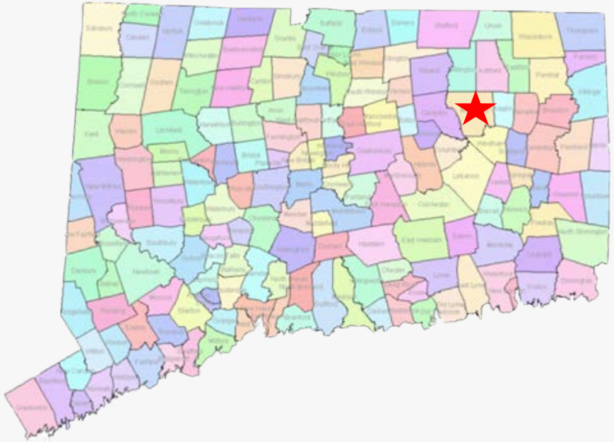
Stormwater Runoff Reduction Plan

Town of Mansfield, Connecticut



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Contents

Summary

During the Spring 2019 semester, a team of UConn Students and extension faculty performed an evaluation of potential stormwater remediation opportunities for the Town of Mansfield, Connecticut. The process involved a desktop analysis and field visits to determine where potential green stormwater infrastructure installation opportunities existed on publicly owned land parcels. Calculations were performed to determine the potential stormwater and pollution reduction benefits from each of the proposed installations. If all projects identified in the report are implemented, 112,728.78 ft^2 of impervious cover will be disconnected from the stormwater drainage system. This means that 2,984,482 gallons of untreated stormwater, 30.884 pounds of nitrogen and 3.912 pounds of phosphorus will be prevented from entering local water bodies annually.

In This Report

Included are recommendations for green infrastructure practices at 8 sites in the town of Mansfield. Each site is introduced with an aerial photo from google maps and includes its address, and total impervious area to be disconnected from the stormwater system. Following the introduction is a google map displaying all options for the site showing impervious surface types. Each option is then individually displayed with an google map of the recommended practice, detailed description of our recommendations, and an informational table. Each table shows an estimated drainage area, our recommended green infrastructure, annual gallons of runoff treated, nitrogen and phosphorus pollution reduction amounts, and the suggested size of each practice. These estimations were calculated based on the drainage area, annual rainfall estimates specific to Connecticut and literature export values.

Impervious Surfaces & Runoff

Impervious surfaces, including roads, rooftops, parking lots, and other developments do not allow water to penetrate through them. Natural surfaces, such as grass, leaf litter, vegetated areas, or dirt areas absorb a significant portion of water from precipitation and runoff. Once water penetrates the ground, it then flows into surface water bodies or is recharged into groundwater aquifers. When natural surfaces are replaced with impervious surfaces, the water cycle is disrupted. As a result, soil infiltration decreases, while surface runoff increases substantially and is often diverted into stormwater management systems and discharged directly into the local water bodies. Runoff over impervious surfaces collects pollutants, and causes flooding and erosion that negatively affect the water quality of local water bodies. To prevent a decrease in water quality, runoff can be disconnected from the stormwater system by implementing green infrastructure practices that reduce or convert impervious practices. For instance downspouts on buildings and large areas, box planters, tree box filters, or rain barrels. Pervious impervious surfaces (roads, parking lots, pathways, etc) can be converted into pervious surfaces using previous alternatives to traditional materials.

