Stormwater Runoff Reduction Plan

New Canaan, CT

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Summary

In the summer of 2024, UConn students and faculty conducted a stormwater retrofit assessment in the town of New Canaan, CT. The town first recommended potential town-owned sites. Then, a desktop analysis and field site visits were conducted to determine where potential green stormwater infrastructure may be installed.

A total of **12 potential projects** were identified. If all projects are installed, **75,520 ft**² of impervious cover will be disconnected.

Impervious Surfaces and Stormwater Runoff

Increased development in the state of Connecticut has ultimately caused an immense increase in the amount of impervious cover throughout the state. Impervious surfaces, such as rooftops, parking lots, roads, and more, increase the amount of stormwater runoff that flows into waterways. Traditional stormwater infrastructure disrupts the water cycle, increases the number of pollutants in our waterways, and increases flooding and erosion. By installing green stormwater infrastructure, impervious surfaces are disconnected from stormwater management systems and stormwater can naturally infiltrate into the ground.

MS4 Requirements

As part of the **Federal Clean Water Act**, the Connecticut Department of Energy and Environment Protection (**DEEP**) requires Municipalities to regulate stormwater discharges into water bodies.

- Nonpoint Source Pollution: stormwater runs across impervious surfaces, collecting pollutants before it flows into storm drains and eventually waterways
- The MS4 General Permit and other stormwater permitting programs prefer the use of Low Impact Development (LID) practices, including green stormwater infrastructure, wherever possible to mitigate pollution in waterways.
- LID practices aim to preserve pre-development hydrology, with an emphasis on treatment and retention of stormwater onsite.
- MS4 Towns, including New Canaan, are required to develop and work to implement a plan to disconnect 1% of their impervious surfaces from draining into the stormwater system.





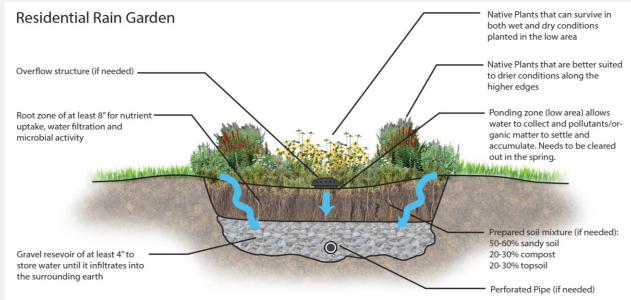
Green Stormwater Infrastructure Practices

This report centers on rain gardens as the main source of green stormwater management. However, there are several other types of green stormwater infrastructure that will be detailed in order to provide greater context and inform the town of potential practices that they may invest in in the future. Types of green stormwater infrastructure include: rain gardens, bioretention basins, pervious pavement, tree box filters, green roofs, and rainwater harvesting.



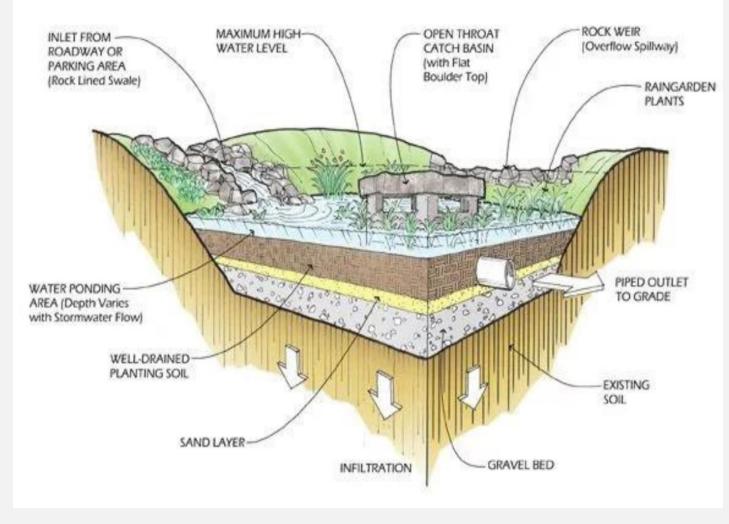
Rain Gardens

- Collects stormwater runoff from roofs via disconnected gutters or from impervious surfaces and infiltrates runoff into the ground naturally
- Involves a 6+ inch depression, often with grass, native plants, or stone
- \odot May include curb cuts, gravel, or stone to prevent erosion
- Aesthetically pleasing and provides greater biodiversity
 - o Pollinator pathways
 - Less costly than other types of green stormwater infrastructure
 - Maintenance includes weed/invasive removal and flow path inspections
 - $\circ~$ Avoid creating mowing islands and building too close to the tree roots
 - Rain gardens drain within **12-24 hours**
 - o If drained in this timeframe, they would *not* be breeding ground for mosquitoes and other bugs



