Stormwater Runoff Reduction Plan Burlington, CT

Stormwater Corps UConn students:
Dylan Steer (Environmental Studies & Political Science Class of 2025)
&
Tessa Cannon (Environmental Engineering Class of 2024)

Supervisors:
Michael Dietz & David Dickson

Table of Contents

Summary

- Stormwater runoff from impervious surfaces causes both water quality and quantity challenges for CT municipalities.
- Green Stormwater Infrastructure practices help communities address those problems by seeking to infiltrate stormwater into the ground close to where it falls rather than runoff into the stormwater system.
- In this independent study, students will apply concepts and methods learned in the Spring Semester 2023 course “Green Stormwater Infrastructure Practices” to conduct stormwater retrofit assessments and regulation reviews for CT municipalities.

Our Project

- We were assigned a town to work with for this semester. We were given the town of Burlington.
- Our first steps included looking for potential implementation sites via Google Maps and cross referencing CT ECO for topographic contours.
- Our next step was to conduct site visits to confirm that our choices were suitable for Low Impact Development (LID)/Green Stormwater Infrastructure (GSI) implementation.
- During our site visits, we located catch basins, downspouts and any existing elements that we could utilize in our retrofits.
- For sizing of GSI practices like rain gardens, we used a rain garden sizing calculator to get the right size for the relative drainage area, rainfall depth and storage depth (which is adjustable).

Impervious Surfaces and Runoff

- Impervious surfaces are areas, usually developed, where stormwater cannot permeate which produces runoff.
- These surfaces include roofs, pavement, stones, concrete, bricks etc.
- Usually the stormwater is directed to a nearby catch basin in order to prevent flooding in that area. However, this disrupts the natural water cycle and the water is filled with pollutants that it picks up as it flows over impervious surfaces.
- By redirecting this stormwater into the ground, we allow vegetation to remove any pollutants and recharge the groundwater in that area.
- This also lowers the burden on existing stormwater infrastructure, which can reduce flood risks and high-flow events in local streams.

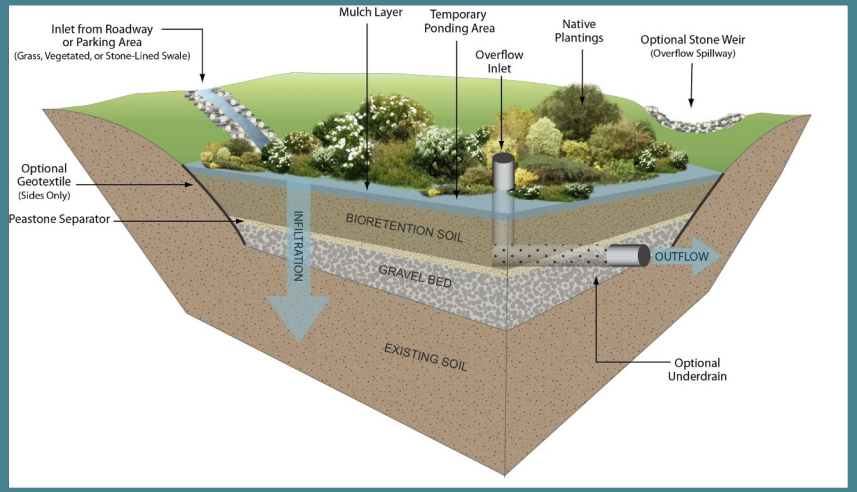
https://www.stormwatershepherds.org.au/stormwater-utility-charge/what-is-an-impervious-surface/

Green Stormwater Infrastructure (GSI)

Green Stormwater Infrastructure (GSI) disconnects stormwater runoff from municipal sewer systems allowing for infiltration into the ground. This also helps reduce stress on combined municipal sewer systems, reducing flood risks and high flow events of local rivers & estuaries. GSI includes rain gardens, bioswales, treebox filters, and permeable pavement. Each of these are described in the following slides.

Rain Garden/Bioswale

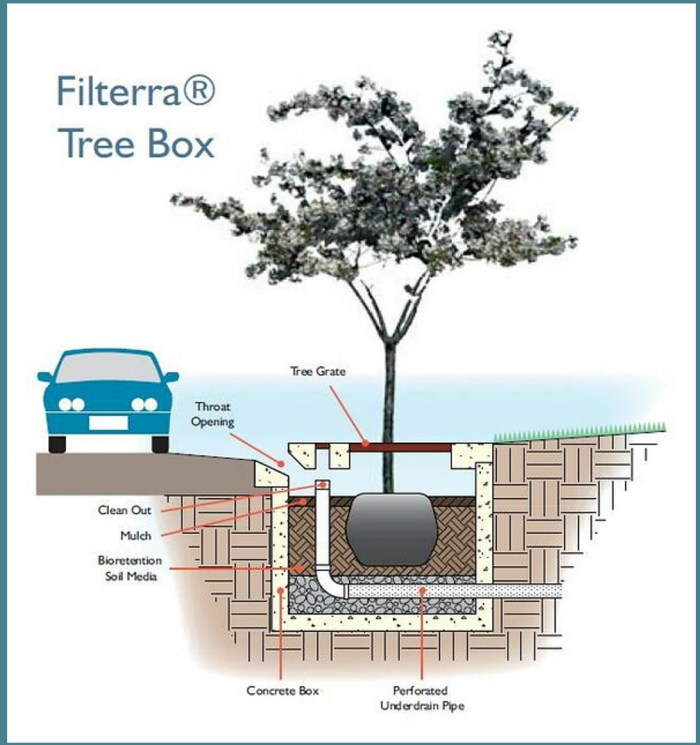
- A rain garden, or bioretention garden, is an area designated for the absorption of rainwater by directing water from surrounding areas to the rain garden.
- Rain gardens consist of native plants and are rated to treat the water from most storm events. For when there is too much water for the garden to treat, the water is directed to an overflow drain.
- A bioswale is a more simplified version of a rain garden, usually just containing grass or some low maintenance vegetation.
- This is the lowest cost and lowest maintenance green stormwater infrastructure method we are suggesting.



