Town of Ellington, CT

Stormwater Runoff Reduction Plan

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CLEAR
University of Connecticut

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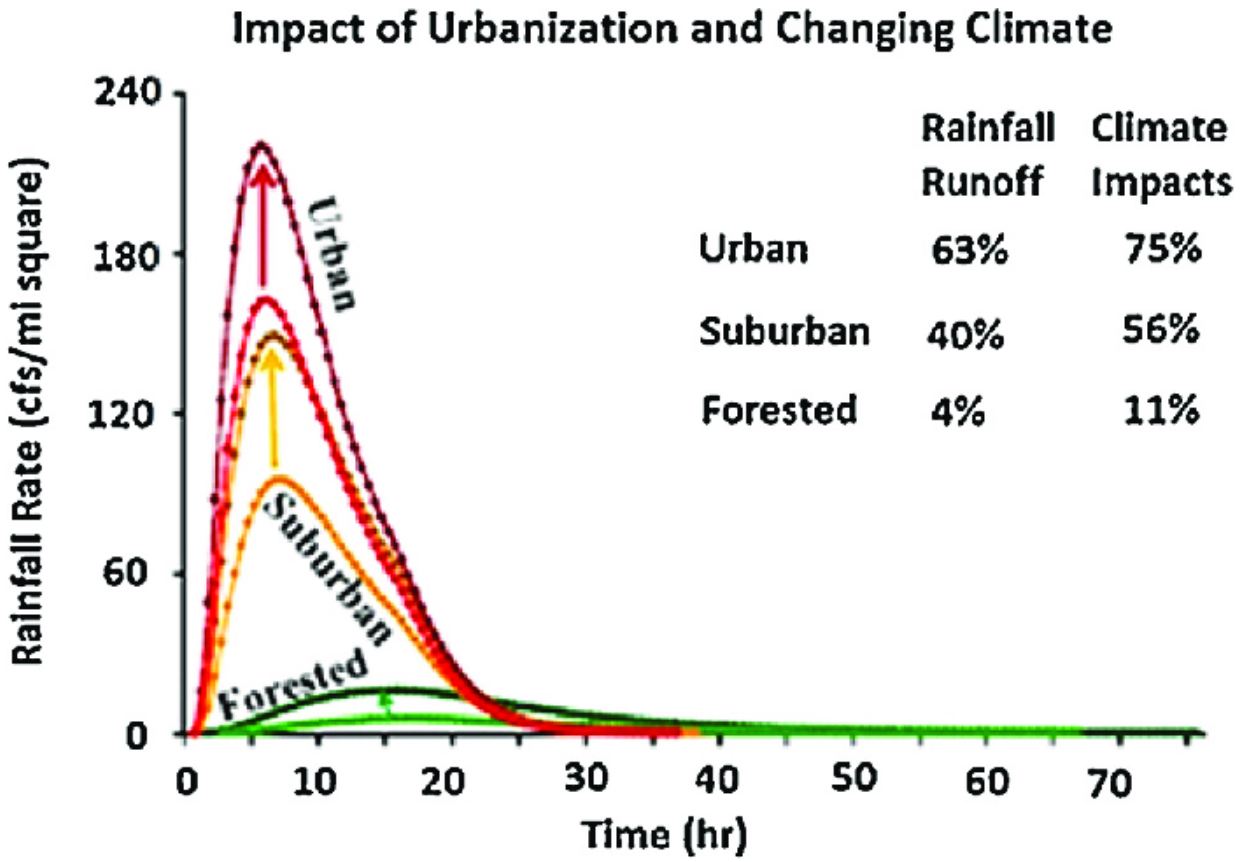
Summary

In the Fall semester of 2024, UConn students and faculty conducted a stormwater retrofit assessment in the town of Ellington, CT. A discussion with the town, 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, **47,811 ft²** of impervious cover will be disconnected.

Impervious Surfaces and Stormwater Runoff

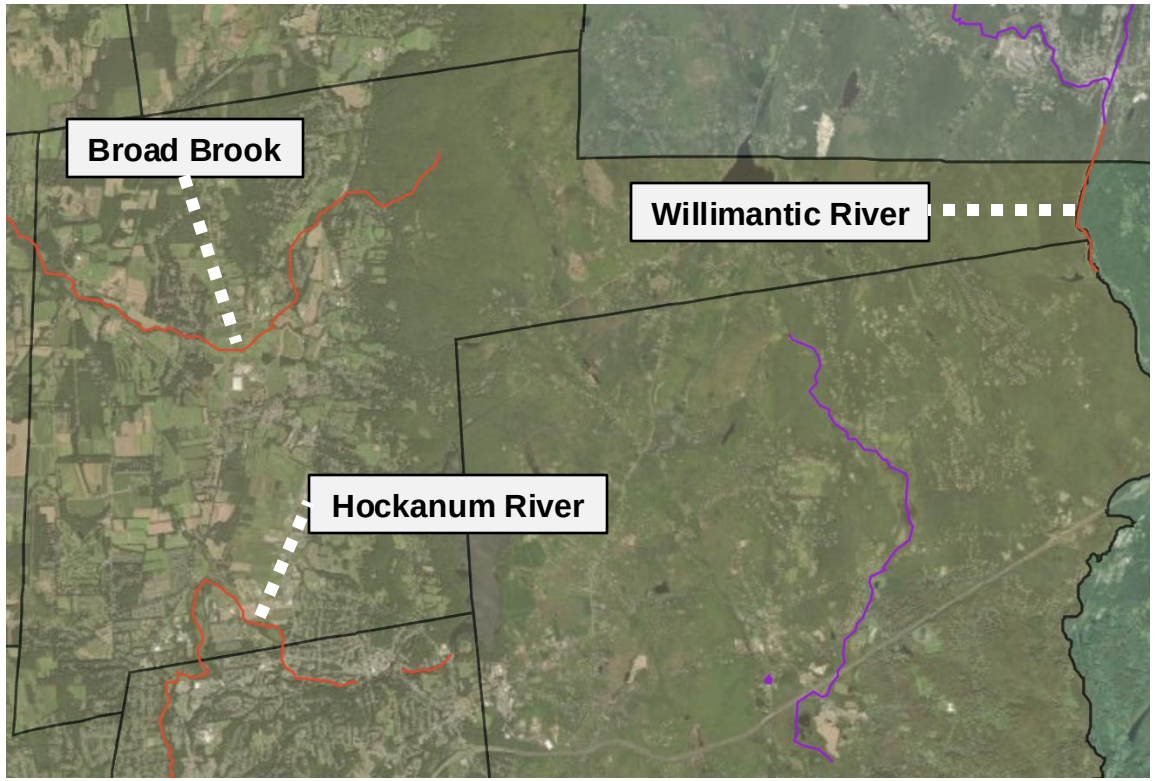
- As Connecticut **becomes more developed, impervious cover increases**.
- Impervious surfaces include rooftops, parking lots, and roads.
- Traditional stormwater infrastructure **increases the number of pollutants** in our waterways and **amplifies the impacts of flooding and erosion**.



MS4 Requirements

- As part of the Federal Clean Water Act, the Connecticut Department of Energy and Environment Protection requires municipalities to regulate stormwater discharges.
- **Nonpoint Source Pollution:** stormwater runs across impervious surfaces, collecting pollutants before flowing into storm drains.
- The MS4 General Permit prefers the use of Low Impact Development (LID) practices.
- LID practices aim to **preserve pre-development hydrology**, with an emphasis on **treatment and retention of stormwater onsite**.
- MS4 Towns are required to develop and work to implement a plan to **disconnect 1% of their impervious surfaces** from the stormwater system.

The town of Ellington currently has three impaired water bodies: Broad Brook, Hockanum River, and the Willimantic River.



Green Stormwater Infrastructure Practices

- Green stormwater infrastructure disconnects impervious cover from traditional stormwater management systems and **allows it to infiltrate naturally into the ground**.
- Types of green stormwater infrastructure:
  - Rain gardens, bioretention basins, pervious pavement, tree box filters, green roofs, and rainwater harvesting.

Rain Gardens

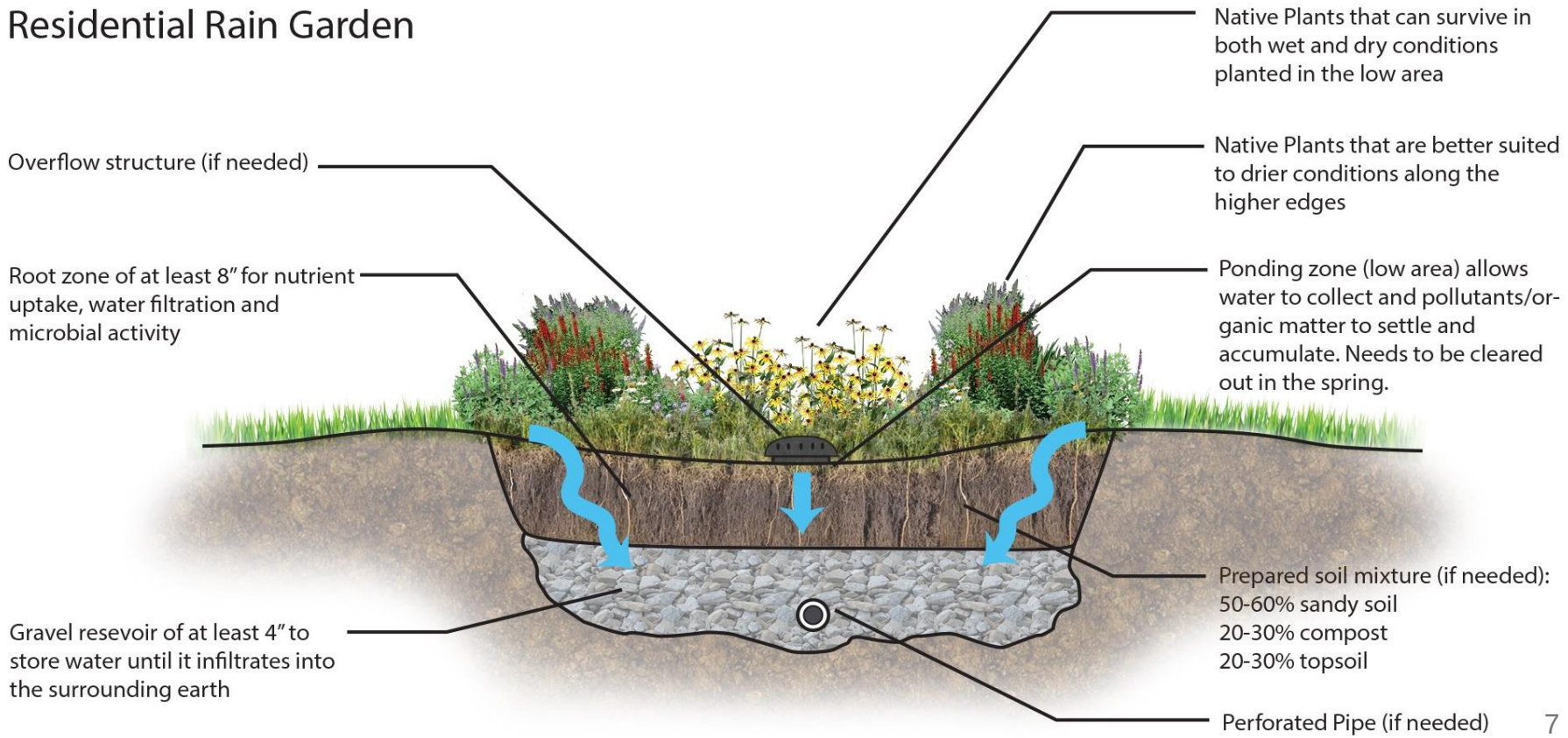
- **Collect stormwater runoff** from roofs via disconnected gutters or from impervious surfaces and **infiltrate it into the ground**.
- Often involve **a 6+ inch depression**, with grass or native plants.

