PERFORMANCE BENEFITS

REVIEW DESIGN, CALCULATE BENEFITS, RE-DESIGN, COMMUNICATE
PROJECT 3

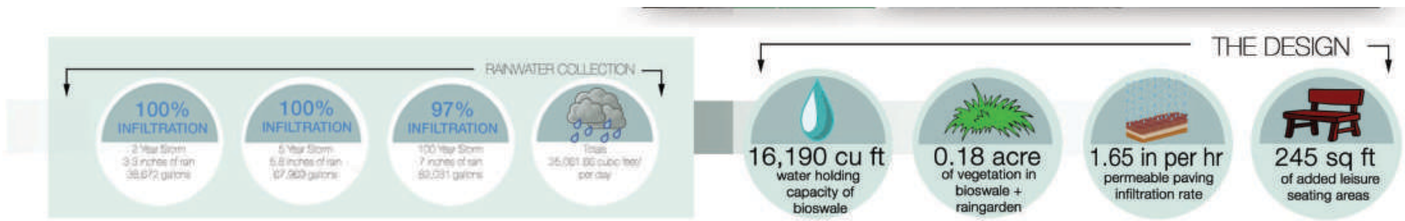


image from: LA 402, fall 2015 student work

introduction

The third project in the technical module will have you calculate the performance benefits for your studio project. If you have not already established the baseline conditions for your site, you will need to calculate that as well.

This project is intended for you to understand how your design decisions have improved (hopefully) aspects of landscape performance within your project. You are expected to recall earlier work from the quarter regarding the communication of landscape performance and the methodology of calculating baseline conditions. Use of the Landscape Performance: A Guidebook for Metric Selection, the LAF Landscape Performance Case Studies and the LAF Landscape Performance Fast-Fact library are required references for this work.

As with project 2 in this series, it is important to understand that there are not simple or direct methods for calculating baseline data. While there are some helpful internet calculators to use, most of the work will rely on emulating methods established in the case studies. This work requires an ability to dissect case studies and an ability to work through problems to a point of resolution.

scope of work

Reviewing your studio work to date, establish baseline data and noted improvements in landscape performance for your studio project. For this project, you will create 11x17 sheets that document <u>your work and your calculations.</u>

STEP 1

Review your site(s) in person and delineate site boundaries for your work. Quantify the following data for your existing site:

- Total Square Footage of Refined Site
- Square Footage of Individual Surfaces
  -Materials (Asphalt, Concrete, Lawn, Ground Cover, etc.)
  -Impermeable vs. Permeable
  -Hardscape vs. Softscape
  -Uses – Parking/Car/Bike vs. People/Social
- Drainage Area (Square Footage of landscape that create a contributory watershed for your project)
- Any baseline(existing) conditions for the Environmental or Social Metrics you have considered in your design.

STEP 2

Review and evaluate your current design. Many of you have noted improvements in conditions. Review and follow-through with these efforts for each category of performance. For each category you must have existing and proposed benefits. While this work might seem painstaking or tedious, consider how you might use your final data to help frame your design proposal.

STEP 3
Document your calculations. In order for your performance benefits to move from ‘claims' to ‘calculations' you must document how you established your baseline and improved benefits. Keep your work legible, simple and easy-to-follow.

STEP 4
Create compelling GRAPHICS for your before and after conditions. Consider how this work reads as stand-alone graphics as well as could be integrated into your final design boards.

For the submission of this work, all work should be on 11x17 sheets. The first page should clearly identify your site, site boundaries and an overview of landscape performance. The following pages should CLEARLY note ‘current' and ‘improved' (or BEFORE and AFTER) conditions. The remaining pages should include your calculations. The last page should include any references. This work will be featured on Landscape Performance Series ‘Resources for Educators' website.

deliverables + schedule

1. A 11x17 package as noted above.
2. All work should be completed by Wednesday, December 7th at 12noon and uploaded to Polylearn.

project goals

1. **to apply basic landscape performance metrics and methodologies to gauge changes in performance within your studio project**

metrics

Total Square Footage of Refined Site (Everyone Must complete these)
Square Footage of Individual Surfaces
-Materials (Asphalt, Concrete, Lawn, Ground Cover, etc.)
-Impermeable vs. Permeable
-Hardscape vs. Softscape
-Uses – Parking/Car/Bike vs. People/Social

Environmental Metrics

Plant Facts:
-Water Use (high, medium, low)
-Ecological Value (food, pollination, habitat, etc.)
-Lawn, Ground Cover, Shrubs, Trees (square footage or quantities)

Tree Facts:
-Storm Water
-Carbon Sequestration
-Shade
-Air Pollutant Removal

Water Facts:
-Annual Precipitation
-Annual Volume of Storm Water
-Average Storm Size
-Volume of Water in Average Storm Size

Transportation Facts:
-Automobile lanes and parking
-Bike Lanes and bike parking
-Walkways

