

# San Antonio River Authority Stream Restoration Program

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# What is Stream Restoration?

- The re-establishment of the general structure, function and self-sustaining behavior of the stream system that existed prior to disturbance.
- Holistic process

Doll, B.A. et. al. (1999) *Stream Restoration: A Natural Channel Design Handbook*. Preface. North Carolina Stream Restoration Institute.



# The Importance of Stream Restoration

- Restores/enhances ecological health
  - Increases native biodiversity
  - Provides habitat for new or previously existing flora and fauna
  - May reduce invasive species
- Restores functionality
  - Establishes stable flow patterns
  - Improves connection to the floodplain
  - Balance sediment transport
- Allows for increased education and community interaction
  - Recreation
  - Land cooling
  - Aesthetics



# Impacts to a Stream

## Direct Impacts (Changes to the stream)

- Flow Regulation
- Channelization and Dams
- Point Source Discharges
- Floodplain Encroachment
- Snagging and Removal of Wood
- Road / Utility Crossings
- Livestock Access to Channel



## Indirect Impacts (Changes to the watershed)

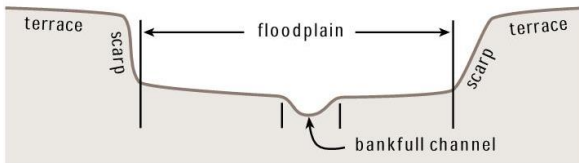
- Agriculture
- Forestry/Tree Harvesting
- Urbanization
- Road density



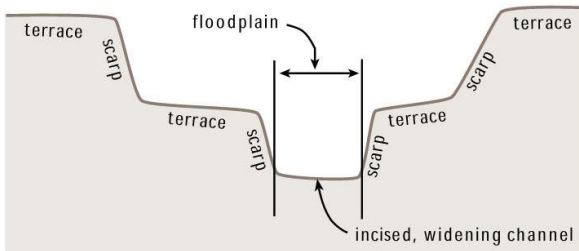


# As Watersheds Change, so does the Stream...

A. Nonincised Stream



B. Incised Stream (early widening phase)



C. Incised Stream (widening phase complete)

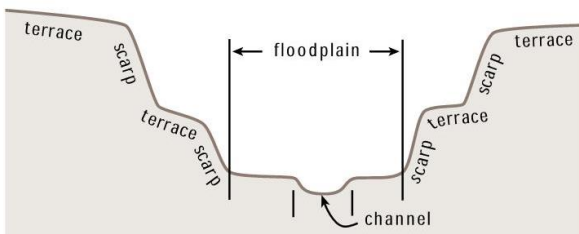
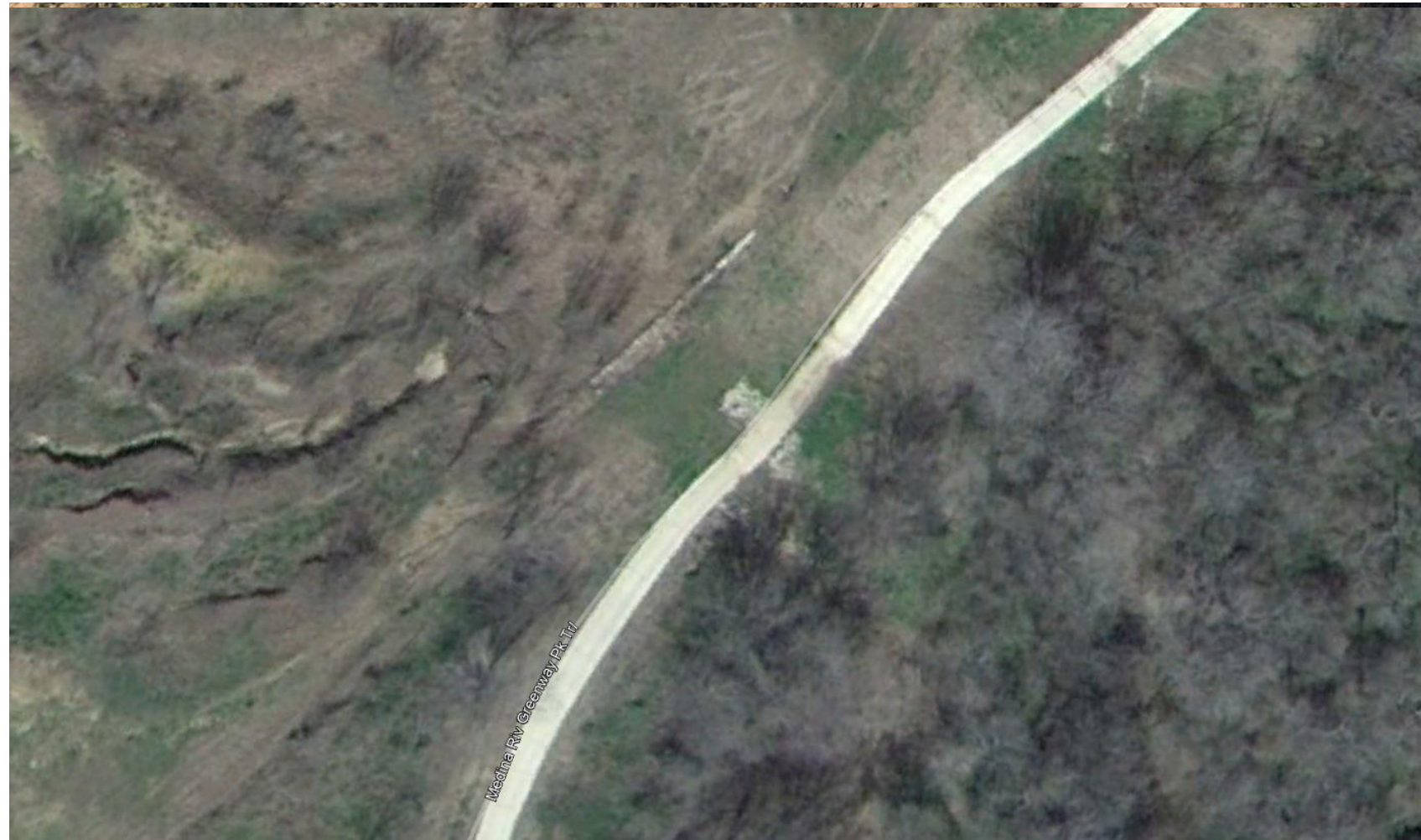
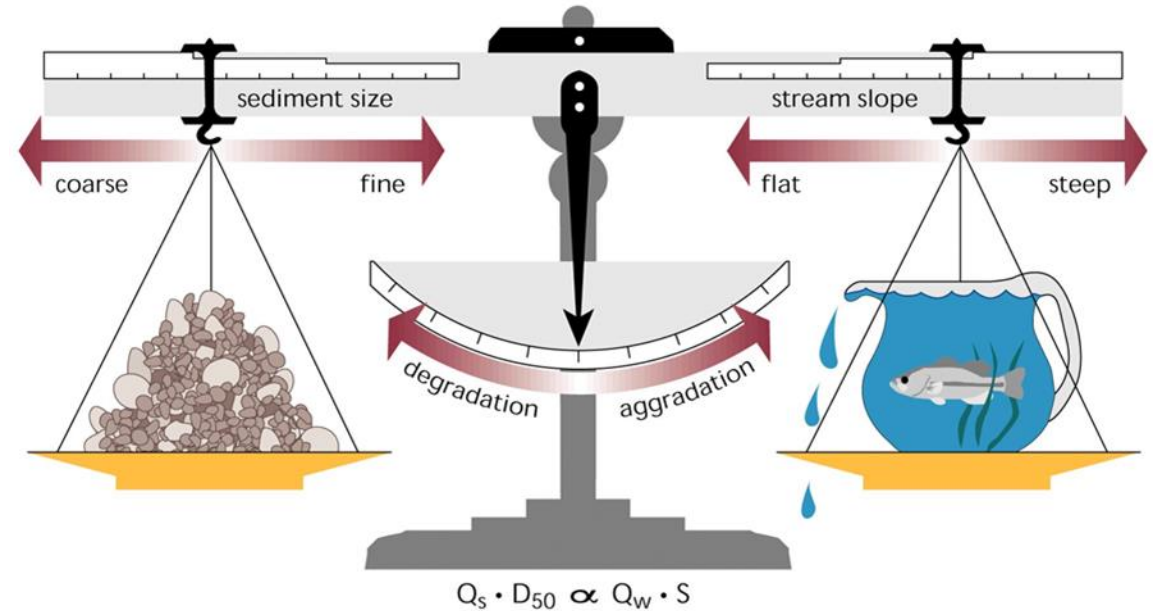


