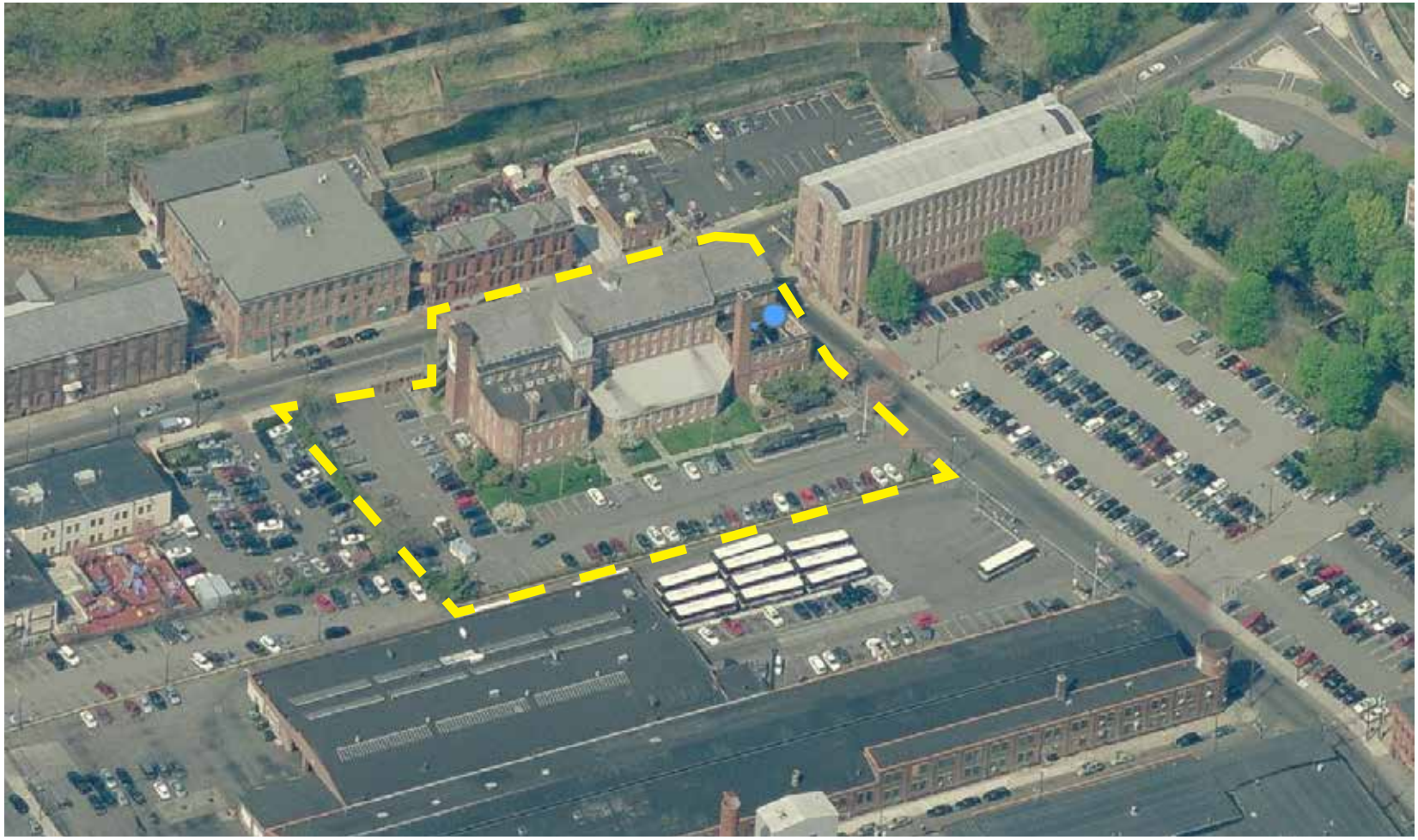
