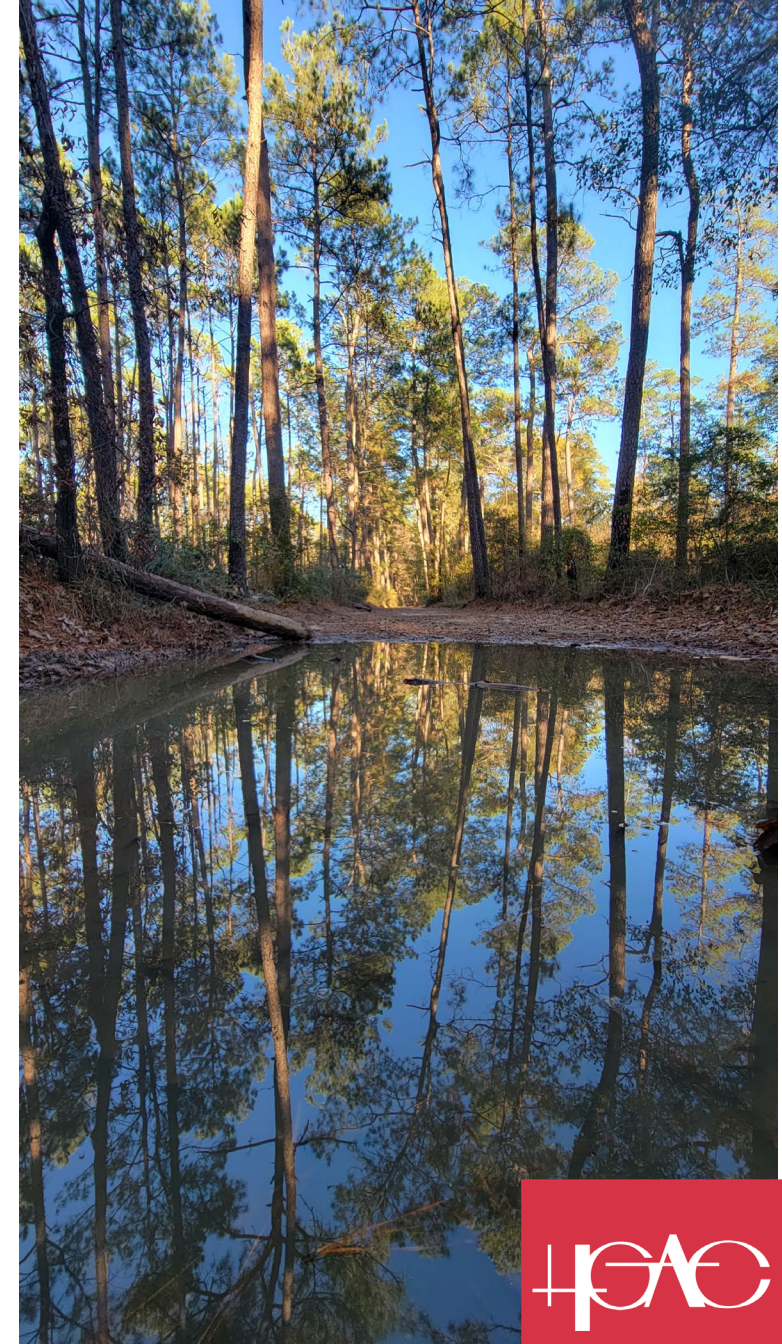


Regional Flood Management Committee

Quarterly Meeting, 7/19/23



Houston-Galveston
Area Council

AGENDA

1:30 PM

Welcome

Michael Shannon, P.E., Chair

Public Comment (3 minutes per speaker)

Update: Hurricane Preparedness

Ashley Seals

Houston-Galveston Area Council (H-GAC)

Update: Regional and State Flood Planning Efforts

Cory J. Stull, P.E., CFM & Maggie Puckett

Freese & Nichols | San Jacinto Regional Flood Planning Group

Speaker Presentation: Hazard Mitigation Assistance Program Updates

Merryl Holmes

Texas Division of Emergency Management (TDEM)

Speaker Presentation: Cedar Bayou Bond Implementation Program & Crosby Eastgate Mitigation Bank

Benjamin Castleberry, P.E., CFM, He Xin, P.E., CFM, & Jonathan Holley

Harris County Flood Control District (HCFCD)

Speaker Presentation: Buffalo Bayou Community Plan - Working to Increase Resiliency & Reduce Flood Risk

Alan Steinberg, Ph.D., & Guy Hagstette, FAIA

West Houston Association | Houston Stronger

Other Announcements or Business

3:30 PM

Adjourn



Update: Hurricane Preparedness

Ashley Seals
H-GAC



Update: Regional and State Flood Planning Efforts

*Cory J. Stull, P.E., CFM & Maggie Puckett
Freese & Nichols | San Jacinto Regional
Flood Planning Group*



Update for HGAC RFMC



SAN JACINTO REGIONAL FLOOD PLANNING GROUP

R E G I O N 6

July 19, 2023

Agenda

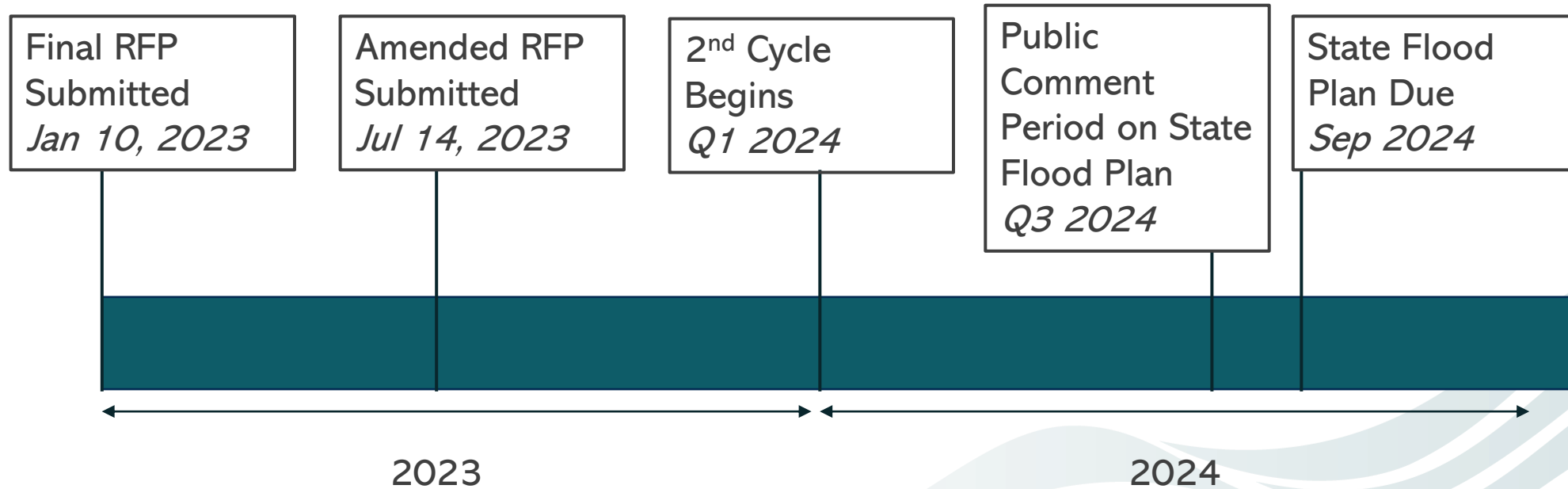
- Updates on Amended Regional Flood Plan Content
- Coordination with Ongoing Studies
- Upcoming Regional Flood Planning Schedule Milestones



Amended Regional Flood Plan

Adopted by the San Jacinto RFPG on June 8, 2023.

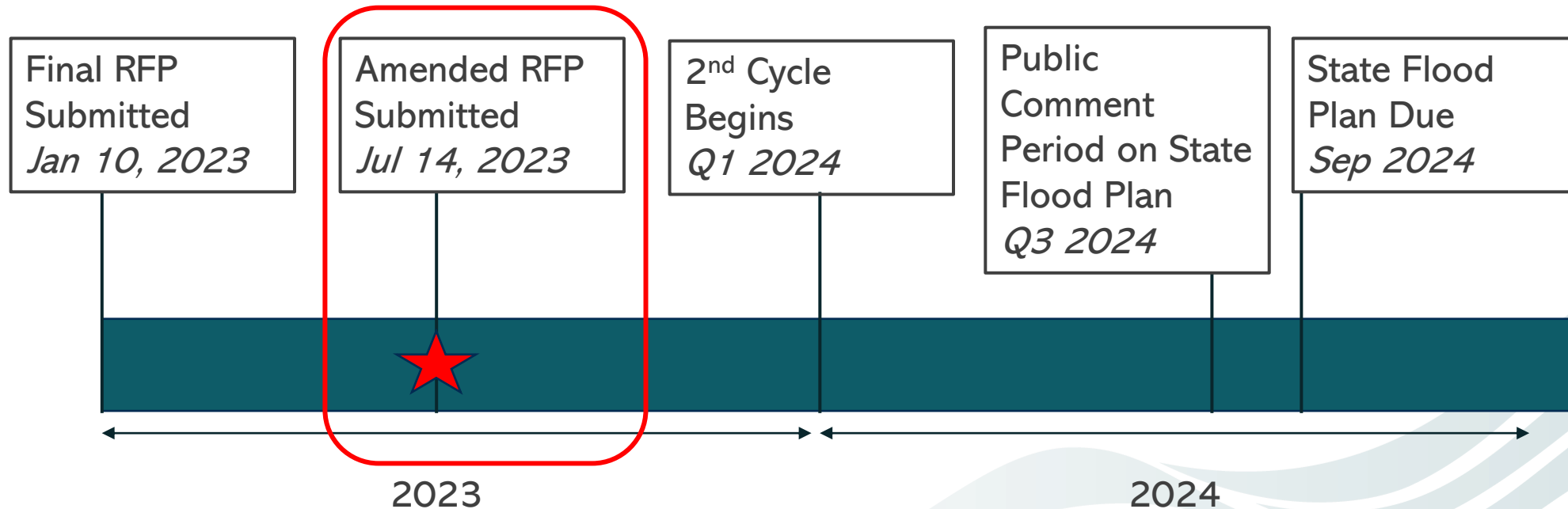
Submitted to the TWDB on July 14, 2023.



Amended Regional Flood Plan

Adopted by the San Jacinto RFPG on June 8, 2023.

Submitted to the TWDB on July 14, 2023.



Amended Regional Flood Plan

Task 12

Elevate FMEs to FMPs

Efforts included:

- Development of FME prioritization framework
- Additional Coordination with Sponsors
- Executing 12 FMEs

Task 13

Amend the Regional Flood Plan

Efforts included:

- Collecting additional data from sponsors
 - Incorporating new FMXs
 - Revising data and RFP Chapters
- 

Amended RFP - Task 12

Project Name	FME ID		NEW FMP ID
Rivershire West – Grand Lake Creek	061000453	➡	063000453
37 th Street, Galveston, Drainage Project	061000311	➡	063000311
Goose Creek Flood Risk Reduction Phases 1, 2, & 3	061000334	➡	063000334
White Oak Bayou – Woodland Trails Stormwater Detention Basin	061000344	➡	063000344
Willow Creek – M120 Detention/Preservation Site	061000339	➡	063000339
City of Friendswood – Inline & Offline Detention	061000424	➡	063000424
Addicks Reservoir Channel Improvements, Bypass Channel, and Detention Basin along South Mayde Creek	061000315	➡	063000472
Mary's Creek Improvements	061000063	➡	063000056
Brays Bayou – Keegans Bayou Flood Risk Reduction	061000328	➡	063000328
Blalock Road Drainage Improvement Project	061000327	➡	063000327
G103-38-00 Kingwood Diversion Ditch	061000360	➡	063000360
Danubina Drainage Improvements	061000422	➡	063000422

New FMEs, FMSs, and FMPs

- Total New FMXs (Task 13)
 - 21 New FMPs (*in addition to Task 12*)
 - 84 New FMEs
 - 2 New FMSs
- Sponsors represented:
 - Brookshire-Katy Drainage District
 - City of Baytown
 - City of Bellaire
 - City of Galveston
 - City of Houston
 - City of Huntsville
 - City of League City
 - City of Webster
 - Coastal Prairie Conservancy
 - HCFCD
 - HCED
 - Harris County MUD 365
 - Liberty County WCID#1
 - Montgomery County MUDs 83 & 84

New FMEs, FMSs, and FMPs

- Total New FMXs (Task 13)
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- Brookshire-Katy Drainage District

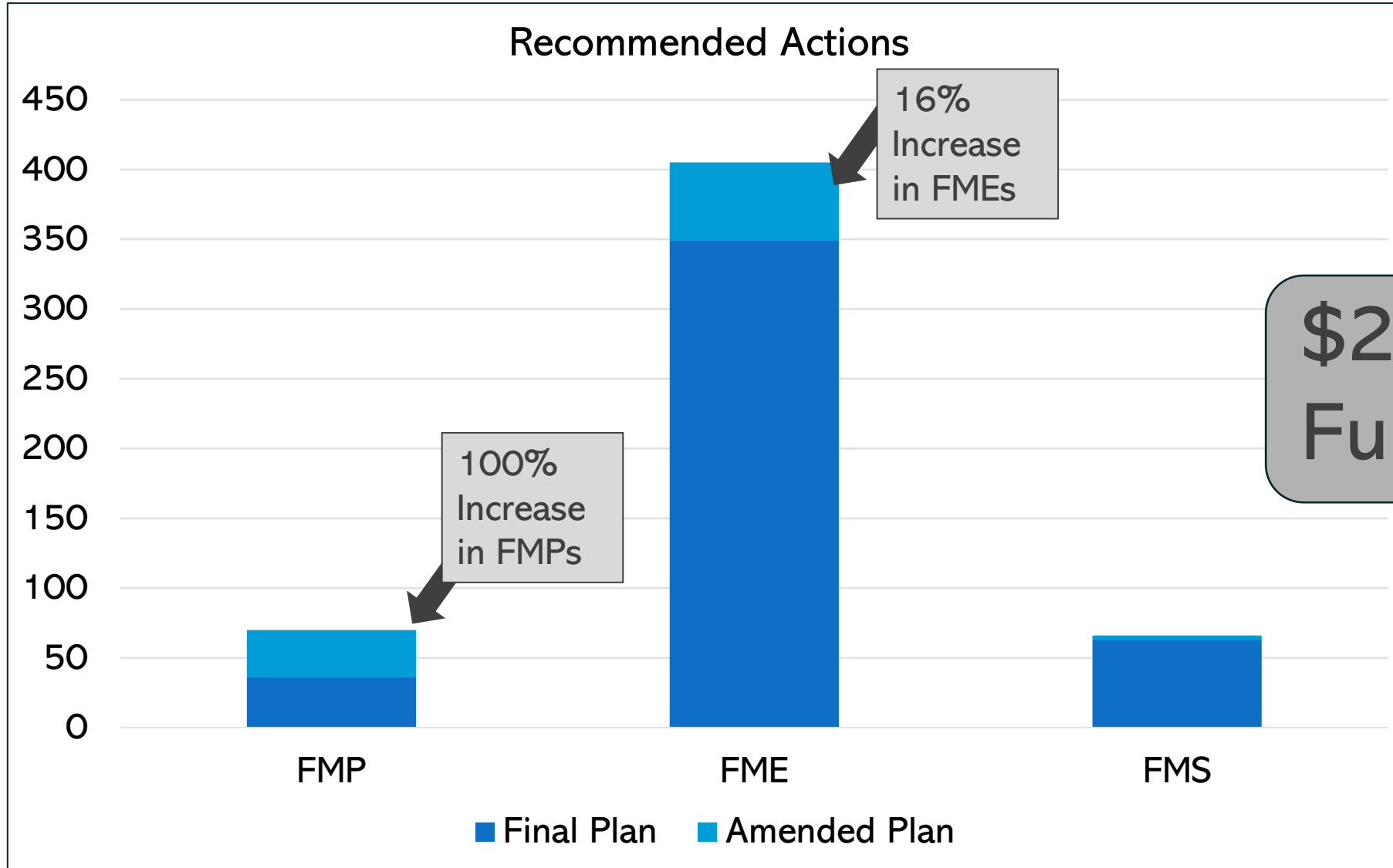
- City of Baytown
 - City of Bellaire
 - City of Galveston
 - City of Houston
 - City of Huntsville
 - City of League City