https://www.willowgateslandscaping.com/blog/what-is-a-rain-garden/

Tree Box Filter

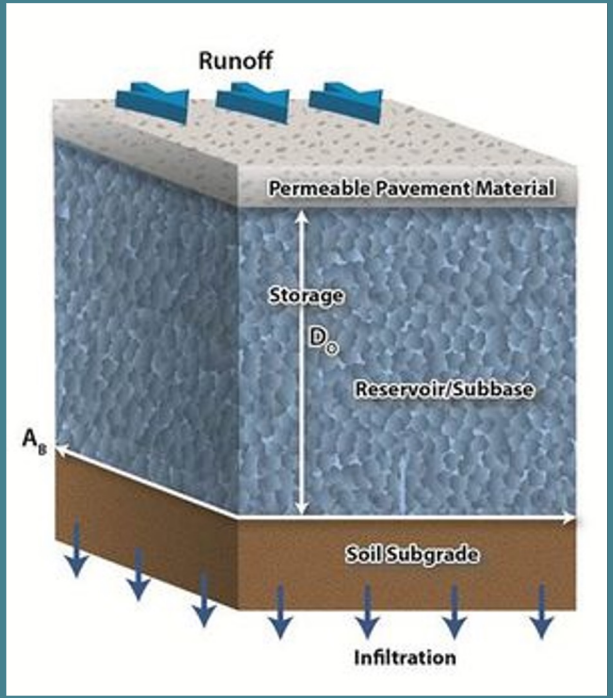
- Tree box filters are a precast or cast-in concrete curb inlet structure covered with a top slab with a cast tree frame and grate. Components include an underdrain consisting of a perforated pipe surrounded by drain rock underneath engineered biofiltration media topped with mulch that supports common landscape plantings.
- Treebox filters are great at disconnecting a large area with a small footprint of the GSI itself. Commonly used along sidewalks and roadways.
- The only maintenance for the filters is the removal of debris from the structure and the replacement of mulch used as a filter.



https://www.flickr.com/photos/mocobio/8816807652/in/photostream/

Pervious Pavement

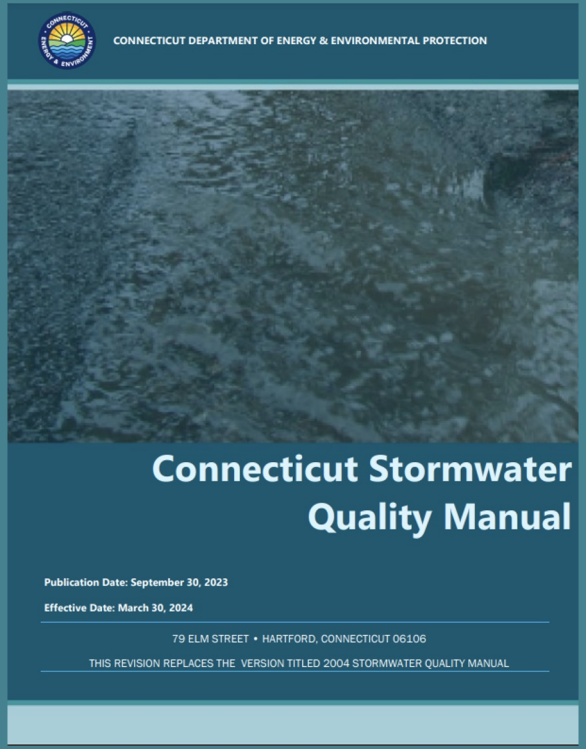
- Pervious pavement, unlike regular pavement, allows for the infiltration of water through the material, disconnecting the area of the pervious pavement as well as impervious pavement surrounding the pervious pavement that directs water to the pervious pavement.
- Typically, there is about a ratio of 1:6 pervious to impervious pavement that is acceptable in treating the areas of parking lots, where this GSI is commonly used.
- Maintenance for the pervious pavement includes cleaning the pavement with a specialized regenerative air sweeper machine that dislodges any clogs that accumulates. This maintenance is recommended to be done every 6-12 months, depending on need.



https://stormwater.pca.state.mn.us/index.php/Calculating_credits_for_permeable_pavement

Overview of Calculations

- For calculating the size of the rain gardens, the area of the impervious cover being disconnected was used as the basis for calculating the water quality volume using the updated 1.3 inch storm event standard.
- The nutrient reductions for nitrogen and phosphorus were calculated using accepted export coefficients.
- The annual gallons treated was calculated based on the size of the drainage area for each GSI and on CT's average annual rainfall of 4 ft.



