

USACE GALVESTON DISTRICT SUMMER 2017 STAKEHOLDER PARTNERING FORUM

BUFFALO BAYOU & TRIBUTARIES, HOUSTON, TEXAS ADDICKS AND BARKER RESERVOIRS DAM SAFETY MEGA PROJECT OVERVIEW



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Addicks and Barker Dams

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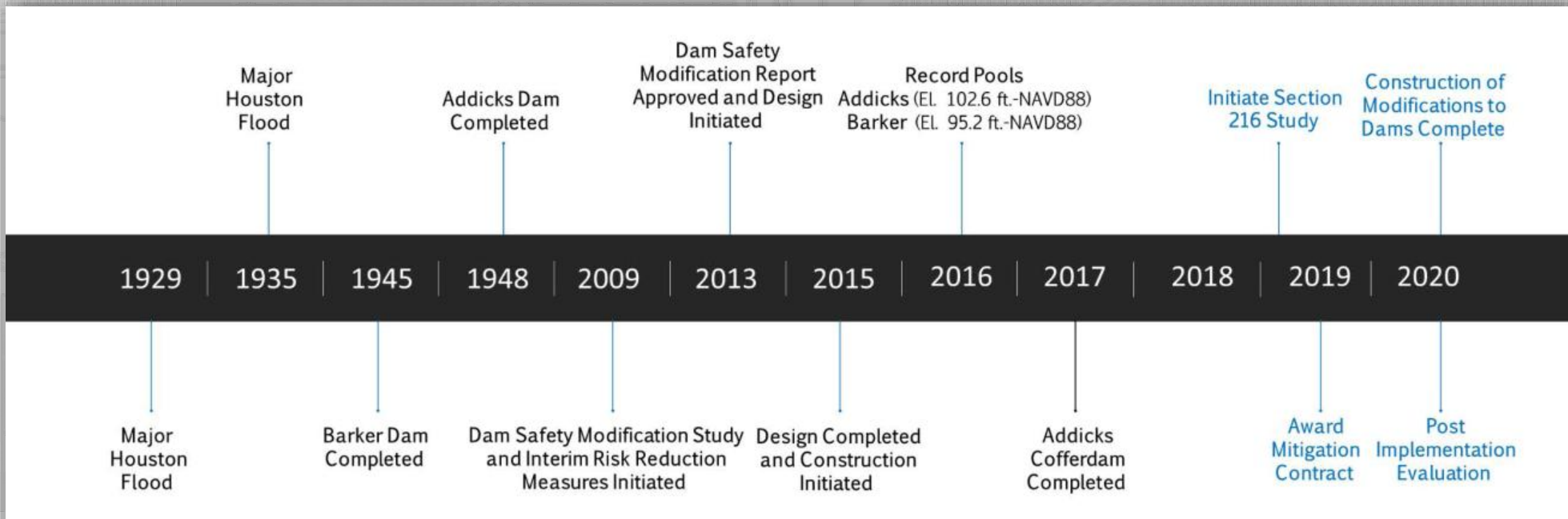


- Background
- Project Status
- Critical Issues



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BACKGROUND



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Overview

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Project: Buffalo Bayou, Addicks and Barker Dams

Location: Houston, Texas

Program: Dam Safety

Purpose: Flood Risk Management

Phase: Construction

Total Authorized Project Cost: \$129,883,340

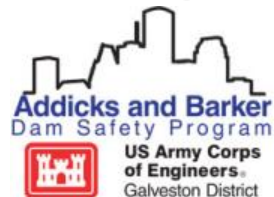
Sponsor: 100% Federal

Dam Safety Action Classification (DSAC): DSAC 1

Dam Safety Issues: High risk associated with seepage and piping beneath, around, and near the outlet works structure conduits and risks associated with auxiliary spillway flows and flows around the ends of the dams

Population at Risk: 1.2 million

Potential Economic Consequences: \$60 billion



Addicks Dam

Dam Type: Earth Embankment

Max. Height: 48.5-ft

Max Pool Elevation: 115-ft NAVD88

Length: 11.6 miles

Outlet Works: 5 – 8-ft x 6-ft gated conduits

Watershed/Drainage Area: 136 sq. mi.

Barker Dam

Dam Type: Earth Embankment

Max. Height: 36.5-ft

Max Pool Elevation: 108-ft NAVD88

Length: 13.6 miles

Outlet Works: 5 – 9-ft x 7-ft gated conduits

Watershed/Drainage Area: 130 sq. mi.



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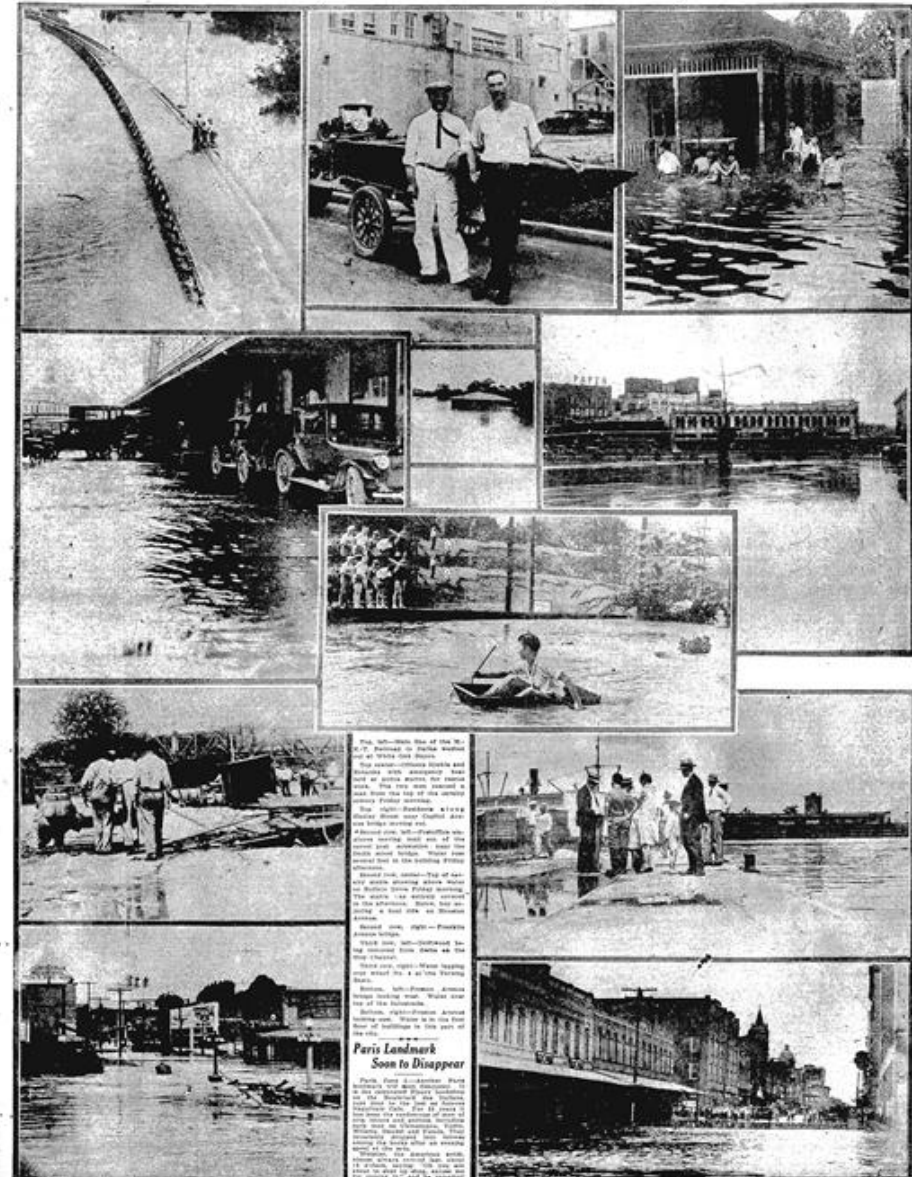
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Early Houston Floods