Figure 1.24: Terraces in (A) nonincised and (B and C) incised streams. Terraces are abandoned floodplains, formed through the interplay of incising and floodplain widening.



# How does a Channel Change?

- Stream responds to changes in flow and sediment
- Movement of Sediment



From Rosgen (1996), from Lane, Proceedings, 1955.  
Published with the permission of American Society of Civil Engineers.

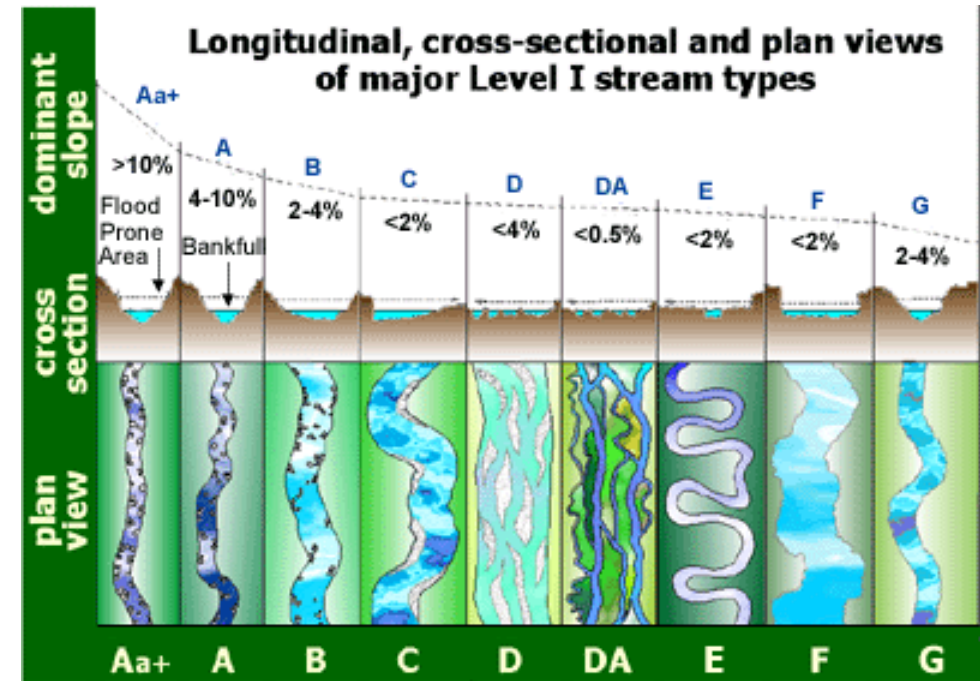
Fig. 1.13 – Factors affecting channel degradation and aggradation: Concept of "Stream Balance".  
In Stream Corridor Restoration: Principles, Processes, and Practices, 10/98.  
Interagency Stream Restoration Working Group (15 Federal Agencies of the US).



