GREEN INFRASTRUCTURE FEASIBILITY STUDY

MONTCLAIR

PASSAIC VALLEY SEWERAGE COMMISSION

"Protecting Public Health and the Environment"

RUTGERS
New Jersey Agricultural Experiment Station

ACKNOWLEDGEMENTS

This document has been prepared by the Rutgers Cooperative Extension Water Resources Program with funding and direction provided by the Passaic Valley Sewerage Commission and the New Jersey Agricultural Experiment Station. We would like to thank the Township of Montclair for their input and support in creating this document.

"Protecting Public Health and the Environment"

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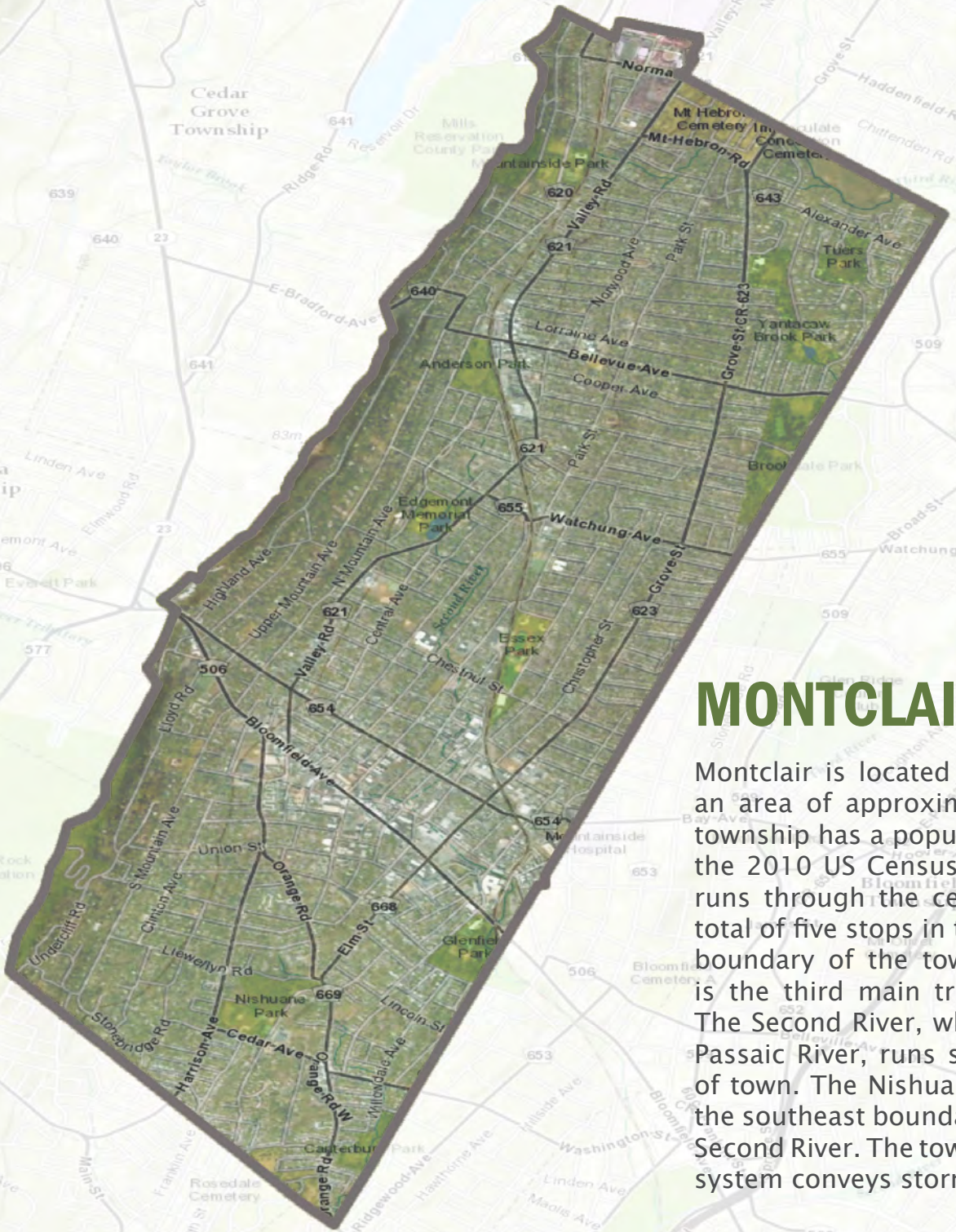
INTRODUCTION

In 2013 Passaic Valley Sewerage Commission (PVSC) began a new initiative to assist the 48 municipalities address flooding and combined sewer overflows. PVSC is dedicated to leading efforts throughout the PVSC Sewerage District 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 Rutgers Cooperative Extension (RCE) Water Resources Program.

Montclair is a community with a municipal separate storm sewer system (MS4), meaning that stormwater and wastewater are managed in two separate sets of piping and infrastructure. When it rains, stormwater runoff causes localized flooding and contributes to downstream flooding and negative water quality impacts. By using cost-effective green infrastructure practices, Montclair can begin to reduce the negative impacts of stormwater runoff, reduce pressures on the local infrastructure and protect the health of our waterways.

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

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



Source: ExpatAussieInNJ

Source: Montclair Book Center

Source: Township of Montclair

MONTCLAIR

Montclair is located in Essex County and covers an area of approximately six square miles. The township has a population of 37,669 according to the 2010 US Census. The NJ transit train system runs through the center of the township with a total of five stops in the township. At the northern boundary of the town is the Third River, which is the third main tributary of the Passaic River. The Second River, which is also a tributary of the Passaic River, runs southeast through the center of town. The Nishuane Brook, which is located at the southeast boundary of the town, flows into the Second River. The township's separate storm sewer system conveys stormwater to these waterways.

WHAT IS STORMWATER?

When rainfall hits the ground, it can soak into the ground or run off the surface. When rainfall runs off 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 Cone Flower


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 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 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.

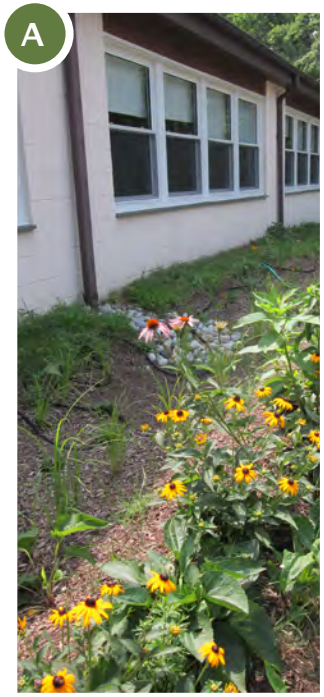
B ***DEPAVING:*** Depaving is the process of removing hardscape such as asphalt or concrete.

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.