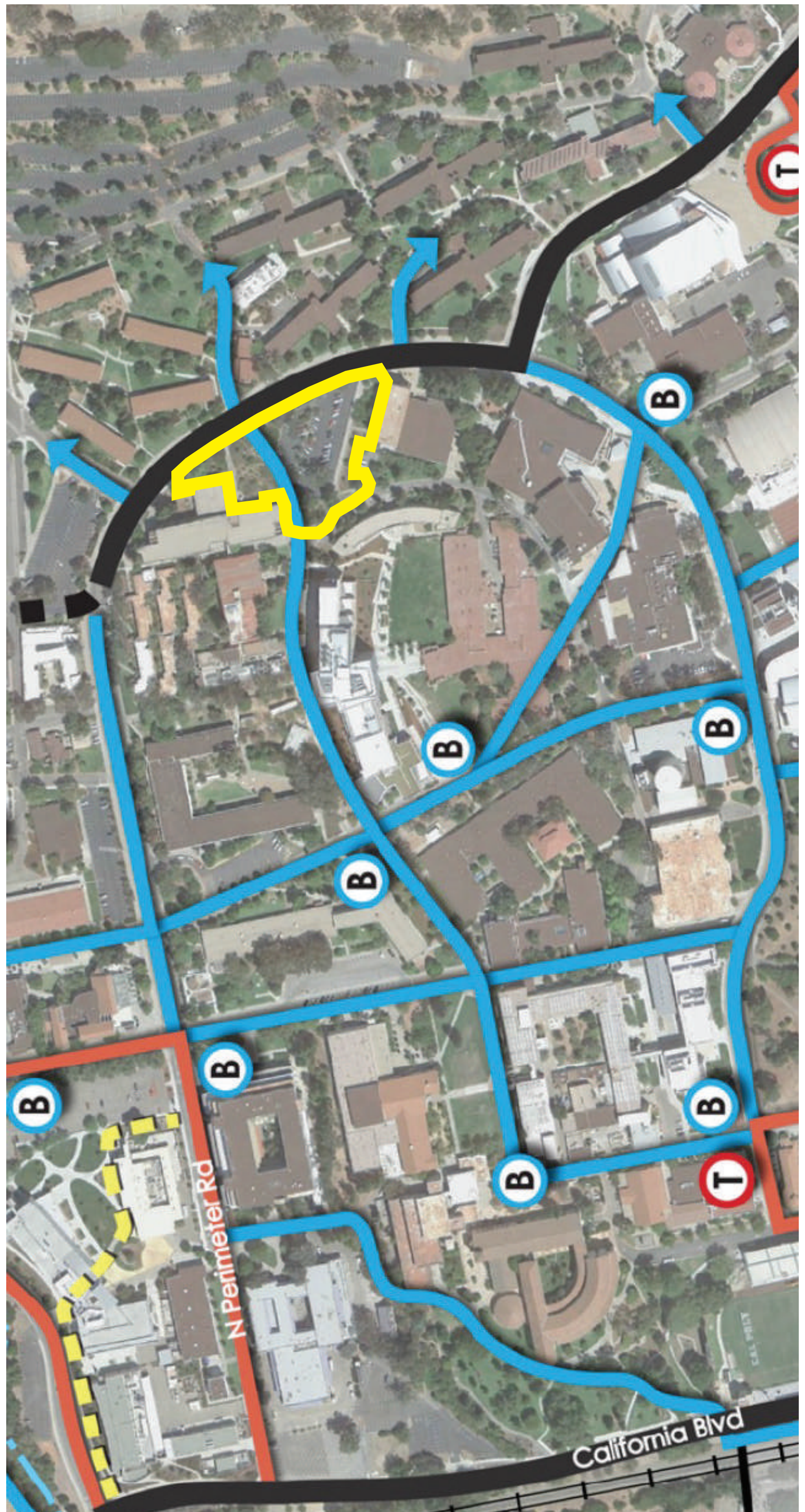
Social Metrics

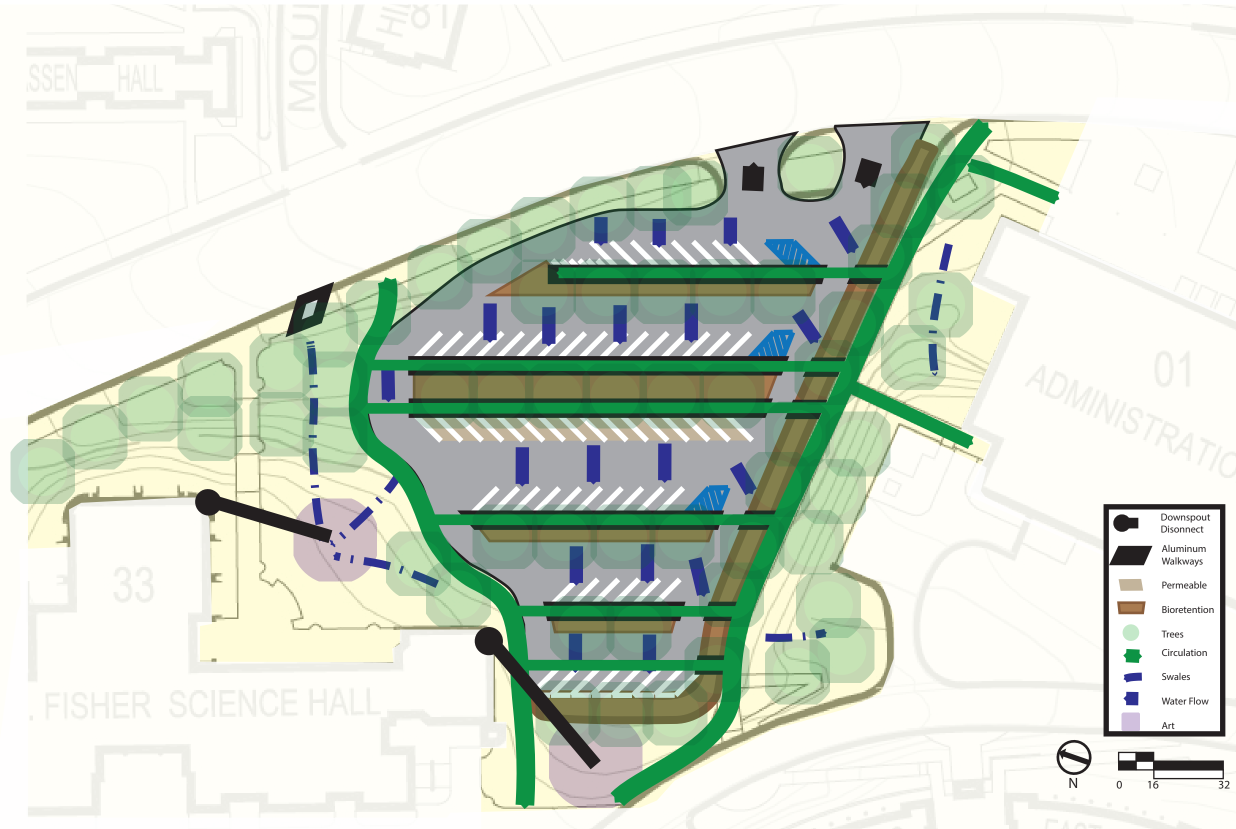
Recreational/Social Value:
-Seating
-Play / Recreation
-Study spaces
-Number of Visitors / Overall Use

Educational Value:
-Signage
-Teachable moments

Awareness, Access + Safety:
-Directional signage
-Lighting
-Accessible features

Green over Gray:
An Exploration of Landscape Performance





Landscape Performance Goals:

1) Capture and infiltrate ~100% of stormwater on site

2.) Increase carbon sequestration

3.) Reduce heat island effect

4.) Provide safe pedestrian routes

5.) Improve cultural quality

Site Location:

-Parking Lot #A1 on Cal Poly's campus

-Between Administration & Clyde P. Fisher Science buildings

Overview of Landscape Performance:

According to the Landscape Performance Series website, landscape performance is defined as "a measure of the effectiveness with which landscape solutions fulfill their intended purpose and contribute to sustainability." The measures focus on the three pillars of sustainability: environmental, social, and economic. By incorporating landscape performance measures into design and development programs, the quantifiable benefits will inform investors and may potentially have a positive impact on public policy.

Existing Site Conditions

Stormwater

Site area:
76,752.72 sq ft

Annual rainwater:
1,044,953.47 gallons

Storm drains capture 100% of parking lot runoff

Storm drains capture runoff from planted areas that does not infiltrate

Trees

59 trees of varying sizes and species

Carbon sequestered:
4,567 pounds

Stormwater intercepted:
35,696 gallons

Parking

Heat island effect: Parking lot is oriented so that cars park in N/S direction

Heat island effect: Small trees in parking lot do not cast shade onto asphalt surface

66 parking spaces:
4 handicap
4 motorcycle
9 staff loading
49 metered

Pedestrian

One primary pedestrian route on south side, near Admin building

Pedestrians have created a path on north side of site, cutting through the ground cover

Pedestrians must walk through parking lot and/or cross planting areas once they exit their vehicle

Cultural

Two benches are available for seating

Lacks interest and cultural value

Overall appearance and plantings lack interest or cohesion

Proposed Site Conditions

Stormwater

Site area:
76,752.72 sq ft

Annual rainwater:
1,044,953.47 gallons

Infiltrate ~100% of site stormwater

Additional runoff captured from road:
37,955.18 gallons

Additional runoff captured from downspout disconnects:
91,922.69 gallons

Trees

59 Coast Live Oaks mature,18” diameter

Carbon sequestered:
19,470 pounds

Stormwater intercepted:
95,757 gallons

Parking

Heat island effect:
Parking lot orientation changed so that cars park in E/W direction

Heat island effect:
Mature oak trees cast shade on asphalt surfaces:
-west in the morning
-east in afternoon and evening

68 parking spaces:
3 handicap
7 motorcycle
7 staff loading
51 metered

Pedestrian

One primary pedestrian route on south side, near Admin building

One new pedestrian route created for north side circulation

Five new pedestrian designated routes created over infiltration basins for safety and aesthetic value

Cultural

Five benches are available for seating

Two art pieces are added for cultural value

Cohesive planting of California natives will unite the site, provide aesthetic value, and improve biodiversity

Overview and Metric Calculations

Total Site Area = 76,752.72 sq ft

Overview:

	Existing:	Proposed:
Impermeable area:	35,414.28 sq ft	34,592.15 sq ft
Permeable area:	41,338.44 sq ft	42,160.57 sq ft
Asphalt area:	27,573.48 sq ft	26,751.35 sq ft
Concrete area:	7,840.80 sq ft	7,840.80 sq ft
Ground cover area:	41,338.44 sq ft	27,038.68 sq ft
Infiltration basin area:	0	10,862.29 sq ft
Permeable pavers area:	0	4,259.60 sq ft
Carbon sequestered:	4,567 lbs	19,470 lbs
Stormwater intercepted:	35,696 gallons	95,757 gallons
Stormwater (in gallons)		
site- annual total:	1,044,953.47	1,044,953.47 gallons
captured from downspout disconnects:	0	91,922.69 gallons
captured from roadway:	0	37,955.18 gallons

