



FLOOD



# UNPRECEDENTED

Federal Briefing 2018

OPPORTUNITY





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*Chief Engineer*
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*Project Manager*

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# Introduction to HCFCD

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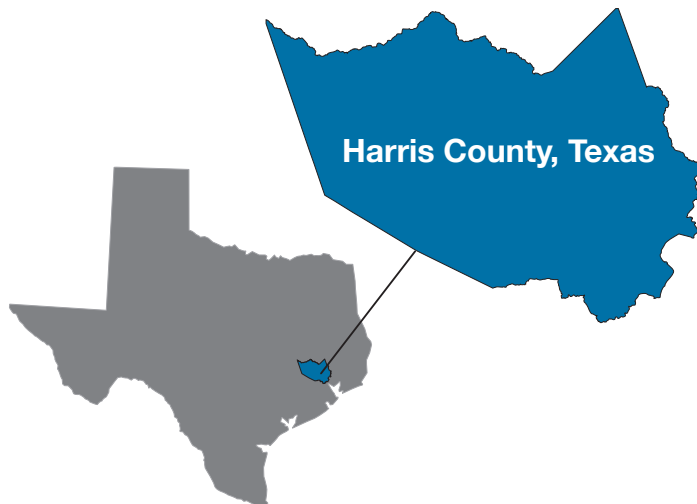


# Our Mission

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

Reduce the risk of flood damage by:

- Devising flood damage reduction plans
- Implementing the plans
- Maintaining the infrastructure



# VISION, MISSION, VALUES, GOALS

## VISION

To be respected for effectively implementing projects and programs that reduce flooding risks and damages and that improve quality of life with broad public support.

## MISSION

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

## VALUES

- Service to the community
- Fiscal accountability
- Responsible environmental stewardship
- Honesty, integrity and ethics in all work practices
- Accountability for our actions
- Positive attitude, respect and professionalism
- Open and effective communication
- Safe, productive, efficient and enjoyable work environment and teamwork
- Continuous improvement in all areas of our organization

## GOALS

- Reduce flood impacts by planning and implementing:
  - flood damage reduction projects that increase the carrying capacity of channels and create stormwater storage in detention basins.
  - flood risk reduction programs such as flood preparedness education, floodplain management support, flood warning and property acquisition.
- Optimize the service of and efficiently maintain District channels, detention basins and other infrastructure.
- Build and maintain District facilities that avoid, minimize, and/or mitigate environmental impacts.
- Incorporate multi-use elements in District facilities, such as recreation, open space, and environmental preservation and enhancements, if feasible.
- Promote the successful design, construction and function of District facilities built or modified by others for land development and infrastructure projects.
- Encourage and promote local, state and federal partnerships.





## Background

- The Harris County Flood Control District (District) is a special purpose district created by the Texas Legislature in 1937 in response to devastating floods that struck the region in 1929 and 1935. Harris County Commissioners Court is the governing body of the District. The District's boundaries are coincident with Harris County, a community of more than 4.5 million that includes the City of Houston. The District's mission, in simple terms, is to: (1) Devise flood damage reduction plans; (2) Implement the plans; and (3) Maintain the infrastructure.
- Nature gave us 22 primary watersheds within the county's 1,756 square miles, each with its own independent flooding problems. The District's drainage and flood control infrastructure is extensive, including more than 1,500 channels totaling about 2,500 miles in length (about the distance from Los Angeles to New York); and more than 200 stormwater detention basins (9,189 acres) ranging in size (from 1 to 1,400+ acres). Nature also challenges us with flat terrain, clay soils that do not absorb water well, and an average annual rainfall of 48 inches. The flooding problems in the community are severe with over a hundred thousand homes and businesses in the identified 1% FEMA flood plain (not all flooding areas are mapped), and projects to reduce the risk are estimated to cost several billion dollars.
- The District's income is derived primarily from a dedicated ad valorem property tax. The rate is currently set at 2.831 cents per \$100 valuation (the statutory limit for the District's tax rate is 30 cents). Capital projects are funded with pay-as-you-go cash in hand, long term bonds, impact fees, as well as funds received from federal partnerships. By using these combined resources, we are able to leverage our local resources to implement more projects across Harris County. The District's Capital Improvement Program proposed for FY2018-19 is locally funded to \$60 million based upon our tax rate.
- The District has just over 300 full time staff. The District obtains virtually all engineering design work for capital projects and maintenance repairs through consulting contracts, and obtains all construction work through competitive bidding. All of the District's routine maintenance (primarily mowing) is performed through contracts with private companies.
- The District's Mission Statement is: "Provide flood damage reduction projects that work, with appropriate regard for community and natural values." This balancing act is a continual challenge in the third most populous county in the United States, and achieving needed flood risk reduction within financial limitations is the major component of the District's commitment to make every taxpayer dollar count.

## Fact Sheet

### Background

- Special purpose district created by the Texas State Legislature in 1937.
- HCFCD boundaries coincident with Harris County, 1,756 square miles.
- Harris County Commissioners Court oversees HCFCD and appoints Executive Director.
- Harris County population – 4.5 million, 3rd most populous in U.S.
- 34 cities in Harris County, including Houston, 4th most populous city in U.S.
- 9 U.S. Congressional Districts.
- 22 primary watersheds, 1,500 channels, and 2,500 miles of channel.
- 200 detention basins, covering 9,189 acres and ranging in size from 1 to 1,440 acres.
- 3,030 buyout lots covering about 1,060 acres.

### Funding

- Current Fiscal Year Funding
  - *Operations and maintenance – \$76 million*
  - *Capital projects – \$178 million*
- Operation and maintenance funding source – dedicated ad valorem property tax. In 2017, rate was 2.831 cents per \$100 valuation.
- Capital projects funding source – pay-as-you-go cash in hand, long term bonds, and impact fees.
- Capital Improvement Program – currently \$100 million/year (includes Federal funds leveraged with HCFCD funds. Does not include Federal funds spent directly by the Corps of Engineers).
- HCFCD is currently authorized to issue up to \$64 M in bonds to support its CIP.

### Staffing

- 300 plus full time employees
- Almost all planning, design, maintenance, and construction are contracted.
  - 25 term maintenance contracts
  - 100+ active engineering contracts for capital and maintenance support
  - 39 active construction contracts for capital and maintenance work

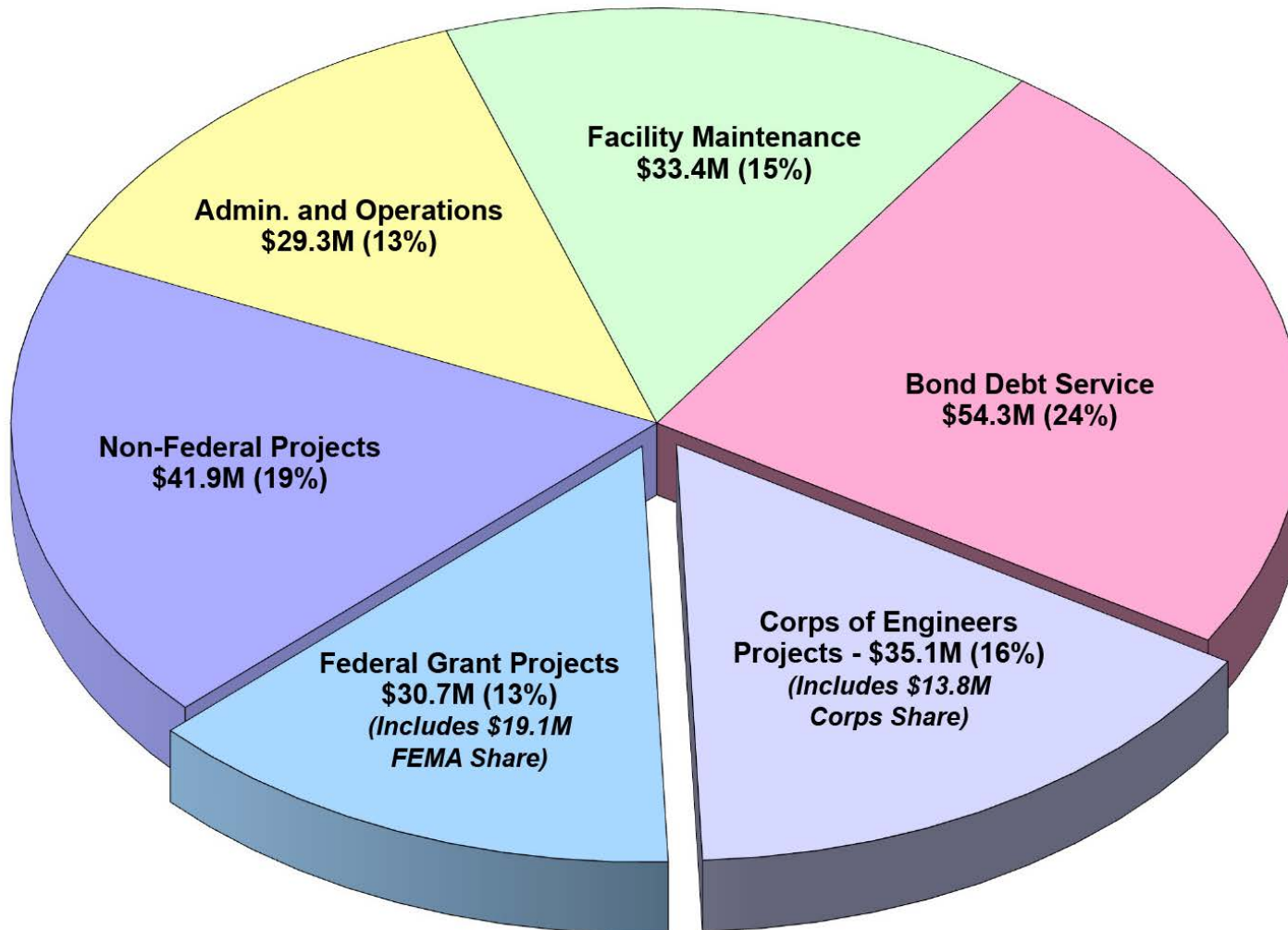
### Federal Partners

- U.S. Army Corps of Engineers – Flood Damage Reduction Projects (6 active projects).
- Federal Emergency Management Agency – Floodplain Model and Map Management; LOMR Delegation; Hazard Mitigation Grant Program, Flood Mitigation Assistance, and Pre-Disaster Mitigation (home buyouts and structural projects).
- National Weather Service – Flood watch and flood warning collaboration, cooperative data collection and analysis.
- U.S. Geological Survey – Streamgauge network cooperating partner and assistance with local data collection.
- Natural Resources Conservation Service – Emergency Watershed Protection Program (Infrastructure repairs).



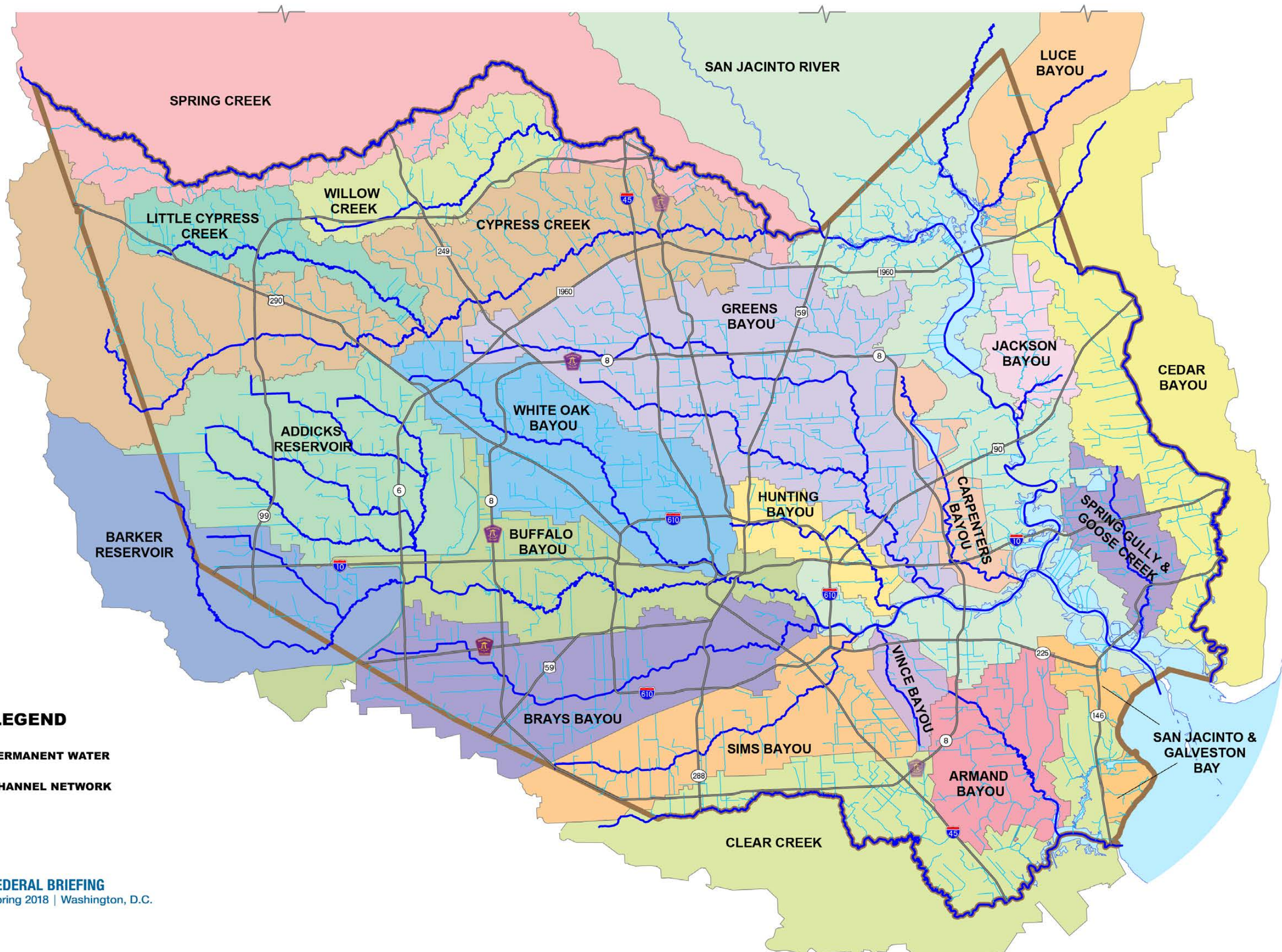
## HCFCDD Expenditures for FY2017-2018 (millions)

Total - \$224.7 million





# Harris County Watersheds



## LEGEND

- PERMANENT WATER
- CHANNEL NETWORK



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# Hurricane Harvey

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## Hurricane Harvey

When Tropical Storm Allison drowned most of Harris County in 2001, it was an extraordinarily devastating flood. We knew it was not the last. Tropical rain and flooding will always be the primary natural threats to Harris County and the Gulf Coast. In late August 2017, 16 years after Allison, Hurricane Harvey set almost unimaginable new precedents of flooding and destruction in Harris County, southeast Texas, and along the Texas coast. Now, in the wake of unprecedented disaster, there is also opportunity – to apply lessons learned; to expedite the completion of active projects; to better understand and reduce flood risks through new studies and projects; to harness improvements in technology and data; to build new partnerships and strengthen old ones.

Hurricane Harvey was a dramatic continuation of one of the most active periods of rainfall and flooding in recent history across Harris County. Since 2015, following a multiyear drought, Harris County residents experienced six major floods (including one just weeks before Harvey) and several minor floods or significant rainfall events. However, unlike any event that came before it, Harvey's impacts were disastrous across nearly all of Harris County's 22 watersheds. This pattern in recent years has understandably heightened public awareness and expectations of the work that HCFCD carries out with its Federal partners. No project will completely protect against an event like Harvey, but we are committed to further reducing the risk through the opportunities that are before us.

### Overview

- Landfall 10:00 p.m., Friday, August 25, 2017 near Rockport, Texas as a Cat 4 hurricane (130 mph). Tracked northwest, stalled southwest of Harris County and then slowly meandered south and east of Harris County for 4 days. Ended up making 3 landfalls while meandering.
- Almost the entire time, heavy rainfall occurred somewhere in Harris County.
- High winds and wind-related damages did not occur in Harris County.
- Storm surge was not a factor in Harris County.

### Rainfall

- Rainfall occurred over 7 days, but flooding was a result of an extraordinarily high 4-day rainfall event of 28-44" widespread with an isolated 47.4" peak at I-45 and Clear Creek southeast Harris County (95% of the probable maximum precipitation). The peak 1-hour amount was 6.8".
- Harvey set county record rainfall amounts for all durations except for 6, 12, and 24-hour durations. Tropical Storm Allison in June 2001 still holds those records.
- Harvey shattered U.S. record for 5-day rainfall average over a 2,000 square mile area (about the size of Harris County) - 43.7" (previous record 29.8" in 1940 in Louisiana).
- Four-day rainfall average over the entire county was 33.7" (69% of the probable maximum precipitation) and the volume was about one trillion gallons which would fill the Astrodome 3,200 times.

### Impacts - Harris County

- 4.7 million people impacted – Everyone!
- 60,000+ persons rescued
- 32,000 sheltered
- 36 fatalities (5 in home or at work)
- Estimated 140,000-160,000 homes/businesses flooded (TS Allison 73,000)
- 300,000 vehicles flooded
- 47,000+ flood insurance claims (\$2.9B so far)
- 15,800 Small Business Loans (\$1.2B so far)
- 177,600 Individual Assistance approvals (\$4.8B)
- Est. damage to HCFCD infrastructure \$80 M
- Est. total regional damage \$125B (Katrina \$160B, Sandy \$70B) – among the costliest in U.S. history



## **Avoided Damages**

Where event-specific benefits have been modeled, HCFCD estimates that its Federal partnership projects prevented flooding of more than 20,000 homes during Hurricane Harvey:

- Brays Bayou Section 211(f) Project: 10,000 homes
- Sims Bayou Federal Project: 6,500 homes
- White Oak Bayou Section 211(f) Project: 5,500 homes
- Home Buyout (including FEMA-partnered): 2,300 homes

HCFCD also estimates that the above projects and home buyouts have cumulatively avoided flooding of more than 35,000 homes across six major floods since 2015.

Although difficult to accurately quantify, total avoided damages across Harris County during Hurricane Harvey and other recent floods certainly exceed the above totals. Federal projects in the Greens Bayou, Hunting Bayou, and Clear Creek watersheds continue to reduce flood risks as they are built. Across Harris County, local and regional HCFCD flood damage reduction projects have reduced flood risks for tens of thousands of homes over the decades. And since the 1980s, improved development and drainage regulations have reduced flood risks in new development while not increasing risks downstream. As a result, a substantial number of the hundreds of thousands of homes built in Harris County since the 1980s have been spared from flooding in recent decades. The population of Harris County has steadily risen by nearly two million people during this time.

## **Blessings**

- Not a wind event in Harris County → electricity outages, wind damage, and storm surge minor
- People took warnings seriously – stayed home Saturday night!
- First week → No work, no school – helped friends, family, neighbors, strangers
- Outpouring of support from Texas and nation
- Cool front a few days later
- Survivor's Resolve

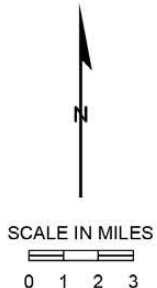
## **Lessons Learned**

- Preparation - plans, procedures, and practice important
- Public comprehension of forecasted rainfall and potential flooding
- Nonstop curve balls, change-ups, and fast balls
- Effective communication between departments, agencies, media, and public critical
- Partnerships matter!
- Be flexible & make improvements

## **Recovery**

- Emergency repairs to HCFCD infrastructure complete (\$5 M)
- Removal of debris from channels about 90% complete, 100,000+ CY to date
- Repairs to damaged channels, facilities, and gages ongoing, with more planned
- Countless lives forever changed

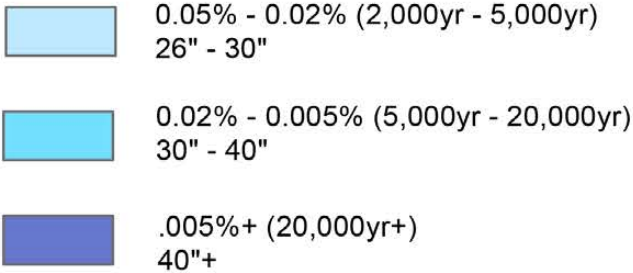
# Four Day Peak Rainfall Frequency



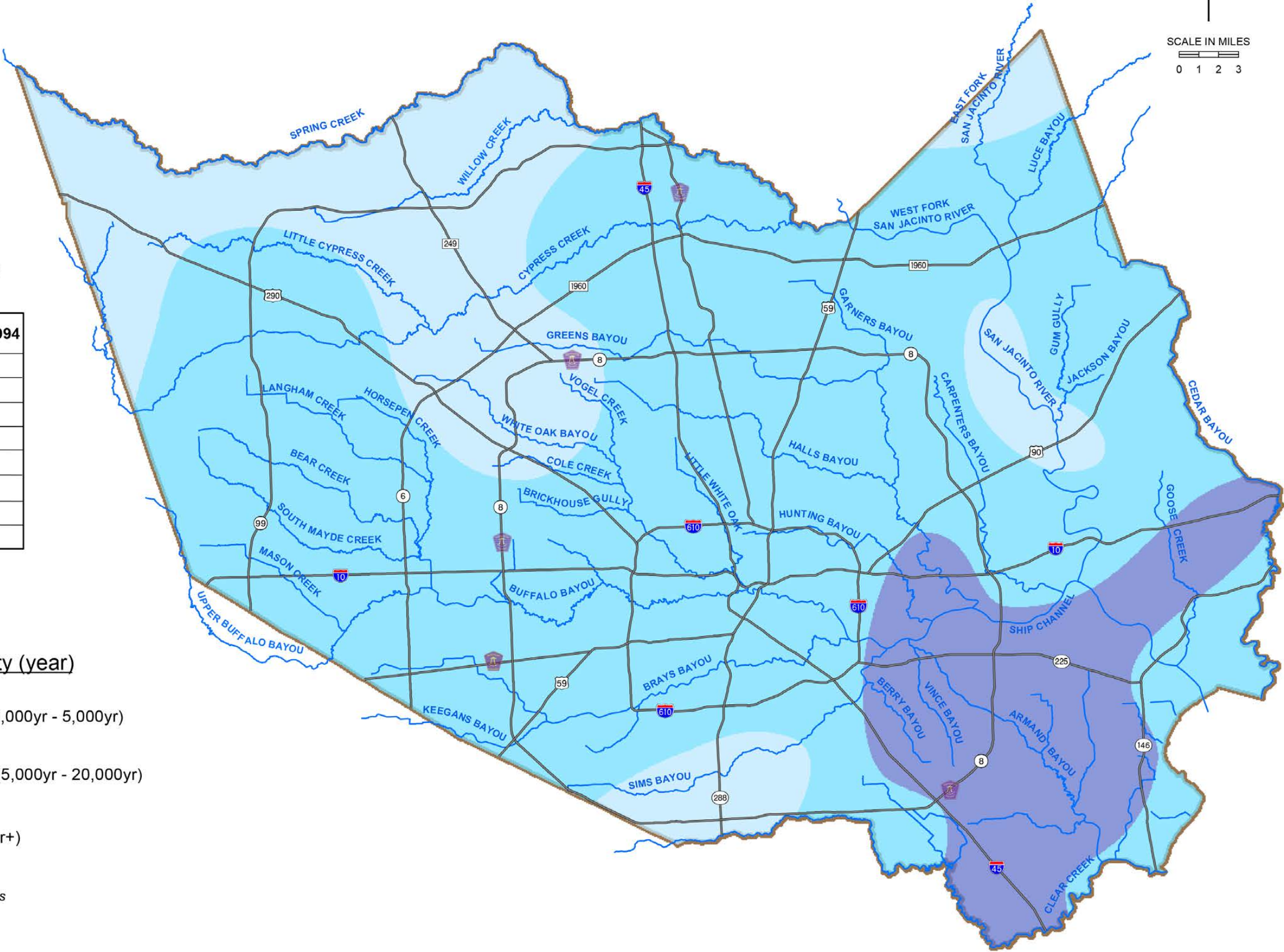
## Harvey Versus Other Major Floods

Duration	Harvey August 2017	Allison June 2001	Tax Day April 2016	October 1994
1-hr	6.8	5.7	4.7	3.7
2-hr	11.9	9.9	7.3	4.7
3-hr	14.8	13.5	8.3	5.3
6-hr	18.9	21.2	13.9	7.2
12-hr	20.9	28.3	16.7	12.0
24-hr	25.6	28.4	17.4	20.9
2-days	35.2	28.5	17.5	23.1
4-days	47.7	38.5	N/A	28.9

### Exceedance Probability (year)

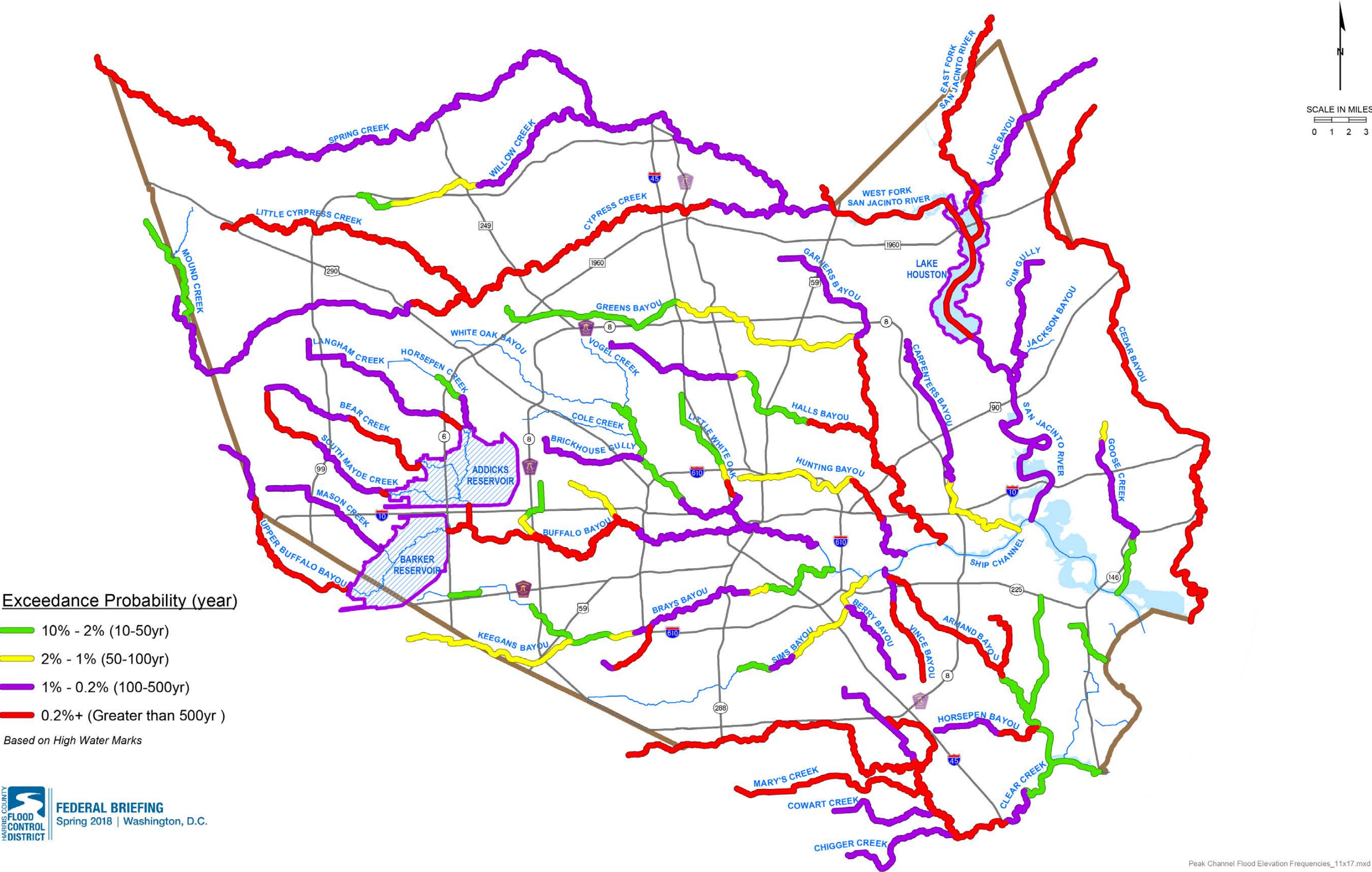


Based on HCFCD Rainfall Gages





# Peak Channel Flood Elevation Frequencies







Addicks Reservoir, West Harris County  
Hurricane Harvey  
August 2017



Barker Reservoir, West Harris County  
Hurricane Harvey  
August 2017



Buffalo Bayou Watershed, West Harris County  
Hurricane Harvey  
August 2017





Inverness Forest Levee near Hardy Toll Road  
North Harris County  
Hurricane Harvey  
August 2017



Cypress Creek Watershed  
Northwest Harris County  
Hurricane Harvey  
August 2017



Cedar Bayou Watershed, East Harris County  
Hurricane Harvey  
August 2017





San Jacinto River at US-59, Northeast Harris County  
Hurricane Harvey  
August 2017



Kingwood High School  
Northeast Harris County  
Hurricane Harvey  
August 2017



Lake Houston Spillway  
Northeast Harris County  
Hurricane Harvey  
August 2017



Halls Bayou Watershed, Central Harris County  
Hurricane Harvey  
August 2017

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# Historic Flooding

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## National Flood Insurance Program (NFIP) Statistics for Harris County, Texas 1978 - 2017

**Total number of claims:** 86,559 (2016); 2017 TBD

**Total claims paid:** \$2,639 million at time of payment (1978-2016)  
\$3,507 million in 2017 dollars

**Number of policies:** 179,440 in 2001  
274,239 in 2017

### Top 10 Number of Claims/Year

Event	Year	Number of Claims	Claims Paid Unadjusted (millions)	Claims Paid 2016 Dollars (millions)
Hurricane Harvey	2017	TBD*	TBD**	TBD
Tropical Storm Allison	2001	20,165	\$782.8	\$1,077.2
Hurricane Ike	2008	7,491	\$277.5	\$310.7
2 spring floods	2016	6,986	\$427.0	\$434.0
Tropical Storm Claudette + 2 floods	1979	6,092	\$50.0	\$169.4
Memorial Day and Halloween Floods	2015	6,060	\$387.7	\$398.0
2 spring floods	1989	4,609	\$63.6	\$125.5
2 spring floods	2009	4,195	\$133.2	\$151.3
Hurricane Alicia + 1 fall flood	1983	4,066	\$51.9	\$127.8
1 spring flood	1981	3,850	\$22.8	\$61.6
3 fall floods	1998	3,052	\$63.5	\$95.4
<b>Totals (thru 2016)</b>		<b>66,566</b>	<b>\$2,260.0</b>	<b>\$2,950.9</b>

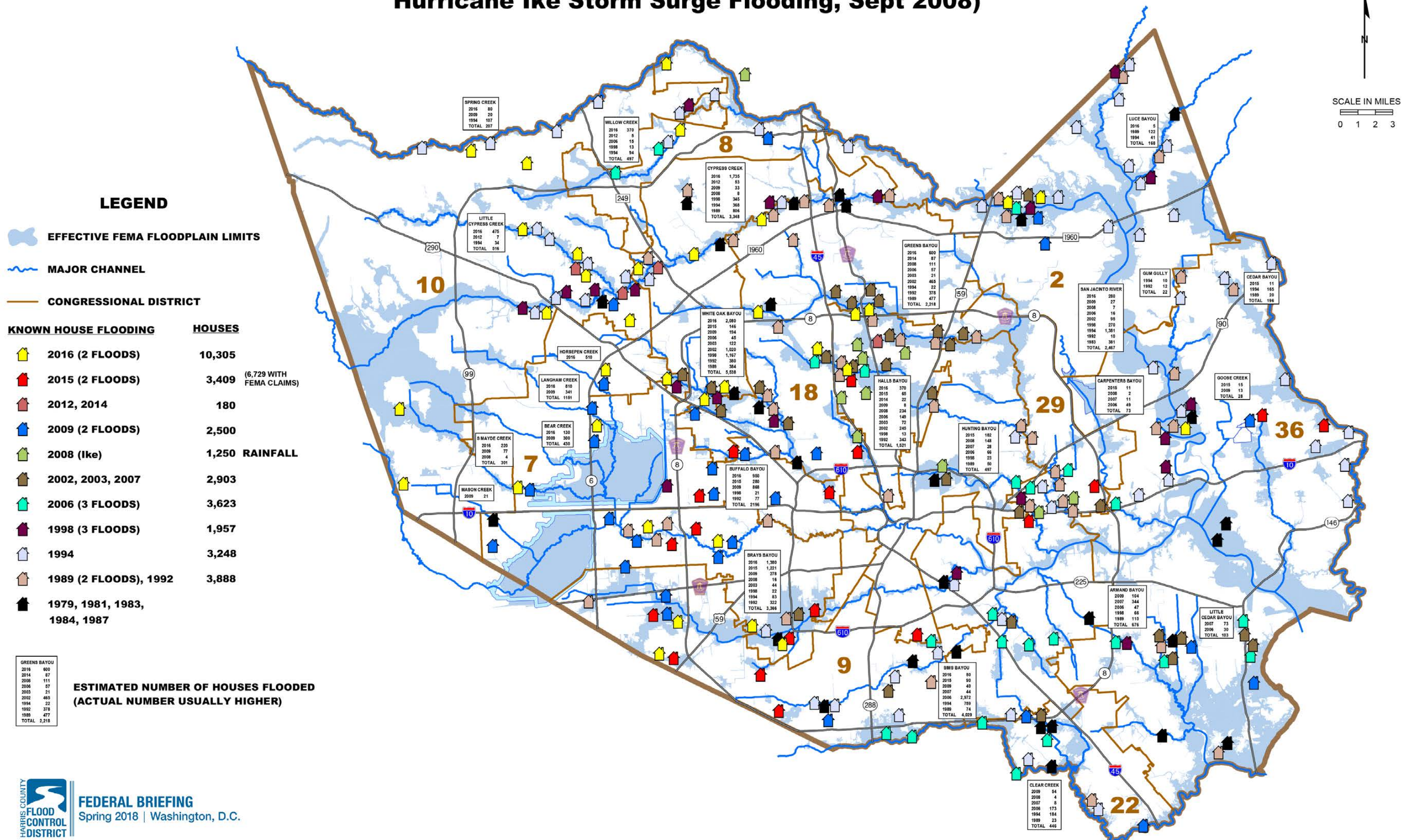
\*47,000 claims as of 1/12/18

\*\*\$2.9 B paid as of 1/12/18



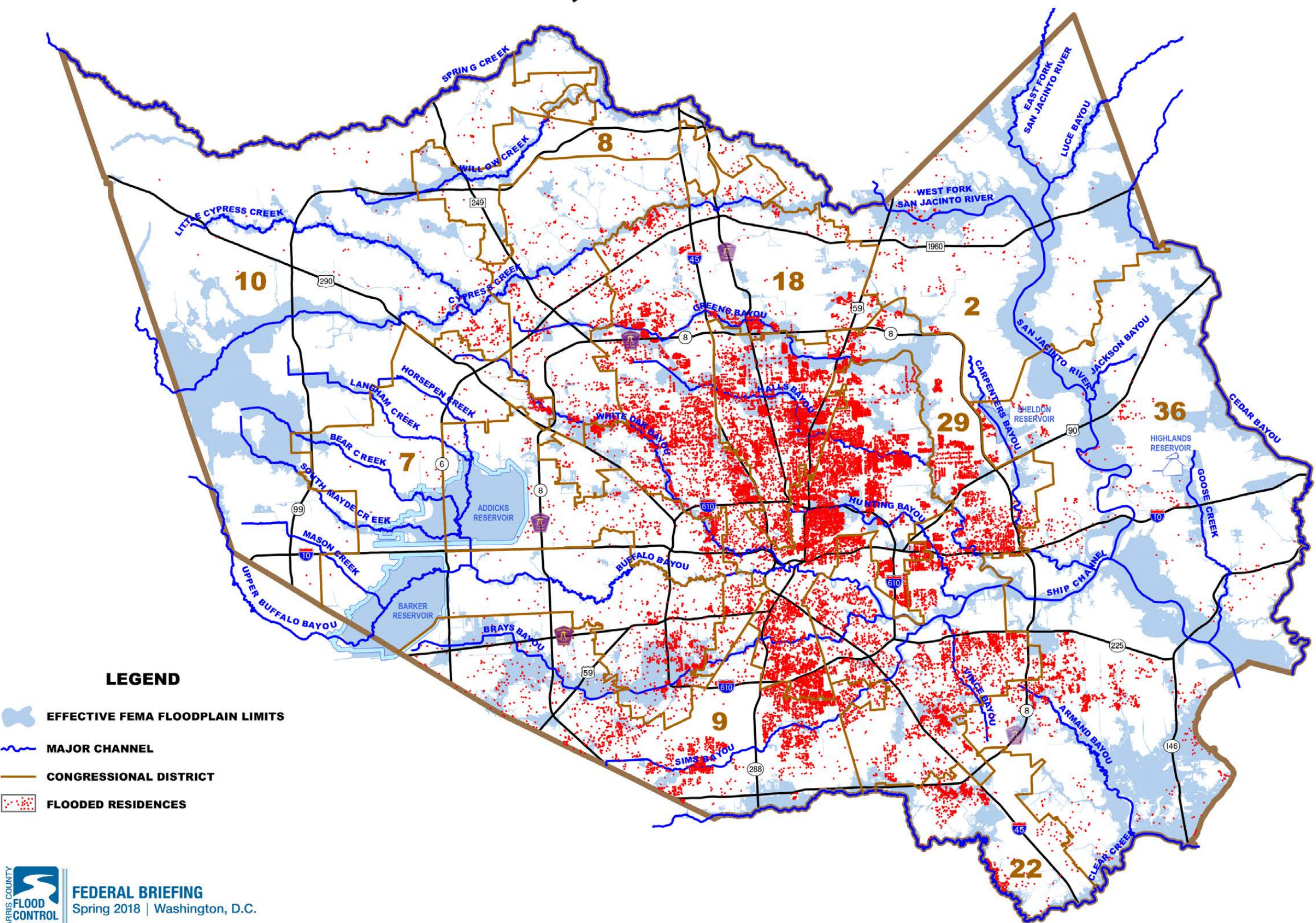
# House Flooding and 1% (100 Year) Floodplains

