THE WEST UNIVERSITY WASH REVIVAL

2017 EPA RainWorks
Competition Submission
University of Arizona, Tucson
Registration #M46

Team Members:
MLA Candidates
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Brendan Ore – BA Fine Arts

ABSTRACT

This green infrastructure (GI) design proposal addresses one of the top-10 flooded areas at the University of Arizona. The campus struggles with dangerous and damaging flooding during the monsoon season and inefficient management of water resources, problems which can only be exacerbated in the face of climate change. These situations are further complicated by historic buildings that lay within the 100-year floodplain, and historic trees and landforms that fall under the protection of the campus’s Historic District. The site of the historic West University Wash is just such an example.

Key components of our integrated GI design include: a network of xeroriparian basins as an interpreted daylighted wash, the removal of turf and the implementation of hydrozones, and cisterns and basins which allow the strategic active and passive utilization of water resources. Site verification of soil infiltration capacities were conducted. Through a series of modeling analyses, we anticipate that the design would reduce the 100-year flood plain area by 75%, reduce the peak discharge from 624 CFS to 151 CFS, reduce surface water runoff by 50%, reduce irrigation use by 58%, and harvest 2.4 acre-feet of water on-site.

In addition to these water-centric improvements, other added benefits are enormous, such as the adaptation of arboretum and historic vegetation and landforms to changing climatic conditions, improving circulation and accessibility while maintaining emergency routes, and enhancing and creating a variety of social spaces and educational opportunities. In summary, this project mitigates a major flooding problem for the University while layering green infrastructure with social, ecological, and economic improvements.
The project site is an historic waterway called West University Wash, now a paved, one-way road called James E. Rogers Way. Challenges of the site are characterized primarily by stormwater management, high irrigation use, and missed opportunities for water resources.

Most notably, our site encompasses one of the top ten problem flooding areas as designated by the University of Arizona (UA) Stormwater Management Plan. One historic building on-site (the Yuma Residence Hall) has a finished floor elevations below the current 100-year floodplain.1

Our site also occurs completely within the Campus Historic District, which includes buildings, landscapes, and landscape features. According to the UA Historic Preservation Plan, the orange grove, olive allee, and landscape terracing are all currently potential historic district additions. Most trees on-site are part of the Campus Arboretum, which showcases species significant at the local and state level.2

Climate change will affect the University of Arizona campus differently than most campuses around the country. Southwestern cities, which house more than 90% of the region’s population, will have higher threat and costs to public health due to temperature increase and urban heat island effect. Disruptions to rigid infrastructures will exacerbate these threats and costs. Water resources will be severely strained by drought, stressing not only cities but the Southwest’s singular and rich biodiversity and ecosystems.3 Our design seeks to imbue our campus with resiliency through green infrastructure.

Figure 1: Campus watersheds
The UA Stormwater Management Plan designates these six watersheds (A-F) within the UA campus as well as the sub-watersheds (see Fig. 3). Our site occurs primarily in Watershed D, with two small areas along the northern edge of Watershed E. The top ten problem flooding areas are shown with red stars.

Figure 2: Site outline
The site occurs at the southeast corner of the intersection of Park Avenue and 2nd Street, encompassing a major portion of James E. Rogers Way. Three dormitory buildings line the north edge of the site, while educational buildings line the south edge.
Inefficient management of water resources and dangerous seasonal flooding.

Stormwater flows concentrate along James E. Rogers Way and 2nd St, causing the intersection of Park Ave and James E. Rogers Way to be one of the **top ten worst flooding areas** on campus with 3.84 acre-feet of water in a 100-year storm event. 3.84 acre-feet

Low-grade turf grass blankets our site at 41% of the total land use. Site surface consists of 41% turf grass, 20.5% mulch, 8% sidewalk, 8.5% roadway, and 29% roof. With an area of 302,320 sq ft, a total of **4.05 acre-feet of precipitation** falls on-site over 60 min in a 100-year storm event. With landscape intervention, the current **100-year floodplain can be reduced** from 624 CFS to 151 CFS.

The proposed green infrastructure plan would reduce the current 100-year floodplain area by XX% and a reduction of the peak discharge from 624 CFS to 151 CFS. These performance benefits meet/exceed the University of Arizona’s goals as outlined in the Stormwater Management Plan.
There are a total of 35 parking spaces within the site. These consist of 4 service permit spaces, 2 loading zones, 12 paid parking spaces, 9 handicapped spaces, and 7 motorcycle spaces. Removal of spaces along James E. Rogers Way may be offset by increasing parking to the south.