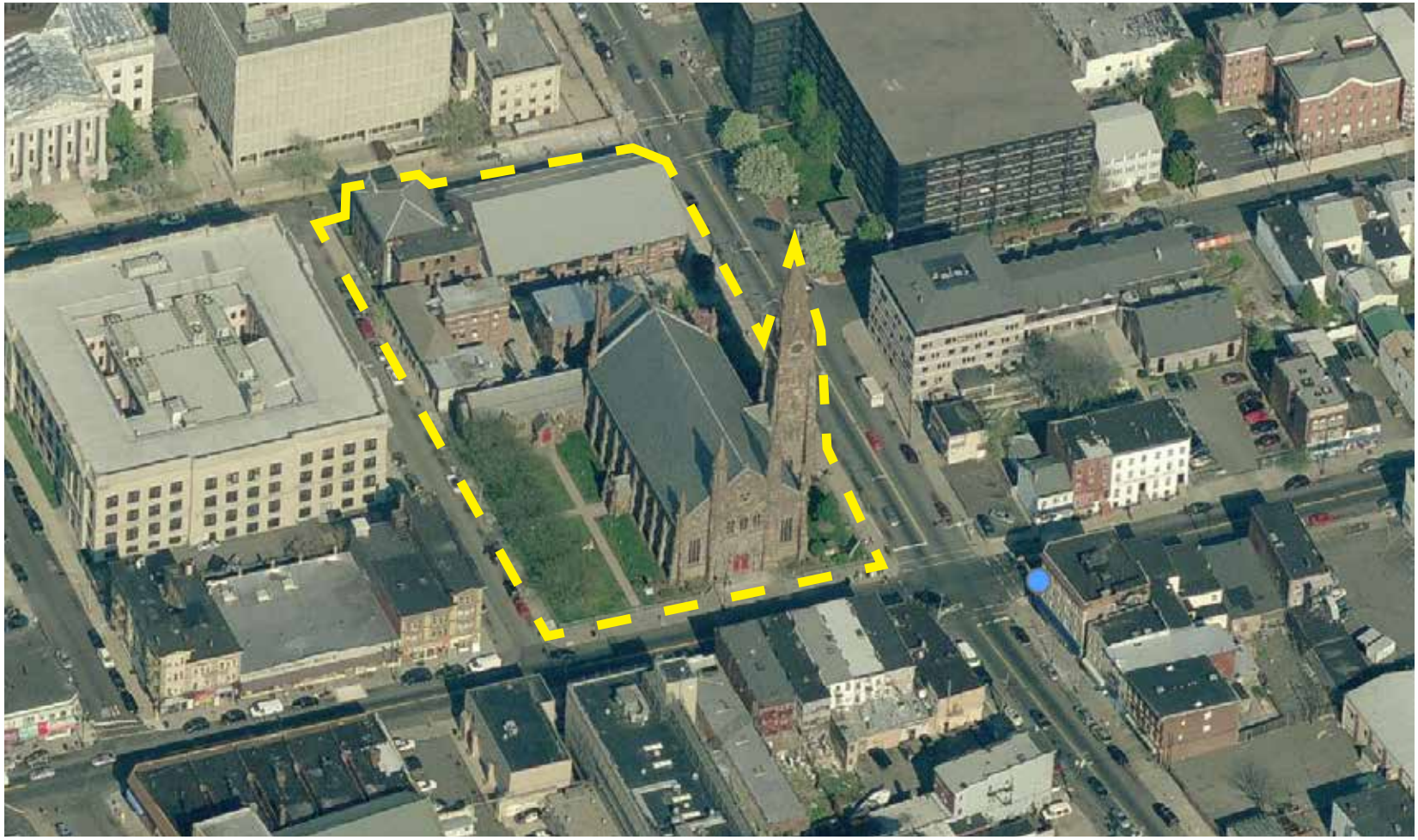