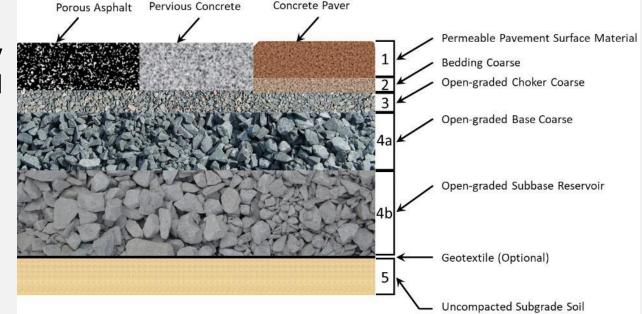
Bioretention Basins

- Serve the same function as rain gardens
- Key differences include: special soil media, overflow structures, and underdrains
- Essentially involve more engineering than rain gardens and are typically done in either more developed areas or areas where the soil conditions require it



Pervious Pavement

- Serve as an alternative to traditional pavement by allowing water to infiltrate into the ground instead of running off
 - Typically installed in areas that are already being repaved to avoid excess construction
 - Cost competitive with typical pavement
- \odot Ideally installed somewhere relatively flat and already deals with large amounts of runoff



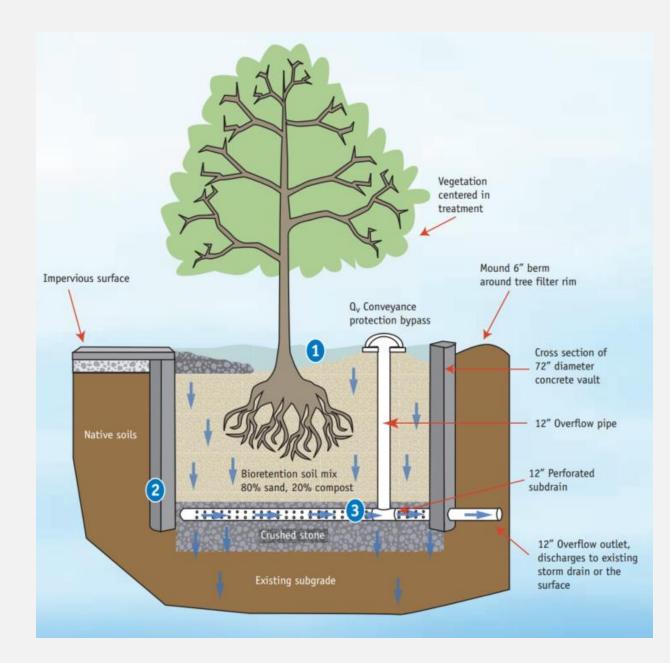
- Needs to be maintained effectively (pressure washing and vacuum sweeping) to make sure that stormwater can still infiltrate well
- Requires less snow maintenance than traditional pavement
- Needs to be replaced less frequently than traditional pavement because it doesn't contract and expand as much with the changing seasons and temperatures

Tree Box Filters

 Aesthetically pleasing practice that filters runoff through tree roots

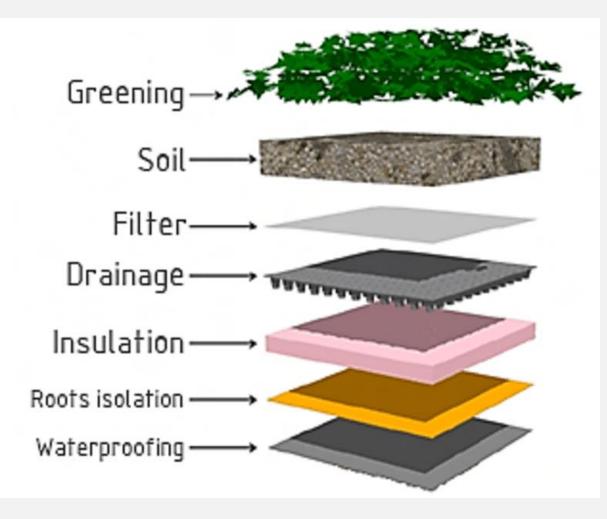
 Stormwater enters the installation through a grate, then infiltrates through the soil and root system of the tree, filtering out pollutants in the process

 In the case of extreme amounts of stormwater present near the filter, an underdrain may be required to prevent flooding



Green Roofs

- Allows runoff to infiltrate substrate directly
- Disconnects about 50% of the stormwater from roof
- Most expensive practice, but offers great educational opportunities for nearby communities and adds to the aesthetic
- Green roof trays may be a more affordable option and will give many of the same benefits
- Implementation of a green roof depends on the structural support of the roof and proper roof access



Rainwater Harvesting

- Rainwater harvesting is the capture and reuse of rainwater from gutters and downspouts
- Roof runoff is fed into large cisterns which retain the water until it can be repurposed
 - Cisterns require minimal maintenance
 - May need to be moved in the winter months to prevent freezing.
- Reduces stress on private wells and municipal water supplies
- \odot The required size of the rain barrel depends on the collection area
- $\odot\,\textsc{Materials}\,\textsc{can}\,\textsc{range}\,\textsc{from}\,\textsc{PVC}\,\textsc{to}\,\textsc{steel}$
- $\odot\,\mbox{Filters}$ can be installed to remove pollutants if needed



Site Selection and Approach

Before visiting sites, team members used aerial imagery tools to view different locations to determine possible sites suitable for green infrastructure practices. This work included using the statewide **high-resolution impervious surface maps** to get an overall feel for the site, following **contour lines provided by ArcGIS** to estimate drainage patterns, and examining **images from Google Maps** to locate possible disconnection sites.

