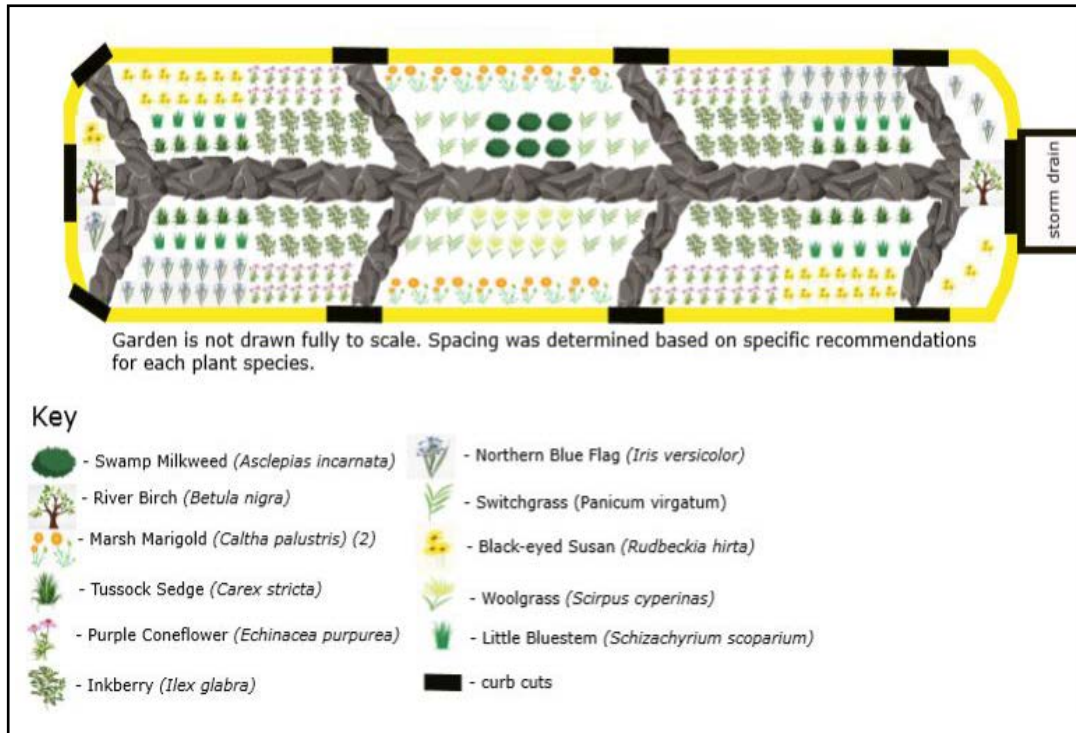




Sea Girt Rain Garden Proposal

Sea Girt National Guard Training Center
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1.0 Project Overview

Property managers at the Sea Girt National Guard Training Center (NGTC) would like to transform a median berm at the entrance of the site at the intersection of Sea Girt Ave and Camp Drive into a rain garden. The proposed garden area, as shown in Figure SG1 of Appendix A, is a 130 ft by 10 ft rectangular berm. The structure of a rain garden is meant to be a shallow depression that is landscaped to infiltrate stormwater and reduce flooding. According to the NJ Department of Environmental Protection, Stormwater runoff is responsible for 60% of water pollution problems and therefore is the largest source of pollution to New Jersey waterways. Enacting stormwater management practices is pivotal to decrease the amount of water pollution. Constructing a rain garden in the median at the intersection of Camp Drive and Sea Girt Ave will remove water from the impervious roadway and allow it to filter naturally into the groundwater system. It can also decrease erosion and damage to nearby buildings, roads, and landscapes caused by run-off water. In addition to being an effective means of stormwater management, this rain garden would also contribute to the NGTC natural resource management program by creating habitat for birds, butterflies, and other beneficial pollinators attracted to the native plants. Additionally, the Sea Girt NGTC receives a high number of visitors year-round to utilize the beach, campground, athletic fields, and museum. Having a rain garden by the entrance of the facility would highlight the natural beauty of the site while showcasing the National Guards commitment to environmental stewardship.

The Environmental Management Bureau (EMB) has tasked the Stockton University Environmental Internship Program (SUEIP) with developing a proposal for the establishment of this rain garden, including the architectural design, recommended plant species, garden maintenance, and costs. The proposed architectural design of the rain garden along with the specific plant species chosen to form the garden make it an effective, aesthetically pleasing way of reducing surface and groundwater degradation.

2.0 Rain Garden Architectural Design and Considerations

When designing a rain garden, it is imperative to address the following variables: Soil Properties, Water Input, Drainage and Outflow, Suitable Vegetation, and Aesthetics and Wildlife Habitat. These conditions and variables can be dramatically different from one project area to another. Designing an effective, successful, and self-sustaining rain garden depends on properly addressing each of these variables, tailoring the design to the unique project area, and manipulating the landscape as necessary. This section of the proposal describes the current status of the project area, addresses each of the aforementioned variables, provides detailed design and construction instructions for the proposed rain garden, and identifies challenges associated with project area.

2.1 Current Status & Characteristics of Proposed Project Area

Preliminary soil boring was conducted on the berm, it was determined at a depth of 4'8" that it was mostly dry clay. The berm will be excavated, and its soil will be replaced to ensure it is able to take in and filtrate large amounts of water. The landscaping of this project is going to be challenging as there is 6-8" of dyed mulch currently in the berm that would need to be removed, and a possibility of fiber optic cables in the underground area. Curb cuts will also have to be made into the berm to act as an inlet that allows water from the road to enter the system. The outlet of the system can be directed into the storm sewer at the downhill end of the project area, in case of overflow.

2.2 Potential Challenges

When planning and designing a rain garden, there are always a few challenges based on location and the size of the garden. Before building can begin, it is mandatory due to New Jersey Administrative Code, Title 14, Chapter 2 that a utilities survey be conducted on the area in order to determine if underground fiberoptic cables or other utilities are present which could disrupt excavation. This can be done by calling 1-800-272-1000. A rain garden cannot be built within 5' horizontally and 1' vertically from any utilities. When first preparing the berm for the rain garden, the 6-8" of dyed mulch that is currently in place must be discarded or repurposed. This mulch is not suitable for a rain garden since it does not absorb water effectively and can easily float away and rearrange itself every time it rains. The used mulch could be used in other places on site, like under the signage for the museum or entrance. The natural clay soil found underneath this mulch is to be replaced by a mixture of sand and compost. It is also recommended that portions of the berm curb be cut in order to allow water from the road to flow into the garden. The curb cuts will act as the inlet, allowing water from the street to enter the system and an additional curb cut can act as the outlet. This will allow the water to drain properly into the storm drain if the garden reaches its maximum drainage capacity (Diagram SG4).

2.3 Soil Properties

One of the many components that needs to be considered in building the rain garden is the soil. According to the Sightline Institute, the ideal soil mix for a rain garden is 35 to 40 percent compost and 60 to 65 percent coarse sand. Based on soil borings of the berm at a depth of 4'8", the soil currently consists of dry clay. The current layout of the berm and its soil layers can be seen in Figure 3. The soil used in a rain garden should be highly permeable, making it easier for water to pass through the surface and reduce excess run-off. As dry clay is not very permeable, the soil must be replaced to ensure the rain garden can take in a certain amount of water per hour. Replacing the soil will also help the plants grow and increase their survival rate. For this project, the soil found below the mulch and up to 2 feet must be removed and discarded or used for other projects on site that do not require fast draining soil. Then, the new soil

consisting of a bioretention mix of compost and sand will be added to replace the existing soil. For this, the berm would require about 2,600 cubic feet of new soil.

