



Green Infrastructure Tools for Arid and Semiarid Regions

TUCSON, ARIZONA

Project Summary

The Pima County Regional Flood Control District and the City of Tucson have collaborated in developing the *Low Impact Development and Green Infrastructure Guidance Manual*. The manual provides guidance for implementing neighborhood-scale water harvesting, green infrastructure, and low impact development practices throughout Pima County to improve surface water quality. The most up-to-date version of the manual can be downloaded from [Pima County's](#) Web page.

The manual provides an in-depth discussion of green infrastructure / low impact development site assessment, planning, and design process and site planning practices. It presents technical guidance on how to design, install, and maintain structural green infrastructure practices. The manual also outlines the

common components of green infrastructure (e.g., inlets, outlets, check dams, soil amendments, and vegetation) and how to use them in green infrastructure designs. Finally, the manual includes guidance on sizing practices and selecting native and locally adapted plants for vegetated features.

Through the Green Infrastructure Technical Assistance Program, the U.S. Environmental Protection Agency (EPA) provided support to the Pima County Regional Flood Control District and the City of Tucson to enhance the manual. EPA developed a menu of outreach options to promote the manual and green infrastructure implementation, as outlined in Table 1. EPA also performed a third-party technical review of the manual, added technical content and literature references throughout, and developed engineering design templates

and standard details for structural green infrastructure practices.

EPA anticipates that other communities will be able to benefit from the guidance developed by the Pima County Regional Flood Control District and City of Tucson, particularly communities in arid and semiarid areas and those interested in improving their resilience to prolonged drought and uncertain rainfall patterns caused by climate change. The outreach options presented in Table 1 also can be used by others who seek to educate and engage green infrastructure designers and the development community in promoting widespread green infrastructure implementation.

Outreach for the *Low Impact Development and Green Infrastructure Guidance Manual*

The Pima County Regional Flood Control District and the City of Tucson are implementing a joint outreach and education program to promote the planning, design, and implementation concepts outlined in their manual. Integrating green infrastructure practices into new development and redevelopment projects in southern Arizona will largely depend on adoption of the concepts by professionals involved in design, engineering, architecture, landscaping, and other specialties. Some basic level of support also will be required from property owners, managers, and lending institutions.

Crafting an outreach and education program for those target audiences requires careful consideration of the engineering, scientific, technical, construction, operation, and maintenance aspects of green infrastructure.

For example, can the integrated components and the design concepts they support be addressed most successfully in a single workshop, through online versus live training, or in presentations versus interactive formats? How much time should be devoted to rollout meetings, presentations, and training? How can participation of members of the target audiences be ensured?

Table 1 summarizes various approaches to outreach and education that promote rollout of the guidance manual. The list of options in the table is not exhaustive but is intended to spur brainstorming and discussion among city and county personnel on the best way to engage the target audience(s) in improving their understanding of—and support for—green infrastructure.

Venues, advantages and disadvantages, costs, and planning time for each option are general estimates offered to provide some sense of context and proportionality to deliberations on a final rollout plan.

The approaches summarized in the table address only the initial phase of the outreach and education program for the manual. It is likely that additional workshops, webinars, and other events will be required to maintain momentum and support for green infrastructure. The best strategy for implementing a longer term program of outreach and education will become more evident after this initial phase is complete.

Table 1. Outreach options for rolling out the Pima County/City of Tucson *Low Impact Development and Green Infrastructure Guidance Manual*

Outreach Format	Advantages	Disadvantages	Relative Cost ^a	Planning Time
Emailed message with a Web link to the guidance manual sent to targeted individuals encouraging its use ^{b,c}	<ul style="list-style-type: none"> No limit on intended recipients Can use feedback to edit manual Low commitment of resources Can be used to track receipt and follow-through of messages 	<ul style="list-style-type: none"> Impersonal, detached outreach Hard to address questions, concerns Complex topics might be difficult to explain concisely in an email Email addresses can become outdated and hard to obtain if you do not already have a sufficient list or database 	Very Low	2–3 weeks
Mailed hardcopy guidance manual to targeted individuals with a letter encouraging its use	<ul style="list-style-type: none"> More personal than email message Hardcopy more likely to be reviewed Fairly low commitment versus live training 	<ul style="list-style-type: none"> Manual might be shelved without follow-up Difficult to gauge reaction of target audience Complex topics might be difficult to explain concisely in a discussion setting 	Low ^d	4–6 weeks