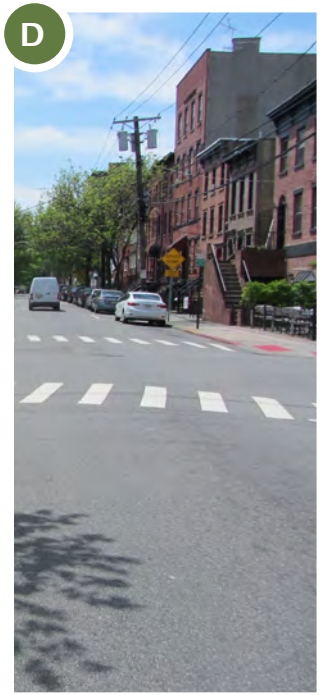
A



B

C

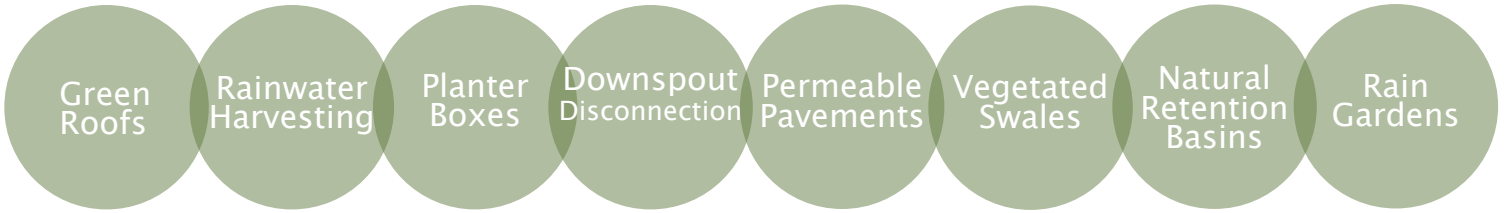
D



E

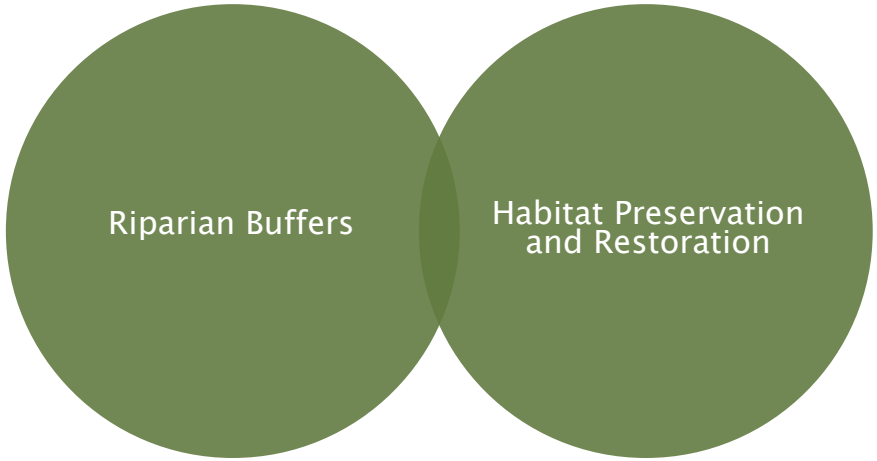
GREEN INFRASTRUCTURE STRATEGIES

SITE



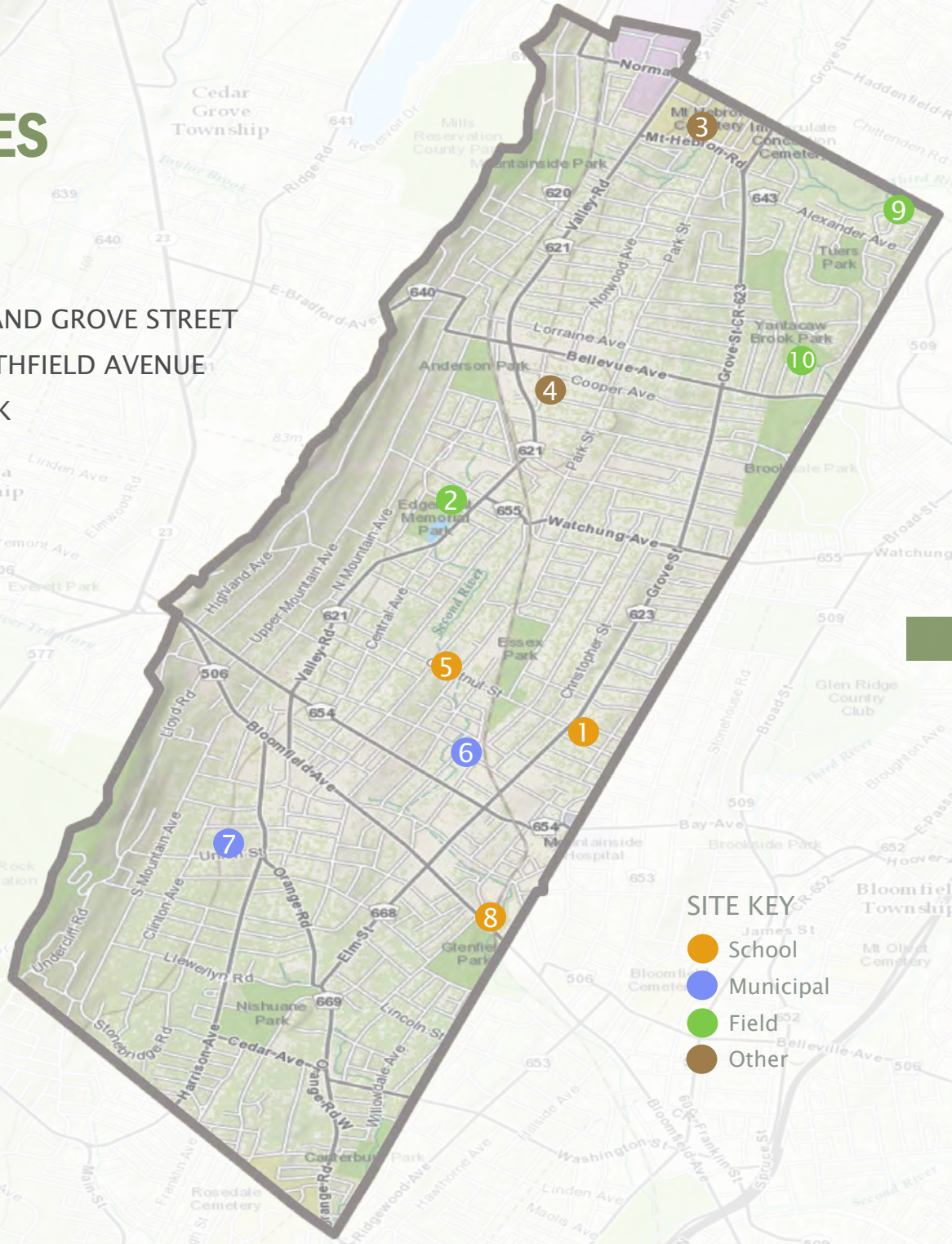
NEIGHBORHOOD

WATERSHED



POTENTIAL PROJECT SITES

1. THE DERON SCHOOL
2. EDGEMONT MEMORIAL PARK
3. INTERSECTION AT MOUNT HEBRON ROAD AND GROVE STREET
4. INTERSECTION AT VALLEY ROAD AND NORTHFIELD AVENUE
5. MONTCLAIR HIGH SCHOOL AND RAND PARK
6. MONTCLAIR ANIMAL SHELTER
7. MONTCLAIR COMMUNITY FARMS
8. GLENFIELD MIDDLE SCHOOL
9. ALONZO BONSAL WILDLIFE PRESERVE
10. YANTACAW BROOK PARK