A percolation test was completed to see how long the native clay soil will retain water. These results determine whether the existing soil will be suitable for a rain garden or if it will need replacing or amending. The percolation test for this site was completed on June 2nd, 2020 and is shown in Figure 4. Three holes were dug at 12", 18", and 24". The deepest 24" hole drained immediately and then drained within a few minutes again when another 12 inches of water was added to it. The 18" hole drained almost immediately and then drained at a rate of 2.18 inches per hour when the hole was refilled. The 12" hole took approximately 2.73 inches per hour to drain and was not filled a second time. For most perc tests, the holes must be refilled to get the proper drainage rate. Time constraints limited the team from refilling the holes with water. However, since the initial draining of the soil was so slow for the first two holes, the soil must be removed up to two feet.

2.4 Water Input and Outflow

The main purpose of the rain garden is to take in stormwater and filter it naturally. This can only be done if rainwater is efficiently taken off the street and rerouted into the garden. Runoff volumes are influenced primarily by the total amount of rainfall. Runoff rates from a given rainfall are influenced primarily by the rainfall's distribution, which is how the rainfall rate or intensity varies over a period. As stated in the NJDEP-N.J.A.C. 7:8, Stormwater Management rule, the water quality design storm is 1.25 inches of rainfall in two hours. Therefore, this rain garden must be designed to at least meet this standard. Based on historical rain fall in Monmouth County NJ, the annual rain fall average for the past 30 years has been 46.36 inches. Based on the road surrounding the rain garden, the surface area of impermeable surface which would contribute to the rain garden is 324 square meters or 3,487.51 feet squared as shown in Figure SG 2 of Appendix A. By knowing that 95% of rainfall events are less than 3.3 inches, the gallons of water taken in and filtrated by garden can be calculated:

$$.95 \times 46.36 \text{ inches of rain} = 44.042 \text{ inches of rain a year}$$

$$44.042 \text{ in} / 12 \text{ inches} = 3.67 \text{ feet of rain per year}$$

$$3.67 \text{ feet} \times 3,487.51 \text{ ft}^2$$

$$= 12,800 \text{ cubic feet of rain or } 95750.649 \text{ gallons}$$

To summarize this calculation, only 95% of the annual rainfall in Monmouth county was taken into consideration since the rain garden is only being built to take in 0.125 feet of rain at a time. Then the inches of rain per year was converted into feet and multiplied by the square footage of the drainage area leading into the rain garden. This equals the cubic feet of rain that will be taken in each year which was then converted to gallons.

In order to find the depth of the rain garden, the area surrounding the median, the surface area of the rain garden, and the inches of rain the garden is being built for must all be considered:

$324 \text{ m}^2 = 3,487.51 \text{ ft}^2$ as the drainage area

1.5 inches of rain = 0.125 feet of rain

$3,487.51 \text{ ft}^2 \times 0.125 \text{ feet of rain} = 435.94 \text{ ft}^3$ of rain from impervious surface

$435.94 \text{ ft}^3 \times \text{depth} = 1,300 \text{ ft}^2$

$435.94 \text{ ft}^3 / 1,300 \text{ ft}^2 = 0.335 \text{ feet}$ or 4.02 inches deep

To summarize this calculation, the depth of the rain garden can be found by first converting the meters squared of the drainage area to feet squared. Then, the inches of rain that garden is being built for is converted to feet. The drainage area is then multiplied by the inches of rain to get the amount of incoming rain that is from the surrounding impervious surface in cubic feet. This value divided by the surface area of the berm determines the depth as being 4.02 inches.

2.5 Drainage and Outflow

Before replacing the soil, the berm must be free of the mulch and the plastic landscaping tarp and then excavated to the appropriate depth. Since the mulch layer is 6-8" thick, the depth of the soil will have to extend deeper than this to make sure an appropriate amount of new soil can be added. Based on the calculations explained in section 2.3, the depth of the garden is going to be approximately 4 inches. There are three zones that make up a rain garden. The center section, known as the base, is the wettest and deepest section. It should contain plants that prefer very moist soil. This area must be able to drain within 24 hours to avoid becoming mosquito habitat. Surrounding the base is the slope that is moderately wet, and it can act as a holding area to store excess runoff awaiting infiltration. The slope also connects the outer zone to the base, while the outer section is called the buffer. This creates a smooth transition from the surrounding area to the rest of the rain garden. This section is the driest area and should be several inches higher than the base. The soil must be dug to meet the specifications of these zones, as shown in diagram SG2 to ensure the rain garden works properly. Next the curb surrounding the berm must be prepared. The curb-cuts are to be cut based on the layout demonstrated in Diagram SG4. Following the inlet sections, rocks should be put in place to slow down the water flow and prevent erosion of the garden. They also eliminate the need for landscaping cloth which is also used to keep the soil in place and prevent erosion. The rocks are to lead out of each curb-cut located on the sides of the median and lead into the center. At the center, the rocks are to line the length of the basin to help filtrate water and to keep the mulch in place. An additional curb-cut will also be built at the end of the berm to act as an outlet, allowing excess water to drain directly into the storm drain.

2.6 Suitable Vegetation

Once the soil of the rain garden is put in place and the zones are dug to their proper depths, planting can begin. The profiles of the plant species selected for the garden are described in section 3.0 of this report. These plants were selected based on many factors such as whether they are native, how much water they intake, and whether they are salt spray tolerant. This is important since the Sea Girt facility is right along the coast and the plants would likely experience sea spray. The plants that were chosen are also going to be already established, as more mature plants have a higher survival rate than younger plants. The design of the garden is shown in Figure 2 along with the proposed planting arrangement. Once the planting is complete the proposed signage as shown in Appendix D will be put in place. The sign will inform the public about what the rain garden is, its purpose, and the features that it has. After the public is educated about this type of stormwater management, they may be inspired to implement their own.

There are a variety of plants suitable for rain gardens and high moisture areas. Species chosen for the garden were researched for their resistance to sea salt spray, drought, and other characteristics. Switchgrass (20), tussock sedge (20), wool-grass (10), and little bluestem (30) were the grass species chosen to plant in the rain garden. These species are NJ natives except for little bluestem and display some resistance to sea salt spray. The grasses are relatively low maintenance and can grow in a variety of different soils. The grasses are suited best when planted in the base of the garden in the most moisture ridden areas. Northern blue-flag (20), black-eyed Susan (30), marsh marigold (15), and purple coneflower (20) were the flowers chosen for the garden. All these species are NJ natives and sea salt spray tolerant apart from the purple coneflower. They have been chosen because they provide bright, colorful additions to the garden and attract many pollinators and wildlife. The flowers will do well when planted on the border or slope of the garden with a lot of sun. Inkberry (15), river birch (2), swamp milkweed (10), and spicebush (8) were the other shrubs and trees chosen to plant in the garden. The species are all NJ natives with the exception of river birch, and all have sea salt spray tolerance. These moisture loving shrubs were chosen because they are mostly slow-growing perennials that are low maintenance and provide for wildlife as well. Inkberry, swamp milkweed and spicebush need a lot of water and would thrive in the base of the garden, while river birch can be planted on the borders or slopes of the garden.

2.7 Aesthetics and Wildlife Habitats

A rain garden is considered a stormwater management tool, but it is still a garden. Therefore, the space must be aesthetically pleasing and help beneficial insects and animals. The selection of plants for this garden consists of beautiful and efficient species that are all different. There are a variety of different colors, shapes, and sizes of suitable plant species that will diversify and liven up the space. Some of these species also attract and provide food for insects

and birds and vital pollinators. For example, the swamp milkweed is a food source for monarch butterflies and many additional pollinators.