31 May 1929, 1-2 June 1929 and 7-10 December 1935

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Saturday, June 1, 1929 THE HOUSTON CHRONICLE
Scenes Taken in Many Sections of City Showing Flood Condition



HOME EDITION THE HOUSTON CHRONICLE
FLOODED BAYOUS ARE THREATENING HOUSTON



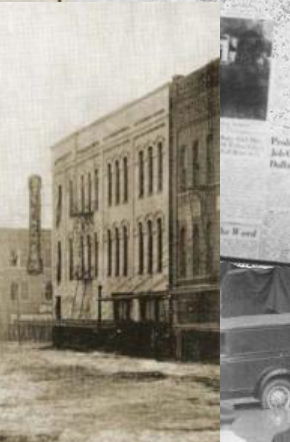
CITY, COUNTY ORDER FLOOD CONTROL PLAN
Little Girl Who Lost Doll In Flood Asks Goodfellows To Bring Toys To Little Brother



THE HOUSTON CHRONICLE
Anti-Looting Patrol Ordered: Brays Bayou Slowly Receding



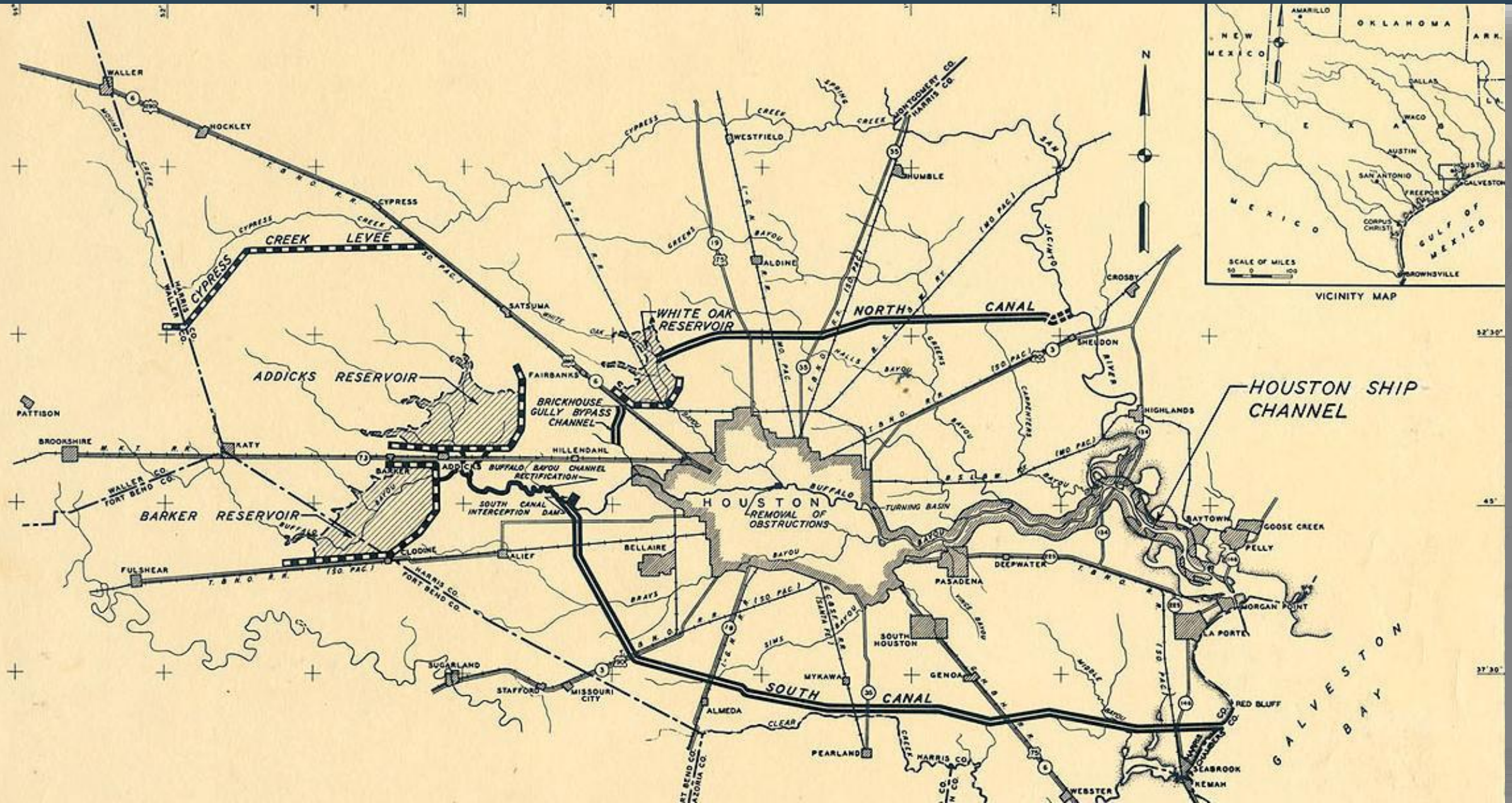
THE HOUSTON POST
Putney Fears Major Flood Here; Homes in Jacinto City Evacuated



THE HOUSTON POST
When Ramping Waters of Buffalo Bay Brought Houston's Most Disastrous



