The MSU Union Green

EPA Campus Rainworks Challenge 2013

Project Location
Mississippi State University

Registration number: S35

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The “Cloud” Sculpture, located at the center of the site, symbolizes the natural hydrologic cycle and emits a light mist on summer days.

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Site Design

Bio-retention facilities are incorporated into the terraces of the amphitheater and are connected to a 10,000 gallon sub-surface cistern.

Project Abstract

Project Overview:

- Mitigates over 99% of the average annual rainfall runoff for 1.29 acres of campus
- Mitigates 2-year / 24 hour event to pre-settlement conditions
- Creates an outdoor dining and seating space for the campus
- Three BMPs types adapted to local site conditions
- Kiosks provide public education on sustainable stormwater management

The purpose of our design is to create a site that manages stormwater quality and quantity. The Union Green, located at the epicenter of campus, will be a model for current green infrastructure practices, displaying bio-retention cells, cisterns, pervious pavement, and our unique water conveyance system. The goal of our design is to efficiently and effectively manage stormwater runoff by decreasing the amount of impervious area on site, incorporating on-site water treatment facilities, and utilizing recycled materials. The site design reflects the ethos of the campus master plan through the preservation of tradition, improving campus life, and promoting a belief of stewardship and sustainability.

In continuation of academic excellence, The Union Green will serve as an outdoor classroom, providing learning experiences for all students and visitors.

Users will have the opportunity to interact with the site through information kiosks that explain aspects of stormwater management and its importance to the community. These elements will contribute to the value of campus life by creating social infrastructure and encouraging interaction amongst peers. It is our goal that Mississippi State University become a trailblazer for sustainable stormwater management design.

The Union Green site design provides a comprehensive framework for green infrastructure and social and educational foundation for this special space on campus. The design displays principles of low impact development which are flexible to accommodate changing cultural and academic needs. The site's composition preserves and contributes to the value of our long-standing history which continues to grow. Through innovation, the design aims to enhance the formal educational experience for students in an informal learning environment while promoting socialization amongst students. In conjunction with the University's Master Plan goals, the site design fosters connectivity throughout the campus by complimenting the traditional architectural style of campus buildings and landscape.

EPA Rainworks Challenge 2013 Video
http://www.youtube.com/watch?v=KtAvz5iSTGA

Master Plan

1. Partial Infiltration Basin
2. Elevated Aqueduct
3. Native Understory Garden
4. Recycled Composite Deck
5. The “Cloud” Sculpture
6. Trench Drain
7. Sea-glass Paving
8. Pervious Concrete
9. Accessible Ramp
10. Amphitheater Lawn
11. Partial Infiltration Planter
12. Information Kiosk
13. Pervious Paver Parking

1. Partial Infiltration Basin
2. Elevated Aqueduct
3. Native Understory Garden
4. Recycled Composite Deck
5. The “Cloud” Sculpture
6. Accessible Ramp
7. Partial Infiltration Planter
8. Amphitheater Lawn

Function:
The Union Green functions as the heart of campus. It is the threshold at which students and faculty cross each day, to commute to class and work. This design provides connectivity to most of the campus' eateries, including the historical Perry Dining Hall, State Fountain Bakery and the University's florist and newspaper. This multifunctional space allows socialization to occur with formal and informal outdoor seating, while providing an educational exhibition for sustainable site design

Innovation:
Innovation is achieved through the design's combination of partial infiltration systems, cisterns, recycled materials, the artistic rain features. These components add richness to our campus' landscape, being the first site on campus that emphasizes stormwater management. As trailblazers of sustainable stormwater management, we will continue to advocate for the implementation of green infrastructure on Mississippi State University's campus.

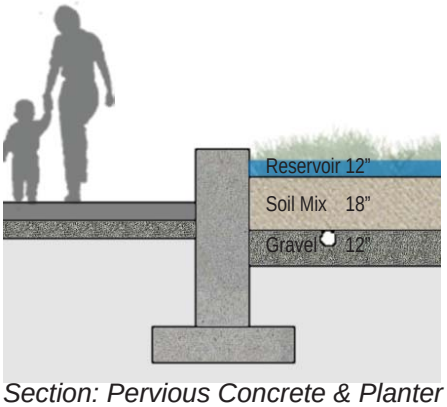
Value:
The design brings value to the campus' tradition and respects the idea of low impact development. Not only does the site design contribute to the campus' value but also to the surrounding community. The Union Green provides an example of appropriate stormwater management techniques that will subsequently help improve water quality for the campus.

