

**North Central Texas Council of Governments**

# Green Stormwater Infrastructure: Unfiltered Advice From Those in the Know

**NCTCOG Webinar  
November 30, 2023**

*Prepared in cooperation with the  
Texas Commission on Environmental Quality  
and U.S. Environmental Protection Agency*

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[www.nctcog.org/WaterResources](http://www.nctcog.org/WaterResources)

# Procedures for Webinar

- The webinar is being recorded and will be posted to NCTCOG's website under the green banner called "Webinars" here:
- <https://www.nctcog.org/envir/natural-resources/water-resources>
- If you submitted a RSVP for this webinar, you will receive an email with the presentation slides, and eventually, a link to the recording. If you did not RSVP and would like these webinar materials, please email [aknox@nctcog.org](mailto:aknox@nctcog.org).
- Please keep your microphone on mute until the Question-and-Answer period at the end of each presentation.
- Thank you!





# Webinar Agenda

- Welcome and Introduction of Speakers
  - **“Installation and Maintenance of Green Stormwater Infrastructure: TRWD Rainscapes”- Michelle Wood-Ramirez**
  - **“Two Case Studies of Green Infrastructure in Houston, TX: Exploration Green & MD Anderson”- Charriss York**
- Time for Q & A after each presentation

# Speaker Introduction

## **Michelle Wood-Ramirez**

- **Urban Watershed Programs Coordinator, Tarrant Regional Water District**



# Installation and Maintenance of Green Stormwater Infrastructure: TRWD Rainscapes

Michelle Wood-Ramirez  
Urban Watershed Programs Coordinator  
[michelle.wood-ramirez@trwd.com](mailto:michelle.wood-ramirez@trwd.com)

# The TRWD Rainscapes

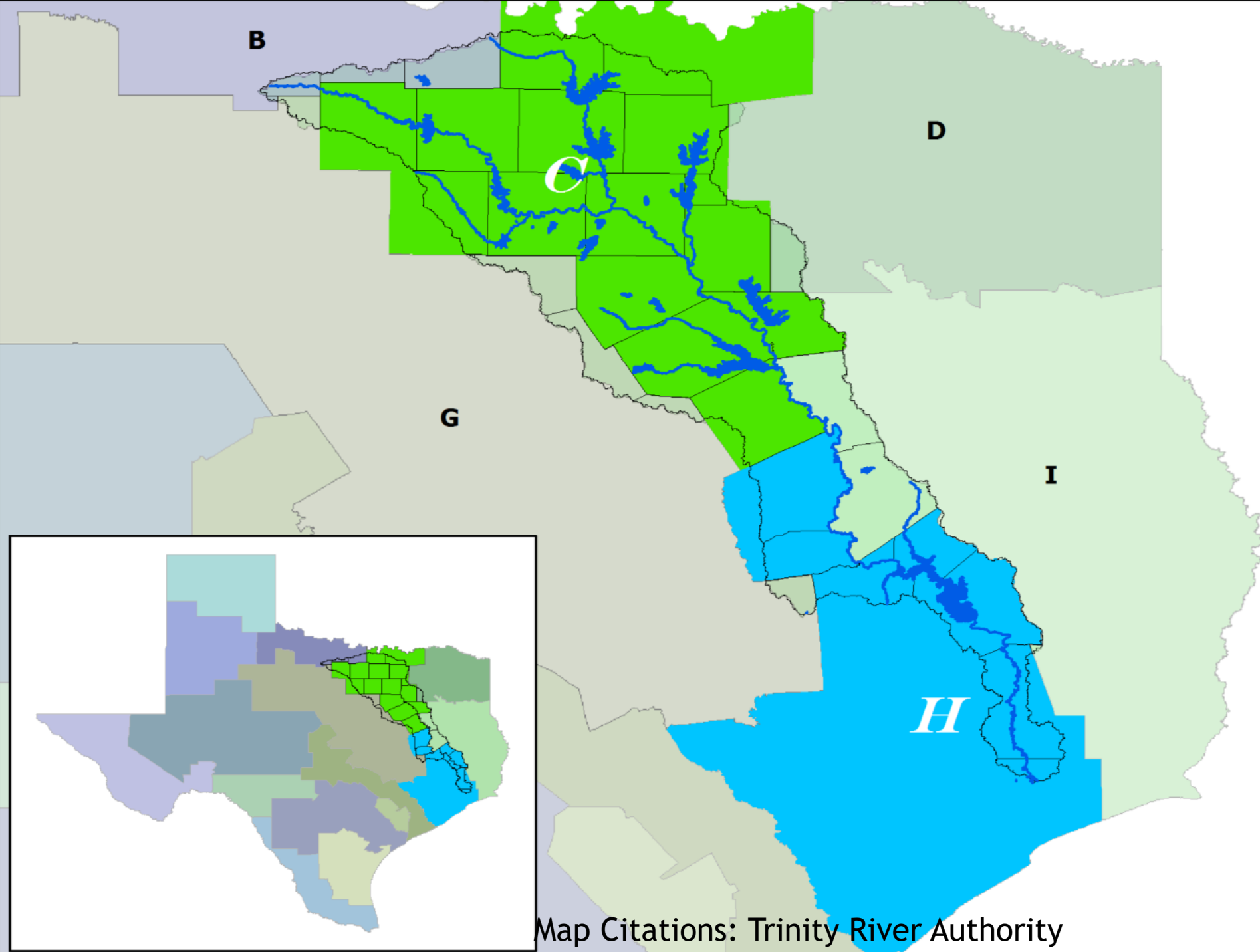
-----> Goals

- ▶ Intro
- ▶ What are rainscapes?
- ▶ Case Study Discussions
  - ▶ Conception to Construction
  - ▶ Maintenance Lessons Learned
- ▶ EE & O
  - ▶ Local Adoption
  - ▶ BGIN

To demonstrate methods for planning and implementing:

1. Water conservation
2. Stormwater management
3. Pollutant reduction
4. Optimization: budgets, time, space, and profitability