Buffalo Bayou & Tributaries 1940's Original Plan



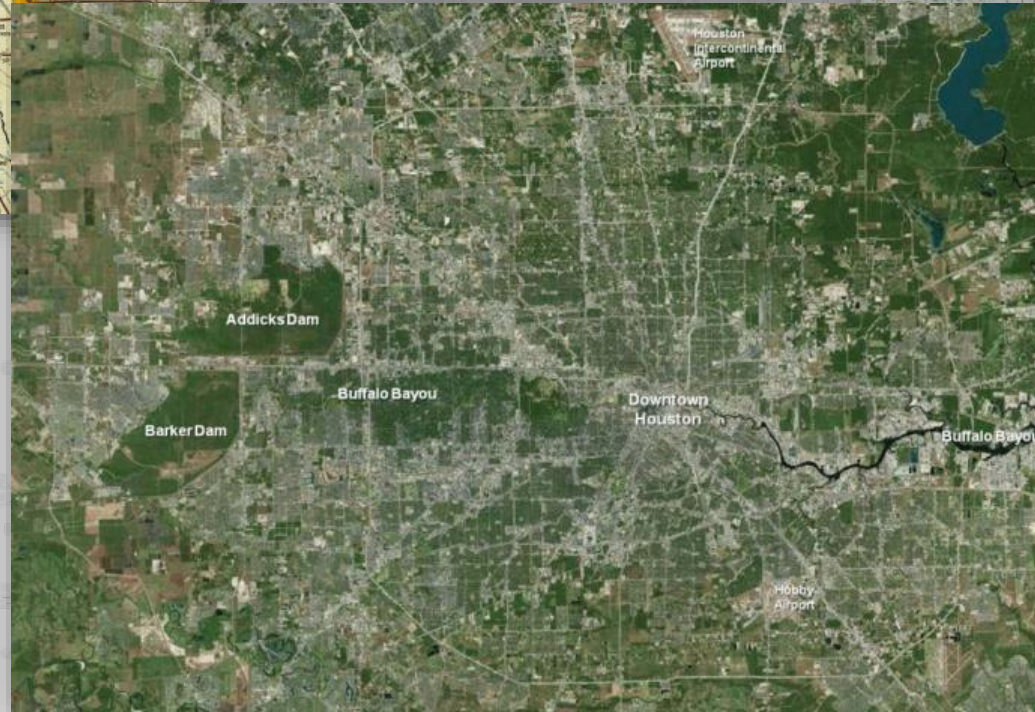
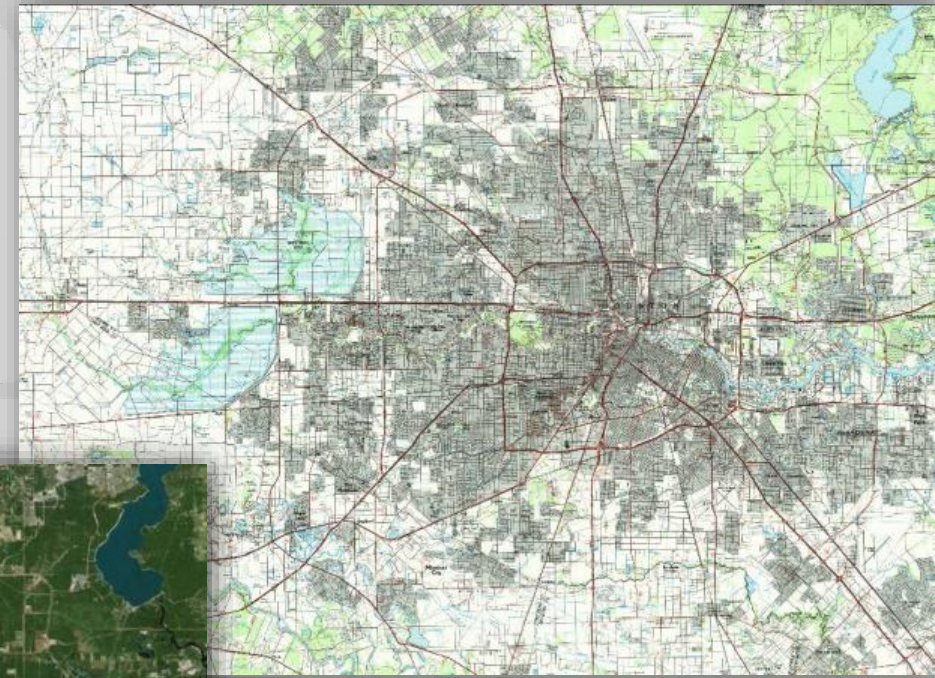
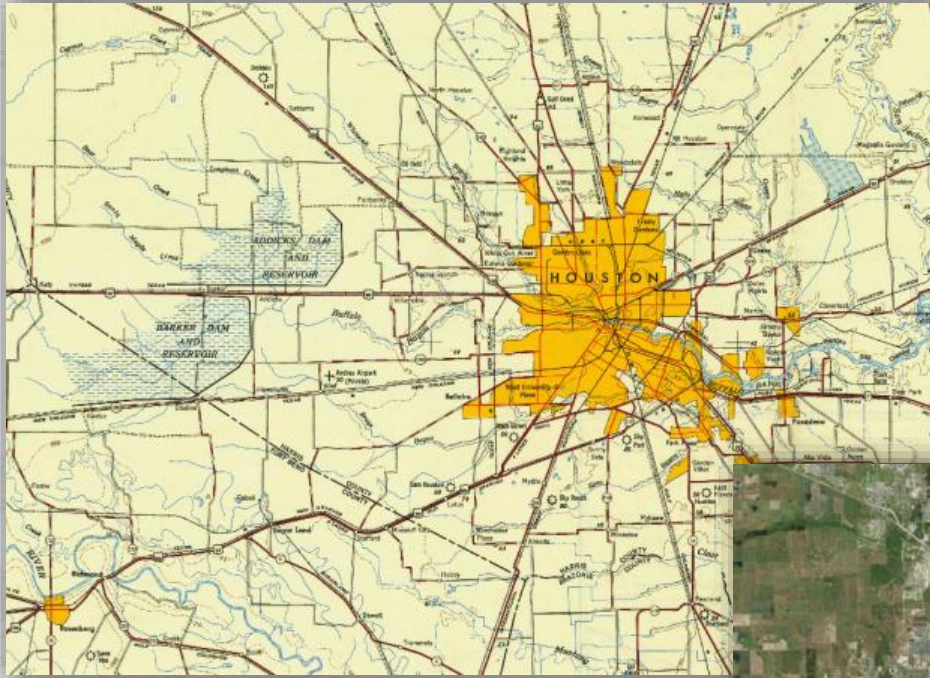
Construction of Addicks and Barker Dams 1942-1948

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Houston 1950, 1992, 2017

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Dam Safety Action Classification (DSAC)

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Urgency of Action (DSAC)	Actions for Dams in This Class	Characteristics of This Class
Very High (1)	Take immediate action to avoid failure. <u>Communicate findings to sponsor, local, state, Federal, Tribal officials, and the public. Implement interim risk reduction measures</u> , including operational restrictions. Ensure the emergency action plan is current and functionally tested for initiating event. Conduct heightened monitoring and evaluation. <u>Expedite investigations to support remediation</u> using all resources and funding necessary. Initiate intensive management and situation reports.	CRITICALLY NEAR FAILURE: Progression towards failure is confirmed to be taking place under normal operations. Dam is almost certain to fail under normal operations within a few years without intervention. OR EXTREMELY HIGH INCREMENTAL RISK: <u>Combination of life and economic consequences with likelihood of failure is very high. USACE considers this level of life-risk to be unacceptable</u> except in extraordinary circumstances.

September 2009: Issue Evaluation Study Team recommends classification be changed from DSAC 2 to DSAC 1

October 2009: Dam Senior Oversight Group concurred with recommendation and changed classification to DSAC 1