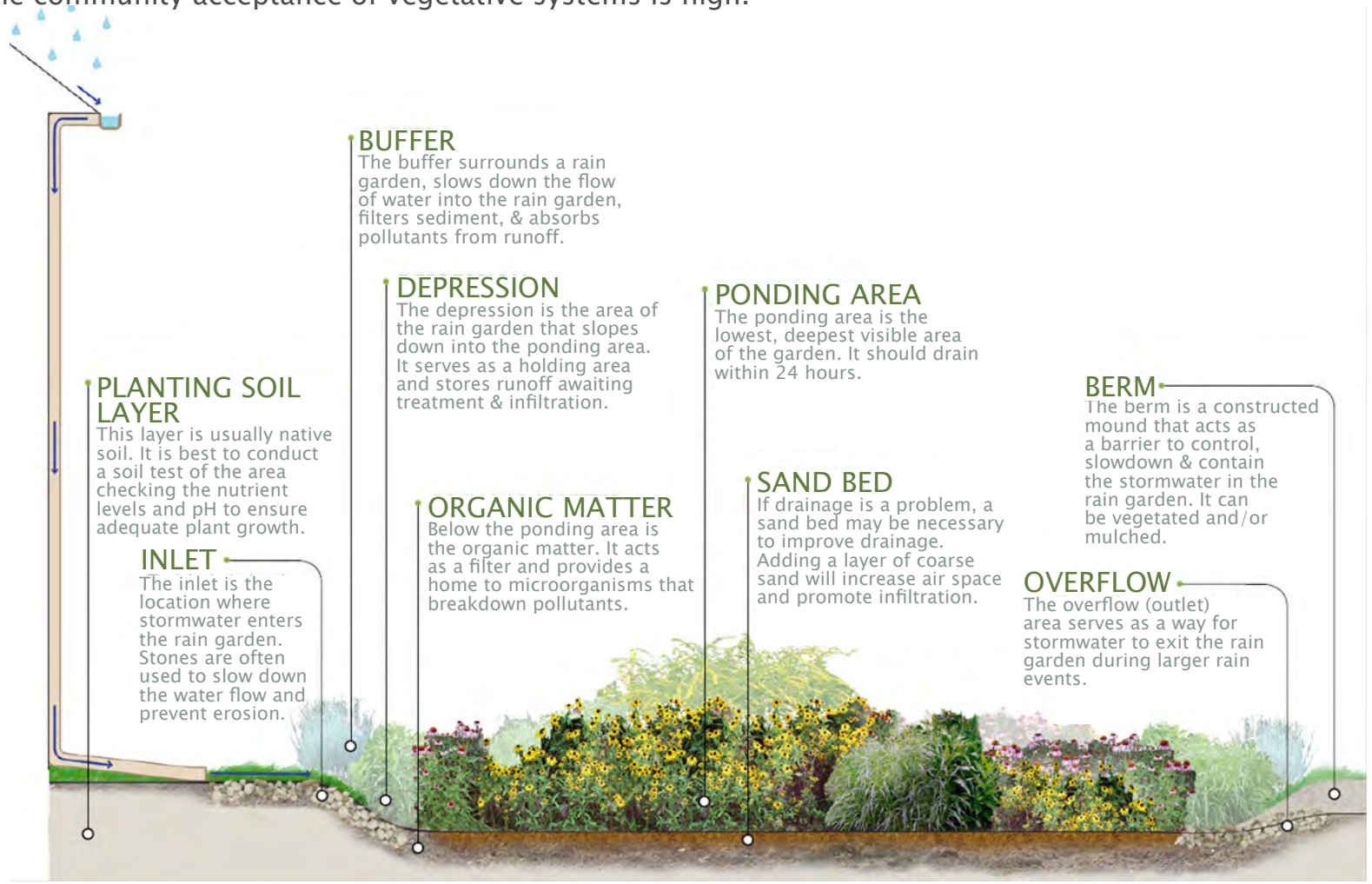



STATE OF
NEW JERSEY
DEPARTMENT OF
ENVIRONMENTAL
PROTECTION

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

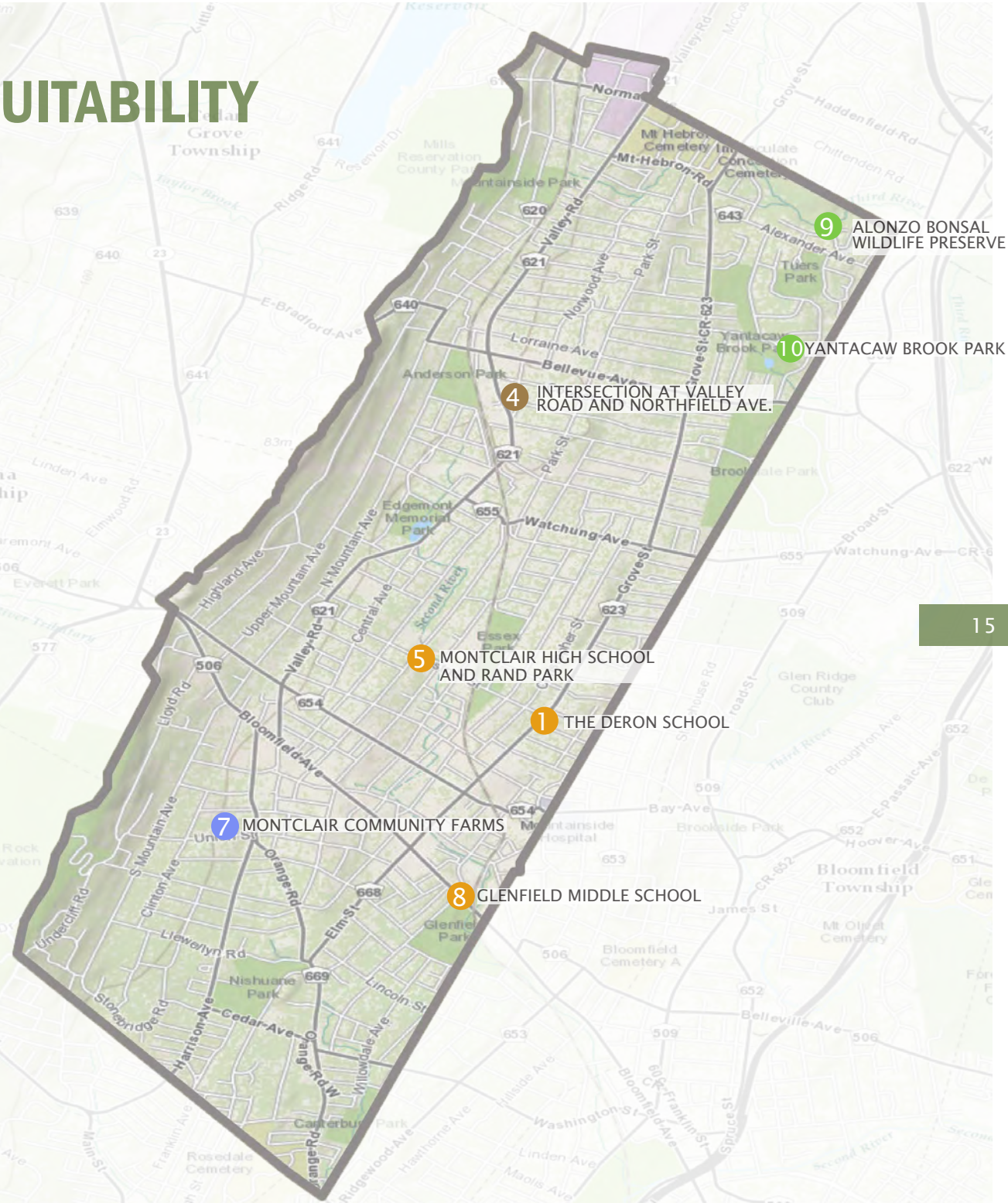
VEGETATED SYSTEM SUITABILITY

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:

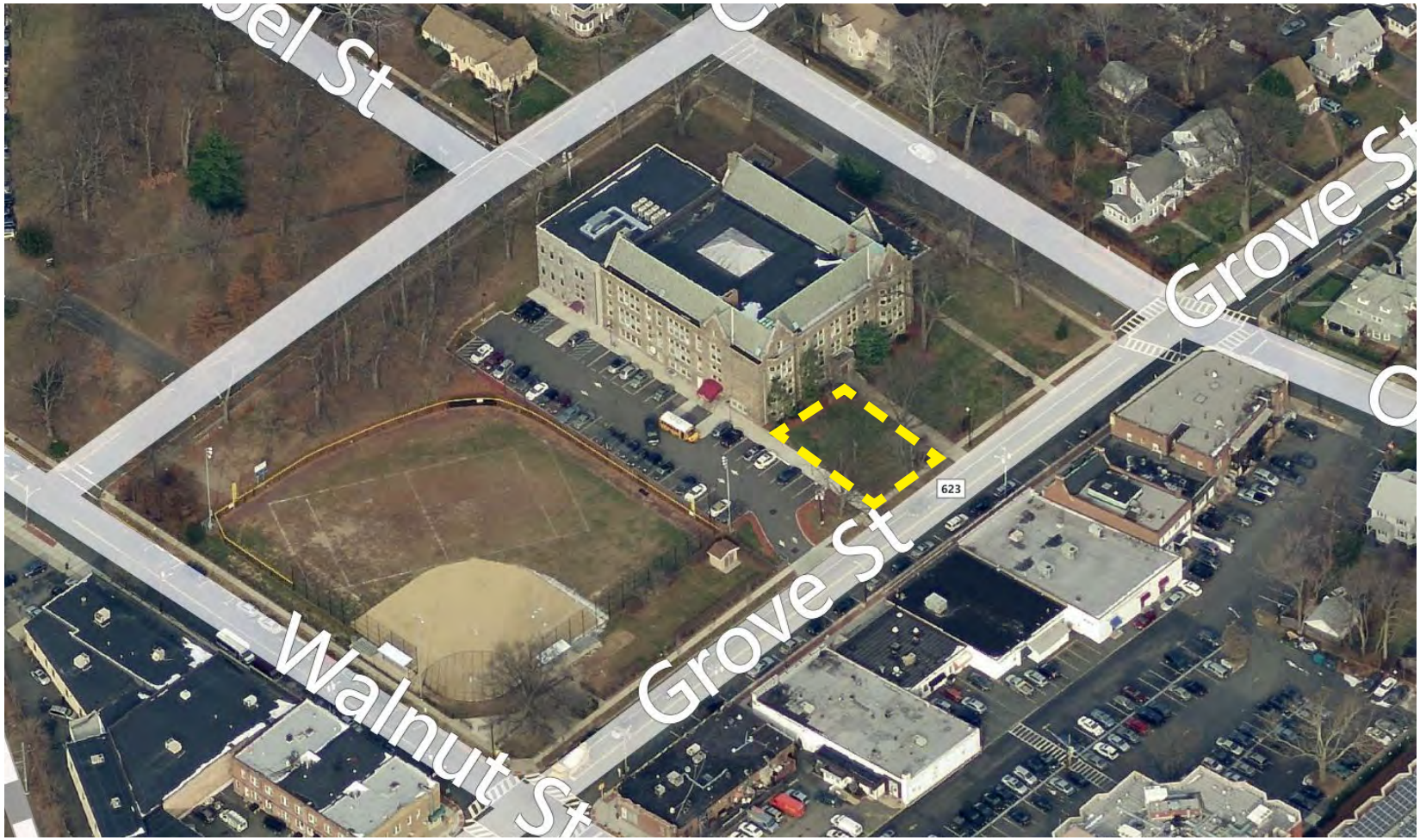
- Capture stormwater runoff, reducing soil erosion and sedimentation and the amount of water that flows to our streams and waterways during rain storms
- Protect water quality by filtering out and breaking down pollutants
- Infiltrate runoff and recharge groundwater supplies by providing base flow to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