# Methods of Stream Restoration

- Rosgen

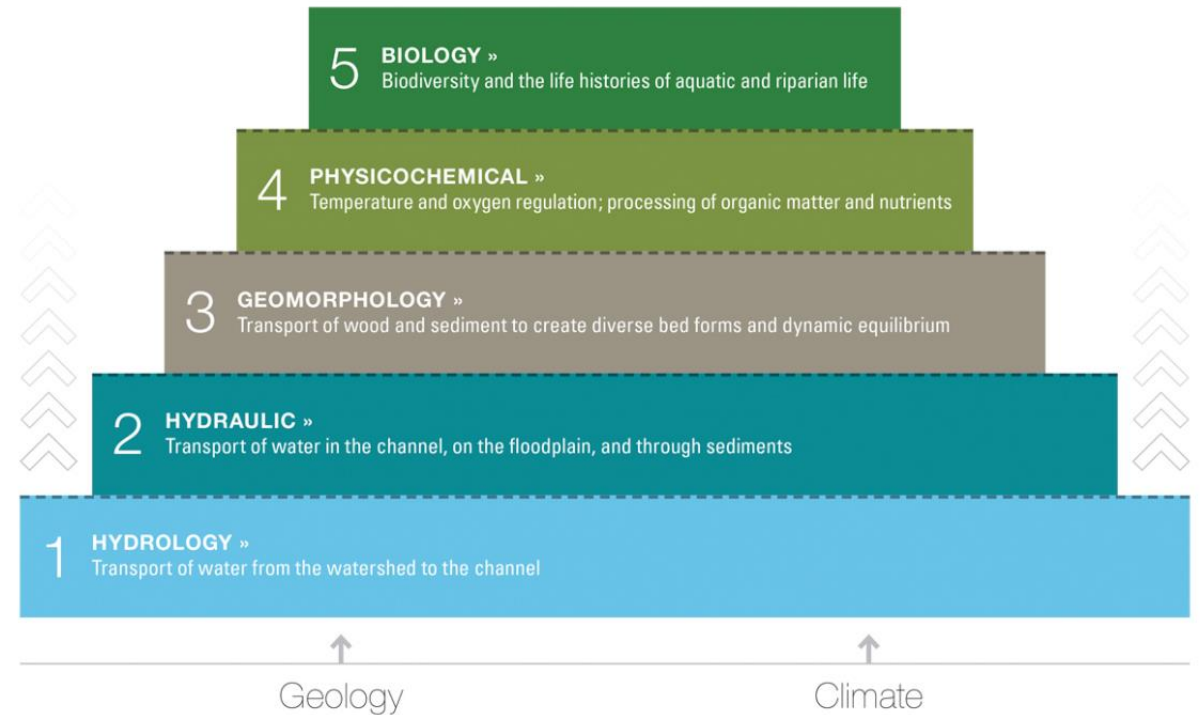
- Stream categories based on channel morphology
- Uses stream classification to establish a baseline to predict stream behavior from its physical characteristics and to compare various stream conditions with site-specific data
- 4 Levels
  - I: Geomorphology
  - II: Morphological description (measurements)
  - III: Stream condition and stability
  - IV: Verification of predictions





# Methods of Stream Restoration

- Stream Mechanics – Harman et al.
  - Uses a function-based approach
  - Functional Pyramid and Uplift Table
  - Identifies 15 functions critical to stream health and riparian ecosystems, with emphasis on the base building upward (broad-level view)
  - 5 Main levels
    - Hydrology
    - Hydraulic
    - Geomorphology
    - Physicochemical
    - Biology



Harman, W., R. Starr, M. Carter, K. Tweedy, M. Clemmons, k. Suggs, C. Miller. 2012. *A Function-Based Framework for Stream Assessment and Restoration Projects*. US Environmental Protection Agency, Office of Wetlands, Oceans, and Watersheds, Washington DC EPA 843-K-12-006.





# Program Overview and Plans



# Stream Restoration Program History

The program was developed in 2009 in response to the recurrent challenges posed by channel erosion and instability.

## Successes:

- Natural Channel Design Protocol
- Stream Restoration Potential Database
- Stream Restoration Potential Projects List
- Regional Curves
- Reference Reach Data
- Training
- Banking Mitigation Feasibility Study
- Project Design and Construction





# Past Project Selection

Project selection has historically been based largely on desktop analysis and/or a reactionary basis to events such as bank failure or impending risk to infrastructure.





# Program Initiatives

Biologist

Ecologist

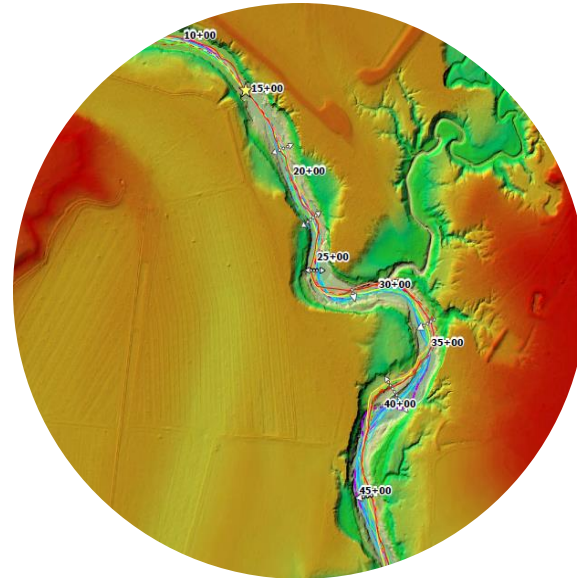
Project  
Manager



Engineer

Surveyor

**MULTI-  
DISCIPLINARY TEAM**



**REACTIVE &  
PROACTIVE**



**HOLISTIC  
APPROACH**





# Project Selection



# Data

## Available

- Water quality sampling data
- Biological monitoring
  - Fish
  - Macroinvertebrate
  - Mussel
- Watershed Master Plan Viewer