2.8 Rain Garden Construction Process

1. Remove the existing mulch and any plants currently in place. Discard mulch and plants or use elsewhere on the property. For example, the mulch can be used for other landscaping projects on-site, such as the future landscaping efforts along the Stockton Lake bulkhead. The plants could be used to beautify the welcome sign out front or can simply be discarded.
2. Remove and discard existing landscaping fabric layer.
3. Excavate the existing soil to a depth of 24". Excavated soil should be repurposed if possible. Some of the soil could be compiled and used to fill in some of the mosquito breeding habitats as discussed in the 2019 and 2020 Mosquito Breeding Habitat reports.
4. Fill the berm basin with new soil composed of 40% sand and 60%. The slope and the base should both be four inches deeper than the buffer (see Diagram SG 2).
5. Once the garden is dug out to these specific dimensions, the plants can be planted accordingly as shown in Figure 2 and the rocks can get placed around the inlet areas, leading down into the base.
6. A final layer of 3 inches of hardwood undyed triple shredded mulch must then be added on top of the soil.
7. Finally, the signage can be added to the completed project and minimal maintenance is required as defined for each plant in section 3.

2.9 Garden Maintenance

Although rain gardens typically require minimal maintenance and are designed to be self-sustaining, they do need extra care in the first year or two to become established. Under each species profile below, the maintenance required of each plant is described in the 'Species Details' table. Most species require weeding or little maintenance at all. Certain species may require more care than others due to various tolerances that the plants possess. After initial planting, the garden should be watered regularly to a depth of several inches until the plants are well established. After the first growing season, the garden should not need watering unless it experiences lengthy periods of drought. Weeding is important during establishment of the plants. Mulching annually with 3 inches of undyed triple shredded hardwood mulch will also help to prevent the garden from hardpan-ing; diminishing the amount of rainwater that infiltrates the surface.

The grasses such as switchgrass, tussock sedge, wool-grass, and little bluestem require very little maintenance with the exception of annually weeding to remove competitive invaders and removal of dried dead growth from little bluestem is necessary. Tussock-sedge can be cut back for aesthetic reasons in the beginning of the spring season to allow new growth. If the

ground is particularly dry, fertilizing may be necessary but only needs to be done once a season or when things are particularly dry. The flowers including black-eyed Susan, purple coneflower, marsh marigold, and northern blue flag require very little maintenance. They require water once a week in the summer if the rainfall is less than 1" per week. The purple coneflower likes compost or fertilizer once a season and mulch can be applied to prevent weeds but is not necessary. The northern blue flag prefers to be planted in clusters and after planting it simply needs weekly watering when dry. Black eyed Susan and marsh marigold are very tolerant of different habitats and do not require much support after planting other than weekly watering when dry. The other shrubs and trees are also quite low maintenance with the exception of pruning. Inkberry is dioicous and needs male and female plants present if the drupes are aesthetically desired. They can be pruned in the beginning of spring but usually aren't unless they are being used as a hedge. The river birch requires supplemental water during dry periods, and they should not be pruned before the leaves emerge in spring. Swamp milkweed and spicebush require the least amount of work and only need to be fertilized once a year. Swamp milkweed will spread and reoccur naturally.

3.0 Species Profiles

Establishing a successful rain garden relies heavily on selecting appropriate plant species well suited for the conditions of your project area. Suitable plant species for this project must be salt-spray tolerant, able to withstand occasional flooding, tolerate direct sunlight, and require relatively low maintenance. Additionally, to support the natural resource program initiatives at this site, preference was given to native plants when possible. SUEIP researched dozens of potential candidate species for this project, and selected the following plants based on species-specific habitat requirements and overall aesthetic value

3.1 Switchgrass (*Panicum virgatum*)

AKA: tall panic grass, tall prairie grass, wild redtop, and thatch grass.

NJ Native? Yes

Salt Spray Tolerant? Yes



Pros:

- They come in several colorful plumes
- Tolerant of beachfront, sand, full sun, drought, and occasional flood

Cons:

- Potential die back in the winter
- Grasshoppers, crickets, corn flea beetles, and other insects can be a problem with new seedlings.

Species Details	
Sun	Full
Soil moisture/preference	Sandy-clay loam
Height	3-6'
Spread	2-3'
Spacing	18"
Sea salt spray tolerance	Tolerant of salt spray
Other tolerances	Drought, occasional flood, and sand
Maintenance	Fertilizing is necessary once of year only in dry soils. Weeding is necessary to exclude the highly competitive plants.

Additional Information: Switchgrass is native to everywhere in the US except California and the Pacific Northwest. It is a perennial and sod-forming plant and they come in varying heights. It is also known to provide a good warm pasture and hay source for livestock. Switchgrass would need more maintenance than the other plants in the garden because the area surrounding it needs weeding and the plant itself needs to be cut back each year. Suits well when planted in the base or slope of the garden.

3.2 Tussock Sedge (*Carex stricta*)

AKA: Common Tussock, Hummock, or Meadow Sedge

NJ Native? Yes

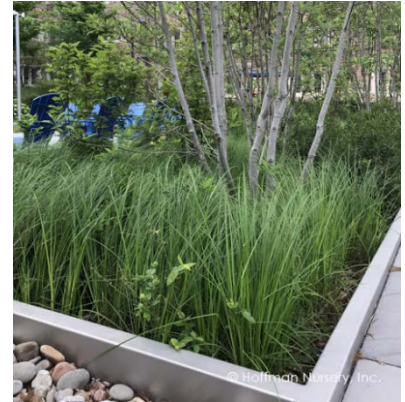
Salt Spray Tolerant? Yes

Pros:

- They thrive in swamps, shorelines, low fields, and marshes.
- Food for birds, and a host for butterflies and moths.
- Deer and rabbit resistant.

Cons:

- This species prefers shallow water of 6" of inundation or less to wet/saturated conditions.
- Easily grows and spreads rapidly
- The site should be weeded regularly to stop the spread of canary grass, hybrid cattails and other aggressive invaders.



Species Details	
Sun	Full
Soil moisture/preference	Medium drained to wet soil moisture, prefers slightly acidic sandy loam
Height	3-4'
Spread	1-2'
Spacing	12"
Sea salt spray tolerance	Tolerant of salt spray
Other tolerances	Deer resistant, clay soils
Maintenance	Weeding is necessary to stop the spread of aggressive invaders. For aesthetic reasons, the foliage can be cut to the ground before the new growth is initiated.

Additional Information: Tussock Sedge is a vigorous sedge that forms numerous leafy culms from underground rhizomes. The mounded clumps called tussocks sit just above the water. It prefers wetlands, marsh edges, wet meadows and savannas. Wetland birds and turtles feed on the seed and it provides habitat for different species of moths, skippers, and butterflies. Suits well when planted in the base of the garden.

3.3 Wool-grass (*Scirpus cyperinus*)

AKA: cotton grass bulrush, common wool-grass

NJ Native? Yes

Salt Spray Tolerant? Yes



Pros:

- Attractive gold brown seed clusters
- Plants are relatively pest free and deer resistant.
- Soil stabilizer

Cons:

- Should not be planted in areas with limited space
- Can outgrow other species that aren't as aggressive

Species Details	
Sun	Partial to full
Soil moisture/preference	Wet soil to standing water
Height	3-5'
Spread	3-5'
Spacing	4'
Sea salt spray tolerance	Tolerance to sea salt spray
Other tolerances	Pest and Deer resistant
Maintenance	Wool-grass is relatively low maintenance but requires periodic flooding for seed establishment.

Additional Information: This plant has aggressive roots and rhizomes that are meant for wetlands. Along with this, wool-grass provides shelter, food, and nesting materials for birds and wildlife. The blooms last from summer to winter and there are not any known pests. Wool-grass occurs naturally in wet meadows and marshes, while tolerating occasional dry periods, it is the ideal plant for rain gardens. Suits well when planted in the base of the garden.

3.4 Little Bluestem (*Schizachyrium scoparium*)

AKA: povertygrass, broom bluestem, broom beardgrass, prairie beardgrass, small feathergrass

NJ Native? No

Salt Spray Tolerant? Some

Pros:

- Tolerable of a wide range of soil types.
- Ornamental grass usually used for borders of gardens
- Low maintenance



Cons:

- Prefers full sun and dryer soil

Species Details	
Sun	Full
Soil moisture/preference	Low to medium
Height	18" to 3'
Spread	1'
Spacing	12-18"
Sea salt spray tolerance	Some tolerance to sea salt spray
Other tolerances	Excellent drought and good shade tolerance
Maintenance	The dried foliage and flower stalks of little bluestem grass should be cut back to make way for the new spring foliage—but not until late March because the seeds provide winter food for songbirds.