VEGETATED SYSTEM SUITABILITY: EXAMPLE PROJECT SITE

The site is The Deron School at 130 Grove Street. On the west site of the building there are multiple ponding areas and erosion in existing lawn. Multiple downspouts around the building are connected to the storm sewer system. Downspouts can be disconnected and directed into a rain garden, infiltrating runoff from the building's roof. The parking lot has two storm drains in the center of the pavement; the pavement is in relatively good condition, and any islands added would reduce available parking. While bioswales or bioretention islands in the parking areas are an option, alternatives for building rain gardens in existing lawn areas should be the first priority.

RAINWATER HARVESTING SYSTEMS

Rainwater harvesting systems focus on the 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 rain water harvesting systems is moderate to high. Rainwater harvesting systems include rain barrels and cisterns.

RAIN BARREL DIAGRAM

INLET
Rain water collected in gutters is released into the barrel here

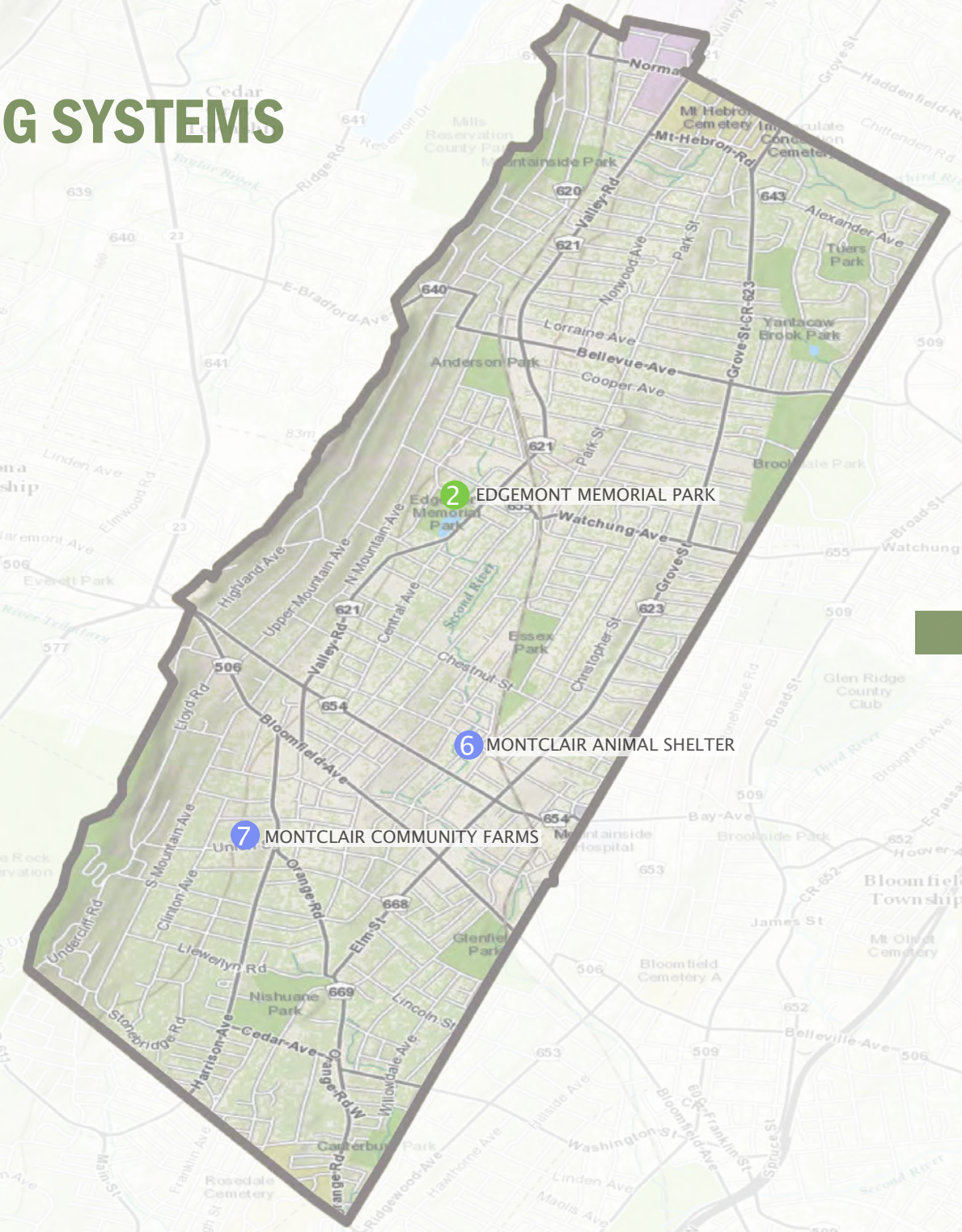
OVERFLOW OUTLET
Releases water when the rain barrel reaches capactiy

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 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 by reducing the use of potable water supplies.