Common Green Infrastructure Practices

Rain Gardens and Bioretention systems

Pervious Pavement

Tree Box Filters

Rainwater Harvesting

Planters

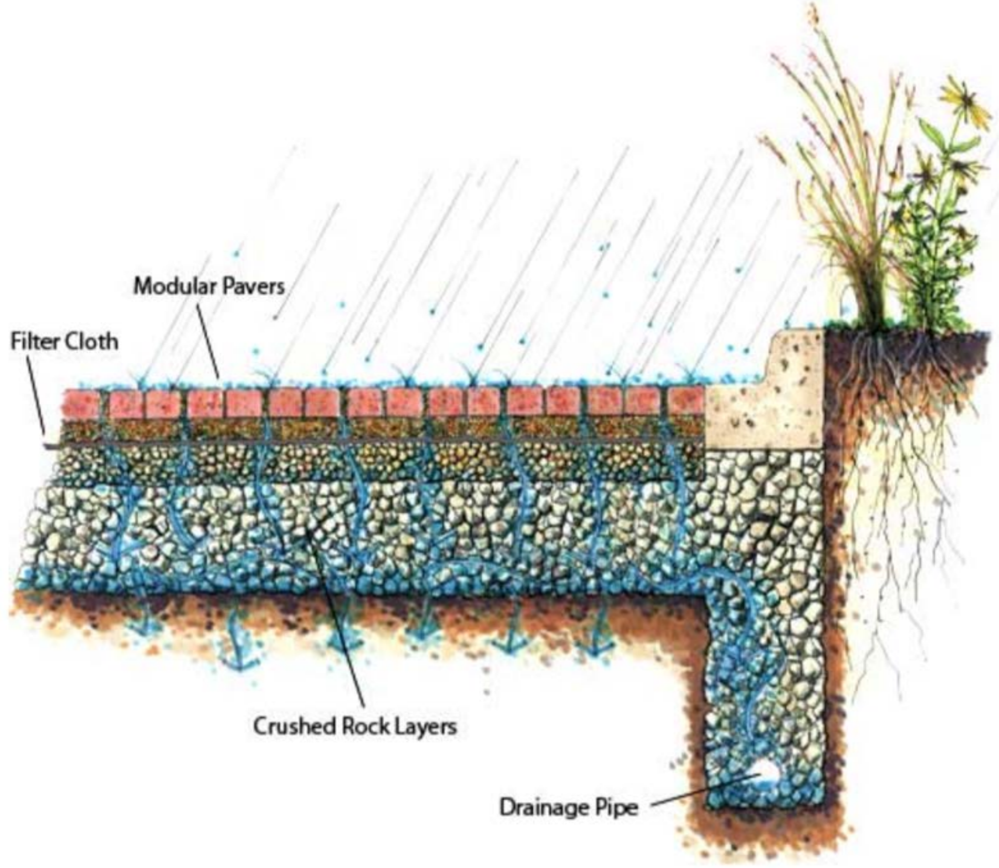
Rain Gardens

A **rain garden** is designed to capture precipitation runoff from an impervious surface. By doing so, water is allowed to percolate into the ground rather than directly entering stormwater management systems. They are usually built adjacent to the impervious area in question and are depressed approximately around 6 inches, depending on how much area is available. Rain gardens not only help to reduce pollution of local waters, but also add to the aesthetic appeal and biodiversity of urban areas.

When built next to parking lot, one or more sections of curb is cut and water is directed through a path composed of cobble or gravel to minimize erosion. If implemented next to a building, hutters can direct water into the garden. From here, the water is either taken up by plants or enters the soil and eventually the water table via percolation Appropriate plants for a rain garden tend to be shrubs or grasses that are tolerant to drought, flooding, and exposure to high salt concentrations. Ideally these gardens are planted with hardy native perennials to minimize the need for maintenance. A bioretention is an enlarged rain garden specifically engineered to handle larger quantities of water


BUFFER
The buffer surrounds a rain garden, slows down the flow of water into the rain garden, filters out sediment, and provides absorption of pollutants in stormwater runoff.
DEPRESSION
The depression is the area of the rain garden that slopes down into the ponding area. It serves as a holding area and stores runoff awaiting treatment and infiltration.
PONDING AREA
The ponding area is the lowest, deepest visible area of the rain garden. The ponding area should be level so that the maximum amount of water can be filtered and infiltrated. It is very important that this area drains within 24 hours to avoid problems with stagnant water that can become mosquito breeding habitat.
PLANTING SOIL LAYER
This layer is usually native soil. It is best to conduct a soil test of the area checking the nutrient levels and pH to ensure adequate plant growth.
BERM
The berm is a constructed mound, or bank of earth, that acts as a barrier to control, slowdown, and contain the stormwater in the rain garden. The berm can be vegetated and/ or mulched.
SAND BED
If drainage is a problem, a sand bed may be necessary to improve drainage. Adding a layer of coarse sand (also known as bank run sand or concrete sand) will increase air space and promote infiltration. It is important that sand used in the rain garden is not play box sand or mason sand as these fine sands are not coarse enough to improve soil infiltration and may impede drainage.
ORGANIC MATTER
Below the ponding area is the organic matter, such as compost and a 3" layer of triple shredded hardwood mulch. The mulch acts as a filter and provides a home to microorganisms that break down pollutants.
INLET
The inlet is the location where stormwater enters the rain garden. Stones are often used to slow down the water flow and prevent erosion.
OVERFLOW
The overflow (outlet) area serves as a way for stormwater to exit the rain garden during larger rain events. An overflow notch can be used as a way to direct the stormwater exiting the rain garden to a particular area surrounding the rain garden.