The diagrams below illustrate the 3 conditions of the watershed analyzed.

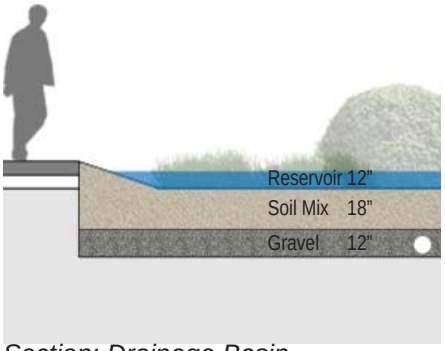
Pre-settlement

Existing

Proposed



Section: Pervious Concrete & Planter



Section: Drainage Basin

Cistern precedent on MSU Campus

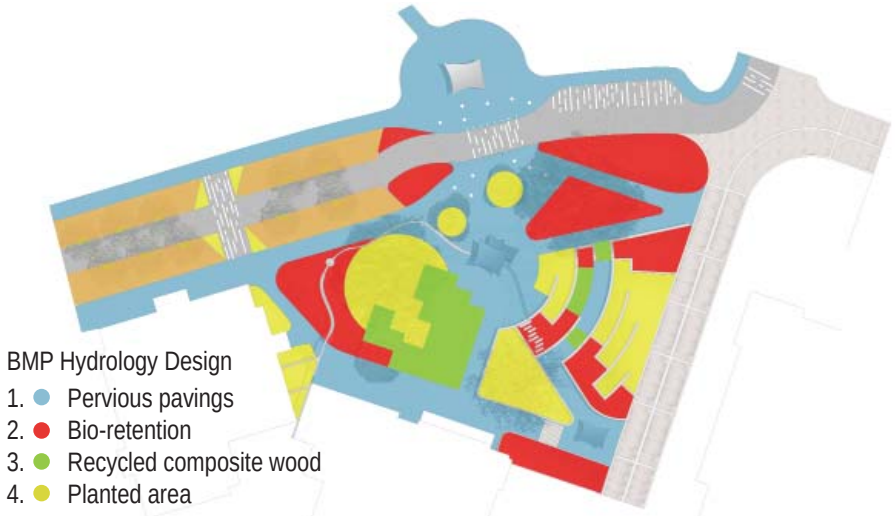
As highlighted by the watershed diagrams to the left, the site design manages 1.29 acres of the core of the MSU campus. Through a combination of Best Management Practices (BMPs), including pervious pavement, bio-retention and cisterns, the design will mitigate the peak flow of the 2-year, 24-hour rain event to less than the pre-settlement condition. Additionally, the plan will manage over 99% of the average annual rainfall as illustrated on the following page.

Best Management Practices

Due to the heavy clay condition of the site, BMPs are modified to allow for proper drainage. For the hardscapes, there are two kinds of pervious pavement: pervious concrete and recycled composite wood decking. Pervious concrete is layered with 6 in. of pervious concrete on top of 6 in. of clean no-fines aggregate.

Bio-retention includes the planters at the terrace and partial infiltration basins. Both types are layered with a 12 in. deep reservoir, 18 in. of soil , 12 in. of gravel and 6 in. perforated under drain. The soil is a mixture of sand, top soil and organic materials designed to infiltrate at 2 inches per hour.

There are two cisterns on the site. One has a capacity of 10,000 gallons, which is located under the terrace. The other has a capacity of 1,000 gallons which is located above ground at the west side of the site. Both will be used to irrigate the landscape during drought conditions, as well as for water features.