RAINWATER HARVESTING SYSTEM SUITABILITY: EXAMPLE PROJECT SITE

EDGEMONT MEMORIAL PARK

274 Valley Road
Montclair, NJ 07043

RAINWATER HARVESTING SYSTEM SUITABILITY: EXAMPLE PROJECT SITE



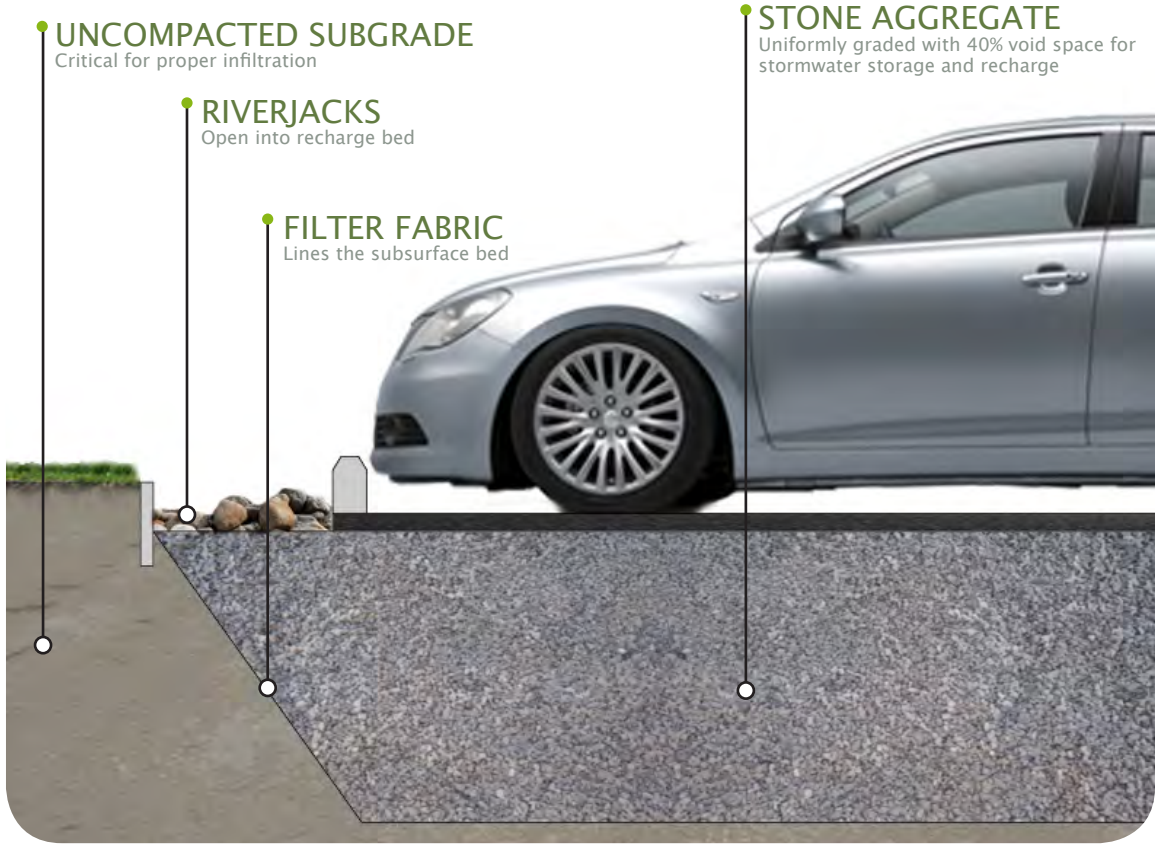

The site is Edgemont Memorial Park at 274 Valley Road. The park contains a large reservoir that is fed on the north end by the Second River and drains on the south end out to the Second River. There are often geese inhabiting the reservoir. A buffer around the reservoir could help address the geese problem. Healthy buffer vegetation will also filter stormwater runoff from surrounding lawn and park areas. The park has a small municipal building whose backyard slopes toward the river. The municipal building represents a good opportunity for implementing multiple demonstration practices, such as a rain barrel or rain garden. There is also a small parking lot with old and deteriorated pavement that could be replaced with new pervious materials.

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

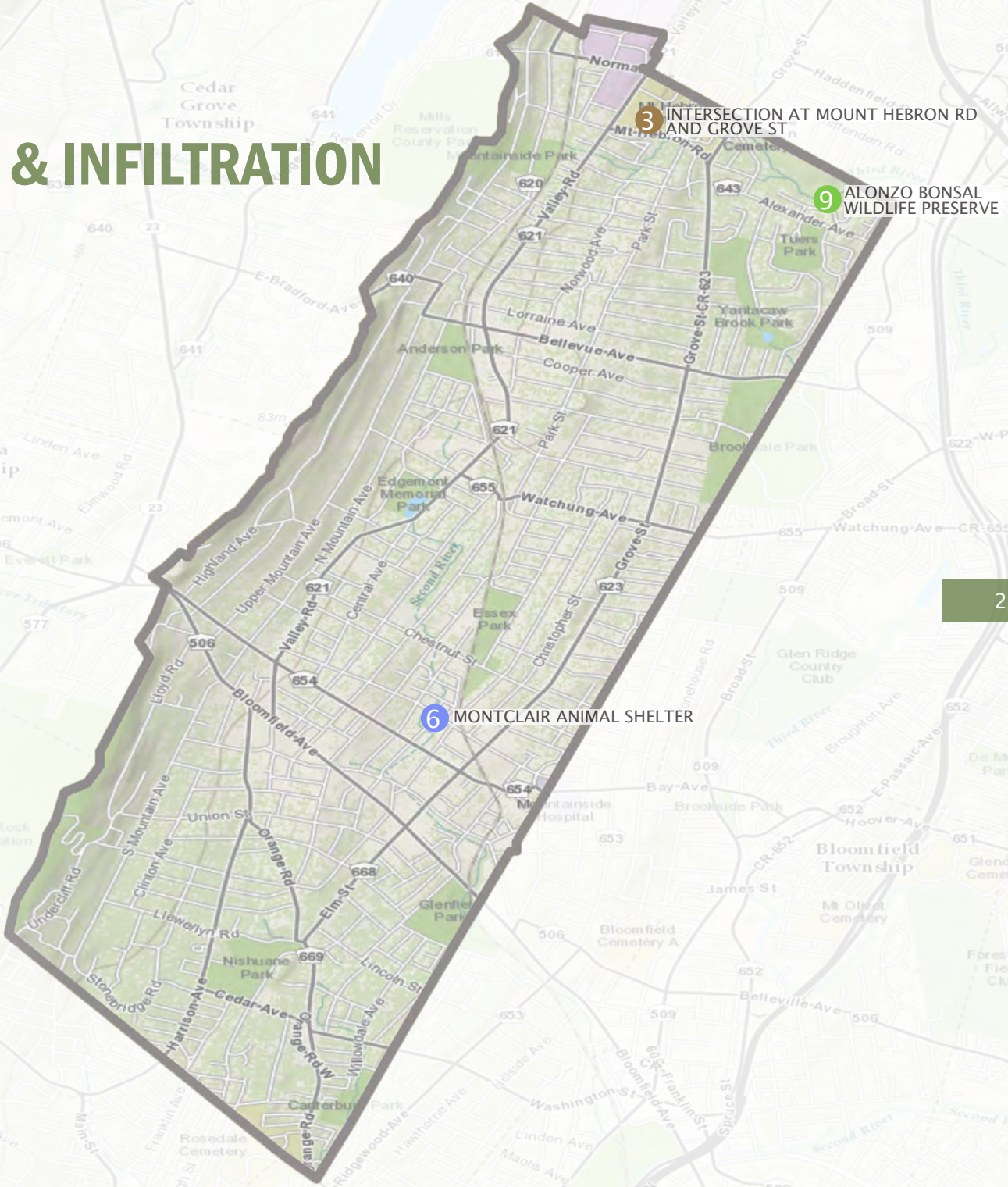
STORAGE, QUANTITY, & INFILTRATION SYSTEM SUITABILITY

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

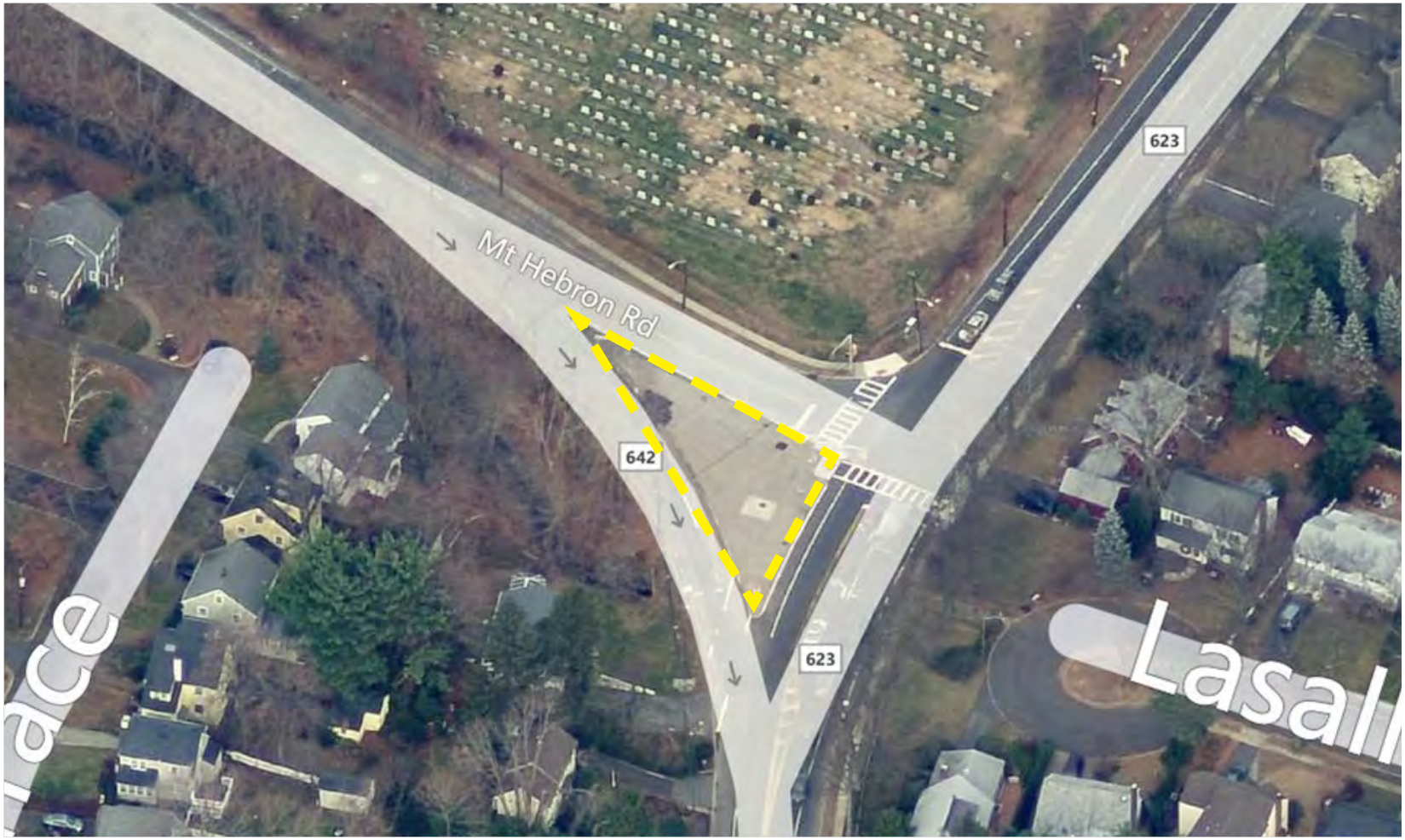
- Permeable pavers
- Porous asphalt
- Pervious concrete

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



INTERSECTION OF MT. HEBRON RD. & GROVE ST.

