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School of Environmental
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Rain Garden Measurement & Evaluation Guide

Landscape Architecture Foundation
Rutgers MLA Program • Fall 2017
By: J.M. Hartman and M. Robison

An Introduction to Rain Garden Measurement & Evaluation

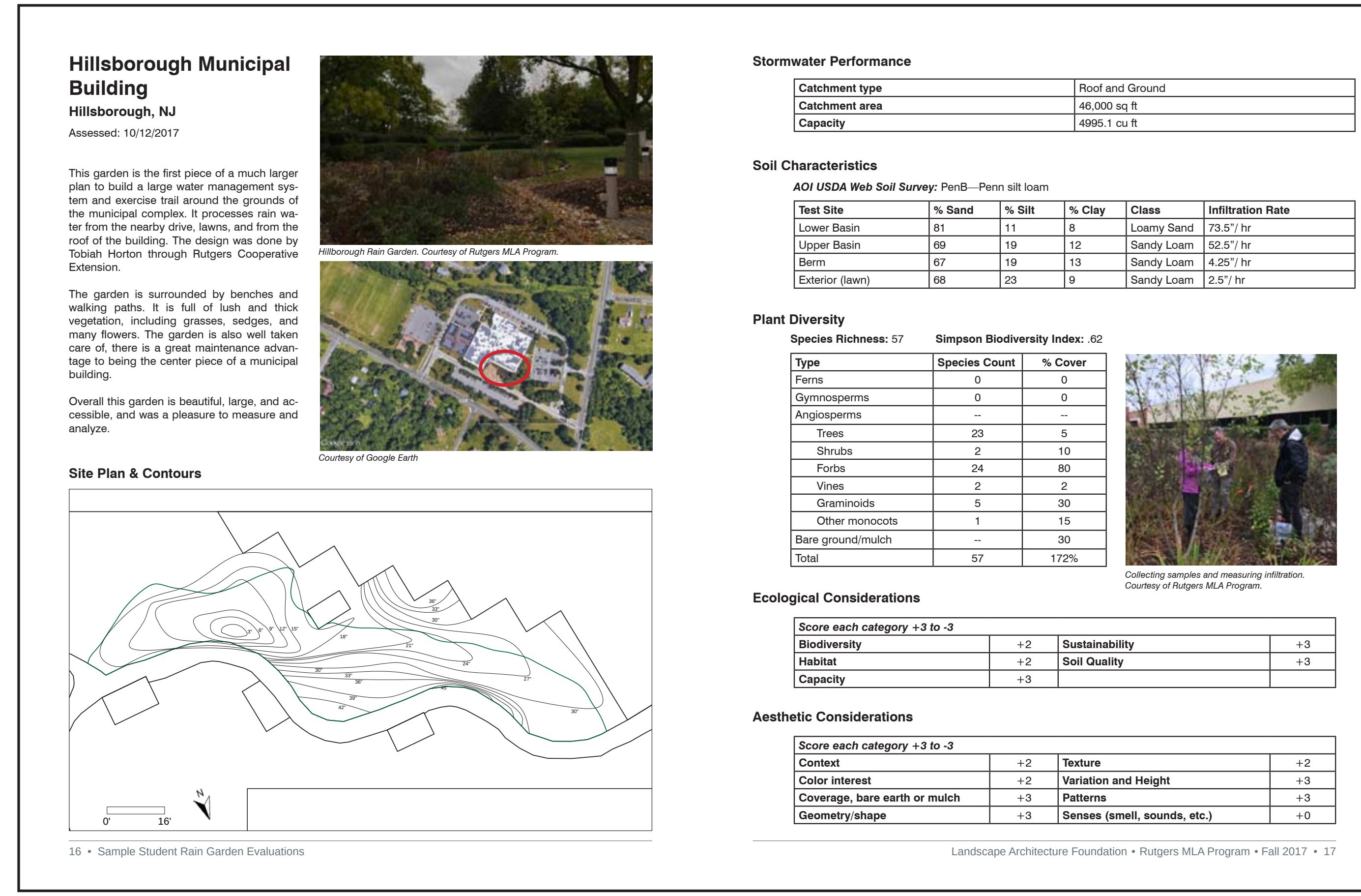
Rain gardens have been hailed as the a tremendous ecological addition to our landscapes. They are capable of reducing runoff, slowing down the flow of water, keeping water out of the sewer system, cleaning the water that passes through them, and greatly increasing local biodiversity through the inclusion of native plants. With all of these positive capabilities, it is no wonder that their virtues have been extolled far and wide by gardeners, river keepers, and ecologists alike. In this exercise, we are questioning the concept of what a rain garden can do, and assessing what they really are capable of. Do rain gardens live up to their expectations? Through a multifaceted assessment, we aim to quantifiably answer that question.

To make an objective assessment of a rain garden's performance, we chose to assess several specific characteristics:

- **Stormwater Performance**
- **Soil Characteristics & Water Infiltration**
- **Plant Diversity & Coverage**
- **Ecological Considerations**
- **Aesthetic Considerations**

Each of these contributes to the overall goals that rain gardens are thought to achieve. By making objective or quantifiable subjective assessments at a number of different rain gardens sites, we can better understand how they function and how well the gardens are achieving their purpose.

Rain gardens are important landscape tools for creating biodiversity, managing water, and adding beauty to the landscape. To determine what makes a rain garden successful, we created different rubrics by which we could measure and rate the success of the gardens. In studying, measuring, and analyzing several rain gardens we were not only able to learn how to assess a rain garden, but learn about what constitutes a successful rain garden. Through learning about what makes a rain garden succeed, we also intend to learn how to better design rain gardens.



Hillsborough Municipal Building

Hillsborough, NJ

Assessed: 10/12/2017

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The garden is surrounded by benches and walking paths. It is full of lush and thick vegetation, including grasses, sedges, and many flowers. The garden is also well taken care of, there is a great maintenance advantage to being the center piece of a municipal building.

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Hillborough Rain Garden. Courtesy of Rutgers MLA Program.

Courtesy of Google Earth

Site Plan & Contours

16 • Sample Student Rain Garden Evaluations

Stormwater Performance

Catchment type	Roof and Ground
Catchment area	46,000 sq ft
Capacity	4995.1 cu ft

Soil Characteristics

AOI USDA Web Soil Survey: PenB—Penn silt loam

Test Site	% Sand	% Silt	% Clay	Class	Infiltration Rate
Lower Basin	81	11	8	Loamy Sand	73.5"/ hr
Upper Basin	69	19	12	Sandy Loam	52.5"/ hr
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Exterior (lawn)	68	23	9	Sandy Loam	2.5"/ hr

Plant Diversity

Species Richness: 57 **Simpson Biodiversity Index:** .62

Type	Species Count	% Cover
Ferns	0	0
Gymnosperms	0	0
Angiosperms	--	--
Trees	23	5
Shrubs	2	10
Forbs	24	80
Vines	2	2
Graminoids	5	30
Other monocots	1	15
Bare ground/mulch	--	30
Total	57	172%

Collecting samples and measuring infiltration. Courtesy of Rutgers MLA Program.

Ecological Considerations

Score each category +3 to -3			
Biodiversity	+2	**Sustainability**	+3
Habitat	+2	**Soil Quality**	+3
Capacity	+3		

Aesthetic Considerations

Score each category +3 to -3			
Context	+2	**Texture**	+2
Color interest	+2	**Variation and Height**	+3
Coverage, bare earth or mulch	+3	**Patterns**	+3
Geometry/shape	+3	**Senses (smell, sounds, etc.)**	+0

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Methods of Measurement: Worksheet & Site Description

Each student was required to complete a Rain Garden Analysis Worksheet, a sample of which is illustrated above. The name of the building site, town and state, and date of assessment was noted. A brief description was also provided that included contextual and historical notes, as well as any other relevant observations. Photos are included to give a general overview of the site, provide context in the greater landscape and illustrate the relationship to nearby architecture.

The following pages will discuss the specific rain garden characteristics previously mentioned in detail, the approach to assessment and the method of measurement and data collection on the worksheet in detail.