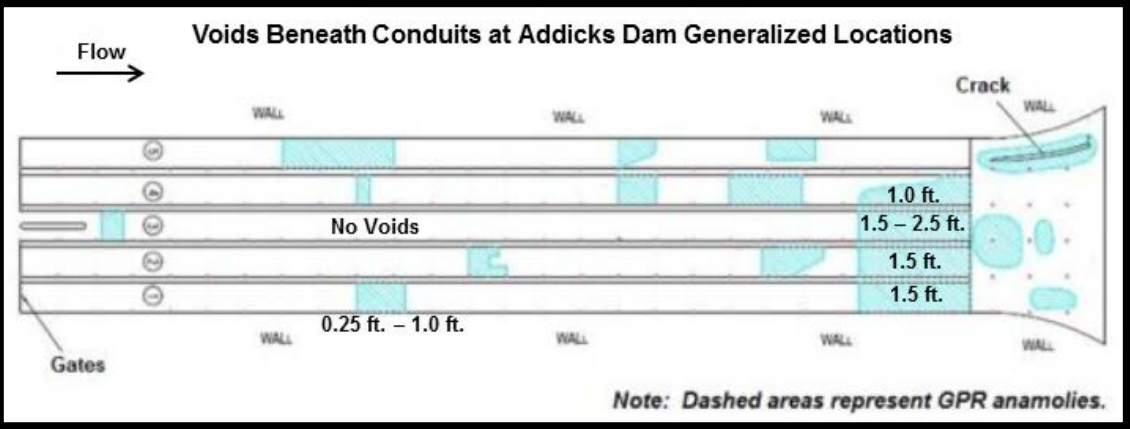
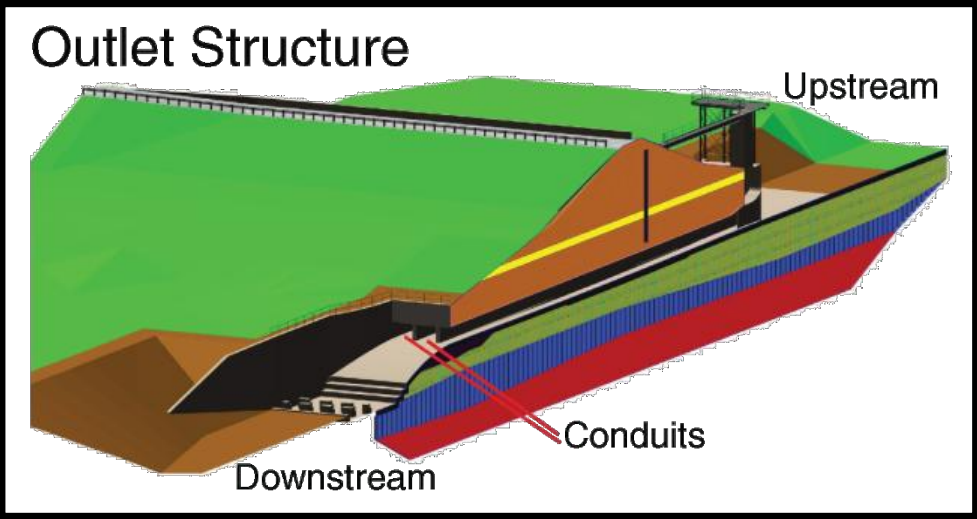


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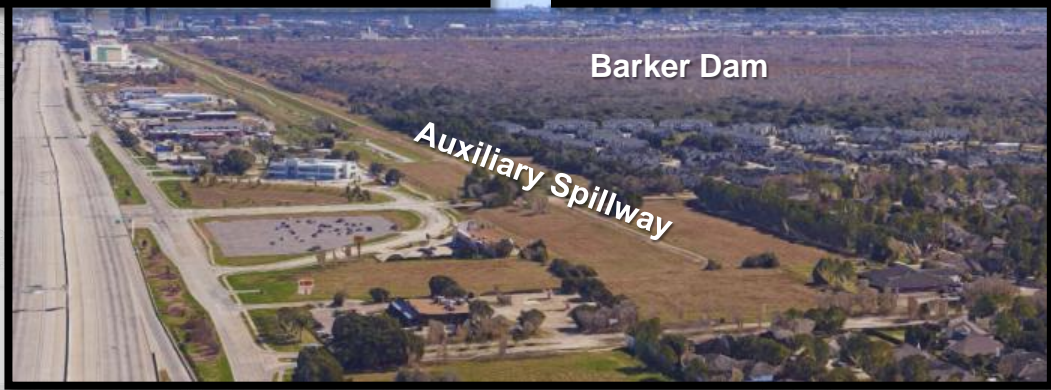


Dam Safety Issues

Seepage and Piping Beneath, Around, and Near the Conduits



Auxiliary Spillway Flows and Flows Around the Ends of the Dams



Interim Risk Reduction Measures

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Grouting of Conduits and Parabolic Chute



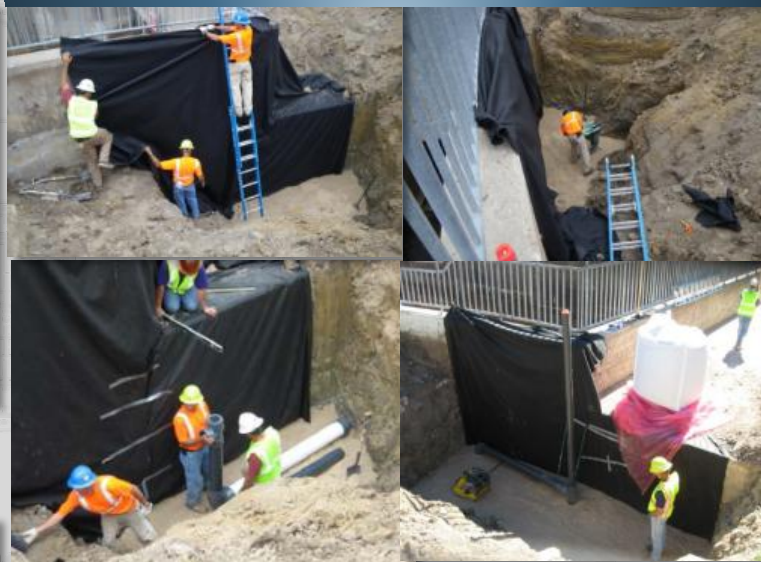
Parabolic Chute Slab Steel Plate



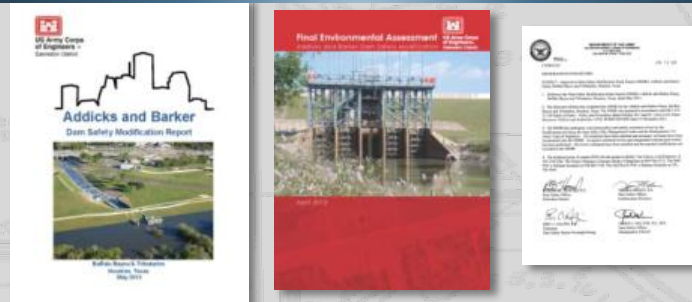
Gate Operators & Emergency Generators



Granular Filter Around Ends of Conduits



Dam Safety Modification Study



Barker Gate Replacement



September 2010
Polyurethane Grouting of Conduits & Parabolic Chute

April 2011
Cementious Grouting of Conduits & Parabolic Chute

May 2011
Granular Filter Around Ends of Conduits

August 2012
Barker Gate Replacement
Gate Operators & Actuators
Emergency Generators & Lighting

June 2013
Dam Safety Modification Report

July 2013
EA & FONSI

October 2014
Parabolic Chute Slab Steel Plate



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Public Meetings

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Public Meetings

- 12 Feb 2010 Public Release
- 17 Feb 2010 Mtg 1
- 18 Feb 2010 Mtg 2
- 24 Feb 2010 Mtg 3
- 25 Feb 2010 Mtg 4
- 09 Nov 2010 Mtg 5
- 29 Oct 2014 Mtg 6
- 09 Mar 2016 Mtg 7



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Social Media

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Galveston District, U.S. Army Corps of Engineers

HOUSTON (Sept. 14, 2016) - U.S. Army Corps of Engineers Galveston District and Houston Country Flood Control District staff provide Gary Waxman, Office of Management and Budget, with a tour of the of the ongoing construction at the Addicks and Barker reservoirs. The USACE Galveston District awarded a contract in the amount of \$71,902,340 to Granite Construction Company in 2015 for construction of new outlet structures at the dams in west Houston. Historic rains postponed construction earlier this year, but construction has resumed at the dams. Learn more about our projects at www.swg.usace.army.mil.