On location, site specific recommendations were selected based on suitability for implementation of green infrastructure practices. Criteria used include:

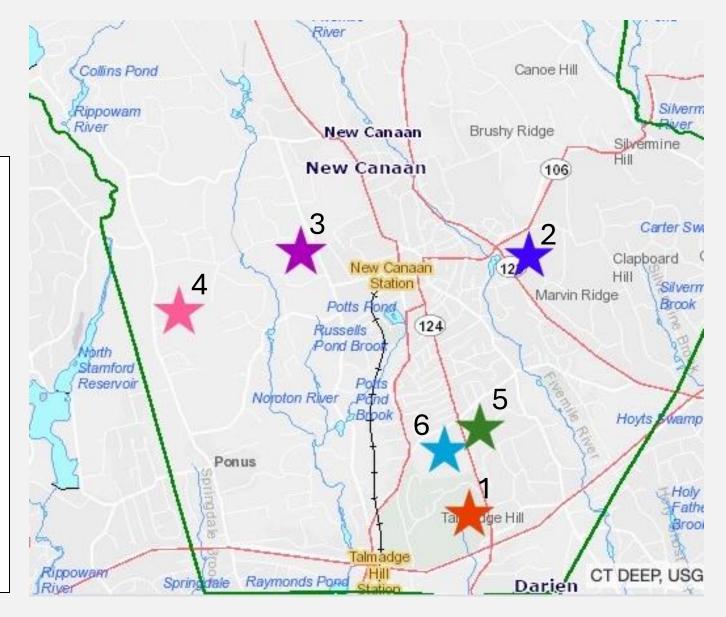
- **Slope** of surrounding land
- Land available for use
- Locations of existing storm drains or other overflow opportunities
- Above ground and underground obstructions (large trees, pipes, utilities, etc.)
- Pre-existing green infrastructure practices

- Maintenance concerns
- Educational value
- Visibility
- Safety
- Volunteer opportunities
- Size of disconnect/impact

Recommendations Overview

Map Legend

Location 1: Waveny Park Location 2: East Elementary School Location 3: Irwin Park Location 4: West Elementary School Location 5: Saxe Middle School Location 6: South Elementary School



Explanation of Calculations

- Drainage Area: The potential watershed area for each retrofit was estimated using topographic tools and confirmed during site visits.
- Rain Garden Size: Rain garden area and depth is heavily dependent on the estimated drainage area and amount of rainfall expected. All rain gardens in this presentation are sized to handle a 1.3 inch rainstorm event. Rain gardens should be able to hold the same volume so the area and depth is altered accordingly. Rain gardens deeper than 12 inches are avoided for safety reasons.
- Nutrient Reductions: The area of land treated and estimated concentrations of nutrients that runoff into that area is equal to the amount of nutrients that can be directed away from that watershed, as calculated by Charles Frink in a paper discussing nutrient concentrations in Connecticut by major type of land cover. Point source pollution was not taken into consideration in these calculations as it varies depending on the site.
- **Gallons Treated:** The volume of stormwater treated was determined with the assumption that Connecticut experiences around 48 inches of rain annually.

Location #1: Waveny Park 677 South Avenue

We recommend the installation of two rain gardens at this site to disconnect part of the roof of Waveny House and part of the parking lot by the Community Center. These will add to aesthetics in both areas.

Possible <u>disconnection of</u> <u>12,066 sq. ft</u> of impervious cover with the implementation of rain gardens.

> COLOR KEY Drainage Area <mark>Proposed Rain Garden Area</mark>









COLOR KEY Drainage Area <mark>Proposed Rain Garden Area</mark>

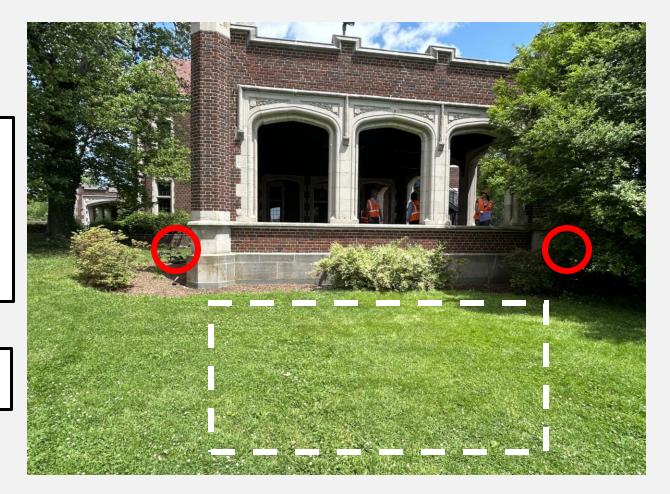
- Blue arrows indicate the direction of water flow
- Red circles indicate downspouts to disconnect