Map Citations: Trinity River Authority





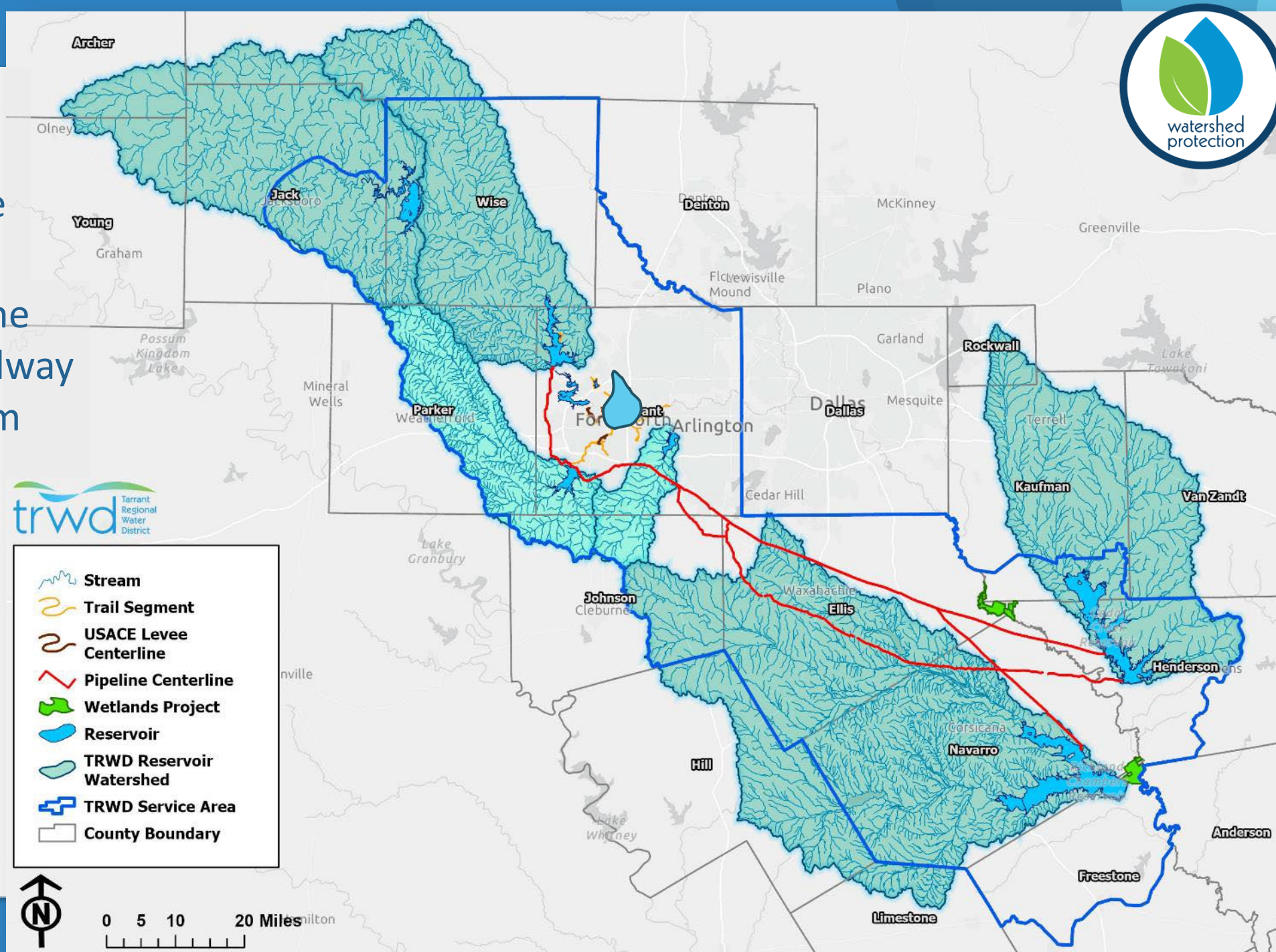


4 Major Reservoirs  
- >97,000 surf. ac.  
- >760 mi. shoreline

- >276 mi. of pipeline  
- 21 mi. of FW floodway  
- 77 mi – trail system

### Watersheds

- >5,000 mi<sup>2</sup>  
- 7,683 stream mi.  
- 2,000 ac. reuse wetlands (RC)  
- 5000 ac. site for CC (2030)





# TRWD Rainscapes Fort Worth Campus



0 25 50 100 150 200 Feet

Map made by: Jayce Proctor 07/22/2020



# TRWD Rainscapes



## ▶ What are RainScapes?\*

A RainScape is a landscape design technique that helps reduce stormwater runoff.

## ▶ Where are RainScapes?

Single Family Residential  
Parks/Open Spaces  
Commercial/Industrial  
Campus  
HOA or Multifamily scale

## ▶ Why do we do it?

Campus initiative designed to demonstrate a variety of *functional, beneficial, and attractive* stormwater landscaping options.

Targeted audiences consist of *developers, builders, engineers, homeowners, and the education to the public.*

\* [MontgomeryCountyMD.gov/water/rainscapes/rebates.html](http://MontgomeryCountyMD.gov/water/rainscapes/rebates.html)





# TRWD Rainscapes, Fort Worth Campus







# TRWD RAINSCAPES

## MANAGING STORMWATER

<https://youtu.be/68rPJ8L6r7o>



# TRWD Rainscapes Henderson Wetland Case Study







2019



**Planting Notes**

1. All plants should be planted in water less than 6" deep at the standing water level, with the exception of Water lilies.
2. Common rush/*Juncus effusus* (not shown) is to be planted on random 3'-8' centers throughout the Trickle Channel Zone.
3. Substituted species may not be adapted to aquatic settings.



