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Houston | Bay Area Storm Water Flooding Forum

Hurricane Harvey Impacts

November 28, 2017



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Hurricane Harvey

- Category 4 hurricane - landfall August 25, 2017
- Estimated \$150 to \$180 billion in Harvey damages statewide
- Damage to structures caused by rainfall, bayou flooding, and release of water from Addicks/Barker reservoirs and San Jacinto River



Hurricane Harvey Rainfall

- **51.88** inches of rain recorded by a gauge near Mont Belvieu, according to the National Weather Service
- **49.77** inches - before Harvey, this was the highest annual rainfall recorded at Bush Intercontinental Airport
- **16.07** inches - August 27, 2017, wettest day on record in Houston; August 26 experienced 8.37 inches, making it the fifth wettest, according to the National Weather Service



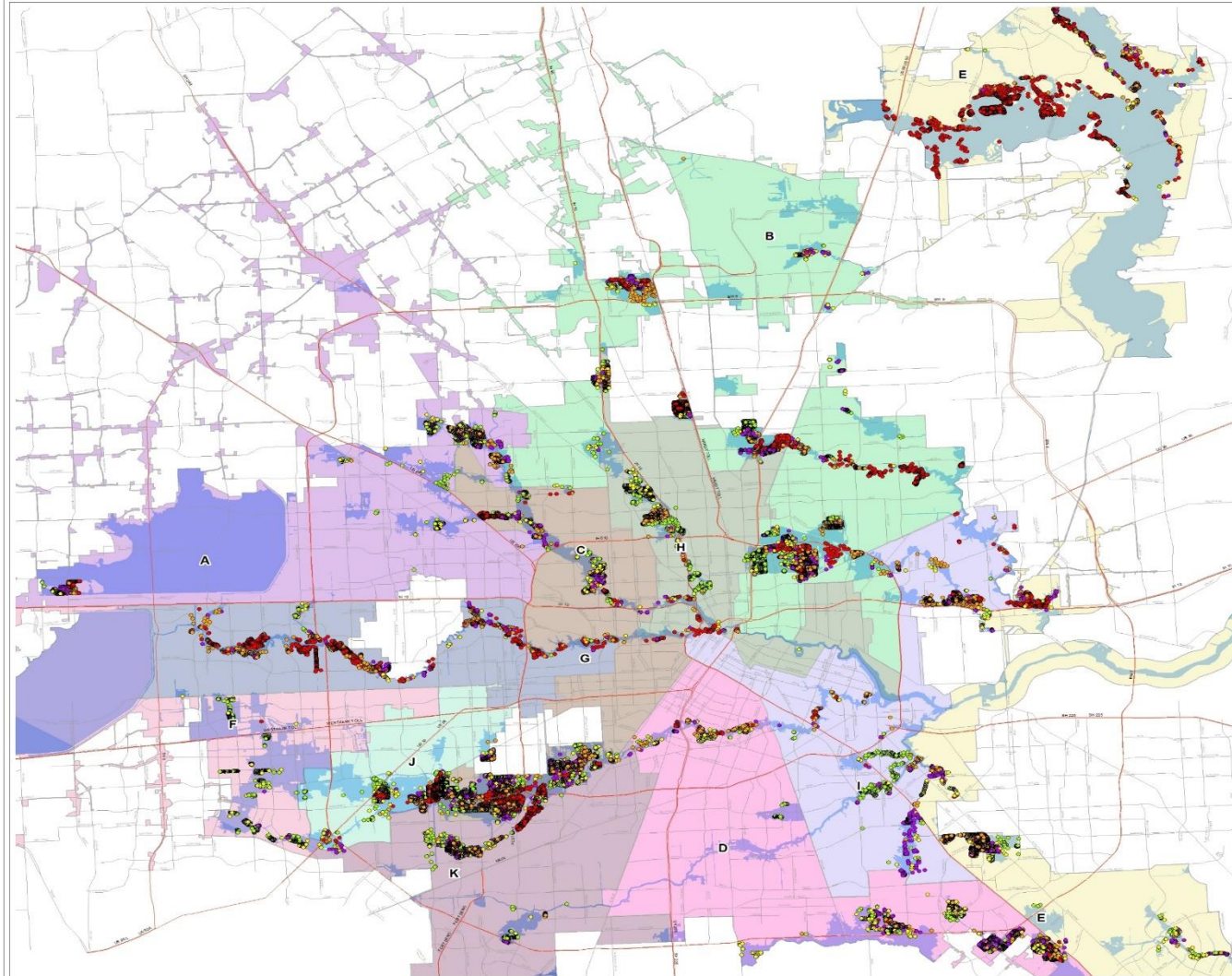
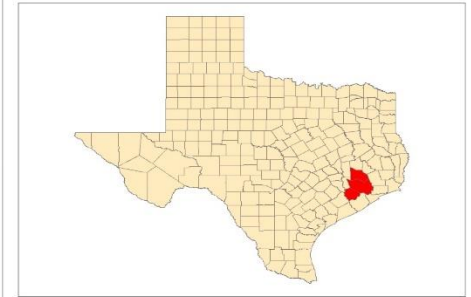
Hurricane Harvey Impacts