Site notes:

- High visibility
 - Opportunity to put in educational sign about the rain garden
- Will help add more color to already manicured area
- Don't build too close to the roots of existing trees

SYMBOLS KEY

- Red circles indicate downspouts to disconnect



Drainage Area (ft ²)	Suggested Green Infrastructure	Annual Gallons Treated	Annual Nitrogen Reduction (lb N / yr)	Annual Phosphorus Reduction (lb P / yr)	Suggested Prac tice Size (ft ²)
828	Rain Garden	21,794	0.18	0.02	179 (Depth of 6 in)





COLOR KEY Drainage Area <mark>Proposed Rain Garden Area</mark>

- Blue arrows indicate the direction of water flow
- White arrows indicate recommended curb cuts
- Red circle indicates existing drain

Site Notes:

- Existing drain indicates water is flowing that direction
- High visibility and high educational value
 - Possible volunteer opportunity
 - Opportunity to put in educational sign
- Will help add more color to the community center

- White arrows indicate recommended curb cuts
- Red circle indicates existing drain



Drainage Area (ft²)	Suggested Green Infrastructure	Annual Gallons Treated	Annual Nitrogen Reduction (lb N / yr)	Annual Phosphoru s Reduction (lb P / yr)	Suggested Practice Size (ft ²)
11,238	Rain Garden	295,944	2.46	0.31	2,435 (Depth of 6in)

Location #2: East Elementary School 54 Little Brook Road

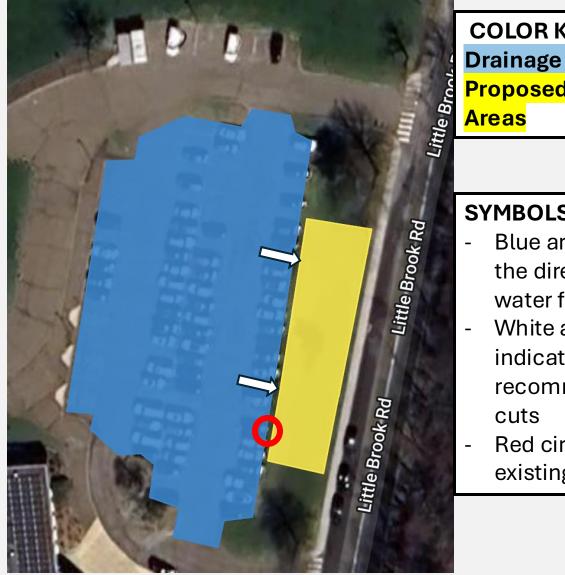
We recommend the installation of two rain gardens at this site to disconnect most of the parking lot and part of the parking loop. These will add to aesthetics of the school and provide great educational value.

Possible <u>disconnection of 33,629 sq. ft</u> of impervious cover with the implementation of rain gardens.

COLOR KEY Drainage Areas Proposed Rain Garden Areas







COLOR KEY Drainage Areas **Proposed Rain Garden**

- Blue arrows indicate the direction of water flow
- White arrows indicate recommended curb
- Red circle indicates existing drain

Site notes:

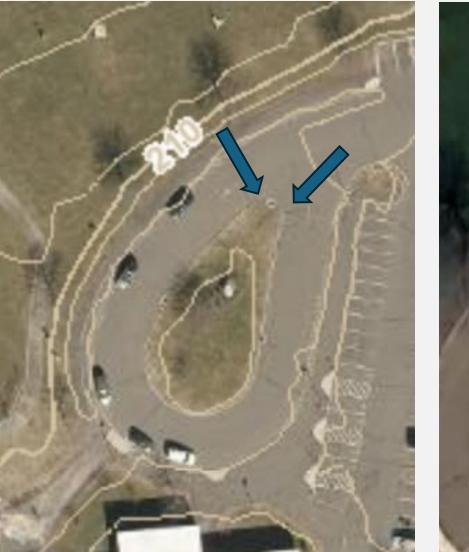
- Existing drains indicate direction of water flow
- High visibility and high educational value
- Will disconnect entire lot
- Will help add color to this area
- The island is already sloped downward which would help efficacy of the rain garden



SYMBOLS KEY

- White Arrows indicate recommended curb cuts

Drainage Area (ft ²)	Suggested Green Infrastructure	Annual Gallons Treated	Annual Nitrogen Reduction (lb N / yr)	Annual Phosphorus Reduction (lb P / yr)	Suggested Practice Size (ft ²)
28,445	Rain Garden	749,046	6.22	0.79	6,163 (Depth of 6in)





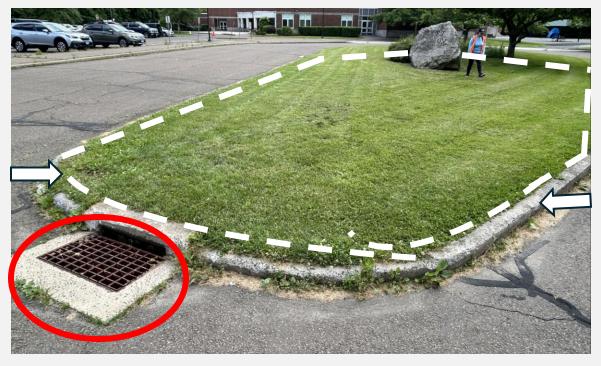
COLOR KEY Drainage Area Proposed Rain Garden Area

