Nature-Based Solutions for Flood Mitigation

Overview for Region 12 RFPG

Presentation Outline

- Region 12 flooding concerns
- What are nature-based solutions?
- Examples of nature-based solutions
- Co-benefits
- Case studies
- Funding for nature-based solutions
- Local recommendations
- Equity concerns

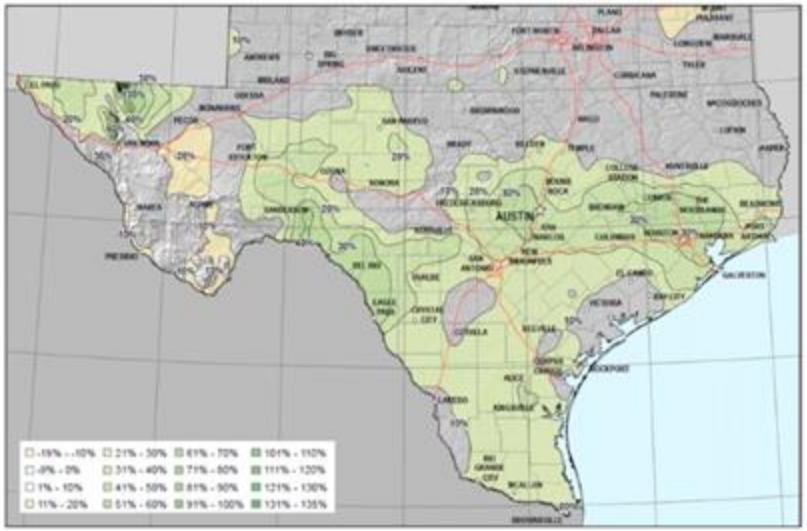
Source: San Antonio RiverWalk Association

Nature-Based Flood Mitigation Infrastructure & RFPGs

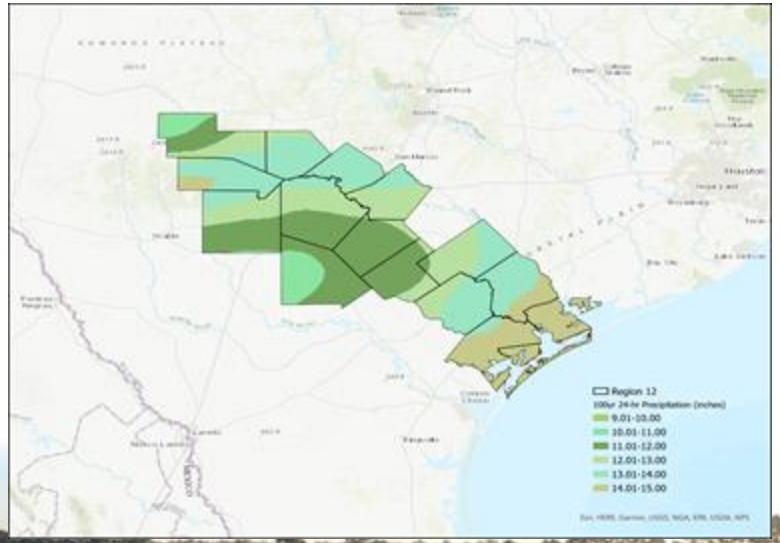
RFPGs are required to ***describe natural flood mitigation features*** in the RFP (TAC Rule 361.31) and ***shall identify and evaluate*** potential FME's and ***potentially feasible FMSs and FMPs, including nature-based solutions***...(TAC Rule 361.38).

Region 12 Flooding Concerns

NOAA Atlas 14 vs. 2004 USGS Rainfall Atlas
% Difference in 100-yr 24-hr Precipitation



NOAA Atlas 14 100-yr 24-hr Precipitation Depths for the San Antonio Region



Land Use Changes in San Antonio Watershed

Percent Net Increase of Developed Area

22.04%

Percent Net Increase of Impervious Surface Area

29.75%

Land Cover Area and Change Distribution

Land Cover	1996 sq.mi	Lost sq.mi	Gained sq.mi	2016 sq.mi	Net Change sq.mi	Change %
HID	8.78	0.00	3.82	12.60	3.82	43.54
LID	22.91	-0.04	3.77	26.64	3.74	16.32
OSD	5.35	-0.09	0.70	5.96	0.60	11.28
GRS	18.31	-7.05	4.95	16.21	-2.10	-11.45
AGR	718.69	-10.21	24.18	732.66	13.97	1.94
FOR	140.69	-5.78	1.88	136.78	-3.90	-2.77
SCB	494.20	-29.57	9.07	473.70	-20.50	-4.15
WDW	55.53	-1.65	1.39	55.27	-0.26	-0.47
EMW	6.75	-1.38	2.11	7.49	0.74	10.90
BAR	5.17	-1.33	5.18	9.02	3.85	74.34
WTR	8.57	-1.58	1.62	8.61	0.04	0.48

Source: National Oceanic and Atmospheric Administration, Office for Coastal Management. "Lower San Antonio Watershed." Coastal Change Analysis Program (C-CAP) Regional Land Cover. Charleston, SC: NOAA Office for Coastal Management.

