



Integrating Green Infrastructure Tools into Hazard Mitigation Plans



Sustainable Communities
Building Blocks

Background

U.S EPA and FEMA sponsored technical assistance for Maricopa County jurisdictions to:

- identify green infrastructure/low impact development (GI/LID) options,
- to incorporate into the 2020 Maricopa County Multijurisdictional Hazard Mitigation Plan (MHMP).



Regional Workshop

The technical assistance centered around a workshop held on December 10-11, 2019 with nearly 60 participants from local jurisdictions, federal agencies and regional partners.

This presentation summarizes the outcomes of the technical assistance.



Presentation Overview

- Hazard Mitigation Plans
- Green Infrastructure Benefits
- Hazard Mitigation Plan Process
- GI/LID Mitigation Actions
- Building Regional Capacity



HMP Overview



What is a Hazard Mitigation Plan?

- Disaster Mitigation Act of 2000 - Requires state, local, and tribal governments to have a FEMA approved hazard mitigation plan (HMP) in order to establish eligibility for FEMA's Hazard Mitigation Assistance (HMA) funding programs.
- Focus on mitigating natural hazard that impact the community.
- Projects must align with the plan's priorities and mitigate the vulnerabilities and impacts identified.
- Plans must be updated every 5 years and can be amended throughout the 5-year plan lifecycle.



What's included in an HMP?

**Identify
Hazards**

**Assess Risks and
Vulnerabilities**

**Outline Mitigation
Capabilities**

**Strategies to
Reduce Risk**



Why Consider GI/LID in HMPs Now?

FEMA recently incorporated into HMP Guidance



More focus on integrated planning including natural resources.



Future conditions considerations including impervious area expansion.



Incentives to exceed the minimum plan content requirements - “Enhanced Plans” are eligible for more post-disaster funding.



FEMA focus on resilience creates openness for local initiatives integrated into planning.