Mt. Hebron Rd. & Grove St.
Montclair, NJ 07043

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



The site is located at the intersection of Mt. Hebron Road and Grove Street. The traffic triangle can be depaved and with the addition of curb cuts or stormwater planters could provide improved stormwater management. The center of the triangle appears to be a low point with residual sediment. If areas need to be repaved, pervious pavement could be used. It should be noted that there are likely utilities under the triangle.


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 rain water 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 runs off of hard surfaces like rooftops, driveways, roadways, parking lots, and compacted lawns, it carries with it pollution to our local waterways. Harvesting the rainwater in a rain barrel is just one of the ways homeowners can reduce rainwater from running off 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 offered to meet a variety of schedules.




MAINTENANCE PROCEDURES

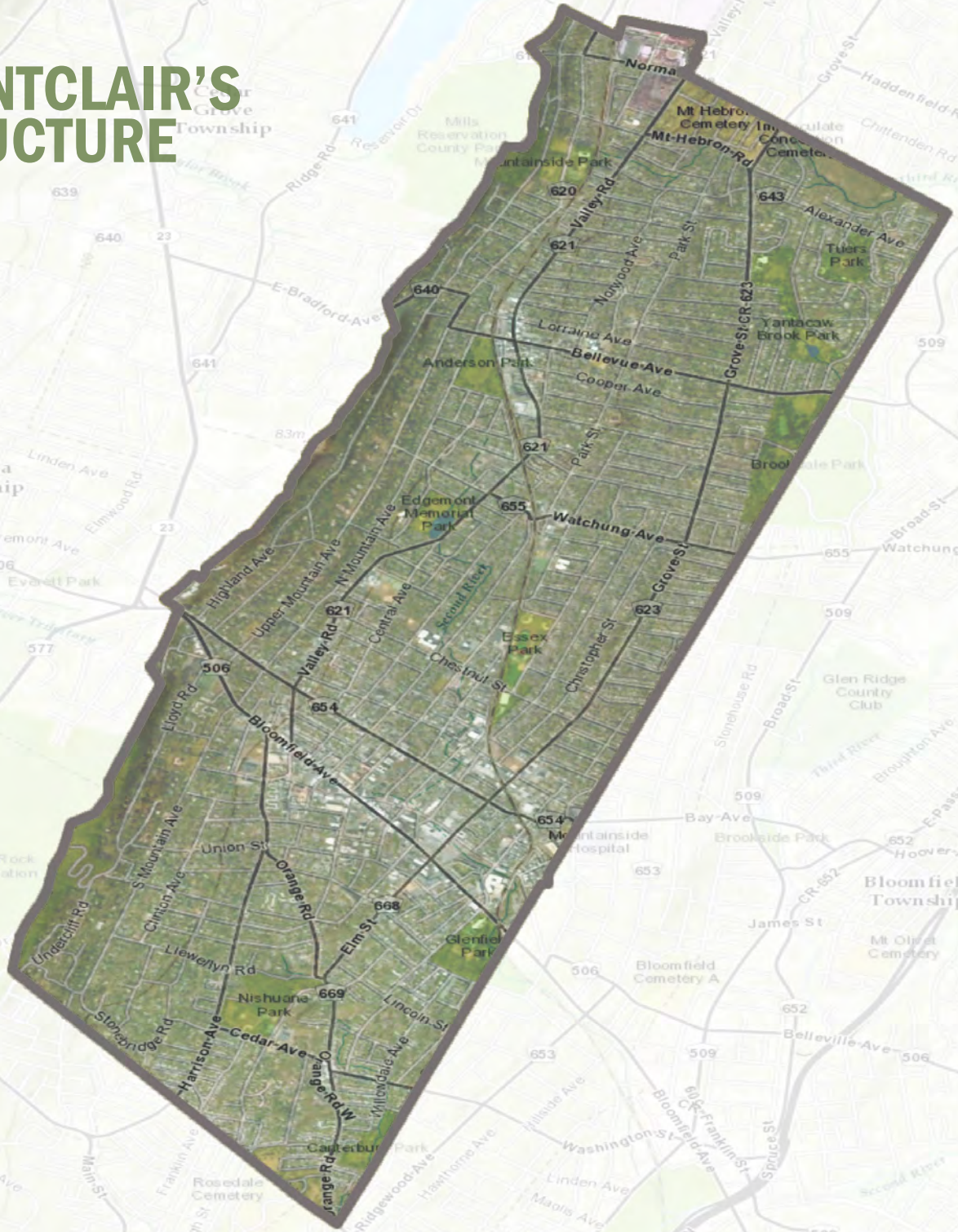
MAINTAINING MONTCLAIR'S GREEN INFRASTRUCTURE SYSTEMS

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

- 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

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 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, 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:

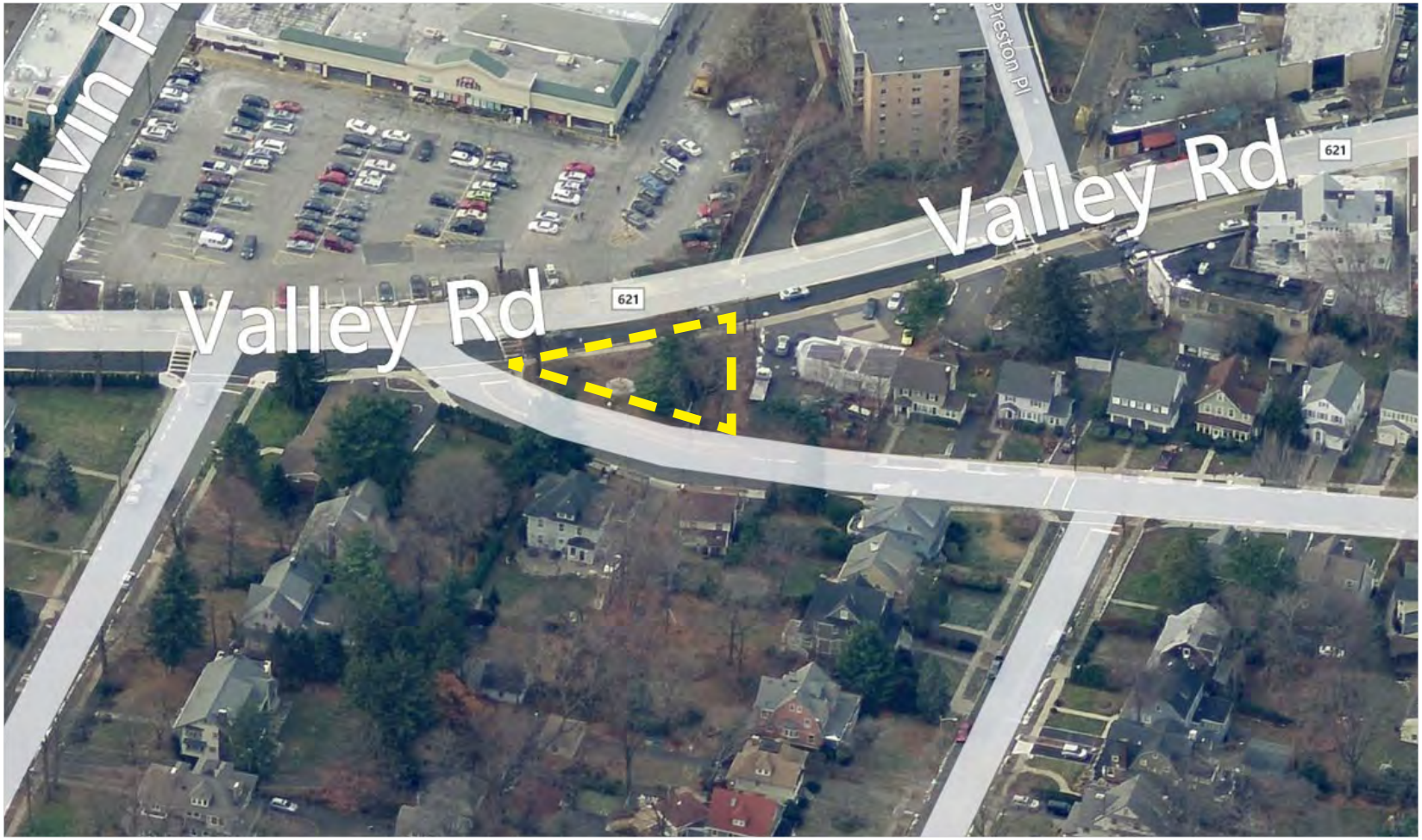
- Materials cost is ~20-25% more than traditional asphalt or concrete
- Long-term maintenance is required by routine quarterly vacuum sweeping
- Sweeping cost may be off-set by reduced deicing costs
- Asphalt repairs can be made with standard asphalt not to exceed 10% of surface area.
- Concrete repairs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



INTERSECTION AT VALLEY RD. AND NORTHVIEW AVE.