What are Nature-Based Solutions?

Nature-based flood mitigation includes “mitigation approaches involving the use of natural features, materials, and processes to reduce the risk and impacts of flooding” (TAC 361.10).

- Includes **natural ecosystems** and **engineered features** that use materials that are designed to *mimic functioning of natural ecosystems*
- Centers around **conservation**, **restoration**, or **emulation** of an existing natural ecosystem
- Provide flood protection while **increasing resilience** and providing **additional co-benefits**

Source: San Antonio RiverWalk Association

Nature-based Flood Solutions

Types of Nature-Based Infrastructure

1. Stream Restoration

Re-establish structure, function and the **self-sustaining behavior** of stream system.

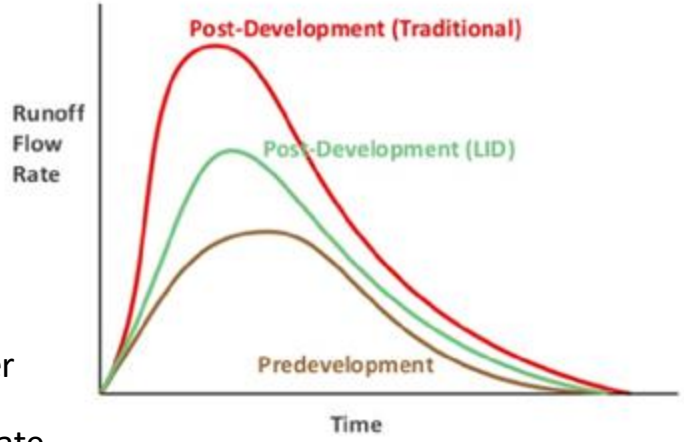
Preservation or restoration of **tributaries and their headwaters** is a priority to mitigate flooding and protect downstream floodplains.

East Salitrillo Creek Stream Restoration Project

Figure 13: Typical Erosion at East Salitrillo Creek Prior to Construction (left) and View of Project During Construction (right).

Source: San Antonio River Authority

Types of Nature-Based Infrastructur



2. Low Impact Development (LID)

A variety of development practices that **use** or **mimic natural processes** that result in the infiltration and/or use of stormwater

Reduces floodwaters by storing stormwater allowing it to infiltrate

Source: Michael F. Bloom, P.E., 2017




Types of Nature-Based Infrastructure

3. Conservation easements

Landowner voluntarily gives an easement holder certain rights to limit uses of the land in perpetuity to promote conservation.

4. Buyouts

Removes built structures from areas vulnerable to flooding typically through voluntary purchases.

Types of Nature-Based Infrastructure

5. Wetland Restoration and Constructed wetlands

Uses restored or built wetlands to store and filter up to 330,000 gallons of water per acre

INVISTA Wetland in Victoria, Texas

6. Living Shorelines

Range of shoreline stabilization techniques to reduce erosion through the use of ecological approaches

Bulkhead

Living Shoreline

Source: https://www.visd.net/apps/pages/INVISTA, Smith et. al, 2018, https://www.eesi.org/papers/view/fact-sheet-nature-as-resilient-infrastructure-an-overview-of-nature-based-solutions

Co-Benefits of Nature-based Solutions

Under TAC 361.38, "evaluations of potentially feasible FMS and FMPs shall include. . . a ***description of potential . . . benefits*** from the FMS or FMP to the ***environment, agriculture, recreational resources, navigation, water quality, erosion, sedimentation***, and impacts to any other resources deemed relevant."