- Undisturbed forested
- Trickle Channel
- Shallow Area
- Micro Pools







2019





2020



2021





2023









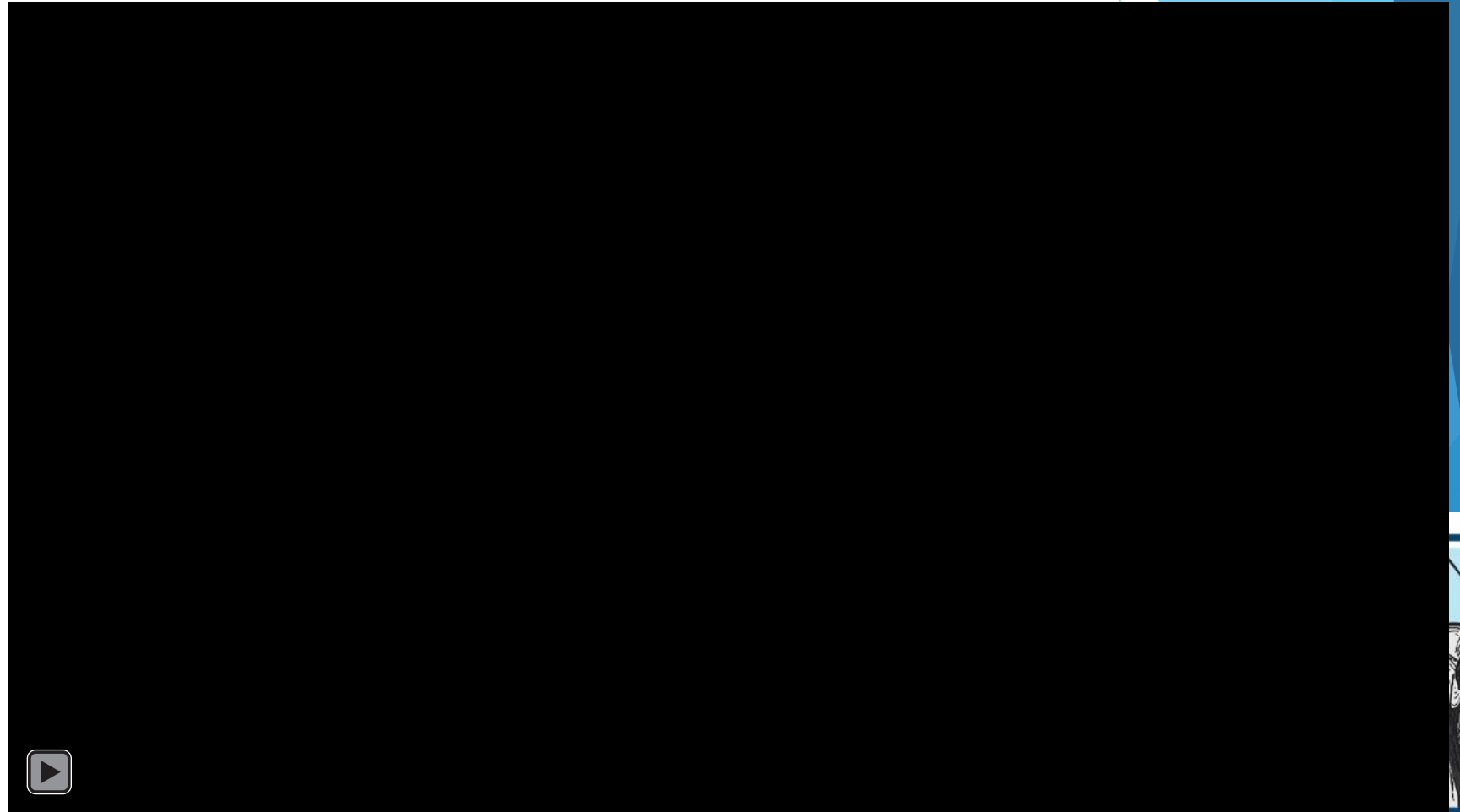


# TRWD Rainscapes

## Henderson Wetland Case Study



- ▶ Construction
  - ▶ Contractor timing
  - ▶ Growing season
  - ▶ Fiscal year
  - ▶ Bid packet accountability



# TRWD Rainscapes

## Henderson Wetland Case Study



- ▶ Lessons Learned: Design, Planning, Construction
  - ▶ Timing
  - ▶ Securing vendors
  - ▶ Planting Season
  - ▶ Marketing/Outreach
  - ▶ Final Inspections
  - ▶ Bid packet expectations and accountability



# The TRWD Rainscapes

## Goals

- ▶ Intro
- ▶ What are rainscapes?
- ▶ Case Study Discussions
  - ▶ Conception to Construction
  - ▶ Maintenance Lessons Learned
- ▶ Maintenance vs Monitoring
- ▶ Education, Engagement, & Outreach
  - ▶ Local Adoption
  - ▶ BGIN

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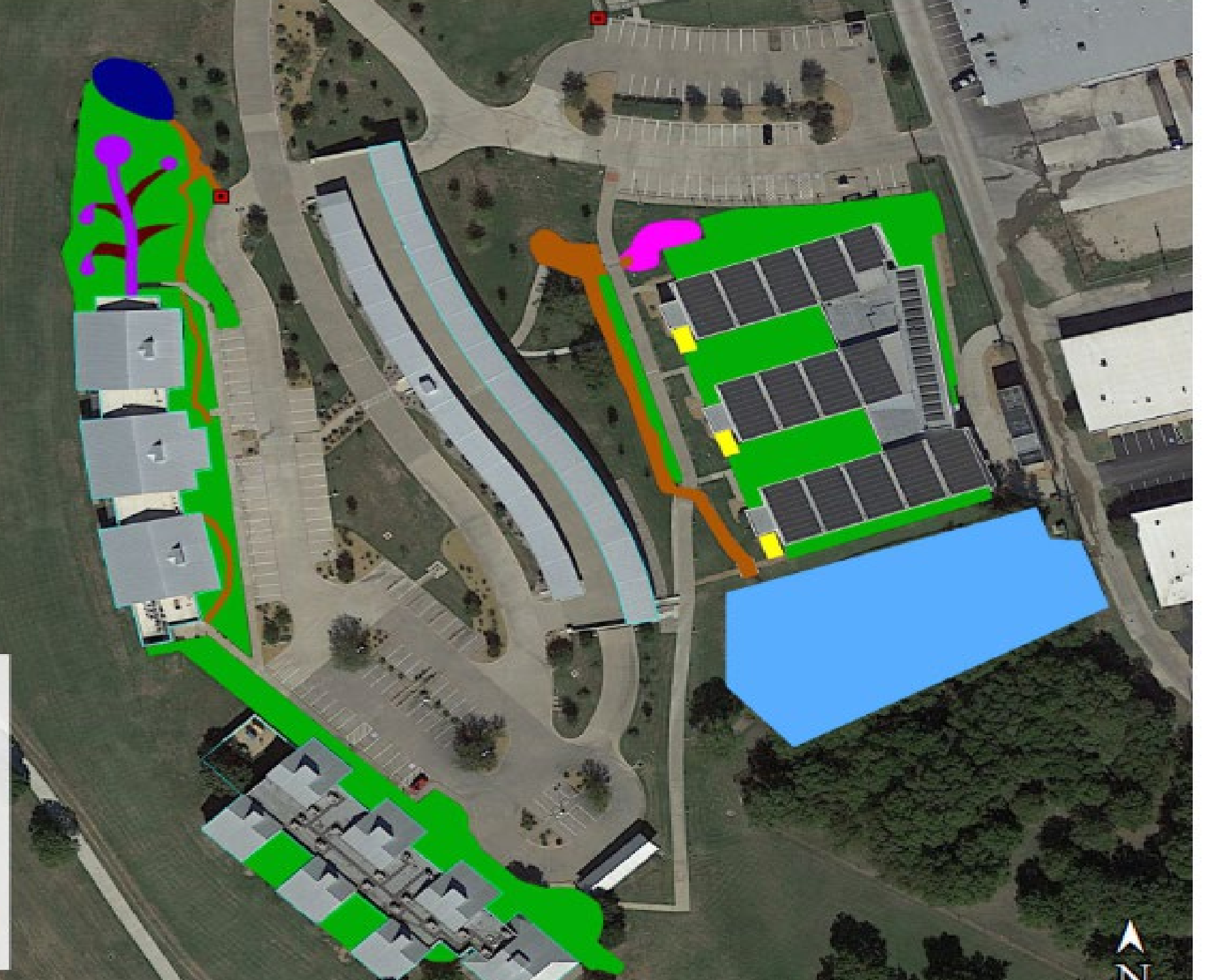