YouTube Addicks and Barker Dam Safety Program Video

Survey teams inspect Addicks and Barker dams [Image 3]

HOUSTON, TX, UNITED STATES 04.27.2016

Photo by Sandra Arnold

U.S. Army Corps of Engineers, Galveston District

HOUSTON (April 27, 2016) - David Byers, U.S. Army Corps of Engineers, Galveston District, and Jonathan Whitmore, USACE Galveston District survey Addicks and Barker dams as part of routine maintenance to mitigate the risk of flooding both above and below the dams. U.S. Army photo by Edward N. Johnson.

Addicks and Barker Dams

Search filters - Show

New to Twitter? Sign up now to get your own personalized timeline!

John Culberson @CongCulberson · 3 Oct 2016 Today, I toured the Addicks and Barker dams with the U.S. Army Corps of Engineers to discuss how... [instagram.com/p/BLHWmjCgS4/](https://www.instagram.com/p/BLHWmjCgS4/)

Tamara Hancock @Tamara_AGC · 25 Aug 2016 UGH! And, more rain is coming: Renovations to Addicks, Barker dams continue months after catastrophic flooding

USACE Galveston @USACEGALVESTON

TWEETS 1,973 FOLLOWING 861 FOLLOWERS 1,959 LIKES 146

USACE Galveston @USACEGALVESTON · 3 Aug 2016 Construction is underway for the Addicks and Barker Dam Safety Program. #AddicksandBarker swg.usace.army.mil/Missions/Dam-S...

Addicks and Barker Dam Safety Program

US Army Corps of Engineers Galveston District

0:14 / 18:24

Addicks and Barker Dams

More than a half century ago, in response to devastating floods that occurred in Houston in 1929 and 1935, the U.S. Army Corps of Engineers began construction of Addicks and Barker Dams in what was then undeveloped areas in far west Harris and west Fort Bend counties. This undertaking was a milestone in a longstanding partnership between the Corps and the greater Houston community.

Addicks and Barker reservoirs are located near the intersection of I-10 and State Highway 6. In an area considered to be in the upper watershed of Buffalo Bayou. They provide flood damage reduction along Buffalo Bayou downstream of the reservoirs and through the center of the City of Houston. But like much of our national infrastructure, Addicks and Barker have been around a long time. The Corps continuously inspects all of its dams nationwide to ensure the safety of the dams and the environment by ensuring that all dams are designed, constructed, operated and maintained as safely and effectively as possible.

under its Dam Safety Program, a program that shows our commitment to protecting lives, property and the environment by ensuring that all dams are designed, constructed, operated and maintained as safely and effectively as possible. The Corps Dam Safety Program provides a framework to ensure that both short and long term solutions are studied and applied and helps to ensure public safety for our local communities.

March 9, 2016 Public Meeting

HOUSTON - The U.S. Army Corps of Engineers Galveston District held a public meeting March 9, 2016, from 6:30 to 8:30 p.m. at Bear Creek Community Center, 3055 Bear Creek Drive, Houston, TX 77064, to update area residents and business owners about the Addicks and Barker Dam Safety Program, the 2016 Addicks and Barker construction plans and the proposed Section 216 Study. The USACE Galveston District awarded a contract in the amount of \$71,902,340 to Granite Construction Company in 2015 for construction of new outlet structures at the Addicks and Barker Dams in west Houston.

• March 9, 2016 Presentation slides

• Transcript

Dam Safety Program

The U.S. Army Corps of Engineers has a rigorous Dam Safety Program. As part of this program, the Corps continuously inspects all of its dams nationwide. This ongoing inspection and safety program demonstrates our commitment to protecting lives, property and the environment by ensuring that all of our dams are designed, constructed, operated and maintained as safely and effectively as possible.

The way we look at dam safety is changing. In the past, we looked primarily at the structural integrity of our dams as we assessed their risks to the public. Today, though, we are using a formula that combines dam safety risk

News: Construction Contract

Read more here about recent construction updates.

Corps Connections

3D Modeling Used

Addicks & Barker Master Plan

Addicks Reservoir Water Levels

Barker Reservoir Water Levels

Buffalo Bayou Water Levels at Piney Point

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New Outlet Structures Design and Construction

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Design Completion: May 2015

Contract Award: August 2015

Contractor: Granite

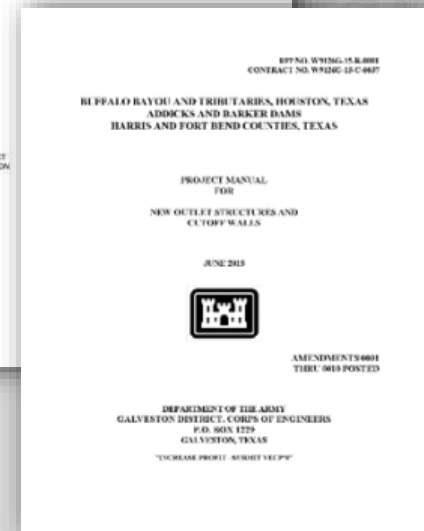
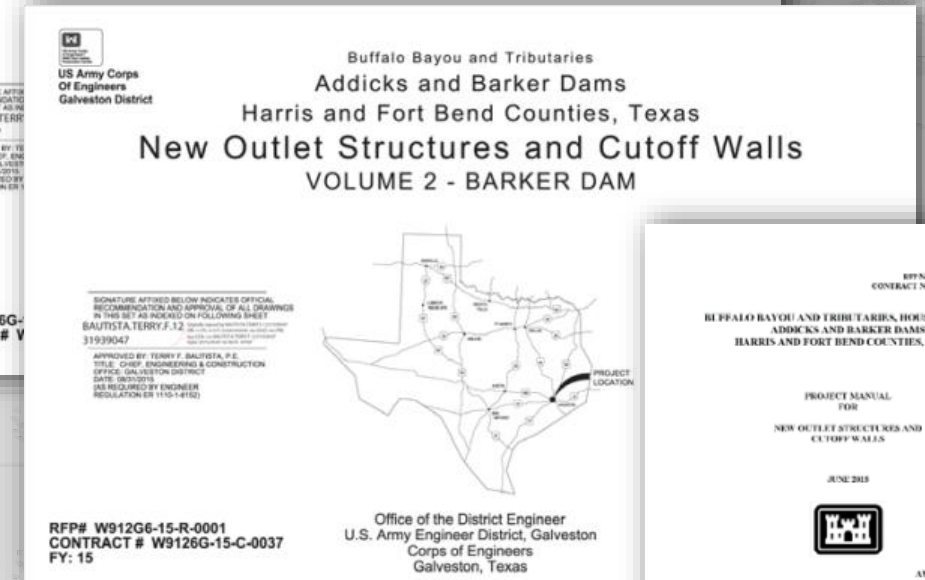
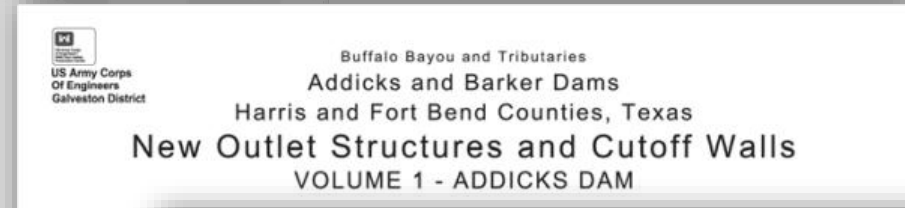
Construction Start: November 2015