(Does Not Include Hurricane Harvey, August 2017, Tropical Storm Allison, June 2001 or Hurricane Ike Storm Surge Flooding, Sept 2008)





# Tropical Storm Allison June 8-9, 2001 Flooded Residents



## Harris County Residential Flooding Only

59,000	HOUSES
11,000	APARTMENT UNITS
2,500	MOBILE HOME
72,500	TOTAL

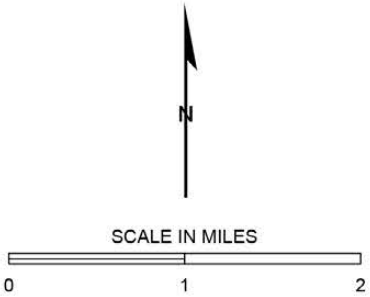
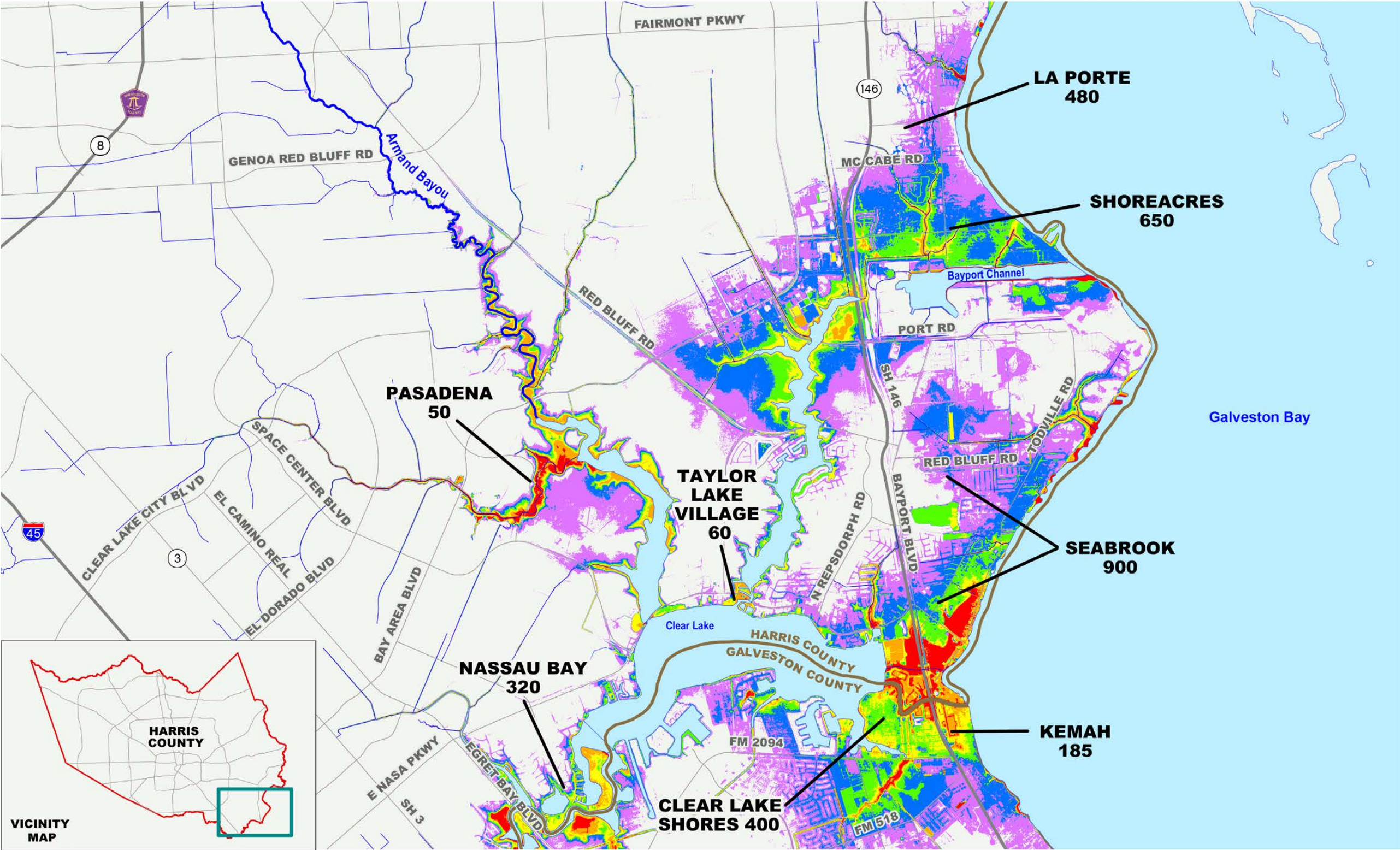
## By Watershed

Armand Bayou	1,990
Brays Bayou	6,200
Buffalo Bayou	2,620
Carpenters Bayou	550
Clear Creek	1,770
Cypress Creek	1,140
Greens Bayou	15,590
Halls Bayou	12,820
Hunting Bayou	8,270
San Jacinto River	2,880
Sims Bayou	6,290
Vince Bayou	1,430
White Oak Bayou	11,140

Other watersheds had less than 150 each.

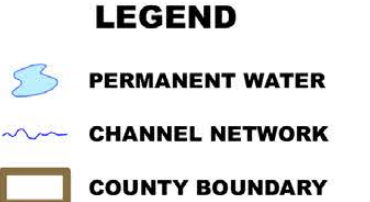


# Hurricane Ike Storm Surge Flooding September 12-13, 2008



SURGE HEIGHT: 10' - 12.5'  
WAVE HEIGHTS: 4' - 6'

HARRIS COUNTY HOUSE  
FLOODING ESTIMATE -  
STORM SURGE ONLY: 2450



SEABROOK 900 - HOUSE FLOODING  
ESTIMATE - STORM  
SURGE ONLY



Note: Area of highest damage from storm surge in Harris County shown here.





Downtown Houston, April 2016



Near White Oak Bayou, April 2016



Greens Bayou near Hardy Toll Road, April 2016





Brays Bayou near State Highway 288, May 2015



Brays Bayou looking toward West Loop, May 2015



Near Brays Bayou, May 2015



Brays Bayou just inside West Loop, May 2015





Greens Bayou, Tropical Storm Allison, 2001



San Jacinto River Flood, 1994



Downtown Houston, Tropical Storm Allison, 2001





Halls Bayou, 2006



Halls Bayou near West Mount Houston Road near I-45, 2009

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# Federal Project Summaries

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## Active Federal Projects Status Summary

PROJECT	DESCRIPTION	CURRENT PROJECT AUTHORIZATION	CURRENT PHASE/STATUS	CURRENT PHASE EST. COMPLETION	TOTAL COST (spent to date)	FEDERAL (spent to date)	NON-FED (spent to date)
Sims Bayou	19.3 miles of channelization (flood bench section); environmental mitigation & enhancements; 4% level of protection (full development); BCR=6.5/na	1986, 1990,1992	Construction started 1994, completed 2015; Closing out	2018	\$390 million (\$389 million)	\$265 million (\$264 million)	\$125 million (\$125 million)
Clear Creek & Tributaries	3 detention basins & in-line detention; 20.4 miles channelization; environmental enhancements; 10% level of protection (partial development); BCR=1.8/1.1	1968	Need construction restart, 0% complete	??	Current est. \$193 million (\$55 million)*	\$125 million (\$35 million)*	\$68 million (\$20 million)*
Greens Bayou	1 detention basin; 3.7 miles channelization; environmental enhancements; 10% level of protection (partial development); BCR=4.9/2.7	1990	New construction start FY15, 50% complete	2019	\$45 million (\$19 million)	\$34 million (\$17 million)	\$11 million (\$2 million)
Brays Bayou; Section 211(f)	4 detention basins; 21.2 miles channelization; environmental enhancements; near 1% level of protection (full development); BCR=7.0/3.5	1990	Construction (started 1994), 80% complete; PCA amended Mar. 2010	2021 (assumes \$20M/year fed. reimbursement)	\$480 million (\$350 million)	\$240 million (\$203 million)	\$240 million (\$147 million)
Hunting Bayou; Section 211(f)	1 detention basin; 3.8 miles channelization; environmental enhancements; near 1% level of protection (partial develop.); BCR=2.0/1.0	1990	Construction (started 2008, 35% complete) Need CG restart	2023 (assumes \$15M/year fed. reimbursement)	\$110 million** (\$40 million)	\$60 million (\$0 million)	\$50 million** (\$40 million)
White Oak Bayou; Section 211(f)	4 detention basin complexes; 15.0 miles channelization; recreation; environmental enhancements; near 10% level of protection (full development); BCR=7.2/4.3	1986	Construction (started 1998, 70% complete) Need CG new start	2022 (assumes \$15M/year fed. reimbursement)	\$124 million, \$13M for recreation (\$85 million)	\$70 million (\$0 million)	\$54 million (\$85 million)
Halls Bayou; Formerly Section 211(f)	Without Project Conditions & ATR completed 2009; component identification 2010; HCFCD developing watershed plan	1990	General Reevaluation (started 2006), 30% complete	On Hold by HCFCD	--	--	--
Buffalo Bayou - Main Stem; Formerly Section 211(f)	Without Project Conditions & ATR completed 2010; component identification 2011; HCFCD developing watershed plan	1954	General Reevaluation (started 2006), 30% complete	On Hold by HCFCD	--	--	--

Notes: BCR = planning % / 7%

Section 211(f) = Local Lead Project

\* Includes costs for both GRR and channelization project currently on hold.

\*\* Total Cost and Non-Fed Share of LPP assume \$60 M savings on vehicular and pedestrian bridges.

## Federal Flood Control Projects in Harris County, Texas Milestone Date Summary

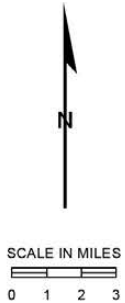
PROJECT	STUDY AUTHORIZATION	PROJECT AUTHORIZATION	LCA, PCA, or PPA	PHYSICAL CONSTRUCTION START	PHYSICAL CONSTRUCTION COMPLETE
<b>--- Completed ---</b>					
Addicks and Barker Reservoirs, Buffalo Bayou	1936	1940	1940	1940	1948
Brays Bayou	1948	1954	1955	1957	1968
White Oak Bayou	1948	1954,1965	1955,1967	1964	1976
Vince Bayou	1958	1962	1964	1973	1980
Little Vince Bayou	1958	1962	1964	1986	1988
Cypress Creek	1946	1988	2001	1999	2001
<b>--- Under Construction ---</b>					
Sims Bayou	1948	1986,1990,1992	1990	1994	2015
Clear Creek	1962	1968	1986	1988	--
Brays Bayou*	1948	1990	2000, 2010	1994	--
Hunting Bayou*	1948	1990	2014	2008	--
White Oak Bayou*	1948	1986	2014	1998	--
Greens Bayou	1948	1990	2015	2015	--
<b>--- Authorized ---</b>					
Halls Bayou	1948	1990**	--	--	--
Buffalo Bayou - Main Stem	1948	--	--	--	--
Carpenters Bayou	1948	1990	--	--	--
Little White Oak Bayou	1948	1990	--	--	--

\* Section 211(f) Projects

\*\* Project deauthorized in 2016



# Active and Completed Corps of Engineers Projects



**LEGEND**

CHANNEL NETWORK

CONGRESSIONAL DISTRICT

**COMPLETED**

CHANNEL

DETENTION BASIN

BUYOUT

**CONSTRUCTION PHASE**

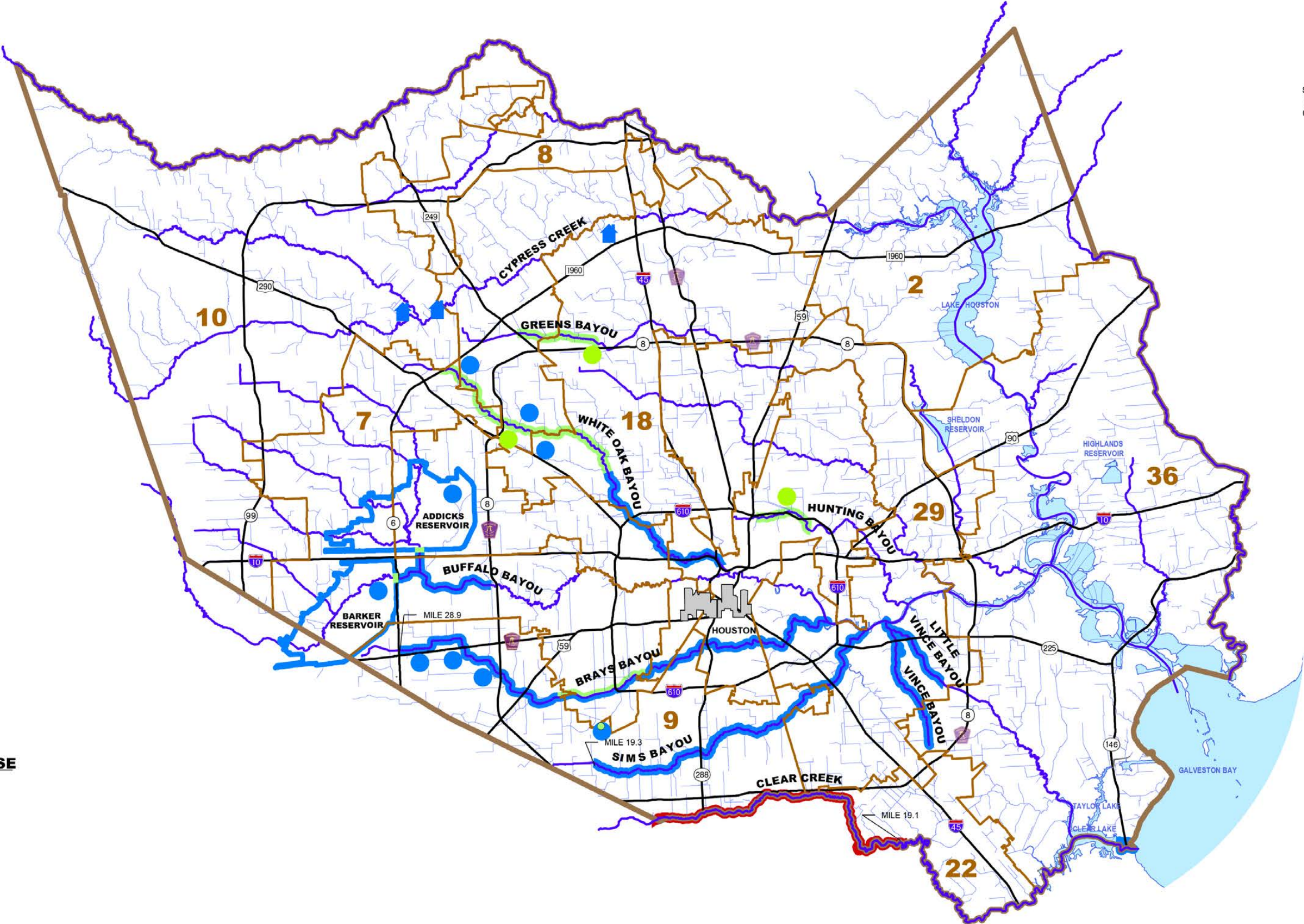
CHANNEL

DETENTION BASIN

**PENDING CONSTRUCTION PHASE**

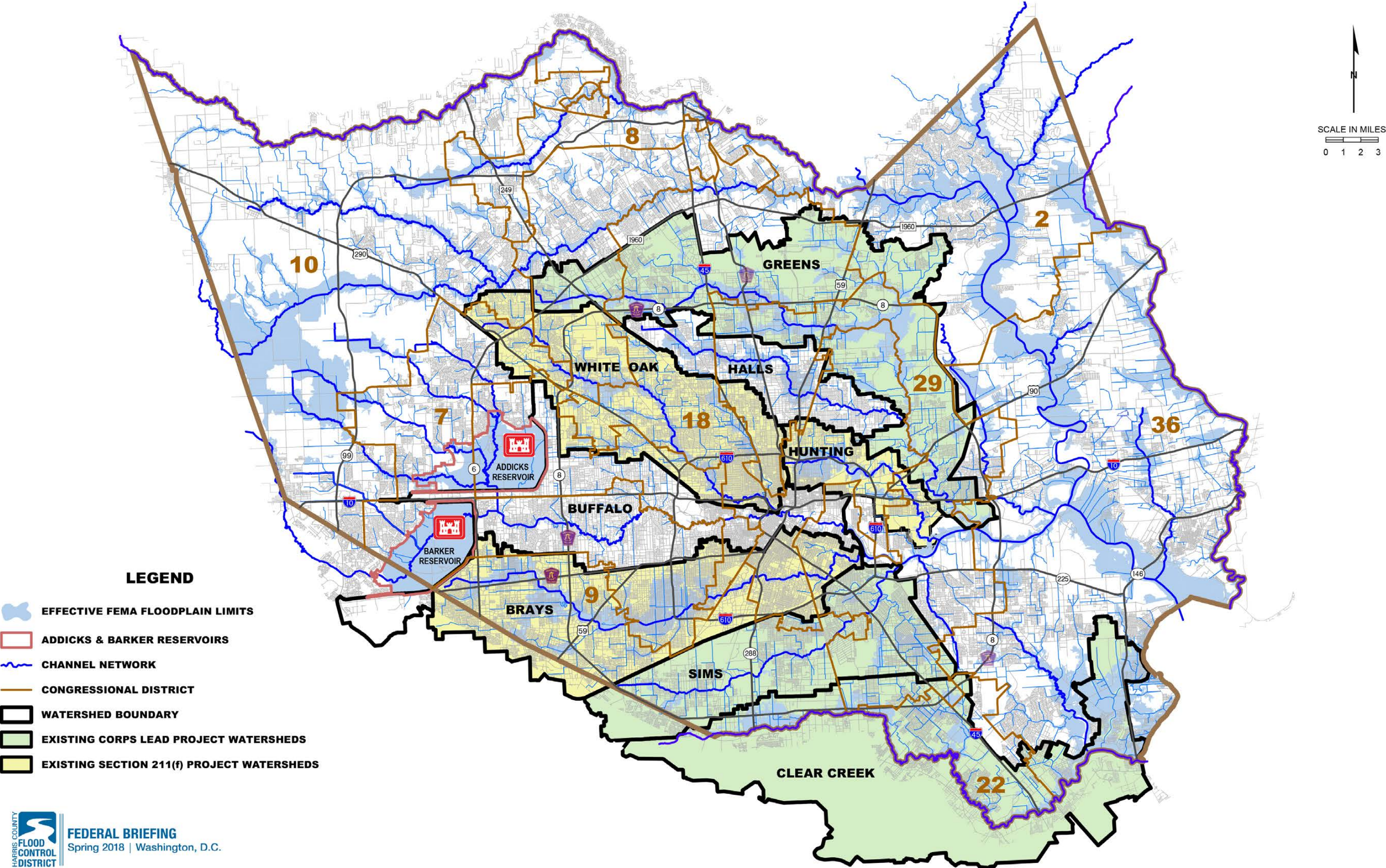
CHANNEL

PROPOSED DETENTION SITE (GENERAL LOCATION)





# Active Federal Flood Damage Reduction Projects





# Corps of Engineers Project Development Process for Flood Risk Reduction Projects

<b>Major Phases</b>	<b>Feasibility</b>	<b>Preconstruction Engineering &amp; Design</b>	<b>Construction</b>	<b>Operation &amp; Maintenance</b>
<b>Activity</b>	Feasibility or General Reevaluation Study	Preliminary Engineering and Design for First Construction Phase	LERRDS, Design, Construction	Operation, Maintenance, Repairs, Replacements, Rehabilitation
<b>Duration</b>	3 - 10+ years	2± years	Project Dependent	Until Project is Deactivated
<b>Federal Funding Category</b>	General Investigation (GI)	↔	Construction General (CG)	↔
<b>Congressional Action</b>	GI Funding Appropriation	Project Authorization: WRDA and CG Funding Appropriation (New Start)	CG Funding Appropriation	
<b>Agreement</b>	Feasibility Cost Sharing (FCSA)	Design (Optional)	Project Cooperation or Partnership (PCA or PPA)	None
<b>Deliverables by Lead Agency</b>	Feasibility or General Reevaluation Report & NEPA Documentation	Engineering Design Report and Plans & Specs	Plans & Specs; O & M Manual	Annual Inspection Reports
<b>Cost Sharing</b>	50% Federal, 50% Non-Fed	Same as Construction	Current Projects: 75% Federal, 25% Non-Fed <sup>1</sup>	100% Non-Federal
<b>HCFCF Studies / Projects</b>	Buffalo Bayou <sup>2</sup> Halls Bayou <sup>2</sup>	Clear Creek	Brays Bayou Greens Bayou Hunting Bayou White Oak Bayou	Brays Bayou <sup>3</sup> White Oak Bayou <sup>3</sup> Vince Bayou Little Vince Bayou Clear Creek (2nd Outlet) Cypress Creek (buyout) Sims Bayou

<sup>1</sup> New Projects: 65% Federal, 35% Non-Fed; <sup>2</sup> On hold by HCFCF; <sup>3</sup> Original federal projects completed in 1970's

## Commonly Used Acronyms

<b>AFB</b> - Alternative Formulation Briefing
<b>ASA(CW)</b> - Assistant Secretary of the Army (Civil Works)
<b>ATR</b> - Agency Technical Review
<b>BBA</b> - Bipartisan Budget Act of 2018
<b>CG</b> - Construction General
<b>DS</b> - Discrete Segment
<b>E&amp;D</b> - Engineering and Design
<b>EA</b> - Environmental Assessment
<b>EIS</b> - Environmental Impact Statement
<b>EPA</b> - Environmental Protection Agency
<b>F&amp;WL</b> - Fish and Wildlife
<b>FEMA</b> - Federal Emergency Management Agency
<b>FONSI</b> - Finding of No Significant Impact
<b>FY</b> - Fiscal Year
<b>GI</b> - General Investigation
<b>GRR</b> - General Reevaluation Report
<b>IEPR</b> - Independent External Peer Review
<b>LERRD</b> - Lands, Easements, Rights-of-Way, Relocations and Disposal/Borrow Areas
<b>M</b> - Million
<b>NED</b> - National Economic Development
<b>NEPA</b> - National Environmental Policy Act of 1969
<b>NER</b> - National Environmental Restoration
<b>NRCS</b> - Natural Resources Conservation Service
<b>OMRR&amp;R</b> - Operations, Maintenance, Repair, Replacement and Rehabilitation
<b>PCA</b> - Project Cooperation Agreement
<b>PED</b> - Preconstruction Engineering and Design
<b>P.L.</b> - Public Law
<b>PPA</b> - Project Partnership Agreement
<b>USACE</b> - United States Army Corps of Engineers
<b>USGS</b> - United States Geological Survey
<b>WIIN</b> - Water Infrastructure Improvements for the Nation (Act)
<b>WRDA</b> - Water Resources Development Act
<b>WRRDA</b> - Water Resources Reform and Development Act



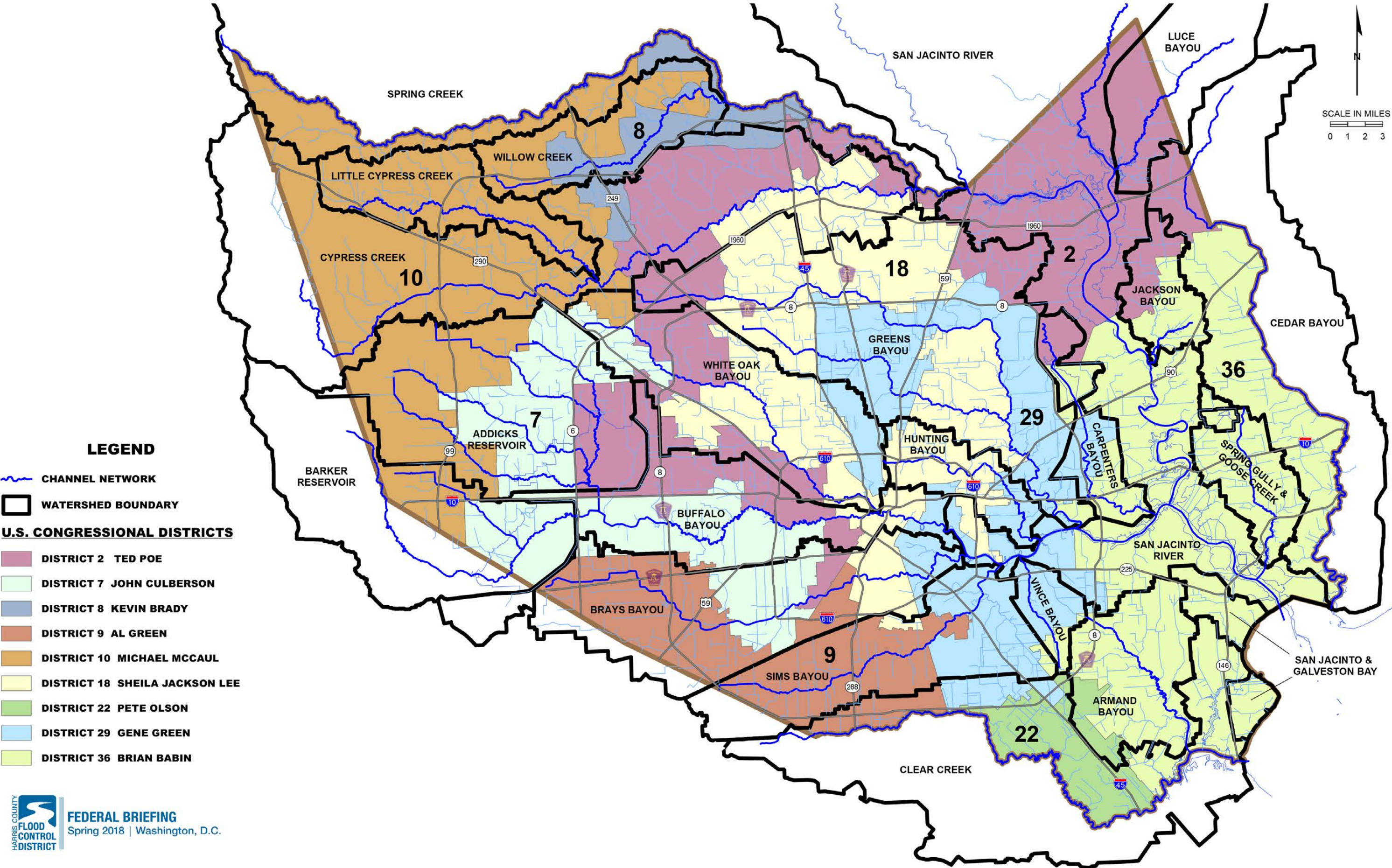
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# Congressional Districts

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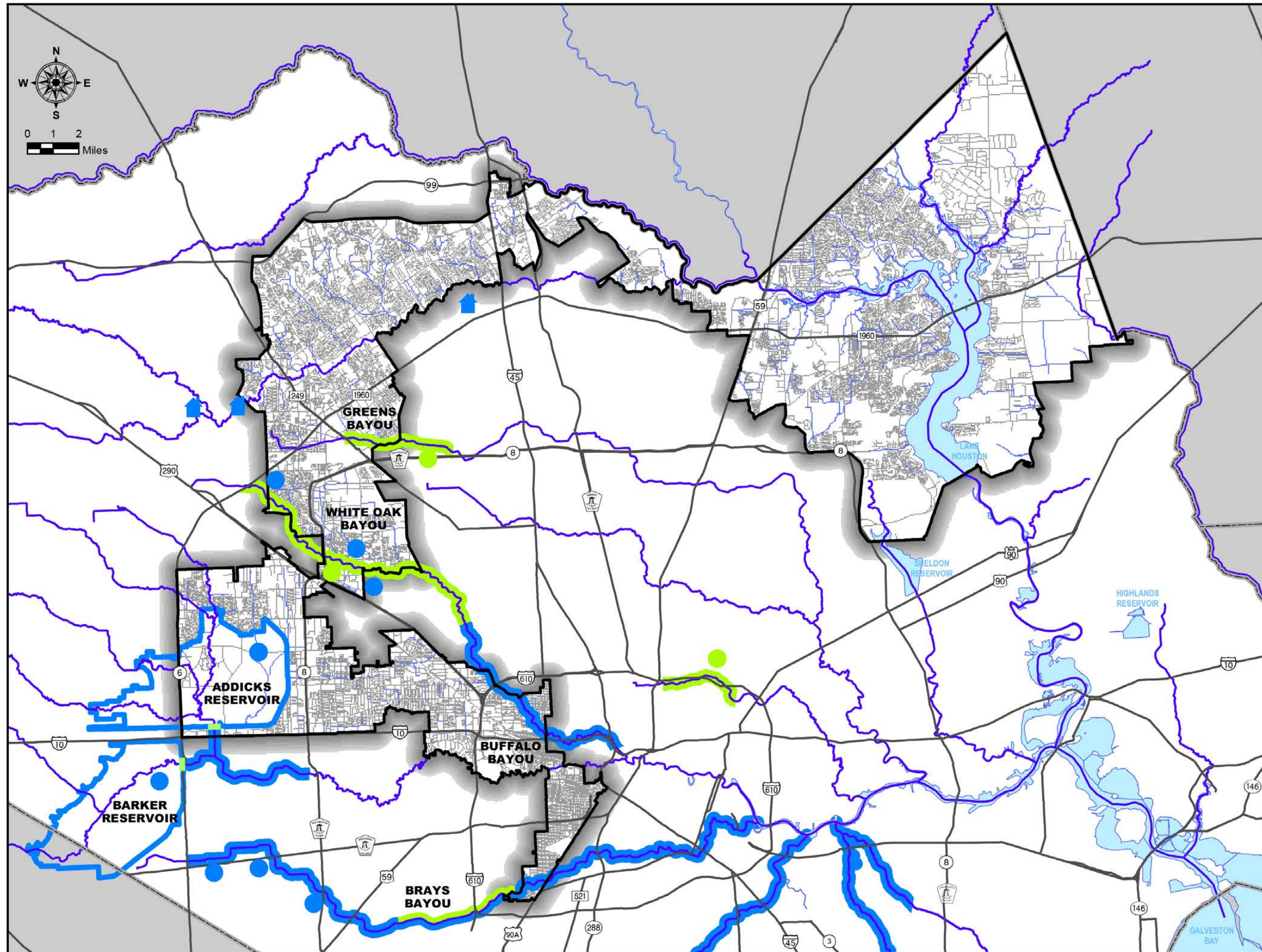
# Watersheds and Congressional Districts



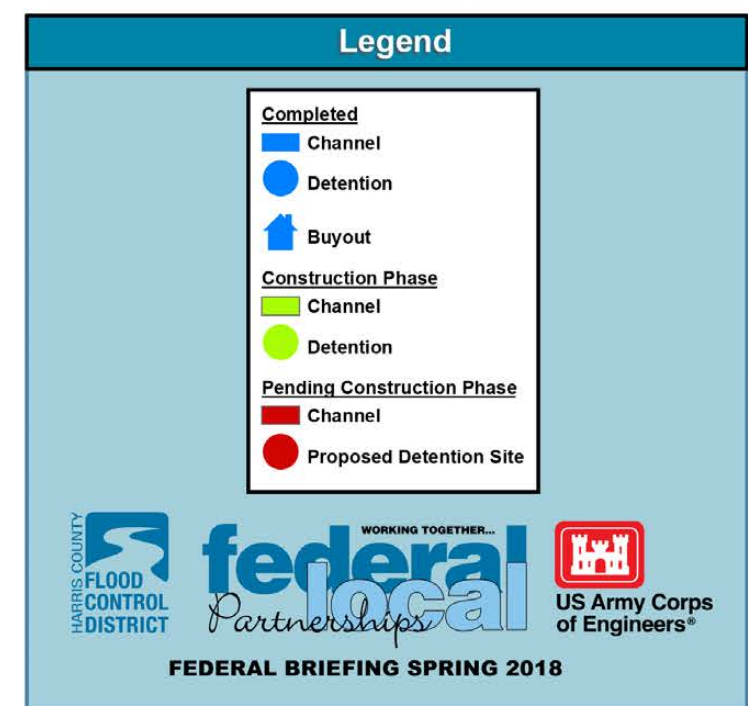
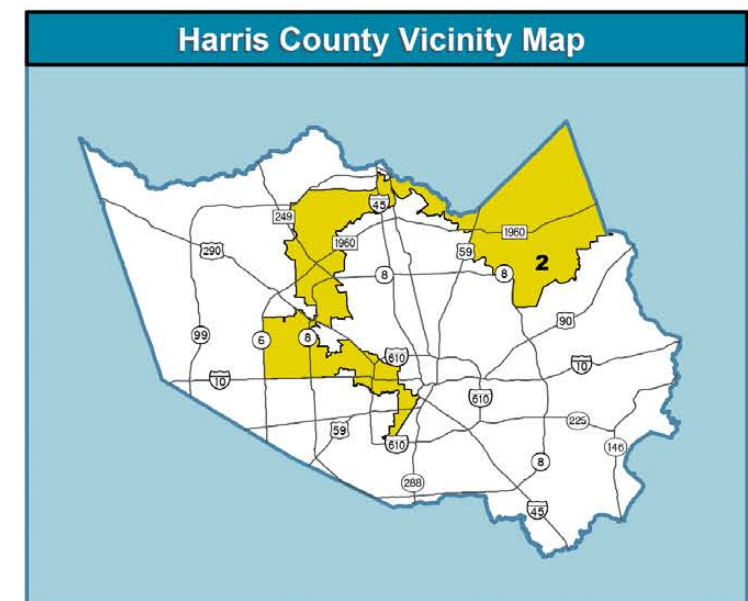
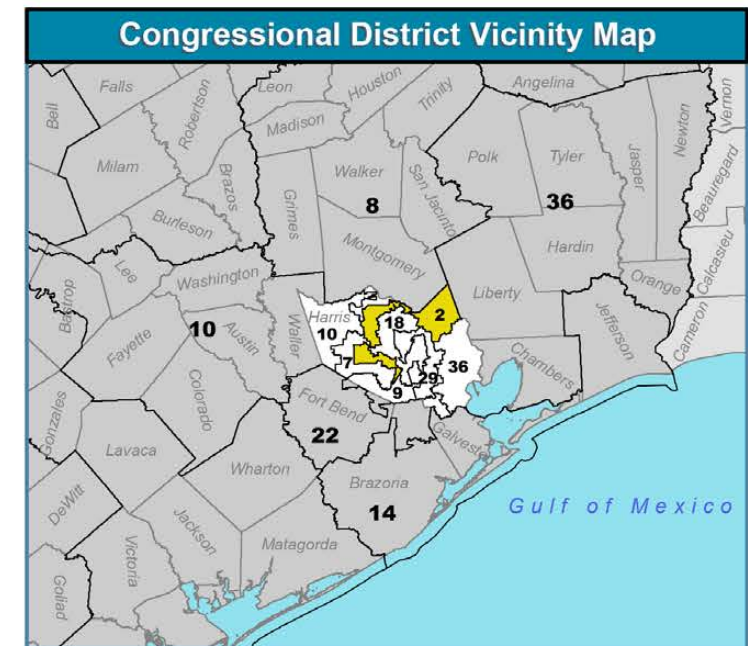