Arid Climate Risks Most Suitable for GI Mitigation Strategies



DROUGHT MITIGATION through water storage and lower potable water demand



EXTREME HEAT MITIGATION through reduced urban heat island effect



FLOOD MITIGATION through diversion, infiltration and storage

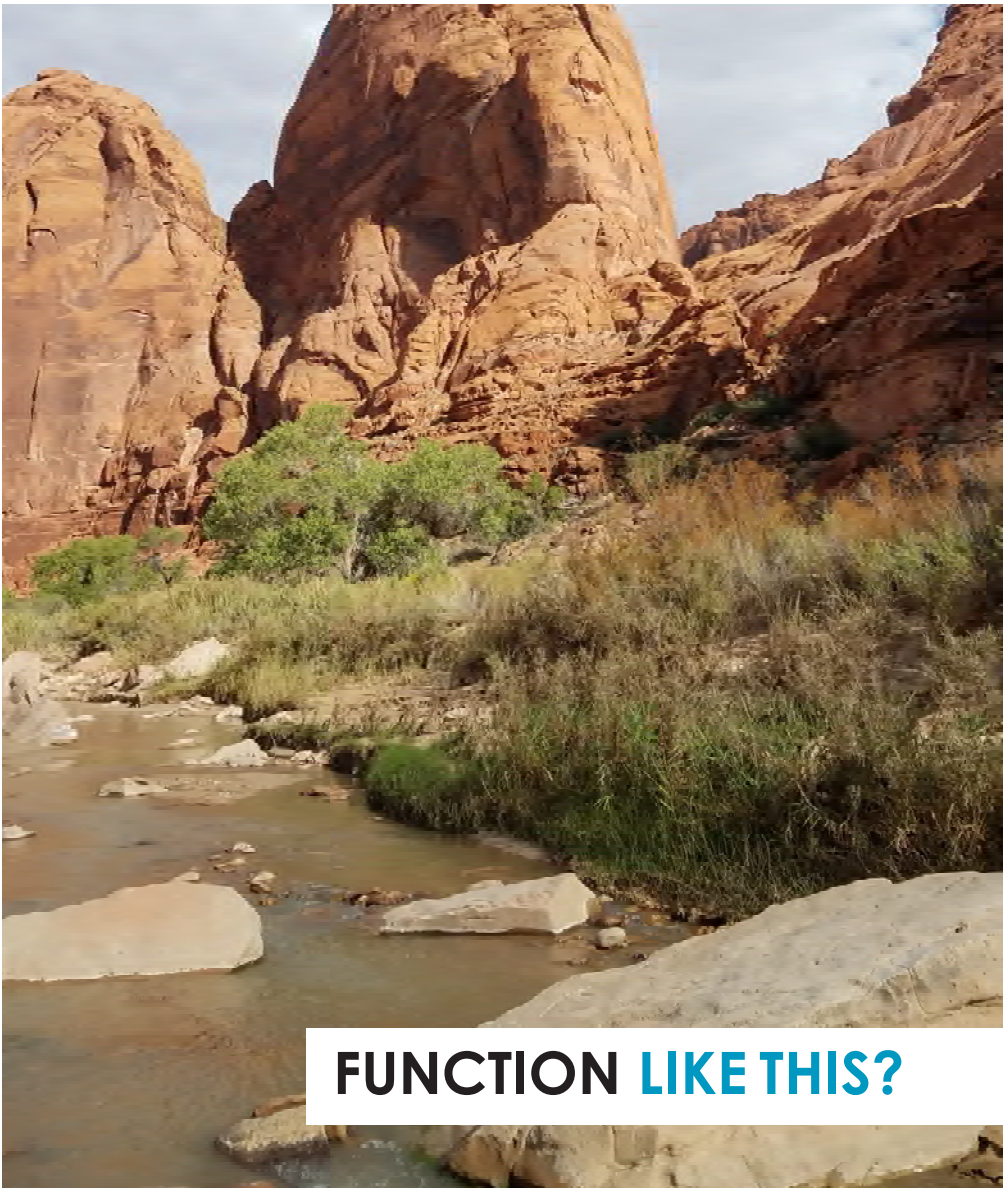
Green Infrastructure



Image Credits: Left: GI for Desert Communities, Watershed Management Group. Right: Pima County and City of Tucson. Low Impact Development and Green Infrastructure Guidance Manual.



HOW DO WE MAKE THIS...



FUNCTION LIKE THIS?

GI STORMWATER FUNCTIONS



CAPTURE

stormwater for
specific use



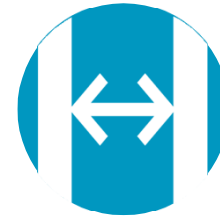
DETAIN

stormwater and
slowly release it
at a controlled rate



INFILTRATE

stormwater into the
ground



DISCONNECT





impervious areas to
divert stormwater








SLOW

the movement
of stormwater

GI/LID Technologies

Technology	Description
	<p>Conservation area</p> <p>Conservation areas protect undeveloped drainage areas to tap into their natural infiltration and storage capacity. Conserved areas can potentially offer more co-benefits than constructed GI/LID features and are most readily implemented in larger sites such as lower density residential developments and open space.</p>
	<p>Vegetated bioswale</p> <p>Vegetated swales are long, shallow channels covered by vegetation and pervious rock or gravel. They provide an alternative to storm drain systems and are best implemented together with other GI/LID technologies, such as sediment traps, infiltration trenches, rock check dams, and curb cuts.</p>
	<p>Bioretention/stormwater harvesting</p> <p>Bioretention or stormwater harvesting basins are shallow depressions that collect runoff and use it to support planted vegetation, often adjacent to impervious areas such as parking lots.</p>
	<p>Rainwater harvesting</p> <p>Rainwater harvesting uses containers such as cisterns to collect rain for non-potable use at residential and commercial properties.</p>

GI/LID Technologies

Technology	Description
	<p>Curb extension</p> <p>Curb extensions are landscaped areas built out from a low-speed vehicle travel or parking lane.</p>
	<p>Permeable pavement</p> <p>Permeable pavement is pavement with small voids to allow water to infiltrate or drain into a reservoir below. It is appropriate for parking lots with vehicle travel speeds of less than 30 miles per hour.</p>
	<p>Roof storage</p> <p>Green roofs use vegetation and soils on relatively flat building rooftops to retain stormwater. They require irrigation in arid and semi-arid climates.</p>
	<p>Infiltration trench</p> <p>Infiltration trenches are narrow gravel-filled channels that retain stormwater or transfer it to another location. They are appropriate for commercial, industrial or high-density residential sites. Vegetation cannot be grown on the trenches.</p>
	<p>Dry well</p> <p>Dry wells are gravel-filled excavations that are only a few feet in diameter and are applicable for multi-family residential and commercial sites.</p>