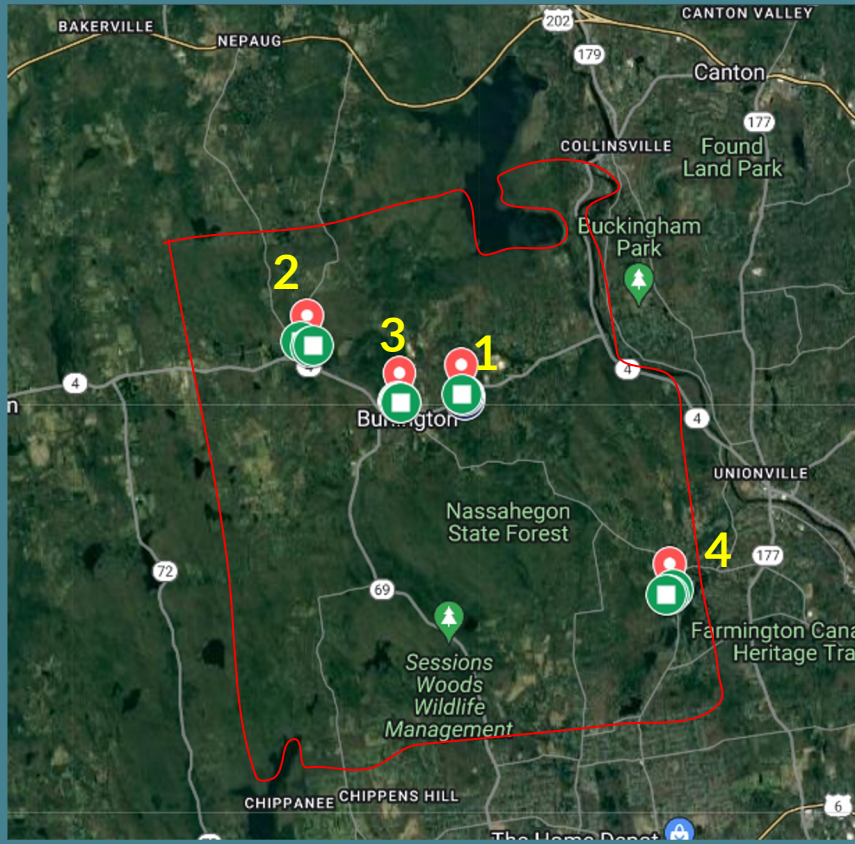
Map of Disconnects

1: Burlington Town Hall

2: Lewis S. Mills High School/ Har-Bur Middle School

3: Burlington Public Library

4: Lake Garda Elementary School



Site 1: Burlington Town Hall

Parking lot that would all be disconnected with rain garden

Roofing that would disconnected with rain garden.

Water from Mills Drive would lead into the rain garden.

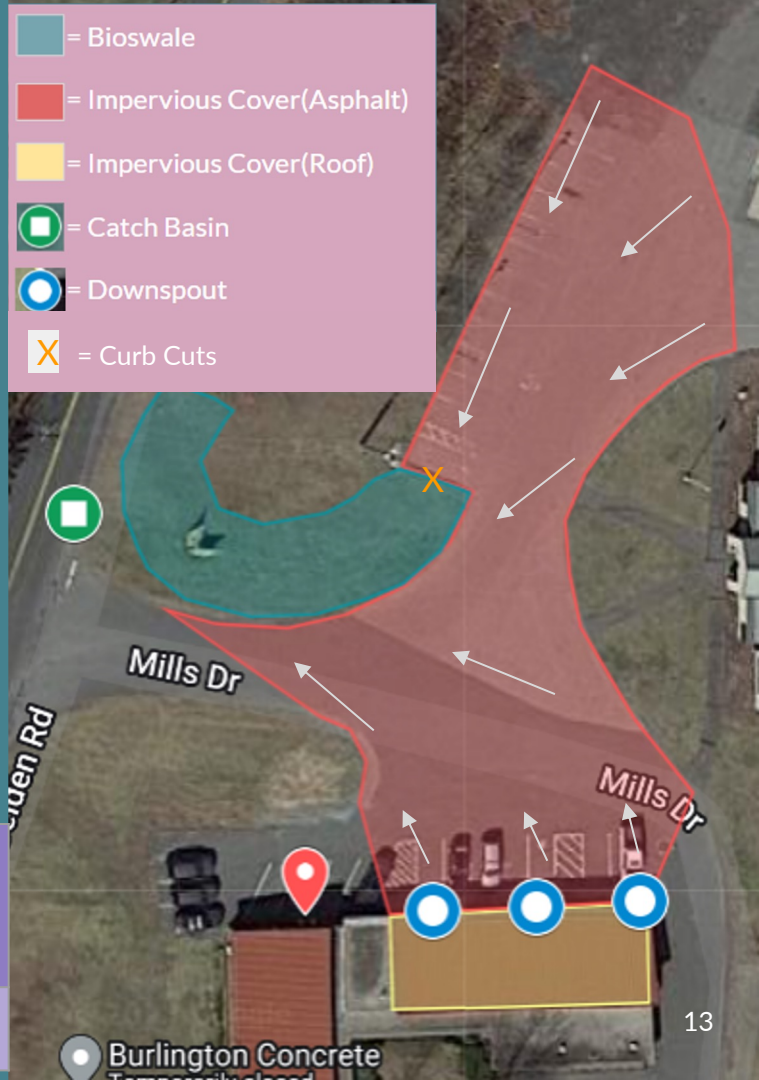
Storm drain for overflow on Belden Rd

Site 1: Burlington Town Hall

200 Spielman Highway, Burlington, CT

- We noticed that the pavement slopes towards the grassy area, but the runoff cannot enter because the pavement is curved up and directs it into the catch basin on Belden Rd.
- This grassy area is suitable for a bioswale with an area of 4500 sq ft and 7 inches deep.
- The site itself would have to dug down a significant portion to allow the direction of water into the desired area, including the pavement adjacent to Mills Dr.
- Curb cuts would be needed at the top of the bioswale adjacent to the parking spaces.

Annual Runoff Reduction	Total Phosphorus (lbs/yr)	Total Nitrogen (lbs/yr)	Drainage Area (sq ft)	Suggested GSI
637,788 gal	0.84	6.62	24,220	Bioswale