# Federal Flood Control Projects

## U.S. Congressional District 2



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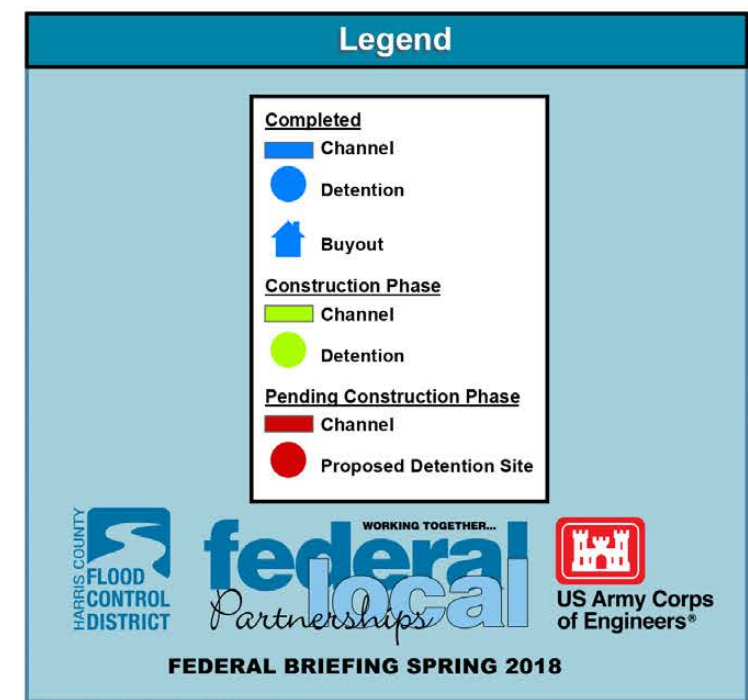
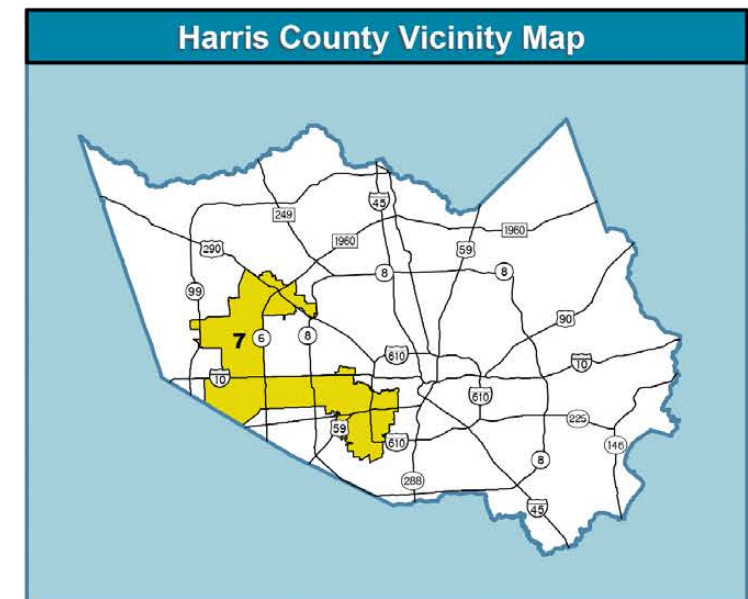
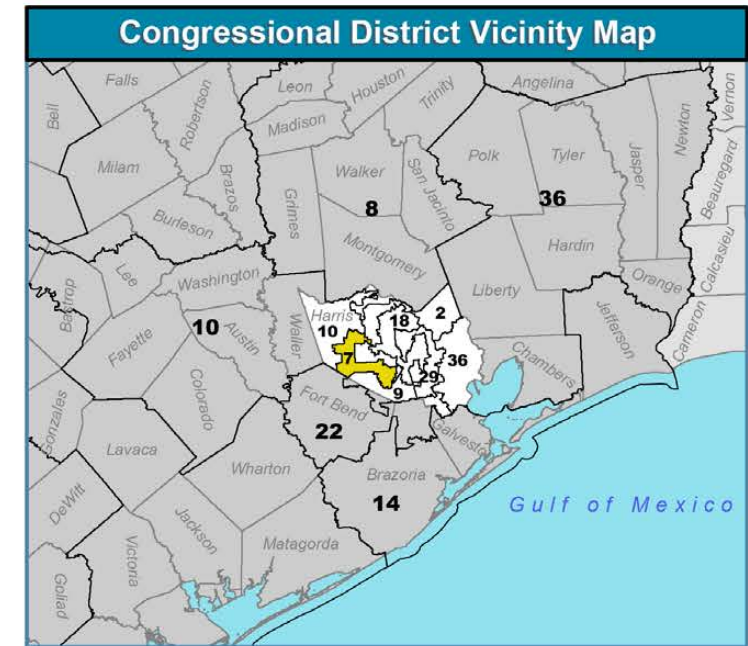
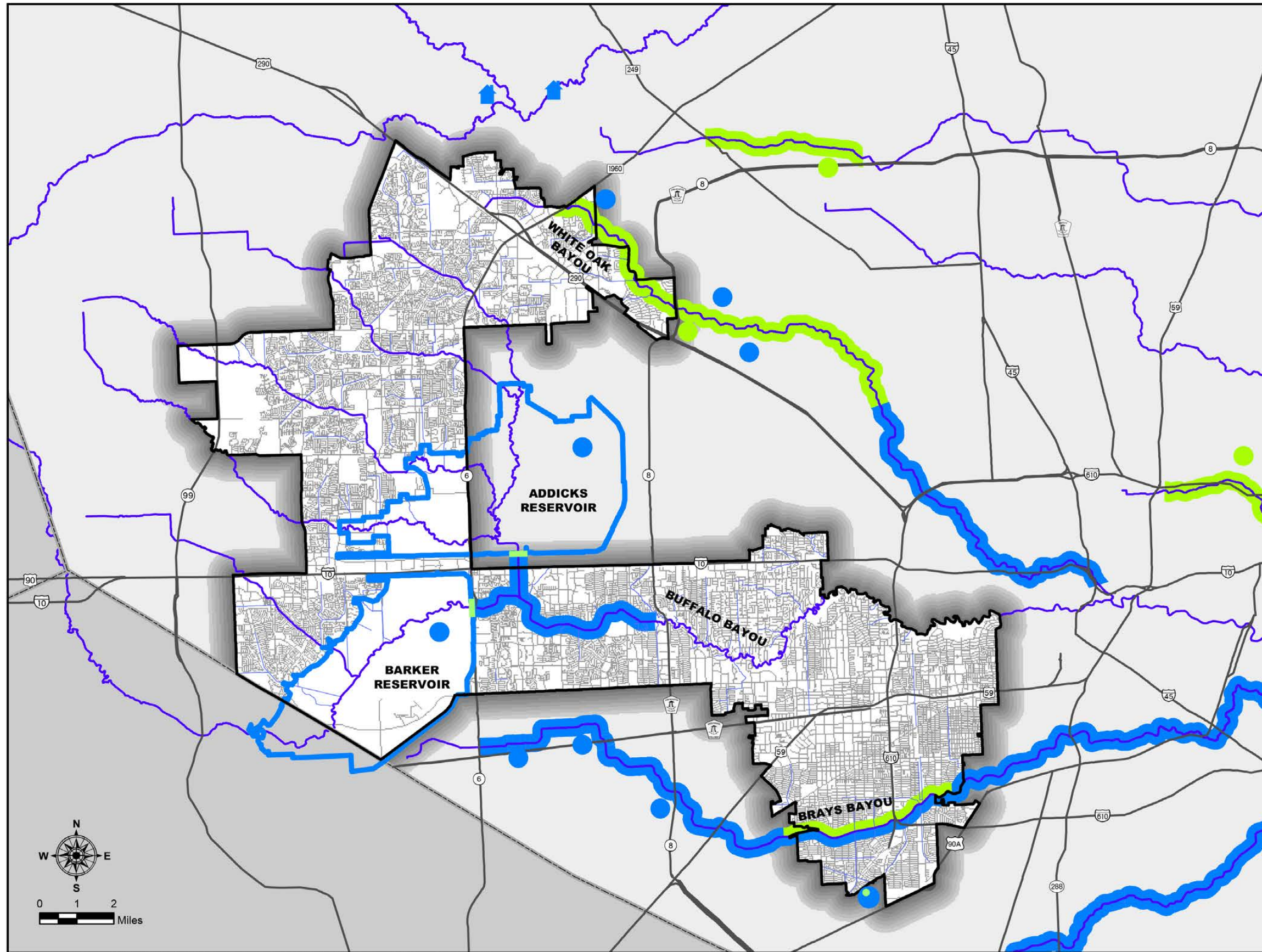


SF-Congressional District Briefing (District 2) 11x17.mxd



# Federal Flood Control Projects

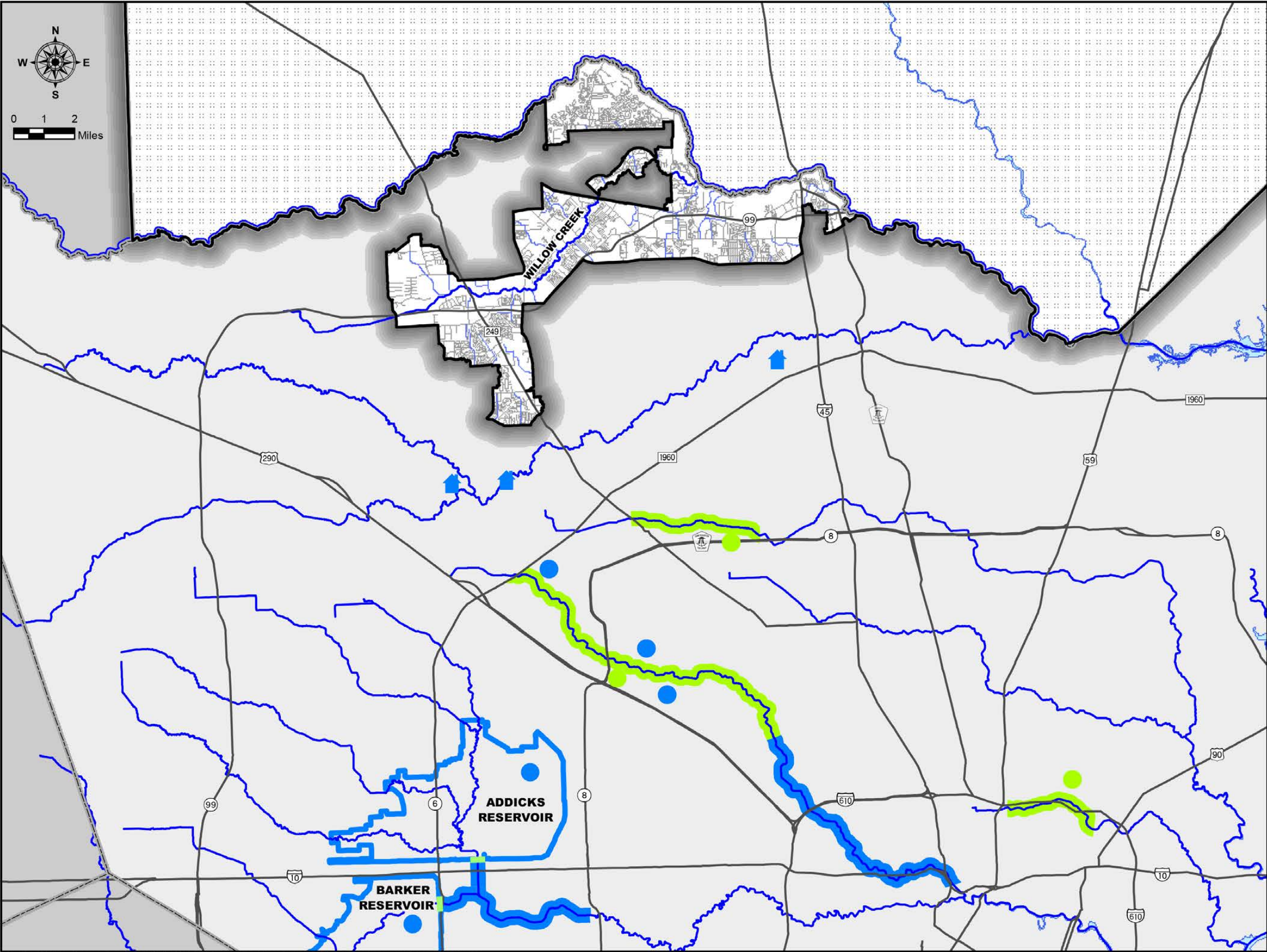
## U.S. Congressional District 7



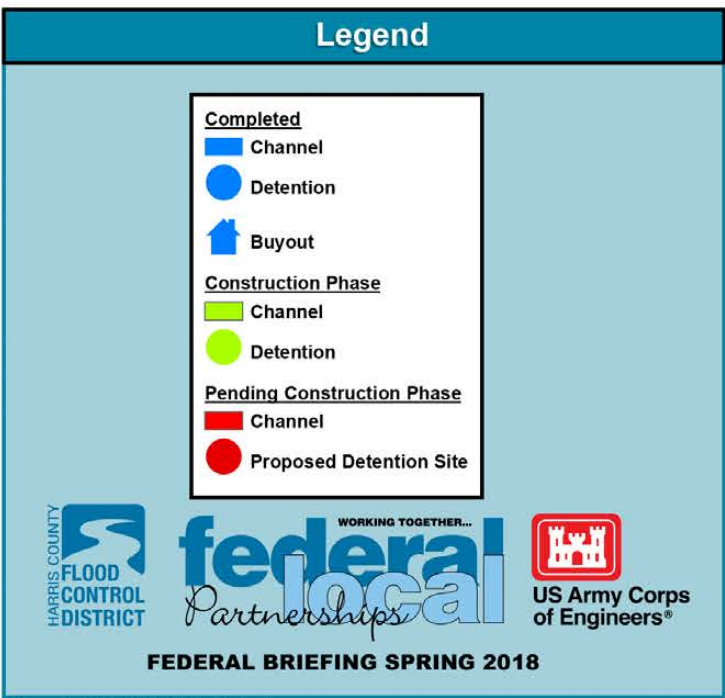
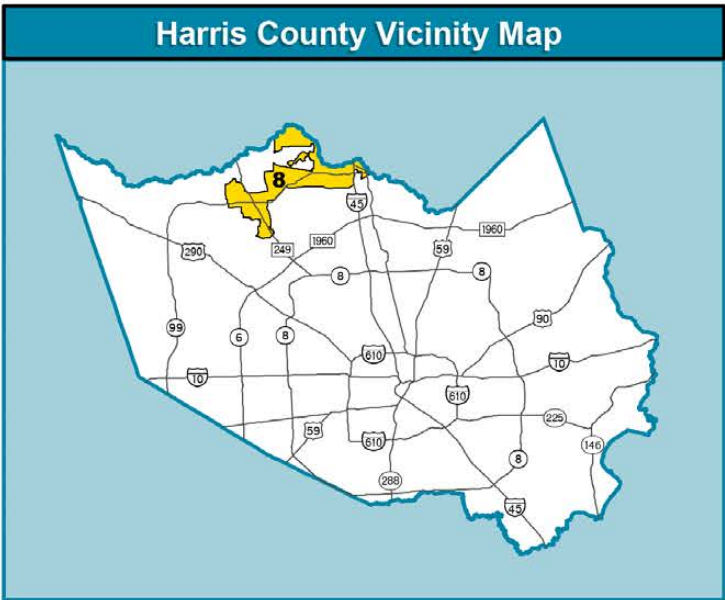
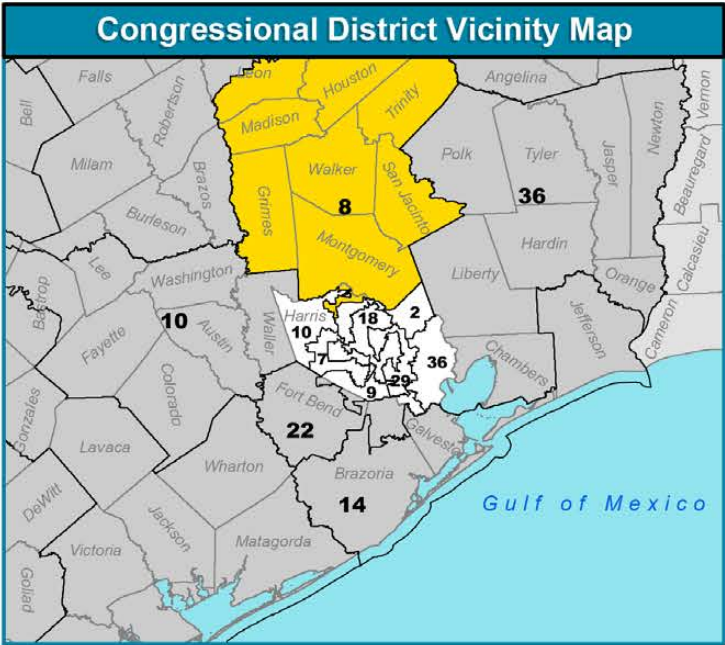


# Federal Flood Control Projects

## U.S. Congressional District 8



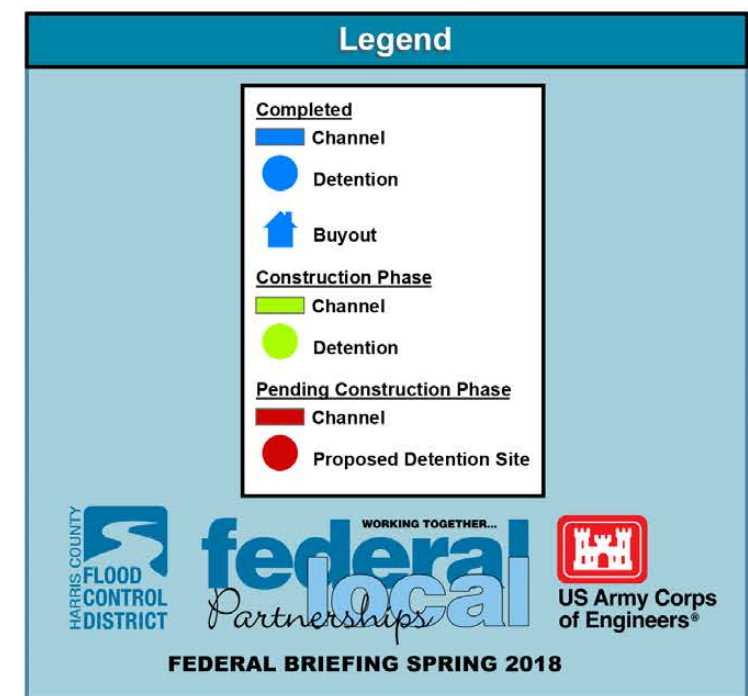
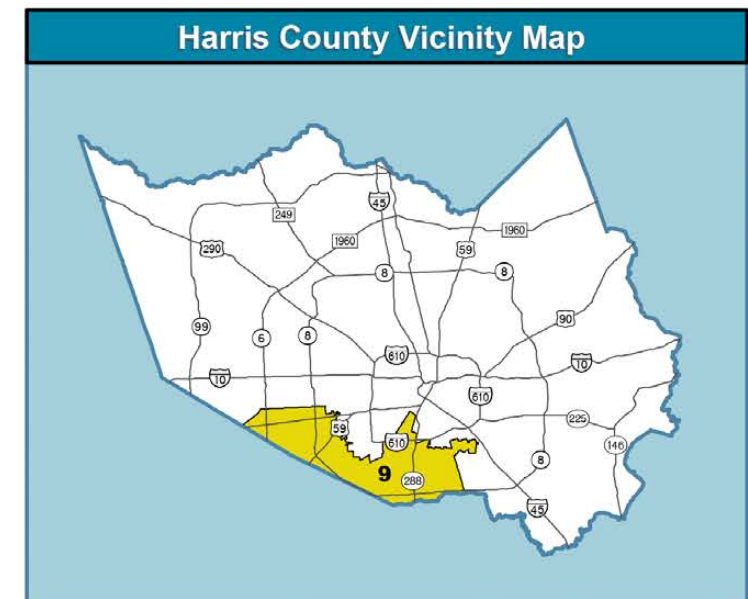
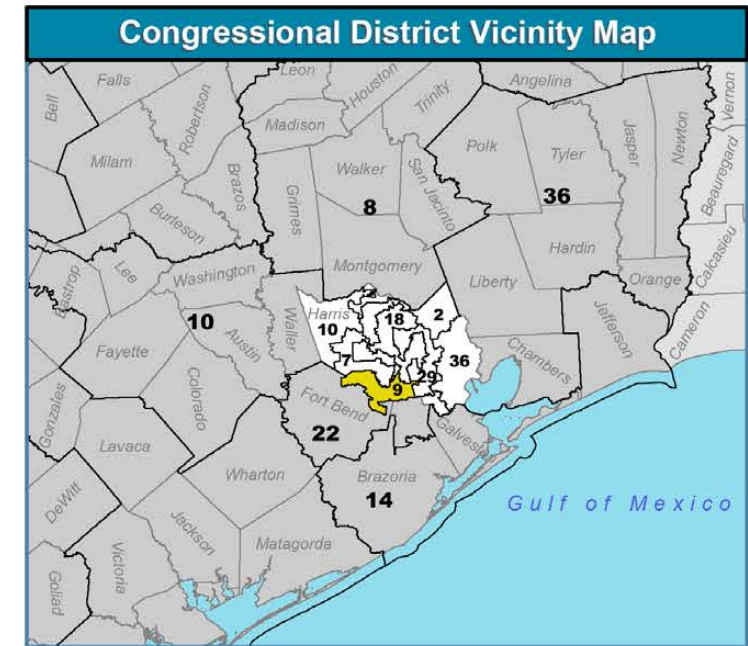
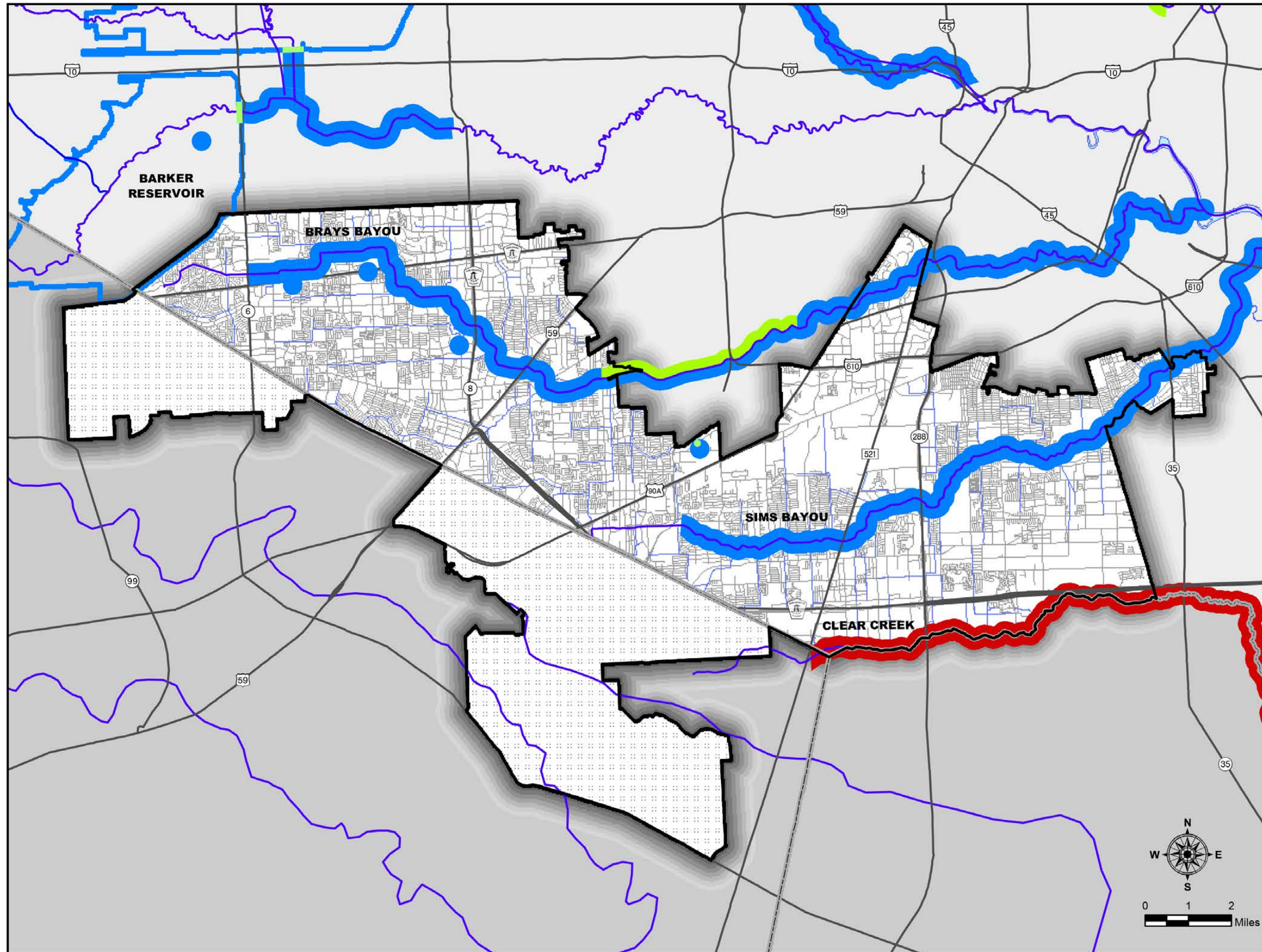
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# Federal Flood Control Projects

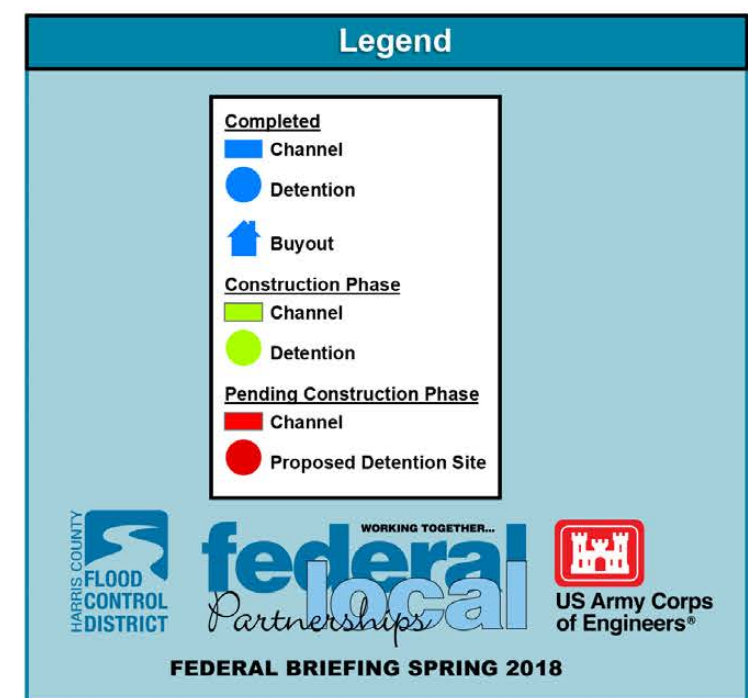
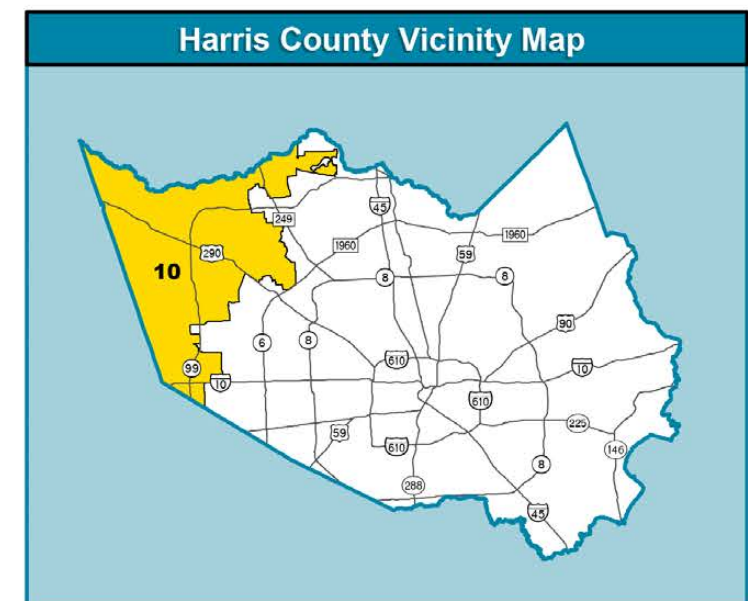
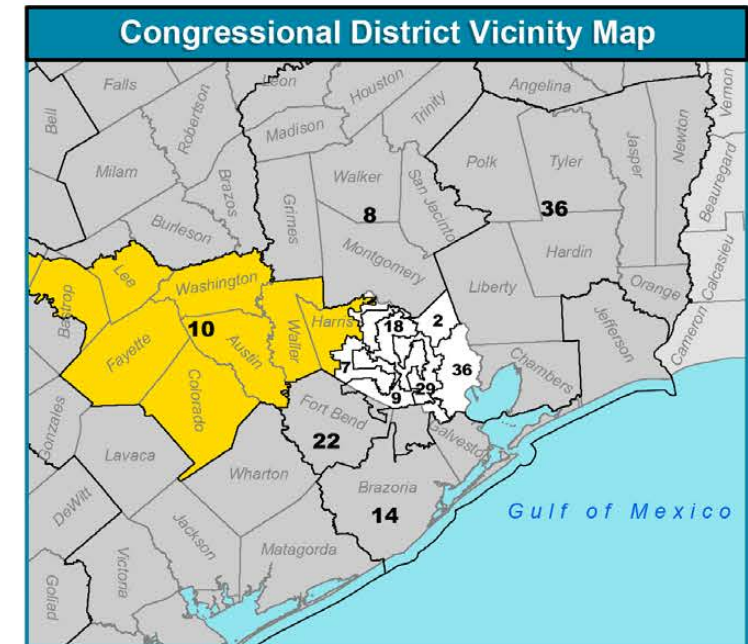
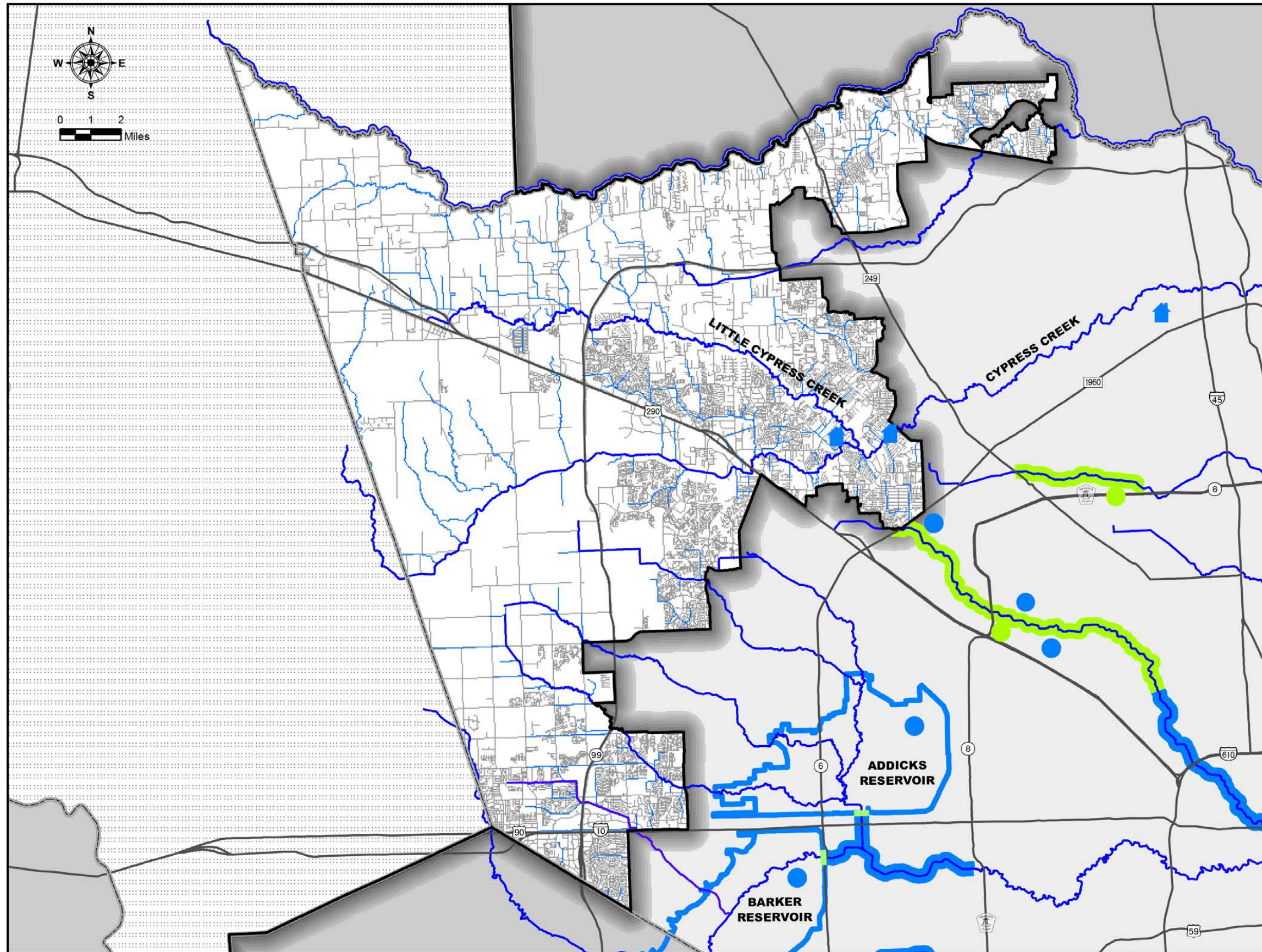
## U.S. Congressional District 9





# Federal Flood Control Projects

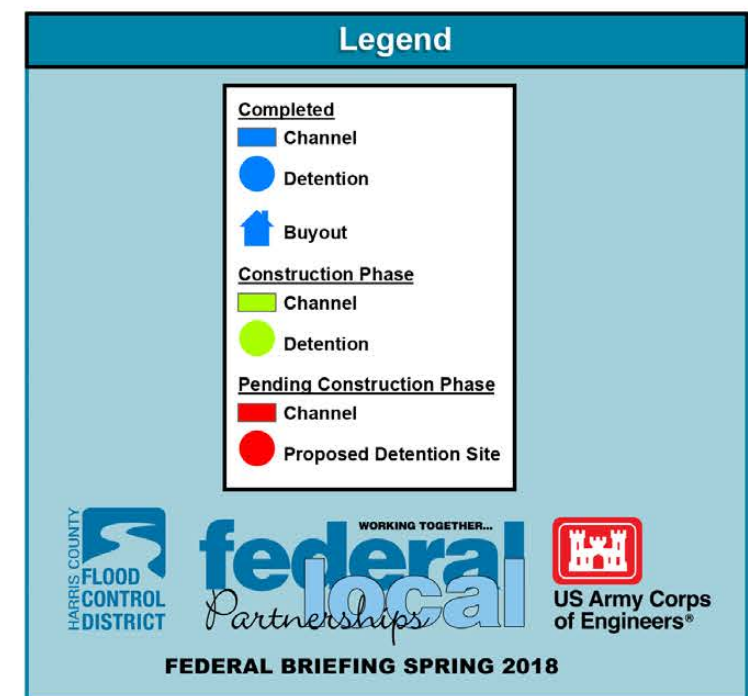
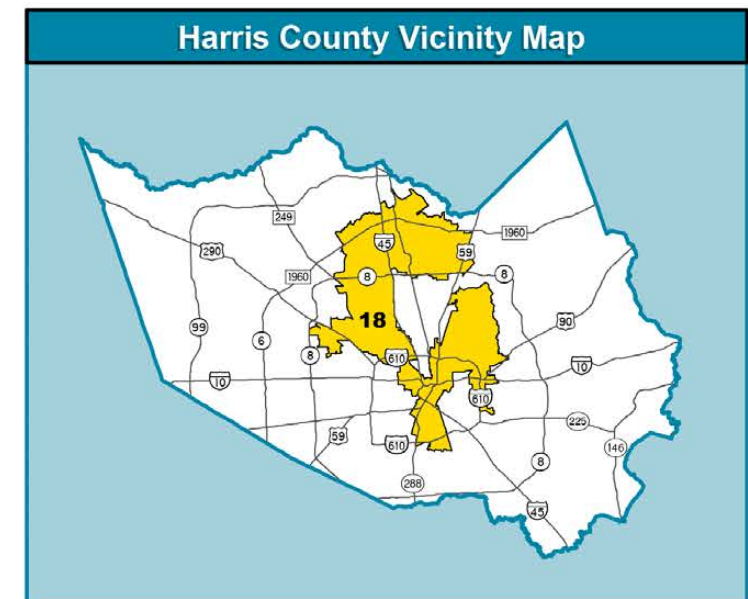
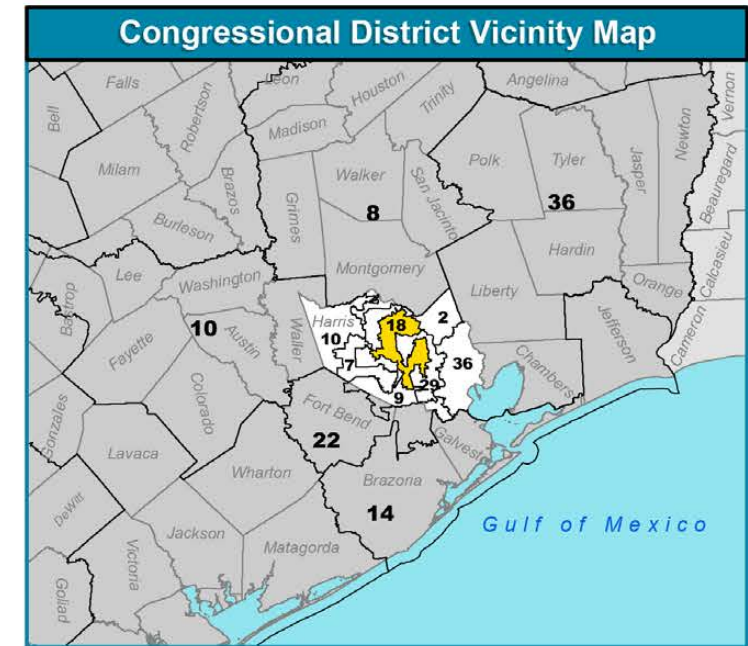
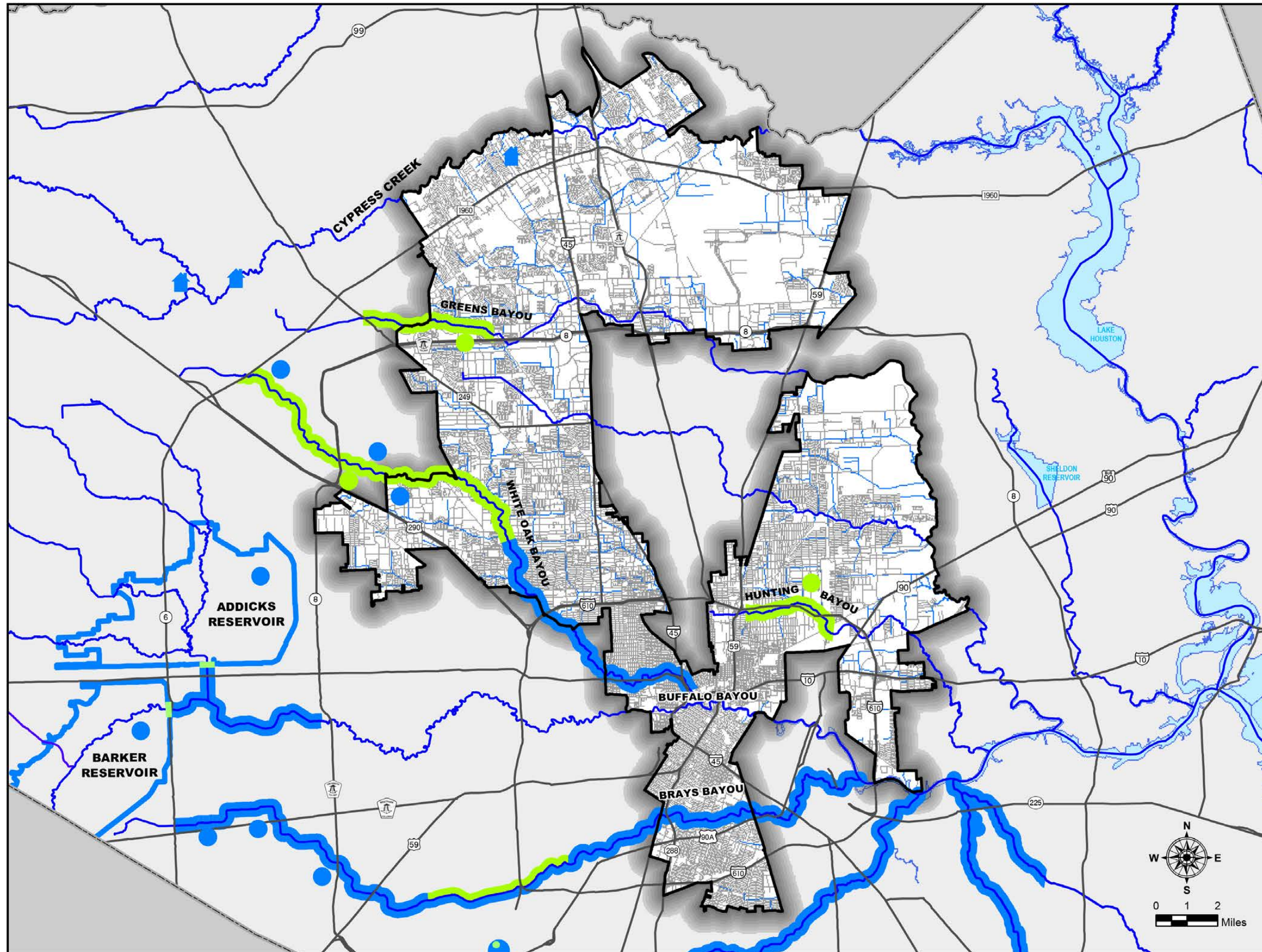
## U.S. Congressional District 10