# TRWD Rainscapes

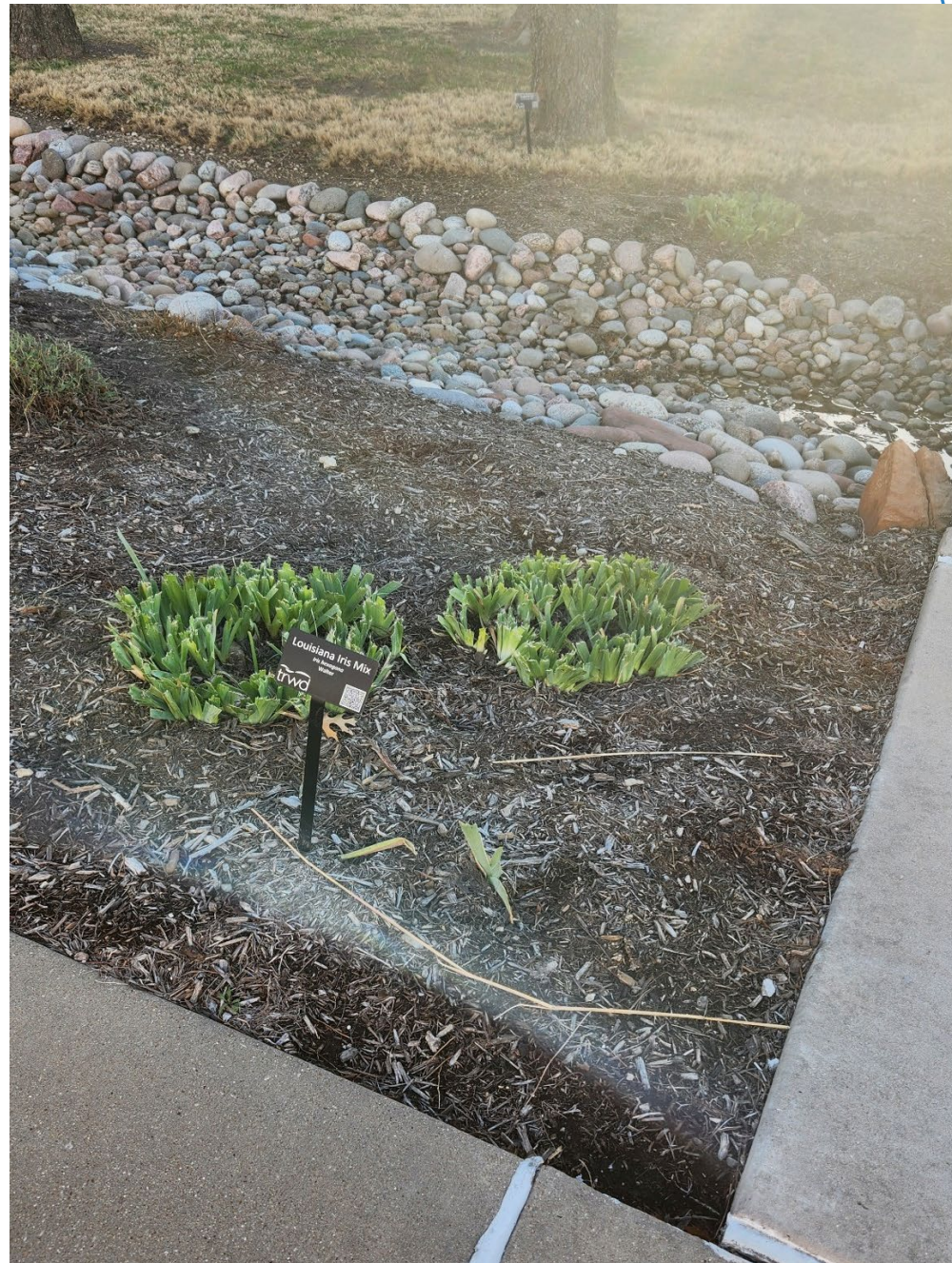
Current Status - 2020

## Legend

-  Bioswale
-  Gravel Walkways
-  Native-Adapted Plants
-  Permeable Concrete
-  Raingarden
-  Rainwater Harvesting
-  Redesigned Stormwater Wetland
-  Rock Channels

























# Maintenance

- ▶ Was the contract specific enough?
  - ▶ Wording, language
    - ▶ Organic vs. chemical usage
    - ▶ Soil, fertilizers, invasive species
    - ▶ Accidental plant deaths
- ▶ 2021: 4 concurrent external Contractors
  - ▶ Rainscapes
  - ▶ The Overlook (2021FY construction)
  - ▶ Mowing
  - ▶ RWH
  - ▶ Facilities, Watersheds, Water Conservation
    - ▶ All the maintenance agreements go through facilities



# Maintenance



- ▶ Inspection sheets
  - ▶ Yearly inspection done to guarantee the stormwater fee reduction
- ▶ Rainwater Harvesting Cisterns
- ▶ Weed control and cutbacks
- ▶ Irrigation cycles and control boxes
- ▶ Utilities mapping and leaks
- ▶ ADA/EOC/Safety compliance

Date: 05/01/2020 Time: 1:00

**DRY DETENTION BASIN INSPECTION**

Inspection	Yes	No	N/A	Corrective Actions	Expected Completion date
<b>Overall Observations</b>					
1) Any reports of basin not functioning?		✓			
2) Does stormwater remain in the basin more than 72 hours after a storm?		✓			
3) Are there any structures in the basin no longer in use?		✓			
4) Is water entering the basin and directly exiting the basin outlet without coming in contact with the bottom soil and vegetation?		✓			
<b>Inlet</b>					
1) Signs of breakage, damage, corrosion or rusting of inlet structure/pipe?		✓			
2) Excess debris or sediment accumulation in or around the inlet, potentially clogging it?		✓			
3) Erosion; undermined embankment, or damaged soils, rock or vegetation on or around the basin inlet structure?		✓			
4) Tree roots, woody vegetation growing close to or through the inlet structure?		✓			
5) Is the pretreatment structure filled with debris or sediment?		✓			
<b>Basin (includes interior and exterior side slopes and bottom vegetation rock)</b>					





# Maintenance lessons learned

- ▶ Understanding and Communicating the function and goals of the system
  - ▶ Saves money & money
  - ▶ Each field has a different way to communicate
- ▶ Education
  - ▶ Classes, tours, walking the grounds weekly/monthly
- ▶ Recognition
  - ▶ How to maintain needed data and info
  - ▶ What is our water story?





# Maintenance vs Monitoring

- ▶ Monitor Rainwater Cisterns
  - ▶ Flow meter
    - ▶ Total RHW & city water use
- ▶ Prepped Before Rainfall
  - ▶ Cisterns emptied manually
  - ▶ Trash baskets at the wetland cleared
- ▶ Leak Detection
- ▶ Pump to irrigation never working



