Case Studies
Low Impact Development
Green Infrastructure

LID Working Group
January 2014
<table>
<thead>
<tr>
<th>LID Categories</th>
<th>COMMERCIAL- OFFICE- RETAIL</th>
<th>INDUSTRIAL</th>
<th>INSTITUTION</th>
<th>RECREATION</th>
<th>RESIDENTIAL</th>
<th>TRANSPORTATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NEW Small Office</td>
<td></td>
<td></td>
<td>NEW Linear Park</td>
<td>NEW Single Family</td>
<td>NEW Local Neighborhood</td>
</tr>
<tr>
<td></td>
<td>RETRO Small Office</td>
<td></td>
<td></td>
<td>RETRO Linear Park</td>
<td>RETRO Single Family</td>
<td>RETRO Local Neighborhood</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NEW Neighborhood Park</td>
<td>NEW Multi-Dwelling</td>
<td>NEW Collector</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>RETRO Neighborhood Park</td>
<td>RETRO Multi-Dwelling</td>
<td>RETRO Collector</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NEW Regional Park</td>
<td>NEW Subdivision</td>
<td>NEW Terminal</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>RETRO Regional Park</td>
<td>RETRO Subdivision</td>
<td>RETRO Terminal</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NEW Basin</td>
<td>NEW Master Planned Community</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>RETRO Basin</td>
<td>RETRO Master Planned Community</td>
<td></td>
</tr>
</tbody>
</table>

### NEW Categories:
- Commercial: Small Office, Medium or Grouped Use, Large
- Industrial: Distribution, Manufacturing-Fabrication
- Institution: Education-K12, Non-Profit, Medical, Municipal Facilities
- Recreation: Linear Park, Neighborhood Park, Regional Park, Basin
- Residential: Single Family, Multi-Dwelling, Subdivision, Master Planned Community
- Transportation: Local Neighborhood, Collector, Terminal
## ICONS FOR LID PRACTICES

<table>
<thead>
<tr>
<th>SYM</th>
<th>PRACTICE</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Berms and/ or Vegetated/ Rock Swales" /></td>
<td>Berms and/ or Vegetated/ Rock Swales</td>
</tr>
<tr>
<td><img src="image" alt="Inlets or Curb Openings/ Access to Landscape Area" /></td>
<td>Inlets or Curb Openings/ Access to Landscape Area</td>
</tr>
<tr>
<td><img src="image" alt="Roof Runoff to Landscape (new icon 12/17/2013)" /></td>
<td>Roof Runoff to Landscape (new icon 12/17/2013)</td>
</tr>
<tr>
<td><img src="image" alt="Native Vegetation/ Canopy" /></td>
<td>Native Vegetation/ Canopy</td>
</tr>
<tr>
<td><img src="image" alt="Raised Path" /></td>
<td>Raised Path</td>
</tr>
<tr>
<td><img src="image" alt="Disconnect Impervious Surfaces" /></td>
<td>Disconnect Impervious Surfaces</td>
</tr>
<tr>
<td><img src="image" alt="Cisterns or Underground Storage" /></td>
<td>Cisterns or Underground Storage</td>
</tr>
<tr>
<td><img src="image" alt="Pervious Pavement" /></td>
<td>Pervious Pavement</td>
</tr>
<tr>
<td><img src="image" alt="Infiltration Trenches" /></td>
<td>Infiltration Trenches</td>
</tr>
<tr>
<td><img src="image" alt="Use of Condensate" /></td>
<td>Use of Condensate</td>
</tr>
</tbody>
</table>
COMMERCIAL
OFFICE ■ RETAIL ■ MEDICAL
SMALL
MEDIUM
LARGE
<table>
<thead>
<tr>
<th>COMMERCIAL - Office - Retail - Medical</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEW Small Office</td>
</tr>
<tr>
<td>RETRO Small Office</td>
</tr>
<tr>
<td>NEW Medium or Grouped Use</td>
</tr>
<tr>
<td>RETRO Medium or Grouped Use</td>
</tr>
<tr>
<td>NEW Large - Mall, Campus</td>
</tr>
<tr>
<td>RETRO Large - Mall, Campus</td>
</tr>
</tbody>
</table>

Under consideration:
- Cat Mountain Lodge Bed & Breakfast
- Ewing Irrigation
- Rob Paulus Office
- Target- Oracle Road
INDUSTRIAL DISTRIBUTION MANUFACTURING - FABRICATION
<table>
<thead>
<tr>
<th>INDUSTRIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEW Distribution</td>
</tr>
<tr>
<td>RETRO Distribution</td>
</tr>
<tr>
<td>NEW Manufacturing- Fabrication</td>
</tr>
<tr>
<td>RETRO Manufacturing- Fabrication</td>
</tr>
</tbody>
</table>
INSTITUTION
EDUCATION- K THRU COLLEGE
NON-PROFIT
MEDICAL
MUNICIPAL FACILITY
<table>
<thead>
<tr>
<th>INSTITUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NEW Education- K12- College</strong></td>
</tr>
<tr>
<td>UofA CAPLA (College of Architecture, Planning and Landscape Architecture)</td>
</tr>
<tr>
<td>UofA Residence Halls</td>
</tr>
<tr>
<td><strong>RETO Education- K12- College</strong></td>
</tr>
<tr>
<td>UofA Visitor’s Center</td>
</tr>
<tr>
<td><strong>NEW Non-Profit</strong></td>
</tr>
<tr>
<td><strong>RETO Non-Profit</strong></td>
</tr>
<tr>
<td>Nature Conservancy</td>
</tr>
<tr>
<td><strong>NEW Medical</strong></td>
</tr>
<tr>
<td><strong>RETO Medical</strong></td>
</tr>
<tr>
<td>TMC East Campus Renovation</td>
</tr>
<tr>
<td><strong>NEW Municipal Facilities</strong></td>
</tr>
<tr>
<td>Forensic Crime Laboratory- Tucson Police Department</td>
</tr>
<tr>
<td>ROMP</td>
</tr>
<tr>
<td><strong>RETO Municipal Facilities</strong></td>
</tr>
</tbody>
</table>

Under consideration:  
- Community Food Bank  
- Habitat for Humanity  
- La Paloma Family Services  
- Manzo Elementary School  
- National Outdoor Leadership School  
- Tanque Verde Elementary School  
- Tucson Water- Eastside Service Center  
- U of A Student Recreation  
- UMC Cancer Center
PROJECT NAME: UA CAPLA
College of Architecture, Planning and Landscape Architecture - Tucson, AZ

PROJECT TYPE: INSTITUTIONAL □ Educational K-12 - College □ New

LOCATION: 1040 N. Oak Road, UA campus

ACRES: 0.21 Acres (9,066 ft²)

CLIENT: Arizona Board of Regents on behalf of University of Arizona CAPLA (College of Architecture + Planning + Landscape Architecture)

CONTACT: Ron Stoltz, Professor CAPLA; rnotto@email.arizona.edu

DESIGNED BY: Ten Eyck Landscape Architects, Austin

FINISHED PROJECT DESCRIPTION: Reclaimed 2.2 acres of parking lot to create a Sonoran Desert-based community landscape. Native fauna introduced (endangered fish and frogs) or integrated (road runner, gray fox) have thrived. Repopulation and active predation activities have been observed. Establishment period (first 3-5 years) reduced potable water use by 85% (280,000 gallons annually). After establishment, use of potable water should be eliminated. Reused brick and concrete, salvaged from the partial building demolition, to line the Desert Riparian channels.

SUMMARY:

GOALS

- CONSERVE water by totally integrating building mechanical systems with landscape fully integrated with building mechanical systems. ET rates integrated into high-efficiency drip-irrigation systems. Significant terrestrial and aquatic habitat created.
- Adapts rain gardens to stormwater drainage system. High-efficiency drip-irrigation system is controlled by monitoring ET rates.
- New, 1,100 gallon water tank (7’ diameter x 38’ tall)

COST

- ESTIMATED COST: $40,000 - planting, irrigation, lighting

- FUNDING SOURCE: Many sources

- CONSTRUCTION: Hardscape professionally constructed for about $200,000.
- LABOR: Remainder was volunteer, primarily AAA Landscape


- MAINTENANCE: AAA Landscape (donated)

- COMPARISON TO CONVENTIONAL: This project shows that a high performance design that harvests water, mitigates urban heat island, reduces urban flooding, integrates urban wildlife habitat and provides an aesthetic and comfortable environment can be achieved at a relatively low cost.

- TIME TO BUILD: 2.5 months

- LOCATION MAP

- PHOTOS

- PHOTOS

- PHOTOS

- PHOTOS

- PHOTOS

- PHOTOS

- PHOTOS
LOCATION: Tucson, AZ

PROJECT NAME: UNIVERSITY OF ARIZONA SIXTH STREET RESIDENCE HALLS
PROJECT TYPE: INSTITUTIONAL

LOCATION

The University of Arizona

ACRES

Arbol de la Vida - 2 AC; Likins Hall - 2.2 AC

CLIENT

The University of Arizona

CONTACT

Debra Johnson, University of Arizona Project Manager
email: debraj@email.arizona.edu | phone: (520) 626-2420

DESIGNED BY

Stantec Engineering, Ltd

Carl Kominsky, irrigation design (subconsultant to WSA)

FINISHED PROJECT DESCRIPTION

The landscape design uses Sonoran Desert plant materials, and implements passive water harvesting techniques. The landscape concept for both buildings was influenced by local elements: at Arbol de la Vida, a “slot canyon” orients rooms around oblique courtyards; at Likins the buildings are situated along the path of a former urban drainage corridor, expressing the arroyo in a more natural form.