# Federal Flood Control Projects

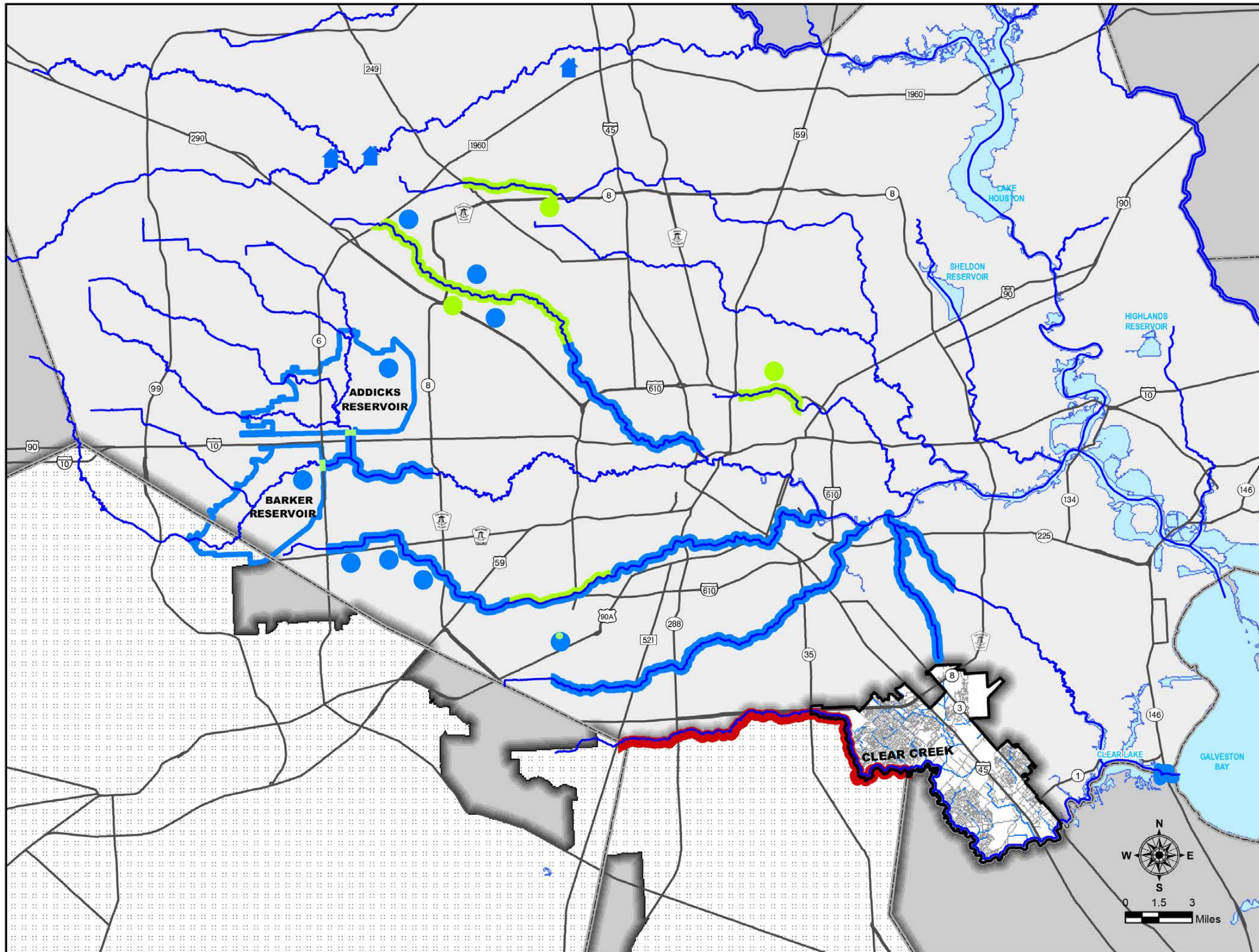
## U.S. Congressional District 18



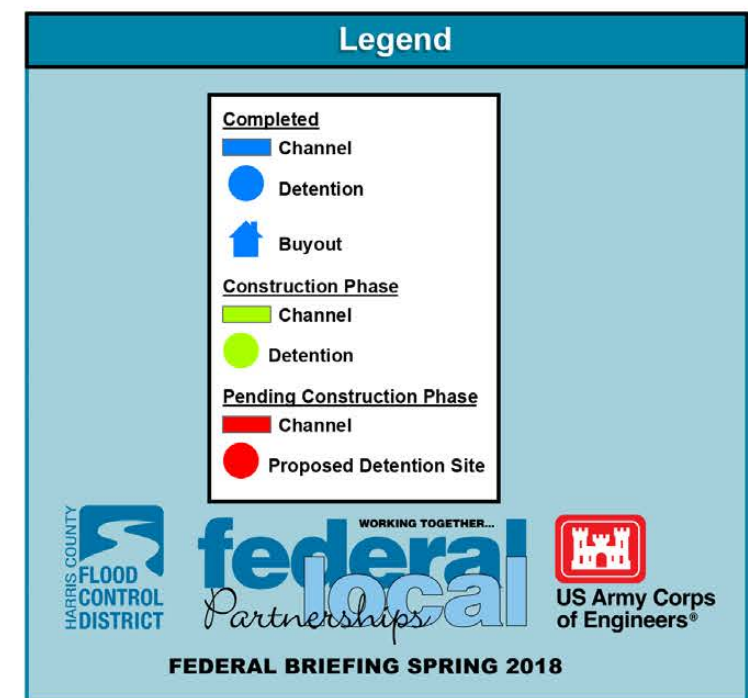
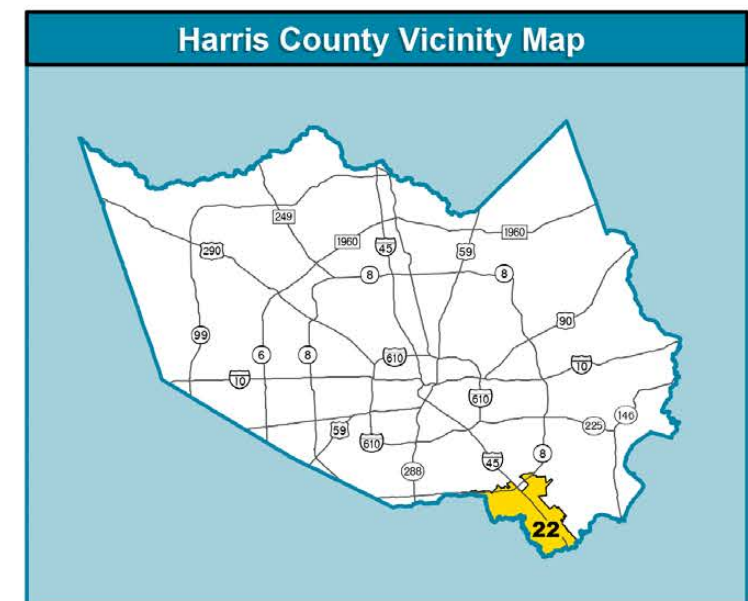
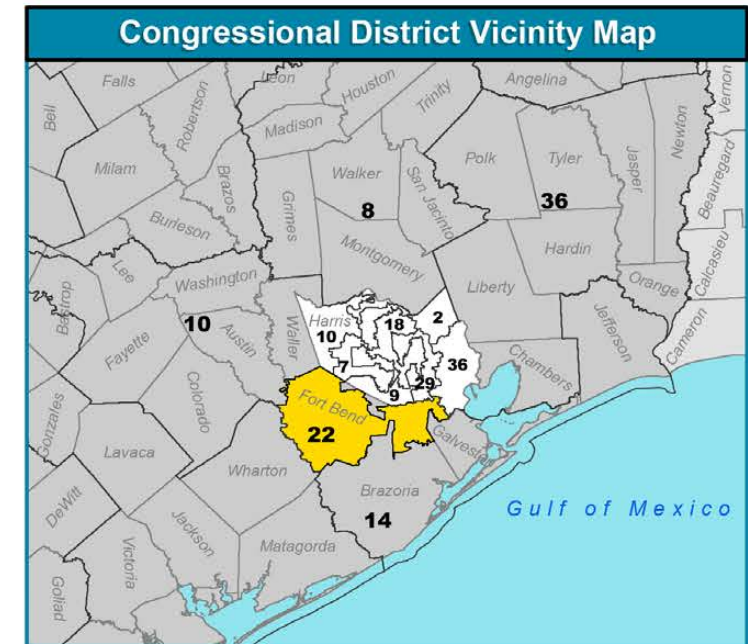


# Federal Flood Control Projects

## U.S. Congressional District 22



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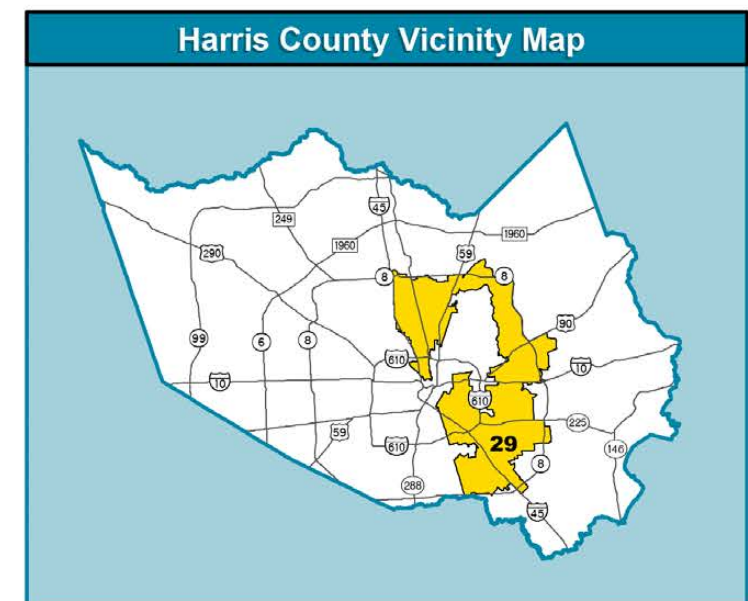
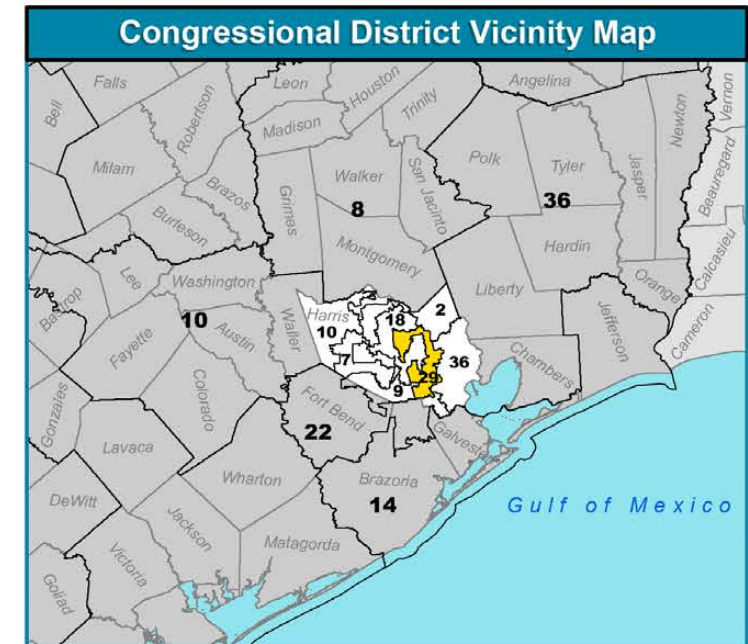
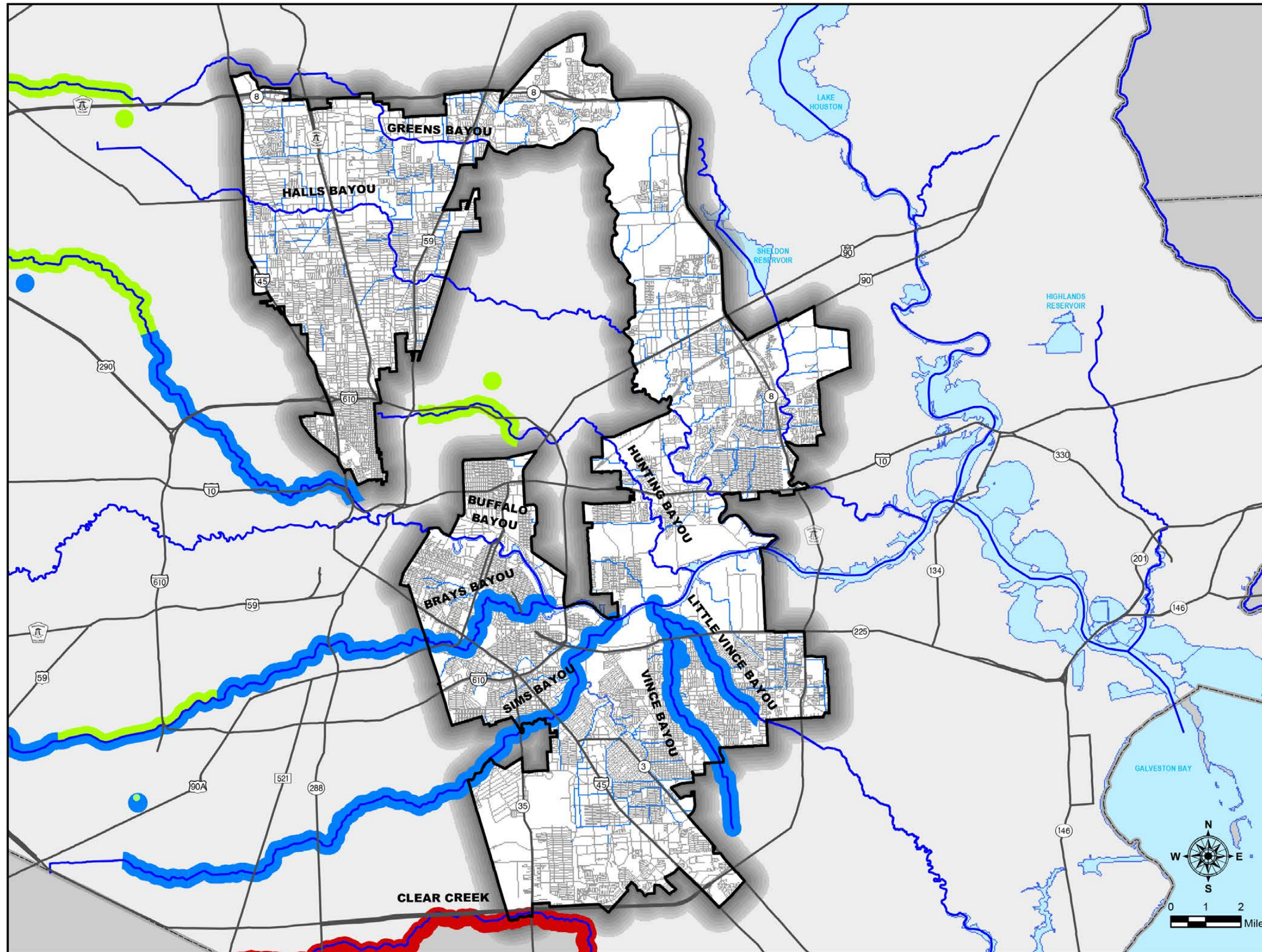


SF-Congressional District Briefing (District 22) 11x17.mxd



# Federal Flood Control Projects

## U.S. Congressional District 29



### Legend

- Completed**
  - Channel
  - Detention
  - Buyout
- Construction Phase**
  - Channel
  - Detention
- Pending Construction Phase**
  - Channel
  - Proposed Detention Site

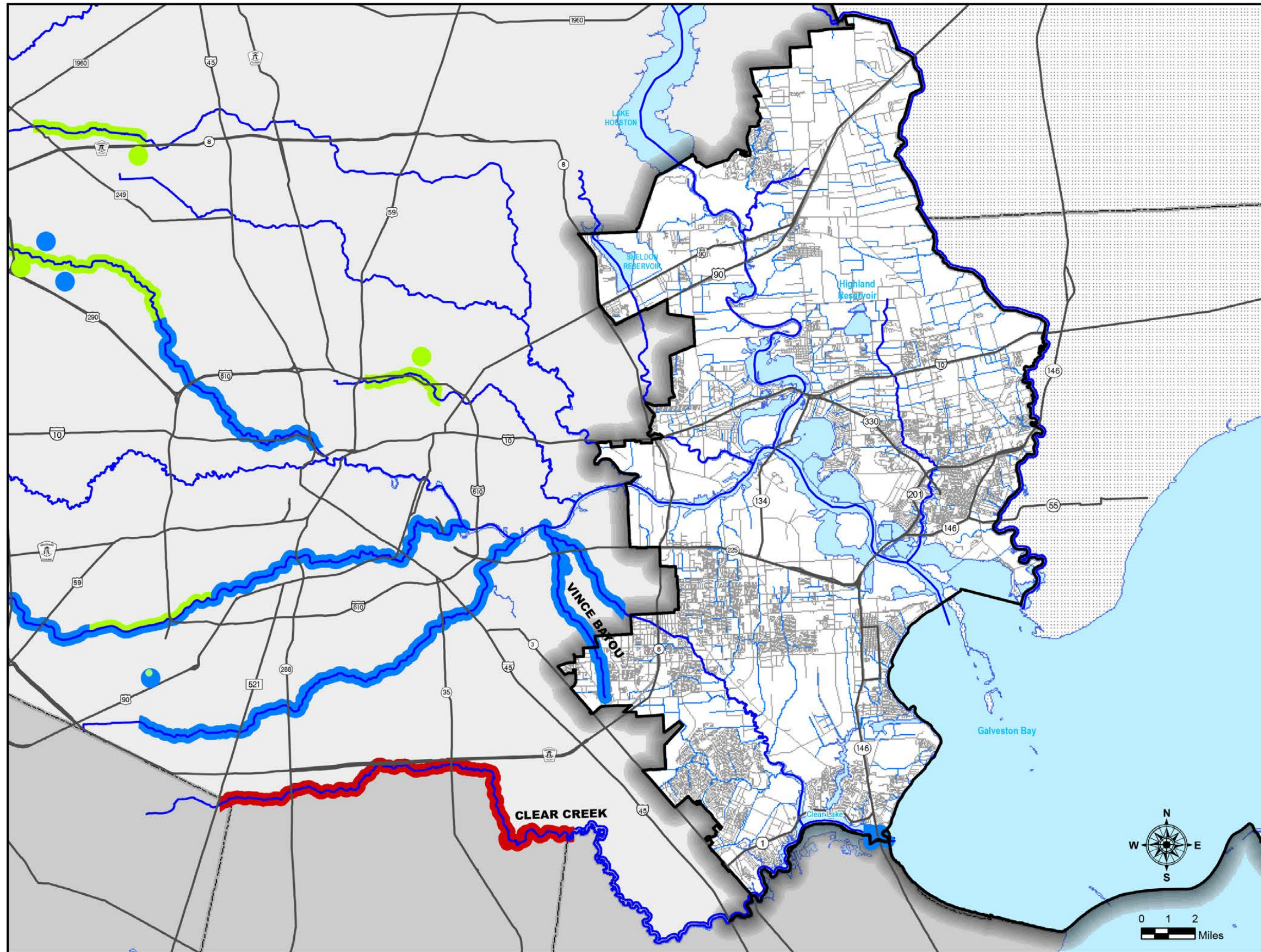
**FEDERAL BRIEFING SPRING 2018**

Logos for Harris County Flood Control District, federal local Partnerships, and US Army Corps of Engineers are displayed at the bottom.

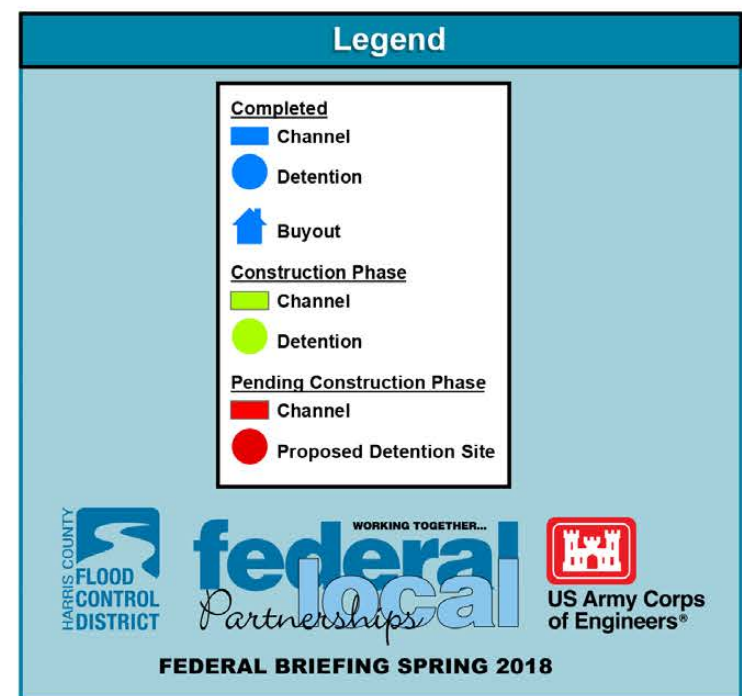
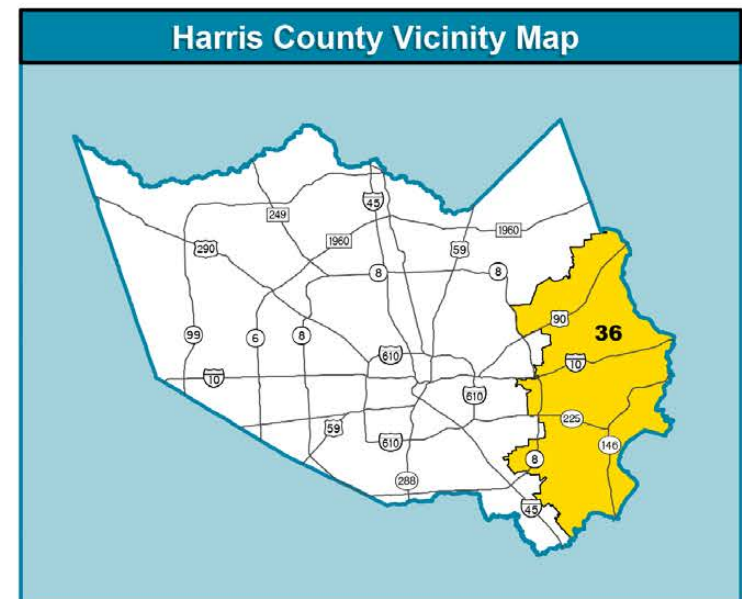
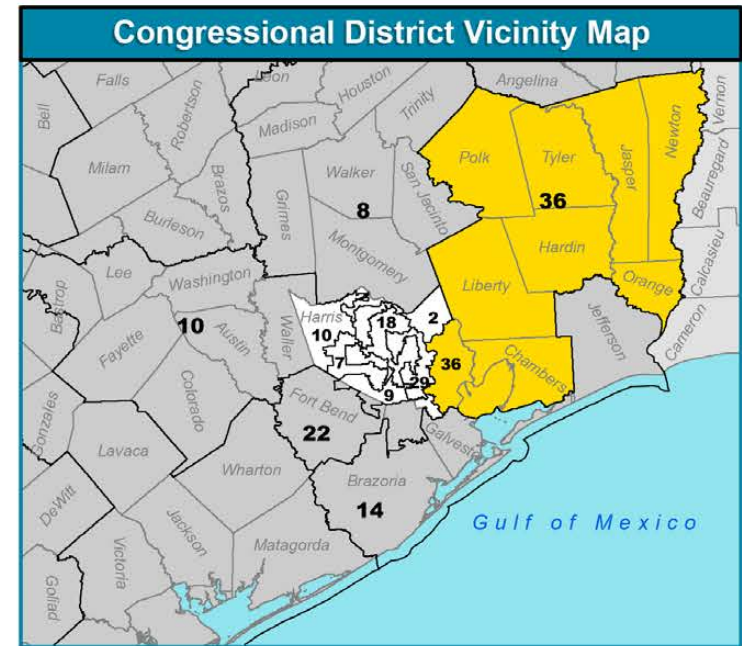


# Federal Flood Control Projects

## U.S. Congressional District 36



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# Authorizations

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## Authorizations - WRDA

The Harris County Flood Control District (HCFCD) supports the timely consideration and enactment of a Water Resources Development Act (WRDA) in 2018 to recognize the vital importance of water resources infrastructure to our nation's well-being and quality of life while ensuring public safety and balancing economic and human needs with environmental and ecological considerations. The biennial passage of WRDA helps the Corps of Engineers move studies and projects forward more efficiently; as well as operate, maintain, and repair existing projects more effectively.

**With passage of the next WRDA, we urge Congress to ensure an open and transparent process for the development of implementation guidance by requiring consultation with non-Federal sponsors prior to public comment on any provision impacting their responsibilities and cost share.** Non-Federal sponsors are equal partners with the Corps of Engineers and are assuming more responsibility for the study and construction of Federal Projects. Recommended language patterned after WRRDA 2014, Section 1018 is:

- (3) *NON-FEDERAL SPONSOR, STAKEHOLDER, AND PUBLIC PARTICIPATION.—Before issuing any new or revised guidance, regulations, or guidelines or any subsequent updates to those documents, the Secretary shall—*
- (A) *consult with affected non-Federal Sponsors; and then*
  - (B) *publish the proposed guidelines developed in the Federal Register; and*
  - (C) *provide stakeholders and the public with an opportunity to comment on the proposed guidance, regulations, or guidelines.*

The HCFCD also offers three specific recommendations for the next WRDA:

**First, clarify the Bipartisan Budget Act of 2018 Public Law No. 115-123 to include eligible outstanding reimbursements of the Federal cost share to the non-Federal sponsor for completion of ongoing construction projects.** The HCFCD is the non-Federal sponsor and is in the lead on three Corps of Engineers' ongoing construction projects in Harris County, Texas — Brays Bayou, Hunting Bayou, and White Oak Bayou. As specified in the project partnership agreements for each of the projects, the HCFCD must satisfactorily complete design and construction of a discrete segment at HCFCD expense before seeking reimbursement of the Federal cost share. Currently, the HCFCD has outstanding reimbursements of the Federal cost share for completed discrete segments of about \$80 million, and will have an additional \$35 million for ongoing construction.

If the next WRDA can amend Public Law No. 115-123, the HCFCD requests modifying the following provision under Title IV, Corps of Engineers, Construction, as shown below:

*Provided further, that the completion of ongoing construction projects receiving funds provided under this heading shall be at full Federal expense with respect to such funds, including eligible reimbursements to the non-Federal sponsor for construction completed or ongoing as of the date of passage of the Act:*

If the next WRDA cannot amend Public Law No. 115-123, the HCFCD recommends that the underlined language instead be used to clarify the provision in the next appropriations act.

**Second, repeal Section 575 of WRDA 1996, as amended by WRDA 1999 and WRDA 2007.** This provision was intended to prevent structural and nonstructural actions by non-Federal interests in watersheds of specific authorized Federal projects from adversely affecting the benefit-cost performance of the Federal projects. In practice, following the Corps' 1997 Implementation Guidance, the benefit of Section 575 has not been significant enough to modify any of the three Recommended Plans in Harris County for which it has been analyzed. The HCFCD requests repeal of the provision to streamline the economic analysis of future projects.



**Third, in order to improve the opportunity for a non-Federal sponsor to take the lead on the design and construction of such projects in collaboration with the Corps of Engineers, the HCFCD recommends amending Section 1014 of WRRDA 2014 entitled “Study and Construction of Water Resources Development Projects by Non-Federal Interests” to allow a non-Federal sponsor to become eligible for reimbursement for the Federal share of work if such work is later recommended by the Chief of Engineers and approved by the ASA (CW).** This would allow a non-Federal sponsor to begin implementing work on the project, at their risk, prior to the study being approved, Federal appropriations, and a final agreement reached. This is particularly important in urban areas where implementation opportunities can disappear quickly and the need to be ready for the next flood event is imperative. Wording from Section 211 (e)(2)(A) of WRDA 1996 is recommended -

*(2) SPECIAL RULES.—*

*(A) REIMBURSEMENT OR CREDIT.—For work (including work associated with studies, planning, design, and construction) carried out by a non-Federal interest with respect to a project described in subsection (f), the Secretary shall, subject to the availability of appropriations, reimburse, without interest, the non-Federal interest an amount equal to the estimated Federal share of the cost of such work, or provide credit (depending on the request of the non-Federal interest) for the non-Federal share of such work, if such work is later recommended by the Chief of Engineers and approved by the Secretary.*



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# Appropriations

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## Emergency Appropriations Since Hurricane Harvey

With 17 named storms, six major hurricanes, and two major hurricanes hitting the continental U.S. for the first time since 2005, the 2017 Atlantic hurricane season was among the most active on record. 2017 also surpassed 2005 as the costliest season on record; consecutive blows from Hurricanes Harvey, Irma, and Maria took a widespread toll in August and September 2017 across the United States and the Caribbean.

HCFCFCD thanks Congress and the Texas delegation for their efforts toward passing three supplemental appropriations measures in response to the devastating natural disasters of 2017: PL 115-56 (September 8, 2017), PL 115-72 (October 26, 2017), and PL 115-123 (February 9, 2018). These acts have paved the way for recovery and mitigation in Harris County and other areas affected by the 2017 storms and other natural disasters.

The third supplemental was the most substantial to date, providing a total of \$89.3 B in disaster aid as part of the Bipartisan Budget Act of 2018 (BBA). Several highlights from the package could assist HCFCFCD programs, projects, and studies:

- \$17.4 B to the U.S. Army Corps of Engineers (Corps)
- \$23.5 B to the Federal Emergency Management Agency (FEMA) Disaster Relief Fund
- \$28 B to the Department of Housing and Urban Development (HUD) Community Development Fund
- \$541 M to the Natural Resources Conservation Service (NRCS) Emergency Watershed Protection (EWP) Program
- \$600 M to the Department of Commerce for Economic Development Administration grants

HCFCFCD is particularly appreciative of the funding provided for Corps Construction (\$15.055 B) and Investigations (\$135 M), and the provisions associated with those funds. The following map highlights four active construction projects and one new study that HCFCFCD recommends as priorities for selection as the Corps' supplemental funding is allocated. HCFCFCD has project and study recommendations beyond the top priorities, as well.

Under Corps Construction, HCFCFCD recommends that the remaining work (including outstanding reimbursements) on four active construction projects in Harris County be selected for funding at full Federal expense. HCFCFCD estimates that it could complete its Section 211(f) local-lead projects (Brays Bayou, White Oak Bayou, and Hunting Bayou) within five years if remaining work is fully funded. The Corps would lead construction on Clear Creek, which could be completed within five to ten years if constructed at the same pace as envisioned for the HCFCFCD-lead projects. Continuing and completing these projects will provide immediate and substantial flood damage reduction benefits to the people of Harris County.

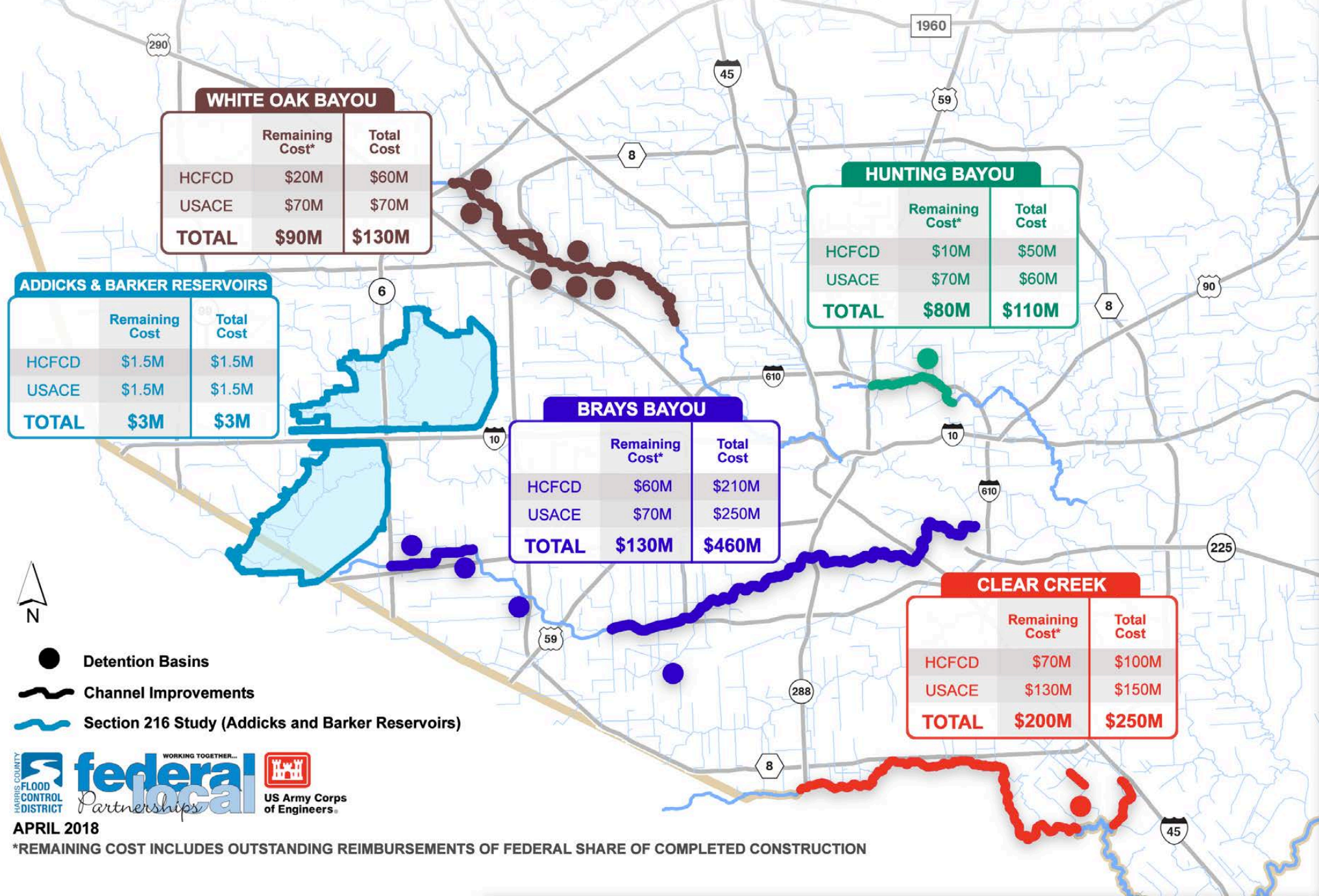
Under Corps Investigations, HCFCFCD urges funding and initiating a study of the Addicks and Barker reservoirs, including watersheds upstream and downstream, under the Corps' Section 216 authority. As Hurricane Harvey made clear, the physical, economic and environmental conditions within and around the reservoirs have drastically changed since they were built in the 1940s. A thorough study of the reservoir system, accounting for conditions today and into the future, is warranted to develop physical and operational recommendations that will improve the effectiveness of the reservoirs in reducing flood risks upstream and downstream. HCFCFCD has submitted Letters of Intent for this study, and is committed to providing the resources necessary to complete it in three years or fewer.