- Blue arrows indicate
 the direction of water flow
- White Arrows indicate recommended curb cuts
- Red circle indicates existing drain

Site notes:

- Existing drain indicates direction of water flow
- High visibility and high educational value
- Will help add color to this area
- Rock can be included in the garden to minimize maintenance disruptions
- Don't build too close to the roots of the tree

- White arrows indicate recommended curb cuts
- Red circle indicates existing drain



Drainage Area (ft ²)	Suggested Green Infrastructure	Annual Gallons Treated	Annual Nitrogen Reduction (lb N / yr)	Annual Phosphorus Reduction (lb P / yr)	Suggested Practice Size (ft ²)
5,183	Rain Garden	136,501	1.13	0.14	1,123 (Depth of 6in)

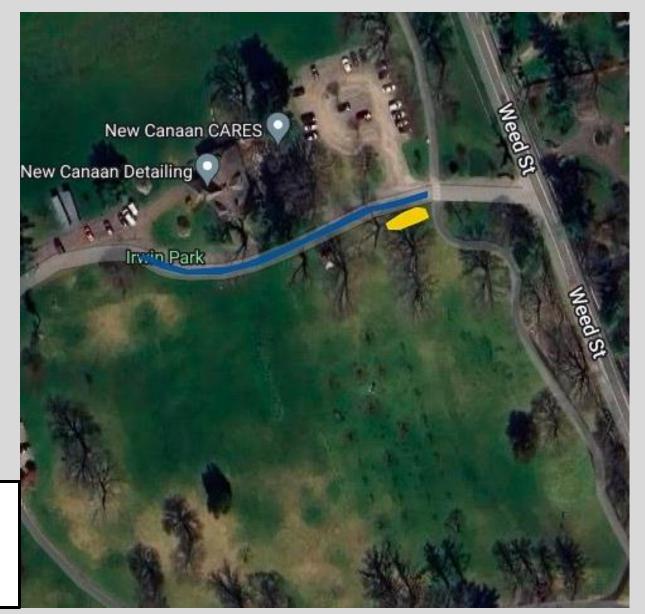
Location #3: Irwin Park

848 Weed Street

We recommend the installation of one rain garden at this site to disconnect part of the roadway. This will add to aesthetics of the park and pair well with the GSI already installed.

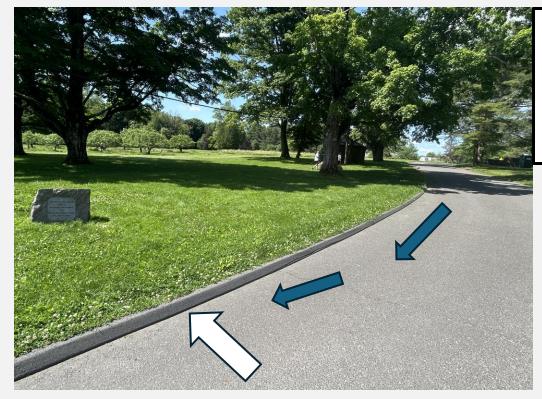
Possible <u>disconnection of 3,367 sq. ft</u> of impervious cover with use the implementation of rain gardens.

> COLOR KEY Drainage Area Proposed Rain Garden Area



Irwin Park Site 1





- Blue arrows indicate the direction of water flow
- White arrows indicate recommended curb cuts



Irwin Park Site 1





Irwin Park already has several pervious pavement paths, specifically made of a material called Flexi-Pave. The photo on the right shows a path made of Flexi-Pave that would lie right next to the potential rain garden. Having both green stormwater practices work in tandem could prove very beneficial for both the surrounding environment and educational benefits towards the community. This serves as an opportunity to further provide education to the community.

Irwin Park Site 1

Site Notes

- High visibility area
- We received positive feedback at this site
- Due to the pervious pavement already installed there is the opportunity for education about multiple green stormwater practices
- Avoid installing the garden too close to trees
- The rock in the green space can be incorporated into the garden
- Matches the aesthetic of the rest of the park