Calculations:

Basic Information and Conversion Calculations:

Historic Cal Poly Annual Rainfall:	21.82 inches
Rainfall conversion to feet:	21.82 / 12 inches= 1.82 feet
Gallon conversion:	One cubic foot = 7.48052 gallons

Stormwater Calculations:

Site area:	76,752.72 square feet
x rainfall conversion:	x 1.82 feet
=	139,689.95 cubic feet
x gallon conversion:	x 7.48052 gallons
=	**1,044,953.47 annual gallons**

Downspout Disconnect Capture:

Rooftop drainage area:	6,751.80 square feet
x rainfall conversion:	x1.82 feet
=	12,288.276 cubic feet
x gallon conversion:	x7.48052 gallons
=	**91,922.69 annual gallons**

Roadway Runoff Capture:

Roadway drainage area:	2,787.84 square feet
x rainfall conversion:	x1.82 feet
=	5,073.8688 cubic feet
x gallon conversion:	x7.48052 gallons
=	**37,955.18 annual gallons**

Performance References:

Landscape Performance Series website
-Case Studies and Fast-Fact Library: http://landscapeperformance.org

Landscape Performance: A Guidebook for Metric Selection

National Tree Benefit Calculator: http://www.treebenefits.com/calculator/treeinfor.cfm?zip=93407&city=SAN%20LUIS%20OBISPO&state=CA&climatezone=Inland%20Valleys&country=US

U.S. Environmental Protection Agency website: https://www.epa.gov/heat-islands

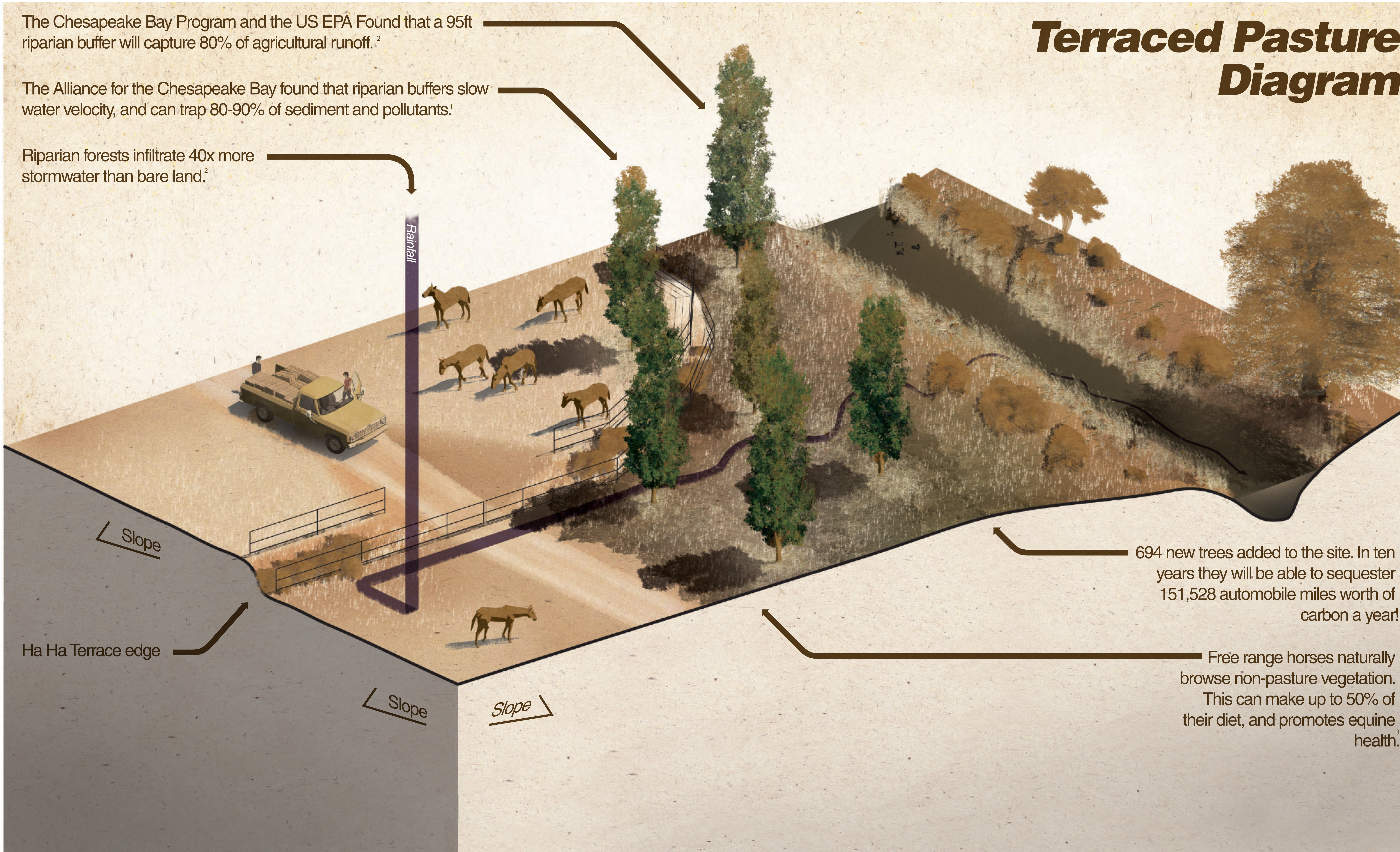
Patrick Kelty - LA 402 - Fall Quarter 2016 - Professor Joe Ragsdale

Performance Improvements at the Cal PolyEquine Facility

The existing conditions on the Cal Poly Equine Unit site feature relatively small remnant areas of riparian habitat beside two of the campuses major reservoirs. The bulk of the site is made up of heavily grazed pasture areas. During rain events these areas flow storm water into the adjacent reservoirs, and eventually into Stenner creek further downstream. Pollution from nitrates running into Stenner creek has resulted in fines to the Cal Poly University in the past.

The area marked out in the red dotted line identifies the boundaries for the site. This proposed design adds wide riparian buffer areas adjacent to all waterways in order to mitigate storm water pollution. This will entail, amongst other things, the planting of 694 poplar trees on site. These trees are intended to intercept nitrates flowing from horse pastures into adjacent water bodies. These trees also provide an opportunity for carbon sequestration on site and act as a source of browse for the horses grazing in the pastures. This non-pasture browsing mimics browsing behavior horses normally engage in in the wild. The diagram on the proceeding page illustrates the movements of water across terraced pasture areas proposed in the site, and illustrates the relationship between grazing land, riparian areas, and water bodies on site.

Terraced Pasture Diagram



Work Cited:

[1] Alliance for the Chesapeake Bay. January 1996. Alliance for the Chesapeake Bay white paper: Riparian forest buffers. Accessed 9/25/02. www.acb-online.org/forest.htm.

[2] Chesapeake Bay Program, and US EPA. March 1999. Riparian forest buffers: Linking land and water. United States Environmental Protection Agency. CBP/TRS 220/99. EPA 903-R-99-002.

[3] Putman,R.J., Pratt, R.M., Ekins, J.R., and Edwards, P.J. 1987. Food and Feeding Behavior of Cattle and Ponies in the New Forest, Hampshire Journal of applied Exology 24, 369-380.