BMP Hydrology Design

1. Pervious pavings
2. Bio-retention
3. Recycled composite wood
4. Planted area

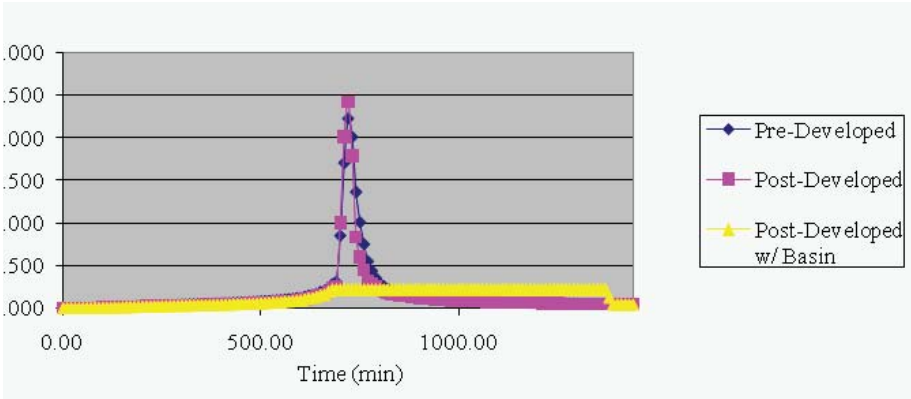
A 24-hour, 10-minute time-step model based on the Santa Barbara Urban Hydrograph Method was used to calculate the peak flow for the site for the pre-settlement, existing and proposed conditions. The curve numbers used for the various surface materials is provided in *Table 1*. The analysis indicates that the design will reduce the peak run-off for the 2-year, 24-hour event to below the pre-settlement condition.

Roof	98
Concrete	98
Basin	85
Pervious Concrete	65
Grass	61

Table 1- CN Table

Condition	Weighted CN	Area	Peak CFS
Pre-settlement	61	1.29	0.36
Existing	90	1.29	2.42
Proposed	86	1.29	0.22

Table 2- 2-Year, 24-Hour Hydrology Analysis



Event	**Rainfall (in)**	**Total (in)**	**Percentile** (%)
First			
first flush	0.5	1113.92	55
	0.75	683.07	69
	1	679.47	78
	1.5	1038.6	82
	2	708.41	95
1-year	3.6	764.27	99
2-year	4.2	90.08	99
5-year	5.3	65.64	100
10-year	6.1	28.78	100
15-year	6.8	13.32	100
25-year	7	0	100
50-year	7.9	0	100
100-year	8.7	16.33	100
>100 year	>8.7	0	100
Total Inches		5201.89	

Table 3 - Historical Rainfall Analysis

The Average Annual Rainfall Analysis in *Table 3* uses data collected on the MSU campus from 1910-2009. Rainfall events that were less than 0.1" were removed from the analysis. The analysis indicates that MSU's 95th percentile event is the 2" rain event.

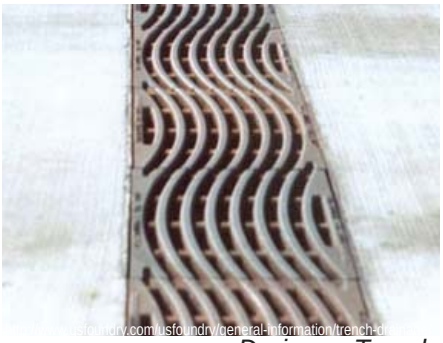
Based on the cumulative impact of the BMPs used in the design, the site will manage greater than the 2-year event or over 99% of the average annual rainfall. *Table 4* represents the percentage of each flood risk event the site design will be able to mitigate.

Event	Mitigation (%)
1-year	100
2-year	100
5-year	79
10-year	66
25-year	56
100-year	44

Table 4 - Percentage of Events Mitigated

Materials were selected based on the sustainable principles of perviousness, locally purchasable, low maintenance, and potential to be recycled.