Less costly than other LID practices

Aesthetically pleasing

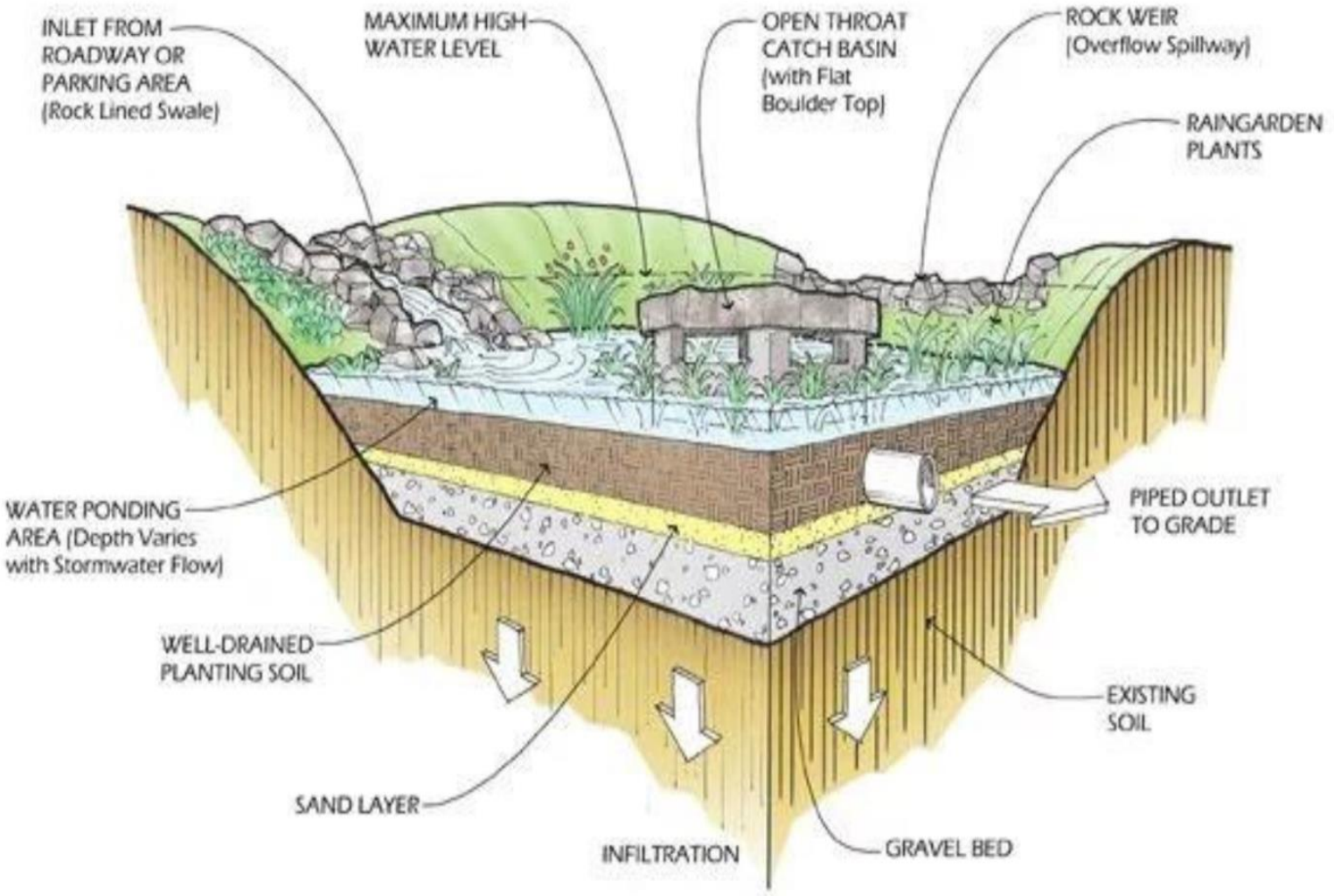
Provides biodiversity for pollinators

- May include **curb cuts, gravel, or stone to prevent erosion**.
- Maintenance includes weed/ invasive removal and flow path inspections.
- Avoid **creating mowing islands and building too close to the tree roots**.
- Usually drains **within 12-24 hours**.
  - If drained in this timeframe, they would *not* breed mosquitoes.



Bioretention Basins

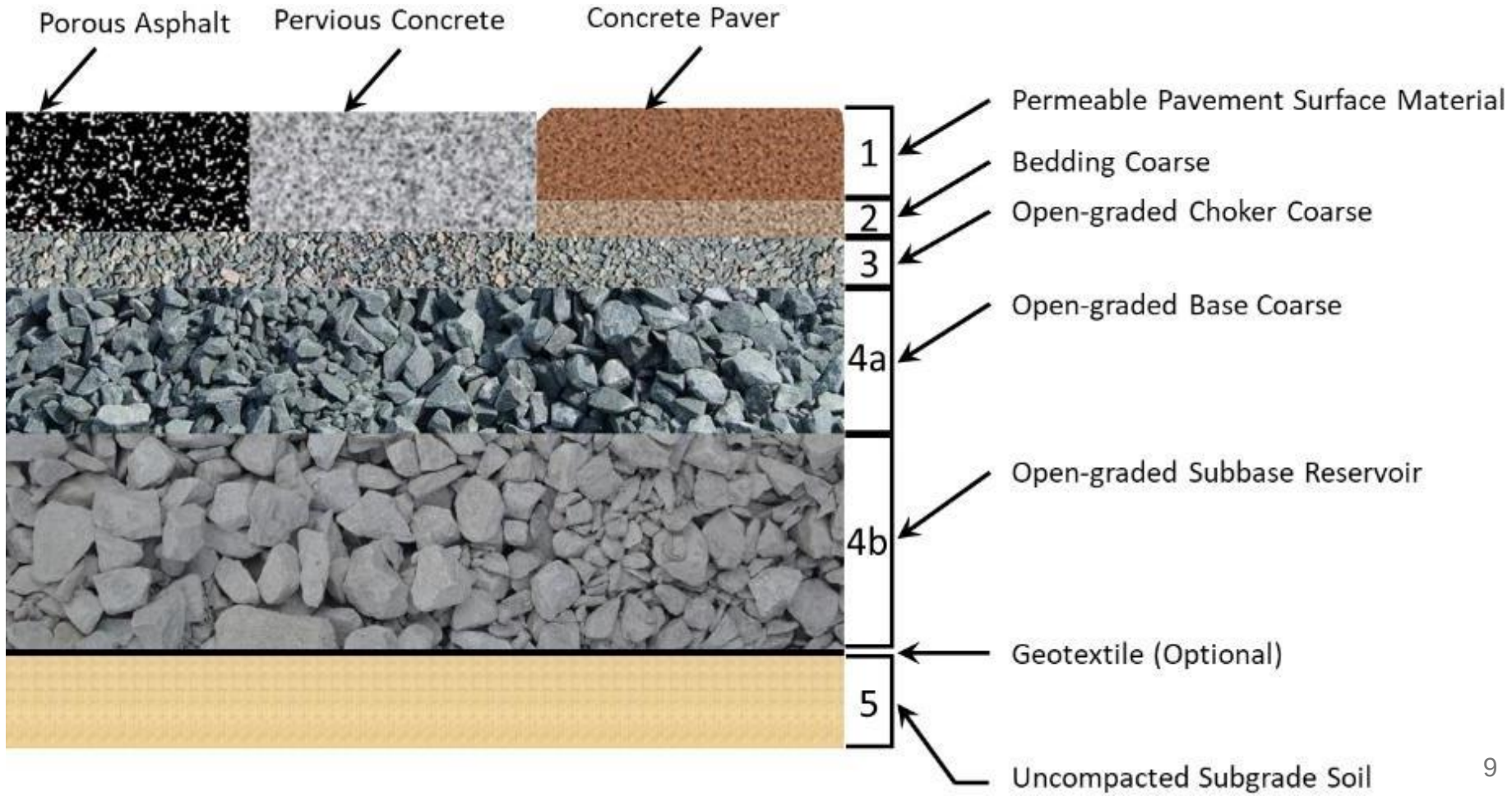
- Serve the same function as rain gardens.
- Key differences include special **soil media, overflow structures, and underdrains**.
- Involve **more engineering** than rain gardens.
- Typically installed in **more developed areas** or **areas where the soil conditions require it**.