2 Market Street
Paterson, NJ 07501

The site is the Paterson Museum located at 2 Market Street. The site appears to have relatively little slope except for a slight slope of the road where each side slopes to the center of the parking lot. The main parking lot has many potholes, and the pavement is in poor condition. It is recommended that it be repaved with pervious pavement. The building has many downspouts that discharge to a lawn which can support a rain garden.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

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





The site is the Cathedral of St. John the Baptist located at 381 Main Street. The site seems to slope from north to south. All of the existing pavement appears to be in good condition. The north side of the site has a grassed area with downspouts that could be disconnected into a rain garden.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

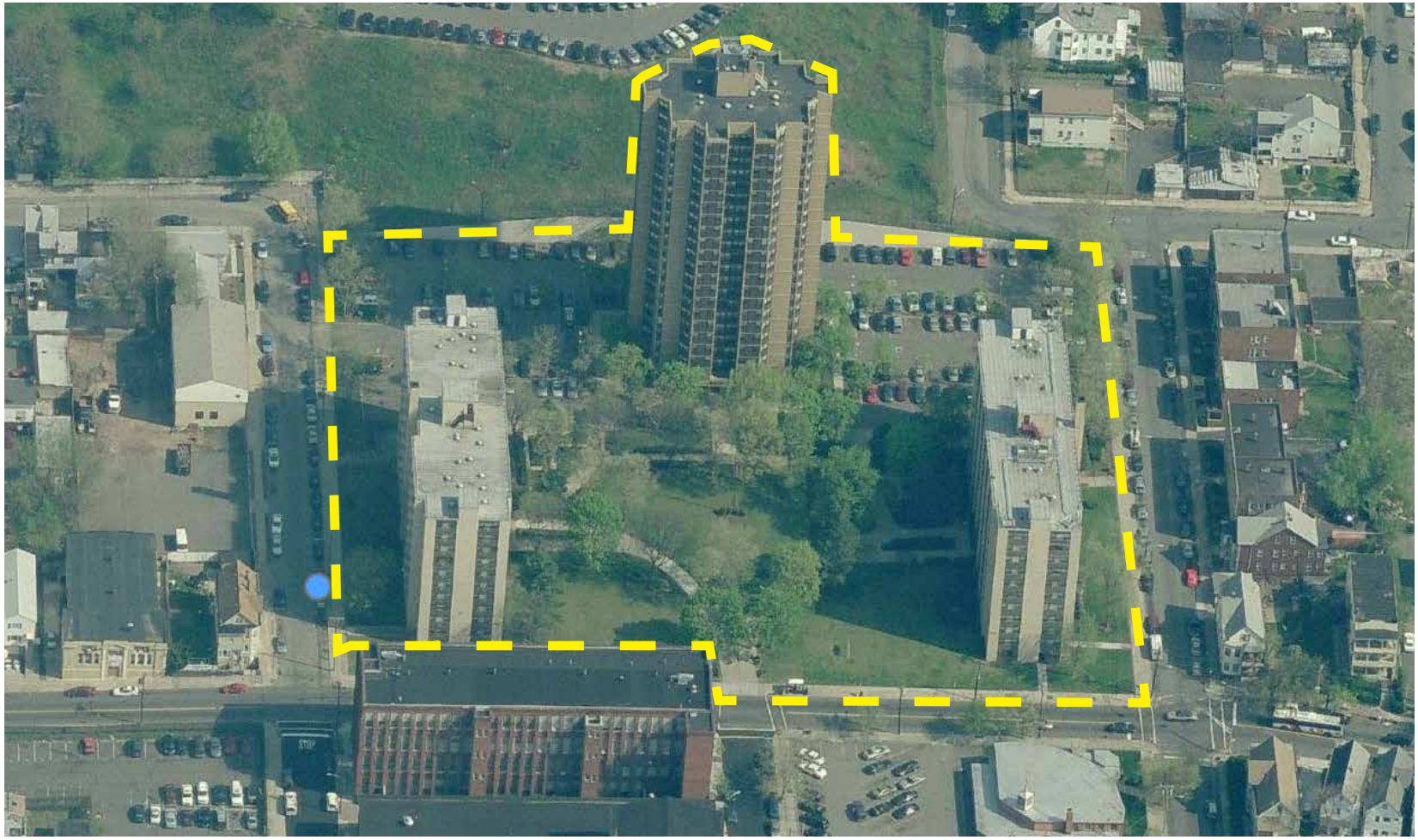
- [x] rain gardens
- [ ] curb cuts
- [ ] stormwater planters
- [ ] rain barrels
- [ ] buffers
- [ ] cisterns
- [ ] pervious pavement
- [ ] bioswales
- [ ] depaving



The site is St. Anthony's Roman Catholic Church located at 138 Beech Street. The site slopes from southeast to northwest. The parking lot and pavement appear to be in good condition. There are downspouts on the front, east facing side of the building that can discharge into rain gardens. There are also downspouts in the back that could discharge into rain gardens.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