Pervious Pavement

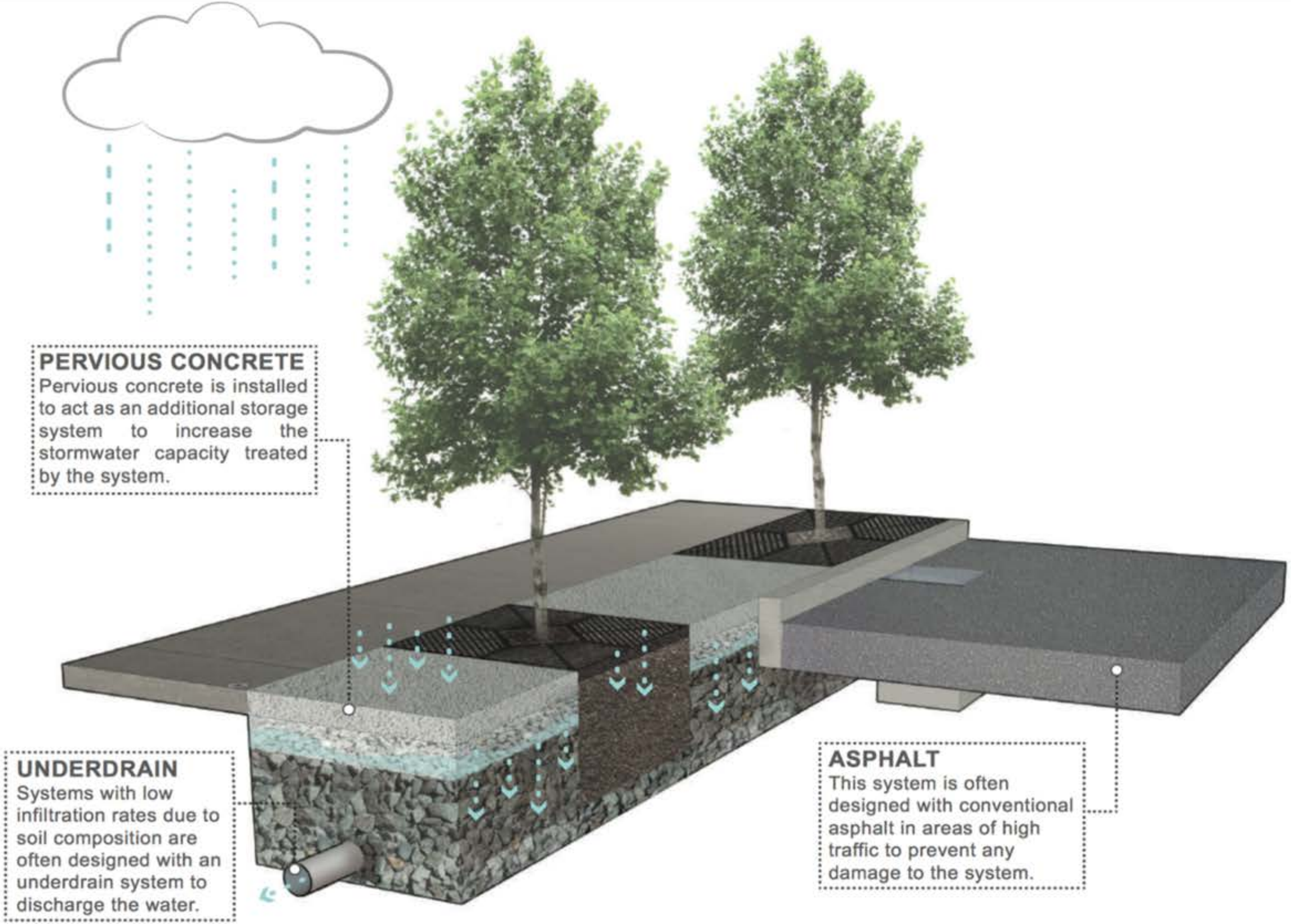


Pervious paving is an alternative to traditional asphalt or concrete that allows for the infiltration of water. Ideal locations for pervious paving are relatively flat areas that take on a fair amount of water from surrounding impervious surfaces during storm events. Pervious asphalt needs to be replaced less often than traditional asphalt. As a result of the material being purpose, it is less susceptible to seasonal expansion and contraction than traditional asphalt. This reduces the occurrence of frost heaves and seasonal crack and prolongs its lifespan. Pervious paving is the most costly green infrastructure practice, including cleaning techniques such as pressure washing and vacuum sweeping to dislodge sand, dirt, leaves and other debris that infiltrate the void structure of the pervious concrete and inhibit its permeability.

Pervious paving often reduces the need for snow removal as well. With traditional concrete and asphalt, water from melted snow cannot infiltrate so it often freezes into black ice or acts as runoff and takes salt with it. Pervious paving allows this water to enter the ground, resulting in a decreased need for salting as well as less cost for snow removal maintenance. This not only puts less stress on the storm water management system, but relieves local aquatic ecosystems as well.

Tree Box Filters

Tree box filters are an aesthetically pleasing green infrastructure practice that directs stormwater runoff through soil and other substrates with excellent filtration qualities before allowing it to enter municipal stormwater systems. Stormwater runoff flowing over impervious sidewalks and roads enter the tree box filter through a grate. Once inside the box, the water infiltrates through a special soil mixture a mulch layer and a shrub or tree root system that are specifically designed to filter out pollutants and contaminants.


PERVIOUS CONCRETE
Pervious concrete is installed to act as an additional storage system to increase the stormwater capacity treated by the system.
UNDERDRAIN
Systems with low infiltration rates due to soil composition are often designed with an underdrain system to discharge the water.
ASPHALT
This system is often designed with conventional asphalt in areas of high traffic to prevent any damage to the system.

Rain Harvesting & Planters

Rainwater harvesting is the diversion of water from gutters and downspouts which would otherwise end up in the municipal stormwater management system. Roof runoff is fed into large cisterns which retain the water until it can be repurposed for garden watering, domestic use, fire protection and a variety of other ways. Not only does this aid in reducing runoff and the issues that come with that, but it also reduces stress on private well and municipal water supplies. Cisterns are usually situated beside buildings where gutters drain water from the roof.