Construction Completion: February 2020

Contract Award with Options: \$71,981,540

Contract Modifications: \$1,780,712

Current Contract Amount: \$73,762,252

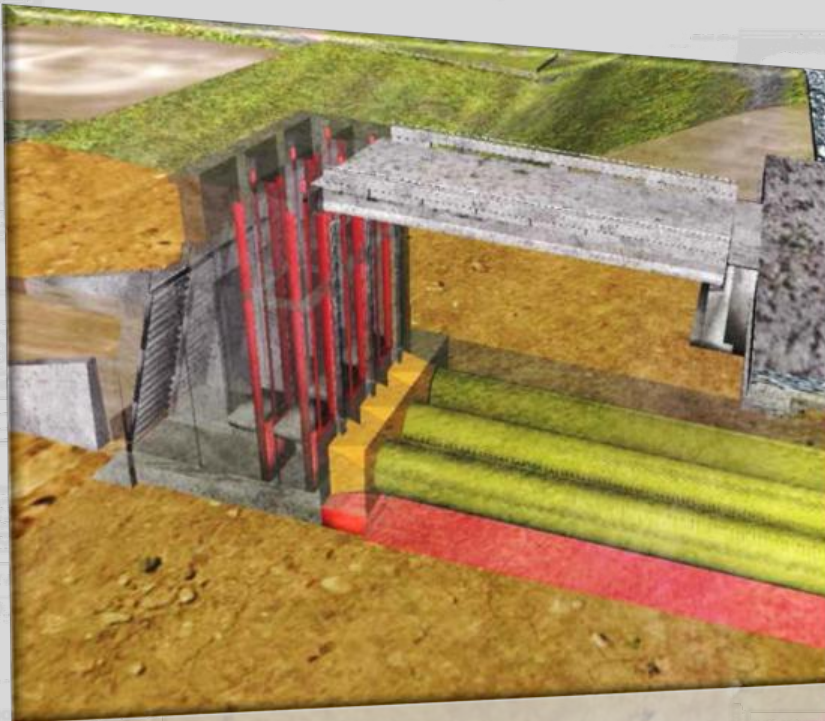


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Addicks and Barker Dams 3-D Model of New Outlet Structures

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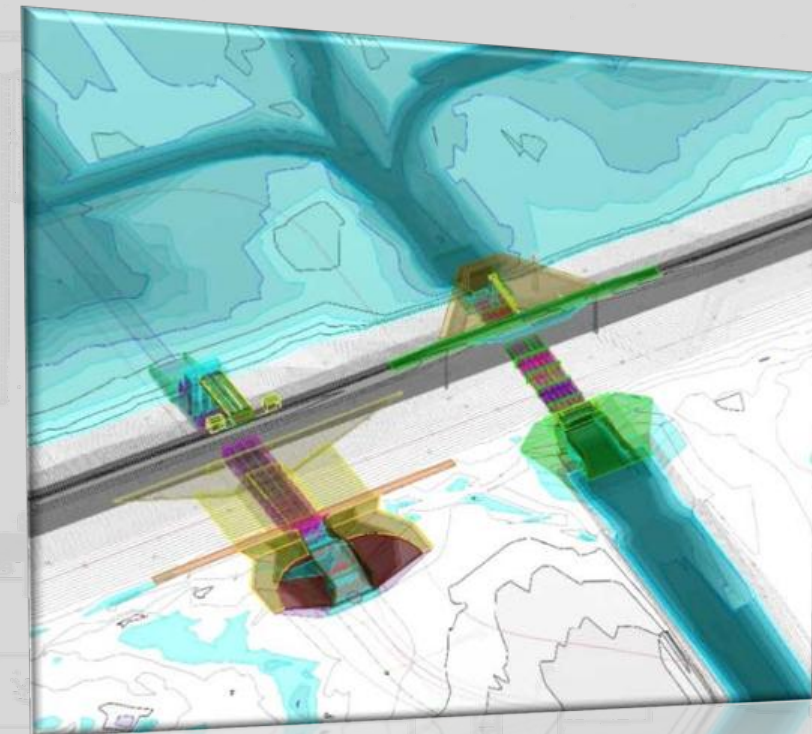


Barker New Outlet Structure

- Located within Existing Dam Embankment
- Approximately 400 Feet North from Existing Outlet Structure
- Three 12-Foot Diameter Steel Lined Conduits
- 12X12-Feet Rectangular Steel Gates at the Intakes

Noble Road Cut-off Wall

- 1,400-Feet long cement bentonite slurry cut-off wall
- Located along upstream embankment at Noble Road
- Will Address Seepage Issues at this Location



Addicks New Outlet Structure

- Located within Existing Dam Embankment
- Approximately 400 Feet West from Existing Outlet Structure
- Three 10-Foot Diameter Steel Lined Conduits
- 10X10-Feet Rectangular Steel Gates at the Intakes



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Addicks Dam Record Pools

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Addicks Dam Record High Pool

Elevation: 102.6 feet
Acre Feet: 123,067
Datum: NAVD 1988
Date: April 23, 2016

Addicks Dam Previous Record High Pool

Elevation: 97.4 feet
Acre Feet: 65,264
Datum: NAVD 1988
Date: March 9, 1992



SE Corner of Reservoir

Eldridge Parkway

State Hwy 6

Outlet Structure

Barker Dam Record Pools

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Barker Dam Record High Pool

Elevation: 95.2 feet

Acre Feet: 85,816

Datum: NAVD 1988

Date: April 23, 2016

Barker Dam Previous Record High Pool

Elevation: 93.6 feet

Acre Feet: 66,489

Datum: NAVD 1988

Date: March 6, 1992



NE Corner of Reservoir

Outlet Structure

George Bush Park

Westheimer Parkway

Addicks and Barker Dams Tax Day Flood Pools Emptied

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Addicks Dam 5 July 2016



Barker Dam 7 July 2016



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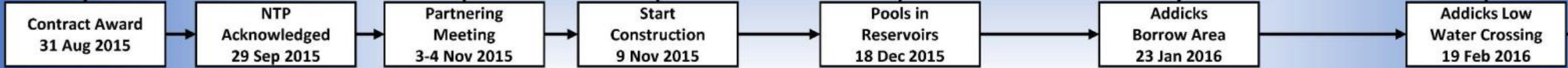
PROJECT STATUS