Stormwater Performance

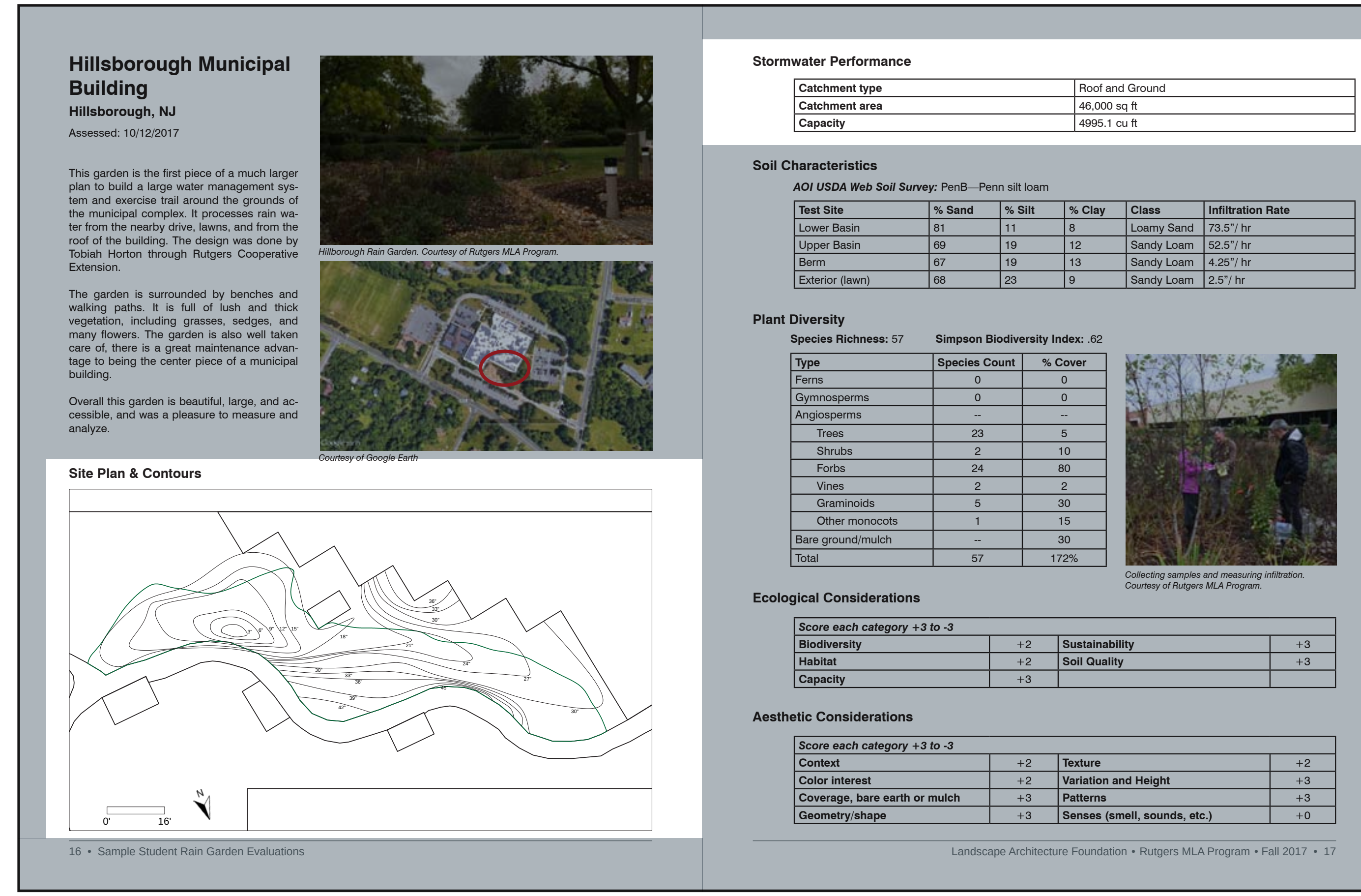
Rain water and runoff infiltration are the primary functions of rain gardens. If they cannot do this, then they really are just regular gardens, or perhaps something worse. Every rain garden should be designed to hold a certain volume of water from a predetermined catchment area. To assess the garden's performance, we measured the garden's volume. It is important that a rain garden be appropriately sized for its catchment area. If a garden is too small, it will overflow during too many rain events and not be effective at keeping water out of the storm or combined sewer system. If a garden is too large, the plants growing in it will not receive enough water, and the garden will be in a permanently droughty condition. This will likely reduce biodiversity and ground cover over time. A correctly sized garden is of prime importance to the function of the garden—managing water.

Methods of Measurement: Catchment Type, Catchment Area & Stormwater Capacity

During site visits students make observations to determine obvious catchment areas for the rain garden. These may include building roof downspouts or ground level non-permeable surfaces, such as parking lots, sidewalks and compacted lawn areas that create run-off into the garden. **Stormwater Type** was then categorized on the worksheet as *Roof, Ground* or *Roof and Ground***.**

On-site measurements and satellite images sourced from tools such as Google Maps allow students to determine reasonable approximations of a total **Catchment Area** for the rain garden and are recorded as *square feet*.

Line level measurements are taken by students at each rain garden. Spot elevations are later interpolated to create contour maps for each site. The contours allow students to calculate the volume between the berm of the rain garden and its catchment basin providing a reasonably accurate description of **Stormwater Capacity** of the rain garden and is recorded on the work sheet as *cubic feet.*



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Site Plan & Contours

0' 16'

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Capacity	+3		

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16 • Sample Student Rain Garden Evaluations

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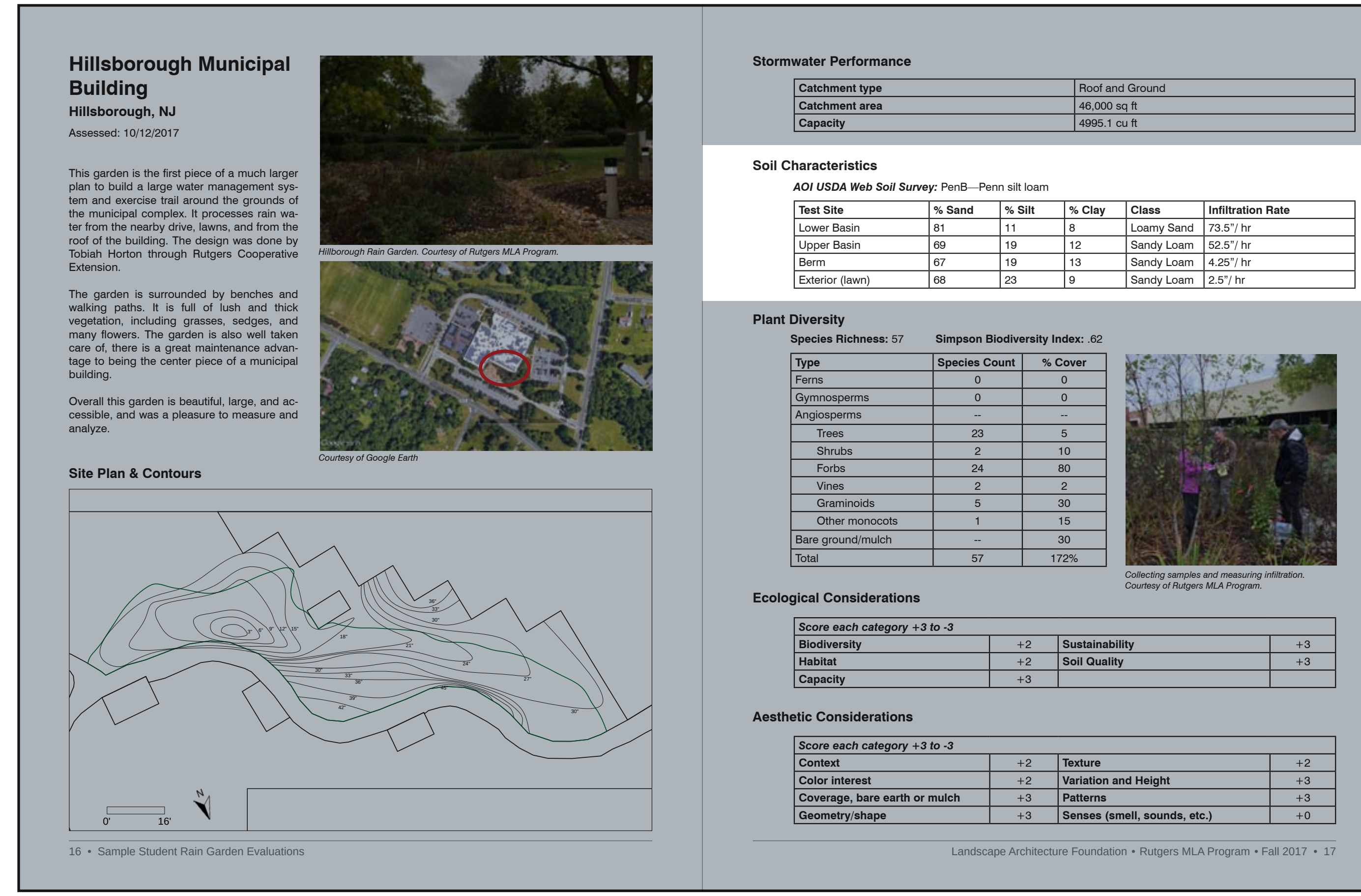
Soil Characteristics & Water Infiltration

Rain gardens need to strike a careful balance between quickly infiltrating water and holding enough water and nutrients to successfully support a diverse array of plants. If a garden has the appropriate soil texture, it will be able to do all of these things. Additionally, it will need to have different soil textures in different areas of the garden. The basin of the garden needs to infiltrate large volumes of water quickly, while the sides need to support the shape of the garden and its plantings against potential erosion. To measure the success of the gardens and to learn about which soil textures supported the best gardens, we collected soil samples from different areas of each garden. We analyzed the texture of these samples to compare them and determine how the soil supports the function of the garden. And finally, we considered the types of soils present in comparison to the results of water infiltration test results at these locations.