A chaotic choke point occurs on-site where a bike and pedestrian-only path intersects James E. Rogers Way. This problem can be alleviated by removing or modifying vehicular flow at this intersection.

Issues can be solved holistically through proposed green infrastructure

**Site Assessment, Cont.**

**Design Program**

1. **Manage Stormwater**
   - Slow rate of flow
   - Reduce floodplain
   - Capture stormwater

2. **Improve Climate Resilience**
   - Preserve historic and arboretum trees
   - Reduce irrigation needs
   - Hybridize the built and natural environments

3. **Activate Site**
   - Facilitate educational activity
   - Facilitate social activity
   - Improve site walkability
PARK WATER, NOT CARS

Concept 1: Park Water Not Cars employs the designation of a series of catchment basins along a central axis. These basins intercept water as it flows to the west down pedestrian only pathways.

ILLUMINATED H2O

Concept 2: Illuminated H2O exchanges the main arterial roadway for an opportunity to daylight University Wash. Pedestrian circulation is adjacent to the wash along with reduced turf and irrigated landscape.

FEEDBACK AND DEVELOPMENT

The design development of the West University Wash Revival benefited with input from multiple partners and team ground work. Eric Scharf, Former Principal of Wheat Design Group, assisted the development of our conceptual work by asking that we continually hold both end users and water movement in mind while designing. Professor Grant McCormick allowed our team the opportunity to present schematic design ideas to his undergraduate water harvesting class, receiving feedback on student use, educational opportunities, and historic interpretation. Dr. Tanya Quist Director of the University of Arizona Arboretum, was also able to review our schematic design preparations and whole heartedly endorsed the removal of turf grass and its redirection to appropriately sized landscape rooms for exercise and activity. She also appreciated the care that was taken to design landscaping that sank more water into the soil near the historic olive plantings along James E. Rogers Way. Lastly, as a team, we regularly visited the site to visualize design ideas as well as conduct appropriate tests to support quantitative conclusions. This is best exemplified in our use of an infiltrometer to record water infiltration rates on the various surfaces that surrounding the site.
**MASTER PLAN**

A dynamic green infrastructure design that integrates social, environmental, and economic benefits to the U of A.
WATER MANAGEMENT
GREEN INFRASTRUCTURE + RESILIENCY + PERFORMANCE

The West University Wash Revival is a layered and sensitive approach to mitigating stormwater. It meets standards set by the University management plan and exceeds EPA performance standards.

Our site contains one of the University’s top ten problem flooding areas. One of the University’s proposals to solve this is a single large open air basin on the west end of the site. While effective, this blindly cuts through the historic landscape and provides no supplementary benefits for students or visitors.

Using that stormwater management plan as a metric for quantitative success (2.49 ac-ft), we decided to mitigate a large bulk of our water capturing needs with underground cisterns in three strategic places targeting sub-shed inflows in areas least likely to disturb the campus’ historic landscape. This tiered system treats and uses water across our site through permeable tanks and pipes that contribute to the revitalized wash once storage meets capacity.
WATER MANAGEMENT
GREEN INFRASTRUCTURE + RESILIENCY + PERFORMANCE

PHASE I of project implementation lays down the physical infrastructure of underground water cisterns, above ground micro-basins, connected basins of the day-lighted wash, porous pavers, and above ground rain-water catchment cisterns. This initial infrastructure creates a hydrologically enriched landscape that functions to support subsequent project phasing.

DAYLIT WASH
The natural topography of the site dictated that the wash run along the southern end of James E Rogers Way. This opportunity allows us to move surface water and cistern overflow through our wash, which is comprised of surface basins connected by arroyos and smaller pipes. These act like check dams to maximize capacity and minimize runoff while passively informing visitors of water movement, not just in storm events, but during dry seasons as well.

TURF + SURFACE BASINS
Cisterns and washes aren’t the only interventions being proposed; as we have conserved the terracing from the historic landscape to enable our turf areas to act as basins. We’ve also proposed a string of detention basins along the northern alley which pulls water off 2nd St, slowing it, treating it and using it to vegetate and enhance the overall street scape experience.

RAINFALL TANKS
Attached to the adjacent buildings along the site are a collection of rain-tanks that collect roof-water during storm events through redirecting roof storm drains into the tanks. This further mitigates runoff rates and supplements irrigation needs later on as water is fed, using gravity, into a network of arroyo gutters and pipes.
We have created a multi-dimensional green infrastructure design by layering infrastructure with opportunities for the campus community and public to appreciate and participate in the exploration of a richly meaningful site.