Pervious Concrete for all walks



Drainage Trench

Anodized Brushed Aluminum for " Cloud" Sculpture

Galvanized Steel for aquaduct

Aggregated Concrete with Sea-glass for plaza

Recycled Composite Wood Decking for seating area

Magnolia virginiana

Clethra alnifolia

Aronia arbutifolia

Iris virginica

Planting Zones

1. Bio-retention
2. Native understory garden
3. Street trees
4. Accent trees

The overall planting guidelines demonstrate characteristics of sustainability through the use of native plants which are adaptive to both wet /dry, sunny/shady environments, and are low in maintenance. The following plants were selected to address site conditions:

Trees

Swamp red maple	Acer rubrum var. drummondii
Green ash	Fraxinus pennsylvanica
Swamp black gum	Nyssa sylvatica var. biflora
Willow oak	Quercus phellos
Sweetbay magnolia	Magnolia virginiana
Pond cypress	Taxodium ascendens
Mayhaw	Crataegus opaca

Shrubs

Dwarf palmetto	Sabal minor
Chokeberry	Aronia arbutifolia
Buttonbush	Cephalanthus occidentalis
Summersweet	Clethra alnifolia
Titi	Cyrilla racemiflora
Buckwheat tree	Cliftonia monophylla

Perennials

Joe pye weed	Eupatorium fisulosum
Cardinal flower	Lobelia cardinalis
Stokes aster	Stokesia laevis
Rose mallow	Hibiscus coccinea
Louisiana iris	Iris virginica
Obedient plant	Physostegia virginiana
Horsetail	Equisetum hyemale

Grass & Sedges

River oats	Chasmanthium latifolium
Blue sedge	Carex glauca
Woolgrass	Scirpus cyperinus
Panic grass	Panicum virgatum
Little bluestem	Andropogon virginicus
Spikerush	Eleocharis spp.

Site Implementation

The elevated aqueduct above the bio-retention basin provides visual water conveyance, irrigation and educational exhibition of stormwater management.

Heritage Museum signage created from recycled materials

Roof garden

The Union Green was selected for site design because of its feasibility to design and build. Though situated in the most active area of campus, The Union Green has the potential to become more developed, which would increase activity within the space. The Union Green also has the ability to become an outdoor learning environment for students and visitors. Learning will occur through outdoor lectures, while visitors have access to kiosks that provide information about green infrastructure benefits. The simplicity of the design and plant palette will also foster ease of maintenance and ensure lasting success.

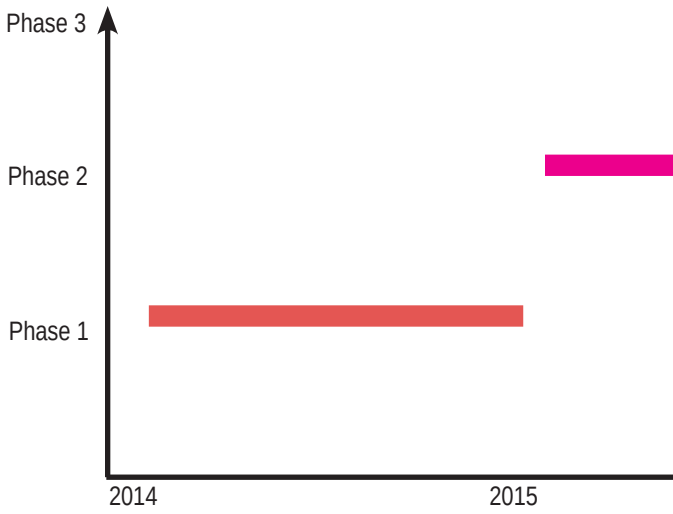
It is our intention that students gain experience through the development of the site. For the last 5 years, Mississippi State University's Landscape Architecture Department has given students the opportunity to experience and participate in a design-build project. Landscape Architecture students assisted in the design and implementation of the Oktibbeha County Heritage Museum which showcases the successful development of a low impact development.

Consisting of stormwater management elements such as an above ground cistern, roof garden, bioretention cells, visible water conveyance systems, and educational kiosks, the museum educates the visitor about green infrastructure. The Union Green will be a continuation of the efforts to the Heritage Museum, continuing our contribution to sustainability.