LESIONS LEARNED

SUCCESSFUL TEAM COLLABORATION LED TO THE DEVELOPMENT AND INSTALLATION OF THE INNOVATIVE DEEP WATER DISTRIBUTION SYSTEM WHICH PROVIDES SUPPLEMENTAL IRRIGATION TO THE DEEP-ROOTED MESORIPARIAN TREE SPECIES USED IN THE CANYON-LIKE COURTYARDS OF THE BUILDINGS.

SOMETHING TO BE DONE DIFFERENTLY:

WSA’S DESIGN PROCESS BALANCED LANDSCAPE WATER NEEDS (DEMAND) AND SUPPLY BUT COULD NOT ACCOMMODATE ACTIVE HARVESTING. IDEALLY, BUY IN FROM THE CLIENT AND STAKEHOLDERS early to support a balanced, self-sufficient landscape design.

SOMETHING TO BE PROUD OF:

SUCCESSFUL TEAM COLLABORATION LED TO THE DEVELOPMENT AND INSTALLATION OF THE INNOVATIVE DEEP WATER DISTRIBUTION SYSTEM—which provides supplemental irrigation to the deep-rooted mesoriparian tree species used in the canyon-like courtyards of the buildings.

TO BE PROUD OF:

SUCCESSFUL TEAM COLLABORATION LED TO THE DEVELOPMENT AND INSTALLATION OF THE INNOVATIVE DEEP WATER DISTRIBUTION SYSTEM—which provides supplemental irrigation to the deep-rooted mesoriparian tree species used in the canyon-like courtyards of the buildings.

TO BE DONE DIFFERENTLY:

WSA’S DESIGN PROCESS BALANCED LANDSCAPE WATER NEEDS (DEMAND) AND SUPPLY BUT COULD NOT ACCOMMODATE ACTIVE HARVESTING. IDEALLY, BUY IN FROM THE CLIENT AND STAKEHOLDERS early to support a balanced, self-sufficient landscape design.

TO BE PROUD OF:

SUCCESSFUL TEAM COLLABORATION LED TO THE DEVELOPMENT AND INSTALLATION OF THE INNOVATIVE DEEP WATER DISTRIBUTION SYSTEM—which provides supplemental irrigation to the deep-rooted mesoriparian tree species used in the canyon-like courtyards of the buildings.

DESIGN FEATURES:

- Numerous passive water harvesting techniques were implemented. Traditional practices such as micro-basins, swales, check-dams, and recessed grading were employed. Given the deep rooting characteristic of mesoriparian tree species, a Deep Water Distribution System (DWDS) for distributing harvested stormwater to subsurface soil depths was devised in collaboration with Stantec Civil Engineers. The Deep Water Distribution System is a buried, sloped manifolded system comprised of 4” – 6” solid and perforated PVC piping which distributes stormwater to a soil depth of 3+ feet. Clean outs and elbow sweeps were included for maintenance purposes.

- To improve water delivery effectiveness and reduce water consumption, separate valves for the meso-riparian tree species were installed. Soil moisture sensors were installed at depths of 8 and 24 inches and linked to the irrigation controller prevent both under and over-irrigation.

- The first residence halls in the state to achieve LEED Platinum certification.

- Successful team collaboration led to the development and installation of the innovative Deep Water Distribution System which provides supplemental irrigation to the deep-rooted mesoriparian trees used in the canyons-like courtyards of the buildings.

- The landscape concept for both buildings was influenced by local elements: at Arbol de la Vida, a “slot canyon” orients rooms around oblique courtyards; at Likins the buildings are situated along the path of a former urban drainage corridor, expressing the arroyo in a more natural form.

- The landscape design uses Sonoran Desert plant materials, and implements passive water harvesting techniques.

- Given the deep rooting characteristic of mesoriparian tree species, a Deep Water Distribution System (DWDS) for distributing harvested stormwater to subsurface soil depths was devised in collaboration with Stantec Civil Engineers. The Deep Water Distribution System is a buried, sloped manifolded system comprised of 4” – 6” solid and perforated PVC piping which distributes stormwater to a soil depth of 3+ feet. Clean outs and elbow sweeps were included for maintenance purposes.

- To improve water delivery effectiveness and reduce water consumption, separate valves for the meso-riparian tree species were installed. Soil moisture sensors were installed at depths of 8 and 24 inches and linked to the irrigation controller prevent both under and over-irrigation.

- The first residence halls in the state to achieve LEED Platinum certification.

- Successful team collaboration led to the development and installation of the innovative Deep Water Distribution System which provides supplemental irrigation to the deep-rooted mesoriparian trees used in the canyons-like courtyards of the buildings.

- The landscape concept for both buildings was influenced by local elements: at Arbol de la Vida, a “slot canyon” orients rooms around oblique courtyards; at Likins the buildings are situated along the path of a former urban drainage corridor, expressing the arroyo in a more natural form.

- The landscape design uses Sonoran Desert plant materials, and implements passive water harvesting techniques.
PROJECT NAME: U of A VISITOR CENTER
PROJECT TYPE: INSTITUTIONAL  ■  Educational College  ■  Retrofit

Tucson, AZ

LOCATION
811 N. Euclid Avenue, Tucson AZ 85721

ACRES
32,158 sf
0.74 acres

CLIENT
University of Arizona

DESIGNED BY
UA Planning, Design and Construction, in collaboration with students, faculty, staff, and West University Neighborhood representatives

COMPLETED
Fall 2007

DATA

FUNDING SOURCE
Funding provided by the UA Visitor's Center. Some funding of student labor was provided via a grant from the UA WRRC (Water Resources Research Center).

ESTIMATED COST
$25,000 - $30,000

ACTUAL COST

MAINTENANCE
Maintained by UA Facilities Management Grounds Services

TIME TO BUILD
4 months

GOALS

STAKEHOLDERS:
■ Primary stakeholder: UA Visitor’s Center. ■ Goals: Improve the site’s landscape for Center employees and visitors. ■ Create a demonstration of sustainable landscape. Prior to the project there was a sparsely planted gravel landscape that was a relic of a prior water-intensive Mediterranean-styled commercial landscape. ■ West University Neighborhood representatives. ■ Goals: Create a forum to educate the community about water harvesting. ■ Include the possibility to sustain higher water-use crops such as citrus, due to the savings from remnant plants.

PROJECT RECOGNITION:
No LEED points sought. Recognition received through dedication ceremony and the site is a frequent stop on campus tours as well as tour for sustainability/water harvesting conferences.

PERFORMANCE MEASURES:
■ Historic review affirmed appropriateness of the design. ■ Almost all rain from most events is retained, mitigating runoff from the existing parking. ■ A good example of minimizing and disconnecting paved surfaces to provide greater infiltration. ■ A good example of passive irrigation catchments and flow paths keyed to the eventual spread of the mature landscape. ■ Goal to remove native plants from drip irrigation is progressing.

PHOTOS

SUMMARY

DESIGN FEATURES:
■ Roof gutters and corrugated metal cisterns. ■ Electronic valve actuated gravity flow irrigation system for cistern water. ■ From the cistern, the water is delivered to planting terraces via bubblers. ■ Recessed water harvesting basins were designed in response to a number of site conditions. ■ Native landscape plants were selected due to their character to use harvested water as passive irrigation.

FINISHED PROJECT DESCRIPTION:
Existing landscape was renovated using native plants and water harvesting, including addition of two cisterns. Project designed Spring 2007 and installed summer/fall 2007. Drip irrigation was provided to allow native plants to become established. Eventually they will be weaned from irrigation. The citrus will remain on irrigation which will be used during harshest months in case rainfall or stored catchment is not adequate.

LESSONS LEARNED

LOCATION MAP

SOMETHING TO BE PROUD OF:
■ Natural-ecological characteristics of the site have been enhanced. ■ Edible fruit tree (Lemons) included in project to demonstrate use of harvested cistern water in supporting edible landscape. ■ Project users have been pleased with the result, both as a work environment and as a demonstration/education site. ■ The collaboration of students, faculty, and staff in made this project feasible. ■ The project continues to serve as a demonstration for visitors as well as for the design of subsequent campus projects.

SOMETHING TO BE DONE DIFFERENTLY:
■ Much of the passive water harvesting (basin excavation, landforming, surfacing) and planting was completed by student labor. Implementing a project of this scope using student labor is challenging. Subsequent student projects have been more modest in scope. ■ It may have been helpful to provide a specific maintenance plan and schedule to help clarify planting goals for future maintenance staff as well as to help in transitioning from drip irrigation to only harvested water.