[4] http://www.treebenefits.com/calculator/

Calcs:

http://www.treebenefits.com/calculator/

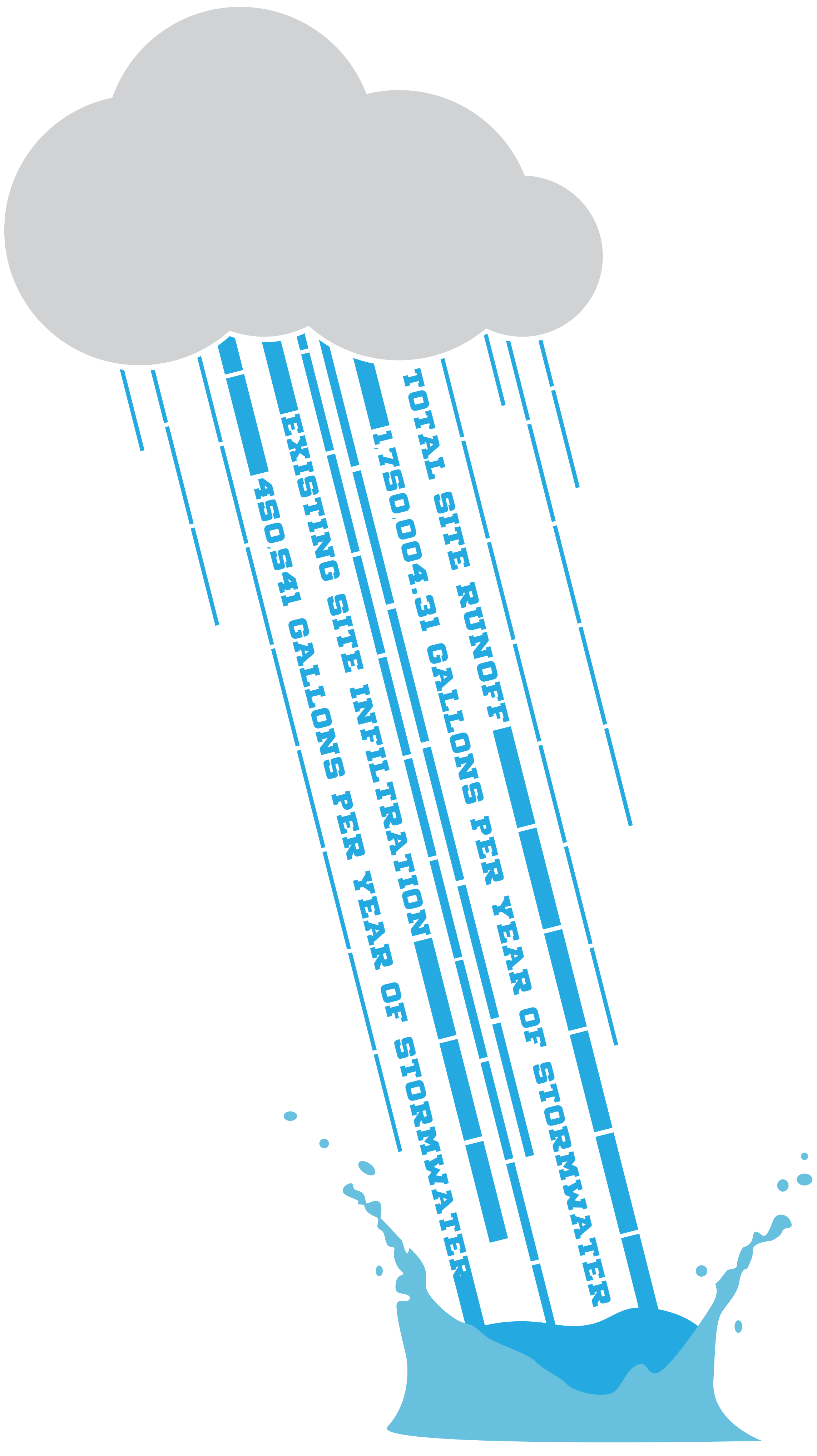
This calculation assumes . . .

- 694 *Populus nigra* 'italica' planted on site.
- Trees planted through out the site at 30' intervals.
- A canopy width of about 15' at maturity.
- A park like or other vacant land setting.
- 12" caliper at 10yrs after planting.

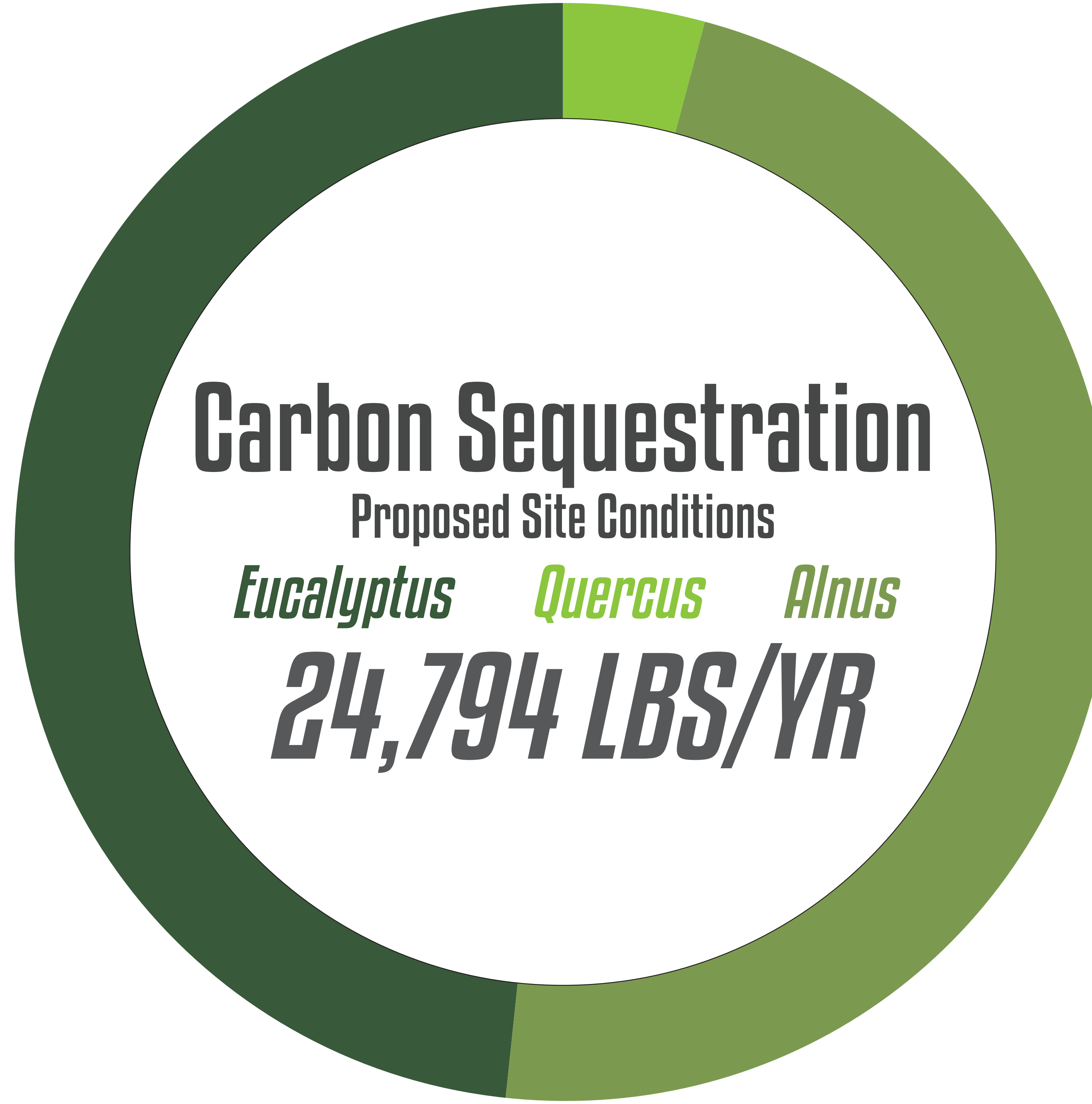
According to the tree calculator; in 10 years each tree will be sequestering 200lb of carbon.
According to the tree calculator; 12,000 driven automobile miles equates to 11,000lbs of CO_2, or .916lbs of CO_2 for each mile driven.

200lb x 694 = 138,800lbs of carbon sequestered a year on site.