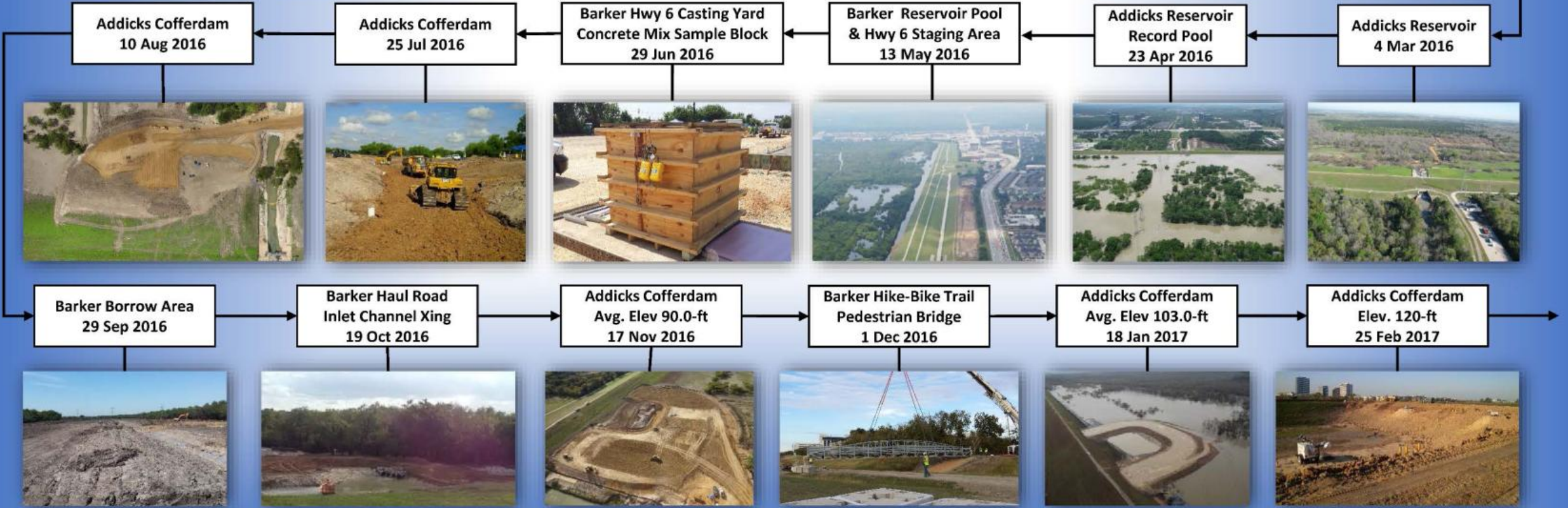
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Addicks and Barker Dams Construction Timeline





Addicks Cofferdam
Accepted
6 Mar 2017



Barker Cofferdam
20 Apr 2017



Addicks Primary
Excavation Mud Slab
19 May 2017



Barker Dam T-wall
Demolition
15 Jun 2017



Barker Cofferdam
Accepted 31 Jul 2017

Addicks Conduit
Installation
3 Aug 2017



Addicks and Barker Dams Construction Timeline

Addicks Dam New Outlet Structure and Cut-off Wall

A3 - Addicks New Outlet Channel Area



Addicks Reservoir

A1



A2

A3



A1 – Addicks Borrow Area and Haul Road



A2 – Addicks Muds Slab for New Outlet Structure



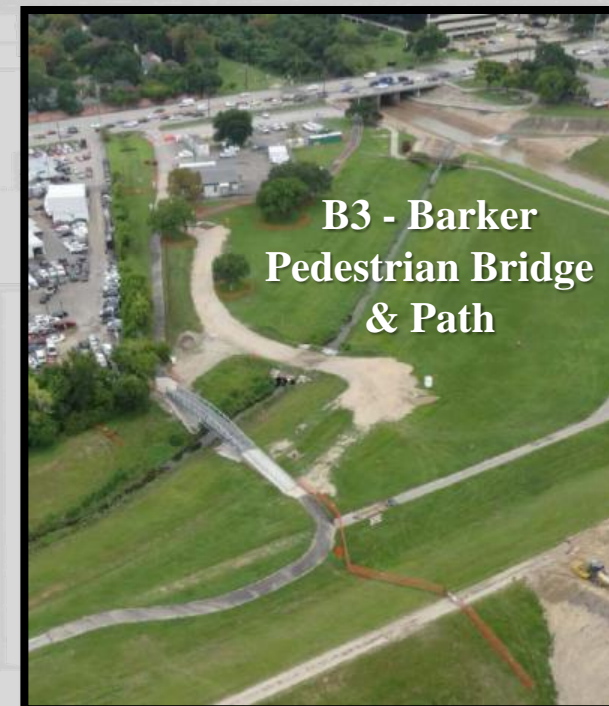
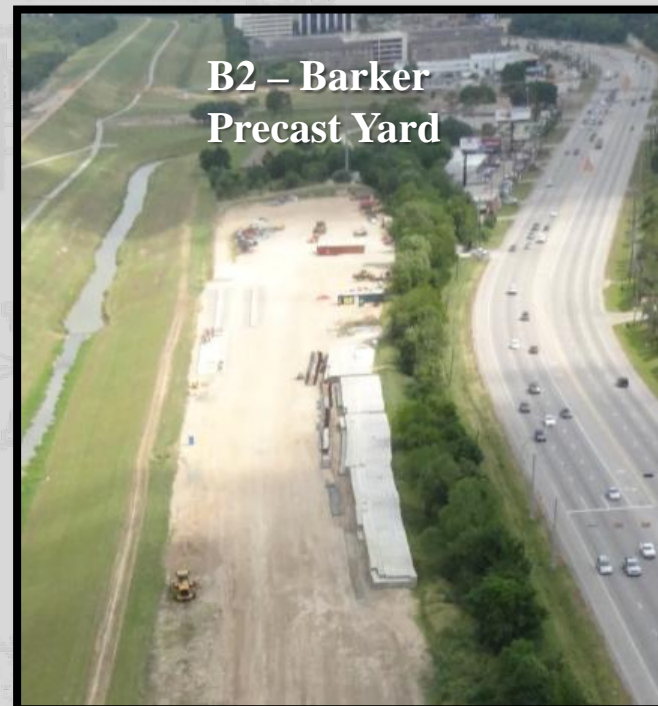
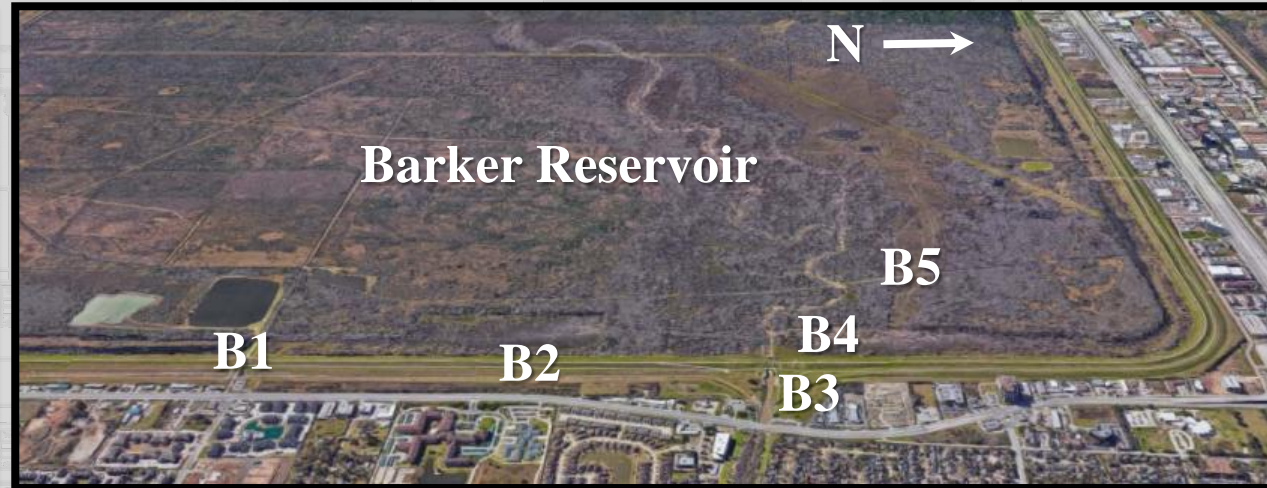
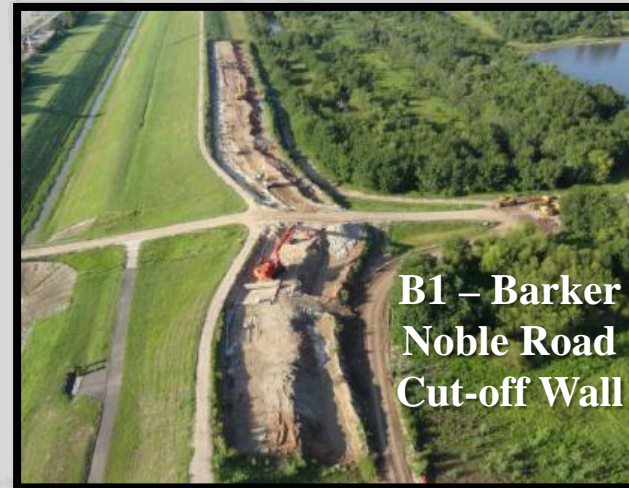
A2 - Addicks Cofferdam and Primary Excavation