★ New entities sponsoring potential FMXs

- City of Webster
- Coastal Prairie Conservancy
- HCFCD
- HCED

- Harris County MUD 365
- Liberty County WCID#1
- Montgomery County MUDs 83 & 84

Adoption of Amended Plan



**\$24.8 Billion
Funding Need**

San Jacinto Regional Flood Plan

Identified and Recommended Actions to Improve Regionwide Understanding of and Reduce Flood Risk



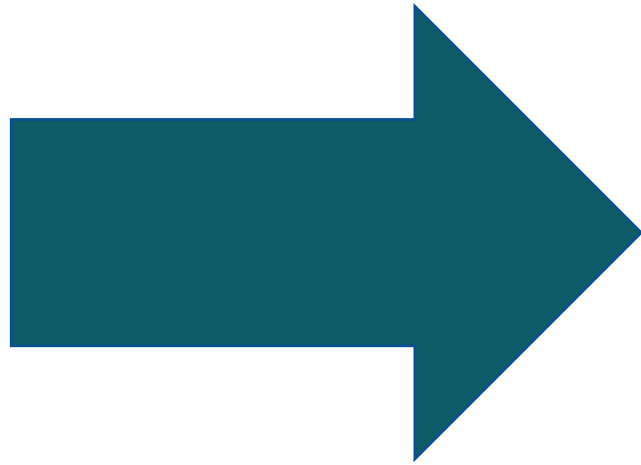
405 FMEs



65 FMSs



70 FMPs



\$36.3B

*Total reported costs of recommended
FMEs, FMSs, and FMPs*

Moving Forward - Website Updates

Check out the Regional Flood Plan StoryMap

This summary provides an overview of each chapter of the Final Regional Flood Plan submitted to the Texas Water Development Board on January 10, 2023.

The StoryMap includes relevant links and an interactive dashboard on the flood risk and

The complete Regional Flood Plan and associated appendices can be found on the Texas



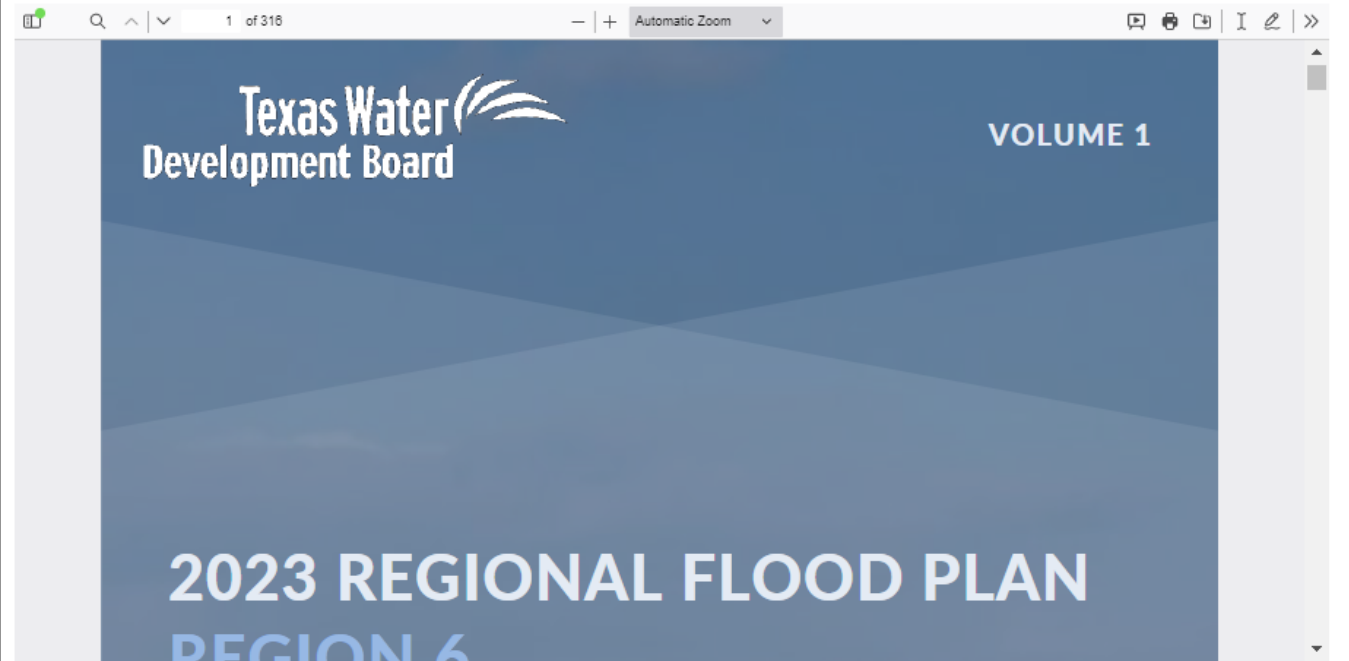
[Home](#) » Technical Documents

Technical Documents

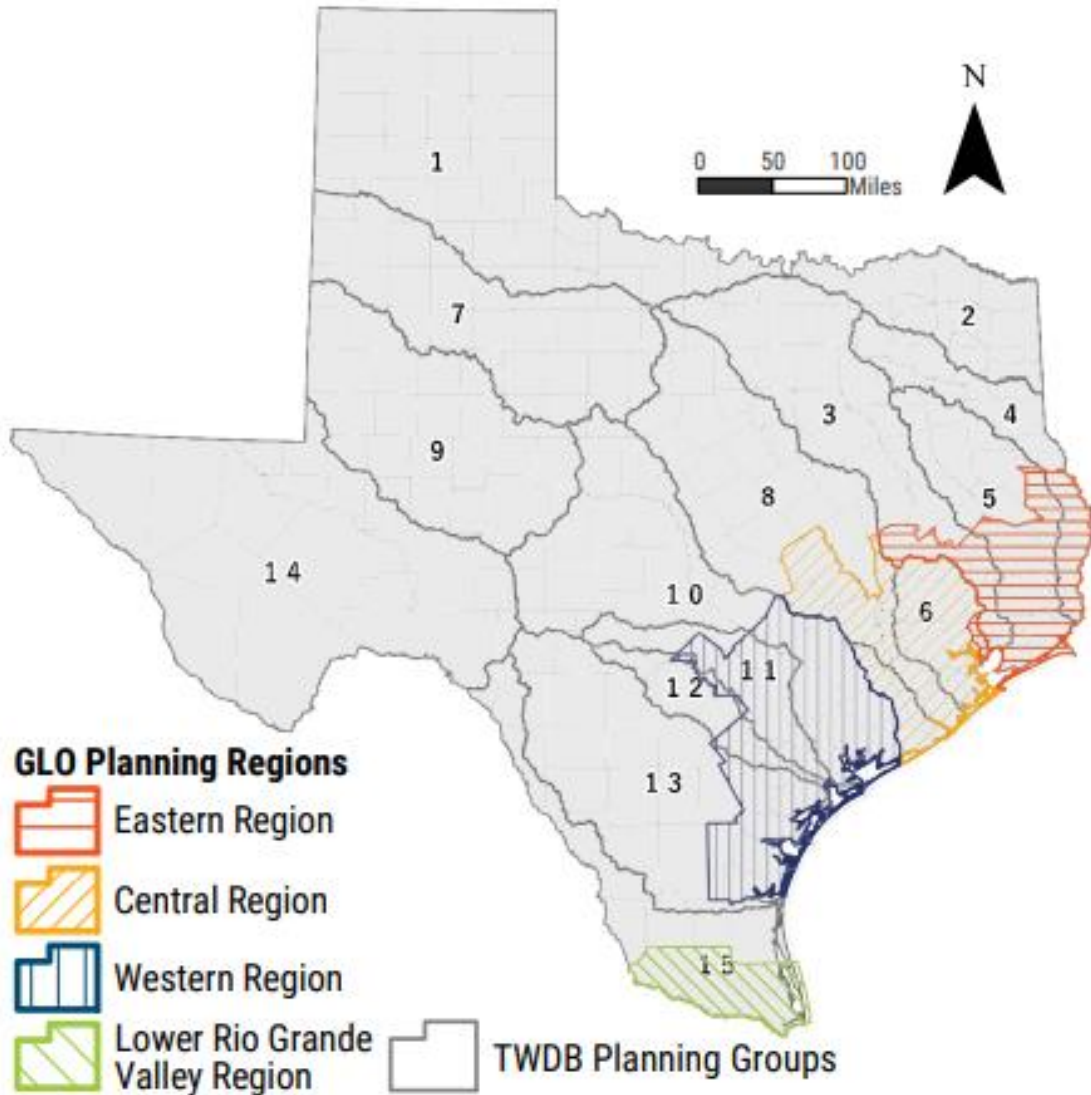
Final Regional Flood Plan

[DRAFT Regional Flood Plan \(Volume 1\)](#) – This volume contains an executive summary and all chapter text.

Use the "play" icon located in the right upper corner of the e-reader to launch presentation mode to view the document in full screen.



Moving Forward - Data Sharing



Data Sharing with overlapping GLO RBFS regions.

Amended Regional Flood Planning Data will be provided to both the Central and East Regions.

Upcoming Schedule Milestones

August 2023

- RFPG meeting to fill Public (#1) voting member and select local sponsor for 2nd Cycle of Flood Planning

Sep-Dec 2023

- TWDB to present the following to their Board:
 - Formal RFP rule changes
 - 2nd Cycle Funding for 15 regions
- TWDB/Local Sponsor aim to execute contract end of 2023

Jan-Jun 2024

- RFPGs onboard Technical Consultants
- TWDB to release Flood Infrastructure Fund Intended Use Plan (FIUP)
- TWDB to compile State Flood Plan

Questions or Comments?

Please Email: SJRFPG.TechCon@freese.com



SAN JACINTO REGIONAL FLOOD PLANNING GROUP
R E G I O N 6

Hazard Mitigation Assistance Program Updates

Merryl Holmes
TDEM



TEXAS DIVISION OF EMERGENCY MANAGEMENT

Hazard Mitigation



1

Mitigation Coordinator

Districts 16A & 16C



E: meryll.holmes@tdem.texas.gov
C: (281) 794 - 4102



2

Mitigation Coordinator District 16 B



E: Matthew.Holloway@tdem.texas.gov
C: (346) 667-2583

Galveston County



E: Walter.Zelezniak@tdem.texas.gov
C: (713) 304 - 7893

Fort Bend County



E: Alexander.Rodriguez@tdem.texas.gov
C: (346) 234-4740

Brazoria County



3

HMGP Funding Opportunities

Texas Severe Winter Storm 2023

- **Incident Period:** January 30, 2023 – February 2, 2023
- **Declaration Date:** April 21, 2023
- **Application Period:** Closes November 3, 2023 at 5:00pm

APPLY NOW
\$7,500,000.00



4

Grant Terms & Conditions updates

- Federal Procurement training
- Single Audit
- Quarterly Progress Reports
- Request for information Policy
- Recoupment Policy
- Signature Page



5

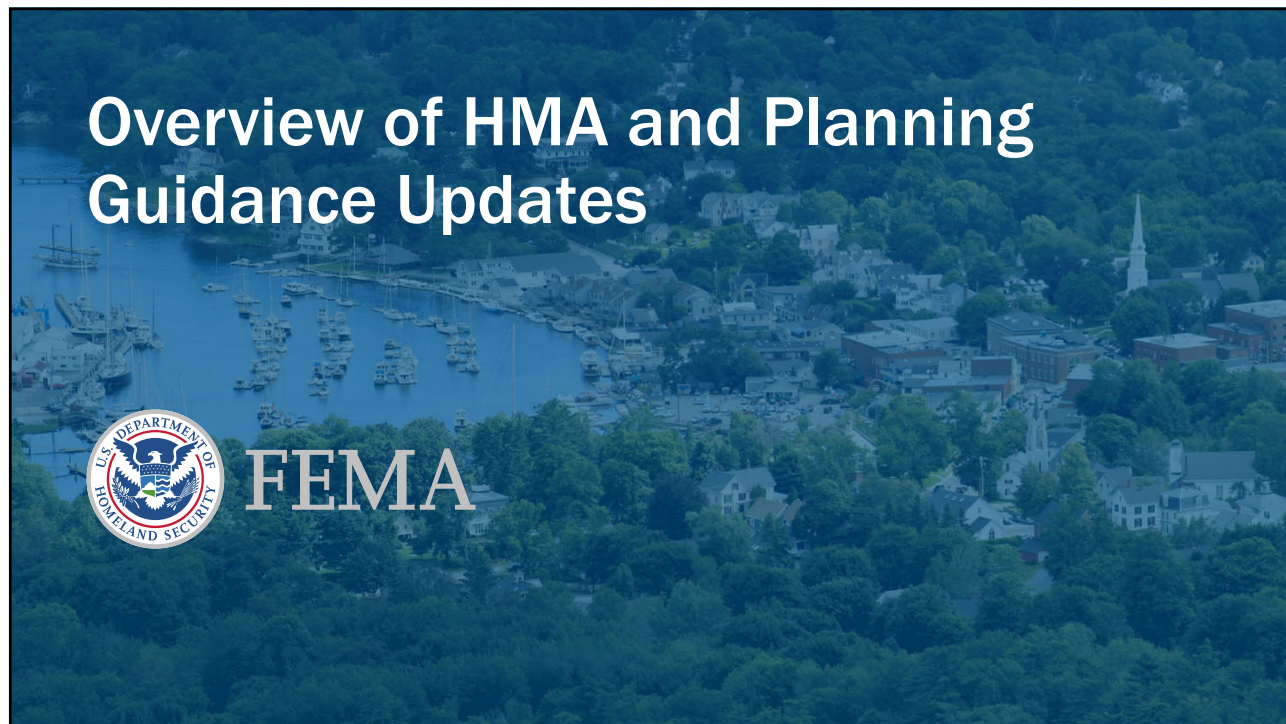
Grants.TDEM.Texas.Gov



- [Texas State Administrative Plan HM
FINAL 2023](#)



6



7

Element Location Significant Changes

- Continued Public Participation A5 to D1-a
- Plan Monitoring A6-a to D2-a
- Plan Evaluation A6-b to D2-b
- Plan Update A6-c to D2-c
- Progress on HM Plan incorporation C6 to D3-a
- Changes in Development D1 to E1-a
- Revisions based on changing priorities D3 to E2-a
- Progress on Mitigation Actions D2 to E2-b
- Plan Adoption E1&2 to F1&2



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8

8

Element A2-a Stakeholders

- Does the plan identify all stakeholders involved or given an opportunity to be involved in the planning process, and how each stakeholder was presented with this opportunity?
 - At least one of each type of stakeholder must be **clearly requested to attend**.
 - **Representatives of businesses, academia, and other private organizations:**
 - Examples include private utilities or major employers that sustain community lifelines.
 - **Representatives of nonprofit organizations, including community-based organizations, that work directly with and/or provide support to underserved communities and socially vulnerable populations, among others:**
 - Examples include housing, healthcare or social service agencies.



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9

9

Element A3-a Planning Process

- Does the plan document how the **public was given the opportunity** to be involved in the planning process and how their feedback was included in the plan?
 - The plan **must** include special considerations to invite/target underserved communities and vulnerable populations.