# Experience Summary

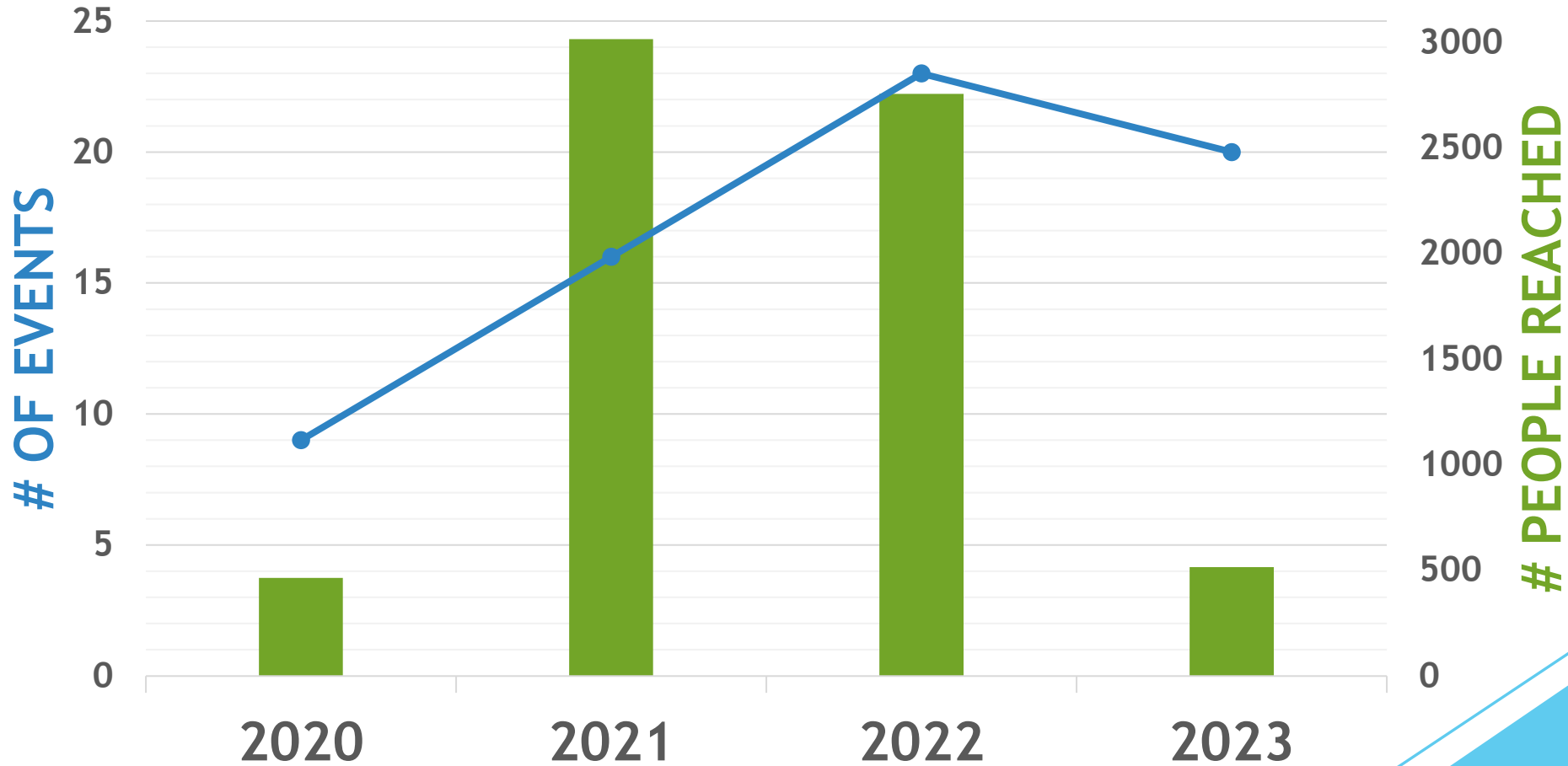
- ▶ Increased Specificity with Bid Packets and Contracts
  - ▶ Working with the designer/PM is best
- ▶ Increased Internal and External Collaboration
- ▶ New Technologies
- ▶ SOPs
  - ▶ Be honest up front with strengths & weaknesses or risk losing credibility
  - ▶ Don't bid cheap - no one's happy





# Education, Engagement, & Outreach Metrics

## Rainscapes Program EE&O





# TRWD Rainscapes



To learn more,  
scan the code or visit  
[www.trwd.com/education](http://www.trwd.com/education).

trwd  
Tarrant Regional Water District







# BGIN = Blue-Green Infrastructure Network

▶ <https://denton-bgi-pmaps-tx.hub.arcgis.com/>



**SAVE THE DATE**

**Kickoff Workshop  
Jan 26, 2024**

10am-2pm  
Dallas AgriLife Research and  
Extension Center



Visit the BGIN Hub site  
for more info and to join  
our mailing list for  
updates.

<https://denton-bgi-pmaps-tx.hub.arcgis.com/>

**Workshop registration  
link coming soon!**



Tarrant Regional Water District



# Questions?



# Speaker Introduction

**Charriss York**

- Program Director of Green Infrastructure for Texas (G.I.F.T.)

TEXAS A&M AGRILIFE

# Two case studies of green infrastructure in Houston, TX: Exploration Green & MD Anderson

TEXAS A&M  
**AGRILIFE**  
EXTENSION  
DISASTER ASSESSMENT  
AND RECOVERY

**Charriss York**  
[charriss.york@ag.tamu.edu](mailto:charriss.york@ag.tamu.edu)

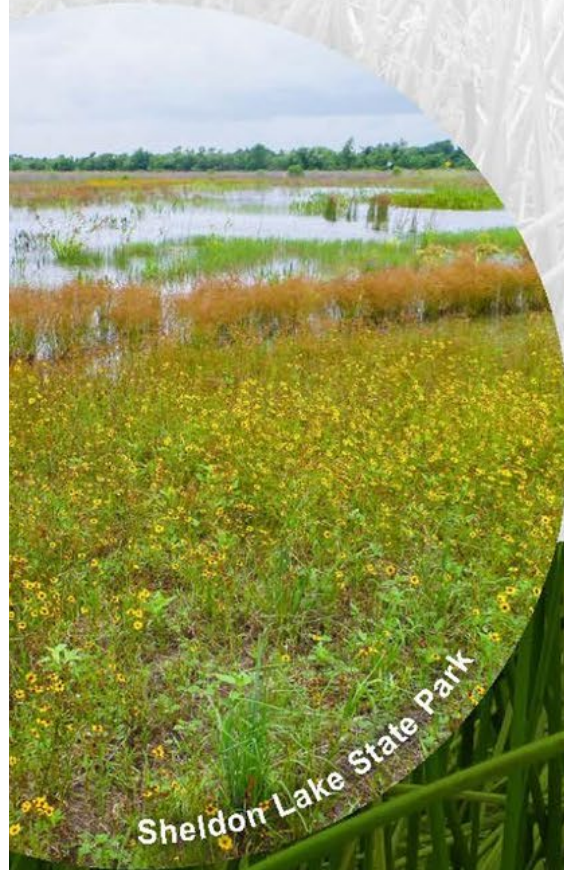




# GIFT

## GREEN INFRASTRUCTURE FOR TEXAS

[agrilife.org/gift](http://agrilife.org/gift)



*Empowering Texans to build resilient communities adaptable to social, economic, and environmental change.*

**AgriLife.org/GIFT**



# Green Infrastructure for Texas



## Education

- Workshops
- Presentations
- Technical Assistance
- High School Internships



## On the Ground Projects

- Exploration Green
- Ghirardi Family WaterSmart Park
- Sheldon Lake State Park restoration



## Research

- Water quality
- BMP Performance
- Plant propagation



# What is green infrastructure?

- An approach to development or re-development
- Captures, stores, or infiltrates water (rain fall, stormwater, flood water) close to its source
- Works with nature
- Compliments gray infrastructure.