While Corps Implementation Guidance and selection is underway, HCFCFCD is actively pursuing other funding made available through BBA. HCFCFCD is in the process of submitting Notices of Intent for structural and nonstructural projects that are eligible under FEMA's grant programs, and a collective \$80 M of infrastructure damages have already been submitted to NRCS and FEMA for maintenance repair assistance. HCFCFCD is also exploring funding opportunities through HUD and the Economic Development Administration.



# HCFCF PRIORITIES FOR EMERGENCY SUPPLEMENTAL FUNDING

## PROJECTS UNDER CONSTRUCTION TO COMPLETE AND NEW STUDY



APRIL 2018

\*REMAINING COST INCLUDES OUTSTANDING REIMBURSEMENTS OF FEDERAL SHARE OF COMPLETED CONSTRUCTION



## Federal Appropriations <sup>1</sup>

(In Thousands)

	HCFCD LEAD PROJECTS, Section 211(f)			CORPS LEAD PROJECTS			
PROJECT	Brays Bayou <sup>3</sup>	Hunting <sup>4,15</sup> Bayou	White Oak <sup>15</sup> Bayou	Clear Creek	Greens <sup>6</sup> Bayou	Sims Bayou <sup>5</sup>	
FUND TYPE	CG	GI, CG	GI, CG	CG	GI, CG	CG	TOTALS
FY98 <sup>2</sup>	\$2,000	\$500	\$150	\$750	\$1,000	\$12,000	\$4,400
FY99 <sup>2</sup>	\$4,500	\$500	\$300	\$1,770	\$600	\$12,000	\$7,670
FY00	\$9,800	\$328	\$300	\$2,900	\$560	\$18,300	\$13,888
FY01	\$6,000	\$500	\$230	\$1,525	\$434	\$11,820	\$8,689
FY02	\$4,066	\$0	\$1,100	\$1,200	\$377	\$9,000	\$6,743
FY03	\$5,000	\$2,000	\$400	\$1,200	\$350	\$9,000	\$8,950
FY04	\$6,000	\$750	\$575	\$1,200	\$774	\$12,000	\$9,299
FY05	\$10,000	\$625	\$350	\$1,200	\$340	\$16,000	\$12,515
FY06 <sup>7</sup>	\$11,800	\$375	\$50	\$1,125	\$75	\$18,000	\$13,425
FY07	\$15,387	\$0	\$100	\$1,000	\$100	\$22,400	\$16,587
FY08	\$13,453	\$0	\$98	\$936	\$480	\$20,075	\$14,967
FY09	\$5,011	\$0	\$96	\$478	\$0	\$19,426	\$5,585
FY10	\$7,777	\$100	\$90	\$1,211	\$0	\$20,736	\$9,178
FY11 <sup>8</sup>	\$23,239	\$0	\$0	\$359	\$0	\$0	\$23,598
FY12 <sup>9</sup>	\$5,004	\$0	\$0	\$250	\$0	\$1,000	\$5,254
FY13 <sup>8</sup>	\$37,247	\$0	\$0	\$0	\$0	\$2,167	\$37,247
FY14 <sup>10</sup>	\$8,975	\$0	\$0	\$0	\$0	\$0	\$8,975
FY15 <sup>11</sup>	\$25,754	\$0	\$0	\$0	\$8,000	\$802	\$33,754
FY16 <sup>12</sup>	\$15,565	\$0	\$0	\$0	\$25,865	\$0	\$41,430
FY17	\$11,989	\$0	\$0	\$0	\$0	\$0	\$11,989
FY18 <sup>13</sup>	?	?	?	?	?	?	?
<i>FY19 President's Budget</i>	\$0	\$0	\$0	\$0	\$0	\$0	\$0
<i>FY19 Could Be Used<sup>14</sup></i>	\$50,000	\$15,000	\$50,000	\$100	\$0	\$0	\$115,100

1- Actual funding through FY05 is less than appropriations. GI typically 15%-35% less. CG typically 15%-25% less.

2- In Act language.

3- Project Cooperation Agreement amended in March 2010 incorporating the downstream element into the Federal project.

4- Construction new start FY03.

5- Hurricane Ike Supplemental Funds of \$5,000 in FY08 and \$1,000 in FY09 not shown. ARRA Funds of \$7,768 in FY09 and \$15,133 in FY10 not shown.

6- Construction new start in FY15.

7- Major changes made to Corps budget processes and procedures in FY06.

8- Amounts designated in Corps Work Plan.

9- Amounts include \$3,000 for Brays Bayou appropriated by Congress; \$2,064, \$1,000, and \$250 added in the Corps Work Plan for Brays, Sims, and Clear Creek, respectively.

10- Amount includes \$2,500 for Brays Bayou appropriated by Congress and \$6,475 added in the Corps Work Plan for Brays Bayou.

11- Amount includes \$1,800 for Brays Bayou appropriated by Congress; \$19,235.5 and \$8,000 added in the February Corps Work Plan for Brays and Greens, respectively; \$4,718.00 and \$801,500 added in July Revised Work Plan for Brays and Sims, respectively.

12- Amount includes \$16,287 appropriated by Congress for Greens Bayou; \$15,565 and \$9,578 added in the Corps Work Plan for Brays and Greens, respectively.

13- Continuing Resolution through March 23, 2018.

14- Amounts needed if projects are not fully funded through Bipartisan Budget Act of 2018 supplemental appropriation.

15- Project Partnership Agreement executed in December 2014. Assumes FY18 construction new start.



# FY98-FY17 Federal Funds for Corps Projects in Harris County

## As of March 2018 (In Thousands)

Federal Fiscal Year	HCFCD LEAD PROJECTS (Section 211(f))											
	Brays Bayou (CG) <sup>4</sup>			Hunting Bayou (GI,CG) <sup>3,7</sup>			White Oak Bayou (GI,CG) <sup>7</sup>			TOTALS		
	Approp.	Actual <sup>2</sup>	Reprog.	Approp.	Actual <sup>2</sup>	Reprog.	Approp.	Actual <sup>2</sup>	Reprog.	Approp.	Actual <sup>2</sup>	Reprog.
FY98 <sup>1</sup>	\$2,000	\$2,000	\$0	\$500	\$500	\$0	\$150	\$150	\$0	\$2,650	\$2,650	\$0
FY99 <sup>1</sup>	\$4,500	\$4,500	\$0	\$500	\$500	\$0	\$300	\$300	\$0	\$5,300	\$5,300	\$0
FY00	\$9,800	\$8,404	-\$3,585	\$328	\$282	-\$282	\$300	\$258	-\$258	\$10,428	\$8,944	-\$4,125
FY01	\$6,000	\$5,040	-\$6,612	\$500	\$375	\$0	\$230	\$172	-\$150	\$6,730	\$5,587	-\$6,762
FY02	\$4,066	\$3,416	-\$3,200	\$0	\$0	-\$375	\$1,100	\$693	-\$450	\$5,166	\$4,109	-\$4,025
FY03	\$5,000	\$3,776	\$180	\$2,000	\$1,127	-\$1,117	\$400	\$273	-\$538	\$7,400	\$5,176	-\$1,475
FY04	\$6,000	\$4,637	\$600	\$750	\$580	-\$578	\$575	\$374	-\$374	\$7,325	\$5,591	-\$352
FY05	\$10,000	\$8,884	\$0	\$625	\$556	-\$550	\$350	\$278	-\$50	\$10,975	\$9,718	-\$600
FY06	\$11,800	\$11,682	\$0	\$375	\$371	-\$28	\$50	\$49	\$0	\$12,225	\$12,102	-\$28
FY07	\$15,387	\$15,387	\$0	\$0	\$0	-\$34	\$100	\$100	\$0	\$15,487	\$15,487	-\$34
FY08	\$13,453	\$13,453	\$0	\$0	\$0	\$0	\$98	\$98	\$0	\$13,551	\$13,551	\$0
FY09	\$5,011	\$5,011	\$0	\$0	\$0	\$0	\$96	\$96	\$0	\$5,107	\$5,107	\$0
FY10	\$7,777	\$7,777	\$9,500	\$100	\$100	\$0	\$90	\$90	\$0	\$7,967	\$7,967	\$9,500
FY11 <sup>5</sup>	\$23,239	\$23,237	\$0	\$0	\$0	-\$369	\$0	\$0	-\$100	\$23,239	\$23,237	-\$469
FY12 <sup>5</sup>	\$5,004	\$5,004	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$5,004	\$5,004	\$0
FY13 <sup>5</sup>	\$37,247	\$37,247	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$37,247	\$37,247	\$0
FY14 <sup>5</sup>	\$8,975	\$8,975	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$8,975	\$8,975	\$0
FY15 <sup>5</sup>	\$21,036	\$25,754	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$21,036	\$25,754	\$0
FY16 <sup>5</sup>	\$15,565	\$15,565	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$15,565	\$15,565	\$0
FY17 <sup>5</sup>	\$11,989	\$11,989	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$11,989	\$11,989	\$0
FY18 <sup>6</sup>	?	--	--	?	--	--	?	--	--	?	--	--
PROJECT TOTALS	\$223,849	\$221,738	-\$3,117	\$5,678	\$4,391	-\$3,333	\$3,839	\$2,931	-\$1,920	\$233,366	\$229,060	-\$8,370

1- In Act language for Section 211(f) projects.

2- Amount Corps received after OMB savings and slippage deducted. From FY07 to present, no deductions were made.

3- Construction new start in FY03.

4- \$159.5 million reimbursed to HCFCD for federal cost share.

5- Amounts designated in Corps Work Plan. In FY15, work plan revised July 1, 2015.

6- Pending FY18 Corps Work Plan.

7- Project Partnership Agreement executed December 2014.



# FY98-FY17 Federal Funds for Corps Projects in Harris County

## As of March 2018 (In Thousands)

Federal Fiscal Year	CORPS LEAD PROJECTS												ALL PROJECTS		
	Clear Creek (CG)			Greens Bayou (GI,CG) <sup>5</sup>			Sims Bayou (CG) <sup>3</sup>			TOTALS			TOTALS		
	Approp.	Actual <sup>2</sup>	Reprog.	Approp.	Actual <sup>2</sup>	Reprog.	Approp.	Actual <sup>2</sup>	Reprog.	Approp.	Actual <sup>2</sup>	Reprog.	Approp.	Actual <sup>2</sup>	Reprog.
FY98 <sup>1</sup>	\$750	\$704	\$300	\$1,000	\$816	\$105	\$12,000	\$12,209	-\$800	\$13,750	\$13,729	-\$395	\$16,400	\$16,379	-\$395
FY99 <sup>1</sup>	\$1,770	\$1,646	-\$1,355	\$600	\$504	\$292	\$12,000	\$11,158	-\$2,312	\$14,370	\$13,308	-\$3,375	\$19,670	\$18,608	-\$3,375
FY00	\$2,900	\$2,487	-\$1,699	\$560	\$482	\$219	\$18,300	\$15,694	-\$4,284	\$21,760	\$18,663	-\$5,764	\$32,188	\$27,607	-\$9,889
FY01	\$1,525	\$1,281	-\$103	\$434	\$325	\$254	\$11,820	\$9,929	\$6,177	\$13,779	\$11,535	\$6,328	\$20,509	\$17,122	-\$434
FY02	\$1,200	\$1,008	\$289	\$377	\$238	\$410	\$9,000	\$7,562	\$16,465	\$10,577	\$8,808	\$17,164	\$15,743	\$12,917	\$13,139
FY03	\$1,200	\$978	\$571	\$350	\$238	\$350	\$9,000	\$7,388	\$2,480	\$10,550	\$8,604	\$3,401	\$17,950	\$13,780	\$1,926
FY04	\$1,200	\$927	\$205	\$774	\$508	\$63	\$12,000	\$9,273	\$1,403	\$13,974	\$10,708	\$1,671	\$21,299	\$16,299	\$1,319
FY05	\$1,200	\$1,066	\$293	\$340	\$270	\$70	\$16,000	\$14,214	-\$1,377	\$17,540	\$15,550	-\$1,014	\$28,515	\$25,268	-\$1,614
FY06	\$1,125	\$1,114	\$69	\$75	\$74	\$0	\$18,000	\$17,820	\$0	\$19,200	\$19,008	\$69	\$31,425	\$31,110	\$41
FY07	\$1,000	\$1,000	\$0	\$100	\$100	\$0	\$22,400	\$22,400	\$0	\$23,500	\$23,500	\$0	\$38,987	\$38,987	\$0
FY08	\$936	\$936	\$525	\$480	\$480	\$0	\$20,075	\$25,075	\$0	\$21,491	\$26,491	\$525	\$35,042	\$40,042	\$525
FY09	\$478	\$478	\$0	\$0	\$0	\$0	\$19,426	\$28,194	\$0	\$19,904	\$28,672	\$0	\$25,011	\$33,779	\$0
FY10	\$1,211	\$1,211	\$0	\$0	\$0	\$0	\$20,736	\$29,069	-\$10,000	\$21,947	\$30,280	-\$10,000	\$29,914	\$38,247	-\$500
FY11 <sup>4</sup>	\$359	\$359	\$0	\$0	\$0	-\$4	\$0	\$0	-\$5,449	\$359	\$359	-\$5,453	\$23,598	\$23,596	-\$5,922
FY12 <sup>4</sup>	\$250	\$250	\$0	\$0	\$0	\$75	\$1,000	\$1,000	\$0	\$1,250	\$1,250	\$75	\$6,254	\$6,254	\$75
FY13 <sup>4</sup>	\$0	\$0	\$0	\$0	\$0	\$0	\$2,167	\$2,167	\$0	\$2,167	\$2,167	\$0	\$39,414	\$39,414	\$0
FY14	\$0	\$0	\$0	\$0	\$0	\$50	\$0	\$0	\$50	\$0	\$0	\$100	\$8,975	\$8,975	\$100
FY15 <sup>4</sup>	\$0	\$0	\$0	\$8,000	\$8,000	\$50	\$0	\$802	\$0	\$8,000	\$8,802	\$50	\$29,036	\$34,555	\$50
FY16 <sup>4</sup>	\$0	\$0	\$0	\$25,865	\$25,865	\$0	\$0	\$0	\$0	\$25,865	\$25,865	\$0	\$41,430	\$41,430	\$0
FY17	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$11,989	\$11,989	\$0
FY18 <sup>6</sup>	?	--	--	?	--	--	?	--	--	?	--	--	?	--	--
PROJECT TOTALS	\$17,104	\$15,445	-\$905	\$38,955	\$37,900	\$1,934	\$203,924	\$213,954	\$2,353	\$259,983	\$267,299	\$3,382	\$493,349	\$496,358	-\$4,988

1- In Act language for Section 211(f) projects.

2- Amount Corps received after OMB savings and slippage deducted. From FY07 to present, no deductions were made.

3- Includes Hurricane Ike Supplemental Funds of \$5,000 in FY08 and \$1,000 in FY09; and ARRA funds of \$7,768 in FY09 and \$8,333 in FY10.

4- Amounts designated in Corps Work Plan.

5- New construction start FY15.

6- Pending FY18 Corps Work Plan.



## Energy and Water Development Appropriations Act, 2000

**Sec. 102.** Agreements proposed for execution by the Assistant Secretary of the Army for Civil Works or the U.S. Army Corps of Engineers after the date of enactment of this Act pursuant to

- section 4 of the Rivers and Harbor Act of 1915, Public Law 64–291;
- section 11 of the River and Harbor Act of 1925, Public Law 68–585;
- the Civil Functions Appropriations Act, 1936, Public Law 75–208;
- section 215 of the Flood Control Act of 1968, as amended, Public Law 90–483;
- sections 104, 203, and 204 of the Water Resources Development Act of 1986, as amended (Public Law 99–662);
- section 206 of the Water Resources Development Act of 1992, as amended, Public Law 102–580;
- **and section 211 of the Water Resources Development Act of 1996, Public Law 104–303,**

shall be limited to a single agreement per project, ~~credits and reimbursements per project not to exceed \$10,000,000 in each fiscal year,\*~~ and total credits and reimbursements for all applicable projects not to exceed **\$100,000,000\*** in each fiscal year.

*\*Changed from \$50,000,000 to \$100,000,000 for all applicable projects and individual project limit discontinued in Energy and Water Development Appropriations Act, 2006*

### APPROPRIATION PROJECTIONS FOR SECTION 211(f) PROJECTS IN HARRIS COUNTY ARE WITHIN CURRENT FUNDING LIMITATIONS IN SECTION 102<sup>1</sup>

PROJECT	FUND TYPE	FY98-FY99 <sup>2</sup>	FY00-FY10 <sup>3</sup>	FY19	FY19 <sup>4</sup> Could Be Used	FY20-FY23 <sup>4</sup>
Hunting Bayou <sup>5,6</sup>	GI,CG	\$1,000,000	\$4,678,000	\$?	\$15,000,000	\$15 M/year
White Oak Bayou <sup>6</sup>	GI,CG	\$450,000	\$3,389,000	\$?	\$50,000,000	\$15 M/year
	<b>TOTALS</b>	<b>\$1,450,000</b>	<b>\$8,067,000</b>	<b>\$?</b>	<b>\$65,000,000</b>	<b>\$30 M/year</b>

1 - Actual funding through FY05 is less than appropriations. GI typically 15%-35% less. CG typically 10%-20% less.

2 - In Act language, cannot be reprogrammed.

3 - Most has been reprogrammed. In FY11, new budget rules discouraged reprogramming.

4 - For reimbursement of Federal share for discrete segments. White Oak reimbursements could end in FY22.

5 - Construction new start in FY03.

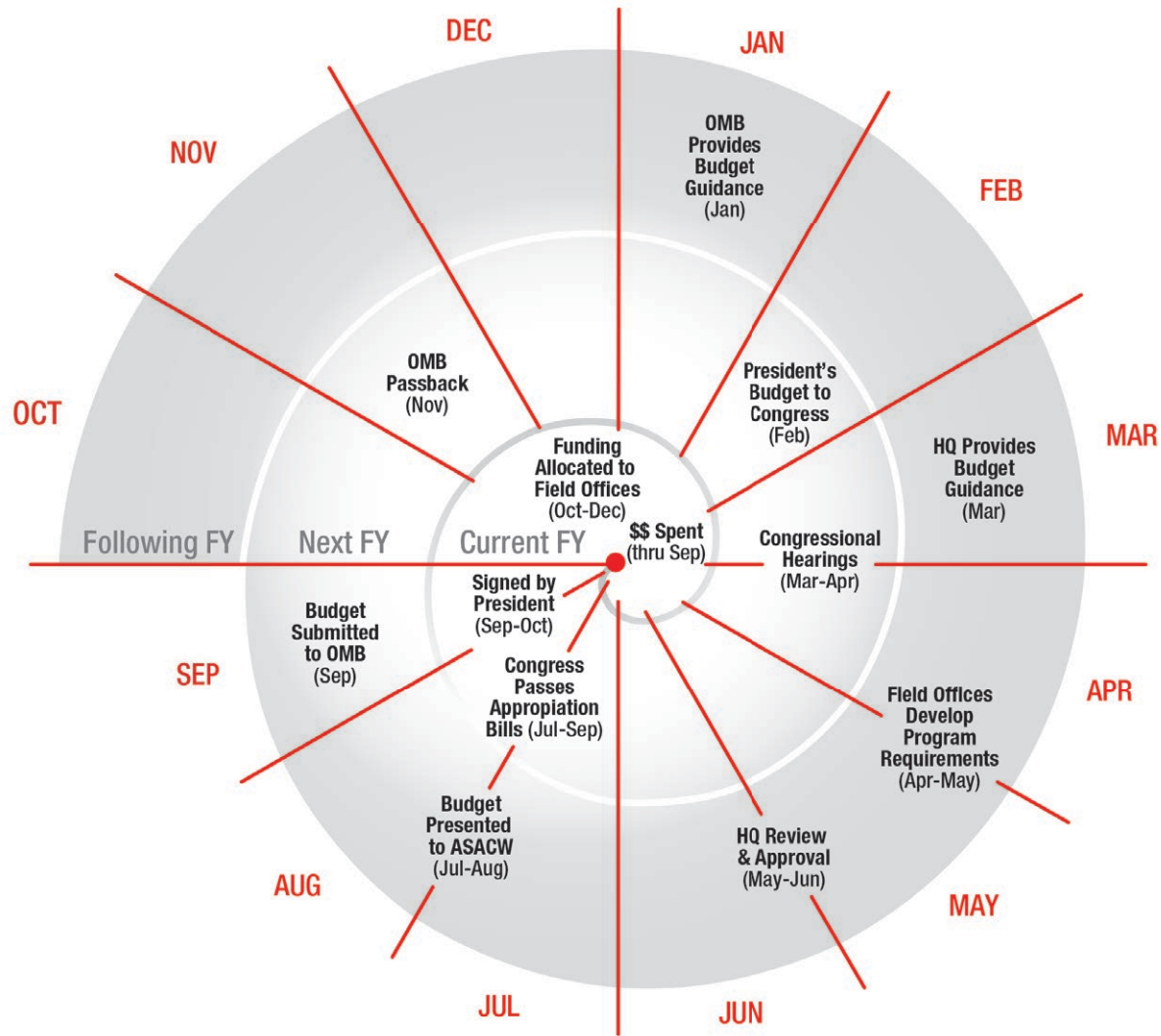
6 - Project Partnership Agreements executed December 2014

Note: Brays Bayou is not subject to Section 102 limits per ASA(CW) letter dated 11/18/99.



# FEDERAL BUDGET CYCLE

## for the US Army Corps of Engineers





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# HCFCD Lead Projects

## Section 211(f)

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## Harris County Flood Control District Lead Projects

### **Sections 203 and 204 - Water Resources Development Act of 1986, as Amended**

Section 1014 of the Water Resources Reform and Development Act of 2014, entitled “Study and Construction of Water Resources Development Projects by Non-Federal Interests,” amended Sections 203 and 204 of WRDA 1986 by consolidating several non-Federal interest lead authorities in different business lines. However, Section 1014 did not affect projects with agreements in place between the Corps of Engineers and non-Federal interest on or before December 31, 2014. Project partnership agreements for Brays Bayou, White Oak Bayou, and Hunting Bayou were in place by the deadline, therefore, they will continue to be implemented under Water Resources Development Act (WRDA) of 1996, Section 211.

### **Section 211 - Water Resources Development Act of 1996**

Section 211 allowed local sponsors to take the lead role in the planning, design, and construction of flood damage reduction projects rather than the Corps taking the lead role. The Corps provides oversight and verifies the work is done in accordance with established regulations, guidance, and requirements for Federal participation. The Federal/local sponsor cost sharing is the same as Corps lead projects. The local sponsor pays all costs in advance of Federal appropriations and is reimbursed for the Federal share provided certain conditions are satisfied.

Section 211 has changed our relationship with the Corps. By taking the lead in moving the projects forward, the HCFCD and the Corps assumed new roles. Eventually, we learned to appreciate our new respective roles and perspectives. Our communications and coordination on all projects are significantly more productive. Due to our stronger partnership, we work on more projects more efficiently by sharing the workload.

Subsection (f) of Section 211 designated three HCFCD projects in WRDA 1996 and an additional two were added in WRDA 2007 to demonstrate the advantages and effectiveness of non-Federal implementation. At our own financial risk, the HCFCD had the option to design and build the project in advance of plan approval by the Assistant Secretary of the Army for Civil Works and before agreements were in place. For Brays Bayou, White Oak Bayou, and Hunting Bayou, the HCFCD did begin building the projects prior to approval of the plans and execution of the project partnership agreements. Being able to begin implementation as soon as possible was critical in rapidly developing urban areas like Harris County, Texas so benefits could be realized much sooner and costs lower.

In establishing the policy guidance for Section 211(f), the Corps recognized the need for periodic reimbursement as opposed to reimbursement once the entire project is complete. Under Policy Guidance Letter No. 53, the HCFCD qualified for reimbursement of the Federal share for complete and functional “discrete segments.” However, the federal funds paid to the HCFCD must be returned if the entire project is not completed. Section 1014, WRRDA 2014 did not include language that allows for periodic discrete segment reimbursement, only the complete project or separable element of the project, which is prohibitively expensive for local sponsors to build in advance of reimbursement. This was corrected by WRDA 2016 (Title I of the WIIN Act-Pub. Law 114-322), Section 1127 entitled “Non-Federal Construction of Authorized Flood Damage Reduction Projects” by amending Section 204 to include the option of periodic reimbursement for discrete segments with conditions. In summary, this section says that the Corps of Engineers may authorize credits or reimbursements for discrete segments of a flood reduction project under WRDA 1986 before final completion of the project if the non-Federal interest can independently operate and maintain the segment without creating a hazard in advance of project completion.

The HCFCD began general reevaluation studies for the two Section 211(f) projects added in WRDA 2007, Buffalo Bayou and Halls Bayou. After completing the “without project conditions” analysis and identifying initial components in 2011, the HCFCD chose to focus on developing comprehensive plans for each watershed. Since no agreements were executed before the Section 1014, WRRDA 2014 deadline, they are no longer Section 211 projects. The HCFCD may reinstate a Corps study under Section 203, WRDA 1986 as amended, in the future. The HCFCD has submitted a Letter of Intent to reinstate a Halls Bayou study under this authority.



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# Brays Bayou

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## Brays Bayou Section 211(f) Flood Control Project Information

### Description

- Upstream Element (upstream-west of Sam Houston Tollway)
  - 3 detention basins: 595 surface acres; 9,623 acre-feet of storage (6.0 Astrodomes)
  - 3.7 miles of channel conveyance improvements, including control structures, from Old Westheimer Rd. to SH 6
- Downstream Element (downstream-east of Sam Houston Tollway)
  - 17.5 miles of channel conveyance improvements from the mouth to Fondren Rd.
  - 1 detention basin: 252 surface acres; 1,865 acre-feet of storage (1.2 Astrodomes)
  - 30 bridge replacements/extensions
- Includes Environmental Quality Features – wetland creation, trees and shrubs; and aesthetic layouts
- Harris County Flood Control District (HCFCD) – manages, designs, and builds the project; buys land, easements, rights-of-way (ROW); relocates utilities; adjusts bridges (except for railroads); operates and maintains the channel after construction
- USACE – monitors the overall project, approves HCFCD work, and reimburses the design and construction cost
- Project Cooperation Agreement executed March 2000; amended March 2010
- Estimated Completion – dependent on Federal appropriations
  - 2021 (assumes annual \$20M Federal reimbursement & \$20M HCFCD expenditure)
  - 2035 (assumes annual \$5M Federal reimbursement & \$5M HCFCD expenditure)

### Progress – 2017

- Willow Waterhole control structures under construction
- Continue constructing one channel segment (2.5 mi.); final channel segment in design (2.8 mi.)
- 2017 expenditures: \$25M
- Invoices and Reimbursements – 13 D.S. totaling \$27M pending; 6 D.S. totaling \$28M will be submitted during FY18

### Cumulative Progress

- ROW - 926 acres acquired for all four basins; Additional ROW needed for channel work
- Detention Excavation Completed to Date – 11,488 acre-feet, 3.7 billion gallons, 7.2 Astrodomes
  - Sam Houston Parkway (2008), Old Westheimer (2007), and Eldridge (2015) basins completed
  - Willow Waterhole basin completed (2016)
- Channel Conveyance Improvements – 10 Discrete Segments (D.S.) completed (16.4 miles)
- Bridges - 14 replacements or modifications completed; 10 in design
- Invoices and Reimbursements – received \$203M for 50 D.S.

### Benefits / Costs

- Upstream Element – 1% (100-yr.) level of flood protection (under full development)
- Downstream Element
  - Number of structures subject to 4% (25-year) flood reduced from 3,520 to 50
  - Number of structures subject to 1% (100-year) flood reduced from 16,800 to 1,800
- Total Cost Estimate (Fully Funded) - \$480M: HCFCD \$240M (50%), Corps \$240M (50%)
- Expenditures to Date – Total \$350M: HCFCD \$147M (42%), Corps \$203M (58%)
- Benefit Cost Ratio – 7.0 (3.375%) 3.5 (7.0%)

**Federal Funding** \*BRAYS BAYOU IS NOT SUBJECT TO SECTION 102 LIMITS PER ASA(CW) LETTER DATED 11/18/99

\*\* REMAINING WORK AT FULL FEDERAL EXPENSE = \$130 M – INCLUDES REIMBURSEMENTS OF FEDERAL SHARE OF COMPLETED WORK (\$20 M) AND FUTURE WORK (\$50 M).\*\*

OR, IF NOT SELECTED FOR FUNDING WITH FY18 SUPPLEMENTAL APPROPRIATION:

	<i><b>FY98 – FY17</b></i>	<i><b>FY18</b></i>	<i><b>FY 19 Needed</b></i>	<i><b>FY 20 – FY21</b></i>
Appropriations	\$223,849,000	?	\$50,000,000	\$20 million/year
For design/constr	55 completed D.S.		9 D.S. by Aug 2018	Remaining D.S.

### Congressional/ Administration Support Needed

- If remaining work is not funded at full Federal expense, continue annual funding to complete construction.

## Brays Bayou Life and Health Safety Infrastructure (Compiled in 2011)

4.1 million people live and work in Harris County, Texas, and a large majority are affected directly or indirectly by the Life and Health Safety Infrastructure along Brays Bayou. A 0.2% (500-year) flood along Brays Bayou would impact:

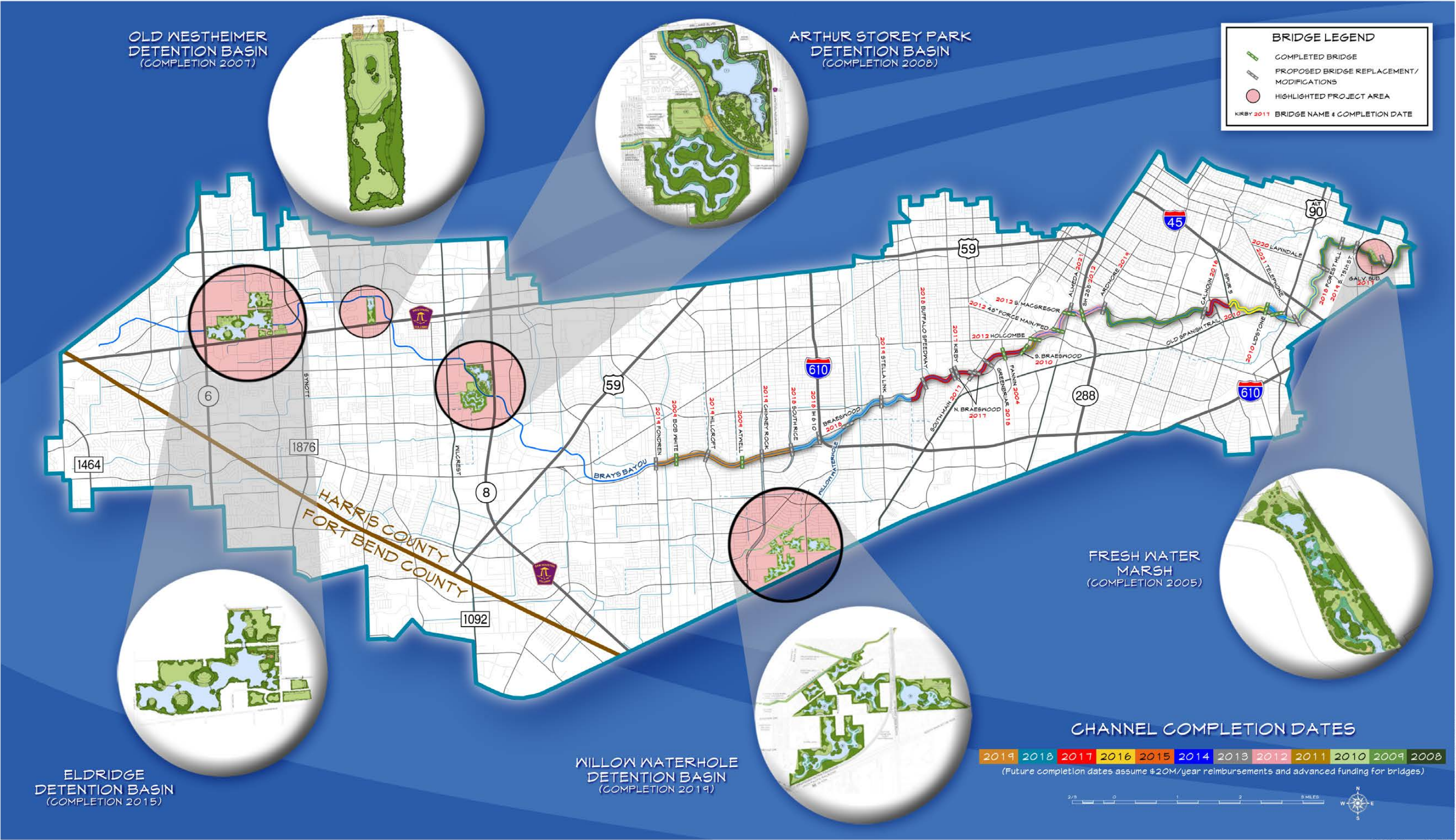
- 5 Facilities on the Critical Infrastructure and Key Resources (CI/KR) Support Annex of the National Response Framework (NRF)
- 12 Police & Fire Stations
- 25 Government Facilities
  
- 24 Hospitals
- 138 Health Clinics
- 88 Pharmacies
  
- 6 Universities
- 51 Public Schools
- 302 Day Care and After School Facilities
  
- Interstate 45, a hurricane evacuation route through Houston and Harris County
- State Highway 288, a major commuter route and depressed highway below ground level for much of its length crossing the Brays Bayou watershed. It has filled 3 times with stormwater since it was built.
- 21 miles Major Thoroughfares
- 12 miles Railroads
- 3 miles Local Rail Service
  
- 8 Electrical Substations
- 60 miles Electrical Transmission Lines
- 36 miles Pipelines
  
- 18,000 Businesses
- 252,131 Residents (2010 Census)
- 40,000 Homes
- 2,500 Commercial and Industrial Facilities

**The Texas Medical Center (TMC)**, which was unreachable by roads as a result of the rainfall in Tropical Storm Allison in 2001, is the largest patient care, teaching, and research medical center in the world. It covers more than 1,000 acres. It has 6,800 patient beds and 93,500 employees including 20,000 physicians, scientists and researchers. It hosts 160,000 daily visitors and 6 million annual patient visits with 18,000 being international patient visits. There are 40 buildings at the TMC located in a 100-year floodplain and daily economic loss during a flood is more than \$30 million. Major Life safety concerns related to TMC during major flood events are:

- Inability to transport patients for critical life saving care to trauma centers due to high water
  - Staff and physicians not being able to reach the 14 hospitals and trauma centers to provide care because of impassible streets. Many live in nearby cities and subdivisions in the Brays Bayou watershed which, too, are at risk of flooding. Loop 610, US 59 and SH 288 surround the TMC and all are subject to flooding.