For a garden to effectively infiltrate water, it needs to be able to hold water long enough to hydrate the plants, but infiltrate the soil quickly enough that mosquitoes cannot begin to breed. Since infiltration is a primary function of rain gardens, measurement was of critical importance. Determining how fast a rain garden allows water to infiltrate the soil we can determine if it can do its job effectively.



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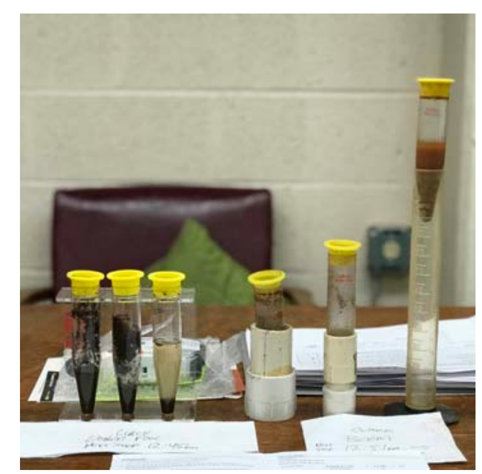
Methods of Measurement: USDA Web Soil Survey, Soil Texture Tests & Infiltration Rates

Students examine the topography of the rain garden and identify four areas for testing: *Lower Basin*, the lowest point in the rain garden; *Upper Basin*, a higher point still in the basin bowl; *Berm*, the top point of the constructed berm, or if absent, the highest limiting edge of the basin; and *Exterior*, a point in the nearby surrounding landscape, often a lawn, to compare average existing soil.

Soil samples are taken using a *tube sampler soil probe*. The samples are bagged and taken back to a lab where they are tested using a *LaMotte Soil Texture Kit.* Each sample is then noted for its percentage of each *soil separate (***sand, silt clay***)*. **Soil classification** is then determined using the *soil triangle*.



At each test site, students use an *Turf-tec Infiltrometer*, to determine the saturated soil infiltration rate (a.k.a. K_{sat}). The cutting blades are inserted into the soil test site to the level of the depth limiting ring. The double rings of the instrument are then both filled with clean water brought to the site in a collapsible bag and a timer was set for 15 minutes. A reading on the scale above the floating gauge ia taken at the end of the 15 minutes test. At sites where infiltration was particularly quick, readings were taken at shorter regular intervals. Ultimately, a one hour saturated soil **infiltration rate** was calculated for each test site from the data.

Plant Diversity & Coverage

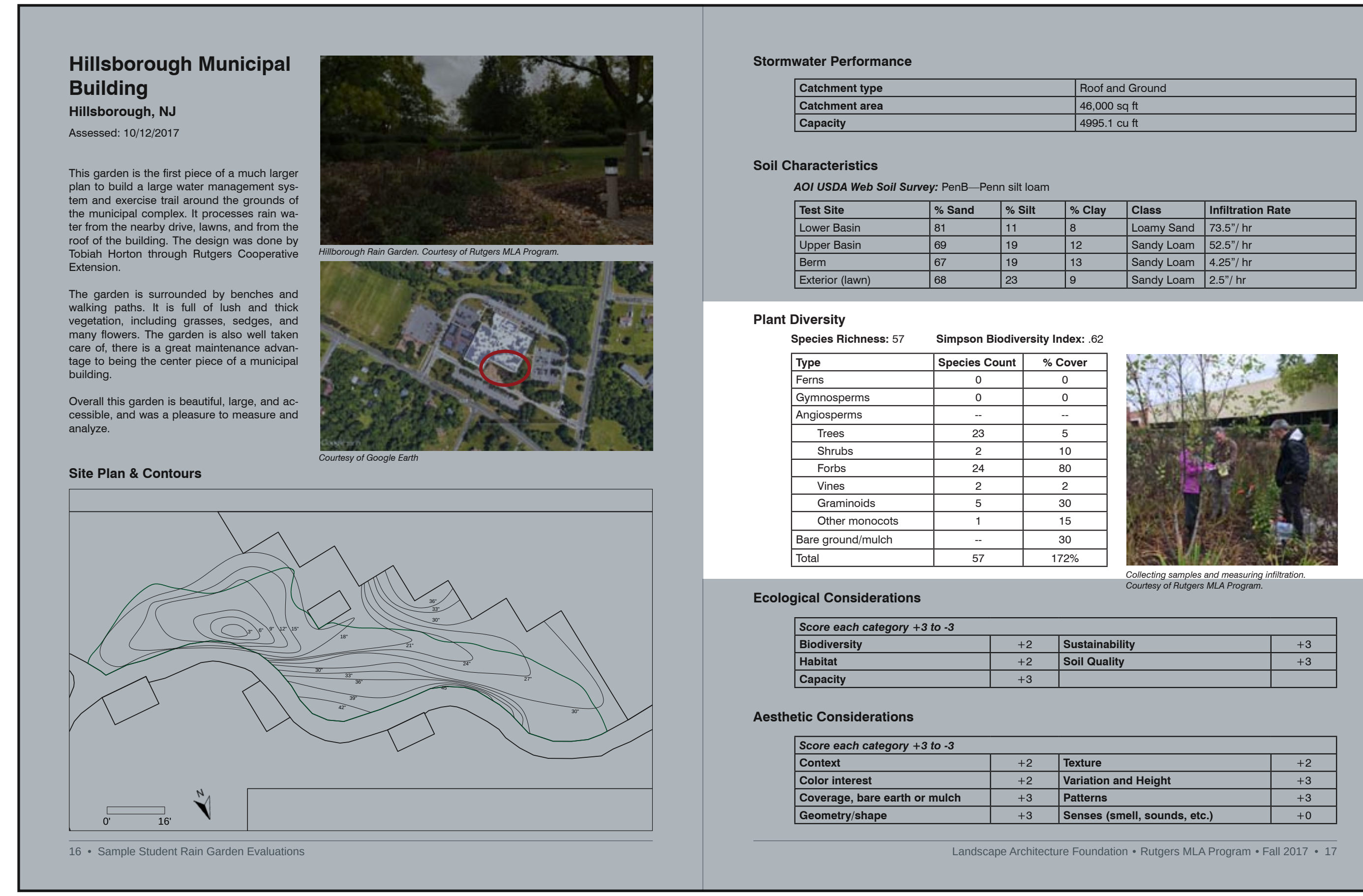
Rain gardens have abilities besides managing water, they may also be small pockets of intense biodiversity. This is not only an important secondary attribute of rain gardens, but helps support the first intention. Plants absorb water, and plant roots help to clean the water while also helping increase soil permeability. Biodiversity means more than just a few different kinds of plant species planted in the garden. It also means more than thick plant coverage. Biodiversity means that there are many different species or plants and different types of plants. To assess this aspect, we cataloged the number of plant species present for several different categories. This included every different kind of plant present in the garden, from trees to tiny weeds. Having a great number of different plant species in different categories is a good indicator that the garden that it well-constructed and healthy.

Naturally, to support greater biodiversity, a garden needs to be dense as well as diverse. We visually assessed the proportion of garden area covered by each category of plant. A garden that had good coverage in a number of different plant categories would be considered successful, while a garden with coverage from only one category or fewer categories would be less biodiverse and deemed not as successful.

Methods of Measurement: Species Count & Coverage

At each site, students survey the rain garden and, using hand shears, take small samples from each plant species present. The samples are laid out on-site and examined to remove duplicates. The students tally the number of species in each classification and record the total in the **Species Count** column. The total number of species noted on-site is used as the **Species Richness** value of the first biodiversity metric.

Plant Cover is determined by observation alone, and therefore is one of the more subjective variables recorded. Students observe the garden as a whole and for each plant classification and make



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Ecological Considerations

Score each category +3 to -3			
Biodiversity	+2	**Sustainability**	+3
Habitat	+2	**Soil Quality**	+3
Capacity	+3		

Aesthetic Considerations

Score each category +3 to -3			
Context	+2	**Texture**	+2
Color interest	+2	**Variation and Height**	+3
Coverage, bare earth or mulch	+3	**Patterns**	+3
Geometry/shape	+3	**Senses (smell, sounds, etc.)**	+0

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a determination of percentage of cover. To help remedy personal subjectivity, individual students may make their own evaluations and then confer to agree upon an average coverage percentage for each tally. Since plants of different types may layer over one another, or for example a ‘tree’ may layer over ‘bare ground,’ the **Plant Cover Total** should always exceed 100%, may often be near 200%, and in mature systems may exceed 300%.

The second biodiversity metric, the **Simpson Biodiversity Index,** reflects the probability that two species chosen at random from a community would belong to the same species. In our application, it is calculated using observed coverage scores for each category, where $D = \sum n_1(n_1\text{-}1) / N (N\text{-}1)$. Since D is a measure of species dominance, then calculate 1 - D to arrive at value that better reflects an intuitive representation of diversity. The value will always be between 0 and 1, with results closer to 1 reflecting greater biodiversity.