Additional Information: Its roots can extend down as far as 5 feet and it forms firmly anchored 18-inch clumps which spread through self-seeding. Little bluestem is known for the blue tinge that runs down the leaves in spring; at maturity the leaves will be blue-green in the spring/summer and turn bronze or burgundy in the fall. Little bluestem attracts butterflies and other pollinators but is not appealing to deer. Suits well when planted in the base of the garden

3.5 Northern blue flag (*Iris versicolor*)

AKA: harlequin blue flag, blue flag iris, large blue iris, larger blue flag, purple iris

NJ Native? Yes

Salt Spray Tolerant? Yes



Pros:

- Brightly colored floral display, good for gardens.
- Soil stabilizer

Cons:

- They need almost constant moisture

Species Details	
Sun	Full to partial
Soil moisture/preference	It craves a loamy soil that is rich in organic matter. But the plant can grow in other soil types when given enough moisture.
Height	2-3'
Spread	2-3'
Spacing	1'
Sea salt spray tolerance	Tolerant of salt spray
Other tolerances	Tolerant of deer and pests
Maintenance	Low maintenance, plant in groups of 3-5.

Additional Information: The Blue Flag's mass roots protect shorelines of rivers and lakes. Many bugs such as bumblebees, skipper butterflies, moths, etc are attracted to the flower, though do not always transfer pollen. There is no documentation of any animal consumption. Blue flag irises provide splashes of color that add interest to any garden, while the root system works to stabilize soil and reduce erosion. Suits well when planted in the buffer or slope of the garden.

3.6 Black-eyed Susan (*Rudbeckia hirta*)

AKA: brown-eyed Susan, brown betty, gloriosa daisy, golden Jerusalem, English bull's eye, poor-land daisy, yellow daisy, and yellow ox-eye daisy.

NJ Native? Yes

Salt Spray Tolerant? Yes



Pros:

- Bright, vibrant blooms
- Reseed after first season of planting
- Fast growing

Cons:

- They are susceptible to fungal diseases

Species Details	
Sun	Full to partial
Soil moisture/preference	Moist, well drained soils are preferred by the black-eyed Susan
Height	Various; 18" to 7'
Spread	12-18"
Spacing	12-18"
Sea salt spray tolerance	Tolerant of salt spray
Other tolerances	Heat and drought tolerant
Maintenance	Low maintenance, this plant thrives in many conditions after planting.

Additional Information: Black eyed Susan's are useful in the prevention of soil erosion and they are a good choice for gardens since they attract bees, butterflies, and other pollinators. They are wildflowers and will inhabit various habitats with ease. They are members of the sunflower family and they bloom from June to October. Suits well when planted in the buffer or slope of the garden.

3.7 Inkberry (*Ilex glabra*)

AKA: Gallberry, bitter gallberry, winterberry, Canadian winterberry, evergreen winterberry

NJ Native? Yes

Salt Spray Tolerant? Yes



Pros:

- Evergreen leaves provide an aesthetically pleasing shrub throughout the year
- Easy to grow

Cons:

- Slow growing
- Susceptible to chlorosis (yellowing of leaves) in high pH soils.

Species Details	
Sun	Full to partial
Soil moisture/preference	Rich, consistently moist, acidic soils
Height	5-8'
Spread	5-8'
Spacing	36-48"
Sea salt spray tolerance	Tolerant of sea salt spray
Other tolerances	Shade, rabbit, deer, erosion, wet soil, air pollution
Maintenance	Inkberries are dioecious (separate male and female plants). Female plants need a male pollinator in order to produce the berry-like drupes that are characteristic of the species and cultivars. Prune to shape in early spring just before new growth begins. Plants generally need minimal pruning unless used as a hedge.

Additional Information: Inkberry shrubs hold up well to polluted urban conditions. Bees are fond of the flowers, and the resulting honey has a highly prized, unique flavor. Inkberry is sometimes planted as a source of food for beehives. Wild birds are also drawn to inkberry. Inkberry is resistant to deer, and thus is a good choice in areas where browsing deer are a problem for other shrubs. Leaf spot is an occasional problem. Spider mites sometimes appear, especially in dry conditions. Suits well when planted in the base of the garden.

3.8 River birch (*Betula nigra*)

AKA: red birch

NJ Native? No

Salt Spray Tolerant? Yes

Pros:

- As a landscape tree, it can be planted almost anywhere
- Fast growing



Cons:

- Should not be planted in very alkaline soils
- Attracts deer

Species Details	
Sun	Full to partial shade
Soil moisture/preference	Need deep, wet, acidic soils
Height	40-70'
Spread	40-60'
Spacing	15-20'
Sea salt spray tolerance	Moderately tolerant
Other tolerances	Drought, poor drained soils, to an extent.
Maintenance	Birches are considered “bleeders”, avoid pruning in late spring before leaves emerge. Needs supplemental water in dry periods.

Additional Information: The small but plentiful seeds are appreciated by a wide range of songbirds. The catkins of the River Birch are used by redpolls and pine siskins. The foliage is eaten by deer and other browsers. Works well for holding stream banks and keeping erosion in check. This species is also the most resistant to birch borers. Develops an aesthetically pleasing cinnamon-colored bark that curls and peels (once mature). It can also grow as single stem and multi stem (as shown in the picture). Suits well when planted on the border or slope of the garden.

3.9 Swamp Milkweed (*Asclepias incarnata*)

AKA: rose milkweed, rose milkflower, swamp silkweed, or white Indian hemp

NJ Native? Yes Salt Spray

Tolerant? Yes



Pros:

- Attracts butterflies, including the monarch
- Low maintenance
- Plants mingle easily with other sun and moisture lovers

Cons:

- Attracts the orange milkweed aphid

Species Details	
Sun	Full
Soil moisture/preference	Moist to wet
Height	2'
Spread	2-3' (Varies)
Spacing	30-36"
Sea salt spray tolerance	Tolerant of sea salt spray
Other tolerances	Deer, rabbit, and clay soils
Maintenance	Very low maintenance doesn't require fertilizer either; performs well in poor soil. Doesn't need trimming or pruning unless desired aesthetically. Milkweed will naturally seed and spread over time.

Additional Information: Swamp milkweed is a native, colonizing, perennial wildflower useful for wetland rehabilitation. It is a good component of a wildlife seed mixture when seeded with native grasses and wildflowers. Hummingbirds are also attracted to the plant. Swamp milkweed spreads through rhizomes; established plants can be divided in late spring. Swamp milkweed is a relatively long-lived (and slow-growing) herbaceous perennial which is perfect for rain gardens. They provide showy pink flowers that provide aesthetically pleasing contrasts with other flowers such as the black-eyed Susan. Suits well when planted in the base of the garden since it is moisture loving and it is a prized food source for monarch butterflies.

3.10 Spicebush (*Lindera benzoin*)

AKA: Northern spicebush, Benjaminbush

NJ Native? Yes

Salt Spray Tolerant? Yes



Pros:

- Strong wildlife tree
- Colorful in fall and spring
- Fragrant

Cons:

- N/A. There are no serious disease or insect problems.

Species Details	
Sun	Full sun to partial shade
Soil moisture/preference	Rich, acidic to basic well drained soil
Height	3-9'
Spread	3-9'
Spacing	8-12'
Sea salt spray tolerance	Tolerant of sea salt spray
Other tolerances	Deer
Maintenance	Low; fertilizer with a balanced granular formula and prune after flowering in the spring to keep the shape.