Pervious Pavement

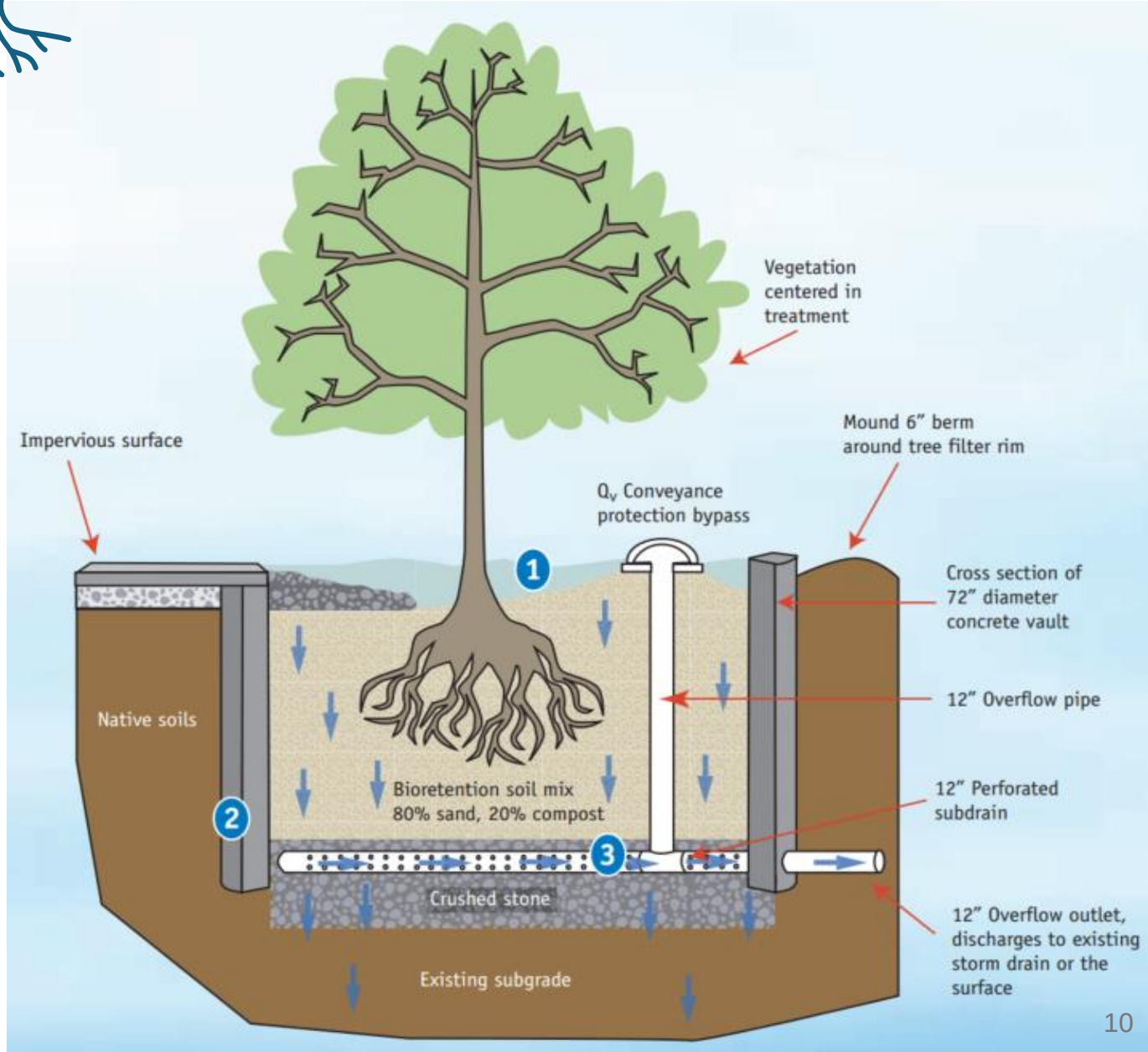
- Ideally installed somewhere **relatively flat that deals with large amounts of runoff.**
- Serves as alternative to traditional pavement by allowing water to infiltrate into the ground
  - Typically installed in areas that **are already being repaved to avoid excess construction**
  - **Cost competitive** with traditional pavement

- Needs to be maintained effectively (**pressure washing and vacuum sweeping**) to ensure effective infiltration
- Requires **less snow maintenance** than traditional pavement
- Needs **replacement less often** than traditional pavement because it doesn't expand and contract as much with changing seasons and temperatures



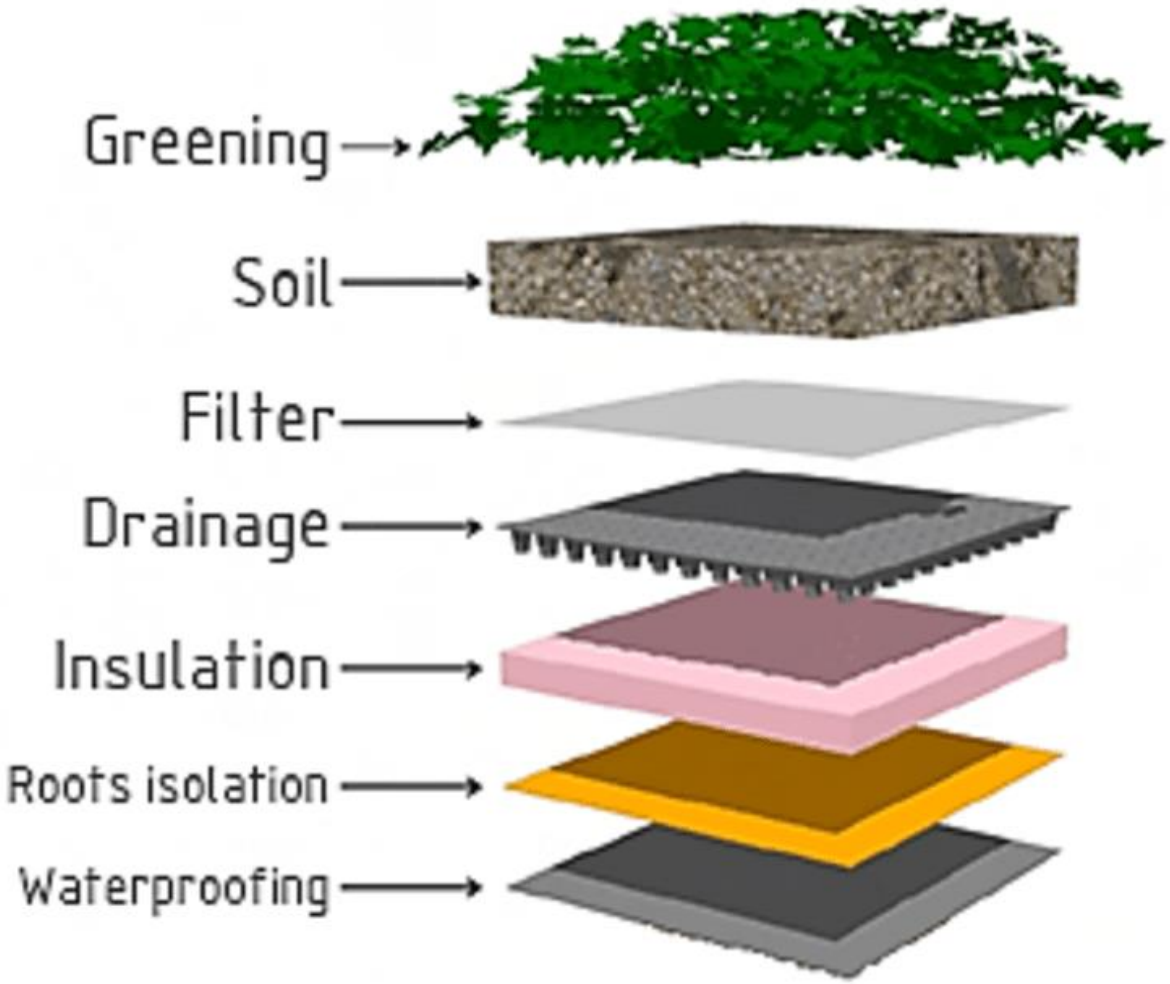
Tree Box Filters

- **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
- During extreme storms, an underdrain may be required to prevent flooding



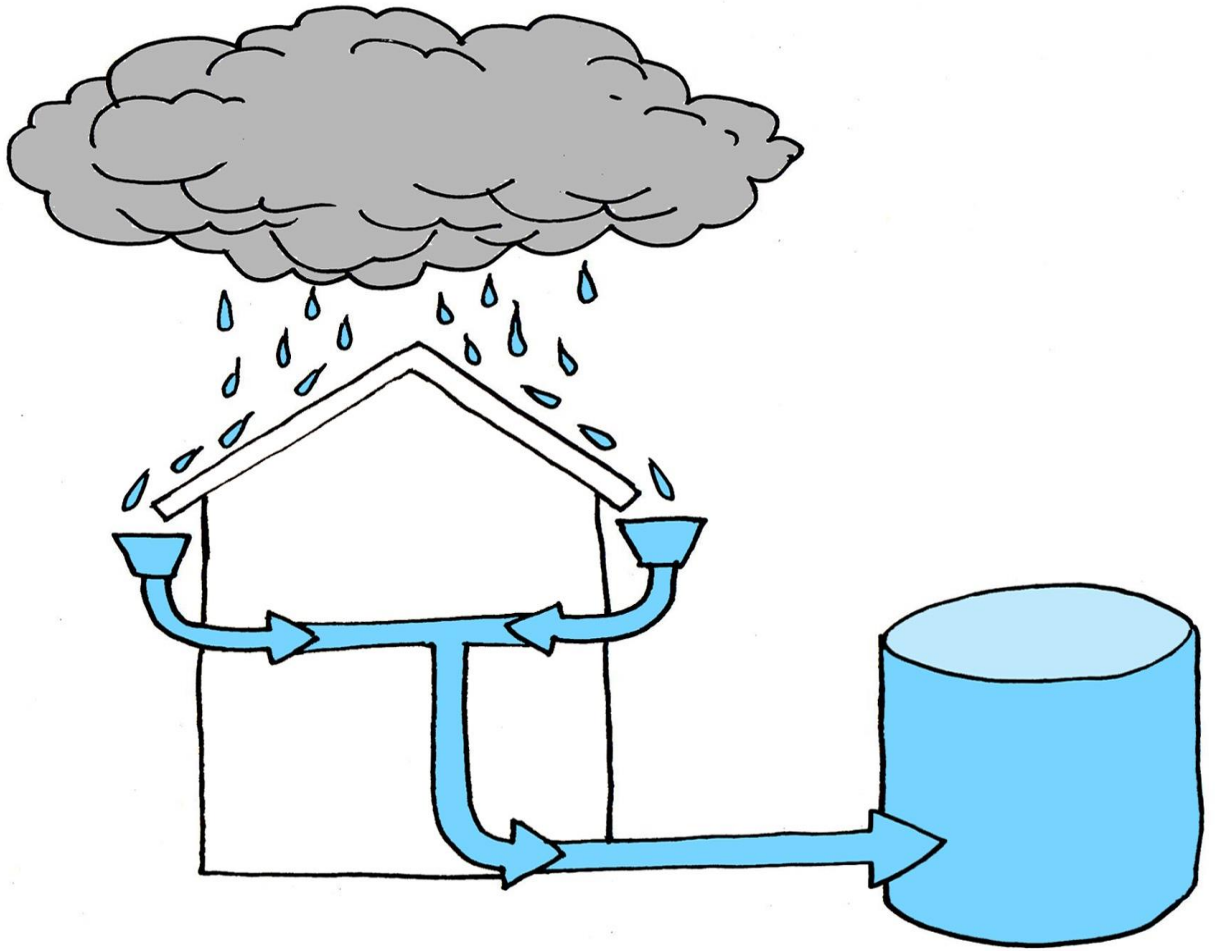
Green Roofs

- Runoff **infiltrates substrate directly**.
- Disconnect about **50%** of the stormwater from roof.
- Most expensive practice but offers great educational opportunities and is aesthetically pleasing.
- **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