- Urban heat islands (Willis & Petrokofsky, 2017)
- Water quality improvement (Guerrero et al., 2020)
- Human health and societal benefits (Spano et al., 2021)
- Recreation and eco-tourism (Bureau of Economic Analysis, 2019)
- Green economies and jobs (Kabisch et al., 2017)

Hybrid Infrastructure

Service	Potential Sources of Infrastructure Cost Reduction
River flood management	Floodplains lower costs for gray infrastructure such as flood control embankments, sluice gates, and pumping stations. The floodplains store flood waters and lower flood levels, thus potentially lowering the cost and/or improving the resilience of the built solution.
Urban stormwater management	Stormwater retention areas lower costs for stormwater drains, pump stations, and treatment of wastewater discharges. They filter pollutants and can remove up to 90% of heavy metals from stormwater.

Chain of Wetlands, Dallas Floodway Extension

San Antonio River Authority, Euclid Location

Source: Browder et. al., 2019

Case Study: Channelization on Urban Watersheds in Houston, Texas

Buffalo Bayou

- Natural Drainage and setbacks
- Remains one of few natural riparian waterways in Houston
- **More successful at minimizing adverse impacts of urban development** on riverine flooding over time

Brays Bayou:

- Largely channelized
- Increasingly prone to flooding

Source: Juan et. al., 2020

Case Study: Exploration Green, City of Webster, TX

- Converted golf course into series of **detention** and **wetlands** projects designed to detain and slow floodwaters
- **Cleans runoff from 95% of storms** that occur in the community
- Phase 1 when 80% complete **detained 100 M gallons of Harvey Stormwater**
- Once complete it will have a storage capacity of **1,680 acre-feet**

Figure 1: Aerial view of Exploration Green – artist's rendering

Source: Exploration Green! A Case Study in Effective Floodplain Management, 2018

Case Study: Mission Reach, San Antonio, Texas

- Stream restoration project that incorporated riparian woodland and aquatic habitat restoration
- **$384.1 million public investment** for the larger San Antonio River Improvement Project
- Utilized environmentally sensitive methods enhancing existing flood management elements
- **Resulted in:**
  - Stronger connection between the river and the community
  - Improved water quality and healthier ecosystems and increased recreational use

Source: San Antonio RiverWalk Association

Case Study: SARA Funded Green Infrastructure Projects

- Total number of green infrastructure sites: **40**
  - 21 Bioretention BMPs
  - 14 Cistern BMPs
  - 5 Permeable pavement BMPs
  - 6 Bioswales BMPs
  - 1 Green roof BMP
- Invested **$1.6 million** in GI
- Stormwater volume controlled: **34 million gallons** (104.4 acre-feet)
  - Equivalent detention pond estimated to cost only 10% less, without associated co-benefits
- Treated stormwater volume: **879,338 cubic feet**
- Total Nitrogen removed: **65 pounds**
- Total suspended solids removed: **13,000 pounds**

Source: San Antonio River Authority website

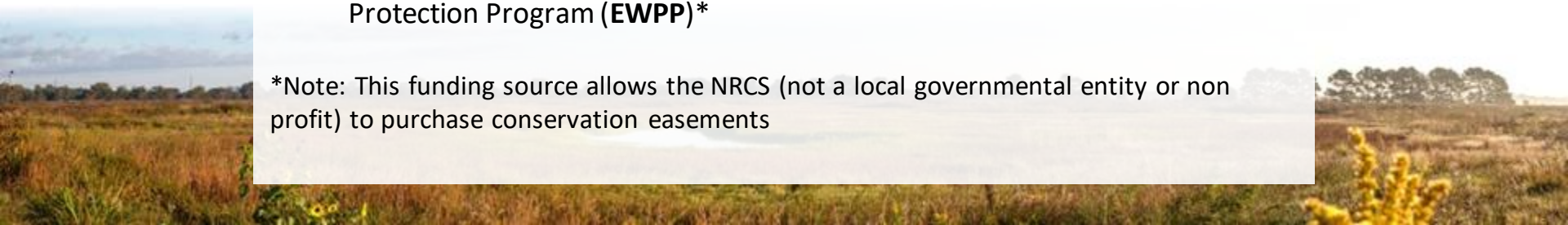
Funding Opportunities for Nature-Based Infrastructure

Under TAC 361.38, "evaluations of potentially feasible FMS and FMPs shall include. . . and be based on. . .an indication regarding the ***potential use of federal funds,*** **or other sources of funding** as a component of the total funding mechanism."