**HYDROZONES**

Harvesting water is not the only strategy we use to imbue our site with ecological resilience. Our design reduces turf by 70% and implements hydrozones, reducing irrigation by 58%. These hydrozones are strategically designed to preserve irrigation for historic and arboretum vegetation as designated by the University’s Historic Preservation Plan. They also provide “landscape rooms” of turf that can be arrived to (instead of just blanketing the area), and increase biodiversity and aesthetic richness of the site.

**PHASE II** of project implementation activates the site by the strategic plantings of hydrozoned plant materials and specific turf areas. These ecological amendments enhance historic plant materials, improve water infiltration, reduce irrigation by 59% while also improving climate resilience by promoting biodiversity.
Species are characterized by drought tolerance and low water use. All species selected are Sonoran Desert native plant materials.

**DESERT SCRUB**

Species selected are adapted to survive along ephemeral watercourses. They require minimal irrigation and are desert adapted.

**XERO-RIPARIAN**

Species selected are heat and drought tolerant displaying green-gray foliage characteristic of Mediterranean plantings. Irrigation demands are greater for certain exotic and naturalized species.

**TRANSITIONAL**

- *Encelia farinosa* Brittlebush
- *Ericameria laricifolia* Turpentine Bush
- *Dasylirion wheeleri* Desert Spoon
- *Muhlenbergia rigens* Deer Grass
- *Rosemary officinalis* Rosemary
- *Ruellia brittoniana* Katie Ruellia
- *Dasylirion wheeleri* Desert Spoon
- *Sphaeralcea ambigua* Globe Mallow
- *Muilenbergia dumosa* Bamboo Muhly
- *Agave vilmoriniana* Octopus Agave
- *Aloe vera* Aloe
- *Hesperaloe funifera* Giants Hesperaloe
- *Larrea tridentata* Creosote
- *Ambrosia deltoidea* Triangleleaf Bursage
- *Simmondsia chinensis* Jojoba
- *Lycium fremontii* Wolfberry
- *Hesperaloe parviflora* Red Yucca
- *Artemisia ludoviciana* White Sage
- *Calliandra eriophylla* Pink Fairy Duster
- *Cordia parvifolia* Little Leaf Cordia
- *Luecophyllum laevigatum* Chihuahuan Sage
- *Ruellia peninsularis* Baja Ruellia
- *Dodonaea viscosa* Hop Bush
- *Feijoa sellowiana* Pineapple Guava
- *Acacia farnesiana* Sweet Acacia
- *Parkinsonia microphylla* Foothill Palo Verde
- *Prosopis velutina* Velvet Mesquite
- *Olneya tesota* Ironwood
- *Olea europaea* Olive
- *Quercus virginiana* Live Oak
SOCIAL ACTIVATION
PERFORMANCE + INNOVATION AND VALUE TO CAMPUS

PHASE III of project implementation takes the foundation that has been laid by the enhancement of water and plant resources and adds the final layer of sociability. This is accomplished by the introduction of interpretive sculptures, social spaces, educational stations, and seating.

Other ecological features of our design are integrated into the changes in circulation we propose. Permeable pavement makes up the handicap parking extension and the pedestrian sidewalks and bike-way which replace the one-way road along James E. Rogers Way. Bike stations are placed at the Park Ave drop-off circle, and the previously congested vehicular intersection is converted into a safe, legible bike and pedestrian-only roundabout.

Social activation of underutilized spaces and the educational functionality of our site are also major components of our green infrastructure design. We provide a diversity of functional social areas, including the solar ramada workstation, the grass “landscape rooms”, the “observation decks” along the bikeway, and the naturalized, discoverable spaces throughout the daylighted wash. Our team reached out to Technicians for Sustainability, a Tucson local solar installation company who assisted us in analyzing what our photo voltaic output would be. With 16 430 watt modules our ramada would produce a conservative output of 6.1 KwHrs. This is plenty of power to charge several electronic devices at a time while charging a small battery bank to power lights and make the space usable at night for students to work.

Throughout the site, interpretive sculptural art pieces and educational signage boost landscape literacy by showcasing the site’s arboretum trees, the infrastructural components of our design that students and visitors can interact with, and stories about the site’s Historic District features.
PERSPECTIVES
When completed all three phases act in synergy to support the University of Arizona’s interconnected ecological, social, and economic systems.

REFERENCES

### Calculations

#### Surface & Subsurface Basins

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#### Hydrozones: EPA Watersense Budget Tool

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#### Surface Runoff: Curve Method

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\[ Q = \frac{(P - 0.2S)}{P + 0.8S} \]

\[ S = \frac{1000}{CN} - 10 \]

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