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10

10

Element A4-a Planning Process

- Does the plan document what **existing plans, studies, reports and technical information** were reviewed for the development of the plan, as well as how they were incorporated into the document?
 - For local governments participating in the National Flood Insurance Program (NFIP), **regulatory flood mapping products** are required to be incorporated, if appropriate.
 - Sanctioned and communities choosing not to participate are not required to reference regulatory mapping products.
 - Participants may use other jurisdiction-specific materials, including non-regulatory flood mapping products, that improve upon NFIP regulatory flood mapping products.



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11

11

Element B1-c Extent

- Does the plan describe the **extent** for each identified hazard?
 - Speed of onset and duration are not considered measures for extent.
 - For combination events (ex. Thunderstorm) the plan must either provide an extent scale of the entirety of the hazard (Ex. TS Scale, etc...) or provide extent scales for each component of the combo hazard. (Ex. Wind, Hail, Lightning, etc...)
 - Lightning extent can be described as any lightning strike to the assets of the community, using lightning activity level per event, anticipated current, or in terms of lightning protection levels.
 - For all types of flooding, extent is described by the amount of water inundating a specific area. (i.e. depth, flow rate, flood stage)



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12

12

Element B1-d Previous Occurrence

- Does the plan include the history of previous hazard events for each identified hazard?
 - The plan must include information on previous hazard events for each hazard that affects the planning area. **At a minimum, this includes any state and federal major disaster declarations for the plan**
 - Plan updates must include additional federally declared and state disaster occurrences since the last plan approval or note occurrences have not occurred since the last version of the plan.
 - If a presidential declaration **has affected** a plan participant, this hazard cannot be omitted for that participant.



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13

13

Element B1-e Probability

- Does the plan include the probability of future events for each identified hazard? Does the plan describe the effects of future conditions, including climate change (e.g., long-term weather patterns, average temperature and sea levels), on the type, location and range of anticipated intensities of identified hazards?
 - The plan must address whether probability was affected by the effects of changing conditions as it relates to types, location, and extent.



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14

14

Element B1-f Risk Assessment

- For participating jurisdictions in a multi-jurisdictional plan, does the plan describe any hazards that are unique to and/or vary from those affecting the overall planning area?
 - For multi-jurisdictional plans, when hazard risks differ across the planning area and between participating jurisdictions, the plan must specify the unique and varied risk information for each applicable jurisdiction and their assets outside the planning area.
 - Since no two communities are identical, the plan must include the differences in the various communities that make their hazard impacts different from the rest of the planning area.
 - Special/school districts are not assumed to have equal risk as the other plan participants. The special/school districts must also be fully profiled in the plan.
 - Special districts must consider the areas of their land use authority, not district boundaries.



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15

15

Element B2-b Hazard Impacts

- For each participating jurisdiction, does the plan describe the potential impacts of each of the identified hazards on each participating jurisdiction?
 - The plan must discuss how the effects of
 - climate change,
 - changes in population patterns (migration, density, or the makeup of socially vulnerable populations), and
 - changes in land use and development
 alter the impact of the hazards on the vulnerable assets.
 - For multi-jurisdictional plans, the plan must describe any hazard impacts that are unique and/or varied from those affecting the overall planning area.



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16

16

Element C1-a Existing Capabilities

- Does the plan describe how the existing capabilities of each participant are available to support the mitigation strategy? Does this include a discussion of the existing building codes and land use and development ordinances or regulations?
 - This must also include a discussion of the existing building codes, and land use and development ordinances or regulations.
 - If no building codes and land use and development ordinances or regulations exist this must be stated



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17

17

Element C2-a NFIP Participation

- The plan must describe participation in the NFIP for each participant, as applicable, in accordance with NFIP regulatory requirements. The following information must be provided for each participant.
 1. Adoption of NFIP minimum floodplain management criteria via local regulation.
 2. Adoption of the latest effective Flood Insurance Rate Map (FIRM), if applicable.
 3. Implementation and enforcement of local floodplain management regulations to regulate and permit development in SFHAs.
 4. Appointment of a designee or agency to implement the addressed commitments and requirements of the NFIP.
 - a. If no one has been appointed the plan must demonstrate how they will appoint a FPA. This can be a statement of intent or included as an action item, or specifically included in the discussion of expanding capabilities.
 - b. If another entity outside of the participant is responsible for floodplain management, this authority must be described.
 5. Description of how participants implement the substantial improvement/substantial damage provisions of their floodplain management regulations after an event.



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18

18

Element C4-a Mitigation Actions

- Does the plan include an analysis of a comprehensive range of actions/projects that each jurisdiction considered to reduce the impacts of hazards identified in the risk assessment?
 - The plan must show all the actions considered.
 - Actions must describe how they reduce identified risk
 - The range of actions must include at least one action reducing risk to existing buildings, structures and infrastructure, as well as limiting risk to new development and redevelopment.
- A comprehensive range means the plan must include at least **one (new or unimplemented) action per hazard per participant.**



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19

19

Element E2-b Previous Mitigation Actions

- Does the plan include a status update for **all** mitigation actions identified in the previous mitigation plan?
 - Identify whether they have been completed or not, for each jurisdiction.
 - For actions that are not complete, the plan must state whether the action is no longer relevant or will be included in the updated comprehensive range of mitigation actions.



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20

20

FEMA Mitigation Planning Websites

- [Mitigation Planning Policy Updates | FEMA.gov](#)
- [Mitigation Planning Training | FEMA.gov](#)
- [Create a Hazard Mitigation Plan | FEMA.gov](#)



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21

21

Remember...

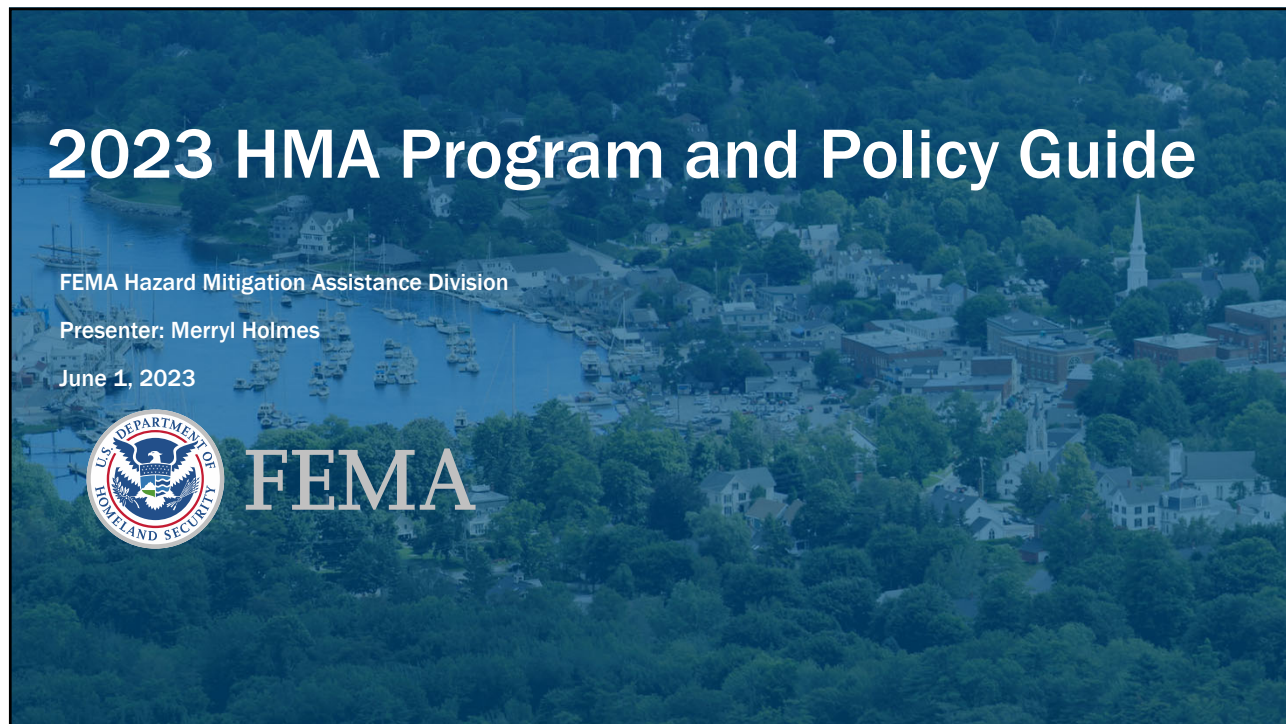
- Early coordination with your state mitigation planners is key!
- Contact the TDEM Mitigation Planning Group for training and questions



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22

22



23

Overview

- HMA Program and Policy Guide or HMA Guide, combined the existing 2015 Guidance and Addendum into one document
- The HMA Guide:
 - Consolidates HMA program eligibility information
 - Outlines HMA policies and grant requirements
 - Streamlines programmatic information for federal, state, tribal, territorial, and local officials
 - Details activity specific requirements
 - Applies to all disasters/NOFOs after the publication (i.e., revised Policies and Guidance will not be applied retroactively).

The 2023 HMA Guide supersedes the 2015 HMA Guidance and Addendum

24

Programs Covered in the HMA Guide

- The HMA Guide covers the HMGP, HMGP Post Fire, BRIC and FMA programs.



HMGP

A **post**-disaster program funded by a Presidentially declared disaster



BRIC

A **pre**-disaster program funded by a 6% set aside from federal post-disaster grant funding



HMGP Post Fire

A **post**-disaster program funded by an FMA-declared disaster



FMA

A **pre**-disaster program funded by annual appropriations



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25

25

When is the HMA Program and Policy Guide Effective?

- The HMA Program and Policy Guide will apply as follows:



HMGP

All **major disaster declarations** issued on or after the date of publication



HMGP Post Fire

All **FMA-declared disasters** issued on or after the date of publication



FMA & BRIC*

Notices of Funding Opportunity (NOFOs) published on or after the date of publication

*The HMA Guide will generally apply to PDM NOFOs published on or after the date of the HMA Guide's publication



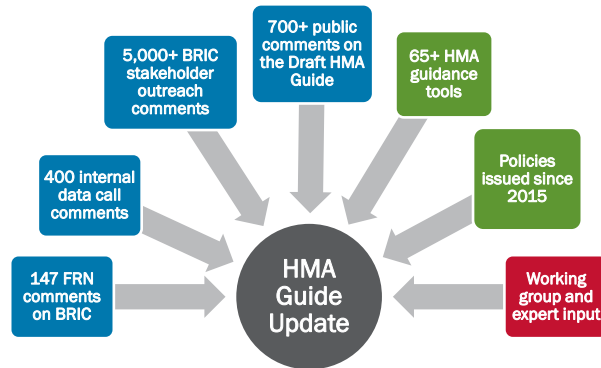
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26

26

HMA Guide Update: Purpose and Scope

- Incorporate policies and other materials issued since 2015 HMA Guidance, including legislative and regulatory changes
- Update FEMA guiding principles and priorities
- Reduce complexity by streamlining and eliminating duplicative content
- Incorporate internal and external stakeholder feedback
- Regional and HQ coordination throughout drafting and concurrence



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27

27

Consolidation and Reorganization



- Combined Guidance and Addendum into one document
- Consolidated standalone guidance documents and tools released since 2015 within the comprehensive HMA Guide
 - Incorporated Program Administration by States (PAS) guide
- Better organized content around the stages of the grant cycle
- Each program and activity type has its own part or section



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28

28

New and Expanded Content



- New policies from the Disaster Recovery Reform Act of 2018:
 - Inclusion of Building Resilient Infrastructure and Communities program, Hazard Mitigation Grant Program Post Fire, HMGP Management Costs, earthquake early warning systems, and expanded wildfire mitigation activities
- Legislative and regulatory changes, as well as citations throughout the document
- Expanded information on:
 - Cost-effectiveness (Part 5)
 - Activity types:
 - Capability and Capacity Building (Part 11)
 - Mitigation Projects (Part 12)
 - Management Costs (Part 13)



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29

29

HMA Guide – Organizational Structure Overview

Part 1-4, Part 6-9

- Presented in the order of the grants cycle
- Contains content from the 2015 HMA Guidance, with new titles
- Part 4 – eligibility and compliance info across all programs/project types

Part 5 (New)

- Provides details on cost effectiveness

Part 10

- Provides overview of each HMA Program

Part 11 (New)

- Focused on capability and capacity building activities
- Applies to not only BRIC and FMA, but many activities now eligible under HMGP and HMGP Post Fire

Part 12

- Built from the 2015 HMA Addendum but includes new project types
- Details each project type with eligibility requirements, cost effectiveness, feasibility and effectiveness, EHP and NFIP requirements, application submission information, subaward implementation, and closeout

Part 13

- Management Costs

Part 14 (New)

- Program Administration by States

Part 15

- Regional and state contact information

Part 16

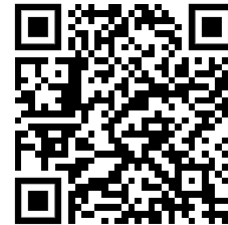
- Contains the acronyms guide, glossary, list of program authorities, and the Minimum Eligibility Criteria checklist for the PAS program

30

Resources Available

- [Hazard Mitigation Assistance Program and Policy Guide | FEMA.gov](#)
 - Policy Guide
 - Summary of Changes
 - 101 Webinar

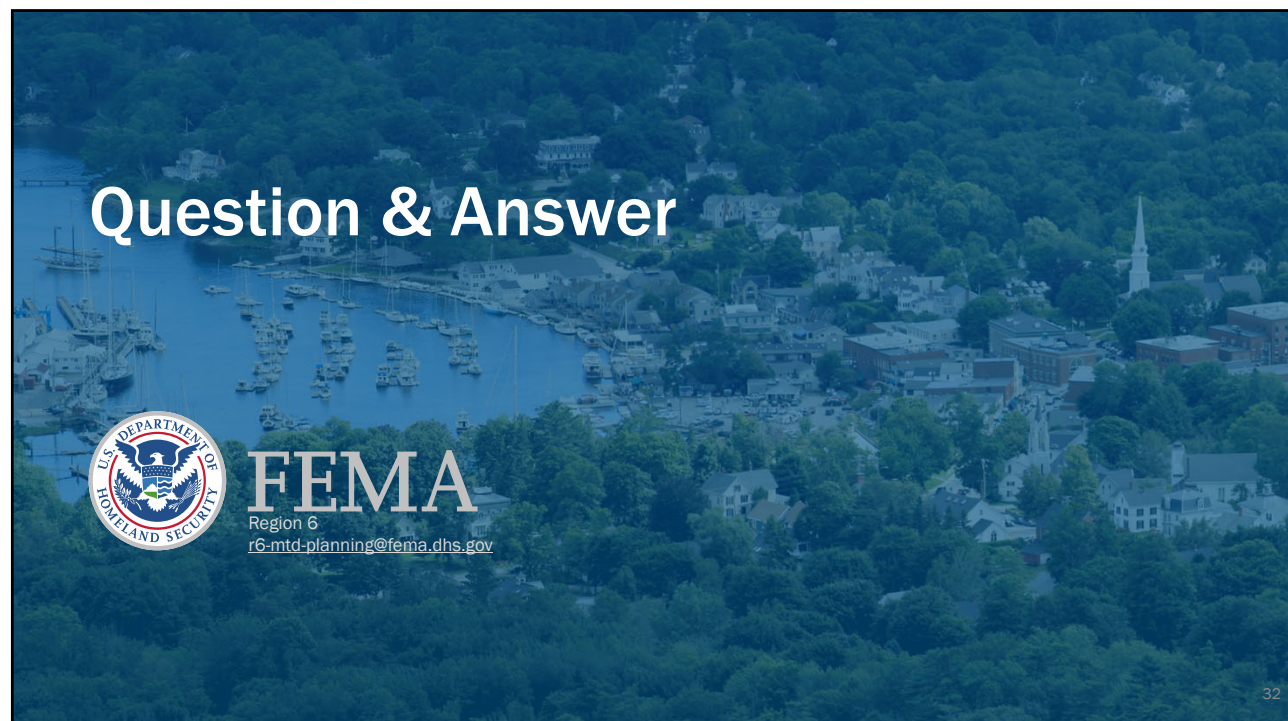
Scan here to go to FEMA.gov



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31

31



32

Cedar Bayou Bond Implementation Program & Crosby Eastgate Mitigation Bank

*Benjamin Castleberry, P.E., CFM, He Xin, P.E.,
CFM, & Jonathan Holley
HCFCFCD*



H-GAC Regional Flood Management Committee Quarterly Meeting

July 19, 2023 from 1:30 to 3:30 p.m.