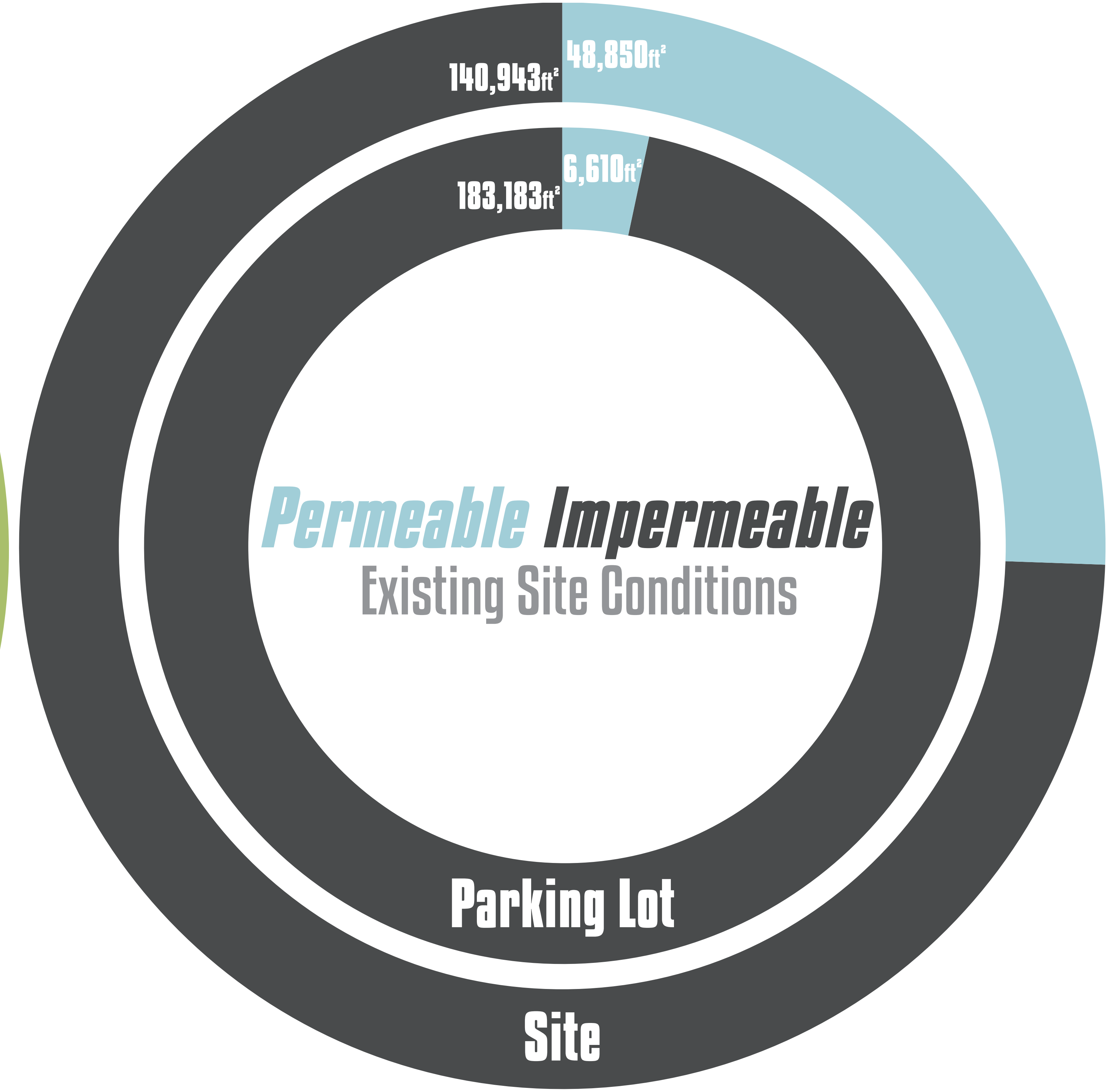
138,800lbs sequestered / .916lbs CO_2 burned in a mile of driving = 151,528 driven automobile miles worth of carbon offset.


TOTAL SITE RUNOFF
1,750,004.31 GALLONS PER YEAR OF STORMWATER
EXISTING SITE INFILTRATION
450,541 GALLONS PER YEAR OF STORMWATER


TOTAL SITE RUNOFF
1,750,004.31 GALLONS PER YEAR OF STORMWATER
PROPOSED SITE INFILTRATION
1,347,503 GALLONS PER YEAR OF STORMWATER



Quercus agrifolia sequesters 521 lbs per year, with two on site, they sequester a total of 1042 lbs/yr. The Ficus benjamina on the site each process 39 lbs per year, and with four on site, they process 156 lbs/yr. The 18 Eucalyptus globulus on site process 664 lbs per year, totaling 11,952 lbs/yr. This brings the site total to 13,150 lbs/yr for the existing conditions. The site proposal includes the removal of the four Ficus, and an addition of 50 Alnus rhombifolia, increasing the site total carbon sequestration to 24,794 lbs/yr



The current permeability conditions account for the parking lot tree planters and barriers for the parking lot, as well as the entirely permeable riparian corridor. The parking lot is almost entirely impermeable, at 3.59% permeable, with the creek conditions, it has a baseline of 25.74% permeability. The proposed additions would essentially triple that, bringing site permeability up to 77%, including the addition of 24,094 sq. ft. of bioswales. The only impermeable surfaces are the proposed dormitory additions, and the paved/covered walkways.

Landscape Performance

Project By: Nathan Torres

Introduction to Perforamce

Landscape Performance is the quantifiable benefits that a site will receive if a certain design is installed. The two main metric systems that are calculated are environmental and social.

Site Vicinity Map

Performance Metrics Utilized

Base Conditions

Total Site Area:
250,350 sq ft
Site Stormwater:
1,872,618 gal

Total Watershed Area:
713,686 sq ft
Watershed Stormwater:
8,450,634 gal

Calculations

Stormwater Calculations:
Watershed Area 713,686 sq ft
Annual SLO RainFall 1.583 ft *x*
1,129,764 ft^3 *=*
Gallon Conversion 7.48 *x*
8,450,634 gal =

Material Conditions

Site Impermeable Area:	130,584 sq ft
Site Permeable Area:	119,766 sq ft
Total Tree Count:	53
Stormwater Intercepted:	73,803 gal
Carbon Sequestration:	17,353 lbs

Proposed

100% Permeability

Area Calculations created using DaftLogic.com

UPGRADE: Performance Benefits

Landscapes and landscape infrastructure posses the potential power to do more than merely their intended purpose. Beautification through aesthetics, as well as utilitarian function, are not mutually exclusive. These seemingly disparate elements of design can come together harmoniously under proper conditions, creating sustainable beauty that performs socially, economically, and environmentally. Landscape architects have the ability to right the wrongs of the past; to shake up the norms and put a spin on tradition. Even in little ways, we can make our landscapes do more for us and other creatures who call this planet home.

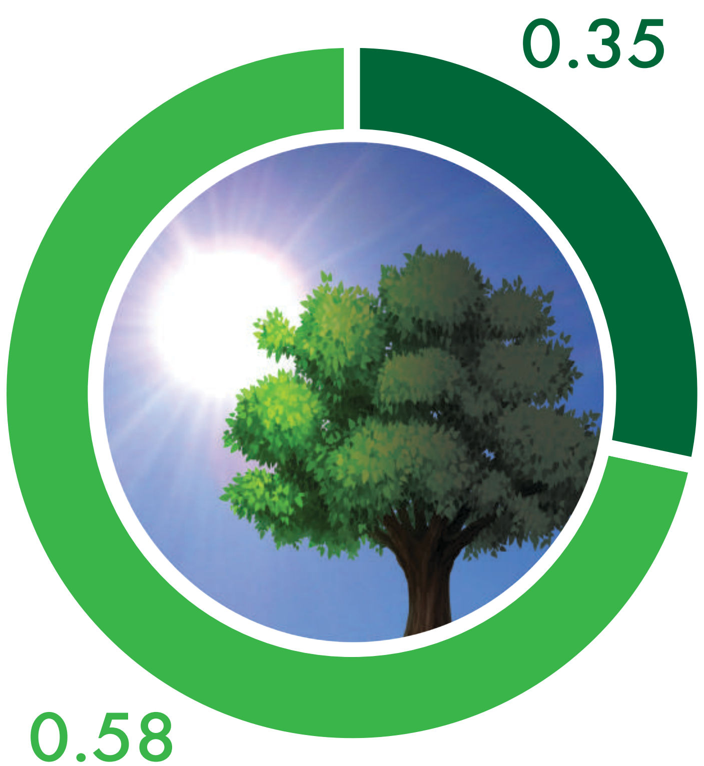
What **more** can your project do for you?

