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Desert Landscape Conservation Cooperative WaterSMART Program Grant

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**Project Title:** Utility Guide to Rainwater/Stormwater Harvesting as an Adaptive Response to Climate Change

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**Report Term or Frequency:** Final

**Mandatory Reporting Category:** Accomplishments

This report describes the major goals of the project and accomplishments to date. The original project schedule was extended to accommodate unforeseen delay and subsequent time constraints of project team members, TAC members and stakeholders. Substantial work on the project was completed before the delay, and the final product, the Water Harvesting Assessment Toolbox, available at <http://wrrc.arizona.edu/DWHI/toolbox>, was completed by the end of the reporting period. Dissemination of information on the Toolbox continues.

***What are the major goals of the activity?***

The project goal was to develop a prototype guidance tool for public utilities and agencies to use to evaluate the suitability and cost-effectiveness of rainwater and stormwater capture at various scales for multiple benefits to the community, as a strategy for adapting to climate change.

This project was planned to directly benefit the water management of communities in the Desert LCC by offering a tool to help communities adapt to the changing climate and effects on availability of water supplies and other impacts. In water-scarce urban environments there are unused opportunities to create more livable outdoor spaces with a water conservation strategy that makes use of in situ resources (rainfall), rather than diverting water from its natural path. Capturing water from impervious surfaces for use on landscaping and related needs is a strategy with the potential to maximize benefits from a previously under-utilized resource.

The intent of the project was to develop guidance for use in assessing and planning water harvesting at multiple scales in multiple land use sectors, to help meet the challenges of managing water resources under conditions of changing climate and increasing demands. The final product was envisioned as a prototype tool to demonstrate the usefulness of the concept to utilities, funders and others.

### ***What was accomplished under these goals?***

Through a process of literature review, expert consultation and iterative development the project team leveraged existing resources and conducted “test drives” with representatives from regional entities to create a prototype Water Harvesting Assessment Toolbox. Based on the specific conditions and experience in the greater Tucson area, a prototype assessment toolbox and supporting guidance was developed that leads users through recommended steps to assessing the potential, techniques and implementation opportunities for using water harvesting to address multiple challenges and provide multiple benefits at a range of community-appropriate scales.

The approach used involved five overlapping stages:

1. *Research design and planning;*
2. *Data gathering and consultation;*
3. *Preparing and testing draft assessment tool;*
4. *Preparation of final project outputs: and*
5. *Dissemination of research results, including the prototype tool and guidance.*

A Technical Advisory Committee (TAC), was assembled prior to the startup of the project with the intention of utilizing a pool of experts who could help to refine the scope of the project; identify data sources and commit to providing data; review progress, suggest new data sources, and supply advice on tool development. The expertise of the TAC was invaluable in offsetting the lack of data with expert opinion.

An initial TAC meeting was held on November 29<sup>th</sup>, 2011 at which the grant goals and scope of work were presented. The TAC provided feedback on the directions for research and refining of research objectives.

The Rainwater Stormwater Professionals Network (RSPN) was also tapped to provide additional input. Meetings of the RSPN were held on October 25<sup>th</sup>, 2011 and on March 30, 2012. The grant goals and scope of work were described in the October meeting, and members of the RSPN were enthusiastic about the potential of the project. They also emphasized that the full range of water harvesting benefits should be included in the benefit-cost comparisons. At the March meeting team members presented a preliminary presentation of the guidance tool and the RSPN provided useful feedback on the tool format and contents.

A comprehensive literature review was undertaken into data availability, other guidance materials, and tools for calculating costs and benefits. In addition, TAC members and other experts/practitioners were consulted, who reinforced the importance of incorporating qualitative benefits of water harvesting into any benefit-cost comparison. Research and data collection therefore focused on this aspect of the research. The literature review incorporated research that investigates ways to quantify the qualitative benefits provided by water harvesting. Through scanning the growing number of news articles and web sites on Green Infrastructure /Low Impact Development (GI/LID) and participating in various webinar presentations, the team kept abreast of new research and practices.

To address the lack of data, the project team spearheaded organization of a workshop in conjunction with AridLID 2012, “Integrated Approaches to Green Infrastructure and Low Impact Development,” a Southwest-regional conference focusing on the sustainable management of stormwater through the use of green infrastructure and low impact development. The conference was held in Tucson on March 27-

29, 2012, and the workshop introduced the guidance tool concept to an audience broadly representative of water managers across the Southwest. The workshop, held on March 28, was designed to be participatory and interactive. Emphasis was placed on creating a prioritized list of research needs, as well as garnering input into identification of already-existing data and ways to fill the research gaps. The information gathered from the workshop was compiled and synthesized into a report that was distributed to all participants. Results were also presented to the TAC in June-July, 2012, and TAC members provided comments. (Available at [wrrc.arizona.edu/sites/wrrc.arizona.edu/files/AridLID-2012-Research-Workshop-Report\\_final.pdf](http://wrrc.arizona.edu/sites/wrrc.arizona.edu/files/AridLID-2012-Research-Workshop-Report_final.pdf))

Members of the project team met with a wide variety of researchers and practitioners to gather input and guidance. Meetings with the following experts were held on the dates noted.