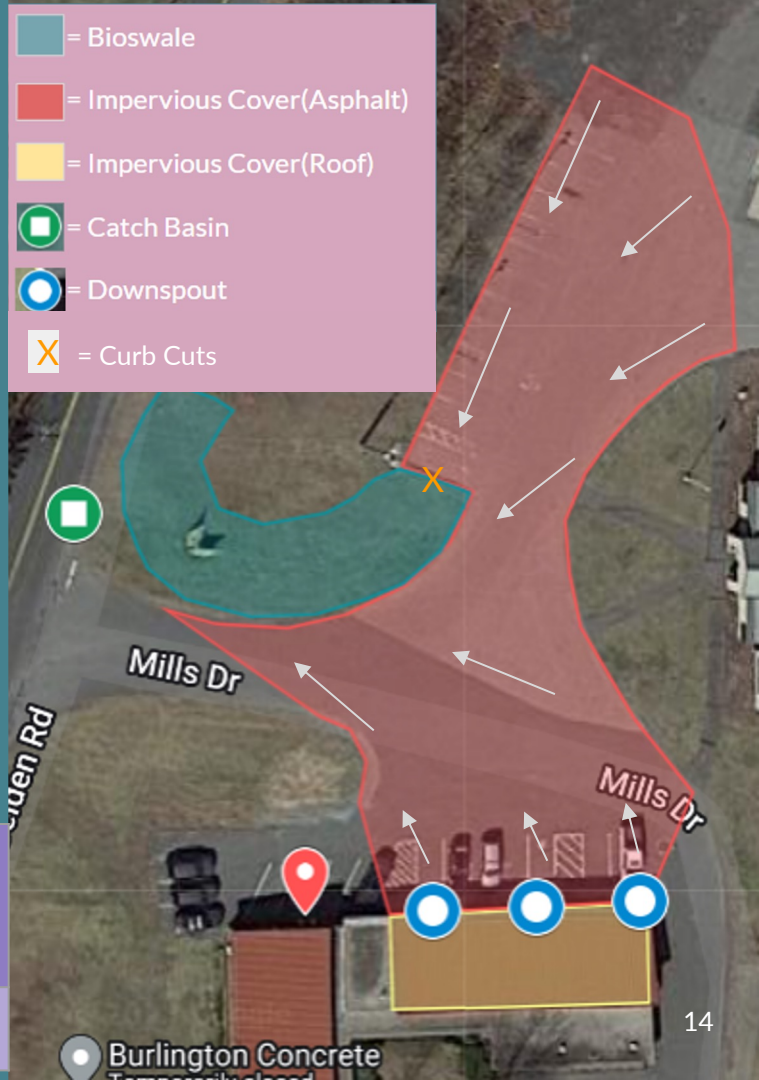


Site 1: Burlington Town Hall

200 Spielman Highway, Burlington, CT

- The display of the plow would likely be able to be incorporated into the garden on the center mound.
- The catch basin would serve as the overflow drain in case of high rain events.
- The high visibility and location at the town hall makes this an ideal location for GSI implementation.

Annual Runoff Reduction	Total Phosphorus (lbs/yr)	Total Nitrogen (lbs/yr)	Drainage Area (sq ft)	Suggested GSI
637,788 gal	0.84	6.62	24,220	Bioswale

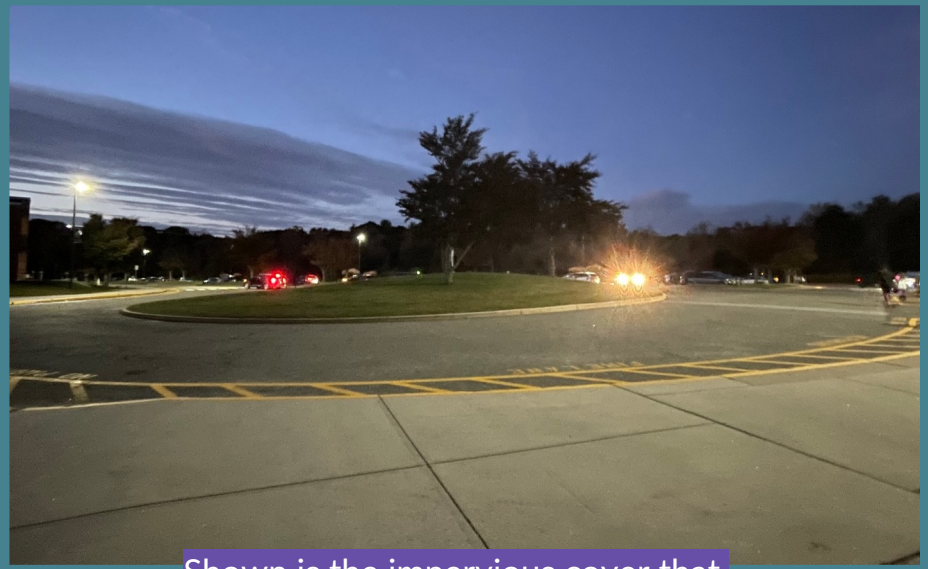


Site 2: Lewis S. Mills High School/Har-Bur Middle School

24 Lyon Rd, Burlington, CT

Label each suggestion with a, b, c

Site 2: Har-Bur Middle School - Traffic Loop area



Shown is the impervious cover that would lead into tree box filters.

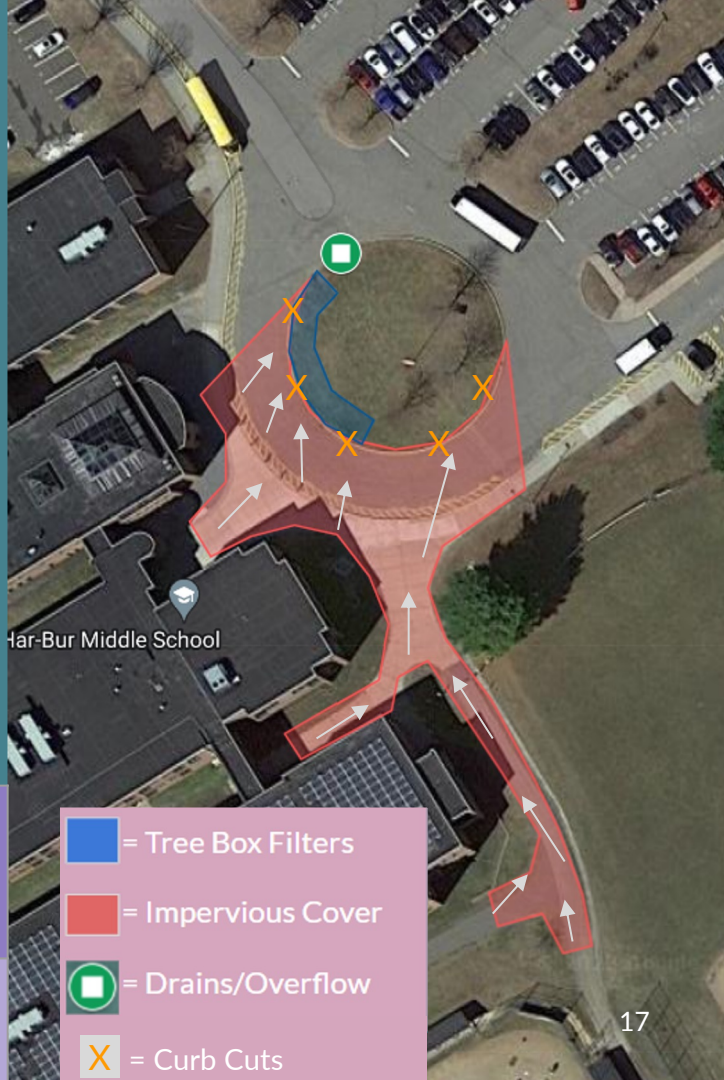
Area where tree box filters would be installed. Storm drain for overflow depicted as well.