Zach Streed
Cal Poly San Luis Obispo
LA 402, Fall 2016

UPGRADE: Performance Benefits

Current Conditions

Project Proposal

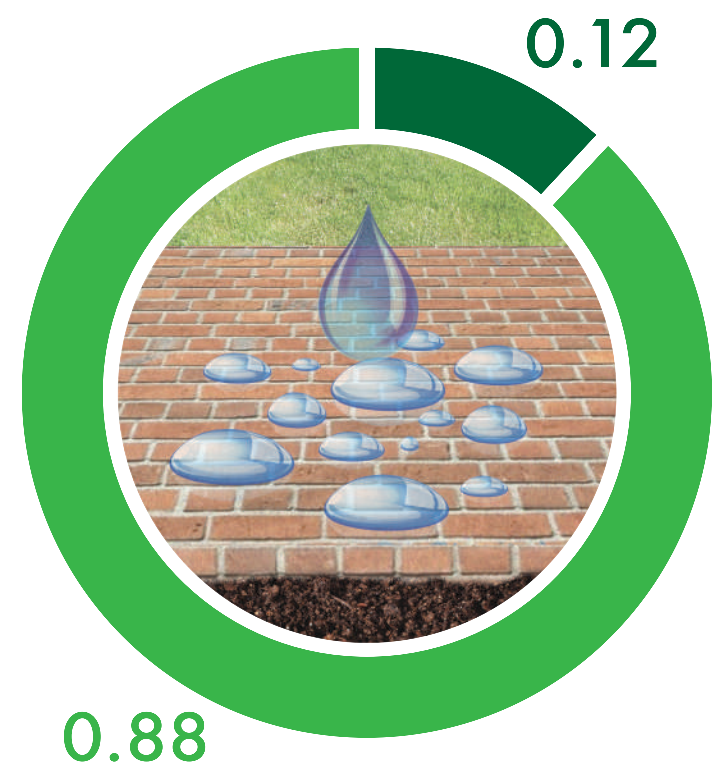


Shade
(Acres)

The addition of the proposed elevated structure would cast shade upon the entirety of the existing site below it. Additionally, tree-like structures on its surface would provide shade to users on the second floor.

Peak Runoff
(Cubic Feet per Second)

Permeable pavers and turf have lower runoff coefficients than concrete, and their inclusion would drop the peak runoff in a typical storm down to a cubic foot every four seconds, rather than every three.



Permeability
(Acres)

The proposed structure acts as a massive funnel that gently and slowly channels water into a controlled, decentralized permeable rill. This method would increase the area of permeability by a factor of over seven.

Usable Space
(Acres)

The current library entrance plaza Is accessible and well-used. The proposed project would only improve it further by doubling the amount of space for pedestrian use, offering choices of full sun, part sun, and full shade.

UPGRADE: Performance Benefits

Shade

DaftLogic Area Calculator was used to define the boundaries of the site (0.58 acres). The selection was then contracted to include only areas within the boundaries beneath the canopies of existing trees or structures, yielding a total of 0.35 acres.

The proposed strcuture in my project would cover the entire existing site, rasing the shaded area up to 100%, or the full 0.58 acres.

Peak Runoff

To calculate the peak runoff of the site in a typical storm, rational method was used. It requires prior information, including rainfall intensity, area, and runoff coefficients for various surface types.

Data from tables provided by the State Water Resources Control Board gave the following coefficients needed:

Lawns: 0.06
Concrete Streets: 0.80
Permeable Pavers: 0.25

The existing site consists of 0.58 acres of lawn and concrete. The proposed site consists of 0.88 acres of permeable pavers and lawn. I divided the acreage into its constituents and calculated the total runoff for each site under the conditions of 1 inch of rainfall (typical for San Luis Obipo).

$Q = ciA$
$Q = (1)(0.06)(0.58) + (1)(0.80)(0.58)$
$= 0.34$ ft3/s

$Q = (1)(0.25)(0.88)$
$= 0.26$ ft3/s

Permeability

DaftLogic Area Calculator was used to define the perimeter of permeable areas within the existing site (lawns and tree wells, 0.12 acres) as well as the impermeable (concrete, 0.46 acres). An extrapolation technique provided the area of the proposed site, 0.88 acres, all of which were funneled into permeable surfaces.

Usable Space

A direct comparison of the original area of the site, obtained from DaftLogic Area Calculator, with the area of the new site.

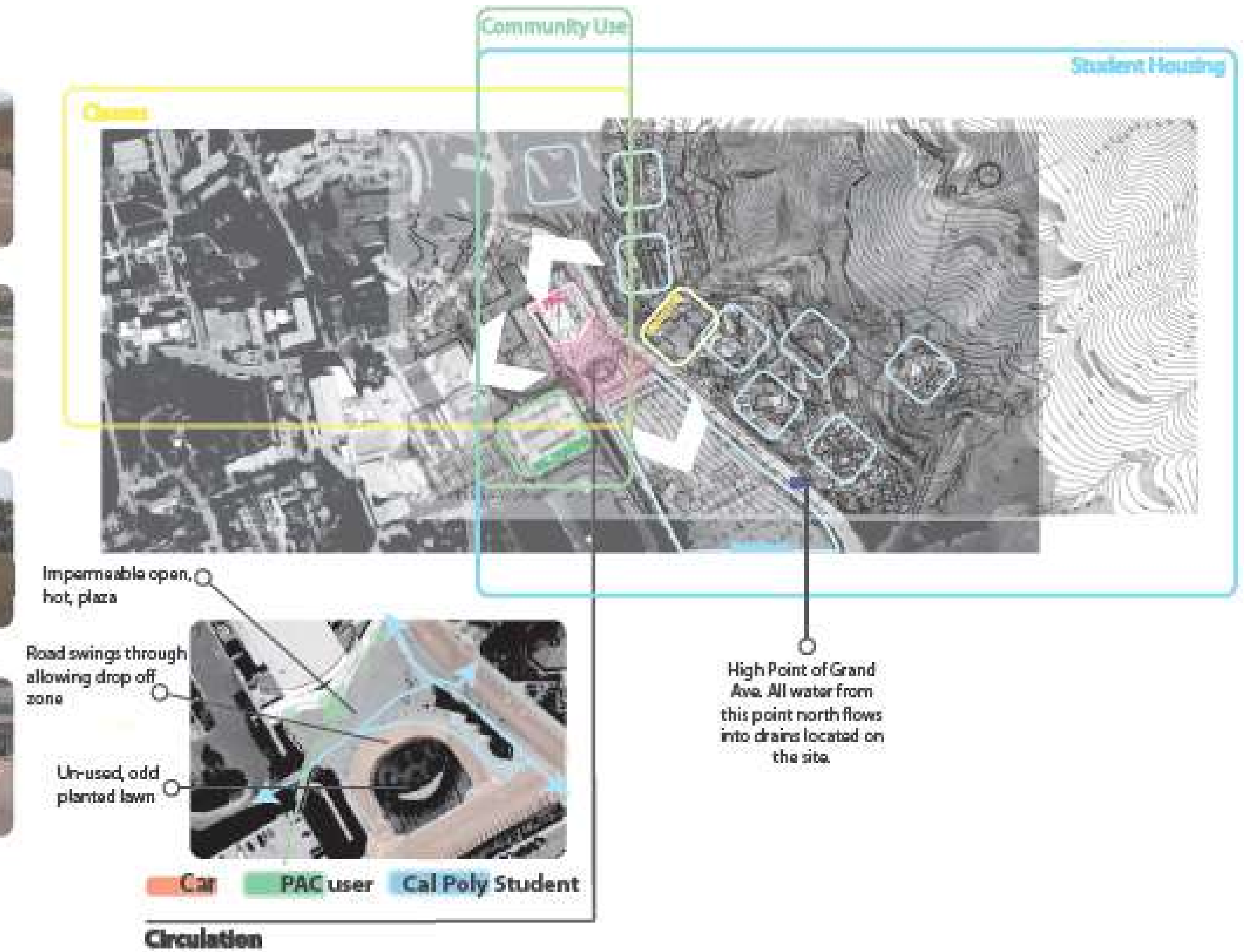
Existing area: 0.58 acres
Area of proposal: 0.88 acres