Additional Information: Over 20 species of birds, as well as deer, rabbits, raccoons, and opossums have been recorded as browsing the leaves or eating the fruits. The fruits are a special favorite of wood thrushes. Its entire, obovate (egg-shaped), alternate leaves turn a bright yellow in fall. Small yellow flowers growing in clusters held close to the stem appear in early spring. It is a dioecious plant with only the female plants producing fruits (drupes), assuming the presence of both male and female plants. Suits well when planted in the base or slope of the garden.

3.11 Marsh Marigold (*Caltha palustris*)

AKA: cowslip, cowflock, or kingcup

NJ Native? Yes

Salt Spray Tolerant? Yes



Pros:

- Strong wildlife tree
- Yellow blooms

Cons:

- N/A, no serious issues.

Species Details	
Sun	Full to partial shade
Soil moisture/preference	Wet, mucky soils
Height	8-24"
Spread	1-2'
Spacing	18-24"
Sea salt spray tolerance	Tolerant of sea salt spray
Other tolerances	Pest, deer and rabbits; their leaves have high levels of alkaloids and glycosides
Maintenance	Very low maintenance, keep soil moist.

Additional Information: *Caltha palustris* is a low mounding perennial with hollow branched stems and shiny foliage. The glossy leaves are bright green and heart shaped or kidney shaped with wavy margins. Floral displays begin early in the season and are considered to be a welcome sign of spring. The 1" blossoms are waxy, cup shaped and similar to those of its buttercup cousins. After establishment, excess shade, competition from neighboring plants or drought are the only conditions that hinder growth. Suits well when planted on the border or slope of the garden.

3.12 Purple coneflower (*Echinacea purpurea*)

AKA: Eastern Purple Coneflower

NJ Native? No

Salt Spray Tolerant? No



Pros:

- Strong wildlife flower attracts birds, butterflies, and bees.
- Long blooming

Cons:

- Keep an eye out for aster yellows, a systemic plant disease that causes growth deformities in the flowers

Species Details	
Sun	Full to partial shade
Soil moisture/preference	Average, well drained soils, sandy-clay.
Height	2-5'
Spread	1-2'
Spacing	1-3'
Sea salt spray tolerance	Least tolerant of sea salt spray
Other tolerances	Deer, drought
Maintenance	Apply a thin layer of compost each spring, followed by a 2-inch layer of mulch to retain moisture and control weeds. Water plants during the summer if rainfall is less than 1 inch per week.

Additional Information: Widely renowned as a medicinal plant, coneflowers are a long-flowering perennial for borders, wildflower meadows, and prairie gardens. Blooming midsummer to fall, the plants are relatively drought-tolerant and rarely bothered by pests. The flowers are a magnet for butterflies, and the seeds in the dried flower heads attract songbirds. It is a medium growing plant and suits best when planted on the border or slope of the rain garden but will do well almost anywhere in the garden.

4. Budget and Cost Analysis

Project Information

Name: Sea Girt Rain Garden

Area: 130 ft x 10 ft

Task Name	Resource	Spacing	Count	Rate	Estimate
Plants					
Switchgrass	Woodie's Garden Goods	4'	20	\$24.90	\$498.00
Tussock Sedge	ShrubBucket	3'	20	\$23.99	\$479.00
Wool-grass	Tennessee Wholesale Nursery	4'	10 Bare-root plugs	\$13.99	\$13.99
Little Bluestem	Lauren's Garden Service	12-18"	20	\$11.00	\$220.00
Northern blue flag	Prairie Nursery	1'	31	\$4.99	\$154.69
Black-eyed Susan	Lowe's	1'	31	\$3.75	\$115.75
Inkberry	Grower's Solution	2'	40	\$17.95	\$718.00
River birch	Brighter Blooms	15-20'	2	\$69.99	\$139.98
Swamp Milkweed	Woodie's Garden Goods	30-36"	6	\$24.95	\$149.70
Spicebush	Joyful Butterfly	8-12'	0	\$13.95	\$0
Marsh Marigold	Pond Plants Online	18-24"	20	\$7.75	\$155.00
Purple coneflower	Lowe's	1'	60	\$3.75	\$225.00
Soils					
Mulch (triple-shredded hardwood)	Home Depot	Continuous	12.5 cubic yards	\$3.48 x cubic ft	\$437.50

with no dye) at depth of 3”					
Fertilizer	Lowe’s	Continuous	12.5 cubic yards	1 bag = covers 1500 sq ft	\$58.98
Sand/Compost	NJ Sand and Gravel Company	Continuous	85 cubic feet	\$2,745	\$2,745
Additional Costs					
Black Mexican Beach Unpolished Pebble	Home Depot	Continuous around Curb cuts	20, 0.5 cubic ft bags	\$20.99 per bag	\$419.80
Sign	Myparking-sign.com	N/a	1	\$30	\$30
Total Costs					~\$6,560.39

The first set of costs are going towards quality 1-gallon plants instead of growing from seed. Plants were picked based on pricing and low maintenance to keep their on-going costs low. Since the garden is very large, it was necessary to estimate for a large number of plants and trees in order to fill the garden to make it aesthetically pleasing and brighten the entrance to the Sea Girt National Guard Training Center. Most of the cost is going towards the large amount of soil needed for the space. The fertilizer for the plants and three-inch mulch layer is also necessary to complete the rain garden. Additional costs include the landscaping requirements for the garden such as the rocks and signage. The cost of the curb cuts is negligible because the National Guard already has the equipment necessary to create them. If the curb cuts were to be constructed by an outside company, there would be an additional cost of approximately \$2,700.

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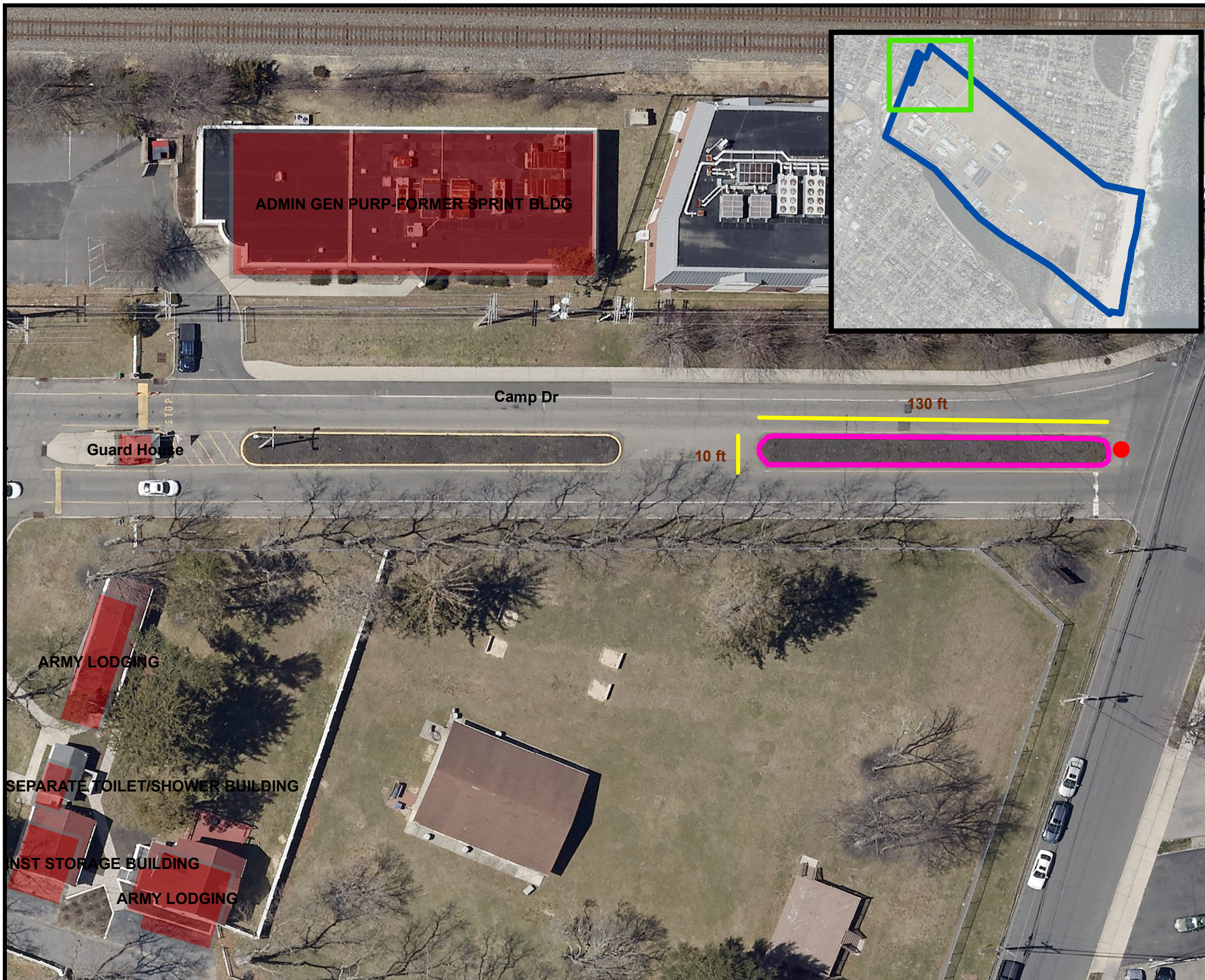
Appendix A: Project Area Maps