## Goals

- Aquatic connectivity database
- eDNA
- Plantings list to target specific pollutants
- Holistic Project Selection Tool




# Available Data




# Water Quality Sampling Data





**SAN ANTONIO RIVER AUTHORITY**

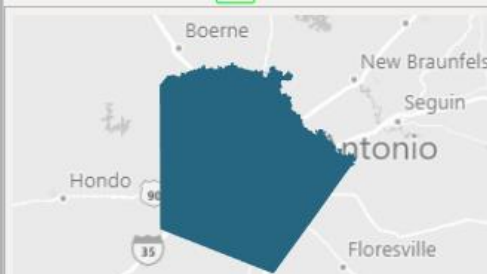


PROFIT PEOPLE SUSTAINABILITY PLANET

Use filters below to help reduce the number of alternatives on the stations' map or search by station id on the right.


[Current](#) [Historic](#) [Recreation](#)

by Counties [Download data by County.](#)



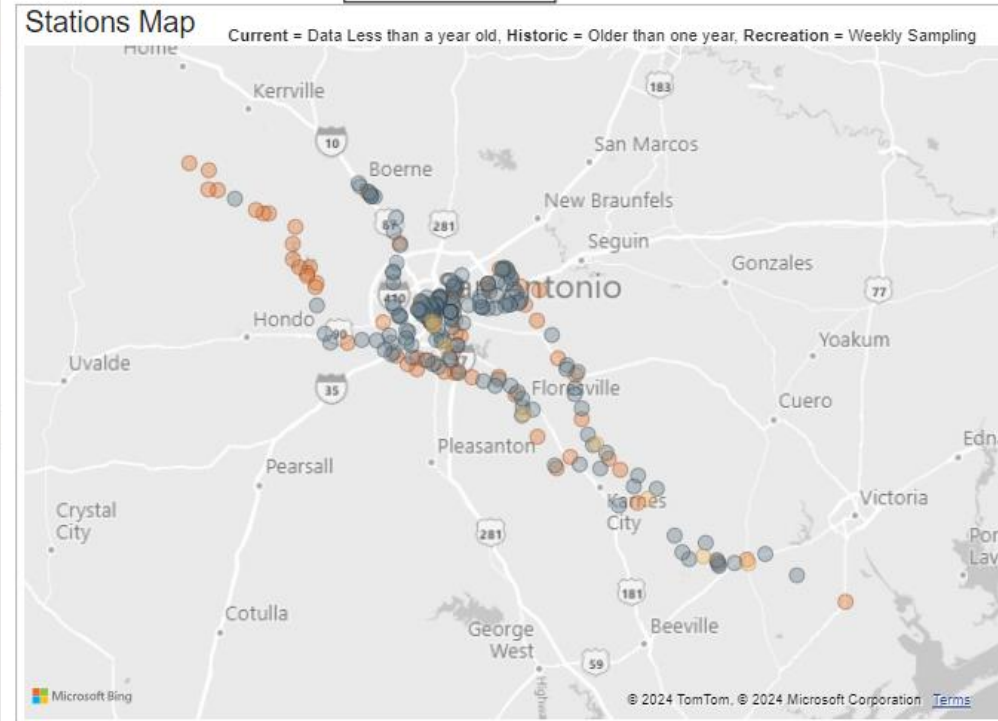
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by Watersheds [Download data by Watershed.](#)



Search by Station ID:  Search

Stations Map Current = Data Less than a year old, Historic = Older than one year, Recreation = Weekly Sampling



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● Current ● Historic ● Recreation