**Cedar Bayou Bond Implementation Program
& Crosby Eastgate Mitigation Bank**

Agenda

- Harris County Flood Control District Overview
- Cedar Bayou Bond Implementation Program Overview
- Crosby Eastgate Mitigation Bank Overview
- Q&A

Harris County Flood Control District

- A special purpose district created in 1937 by the Texas Legislature
- In response to floods that devastated the Houston-area in 1929 and 1935
- Serves as a local partner to leverage federal dollars for flood damage reduction
- Harris County Commissioners Court serves as our board of directors or governing body

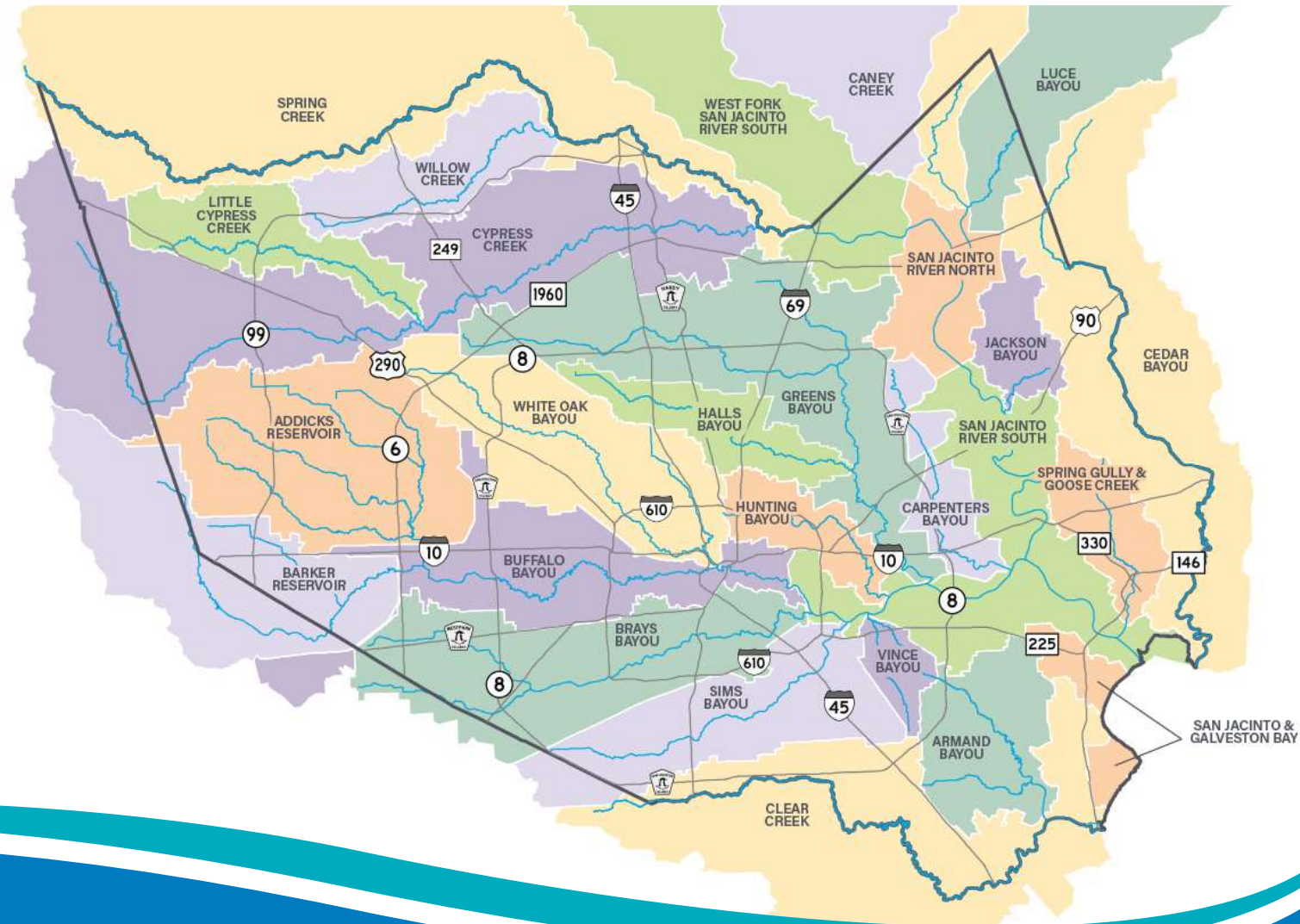
Our Mission

Provide flood damage reduction projects that work, with appropriate regard for community and natural values.

Harris County Watersheds

What is a watershed?

A geographical region of land or "drainage area" that drains to a common channel or outlet, mostly creeks and bayous in Harris County. Drainage of the land can occur directly into a bayou or creek, or through a series of systems that may include storm sewers, roadside ditches, and/or tributary channels.

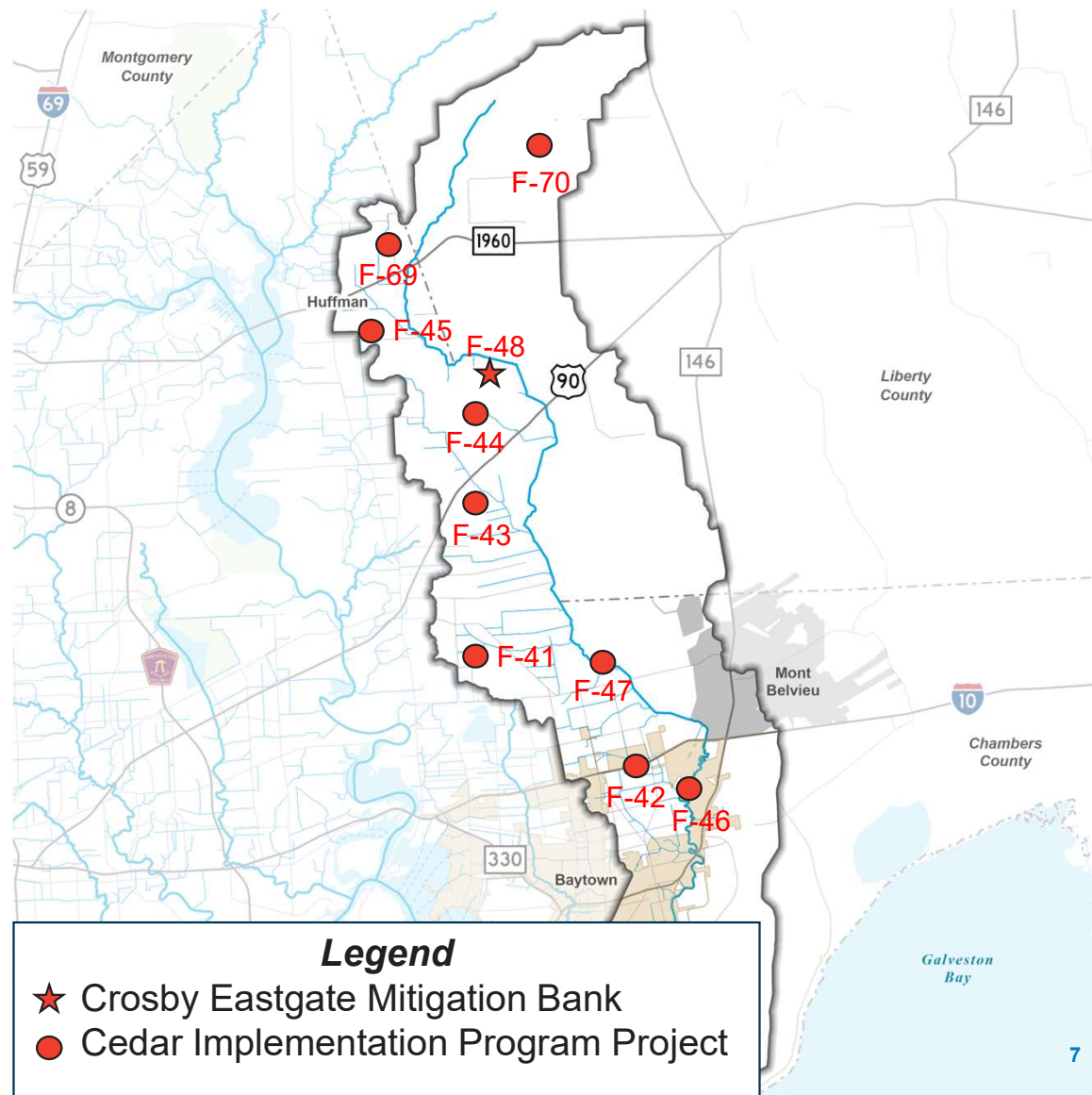


Cedar Bayou Bond Implementation Program Overview

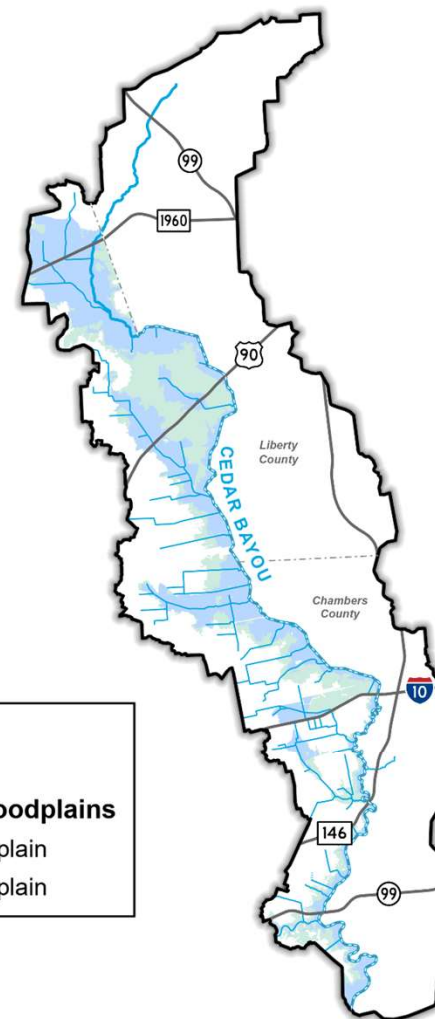
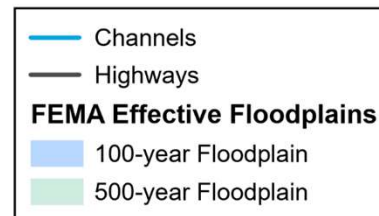
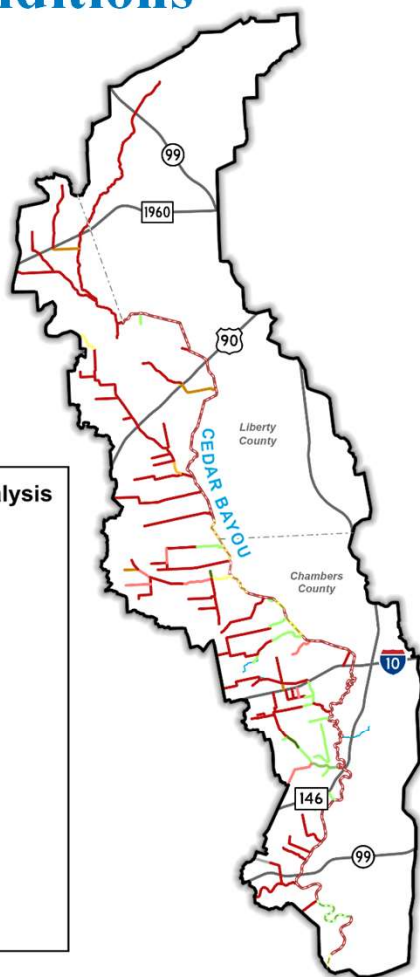
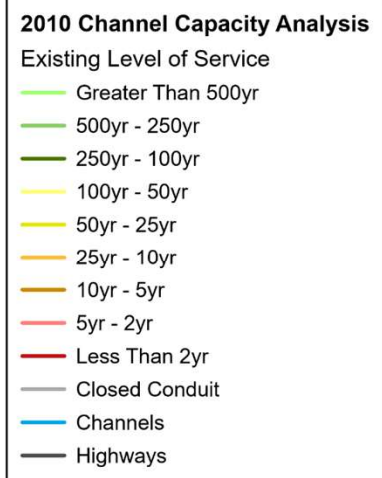


Cedar Bayou Bond Implementation Program

- The Flood Control District, in partnership with the Texas Water Development Board, completed a Cedar Bayou Flood Risk Reduction Study to identify potential projects in the watershed.
- Projects range from channel conveyance improvements, stormwater detention basins and a wetlands mitigation bank.