PROJECT TYPE: INSTITUTIONAL
■ Educational College
■ Retrofit

PROJECT NAME:
U OF A VISITOR CENTER
**PROJECT NAME:** NATURE CONSERVANCY

**PROJECT TYPE:** Non-Profit  Retrofit

**LOCATION:** 1510 E. Ft. Lowell Road

**ACRES:** 2.29 acre

**CLIENT:** Tucson Nature Conservancy

**MANUFACTURED BY:** Water Harvesting Solutions

**DESIGN COST:**

**CONSTRUCTION COST:**

**ACTUAL COST:** Donation

**ESTIMATED COST:**

**FUNDING SOURCE:** Donation

**MAINTENANCE:** Volunteer

**COMPLETED:** 2009 with upgrades through 2012

**FINISHED PROJECT DESCRIPTION:**

- The Tucson Nature Conservancy has a long history of sustainable practices that demonstrate sustainable landscaping, water harvesting and solar power.
- The site includes both active and passive rainwater harvesting techniques: three above-ground cisterns, vegetated swales, basins, curb cuts, dirt berms and permeable paving.
- In 2012, an underground cistern (30,000 gallons capacity) was added to the project site, because the existing above-grade cistern (3,800 gallons capacity) was not large enough to store the rainwater needed for irrigation, and there was no room on the property for a larger tank.
- The updated system's passive water quality management uses natural thermal and capillary action to keep water in the cistern moving with a circulation pump, and a natural bio-film on the plates and in the sand layer improves the quality of the water in storage.
- The system is expected to save 60-70,000 gallons per year while providing a demonstration project to the visiting public on rainwater harvesting storage and treatment methods.

**DESIGN FEATURES:**

- The new underground cistern was constructed on-site out of 85% recycled polypropylene crates (Atlantis Underground Tank System from Wahaso). Rainwater is collected from both the building rooftop and off the solar car shade surfaces.
- A dual filtration step with U.V. sanitation filters the water to 5 microns and essentially sterilizes the water exiting to the irrigation system to minimize any risk to public health.
- The long dry season required a system that could store the water for months without the risk of it going anaerobic with the associated issues of bad odors and color.

**PROJECT RECOGNITION:** None was sought.

**PERFORMANCE MEASURES:** The Tucson Nature Conservancy has a long history of sustainable practices that have been used to demonstrate sustainable landscaping, vegetated swales and rainwater harvesting. The updated system is expected to save 60-70,000 gallons per year with updated drip irrigation system and expanded cistern.

**STAKEHOLDERS:** Tucson Nature Conservancy and its partners

**REGULATORY:** City of Tucson

**GOALS:**

**SUMMARY:**

**LESSONS LEARNED:**

**SOMETHING TO BE PROUD OF:**

- The rainwater harvesting project helps to promote appropriate rainwater harvesting and demonstrate beneficial effects of designing with nature, while it also contributes to reducing potable water use and soil erosion.
- The Nature Conservancy sees the grounds as a community asset where one can learn about sustainability and common sense approaches to sustainable design and practices.

**SOMETHING TO BE DONE DIFFERENTLY:** Nothing
DATA

LOCATION: 3300 E. Craycroft Road, Tucson, Arizona 85710
Northwest corner Craycroft Road and Grant Road

ACRES: 15.38 Acres (67,031 SF)

CLIENT: TMC
President: Judith F. Rich
Interim President: Richard Prevallet

FACILITIES AND LANDSCAPE ARCHITECT
DESIGN GROUP - Design Manager

CONTACT: Harvey Mitchell
Harvey.Mitchell@tmcaz.com

DESIGNED BY: RBF Consulting Engineer
Kimley-Horn - Landscape Architect
DIA Group - Design Manager

PROGRAMMED AND BUILT
2013

PROJECT NAME: TMC EAST CAMPUS
PROJECT TYPE: INSTITUTIONAL [ ] Medical Campus [ ] Retrofit

ESTIMATED COST: Project scope changed monthly - no initial estimate requested.
FUNDING SOURCE: TMC

COST

ACTUAL COST: DESIGN COST: $154,451 (Landscape)
CONSTRUCTION COST: 12.5 M (A 4 project)

MAINTENANCE: TMC: Grounds

COMPARE TO CONVENTIONAL:
Not evaluated

TIME TO BUILD: 18 months

REGULATORY:
[ ] Design had to meet the POF (Planned Area Development), a document that surrounding neighbors helped draft with the CDT Planning Department.
[ ] The Alamo Wash complied with the City of Tucson Water Treatment Ordinance.

STAKEHOLDERS:
[ ] TMC wanted a design that is aesthetically pleasing and complies with the City of Tucson Water Treatment Ordinance.

GOALS

The design team was able to fulfill the PAD (Planned Area Development) requirements and create an aesthetically pleasing campus landscape.

PHOTOS

Before-2010

After-2012

After-2013

Before-2010

After-2013

PHOTOS

SOMETHING TO PROUD OF:
[ ] Early in the project, DOT CDT called and offered a large saguaro from the adjacent roadway widening project that would have to be destroyed because it was too large to move. TMC accepted the saguaro and it was carefully integrated into the early design so no impacts would occur during construction.
[ ] Teamwork was very positive on the project: The Civil Engineer at RBF worked closely with the Landscape Architect at THA, to provide effective water harvesting throughout the parking and perimeter landscaping. This coordination and teamwork allowed the functional and aesthetic sides of the project’s drainage/water harvesting system to be fully blended. The contractor, Borderland Construction, also was diligent to clarify design issues rather than make assumptions that could alter the integrity of the design.

SOMETHING TO BE DONE DIFFERENTLY:
Although it was out of the question at the time of the project, the ultimate achievement would have been to naturalize the Alamo Wash from its concrete-lined channel back to the earthen channel as found on the upstream and downstream ends.

LOCATION MAP

Low Impact/ Green Infrastructure

LESIONS LEARNED

DESIGN FEATURES:
[ ] Required parking lot landscaping was provided in linear medians located at the head-end of the parking area. All medians have flush curbs allowing surface runoff access to landscape areas, plus a raised curb on the opposing side to delay the rainfall and allow greater infiltration.

SUMMARY

DESIGN FEATURES:
[ ] The civil and landscape improvements provide a fresh face to the TMC east campus which had not been upgraded for some time. Since many of the shrubs were overgrown, creating hiding spaces, each area was evaluated to determine whether pruning or removal was required.
[ ] A new bridge allowed access from Craycroft Road.

FINISHED PROJECT DESCRIPTION:
[ ] The civil and landscape improvements provide a fresh face to the TMC east campus which had not been upgraded for some time. Since many of the shrubs were overgrown, creating hiding spaces, each area was evaluated to determine whether pruning or removal was required.

THE IMPACT/INFRASTRUCTURE MONTHLY NO ESTIMATE REQUESTED.

The creation of a winding swale, lined with angular rock allows slowing of the stormwater flow and optimal infiltration to support the adjacent landscaping.
**PROJECT NAME:** FORENSIC CRIME LABORATORY - Tucson Police Department  
**PROJECT TYPE:** INSTITUTIONAL  
**Municipal Facility**  
**New**

**Tucson, AZ**

**LOCATION**: 1306 W. Miracle Mile, Tucson, Arizona 85705  
**NEEDS**: Northeast City of Tucson  
**FUNDING**: $20 Million  
**MAINTENANCE**: City of Tucson  
**REFERENCE**: Michael Becherer RA  
**FUNDING SOURCE**: Public  
**DESIGNED BY**: WSM - Architects, DOWL HKM - Engineering, Kimley-Horn - Landscape Architecture  
**CONTACT**: Michael Becherer RA  
**CONTACT EMAIL**: mbecherer@wsmarch.com  
**TIME TO BUILD**: 18 months  
**ACTUAL COST**: DESIGN COST: $45,000 (Landscape)  
**ESTIMATED COST**: $20 Million  
**CONSTRUCTION COST**: $23M (Total)  
**COMPLETED**: August, 2011  

**COST**

**SUMMARY**

**DESIGN COST**: $45,000 (Landscape)  
**CONSTRUCTION COST**: $23M (Total)  
**MAINTENANCE**: City of Tucson  
**TIME TO BUILD**: 18 months  

**DESIGN FEATURES**:  
- The project was designed with a high-tech drip irrigation system including a state-of-the-art weather monitoring equipment that adjusts irrigation based on localized weather data. This system will assure establishment of the low water-use drought tolerant plants selected from the Arizona Department of Water Resources plant list.  
- The project was designed with a high-tech drip irrigation system including a state-of-the-art weather monitoring equipment that adjusts irrigation based on localized weather data. This system will assure establishment of the low water-use drought tolerant plants selected from the Arizona Department of Water Resources plant list. 
- The project was designed with a high-tech drip irrigation system including a state-of-the-art weather monitoring equipment that adjusts irrigation based on localized weather data. This system will assure establishment of the low water-use drought tolerant plants selected from the Arizona Department of Water Resources plant list. 
- The project was designed with a high-tech drip irrigation system including a state-of-the-art weather monitoring equipment that adjusts irrigation based on localized weather data. This system will assure establishment of the low water-use drought tolerant plants selected from the Arizona Department of Water Resources plant list.

**GOALS**

**REGULATORY**:  
- Design had to blend with the adjacent Westside Police Substation.  
- Compliance with City of Tucson Development Standards was required, including the addition of landscape borders and compliance with the Native Plant Preservation Ordinance.  
- While the City’s Commercial Rainwater Harvesting Ordinance had not yet taken effect, this project was asked to comply as closely as possible to serve as a model for future municipal construction projects.

**STAKEHOLDERS**:  
- All stakeholders for the project must come from on-site sources, including rainfall captured from the roof, HVAC condensate (which minimizes waste and recovers energy), backwash from a large-scale reverse osmosis system, and graywater from fixture waste.  
- The harvested water is stored in a series of underground tanks.  
- Must allow adjacent Tucson Police substation to use excess harvested water.  
- Water Resources plant list.  
- A weather station will be incorporated into the irrigation controller so that the system can effectively monitor the precise amount of irrigation that is required based on the local weather conditions and on the needs of the plants.