# What should we call it?



## **Green Infrastructure**

Practices that use plants and soil to capture, store, or infiltrate stormwater. Often used in conjunction with gray infrastructure.



## **Nature-based Solutions**

Sustainable planning, design, environmental management, and engineering practices that connect natural features and the built environment.



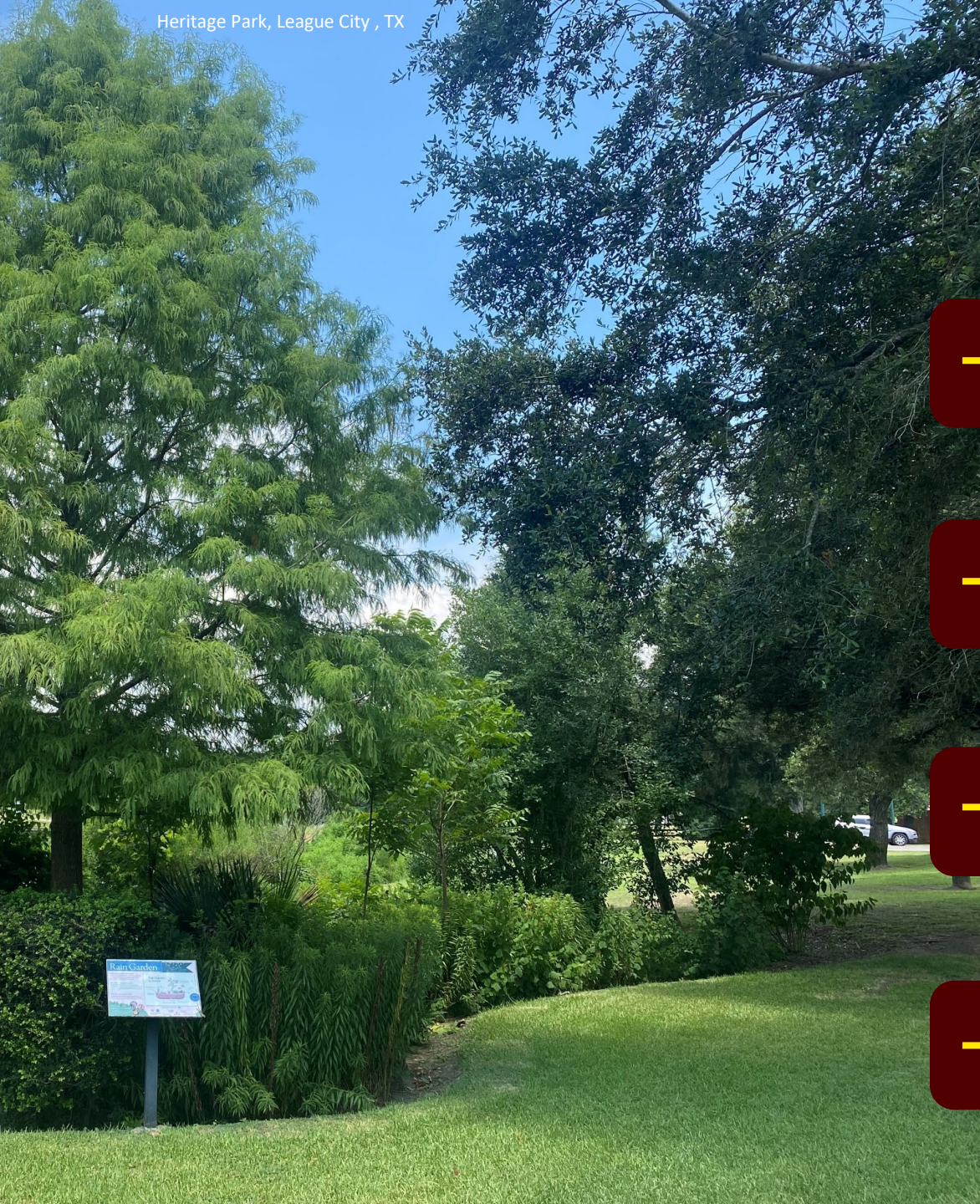
## **Green Stormwater Infrastructure**

Site scale green infrastructure practices such as rain gardens, pervious pavement, or rainwater harvesting. Often used as a synonym for LID.



## **Low Impact Development**

An approach to site-scale development or redevelopment that strives to limit impervious cover. Often used as a synonym for GSI.





# Why consider green infrastructure solutions?

- Create multi-use areas
- Mitigate flooding
- Improve water quality
- Meet MS4 permit requirements
- Increase habitat
- Provide recreation areas