Existing Conditions



H-GAC Regional Flood Management Committee

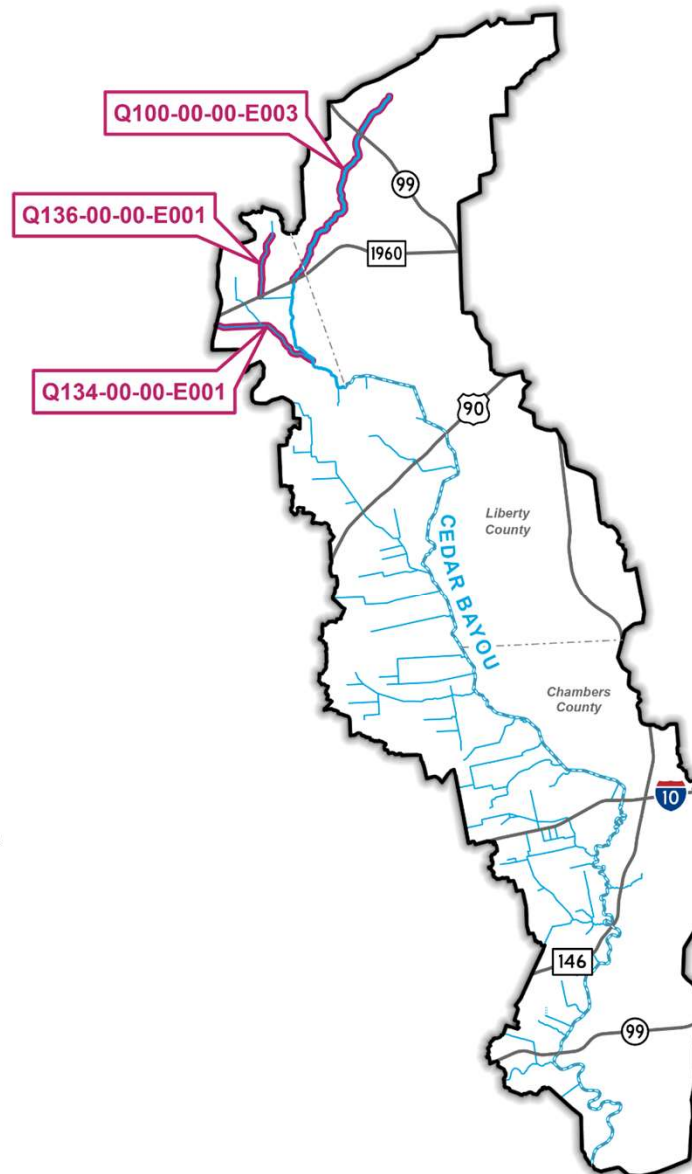
July 19, 2023

**All data depicted is pre-Atlas 14.*

Upstream Projects

Project Status

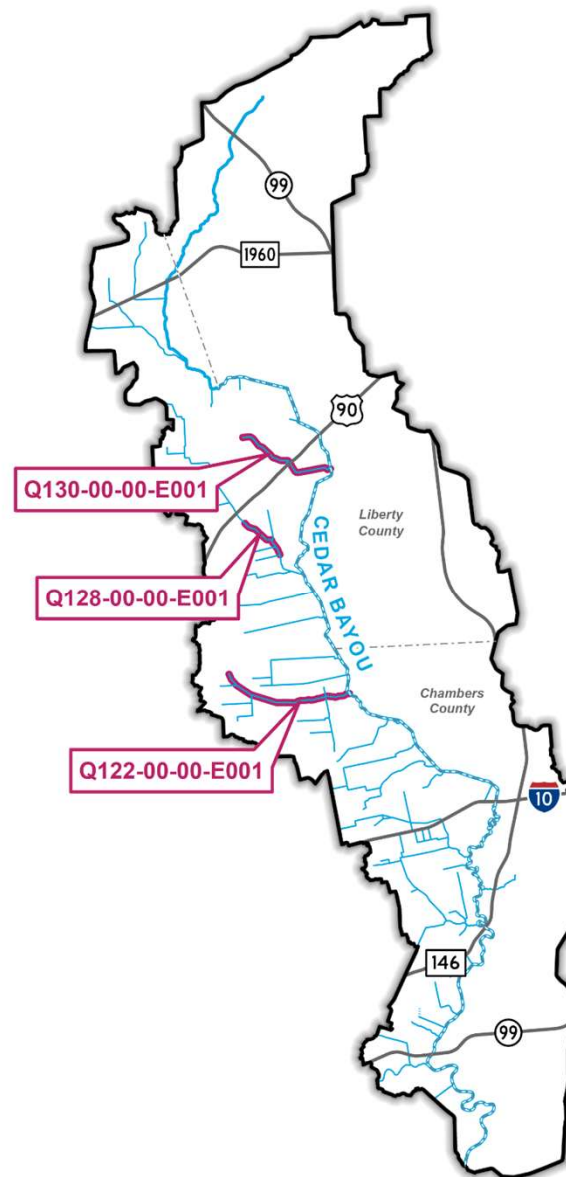
- Q100-00-00-E003, Bond ID: F-70
 - **Stage:** PER
 - **Project:** Channel conveyance improvements and stormwater detention
 - **Bond budget:** \$74 million
- Q134-00-00-E001, Bond ID: F-45
 - **Stage:** ROW Acquisition
 - **Project:** Stormwater detention basin
 - **Bond budget:** \$22 million
- Q136-00-00-E001, Bond ID: F-69
 - **Stage:** PER
 - **Project:** Stormwater detention basin & channel conveyance improvements
 - **Bond budget:** \$10.5 million



Midstream Projects

Project Status

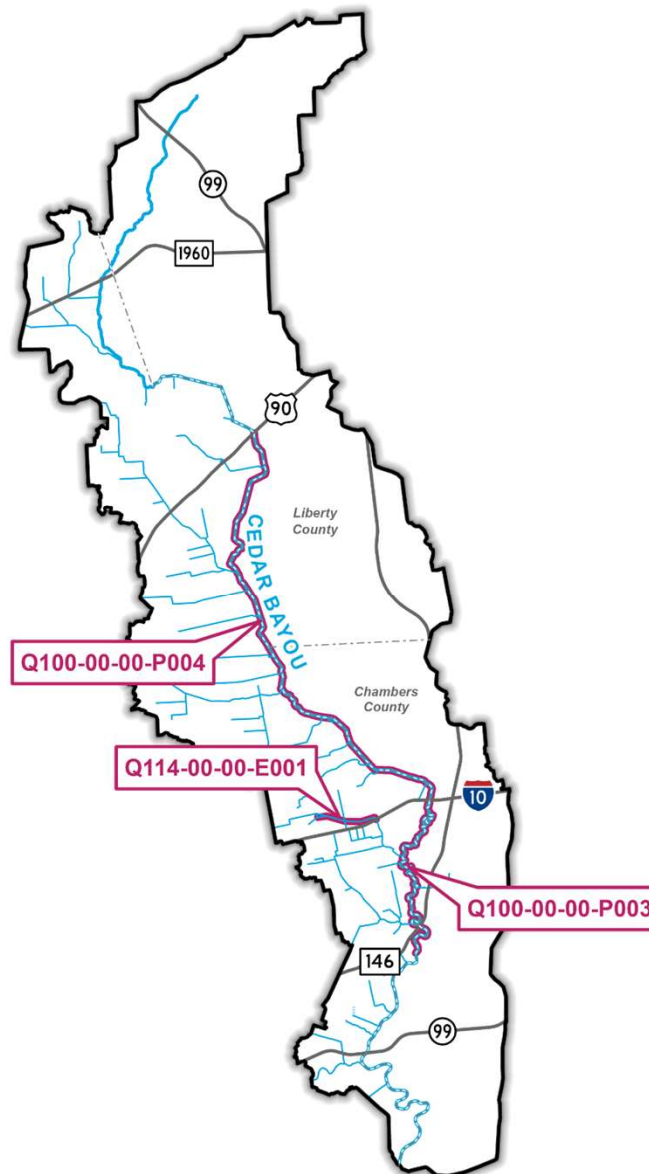
- Q130-00-00-E001, Bond ID: F-44
 - **Stage:** ROW Acquisition
 - **Project:** Stormwater detention basin & channel conveyance improvements
 - **Bond budget:** \$18 million
- Q128-00-00-E001, Bond ID: F-43
 - **Stage:** ROW Acquisition
 - **Project:** Stormwater detention basin & channel conveyance improvements
 - **Bond budget:** \$20 million
- Q122-00-00-E001, Bond ID: F-41
 - **Stage:** ROW Acquisition
 - **Project:** Stormwater detention basins
 - **Bond budget:** \$19 million



I-10 Corridor Projects

Project Status

- Q100-00-00-P004: Bond ID: F-47
 - **Stage:** PER
 - **Project:** Stormwater detention basin
 - **Bond budget:** \$19.9 million
- Q114-00-00-E001, Bond ID: F-42
 - **Stage:** PER
 - **Project:** Stormwater detention basin & channel conveyance improvements
 - **Bond budget:** \$33 million
- Q100-00-00-P003: Bond ID: F-46
 - **Stage:** PER
 - **Project:** Stormwater detention basin
 - **Bond budget:** \$22.9 million



Crosby Eastgate Mitigation Bank

HCFCF Unit ID: Q700-01-00

Bond ID: F-48

Environmental Mitigation

- Mitigation is the sequence of avoiding, minimizing or compensating for impacts to (or losses of) regulated resources.
- Compensatory mitigation is the restoration, preservation or establishment of aquatic resources to offset permitted impacts.
- USACE-permitted methods of compensatory mitigation include permittee responsible mitigation, in-lieu fee programs and mitigation banks.
- Mitigation banks allow the Flood Control District to compensate for unavoidable loss of wetlands from other projects, especially widening channels and constructing basins, while preserving the floodplain.

Mitigation Banks

- **Mitigation Bank:** A compensatory mitigation site where resources are restored, established, enhanced, and/ or preserved, such as streams, riparian areas, or wetlands.
- **Mitigation Credits:** A unit of measure of aquatic functions generated by a mitigation bank to offset debits resulting from impacts of a project to Waters of the United States, based on the resources restored, established, enhanced or preserved.
- **Mitigation Banking Instrument (MBI):** The legally binding agreement between USACE and the mitigation bank sponsor that governs the operation and use of the bank.

Existing Mitigation Bank Projects

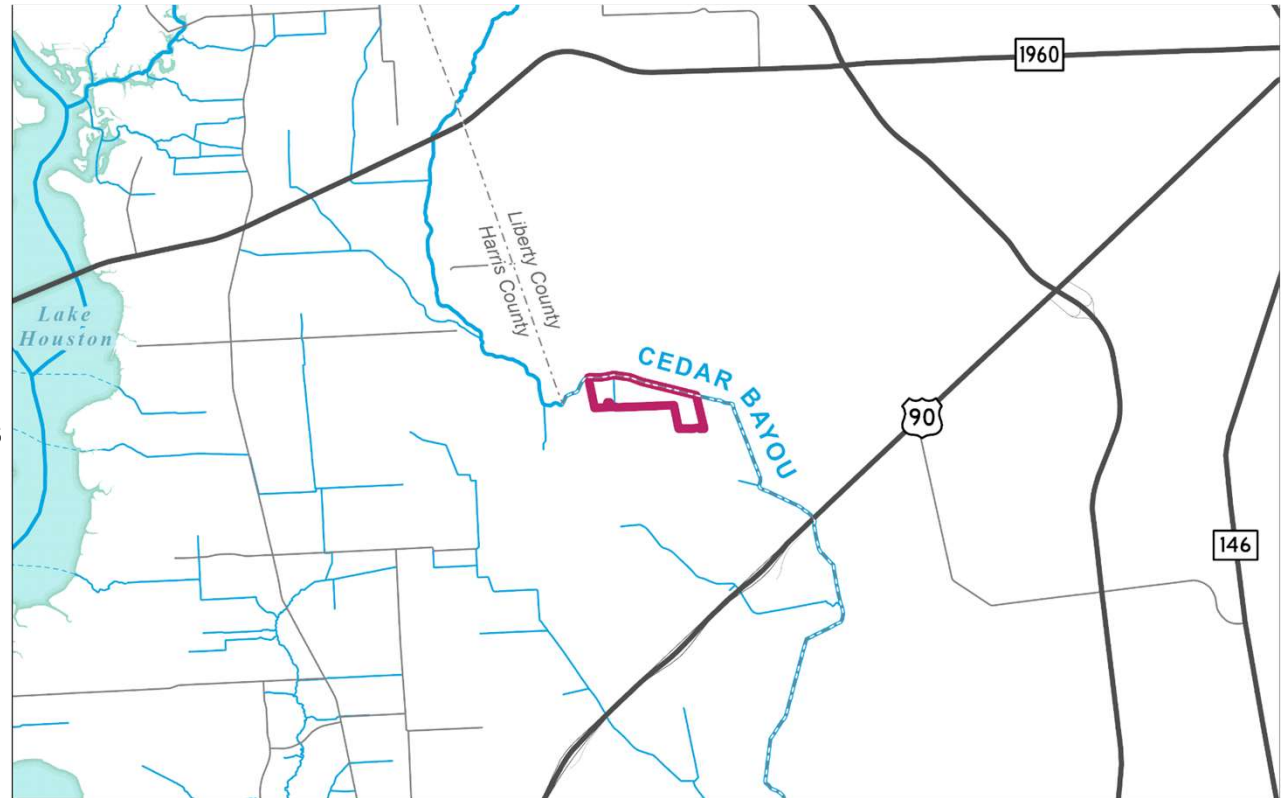
- Greens Bayou Wetlands Mitigation Bank (GBWMB) *(Completed in 1997) (Pictured right)*
- Katy Hockley Mitigation Bank (KHMB) *(Completed in 2021)*
- Clear Creek Regional Mitigation Bank *(Preliminary Engineering Stage)*
- West Harris County Wetlands Mitigation Bank *(Preliminary Engineering Stage)*



Greens Bayou Wetlands Mitigation Bank

Crosby Eastgate Mitigation Bank

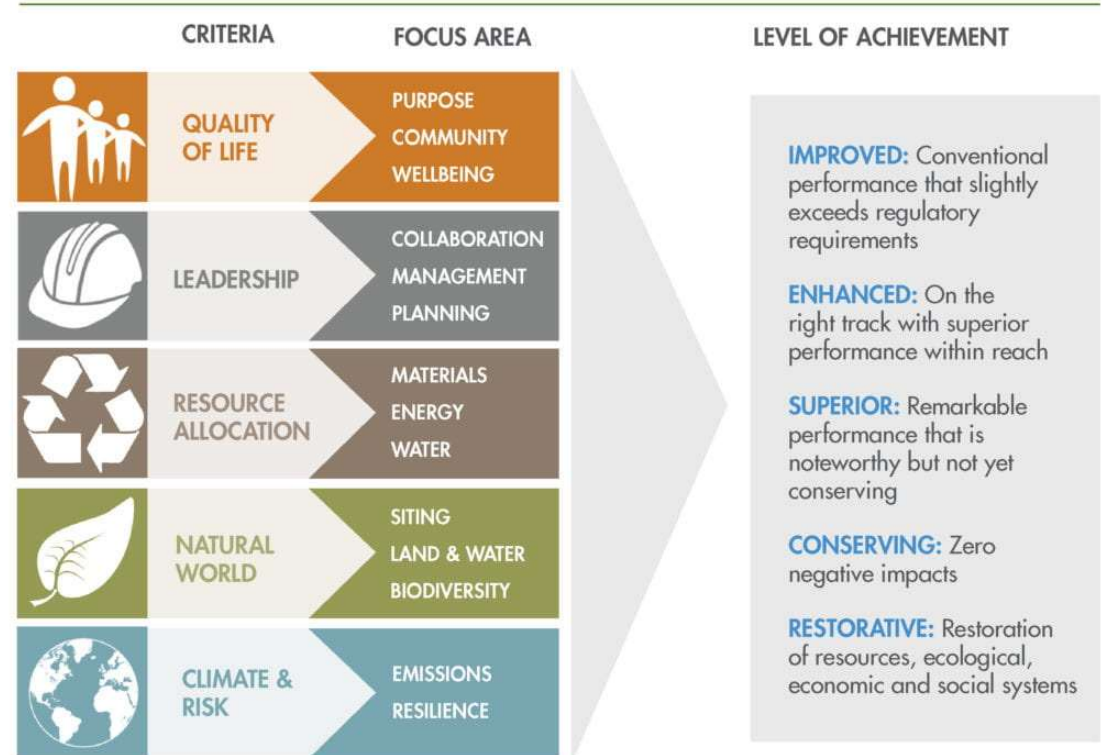
- Wetland restoration project to generate mitigation credits that will offset permitted impacts caused by other Flood Control District projects.
- 226 acres in area, with 70 acres of wetlands being enhanced and 85 acres being restored.
- Total estimated cost is \$6.5 million.
- Construction anticipated to begin in 2025.
- The Flood Control District is partnering with H-GAC on the project.



Envision Certification

- The Envision framework is a project planning and design tool created by the Institute for Sustainable Infrastructure.
- Envision certification verifies that a project meets the Envision sustainability criteria at five levels of achievement.

THE ENVISION SUSTAINABILITY RATING SYSTEM



We want to hear from you!

Your input is critical to our efforts across Harris County.

Please visit **hcfcd.org** to learn more about the
Cedar Bayou watershed, ask questions
and sign up for our mailing list.

Buffalo Bayou Community Plan- Working to Increase Resiliency & Reduce Flood Risk

Alan Steinberg, Ph.D., & Guy Hagstette, FAIA
West Houston Association | Houston
Stronger





Buffalo Bayou Community Plan

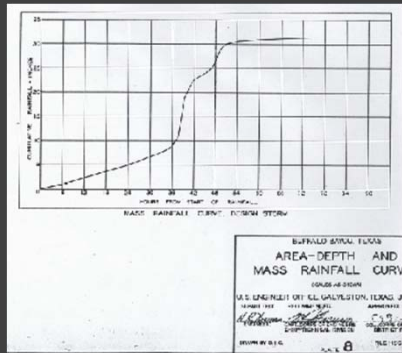
Working to Increase Resiliency and Reduce Flood Risk

BACKGROUND FOR SECTION 7001 PROPOSAL

July 19, 2023

DRAFT

- U.S. Army Corps of Engineers developed flood mitigation plan in 1940 after catastrophic flooding in 1929 and 1935.
- The region has experienced several rains of around 30" since record-keeping began.
- Harvey produced 31" of rain in west Harris County and 47" in southeast Harris County.