**PROJECT RECOGNITION**:  
- 2012 Merit Award Winner for “Best Of” Government/Public Buildings in Arizona/Nevada/New Mexico - ENR-Southwest Contractor  
- 2012 Merit Award Winner for “Best Of” Government/Public Buildings in Arizona/Nevada/New Mexico - ENR-Southwest Contractor  
- The project was designed with a high-tech drip irrigation system including a state-of-the-art weather monitoring equipment that adjusts irrigation based on localized weather data. This system will assure establishment of the low water-use drought tolerant plants selected from the Arizona Department of Water Resources plant list.  
- The project was designed with a high-tech drip irrigation system including a state-of-the-art weather monitoring equipment that adjusts irrigation based on localized weather data. This system will assure establishment of the low water-use drought tolerant plants selected from the Arizona Department of Water Resources plant list.  
- The project was designed with a high-tech drip irrigation system including a state-of-the-art weather monitoring equipment that adjusts irrigation based on localized weather data. This system will assure establishment of the low water-use drought tolerant plants selected from the Arizona Department of Water Resources plant list.  
- The project was designed with a high-tech drip irrigation system including a state-of-the-art weather monitoring equipment that adjusts irrigation based on localized weather data. This system will assure establishment of the low water-use drought tolerant plants selected from the Arizona Department of Water Resources plant list.

**COMPARE TO CONVENTIONAL**

**MAKE IT HAPPEN**

**FINISHED PROJECT DESCRIPTION**:  
- The project was designed with a high-tech drip irrigation system including a state-of-the-art weather monitoring equipment that adjusts irrigation based on localized weather data. This system will assure establishment of the low water-use drought tolerant plants selected from the Arizona Department of Water Resources plant list.  
- The project was designed with a high-tech drip irrigation system including a state-of-the-art weather monitoring equipment that adjusts irrigation based on localized weather data. This system will assure establishment of the low water-use drought tolerant plants selected from the Arizona Department of Water Resources plant list.  
- The project was designed with a high-tech drip irrigation system including a state-of-the-art weather monitoring equipment that adjusts irrigation based on localized weather data. This system will assure establishment of the low water-use drought tolerant plants selected from the Arizona Department of Water Resources plant list.  
- The project was designed with a high-tech drip irrigation system including a state-of-the-art weather monitoring equipment that adjusts irrigation based on localized weather data. This system will assure establishment of the low water-use drought tolerant plants selected from the Arizona Department of Water Resources plant list.

**FINISHED PROJECT DESCRIPTION**:  
- The project was designed with a high-tech drip irrigation system including a state-of-the-art weather monitoring equipment that adjusts irrigation based on localized weather data. This system will assure establishment of the low water-use drought tolerant plants selected from the Arizona Department of Water Resources plant list.  
- The project was designed with a high-tech drip irrigation system including a state-of-the-art weather monitoring equipment that adjusts irrigation based on localized weather data. This system will assure establishment of the low water-use drought tolerant plants selected from the Arizona Department of Water Resources plant list.  
- The project was designed with a high-tech drip irrigation system including a state-of-the-art weather monitoring equipment that adjusts irrigation based on localized weather data. This system will assure establishment of the low water-use drought tolerant plants selected from the Arizona Department of Water Resources plant list.  
- The project was designed with a high-tech drip irrigation system including a state-of-the-art weather monitoring equipment that adjusts irrigation based on localized weather data. This system will assure establishment of the low water-use drought tolerant plants selected from the Arizona Department of Water Resources plant list.

**MAKE IT HAPPEN**

**SUMMARY**

**DESIGN FEATURES**:  
- The project was designed with a high-tech drip irrigation system including a state-of-the-art weather monitoring equipment that adjusts irrigation based on localized weather data. This system will assure establishment of the low water-use drought tolerant plants selected from the Arizona Department of Water Resources plant list.  
- The project was designed with a high-tech drip irrigation system including a state-of-the-art weather monitoring equipment that adjusts irrigation based on localized weather data. This system will assure establishment of the low water-use drought tolerant plants selected from the Arizona Department of Water Resources plant list.  
- The project was designed with a high-tech drip irrigation system including a state-of-the-art weather monitoring equipment that adjusts irrigation based on localized weather data. This system will assure establishment of the low water-use drought tolerant plants selected from the Arizona Department of Water Resources plant list.  
- The project was designed with a high-tech drip irrigation system including a state-of-the-art weather monitoring equipment that adjusts irrigation based on localized weather data. This system will assure establishment of the low water-use drought tolerant plants selected from the Arizona Department of Water Resources plant list.

**MAKE IT HAPPEN**

**LESSONS LEARNED**

**SOMETHING TO BE PROUD OF**:  
- The approach of requiring the Crime Lab site to use no potable water for landscaping plus providing sufficient non-potable/harvested water for the adjacent Police Substation landscaping resulted in receipt of the 2012 Merit Award Winner for “Best Of” Government/Public Buildings in Arizona/Nevada/New Mexico - ENR- Southwest Contractor.

**SOMETHING TO BE DONE DIFFERENTLY**:  
- The biggest challenge that the project has faced post-construction is the quality of the water that is originating from the rainwater harvesting tanks. Recent analysis has shown excessive amounts of sodium which is negatively impacting the plants. The high sodium content is likely due to the addition of water draining from the cooling tower blowdown or the Reverse Osmosis Reject water. Efforts are underway to improve water quality by preventing water from these sources from entering the tanks.
PROJECT NAME: WATER & ENERGY SUSTAINABILITY CENTER, aka ROMP LAB

PROJECT TYPE: ■ INSTITUTIONAL ■ Municipal Facility ■ New

Tucson, AZ

LOCATION: 3035 W El Camino del Cerro, Tucson, AZ 85745

ACRES: 11 AC

CLIENT: Pima County Regional Wastewater Reclamation Department

CONTACT: Adam Bliven, Pima County Regional Wastewater Reclamation Department
email: Adam.Bliven@wwm.pima.gov; phone: 520-690-2745

DESIGNED BY: Wheat Scharf Associates - Planting, Hardscape and Water Harvesting design
Stantec Consulting Services - Civil Engineer
HDR - Architect
Pattison Evanoff Engineering - Geotech

COMPLETED: December, 2011

PROJECT TYPE: ■ INSTITUTIONAL ■ Municipal Facility ■ New

LOCATION MAP

DATA

REGULATORY: Pima County Regulations as well as City of Tucson regulatory requirements for a critical facility

STAKEHOLDERS: ► Pima County Regional Wastewater Reclamation Department.
■ Goal: LEED Certification.

GOALS

PROJECT RECOGNITION: Registered with USGBC; nominated for Common Ground award

PERFORMANCE MEASURES: LEED Certification: Reduce potable water consumption for irrigation by 50% from a calculated mid-summer baseline case (LEED for New Construction)

COST

ESTIMATED COST: 28 million

FUNDING SOURCE:
- DESIGN COST: $123,000 Irrigation; $137,000 Pathways
- Site furnishings: $50K Gabion; $63K Site furnishings
- $46K Riprap; $75K Plantings

CONSTRUCTION COST: $28,870,000.

ACTUAL COST:
- Design:
  - Landscape: $123,000
  - Irrigation: $137,000
- Site furnishings: $50,000
- Riprap: $46,000
- Plantings: $75,000

MAINTENANCE:
- Public - Pima County

COMPARE TO CONVENTIONAL: N/A

TIME TO BUILD: 12 months

SUMMARY

FINISHED PROJECT DESCRIPTION:
- Part of Pima County’s Regional Wastewater Reclamation complex, this project’s charge included demonstrating and showcasing County sustainability goals including water harvesting and the use of indigenous landscape plants.
- WSA developed the overall landscape concept with pedestrian circulation and interpretive trails including interface with The Loop, and incorporating passive water harvesting throughout.
- Techniques and features include microbasins, gabion weirs, curb cuts, and swales with check dams.
- Fine grading directs site and parking stormwater runoff to recessed planting areas.
- Secondary stabilized DG pathways are raised above landscape areas.
- Roof drains direct storm water through a water feature into a sequence of planted water harvesting basins linked by weirs.
- Sonoran Desert plant species, including a diverse collection of cacti, showcase the beauty of native, low-water usage plants.

DESIGN FEATURES:
- Water harvesting techniques include microbasins, weirs using rock-filled gabions, curb cuts, and swales with check dams.
- Water is collected from the roof and directed to a rain-event water feature and site runoff is directed through the weirs to recessed planting areas. ■ The trees and shrubs selected are primarily arid adapted, desert plant species. Mesquite and Palo Verde figure prominently in the planting design and are keystone Sonoran Desert native plants. ■ A large detention basin features native species like Net-leaf Hackberry and Arizona Walnut that are adapted to periodic inundation. ■ All supplemental water used for landscape irrigation is reclaimed. ■ Pervious pavement allows additional water capacity on-site.

LESSONS LEARNED

SOMETHING TO BE PROUD OF:
- An existing site, devoid of vegetation, has been transformed into a showcase of sustainability.
- The landscape has been embraced by the staff - soon after the landscape was installed, WSA was asked to create a brochure detailing plant material and water harvesting features in order to assist staff when giving tours to the public.
- Supported by extensive water harvesting, the landscape is primed to endure and inspire for many years.