- **Roof runoff is fed from downspouts into large cisterns** which retain the water until it can be repurposed.
  - Cisterns require **minimal maintenance**.
    - May need to be moved in winter months to prevent freezing.
- **Reduces stress on private wells and municipal water supplies**.
- Size of the rain barrel depends on the collection area.
- Materials can range from PVC to steel.
- Filters can be installed to remove pollutants.



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
- **Cost**

Explanation of Calculations

- **Drainage Area:**
  - Estimated using topographic tools and confirmed during site visits
- **Rain Garden Size:**
  - Area and depth depend on estimated drainage area and amount of rainfall expected
  - All rain gardens in this presentation are sized to handle a 1.3-inch rainstorm event
    - Area and depth is altered accordingly
    - Must be at least 6 inches deep
  - Rain gardens deeper than 12 inches are avoided for safety reasons
- **Nutrient Reductions:**
  - Area of land treated and estimated concentrations of nutrient runoff equals the amount of nutrients that can be directed away from the watershed, as described by Charles Frink
- **Gallons Treated:**
  - Volume of stormwater treated was determined with the assumption that Connecticut experiences around 48 inches of rain annually

Site Overview:

Ellington Middle School

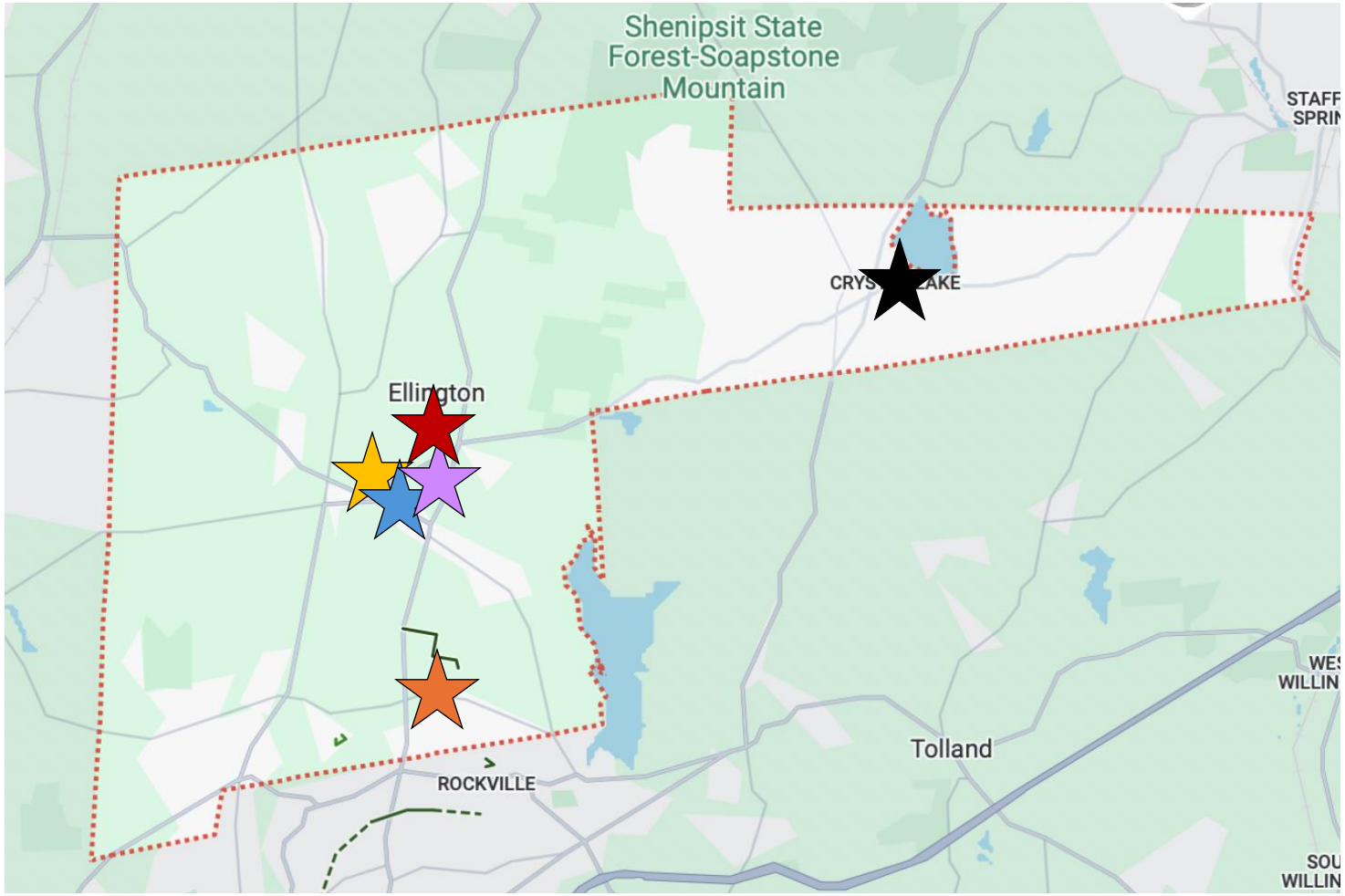
Center Elementary School

Town Hall Annex

Ellington High School

Crystal Lake Elementary School

Senior Center



Ellington Middle School
46 Middle Butcher Road

At this site, we recommend five potential projects. These projects would help to disconnect a very large area of impervious cover and add to the aesthetics of these areas that are highly visible. Additionally, the location of these recommendations provide educational opportunities.

Possible disconnection of **25,830 feet²** of impervious cover at this site.

Ellington Middle School
Site 1: Rain garden

Key:
Storm drain =
Curb cuts =

Before

After

Ellington Middle School
Site 1: Rain garden

Key:
Curb cuts =
Water flow =
Storm drain =
Drainage area
Rain garden

Site considerations:

- Avoid lamp post and its wiring located at the gap between the rain garden and the drainage area
- Add two curb cuts
- Will need to be 10 inches deep to maximize the available space

Benefits:

- Large disconnection
- High educational value
- Rain garden is in a previously barren area that is visible from the street
  - Will help add to aesthetic value

Drainage area (ft^2)	Annual gallons treated	Annual nitrogen reduction (lb N / yr)	Annual phosphorus reduction (lb P / yr)	Suggested practice size (ft^2)
14,509	382,064	3.17	0.40	1,886 (10 inch depth)

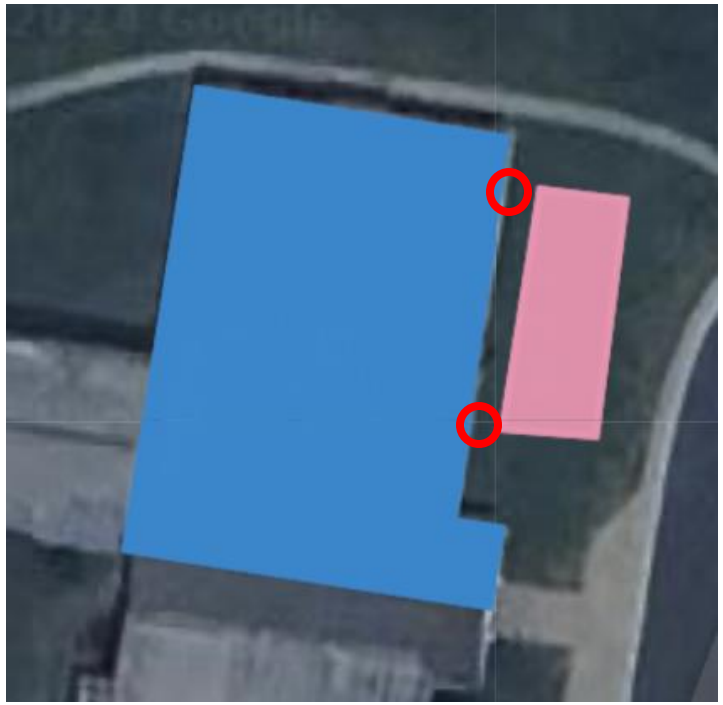
Ellington Middle School
Site 2: Rain garden

Key:
Downspouts = O

Before

After

Ellington Middle School
Site 2: Rain garden



Key:

Downspouts= ○

Drainage area Rain garden

Benefits:

- Large disconnection
- Large empty area with no prior aesthetic appeal

Site considerations:

- Will need to be 10 inches deep to maximize the available space
- Two downspouts will be disconnected into pipes that will run into the base of the rain garden
- The rain garden will be 10 feet away from the building to leave space for the doors along the outer wall and allow for mowing

Drainage area (ft^2)	Annual gallons treated	Annual nitrogen reduction (lb N / yr)	Annual phosphorus reduction (lb P / yr)	Suggested practice size (ft^2)
5,442	142,777	1.19	0.15	705 (10 inch depth)