USACE's early design storm graph for Buffalo Bayou indicating 30"+ cumulative rainfall



1935

Flooding in Downtown Houston



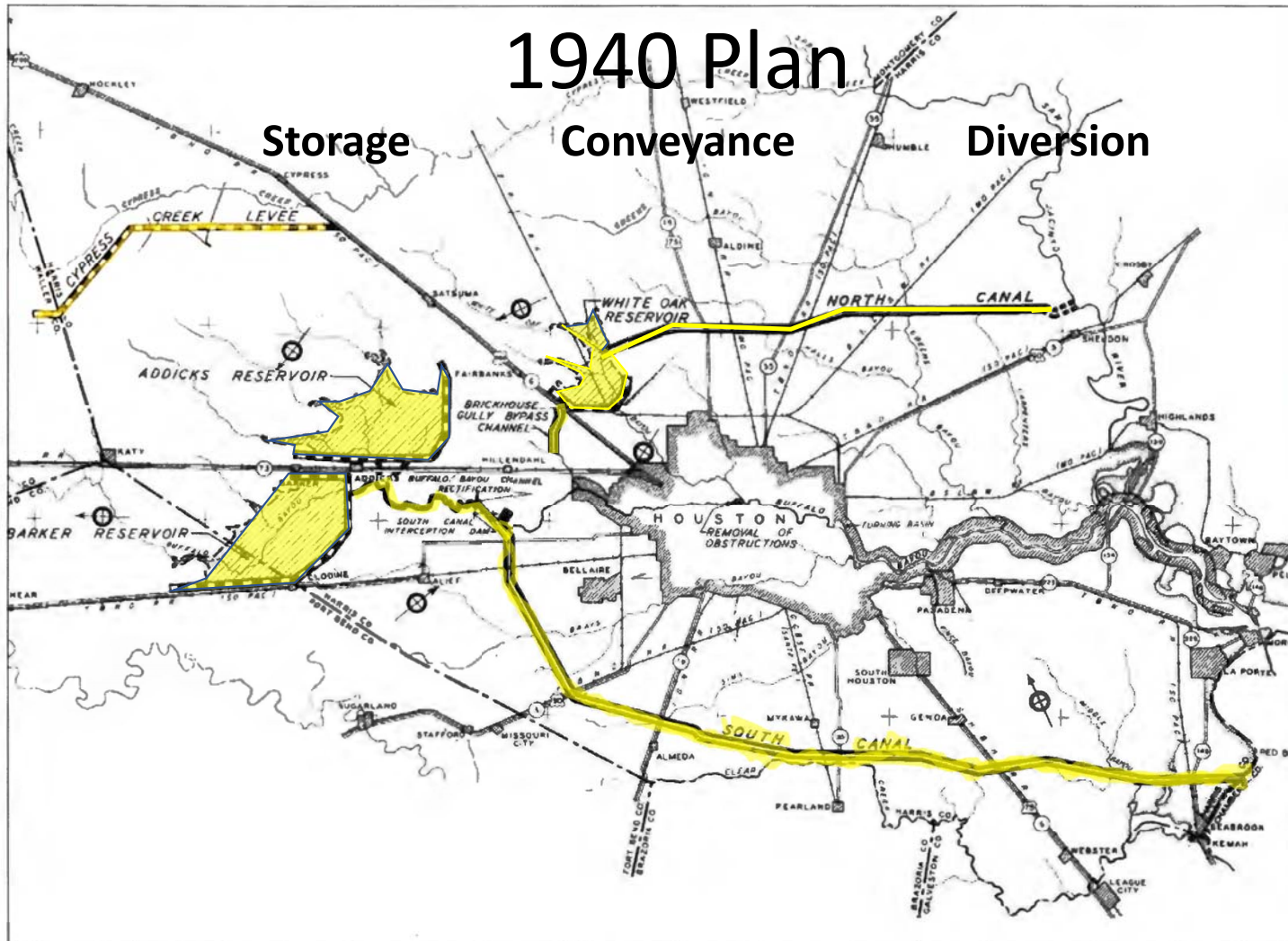
2017

1940 Plan

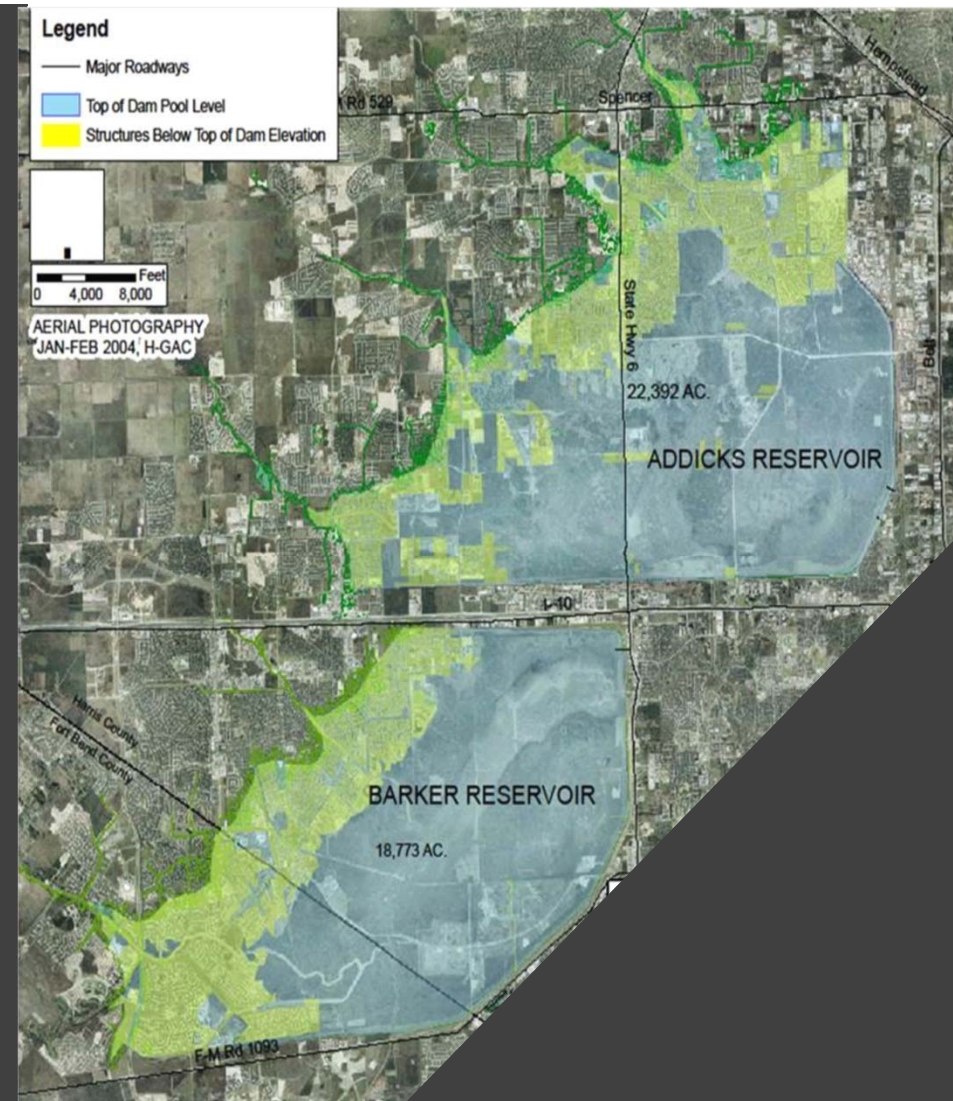
Storage

Conveyance

Diversion



- Reservoirs were built in the 1940s without gates, and 15,000 cfs could be discharged into Buffalo Bayou.
- The south canal, White Oak reservoir, north canal and Cypress Creek levee were never built.
- Reservoir watersheds are now largely developed.
- When gates were added in the 1960s, the maximum flood pool grew to include land that remains privately-owned today.



Hurricane Harvey and Dam Safety

BUFFALO BAYOU COMMUNITY PLAN

- During Harvey, 31 inches fell on the reservoir's watershed, and Houston's southeast side received 47 inches. About 72,000 cfs flowed into Addicks (143,000 acre-feet/day; its capacity on government-owned land is 200,800 acre-feet).
- With thousands of properties already inundated in the flood pools and water flowing uncontrolled around the north end of Addicks Reservoir, the Corps began opening the gates at 2:00 a.m. on August 29, 2017.
- If Harvey made a final turn west as predicted by the weather forecast, it could have dropped an additional 10-20 inches on the reservoirs' watersheds.
- As recently as 2020, the dams were classified as unsafe, and USACE has completed new gate structures since that time; however, no major work on the levees has occurred.

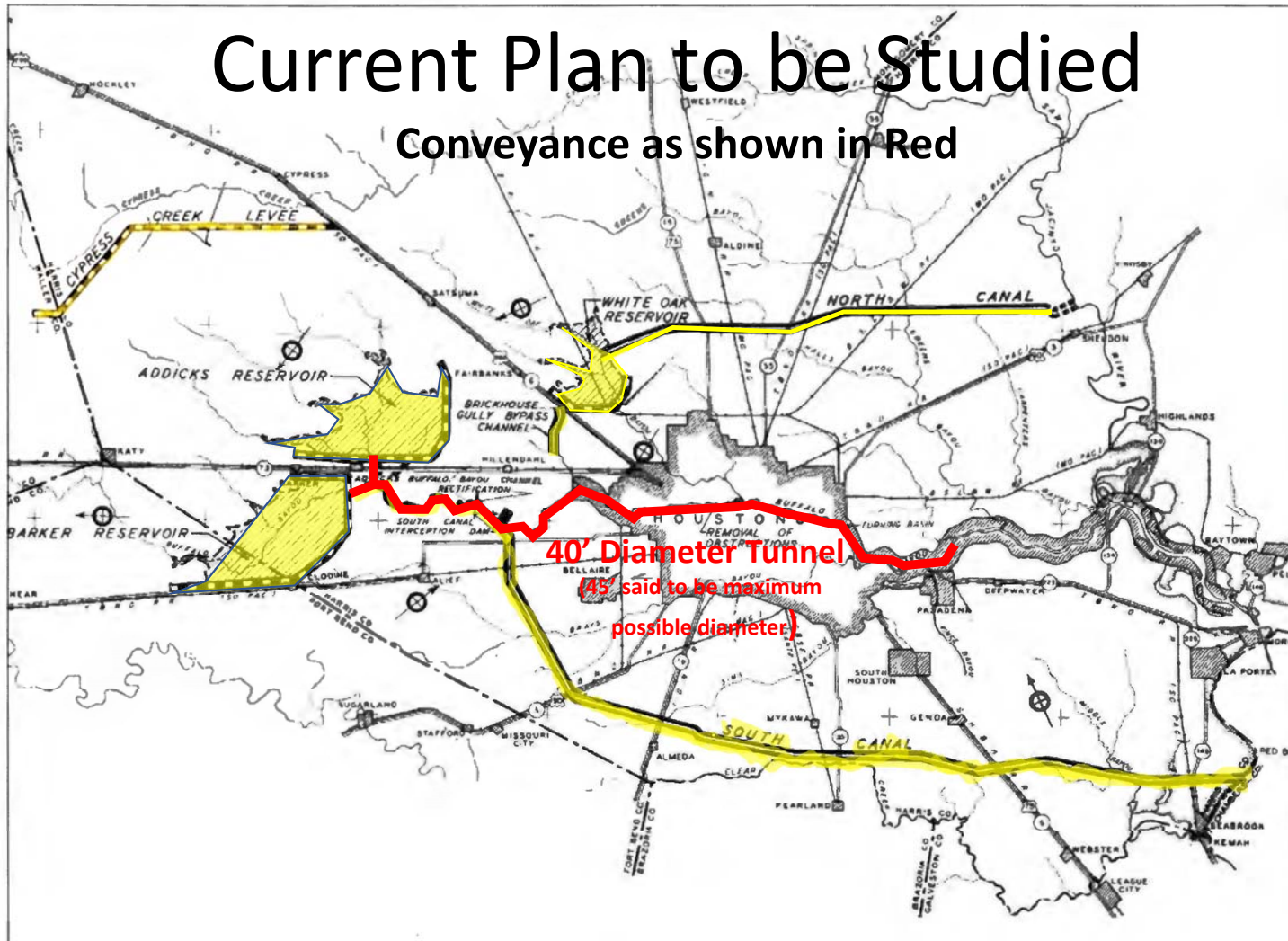
Interim Report and Completing the BB&TRS Study

BUFFALO BAYOU COMMUNITY PLAN

- The Corps' Interim Report for the Buffalo Bayou and Tributaries Resilience Study favored two solutions:
 - **Alternative 2 - Conveyance:** Channelizing Buffalo Bayou
 - **Alternative 6 - Storage:** Constructing a “third reservoir” on the Katy Prairie
- There was strong community opposition to both proposals.
- Today, USACE with HCFCD are poised to update the study with new modeling information, analysis based on comprehensive benefits, and a focus on a tunnel.

Current Plan to be Studied

Conveyance as shown in Red



Buffalo Bayou Community Plan Goals

BUFFALO BAYOU COMMUNITY PLAN

- **Goal 1:** Contain flood waters within the boundaries of federally-owned lands for Barker and Addicks Reservoirs.
- **Goal 2:** Mitigate flooding resulting from local rainfall in Buffalo and other bayous downstream of the reservoirs.
- **Goal 3:** Avoid negative environmental impacts and enhance benefits for the Katy Prairie, reservoirs, Buffalo Bayou, Houston Ship Channel, and Galveston Bay.
- **Goal 4:** Develop broad, diverse and prolonged community support and help secure funding for the eventual proposal.

While the tunnel is absolutely essential, it alone will not achieve these goals - if a storm the size of Hurricane Harvey were to strike again.

Model Assumptions for Three Scenarios

- Gates can discharge 4,000 cfs total without flooding downstream structures if there is not an ongoing rain event; however, USACE's operating plan calls for the gates to be closed when Buffalo Bayou is in flood stage. As a result, our models assumed closed gates.
- A 40-foot diameter tunnel can discharge 12,000 cfs total per HCFCD study.
A 45-foot diameter tunnel can discharge 18,000 cfs total per HCFCD study.
- The two reservoirs can store a combined 210,512 acre-feet of flood water on government-owned land.
- **The added storage needed in these scenarios:**
 - 500-Year Event with 40-foot diameter tunnel: +/- 72,000 acre-feet of added storage.
 - 500-Year Event with 45-foot diameter tunnel: +/- 43,000 acre-feet of added storage.
 - Repeat of Harvey with a 45-foot diameter tunnel: +/-152,000 acre-feet of added storage.

We suggest the tunnel design be evaluated to allow “balancing” of water levels between the reservoirs, so added storage in each reservoir could vary as long as the total is achieved.

Model Results with 500-year Atlas 14 Storm (24.2"/24 hours) 40-foot Diameter Tunnel

Scenario	Discharge (cfs)	Addicks WSEL	Barker WSEL
Existing System	0 (gates closed)	108.8 (<1' ↑ north spill)	100.8 (4' to spill)
Tunnel	12,000 (A=6k, B=6k)	105.0 (2' above GOL)	98.1 (3' above GOL)
Tunnel + Storage	12,000 (A=6k, B=6k)	103.0 (at GOL) +29,250 ac-ft	95.0 (at GOL) +42,400 ac-ft

Total Added Storage Required in Both Reservoirs

71,650 ac-ft*

Model based on MAAPnext for 500-year storm. The direct watersheds are similar, so Cypress overflows are removed to simulate Barker inflow.