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

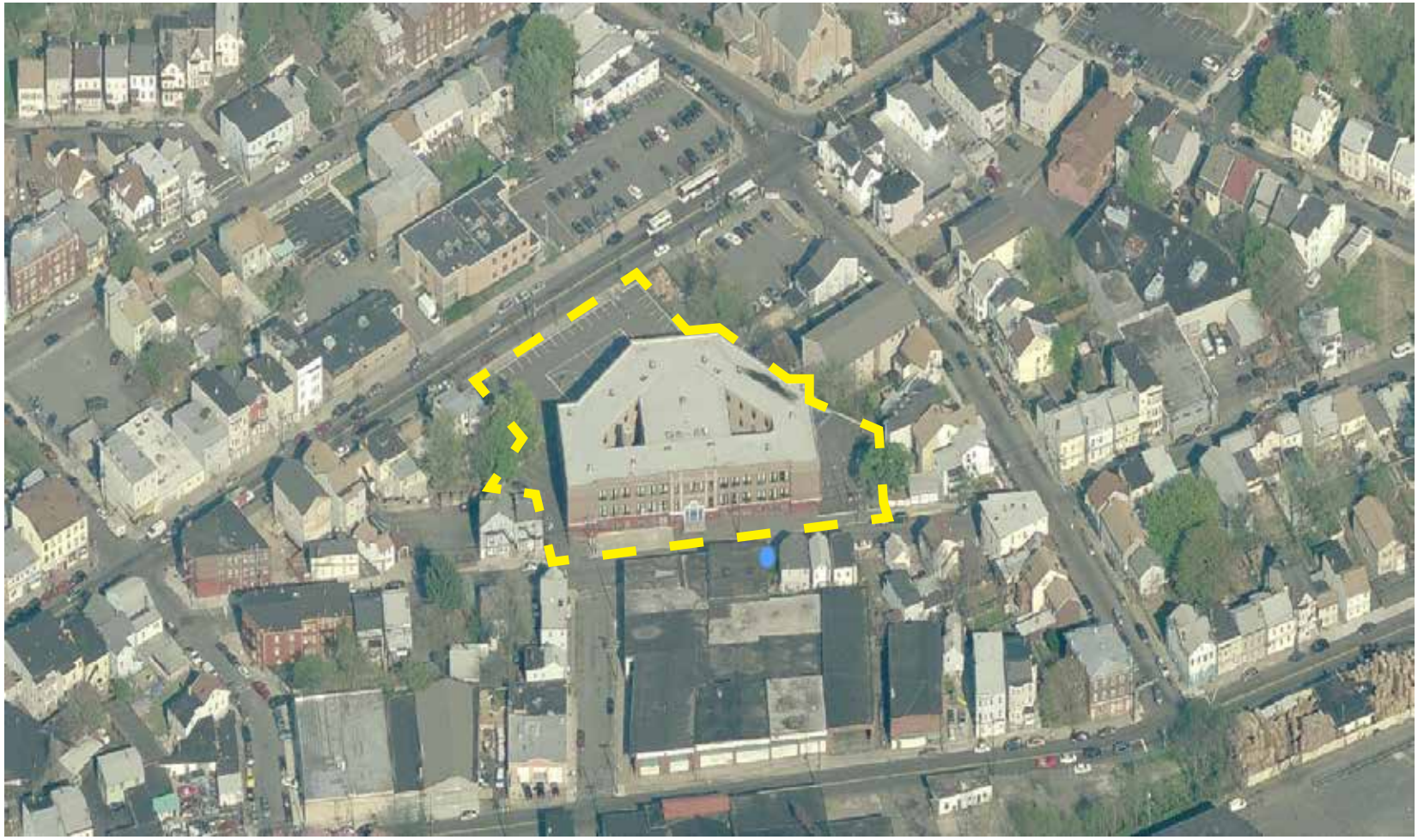




The site is the Governor Residential Apartments located at 27 State Street. The site has a slope from the southwest to northeast. There is also a slight slope north. There are islands in the parking lot that can be converted into bioswales. The sidewalk slopes directly into the parking lot; a rain garden can be placed next to it to divert rainwater from the impervious surface. There is also a courtyard in the center of the complex in which a rain garden or a bioswale can be installed.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

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





The site is Paterson School #8 located at 45 Chadwick Street. There is little to no identifiable slope to the site. There are no external downspouts on the building. The pavement appears to be in good condition, and the site is almost entirely impervious. Depaving and stormwater planters could be used to reduce runoff.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

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



The site is St. Paul's Episcopal Church located at 630-648 E 18th Street. The site slopes north towards Broadway. There is a parking lot to the west of the church building which has a single downspout discharging to the pavement. The parking lot could use repaving; pervious pavement should be considered. In the front of the church, facing Broadway, there is a downspout that discharges to grass with some erosion and moss growing. A rain garden could be implemented here. On the east side of the church there are two more downspouts that discharge to a grassed area where a large rain garden could capture and treat runoff.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

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



The site is the International High School located at 203 Grand Street. The site slopes from south to north with an extremely steep slope on the north, facing the front left side of the building. In the rear of the building there is an eastbound slope. The pavement on the site looks new and in good condition. However, there is a section of pavement that appears to not drain and has collected water. Also in the rear are downspouts that discharge to pavement. The pavement can be converted to planters or pervious pavement to prevent runoff. On the east side of the site there is a lawn that could include a rain garden to capture runoff.