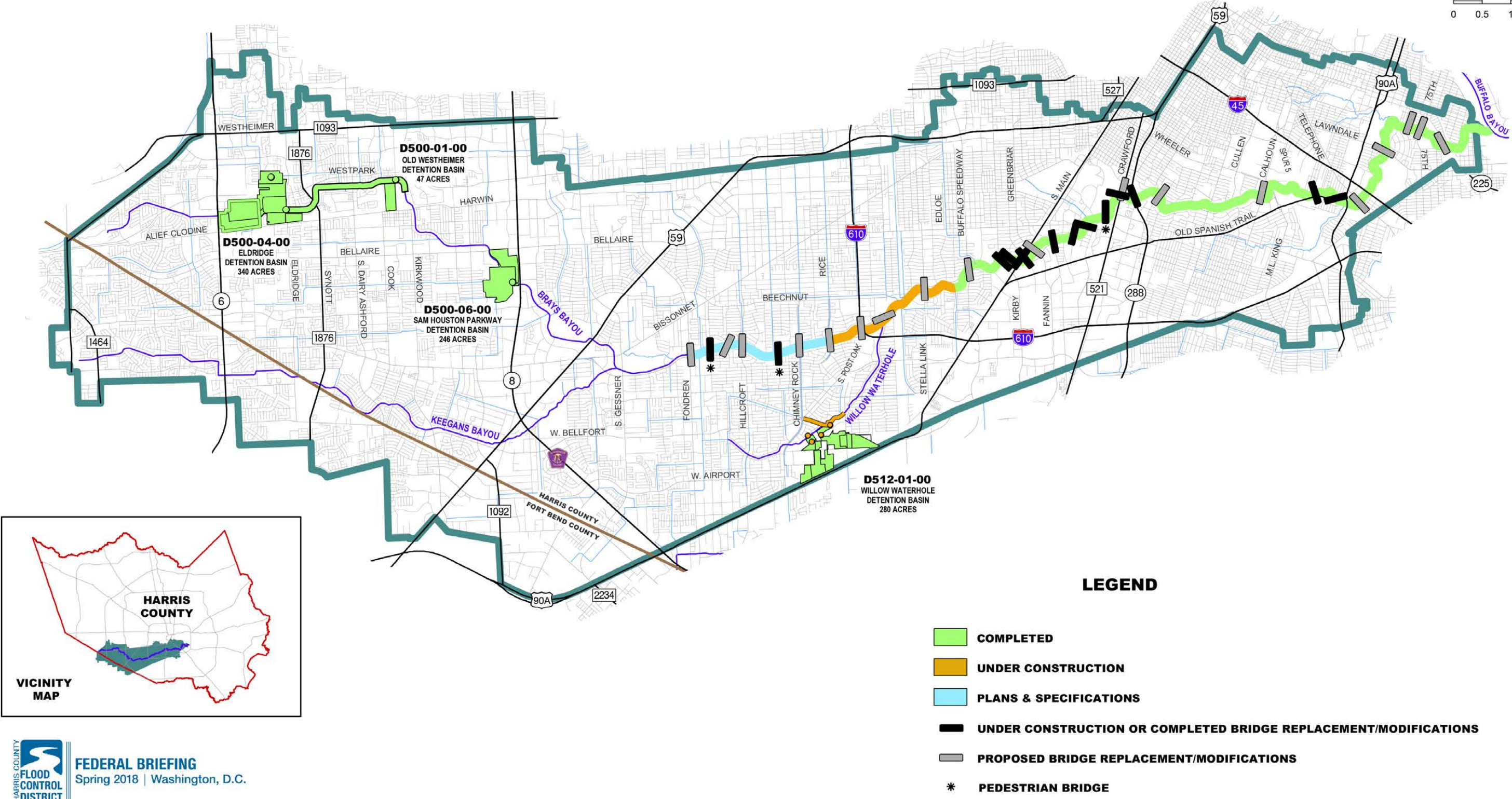
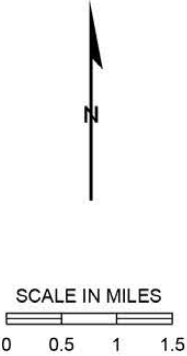
# Brays Bayou Project Locations



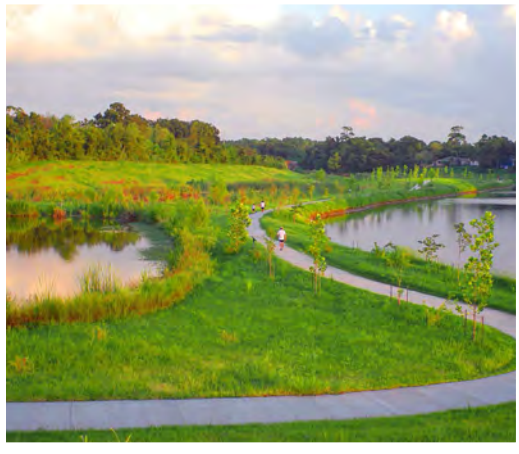


# Brays Bayou

## Section 211(f) Federal Flood Control Project







Brays Bayou Federal Project



Freshwater Tidal Marsh and Channel  
Construction Complete, 2014



Brays Bayou Federal Project  
Mid-Reach Channel Modification at SH 288, 2012



Brays Bayou Federal Project, Construction near Stella Link Blvd., 2017





Brays Bayou Stormwater Detention Basin/Arthur Storey Park  
West Sam Houston Parkway  
Completed 2014



Brays Bayou Control Structure at Old Westheimer Rd.  
Stormwater Detention Basin  
Construction Complete, 2017



Hurricane Harvey  
August 29, 2017





Brays Bayou Federal Project  
Old Westheimer Rd. Stormwater Detention Basin  
Construction Complete, Trees Planted, 2014



Brays Bayou Federal Project  
Completed Channel Construction and  
Tree Planting. Near Dairy Ashford, 2007



Brays Bayou Federal Project, Eldridge Stormwater Detention Basin, Construction Complete, 2015

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# White Oak Bayou

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## White Oak Bayou Section 211(f) Flood Damage Reduction Project Information

### Description

- Project Features
  - 15.3 miles grass-lined channel conveyance improvement
  - 4 detention basin complexes (covering 352 acres storing 2,940 acre-feet of water)
  - 12 miles of linear park/trails along the channel and multi-purpose fields, play areas, trails, etc. in detention basins
  - Aesthetic and environmental quality features
- Harris County Flood Control District (HCFCFCD) – manages, designs, and builds the project; buys land, easements, rights-of-way; relocates utilities; adjusts bridges (except for railroads); and operates and maintains the project features after construction
- USACE – monitors the overall project, approves HCFCFCD work, and reimburses the design and construction cost

### Progress – 2017

- No construction

### Prior Progress

- Reimbursement Agreement for reconnaissance report and General Reevaluation Report (GRR) executed August 2006
- GRR approved by ASA(CW) August 2014
- Project Partnership Agreement executed December 2014
- Remaining ROW - some additional for channel work
- Remaining construction - portion of one basin; some additional channel work
- Invoices and Reimbursements - one totaling \$7.2M submitted FY15, \$5.6M+ during FY16

### Apparent Benefits / Costs

- Number of structures subject to a 10% (10-year) flood reduced from 1,300 to 50
- Number of structures subject to a 4% (25-year) flood reduced from 2,700 to 900
- Number of structures subject to a 1% (100-year) flood reduced from 6,100 to 4,600
- Total first cost estimate - \$124M: HCFCFCD \$54M (43%), Corps \$70M (57%)  
(includes \$13M for recreation; \$6.7M HCFCFCD, \$6.3M Corps)
- Expenditures to date: HCFCFCD \$85M, Corps \$0M
- Benefit-to-Cost ratio = 7.2 (3.5%) 4.3 (7.0%)

### Federal Funding

**\*\* REMAINING WORK AT FULL FEDERAL EXPENSE = \$90 M – INCLUDES REIMBURSEMENTS OF FEDERAL SHARE OF COMPLETED WORK (\$50 M) AND FUTURE WORK (\$20 M). \*\***

**OR, IF NOT SELECTED FOR FUNDING WITH FY18 SUPPLEMENTAL APPROPRIATION:**

	<b><i>FY98 – FY10</i></b>	<b><i>FY18</i></b>	<b><i>FY19 Needed</i></b>	<b><i>FY 20- FY22</i></b>
Appropriations For	\$3,839,000 GRR	?	\$50,000,000 Initial discrete segments reimbursement	\$15 million/year Design/construction reimbursement

### Congressional/ Administration Support Needed

- If remaining work is not funded at full Federal expense, need construction new start and initiate construction general funding.

## HCFCFCD Regional Flood Control Project

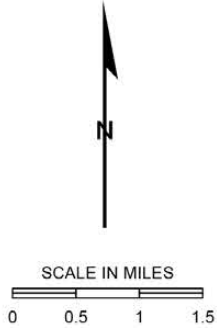
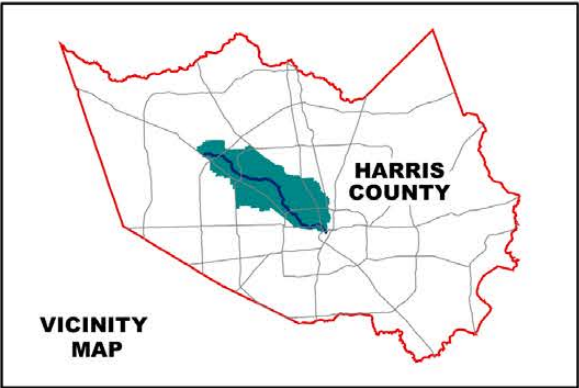
### General Information

- Purchased 10 detention sites totaling 490 acres; excavated 9.7 million cubic yards (1.9 billion gallons, 3.9 Astrodomes)
- Completed 7.5 miles of channel conveyance improvement from Tidwell Rd. to the Sam Houston Tollway
- Completed 2.0 mile Jersey Village diversion channel improvement in 2010
- Completed 1 detention basin in 2010; completed a second in 2013
- Expenditures to date - \$85.2M
- Federal Project incorporates many of these components



# White Oak Bayou

## Section 211(f) Federal Flood Damage Reduction Project

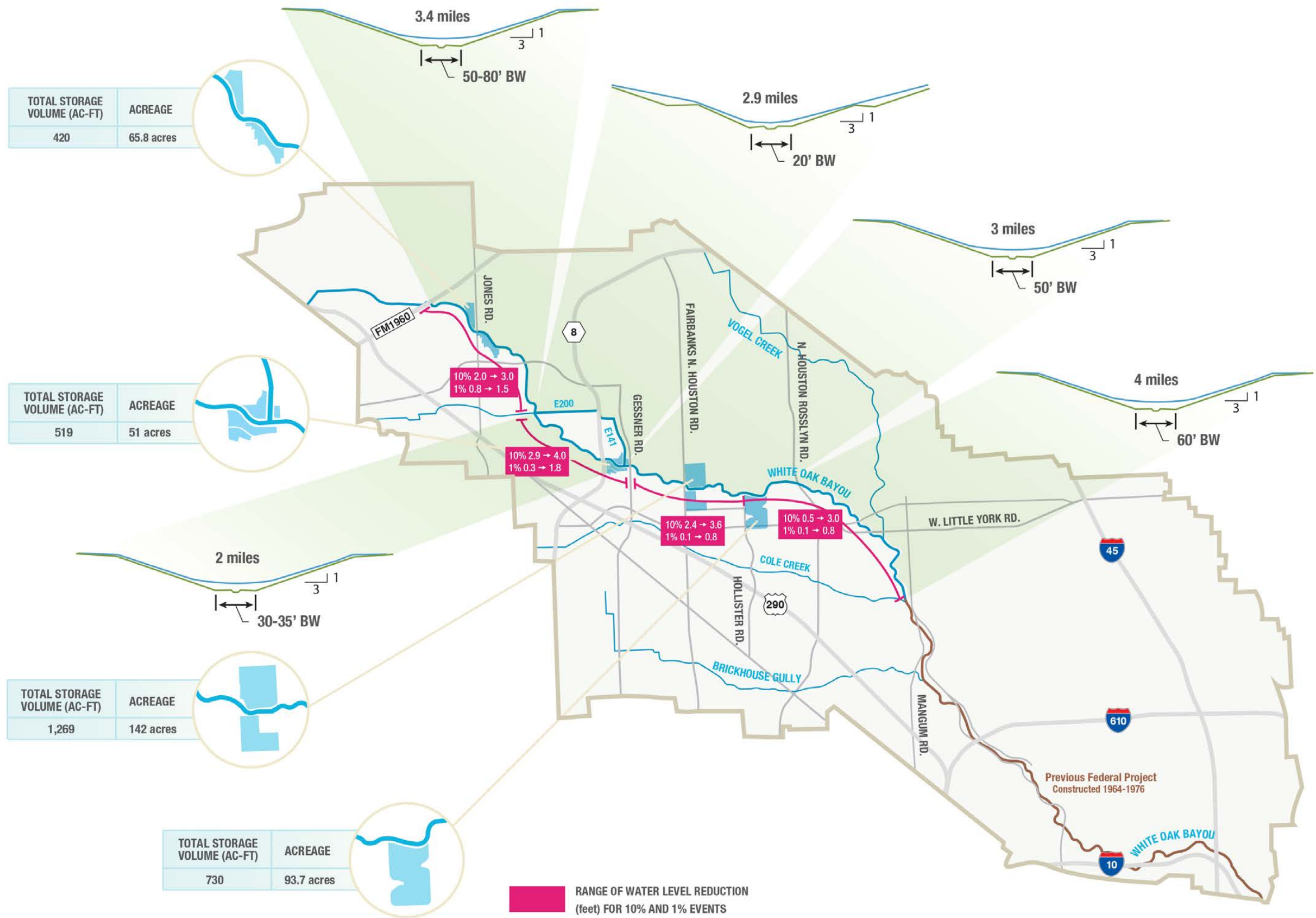


### LEGEND

- COMPLETED
- UNDER CONSTRUCTION
- PLANS & SPECIFICATIONS
- PRELIMINARY DESIGN
- EXISTING REGIONAL DETENTION EXCAVATION
- CORPS CHANNEL BUILT IN 1960's
- RECREATION COMPONENTS

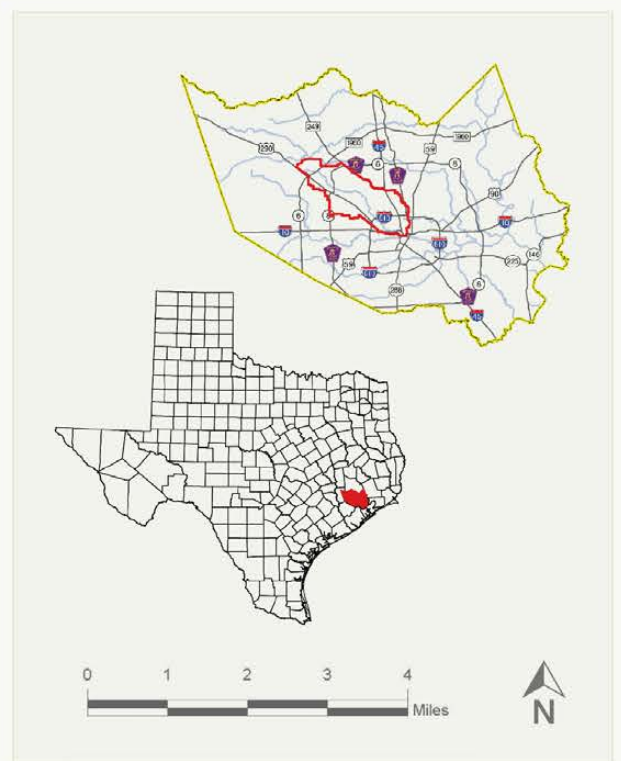
REGIONAL DETENTION BASINS ARE NOT PART OF FEDERAL PROJECT





# WHITE OAK BAYOU WATERSHED

## WHITE OAK BAYOU FEDERAL FLOOD DAMAGE REDUCTION PROJECT



NUMBER OF FLOODED STRUCTURES			ECONOMIC SUMMARY	
FREQUENCY	WITHOUT PROJECT	TENTATIVELY RECOMMENDED PLAN	Total cost	\$110.6 Million
10%	1,333	48	Benefit to Cost Ratio	7.2
1%	6,074	4,563	Annual Flood Damage Reduction Benefit	\$36.1 Million
			Fiscal Year 2014, Interest Rate of 3.50%	





White Oak Bayou Federal Detention Basin  
Jersey Village at W. Sam Houston Tollway  
Construction Complete, Trees Planted, 2009



White Oak Bayou Federal Detention Basin, Jones Rd.  
2014



White Oak Bayou, Spillway Near Jones Road, 2009



White Oak Bayou, Federal Detention Basin on Jones Road, 2014





White Oak Bayou Federal Detention Basins  
Fairbanks-N. Houston Rd., 2007



White Oak Bayou Federal Detention Basins  
Fairbanks-N. Houston Rd.  
Storing Water During Flood, 2002



White Oak Bayou Regional Detention Basin  
W. Little York Rd., 2012



White Oak Bayou Federal Detention Basin  
Hollister Road and West Little York Road, 2012



White Oak Bayou Federal Detention Basins  
Downstream of Fairbanks-N. Houston Rd.  
Storing Water During Flood, April 2016





White Oak Bayou, I-10 at TC Jester, 1992



White Oak Bayou, 1992



White Oak Bayou, 1992



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# Hunting Bayou

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## Hunting Bayou Section 211(f) Flood Risk Management Project Information

### Description

- Project Features
  - 3.8 miles grass-lined channel conveyance improvement
  - 75 acre detention basin storing 1,000 acre-feet of water
  - 17 bridge replacements/modifications
  - Aesthetic and environmental quality features are included
- Harris County Flood Control District (HCFCD) – manages, designs, and builds the project; buys land, easements, rights-of-way; relocates utilities; adjusts bridges (except for railroads); and operates and maintains the project features after construction
- USACE – monitors the overall project, approves HCFCD work, and reimburses the design and construction cost

### Progress 2017

- Initial channel work between Pickfair and upstream end completed
- One discrete segment of channel and final phase of basin under construction
- Two discrete segments in design: one channel, railroad bridges
- 2017 Expenditures: \$2.2M

### Prior Progress

- 2nd phase construction of 75 acre detention basin completed in Fall 2015
- General Reevaluation Report (GRR) approved by ASA(CW) December 2014
- Project Partnership Agreement executed December 2014 (includes reimbursement for GRR)
- Initial phase construction on 75 acre detention basin completed in 2009 (\$1.3 million)
- 94 tracts acquired along channel conveyance improvement reach; Initial excavation downstream of Lockwood Dr. completed early 2014
- One railroad bridge expansion, one North Loop 610 bridge crossing, and eastbound Kelly Street bridge are complete
- Invoices and Reimbursements – two totaling \$2.3 M to be submitted FY18, three previous totaling \$7.6M

### Apparent Benefits / Costs

- Number of structures subject to a 10% (10-year) flood reduced from 1,200 to 35
- Number of structures subject to a 4% (25-year) flood reduced from 2,550 to 200
- Number of structures subject to a 1% (100-year) flood reduced from 5,100 to 650
- Total cost estimate (fully funded):
  - NED plan - \$135M: HCFCD \$68M (50%), Corps \$67M (50%)  
Benefit-to-Cost ratio = 2.24 (3.375%) 1.14 (7.0%) FY15 price level
  - Recommended plan (LPP) - \$165M: HCFCD \$98M (59%), Corps \$67M (41%)  
Benefit-to-Cost ratio = 2.02 (3.375%) 1.01 (7.0%) FY15 price level
- HCFCD anticipates up to \$60 M savings on vehicular and pedestrian bridges
- Expenditures to date – Total \$40M: HCFCD \$40M (100%), Corps \$0M (0%)

### Federal Funding

**\*\*REMAINING WORK AT FULL FEDERAL EXPENSE = \$80 M – INCLUDES REIMBURSEMENTS OF FEDERAL SHARE OF COMPLETED WORK (\$10 M) AND FUTURE WORK (\$60 M).\*\***

**OR, IF NOT SELECTED FOR FUNDING WITH FY18 SUPPLEMENTAL APPROPRIATION:**

	<b><i>FY98 – FY10</i></b>	<b><i>FY18</i></b>	<b><i>FY19 Needed</i></b>	<b><i>FY20 – FY23</i></b>
Appropriations For	\$5,678,000 GRR	?	\$15,000,000 Initial discrete segments & GRR reimbursement*	\$15 million/year Design/construction

### Congressional/ Administration Support Needed

- If remaining work is not funded at full Federal expense, resume construction general funding for incremental reimbursements of completed discrete segments until project completion.



# Hunting Bayou Federal Flood Risk Management Project



Hunting Bayou Federal Flood Risk Management Project





Hunting Bayou Federal Project  
Kashmere Gardens  
Upper Channel  
Pre-Project



Hunting Bayou Federal Project, Reach Kashmere Gardens  
Wayne Street - Pre-Project



Hunting Bayou Federal Project  
Proposed Grass-Lined Channel





Hunting Bayou Federal Project, Stormwater Detention Basin  
Phase 2 of 3 Complete, 2016

Hunting Bayou Federal Project,  
Phase 3 Permanent Pool Excavation, 2017



Hunting Bayou Federal Project, Englewood Railroad Yard  
Proposed Bridge Replacements and Channel Work, 2016





## Hunting Bayou Project Federal Funding Request

### Request

- The HCFCD and citizens of Hunting Bayou request the Administration resume construction funding for the Hunting Bayou Flood Damage Reduction Project at \$15 million per year in order to complete the project at the earliest possible date.
- Since Federal reimbursements will be used to design and build future construction segments, the pace of construction will depend on the pace of Federal reimbursement.

### Social Justice Factors

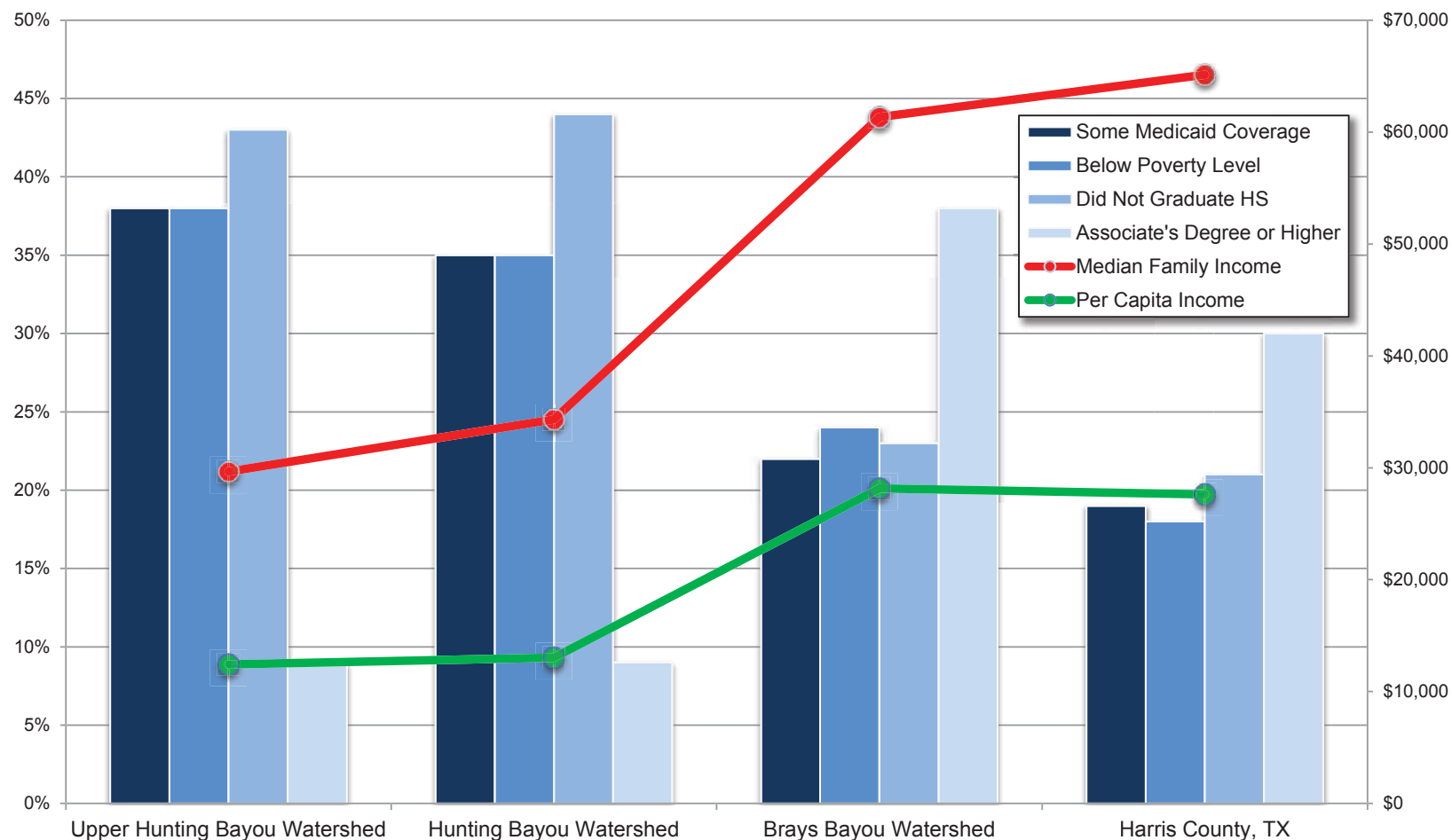
- Residents in the Hunting Bayou watershed deserve the same level of potential flood risk reduction as those who live in other parts of Harris County.
- The economically disadvantaged Hunting Bayou residents struggle severely to recover from house and business flooding.
- The Corps economic analysis is an important factor in prioritizing competing projects for annual Federal funding, but it is biased against economically disadvantaged communities like in Hunting Bayou.

### Public Safety Factor

- With the Hunting Bayou project in place, flood levels would be reduced along two major regional hurricane evacuation routes through Houston that traverse Hunting Bayou, US 59 and Interstate Highway 610; and improve accessibility to the state's busiest Level III trauma center, the LBJ County Hospital.



## USACE/HCFCD 211(f) Projects Comparison: Population Profile



- Poverty rates in the Hunting Bayou watershed are nearly double those in the Brays Bayou watershed and Harris County. Per capita and median family incomes are roughly half.
- Medicaid coverage rates generally mirror poverty rates.
- 2/5 of the Hunting Bayou watershed population never graduated high school, and less than 1 in 10 have graduated higher education.
- See reverse for population demographics.



## Property and Benefits

Geographic Area	Single Family Residential <sup>1</sup> in Watershed		Number of Structures <sup>2</sup> in 4% (25-yr) Floodplain			Number of Structures <sup>2</sup> in 1% (100-yr) Floodplain			B/C <sup>3</sup>	
	Number	Mean Value	Pre-Project	Post-Project	% Reduction	Pre-Project	Post-Project	% Reduction	Planning %	7.00%
Hunting Bayou Watershed	19,460	\$52,650	2,550	200	92%	5,100	650	87%	2.02	1.01
Brays Bayou Watershed	126,860	\$224,520	3,520	50	99%	16,800	1,800	89%	7.00	3.50

Data Source

<sup>1</sup> 2015 Harris County Appraisal District

<sup>2</sup> General Revaluation Report; all structures

<sup>3</sup> Most recent economic update

## 2010 Census Data Demographics

Geographic Area	2010 Population		Race/Ethnicity (Percent)					Percent Hispanic	Median Family Income	Per Capita Income
	Watershed	0.2% (500-yr) Floodplain	White	Black/African American	Asian	Other <sup>1</sup>	Total			
<i>Upper Hunting Bayou Watershed<sup>2</sup></i>	45,641	18,875	27%	51%	0%	22%	100%	46%	\$29,652	\$12,428
Hunting Bayou Watershed	75,908	32,675	39%	34%	0%	26%	100%	61%	\$34,321	\$13,031
Brays Bayou Watershed	717,198	429,717	45%	25%	12%	19%	100%	40%	\$61,344	\$28,156
Harris County	4,092,459	1,818,702	57%	19%	6%	18%	100%	41%	\$65,117	\$27,616

<sup>1</sup> Includes other race, 2 or more races, or American Indian

<sup>2</sup> Includes all Census units upstream of the easternmost IH-610 crossing.

## Population Socioeconomic Profile

Geographic Area	Total Population <sup>1</sup>	Educational Attainment <sup>2,a,b</sup>						Health Insurance Coverage <sup>3,a,c</sup>						Poverty Level <sup>4,a,d</sup>			
		Less than 9th Grade	Less than HS Graduate	HS Graduate or Equivalent	Some College	Associate's Degree	Bachelor's Degree or higher	Insured		Uninsured	Uninsured Rate by Age Group			Below Poverty Level	Poverty Rate by Age Group		
								Medicare (At Least Partial)	Medicaid (At Least Partial)		<18	18-64	65+		<18	18-64	65+
Upper Hunting Bayou Watershed <sup>5</sup>	45,641	22%	21%	31%	17%	3%	6%	16%	38%	33%	17%	46%	4%	38%	50%	34%	26%
Hunting Bayou Watershed	75,908	23%	21%	31%	17%	3%	6%	14%	35%	34%	18%	46%	5%	35%	47%	32%	25%
Brays Bayou Watershed	717,198	14%	9%	20%	19%	5%	33%	9%	22%	30%	15%	38%	6%	24%	36%	20%	16%
Harris County, TX	4,092,459	11%	10%	23%	21%	6%	29%	10%	19%	25%	15%	33%	4%	18%	27%	16%	12%
Texas	25,145,561	9%	9%	25%	23%	7%	27%	12%	17%	22%	13%	30%	2%	18%	25%	15%	11%
United States	308,745,538	6%	8%	28%	21%	8%	29%	16%	18%	14%	7%	20%	1%	16%	22%	15%	9%

<sup>1</sup> U.S. Census Bureau, 2010 Census, Table P12 [Sex By Age]

<sup>2</sup> U.S. Census Bureau, 2010-2014 American Community Survey 5-Year Estimates, Table S1501 [Educational Attainment]

<sup>3</sup> U.S. Census Bureau, 2010-2014 American Community Survey 5-Year Estimates, Table S2701 [Health Insurance Coverage Status]

<sup>4</sup> U.S. Census Bureau, 2010-2014 American Community Survey 5-Year Estimates, Table S1701 [Poverty Status in the Past 12 Months]

<sup>5</sup> Includes all Census units upstream of the easternmost IH-610 crossing.

<sup>a</sup> Data are based on a sample and are subject to sampling variability.

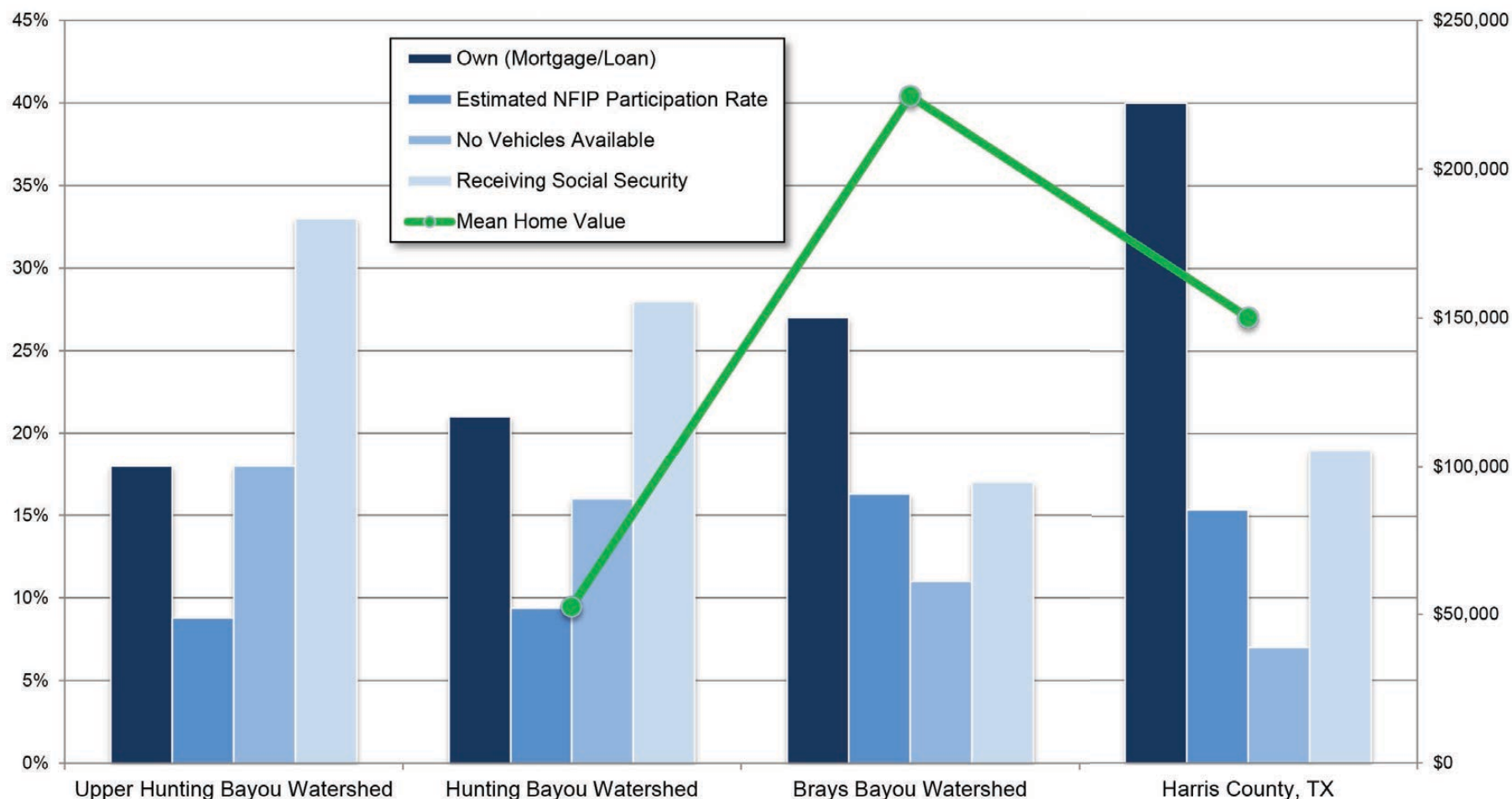
<sup>b</sup> Among population 25 years old and over.

<sup>c</sup> Among civilian non-institutionalized population.

<sup>d</sup> Among population for whom poverty status is determined.



## USACE/HCFCD 211(f) Projects Comparison: Household Profile



- Mean home values in the Hunting Bayou watershed lag significantly behind those in the Brays Bayou watershed and Harris County.
- Relatively few homes in the Hunting Bayou watershed are mortgaged; most are owned outright or are rented (see reverse for more details).
- NFIP participation in the Hunting Bayou watershed is about half the rate seen elsewhere in Harris County, exposing residents to greater financial risk.
- 15-20% of households in the Hunting Bayou watershed do not have access to a vehicle, limiting residents' ability to evacuate or reach safety during a flood.
- 1/3 of households in the upper Hunting Bayou watershed receive Social Security income, indicating an elderly and vulnerable population.



## Property and Benefits

Geographic Area	Single Family Residential <sup>1</sup> in Watershed		Number of Structures <sup>2</sup> in 4% (25-yr) Floodplain			Number of Structures <sup>2</sup> in 1% (100-yr) Floodplain			B/C <sup>3</sup>	
	Number	Mean Value	Pre-Project	Post-Project	% Reduction	Pre-Project	Post-Project	% Reduction	Planning %	7.00%
Hunting Bayou Watershed	19,460	\$52,650	2,550	200	92%	5,100	650	87%	2.02	1.01
Brays Bayou Watershed	126,860	\$224,520	3,520	50	99%	16,800	1,800	89%	7.00	3.50

Data Source

<sup>1</sup> 2015 Harris County Appraisal District

<sup>2</sup> General Revaluation Report; all structures

<sup>3</sup> Most recent economic update

## Household Socioeconomic Profile

Geographic Area	Households <sup>1</sup>	Ownership <sup>1</sup>				Female-Headed Households <sup>2</sup>	Vehicle Availability <sup>3,a</sup>					Receiving Social Security Income <sup>4,a</sup>	NFIP Participation <sup>5</sup>	
		Own Mortgage/Loan	Own Outright	Own Total	Rent		0	1	2	3	4+		Active Policies	Coverage Rate <sup>6</sup>
<i>Upper Hunting Bayou Watershed<sup>7</sup></i>	15,764	18%	31%	49%	51%	42%	18%	41%	26%	10%	4%	33%	1,394	8.8%
Hunting Bayou Watershed	24,383	21%	29%	50%	50%	37%	16%	39%	28%	12%	5%	28%	2,302	9.4%
Brays Bayou Watershed	263,615	27%	13%	40%	60%	35%	11%	45%	32%	9%	3%	17%	42,954	16.3%
Harris County, TX	1,435,155	40%	16%	57%	43%	31%	7%	37%	39%	13%	5%	19%	221,121	15.4%
Texas	8,922,933	42%	22%	64%	36%	29%	6%	34%	40%	14%	5%	25%	587,692	6.6%
United States	116,716,292	45%	20%	65%	35%	31%	9%	34%	37%	14%	6%	29%	5,108,870	4.4%

<sup>1</sup> U.S. Census Bureau, 2010 Census, Table H4 [Tenure]

<sup>2</sup> U.S. Census Bureau, 2010 Census, Table H18 [Tenure By Household Type By Age Of Householder]

<sup>3</sup> U.S. Census Bureau, 2010-2014 American Community Survey 5-Year Estimates, Table B08201 [Household Size By Vehicles Available]

<sup>4</sup> U.S. Census Bureau, 2010-2014 American Community Survey 5-Year Estimates, Table B19055 [Social Security Income in the Past 12 Months for Households]

<sup>5</sup> Policies within Harris County active as of July 31, 2015. State and national policies active as of December 31, 2015.

<sup>6</sup> Commercial coverage unaccounted; estimates high.

<sup>7</sup> Includes all Census units upstream of the easternmost IH-610 crossing.

<sup>a</sup> Data are based on a sample and are subject to sampling variability.