Intersection at Valley Rd. and Northview Ave., Montclair, NJ 07043

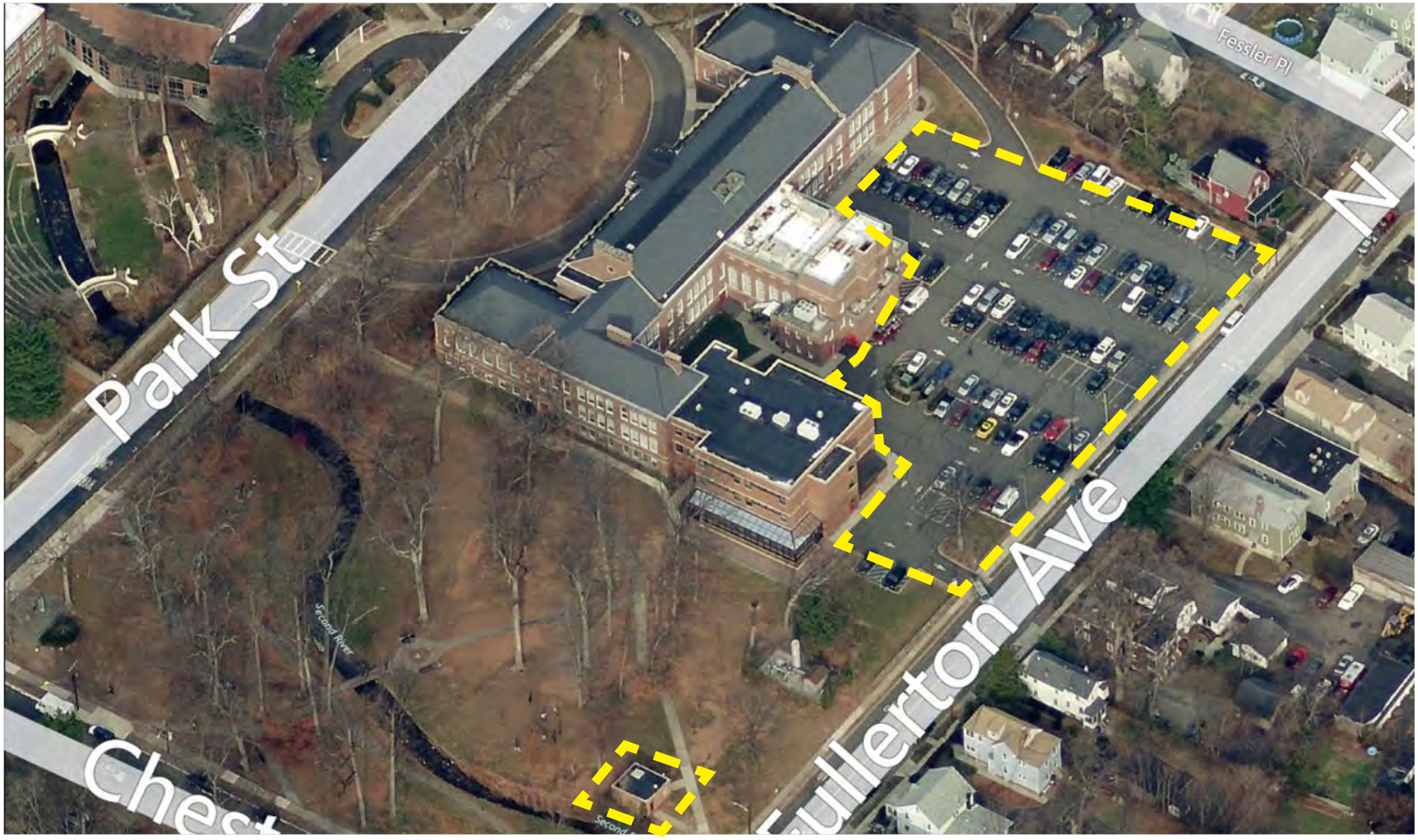
The site is located at the intersection of Valley Road and Northview Avenue. Northview Avenue slopes downhill towards Valley Road, with a storm drain located just before the end of the avenue. A large area of lawn is located at the intersection, which would allow for curb cuts and a rain garden to intercept the runoff that currently flows directly to the storm drain.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

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

INTERSECTION AT VALLEY RD. AND NORTHVIEW AVE.