Figure SG1

Sea Girt National Guard
Training Center

Rain Garden Proposal

2020



- Proposed Project Area
- Storm Drain

0 25 50 100 Feet

1 inch = 35 feet



Scale: 1 inch = 35 feet

Date: 5/1/2020



Created by: John Hallagan

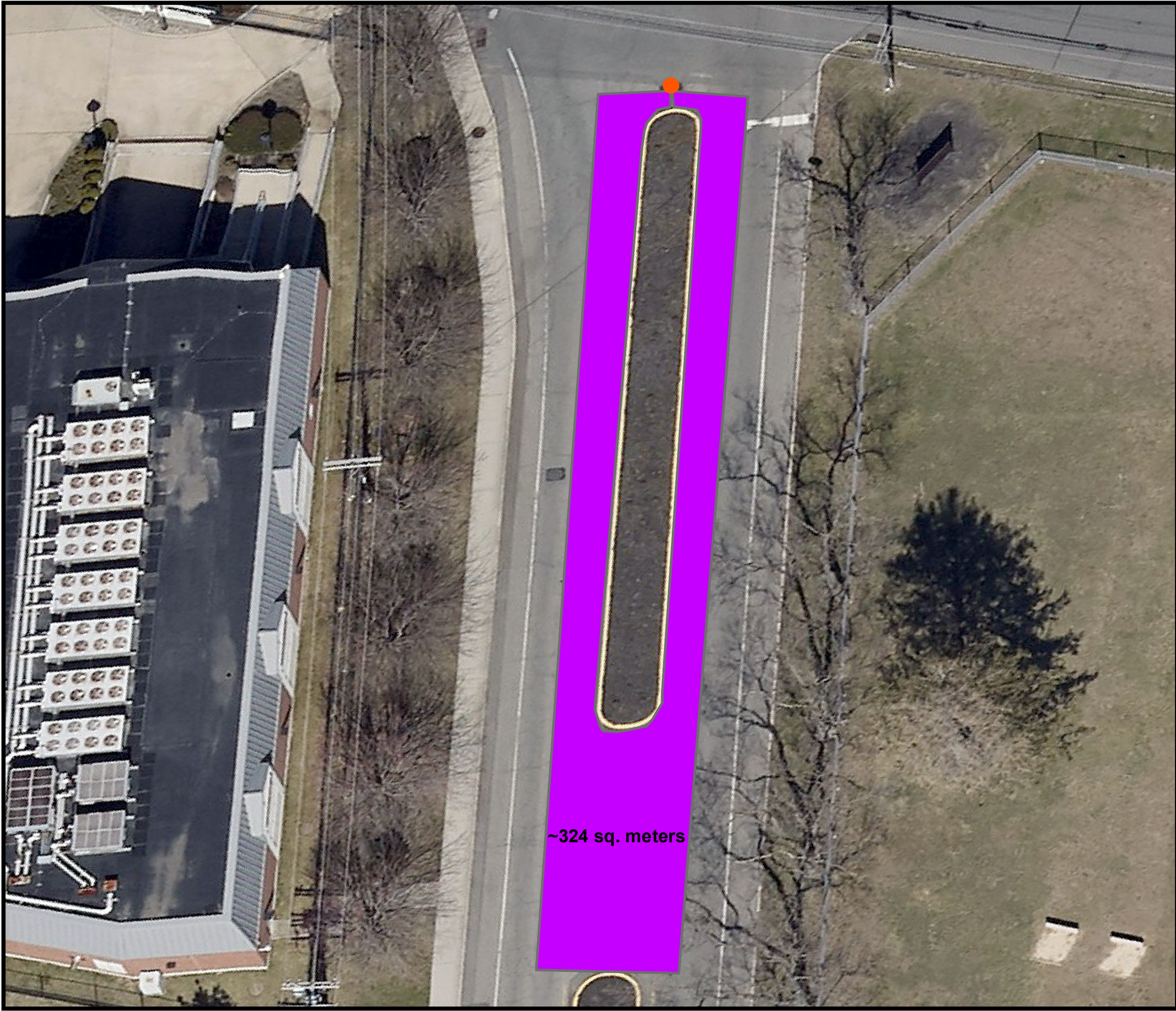
Stockton University
Environmental
Internship Program



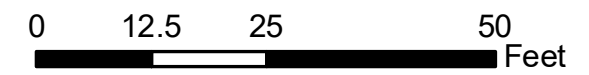
Figure SG2
Impermeable Surface Area - Stormwater
Runoff Contribution To Garden
Sea Girt National Guard Training Center

Legend

-  Storm Drain
-  Surface Area of Stormwater Runoff Contribution To Garden



~324 sq. meters



Scale: 1 inch = 21 feet
File: Figure SG2
Date: 8/4/2020
Created By: John Hallagan



Figure SG3
Rain Garden Percolation Test
Sea Girt National Guard Training Center



Legend

-  Percolation Test Points



Scale: 1 inch = 25 feet
File: Figure SG3
Date: 7/17/2020
Created By: Greg Fischer



Appendix B: Project Area Photographs



Photo 1: South Facing view of the median along Camp drive.

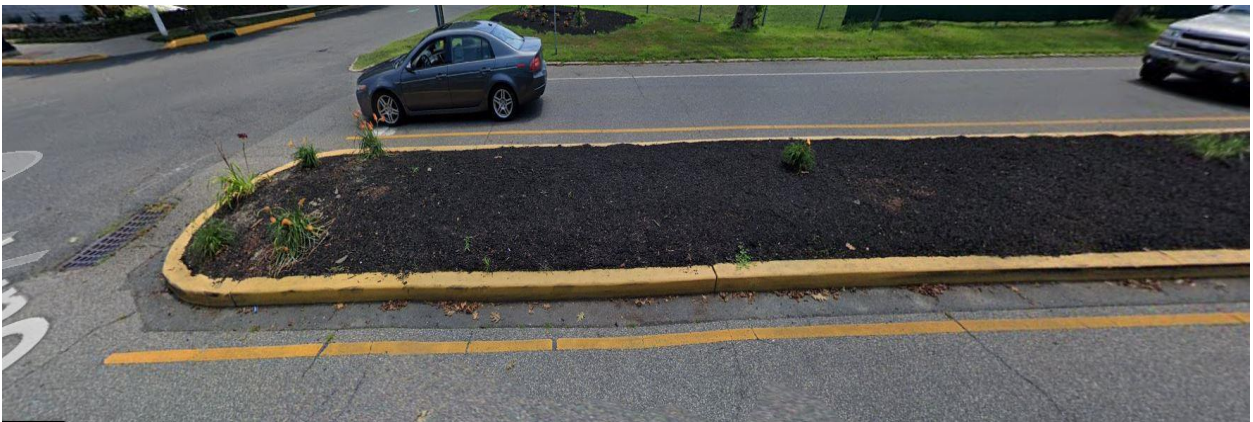


Photo 2: West Facing view of the median along Camp drive.