- November 15, 2011: the research team of the WaterSMART grant “Arid Cities in Changing Climates” to discuss project overlap and possible data sharing
- January 10, 2012: Mike Crimmins (associate professor and Extension specialist in climate science) to discuss available climate change data and measurable impacts for the Tucson/Southwest region
- January 18, 2012: Cindy Wallace (USGS), Josh Pope (Pima Association of Governments GIS manager) and Ashley Schmeltzer (grad student working on remote sensing work for “Arid Cities” grant) to discuss GIS and other spatial data available for the Tucson/Southwest region
- February 8, 2012: the University of Arizona’s Surface Water Working Group, composed of professors, students, grounds crew members, and campus Planning Design and Construction employees who utilize passive and active rainwater harvesting techniques, to address stormwater issues on campus
- February 23, 2012: Gregg Garfin (assistant professor and Extension specialist in climate, policy and natural resources; director of science translation and outreach, Institute of the Environment) to discuss climate change data and the City of Tucson climate change action plan
- July 11, 2012: Evan Canfield (Pima County Regional Flood Control District, Planning and Development Division) to discuss Pima County’s motivation and experience in incorporating green infrastructure and low-impact development into flood control projects
- July 25, 2012: Marie Light (Principal Hydrologist, Pima County Department of Environmental Quality) to understand how MS3 communities interpret and react to EPA’s encouragement of green infrastructure elements in stormwater plans
- August 30, 2012: Theresa Crimmins (National Phenology Network, Partnership and Outreach Coordinator) to discuss local climate change impacts and citizen science

In addition, the draft tool was presented to two Tucson-area water utilities: on April 5, 2012 team members Ann Audrey and Jenna Cleveland presented the concept to the Oro Valley water and stormwater utilities and on April 11, 2012, to the Metro Water District. Crucial input was received from both meetings to help guide the further development of the model. For additional input, members of the research team traveled to Phoenix to present the draft prototype to the Arizona Municipal Water Users Association on June 6, 2012.

The project team developed a testing method for evaluating the prototype tool in a group setting, which included presentation of information and discussion of the local situation and local priorities. Participants were asked to complete an evaluation form, collected at the end of each test session. Audio recordings were made of each of the test drive sessions. These recordings, along with notes taken during the session and the written comments of participants, were used to refine the assessment tool after each session. The TAC was invited to observe each test.

The project team, in partnership with TAC members, identified three jurisdictions in southern Arizona for testing the assessment tool:

- Town of Marana, February 26<sup>th</sup>, 2013
- City of Sierra Vista, March 12<sup>th</sup>, 2013
- Town of Sahuarita, March 26<sup>th</sup>, 2013

For each jurisdiction, the project team contacted a facilitator and encouraged that person to invite representatives from a wide range of departments and interests to attend the test drive.

As a result, participants represented a diverse set of departments and responsibilities from within a jurisdiction (for example, water utility, transportation, stormwater, and planning). This diversity was a priority for two reasons—to open channels of communications within the jurisdiction that may not have previously existed and to facilitate the decision-making process by ensuring that all necessary expertise was in the room at the same time. At each session, the presentation included information on water management challenges and water harvesting as a solution to these challenges, with multiple additional benefits. Participants identified relevant challenges and discussed water harvesting potential within their jurisdictions.

Two meetings of the TAC were held December 14<sup>th</sup>, 2012 and April 1<sup>st</sup>, 2013. At both meetings, project team members presented current iterations of the assessment tool and received feedback on methods and data used. The April 1, 2013 meeting of the TAC was also used as a “test drive” of the prototype tool. Two additional TAC meetings were held interspersed with consultations with individual TAC members, who were asked for input as revisions were made. TAC members were invited to the spring meeting of the RSPN on May 15, 2014, at which the final prototype tool was presented.

The project team refined the assessment tool continuously based on feedback received during testing sessions and from the TAC. Project team members met regularly to expand and refine the evolving toolbox and populate spreadsheets with appropriate data and equations. The assessment tool underwent substantial revisions during the course of testing and the format for the final prototype assessment tool was redefined in accordance with evaluation results and to accommodate the variety of situations represented in various jurisdictions. Acknowledged data limitations dictated changes to the form of the tool to allow for assessments based on qualitative inputs.

The assessment tool evolved into a toolbox that includes a stand-alone video slide show that can be paused by a facilitator at appropriate discussion point indicated in the video. The slide show steps users through the assessment process. On-line reference materials and a website resource repository are linked with the video slide show to provide more detailed information, examples and relevant data. The linked resources include 1-2 page “fact sheets” that provide information and background in a brief, easy-to-read format. These fact sheets are designed to function as stand-alone products in addition to serving the needs of project users. Fact sheets—called “Quick Resources”—can be accessed at [wrrc.arizona.edu/DWHI/resources/quickresources](http://wrrc.arizona.edu/DWHI/resources/quickresources). Quantitative tools developed as part of the tool

component refinement process include spreadsheets for determining water harvesting priorities and for calculating catchment-to-canopy ratios for passive water harvesting to support trees and other vegetation. Comments following testing sessions raised the potential need for facilitator training. Guidance was developed to introduce facilitators to the various tools included with the presentation. The Facilitator Instructions are posted with the Toolbox to introduce users to navigating the assessment process.