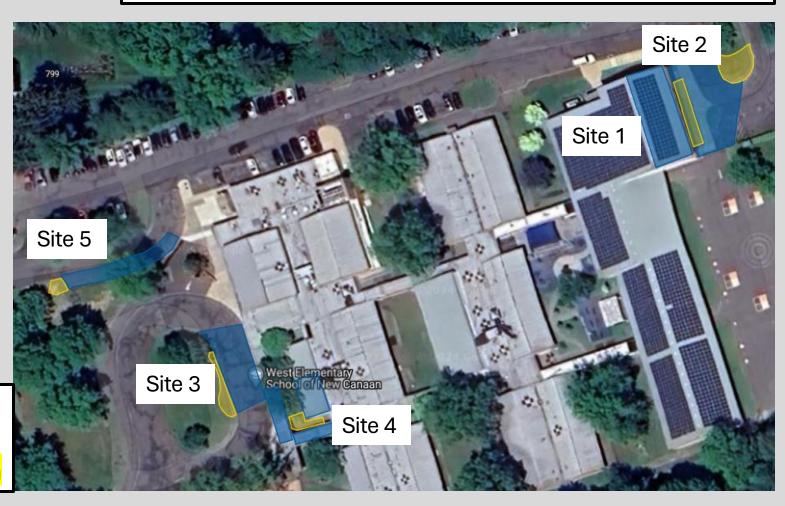
Drainage area (ft ²)	Suggested Green Infrastructure	Annual Gallons Treated	Annual Nitrogen Reduction (lb N/yr)	Annual Phosphorus Reduction (lb P/yr)	Suggested Practice size (ft ²)
3,367	Rain Garden	88,664	0.74	0.09	730 (depth of 6 in)

Location #4: West Elementary School

769 Ponus Ridge Road

Possible <u>disconnection of 12,085</u> sq. ft of impervious cover with use the implementation of rain gardens.

We recommend the installation of five rain gardens at this site to disconnect a back portion of the roof, front portion of the roof, part of the bus loop, and two parts of the parking lot. This will add to aesthetics of the school and provide great educational value.



COLOR KEY Drainage Area <mark>Proposed Rain Garden Area</mark>



COLOR KEY Drainage Area <mark>Proposed Rain Garden Area</mark>

Site notes:

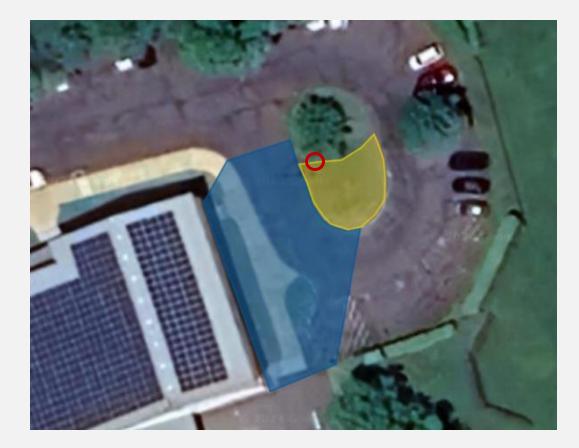
- Low fence around rain garden is suggested to prevent children from falling in since the location is next to the playground
- Rain garden depth must be adjusted to
 7 inches to accommodate small space

SYMBOLS KEY

- Red circles indicate downspouts to disconnect



Drainage area (ft ²)	Suggested Green Infrastructure	Annual Gallons Treated	Annual Nitrogen Reduction (lb N/yr)	Annual Phosphorus Reduction (lb P/yr)	Suggested Practice size (ft ²)
3,093	Rain Garden	81,448	0.68	0.09	574 (Depth of 7 in)





COLOR KEY Drainage Area <mark>Proposed Rain Garden Area</mark>

SYMBOLS KEY

- Red circle indicated existing drain

Site Notes:

- Existing drains indicate direction of water flow
- Note utilities to avoid during installation
- Low visibility in the back of parking lot

- White arrows indicate recommended curb cuts
- Red circle indicates existing drain



Drainage area (ft ²)	Suggested Green Infrastructure	Annual Gallons Treated	Annual Nitrogen Reduction (lb N/yr)	Annual Phosphorus Reduction (lb P/yr)	Suggested Practice size (ft ²)
4,225	Rain Garden	111,257	0.92	0.12	915 (depth of 6 in)



COLOR KEY

Drainage Area

Proposed Rain Garden Area

Rock Channel to guide water

SYMBOLS KEY

Blue arrows indicate the direction of water flow



Site Notes:

- High visibility and educational value
- Will disconnect a large portion of the bus drop off area
- Aesthetic appeal to the entrance of school
- Avoid building too close to trees
- Will cause changes in Maintenace / mowing patterns

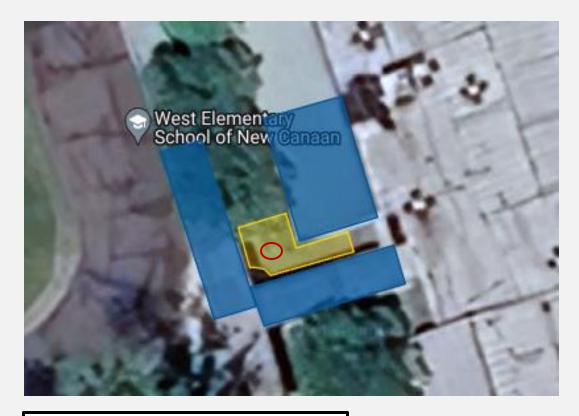
SYMBOLS KEY

- White arrows indicate recommended curb cuts



Drainage area (ft ²)	Suggested Green Infrastructure	Annual Gallons Treated	Annual Nitrogen Reduction (lb N/yr)	Annual Phosphorus Reduction (lb P/yr)	Suggested Practice size (ft ²)
2,004	Rain Garden	52,765	0.44	0.06	434 (depth of 6 in)

West Elementary School Site 4 🔆



COLOR KEY

Drainage Area

Proposed Rain Garden Area

SYMBOLS KEY

- Red circle indicates existing drain.