Photo 3: North facing view of the median located on Camp drive.

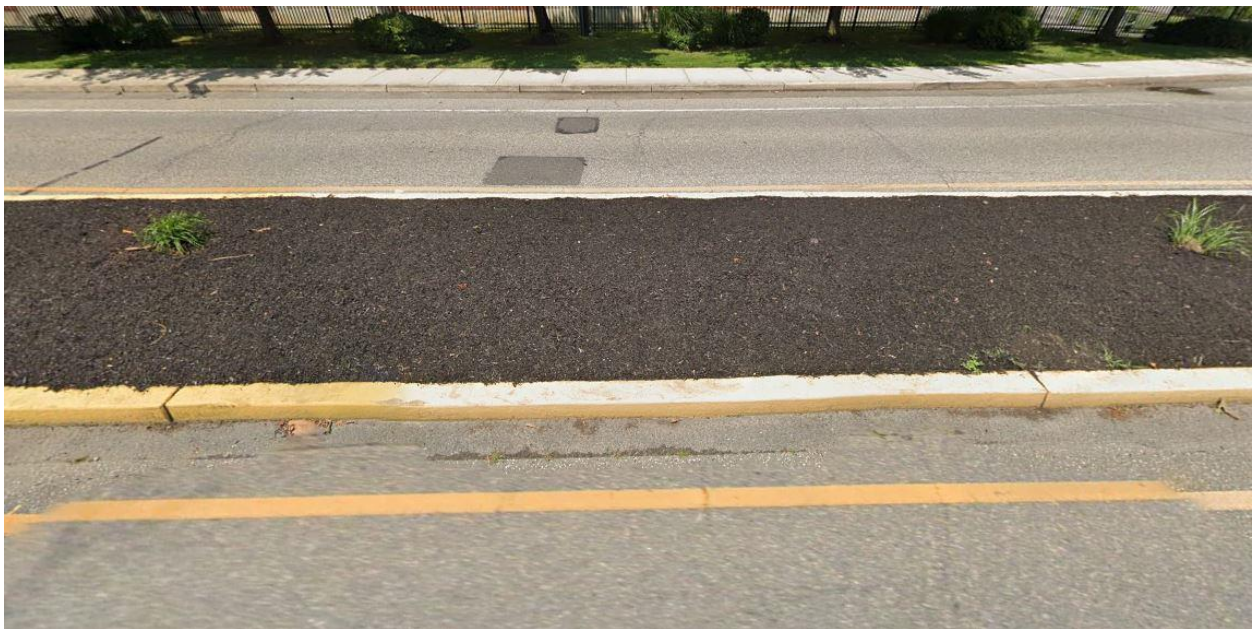


Photo 4: East facing view of the median located on Camp drive.