0.58 + 0.88 = 1.44 acres

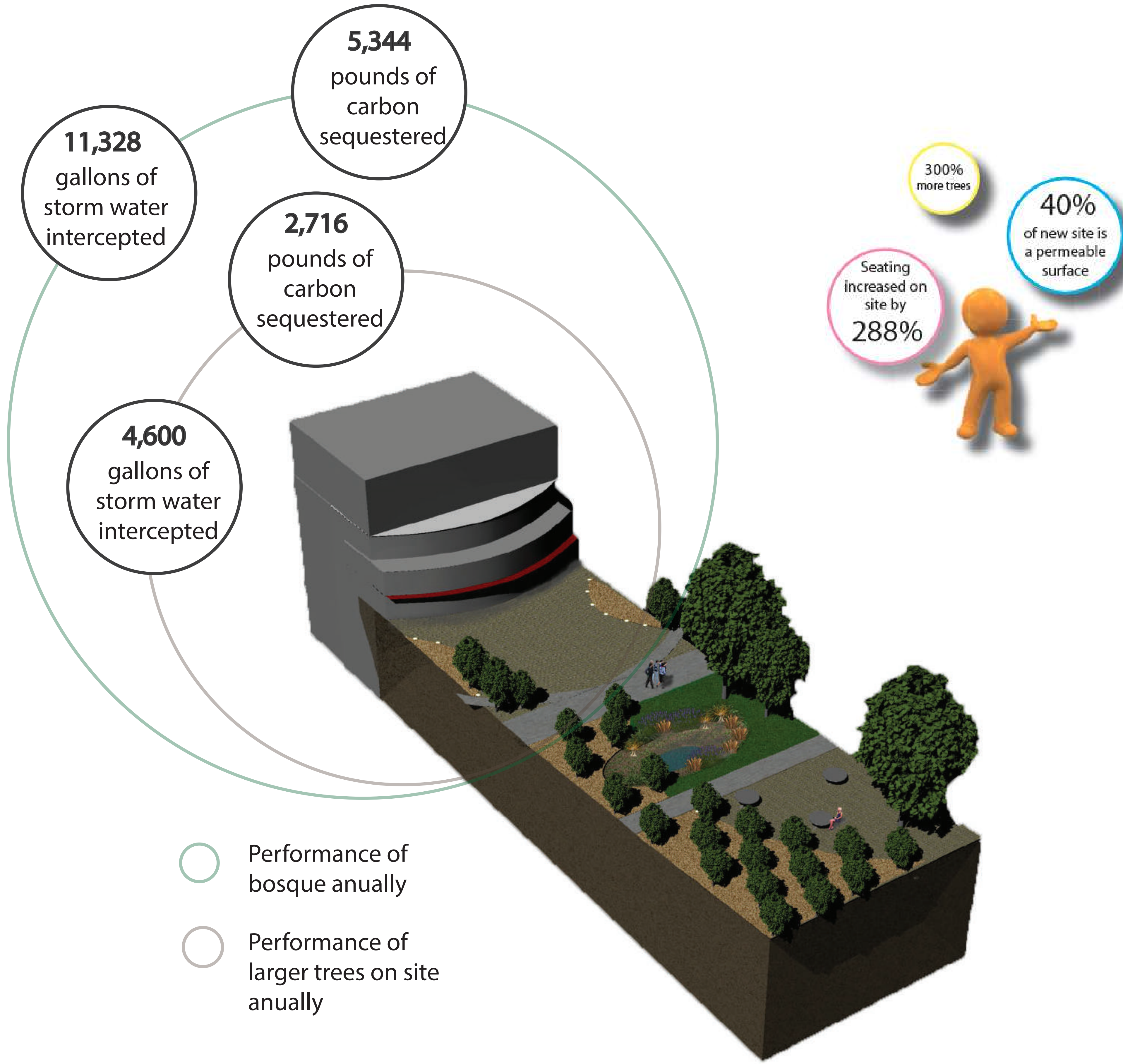
Landscape Performance

LA 402 | Cal Poly | Libby Jacobson

Landscape performance is putting outputs of a design into **quantifyable figures**. In the re-design of the Cal Poly Performing Arts Center Plaza there were many improvments socially and ecologically. Using data to analyze improvments showcases the reasoning behind design choices and the ecosystem services a landscape can provide.



Proposed Site



Exisiting Site

15 trees

8 benches

97,182 sq. feet THE SITE

17% permeable surfaces

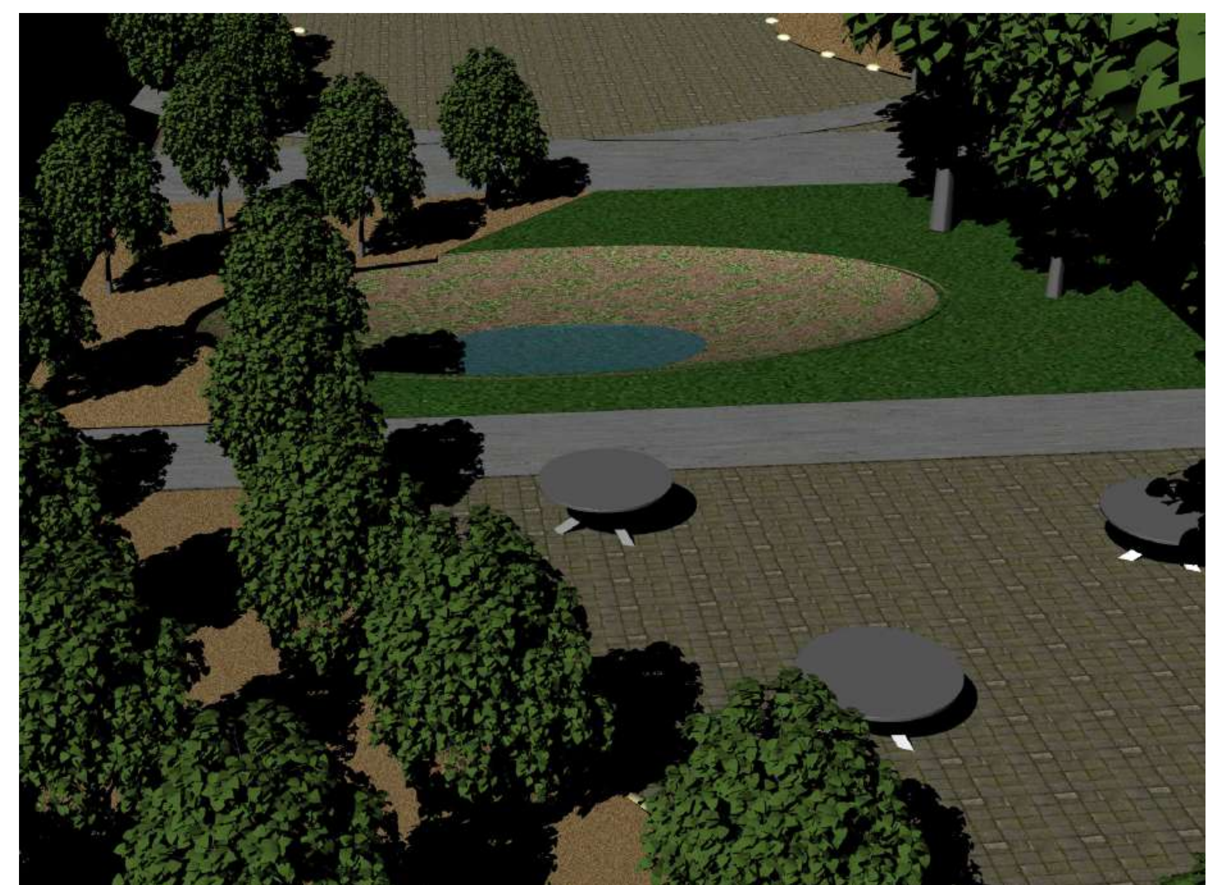
21 Drains

I have established the following performance goals for this project. Socially, I want to increase use and create a space for multiple users. I want to give the space a sense of identity by adding seating, lighting, and sculptures combining art with performance. Ecologically, I want to provide ecosystem services by sequestering carbon, providing shade, and reducing the heat of the plaza by adding trees and plant life. One of the larger goals I have is to treat all the storm water running down Grand Avenue, a surface area of 38,812 square feet. I want to keep all the water on site, by using swales and rain gardens. I want to use permeable pavers and decomposed granite for most of the site to improve ground water infiltration.