Site 2: Har-Bur Middle School

24 Lyon Rd, Burlington, CT

- We noticed that a significant of impervious cover slopes directly into this roundabout
- This area would be suitable for tree box filters, considering there are trees on one side of the circle already.
- We would recommend only 2-3 tree box filters for the area on the green circle, depending on the area rating of the specific treebox filter used.
- A nearby storm drain would act as overflow.
- Great area for GSI exposure/education as this appears to be the pick-up/drop-off area for the middle school.
- Tree-box filters would also serve to stop any parking on the grassy area which appears to be a problem.

Annual Runoff Reduction	Total Phosphorus (lbs/yr)	Total Nitrogen (lbs/yr)	Drainage Area (sq ft)	Suggested GSI
372,798 gal	0.49	3.87	14,157	Tree Box Filters



Site 2: Har-Bur Middle School - Buffered Parking Lot Greenery

Area for rain garden. Portions of the curb here would be removed for curb cuts. The storm drain here would be used for overflow.

Site 2: Har-Bur Middle School

24 Lyon Rd, Burlington, CT

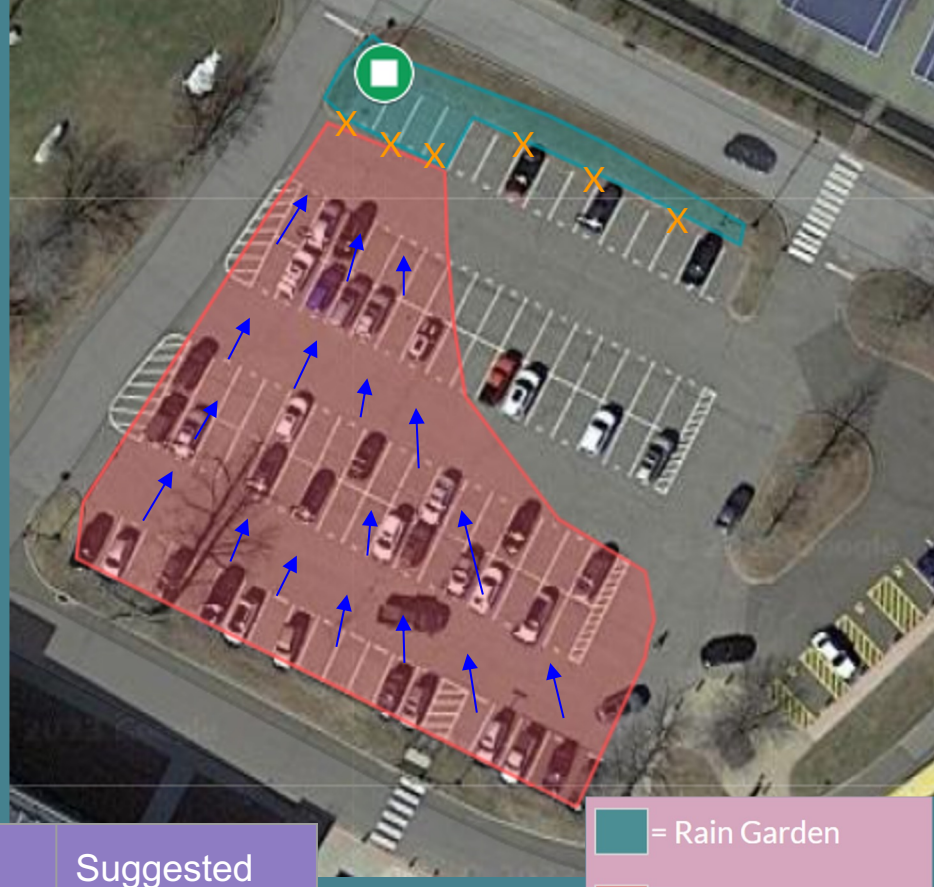
- We noticed that the runoff from this section of the parking lot flows directly into the catch basin
- We can easily direct the runoff into a rain garden where the raised island is.
- The GSI would have an area of 2312 sq ft and 6 inches deep.
- Minimal work would have to be done for this installation, just the normal amount of digging and some curb cuts to allow flow of water into the area.
- A nearby catch basin would act as overflow.

Annual Runoff Reduction	Total Phosphorus (lbs/yr)	Total Nitrogen (lbs/yr)	Drainage Area (sq ft)	Suggested GSI
281,027 gal	0.37	2.92	10,672	Rain Garden

Site 2: Lewis S. Mills High School

24 Lyon Rd, Burlington, CT

- We noticed that the entire parking lot sloped into a curb and a catch basin.
- The island has some potential for a rain garden.
- It would have to be 2039 sq ft and at a depth of 13 inches, in order to avoid potential electrical underground utilities nearby.
- We would have to dig up 4-5 parking spaces in order to meet the area requirements for the GSI.
- This would be a great area as the street just north is the main entrance/exit and there is lots of traffic that goes through there.