SOMETHING TO BE DONE DIFFERENTLY:
- Setting the correct height of the leveling pipe and overflow outlet drains (used to provide overflow from a basin and prevent flooding) can be challenging.
- Early coordination with the Civil Engineer is suggested.
RECREATION
LINEAR PARK
NEIGHBORHOOD PARK
REGIONAL PARK
BASIN
<table>
<thead>
<tr>
<th>RECREATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEW Linear Park</td>
</tr>
<tr>
<td>RETRO Linear Park</td>
</tr>
<tr>
<td>NEW Neighborhood Park</td>
</tr>
<tr>
<td>RETRO Neighborhood Park</td>
</tr>
<tr>
<td>Blue Moon Community Garden- Tucson House* (Residential)</td>
</tr>
<tr>
<td>Highland Vista</td>
</tr>
<tr>
<td>NEW Regional Park</td>
</tr>
<tr>
<td>RETRO Regional Park</td>
</tr>
<tr>
<td>NEW Basin</td>
</tr>
<tr>
<td>RETRO Basin</td>
</tr>
<tr>
<td>Kolb Road Basin</td>
</tr>
</tbody>
</table>

*Cross category

Under consideration:
- Broadmoor Pocket Park
- Centenniel Park
- Julian Wash River Park- Kolb to Rita Ranch
- KERP (Kino Environmental Restoration Park)
- Manuel Herrera Park
- Paseo de las Iglesias
- Star Valley Dog Park
- Tohono Chul Sin Agua Garden
- Tucson Botanical Garden
**PROJECT NAME**: BLUE MOON COMMUNITY GARDEN (Tucson House)

**PROJECT TYPE**: RECREATION • Neighborhood Park • Retrofit

**LOCATION**
1501 North Oracle Road

**ACRES**
1 Acre (+/-)

**CLIENT**
TUCSON HOUSING AND COMMUNITY DEVELOPMENT
305 N. COMMERCE PARK LOOP
TUCSON, ARIZONA 85705

**DESIGNED BY**
Norris Design
418 N. Toole Ave Tucson, AZ 85701 (520) 622-9565

**CONTACT**
Gina Chorover
(520) 837-0946 Gina.Chorover@tucson.gov

**PROJECT RECREATION**

**PROJECT NAME**: BLUE MOON COMMUNITY GARDEN (Tucson House)

**PROJECT TYPE**: RECREATION

**CATEGORY**: Residential - Multi-Dwelling

**COST**

- **ESTIMATED COST**: $288,000.00
- **FUNDING SOURCE**
  - CDBG Grant
  - Tucson Water Grant
  - HCD Grant
  - CPPW Funds

- **ACTUAL COST**: Design Cost: $28,000.00
- **CONSTRUCTION COST**: $260,000.00

- **MAINTENANCE**
  - Community Gardens of Tucson

- **TIME TO BUILD**
  - 5/6/2013

**FINISHED PROJECT DESCRIPTION**
- The Blue Moon Community Garden is the first fully accessible community garden in Tucson.
- The 42,500 square foot site includes 36 garden beds, a citrus grove, butterfly garden, a central promenade, gathering areas with a shade ramada, barrier free design, and a loop trail with connectivity to the Tucson House.
- The landscape architect developed interpretative signage to educate residents and visitors about the garden and the active water harvesting system that provides irrigation to the garden beds.
- In addition, a 35,000 gallon rainwater harvesting tank captures rainwater and 4/2 condensate from a 170 story building, providing water for the landscape plants and fruit trees.
- The garden was selected as a Tucson Water Demonstration Garden.

**GOALS**

- **REGULATORY**: City of Tucson
- **STAKEHOLDERS**:
  - Tucson House, a high rise development which is home to over 600 low-income, disabled, elderly residents and adjacent neighbors.
  - Community Gardens of Tucson
- **PROJECT RECOGNITION**: A2 ASLA Honor Award for General Design 2013

**PERFORMANCE MEASURES**

- ADA Accessibility
- Passive and active rainwater harvesting from 1/4 of the Tucson House roof and condensate from HVAC
- Reuse existing fire suppression 15,000 gallon water tank
- Pump harvested water to second on-site cistern
- Metering devices for both portable and harvested rainwater, and power
- Tucson Water Demonstration Garden, Community Gardens of Tucson design and equipment standards.

**SUMMARY**

**DESIGN FEATURES**

- Reclaimed approximately 1 acre of existing parking lot.
- Reused existing 11,000 gallon water tank.
- Added a second cistern and end pump with brain boxes to irrigate with harvested rainwater.
- Installed meters for portable and reclaimed water and the power used on-site.
- Installed soil moisture sensing devices and controller which automatically adjusts water time using on-site soil moisture as a basis.
- Tied into HVAC condensate line which is also metered.
- Through a charrette process designed garden beds of varying heights and styles to accommodate a variety of disabilities.
- Provided lockers for garden users and a compost station.

**PHOTOS**

- **PHOTOS - Before**
- **PHOTOS - After**

**LOCATION MAP**

**LESSONS LEARNED**

**SOMETHING TO BE PROUD OF**
- The garden was selected as a Tucson Water Demonstration Garden and received A2 ASLA Honor Award for General Design 2013.
- The garden has been designed with metering devices to become a study site with the potential to determine everything from the cost of a harvested gallon of water to the toxicity levels of fruit harvested from the citrus grove.

**SOMETHING TO BE DONE DIFFERENTLY**
- The raised still garden beds which provide accessibility to people in wheelchairs created a drainage issue with the method of construction and the amount of over-watering by its users.
- The center should be water to provide more drain room between the CMU cells and vertical gravel sumps should be installed in future beds of this kind.
**PROJECT NAME:** HIGHLAND VISTA  
**PROJECT TYPE:** RECREATION  
**LOCATION:** Tucson, AZ  
**ACREAGE:** 1.16 Acres (50,700 sq ft)

**DATA**

- **NAME:** Vista GI Development  
- **TYPE:** Neighborhood Park  
- **PROJECT:** Retrofit

**COST**

- **ESTIMATED COST:** Not calculated  
- **FUNDING SOURCE:** Neighborhood Reinvestment Bonds

- **ACTUAL COST:**  
  - DESIGN: $9,335  
  - CONSTRUCTION: $55,462

- **MAINTENANCE:** City of Tucson Parks and Recreation - Focus on reduction of Bermuda Grass.

- **COMPLETE TO:**  
  - DESIGN: Not calculated
  - CONSTRUCTION: 2010

**GOALS**

- **REGULATORY:** Community Initiative, no regulatory requirement
- **STAKEHOLDERS:** (Neighborhood):  
  - Development of a passive recreation park  
  - Use water harvesting techniques to mitigate storm water flow in the residential neighborhood  
  - Transform a problematic stormwater drainage situation into an aesthetic improvement  
  - Create a Natural Area Enhancement  
  - Education  
  - Preservation of natural corridors  
  - Habitat restoration  
  - Recreation  
  - Eliminate pooling water and associated mosquito habitat  
  - Reduce pollutants flowing into washes  
  - Reduce erosion, runoff and sedimentation

- **PROJECT RECOGNITION:** Project did not seek LEED designation.

- **PERFORMANCE MEASURES:** Constructed per plans and specifications. Stakeholder goals met. Greater infiltration has reduced mosquito habitat and runoff.

**SUMMARY**

**DESIGN FEATURES:**  
- "Boomerang Berms" for water harvesting  
- Micro-catchment basins for catching water in shallow depressions  
- Infiltration Basins with Check Dams for capturing off-site runoff and infiltrating it  
- Preservation of existing vegetation  
- Walking path  
- Educational display  
- Native plant palette  
- Inclusion of Brad Lancaster, author of "Rainwater Harvesting for Drylands and Beyond" for design review gave additional insight to the solution.

**FINISHED PROJECT DESCRIPTION:**  
- The project is a riparian restoration for an area in the south portion of 20/30 Park bordered by Arzecia Wash to the south and an existing walking path to the north. Additional paths increase the site’s recreational value. The design includes a system of passive water harvesting basins and plantings to mitigate issues with storm water flow in the area.

**PHOTOS - Progression**

- 2001  
- 2008  
- 2010  
- 2011

**PHOTOS - After**

- 2011  
- 2011  
- 2011
**PROJECT NAME:** KOLB DETENTION BASIN RETROFIT  
**Tucson, AZ**

**LOCATION:** Kolb Road, East side, South of Julian Wash  
16 acres

**DATA**

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>7700 S Kolb Road, East side, South of Julian Wash</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACRES</td>
<td>16 acres</td>
</tr>
<tr>
<td>CLIENT</td>
<td>Pima County and Granite Construction Company</td>
</tr>
<tr>
<td>CONTACT</td>
<td>Novak Environmental, Inc.</td>
</tr>
<tr>
<td>DESIGNED BY</td>
<td>Novak Environmental, Inc. with input from UA Landscape Architecture Student Matthew Bossler</td>
</tr>
<tr>
<td>COMPLETED</td>
<td>January, 2012</td>
</tr>
</tbody>
</table>

**REGULATORY:** Riparian mitigation for land disturbed by Granite Construction at another site.

**STAKEHOLDERS:**  
- Pima County Flood Control District is the owner and primary stakeholder.  
- The District wanted to minimize long-term operations and maintenance commitment by implementing a plan that conserved water, and preserved the existing natural corridor while also enhancing natural areas while limiting the spread of invasive species.