**15645**  
STATION

**Salado Creek Upstream Commer...**  
DESCRIPTION

**Bexar**  
COUNTY

**1910**  
SEGMENT

**Salado Creek**  
WATERSHED

**Go To Station Information**



# Biological Monitoring

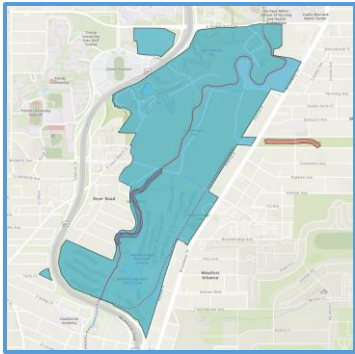


**Committed to Safe, Clean, Enjoyable Creeks and Rivers.**



# Watershed Master Plan Viewer

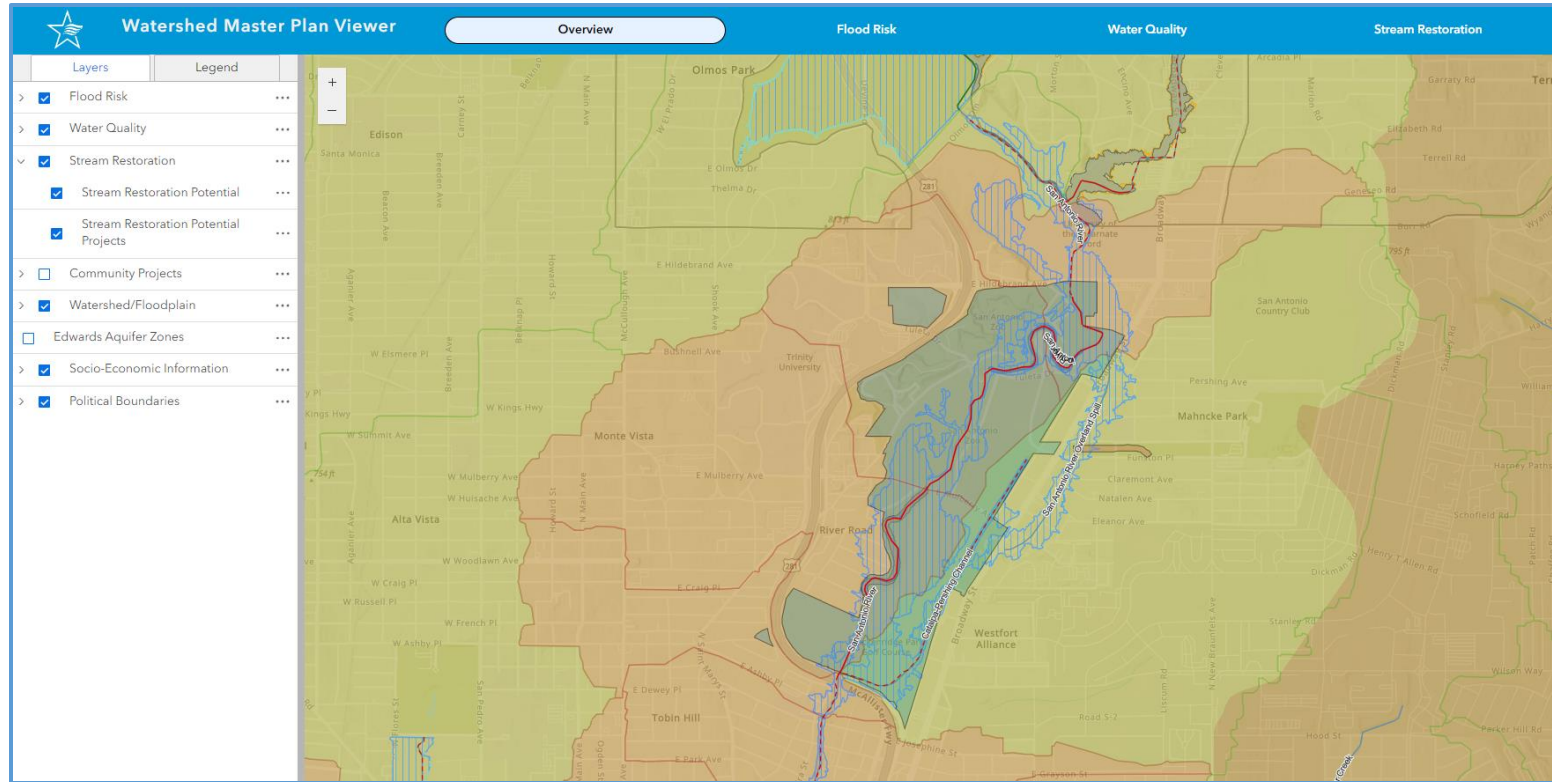
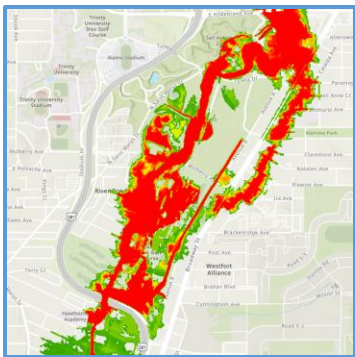
## Stream Restoration