Ecological Considerations

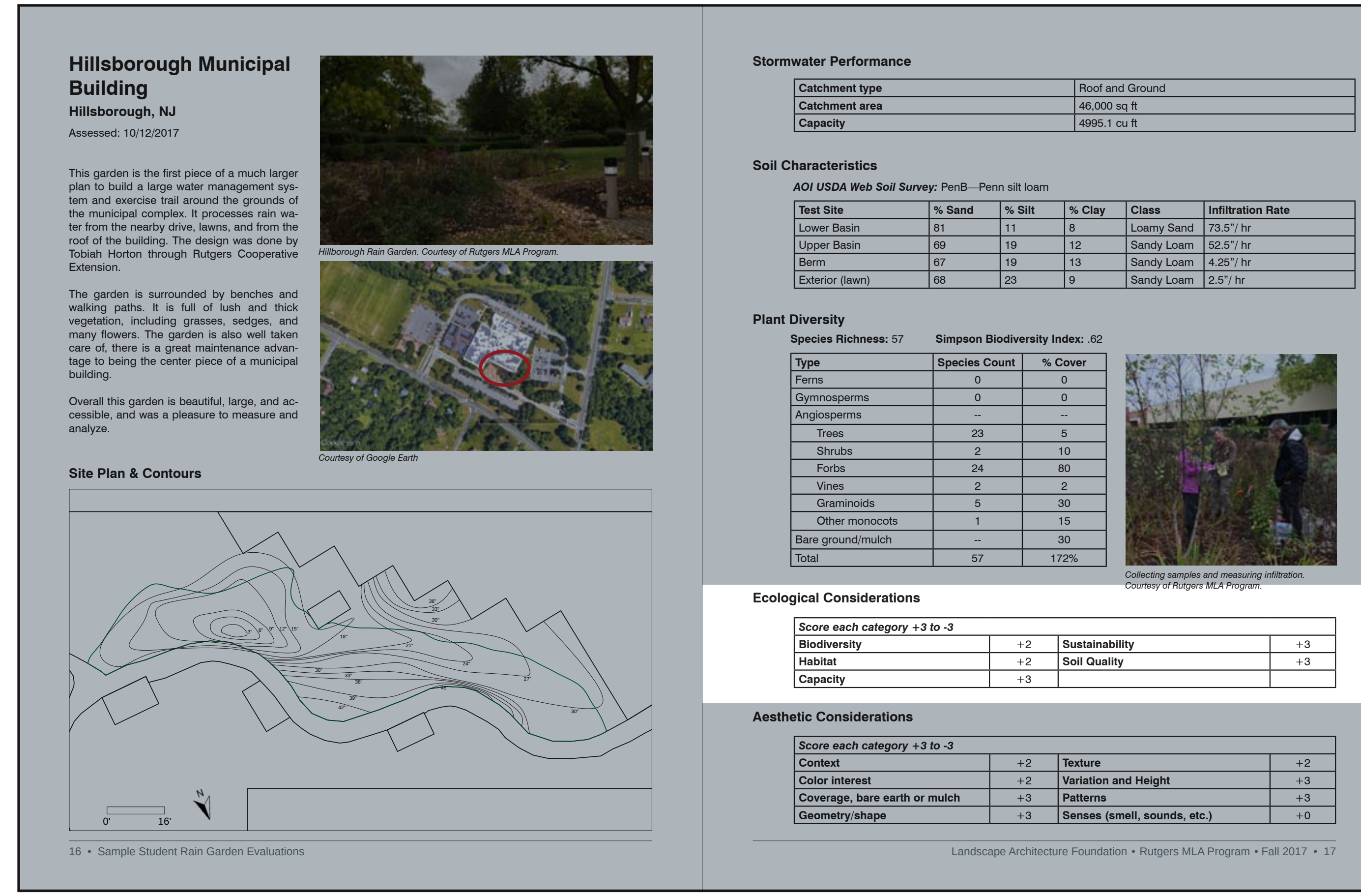
As discussed, the ecological benefits of rain garden design begin with collecting and managing stormwater run-off. As a part of this process, active measures such as soil amendment, or on-going organic processes such as the accumulation of organic materials and active root growth on the site, encourage greater soil permeability, better water infiltration and serves to rehabilitate compacted and damaged soils due to construction or foot traffic.

The ecological benefits of well-designed rain gardens go far beyond only stormwater management. Planting design can re-introduce biodiversity in an area that is otherwise lacking. These plantings can also provide habitat and food sources for a great number of wildlife species that include insects, birds and small mammals.

While we have used an existing biodiversity index to score the plant life present on site, we wanted to create another system by which we could use additional observations to determine ecological benefit.

Methods of Measurement: Ecological Scoring

We have created five broad Ecological Considerations categories: **Biodiversity, Habitat, Capacity, Sustainability** and **Soil Quality**. At the end of this guide there is a ***Rain Garden Assessment, Ecological & Aesthetic Considerations Checklist*** worksheet that includes questions one may ask themselves to help determine whether a rain garden exhibits these positive qualities or is fundamentally lacking in some ways. The questions are meant to be straight-forward and simple to understand, so that the assessment may be done by anyone, even those without a deeper understanding of ecology. Based upon the on-site



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rain garden observations, each Ecological Considerations category should be given a score from -3 to +3. We hope that this scoring approach will allow a reviewer to quickly assess the overall perceived ecological health of a site.

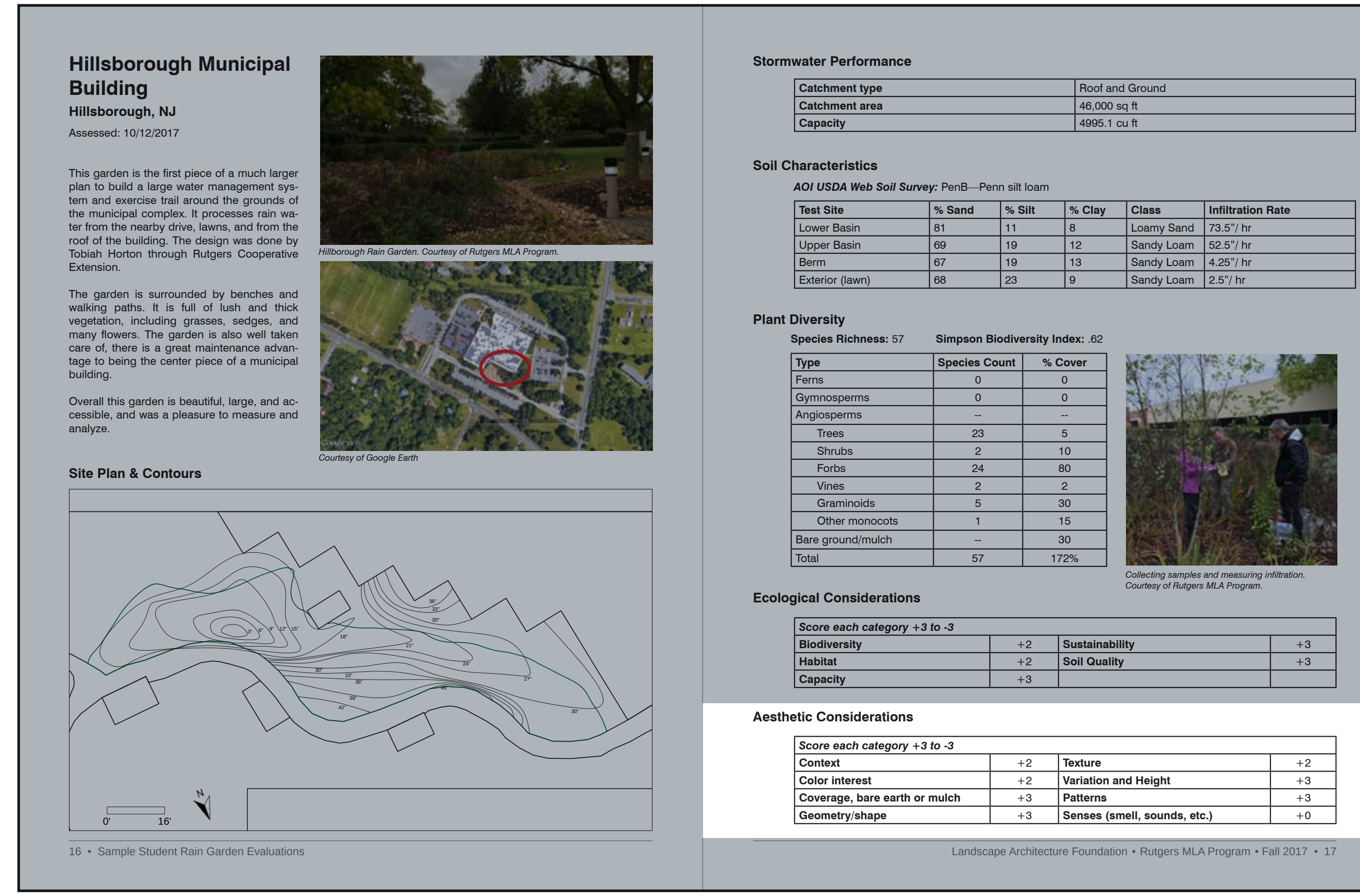
Aesthetic Considerations

While water and biodiversity are the reasons why people build rain gardens, it is people who are building them. If people find them attractive, they may want more. If they are found to be messy, ugly eyesores, they will be disdained. Therefore, we chose to make an aesthetic assessment along with our other assessments. While more subjective than the other assessments, it is also important.