A2/A3 - Addicks Cofferdam, Primary Excavation and New Outlet Channel Area



Barker Dam New Outlet Structure and Cut-off Walls



CRITICAL ISSUES & RISK REALIZED

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**COFFERDAM UNSUITABLE
MATERIALS**



**WATER LEVEL IN
RESERVOIRS**



**CUT-OFF WALL
PERMEABILITY AND STRENGTH**



QA TEST LAB



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Critical Issues and Risk Realized

QA Test Lab (Low Risk)

- Contracting Officer terminated (T4C) QA Test Lab contract due to protest
- Utilized GPC as short term measure
- SWF currently providing field lab support and has established mobile field lab onsite
- ERDC QA Lab inspection conducted 23-24 May 17
- ERDC validation letter forthcoming

Cofferdam Unsuitable Materials (Medium Risk)

- Increase in quantities for directed excavation resulting in contract modifications
 - Addicks Dam: \$540,000 and 27 additional calendars days
 - Barker Dams: \$155,000



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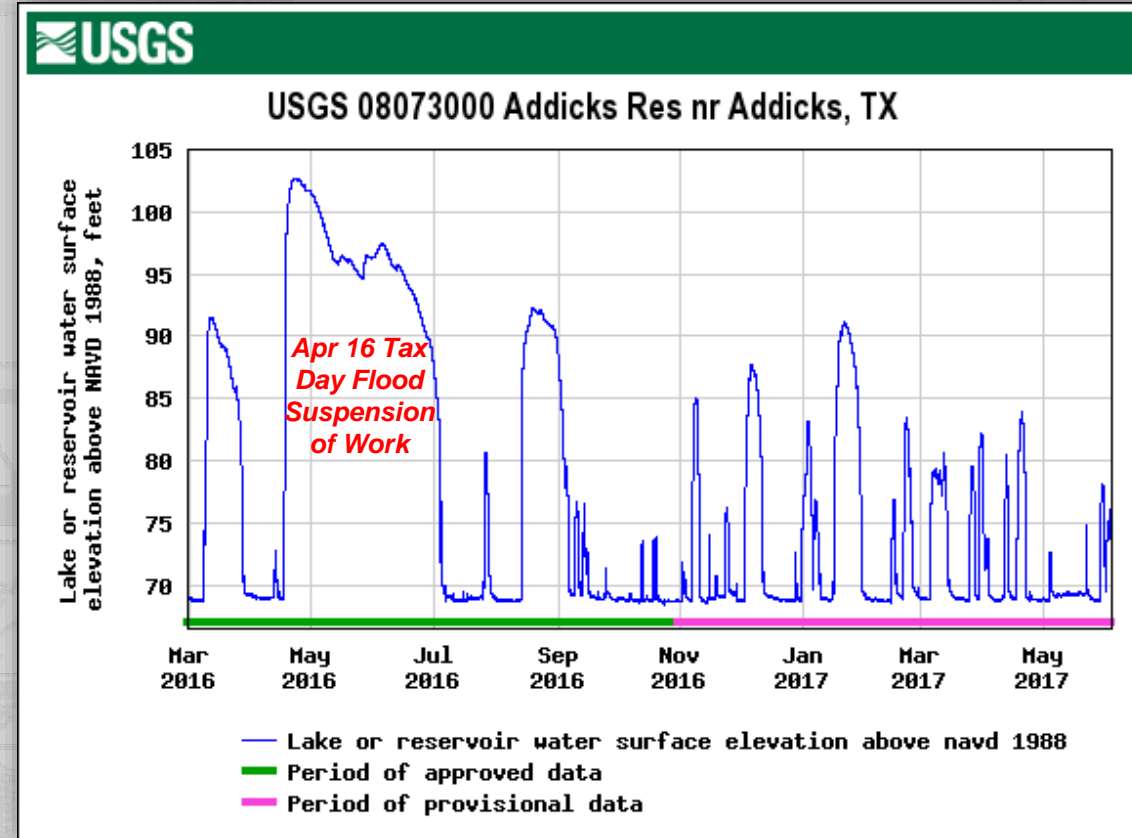


Critical Issues and Risk Realized

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Water Levels in the Reservoirs (High Risk)

- 62% of Calendar Year 2016 Impacted by Weather
 - April 2016 Tax Day Flood Suspension of Work Primary Contributor (22 Apr 16 - 17 Jul 16)
 - » Request for Equitable Adjustment negotiated for \$637,243.65 and 97 calendar days
- Features resequenced outside reservoirs to progress construction
 - Addicks Outlet Channel Clearing and Grubbing
 - Fabrication of Precast Erosion Protection Blocks
 - Alternate access into Barker Borrow Area
- Investigated alternate borrow sources for completion of cofferdams



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Cut-off Wall QA/QC Deficiencies (High Risk)

- Detailed reviews of slurry batching/placement CQC processes did not identify significant deficiencies
- Verification Drilling test results for compression and permeability did not match the results of the produced slurry sampling
- Notice of QA/QC deficiencies issued on 4 May 17 due to the verification drilling results
- Contractor evaluated alternative slurry mixes and performed trial batches
- 75/25% (Slag/Cement Ratio) Mix Approved by Government for use under new structure at Addicks Dam on 27 Jul 2017
- Contractor is of the opinion that SWG's approval of the 75/25 cut-off wall mix for Addicks Dam is a variance from the specifications and considers this as direction by the Government.
- Resident Engineer informed Contractor we do not consider this direction and that they may proceed with installation of the Addicks cut-off wall.
- Installation of the Addicks cut-off wall to start the week of Aug 14th



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Questions

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**Addicks and Barker
Dam Safety Program**

Thank You



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