**GOALS**

**PROJECT RECOGNITION:** No specific project recognition and no LEED points sought.

**PERFORMANCE MEASURES:**  
- The project was completed in January 2012, so it is too early to determine its long-term success.  
- The innovative mid-slope bench water harvest basin is functioning as designed and young revegetative plantings are becoming established.

**ESTIMATED COST**  
- DESIGN COST: $30,000  
- CONSTRUCTION COST: $118,000

**ACTUAL COST**  
- MAINTENANCE: $18,700 for years 1-5

**FUNDING SOURCE**  
- Private Funding—Granite Construction Company, Pima and Granite companies, and the University of Arizona

**COMPLETED**  
- TIME TO BUILD: 3-4 Months

**DESIGN FEATURES:**  
- Approximately 16 acre project site.  
- 6” deep-water harvest basins to capture stormwater entering the site from the Julian Wash and small upstream watersheds.  
- Constructed basins provide about 7 acres of stormwater storage.  
- Constructed basins were placed within sparsely vegetated areas containing native and non-native invasive plant species (buffelgrass, Johnsongrass, African Lovegrass, desert broom).  
- “Planting bench” was constructed to control erosion by collecting stormwater along basin sideoptes and establishing vegetation there.  
- The vegetation planted included 1,329 tall pot plants and about 12 acres of hydroseed.  
- Buffelgrass was removed from areas of existing vegetation to remain.

**SUMMARY**

**FINISHED PROJECT DESCRIPTION:**  
- The Kolb Basin Riparian Habitat Mitigation Project is located near I-10 and Kolb Road, between the Julian Wash-Greenway multi-use path and the University of Arizona Science and Technology Park.  
- The project is a public/private partnership between Pima County Regional Flood Control District and Granite Construction Company with the goal of compensating for impacts to riparian habitat at Granite’s nearby sand and gravel facility.  
- Granite and their consultant, Novak Environmental, Inc. worked with University of Arizona Landscape Architecture Masters student, Matthew Bossler, to design an off-site riparian habitat mitigation project that used stormwater runoff to enhance and establish riparian vegetation within the Kolb Road Detention Basin.

**LESSONS LEARNED**

**SOMETHING TO BE PROUD OF:**  
- This project was a cooperative effort between government and private industry that also included a thesis project for a Master’s student at the University of Arizona.  
- Mitigation for one site’s impacts on riparian habitat was allowed to be provided off-site.  
- Through this effort, Pima County Regional Flood Control District received a list of plants that can withstand varying amounts of inundation.

**SOMETHING TO BE DONE DIFFERENTLY:**  
- The temporary irrigation lines should be installed deeper to minimize the damage by wildlife chewing the tubing.  
- There is some ponding behind the berms and it is unclear whether this will become a long-term problem.

**SECTION**

1. **RAIN FALLS**  
- Constructed grade: 4% 1 slope  
- 24” (approx.) diameter flow pipe  
- Water harvesting basin: max depth 6”

2. **COLLECTS IN BASINS**

3. **WATER SLOWLY SOAKS INTO GROUND**

**PROJECT TYPE:** RECREATION  
- Riparian Habitat Restoration/Mitigation  
- Detention Basin  
- Retrofit

**PROJECT NAME:** KOLB DETENTION BASIN RETROFIT

**LOCATION MAP**

**LID / GI DEVELOPMENT**  
Low Impact / Green Infrastructure
RESIDENTIAL
SINGLE FAMILY
MULTI-DWELLING
SUBDIVISION
MASTER PLANNED COMMUNITY
## RESIDENTIAL

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>NEW Single Family</td>
<td></td>
</tr>
<tr>
<td>RETRO Single Family</td>
<td>Brad Lancaster Residence</td>
</tr>
<tr>
<td>NEW Multi-dwelling</td>
<td></td>
</tr>
<tr>
<td>RETRO Multi-dwelling</td>
<td>Blue Moon Community Garden- Tucson House* (Recreation)</td>
</tr>
<tr>
<td>NEW Subdivision</td>
<td></td>
</tr>
<tr>
<td>RETRO Subdivision</td>
<td></td>
</tr>
<tr>
<td>NEW Master Planned Community</td>
<td></td>
</tr>
<tr>
<td>RETRO Master Planned Community</td>
<td></td>
</tr>
</tbody>
</table>

*Cross category

Under consideration: Civano  
Milagro  
Simpson House  
Sonoran Co-Housing  
Stone Curves  
Willowridge Commons HOA
PROJECT NAME: LANCASTER RESIDENCE and RIGHT-OF-WAY
PROJECT TYPE: RESIDENTIAL ■ Single Family/Public Right-of-Way ■ Retrofit

DATA

LOCATION: 813 N. 9th Avenue, Tucson, AZ 85705

ACRES: 0.14 acre (1/8 acre)/5445 sf

CLIENT: Brad Lancaster

CONTACT: Brad Lancaster, bradlank@gmail.com

DESIGNED BY: Brad and Rodd Lancaster

COMPLETED: (Ongoing since 1994)

REGULATORY: City of Tucson

STAKEHOLDERS: ■ Brad, Rodd, Chi, and Vaughan Lancaster ■ Dunbar/Spring neighbors

GOALS

PERFORMANCE MEASURES:
1. Summer temperatures in shaded areas along right-of-way are reduced 10° from those of pre-development.
2. All native plantings along public right-of-way and on the property are irrigated solely with passively harvested rainwater and street runoff.
3. Six exotic fruit trees are irrigated primarily with on-site rainwater and greywater (100% in year of normal rainfall, 75% in dry years).
4. Vegetable garden is irrigated primarily with on-site rainwater collected in cisterns (95% in year of normal rainfall, 80% in dry years).
5. Total cistern volume is 5,000 gallons.
6. Over 93,000 gallons of rainfall per year of normal rainfall is harvested on our 1/8th-acre site and adjoining public right-of-way.
7. 100% of the household’s greywater is recycled within the landscape.
8. Currently the grid tied rooftop 3.1 KW solar PV system produces 3 times as much energy as the household uses. The surplus goes directly to neighbors’ homes during the day. At night, power is currently drawn from the grid.

PROJECT RECOGNITION:
First Place – Homeowner Landscape under $10,000, Best Water Harvesting, and the J.D. DiMeglio Artistry in Landscaping awards in the 2005 Arizona Department of Water Resources/Tohono Chul Park Xeriscape Contest.

SUMMARY

Time to Build: All has been ongoing since 1994

ESTIMATED COST

Water-harvesting earthworks: $600, cisterns: $5,000, Compact toilet: $100, Greywater-harvesting system: $450, Solar system: $7,800, Retractable catch-side savings: $1,245

COST

CLIENT: Private (home owners)

TIME TO BUILD: The vast majority of the design was installed by the home owners. An architect drew up the workshop expansion plans ($2,100). A local designer designed the solar water heater ($100).

MOTIVATION:
More time was needed for planning and design than a conventional non-integrated plan due to the need to think through and plan how the various elements of our plan could integrate with one another for maximum effectiveness.

PROJECT NAME:
LANCASTER RESIDENCE and RIGHT-OF-WAY

LOCATION MAP

LESSONS LEARNED

SOMETHING TO BE PROUD OF:
1. This residence is a living demonstration garden and an inspiration to the Dunbar neighbourhood, as well as the greater Tucson community.
2. Every possible means to minimize the human impact on and provide support to the local environment has been investigated and implemented when possible. Improvement to water harvesting strategies are continually under evaluation.
3. These principals are clearly illustrated in Rainwater Harvesting for Drylands and Beyond, Volumes 1 and 2 by Brad Lancaster. These works are available at your local bookstore or online.

SOMETHING TO BE DONE DIFFERENTLY:
Design and install a greater capacity for the water-harvesting earthworks. Plant higher water-use fruit trees only after the greywater harvesting system is installed, and use greywater as the sole source for these fruit trees. Before choosing vegetation, estimate the site’s water income (rainfall, runoff, and greywater). Then plant a landscape with water demand that could be met solely by that on-site income.

PHOTOS

Before: Property & ROW
After: Property & ROW

Before: ROW Concept
After: ROW Concept

Before: Public ROW
After: Public ROW

PHOTOS

Reprinted with permission from Rainwater Harvesting for Drylands and Beyond, Volumes 1 and 2 by Brad Lancaster, www.harvestingrainwater.com

PHOTOS

Before: Property & ROW
After: Property & ROW

Before: ROW Concept
After: ROW Concept

Before: Public ROW
After: Public ROW

PHOTOS
PROJECT NAME: BLUE MOON COMMUNITY GARDEN (Tucson House)

PROJECT TYPE: RESIDENTIAL • Multi-unit Dwelling • Retrofit

LOCATION: 1501 North Oracle Road

ACRES: 2 Acre (+/-)

TUCSON HOUSING AND COMMUNITY DEVELOPMENT
305 N. COMMERCIAL PARK LOOP
TUCSON, ARIZONA 85706

CONTACT: CHOROVER
(520) 837-0946-Gina.Chorover@tucsonaz.gov

DESIGNED BY: Norris Design
418 N. Toole Ave. Tucson, AZ 85701
(520) 623-4569

PROJECT RECOGNITION: AZ ASLA Honor Award for General Design 2012

GOALS

REGULATORY: City of Tucson

STAKEHOLDERS:
■ Tucson House, a high rise development which is home to over 600 low-income, disabled, elderly residents and adjacent neighbors.
■ Community Gardens of Tucson

PROJECT RECOGNITION: AZ ASLA Honor Award for General Design 2012

PERFORMANCE MEASURES:
■ ADA Accessibility
■ Passive and active rainwater harvesting from 1/4 of the Tucson House roof and cisterns from HVAC.
■ Reuse existing fire suppression 15,000 gal water tank.
■ Pump harvested water to second cistern.
■ Metering devices for both potable and harvested rainwater.
■ Tucson Water Demonstration Garden, Community Gardens of Tucson design and equipment standards.