As it is subjective by nature, it was more challenging to create a reliable method of assessment. While other aspects are quantifiable and measurable, this one depends far more on the opinion of the person making the assessment. To reduce the variability of this assessment and to give it some structure, we broke it down into different categories that could be assessed on a numerical scale. While still a subjective assessment, this allowed us to quantify aesthetics on a rubric and make comparisons between the different gardens analyzed.

Methods of Measurement: Aesthetic Scoring

The Aesthetic Considerations are divided into eight categories: **Context, Color Interest, Coverage, Geometry/Shape, Texture, Variation & Height, Patterns and Senses**. Again, at the end of this guide there is a ***Rain Garden Assessment, Ecological & Aesthetic Considerations Checklist*** worksheet that will help one conducting an assessment determine the positive, neutral or negative score for each category. The questions are meant to be thought-starters and do not constitute an entirely comprehensive exploration of each category. As each viewer will apply their own perspective as to what qualities are aesthetically pleasing and noting that each site is contextually unique, the assessor should apply their own best judgment



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when scoring each site. Based upon their observations each Aesthetic Considerations category should be given a score from -3 to +3.

RAIN GARDEN ASSESSMENT ECOLOGICAL & AESTHETIC CONSIDERATIONS CHECKLIST

Site Location: Date:

Score each category from +3 to -3. Consider questions below each category to inform your score.

Ecological Considerations		Aesthetic Considerations	
Biodiversity		**Context**	
Are there a significant number of plant species present?		Is the garden suited to its surroundings?	
Are the species of different habits? (ferns, grasses, forbs, woody)		Does design work with nearby buidings?	
Are there multiple flowering species?		Do the plants fit in the greater plant community?	
Are there multiple woody species?			
Are there multiple grasses or other monocot species?		**Color Interest**	
		Is color a tasteful part of the design?	
Habitat		Do the colors work well together?	
Are there obvious signs of insects? (visible or leaf damage)		If only green, is there pleasing variation?	
Are there signs of butterflies or moths? (visible or chrysalis)			
Are there signs of bees, wasps or other pollinators?		**Coverage, Bare earth or mulch**	
Are there signs of birds?		Does the garden appear appropriately "full"?	
Are there signs of small mammals or other animals? (amphibians)		Is there little or no bare earth visible?	
		Are unplanted areas well-tended?	
Capacity			
Is there an obvious, significant depth to the retention area?		**Geometry use / shape**	
Is the area of capture depth significantly broad?		Does the shape of the garden suit the larger site?	
Is there a berm around the retention area?		Is the overall garden shape pleasing?	
Is garden of significant size to handle catchment areas?		Are any other geometric factors (e.g. hardscaping) used well?	
Is there an overflow catchment system in place (drain, basin)?			
		Texture	
Sustainability		Is there a good use of texture in the overall design?	
Is there no standing water?		Do the textures of the hardscaping work with plantings?	
Does water quickly drain from basin point during infiltration test?		Is their pleasing variation in foliage texture?	
Does the area receive full or part sun conditions?			
Does the garden receive runoff that is free of sediments?		**Variation and Height**	
Are plants healthy, dense and free of invasive weeds?		Are there a variety of plant species?	
		Are there woody structural elements for winter interest?	
Soil Quality		Is their a pleasing variation in plant height?	
Is soil texture suited to drain well?			
Is soil loose and pourous with no obvious compaction?		**Patterns**	
Visible presence of orgnaic material?		Are there pleasing massings of plantings?	
Presence of black soils?		Is there a good use of repetition and rhythm?	
Lack of grey, green or mottled soils?			
		Senses (smells, sounds, etc)	
Other notes:		Are there pleasant smells present?	
		Do you notice pleasing sounds (water, foliage rustle)?	
		Are your senses peaked in any other ways?	

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Sample Student Rain Garden Evaluations

Landscape Architecture Foundation
Rutgers MLA Program • Fall 2017

Hillsborough Municipal Building

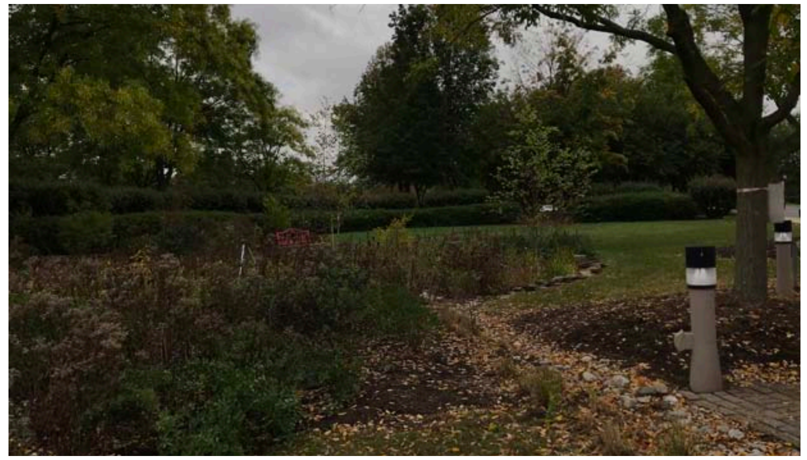
Hillsborough, NJ

Assessed: 10/12/2017

This garden is the first piece of a much larger plan to build a large water management system and exercise trail around the grounds of the municipal complex. It processes rain water from the nearby drive, lawns, and from the roof of the building. The design was done by Tobiah Horton through Rutgers Cooperative Extension.

The garden is surrounded by benches and walking paths. It is full of lush and thick vegetation, including grasses, sedges, and many flowers. The garden is also well taken care of, there is a great maintenance advantage to being the center piece of a municipal building.

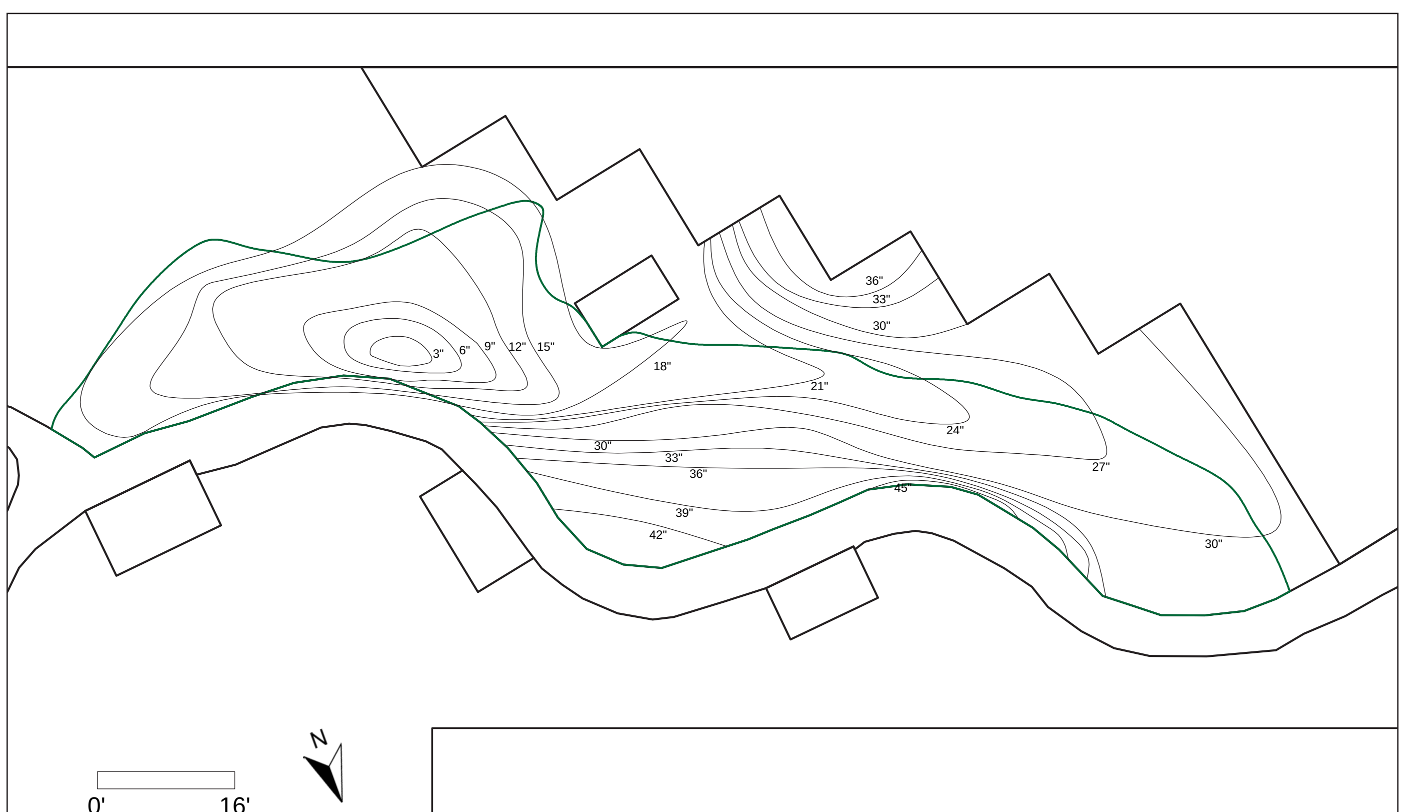
Overall this garden is beautiful, large, and accessible, and was a pleasure to measure and analyze.