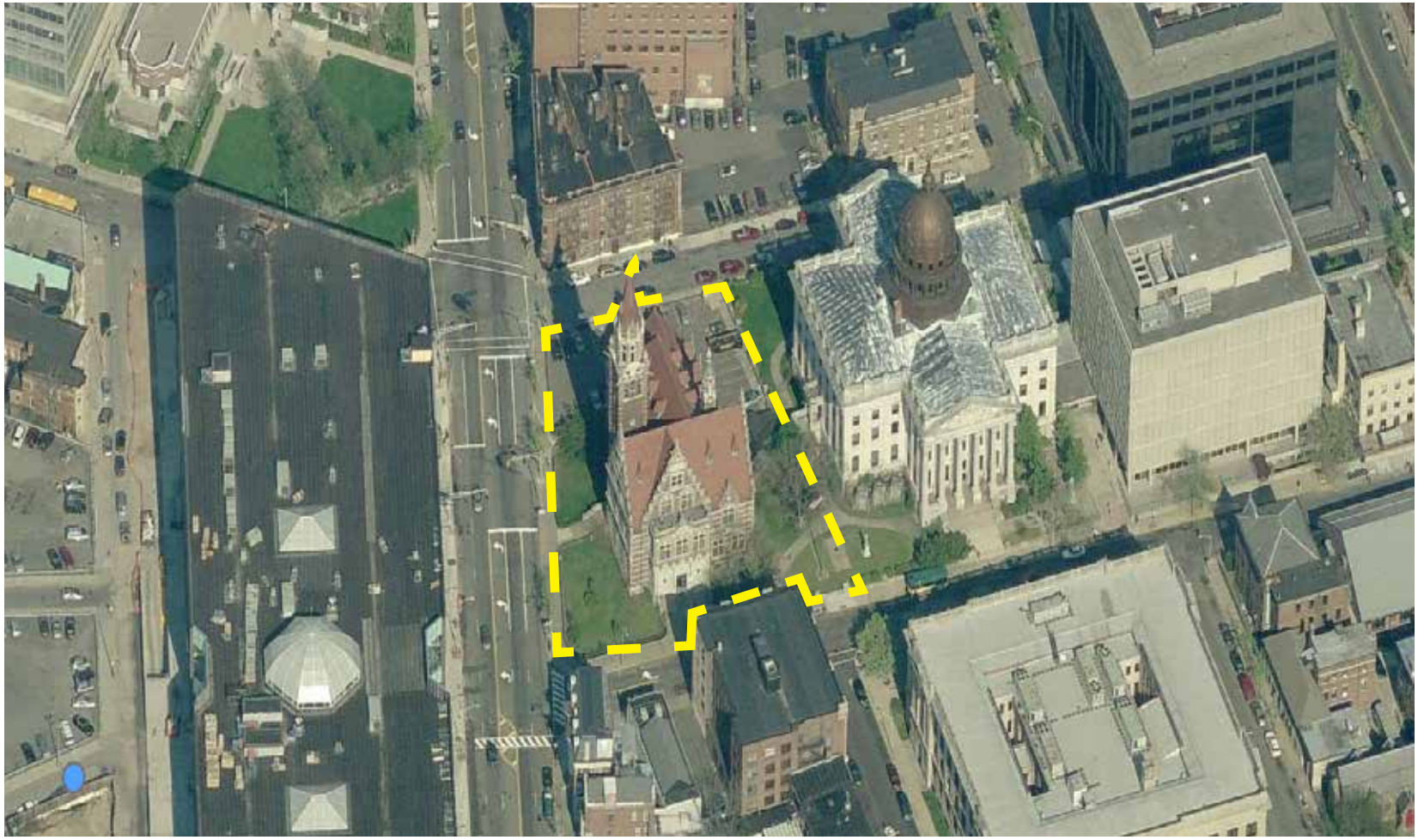
SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