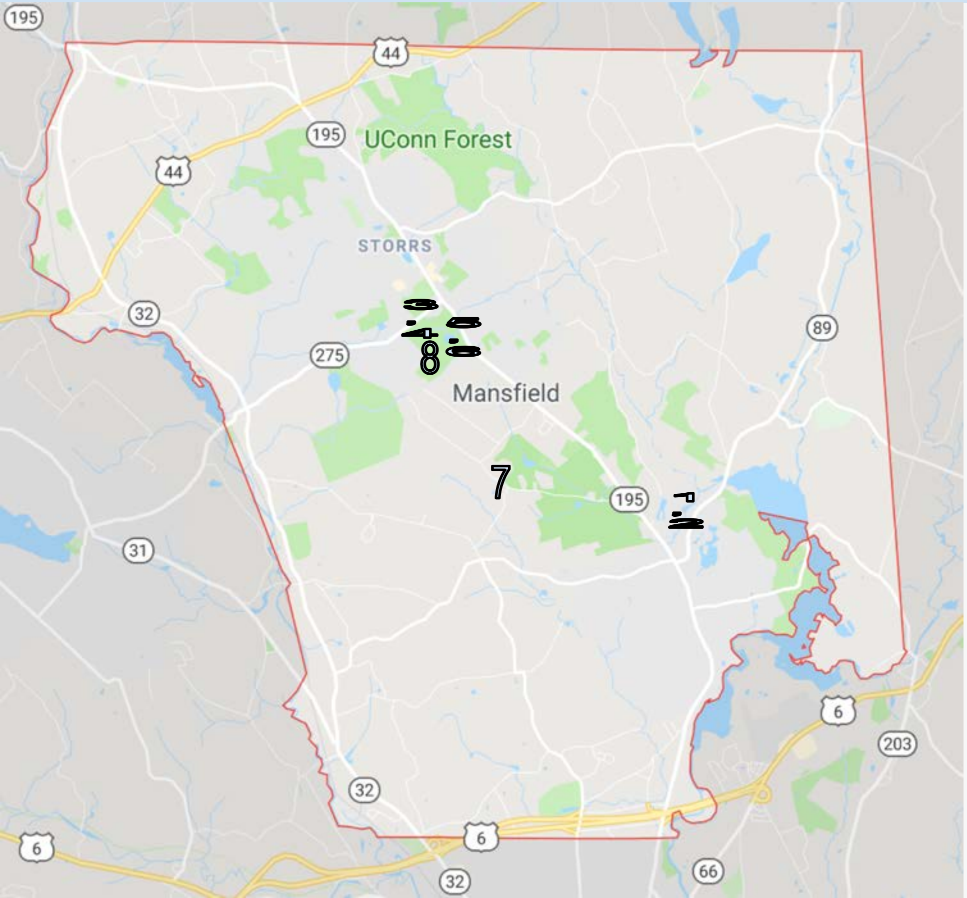
Both the amount of water needed as well as the area of impermeable surface are important to pay attention to when deciding how large a cistern to install. The size of the cistern also dictates what material it should be made of. For small drainage areas, PVC is appropriate, but as the size increases steel or even concrete may be necessary. Depending on the anticipated use of the water, a filter may be imperative to prevent contaminants from entering the cistern. Maintenance practices include relocation of cisterns in the winter months to prevent them from freezing.

Site Selection & Approach

Before visiting sites, team members used various aerial imagery tools to view locations within each town to determine possible sites suitable for green infrastructure practices. The focus was towards sites under municipal control that would otherwise allow for quick installation of practices while also serving to educate the public.

On location, sites and site specific recommendations were selected based on suitability for implementation of green infrastructure practices. The factors used included slope of surrounding land, land available for use, location of existing storm drains, location of above ground and underground obstructions (large trees, pipes, utilities, etc.), and whether or not some form of green infrastructure practice was already in place.

Sites Map



1. Southeast Elementary School
2. Southeast Elementary School
3. E.O. Smith High School
4. E.O. Smith High School
5. Mansfield Community Center
6. Mansfield Community Center
7. Mansfield Middle School
8. Mansfield Town Hall

Top Three Sites for Mansfield

The top three sites for Mansfield were selected based on the same criteria as the site specific recommendations as well as, the visibility from high traffic areas, the educational aspect, the amount of disconnection, and the practicality of implementing the green infrastructure practice.

1. Southeast Elementary School Playground
2. E.O. Smith High School Front Parking Lot
3. Mansfield Middle School

If all top three site projects were implemented, 60,628.58 ft^2 of impervious cover will be disconnected from the stormwater drainage system. This means that 1,902,068 gallons of untreated stormwater, 16.08 pounds of nitrogen, and 2.104 pounds of phosphorus will be prevented from entering local water bodies annually.

Site 1: Southeast Elementary School

LOCATION:

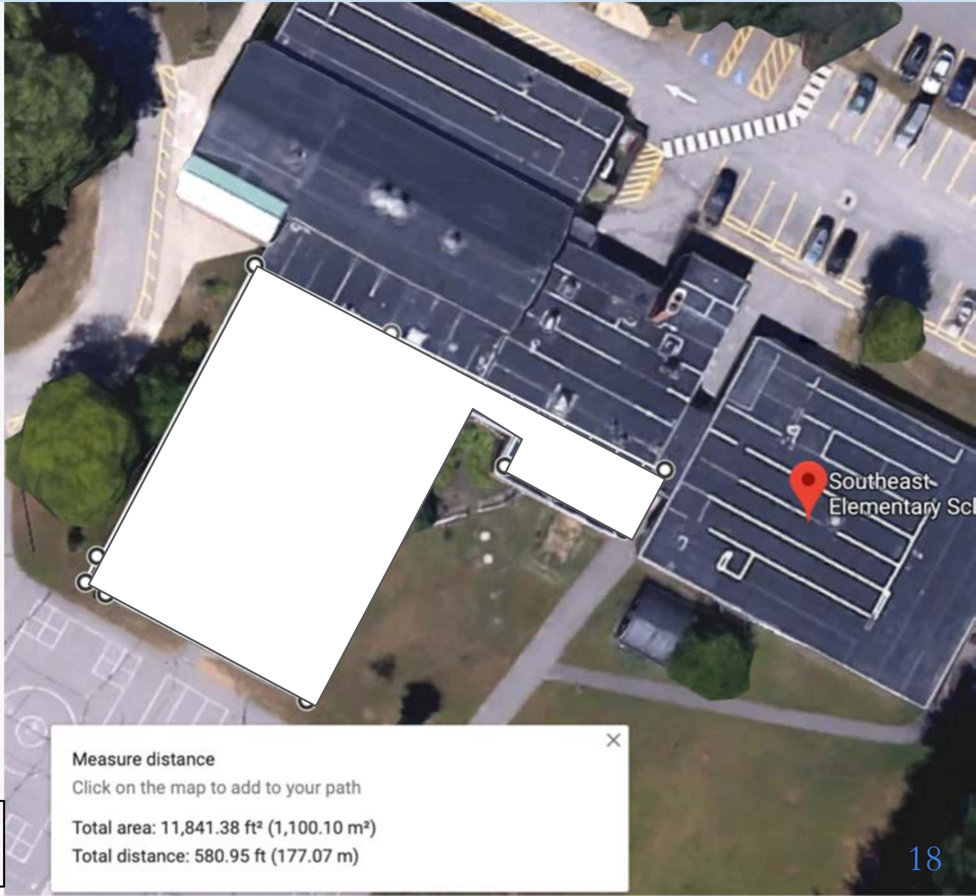
134 Warrenville Rd, Mansfield Center, CT 06250