Intersection at Valley Rd. and
Northview Ave., Montclair, NJ 07043



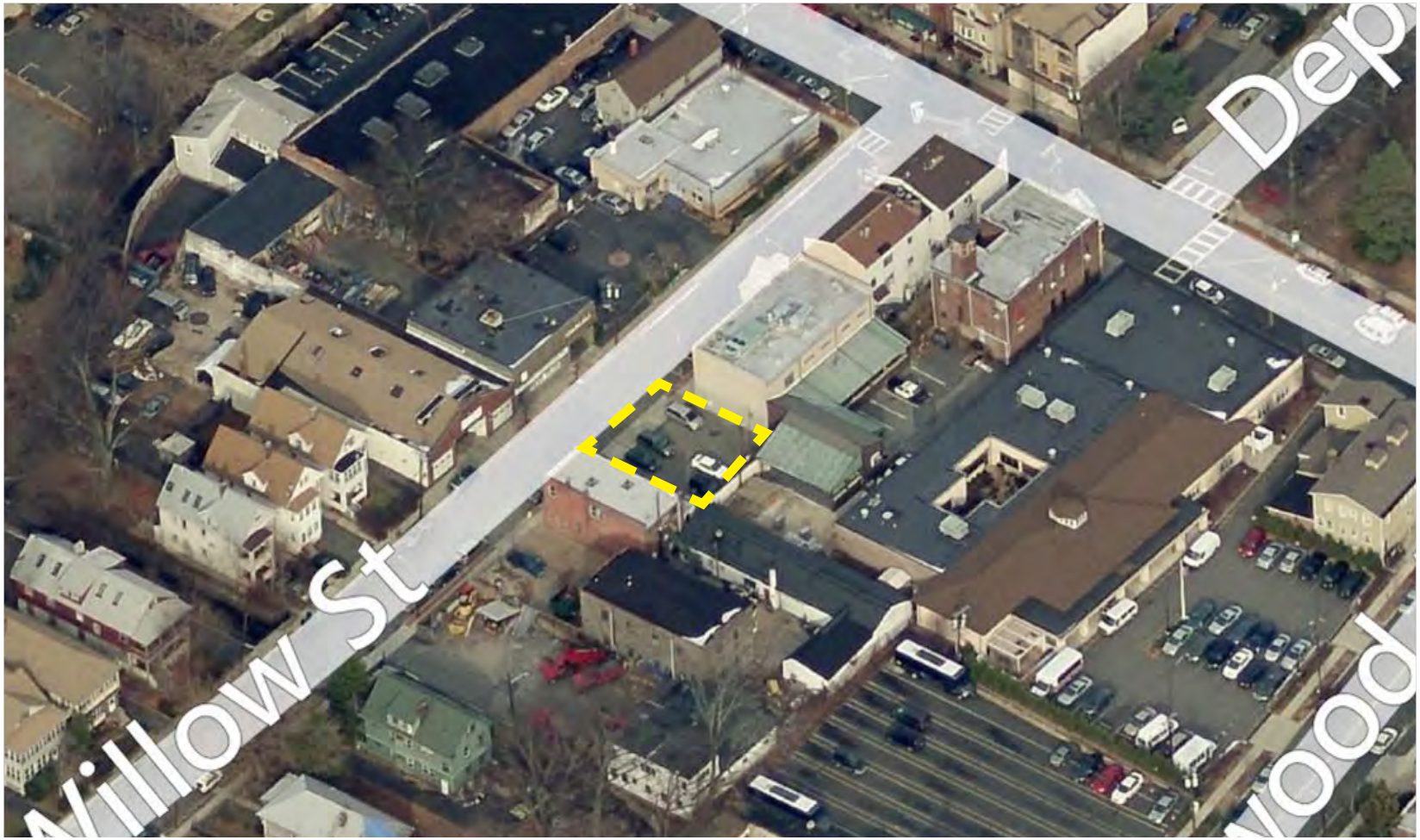
MONTCLAIR HIGH SCHOOL AND RAND PARK

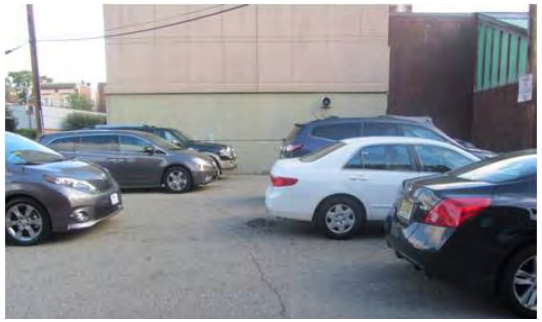
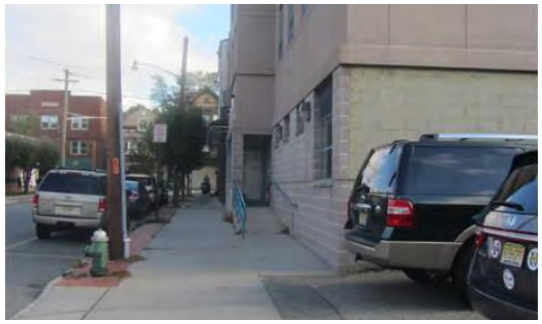
100 Chestnut Street
Montclair, NJ 07043

The site is Montclair High School, next to Rand Park on Fullerton Avenue. The main building of the school is located at 100 Chestnut Street. A stream runs past the west side of the building, through Rand Park. The school building at Fullerton Avenue is surrounded by paved parking, with several storm drains located throughout. Since the parking lot is so large, the most likely option here is to install islands with stormwater planters, bioswales, and/or rain gardens. These systems will intercept the first flush of stormwater runoff from the parking lot, filtering it and increasing infiltration. A demonstration rain garden could be installed along with gutters to capture rooftop runoff from the pump station building in Rand Park. The garden can serve as an outdoor learning site for students.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

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


Willow St

The site is the Montclair Animal Shelter located at 77 Willow Avenue. This site is completely paved. There are no external downspouts on the building. The parking lot area is in poor condition and when replaced, pervious pavement should be considered to reduce runoff. If rooftop runoff can be routed to an external location. A cistern tank could be used to harvest rainwater providing a nonpotable source of water for washing shelter areas.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

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

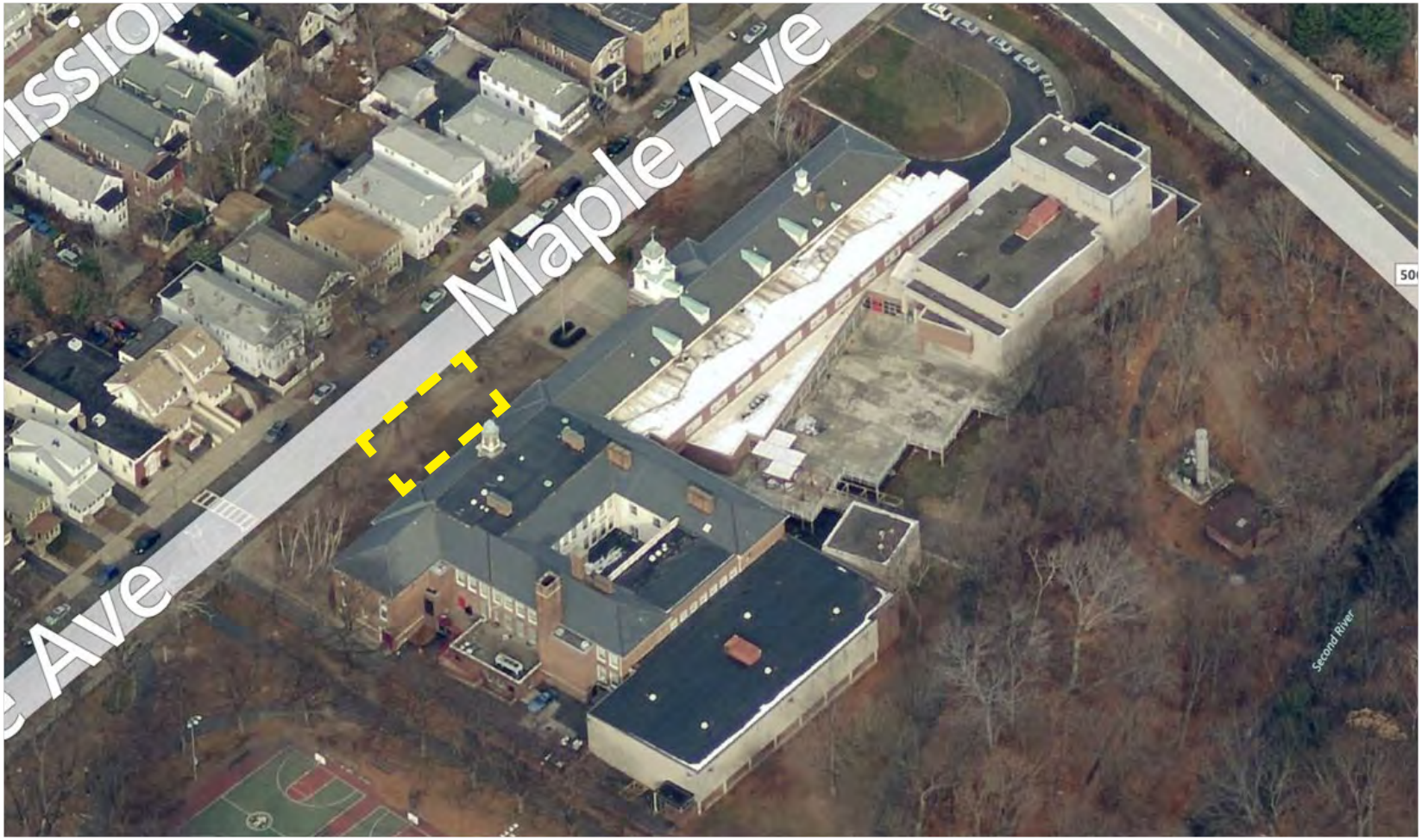
108 Orange Road
Montclair, NJ 07043



The site is Montclair Community Farms located at 108 Orange Road. Significant areas of the community garden are saturated creating ponding near the gate entrance. A rain garden or bioswale could be installed to improve drainage and prevent ponding. A cistern potentially can be connected to a nearby building and installed in the garden to provide water for garden plantings.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

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


Maple Ave
Second River



The site is the Glenfield Middle School at 25 Maple Avenue. The wide front lawn has little landscaping and degraded lawn areas. A downspout on the front (northwest) side of the building discharges onto the lawn, which slopes toward the street. This location serves as an ideal opportunity for a rain garden. A project here could also provide the foundation for an educational program with students and staff at the school.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

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


Third River
Third River
Riverview Dr W
Riverview D



The site is the Alonzo Bonsal Wildlife Preserve located at Riverview Drive. The majority of the preserve is a naturalized area. At the entrance to the preserve the storm sewer appears to discharge directly to the Third River. The discharge pipe has caused significant erosion. The stormwater should be intercepted prior to being discharged via the pipe to prevent erosion and nonpoint source pollution. Certain areas of the road and sidewalk could be converted to pervious pavement, and swales can be installed to slow the flow of water.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

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

1 Yantacaw Brook Road,
Montclair, NJ 07043



This site is Yantacaw Brook Park. The park contains a pond with limited vegetated buffers. Many geese and waterfowl use the pond degrading park areas. Buffer plantings around the pond will help to deter geese and filter stormwater runoff from surrounding park areas.

SUITABLE GREEN INFRASTRUCTURE STRATEGIES:

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