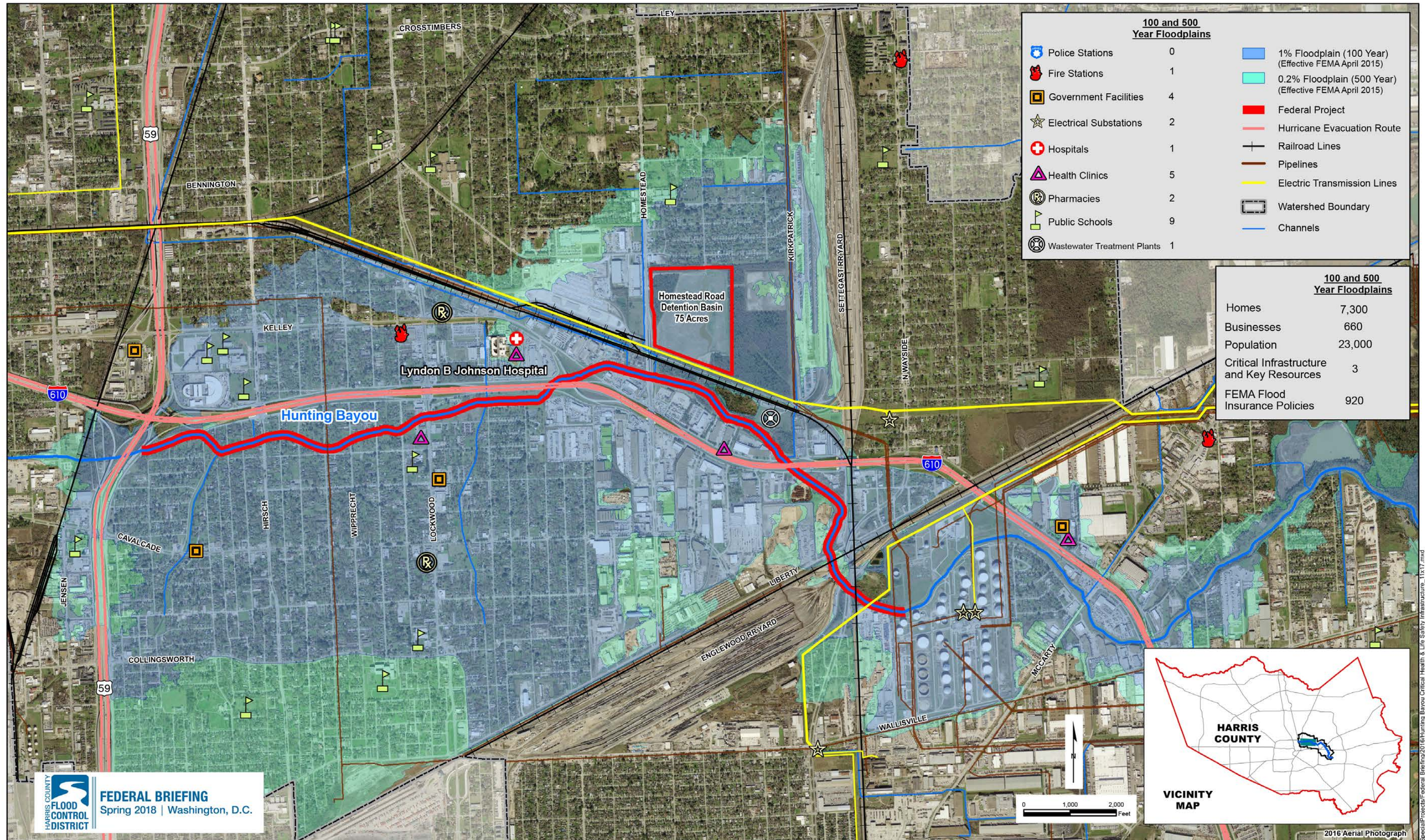




US Army Corps  
of Engineers  
Galveston District

# Hunting Bayou Federal Flood Risk Management Project

## Critical Health And Life Safety Infrastructure







Hunting Bayou Stormwater Detention Basin  
Hurricane Harvey  
August 29, 2017 (two days after peak)



Hunting Bayou Channel Widening, Upstream End  
Hurricane Harvey  
August 29, 2017 (two days after peak)



Hunting Bayou at IH-10  
Hurricane Harvey  
August 29, 2017 (near peak)





Hunting Bayou Stormwater Detention Basin, Flood, April 2016



Hunting Bayou Channel Widening, Flood, April 2016





Hunting Bayou, Tropical Storm Allison Flood, June 2001



Hunting Bayou, Tropical Storm Allison Flood, June 2001





Hunting Bayou, Tropical Storm Allison Flood, June 2001



Hunting Bayou, Tropical Storm Allison Flood, June 2001



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# Corps Lead Projects

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# Clear Creek

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## Clear Creek Federal Flood Risk Management Project Information

### Description

- Project Features:
  - Clear Creek - 15.1 miles of channel rectification and 500 acre-foot in-line detention from Dixie Farm Road to State Highway 288
  - Mud Gully - 0.8 miles of channel rectification; Turkey Creek - 2.4 miles of channel rectification
  - Mary's Creek - 2.1 miles of channel rectification; and 900 acre-foot detention basin
- Harris County Flood Control District (HCFCD) and Galveston County signed Local Cooperation Agreement with Corps 6/30/86
- In June 1999, Corps initiated General Reevaluation Study (GRR) – local sponsors are Brazoria Drainage District #4, Galveston County, and HCFCD
- Corps – manages, designs and builds the project
- HCFCD, Galveston County, and Brazoria Drainage District #4 – buys land, easements, rights-of-way (ROW); relocates utilities; adjusts bridges (except for railroads); and operates and maintains the project features after construction

### 1986 Project Progress

- Expenditures to date (including General Reevaluation Study) – Total \$55 Million: HCFCD and Galveston County \$20M (36%), Corps: \$35M (64%)
- Second outlet channel from Clear Lake to Galveston Bay, and gated control structure complete
- Plans & ROW started from Clear Lake to SH 3 (3.5 miles)
- Bridges – 8 of 11 bridges replaced or modified
- Utility adjustments - Almost complete up to SH 3
- Soil placement areas - 1 completed
- Put on hold in 1999

### General Reevaluation Study Progress

- Draft Supplemental EIS public meeting held January 2012
- Submit final GRR to Southwest Division and Corps Headquarters 2013
- GRR approved February 11, 2013 (delegated to SWD)

### Benefits / Costs

- Number of structures subject to 1% (100-yr.) flood plain reduced from 3,670 to 1,570
- Total first cost estimate \$193 Million: Local Sponsors \$68M (35%), Corps \$125M (65%) Benefit-to-Cost ratio = 2.3 (3.75%)
- Total first cost estimate including previous completed work \$249 Million: Local Sponsors \$98M (39%), Corps \$151M (61%) Benefit-to-Cost ratio = 1.8 (3.75%) 1.1 (7.0%)

### Federal Funding

**\*\*REMAINING WORK AT FULL FEDERAL EXPENSE = \$200 M.\*\***

**OR, IF NOT SELECTED FOR FUNDING WITH FY18 SUPPLEMENTAL APPROPRIATION:**

	<b><i>FY98 – FY12</i></b>	<b><i>FY 19 Needed</i></b>	<b><i>FY 20+</i></b>
Appropriations For	\$17,104,000 GRR	\$100,000 Economic Update	± \$10 million/year Design/construction

### Congressional/ Administration Support Needed

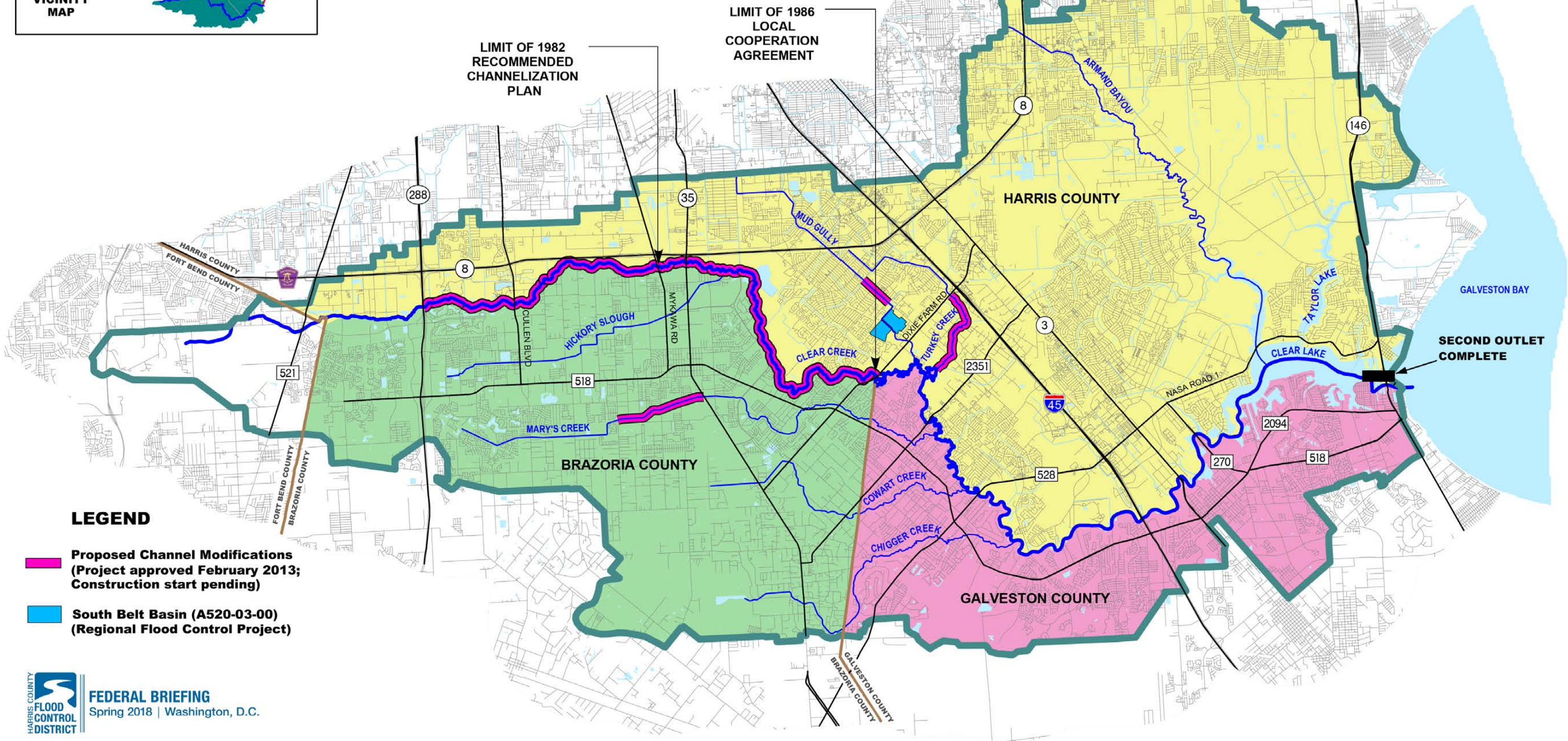
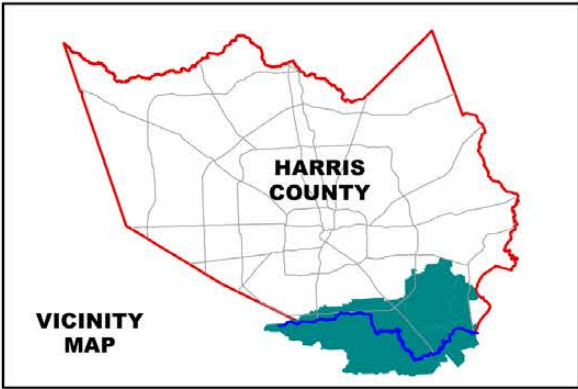
- If remaining work is not funded at full Federal expense, need construction funding for the project through annual appropriations.

### Regional Flood Control Project

HCFCD, Galveston County, and Brazoria Drainage District #4 are working together to build the main stem and Mud Gully detention basins that dropped from the Federal plan. These detention basins are needed to mitigate the Federal Project and future local projects. 1st construction phase (\$5M) for Mud Gully detention basin (South Belt Detention Basin) began late 2014. 2nd construction phase (\$15M) to bid in 2015.

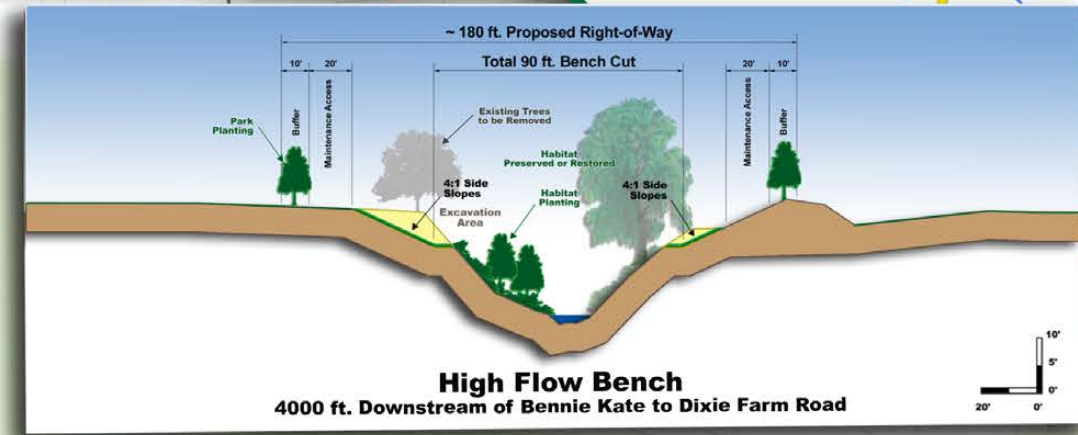
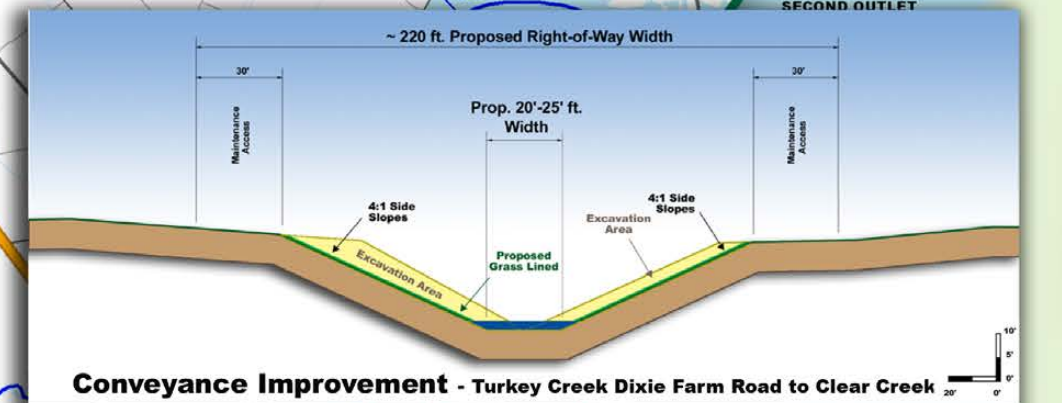
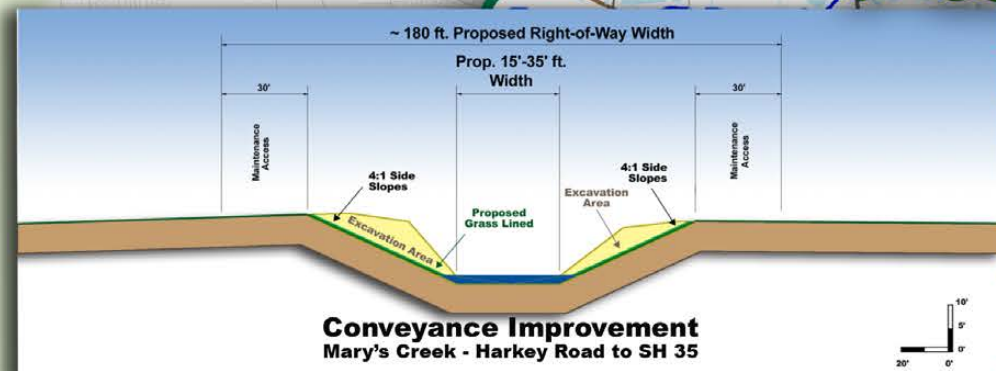
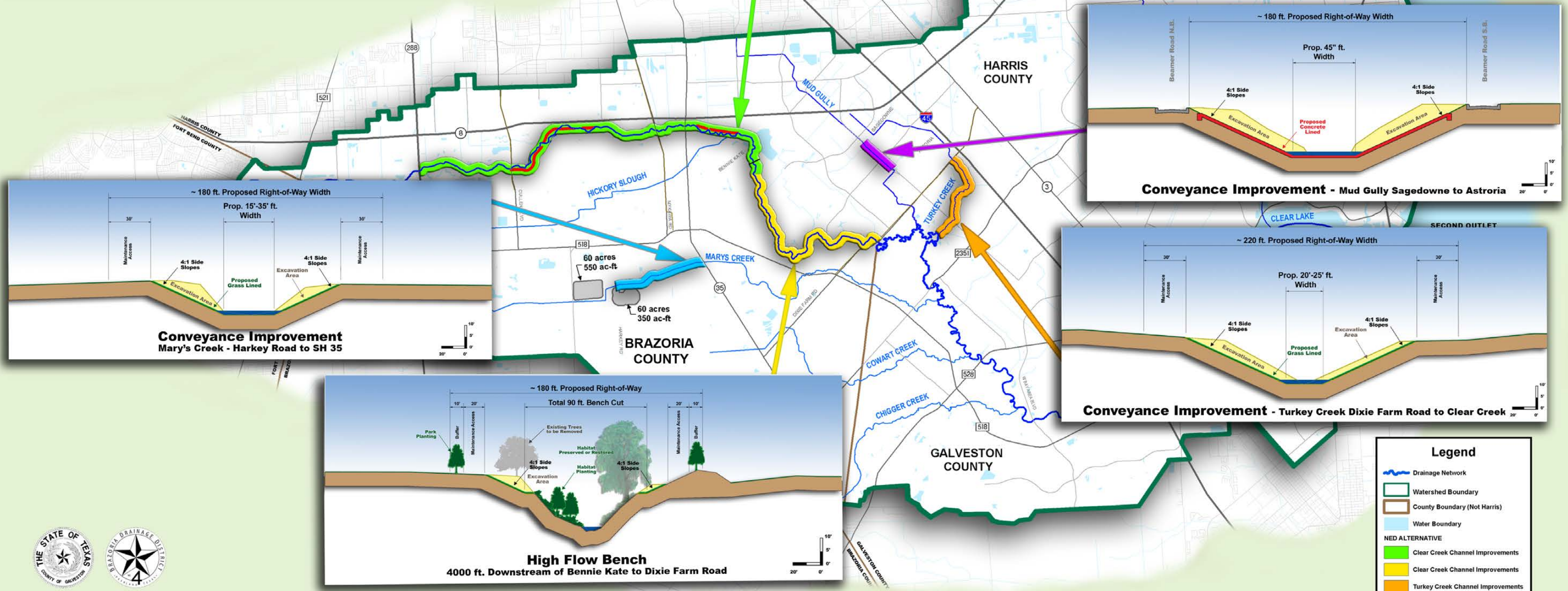
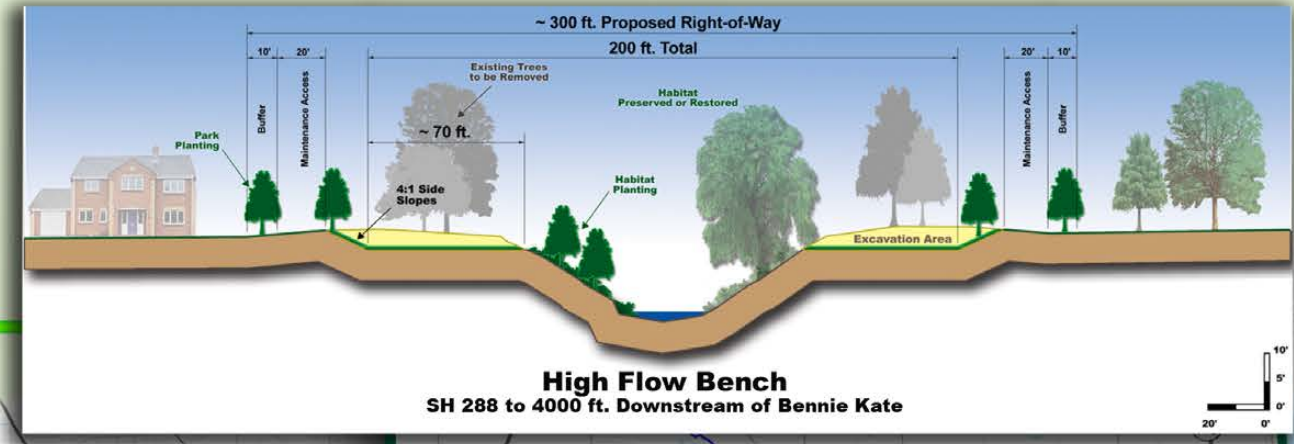
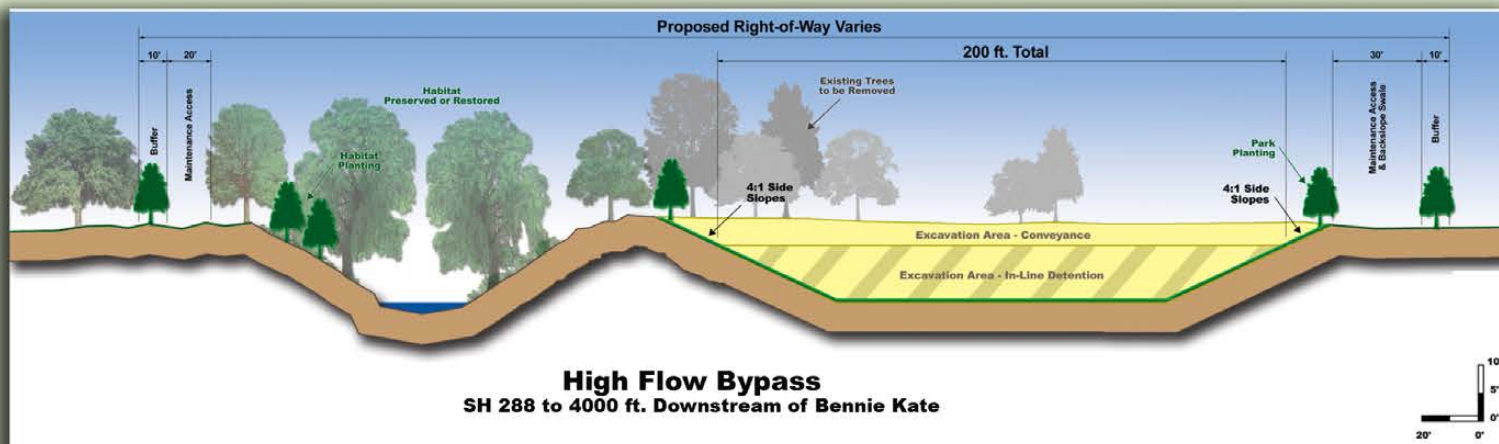
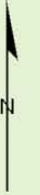


# Clear Creek Federal Flood Risk Management Project





# Clear Creek Federal Flood Risk Management Project



FEDERAL BRIEFING  
Spring 2018 | Washington, D.C.





Clear Creek Watershed  
Hurricane Harvey  
August 29, 2017



Clear Creek Watershed  
Hurricane Harvey  
August 29, 2017



Clear Creek at IH-45  
Hurricane Harvey  
August 29, 2017





Clear Creek Federal Project Completed Second Outlet Gates, 2016



Clear Creek Federal Project Reach, Telephone Road, 2005



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# Greens Bayou

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## Greens Bayou Federal Flood Risk Management Project Information

### Description

- Project Features
  - 138 acre detention basin at W. Greens Rd. and Antoine Dr.; appx. 1,650 acre-feet of storage
  - 3.7 miles of channel conveyance improvements between Veterans Memorial Dr. and Cutten Rd.
  - Environmental and aesthetic features in the channel and detention basin
- USACE – manages, designs, and builds the project
- Harris County Flood Control District (HCFCD) – buys land, easements, rights-of-way; relocates utilities; adjusts bridges (except for railroads); and operates and maintains the project features after construction
- Estimated time to design, build, and closeout – 4 years

### Progress – 2017

- Finished utility relocations, remaining ROW in progress
- Second construction contract (Phase II basin and channel) 40% complete (\$9.5 M spent)

### Prior Progress

- Phase I of detention basin construction complete
- Executed Project Partnership Agreement 2nd quarter CY15
- General Reevaluation Study approved in February 2006
- HCFCD purchased 138 acre detention basin site for project
- Potential local recreation sponsor, Harris County Precinct 4
- Construction General new start FY2015

### Benefits / Costs

- Level of protection is 10% (10-year) for partial development
- GRR estimated total cost - \$38 Million: HCFCD \$9M (25%), Corps \$29M (75%)  
Benefit-to-Cost ratio = 4.0 (5.375%)
- 2014 economic update - \$58 Million: HCFCD \$15M (25%), Corps \$43M (75%)  
(fully funded) Benefit-to-Cost ratio = 4.89 (3.375%) 2.67 (7.0%)
- Expenditures to date - Total \$18.8 Million: HCFCD \$1.9M (10%), Corps \$16.9M (90%)

### Federal Funding

	<i><b>FY98 – FY16</b></i>	<i><b>FY20 Needed</b></i>
Appropriations	\$38,955,000	\$5,500,000
For	GRR, PED, Execute PPA, Phase 1, 2, & 3 construction	Close out & celebration

### Congressional / Administration support needed

- Continue annual funding for the project, if necessary

## HCFCD Regional Flood Control Project

### General Information

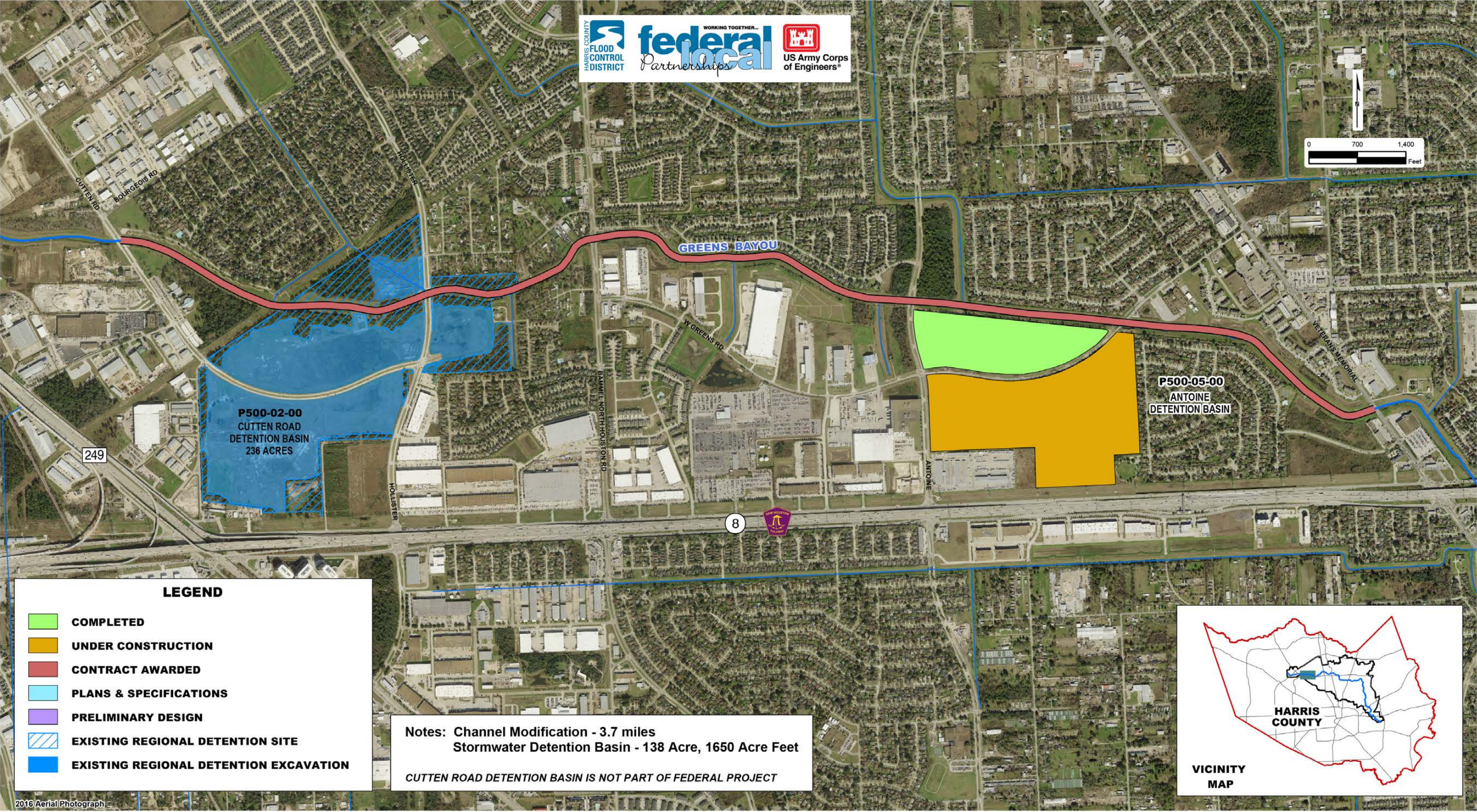
- 8 regional detention basins acquired upstream of US 90; totaling 2,762 acres and costing \$53.5M
- Federal Project incorporates one of the regional project components

### Progress

- 1 regional basin completed, 5 partially excavated
- A mid-reach flood damage reduction study identified 10 miles of channel conveyance improvements and the use of 4 existing detention basin sites
- 2 detention basins under construction; FEMA funding 65% of construction



# Greens Bayou Federal Flood Risk Management Project







Greens Bayou Federal Project, Antoine Detention Basin and Channel Work, 2016

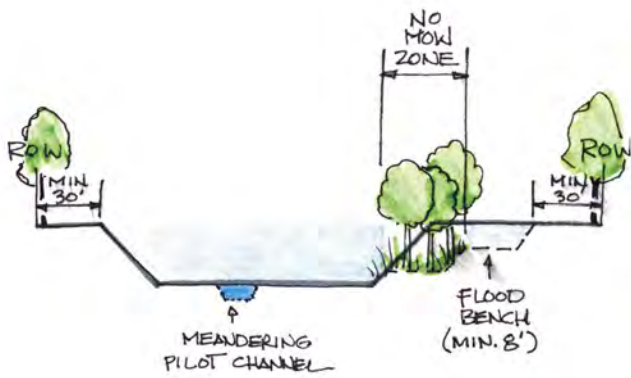


Greens Bayou Federal Project, Antoine Detention Basin, Phase 1 Construction, 2016





Greens Bayou Federal Project Reach, Near Bammel N. Houston Road, 2009



Proposed Greens Bayou Section



Greens Bayou, Looking Upstream at Project Reach  
Tropical Storm Allison, 2001



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# Sims Bayou

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## Sims Bayou Federal Flood Risk Management Project Information - *Completed*

### Description

- Project Features
  - 19.3 miles of channel conveyance improvements (flood bench section) from the Houston Ship Channel to Croquet Street (west of S. Post Oak)
  - Includes environmental mitigation and environmental quality features
  - City of Houston recreation plan sponsor; 13 miles of trails, appurtenances, and parking lots
- Harris County Flood Control District (HCFCD) and Corps signed Local Cooperation Agreement 10/19/90
- Corps – manages, designs and builds the project
- HCFCD – buys land, easements, rights-of-way (ROW); relocates utilities; adjusts bridges (except for railroads); and operates and maintains the project features after construction
- 21 years to build (1994-2015)

### Progress

- Channel Conveyance Improvements
 

<b>Status</b>	<b>Location</b>
Complete	Mouth to Croquet (19.3 miles)
- ROW – All ROW acquisition complete. A total of 925 acres purchased
- Bridges – 22 replacements or modifications completed
- Construction completed December 2015
- Final audit and close out in progress

### Benefits / Costs

- 4% (25-yr.) level of flood protection (under full development)
- 1% (100-yr.) flood plain removed from approx. 35,000 homes and 2,000 commercial structures
- Total cost estimate - \$390M: HCFCD \$125M (32%), Corps: \$265M (68%)
- Expenditures to date – Total \$389.4M: HCFCD \$125M (32%), Corps \$264.4M (68%)
- Benefit-to-Cost ratio = 6.5

### Federal Funding

	<b>FY98 – FY13</b>	<b>FY 19 Needed</b>
Appropriations	\$213,152,000	\$0
For design/constr.	Mouth to Croquet	Construction complete

*\*Includes ARRA and Hurricane Ike Supplement Funds.*

## HCFCD Regional Flood Control Project

### General Information

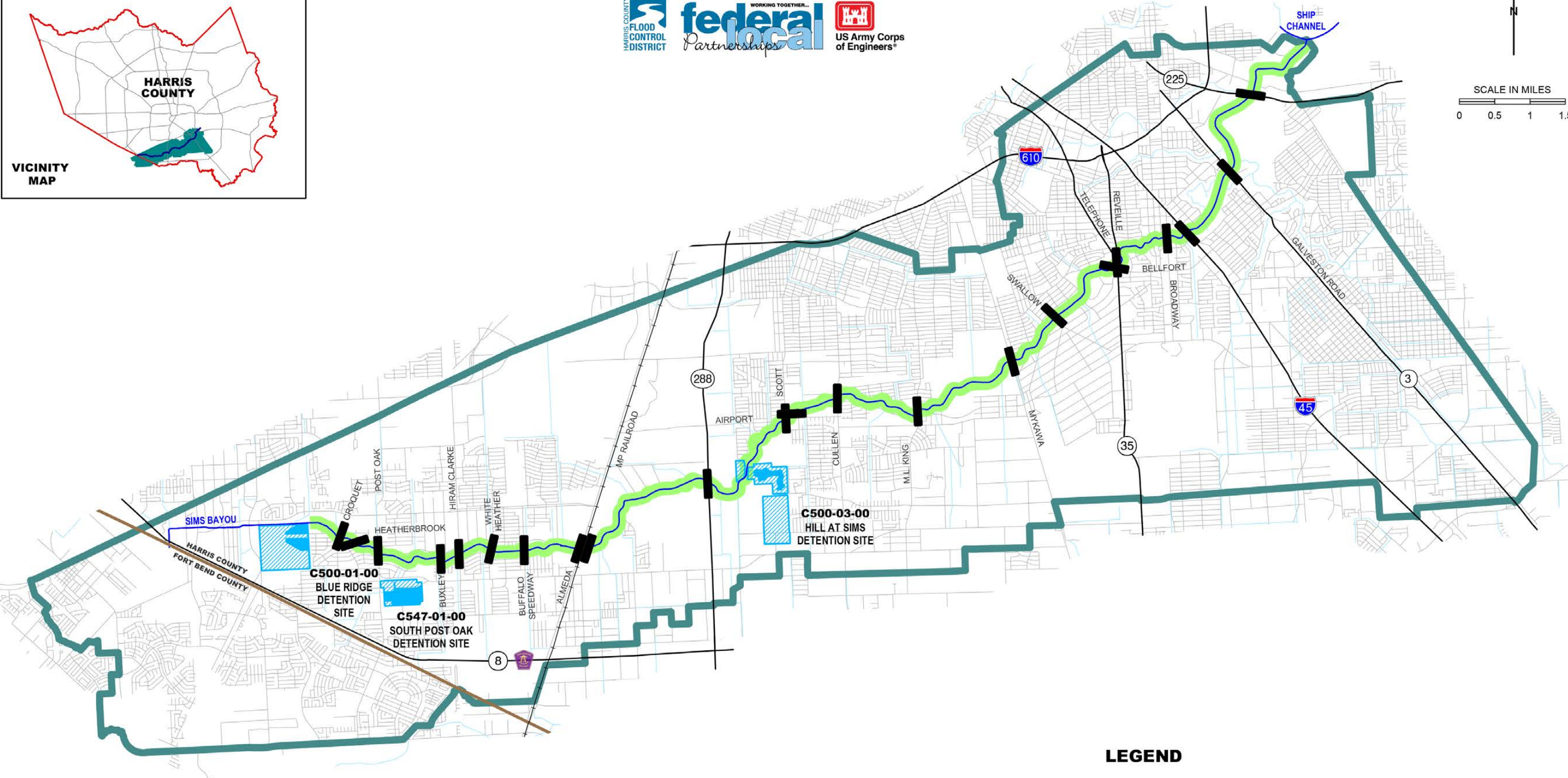
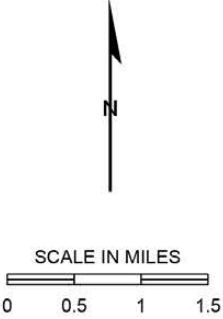
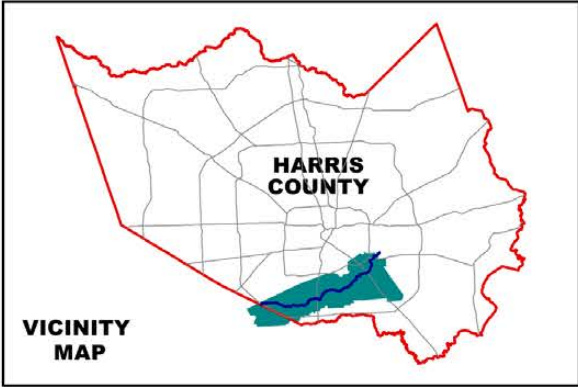
- 3 regional detention basins upstream (west) of Scott St.
- Increases flood protection of Federal Project to near 1% (100-yr.) level under full development

### Progress

- Purchased 3 regional detention sites totaling 700 acres for \$6.1M
- Over 3.6 million cubic yards (across 215 surface acres) excavated since January 1995 by Harris County Toll Road Authority contractors, HCFCD contractors and others



# Sims Bayou Federal Flood Risk Management Project



- LEGEND**
- CONSTRUCTION COMPLETED DECEMBER 2015
  - COMPLETED BRIDGE REPLACEMENT/EXTENSION
  - EXISTING REGIONAL DETENTION SITE
  - EXISTING REGIONAL DETENTION EXCAVATION

REGIONAL DETENTION BASINS ARE NOT PART OF FEDERAL PROJECT





Sims Bayou Federal Project, Channel 17 Years After Completion, Near Broadway, 2014



Local Complement to Sims Bayou Federal Project, Hill At Sims Detention Basin, 2007





Sims Bayou Federal Project  
Work under Buxley Pedestrian Bridge  
2015



Sims Bayou Federal Project, Mykawa Road, 2014



Sims Bayou Federal Project, Scott Street, 2006





Sims Bayou Federal Project, End of Project, 2015



Sims Bayou Federal Project, Airport Boulevard, 2014



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# Addicks and Barker Reservoirs

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## Addicks and Barker Reservoirs

Built by the U.S. Army Corps of Engineers during World War II, the Addicks and Barker stormwater detention reservoirs in western Harris County have reduced flood levels downstream along Buffalo Bayou and through downtown Houston for over 70 years. Unanticipated but much appreciated benefits are the large areas of environmental preservation and the many and varied outdoor activity opportunities within the normally dry reservoirs.