West Elementary School Site 4

Site Notes

- High visibility and educational value
- Will enhance the visual appeal of the area and enhance an existing feature in the area (the memorial rock)
- Avoid building the garden to close to the building and of tree roots
- Will cause changes to the Maintenace/ mowing patterns
- Rain garden must be **8 inches** deep to accommodate the small space.
- Existing drain can be used as an overflow





Drainage area (ft ²)	Suggested Green Infrastructure	Annual Gallons Treated	Annual Nitrogen Reduction (lb N/yr)	Annual Phosphorus Reduction (lb P/yr)	Suggested Practice size (ft ²)
1,917	Rain Garden	50,481	0.42	0.05	312 (Depth of 8 in)

West Elementary School Site 5



COLOR KEY Drainage Area Proposed Rain Garden Area

SYMBOLS KEY

- White arrows indicate recommended curb cuts
- Blue arrows indicate direction of water flow



West Elementary School Site 5

Site Notes

- High visibility due to the potential placement of the garden
- High educational value
- Not a very large disconnection area
- Avoid installing the garden too close to trees
- Changes in maintenance should be minimal



Drainage area (ft ²)	Suggested Green Infrastructure	Annual Gallons Treated	Annual Nitrogen Reduction (lb N/yr)	Annual Phosphorus Reduction (lb P/yr)	Suggested Practice size (ft ²)
846	Rain Garden	22,278	0.19	0.02	183 (depth of 6 in)

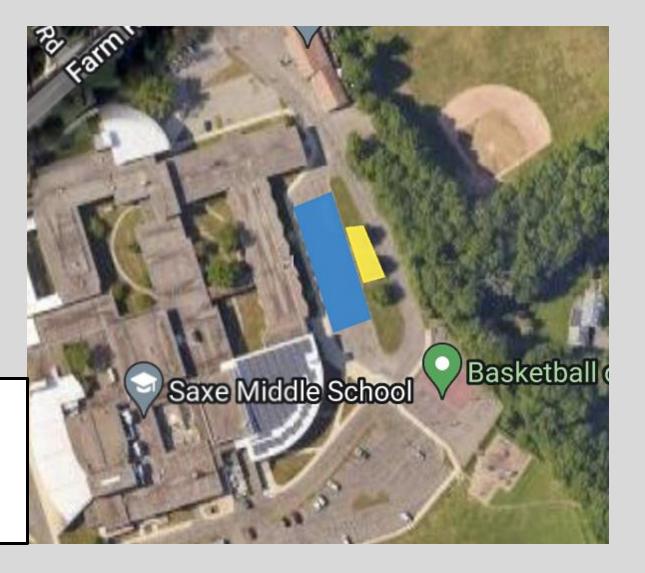
Location #5: Saxe Middle School

468 South Avenue

We recommend the installation of one rain garden at this site to disconnect part of the parking lot. This will add to aesthetics of the school and provide great educational value.

Possible <u>disconnection of 11,761 sq. ft</u> of impervious cover with the implementation of rain gardens.





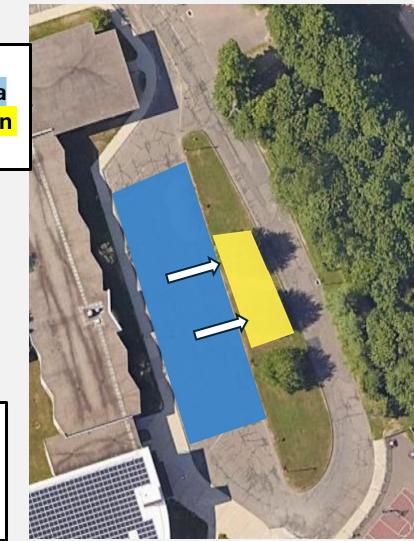
Saxe Middle School Site 1



COLOR KEY Drainage Area Proposed Rain Garden Area

SYMBOLS KEY

- White arrows indicate recommended curb cuts
- Blue arrows indicate direction of water flow



Saxe Middle School Site 1

Site Notes:

- High visibility and high educational value
- Will help add color to this area
- Make sure students don't walk over the area and compact the garden

SYMBOLS KEY

 White arrows indicate recommended curb cuts



Drainage Area (ft²)	Suggested Green Infrastructure	Annual Gallons Treated	Annual Nitrogen Reduction (lb N / yr)	Annual Phosphorus Reduction (lb P / yr)	Suggested Pract ice Size (ft²)
11,761	Rain Garden	309,704	2.57	0.33	2,548 (Depth of 6 in)