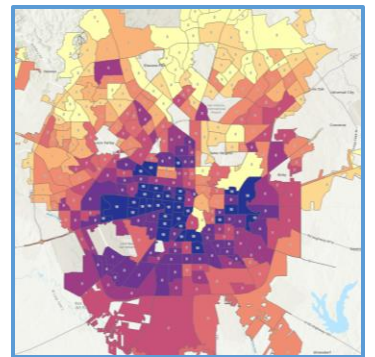
## Water Quality



## Flood Risk



## Equity



# Data Goals



# Aquatic Connectivity

## Southwest Aquatic Resource Partnership Aquatic Connectivity Program



Network Length



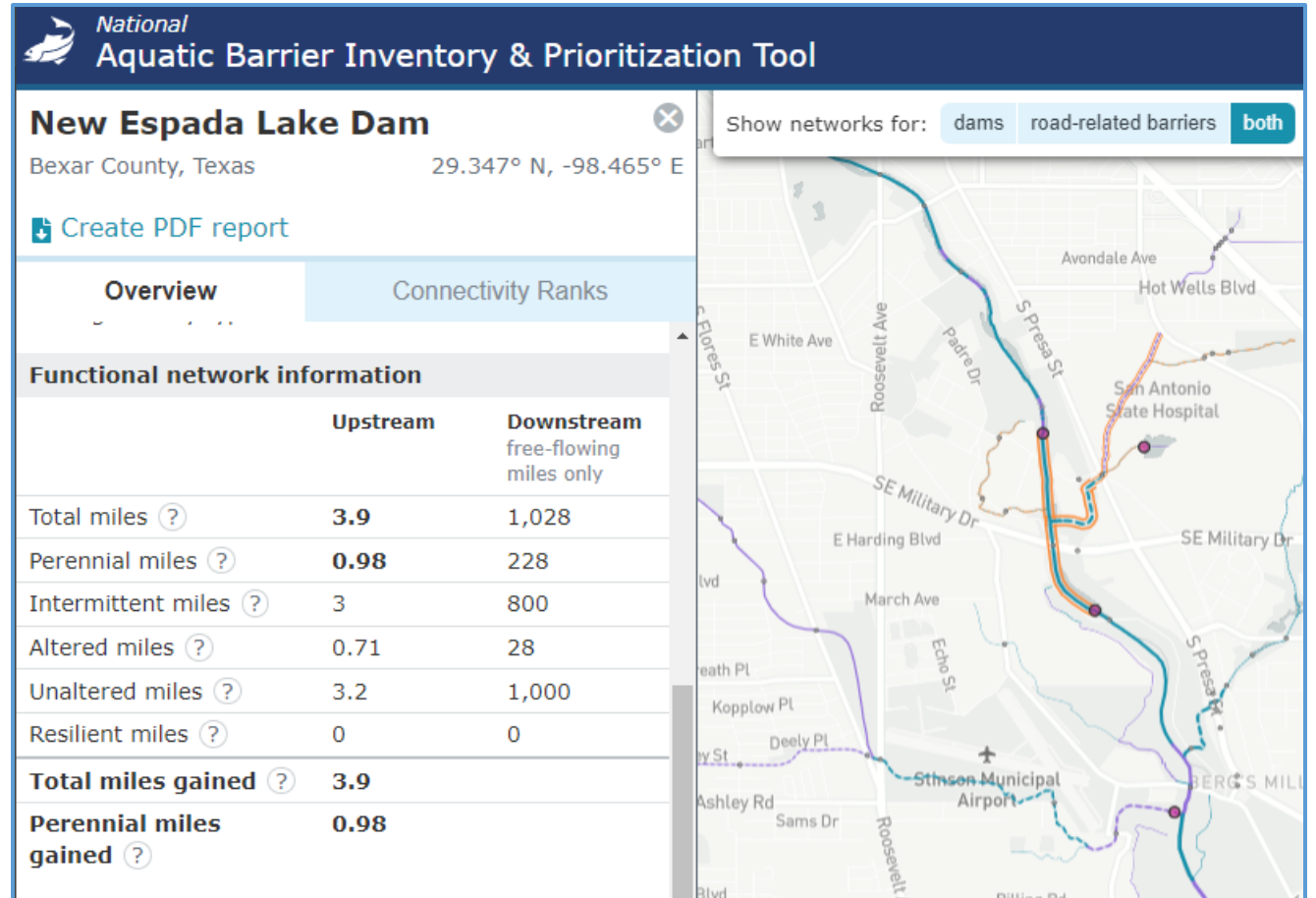
Network Complexity



Channel Alteration



Natural Landcover





# eDNA

- Environmental DNA

- Air
- Sediments
- Water
- Fish
- Plants
- Feces (food identification)



Armored Catfish (*Pterygoplichthys* sp)



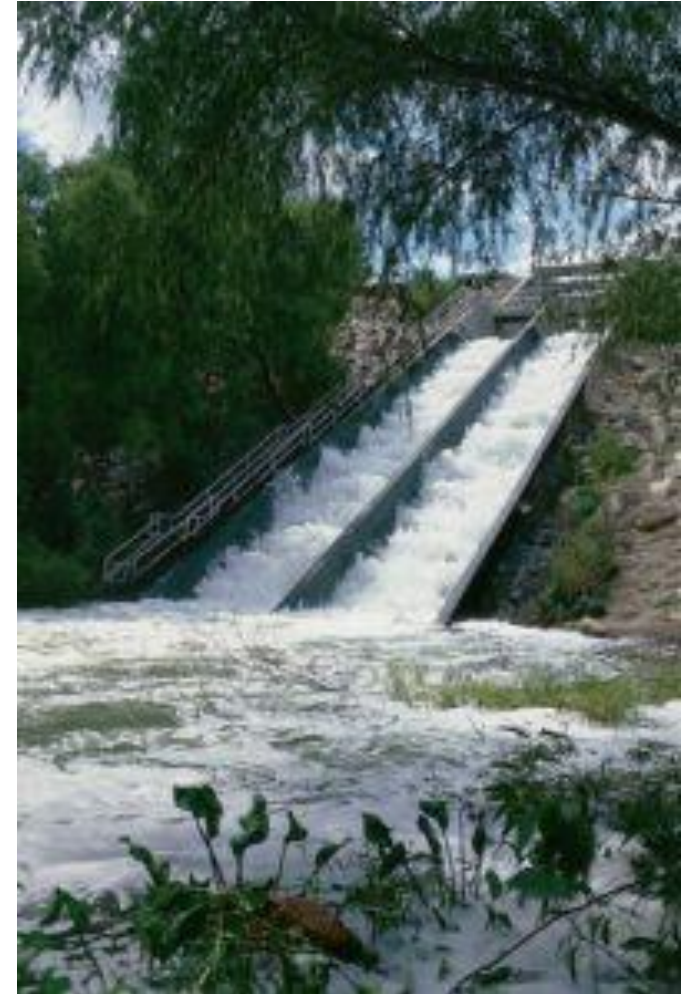
Blue Tilapia

- A resource that helps identify potential factors impacting the river's health (e.g. invasive species), using less resources than current project processes.
- Monitoring and Management