Ellington Middle School
Site 3: Rain garden

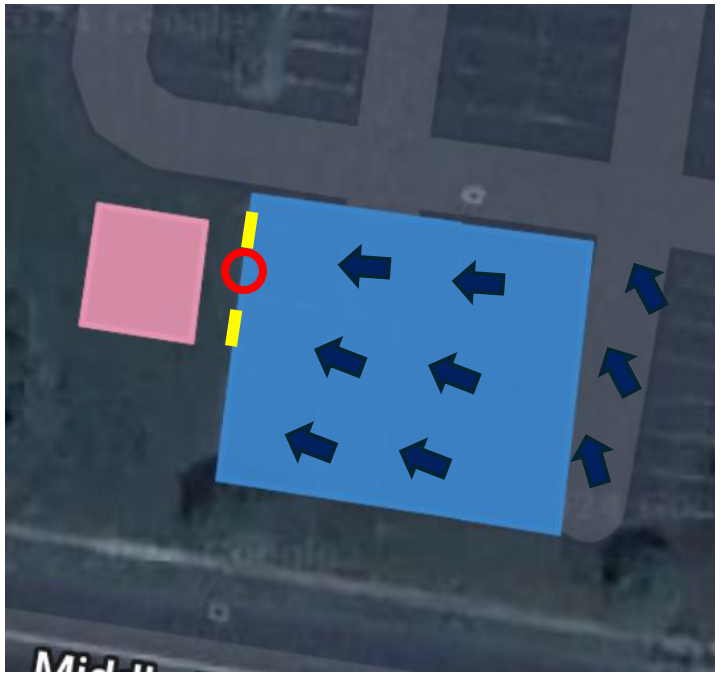
Key:
Storm drain =
Curb cuts =

Before

After

Ellington Middle School
Site 3: Rain garden

Key:
Curb cuts =
Water flow =
Drains =
Drainage area
Rain garden



Site considerations:

- Old basketball hoop could be removed if not used
  - If the hoop is kept, we recommend bee balm and switchgrass plants that would be tolerant to being hit and would grow back upright quickly if knocked over
- Two curb cuts should be added to help water flow into garden

Benefits:

- Large disconnection
- Highly visible from the street
- Will add to aesthetic value of underused area

Drainage area (ft^2)	Annual gallons treated	Annual nitrogen reduction (lb N / yr)	Annual phosphorus reduction (lb P / yr)	Suggested practice size (ft^2)
4,658	122,654	1.02	0.13	606 (10 inch depth)

Ellington Middle School
Site 4: Rain garden

Key:
Downspout =
New gutter =

Before

After

Ellington Middle School
Site 4: Rain garden

Key:

Downspout =

Drainage area Rain garden

Site considerations:

- We recommend adding a gutter to the gable roof and connecting it to the pre-existing downspout, and then disconnecting the downspout into a rain garden
- Water previously ran off the gable roof next to the left side of the rain garden, so a gutter will have to be added to that side of the roof

Benefits:

- Next to the main office entrance of the school
  - Highly visible
- Extension of existing landscaping
  - Minimal maintenance disruption

Drainage area (ft^2)	Annual gallons treated	Annual nitrogen reduction (lb N / yr)	Annual phosphorus reduction (lb P / yr)	Suggested practice size (ft^2)
1,000	26,333	0.22	0.03	130 (10 inch depth)

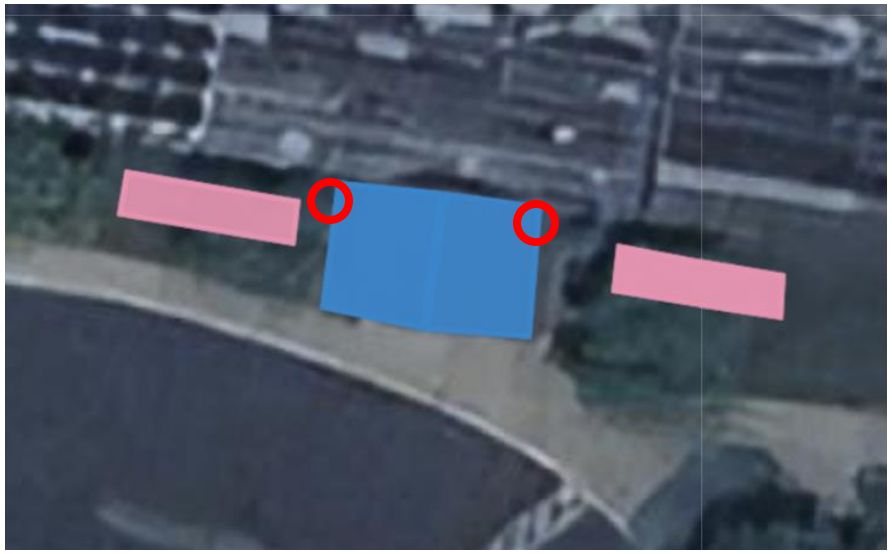
Ellington Middle School
Site 5: Rain gardens

Key:
Downspouts = ○

Before

After

Ellington Middle School
Site 5: Rain gardens



Key:
Downspouts = Drainage area Rain garden

Site considerations:

- Two rain gardens next to the disconnected gable roofs
- Two downspouts disconnected, with pipes running alongside the building to the base of each rain garden
- Rain gardens must be built outside the crown of the pre-existing trees

Benefits:

- Add aesthetic value to a main entrance
  - Highly visible
- Extension of existing landscaping
  - Minimal maintenance disruption

Drainage area (ft^2)	Annual gallons treated	Annual nitrogen reduction (lb N / yr)	Annual phosphorus reduction (lb P / yr)	Suggested practice size (ft^2)
250 x 2 = 500	13,167	0.11	0.01	54 x 2 = 108 (6 inch depth)

Center Elementary School
49 Main Street

At this site, we recommend four potential projects. These projects would help to disconnect a large area of impervious cover and add to the aesthetics of these areas. Additionally, the location of these projects provide educational opportunities.

Possible disconnection of **14,723 feet²** of impervious cover at this site.

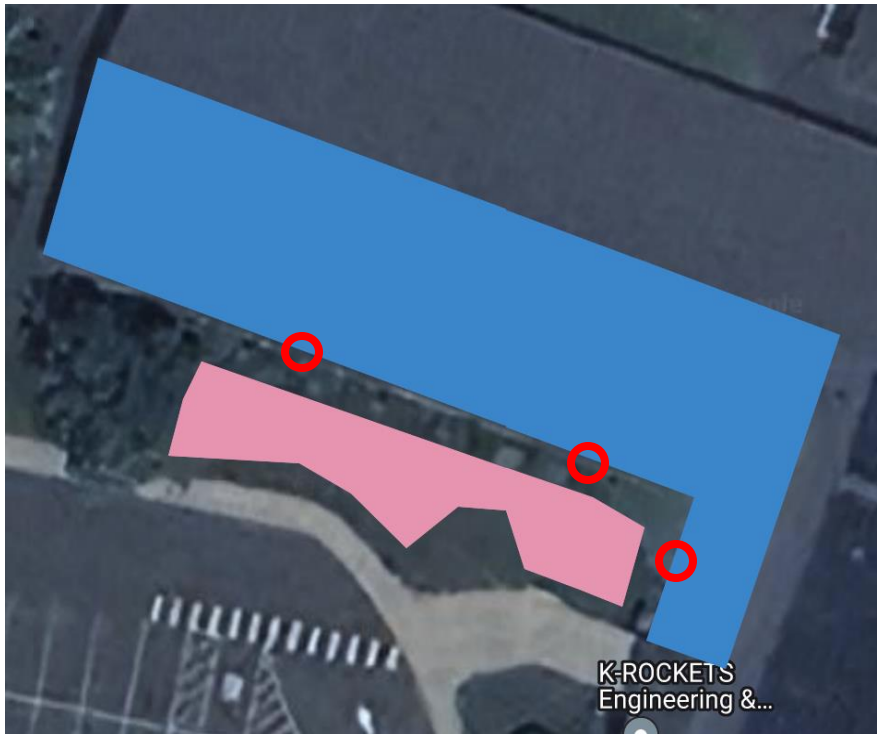
Center Elementary School
Site 1: Rain garden

Key:
Downspouts =

Before

After

Center Elementary School
Site 1: Rain garden



Site considerations:

- Shorter plants to not overshadow bench
- Make sure not to impede with foot traffic
- Basement in this area
  - Will have to build 10+ feet from foundation

Key:

Downspouts = ○

Drainage area Rain garden

Benefits:

- Near the entrance of the school
  - High visibility
- Large disconnection
- Will highlight memorial bench
- Can be incorporated into existing greenery
  - Minimal maintenance disruption

Drainage area (ft^2)	Annual gallons treated	Annual nitrogen reduction (lb N / yr)	Annual phosphorus reduction (lb P / yr)	Suggested practice size (ft^2)
6,578	173,210	1.44	0.18	1,425 (6 inch depth)

Center Elementary School
Site 2: Rain garden

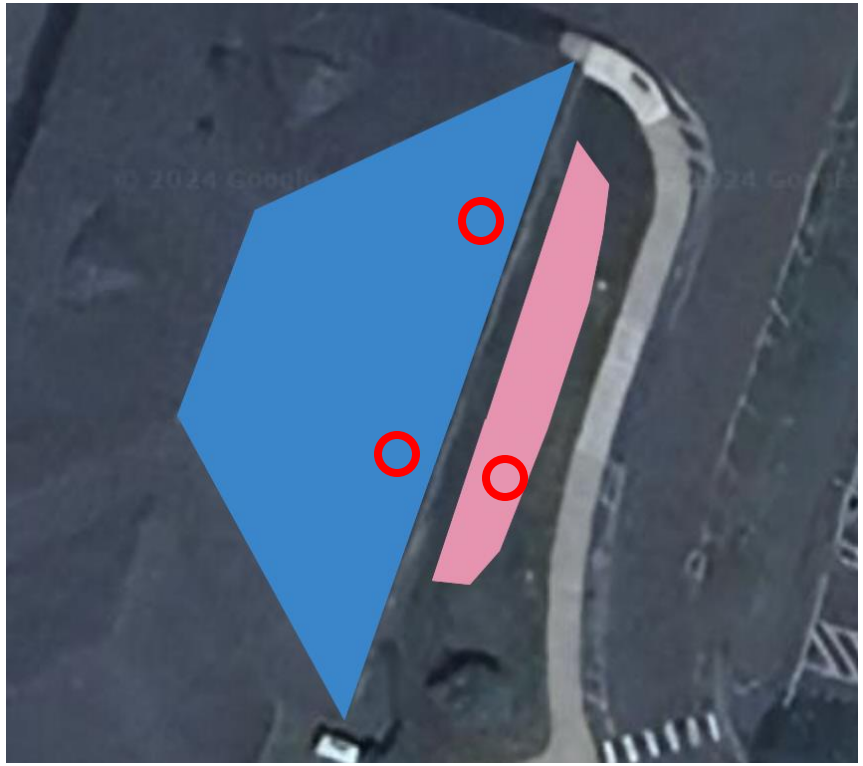
Before

After

Key:

Downspouts/storm drains =

Center Elementary School
Site 2: Rain garden



Site considerations:

- Make sure not to impede with foot traffic
- Drain should be slightly raised to allow water to infiltrate
- Basement in this area
  - Need to build 10+ feet from foundation

Benefits:

- Large disconnection
- Will add to aesthetic of this underused area
- Existing drain can act as an overflow
  - Lower maintenance cost

Key:

Downspouts/storm drains = O

Drainage area Rain garden

Drainage area (ft^2)	Annual gallons treated	Annual nitrogen reduction (lb N / yr)	Annual phosphorus reduction (lb P / yr)	Suggested practice size (ft^2)
3,920	103,226	0.86	0.11	849 (6 inch depth)

Center Elementary School
Site 3: Rain garden

Before

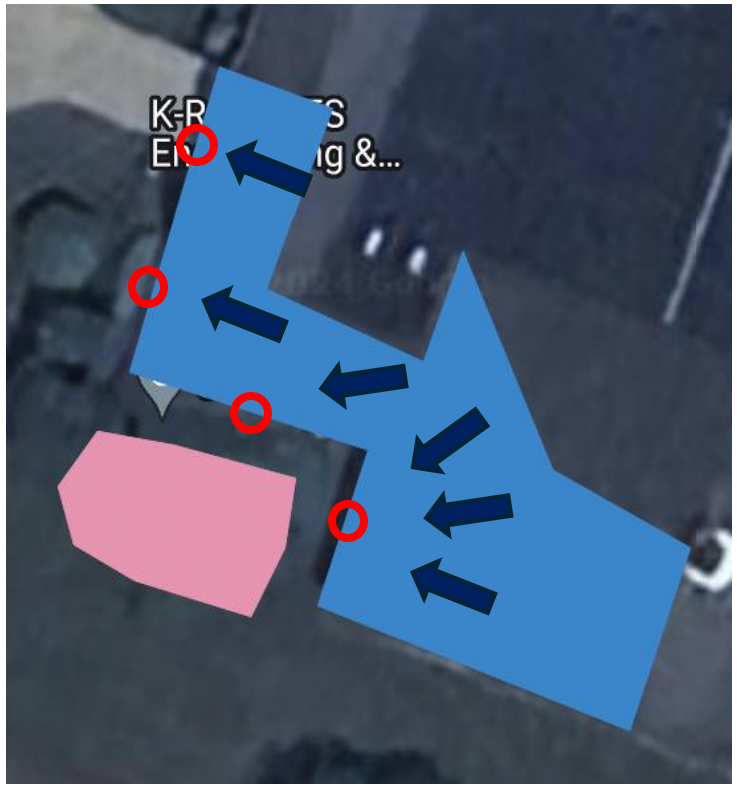
After

Key:

Downspouts =

Downspout redirections =

Center Elementary School
Site 3: Rain garden



Key:

Downspouts =

Water flow =

Drainage area

Rain garden

Benefits:

- High disconnection
- Easily accessible for maintenance
- Add aesthetic value

Site considerations:

- Not super high visibility
- Would disconnect 4 downspouts, 2 of which would have to be piped over to the garden
- Avoid crown of trees to reduce potential impact on tree growth
- Basement in this area
  - Build 10+ feet out from foundation

Drainage area (ft^2)	Annual gallons treated	Annual titrogen reduction (lb N / yr)	Annual phosphorus reduction (lb P / yr)	Suggested practice size (ft^2)
2,483	65,383	0.54	0.07	538 (6 inch depth)

Center Elementary School
Site 4: Rain garden

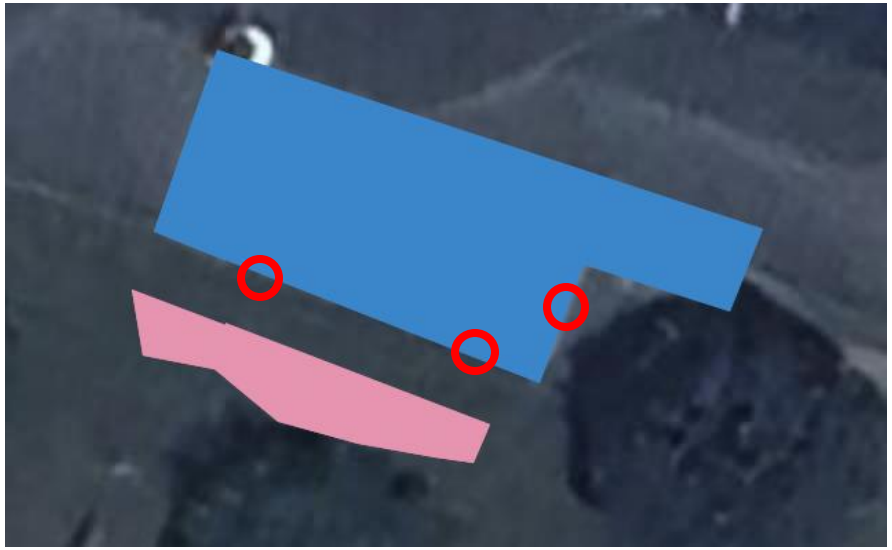
Before

After

Key:

Downspouts = ○ Downspout redirections = ⇨

Center Elementary School
Site 4: Rain garden



Key:
Downspouts = O
Drainage area Rain garden

Site considerations:

- Existing erosion problem, berm needed to prevent further erosion
- Not super high visibility
- Build between trees to optimize for rain garden visibility and prevent damage to the trees
- Basement in this area and a door nearby
  - Need to build 10+ feet from foundation

Benefits:

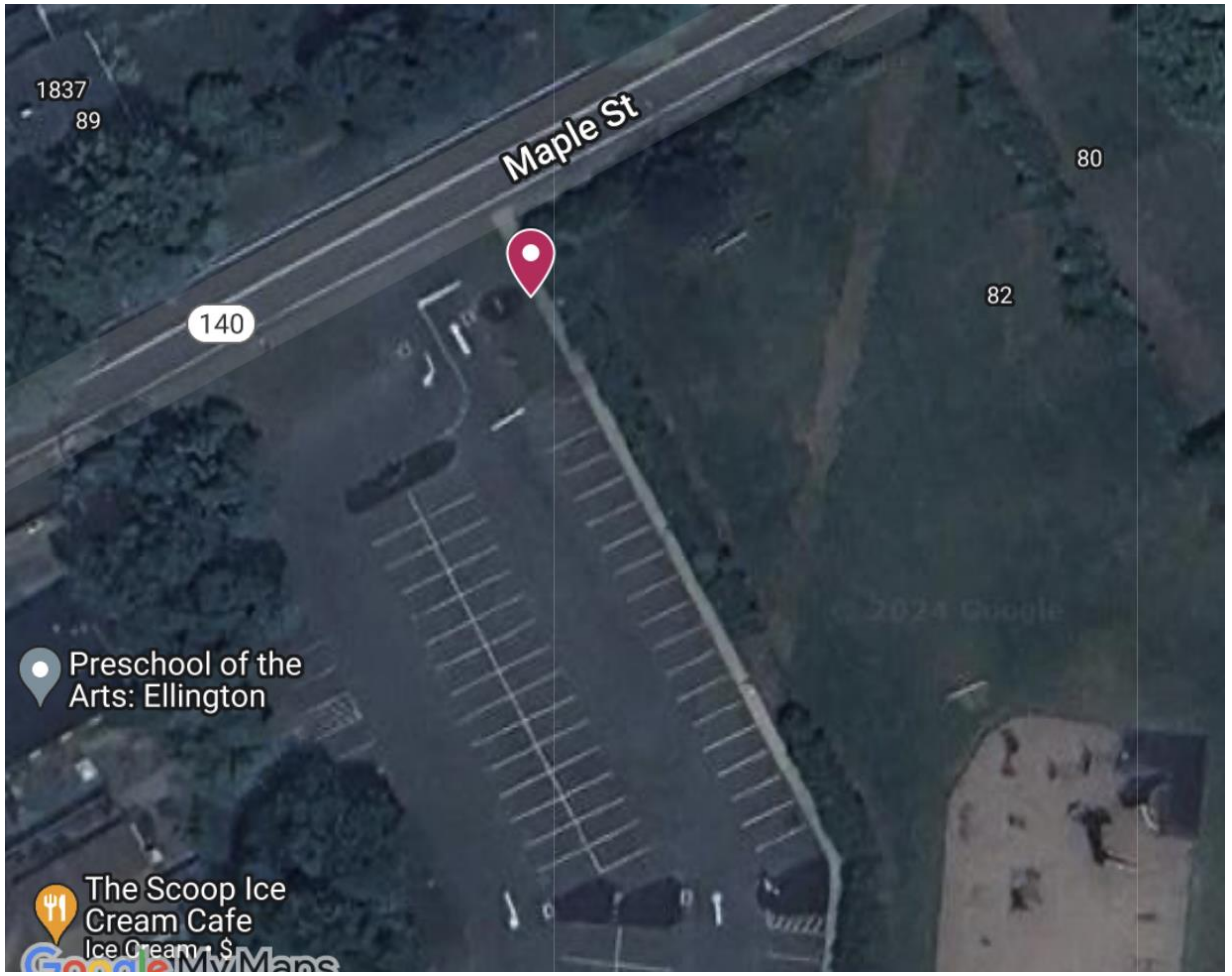
- Large disconnection
- High educational value
- Opportunity to add aesthetic value to underused area

Drainage area (ft^2)	Annual gallons treated	Annual nitrogen reduction (lb N / yr)	Annual phosphorus reduction (lb P / yr)	Suggested practice size (ft^2)
1,742	45,883	0.38	0.05	378 (6 inch depth)

Ellington Town Hall Annex

55 Main Street

At this site, we recommend one potential project. This project will add to the aesthetics of the area and provide a good example for the benefit of bioretention at Ellington's very own town hall. The project will have extremely high visibility because it is right next to the main road.