Federal Funding Sources

- FEMA's Building Resilient Infrastructures and Communities (**BRIC**) Program
- HUD's Community Development Block Grant for Mitigation (**CDBG-MIT**) Funds
- National Resources Conservation Service's (NRCS) Emergency Watershed Protection Program (**EWPP**)*

*Note: This funding source allows the NRCS (not a local governmental entity or non profit) to purchase conservation easements



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State and Local Funding Sources

- Clean Water State Revolving (**CWSRF**) Funds
- Flood Infrastructure Fund (**FIF**)
- Watershed Wise Rebate Program
- Hays County Parks and Open Spaces Bond (2020)

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State and Local Funding Sources

- Clean Water State Revolving (**CWSRF**) Funds
  - *Green Project Reserve* available for nonpoint source protection or estuary management projects
- Flood Infrastructure Fund (**FIF**)
  - Priority points and extra grant opportunities available for nature based projects
- Watershed Wise Rebate Program
- Hays County Parks and Open Spaces Bond (2020)

Local Recommendations for Nature-Based Flood Mitigation

RFPGs are required to *describe natural flood mitigation features* in the RFP (TAC Rule 361.31) and *shall identify and evaluate* potential FME's and *potentially feasible FMSs and FMPs, including nature-based solutions*, **some of which may have already been identified by previous evaluations and analyses by others** (TAC Rule 361.38).

Assess opportunities for creating connected networks to manage water and regulate temperature through ecosystem-based adaptation measures. This could include connecting existing park and open space networks and adjacent areas to provide cooling corridors and stormwater management benefits.

- ***SA Climate Ready: A Pathway For Climate Action & Adaptation***

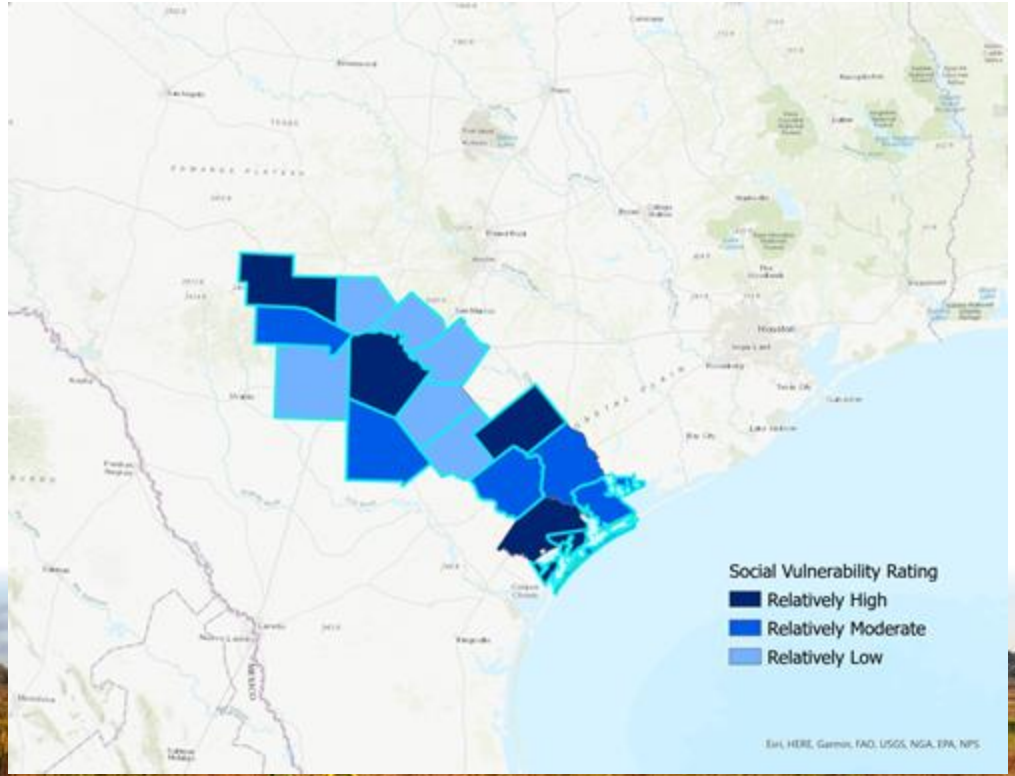
Create incentives, and provide training and recognition opportunities for existing developments to manage stormwater onsite.

- ***City of San Antonio Sustainability Plan***

Explore incentive, voluntary, and other implementation programs for Low Impact Development (LID) and the development of Conservation Subdivisions.

- ***City of San Antonio Sustainability Plan***

Equity Considerations



Under TAC 361.38, "evaluations of potentially feasible FMS and FMPs shall include. . . and be based on. . . an ***equitable comparison*** between consistent assessment of all FMSs and FMPs that the RFPGs determine to be potentially feasible."

Source: Galloway, et. al, 2018

Thank you!

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