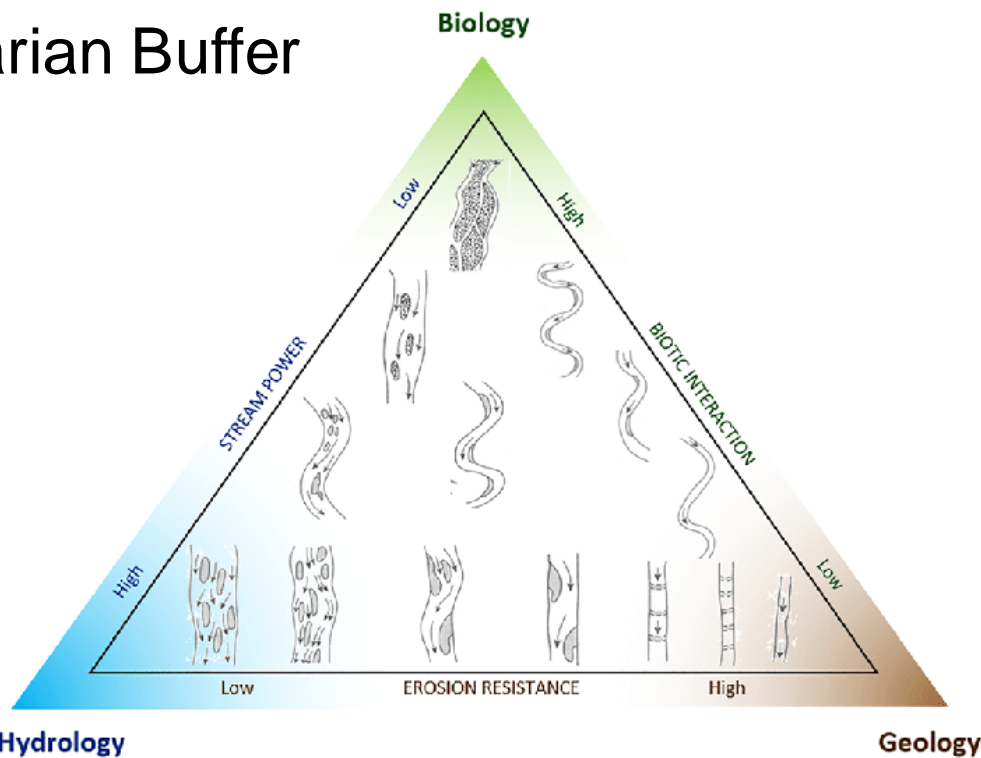
# Aquatic Plants for Bioaccumulation

- Target uptake for excess nitrogen and phosphorous
- Identifying plants with high removal rates and native to our area



# Project Selection Tool

- Water Quality
- Engineered Stability
- Aquatic Habitat
- Riparian Buffer



Criteria	Comments	Scoring
Water Quality	What kind of stream is it?	Perennial Intermittent Ephemeral
	Is the stream in a WQ subbasin?	Yes No
	Is the stream a TCEQ-impaired stream?	Yes No
	Is water quality currently impaired?	Yes No
	Will water quality be improved?	Yes No
Aquatic Habitat	Will native species diversity be enhanced?	No Yes
	Will the proposed project add connectivity?	Yes No
	Will riffles or pools be added?	Yes No, but there is potential No, there is no potential
	Is there large, woody debris?	Yes No

Image: Castro, Janine & Thorne, Colin. (2019). The stream evolution triangle: Integrating geology, hydrology, and biology. River Research and Applications. 35. 10.1002/rra.3421.



# Additional Benefits

- Grants
  - Addressing a variety of goals with a single project
  - Habitat protection
  - Aquatic Connectivity
- State-wide Leader