The figures included in this presentation reflect a cursory review of the performance of the reservoirs and a potential tunnel system under extreme storm events – Harvey and 500-year storms – for the purpose of evaluating the benefits and limitations of a large diameter drainage tunnel in protecting the reservoirs and property owners in the flood pool. Very simplistic modeling methods were used to be able to inform Houston Stronger about the benefits and limitations of potential flood mitigation strategies.

Model Results with 500-year Atlas 14 Storm (24.2"/24 hours) 45-Foot Diameter Tunnel

Scenario	Discharge (cfs)	Addicks WSEL	Barker WSEL
Existing System	0 (gates closed)	108.8 (<1' ↑ north spill)	100.8 (4' to spill)
Tunnel	18,000 (A=9k, B=9k)	103.7 (< 1' above GOL)	99.3 (2.3' above GOL)
Tunnel + Storage	18,000 (A=9k, B=9k)	103.0 (at GOL) +11,050 ac-ft	95.0 (at GOL) +31,800 ac-ft

Total Added Storage Required in Both Reservoirs

+/- 43,000 ac-ft

Model based on MAAPnext for 500-year storm. The direct watersheds are similar, so Cypress overflows are removed to simulate Barker inflow.

The figures included in this presentation reflect a cursory review of the performance of the reservoirs and a potential tunnel system under extreme storm events – Harvey and 500-year storms – for the purpose of evaluating the benefits and limitations of a large diameter drainage tunnel in protecting the reservoirs and property owners in the flood pool. Very simplistic modeling methods were used to be able to inform Houston Stronger about the benefits and limitations of potential flood mitigation strategies.

Model Results with a Repeat of Harvey (31") 45-Foot Diameter Tunnel

Scenario	Discharge (cfs)	Addicks WSEL	Barker WSEL
Existing System	0 (gates closed)	Above north spill	101.8 (3.2 to spill)
Tunnel (40'-diameter)	12,000	107.9 (at north spill)	100.9
Tunnel (45'diameter)	18,000	106.2 (3.2' above GOL)	99.6 (4.6' above GOL)
Discharge Only (GOL)	35,000 needed	103.0 (at GOL)	95.0 (at GOL)
Tunnel + Storage	18,000	103.0 (at GOL) +58,000 ac-ft	95.0 (at GOL) +94,000 ac-ft

Total Added Storage Required in Both Reservoirs **+/-152,000 ac-ft**

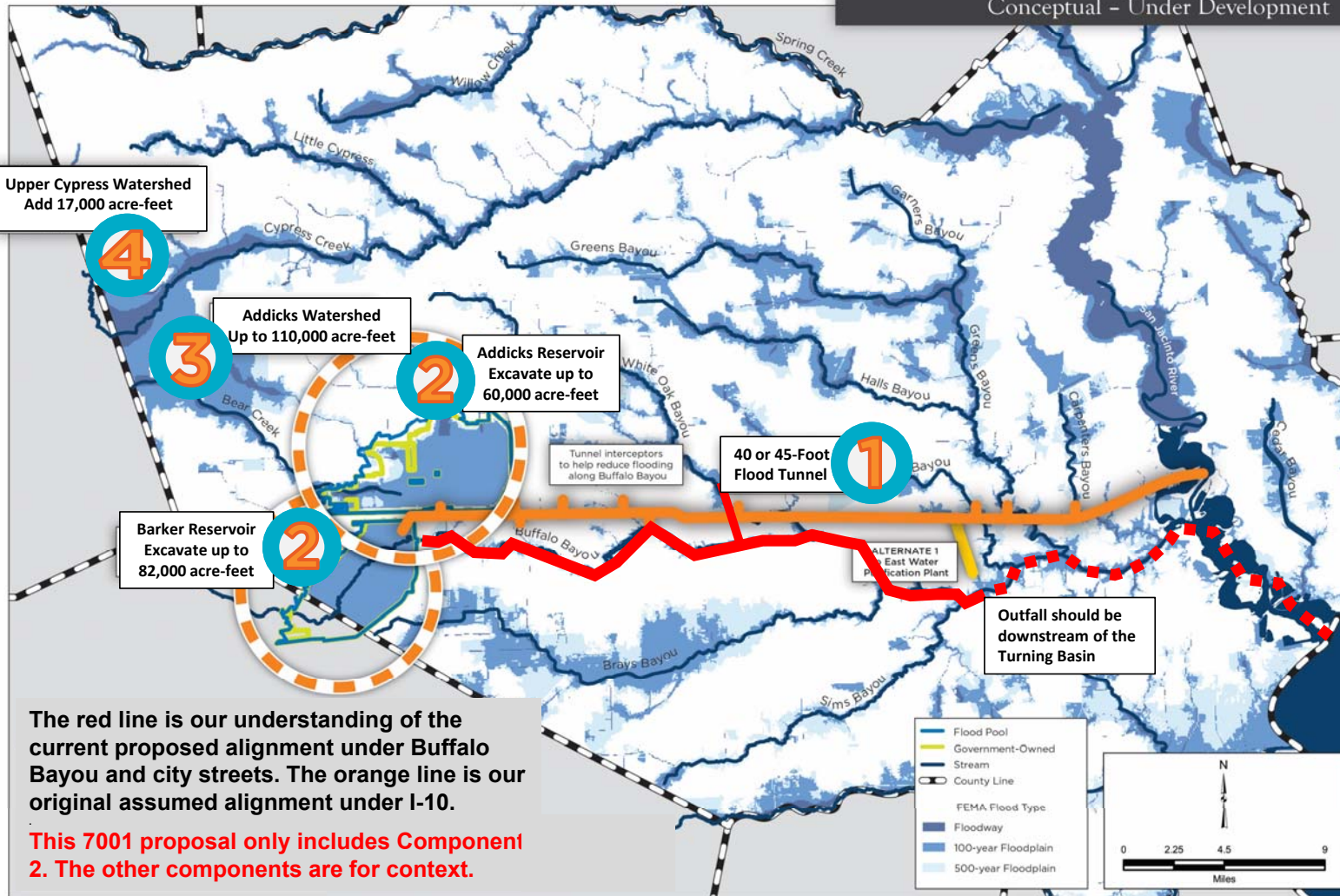
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Buffalo Bayou Community Plan

Conceptual - Under Development



- Comprised of four components to accomplish our four goals in these scenarios:
 - A repeat of Harvey (31" in watersheds)
 - 500-Year Storm (24" in watersheds)



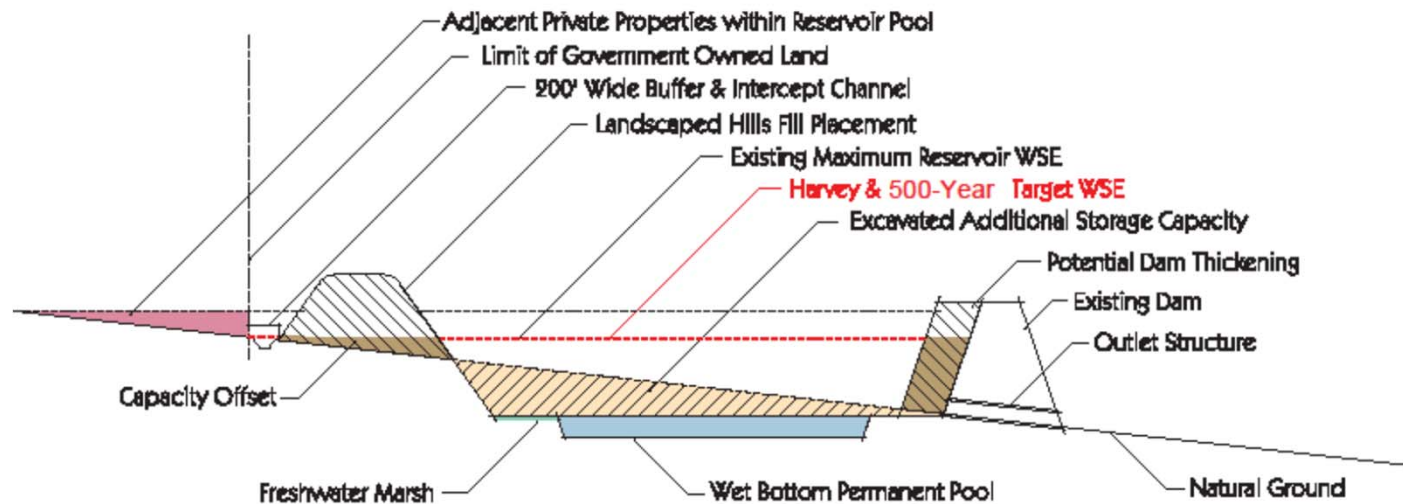
Draft - February 2023



Component 2 – Storage

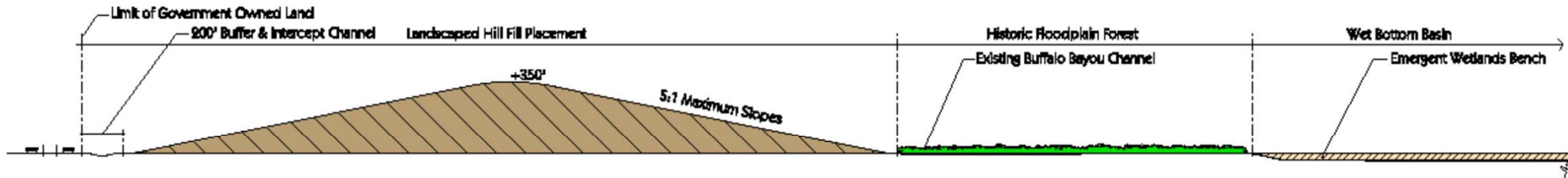
Today, Addicks and Barker Reservoirs can store 210,512 acre-feet of floodwater on government owned land.

- Up to 338,000 acre-feet of added storage could be added without major impacts, but our proposal calls for a maximum of 152,000 acre-feet to be added.
- Excavated areas can become dry bottom forestland or wet-bottom permanent pools, with a water surface elevation at the reservoir gate invert elevation.
- Use excavated dirt to reinforce aging levees.
- Use excavated dirt to create upland “rolling hills” habitat with ecological and recreational value at the upper end of government-owned land.



Reservoir Capacity Alternative Diagram

Not To Scale



Typical Section at Maximum Hill (Barker BH-2)



Benefits of Reservoir Excavation and Restoration

Based on a different set of assumptions:

- Higher-value historic riparian forests and endangered species population footprints are protected and avoided wherever possible.
- Allows roads and active pipelines to remain in their current alignments.
- Existing parks and recreation facilities are impacted only short term.
- Nature-based recreation is expanded far beyond the current +/-10% of reservoir area.
- More diverse high-value lowland and upland habitats, including low-maintenance aquatic, perimeter wetland, wet prairie and waterfowl habitats. Project can be self-mitigating.
- Minimal impacts to surrounding communities because materials are kept on site.
- Perform excavation with very large-scale mining equipment and keep all excavated material on government-owned land in the reservoirs to radically reduce costs.
- Construction schedule can be faster with benefits accrued as excavation occurs.

Excavation/Restoration Using Proven Mining Practices

- Efficient - Excavation can employ large-scale, highly-efficient mining practices because all work will occur on government-owned land.
- Fast – Using mining equipment and practices, work can proceed 10 – 100x faster than conventional excavation used in urban settings on smaller sites. With no off-site impacts, work can occur 24/7.
- Less Expensive – Economies of scale and elimination of long hauls of excavated material save money.

In addition to the equipment shown, dragline buckets also may be an option in shallow-water conditions.



Component 2

Conceptual Capacity

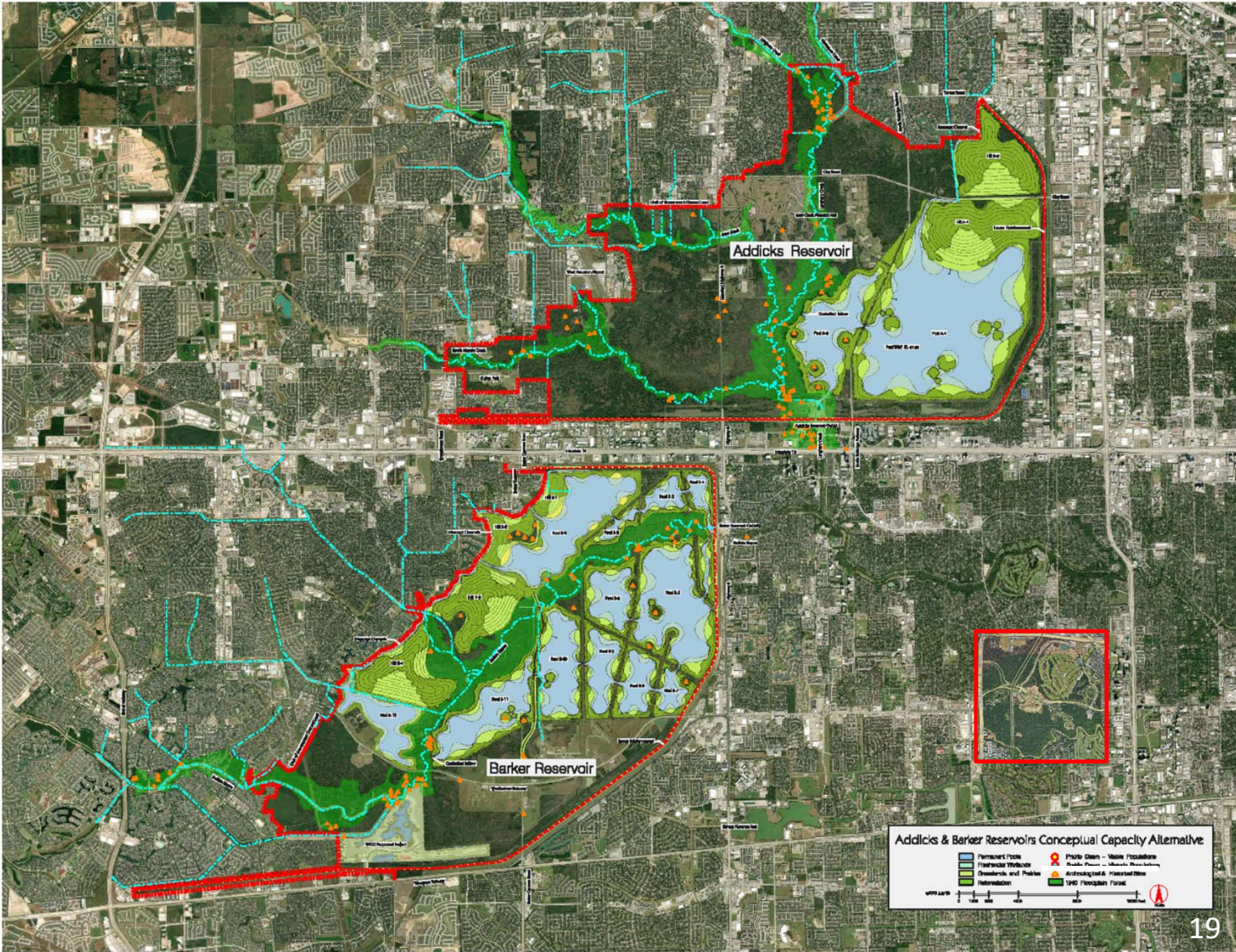
Alternative

By Kevin Shanley

Event	Acre-Feet Added		
	Harvey	500-Year	500-Year
Tunnel	45' Dia.	45' Dia.	40' Dia.
Addicks Reservoir	58,000	11,000	29,000
Barker Reservoir	94,000	32,000	43,000
Total	152,000	43,000	72,000

The plan illustrates 152,000 acre-feet of storage. There would be a combination of fewer and/or shallower basins for lower storage capacities.