### ***What opportunities for training and professional development has the project provided?***

Graduate student Jenna Cleveland has had the opportunity to work closely with environmental consultant Ann Audrey and attends weekly project meetings with Susanna Eden and Jackie Moxley. Jenna has developed her public speaking and presentation skills through a series of presentations to variously-sized audiences, in addition to attending various webinars and special lectures on policy and economic aspects of water harvesting. She has also honed her writing and graphic skills through the process. She became a member of the Pima County Flood Control's LID Working Group, representing the WRRRC during the project. She interacted with a range of water professionals, which led to an internship opportunity.

### ***How have the results been disseminated to communities of interest?***

Initial progress on the project was shared with the RSPN at their semiannual meetings, hosted at the WRRRC, as well as various groups in both the Tucson and Phoenix regions.

A website, titled Desert Water Harvesting Initiative, showcases the project and acts as a data clearinghouse for research and publications related to water harvesting, green infrastructure, and low impact development at [wrrc.arizona.edu/DWHI](http://wrrc.arizona.edu/DWHI). This website was created in response from stakeholder input indicating strong interest in such a site and suggesting that it be made part of the project toolbox. New resources are added to this site as they become available, with an emphasis on reports and studies that focus on arid regions. The project team continues to share progress with the RSPN. In addition, pertinent research, new publications, and news stories have continued to be shared through the RSPN electronic mailing list, which has grown substantially.

The ARCSA Newsletter carried an article on the project: Cleveland, J., S. Eden, and J. Moxley, WRRRC Drafting RWH Guidelines at University of Arizona, Tucson. The Quarterly Newsletter of the American Rainwater Catchment System Association, December 2011.

An article featuring the project was published in the journal of the Arizona Water Association: Eden, S., J. Moxley and J. Cleveland, Desert Water Harvesting Initiative: Rainwater and Stormwater Harvesting, Green Infrastructure and Low Impact Development for Improved Sustainability and Adaption to Climate Change, *The Kachina News*, Spring 2013.

The project team has presented at several regional conferences and meetings, detailed below:

- August 1, 2012: Jenna Cleveland spoke at a regular session of the Brown Bag series held by the Pima County Regional Flood Control District. She presented the draft prototype tool and results of the AridLID research workshop and elicited feedback from audience members
- September 18, 2012: Jenna Cleveland presented on aspects of the project at the LID workshop co-organized by the WRRRC project team and Arizona Cooperative Extension at the annual Arizona

Hydrological Society Symposium. The workshop attracted participants from Phoenix-area municipalities. The workshop was used to elicit and record feedback on issues relating to the project

- September 24, 2012: Jenna Cleveland presented aspects of the project at a regular meeting of the Pima Association of Government's Watershed Planning Subcommittee. Time was set aside to answer questions and elicit feedback
- Jenna Cleveland created a poster highlighting progress on the project and lessons learned to date. That poster was presented at the University of Arizona Student Showcase on November 9, 2012 and won second place in its category.
- February 5, 2013: Jenna Cleveland traveled to Glendale, Arizona for the "LID Basics and Beyond: Low Impact Development Trends in the Southwest" workshop, where she presented the assessment tool to a varied audience and received feedback
- May 3<sup>rd</sup>, 2013: Susanna Eden and Jackie Moxley traveled to Phoenix, Arizona for the "2013 Arizona Water Association Conference", they presented interim outputs
- November 6, 2013: Ann Audrey presented information on the project at the 2013 American Rainwater Catchment Systems Association (ARCSA) conference in Austin, Texas. A half-sheet introduction to the project and website was distributed to attendees at the ARCSA conference to help reach audiences in areas of the Desert LCC outside of Arizona.

A news release publicizing the availability of the Toolbox was sent to a contact list of potentially interested parties, numbering approximately 150 names, throughout the Desert LCC, when the prototype tool was posted and ready for use, as well as appropriate newsletter and other media outlets. Arizona cities and towns were sent the Toolbox announcement, along with members of the RSPN and other individuals in the water community if Arizona, adding approximately 1200 names to the distribution list. In addition the Toolbox was featured on the WRRC's website and news of its release was distributed through the WRRC's Weekly Wave email newsletter to individuals (2400) and numerous listservs reaching the Arizona water community and beyond. Discussions were held on presenting final project outputs to the Desert LCC on the platform of the Bureau of Reclamation's choosing. A one-page summary brochure and a poster have been prepared (appendix A and appendix B).

An article on lessons learned from interactions with stakeholders with diverse roles in municipal planning and operations on development of an assessment toolbox for water harvesting at multiple scales for multiple benefits is being prepared for submittal to *Water Efficiency* and/or *Stormwater*.