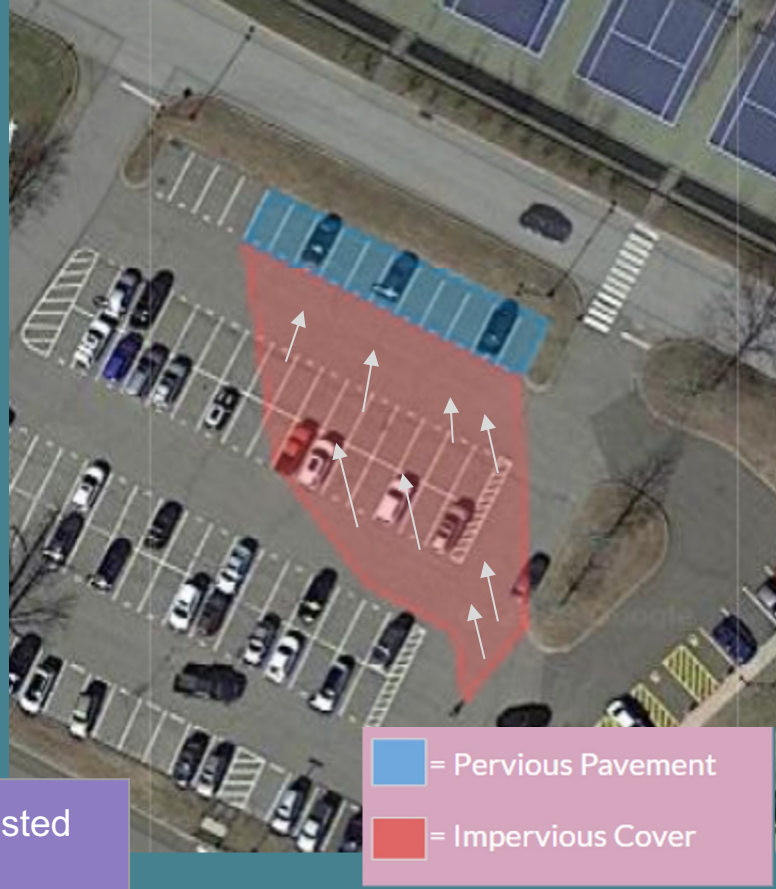


Annual Runoff Reduction	Total Phosphorus (lbs/yr)	Total Nitrogen (lbs/yr)	Drainage Area (sq ft)	Suggested GSI
536,827 gal	0.71	5.57	20,386	Rain Garden

Site 2: Lewis S. Mills High School

24 Lyon Rd, Burlington, CT

- In order to implement the previous GSI, pervious pavement would need to be used for the parking spaces directly adjacent to the curb.
- This GSI will take up 1873 sq ft.
- This will reduce the runoff that would go into the proposed rain garden and possibly just overflow.
- This GSI is more ideal for still keeping parking instead of ripping up an entire row of parking spaces for stormwater management.
- Both GSI are located nearby to the high school pick-up/drop-off which is great for visibility and education.



Annual Runoff Reduction	Total Phosphorus (lbs/yr)	Total Nitrogen (lbs/yr)	Drainage Area (sq ft)	Suggested GSI
277,635 gal	0.32	2.54	7,405	Pervious Pavement

Site 3: Burlington Public Library

34 Library Ln, Burlington, CT

Site 3: Burlington Public Library - End of cul-de-sac area

34 Library Ln, Burlington, CT

Site 3: Burlington Public Library

34 Library Ln, Burlington, CT

- We noticed that a large portion of Library Ln slopes into this catch basin, and there was lots of debris clogging the drain.
- Here we can implement a rain garden with an area of 1614 q ft and 6 inches deep, by doing some digging, curb cuts, and removal of shrubbery, being mindful of the existing tree line.
- The storm water drain beside the stop sign would act as overflow in the event of a high rain storm event.
- This has decent visibility as it is by one of the exits.

Annual Runoff Reduction	Total Phosphorus (lbs/yr)	Total Nitrogen (lbs/yr)	Drainage Area (sq ft)	Suggested GSI
196,155 gal	0.26	2.04	7,449	Rain Garden 1

Site 3: Burlington Public Library - Courtyard area

34 Library Ln, Burlington, CT

Site 3: Burlington Public Library

34 Library Ln, Burlington, CT

- This area is perfect for a rain garden, because of the open space and existing drains for overflow.
- There is a size constraint, so the GSI would have to be 885 sq ft and 8 inches in depth, or we can reduce the number of downspouts directed into the garden to keep it at 6 inches in depth.
- This area has great potential for education as there is a daycare/after-school programs here.
- Note that with this suggestion being close to the building, a buffer of 10 feet between the rain garden and the foundation of the building is necessary.

Annual Runoff Reduction	Total Phosphorus (lbs/yr)	Total Nitrogen (lbs/yr)	Drainage Area (sq ft)	Suggested GSI
143,384 gal	0.19	1.49	5,445	Rain Garden 2