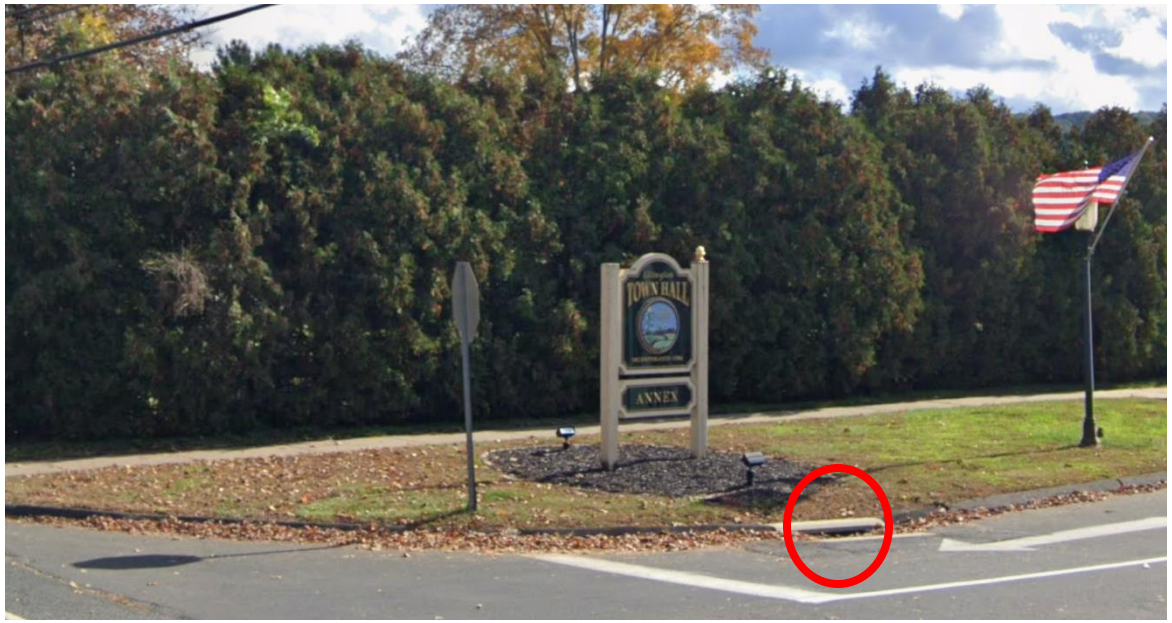


Possible disconnection of **4,713 feet²** of impervious cover at this site.

Town Hall Annex
Rain garden

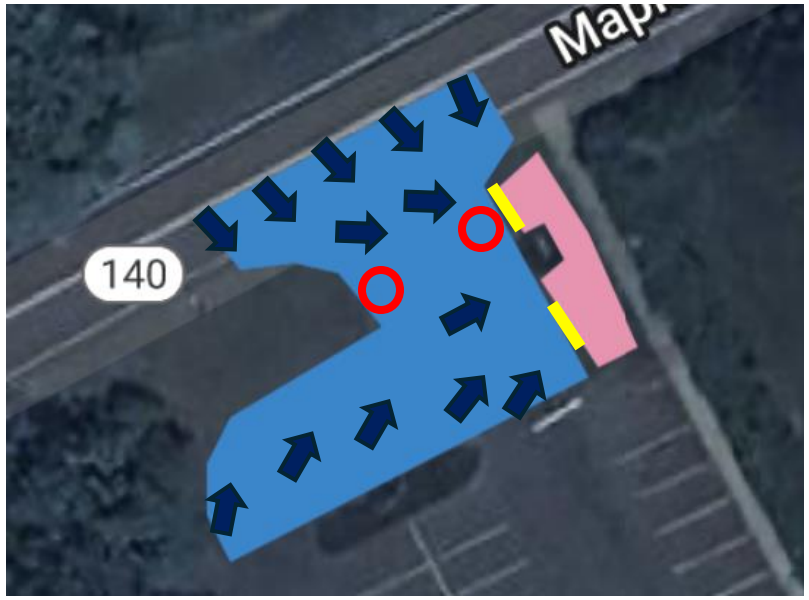
Key:
Storm drain =
Curb cuts =

Before



After

Town Hall Annex
Rain garden



Key:
Curb cuts = Water flow =
Drains = Drainage area Rain garden

Site considerations:

- Must be careful to avoid electrical wiring from the lamp post and lights next to the sign
  - This lamp post and its wiring are located in between the rain garden and drainage area
- Two curb cuts should be added to help water to flow into the garden
- This area may get snow piled on it during winter months

Benefits:

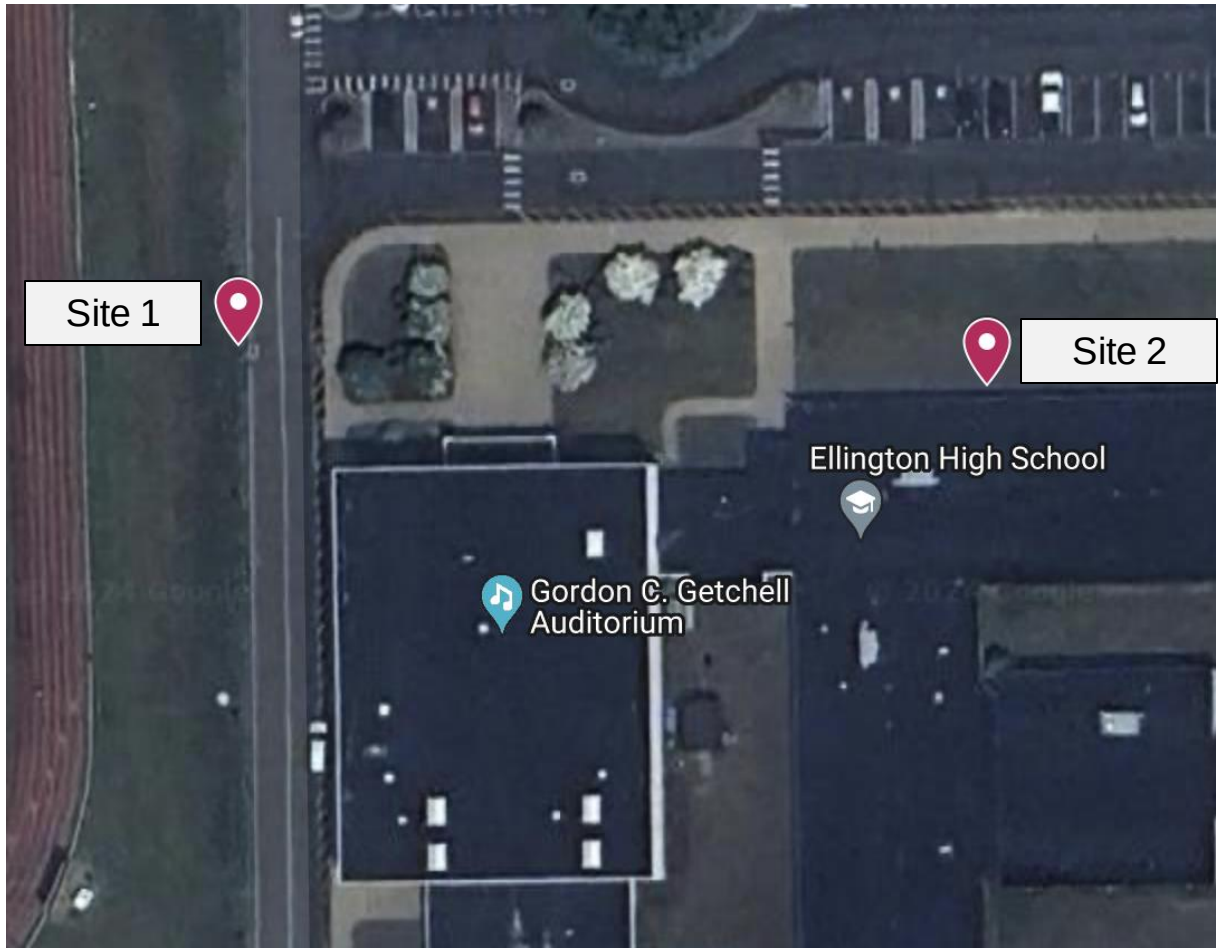
- Large portion of parking lot disconnected
- Educational opportunities for public
- Rain garden is right next to the Town Hall sign on busy road and next to a sidewalk

Drainage area (ft^2)	Annual gallons treated	Annual nitrogen reduction (lb N / yr)	Annual phosphorus reduction (lb P / yr)	Suggested practice size (ft^2)
3,950	104,016	0.86	0.11	514 (10 inch depth)

Ellington High School

37 Maple Street

At this site, we recommend two potential projects, one near the athletic fields, one near the front of the parking lot. Both have high visibility and high educational value due to their location.