Hillborough Rain Garden. Courtesy of Rutgers MLA Program.

Courtesy of Google Earth

Site Plan & Contours



Stormwater Performance

Catchment type	Roof and Ground
Catchment area	46,000 sq ft
Capacity	4995.1 cu ft

Soil Characteristics

AOI USDA Web Soil Survey: PenB—Penn silt loam

Test Site	% Sand	% Silt	% Clay	Class	Infiltration Rate
Lower Basin	81	11	8	Loamy Sand	73.5"/ hr
Upper Basin	69	19	12	Sandy Loam	52.5"/ hr
Berm	67	19	13	Sandy Loam	4.25"/ hr
Exterior (lawn)	68	23	9	Sandy Loam	2.5"/ hr

Plant Diversity

Species Richness: 37 **Simpson Biodiversity Index:** .62

Type	Species Count	% Cover
Ferns	0	0
Gymnosperms	0	0
Angiosperms	--	--
Trees	3	5
Shrubs	2	10
Forbs	24	80
Vines	2	2
Graminoids	5	30
Other monocots	1	15
Bare ground/mulch	--	30
Total	37	172%

Collecting samples and measuring infiltration. Courtesy of Rutgers MLA Program.

Ecological Considerations

Score each category +3 to -3			
Biodiversity	+2	**Sustainability**	+3
Habitat	+2	**Soil Quality**	+3
Capacity	+3		

Aesthetic Considerations

Score each category +3 to -3			
Context	+2	**Texture**	+2
Color interest	+2	**Variation and Height**	+3
Coverage, bare earth or mulch	+3	**Patterns**	+3
Geometry/shape	+3	**Senses (smell, sounds, etc.)**	+0

Jonathan Dayton High School

Springfield, NJ

Assessed: 10/19/2017

Located directly in front of and running the entire length of the high school, this large rain garden was designed to capture runoff from roof and other ground source areas of the site.

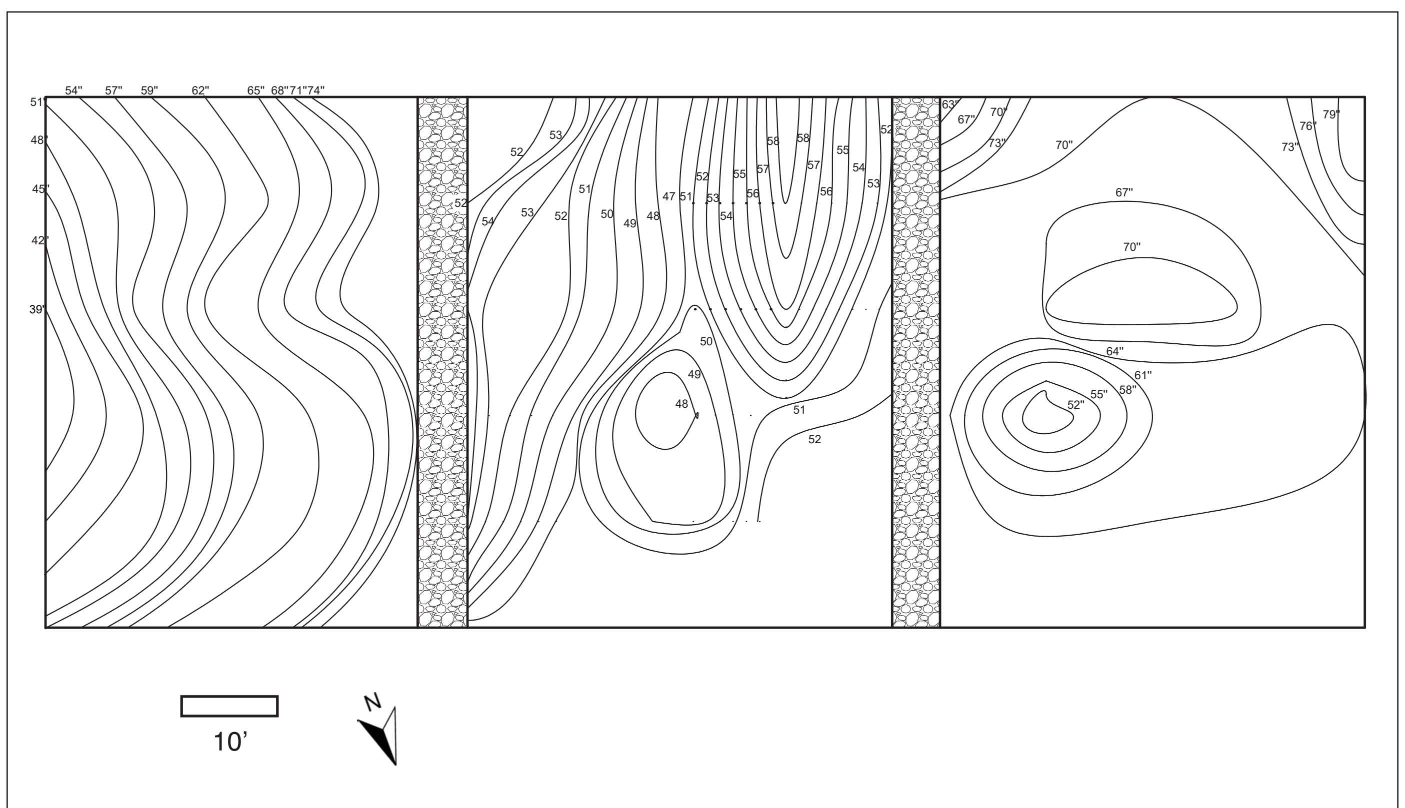
The garden is well-designed and has a multitude of different native species present significantly providing biodiversity in the urbanized suburb of Springfield, NJ. Even in later October, the use of the site as habitat for birds, butterflies and small mammals was readily evident.

The garden is thriving with little evidence of undesirable volunteer species while exhibiting excellent coverage and biodiversity.

Dayton High School Rain Garden. Courtesy of Rutgers MLA Program.

Courtesy of Google Maps

Site Plan & Contours



Stormwater Performance

Catchment type	Roof and Ground
Catchment area	24,954 sq ft
Capacity	697 cu ft

Soil Characteristics

AOI USDA Web Soil Survey: DuuA—Dunellen-Urban land complex

Test Site	% Sand	% Silt	% Clay	Class	Infiltration Rate
Lower Basin	80	12	7	Loamy Sand	150”/ hr
Upper Basin	68	22	10	Sandy Loam	105”/ hr
Berm	85	9	6	Sandy Loam	18”/ hr
Exterior (lawn)	59	31	10	Sandy Loam	6.6”/ hr

Plant Diversity

Species Richness: 51 **Simpson Biodiversity Index:** .71

Type	Species Count	% Cover
Ferns	1	1
Gymnosperms	1	3
Angiosperms	--	--
Trees	6	10
Shrubs	6	15
Forbs	29	70
Vines	1	1
Graminoids	6	30
Other monocots	1	20
Bare ground/mulch	--	25
Total	51	175%

Multi-layered section of the large rain garden. Courtesy of Rutgers MLA Program.

Ecological Considerations

Score each category +3 to -3			
Biodiversity	+3	**Sustainability**	+2
Habitat	+3	**Soil Quality**	+3
Capacity	+1		

Aesthetic Considerations

Score each category +3 to -3			
Context	+0	**Texture**	+1
Color interest	+2	**Variation and Height**	+1
Coverage, bare earth or mulch	+3	**Patterns**	+1
Geometry/shape	+2	**Senses (smell, sounds, etc.)**	+3

Cook-Douglas Lecture Hall Rain Garden

New Brunswick, NJ

Assessed: 9/14/2017

This rain garden is located adjacent to Cook-Douglas Lecture Hall, a long-term 'temporary' structure on the Rutgers New Brunswick Campus.