GI Benefits



Risk Mitigation through GI/LID



***Drought
Mitigation***

66%

lower household water use through rainwater harvesting



***Extreme Heat
Mitigation***

4-6 °F

lower temperatures in suburbs from trees, shrubs and grasses



***Flood
Mitigation***

98%

of rainfall from one-inch storm captured by bioswales in Phoenix, Arizona

GI Features Contribute Co-benefits



Improved water quality



Improved air quality



Lower carbon emissions



Enhanced pedestrian safety



Enhanced community wellness



Improved property values



Long-term cost savings

Co-Benefits by the Numbers

98.4%

Rainfall capture of the
1 in storm with
bioswales and
bioretention basins.

9°

Reduction in
temperatures from
vegetation

58,700

tons of carbon
stored by urban
trees in Phoenix

GI/LID PRIORITIES TO ADDRESS RISK

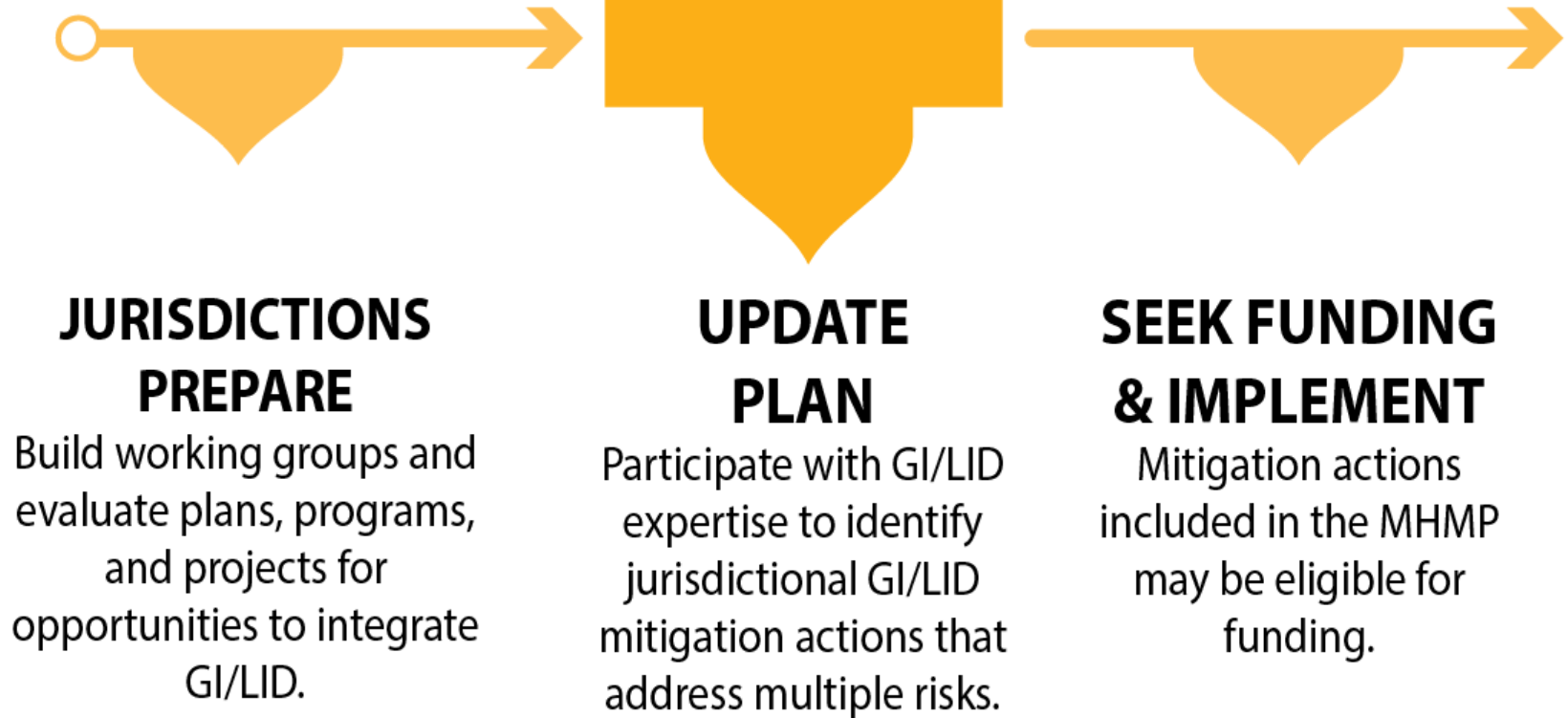
Workshop participants identified the GI/LID strategies as most effective in mitigating extreme heat, drought and flooding:

Extreme heat	Drought	Flooding
<ul style="list-style-type: none">✓ Conservation areas✓ Vegetated bioswales	<ul style="list-style-type: none">✓ Conservation areas✓ Bioswales, bioretention and stormwater harvesting basins✓ Cistern/stormwater harvesting	<ul style="list-style-type: none">✓ Conservation areas (and constructed wetlands)✓ Bioretention and stormwater harvesting basins (detention)

MHMP Planning Process



MHMP PLANNING PROCESS



Jurisdictions Prepare

Local governments may consider the following activities to prepare to integrate GI/LID in the MHMP process:

- Identify staff with GI/LID expertise and form working groups.
- Educate leadership, elected officials and the public.
- Identify near-term updates to relevant plans.
- Review zoning to identify potential conservation areas.
- Identify barriers to and incentives for GI/LID.



Considerations During the MHMP Process

Planning Process:

- Include past and plan updates in plan integration strategy.
- Reference existing GI/LID guidance.
- Include staff with GI/LID expertise in MHMP planning team.

Community Description phase:

- Include overarching policies compatible with GI/LID approach.

Risk Assessment Phase:

- Include most recent local climate and hazard vulnerability data.

Mitigation Strategy:

- Reference GI/LID approach in HMP goals.
- Identify GI/LID mitigation actions to adopt

Jurisdictional Mitigation Capabilities:

- Identify resources needed for GI/LID based on Legal and Regulatory Capability, Fiscal Capability and Staff Capability:

Tools and Definitions:

- Define extreme heat and urban heat island effects.

Potential GI/LID Mitigation Actions



Example Mitigation Strategies

PLANNING

**CAPITAL
PROJECTS**

DEVELOPMENT

EDUCATION

Planning

Potential mitigation actions include:



**INCORPORATE
GI/LID** in
General, Flood,
Stormwater
Management
Plans.



**INCLUDE LAND
ACQUISITION FOR
GI/LID** in the Capital
Improvement or
Management Plan.



**INTEGRATE GI/LID
GOALS AND
STRATEGIES** into
relevant plan
updates.

Example

“Complete and implement a municipal GI Plan for the inclusion of low impact development drainage design into storm drain infrastructure on public and private lands.”

- City of Oakland HMP

Capital Projects

Potential mitigation actions include:



PRIORITIZE GI/LID
in flood control
projects and street
or storm drainage
improvements.



INCORPORATE GI/LID
in civic and school
projects.



**ADOPT AN EVALUATION
METHOD** to incentivize
GI/LID in capital projects.

Example

*“Develop a GI
Plan to identify
areas of
opportunity
and standards
for inclusion of
GI in public
capital
projects.”*

- City of Oakland
HMP

FEMA-Funded Project Case Study:

Squaw Creek Flood Mitigation Project, City of Ames, Iowa

Includes:

- Channel excavation
- Natural channel design, streambank toe protection, and planting native vegetation

Part of City's 2020/2021 Capital Improvements Plan



27 ACRES

of riparian land and
open space



\$1 MILLION

in environmental benefits



75%

funded by FEMA
Hazard Mitigation
Assistance Grant

Development

Potential mitigation actions include:



ASSESS DEVELOPMENT REGULATIONS

to remove barriers and add incentives to integrate GI/LID into new development.

Example

“Remove regulatory barriers and develop programs that support sustainable designs, landscapes, green infrastructure, and development practices. Update and develop new building codes and design standards that help reduce urban heat island effect.”