- 126,000 housing units affected
- 192,000 FEMA individual assistance
- \$2.4 billion damaged city facilities and infrastructure
- 2,500 roadway miles inundated
- 650,000 HPD overtime hours
- 1.2 million cubic yards debris



**City of Houston
2017 Harvey Flood Event
Floodplain Management Office**

**Observed Structural Flooding
in the 100- Year Floodplain**



Legend

Harvey Affected Water Depth	Council Districts
• Less Than 0.5 ft	■ A
• 0.5 ft - 1.0 ft	■ B
• 1.0 ft - 1.5 ft	■ C
• 1.5 ft - 3.0 ft	■ D
• More Than 3.0 ft	■ E
— Major Road	■ F
— Freeways	■ G
■ 100- Yr Floodplain	■ H
	■ I
	■ J
	■ K

SUMMARY	Property Type	Less Than 0.5 ft	0.5 ft - 1.0 ft	1.0 ft - 1.5 ft	1.5 ft - 3.0 ft	More Than 3.0 ft	CITY-WIDE
	Commercial	359	305	549	503	371	2087
	Multi Family	192	336	243	482	528	1781
	Single Family	3663	4029	4155	8739	6038	26624
	Total	4214	4670	4947	9724	6937	30492



Damage Assessments in the Floodplain

Federal Disaster Relief

- Federal funding - \$15 billion initial installment
- \$35 billion relief bill signed into law October 26
- Third supplemental expected

City of Houston initial requests:

- Residential hazard mitigation/housing assistance - \$13.5 billion
- Local drainage infrastructure projects - \$5 billion
- Smart city technology and green infrastructure \$1.7 billion
- Infrastructure consolidation - \$10 billion



Hurricane Harvey Response

Immediate priorities

- Debris removal – second pass to be completed December 2017
- Housing – RFP out for housing program manager
- RFPs will follow for home repair and case management

Longer-term priorities

- \$74 billion in identified recovery, resilience, and mitigation projects (includes \$25 billion HCFCD, \$12 billion coastal spine protection, \$37 billion city projects)