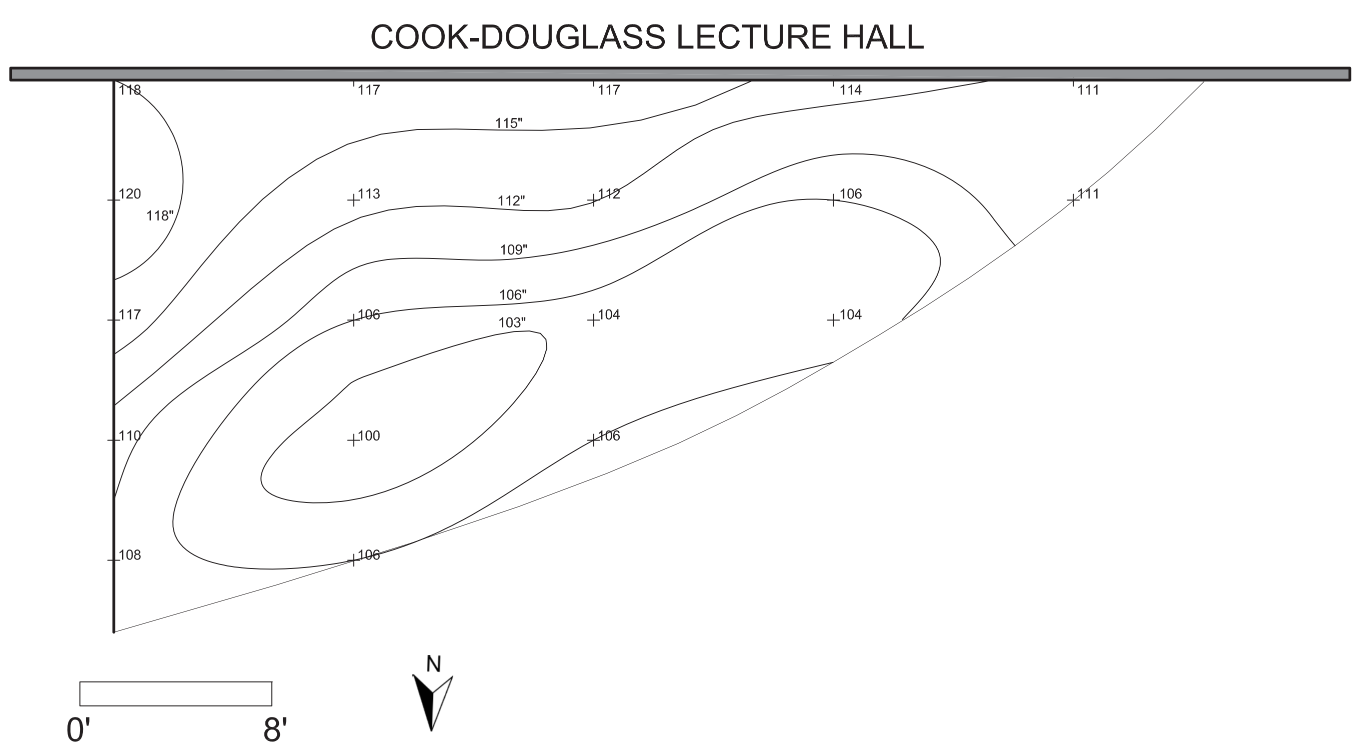
Positioned on the north facing side of the building it receives little sunlight. It is fed runoff from downspouts that account for approximately one-quarter of the building's coverage. Additionally, soil sampling reveals that the site's soil were likely never amended or replaced as the basin soils are largely clay and prone to allowing for standing water for extended periods of time.

Overall, this rain garden is not successfully managing stormwater, and as a result, is also not successfully supporting plant life or providing additional ecological value.

CDL Rain Garden. Courtesy of Rutgers MLA Program.

Courtesy of Google Maps

Site Plan & Contours



Stormwater Performance

Catchment type	Roof
Catchment area	2,710 sq ft
Capacity	34.33 cu ft

Soil Characteristics

AOI USDA Web Soil Survey: DuuA—Dunellen-Urban land complex

Test Site	% Sand	% Silt	% Clay	Class	Infiltration Rate
Lower Basin	48	49	4	Sandy Loam	0"/hr (Standing Water)
Upper Basin	62	34	4	Sandy Loam	.5"/ hr
Berm	78	13	9	Sandy Loam	.75"/ hr
Exterior (lawn)	66	27	7	Sandy Loam	.75"/ hr

Plant Diversity

Species Richness: 29 **Simpson Biodiversity Index:** .76

Type	Species Count	% Cover
Ferns	0	0
Gymnosperms	0	0
Angiosperms	--	--
Trees	2	20
Shrubs	2	15
Forbs	15	25
Vines	2	2
Graminoids	8	15
Other monocots	0	0
Bare ground/mulch	--	80
Total	29	157%

A few planted grasses remain, otherwise volunteers dominate the rain garden.

Ecological Considerations

Score each category +3 to -3			
Biodiversity	+3	**Sustainability**	+2
Habitat	+3	**Soil Quality**	+3
Capacity	+1		

Aesthetic Considerations

Score each category +3 to -3			
Context	-1	**Texture**	-3
Color interest	-2	**Variation and Height**	0
Coverage, bare earth or mulch	-3	**Patterns**	-2
Geometry/shape	-2	**Senses (smell, sounds, etc.)**	-3

Blake Hall Rain Garden

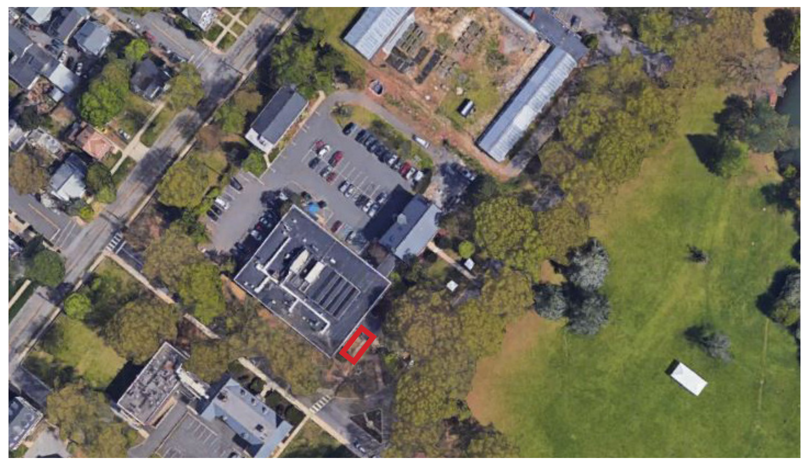
New Bruswick, NJ

Assessed: 9/7/2017

The small rain garden outside of the Rutgers Landscape Architecture Department. It was dominated by irises and vairous shrubs. The plant material was frequently supplemented with plants leftover from other projects, and so its appearance was a bit haphazard. There were not a lot of showy plants, so for much of the year it was not particularly interesting. After rain events it would slowly infiltrate the rain water so that all standing water would be gone within 1-2 days.

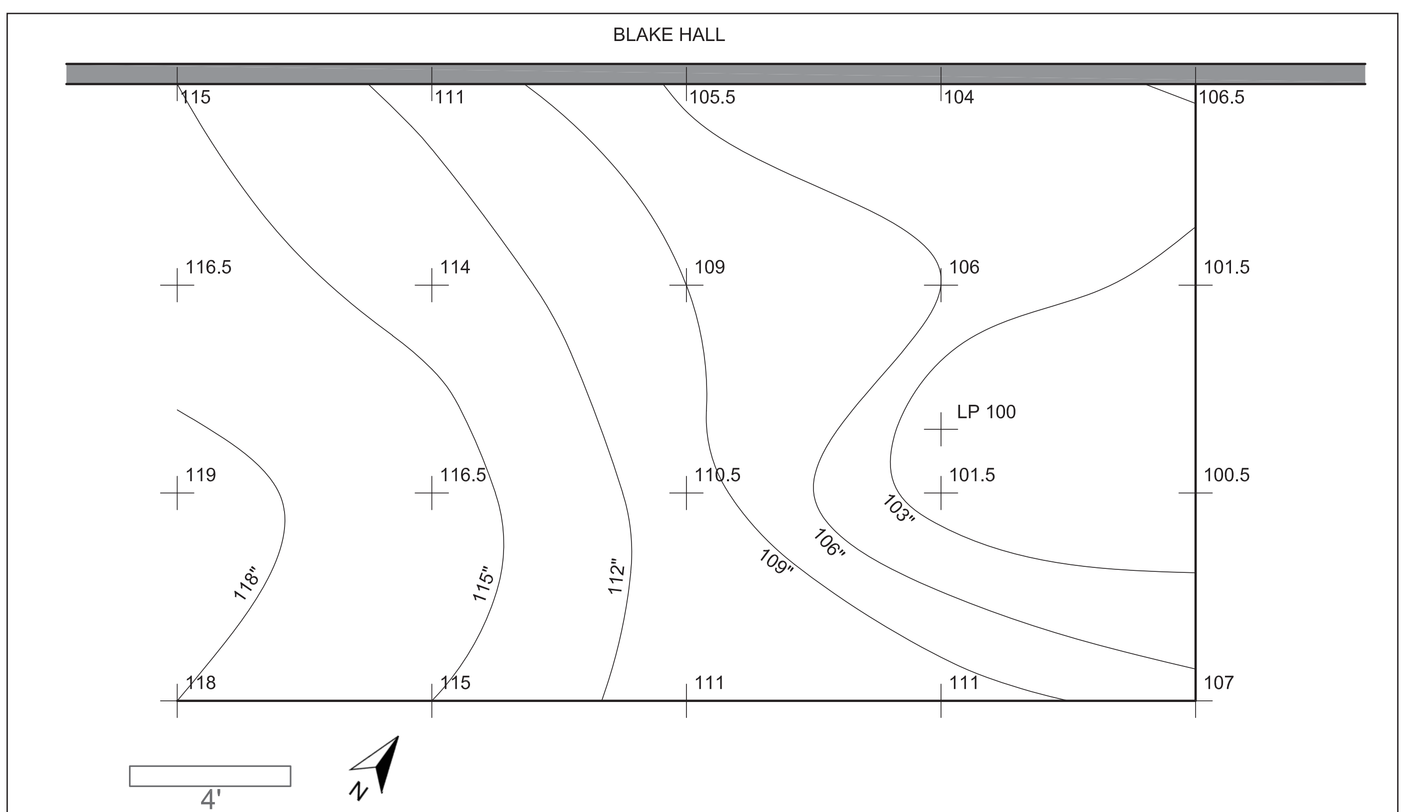
The garden was completely renovated this fall, and so certain metrics are left blank because they were not collected before the renovation.