Review Process

The review process will ensure that we achieve the highest quality design for the Mississippi State University campus. During the previous four months, our team has met with Student Services and Facilities Planning in order to receive feedback on the design process. Our next objective will be to submit our site design proposal to the Campus Master Plan Committee. This committee will provide us with recommendations that meet the requirements for campus design. Once reviewed, our site design will be refined to reflect the given recommendations, and then submitted for approval once more. This process will continue until all recommendations are at the satisfaction of the Campus Master Plan Committee. After being given our last review, a final plan will be produced for the implementation phase to begin.

Project Time-line



Phase I

Phase I is located on the west of the site. It consists of an above ground cistern, outdoor eating deck, and a bio-retention basin. Also, an existing pecan tree stands as the main provider of shade, keeping cool the water which runs beneath its branches. This area was selected as phase I because of its feasibility to be implemented within the given budget and time-frame. We hope to implement the phase by 2014.

Phase II

Phase II contains a 5-step amphitheater which serves many purposes. Beneath this amphitheater is a cistern which captures stormwater runoff from the adjacent university mall, using the water for irrigation. The amphitheater also provides informal seating along its grassy edges. For the convenience of the disabled, a ramp was designed to be graded into the amphitheater seating allowing access to the lower plaza and amphi-

Phase 1

Time-line & Phases

2016

2017

Phase 2

Phase 3

Phase III

Phase III includes the Lee Blvd. re-design, an infiltration basin and street trees. Parking has been adjusted to accommodate pedestrian and service vehicle access around the site. Street trees have been added to provide unique separation for parking spaces. The speed of traffic has been reduced by incorporating a chicane which forces drivers to slow down for pedestrian circulation. The infiltration basin, which manages a large percentage of the site's watershed, also operates as a detour for pedestrians, discouraging unwanted street crossing.

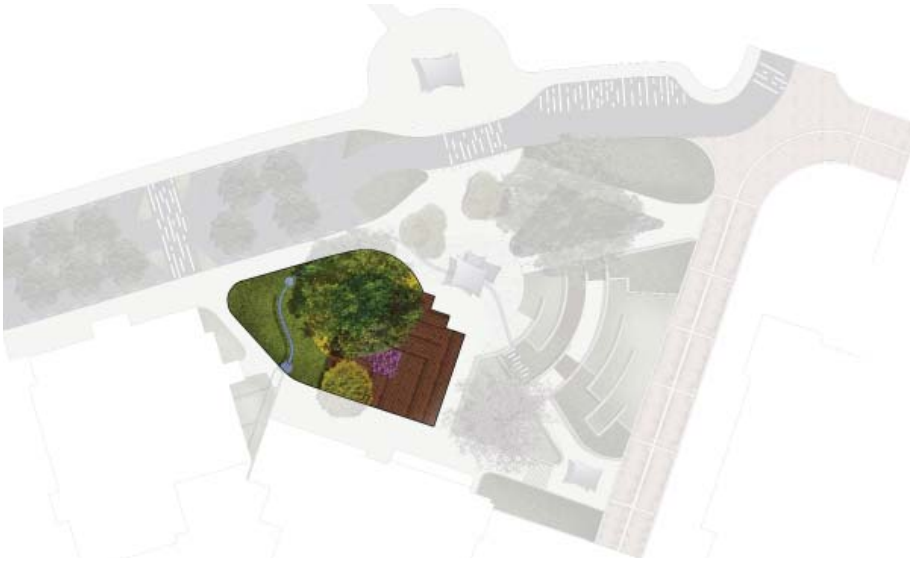
Phase 1 Conceptual Cost Estimate

An estimated cost for phase 1 is shown in *Table 5*.

The project will be built by students and campus facilities through the existing design build process on the campus.

Phase Component	Unit	Size	Unit Price ($)	Item Total ($)
Bio-retention	ft^2	1,872	3	5,616
Understory Garden	ft^2	2,022	1.5	3,033
Aquaduct	ft	93	15	1,395
Composite Deck	ft^2	2,284	4	9,136
Cistern	Gal	1,000	2	2,000
			Sum	21,180
			Contingency	4,236 (20%)
			Total	25,416

Table 5 - Phase 1 Cost



Phase 1