We suggest the tunnel design be evaluated to allow “balancing” of water levels between the reservoirs, so added storage in each reservoir could vary as long as the total is achieved.



Addicks Reservoir Conceptual Capacity Alternative

By Kevin Shanley

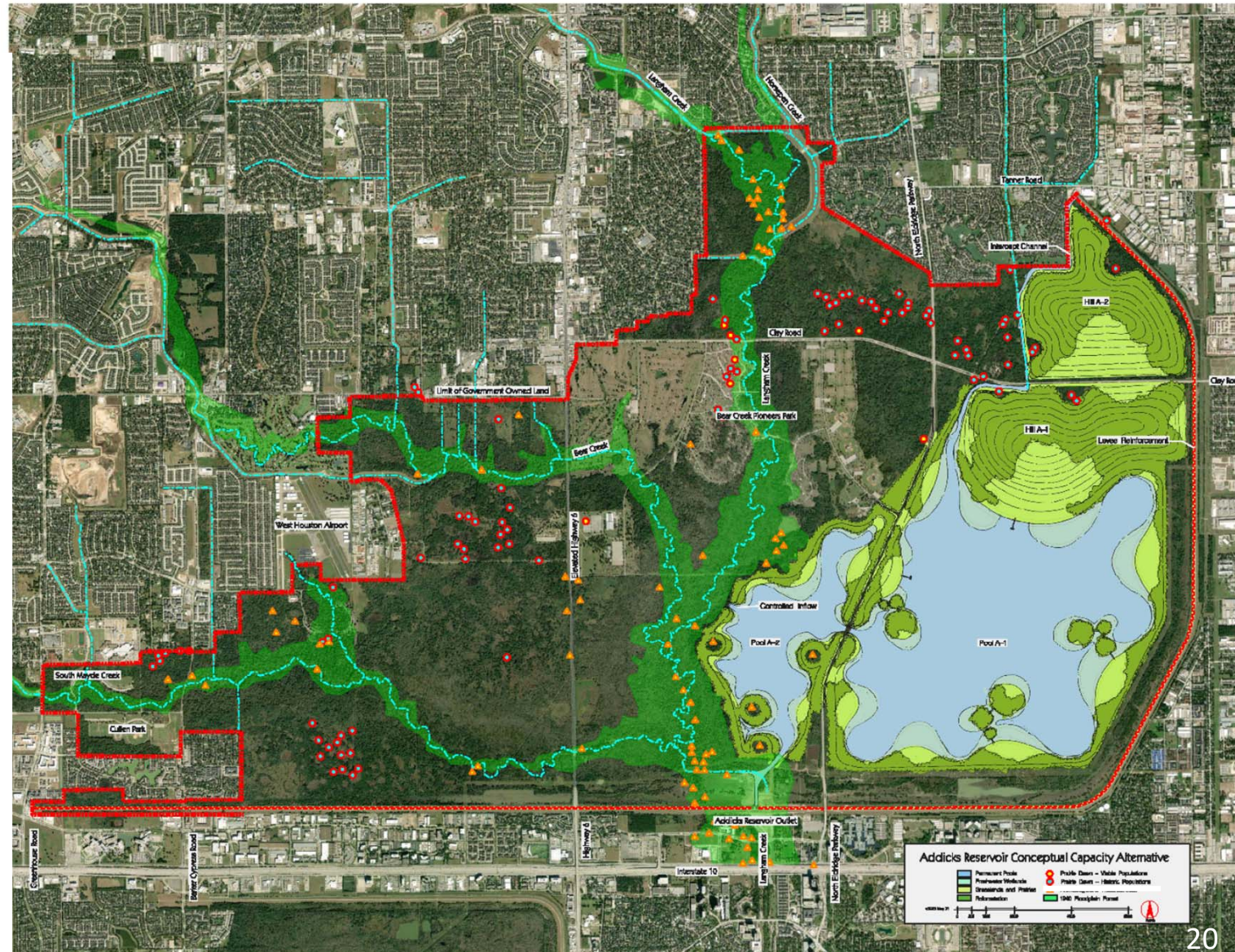
Open Water 1660 acres
Wetlands 600 acres
Wet Prairie 610 acres
Shoreline 14 miles

Excavation 109,500,000 cy
Tallest Hill 350 feet

Bear Creek Park No Change
West of Hwy 6 No Change
(Cullen Park)

Hwy 6 Elevated
Eldridge Pkwy Elevated

Excavation exceeds that required for storage to create permanent wet bottom pools and to account for excavated fill placed below the maximum flood pool elevation.



Barker Reservoir Conceptual Capacity Alternative

By Kevin Shanley

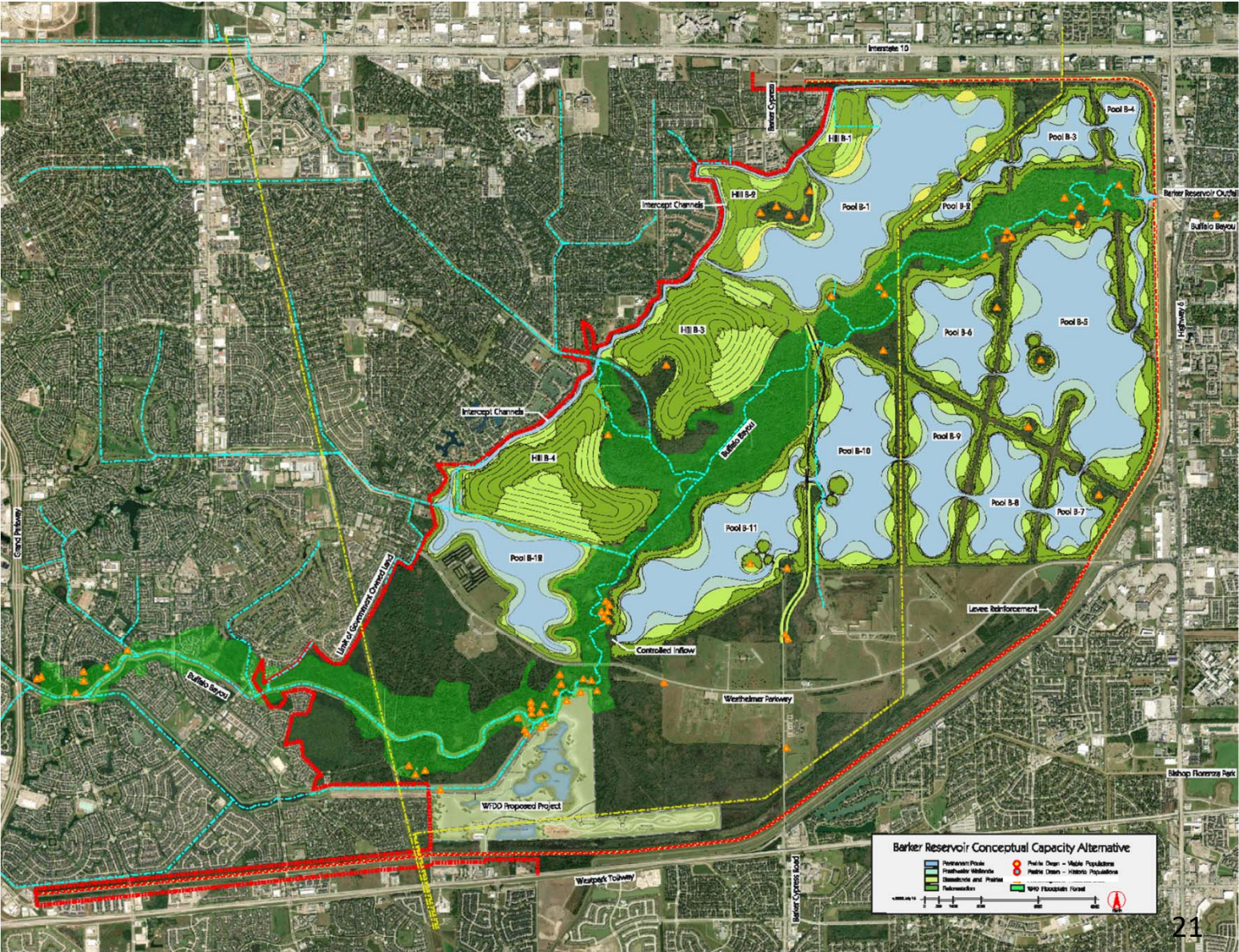
Open Water 2254 acres
Wetlands 844 acres
Wet Prairie 1223 acres
Shoreline 44 miles

Excavation 177,000,000 cy
Tallest Hill 350 feet

G. Bush Park No Change
Project Barker No Change

Westheimer Not Elevated
Pkwy

Excavation exceeds that required for storage to create permanent wet bottom pools and to account for excavated fill placed below the maximum flood pool elevation.





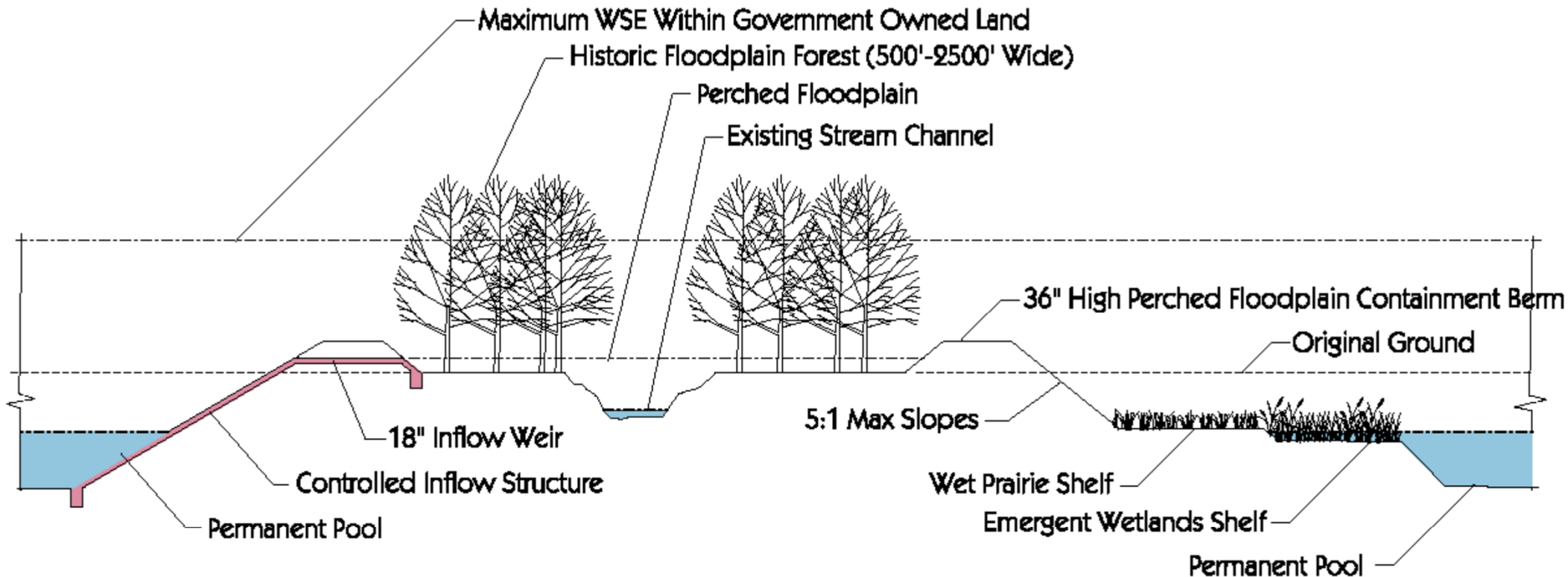
The Reservoir Landscape that can be Created

Concerns about Reservoir Excavation and Restoration

We have adjusted our proposal based on these comments:

- Plan will avoid areas within reservoirs where either archeological remains and/or the presence of Prairie Dawn are identified.
- Reduce chance of bird concentrations near West Houston Airport by avoiding open water in the western areas of Addicks Reservoir.
- Regarding any potential geotechnical/land settlement related to the man-made hills, Frank Ong, a geotechnical engineer involved in the Memorial Park land bridge, stated: “Review of the provided soil boring logs (up to 100 ft deep) show that the subsoils in Addicks and Barker Reservoirs areas generally consist of stiff to very stiff clays interbedded with layers of medium dense to dense sands/silts. We expect similar soil conditions exist for the soils deeper than 100 ft. With the detailed site-specific geotechnical study and construction monitoring, the proposed 350-ft tall hills can be safely constructed to satisfy the stability and settlement requirements over these soil foundations.”
- The proposed scope of work includes intercept channels along the edge of government-owned land to still allow sheet flow to drain into the reservoirs.

This section diagram shows how the hydrology of the existing streams and the preserved forest floodplains / riparian corridors can be maintained for less severe rainfall events.



Perched Floodplain Diagram

Not To Scale

Cost of Reservoir Excavation and Restoration (Harvey)

These are rough estimates of costs

Storage in Acre-Feet	Addicks (58,000)	Barker (94,000)	Total (152,000)
• Creation of Storage	\$ 420,000,000	\$ 682,000,000	\$1,102,000,000
• Elevate Roadways	\$ 28,000,000	\$ 0	\$ 28,000,000
• Parks and Trails	\$ 57,000,000	\$ 84,000,000	\$ 141,000,000
• Contingency (30%)	\$ 151,000,000	\$ 230,000,000	\$ 381,000,000
• <u>Other Costs/Project Mgmt.</u>	<u>\$ 230,000,000</u>	<u>\$ 348,000,000</u>	<u>\$ 578,000,000</u>
• Total - 152,000 acre-feet	\$ 886,000,000	\$1,344,000,000	\$2,230,000,000

Rough cost to address a 24" / 500-Year Event with 40-foot Tunnel: +/\$1,437,000,000

Rough Cost to address a 24" / 500-Year Event with 45-foot Tunnel: +/\$1,150,000,000

Next Steps

BUFFALO BAYOU COMMUNITY PLAN

- Finalize Buffalo Bayou Community Plan
- Secure local support for Section 7001 Proposal for Feasibility Study
- Identify local match funding (estimated at 25% of \$3 million or \$750,000)
- Assist HCFCD with preparing Section 7001 Proposal
- Harris County Commissioners Court approval in early August
- Submit to USACE in August
- Stakeholder/Public Meetings (including potential partners and supporters)
- Advocate to include in 2024 Water Resources Development Act

Other Announcements

Amanda Ashcroft, H-GAC



Other Announcements

- The **Harris County Flood Control District** will hold a **community engagement meeting** on July 26th from 6:30-7:30 PM for the Major Maintenance of Cypress Creek and its Tributaries.
- The **GLO** launched the **Combined River Basin Flood Studies** in the 49 counties which received a presidential disaster declaration due to the impact of Hurricane Harvey in 2015. The studies aim to increase resiliency by helping communities prioritize effective mitigation strategies and pursue additional implementation funds. Public meetings for various watersheds within the study areas are ongoing.
- The **Texas Water Development Board (TWDB)** is **soliciting ideas for research on topics of priority regarding flooding in Texas**. Proposed research ideas may include new projects that support flood planning or flood science, or they may be ideas that build upon previous research projects conducted by the TWDB. The submission deadline for fiscal years 2024-2025 is July 31.
- **DR-4705 Severe Winter Storm 2023 Hazard Mitigation Grant Program Funding opportunity**. The estimated amount of federal funding is \$ 7,500,000.00 for the entire state of Texas. Although all projects are acceptable, smaller projects such as Hazard Mitigation Planning, Generators, and Project Scoping (Phase I), have a greater chance of being awarded. All DR-4705 Severe Winter Storms 2023 applications must be complete and submitted by close of business on November 03, 2023 at 5:00pm.



Member Roundtable



We are adjourned, thank
you for attending!

Contact

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Planner, H-GAC*

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Amanda.Ashcroft@h-gac.com