Mitigation Strategies

Neighborhood-by-neighborhood approach

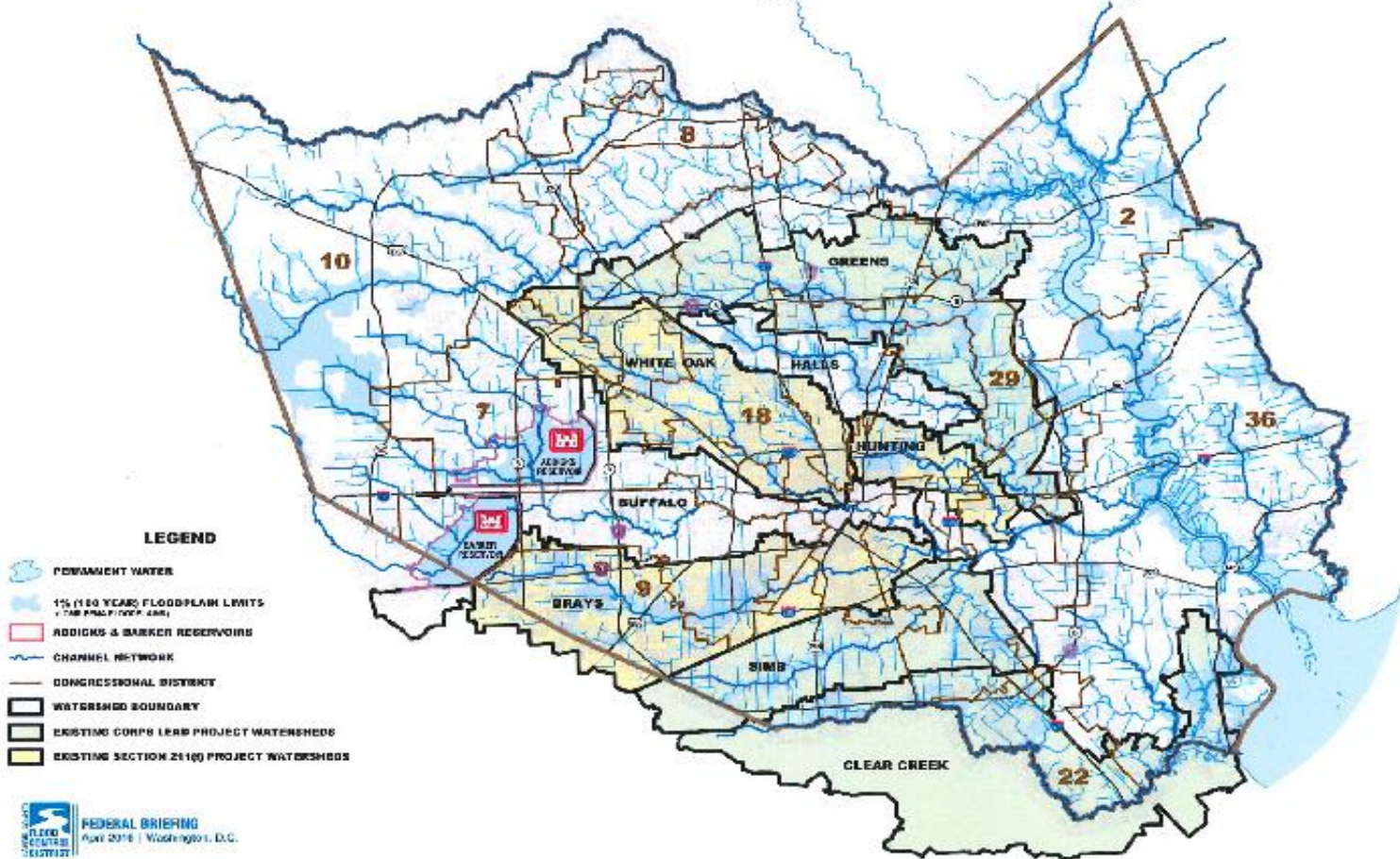
Structural
Project

Acquisition

Elevation or
Mitigation
Reconstruction



Active Federal Flood Damage Reduction Projects



Source: Corps District Office, Houston Region, 2/11/16



Resilience Efforts

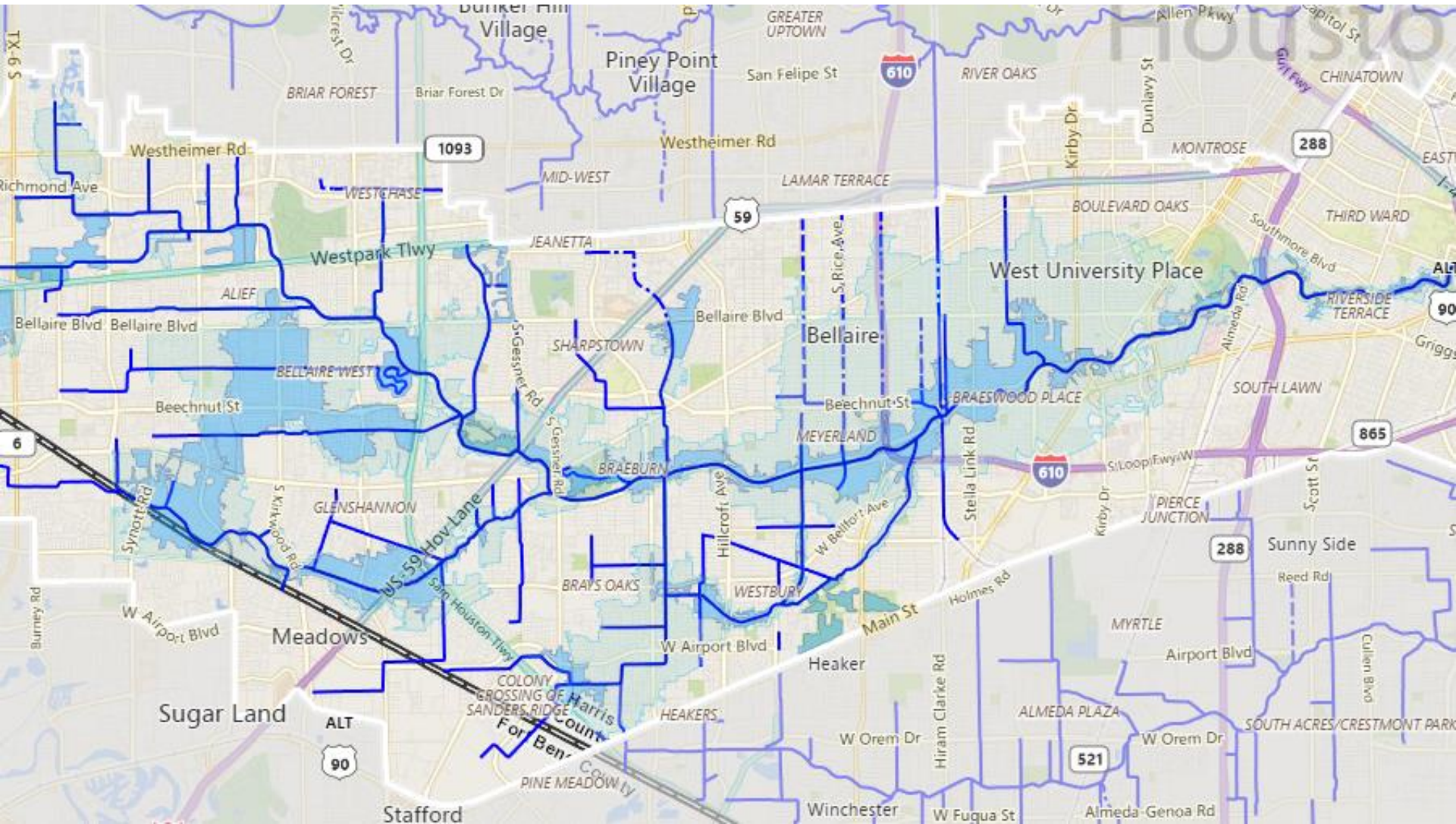
- Integrate stormwater management into Lake Houston
- Increase capacity of Buffalo Bayou downstream of reservoirs
- Protect critical water and sewer plant facilities



Resilience Efforts

- Reevaluate need to update regulatory floodplain
- Develop in-city watershed detention plan
- Reevaluate detention criteria and floodplain ordinance
- Map risk areas post-federal projects for buyout opportunities or structural alternatives
- Explore opportunities for redevelopment of high-risk areas





Beyond the Federal Projects

Resilience Efforts

- Determine non-riverine flood zones
- Develop citywide detention plan for future mitigation
- Develop potential service area impact fee
- Advance green infrastructure program



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