IMPERVIOUS AREA:

11841 ft^2

CONCLUSION:

There would be 4 separate rain gardens but each one could be implemented easily considering the possible impediments.



=impervious surface = green infrastructure practice

Site 1.1: Southeast Elementary School

IMPERVIOUS AREA:

- ~3175 ft^2 of roof coverage drains here

LIMITS:

- Trees in front (~8' in front of building)
- Set max width: 5' at 64' a fence gets in the way
- Total distance between sidewalk and front of building is 20'
- Measurements below are adjusted so that we would not have to work around the trees.

CONCLUSION:

- Can not be done at 6" depth but can easily be done at 10" depth.

Site 1.2: Southeast Elementary School

IMPERVIOUS AREA:

~1513 ft^2 of roof coverage drains here

LIMITS:

- Only 30’ to work with long ways because of tree on one side and playground on the other
- Measurements adjusted to give a few feet of distance between the tree and the garden.

CONCLUSION:

- Cannot be done at 6” depth without infringing on the pavement but it can be done at 8” depth

FRONT OF PLAYGROUND

Site 1.3: Southeast Elementary School

IMPERVIOUS AREA:

~4688 ft^2 of roof coverage drains to here

LIMITS:

- There is a garden already, 60’ down one side of wall

CONCLUSION:

- Can be done easily at 6” depth

Site 1.4: Southeast Elementary School

IMPERVIOUS AREA:

- ~2473 ft^2 of roof coverage drains to here

LIMITS:

- Length caps out at ~27’ because of the pavement
- Don’t want to infringe too much on the playground, therefore included the 6” measurement (any width more than 15.5’ would be unnecessary)

CONCLUSION:

- Can be done at a depth of 6”

Site 2: Southeast Elementary School

LOCATION:
134 Warrenville Rd, Mansfield Center, CT 06250

IMPERVIOUS AREA:
11,607 ft^2

LIMITS:
- Baseball field to the North
- Paved path to the South
- Could not be more than 75' across.
- Structure prevents area going out more than 15'

CONCLUSION:
- Can be done at a depth of 6" with an irregular shape, and 12" with a rectangular shape.

Site 2: Southeast Elementary School

Baseball Field

Surface Area at 6" depth- ~1,937 ft^2

Surface Area at 12" depth: ~976 ft^2

Site 3: E.O. Smith High School

LOCATION:
1235 Storrs Road, Mansfield CT 06268

IMPERVIOUS AREA:
14505 ft^2

LIMITS:
- Row of trees ~12’ from parking lot - have to give them a few feet of room

CONCLUSION
- Can be done at a depth of 6”
- Work around trees

FRONT PARKING LOT

Site 4: E.O. Smith High School

LOCATION:

1235 Storrs Road, Mansfield CT 06268

IMPERVIOUS AREA:

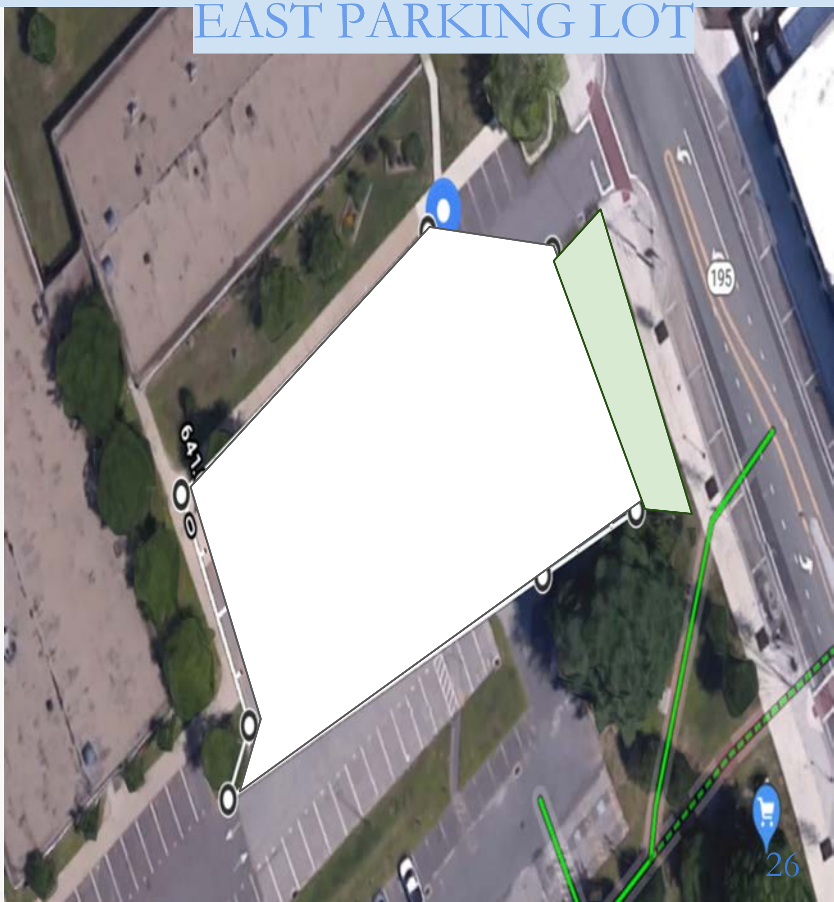
20430 ft^2

LIMITS:

- Telephone poles 17’ from parking lot

CONCLUSION:

- Telephone power infrastructure make rain garden problematic, it would have to be 29” deep.
- Potential detailed evaluation needed to see if



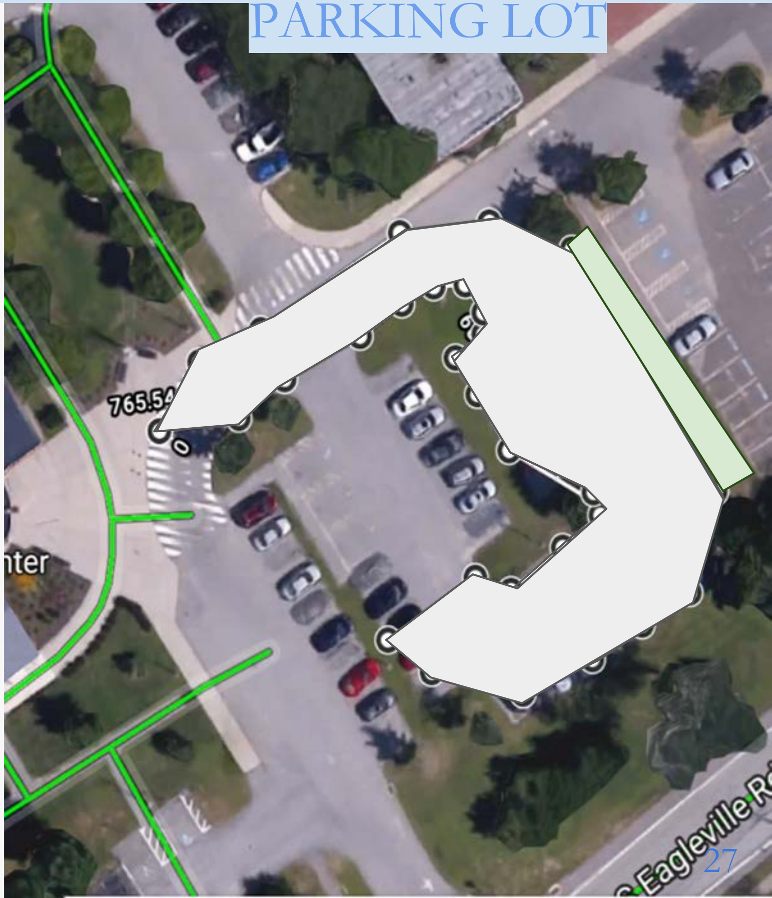
Site 5: Mansfield Community Center

LOCATION:
10 S. Eagleville Road, Storrs, CT 06268

IMPERVIOUS AREA:
11564.60 ft^2

LIMIT:
- The landing is only 5’ wide

CONCLUSION:
- Cannot be done without infringing on the parking spaces
- At a 12” depth - infringe partially on 6 parking spaces



Site 6: Mansfield Community Center

LOCATION:

10 S Eagleville Road, Storrs, CT 06268

IMPERVIOUS AREA:

4504.19 ft^2

LIMIT:

- Large trees on either side of the area, ~30' apart
- Excavate the sidewalk

CONCLUSION:

- Can be done at a depth of 6" easily,
- Already a drain in the middle of the field
- Trees can stay in place

EAST SIDE OF BUILDING

Site 7: Mansfield Middle School

LOCATION:

205 Spring Hill Rd, Storrs, CT 06268

IMPERVIOUS AREA:

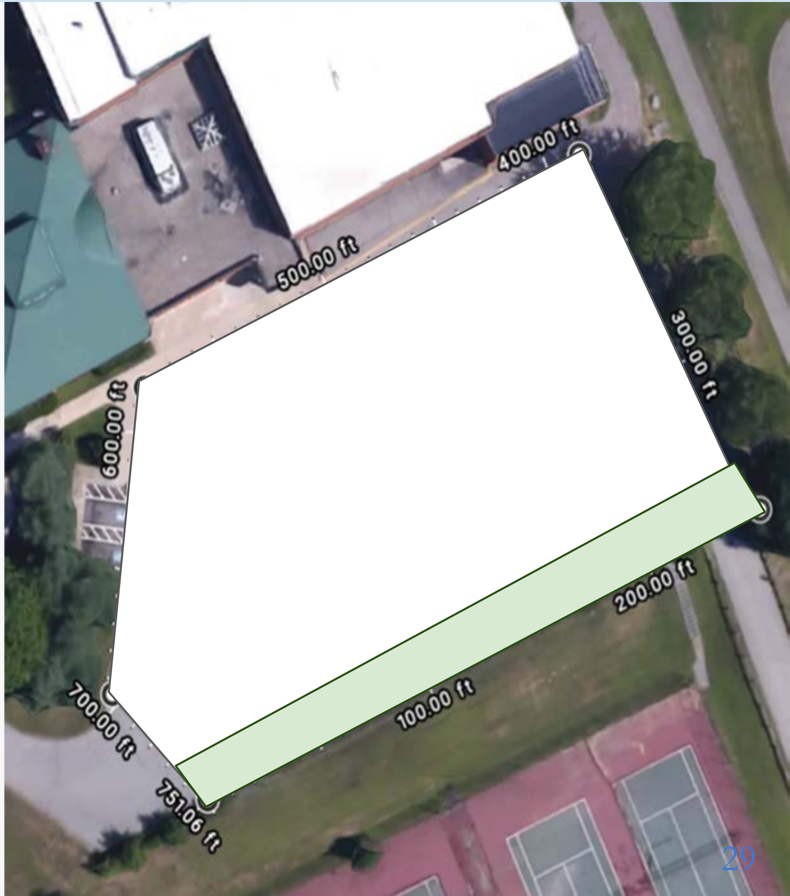
34281.72 ft^2

LIMIT:

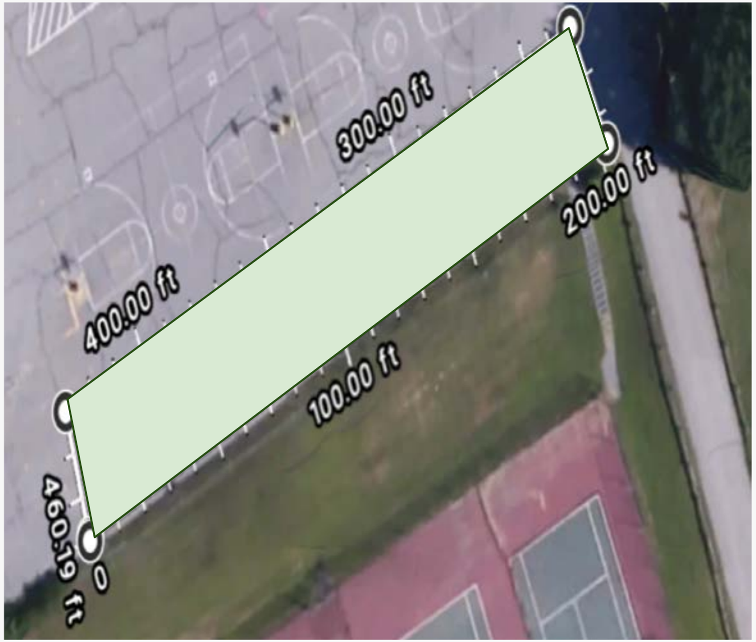
- Don't want to intrude on lot too much (bus area)

CONCLUSION:

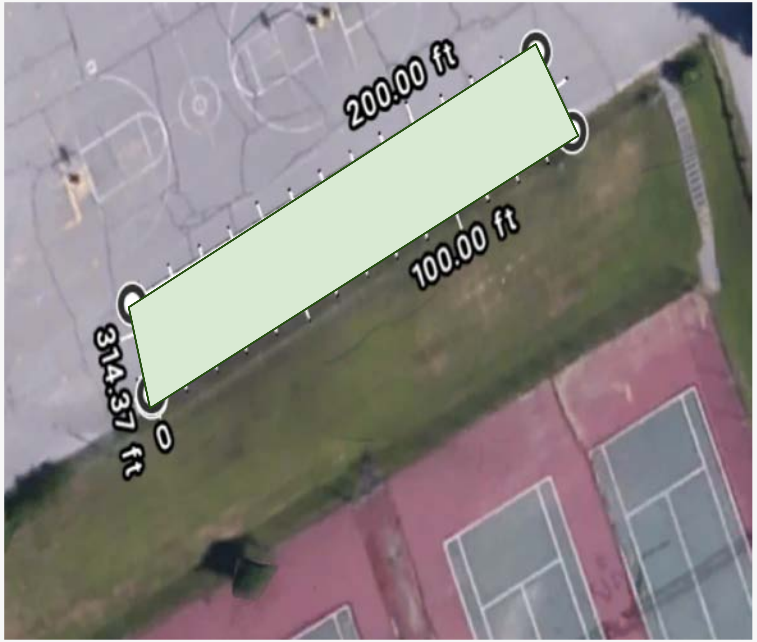
- Practice located at south end of lot
- At 6" depth - area would be very large
- At 12" depth - area would still intrude on lot
- Practice depends on school's use of lot and willing to sacrifice some pavement



Site 7: Mansfield Middle School



Surface Area at 6" Deep:
~5,714 ft^2



Surface Area at 12" Deep:
~2,857 ft^2

Site 8: Mansfield Town Hall

LOCATION:

4 S. Eagleville Rd, Storrs, CT 06268

IMPERVIOUS AREA:

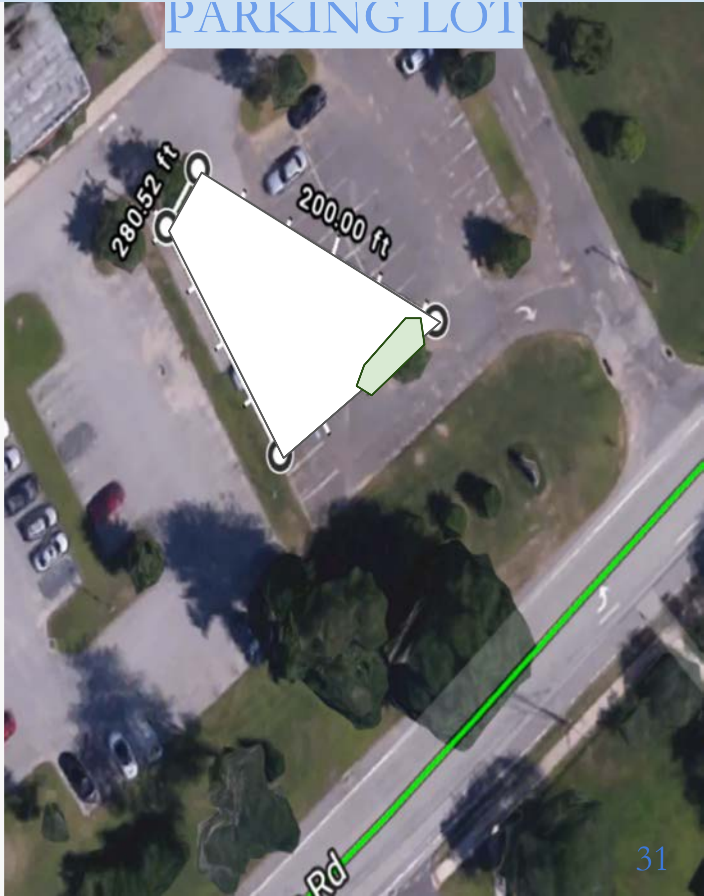
3995 ft^2

LIMIT:

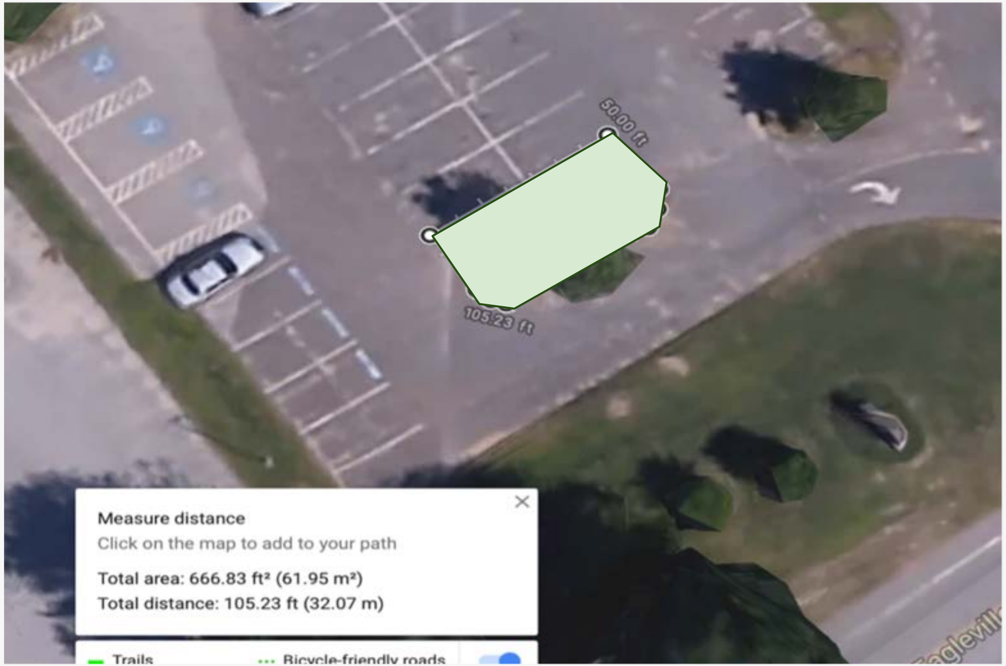
- Try to confine rain garden to the grassy area

CONCLUSION:

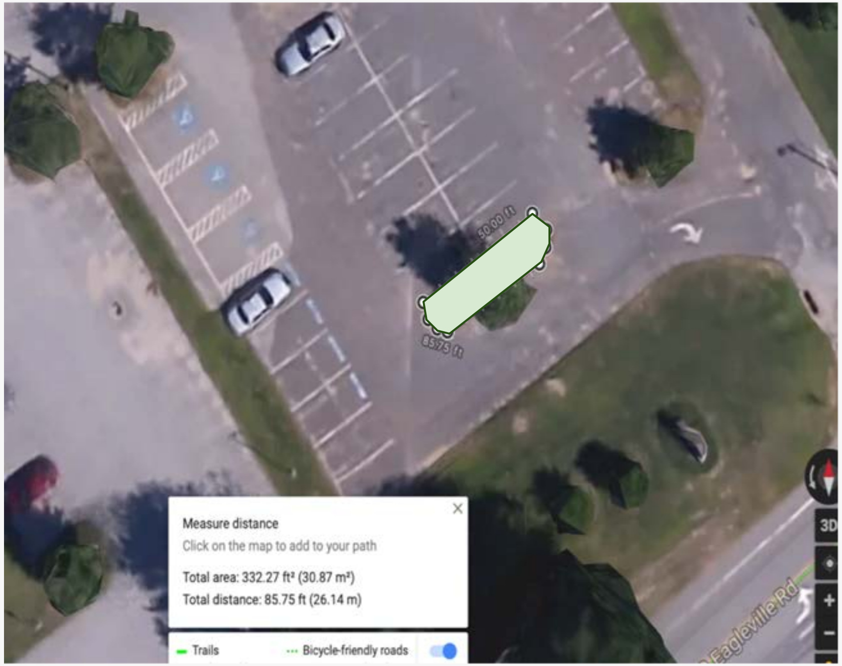
- Infringe on parking spaces at both 6” and 12” depths
- Confining it to the grassy area - depth at >16”



Site 8: Mansfield Town Hall



At 6" depth - take up 2 parking spaces



At 12" depth - partially infringe on 2 parking spaces