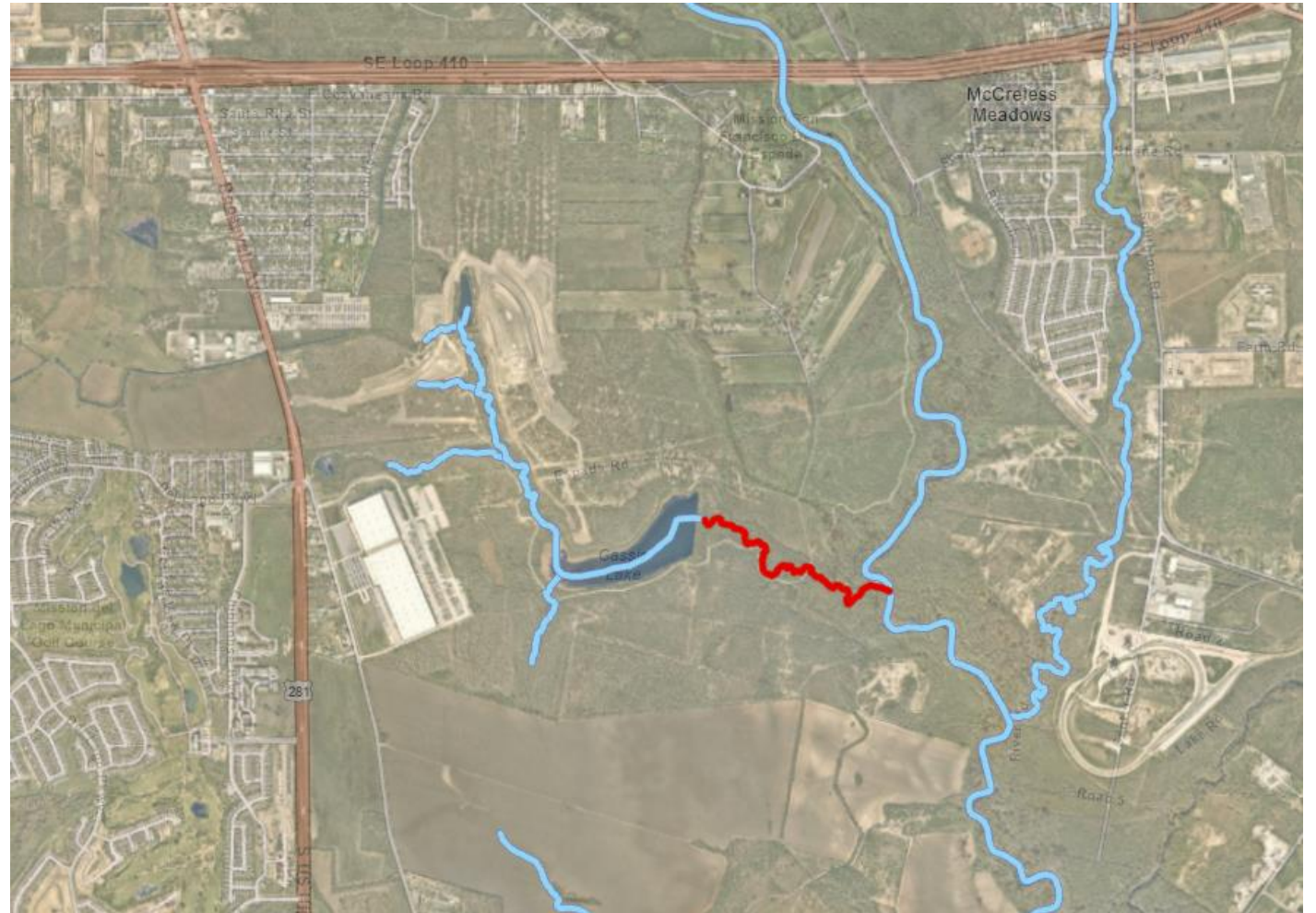


# Active Project



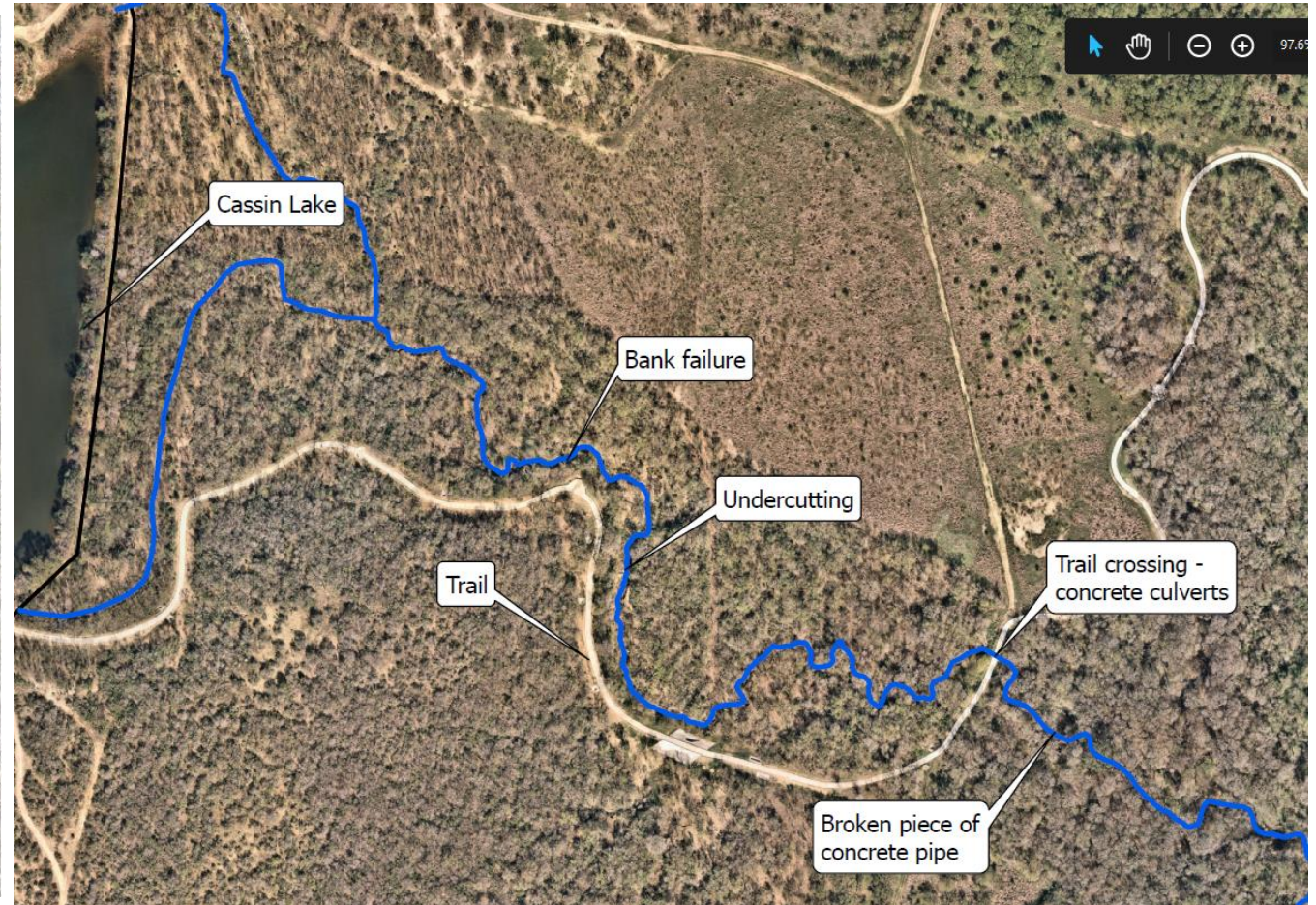
# Minita Creek Stream Restoration

- Downstream of Cassin Lake
- Flows in SAR
- SARA and TAMU-SA property
  - Work with TAMU-SA students
  - Educational site





# Minita Creek





# Questions?