DATA

COST

ESTIMATED COST
$288,000.00

FUNDING SOURCE
CDBG Grant, Tucson Water Grant, HCD Grant, CPPW Funds

ACTUAL COST
DESIGN COST: $28,000.00
CONSTRUCTION COST: $260,000.00

MAINTENANCE
Community Gardens of Tucson

TIME TO BUILD: 15 months

FINISHED PROJECT DESCRIPTION:
■ The Blue Moon Community Garden is the first fully accessible community garden in Tucson. The 40,520 square foot site includes 36 garden beds, a citrus grove, butterfly garden, a central promenade, gathering areas with a shade ramada, barrier free design, and a loop trail with connectivity to the Tucson House. The landscape architect developed interpretive signage to educate residents and visitors about the garden and the active water harvesting system that provides irrigation to the garden beds.
■ In addition, a 15,000 gallon rainwater harvesting tank captures rainwater and HVAC condensate from a 17-story building, providing water for the landscape plants and fruit trees.
■ The garden was selected as a Tucson Water Demonstration Garden.

SUMMARY

DESIGN FEATURES:
■ Reclaimed approximately 1.5 acre of existing parking lot.
■ Reused existing 15,000 gal water tank.
■ Added a second cistern and pump with brain boxes to irrigate with harvested rainwater.
■ Installed meters for potable and reclaimed water and the power used on-site.
■ Installed soil moisture sensing devices and controller which automatically adjusts water time using on-site soil moisture as a basis.
■ Tied into HVAC condensate line which is also metered.
■ Through a charcoal process designed garden beds of varying heights and styles to accommodate a variety of disabilities.
■ Provided lockers for garden users and a compost station.

LESSONS LEARNED

SOMETHING TO BE PROUD OF:
■ The garden was selected as a Tucson Water Demonstration Garden and received AZ ASLA Honor Award for General Design 2013.
■ The garden is in capacity and provides an innovative food source for a neighborhood that has been described as located in a food desert.
■ Through post design assessments we determined the garden has become a gathering place for the Tucson House residents and neighbors.
■ This project has been designed with metering devices to become a study site with the potential to determine everything from the cost of a harvested gallon of water to the toxicity levels of fruit harvested from the citrus grove.

SOMETHING TO BE DONE DIFFERENTLY:
■ The raised still garden beds which provide accessibility to people in wheelchair created a drainage issue with the method of construction and the amount of over-watering try it users.
■ The center should be water to provide more drain risk between the CMU cells and or vertical gravel sumps should be installed in future beds of this kind.

PHOTOS - Before

PHOTOS - After

PHOTOS - Before

PHOTOS - After
TRANSPORTATION
LOCAL NEIGHBORHOOD
COLLECTOR
TERMINAL
<table>
<thead>
<tr>
<th>TRANSPORTATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEW Local Neighborhood</td>
</tr>
<tr>
<td>RETRO Local Neighborhood</td>
</tr>
<tr>
<td>Cambio Grande</td>
</tr>
<tr>
<td>Rincon Heights_ 9th and 10th Avenues from Park to Campbell</td>
</tr>
<tr>
<td>Scott Avenue</td>
</tr>
<tr>
<td>U of A Lester</td>
</tr>
<tr>
<td>NEW Collector</td>
</tr>
<tr>
<td>RETRO Collector</td>
</tr>
<tr>
<td>NEW Terminal</td>
</tr>
<tr>
<td>RETRO Terminal</td>
</tr>
</tbody>
</table>

Under consideration:  
Camino Campestre  
Craycroft Road- River Road to Sunrise  
Fourth Avenue Bike Boulevard- Grant to Ft. Lowell Rd  
Iron Horse Neighborhood  
Mountain Avenue Medians  
Rio Nuevo Grande Roundabout  
San Gabriel Median Park
**PROJECT NAME:** CAMBIO GRANDE STREETSCAPE ENHANCEMENT  
**PROJECT TYPE:** TRANSPORTATION  
- Local Neighborhood  
- Retrofit

**DATA**

- **LOCATION:** Grande Avenue-St. Mary's Rd to Speedway Blvd (0.4 miles)
- **ACRES:** Project area ~33,905 sf
- **CLIENT:** City of Tucson Department of Transportation
- **CONTACT:** City of Tucson DOT  
  M.J. Dillard  
  mj.dillard@tucsonaz.gov
- **DESIGNED BY:** Parson's Brinckerhoff Inc. - Engineer  
  Kimley-Horn (SAGE) - Landscape Architect
- **COMPLETED:** May, 2011

**COST**

- **ESTIMATED COST:** $500,000 to $1,000,000
- **FUNDED FROM:** ADOT Transportation Enhancement Grant and a Pima County Neighborhood Reinvestment Grant
  **SOURCE:** $862,000
- **ACTUAL COST:** Landscape Architecture: $11,600 Phase I (DCR, 30% plans)  
  $23,200 Phase II design (construction documents, NPP, etc.)
  **CONSTRUCTION COST:** $529,871.50
- **MAINTENANCE:** City of Tucson
- **COMPARE TO:** Not evaluated
- **TIME TO BUILD:** 120 days of construction

**DESIGN FEATURES**

- Improvements include landscape nodes irrigated using water harvesting principals only.
- ADA compliant sidewalk upgrades.
- Installation of pedestrian amenities (benches, drinking fountain, lighting, trash receptacles).
- Public art.
- Neighborhood gateway entry.
- Electrical facilities.

**REGULATORY:** City of Tucson Department of Transportation guidelines for non-irrigated landscaping

**STAKEHOLDERS:**
- Barrio Hollywood Neighborhood
- Arizona School for Deaf and Blind (ASDB)

**PROJECT RECOGNITION:** 2012 APWA (Arizona Public Works Association) Chapter Sustainability Award Winner

**PERFORMANCE MEASURES:** Not determined

**FINISHED PROJECT DESCRIPTION:**
- This enhancement changed a typical urban street into a more aesthetic and pedestrian environment.
- There is no permanent landscape irrigation system. Plants will be hand watering for duration of establishment period.
- Planting areas are depressed by 6” to capture rainwater.

**SUMMARY**

- **LESSONS LEARNED:**
  - Initial design plans included scuppers that directed drainage from the roadway into the planting areas. These were unfortunately eliminated due to budget constraints. Ideally, water from the roadway would have provided additional irrigation to the plant materials.

- **GOALS SUMMARY:**
  - **SOMETHING TO BE PROUD OF:**
    - Many of the shrubs and trees show considerable growth in just two years using only harvested water. Although the landscape was limited on the project due to the amount of utility conflicts, the vegetation has grown in quite well and creates a pleasant pedestrian experience along the sidewalk.
  
  - **SOMETHING TO BE DONE DIFFERENTLY:**
    - Ideally, water from the roadway would have provided additional irrigation to the plant materials.
RINCON HEIGHTS: 9TH and 10TH STREETS - CAMPBELL to PARK AVENUE

PROJECT NAME: TRANSPORTATION ■ Local Neighborhood ■ Retrofit

LOCATION:
9th Street from Park Avenue to Campbell Avenue
just south of the University of Arizona

ACRES:
0

CLIENT:
City of Tucson Department of Transportation (COT DOT) and Rincon Heights Neighborhood

CONTACT:
Gary Witwer
Gary.Witwer@tucsonaz.gov

DESIGNED BY:
ECC and COT DOT

DATA

COST
ESTIMATED COST:
$315,000

FUNDING SOURCE:
Neighborhood Reinvestment Grant, Back to Basics Grant

ACTUAL COST:
$51,800

CONSTRUCTION COST:
$35,317 (NC Planting)

PLANTING:
$16,483 (Back to Basics Grant, Neighborhood applied for)

MAINTENANCE:
Rincon Heights Neighborhood

COMPARE TO CONVENTIONAL:
No comparison estimated

TIME TO BUILD:
60 days

PROJECT RECOGNITION:
No awards were pursued.

REGULATORY:
None

GOALS

STAKEHOLDERS:
City of Tucson Department of Transportation ■ Rincon Heights Neighborhood

Objectives: Create safer pedestrian crossings by slowing and calming traffic, as well as pinching the crossing corners with bump-outs. ■ Beautify the streetscape with native plant materials. ■ Provide habitat and food for wildlife such as birds, bees and butterflies. ■ Mitigate heat from the wide expanse of asphalt. ■ Provide shade for both pedestrians and parked cars and reduce ambient temperatures in the area. ■ Create an aesthetic, comfortable environment. ■ Harvest rainwater for the plants, lessen street flooding, and improves the quality of water going into High School Wash.

PROJECT RECOGNITION:
No awards were pursued.

PERFORMANCE MEASURES:
No specific measures were put in place, but plant growth is a true indicator of success.