The design of this site shows vast improvement in landscape performance as shown: Before, 82.5% of the site was impermeable and now only 60.5% is impermeable and that is including the road from its highpoint to the plaza site. Before hand there was only 8 benches and 15 trees. Now there are 12 benches, 13 tables, and 40+ trees. The bosque alone will intercept 11,328 gallons of storm water runoff in and reduce atmospheric carbon by 5,344 lbs annually. The use of seven large trees will provide 4,600 gallons of storm water runoff to be intercepted and 2,716 lbs of carbon sequestered annually. These calculations were determined by using the Tree Calculator from the landscaper performance website. The Environmental Protection Agency claims that shaded surfaces may be a whole 20°-40°F cooler than peak temperatures of non-shaded materials. Having trees near the building will cool the building and the PAC users relaxing on the plaza before or after a show.

Calculation References Include:

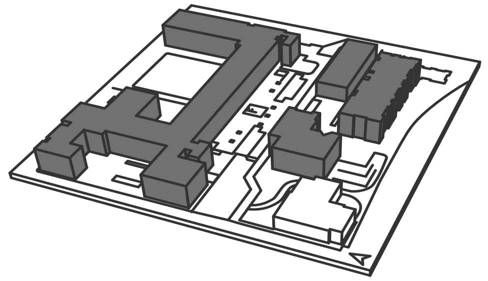
Landscape Performance Series Website
Tree Benefits Calculator
Storm Water Calculator
Cal Poly 2020 Master Plan
EPA



SILVIA VIOLA

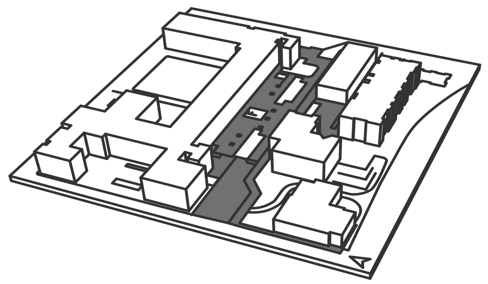
NUVOLA

CALCULATIONS



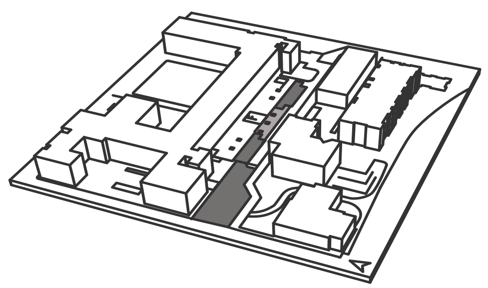
BASELINE

Total Square Footage of Refined Site: or 29107 sq feet
BUILDING FOOTPRINTS
20,189 sq ft of roofs unloading 383,591 cubic feet of water a year onto the site



MATERIALS

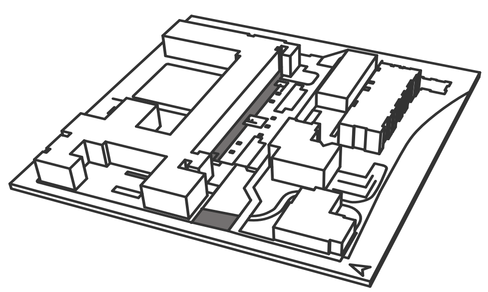
Vegetation: 3233 sq feet
Mulch: 2340 sq feet
Concrete: 25.642 sq feet
Impermeable: 23544 sq feet
80.89%
Permeable: 5563 sq feet

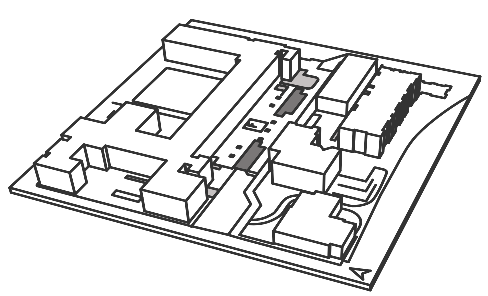


OVERHEATING

Temperature: 18.6 degrees higher than non shaded concrete area
19.3 degrees higher than non shaded softscape areas
36 degrees higher on mulch covered areas than in non shaded concrete areas

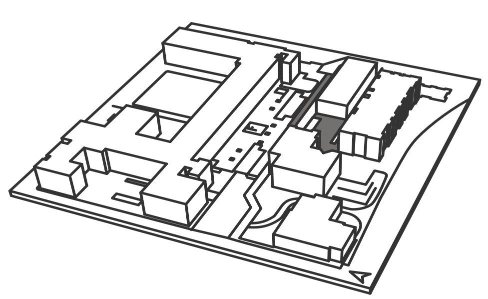
Temperatures registered manually (temperature laser gun)





POOR HYDROLOGY

due to high percentage of impermeable surfaces and roof runoff



SCARCE VEGETATION

provides very small additional value to the site and surrounding buildings

data collected trhough Google Earth and manual measurements on scaled maps

TOTAL SQUARE FOOTAGE OF WATERSHED: 129982 SQ FT
OF WHICH 65584 PAVED

THE POROUS PAVING AND BIOSWALES ARE DESIGNED TO INFILTRATE 100% OF THE SITE'S AND THE WATERSHED'S IMPERMEABLE SURFACES WATER IN AN 85 PERCENTILE DESIGN STORM.

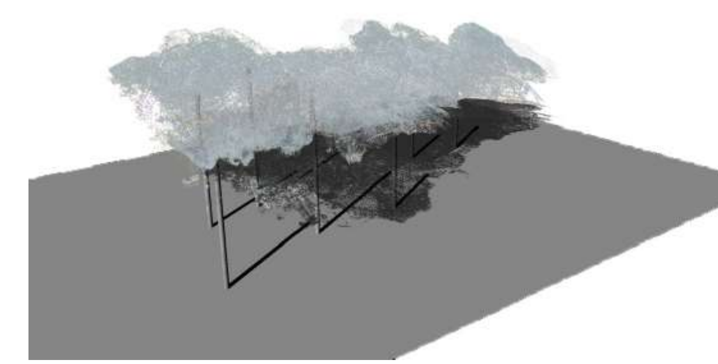
THE OBSERVATION DECKS OFFER AN EDUCATIONAL OPPORTUNITY TO THE CAMPUS COMMUNITY, WHILE THE CLOUD'S UNUSUAL AESTHETICAL QUALITIES CAPTURE THE USER'S ATTENTION

data collected trhough Google Maps and calculated with the California Phase II LID Sizing Tool at http://www.owp.csus.edu/LIDTool/Start.aspx

THE CLOUD

THE IMMENSE STEEL MESH STRUCTURE CAPTURES THE PUBLIC'S ATTENTION AND HOVERS OVER 10,400 SQUARE FEET OF THE SITE, PROVIDING AND ADDITIONAL 19% OF SHADED SURFACE TO THE PLAZA

data collected through manual measurements



THE SWALE SYSTEM INFILTRATES MORE THAN 130,490 CUBIC FEET OF WATER A YEAR, 15 TIMES THE AMOUNT (OF 8,808 CUBIC FEET) INFILTRATED BY THE CURRENT DESIGN.

data calculated with the California Phase II LID Sizing Tool at http://www.owp.csus.edu/LIDTool/Start.aspx