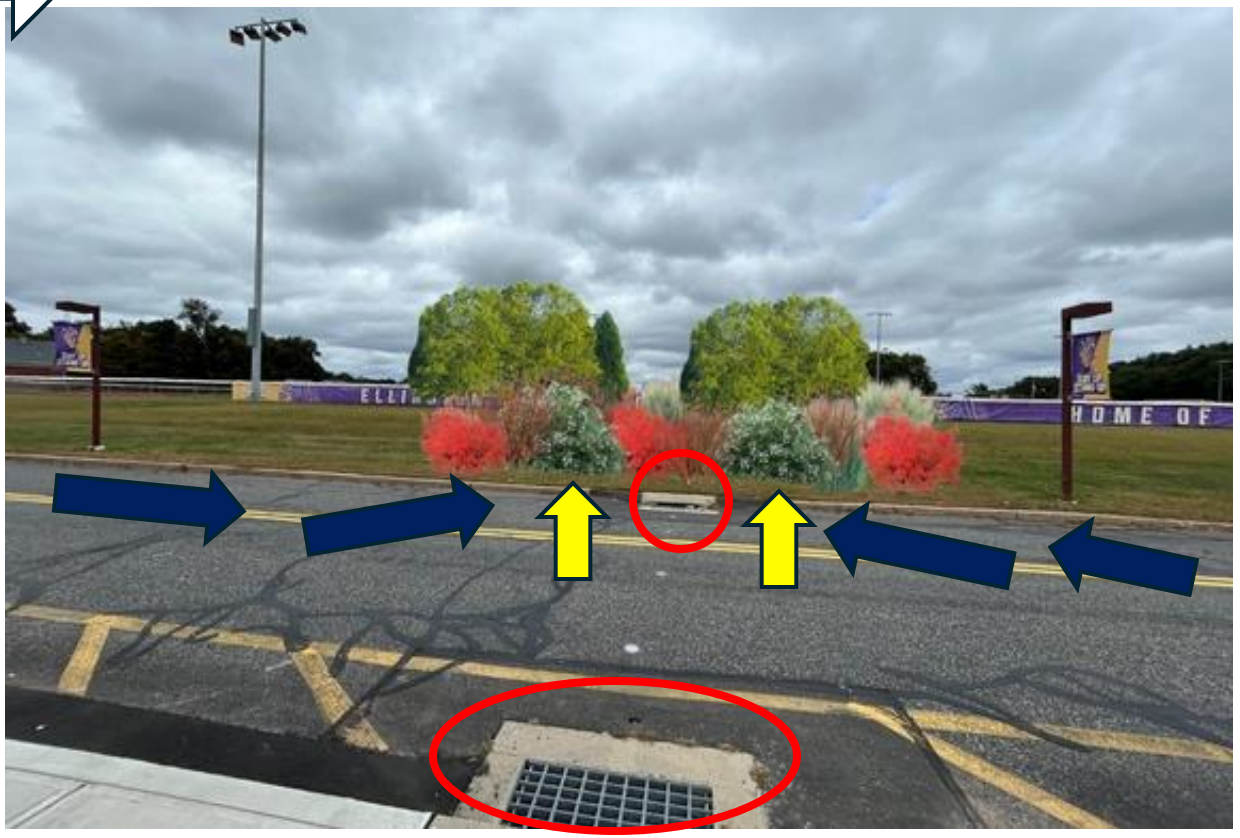


Possible disconnection of **3,049 feet²** of impervious cover at this site.

Ellington High School
Site 1: Rain garden

Before

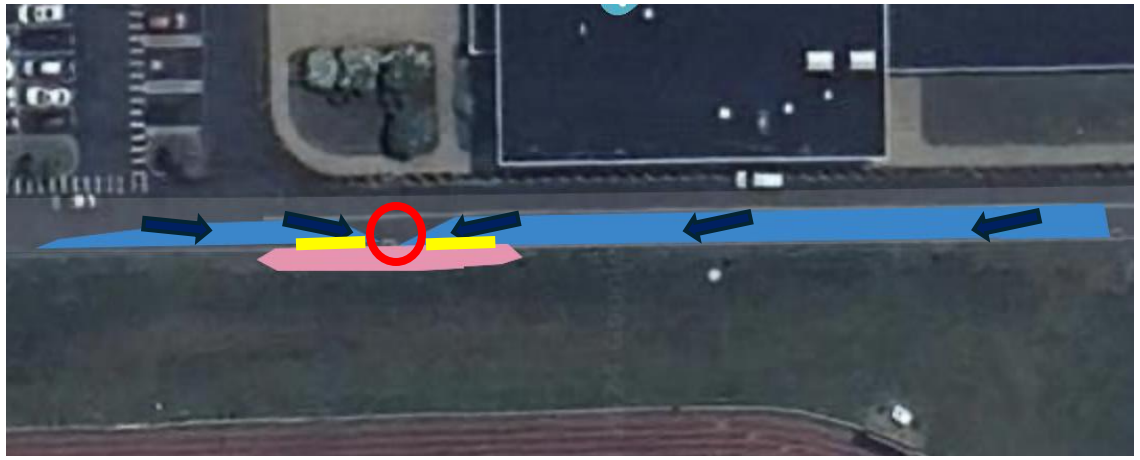
After



Key:

Storm drains = Water flow = Curb cuts =

Ellington High School
Site 1: Rain garden



Key:

Water Flow = ⬆ Curb cuts = ▭

Storm drains = ○ Drainage area

Rain garden

Site considerations:

- Note possible foot traffic due to nearby athletic fields

Benefits:

- Large disconnection
- High visibility
- High educational value
- A lot of greenspace to work with
- Minimal maintenance disruption

Drainage area (ft^2)	Annual gallons treated	Annual nitrogen reduction (lb N / yr)	Annual phosphorus reduction (lb P / yr)	Suggested practice size (ft^2)
3,046	80,295	0.67	0.08	661 (6 inch depth)

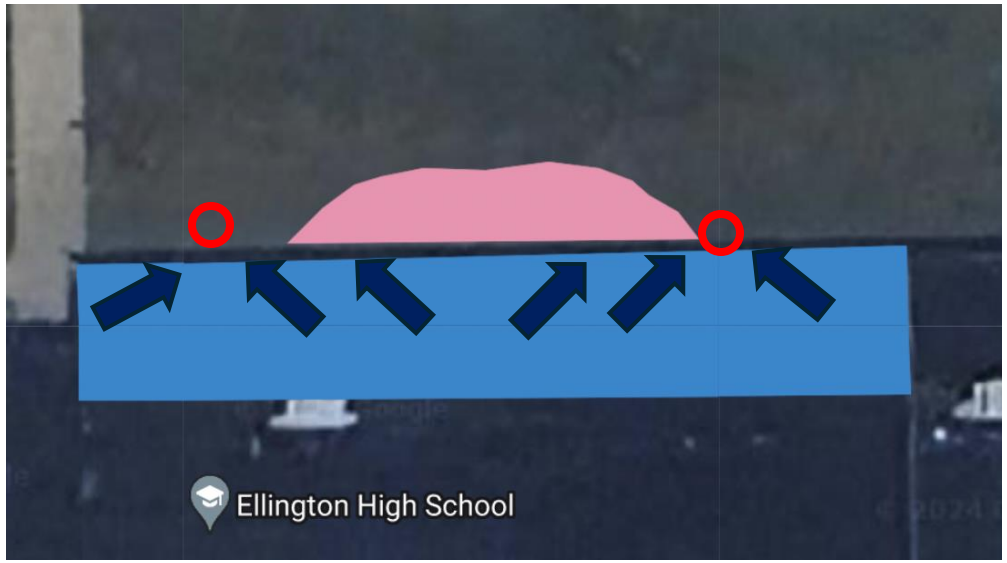
Ellington High School
Site 2: Rain garden

Key:
Downspouts =

Before

After

Ellington High School
Site 2: Rain garden



Key:
Downspouts = Drainage areas
Water flow = Rain garden

Site Considerations:

- Does not impede door access
- This site would **not** count toward MS4
  - Downspout is already disconnected

Benefits:

- Would help to add to aesthetic of existing area
- High visibility
- High educational opportunity
- A lot of green space to work with
  - Minimal maintenance disruption

Drainage area (ft^2)	Annual gallons treated	Annual nitrogen reduction (lb N / yr)	Annual phosphorus reduction (lb P / yr)	Suggested practice size (ft^2)
3,572	94,060	0.78	0.20	774 (6 inch depth)

Crystal Lake Elementary School

59 South Road

It was mentioned in the town's MS4 report that there are two current bioretention basins in the town. If this is one of those bioretention basins, **it can be counted toward the town's MS4 disconnections as the entire lot would be disconnected by this**.

Ellington Senior Center

40 Maple Street

The parking lot of the Senior Center is connected to this detention pond. While the original plans for the detention pond do not specify the intent of the area, the grades suggest that the retained water will infiltrate up to 6” of water through the existing soils. Therefore, we did not include a disconnection for this site, and **the town could take credit for the disconnection**.

Calculation Totals

Site	Disconnected Area (ft^2)	Annual Gallons Treated	Annual Nitrogen Reduction (lb N / yr)	Annual Phosphorus Reduction (lb P / yr)
Ellington Middle School Site 1	14,509	382,064	3.17	0.40
Ellington Middle School Site 2	5,422	142,777	1.19	0.15
Ellington Middle School Site 3	4,658	122,654	1.02	0.13
Ellington Middle School Site 4	1,000	26,333	0.22	0.03
Ellington Middle School Site 5	500	13,167	0.11	0.01
Center Elementary School Site 1	6,578	173,210	1.44	0.18
Center Elementary School Site 2	3,920	103,226	0.86	0.11
Center Elementary School Site 3	2,483	65,383	0.54	0.07
Center Elementary School Site 4	1,742	45,883	0.38	0.05
Ellington Town Hall Annex Site 1	3,950	104,016	0.86	0.11
Ellington High School Site 1	3,049	80,295	0.67	0.08
Ellington High School Site 2	----	----	----	----
Total	**47,811**	**1,259,008**	**10.46**	**1.32**

Top 5 Recommendations

1. Ellington Middle School School Site 1
   - Disconnects entire parking lot
   - High visibility
2. Ellington Middle School Site 2
   - High visibility/educational value
   - High disconnection
3. Ellington Middle School Site 3
   - High disconnection
   - Highly visible
4. Center Elementary School Site 1
   - Near the entrance of the school
   - Can easily be incorporated into existing greenery
   - High disconnection
5. Center Elementary School Site 2
   - High disconnection
   - High visibility and high educational value
   - Will add to aesthetic of underused area

Sites Not Visited/Selected

- Robert Tedford Memorial Fields
  - Not much impervious cover, nothing to disconnect
- Batz Property
  - No buildings with downspouts to disconnect
  - Not much impervious cover, nothing to disconnect
- Pinney Street Fields
  - Not much impervious cover, nothing to disconnect
- Hall Memorial Library
  - Was just redone
- Windmere Elementary School
  - Under construction
- Crystal Lake Elementary School and Ellington Senior Center
  - Most of the impervious surface is already disconnected

Plant Recommendations

(as seen in the rain garden renderings)

Switchgrass

Tall Ironweed

Tickseed

Blue Iris

Wild Bergamot

Cardinal Flower

Button Bush

River Birch

Chokeberry

Red-twig Dogwood

Emerald Green Arborvitae Shrub

More plant recommendations:

https://nemo.uconn.edu/raingardens/plants/

Questions/Discussion

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