Location #6: South Elementary School 68 Gower Road

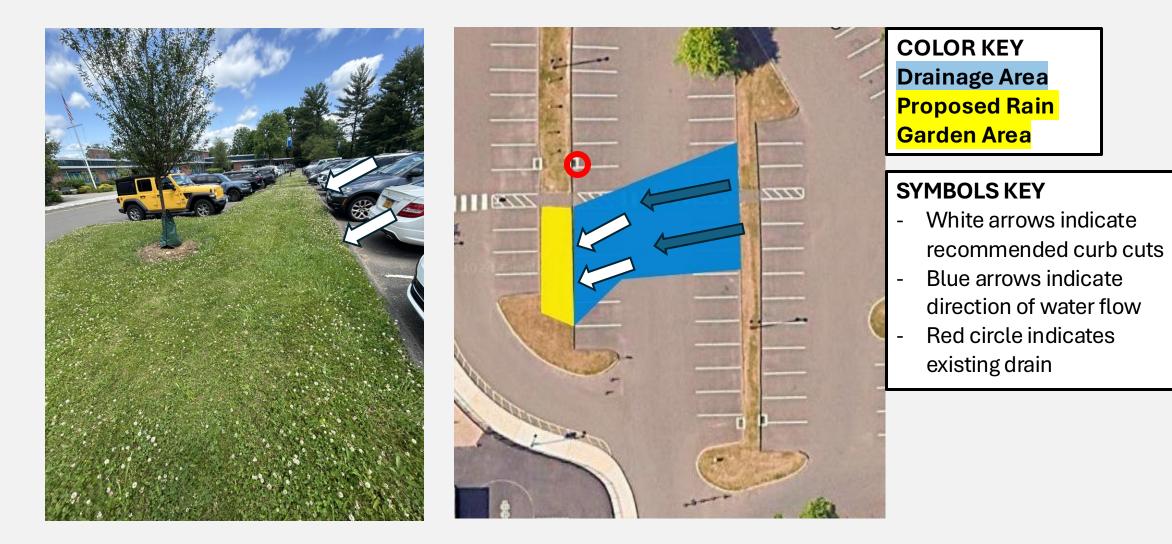
We recommend the installation of one rain garden at this site to disconnect a portion of the parking lot. This will add to aesthetics of the school and provide great educational value.

Possible <u>disconnection of 2,613 sq. ft</u> of impervious cover with use the implementation of rain gardens.

COLOR KEY Drainage Area <mark>Proposed Rain</mark> Garden Area



South Elementary School Site 1



South Elementary School Site 1

Site Notes:

- Relatively high visibility
- High educational value
- The tree in the area is still young and could be incorporated into the rest of the garden
- Potential changes in mowing/maintenance
- Potential high traffic area may be walked over as people walk through the parking lot

Drainage Area (ft ²)	Suggested Green Infrastructure	Annual Gallons Treated	Annual Nitrogen Reduction (lb N / yr)	Annual Phosphorus Reduction (lb P / yr)	Suggested Practice Size (ft ²)
2,613	Rain Garden	68,808	0.57	0.07	566 (Depth of 6 in)

Calculation Totals

Site	Disconnected Area (ft²)	Annual Gallons Treated	Annual Nitrogen Reduction (lb N / yr)	Annual Phosphorus Reduction (lb P / yr)
Waveny Park #1	828	21,794	0.18	0.02
Waveny Park #2	11,238	295,944	2.46	0.31
East Elementary #1	28,445	749,046	6.22	0.79
East Elementary #2	5,183	136,501	1.13	0.14
Irwin Park #1	3,367	88,664	0.74	0.09
West Elementary #1	3,093	81,448	0.68	0.09
West Elementary #2	4,225	111,257	0.92	0.12
West Elementary #3	2,004	52,765	0.44	0.06
West Elementary #4	1,917	50,481	0.42	0.05
West Elementary #5	846	22,278	0.19	0.02
Saxe Middle School #1	11,761	309,704	2.57	0.33
South Elementary #1	2,613	68,808	0.57	0.07
Total	75,520	1,988,690	16.52	2.09

Our Top 5 Recommendations

1. East Elementary Site 1

- o 749,046 gallons treated annually
- \circ Very high educational value
- o Disconnects entire parking lot

2. Waveny Park Site 1

- o 21,794 gallons treated annually
- $\circ~$ High visibility and educational value
- o Will blend in with already tightly manicured area

3. East Elementary Site 2

- o 136,5014 gallons treated annually
- o High visibility and high educational value
- $\circ~$ Existing rock can be built into garden

4. Irwin Park Site 1

- o 88,664 gallons treated annually
- o Great spot to educate public about multiple GSI
- \circ High visibility

5. West Elementary School Site 4

- o 50,481 gallons treated annually
- o Highly visible
- Rock can be built into garden to minimize disruption in maintenance





Sites not visited/not selected

- New Canaan High School was visited, but no potential sites were found.
 - \odot The roofs were flat and there were no viable islands in the parking lots
 - \odot There was potential for green roof trays in their outdoor cafeteria but would be hard to maintain especially in heavily trafficked area
- The Care Center was visited, but no potential sites were found.
 There was limited green space and therefore limited space to put in a rain garden.

Questions/Discussion

Contact information



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