Site 4: Lake Garda Elementary School

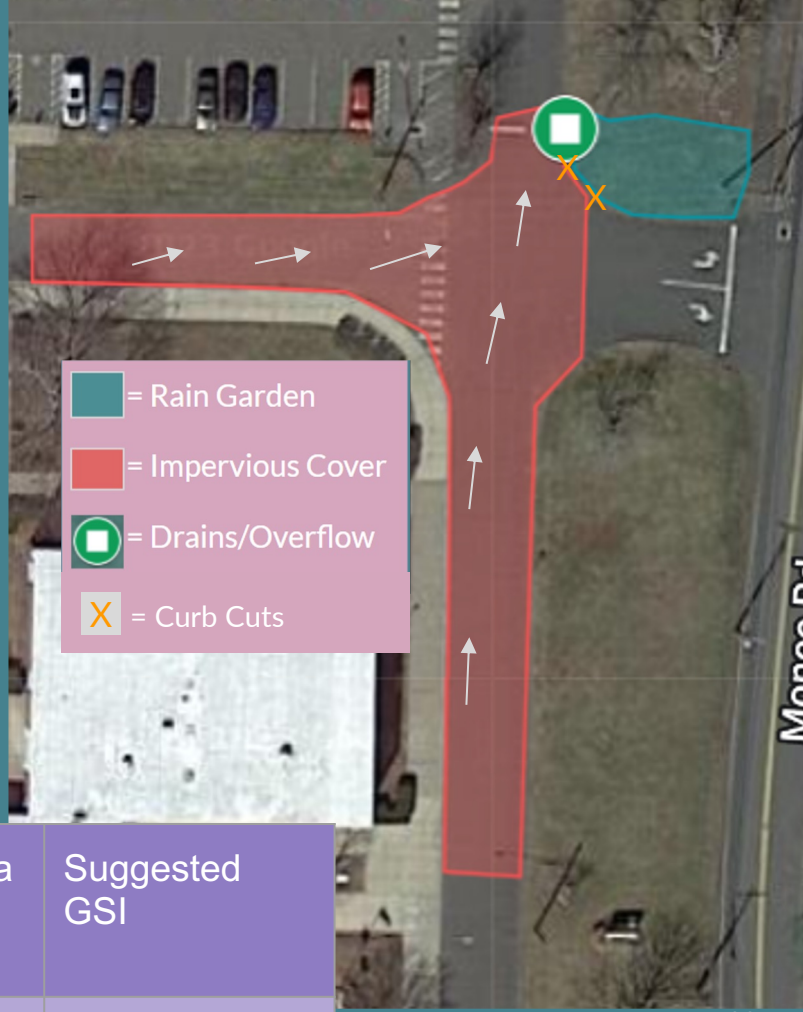
61 Monce Rd, Burlington, CT

Site 4: Lake Garda Elementary School- Entrance area

Site 4: Lake Garda Elementary School

61 Monce Rd, Burlington, CT

- During our site visit, we noticed that all the runoff from the area indicated was going into this one catch basin.
- All that runoff could easily be directed into a rain garden located in adjacent grassy area.
- This GSI would have to be 1290 sq ft and at a depth of 9 inches due to the area constraint from the existing trees.
- Several curb cuts on the corner of the curb would need to be installed for the flow of water to reach the garden area. The storm drain besides the parking sign would serve as overflow in the event of a high rain storm event.
- This area has great visibility as it is near the main exit for the school.

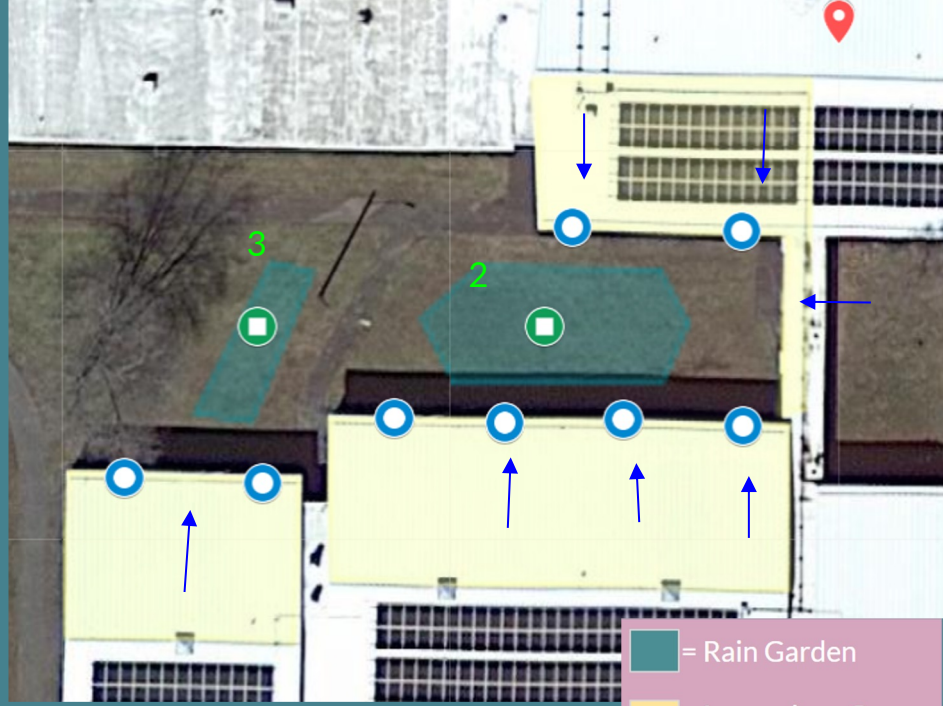


Annual Runoff Reduction	Total Phosphorus (lbs/yr)	Total Nitrogen (lbs/yr)	Drainage Area (sq ft)	Suggested GSI
235,155 gal	0.31	2.44	8,930	Rain Garden 1

Lake Garda Elementary School: Courtyard Area

Site 4: Lake Garda Elementary School

- This area has great potential for two rain gardens, with #2 being 1557 sq ft and 6 inches deep, and #3 being 491 sq ft and 6 inches deep as well.
- The classrooms all have windows pointing into this courtyard area, so it has high visibility.
- All the downspouts can be directed into the GSI for easy disconnecting.
- The existing drains marked in green would be raised to be used for overflow.
- We can use simple rock/gravel paths to direct the downspouts to the proposed GSI areas.
- This school is lacking in decorative vegetation, so this GSI will add some aesthetic appeal to the area.

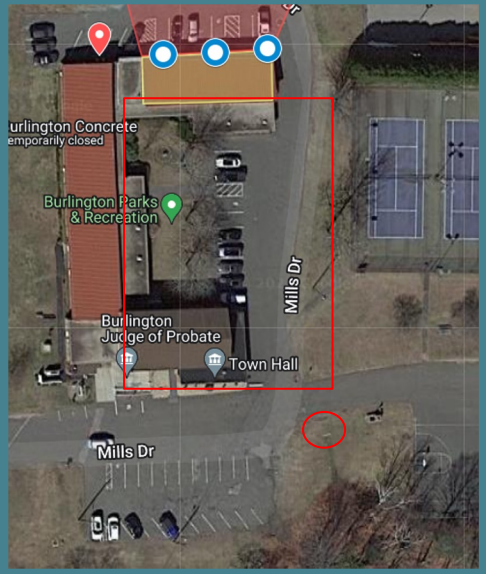


Annual Runoff Reduction	Total Phosphorus (lbs/yr)	Total Nitrogen (lbs/yr)	Drainage Area (sq ft)	Suggested GSI
189,256 gal	0.25	1.97	7,187	Rain garden 2
59,648 gal	0.08	0.62	2,265	Rain garden 3