Outreach Format	Advantages	Disadvantages	Relative Cost ^a	Planning Time
2-hour meeting with target audience to distribute and discuss manual	<ul style="list-style-type: none"> • Live meeting improves interaction • Better solicitation of questions, comments • In-person testimonials increase support 	<ul style="list-style-type: none"> • Limited time, mostly for one-way talks • Not enough time for detailed discussion • Interest will lag if no follow-up 	Low	4–6 weeks
Half-day workshop on guidance manual for target audience ^e	<ul style="list-style-type: none"> • More time allows detailed discussion • Suggests higher level of commitment • More time for networking • Might engage audience to seek out more information or become more involved 	<ul style="list-style-type: none"> • Still not enough time for detailed talks • Requires more planning, resources 	Moderate ^f	6–8 weeks
Full-day workshop on guidance manual for target audience ^{Error!} <small>Bookmark not defined.</small>	<ul style="list-style-type: none"> • Provides for deeper discussion • Time for breakouts, design exercises • Can include case study displays and other visual aids 	<ul style="list-style-type: none"> • Higher level of planning, resources needed • Difficult for attendees to attend a full day • One-time event is hit or miss 	Moderate ^{Error!} <small>Bookmark not defined.</small>	12–14 weeks ^g
Design competition for target audience involving hypothetical project(s) at a real site	<ul style="list-style-type: none"> • Promotes interest, involvement • Can be coupled with live/Web training • High level of publicity possible • End result can be an on-the-ground project • Serves as a teaching/marketing tool 	<ul style="list-style-type: none"> • Takes planning, resources to support • Judging “winners” might be difficult • Difficult to know level of participation in advance • Need to have a good incentive for participation (e.g., cash award) 	High	3–4 months
Series of Web-based workshops (4 x 2-hour) on the guidance manual	<ul style="list-style-type: none"> • Attendees can participate at home or office • Allows in-depth treatment of topic areas • Can be archived for later viewing 	<ul style="list-style-type: none"> • Requires high level of planning, resources • Requires excellent, technically adept speakers • Not as personal, interactive as live sessions 	High	4–6 months
Series of design workshops/ charrettes (4 x 2-hour) on the guidance manual	<ul style="list-style-type: none"> • Ability to address significant detail • Small groups allow more interaction • Easier for audience to attend shorter events 	<ul style="list-style-type: none"> • Scheduling conflicts could hurt attendance • Greater time commitment by audience • More resources required to implement 	Very High	4–6 months

Notes

^a Very Low: less than \$1,000; Low: \$1,000–5,000; Moderate: \$5,000–10,000; High: \$10,000–15,000; Very High: more than \$15,000

^b An email service that can send HTML-formatted emails with pictures and hyperlinks might have more traction. Some e-mail services can provide traffic statistics (e.g., how many people clicked on the email, clicked on a hyperlink in the email, and received the email but did not open it upon receipt). Design of an HTML-enabled email template can add several thousand dollars to the cost of content development.

^c Monthly emails can be sent after the initial email that focus on one practice or topic to spur more interest and provide additional details.

^d Relative cost does not include the cost of printing hardcopies of the manual.

^e Educational or professional credits can be offered to encourage participation in workshops. Additional planning and partnering with a university or other accredited training institution would be required.

^f A fee can be charged to offset some of the costs of the workshop.

^g Timeframe allows for publicity and event registration.

About the Green Infrastructure Technical Assistance Program

Stormwater runoff is a major cause of water pollution in urban areas. When rain falls in undeveloped areas, soil and plants absorb and filter the water. When rain falls on our roofs, streets, and parking lots, however, the water cannot soak into the ground. In most urban areas, stormwater is drained through engineered collection systems and discharged into nearby water bodies. The stormwater carries trash, bacteria, heavy metals, and other pollutants from the urban landscape, polluting the receiving waters. Higher flows also can cause erosion and flooding in urban streams, damaging habitat, property, and infrastructure.

Green infrastructure uses vegetation, soils, and natural processes to manage water and create healthier urban environments. At the scale of a city or county, *green infrastructure* refers to the patchwork of natural areas that provides habitat, flood protection, cleaner air, and cleaner water. At the scale of a neighborhood or site, *green infrastructure* refers to stormwater management systems that mimic nature by soaking up and storing water.

Green infrastructure can be a cost-effective approach to improving water quality and helping communities stretch their infrastructure investments further by providing multiple environmental, economic, and community benefits. This multibenefit approach creates sustainable and resilient water infrastructure that supports and revitalizes urban communities.

EPA encourages communities to use green infrastructure to help manage stormwater runoff, reduce sewer overflows, and improve water quality. EPA recognizes the value of working collaboratively with communities to support broader adoption of green infrastructure approaches.

Technical assistance is a key component to accelerating the implementation of green infrastructure across the nation and aligns with EPA's commitment to provide community-focused outreach and support the President's *Priority Agenda Enhancing the Climate Resilience of America's Natural Resources*.

Creating more resilient systems will become increasingly important in the face of climate change. As more intense weather events and dwindling water supplies stress the performance of the nation's water infrastructure, green infrastructure offers an approach to increase resiliency and adaptability.

For more information, visit www.epa.gov/greeninfrastructure.



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Principal EPA Team

Jamie Piziali, EPA
Christopher Kloss, EPA
Mahri Monson, EPA
Laura Bose, EPA Region 9

Community Team

Lynn Orchard, Pima County
Regional Flood Control District
Evan Canfield, Pima County
Regional Flood Control District
Irene Ogata, City of Tucson

Consultant Team

Jason Wright, Tetra Tech
Brad Wardynski, Tetra Tech
Martina Frey, Tetra Tech
Barry Tanning, Tetra Tech

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