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

The site is Paterson Charter School located at 268 Wabash Avenue. The site slopes east. There is no access due to the site being private. The area is all freshly paved. There are some directly connected downspouts which could discharge to rain barrels.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

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

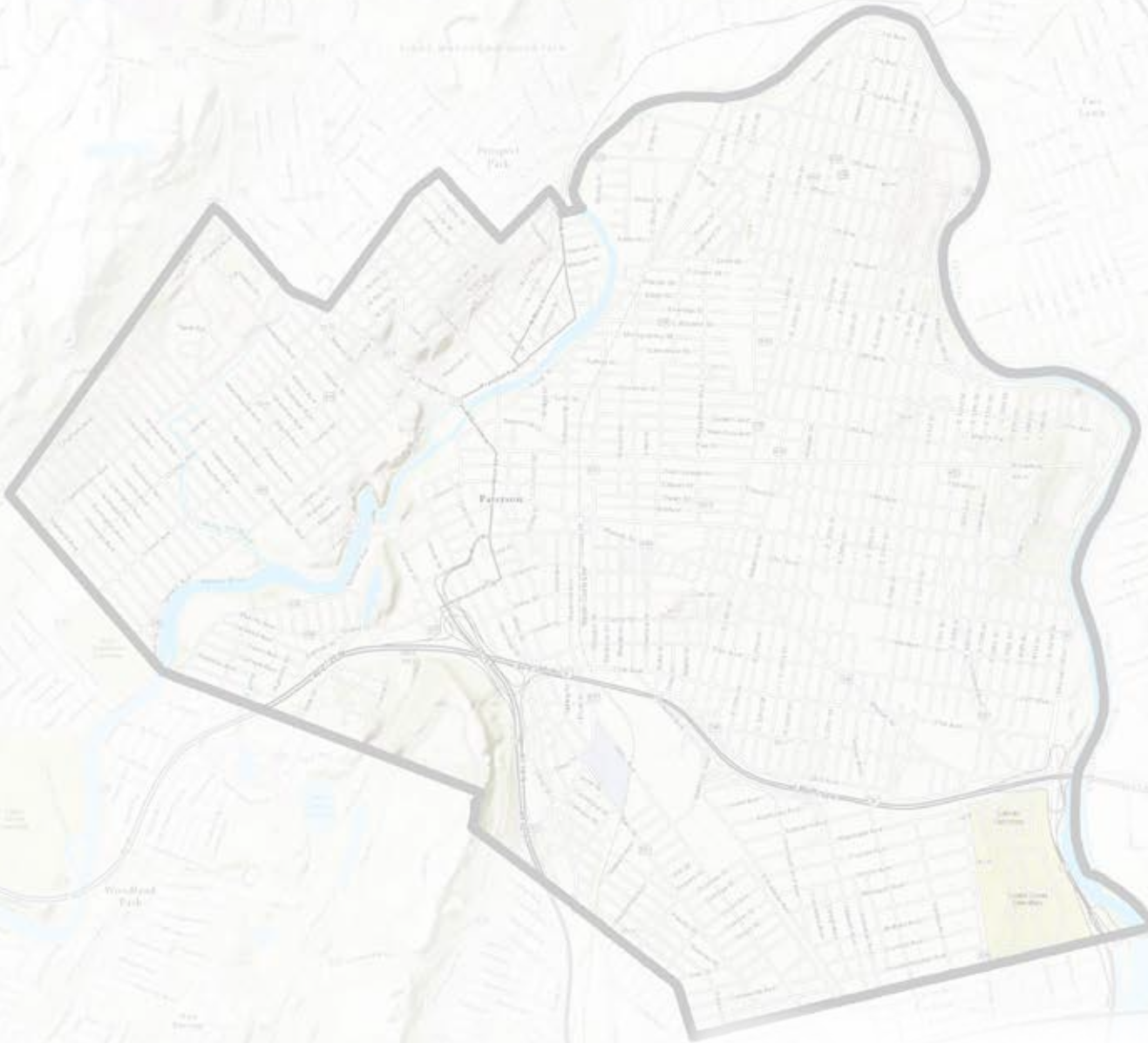




The site is the Passaic County Court House Annex located at 63-65 Hamilton Street. The site has a slope from north to south. On the northwest side there is also a slight slope from east to west. The building has downspouts. It was difficult to tell if they were connected or not, however there is a grassed area in front of each so rain gardens could be installed, specifically, on the southwest side of the building and the northwest side of the building.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

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



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