Students assessing Blake Rain Garden. Courtesy of Rutgers MLA Program.



Courtesy of Google Maps

Site Plan & Contours



Stormwater Performance

Catchment type	Roof
Catchment area	324.5 sq ft
Capacity	228 cu ft

Soil Characteristics

AOI USDA Web Soil Survey: NkbP Nixon-Urban land complex

Test Site	% Sand	% Silt	% Clay	Class	Infiltration Rate
Lower Basin	na	na	na	na	78.75"/ hr
Upper Basin	na	na	na	na	2.5"/ hr
Berm	na	na	na	na	na
Exterior (lawn)	na	na	na	na	22.5"/ hr

Plant Diversity

Species Richness: 47 **Simpson Biodiversity Index:** .70

Type	Species Count	% Cover
Ferns	3	3
Gymnosperms	0	0
Angiosperms	--	--
Trees	2	20
Shrubs	8	20
Forbs	28	60
Vines	0	0
Graminoids	3	10
Other monocots	3	15
Bare ground/mulch	--	25
Total	47	153%

Testing infiltration rates among the Itea virginica. Courtesy of Rutgers MLA Program.

Ecological Considerations

Score each category +3 to -3			
Biodiversity	+2	**Sustainability**	+1
Habitat	+0	**Soil Quality**	+1
Capacity	+1		

Aesthetic Considerations

Score each category +3 to -3			
Context	+0	**Texture**	-2
Color interest	-2	**Variation and Height**	+1
Coverage, bare earth or mulch	+1	**Patterns**	+0
Geometry/shape	+3	**Senses (smell, sounds, etc.)**	-1

Arthur L. Johnson High School

Clark, NJ

Assessed: 10/5/2017

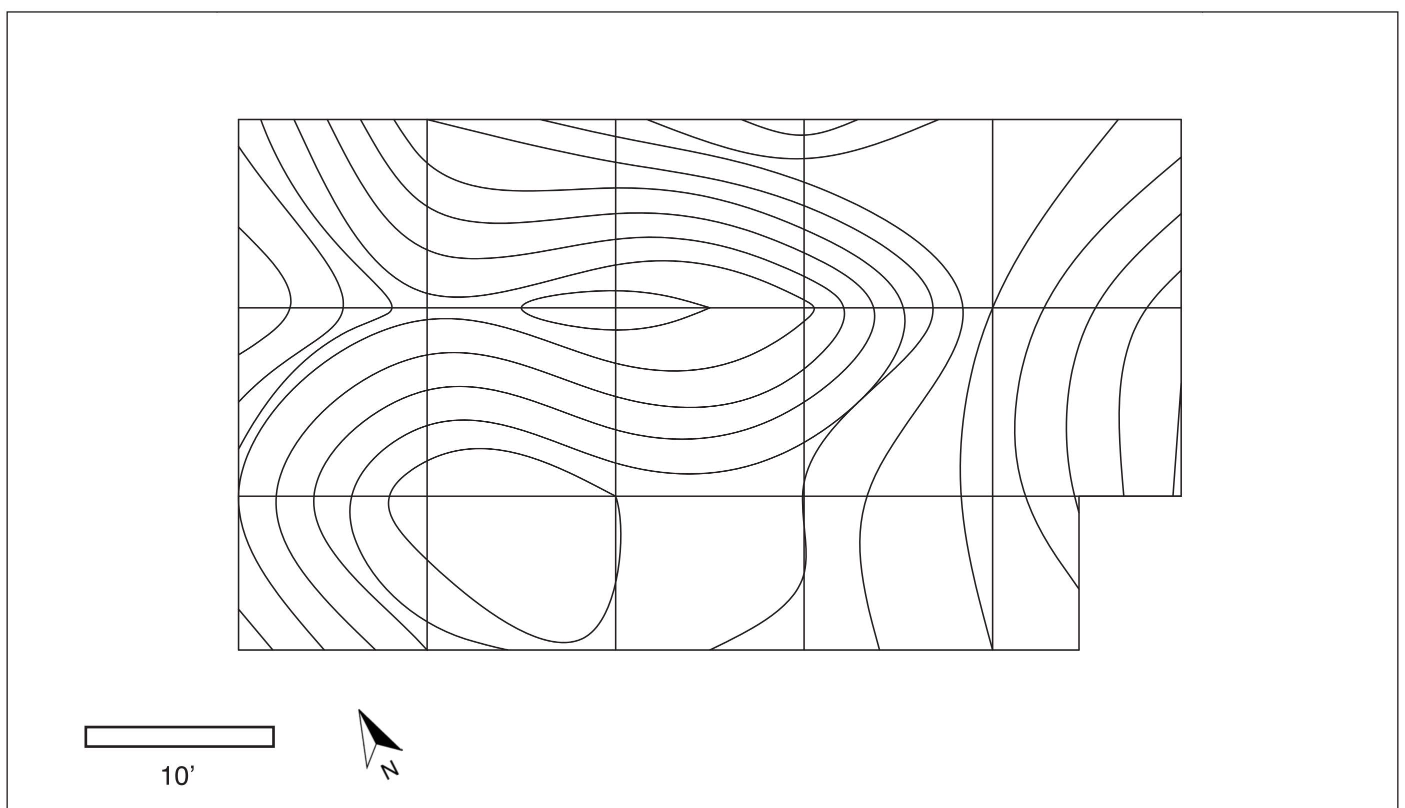
The rain garden was developed in a partnership between the Clark Department of Public Works, the Arthur L. Johnson High School and the Rutgers Cooperative Extension as an overflow area for a Sustainable Car Wash frequently run by students. The site was designed so that rinse water from the car wash would run from a parking lot directly into the garden. Unfortunately, the catchment area also includes a substantial portion of the Public Works parking area which is paved only with stone dust. This creates a substantial amount of erosion deposition at the inlet of the garden.

While a good effort and a structurally successful design, the blocking deposition and the introduction of several undesirable invasive species means the garden needs a considerable amount of maintenance to improve its ongoing performance.

Clark High School Rain Garden. Courtesy of Rutgers MLA Program.

Courtesy of Bing Maps

Site Plan & Contours



Stormwater Performance

Catchment type	Ground
Catchment area	34,000 sq ft
Capacity	1,125 cu ft

Soil Characteristics

AOI USDA Web Soil Survey: HatB—Haledon-Urban land-Hasbrouck complex

Test Site	**% Sand**	**% Silt**	**% Clay**	**Class**	**Infiltration Rate**
Lower Basin	67	23	10	Sandy Loam	19.5"/ hr
Upper Basin	na	na	na	na	na
Berm	45	45	10	Loam	21"/ hr
Exterior (lawn)	67	15	19	Sandy Loam	4.5"/ hr

Plant Diversity

Species Richness: 22 **Simpson Biodiversity Index:** .63

Type	**Species Count**	**% Cover**
Ferns	0	0
Gymnosperms	0	0
Angiosperms	--	--
Trees	3	10
Shrubs	2	12
Forbs	11	85
Vines	0	0
Graminoids	5	60
Other monocots	1	5
Bare ground/mulch	--	20
Total	22	192%

Late season seed heads provide food souces. Courtesy of Rutgers MLA Program.

Ecological Considerations

Score each category +3 to -3			
Biodiversity	-1	**Sustainability**	-1
Habitat	+1	**Soil Quality**	+2
Capacity	-1		

Aesthetic Considerations

Score each category +3 to -3			
Context	-1	**Texture**	+1
Color interest	+0	**Variation and Height**	+1
Coverage, bare earth or mulch	+2	**Patterns**	+1
Geometry/shape	+0	**Senses (smell, sounds, etc.)**	-1