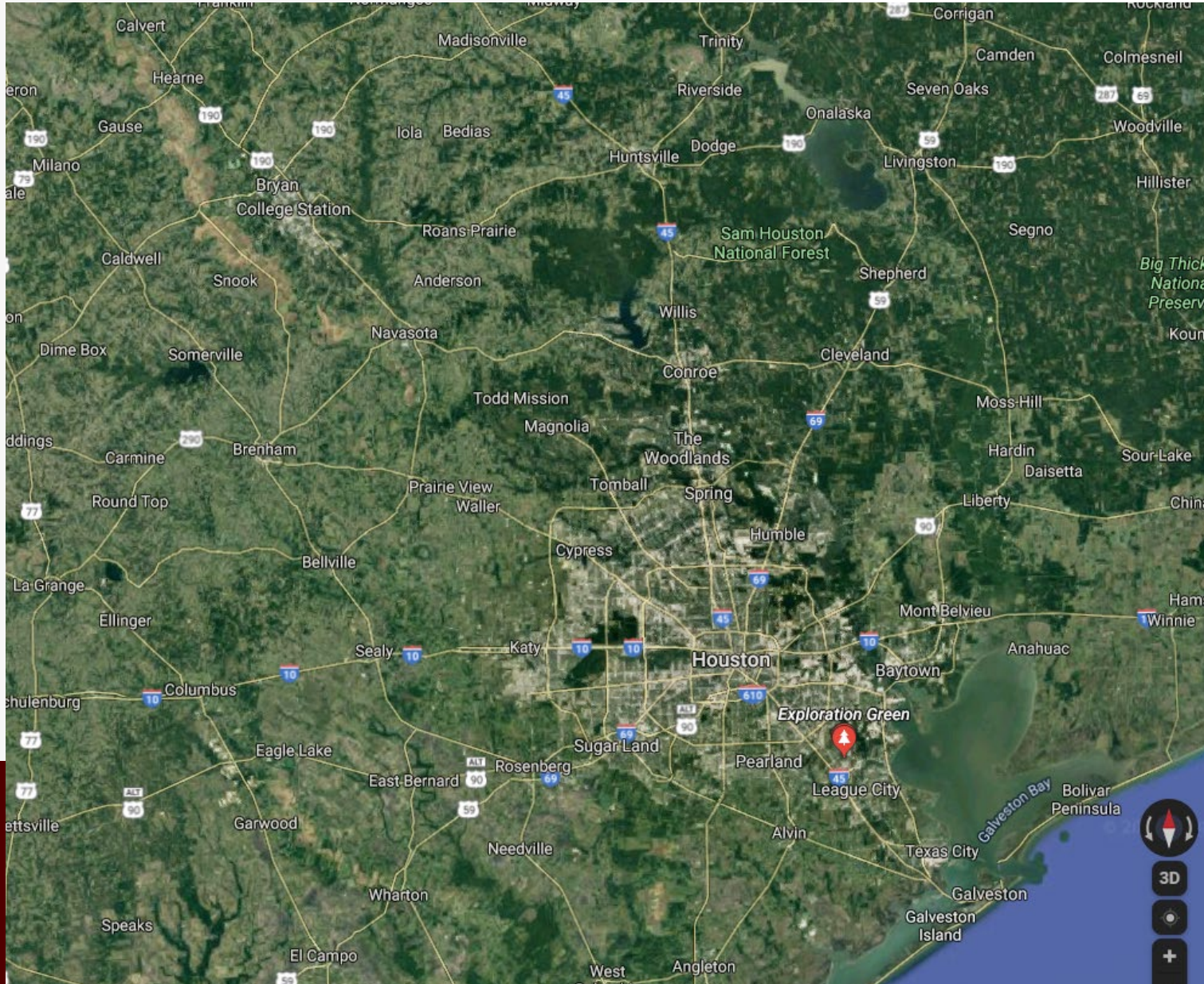




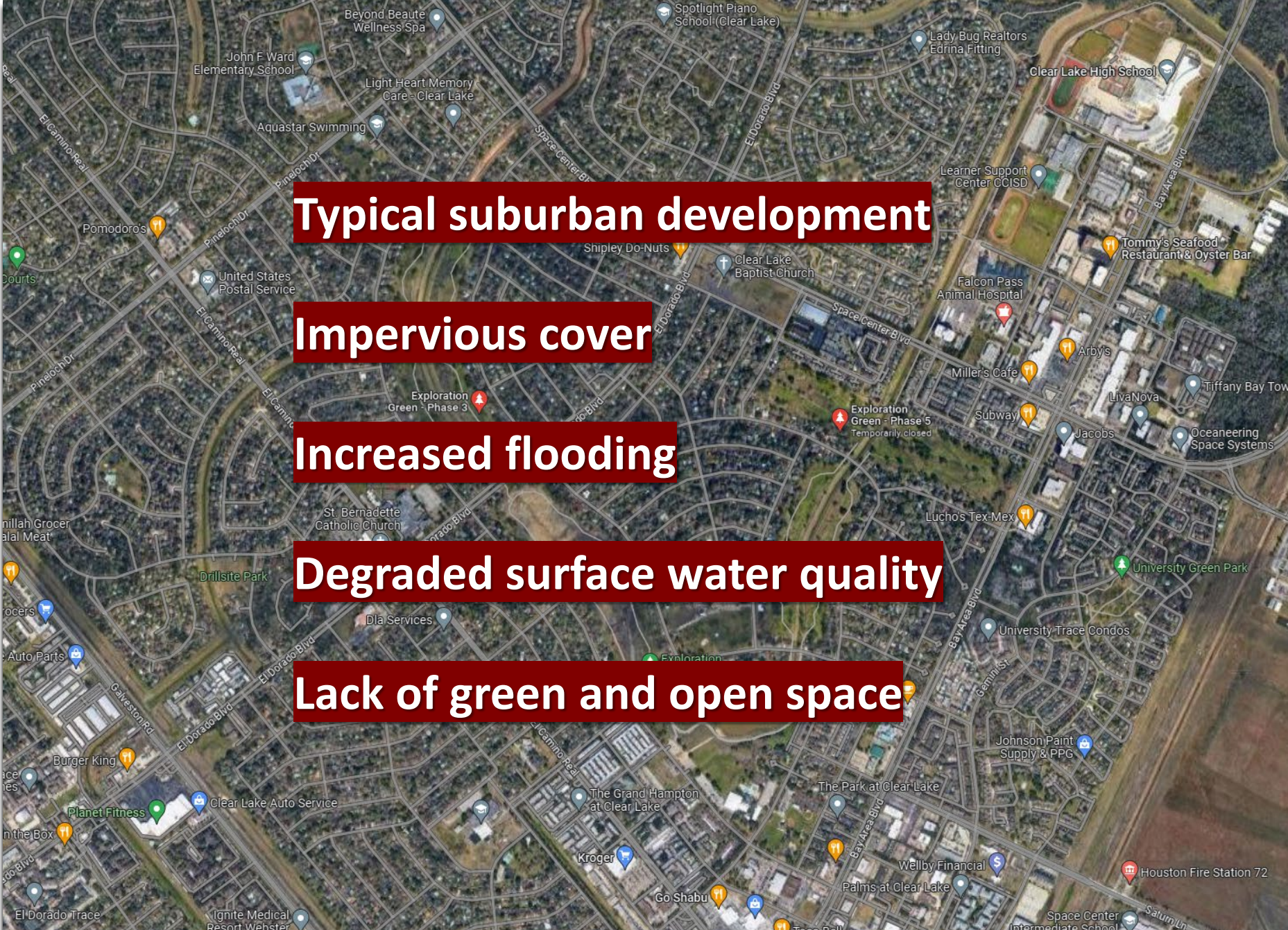
# Exploration Green



# Exploration Green







**Typical suburban development**

**Impervious cover**

**Increased flooding**

**Degraded surface water quality**

**Lack of green and open space**







Master plan: [www.clcwa.org/images/CLCWAmasterplan.pdf](http://www.clcwa.org/images/CLCWAmasterplan.pdf)