Appendix C: Rain Garden Design Diagrams

Diagram SG1: Current Berm Layout

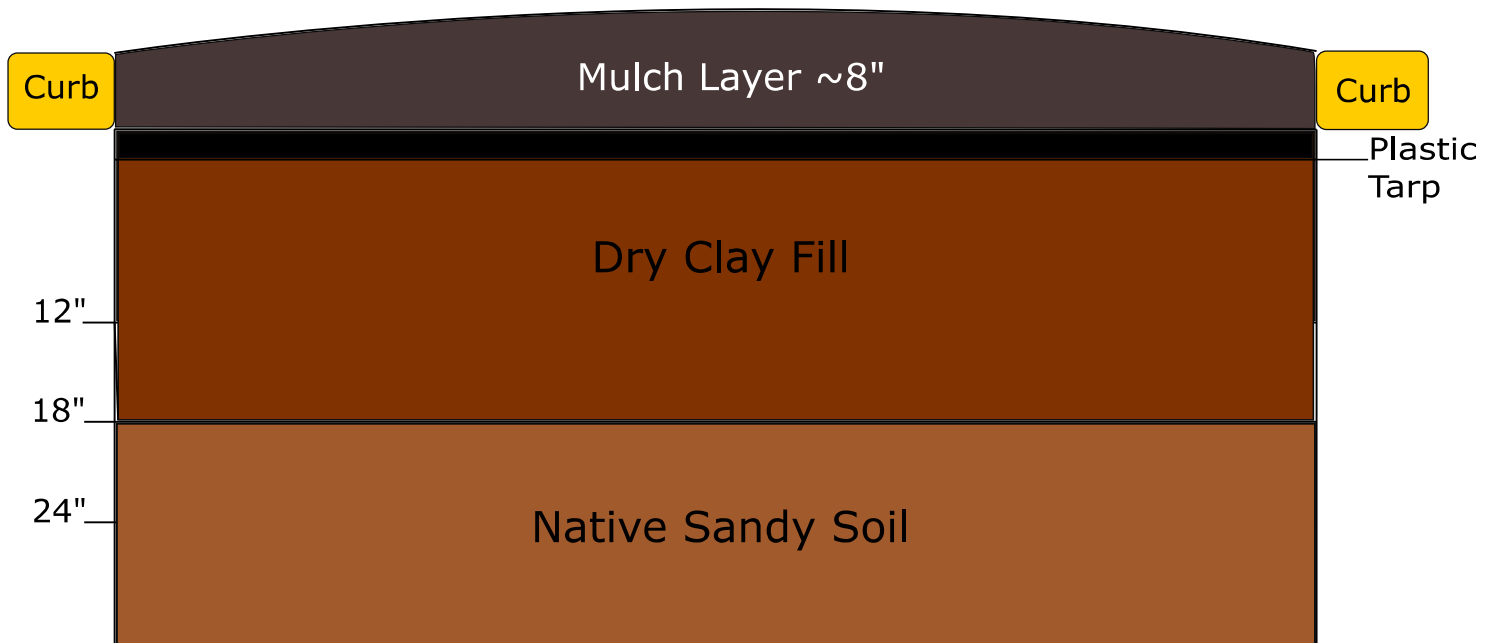


Diagram SG2: Proposed Rain Garden Soil Layers

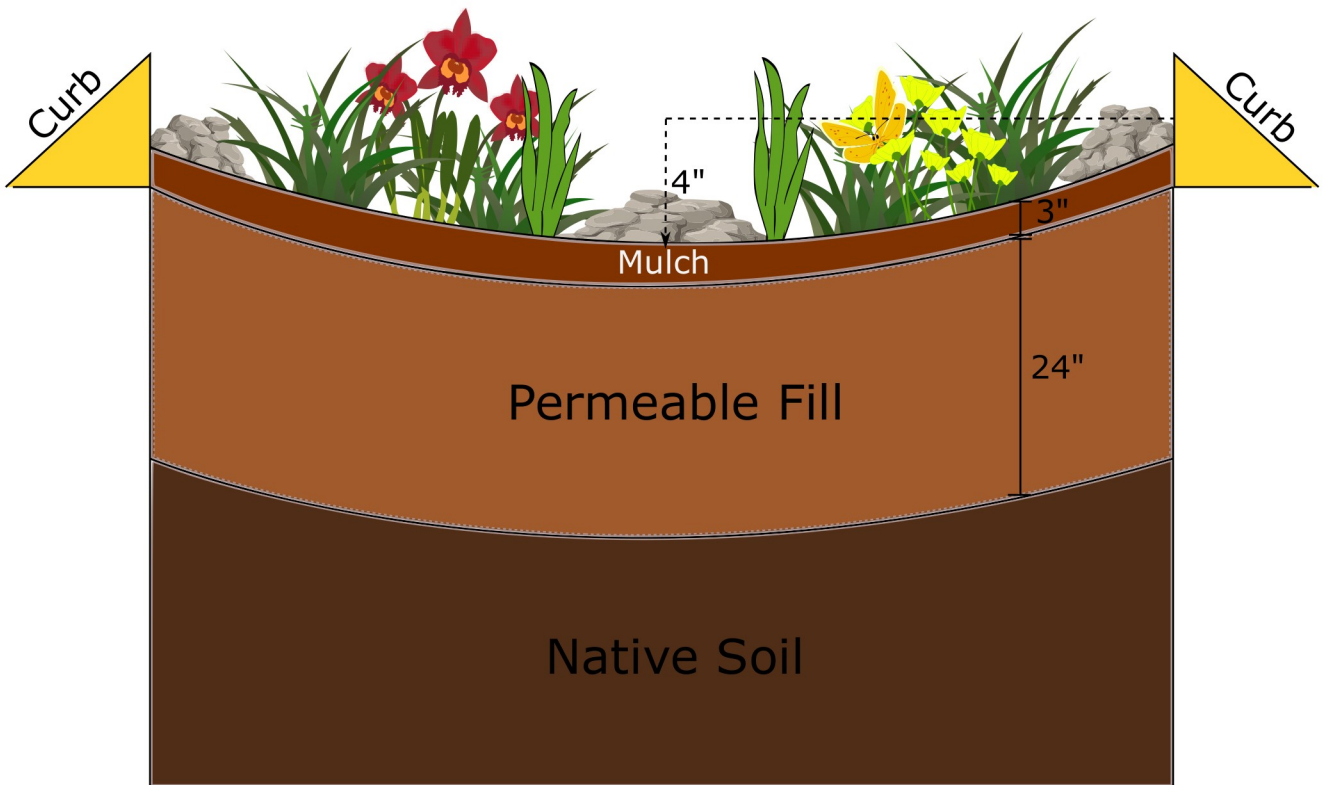


Diagram SG3: Percolation Test Results

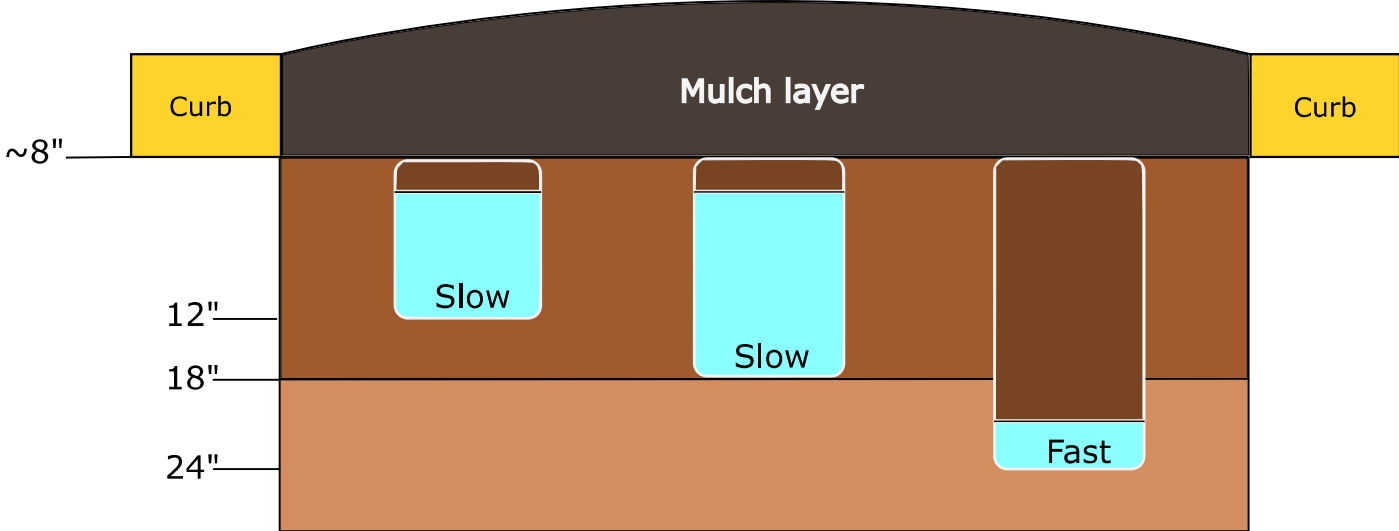
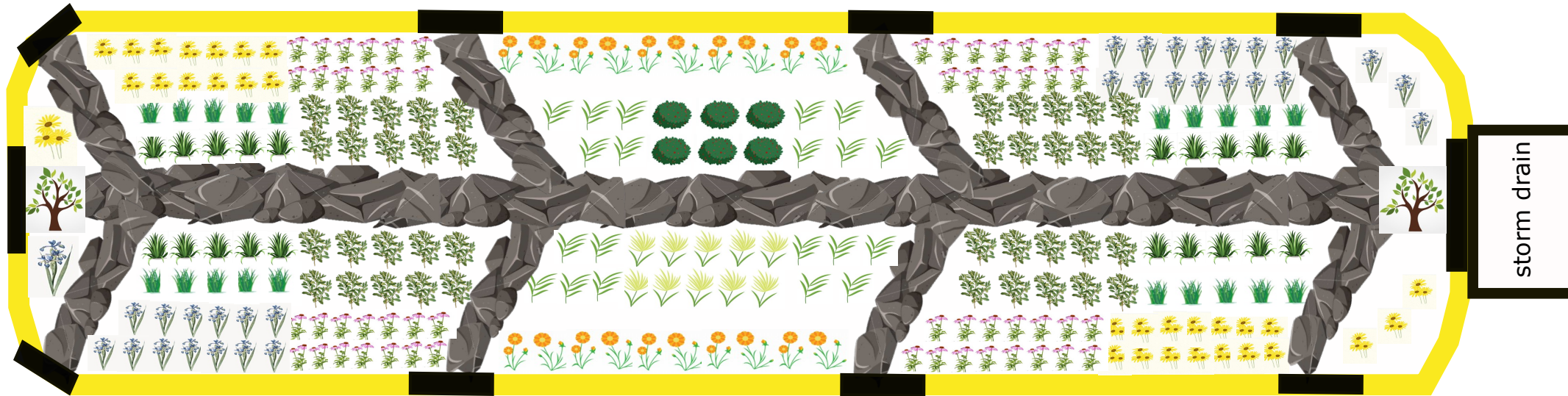














Diagram SG4: Proposed Planting Arrangement & Curb Cut Layout

130 x 10 ft



Garden is not drawn fully to scale. Spacing was determined based on specific recommendations for each plant species.

Key

- | | | | |
|--|---|---|--|
|  | - Swamp Milkweed (<i>Asclepias incarnata</i>) |  | - Northern Blue Flag (<i>Iris versicolor</i>) |
|  | - River Birch (<i>Betula nigra</i>) |  | - Switchgrass (<i>Panicum virgatum</i>) |
|  | - Marsh Marigold (<i>Caltha palustris</i>) (2) |  | - Black-eyed Susan (<i>Rudbeckia hirta</i>) |
|  | - Tussock Sedge (<i>Carex stricta</i>) |  | - Woolgrass (<i>Scirpus cyperinas</i>) |
|  | - Purple Coneflower (<i>Echinacea purpurea</i>) |  | - Little Bluestem (<i>Schizachyrium scoparium</i>) |
|  | - Inkberry (<i>Ilex glabra</i>) |  | - curb cuts |

Appendix D: Proposed Signage



This beautiful rain garden naturally filters around 96,000 gallons of storm water per year. This helps prevent pollution and restores the water to groundwater aquifers. The rain garden also consists of native plants that attract beneficial wildlife such as pollinators, insects, and birds.