Hurricane Harvey was an unprecedented event for Addicks and Barker reservoirs, as it was for all of Harris County. HCFCD supports the Corps' ongoing efforts, as well as future studies and projects, to reduce flood risks upstream and downstream of the reservoirs.

### New Outlet Structures for Addicks and Barker

- Replace 70 year old multiple box culvert outlets due to development of voids and seepage
- U.S. Army Corps of Engineers design and construction project
- New gated outlet structures adjacent to existing ones (400 feet apart)
- Current construction contract \$73.8M; Authorized total project cost: \$129.9M
- Physical construction started November 2015
- Completion estimate April 2020

### Operation Review of Addicks and Barker Reservoirs, Section 216 Study

- Purpose is to review the operations of completed Corps projects due to changed physical, economic, or environmental conditions and propose physical or operational changes to the project, if necessary.
- Follow same guidance and requirements as Corps feasibility studies
- SMART Planning Principles and Procedures apply as well as no more than 3 years and 3 million dollars, and Corps District, Division, and Headquarters active on study team.
- HCFCD is non-Federal Sponsor – 50% cost share (or full Federal expense under BBA provisions, if selected)
- Estimated start 2018 - contingent on Federal appropriations
- Potential study topics:
  - Determine flow path around the ends of the dams and over the emergency/auxiliary spillways
  - Assess the impacts of a range of controlled releases
  - Assess the risks of flooding in areas adjacent to the reservoirs
  - Reevaluate and possibly refine the reservoir operation plan
  - Structural measures, potentially including new Federal facilities upstream of existing reservoirs

### Addicks-Barker Multi-Agency Emergency Coordination Team

- Organized in 2007 after Hurricane Katrina
- Primary Team Members – US Army Corps of Engineers, Galveston District; National Weather Service; US Geological Survey; Harris County Flood Control District; Harris County Office of Emergency Management; Fort Bend County Office of Emergency Management; City of Houston Office of Emergency Management; Texas Department of Public Safety
- Developed Emergency Action Response Chart for each reservoir based on water level elevations – defines roles and responsibility of each agency
- Conducts periodic table top and functional exercises for various scenarios
- Working relationships developed during planning and training beneficial during actual rainfall and flood events

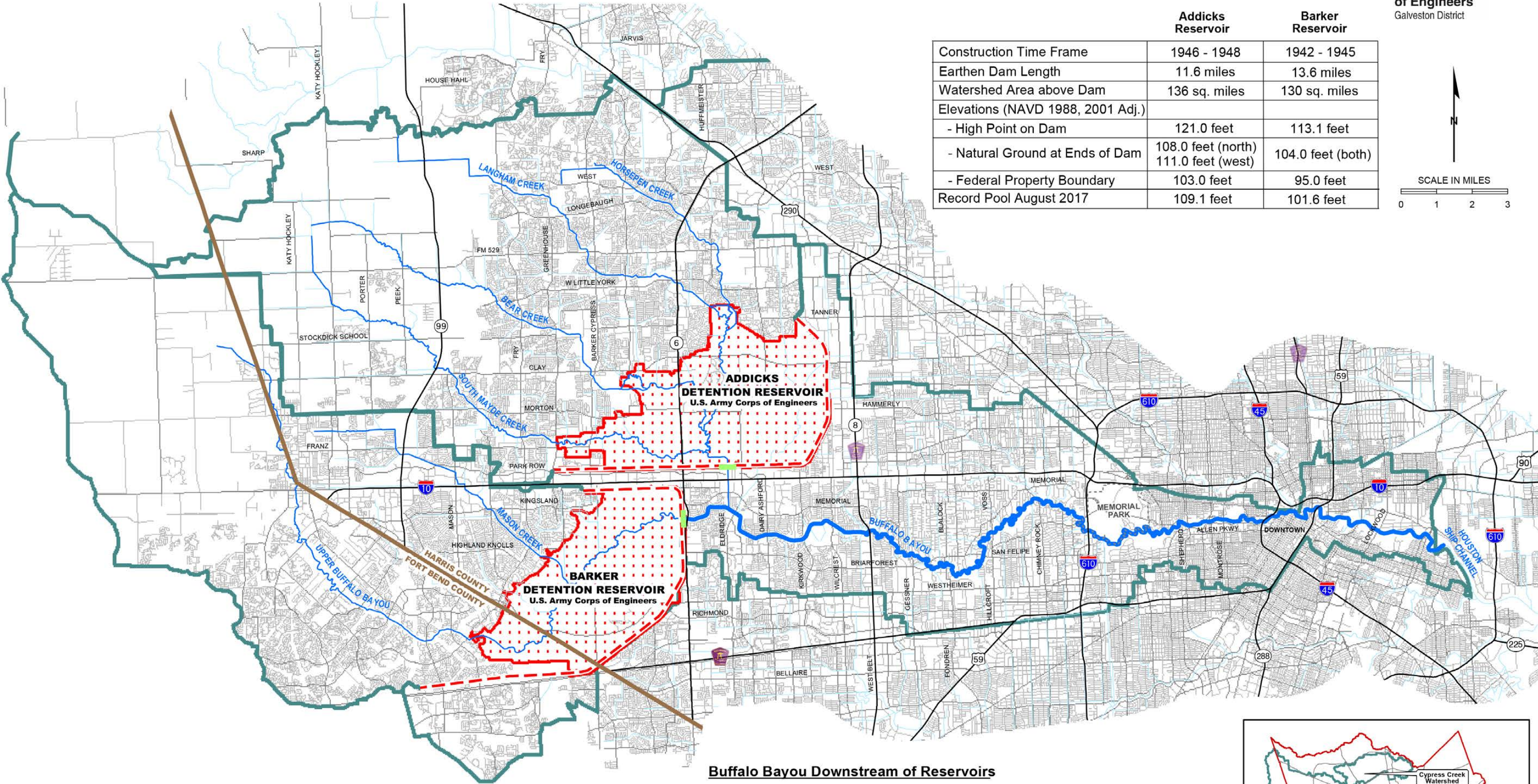
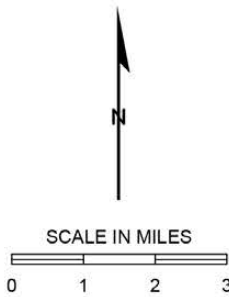


# Addicks and Barker Reservoirs



US Army Corps  
of Engineers  
Galveston District

	Addicks Reservoir	Barker Reservoir
Construction Time Frame	1946 - 1948	1942 - 1945
Earthen Dam Length	11.6 miles	13.6 miles
Watershed Area above Dam	136 sq. miles	130 sq. miles
Elevations (NAVD 1988, 2001 Adj.)		
- High Point on Dam	121.0 feet	113.1 feet
- Natural Ground at Ends of Dam	108.0 feet (north) 111.0 feet (west)	104.0 feet (both)
- Federal Property Boundary	103.0 feet	95.0 feet
Record Pool August 2017	109.1 feet	101.6 feet

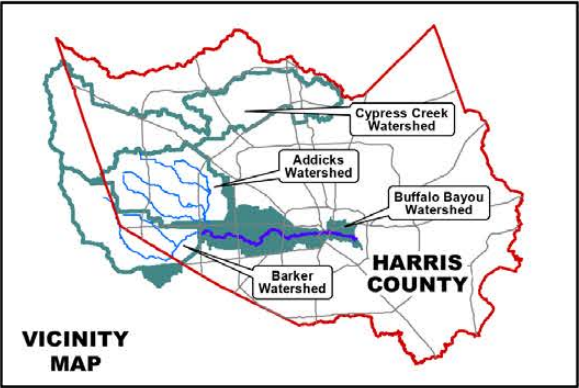


## LEGEND

- WATERSHED BOUNDARY
- LIMITS OF FEDERAL PROPERTY
- DAM LOCATION
- NEW OUTLET STRUCTURES UNDER CONSTRUCTION

## Buffalo Bayou Downstream of Reservoirs

- 25 miles from Barker Reservoir outlet to the Houston Ship Channel.
- In 1948, Buffalo Bayou was straightened and channelized downstream of the reservoirs (about 7.4 miles) to the West Belt.
- Releases from reservoirs typically regulated to 2,000 cfs at the Piney Point Road gage, including local inflows.
- Travel time for water released from the reservoirs to downtown Houston is 18-24 hours.







Addicks Reservoir at Peak Storage  
Hurricane Harvey, August 30, 2017



Natural Cypress Creek Overflow at  
Grand Parkway  
Toward Addicks Reservoir  
Hurricane Harvey, August 29, 2017



Addicks Reservoir Flood Pool  
Hurricane Harvey, August 30, 2017







Barker Reservoir Flood Pool  
August 30, 2017



Barker Reservoir Discharge  
August 30, 2017



Buffalo Bayou near N. Eldridge Pkwy.  
August 2017





Addicks Outlet Project, Construction, 2017



Barker Outlet Project, Construction, 2017



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# FEMA Projects

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# FEMA Model & Map Management

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## FEMA Flood Insurance Study and Maps

New FEMA (Federal Emergency Management Agency) Flood Insurance Rate Maps for Harris County, Texas and associated useful models and technical products were produced through a partnership between the Harris County Flood Control District (HCFCF) and FEMA with federal funding made available after Tropical Storm Allison in 2001. 144 new Flood Insurance Rate Maps (FIRMs) became effective on June 18th, 2007 for the 35 National Flood Insurance Program (NFIP) communities in Harris County. Total project cost - \$32 million; approximately an even split between FEMA and HCFCF. Go to [www.hcfcf.org/FEMT](http://www.hcfcf.org/FEMT) or [www.fema.gov](http://www.fema.gov) for floodplain information.

Since May 2015, the National Oceanic and Atmospheric Administration (NOAA) Hydrometeorological Design Studies Center (HDSC) has been updating precipitation frequency estimates for the state of Texas jointly funded by local, regional, state and federal agencies (HCFCF contributed \$200,000). In late 2017/early 2018, HCFCF participated in the peer review of the initial preliminary study results using about 2,000 gages across Texas for rainfall events from the early 1900s through Hurricane Harvey, including the 1994 floods and Tropical Storm Allison in June 2001. Preliminary results show the estimated 1% probability, 24-hour rainfall depth increasing 3-5 inches across Harris County (currently 12-14 inches). NOAA anticipates a final release of its updated estimates in NOAA Atlas 14, Volume 11, in late 2018. HCFCF is coordinating with FEMA as this information is developed, and is poised to respond to the implications that this final information may have for the current effective FEMA FIRMs and model and map management program.

## Model and Map Management

### Description

- Model and map management is a program to keep the FIRM models as accurate as possible as watershed and channel conditions change in the highly urbanized and developing Harris County.
- Two ongoing tasks performed by HCFCF are:
  - Continuous Updates – Update the maps and models to reflect the latest Letters of Map Revision (LOMR) by working closely with FEMA during the LOMR process.
  - Watershed Model Updates – Regular updates on a watershed wide basis to reflect non-LOMR related changes in the watershed, new model versions, and other issues.
- Benefit - Local officials and engineers will have access to the up-to-date data and models to plan future flood damage reduction projects and land developments; and prepare and submit LOMR.

### Progress

- The HCFCF is the custodian and distributor of the hydrology and hydraulic computer models per the continuous agreement with FEMA.
- Last year, all LOMRs approved by FEMA were incorporated as part of continuous updates.

## LOMR Delegation

Delegation is a major milestone for floodplain management in rapidly developing Harris County. Since September 1, 2010 when the agreement with FEMA was executed, the HCFCF has received 157 submittals and completed 148. Go to <http://www.hcfcf.org/lomrdelegation/> for the status of each project submittal.

## Risk Mapping, Assessment and Planning (Risk Map) Program

HCFCF currently has five watershed model and map update studies underway that will produce Risk MAP products. In watersheds with active Corps of Engineers partnered projects, the updates will show benefits of work completed on those projects and HCFCF regional projects by certain points in time. A sixth study, in Discovery, encompasses three relatively rural watersheds in eastern Harris County with greater development potential. At this time, HCFCF is keeping all Risk MAP studies active in close coordination with FEMA as countywide remapping efforts come into focus.



## Addicks Watershed Study

### Description

- Addicks Reservoir Watershed Model and Map Update study is part of the watershed model update program described above and FEMA's new Risk MAP program.
- Conventional Product – New FEMA Flood Insurance Rate Maps for Addicks Watershed within Harris County, Texas and associated useful models and technical products.
- Risk MAP Products – Maps showing changes from effective maps, multi-frequency flood depth maps, and other products useful to local officials and the public in understanding and assessing present and future flood risks.
- Total estimated project cost - \$1.14 million; approximately 66% FEMA and 34% HCFCD.

### Progress

- Cooperative Technical Partnership Agreement between HCFCD and FEMA executed in 2010.
- HCFCD submitted the final models and floodplain maps to FEMA for review on July 2013.
- Preliminary Flood Insurance Rate Maps were issued July 2015.
- Consultation Coordination Officer meeting with floodplain administrators held September 2015.
- A public open house to present results and discuss next steps was held February 2016.
- Appeal and comment period ended June 21, 2016
- Appeal resolution letters were dated February 1, 2017.
- Appeals have all been resolved. The issuance of the Revised Preliminary Maps is currently on hold.

## Sims Bayou Watershed Study

### Description

- Sims Watershed Model and Map Update study is part of the watershed model update program and will include the Corps of Engineers/HCFCD Sims Bayou project and local regional detention basins.
- The study is divided into two phases.
  - Phase one is Discovery.
    - This Discovery Report shows flood risk areas and produced a flood risk database of the watershed. This will increase awareness among the community and drive them towards mitigation actions if needed. The findings of the report will help the community to make wise investment in flood mitigation projects.
  - Phase two includes model updates and conventional and Risk MAP products.
    - Conventional Product – New FEMA Flood Insurance Rate Maps for Sims Watershed within Harris County, Texas and associated useful models and technical products.
    - Risk MAP Products – Maps showing changes from effective maps, multi-frequency flood depth maps, and other products useful to local officials and the public in understanding and assessing present and future flood risks.
- Total estimated project cost for both phases - \$335,000; approximately 75% FEMA and 25% HCFCD.

### Progress

- Cooperative Technical Partnership Agreement between HCFCD and FEMA executed in 2013 for the first phase (\$134,984.00).
- HCFCD completed the Discovery Report in July 2015.
- Cooperative Technical Partnership Agreement between HCFCD and FEMA executed in 2014 for the second phase (\$200,000.00).
- Started Phase two October 2014.
- Preliminary Flood Insurance Rate Maps were published January 30, 2017.
- Meetings with community leaders and the public to be held by mid-2017, followed by a 90 day appeal and comment period.
- The Appeal and Comment period started February 15, 2018 and will conclude May 15, 2018.



## White Oak Watershed Study

### Description

- White Oak Watershed Model and Map Update study is part of the watershed model update program and will include the local and Corps of Engineers/HCFCD flood damage reduction projects built as of 2015 along White Oak Bayou and its tributaries.
- The study includes model updates and conventional and Risk MAP products.
  - Conventional Product – New FEMA Flood Insurance Rate Maps for White Oak Bayou Watershed within Harris County, Texas and associated support models and technical products.
  - Risk MAP Products – Maps showing changes from effective maps, multi-frequency flood depth maps, and other products useful to local officials and the public in understanding and assessing present and future flood risks.
- Total estimated project cost - \$271,000; approximately 74% FEMA and 26% HCFCD.
- Cooperative Technical Partnership Agreement between HCFCD and FEMA executed in 2015 for the study (\$270,671.00).
- Study initiated October 2015.
- Data was submitted to FEMA February 2017.
- Preliminary Maps have been produced, but their issuance is currently on hold.

## Brays Bayou Watershed Study

### Description

- Brays Watershed Model and Map Update study is part of the watershed model update program and will include the local and Corps of Engineers/HCFCD flood damage reduction projects built as of 2017 along Brays Bayou upstream of Beltway 8.
- The study includes model updates and conventional and Risk MAP products.
  - Conventional Product – New FEMA Flood Insurance Rate Maps for Brays Bayou Watershed within Harris County, Texas and associated support models and technical products.
  - Risk MAP Products – Maps showing changes from effective maps, multi-frequency flood depth maps, and other products useful to local officials and the public in understanding and assessing present and future flood risks.
- Total estimated project cost - \$409,466; approximately 73% FEMA and 27% HCFCD.
- Cooperative Technical Partnership Agreement between HCFCD and FEMA executed in 2016 for the study (\$409,466).
- Study initiated October 2016. Data to be submitted to FEMA by April 2018

## Hunting Bayou Watershed Study

### Description

- Hunting Watershed Model and Map Update study is part of the watershed model update program and reflect the completed elements of the Hunting Bayou Federal Flood Reduction Project.
- The study includes model updates and conventional and Risk MAP products.
  - Conventional Product – New FEMA Flood Insurance Rate Maps for Hunting Bayou Watershed within Harris County, Texas and associated support models and technical products.
  - Risk MAP Products – Maps showing changes from effective maps, multi-frequency flood depth maps, and other products useful to local officials and the public in understanding and assessing present and future flood risks.
- Total estimated project cost - \$270,000; approximately 74% FEMA and 26% HCFCD.
- Cooperative Technical Partnership Agreement between HCFCD and FEMA executed in 2017 for the study (\$270,000).
- Study initiated October 2017.
- Data to be submitted to FEMA early 2018.



## Cedar, Jackson, and Luce Bayou Watershed Discovery Study

### Description

- The Discovery study is part of the watershed model update program and involves the collection, analysis, and summary of available data on flood risk and flood mitigation strategies in these watersheds. The study may result in the recommendation of Model and Map Update studies, or to improvements to existing flood mitigation strategies.
- Total estimated project cost - \$375,000; approximately 67% FEMA and 33% HCFCD.
- Cooperative Technical Partnership Agreement between HCFCD and FEMA executed in 2017 for the study (\$375,000).
- Study initiated October 2017.
- Data to be submitted to FEMA mid 2018.



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# Buyout

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# Completed FEMA Buyout Projects

**LEGEND**

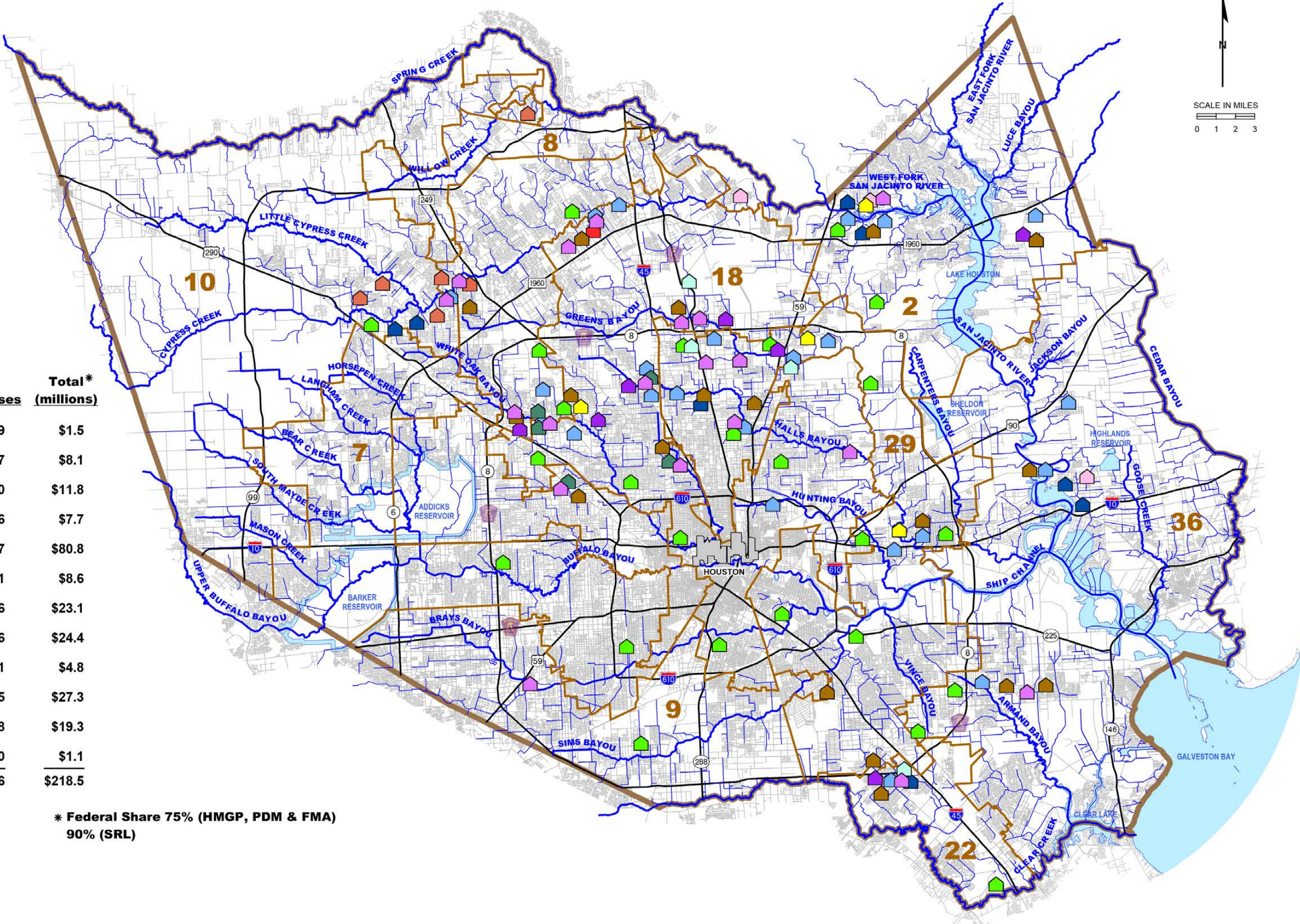
 **PERMANENT WATER**

 **CHANNEL NETWORK**

 **CONGRESSIONAL DISTRICT**

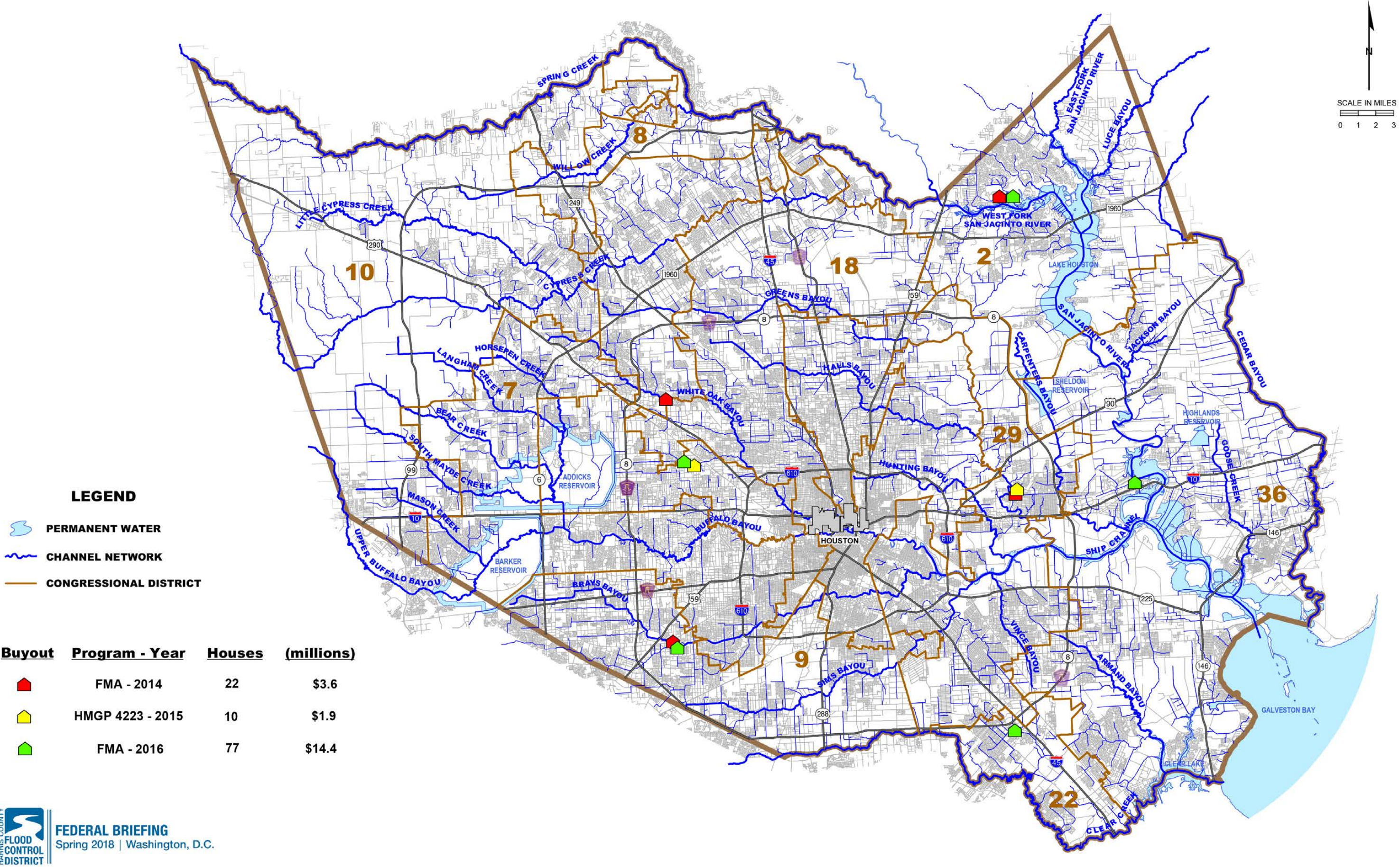
Buyout	Program - Year	Houses	Total* (millions)
	SEC.1362 Grant - 1989	29	\$1.5
	HMGP 1041 - 1994	157	\$8.1
	FMA - 98, 99, 2000, 2005 - 2008	90	\$11.8
	HMGP 1245,1257 - 1998	76	\$7.7
	HMGP TSA - 2001	967	\$80.8
	HMGP 1439,1709 - 2002, 2007	71	\$8.6
	HMGP 1606 - 2005	206	\$23.1
	PDM - 2003, 2005, 2007	236	\$24.4
	PDM - 2008 & 2009	31	\$4.8
	SRL - 2008, 2009, 2011, 2012	195	\$27.3
	HMGP 1791 - 2008 IKE	138	\$19.3
	PDM - 2010	10	\$1.1
Totals		2,206	\$218.5

\* Federal Share 75% (HMGP, PDM & FMA)  
90% (SRL)





# Active FEMA Buyout Projects





# FEMA Buyout Program Status - Active and Submitted

As of March 2018

Program	Approved or Submitted				Current Status					
	Number of Homes	Total (millions)	FEMA Share (millions)	HCFCF Share (millions)	Homes Purchased	Homes Withdrawn	Total Payments	FEMA Share (millions)	HCFCF Share (millions)	Comment
FMA 2016	77	\$14.4	\$13.3	\$1.1	6	3	\$0.9	\$0.7	\$0.2	38 in progress
HMGP 4223 (2015)	10	\$1.9	\$1.5	\$0.4	5	2	\$1.1	\$0.8	\$0.3	3 more to acquire
FMA 2014	22	\$3.6	\$3.3	\$0.3	13	4	\$2.3	\$2.20	\$0.04	2 more to acquire
<b>Subtotals - Active</b>	<b>109</b>	<b>\$19.9</b>	<b>\$18.1</b>	<b>\$1.8</b>	<b>24</b>	<b>9</b>	<b>\$4.3</b>	<b>\$3.7</b>	<b>\$0.5</b>	
FMA 2017	100	\$19.8	\$17.2	\$2.6	0	0	N/A	N/A	N/A	Submitted 10/2/17
HMGP 4272 (2016)	92	\$14.5	\$10.9	\$3.6	0	0	N/A	N/A	N/A	Submitted 1/31/17
HMGP 4269 (2016)	92	\$14.5	\$10.9	\$3.6	0	0	N/A	N/A	N/A	Submitted 10/27/16
<b>Subtotals - Submitted</b>	<b>284</b>	<b>\$48.9</b>	<b>\$39.0</b>	<b>\$9.9</b>	<b>0</b>	<b>0</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	
<b>Totals</b>	<b>393</b>	<b>\$68.8</b>	<b>\$57.1</b>	<b>\$11.7</b>	<b>24</b>	<b>9</b>	<b>\$4.3</b>	<b>\$3.7</b>	<b>\$0.5</b>	

Notes: As of January 2018, 3,715 buyout volunteers; 839 volunteers in HCFCF buyout areas (\$168 M total acquisition cost).

A FMA 2015 application for 63 homes was not selected.

HMGP (DR-4223) application for 107 homes submitted on 12/7/2015 and partially awarded on 9/16/16.

FMA: Flood Mitigation Assistance Program

HMGP: Hazard Mitigation Grant Program





After Demolition

Home Purchased Near Greens Bayou | Before Demolition, 2007



Homes Purchased Near White Oak Bayou, Flood, April 2016



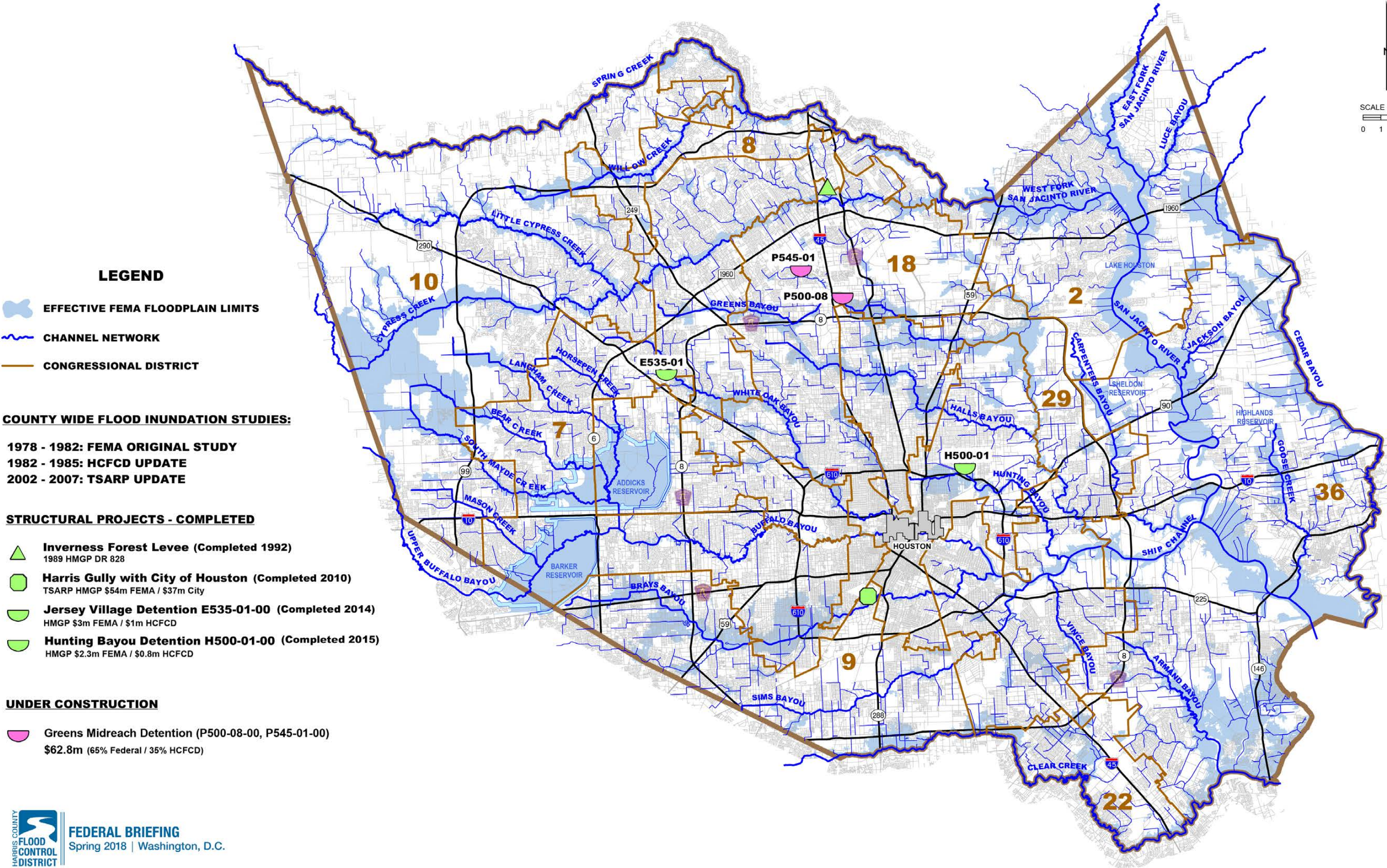
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# Studies & Structural

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# FEMA Studies and Structural Projects







Glen Forest Basin, Hurricane Harvey, August 2017



Jersey Village (E535-01-00) Regional Detention Basin, April 2016



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# USGS

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## USGS Funding for Streamgages

### USGS Groundwater and Streamflow Information Program

- USGS (United States Geological Survey) operates 600 streamgages at which full or partial record discharge is collected in Texas. USGS does not have sufficient funds to continue to operate that entire network and to partner with Harris County to provide the enhancements needed to protect the lives and property of Harris County citizens and businesses.
- Federal Priority Streamgages (FPS) - previously referred to as the National Streamflow Information Program
  - The core streamgage network required to provide a base level of national streamflow information at 100% USGS funding. If fully funded, it would cover the cost of 430 streamgages in Texas. Currently, only 156 streamgages are supported statewide.
- Cooperative Matching Funds (CMF) - previously referred to as the Cooperative Water Program
  - Supports streamgages not fully funded by USGS or by other Federal agencies
  - Cost shared with 100 state and local agencies in Texas (1,450 agencies nationwide)
  - Legislation established a 50/50 cost share program, now it is about 74% local funding partners and 26% USGS in Texas because of insufficient Federal Appropriations to the USGS

### Value of USGS Streamgages

- Quality and consistency in collecting, recording, analyzing, and delivering data
- Free and source is neutral and credible; USGS is non-regulatory and not a resource manager
- Imperative to making water supply and flood control operational decisions on our nation's waterways and to delineate flood plains for FEMA Flood Insurance Rate Maps
- Needed to plan and design reservoirs, detention basins, flood control channels, navigation channels, highways, aquatic habitats, etc.
- Required by the National Weather Service to issue flood warnings to protect life and property

### Users of USGS Streamflow Data

- Water supply managers, reservoir operators, flood control and emergency managers, and recreation users
- Civil and environmental engineers designing water, wastewater, and transportation infrastructure

### Issues

- Current funding to support the FPS is less than 28% of funding needed for full national implementation
- Even though USGS funds to support gage operation and maintenance have increased about 15% from FY07 to FY17, local agency contributions increased about the same amount
- Due to funding constraints, many local agencies cannot afford increases, therefore, the number of streamgages nationwide is decreasing
- More streamgages and data are needed to make better water management and design decisions

### Federal Funding - Nationwide (millions)

	<i>FY13</i>	<i>FY14</i>	<i>FY15</i>	<i>FY16</i>	<i>FY17</i>	<i>FY18</i>	<i>Requested Need</i>
Federal Priority Streamgages	\$19.03	\$23.32	\$24.12	\$24.69	\$24.69	?	\$350
Cooperative Matching Funds (Total)	\$59.48	\$59.48	\$57.71	\$56.71	\$59.89	?	\$55
TOTAL	\$79.51	\$82.80	\$81.83	\$81.40	\$84.58	?	\$405

### Congressional support needed

- Increase funding to the USGS Groundwater and Streamflow Information Program at a level of \$405M to restore 50/50 cost share for the jointly funded activities with localities and States (CMF) and fully fund the high priority core streamgages (FPS) nationwide.



# USGS Gages in Harris County



## LEGEND

- ▲ HCFCG (154 total)
- USGS (56 total)
- USGS & HCFCG (48 combined)
- PERMANENT WATER
- ~ CHANNEL NETWORK
- CONGRESSIONAL DISTRICT

For real time data, go to  
<http://www.harriscountyfws.org>  
<http://waterdata.usgs.gov/tx/nwis/rt>

SCALE IN MILES  
 0 1 2 3