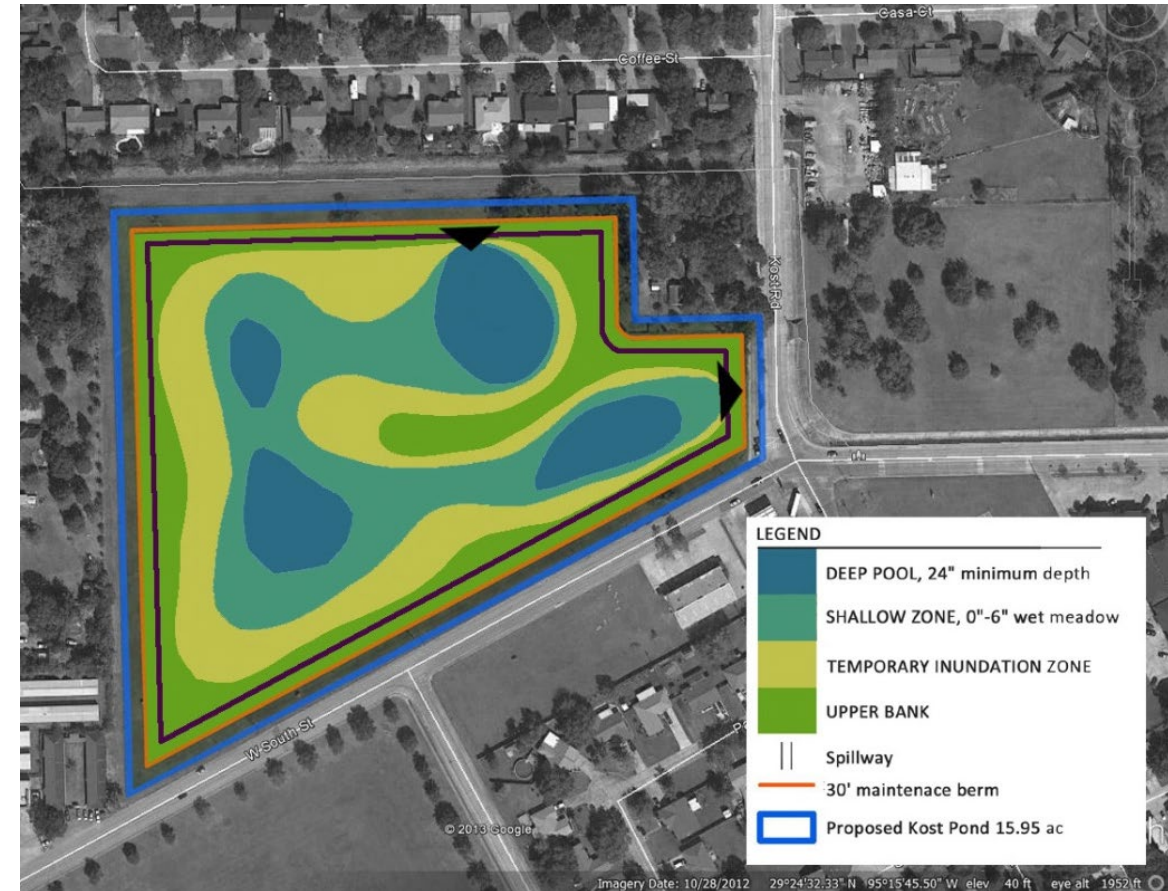
# Constructed Stormwater Wetlands

Engineered, designed wetland, integrated into the drainage system

- Stormwater detention
- Water quality
- Multiple uses

## Considerations

- Contributing watershed
- Multiple depth zones, intentional flow paths, long residence time
- Controlled outflow
- Aesthetic based planting





Phase 4 Pre-Construction,  
2019





Phase 4 Post-Construction,  
2023





Phase 5, 2023  
In construction





Phase 4, 2023  
Post-construction  
vegetation in progress





Phase 1, 2023  
Post-construction  
Vegetation established





**Location:** Houston (Clear Lake City)

**Watershed:** Clear Creek

**Size at completion:** 40-acre wetland  
within 200 acres of parkland

**Major Partners:**

- Clear Lake City Water Authority
- Exploration Green Conservancy
- Texas A&M AgriLife Extension
- Texas Master Naturalist Program
- Galveston Bay Foundation







**Cost:** \$43 million

**Funding:**

- Local taxpayer bond
- No federal flood control funding
- 15,000 volunteer hours
- Accelerated construction timeline

**Community:**

- Manages stormwater from an 8,000 acre watershed
- 16,000 homes & businesses
- 30,000 people

**Conservation Easement:** held by Galveston Bay Foundation



September  
2019



August  
2017



During **Hurricane Harvey** the partially constructed wetland:

- Collected water from 2,000 acres
- Held 100 million gallons of water
- Protected 150 previously flooded homes





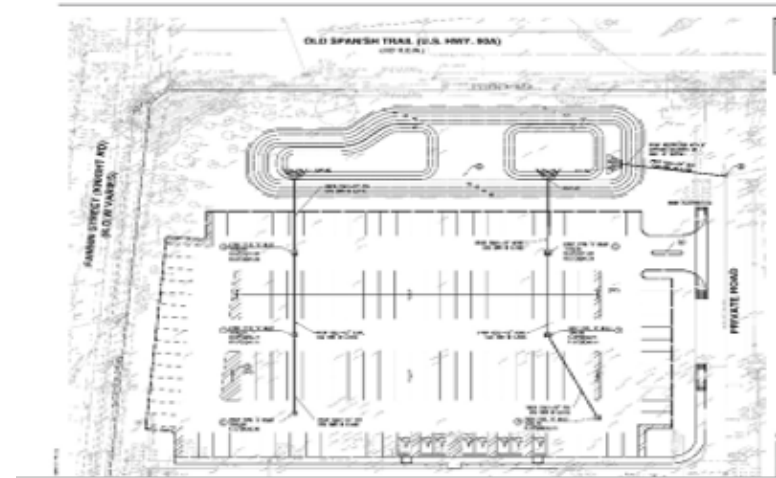
# MD Anderson Houston Campus

Photo provided by MD Anderson



# Proton Therapy Parking lot expansion

- Mix of green and grey infrastructure maximize benefits
- City of Houston
- 0.62 acres









# UTRP Parking Lot



Photos provided by MD Anderson





# Changing a Paradigm

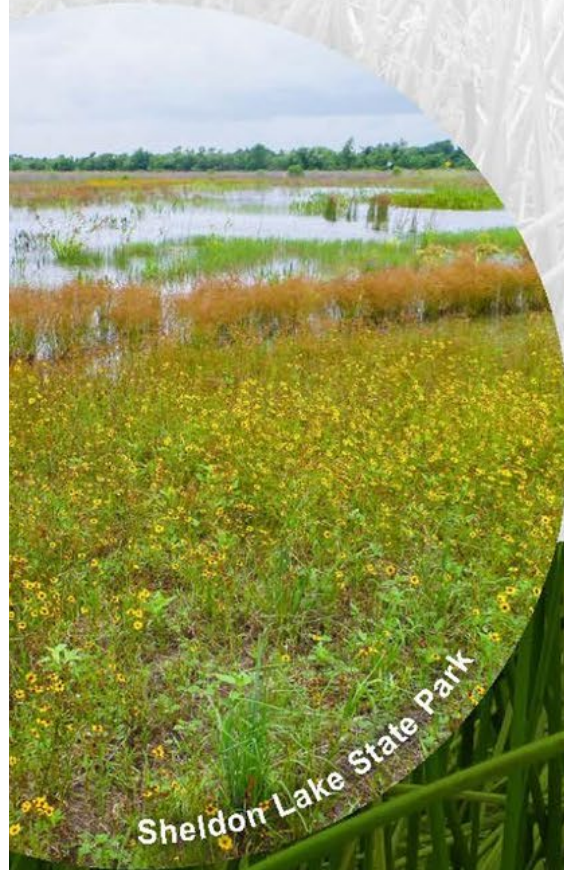




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# Questions?





# Wrap-Up

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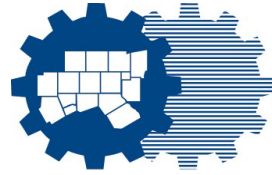


# Webinar Feedback

- Please provide your feedback on today's webinar in this 4-question survey. Thank you!

[Provide Webinar Feedback Here](#)





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# Thank you for attending!

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