- Pima County HMP

Education

Potential mitigation actions include:



**DEVELOP
LANDSCAPE
GUIDANCE** to
educate property
owners on GI/LID.



DEVELOP TRAINING
to deliver to staff,
elected officials and
the development
community.



**CONSTRUCT GI/LID
DEMONSTRATION SITES.**

Example

*“Conduct a
public education
campaign to
increase
awareness of
natural
hazards”*

- Pima County HMP

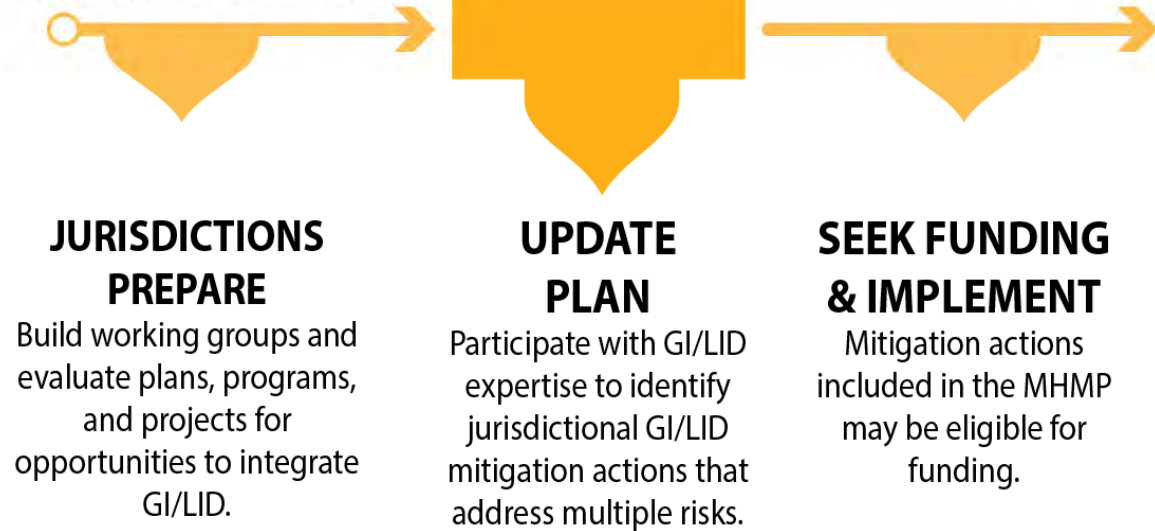
Building Regional Capacity



BUILD REGIONAL GI/LID CAPACITY

Coordination among regional partners and jurisdictions to build regional capacity through convening, research, education and tool development.

MHMP PLANNING PROCESS



BUILD REGIONAL GI/LID CAPACITY

Coordination among regional partners and jurisdictions to build regional capacity through convening, research, education and tool development.



Workshop participants recommended investing in regional capacity to integrate GI/LID into local planning, projects and programs.

Capacity-Building Strategies

1.

**CONFIRM
REGIONAL
PARTNER ROLES**

in building regional capacity to implement GI/LID strategies.

2.

**DEVELOP A
REGIONAL
DATABASE
AND TOOLS** to help prioritize, promote and fund GI/LID implementation across the region.

3.

**DEVELOP TOOLS
TO INCENTIVIZE
DEVELOPERS** to implement GI/LID strategies.

4.

**BUILD
REGIONAL
CAPACITY** through cross-sector trainings and education.



Confirm regional partner roles in building regional capacity to implement GI/LID strategies.

- Form a cross-jurisdictional stormwater subcommittee.
- Adopt a joint resolution that formally articulates support for GI/LID strategies.
- Identify how best to leverage regional authorities and expertise.
- Coordinate a peer exchange.
- Engage the state to integrate GI/LID in the State HMP.
- Fund regionally accessible GI expertise.

Build regional capacity through cross-sector trainings and education.

ORGANIZE TRAINING EVENTS OR A LEADERSHIP ACADEMY to educate municipal staff on GI/LID implementation.

ORGANIZE A WORKSHOP with both local and county decision-makers to explore funding options and to align efforts.

ACTIVATE PUBLIC INTEREST AND SUPPORT by holding tours, trainings and workshops, distributing GI/LID guidance for property owners.



Reference Information