FINISHED PROJECT DESCRIPTION:
9th Street was originally configured to easily carry 4 lanes of traffic, but its residential status never generated such volumes. ■ This allowed portions of the road to be narrowed; some intersection corners were bumped toward the roadway centerline so pedestrians have less exposure to traffic when crossing. ■ 4x4-block bump-outs allow protection to parked cars as well. ■ Selection of plant materials was critical because the City cannot maintain irrigation on residential streets. ■ Plants only receive rainwater, and occasionally supplemental water from the neighbors. ■ The City watered the plantings for one year with a water truck.

SUMMARY

DESIGN FEATURES:
Curved swales were used to narrow the street width. The curb protects the plant materials but curbs cut off street runoff to easily enter the swaled planting area. ■ The swales are curved when space allows, and lined with curbs 4" to 8" rock to slow the flow and allow rainfall additional time to percolate. ■ Native and low water-use plant materials were installed because no-City maintained irrigation is allowed on residential streets.

LESSONS LEARNED

SOMETHING TO BE PROUD OF:
This project was the first in Tucson to showcase how a neighborhood street could be transformed from a wide, hard asphalt corridor that promoted a hot, uncomfortable environment, to a more flowing vegetated and shady boulevard.

SOMETHING TO BE DONE DIFFERENTLY:
■ Be selective about plant species. An open planting design using contrasting form and color is more pleasing than a dense tangle of mass. ■ The propagation of weed weed is always an issue on any site. The City of Tucson DOT cannot maintain residential streets; therefore, the neighbors must pledge to keep the vegetated chicane (bump-out) areas clear of weeds. Although neighbors may enthusiastically pledge at the beginning of a project, resident turn-over, as well as lost interest, may ultimately result in lack of maintenance and a weedy appearance. Some areas are maintained and some are not. ■ Lack of maintenance results in plants growing to heights that can obscure site visibility triangles.
PROJECT NAME: SCOTT AVENUE REVITALIZATION
PROJECT TYPE: ■ TRANSPORTATION ■ Local Neighborhood ■ Retrofit

LOCATION
Scott Avenue, from Broadway to Cushing/14th Street

ACRES
Three blocks; approximately 1/4 mile long

CLIENT
City of Tucson Department of Transportation

CONTACT
City of Tucson Department of Transportation

DESIGNED BY
Stantec Consulting, civil engineering and Project Prime
Wheat Scharf Associates, planting, water harvesting, and hardscape design
Ten Eyck Landscape Architects, landscape design associate firm
Kittelson & Associates, signing and marking
Hines Irrigation Consultants, Inc., irrigation design

FINISHED PROJECT DESCRIPTION:
■ Scott Avenue is an appealing, shady pedestrian way. ■ Sidewalks are a comfortable 8’ minimum; they accommodate crowds attending the theater due to their spacious width and the tree canopies provide climate control. ■ Landscape is lush but composed of native materials. ■ The natives have low water requirements which are supplemented by water harvesting practices which capture significant flows from rainfall events. ■ New site furnishings include benches, bicycle racks, trash/recycling receptacles, drinking fountains (with a separate pet bowl). ■ Solar powered art created a welcoming statement at the entrance to Scott Avenue. ■ These gateway features illustrate through pictures and text the historic and cultural significance of Scott Avenue. ■ A portion of the Presidio Trail, an historic walking trail throughout downtown, was highlighted with glass aggregate pavers and solar powered paver lights.

DESIGN FEATURES:
■ Pedestrians were the focus of the design. ■ The pavement section was narrowed from 55’ curb-to-curb, to a varied 22’ to 33’ width. ■ This allow for wider sidewalks and pedestrian walkways. ■ Water harvesting was an integral part of the design, not an add on. ■ The harvesting principals supplemented the plant water requirements, but also mitigated storm events by decreasing water in the street. ■ New, more comprehensive and energy efficient street and pedestrian lighting, fitted with white lighting for better color rendition.

SUMMARY:

FINISHED PROJECT DESCRIPTION:
■ Scott Avenue is an appealing, shady pedestrian way. ■ Sidewalks are a comfortable 8’ minimum; they accommodate crowds attending the theater due to their spacious width and the tree canopies provide climate control. ■ Landscape is lush but composed of native materials. ■ The natives have low water requirements which are supplemented by water harvesting practices which capture significant flows from rainfall events. ■ New site furnishings include benches, bicycle racks, trash/recycling receptacles, drinking fountains (with a separate pet bowl). ■ Solar powered art created a welcoming statement at the entrance to Scott Avenue. ■ These gateway features illustrate through pictures and text the historic and cultural significance of Scott Avenue. ■ A portion of the Presidio Trail, an historic walking trail throughout downtown, was highlighted with glass aggregate pavers and solar powered paver lights.

DESIGN FEATURES:
■ Pedestrians were the focus of the design. ■ The pavement section was narrowed from 55’ curb-to-curb, to a varied 22’ to 33’ width. ■ This allow for wider sidewalks and pedestrian walkways. ■ Water harvesting was an integral part of the design, not an add on. ■ The harvesting principals supplemented the plant water requirements, but also mitigated storm events by decreasing water in the street. ■ New, more comprehensive and energy efficient street and pedestrian lighting, fitted with white lighting for better color rendition.
## Project Name: U of A Lester Street Landscaping

### Project Type: Local Neighborhood

#### Transportation

#### Retrofit

<table>
<thead>
<tr>
<th><strong>LOCATION</strong></th>
<th>SW corner Lester and Martin</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ACRES</strong></td>
<td>0.31 Acres (13,661 sft)</td>
</tr>
</tbody>
</table>

#### DATA

<table>
<thead>
<tr>
<th><strong>CLIENT</strong></th>
<th>University of Arizona</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CONTACT</strong></td>
<td>Grant McCormick, PDC</td>
</tr>
<tr>
<td><strong>DESIGNED BY</strong></td>
<td>UA Planning, Design, and Construction</td>
</tr>
</tbody>
</table>

#### COST

- **Cost**: $60,000 to $70,000
- **Actual Cost**: Not calculated
- **Maintenance**: Managed by UA Facilities Management Grounds Services
- **Time to Build**: 5 months

#### REGULATORY

- Compliance with University of Arizona’s Design Site Standards (DSS) provisions for surface water management.

#### STAKEHOLDERS

- UA Administration, Facilities Management, Parking and Transportation Services, and Planning, Design and Construction.
- The Jefferson Park Neighborhood to the north.
- The visitors and employees of the Arizona Health Sciences Center.
- UA Administration in conjunction with adjacent UA parking lot development (south of the landscape project).

#### Goals

- **Mitigate Sediment Transport due to Excessive Rain Event Flows off Site.**
- Objectives included providing a forum to educate the community about water harvesting.
- The project provided an opportunity to experiment with a number of fine grading techniques that blend water harvesting with stormwater management. User/stakeholder feedback has been very positive about the results. A valuable asset for the University and adjacent neighborhoods has been created which will serve as a template for future campus edge/buffer landscape projects.

#### Performance Measures:

- Approximately 1” of rain will be held in the landscape basins.
- Natural ecology of the site will be increased as a result of the project – plant materials and canopy cover will promote urban cooling and habitat creation; root structure and extended flow path will increase water infiltration; stabilization of soils due to root knitting and decreased run-off due to plant cover will decrease soil sediment transport.

#### Project Recognition:

- Project did not seek LEED designation.

#### Design Features:

- A series of carefully graded, sloped landforms created the setting for stormwater harvesting and mitigation.  All 1.5 or less basin slopes are covered with 1/2” crushed rock and accented on steeper 1:3 slopes with 3" to 6" rip rap. Fractured rock boulders further accent the design.  They are designed to passively irrigate carefully selected, native plant species.  The stabilized decomposed granite pathways permit access within the garden-like basin area.

#### Summary

- **Estimated Rainfall Held on Site**: 132,000 gallons
- **Estimated Annual Rainfall**: 240,000 gallons
- **Total Site Area**: 69,800 sf
- **Unpaved**: 7,825 sf
- **Paved**: 17,575 sf
- **Rooftop**: 6,500 sf

#### Finished Project Description:

- A series of carefully graded, sloped landforms create the setting for stormwater harvesting and mitigation. All 1.5 or less basin slopes are covered with 1/2” crushed rock and accented on steeper 1:3 slopes with 3” to 6” rip rap. Fractured rock boulders further accent the design. They are designed to passively irrigate carefully selected, native plant species. The stabilized decomposed granite pathways permit access within the garden-like basin area.

#### Design Considerations:

- A series of interconnected basins were created to capture, slow, and infiltrate stormwater collecting on an adjacent parking lot and building to the south.  Terraces and spillways were designed to maximize the flowpath between the source watershed and the outflow, allowing the ideal dispersal of rainwater for beneficial infiltration to plant roots.  Plant selection included drought tolerant species. Drip irrigation was installed.  Decomposed granite pathways were raised to create dry passage during rain events and further retain the rainfall.  There is a standard City of Tucson sidewalk along Lester Street.

#### Lessons Learned

- **To Be Proud Of:**
  - The project provided an opportunity to experiment with a number of fine grading techniques that blend water harvesting with stormwater management. User/stakeholder feedback has been very positive about the results. A valuable asset for the University and adjacent neighborhoods has been created which will serve as a template for future campus edge/buffer landscape projects.

- **To Be Done Differently:**
  - The project was developed over top of a conceptual grading basemap which led to the need for more field interpretation of plans when planting locations did not appear to fit with the actual landform that was created. This suggests it is preferable to develop planting designs over top of the actual grading detailed plan (or develop these plans iteratively).