	Green Stormwater Infrastructure	Impervious Cover Reduced (sq ft)	Annual Runoff Reduction	Total Phosphorus (lb/yr)	Total Nitrogen (lb/yr)
Town Hall	Bioswale	24,220	637,788 gal	0.84	6.62
	Rain Garden	14,505	381,962 gal	0.5	3.97
High School/Middle School	Tree Box Filters	14,157	372,798 gal	0.49	3.87
	Rain Garden 1	10,672	281,027 gal	0.37	2.92
	Pervious Pavement	7,405	277,635 gal	0.32	2.54
	Rain Garden 2	20,386	536,827 gal	0.71	5.57
Library	Rain Garden 1	7,449	196,155 gal	0.26	2.04
	Rain Garden 2	5,445	143,384 gal	0.19	1.49
Elementary School	Rain Garden 1	8,930	235,155 gal	0.31	2.44
	Rain Garden 2	7,187	189,256 gal	0.25	1.97
	Rain Garden 3	2,265	59,648 gal	0.08	0.62
Totals		122,621	4,331,385 gal	5.66	44.64

Areas We Considered

- Southern area of Town Hall
  - This drain (circled) receives runoff from the pavement and roof (rectangle), but there is not enough area to install a rain garden where the drain is, considering the existing trees.
- High school pick up area
  - There is a small strip of grassy area adjacent to the pick-up area at the high school, however, it is too small for any GSI and digging would not be done because electrical utilities will most likely be in the way.



Areas We Considered

- Small garden at Lake Garda Elementary School
  - Created by Boy Scouts, made/donated in 2017 so most likely they would not like for us to change it.
- Library northern parking lot
  - This would be alot of area to disconnect, however, the catch basin (circled) is located in the middle of the parking lot which makes it difficult to implement GSI and not ideal.

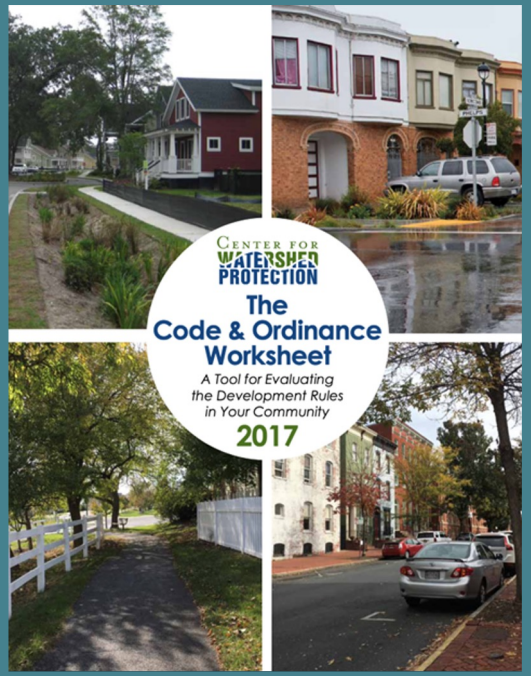
What is the COW?

Code and Ordinance Worksheet - Center for Watershed Protection

Evaluates local ordinances and regulations for site design in order to ‘grade’ it’s water quality-friendliness

Focus on the minimization of impervious cover, conservation of natural areas, and the use of runoff reduction practices to manage stormwater

CENTER FOR WATERSHED PROTECTION

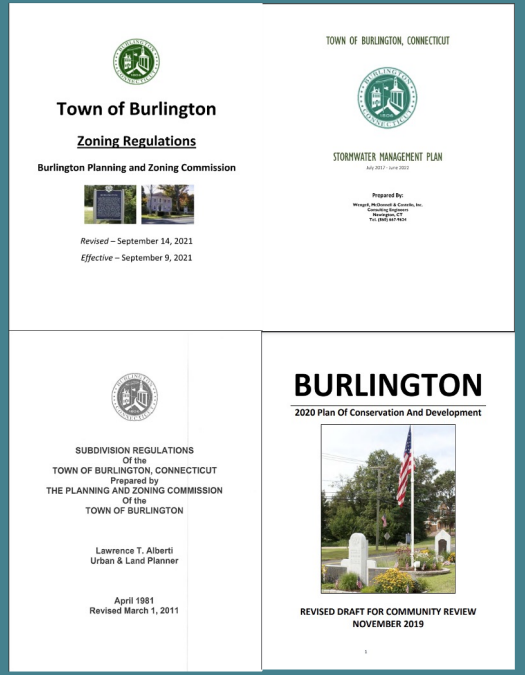


Codes and Ordinances Worksheet Overview

A spreadsheet was made to assess the stormwater regulation standards with the link provided here.

The report showed that while Burlington had some strong language on things like shared parking, much of the regulations lacked specific language in regards to green stormwater infrastructure.

Provided in the report review are some suggested regulation changes, but the entirety of the report is found within the Codes and Ordinances Worksheet spreadsheet.



Contacts

Supervisors-

David Dickson

Email: david.dickson@uconn.edu

Michael Dietz

Email: michael.dietz@uconn.edu

References

Dickson, David. “Permit Basics.” CT NEMO Program, 30 Dec. 2021, nemo.uconn.edu/ms4/permit/.

Honnigford, Laurie. “Tree Box Filters.” Stormwater Equipment Manufacturers Association, www.stormwaterassociation.com/tree-box-filters. Accessed 14 Nov. 2023.

“Soak up the Rain: Rain Gardens | US EPA - U.S. Environmental Protection ...” Soak Up The Rain: Rain Gardens, www.epa.gov/soakuptherain/soak-rain-rain-gardens. Accessed 14 Nov. 2023.

Link to Google Maps with all the sites LID/GSI and IC:

https://www.google.com/maps/d/edit?mid=1YseyKoND1LZ26FKH9KEaAUAm5N-d-wQ&usp=sharing